Operating Manual

OPTIMOD-TV®

Stereo Generator

MODEL 8185A

orban®

IMPORTANT NOTE: Refer to the unit's rear panel for your Model Number.

Model Number:	Manual References	Description:
8182A/U75	8182A	OPTIMOD-TV Audio Processor, 115V 75µs
8182A/J50	8182A + MVM-021 + OPT-018	OPTIMOD-TV Audio Processor, 100V 50µs
8182A/E75	8182A + OPT-021	OPTIMOD-TV Audio Processor, 230V 75µs
8182A/E50	8182A + OPT-021 + OPT-018	OPTIMOD-TV Audio Processor, 230V 50µs
8182AT/U	8182A	*OPTIMOD-TV Audio Processor, 115V 75µs
8182AT/J	8182A + MVM-021 + OPT-018	*OPTIMOD-TV Audio Processor, 100V 50µs
8182AT/E	8182A + OPT-021	*OPTIMOD-TV Audio Processor, 230V 75µs
8182AT/E	8182A + OPT-021 + OPT-018	*OPTIMOD-TV Audio Processor, 230V 50µs
8182AST/U	8182A/ST + MVM-021	OPTIMOD-TV Studio Chassis, 115V
8182AST/E	8182A/ST + MVM-021	OPTIMOD-TV Studio Chassis, 230V
8182AST/J	8182A/ST + MVM-021	OPTIMOD-TV Studio Chassis, 100V
8185A/U	8185A	BTSC TV Stereo Generator, 115V
8185A/E	8185A + OPT-021	BTSC TV Stereo Generator, 230V
8182ASAP/U	8182A/SAP	BTSC SAP Generator w/ Monitor Card, 115V
8182ASAP/E	8182A/SAP + OPT-021	BTSC SAP Generator w/ Monitor Card, 230V
8182APRO	8182A/PRO	BTSC PRO Generator for 8182A/SG
8185APRO	8185A/PRO	BTSC PRO Generator for 8185A

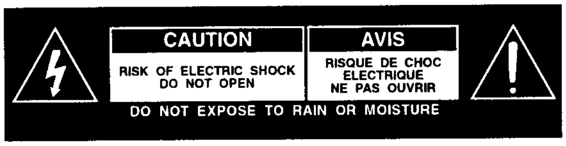
*Supplied with 3 and 4 TX cards and less the 2, 3, 4 and 5 cards.

OPTIONS AVAILABLE

Model Number:	Manual References	Description:
8182ASTSPK		Spare Parts and Semiconductor Kit
ACC021	ACC-021	dbx Monitor Card for earlier 8182/SAP
RET025	RET-025	8180A to 8182A Factory Upgrade
SC4	ACC-014	Clear Security Cover for OPTIMOD TV units
SC2	ACC-012	Clear Security Cover for ST units

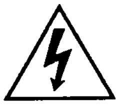
MANUAL:

Part Number:	Description
95076-000-03	8185A Manual



CAUTION: TO REDUCE THE RISK OF ELECTRICAL SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.



This symbol, wherever it appears, alerts you to the presence of uninsulated dangerous voltage inside the enclosure — voltage that may be sufficient to constitute a risk of shock.

This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Read the manual.

IMPORTANT SAFETY INSTRUCTIONS

All the safety and operating instructions should be read before the appliance is operated.

Retain Instructions: The safety and operation instructions should be retained for future reference.

Heed Warnings: All warnings on the appliance and in the operating instructions should be adhered to.

Follow Instructions: All operation and user instructions should be followed.

Water and Moisture: The appliance should not be used near water (e.g., near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool, etc.).

Ventilation: The appliance should be situated so that its location or position does not interfere with its proper ventilation. For example, the appliance should not be situated on a bed, sofa, rug, or similar surface that may block the ventilation openings; or, placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.

Heat: The appliance should be situated away from heat sources such as radiators, heat registers, stoves, or other appliances (including amplifiers) that produce heat.

Power Sources: The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.

Grounding or Polarization: Precautions should be taken so that the grounding or polarization means of an appliance is not defeated.

Power-Cord Protection: Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the appliance.

Cleaning: The appliance should be cleaned only as recommended by the manufacturer.

Non-Use Periods: The power cord of the appliance should be unplugged from the outlet when left unused for a long period of time.

Object and Liquid Entry: Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.

Damage Requiring Service: The appliance should be serviced by qualified service personnel when:
The power supply cord or the plug has been damaged; or
Objects have fallen, or liquid has been spilled into the appliance; or
The appliance has been exposed to rain; or
The appliance does not appear to operate normally or exhibits a marked change in performance; or
The appliance has been dropped, or the enclosure damaged.

Servicing: The user should not attempt to service the appliance beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.

The Appliance should be used only with a cart or stand that is recommended by the manufacturer.

Safety Instructions (European)

Notice For U.K. Customers If Your Unit Is Equipped With A Power Cord.

WARNING: THIS APPLIANCE MUST BE EARTHED.

The cores in the mains lead are coloured in accordance with the following code:
GREEN and YELLOW - Earth BLUE - Neutral BROWN - Live
As colours of the cores in the mains lead of this appliance may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:
The core which is coloured green and yellow must be connected to the terminal in the plug marked with the letter E, or with the earth symbol, (⏚), or coloured green, or green and yellow.
The core which is coloured blue must be connected to the terminal marked N or coloured black.
The core which is coloured brown must be connected to the terminal marked L or coloured red.

The power cord is terminated in a CEE7/7 plug (Continental Europe). The green/yellow wire is connected directly to the unit's chassis. If you need to change the plug and if you are qualified to do so, refer to the table below.

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

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

AC Power Cord Color Coding

Safety Instructions (German)

Gerät nur an der am Leistungsschild vermerkten Spannung und Stromart betreiben.

Sicherungen nur durch solche, gleicher Stromstärke und gleichen Abschaltverhaltens ersetzen. Sicherungen nie überbrücken.

Jedwede Beschädigung des Netzkabels vermeiden. Netzkabel nicht knicken oder quetschen. Beim Abziehen des Netzkabels den Stecker und nicht das Kabel enfassen. Beschädigte Netzkabel sofort auswechseln.

Gerät und Netzkabel keinen übertriebenen mechanischen Beaspruchungen aussetzen.

Um Berührung gefährlicher elektrischer Spannungen zu vermeiden, darf das Gerät nicht geöffnet werden. Im Fall von Betriebsstörungen darf das Gerät nur Von befugten Servicestellen instandgesetzt werden. Im Gerät befinden sich keine, durch den Benutzer reparierbare Teile.

Zur Vermeidung von elektrischen Schlägen und Feuer ist das Gerät vor Nässe zu schützen. Eindringen von Feuchtigkeit und Flüssigkeiten in das Gerät vermeiden.

Bei Betriebsstörungen bzw. nach Eindringen von Flüssigkeiten oder anderen Gegenständen, das Gerät sofort vom Netz trennen und eine qualifizierte Servicestelle kontaktieren.

Safety Instructions (French)

On s'assurera toujours que la tension et la nature du courant utilisé correspondent bien à ceux indiqués sur la plaque de l'appareil.

N'utiliser que des fusibles de même intensité et du même principe de mise hors circuit que les fusibles d'origine. Ne jamais shunter les fusibles.

Eviter tout ce qui risque d'endommager le câble seceur. On ne devra ni le plier, ni l'aplatir. Lorsqu'on débranche l'appareil, tirer la fiche et non le câble. Si un câble est endommagé, le remplacer immédiatement.

Ne jamais exposer l'appareil ou le câble ä une contrainte mécanique excessive.

Pour éviter tout contact averc une tension électrique dangereuse, on n'oouvrira jamais l'appareil. En cas de dysfonctionnement, l'appareil ne peut être réparé que dans un atelier autorisé. Aucun élément de cet appareil ne peut être réparé par l'utilisateur.

Pour éviter les risques de décharge électrique et d'incendie, protéger l'appareil de l'humidité. Eviter toute pénétration d'humidité ou fr liquide dans l'appareil.

En cas de dysfonctionnement ou si un liquide ou tout autre objet a pénétré dans l'appareil couper aussitôt l'appareil de son alimentation et s'adresser à un point de service aprésvente autorisé.

Safety Instructions (Spanish)

Hacer funcionar el aparato sólo con la tensión y clase de corriente señaladas en la placa indicadora de características.

Reemplazar los fusibles sólo por otros de la misma intensidad de corriente y sistema de desconexión. No poner nunca los fusibles en puente.

Proteger el cable de alimentación contra toda clase de daños. No doblar o apretar el cable. Al desenchufar, asir el enchufe y no el cable. Sustituir inmediatamente cables dañados.

No someter el aparato y el cable de alimentación a esfuerzo mecánico excesivo.

Para evitar el contacto con tensiones eléctricas peligrosas, el aparato no debe abrirse. En caso de producirse fallos de funcionamiento, debe ser reparado sólo por talleres de servicio autorizados. En el aparato no se encuentra ninguna pieza que pudiera ser reparada por el usuario.

Para evitar descargas eléctricas e incendios, el aparato debe protegerse contra la humedad, impidiendo que penetren ésta o líquidos en el mismo.

En caso de producirse fallas de funcionamiento como consecuencia de la penetración de líquidos u otros objetos en el aparato, hay que desconectarlo inmediatamente de la red y ponerse en contacto con un taller de servicio autorizado.

Safety Instructions (Italian)

Far funzionare l'apparecchio solo con la tensione e il tipo di corrente indicati sulla targa riportante i dati sulle prestazioni.

Sostituire i dispositivi di protezione (valvole, fusibili ecc.) solo con dispositivi aventi lo stesso amperaggio e lo stesso comportamento di interruzione. Non cavallottare mai i dispositivi di protezione.

Evitare qualsiasi danno al cavo di collegamento alla rete. Non piegare o schiacciare il cavo. Per staccare il cavo, tirare la presa e mai il cavo. Sostituire subito i cavi danneggiati.

Non esporre l'apparecchio e il cavo ad esagerate sollecitazioni meccaniche.

Per evitare il contatto con le tensioni elettriche pericolose, l'apparecchio non deve venir aperto. In caso di anomalie di funzionamento l'apparecchio deve venir riparato solo da centri di servizio autorizzati. Nell'apparecchio non si trovano parti che possano essere riparate dall'utente.

Per evitare scosse elettriche o incendi, l'apparecchio va protetto dall'umidità. Evitare che umidità o liquidi entrino nell'apparecchio.

In caso di anomalie di funzionamento rispettivamente dopo la penetrazione di liquidi o oggetti nell'apparecchio, staccare immediatamente l'apparecchio dalla rete e contattare un centro di servizio qualificato.

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Stereo Generator

MODEL 8185A

orban®

The 8185A OPTIMOD-TV is protected by U.S. patents 4,249,042; 4,208,548; 4,460,871; and U.K. patent 2,001,495.
Other patents pending.

OPTIMOD-TV and Orban are registered trademarks.

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Stereo Generator

Model 8185A

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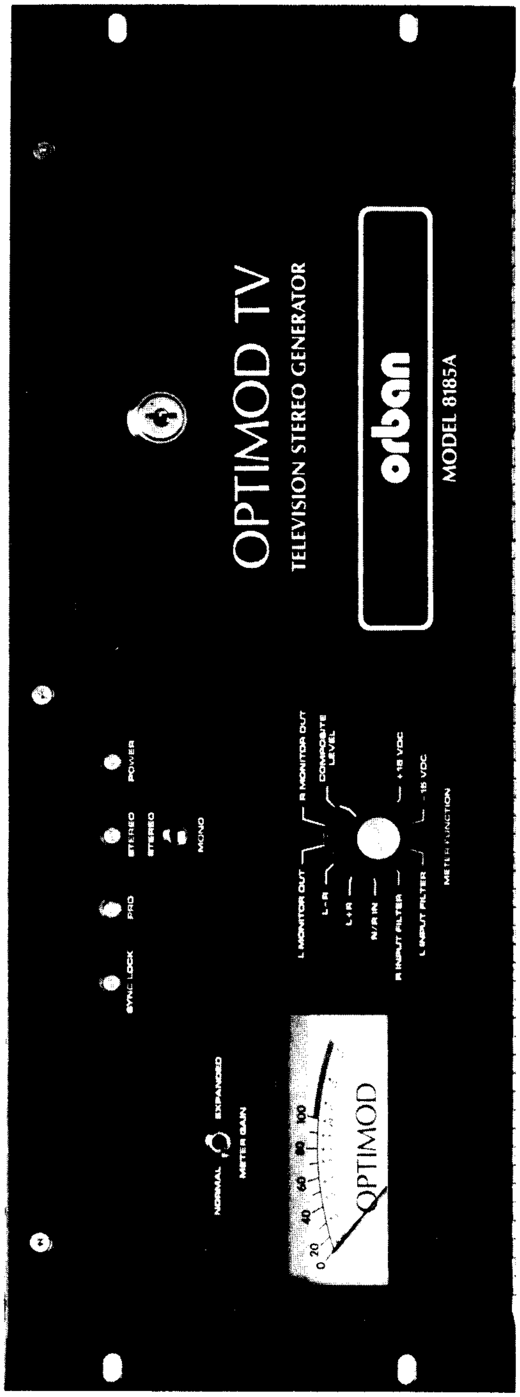
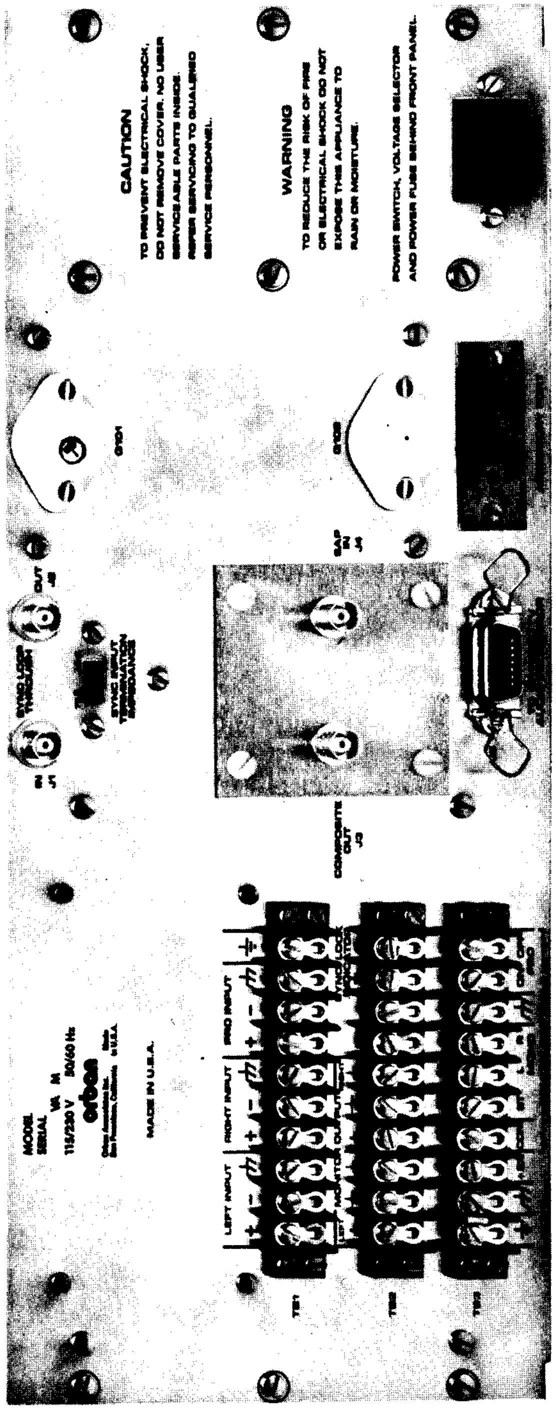
Section 1
Introduction

The 8185A Stereo Generator



Front



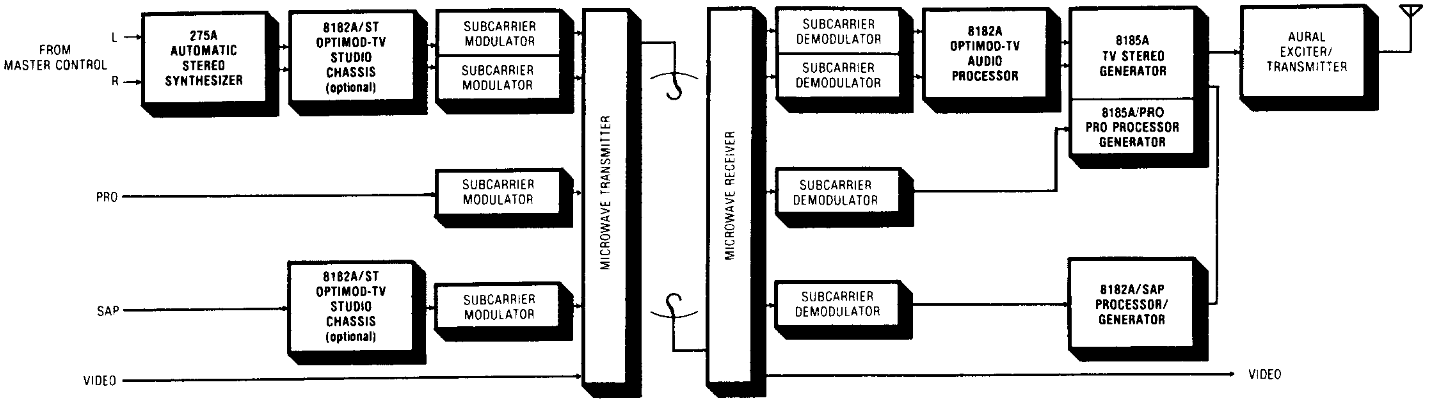
Rear

The Orban OPTIMOD-TV Stereo Generator

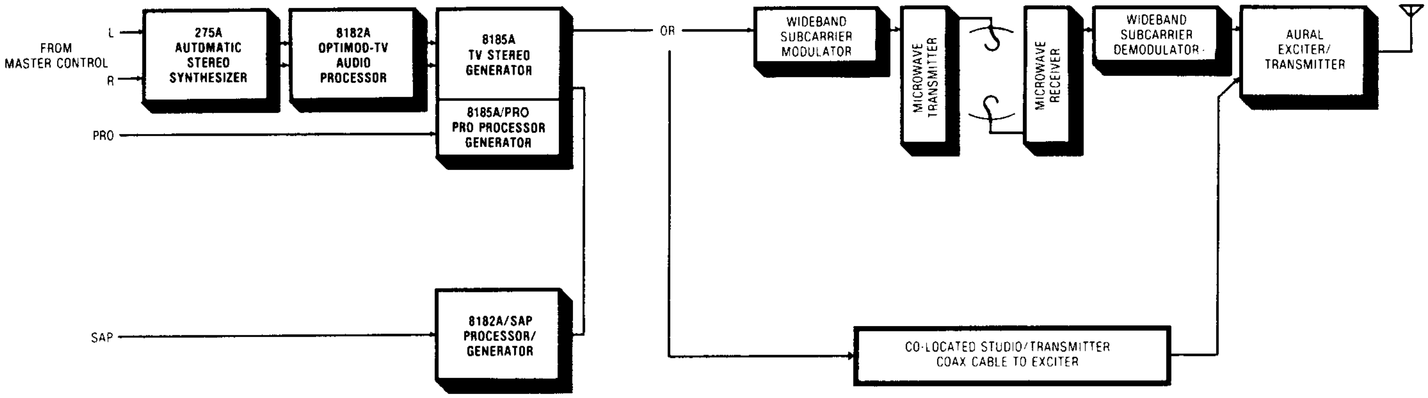
The 8185A Stereo Generator is a high-performance BTSC-standard stereo generator having superb audio quality and exceptional stability. Although the 8185A will work with *any* audio processor, it is designed to be especially effective when used in conjunction with the Orban OPTIMOD-TV audio processor.

The 8185A far exceeds BTSC requirements, delivers unimpeachable subjective audio quality, and uses extremely high-performance low-pass filters to achieve excellent high-frequency response and the industry's best aliasing rejection. The 8185A Stereo Generator has a digital baseband encoder, group delay equalization, and upgraded noise reduction circuitry for better overall performance and tighter specifications.

- Digital baseband encoder generates BTSC-standard stereo subchannel and composite baseband. Fig. 1-2 shows the very clean baseband spectrum produced by the Hadamard Transform Baseband Encoder.™
- Separation performance exceeds all BTSC specifications.
- Works with any audio processor. (Has +10dBm active-balanced left and right inputs, and can accept flat or pre-emphasized input.)
- When used with the Orban 8182A OPTIMOD-TV Audio Processor, a special interface allows interleaving of circuitry to get the brightest sound with the lowest distortion.
- Easy to install and operate.
- Built-in Bessel null calibration tone.
- Built-in peak-indicating meter for input, circuit, and output levels.
- Sharp filtering protects pilot and prevents crosstalk between the main channel and subchannel (see Fig. 1-3).
- Excellent protection from aliasing.
- Group delay equalization of low-pass filters to minimize overshoots (see Fig. 1-4).
- dbx® noise reduction encoder.
- Built-in dbx noise reduction decoder, de-emphasis, and de-matrixing for monitoring audio up to the baseband encoder.
- Optional 8185A/PRO Professional Channel Generator circuitry.
- Input port for separate Second Audio Program channel generator.
- Optically-isolated remote control inputs for switching between stereo and mono operation, for monitoring sync lock status, and for controlling the optional 8185A/PRO Professional Channel Generator.



Stereo TV System with discrete subcarrier microwave STL



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

Fig. 1-1: Common System Configurations

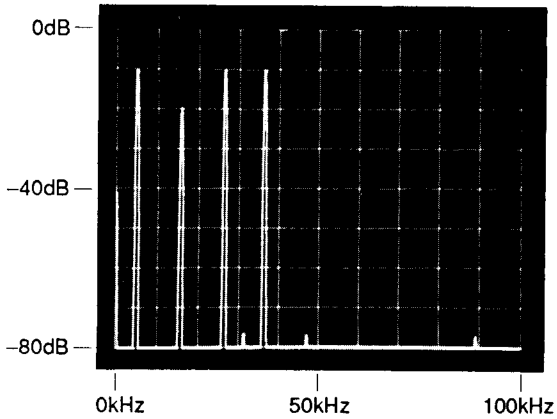


Fig. 1-2: Baseband Spectrum
(5kHz L-only modulation, equivalent mode, ±55kHz devi

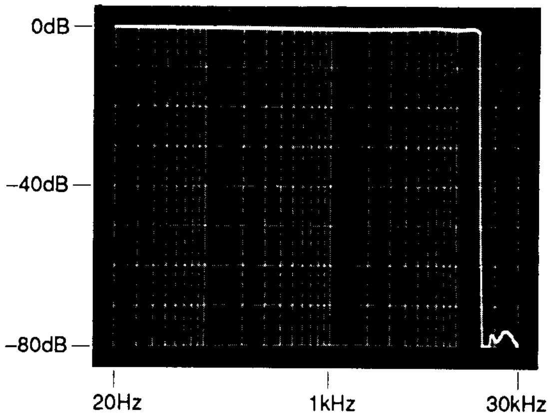


Fig. 1-3: Level vs. Frequency
(Demonstrating stopband filtering effectiveness)

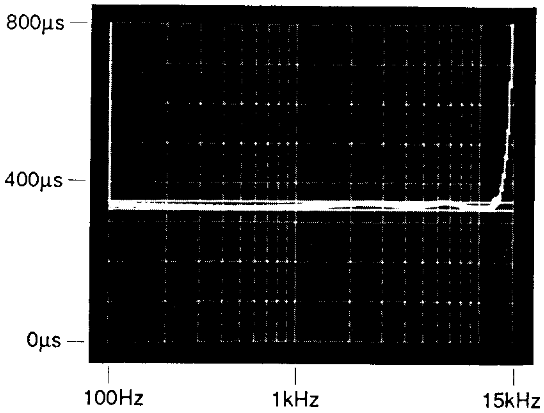


Fig. 1-4: Group Delay vs. Frequency

About Measurements of Separation Performance

A major factor affecting swept sine-wave separation measurements is the matching between the noise reduction encoder in the stereo generator and the decoder in the receiver. When measuring system separation beyond 35dB, minuscule variations between encoders and decoders can skew results by 5dB or more. Orban has been working closely with dbx to optimize system separation. The improved dbx encoder and monitor decoder used in the 8185A reflect this effort.

Nevertheless, swept sine-wave separation measurements cannot predict dynamic separation in BTSC stereo, because they do not correlate well to separation performance with real-world program material. Swept sine-wave measurements are simultaneously *completely insensitive* to dynamic separation artifacts that are produced by non-complementary noise reduction encoder and decoder nonlinearities, and *overly sensitive* to small linear errors which "average out" in the broadband energy of program material. Thus, swept sine-wave measurements could lead one to expect to hear linear interchannel crosstalk that, in fact, cannot be heard, while not revealing non-linear crosstalk distortion that *is* heard.

For these reasons, Orban assesses separation with a dual-channel FFT analyzer, using both program material and pink noise for excitation. The role of swept sine-wave measurements is limited to verifying that BTSC specifications are met. Relying on swept sine-wave measurements alone as a indicator of the overall quality is unwise because such measurements fail to predict dynamic separation and do not excite the aliasing distortion that can result from inadequate audio filtering of program material.

It is well-established that there is no audible improvement in stereo imaging when *real-world dynamic separation* is improved beyond 17dB. Since all Orban stereo generators greatly exceed 30dB dynamic separation at all frequencies contributing to the stereo effect, almost all of the error budget is left for the receiver.

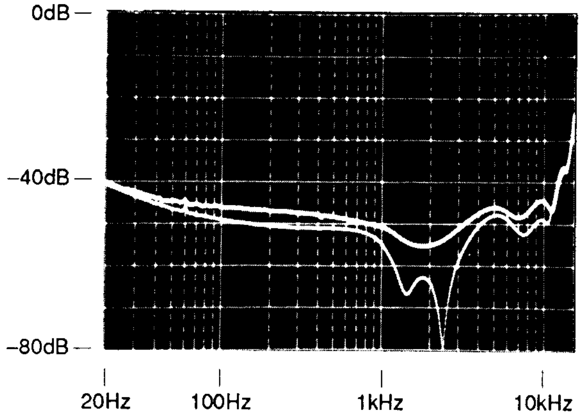


Fig. 1-5: BTSC Swept Sine-Wave Separation Performance
(10% and 30% 75µs equivalent input level)

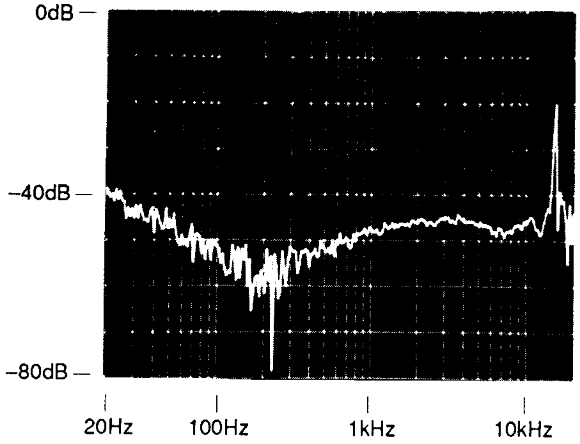


Fig. 1-6: BTSC Separation Performance
With Pink Noise Excitation

BTSC Multichannel Television Sound

The Broadcast Television Systems Committee (BTSC) Multichannel Television Sound (MTS) system was chosen by a vote of industry leaders in late 1983. Extensive testing of rival transmission and noise reduction systems was performed under the auspices of the Electronics Industries Association (EIA), and the results of the tests were published for examination by the industry. As the result, the BTSC standard incorporates the Zenith transmission system and the dbx® noise reduction system.

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 a pilot tone was broadcast at 1H (15,734Hz), then the stereo system in use was required to meet BTSC specifications. These specifications were set forth in the Office of Engineering and Technology publication OET-60A. OET-60A is not complete, in that many details and recommended practices are omitted. These details were left to an industry committee, again working under the auspices of the EIA, which specified them in the EIA publication *BTSC System Television: Multichannel Sound Recommended Practice.*

In the Zenith transmission system specified by the BTSC, a main channel occupying 50–15kHz is modulated with the stereophonic sum (L+R) signal. To be consistent with existing monophonic standards, 100% modulation was defined to be ±25kHz deviation of the aural carrier, and 75µs pre-emphasis was specified.

In the BTSC MTS system, the stereo subchannel carries the stereo difference (L–R) information. Double-sideband-suppressed carrier amplitude modulation was specified. The subcarrier frequency is 2H (31,468Hz). A pilot tone broadcast at 15,734Hz with ±5kHz deviation indicates that stereo is being broadcast and serves as a phase reference to regenerate the subcarrier at the receiver's stereo decoder. 100% modulation of the stereo subchannel is defined to be ±50kHz deviation. 100% modulation of the baseband (the sum of the stereo sum and difference channels) is also defined to be ±50kHz deviation. The recommended practice allows brief, low-energy overshoots induced by low-pass filters to exceed ±50kHz deviation.

The system is similar to that used in FM radio. However, the difference channel does not use fixed pre-emphasis. Instead, the difference signal is processed by the dbx noise reduction encoder to produce a highly compressed signal which can then be recovered at the receiver by a precisely complementary expansion. This restored difference signal is then matrixed with the sum signal in the receiver to produce 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 system depends on a precisely controlled gain between the output of the encoder at the transmitter and the input of the decoder at the receiver. Stereo separation is very sensitive to gain errors in the transmission system.

The BTSC MTS standard provides for a frequency-modulated Professional (PRO) channel subcarrier at 6.5H (102kHz). This is a non-broadcast, communications-quality channel intended for signaling between transmitter, studio, and remote vehicles, and for other similar intra-station communications. The PRO subcarrier deviates the main carrier ±3kHz. Maximum deviation of the PRO subcarrier is also ±3kHz. Audio bandwidth is limited to 3kHz. The PRO channel may be used for digital data with the frequency-shift keying (FSK) method.

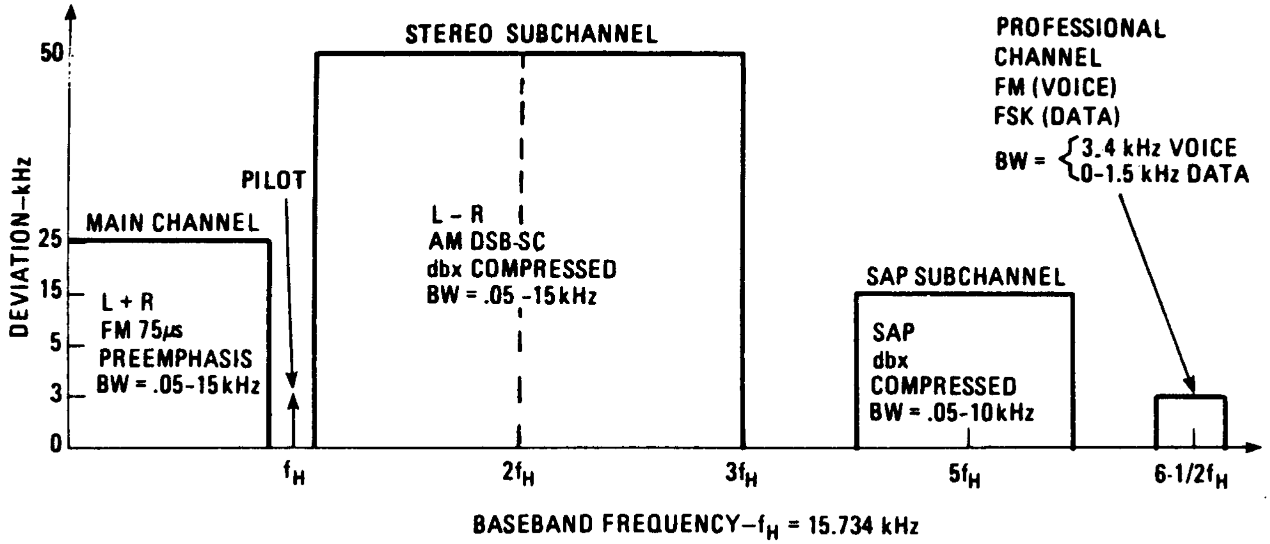


Fig. 1-7: The BTSC MTS Baseband

The BTSC MTS also provides for a Second Audio Program (SAP) on a frequency-modulated subcarrier. The SAP channel is intended for broadcast of a second audio signal with a television program. The Second Audio Program may be dialog in a second language, alternate coverage of sports events, or other program-related material. Audio unrelated to the video or main channel audio may also be broadcast over the SAP channel.

The SAP subcarrier has a carrier frequency of 5H (78,671Hz) in absence of modulation, and modulates the main aural carrier to ±15kHz deviation. 100% modulation of this subcarrier is defined to be ±10kHz deviation of the subcarrier frequency; the audio bandwidth of SAP modulation is limited to 10kHz. Fixed pre-emphasis is not used, but a dbx noise reduction encoder is inserted before the subcarrier generator. A complementary dbx noise reduction decoder in the receiver restores the original signal.

The FCC does not require that the BTSC standard for the SAP channel be adhered to even if the 15,734Hz BTSC stereo pilot is being transmitted. The standard recommended by the EIA therefore suggests that if a non-BTSC subcarrier is transmitted at 5H, it should be broadcast with an injection that results in less than ±7.5kHz main carrier deviation to avoid false triggering of SAP decoders in BTSC receivers.

System Requirements:
STLs, Exciters, Antennas, Sync

It is considerably easier to implement MTS stereo than to implement the other MTS subcarriers (the SAP and PRO channels), since limitations in the exciter, diplexer, and antenna generally do not degrade the quality of the stereo signal below "entertainment quality". (If, however, Incidental Carrier Phase Modulation 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. A more rigorous engineering analysis will probably be required.

It is not necessary to qualify the plant for *all* MTS subcarriers just to implement stereo. Some stations have found it convenient to begin stereo operation without waiting until the plant was upgraded to be able to provide the other MTS subcarriers as well. These stations have found that a very satisfying entertainment-quality signal can be achieved with as little as 20dB midband separation and 12kHz audio bandwidth.

At this writing, the ideal method of transmitting the MTS signal from studio to transmitter is far from being well defined. Many stations use several subcarriers on their video STL to accommodate the various audio signals, including the left and right audio channels, the SAP audio, and the PRO audio. If this method is used, the audio processor and stereo and subcarrier generators should be located at the transmitter.

If the STL has poor signal-to-noise ratio, we recommended that Orban's 8182A Audio Processor (if used) be split, with the dual-band compressor located at the studio end of the STL to protect it from overload and to permit higher average STL modulation. The split chassis configuration employs the optional Model 8182A/ST Studio Chassis. Stations which use telephone lines to carry audio to the transmitter site can also benefit from the split-chassis configuration, because the available signal-to-noise ratio is increased.

If a composite STL system (in which the *entire* stereo baseband, including the stereo, SAP, and PRO subcarriers, is encoded into a single subcarrier of the video STL) is used, the 8185A should be located at the studio, just prior to 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 circuitry involved in the distribution amplifier would certainly degrade the baseband signal.

Broadcast of the full MTS baseband spectrum (which extends to 105kHz and requires a total aural carrier deviation of ±73kHz) places new demands on exciter

performance in the areas of bandwidth, linearity, frequency deviation capability, and group delay. While many existing exciters can be relatively easily adapted to broadcast of the MTS *stereo* signals, many of these exciters are not suited for SAP operation. EIA Standard RS-508 contains specifications for MTS aural exciters (see Fig. 1-8).

The bandwidths of older **RF amplifiers, diplexers, and antennas** may not be sufficiently wide to achieve satisfactory SAP performance. RS-508 provides some guidance here. Rule-of-thumb performance guidelines are ±200kHz (-3dB) bandwidth for the diplexer (with group delay symmetrical around the center frequency), and greater than 1MHz bandwidth for RF amplifiers. As this area is highly specialized, we recommend consultation with the manufacturer of the transmitter and/or diplexer to determine if any modifications are required to make these parts of the system adequate for SAP operation.

The 8185A requires **sync or EIA-standard composite video** at 1-volt peak-to-peak, and is designed with "video loop-through" for maximum flexibility. If both the 8185A Stereo Generator and the optional 8182A/SAP Second Audio Program Generator are fed from a single reference, it may be looped through one and terminated in the other. (Composite video can be looped through without degradation.) Sync input impedance may be switched to 75 ohms to terminate video lines if a separate sync or composite video drive is available to feed the 8185A.

	Composite Input	**Subcarrier Input**
Frequency Range	30Hz–120kHz	16kHz–120kHz
Input Impedance	75 ohms	75 ohms
100% Modulation	1.5V = 75kHz	1.5V = 75kHz
Deviation Capability	>100kHz, 30Hz–50kHz >50kHz, 16kHz–120kHz	>50kHz
Frequency Response	±0.1dB, 50Hz–50kHz ±1dB, 30Hz–120kHz	±1dB
Deviation from Linear Phase	±0.5°, 100Hz–50kHz	
Signal/Noise Ratio (below 25kHz deviation)	55dB, 30Hz–15kHz 60dB at 15.734kHz 50dB, 16kHz–47kHz 44dB, 63kHz–94kHz 40dB, 30Hz–120kHz	44dB, 63kHz–94kHz 40dB, 16kHz–120kHz
THD (30Hz–15kHz)	<0.5% up to 25kHz deviation <1.0% up to 50kHz deviation	(not applicable)
SMPTE IM Distortion	<1.0%	(not applicable)

Fig. 1-8: RS-508 Exciter Performance Specifications

Additional Sources of information

BTSC System Multichannel Television 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 well-grounded 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

Multichannel Television Transmission and Audio Processing Requirements for the BTSC System. FCC Office of Engineering and Technology Bulletin No. 60, April 1984. (Known popularly as OET-60A.)

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

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

Sixty-six pages of 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 about 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 other interesting articles on audio for MTS.

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 pages 3.5-149 to 3.5-154, and on pages 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

Registration, Warranty, Feedback

Registration Card

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

1) It enables us to inform you of new applications, performance improvements, and service aids which may be developed, and
2) It helps us respond promptly to claims under warranty without having to request a copy of your bill of sale or other proof of purchase.

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

Registration Card

Model # ________ Serial # ____________________ Purchase Date ________

Your name ______________________________ Title ____________

Company ______________________________ Telephone ____________

Street ____

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

Nature of your product application ______________________________

How did you hear about this product? ______________ Purchased from ________

Comments ____

____

Which magazines do you find the most useful to your job?

- __ Audio
- __ Electronic Musician
- __ Post
- __ RE/P
- __ TVTech
- __ Broadcast Engineering
- __ EQ
- __ Pro Sound News
- __ Sound & Communications
- __ ____________
- __ ____________
- __ Broadcast
- __ Millimeter
- __ Radio & Records
- __ S & VC
- __ ____________
- __ ____________
- __ dB Magazine
- __ Mix
- __ Radio World
- __ TV Broadcast

95101-000-07 1/91

Warranty

The warranty, which can be enjoyed only by the first end-user of record, is stated on the separate Warranty Certificate packed with this manual. Save it for future reference. Details on obtaining factory service are provided on page 5-13.

User Feedback Form

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

Notes:

Section 2

Installation

CAUTION

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

Installation (Quick Set-up)

The detailed comprehensive installation instructions which follow cover many special situations and include tests of the plant's readiness for BTSC stereo operation. If your plant is qualified for stereo operation and your situation is not unusual, everything you need to know to get up and running is on this page. If you are using the optional 8182A/ST Studio Chassis, you should probably use the comprehensive instructions. *Refer to the comprehensive installation procedure on page 2-3 for more information.*

1) Reset jumpers (if necessary).

If you are using the 8182A OPTIMOD-TV Audio Processor, move these jumpers on its Card #7: jumpers A and B to the "PRE-EMPHASIZED" position, jumper C to the "L OUT" position, and jumper D to "R OUT" (see Fig. 2-6 on page 2-11).

If you are using another audio processor, move these jumpers on the 8185A Stereo Generator's Card #2: jumpers A, C, D, and F to the "EXT. PROCESSOR" position (see Fig. 2-2 on page 2-8). Configure your audio processor for pre-emphasized output, if possible (if only flat output is available, move jumpers B and E on Card #2 to the "FLAT INPUT" position).

2) Mount and connect 8185A Stereo Generator.

Connect power and ground (also connect the chassis ground jumper on the 8185A's rear panel to the audio processor's chassis), input audio (use the supplied interconnect cable for the 8182A Audio Processor), and sync or composite video to the 8185A. Connect the 8185A's composite output to the exciter. Set controls as shown in Fig. 2-11 on page 2-21 (if you are using the 8182A Audio Processor, set its rear-panel STEREO GENERATOR switch to IN).

3) Match audio processor and 8185A Stereo Generator levels.

Feed typical program material at normal levels to the audio processor. Adjust the processor's input level for normal operation. If you are using the 8182A Audio Processor, temporarily set its CLIPPING control to "+2".

Set the 8185A Stereo Generator to L INPUT FILTER, then adjust the audio processor's left output level until the 8185A's VU meter reads *exactly* "0VU" (100%) on peaks. Reset the VU meter selector to R INPUT FILTER, then adjust the audio processor's right output level until the 8185A's VU meter reads *exactly* "0VU" (100%) on peaks. If using the 8182A, reset its CLIPPING control to "−1".

4) Match 8185A Stereo Generator to exciter (Bessel null).

Connect an RF spectrum analyzer to a sample of the aural exciter's output. Set the 8185A Stereo Generator's BESSEL NULL CAL control to TONE. Turn the 8185A's TOTAL BASEBAND OUTPUT LEVEL control fully counterclockwise (up to 18 turns), then slowly turn the control clockwise until the carrier nulls for the first time. Return the BESSEL NULL CAL switch to OPERATE.

5) Complete and return the Registration Card.

Installation (Comprehensive Instructions)

Allow about 2 hours for installation. Follow instructions in the order given, as some steps depend on the results of previous steps.

The 8185A OPTIMOD-TV Stereo Generator can be used with the OPTIMOD-TV Audio Processing System or with other audio processing. The following instructions cover both situations. For those using OPTIMOD-TV processing, detailed instructions for installation of the 8182A OPTIMOD-TV Audio Processor and the optional 8182A/ST Studio Chassis are included.

Installation begins with a check-out of the unit(s) and setting of option jumpers on circuit cards. The unit(s) are mounted in a rack, connected to power and sync, and the 8185A Stereo Generator and audio processor are level-matched. After verification of baseband separation out of the 8185A Stereo Generator, the unit is connected to the exciter. Verifying transmitter sensitivity, verifying separation out of the transmitter, matching levels (Bessel null) between the 8185A Stereo Generator and exciter, connecting the audio inputs and outputs, adjusting input levels with program material, and checking modulation level and air sound complete the process.

Completely install and check the 8185A OPTIMOD-TV Stereo Generator (and the 8182A Audio Processor and 8182A/ST Studio Chassis, if used) before installing the optional OPTIMOD-TV Second Audio Program Generator (8185A/SAP), Professional Channel Generator (8185A/PRO), or Automatic Stereo Synthesizer (275A). See each unit's Operating Manual for installation instructions.

Equipment required:

Low-distortion audio oscillator

Triggered-sweep oscilloscope

With at least 5MHz vertical bandwidth.

RF spectrum analyzer

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

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

CAUTION

Be sure power is off before removing or inserting any of the printed circuit cards.

1) Unpack and inspect.

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

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

Packed with the 8185A OPTIMOD-TV Stereo Generator are:

1	Power cord
1	3-wire power cord plug adapter
4	10-32 × $^{3}/_{4}$-inch rack screws
1	$^{5}/_{64}$-inch hex wrench for front-panel screws
2	Keys for front-panel door
1	Adjustment tool (mounted inside front-panel door)
1	Extender card (shipped in the card rack)
1	Wrench for removing knobs
1	Final Factory Qualification Test Results (3 pages)
1	Memo, "Please Read This"
1	Warranty Certificate
1	Registration Card
1	Operating Manual

And these items for those using the 8182A OPTIMOD-TV Audio Processor:

1	Cable for interconnection with the 8182A Audio Processor
2	Resistors, 620-ohm ±5%, $^{1}/_{4}$-watt, carbon film
1	Retrofit Kit RET-035 for older 8182A units

Packed with the 8182A OPTIMOD-TV Audio Processor are:

1	Power cord
1	3-wire power cord plug adapter
4	10-32 × $^{3}/_{4}$-inch rack screws
1	$^{5}/_{64}$-inch hex wrench for front-panel screws
2	Keys for front-panel door
1	Adjustment tool (mounted inside front-panel door)
1	Extender card (shipped in the card rack)
1	Wrench for removing knobs
1	Final Factory Qualification Test Results
1	Memo, "Please Read This"
1	Warranty Certificate
1	Registration Card
1	Operating Manual

Packed with the optional 8182A/ST OPTIMOD-TV Studio Chassis are:

1	Card #3TX
1	Card #4TX
12	6-32 × 3/16-inch screws for mounting cards
4	6-32 × 1 1/4-inch stand-offs for mounting Card #2
1	3-wire power cord plug adapter
4	10-32 × 3/4-inch rack screws
2	Keys for front-panel door
1	Adjustment tool (mounted inside front-panel door)
1	Wrench for removing knobs
2	Resistors, 620-ohm ±5%, 1/4-watt, carbon film
1	Memo, "Please Read This"
1	Warranty Certificate
1	Registration Card
1	Operating Manual

A☐ Remove the three hex-socket screws at the top of the 8185A Stereo Generator's front panel with the 5/64-inch hex wrench provided with the unit, then tilt the hinged front panel down to reveal the interior.

B☐ Loosen the four DZUS fasteners on the subpanel by turning each fastener 1/4-turn counterclockwise with a long 3/16-inch or 1/4-inch flat-blade screwdriver.

C☐ Taking care not to stress the flat cables beneath it, tilt the top of the subpanel outward and to the left to clear the upper chassis lip and the door support rail at the right.

D☐ Carefully remove each circuit card, check that all IC components are properly seated in their sockets, then return each card to its slot.

E☐ If you are using the 8182A Audio Processor, repeat steps a) through d) for that unit.

2) Connect power.

A☐ DO NOT connect power to the unit yet!

B☐ Check that AC POWER switches behind the front panels are set to ON.

C☐ Check the line voltage.

The 8185A, 8182A, and 8182A/ST are shipped ready for 115 or 230V, 50/60Hz operation. Refer to the unit's rear panel for your Model # and the inside front cover of the manual for your Model #'s line voltage setting. To change the operating voltage, set the VOLTAGE SELECTOR to 115V or 230V as appropriate (voltages 15% of the nominal voltage are acceptable).

⚠

D☐ Check the value of the fuse and change the fuse if the value is incorrect.

For safety the fuse must be 1/2-amp 250V Slow Blow fuse — 3AG or 250mA "T" type as appropriate (for 115-volt *or* 230-volt operation). The 8182A/ST is hard wired for the voltage ordered (instructions for changing the 8182A/ST's voltage are in the 8182A/ST Operating Manual).

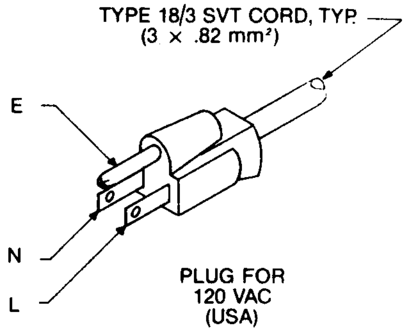
E ☐ Connect the 8185A, 8182A, and 8182A/ST's power cord to an appropriate AC power source.

The power cord is ordinarily terminated in a "U-ground" plug (USA standard), or CEE7/7 plug (Continental Europe), as appropriate to your unit's Model #. The green (or green/yellow) wire from the safety-ground prong is connected directly to the chassis.

If it becomes necessary to lift this ground to suppress ground loops, do so with a three-prong to two-prong adapter plug, rather than by damaging the power plug. But you should *not* defeat the ground unless absolutely necessary, because it eliminates the intrinsic safety feature of the three-wire system.

WARNING

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



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

Fig. 2-1: AC Power Cord Color Coding

3) Check indicators and meters.

[If you would like to perform a complete field audit of the 8185A Stereo Generator's performance before installing it, see **Section 4** *of this manual. Appendix D of the 8182A Operating Manual gives field audit instructions for the 8182A Audio Processor.]*

A ☐ Connect AC power to each unit.

B ☐ Verify that the POWER indicators and the 8182A's GATE indicator light, and that the 8185A's SYNC LOCK, PRO and STEREO indicators, the 8182A's HF LIMIT indicators, and the 8182A/ST's GATE indicator remain unlit.

If indicators do not respond as they should, repeat step 1. If that does not correct the problem, see the troubleshooting routines in **Section 5.**

C ☐ Verify that the VU meters of each unit* reads "0VU" ±1VU when its selector is set to −15 VDC or +15 VDC.

* Except the 8182A/ST's meter should read "−3VU" ±1VU.
If a meter reading is abnormal, repeat step 1; if that does not correct the problem, see **Section 5.**

D ☐ Disconnect the power.

4) Reposition 8185A Stereo Generator Jumpers.

See Fig. 2-2 for jumper positions.

A☐ *If you are using the 8182A Audio Processor*, verify that jumpers A, C, D and F on the 8185A Stereo Generator's Card #2 are in the "8182A" position, and that jumpers B and E on Card #2 are in the "PRE-EMPHASIZED INPUT" position.

The 8185A is shipped with Card #2 jumpers in these positions.

B☐ *If you are using another audio processor*, place jumpers A, C, D and F on the 8185A Stereo Generator's Card #2 in the "EXT. PROCESSOR" position. Place jumpers B and E on Card #2 in the "PRE-EMPHASIZED INPUT" position if you are feeding the 8185 Stereo Generator pre-emphasized audio; place them in the "FLAT INPUT" position if you are feeding "flat" audio.

Feed pre-emphasized audio to the 8185A Stereo Generator, if possible.

C☐ If your exciter requires that the 8185A Stereo Generator have a 75-ohm output impedance, move jumper A on the 8185A Stereo Generator's Card #7 to the "75Ω" position.

See Fig. 2-3. Since normal and suggested practice is to run 0Ω lines which are terminated with 75Ω, this jumper is shipped in the "0Ω" position (see step 13 on page 2-16 for more information).

D☐ If you would like the 8185A Stereo Generator to power up in right channel mono or left channel mono instead of in stereo, move jumper B on the 8185A Stereo Generator's Card #7 accordingly.

See Fig. 2-3 for jumper positions.

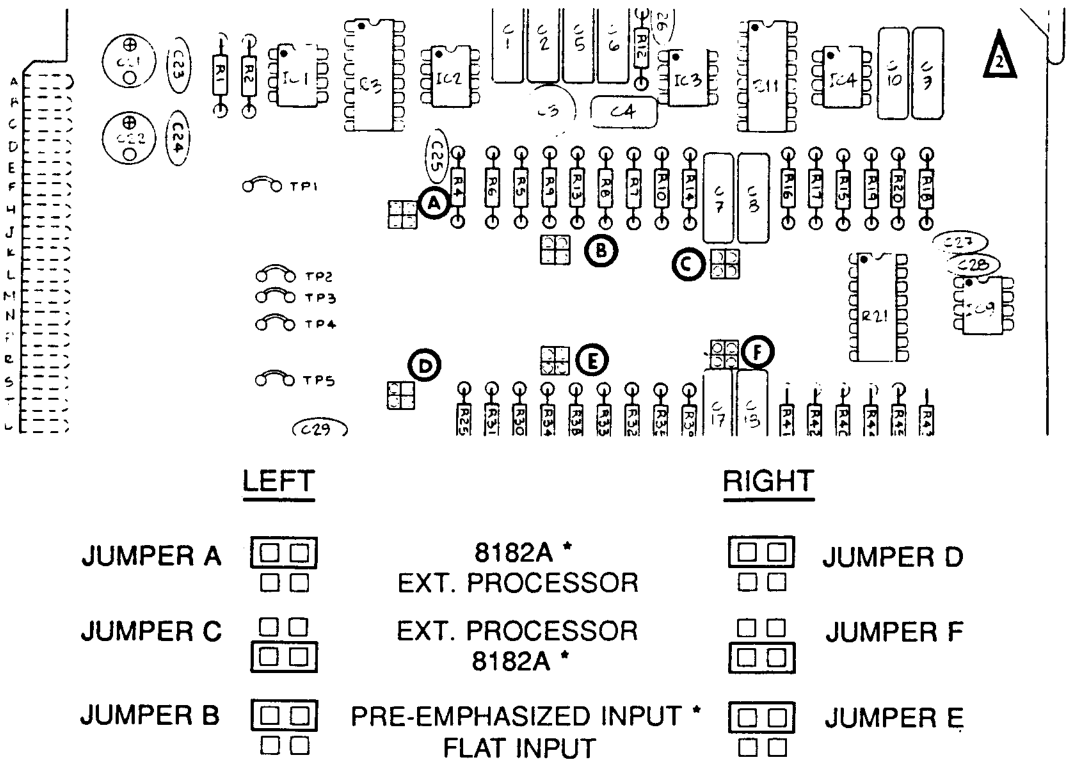
E☐ If you would like the 8185A Stereo Generator to use the right channel for mono input instead of the left, move jumper C on the 8185A Stereo Generator's Card #7 accordingly.

See Fig. 2-3 for jumper positions.

F☐ If you would like make the 8185A Stereo Generator's VU meter a true peak-reading meter, move jumper A on the 8185A Stereo Generator's Meter Resistor Board to the "0ms" position.

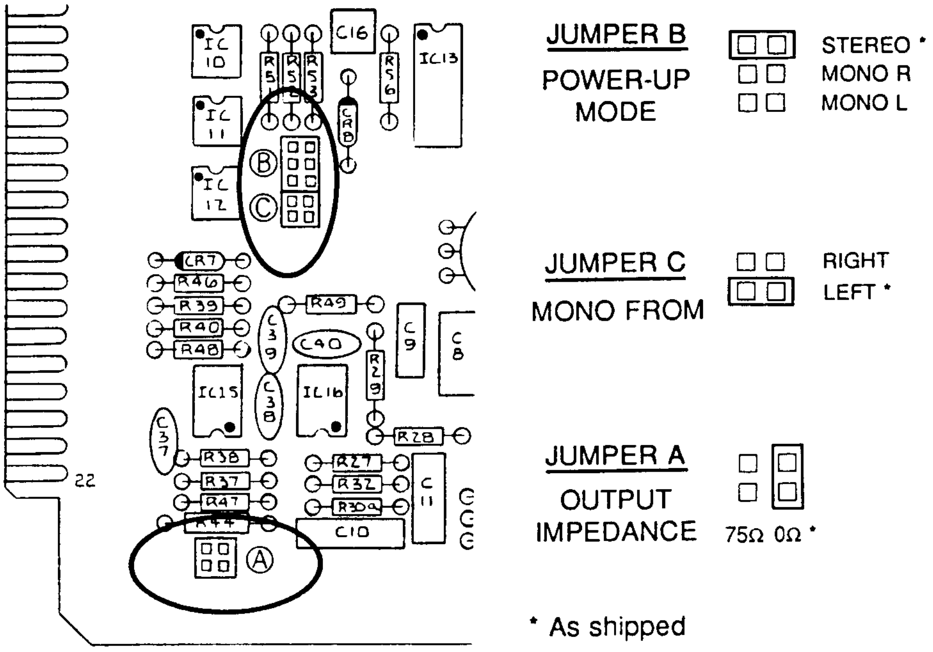
With jumper A in the "0ms" position, the meter will read every transient overshoot from the noise reduction encoder and from the 15kHz low-pass filters. Because such overshoots are so quick that they cause no interference to the video or to other channels, readings of these peaks are not meaningful. With jumper A in the "1.5ms" position (as shipped), the meter reads significant peaks and ignores extremely brief transient overshoots. Even with jumper A in the "1.5ms" position, the meter still responds about 7 times faster than an EBU-standard peak program meter (PPM).

The Meter Resistor Board is mounted on the inside of the front panel. Jumper A is located on the solder side of the board for easy access. See Fig. 2-4 for jumper positions.



* As shipped

Fig. 2-2: Jumper positions, 8185A Stereo Generator Card #2



* As shipped

Fig. 2-3: Jumper positions, 8185A Stereo Generator Card #7

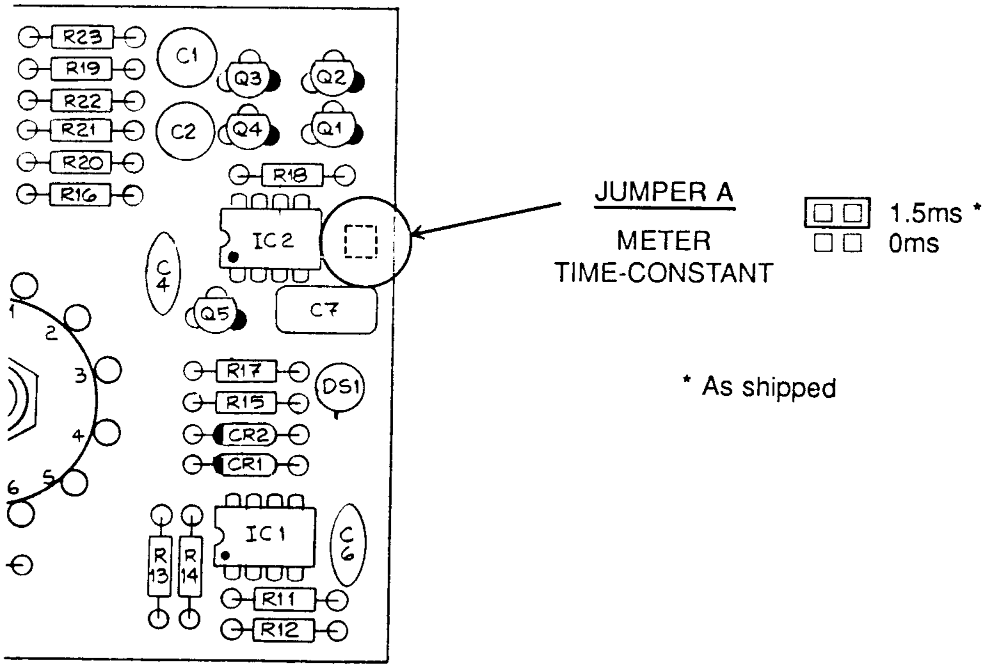


Fig. 2-4: Jumper positions, 8185A Stereo Generator Meter Resistor Board
(Jumper is on solder side — opposite components.)

5) Install 8182A/ST Studio Chassis circuit cards. (optional)

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

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

B☐ Install Card #3TX in the 8182A Audio Processor's slot #3, and install Card #4TX in slot #4.

C☐ Remove the top and bottom covers of the 8182A/ST Studio Chassis, and install circuit cards as shown in Fig. 2-5.

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.

D☐ Replace the top and bottom covers of the 8182A/ST Studio Chassis.

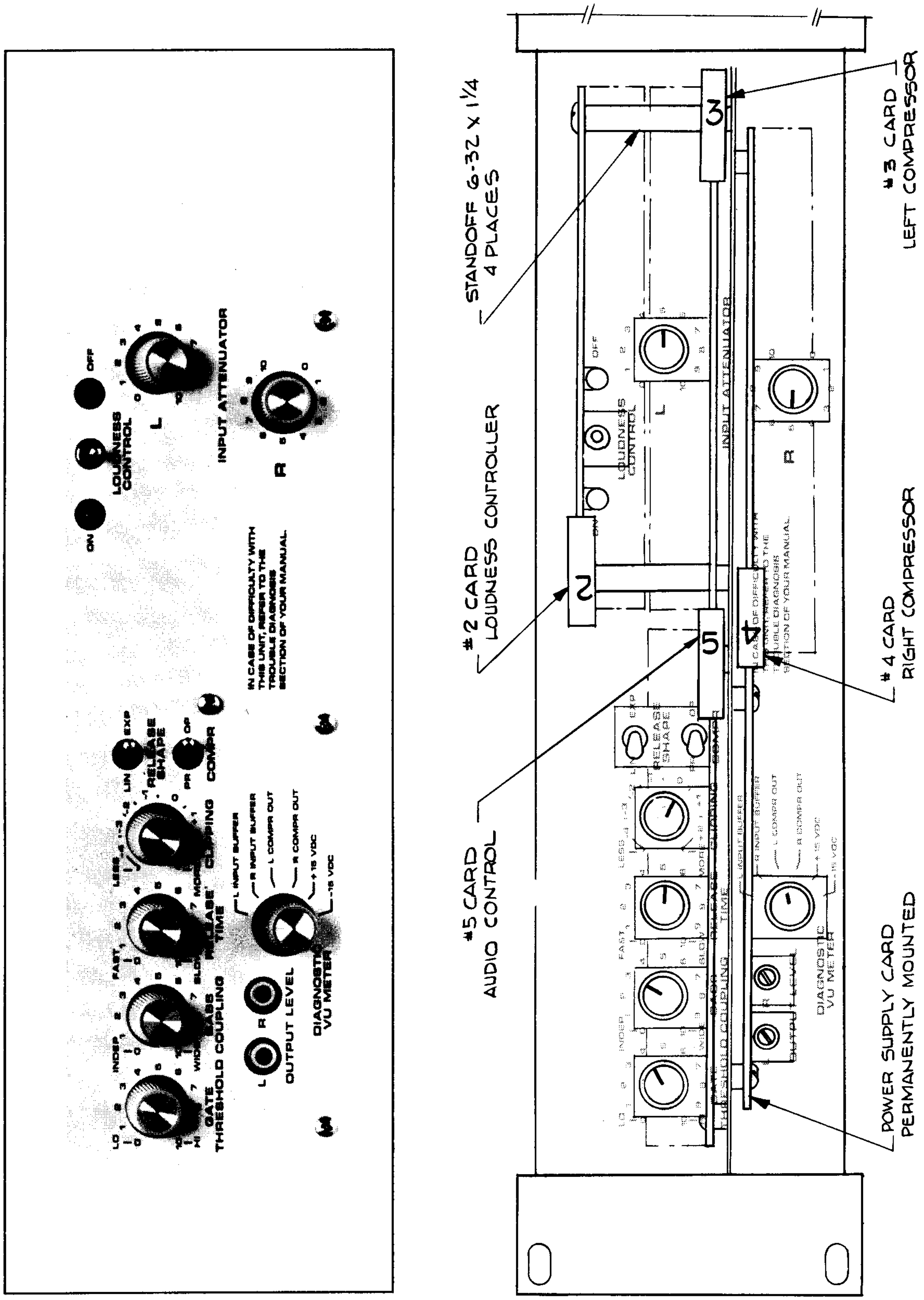


Fig. 2-5: Card Positions, 8182A/ST Studio Chassis

6) Reconfigure 8182A Audio Processor.

[Skip this step if you are not using Orban's 8182A Audio Processor.]

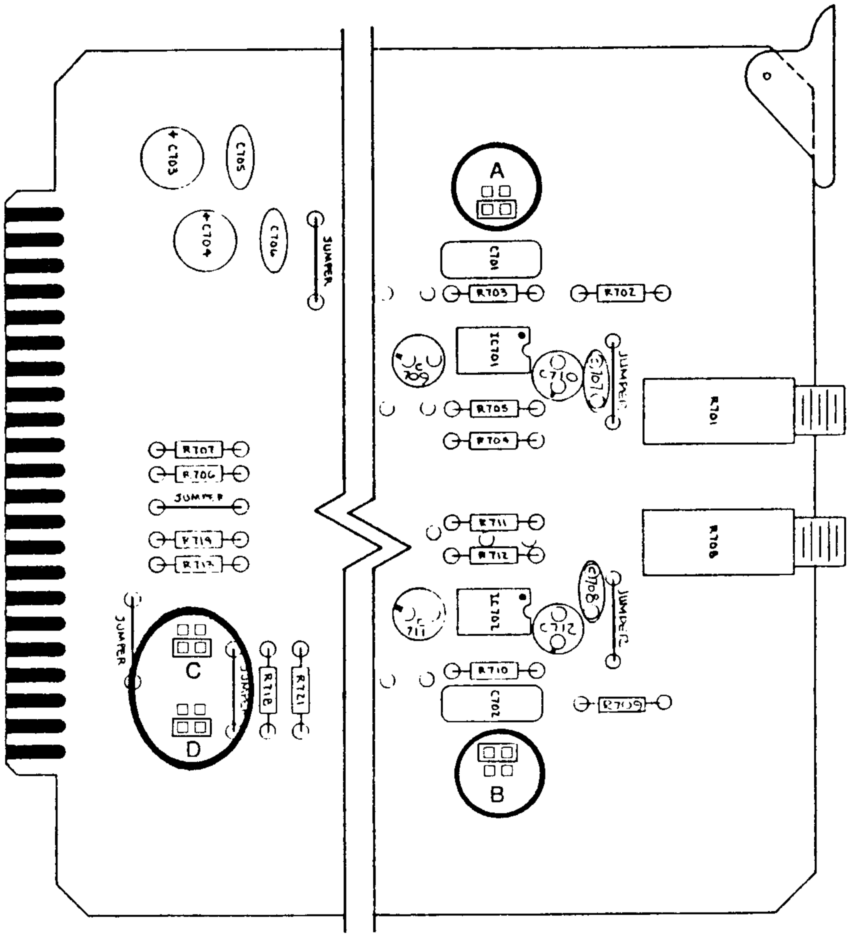
A☐ On the 8182A Audio Processor's Card #7, reposition jumpers A, B, C, and D as shown in Fig. 2-6.

Note that the correct jumper positions for use with the 8185A Stereo Generator are not the same positions that are used with Orban's earlier 8182A/SG Stereo Generator.

B☐ Set the 8182A's rear-panel STEREO GENERATOR switch to IN.

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

C☐ *Only if the serial number of your 8182A Audio Processor is below 780000* will you need to rewire its ACCESSORY PORT (see page 2-28).



JUMPER A — LEFT OUTPUT

□□ FLAT (as shipped)

[□□] PRE-EMPHASIZED

JUMPER B — RIGHT OUTPUT

[□□] PRE-EMPHASIZED

□□ FLAT (as shipped)

JUMPER C — LEFT OUTPUT

□□ SUM OUT

[□□] L OUT (as shipped)

JUMPER D — RIGHT OUTPUT

□□ DIFFERENCE OUT

[□□] R OUT (as shipped)

Fig. 2-6: Jumper Positions, 8182A Audio Processor Card #7

7) Zero VU meters.

A☐ Set the 8185A Stereo Generator's (and, if used, the 8182A Audio Processor's) VU meter selector to one of the unlabeled positions.

B☐ Mechanically zero the VU meter(s).

8) Reassemble units.

A☐ Replace the subpanel and close the front panel of the 8185A Stereo Generator (and of the 8182A Audio Processor, if used).

Be sure that all four fasteners on the subpanel are engaged, since the subpanel is an integral part of the unit's RF shielding.

The DZUS fasteners turn only ¼-turn. Don't force them, lest they be damaged in a way that is very time consuming to repair.

9) Mount and ground units.

A☐ Mount the 8185A Stereo Generator (and 8182A Audio Processor and 8182A/ST Studio Chassis, if used) in appropriate racks.

The 8185A Stereo Generator is ordinarily located close to the transmitter's aural exciter or wideband composite microwave subcarrier generator. If used with the 8182A Audio Processor, the 8185A Stereo Generator must be mounted immediately above (or below) the 8182A. The 8182A/ST Studio Chassis, when used, is located in the studio.

B☐ Connect the 8185A Stereo Generator's circuit ground to the station's RF system ground.

C☐ Connect the chassis ground jumper that is attached to the back of the 8185A Stereo Generator to the audio processor's chassis.

If you are using the 8182A Audio Processor, connect the ground jumper to one of the screws circled in black on the 8182A Audio Processor's rear panel.

D☐ To drive a *balanced* exciter input, connect the 8185A Stereo Generator's circuit and chassis grounds to each other at the rear-panel terminals (as shipped).

If you are using the Orban 8182A Audio Processor, DO NOT connect the 8182A Audio Processor's circuit and chassis ground terminals together.

E☐ To drive an *unbalanced* exciter input, DO NOT connect the 8185A Stereo Generator's chassis and circuit grounds together.

10) Connect the output of the audio processor to the 8185A Stereo Generator's inputs.

If you are using Orban's 8182A Audio Processor, connect the 8182A Audio Processor and 8185A Stereo Generator with the supplied 14-pin interconnect cable.

If you are using other audio processing, feed L and R, ***not*** L−R and L+R audio. Feed either pre-emphasized or "flat" audio (your audio processor and the 8185A Stereo Generator must both be set up for your choice — see step 4).

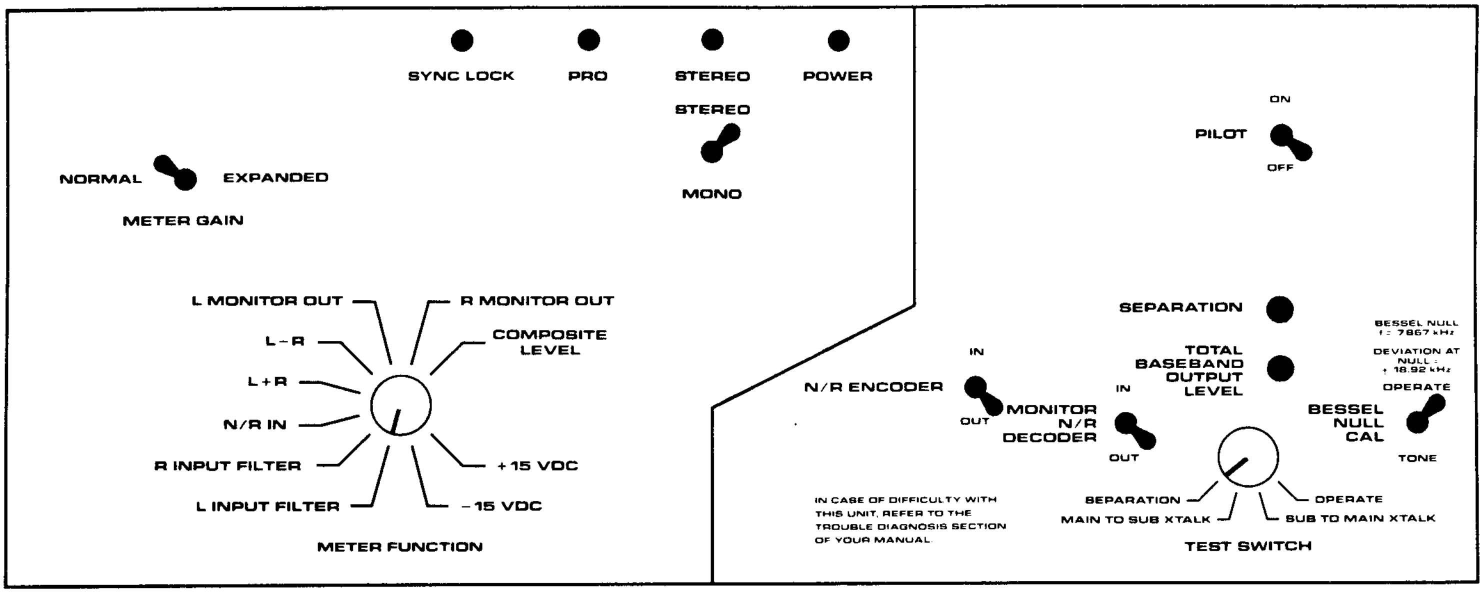
11) Connect sync input.

A☐ Connect sync or composite video to the 8185A 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 8185A 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.

8185A OPTIMOD-TV Stereo Generator:



8182A OPTIMOD-TV Audio Processor:

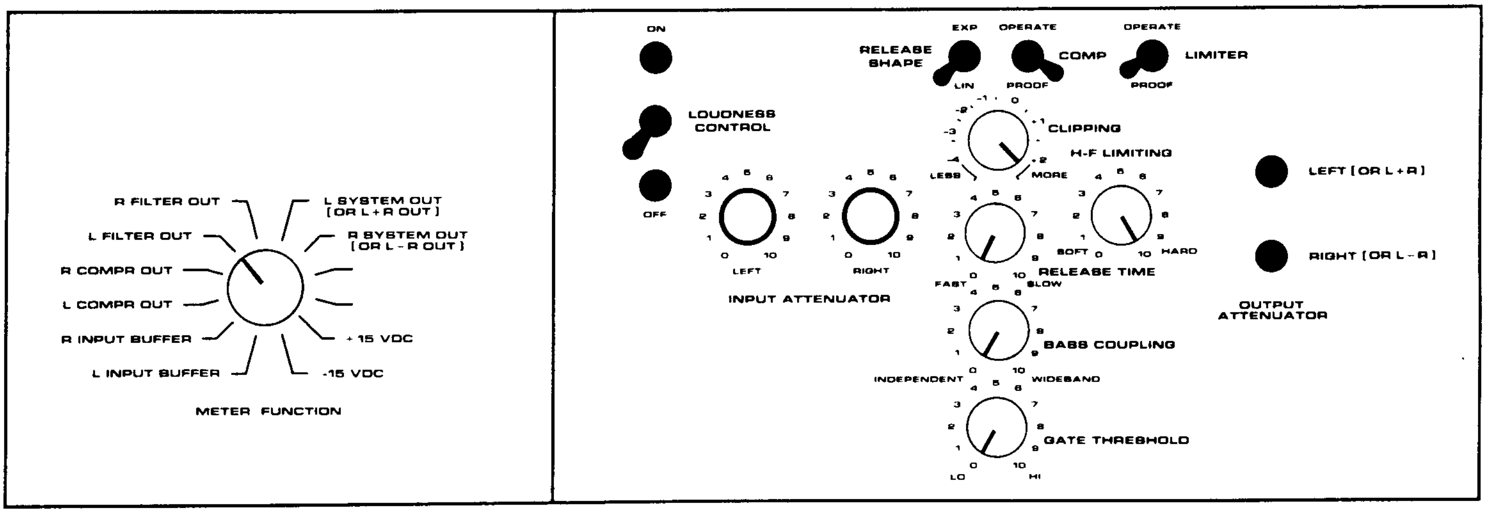


Fig. 2-7: Control Settings for Step 12

12) Match levels of audio processor and 8185A Stereo Generator (with tone).

(Later, when program lines are connected, level-matching can be performed just as effectively with program material as with tone.)

A☐ Set controls as shown in Fig. 2-7. If you are using the 8182A Audio Processor, set its controls as shown in Fig. 2-7.

> **IMPORTANT:** If your audio processor is already installed, record the settings of all controls before proceeding.

B☐ Patch an audio oscillator into the left input of the audio processor. Set the oscillator's frequency to 100Hz.

C☐ Adjust the audio processor to produce a calibrated output equivalent to 100% modulation:

> **8182A Audio Processor** — Adjust the audio oscillator's output level until the 8182A Audio Processor's VU meter reads *exactly* "+3VU".
>
> **Other processors** — Follow manufacturer's instructions.

D☐ Adjust the output level of the audio processor's left channel until the 8185A Stereo Generator's VU meter reads *exactly* "0VU" (100%).

> On the 8182A Audio Processor use the LEFT OUTPUT ATTENUATOR control.

E☐ Disconnect the audio oscillator from the audio processor's left input and connect it to the right input.

> Leave the oscillator's frequency set to 100Hz.

F☐ Set the 8185A Stereo Generator's VU meter selector to R INPUT FILTER. If you are using the 8182A Audio Processor, set its VU meter selector to R FILTER OUT.

G☐ Adjust the audio processor to produce a calibrated output equivalent to 100% modulation:

> **8182A Audio Processor** — Adjust the audio oscillator's output level until the 8182A Audio Processor's VU meter reads *exactly* "+3VU".
>
> **Other processors** — Follow manufacturer's instructions.

H☐ Adjust the output level of the audio processor's right channel until the 8185A Stereo Generator's VU meter reads *exactly* "0VU" (100%).

> On the 8182A Audio Processor use the RIGHT OUTPUT ATTENUATOR control.

I☐ Disconnect the audio oscillator from the audio processor.

13) Verify baseband generator separation.

A☐ Connect an oscilloscope to the 8185A Stereo Generator's COMPOSITE OUTput connector J3.

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

B☐ Set the 8185A Stereo Generator's BESSEL NULL CAL switch to TONE.

C☐ Adjust the 8185A Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control until the oscilloscope indicates a level 0.76V peak-to-peak (0.38V peak).

> This calibrates the output level of the 8185A Stereo Generator to the RS-508 standard of 1.00V peak-to-peak at 100% main channel modulation (±25kHz).

D☐ Set the 8185A Stereo Generator's BESSEL NULL CAL switch to OPERATE.

E☐ Set the 8185A Stereo Generator's VU meter selector to L INPUT FILTER. If you are using the 8182A Audio Processor, set its VU meter selector to L FILTER OUT.

F☐ Patch the audio oscillator into the audio processor's left input. Set the oscillator's frequency to 1kHz, and adjust its output level until the 8185A Stereo Generator's VU meter reads between "−3VU" and "0VU".

G☐ Adjust the audio oscilloscope's timebase, vertical sensitivity, and trigger controls to obtain a display like the one in Fig. 2-8.

H☐ Verify that the baseline is flat.

> A flat baseline indicates that the stereo baseband encoder section of the 8185A Stereo Generator is adjusted for best separation. If your 8185A Stereo Generator is "factory fresh" and the baseline appears to be curved, check it on another oscilloscope before assuming that the 8185A 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 8185A Stereo Generator's SEPARATION control. Increase the scope's vertical gain to see the baseline more clearly.

I☐ Set the audio oscillator to 50Hz, and re-adjust its output level until the 8185A Stereo Generator's VU meter reads between "−3VU" and "0VU".

J☐ Verify that the baseline is flat.

K☐ Set the audio oscillator to 15kHz, and re-adjust its output level until the 8185A Stereo Generator's VU meter reads between "−3VU" and "0VU".

L☐ Verify that the baseline is flat.

> If the baseline is not flat at 15kHz or 50Hz, but was flat at 1kHz, it is highly probable that the scope you are using is not sufficiently accurate to be used in the following verification of separation through the transmitter (see step 15). Get a scope that shows a flat baseline at 50Hz and 15kHz before continuing. (Remember that the scope must be DC-coupled; do *not* use an attenuator probe!)

M☐ Disconnect the oscilloscope.

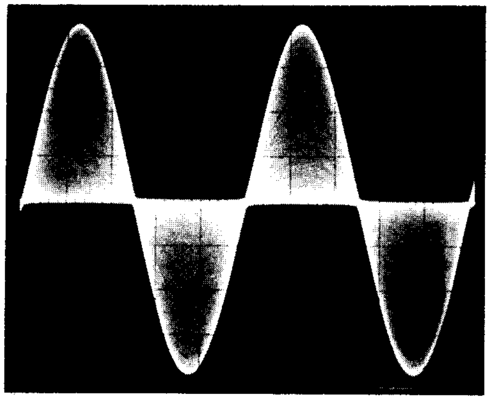


Fig. 2-8: Oscilloscope Display for Steps 13 and 15

Connect 8185A Stereo Generator to exciter.

To feed one exciter, connect the 8185A 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 8185A Stereo Generator'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 "T" (J-P-J) adapters on the 8185A 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 8185A Stereo Generator's Card #7 *must* be in the "0Ω" position.

The 8185A 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.

14) Verify transmitter sensitivity.

A☐ Set the 8185A Stereo Generator's BESSEL NULL CAL switch to TONE.

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

C☐ With a mono or stereo modulation monitor, verify that your main-channel modulation (re ±25kHz) is between 50% and 100%.

If it is not, adjust the aural exciter's composite input level control until the modulation monitor indicates 75% main-channel modulation.

D☐ Set the 8185A Stereo Generator's BESSEL NULL CAL switch to OPERATE.

15) Verify separation through transmitter.

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

A☐ Verify that the controls are set as shown in Fig. 2-7.

B☐ Set the audio oscillator's frequency to 1kHz, and adjust its output level until the 8185A Stereo Generator's VU meter reads between "–3VU" and "0VU".

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

D☐ 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. Is your scope accurate enough? — see step 13-L.

E☐ Adjust the oscilloscope's timebase, vertical sensitivity, and trigger controls to obtain a display like the one in Fig. 2-8.

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 8185A 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
D = peak-to-peak deviation from perfect flatness in volts
P = peak-to-peak level of the total baseband in volts

If separation is less than 40dB after adjusting the SEPARATION control, the most likely cause is bandwidth limitations in the transmission path. Diplexers are particularly suspect. If this is the case, separation at 15kHz (measured in step G, below) will be much worse than it is at 1kHz.

F☐ Set the audio oscillator's frequency to 50Hz, adjust the audio oscillator's output level until the 8185A Stereo Generator's VU meter reads between "–3VU" and "0VU", then adjust the oscilloscope's timebase, vertical sensitivity, and trigger controls to obtain a display like the one in Fig. 2-8.

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 8185A Stereo Generator's SEPARATION *control to try to correct loss of separation at 50Hz.*

G☐ Set the audio oscillator's frequency to 15kHz, adjust the audio oscillator's output level until the 8185A Stereo Generator's VU meter reads between "−3VU" and "0VU", then adjust the oscilloscope's timebase, vertical sensitivity, and trigger controls to obtain a display like the one in Fig. 2-8.

> If the baseline was flat at 1kHz and 50Hz, but is now curved at 15kHz, the problem probably is insufficient bandwidth in the exciter, RF amplifier, or diplexer.
>
> *DO NOT readjust the 8185A Stereo Generator's* SEPARATION *control.*

H☐ Disconnect the oscilloscope.

16) Match 8185A Stereo Generator to exciter (Bessel null).

A☐ Set the 8185A's controls as shown in Fig. 2-9.

B☐ 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, adjust the 8185A Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control to obtain 75.7% modulation (referenced to ±25kHz deviation) as indicated on your mono modulation monitor, or 75.7% main channel modulation as indicated on your stereo modulation monitor. (This is a crude method, since most modulation monitors are not accurate enough for this adjustment; errors can result in loss of stereo separation and possibly in non-compliance with FCC/DOC deviation specifications.)

C☐ Turn the 8185A Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control fully counterclockwise (up to 18 full turns).

D☐ Slowly turn the 8185A Stereo Generator'sTOTAL BASEBAND OUTPUT LEVEL control clockwise until the carrier nulls for the *first* time (see Fig. 2-10).

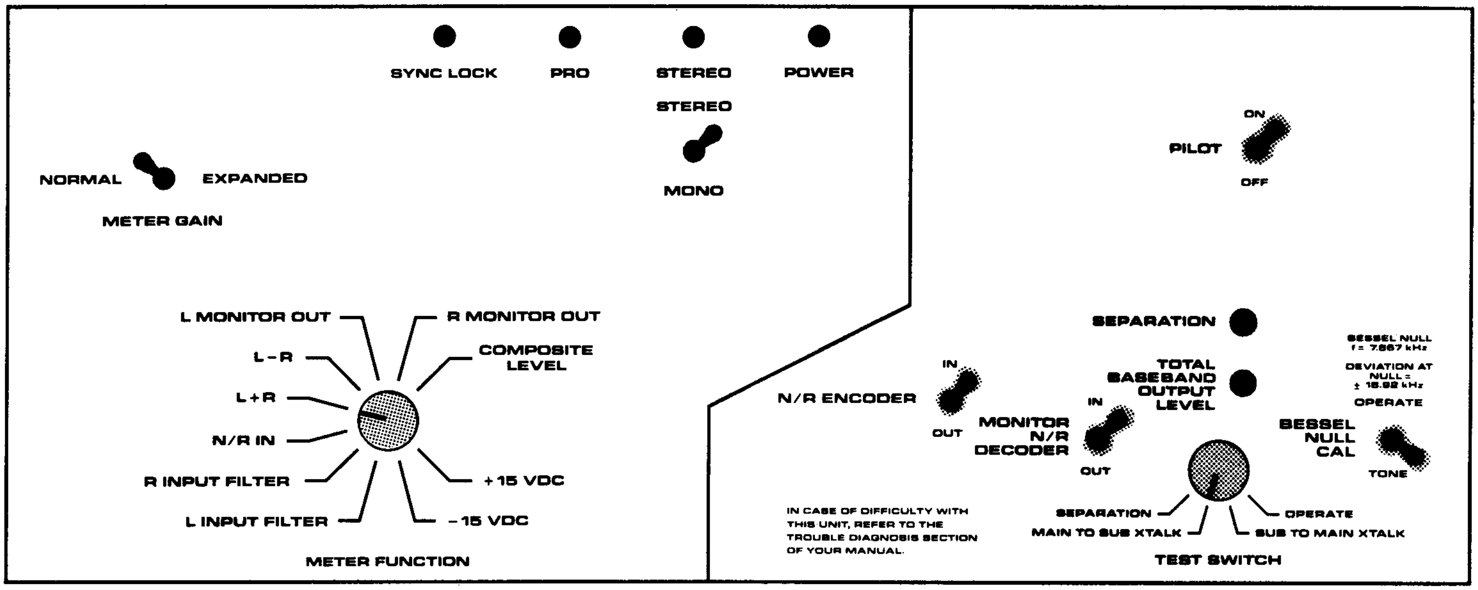
> The 8185A Stereo Generator produces a 7.867kHz (½H) Bessel tone, which results in a first Bessel null at ±18.918kHz deviation. This is 75.673% modulation re ±25kHz carrier deviation. The internal level of the tone has been set so that very accurate (±0.1%) calibration of the noise reduction encoder to exciter deviation gain is possible. **Note, however,** that 100% L+R modulation (±25kHz deviation) is *not* produced, and that this tone *cannot* be used to align certain manufacturers' "stereo reference decoders" that require a reference tone at 100% modulation.

E☐ *If you are feeding more than one exciter,* connect the RF spectrum analyzer to a sample of the second exciter's output, turn the second exciter on, and then adjust the second exciter's composite input level control to achieve the first Bessel null. Adjust additional exciters in the same way.

> **Do not change** the setting of the 8185A Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control.

NOTE: The level relationship between the 8185A Stereo Generator and the exciter(s) is now precisely set. **DO NOT ALLOW THIS RELATIONSHIP TO CHANGE.** *Do not readjust* the 8185A Stereo Generator's TOTAL BASEBAND OUTPUT LEVEL control. Such changes will cause errors in tracking between the dbx® noise reduction in the 8185A Stereo Generator and that in the receiver, leading to rapid deterioration of separation.

8185A OPTIMOD-TV Stereo Generator:



Only shaded controls are set differently than in the last control settings figure.

Fig. 2-9: Control Settings for Step 16

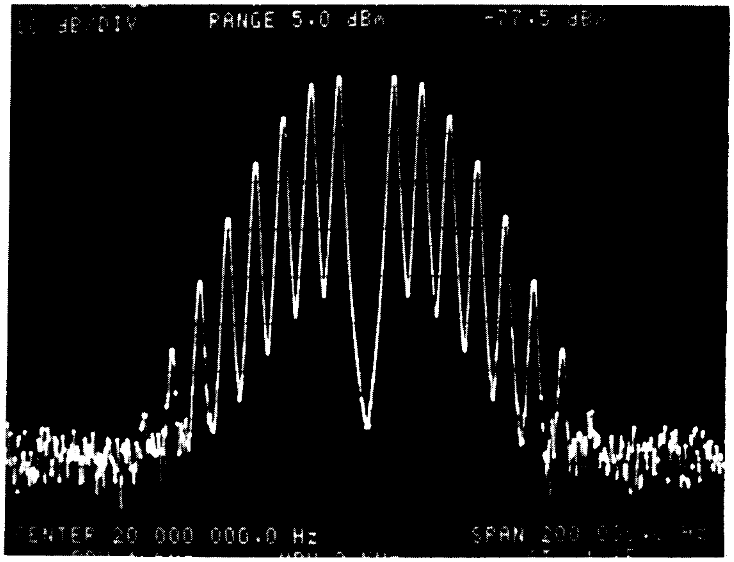


Fig. 2-10: Bessel Null (see step 16)

17) Match levels of the 8182A Audio Processor and the 8182A/ST Studio Chassis.

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

A☐ Set controls as shown in Fig. 2-11.

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.

B☐ Patch an audio oscillator into the L INput of the 8182A/ST Studio Chassis. Set the oscillator's frequency to 1kHz, and adjust its output level until the TOTAL MASTER G/R meter on the 8182A/ST Studio Chassis reads "0dB".

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

C☐ Adjust the 8182A/ST 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 2-22.

Land lines — USA-standard land lines are not pre-emphasized and require a nominal drive level of +8dBm. Turn the 8182A/ST 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 8182A/ST Studio Chassis' OUTPUT LEVEL controls fully clockwise.

STL WITH METER — Adjust the 8182A/ST 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).

D☐ Adjust the 8182A 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.

E☐ Disconnect the audio oscillator from the L INput of the 8182A/ST Studio Chassis and connect it to the R INput.

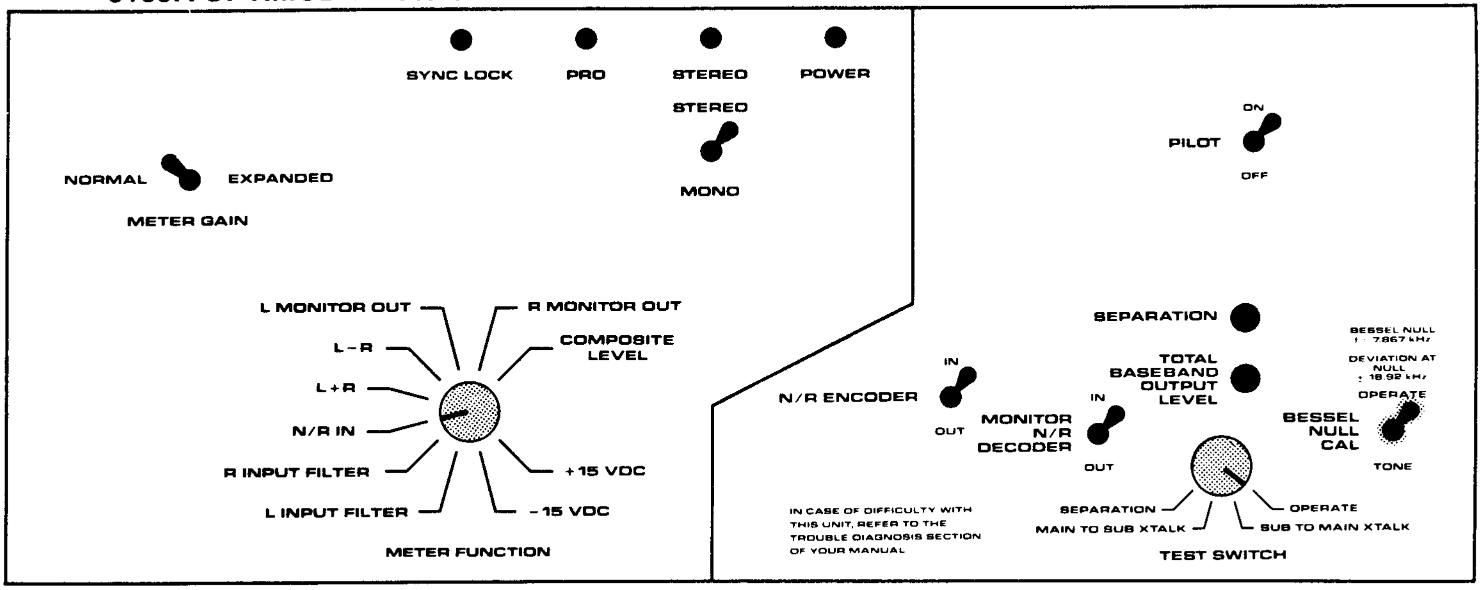
F☐ Adjust the oscillator's output level until the 8182A/ST Studio Chassis' TOTAL MASTER G/R meter reads"0dB".

G☐ Set the 8182A Audio Processor's VU meter selector to R COMPR OUT.

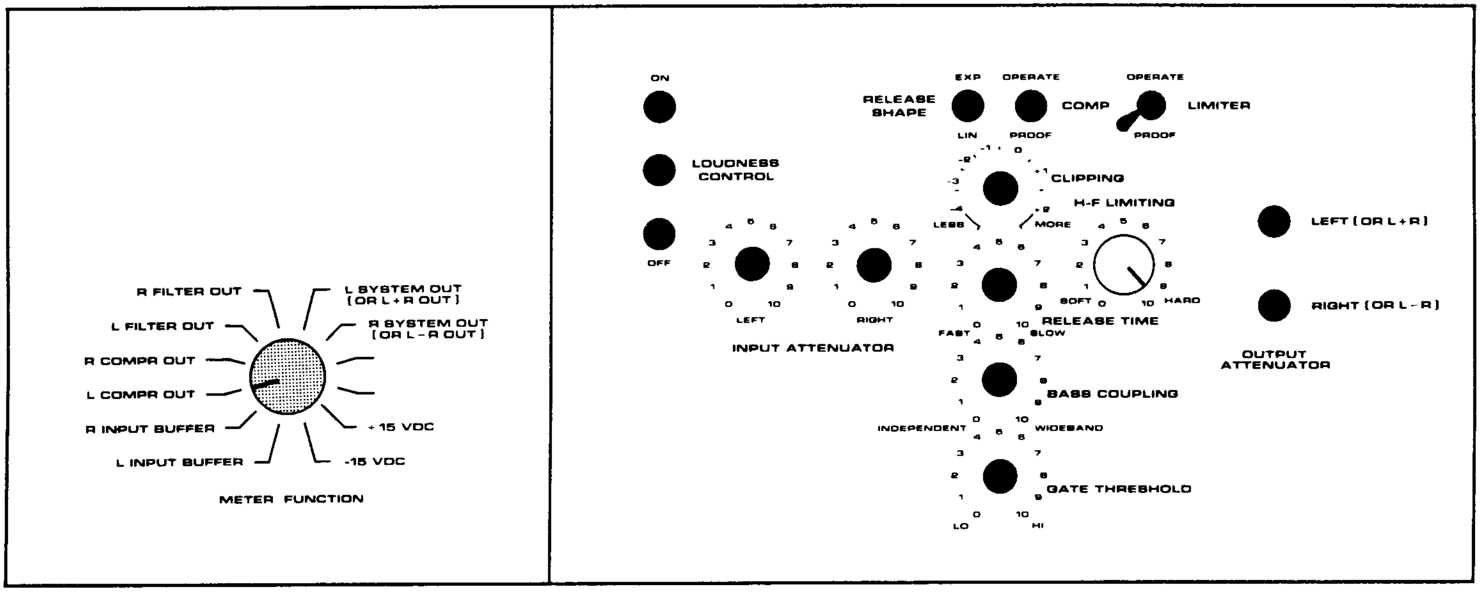
H☐ Adjust the 8182A/ST Studio Chassis' R OUTPUT LEVEL control and the 8182A Audio Processor's RIGHT INPUT ATTENUATION control as in steps 17-C and D, above.

I☐ Disconnect the oscillator.

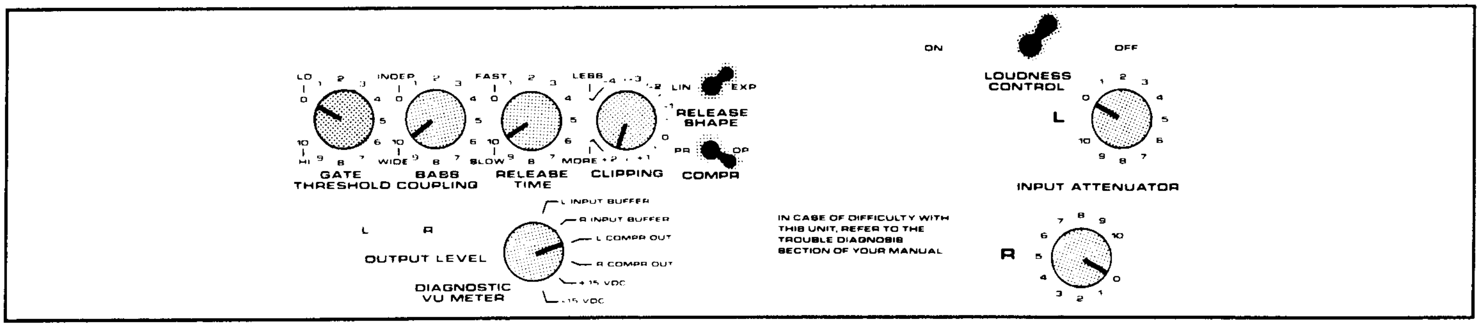
8185A OPTIMOD-TV Stereo Generator:



8182A OPTIMOD-TV Audio Processor:



8182A/ST OPTIMOD-TV Studio Chassis:



Only shaded controls are set differently than in the last control settings figure.

Fig. 2-11: Control Settings for Step 17

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 8182A/ST Studio Chassis' OUTPUT LEVEL controls, instead of those in step 17-C.

1) Feed wideband program audio into the L INput of the 8182A/ST Studio Chassis.

2) Adjust the 8182A/ST Studio Chassis' L INPUT ATTENUATOR control until the 8182A/ST Studio Chassis' TOTAL MASTER G/R meter reads "0dB".

3) Turn the 8182A 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 8182A/ST Studio Chassis' L OUTPUT LEVEL control until none of the audio waveform peaks observed on the oscilloscope exceed ½ of the clipping level measured in step 5 on this page.

   The 8182A/ST 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 8182A Studio Chassis' L INput. Set the oscillator's frequency to 1kHz.

8) Adjust the 8182A/ST Studio Chassis' L INPUT ATTENUATOR control until the 8182A/ST Studio Chassis' TOTAL MASTER G/R meter reads "0dB".

9) Measure the 8182A/ST Studio Chassis' left output level.

10) Connect an audio oscillator to the 8182A/ST Studio Chassis' R INput. Set the oscillator's frequency to 1kHz.

11) Adjust the 8182A/ST Studio Chassis' R INPUT ATTENUATOR control until the 8182A/ST Studio Chassis' TOTAL MASTER G/R meter reads "0dB".

12) Adjust the 8182A/ST Studio Chassis' R OUTPUT LEVEL control until the 8182A/ST Studio Chassis' right output level is the same as that measured for the left output in step 9 on this page.

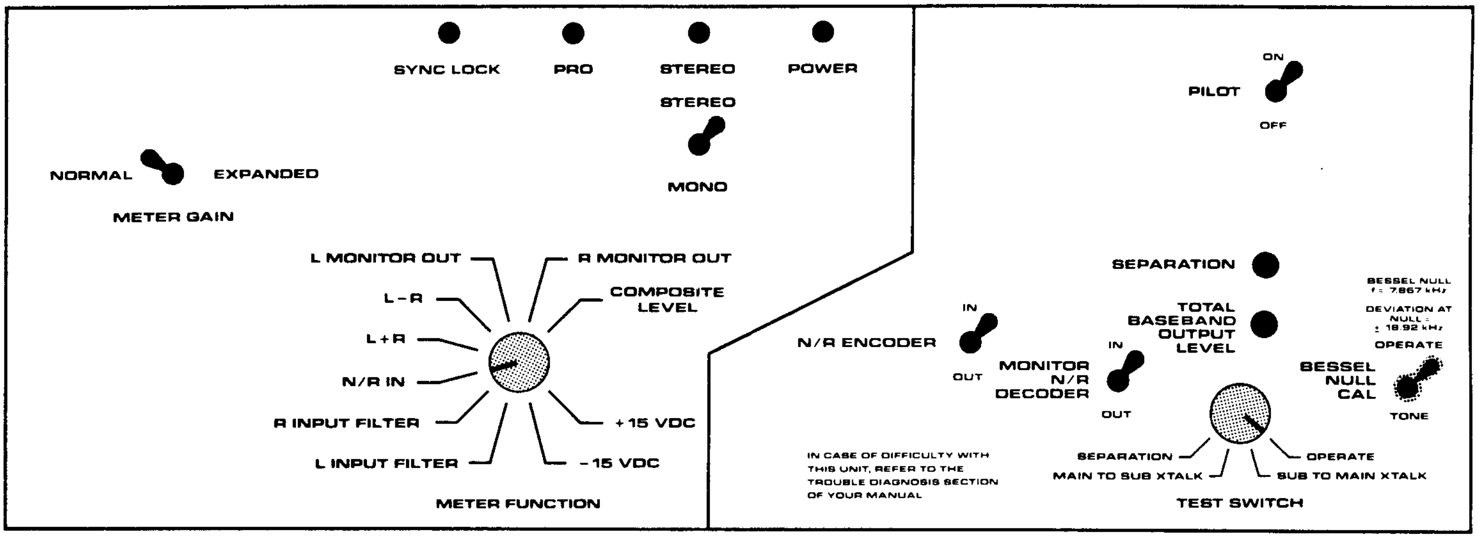
19) Connect audio inputs and outputs.

A☐ Connect the audio program lines to the audio processor's audio inputs.

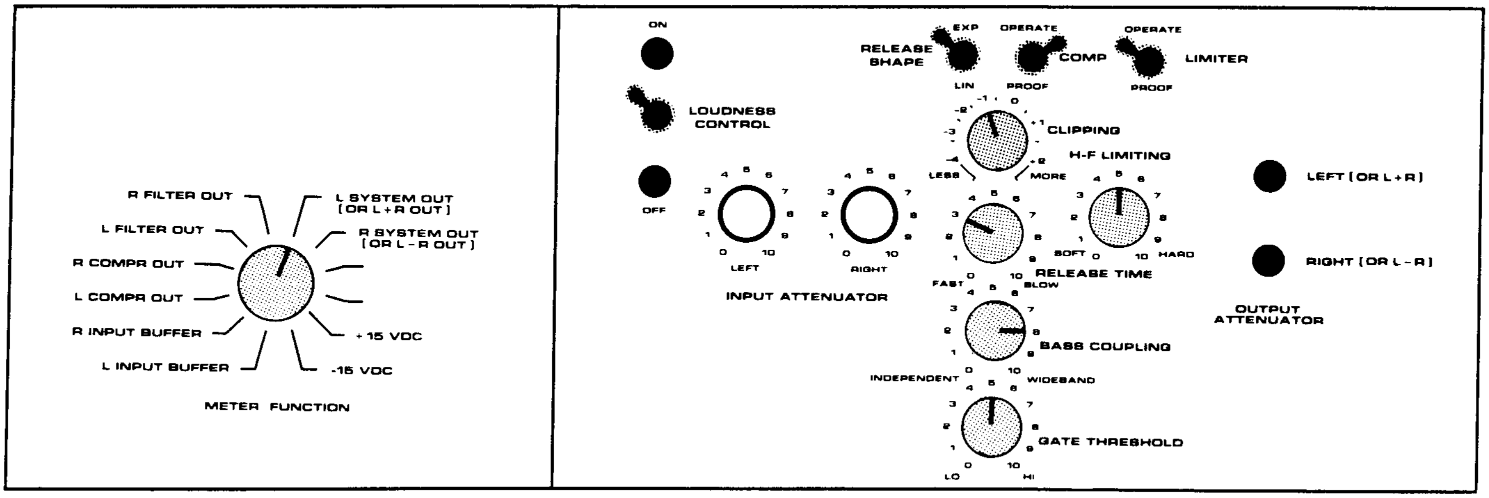
In a ***high RF radiation field***, run fully-balanced audio to the audio processor in 100% foil-shielded twisted-pair cable (e.g., Belden 8451). Connect the shield to chassis ground at the source; connect the shield through a 470pF disc capacitor with leads less than 1/4-inch long to the audio input chassis ground 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.

8185A OPTIMOD-TV Stereo Generator:



8182A OPTIMOD-TV Audio Processor:



Only shaded controls are set differently than in the last control settings figure.

Fig. 2-12: Control Settings for Step 20
(normal operation)

20) Adjust input level with program material.

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

A☐ If you are using the 8182A Audio Processor, set its controls as shown in Fig. 2-12. If you are not using the 8182A Audio Processor, set your processor's controls for normal operation according to the manufacturer's instructions.

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 level until its gain reduction meter indicates the normal operating level, according to the manufacturer's instructions. If you are using the 8182A Audio Processor, adjust its 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 Operating Manual for further information.

E☐ Adjust the audio processor's right input level until the 8185A Stereo Generator's VU meter nulls.

F☐ Set the 8185A Stereo Generator's METER GAIN switch to EXPANDED and fine-adjust the null.

G☐ Reset the METER GAIN switch to NORMAL.

21) Adjust input level with program material.
(with Studio Chassis)

[Skip this step unless you are using the optional 8182A/ST Studio Chassis.]

A☐ Set the controls as shown in Fig. 2-13.

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

C☐ Drive the 8182A/ST Studio Chassis with typical audio at your usual operating level. Peak switcher output meters at 0VU.

D☐ Adjust the 8182A/ST 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 Operating Manual for further information.

E☐ Set the 8182A/ST Studio Chassis' DIAGNOSTIC VU METER switch to L COMPR OUT. Note the VU meter reading.

F☐ Set the 8182A/ST Studio Chassis' DIAGNOSTIC VU METER switch to R COMPR OUT, then adjust the 8182A/ST Studio Chassis' R INPUT ATTENUATOR control until the VU meter reads the same as noted in step e.

A more precise adjustment can be made if an operator is available to observe the 8185A Stereo Generator or if a BTSC stereo monitor is available at the studio:

G☐ Adjust the 8182A/ST Studio Chassis' RIGHT INPUT ATTENUATOR control until the 8185A Stereo Generator's VU meter nulls. Then set the 8185A 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.

22) 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 audio processor 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-60A 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. (As this is being written, the BTSC is working on standards for peak flasher dynamics that will permit the flashers to be used for accurate operational monitoring of modulation while ignoring overshoots inherent in the definition of the BTSC system. We expect that all BTSC monitors will eventually incorporate such standardized dynamic response, which will eliminate the problem described above.)

If you want to adjust modulation, use your audio processor's output level controls — DO NOT READJUST THE 8185A STEREO GENERATOR's TOTAL BASEBAND OUTPUT LEVEL CONTROL! Because the 8185A Stereo Generator's VU meter indicates peaks with accuracy greater than ±2.5% when the VU meter selector is set to L or R INPUT FILTER, it can be used to accurately set modulation with either tone or program material. (See step 3 on page 2-2 for instruction for setting levels with program material.)

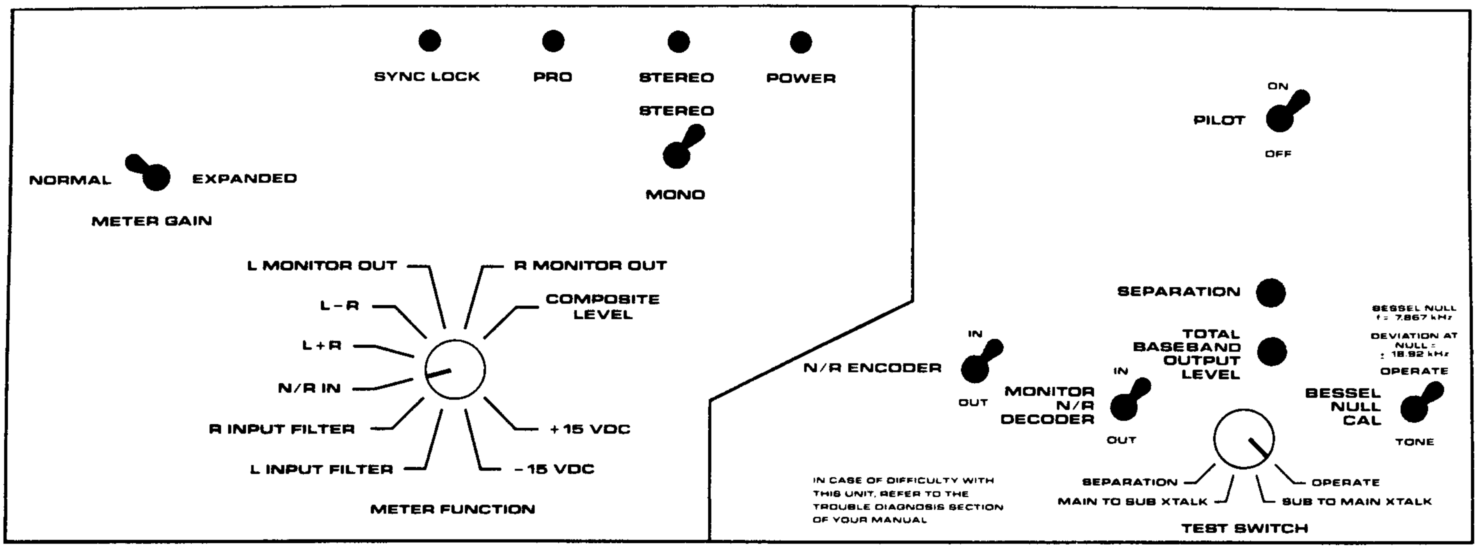
23) Verify audio quality of air sound.

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

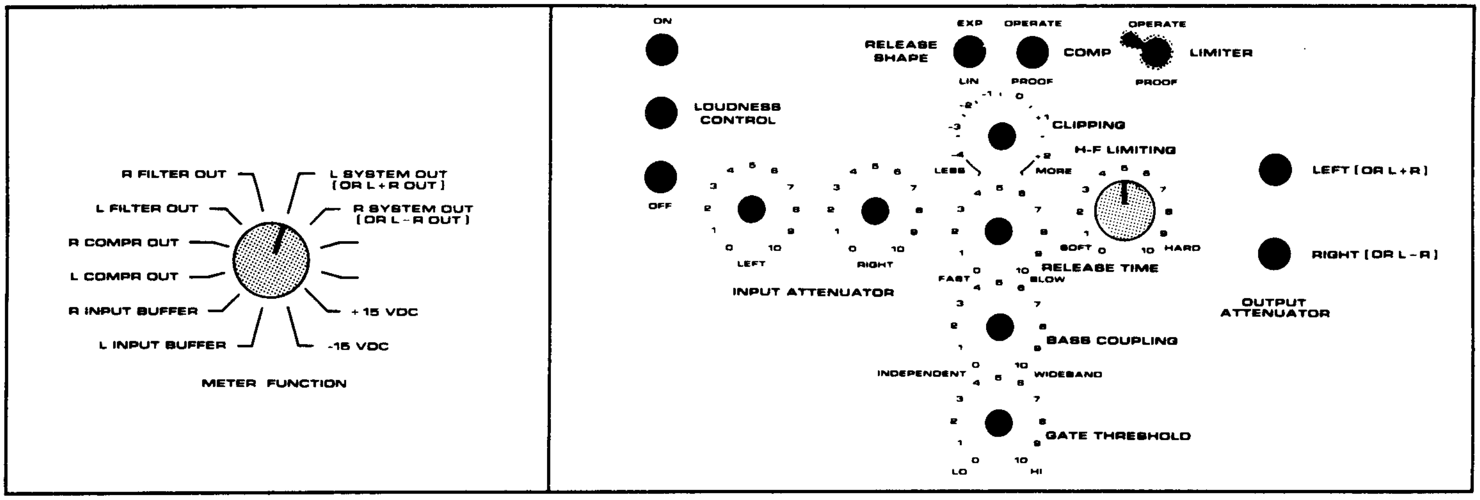
24) Complete the Registration Card and return it to Orban (please).

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

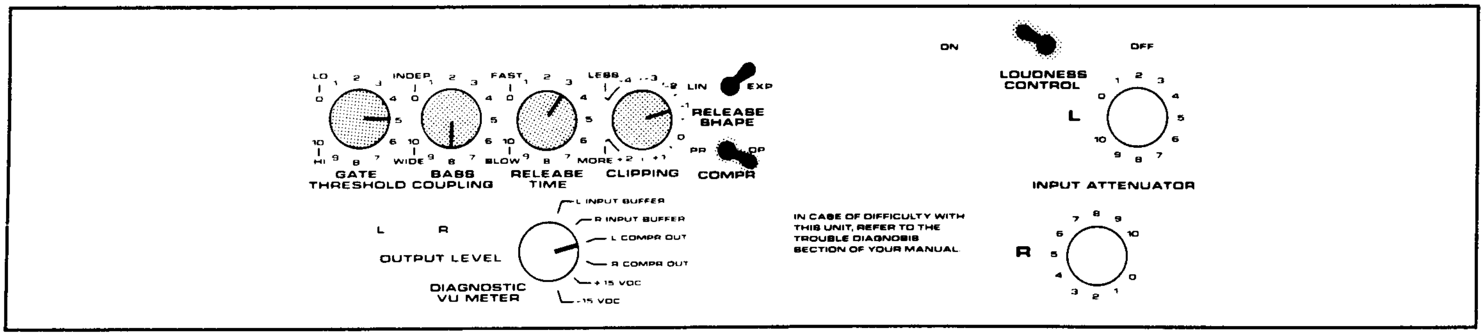
8185A OPTIMOD-TV Stereo Generator:



8182A OPTIMOD-TV Audio Processor:



8182A/ST OPTIMOD-TV Studio Chassis:



Only shaded controls are set differently than in the last control settings figure.

Fig. 2-13: Control Settings for Step 21
(normal operation)

That's it!

The 8185A OPTIMOD-TV Stereo Generator is matched to the exciter for best separation. It will not require frequent adjustment.

If you have also installed the 8182A OPTIMOD-TV Audio Processor, it 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.

Rewiring the 8128A Accessory Port

This procedure is *only* for 8182A OPTIMOD-TV Audio Processors with serial numbers below 780000.

Allow about 45 minutes for this procedure.

You will need a low-wattage soldering iron, rosin-core solder, a solder removal tool (spring-loaded suction type), and general tools. You will also need the following parts, which are supplied with each 8185A OPTIMOD-TV Stereo Generator, and as Retrofit Kit RET-035:

2	Jumpers, white
4	Wires, pre-cut and stripped
2	Lengths of tubing, 1/16-inch diameter

Fig. 2-15 supersedes the drawing in Appendix G of the 8182A Operating Manual (you may want to insert a copy of the new drawing in place of the old).

1) Disconnect the 8182A Audio Processor and remove it from the rack.

2) Remove the eight screws that attach the top cover to the rear panel of the 8182A Audio Processor. Also remove the eight screws that attach the bottom cover to the rear panel.

3) Set the unit on a padded surface with the rear panel facing you and the bottom cover down.

   Leave about 6 inches (15cm) between the rear panel and the edge of the table. Be sure the AC power cord is unplugged.

4) Remove the three groups of three screws circled in black on the rear panel.

5) *Very carefully* pull the rear panel about 3/4-inch (2cm) toward you, and then tilt the top of the rear panel down until the rear panel is horizontal.

   Careful! Watch for snags in the wiring or stress on the ceramic capacitors on the internal divider wall or RF box. These capacitors are very fragile and are difficult to replace.

6) Remove the jumper between solder forks E1 and E2 on the motherboard. Clear excess solder from the forks with the suction tool.

   See Fig. 2-14 for solder fork locations. All E-series solder forks in this procedure are located on the 8182A Audio Processor's motherboard.

7) Remove the jumper between solder forks E3 and E4 on the motherboard. Clear excess solder from the forks with the suction tool.

8) Unsolder the white/blue wire and the violet wire connected to solder fork E21. Clear excess solder from the fork with the suction tool.

9) Solder the white/blue wire just disconnected from E21 to solder fork E2. (Leave room for another wire).

10) Solder the violet wire just disconnected from E21 to the motherboard solder point for pin W of the Card #7 connector.

    Pin W is the fourth pin up from the bottom.

11) Unsolder the blue wire connected to solder fork E23. Clear excess solder from the fork with the suction tool.

12) Solder the blue wire just disconnected from E23 to solder fork E1.

13) Unsolder the gray wire connected to solder fork E25. Clear excess solder from the fork with the suction tool.

14) Solder the gray wire just disconnected from E25 to solder fork E3.

15) Unsolder the white/gray wire and the brown wire connected to solder fork E20. Clear excess solder from the fork with the suction tool.

16) Solder the white/gray wire just disconnected from E20 to solder fork E4.

17) Solder the brown wire just disconnected from E20 to solder fork E22.

18) Solder one end of the shorter of the two supplied jumpers to solder fork E21. Solder the other end to E23.

19) Solder one end of the longer supplied jumper to solder fork E20. Solder the other end to E25.

20) Unsolder and discard the wires connecting the rear-panel AUDIO TEST JACKS to the switch immediately below them.

    Careful! Don't get any solder flux into the switch.

21) Solder one end of the supplied white/blue wire to solder fork E2.

22) Solder one end of the supplied white/gray wire to solder fork E4.

23) Twist the white/blue and white/gray wires together, then slip one of the supplied pieces of tubing over each of the wires.

24) Solder the other end of the supplied white/blue wire to pin 4 of ACCESSORY PORT # 1 connector J3 on the inside of the rear panel.

    It may be convenient to "sweat" solder on the J3 connections: fill a solder cup with solder, let it cool, then re-heat it and place the supplied pre-tinned wire in the cup.

25) Solder the other end of the supplied white/gray wire to pin 6 of ACCESSORY PORT # 1 connector J3 on the inside of the rear panel.

26) Slip the tubing over the J3 connections.

27) Solder one end of the supplied yellow wire to solder fork E21.

28) Solder one end of the supplied red wire to solder fork E20.

29) Twist the yellow and red and wires together.

30) Solder the other end of the supplied yellow wire to L AUDIO JACK J1 on the inside of the rear panel.

31) Solder the other end of the supplied red wire to R AUDIO JACK J2 on the inside of the rear panel.

32) Check your work carefully against Fig. 2-15.

    You can test your work by applying a 400Hz signal at about 1 volt to the left input. Set the COMP and LIMITER controls to PROOF, the NOISE REDUCTION switch on the rear panel to OUT, and the VU meter selector to L FILTER OUT. Turn the LEFT INPUT ATTENUATOR control and verify that the VU meter reading varies as you turn the control. Set the VU meter selector to L SYSTEM OUT and verify that there is a signal. Set the NOISE REDUCTION switch to IN, and the VU meter selector to L FILTER OUT. Verify no signal. Switch the signal from the left input to the right input, and repeat the tests on the right channel.

33) *Very carefully* tilt the rear panel up to the vertical position, and the push the rear panel forward into place.

    Take care that no wires are pinched between the panel and the chassis.

34) Replace the 25 screws removed above.

    Do not tighten any screws until all screws are loosely in place.

35) Re-label the rear-panel NOISE REDUCTION switch to indicate it is now the STEREO GENERATOR switch. Re-label the ACCESSORY PORT #1 as "TO STEREO GENERATOR".

36) Insert a copy of these rewire instructions in Appendix G of the 8182A Operating Manual.

    The drawings on pages J-4, J-21, and J-25 of that manual will be partially incorrect as a result of this rewire. Make a note of those drawings to refer future readers to the copy of these instructions in Appendix G.

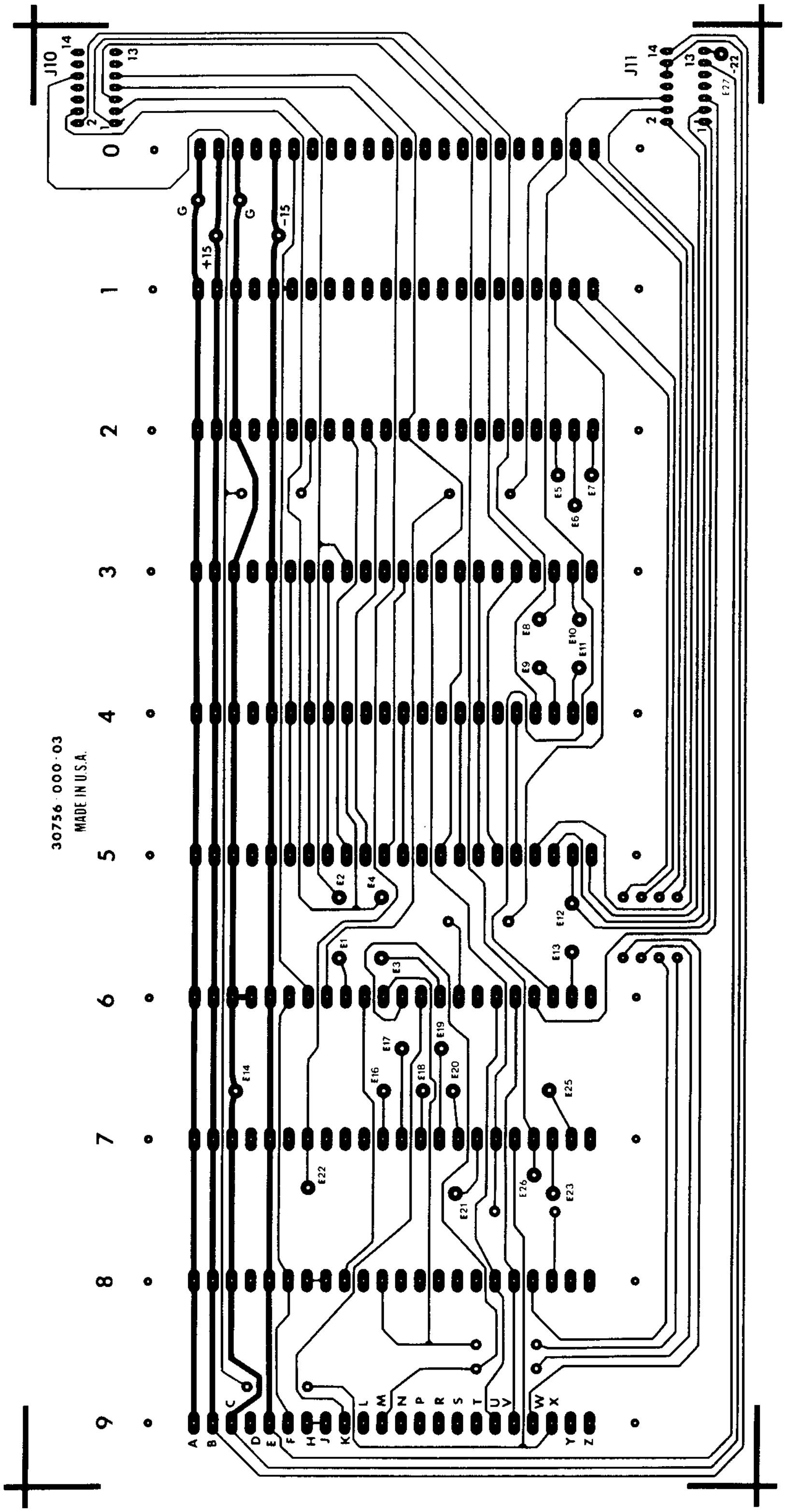
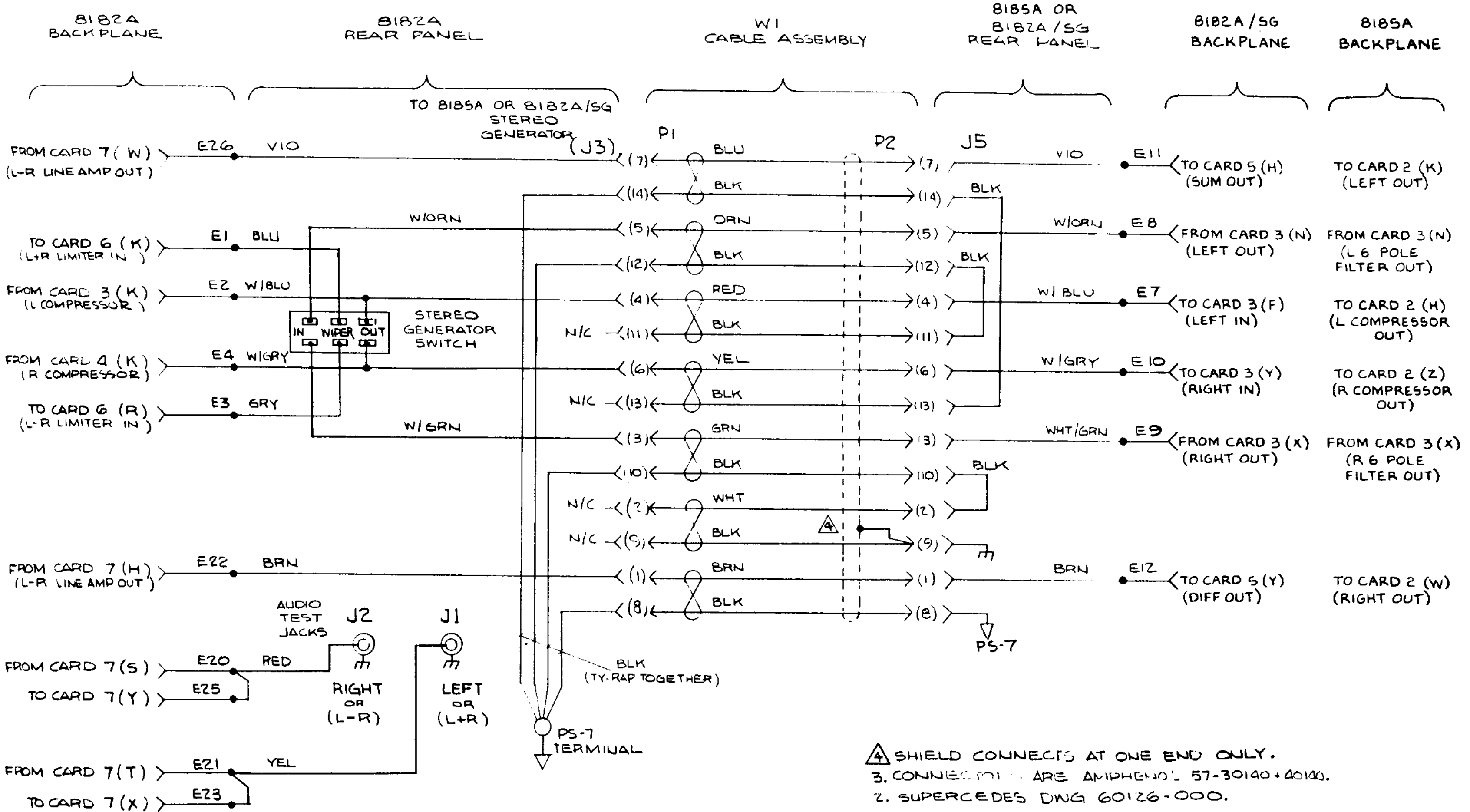


Fig. 2-14: Motherboard Solder Forks, 8182A Audio Processor



4 SHIELD CONNECTS AT ONE END ONLY.
3. CONNECTORS ARE AMPHENOL 57-30140 + 40140.
2. SUPERCEDES DWG 60126-000.
1. WIRE TO BE B-24-19/36U.
NOTES: (UNLESS OTHERWISE SPECIFIED)

Fig. 2–15: Accessory Port Wiring Diagram, 8182A Audio Processor

Section 3
Operation

8185A Stereo Generator Controls and Indicators

SYNC LOCK indicator lights when the 8185A is locked to your sync 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 −22VDC is present at the unregulated power supply.

VU meter and selector switch display peak signal level at various points in the circuitry (see the block diagram in Section 6 on page 6-57) to aid in diagnosing faults. The meter also displays the −15V and +15V power supply voltages ("100%" corresponds to 15VDC). The METER GAIN switch, when set to EXPANDED, causes the AC signal to the VU meter to be amplified by 20dB. The time-constant of the VU meter can be selected with a jumper on the Meter Resistor Board: the 0ms time-constant makes the VU meter more responsive to insignificant overshoots, while the 1.5ms time-constant results in more realistic indications of peak modulation.

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 earlier in the system 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.

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

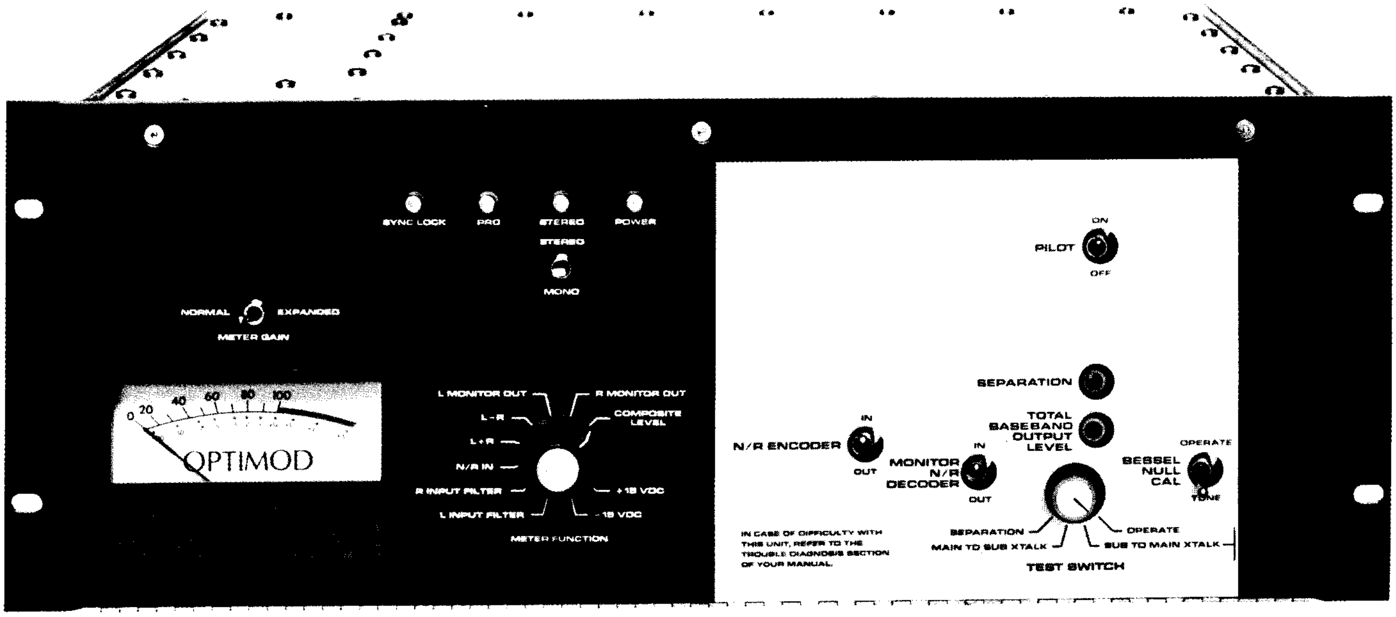
SEPARATION (L+R GAIN) control is used to calibrate the baseband encoder so that the stereo subchannel (L−R) and main channel (L+R) gains are precisely equal. (The BTSC standard requires the L−R gain to be double the L+R gain. This gain ratio is set in the audio circuitry *prior* to the stereo baseband encoder. Calibration of the sum and difference circuitry 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*.)

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).

TEST SWITCH re-routes the L+R signal for testing, as described in Section 4. The switch should be set to OPERATE for normal operation.

BESSEL NULL CAL switch: When set to TONE, a 7.867kHz calibration tone is applied to the L+R input of the baseband encoder (see Bessel null procedure on page 2-18) and the pilot and L−R modulator are defeated.

SUM PHASE-BALANCE trimmer (on Card #3) adjusts the left channel's phase shift relative to the phase shift of the right channel. Relative phase errors between the left and right channels can affect the frequency response of the mono sum (L+R) as heard on 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.


SYNC LOCK
PRO
STEREO
POWER
STEREO
MONO
NORMAL
EXPANDED
METER GAIN
0
20
40
60
80
100
OPTIMOD
L MONITOR OUT
L – R
L + R
N/R IN
R INPUT FILTER
L INPUT FILTER
R MONITOR OUT
COMPOSITE LEVEL
+15 VDC
–15 VDC
METER FUNCTION
PILOT
ON
OFF
SEPARATION
TOTAL BASEBAND OUTPUT LEVEL
N/R ENCODER
IN
OUT
MONITOR N/R DECODER
IN
OUT
BESSEL NULL CAL
OPERATE
TONE
IN CASE OF DIFFICULTY WITH THIS UNIT, REFER TO THE TROUBLE DIAGNOSIS SECTION OF YOUR MANUAL.
SEPARATION
MAIN TO SUB XTALK
OPERATE
SUB TO MAIN XTALK
TEST SWITCH

8182A Audio Processor Controls and Indicators

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 −22VDC is present at the unregulated power supply.

VU meter and selector switch display signal level at various points in the circuitry (see the block diagram in the 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).

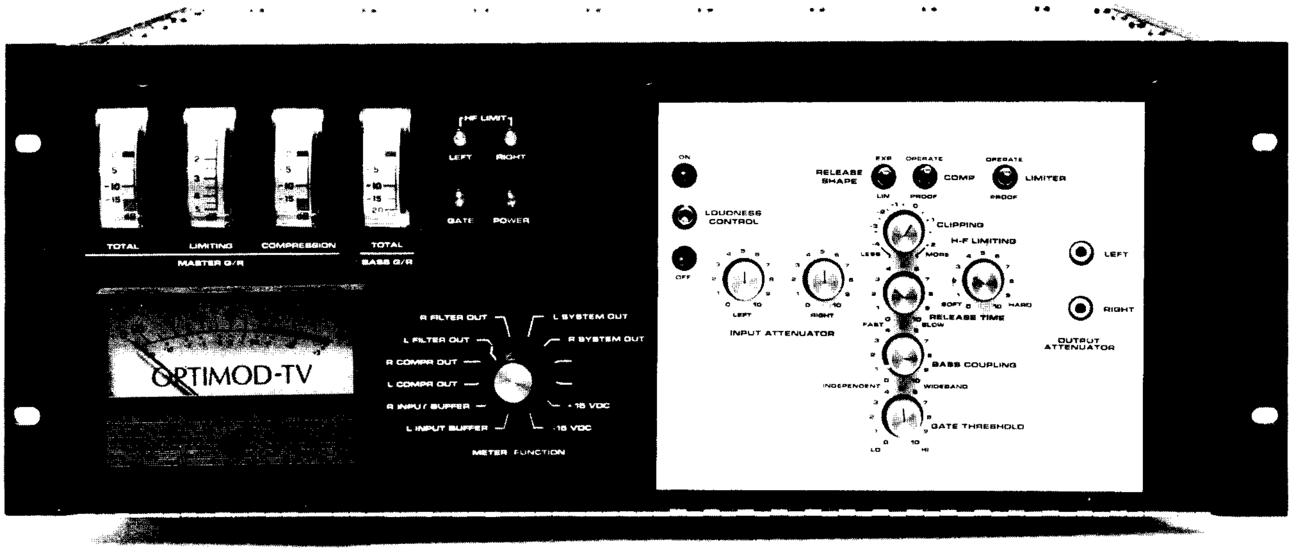
GATE THRESHOLD control determines the lowest input level that the system considers program. Levels below this are considered noise, and cause the AGC/compressor to gate, effectively freezing its gain to prevent noise "breathing" during pauses or low-level passages.

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

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 effected by slow compression, there is no need for separate peak-limiting and compression meters. "0" corresponds to 10dB of gain reduction.



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

NOTE: The following discusses 8182A OPTIMOD-TV Audio Processor controls and functions.

Getting the Sound You Want

If your station has a **general programming format**, the control settings specified at the end of the installation procedure (in Fig. 2-12 or Fig. 2-13) 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 (Fig. 3-1).

Should you wish to modify any control settings from those recommended, read **"Customizing the Settings"**, since it is important to understand the functions and interactions of the audio processing controls before attempting to customize them. "Customizing the Settings" 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 installation procedure (in Fig. 2-13 or Fig. 2-13) 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 Fig. 3-1. 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 "Customizing the Settings", since it is important to understand the functions and interactions of the audio processing controls before attempting to customize them.

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**
INPUT ATTENUATORs Adjust to produce approximately the indicated gain reduction on typical program material 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

* See discussion on following page.

Fig. 3-1: Recommended 8182A Audio Processor Control Settings

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 Audio Processor 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).

Customizing the Settings

If your station has a general programming format, the control settings specified at the end of the installation procedure in Fig. 2-12 or Fig. 2-13 (and repeated in Fig. 3-1) are optimal. If your station has a specialized format, you may prefer to use one of the alternate settings given in Fig. 3-1. 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 Audio Processor and 8185A Stereo Generator 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).

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 Audio Processor, this is realized through the complex circuitry of the loudness controller. The carefully designed dual-band compressor in the 8182A Audio Processor also helps achieve consistent loudness.

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.

When the 8182A Audio Processor 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 typical 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).

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, background music, 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.)

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.)

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 25dB of gain reduction range, 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, voice may cause up to 10dB more peak gain reduction than does music! (A peak program meter [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.

Excessive commercial loudness

The **loudness controller** in the 8182A Audio Processor 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 the same amount of sound energy in a narrower range, and 3) the time-constants of the individual 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.

Peak control

OPTIMOD-TV controls peaks by 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.

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).

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.

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.

Notes:

Section 4

Maintenance

CAUTION

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

Routine Maintenance

The 8185A Stereo Generator is a highly stable device which uses solid-state circuitry throughout. Recommended routine maintenance is minimal.

1) Periodically check VU meter readings.

Familiarize yourself with normal VU meter readings. If any meter reading is abnormal, see Section 5 for troubleshooting information.

2) Listen to the demodulated stereo audio.

A good ear will pick up many failures. Familiarize yourself with the "sound" of the 8185A as you have set it up, and be sensitive to changes or deteriorations. But if problems arise, please don't jump to the conclusion that the 8185A is at fault. The troubleshooting information in Section 5 will help you determine if the problem is with the 8185A or is somewhere else in the station's equipment.

3) Check the demodulated stereo separation

Most failures within BTSC hardware will manifest themselves as loss of separation. Therefore, a quick and effective check of the system can be made by muting the left-channel input to the processing chain and then measuring the amount of residual right channel on the meter of your BTSC stereo monitor. If the stereo generator and transmission system are operating correctly, the level of the right channel should be at least 30dB below the level of the left channel. (The 8185A alone is typically capable of 40dB on this test when measured through its own monitor decoder.)

Failures which occur in the circuitry prior to the sum-and-difference matrix in the 8185A will not cause a loss of separation. In most cases, such failures will cause audible aberrations in one channel only.

If you observe such aberrations or separation loss, perform the **Field Audit of Performance** procedure below to determine if the 8185A is at fault. If it is, refer to **Section 5** of this manual for troubleshooting instructions.

4) Periodically check for corrosion.

Particularly in humid or salt-spray environments, check for corrosion at the input and output terminals and at those places where the 8185A chassis contacts the rack.

5) Periodically check for loss of grounding.

Check for loss of grounding due to corrosion or loosening of rack mounting screws.

6) Clean the front panel when it gets soiled.

Wash the front panel with a mild household detergent and water. Stronger solvents should not be used because they may damage plastic parts, paint, or the silkscreened lettering.

Getting Inside the Chassis

Access:

- **Set-up controls** by opening the small door on the 8185A's front panel with the supplied key.
- The AC POWER **switch,** VOLTAGE SELECTOR **switch, and fuse** by opening the 8185A's front panel.
- The **circuit cards** by opening the 8185A's front panel, then removing the subpanel.

Set-up, adjustment, and alignment of the 8185A only requires access to the front and rear panels and to those interior parts of the unit behind the front panel and subpanel.

Further disassembly of the 8185A may be required for some service procedures:

For access to:	**See:**
Behind front panel	4-5
Behind subpanel	4-5
Behind rear panel	4-6
Beneath top or bottom cover	4-6
Input filter board	4-7
Unregulated power supply chamber	4-8
Power transistors, Card #PS	4-9

NOTE ABOUT SCREWS: This note applies to screws removed in the following disassembly instructions. For best RFI protection, replace *all* screws and tighten normally for firm contact. If screws are lost, replace them with screws of the same length, since longer screws may cause mechanical interference or internal short circuits.

Most screws used in the 8185A are binding head for secure fastening without lockwashers (if a pan head screw is substituted, use an internal star lockwasher to retain this security). Plating on all screws is zinc type II (almost any other plating is also acceptable unless corrosive atmosphere is present).

Front panel — open and close.

To open:

1) Close and lock the set-up controls access door.

2) Remove the three hex-socket screws at the top of the front panel with a 5/64-inch hex wrench (provided with the unit), then tilt the hinged front panel downward to reveal the interior.

To close:

1) Replace the subpanel if it has been removed.

   ⚠ See below. *The subpanel should always be in place,* since it is an integral part of the chassis RFI protection.

2) Raise the front panel and fasten the three screws that secure it in place with the 5/64-inch hex wrench provided with the unit.

Subpanel — remove, replace.

To remove:

1) Open the front panel (see above).

2) Loosen the four DZUS fasteners on the subpanel by turning each fastener 1/4-turn counterclockwise with a long 3/16-inch or 1/4-inch flat-blade screwdriver.

   The DZUS fasteners turn only 1/4-turn. Don't force them, lest they be damaged in a way that is very time consuming to repair.

3) Taking care not to stress the flat cables beneath it, tilt the top of the subpanel outward and to the left to clear the upper chassis lip and the door support rail at the right.

To replace:

The subpanel should always be in place, since it is an integral part of the chassis RFI protection.

1) Taking care not to stress the flat cables beneath it, tilt the top of the subpanel inward and to the left to clear the upper chassis lip and the door support at the right.

2) Turn the DZUS fasteners 1/4-turn clockwise with a long 3/16-inch or 1/4-inch flat-blade screwdriver.

3) Check that the internal AC POWER switch is set to ON.

Rear panel — remove, replace.

To remove:

1) Disconnect the 8185A and remove it from the rack.

   If the covers are still in place, they don't need to be removed.

2) Remove the eight screws holding the top cover to the flange of the rear panel. Also remove the eight screws holding the bottom cover to the rear panel.

   The rear panel will remain solidly in place.

3) Set the unit upright on a padded surface with the rear panel facing you.

   Leave about 6 inches (15 cm) between the rear panel and the edge of the table. Be sure the AC power cord is unplugged.

4) Remove the three groups of three screws *circled in black* on the rear panel.

5) *Very carefully* pull the rear panel about ¾-inch (2 cm) toward you, and then tilt the top of the rear panel down until the rear panel is horizontal.

   Careful! Watch for snags in the wiring or stress to the ceramic capacitors on the internal divider wall or RF box. These capacitors are very fragile and are difficult to replace.

To replace:

1) *Very carefully* tilt the rear panel up until it is vertical, and then push the rear panel forward into place.

   Take care that no wires are pinched between the panel and the chassis.

2) Replace the nine screws in the three groups of three screw holes circled in black on the rear panel. Also replace the sixteen screws that attach the top and bottom covers to the rear panel.

   Do not tighten screws until all screws are loosely in place, and the flanges of the rear panel are properly aligned with those of the side panels.

3) Return the 8185A to its rack, connect and ground unit.

Covers (top, bottom) — remove, replace.

To remove:

Removing the top or bottom covers is tedious because of the large number of screws necessary to achieve an RF-tight seal. Most servicing can be done without removing either cover.

1) Remove all thirty screws holding the top or bottom cover in place.

2) Lift off the cover.

To replace:

1) Position the cover in place and align it with the screw holes in the chassis.

2) Start, but do not tighten, all thirty screws that attach the cover to the chassis.

   Replace *all* screws to ensure good RFI protection.

3) When all screws are in place, tighten them to normal firm tightness.

   Tighten screws nearer the center of the cover first.

Input filter board, RF filter box — remove, replace.

To open RF filter box and remove input filter board:

1) Open rear panel.

   See page 4-6.

2) Remove the four screws that hold the large, flat, metal RF filter box to the inside of the rear panel.

3) *Very carefully and slowly* tilt the top of the metal RF filter box back to reveal the input filter circuit board.

   Careful! Watch for snags in the wiring or stress to the ceramic capacitors on the internal divider wall or RF box. These capacitors are very fragile and are difficult to replace.

4) Remove the four 4-40 screws that attach the input filter circuit board to the rear panel (optional).

To replace input filter board and RF filter box:

1) If it has been removed, attach the input filter board to the rear panel with the four 4-40 screws.

   If components have been replaced, make sure that reassembly will not crush or otherwise damage the components.

2) *Slowly and carefully* position the metal RF filter box so the screw holes in its flanges line up with the screw holes in the rear panel.

   Take care that no wires or components are pinched between the panel and the chassis. Dress wires appropriately.

3) Replace the four screws that attach the RF filter box to the rear panel.

4) Close the rear panel.

   See page 4-6.

Left side panel — remove, replace.

[Remove the left side panel to access the mains and raw DC power chamber.]

To remove:

1) Open the front panel (see page 4-5).

2) Remove the shoulder screw that attaches the door-support rail at the left.

   Note that there is a nylon washer between the rail and the side panel to prevent scraping.

3) Close the front panel and fasten it with the center screw *only*.

4) Turn the chassis so that the left rack flange faces you.

5) Remove the 5 screws that attach the top cover to the top of the left side panel. Also remove the 5 screws that attach the bottom cover to the left side panel.

   The left panel is to the left as you face the front of the unit — the side nearest the VU meter.

6) Remove the 3 circled screws on the rear panel that attach it to the left side panel.

7) Remove the 6 recessed screws on the left side panel.

8) Gently pull the side panel toward you and remove it.

To replace:

1) Position the left side panel and start (*but do not tighten*) the 6 recessed side-panel screws.

   Make sure the door support rail is positioned properly in its slot.

2) Replace (*but do not tighten*) the 3 circled screws that attach the rear panel to the side panel.

3) Replace (*but do not tighten*) the 5 screws that attach the top cover to the top of the left side panel. Also replace the 5 screws that attach the bottom cover to the left side panel.

4) Tighten all 19 screws.

5) Open the front panel (see page 4-5), and replace the shoulder screw.

   Be sure to position the nylon washer next to the left side panel.

6) Close the front panel (see page 4-5).

Power transistors, Card #PS — remove, replace.

To remove:

Because removal of Card #PS is difficult, the card has been designed to permit many servicing operations to be performed *without* removing the card from the chassis. IC chips are in sockets. Many of those components which are not mounted in sockets can be replaced from the top of the card by tack-soldering the new component to the lead stubs of the old, clipped-out component.

If Card #PS *must* be removed, follow these instructions carefully.

CAUTION

The rear panel is a heat dissipator for the power transistors. Proper contact is necessary to ensure sufficient transistor cooling.

1) Remove the 4 press-fit plastic plugs inside the recesses on the power transistor covers, using a pair of chain-nose pliers.

2) Loosen the 2 screws that attach each power transistor.

   These screws have captive nuts that will not fall into the chassis.

3) Remove the transistor covers and the associated screws and lockwashers from the rear panel.

4) Mark each transistor case to indicate the transistor's location and orientation.

5) *Very carefully and slowly* pull each transistor from its socket.

   If the silicone rubber insulator sticks to the panel, release it from the panel so that it sticks to the bottom of the transistor instead. After you remove each transistor, press its insulator back in close contact with the transistor.

   These insulators form themselves to the bottom surface of each transistor. Since they take a "set", they should not be interchanged or reversed.

6) Open the rear panel (see page 4-6).

7) Release Card #PS from its plastic post mounts by squeezing the tangs at each corner of the card, then pull the card off the posts.

To replace:

1) Replace Card #PS onto its plastic post mounts by pressing it over the 4 tangs at each corner of the card.

   Verify that the transistor sockets are aligned so that they seat in the rear-panel holes.

2) *Very carefully* reinstall the power transistors in their sockets.

   Be careful to replace the transistors in the same positions from which they were removed (refer to the marks made on the transistor cases during removal). Verify that the sockets are exactly aligned in the holes.

   The transistor insulators should not have been interchanged or reversed. If you must replace a power transistor, re-use the insulator if it is in good condition. With care, it will re-form itself as necessary. Otherwise, use a conventional mica insulator and white silicone heat-conducting compound.

3) Insert the screws and lockwashers in the transistor covers, and position them over the transistors.

   There *must* be a *split* lockwasher under the head of each screw to accommodate thermal cycling.

   These plastic covers do not attach in a conventional or readily obvious way. They ride on the circumference of the special split lockwasher and do not (and should not) become captured under the head of the screw. Consequently, the cover may be slightly loose even after screws are tightened securely. This is normal — do *not* try to "correct" it.

4) Tighten the screws.

   The screws mounting the transistors should be tightened *evenly*. For best thermal contact, tighten each screw a small amount, alternating between screws. Tighten securely, but not enough to damage the threads in the sockets.

5) Replace the 4 press-fit plastic plugs in the power transistor covers.

6) Close the rear panel (see page 4-6).

In-Line Performance Verification

Use this procedure for checking 8185A performance while it is on the air in your normal transmission chain. A more comprehensive bench test of performance is detailed in "Field Audit of Performance" starting on page 4-16.

While the FCC does not require periodic Proof-of-Performance measurements, it *does* require the system to meet certain performance standards for stereo operation. These are described in the Office of Science and Technology publication OET-60A and described in the EIA document *Multichannel Television Sound: BTSC System Recommended Practices.* (The 8185A has been designed to substantially exceed these standards.)

Most stations will doubtless want to make periodic equipment performance measurements. The measurements described here are based on the BTSC Recommended Practice. (Normal measurements given in these tests are provided for service guidance only, and are not guaranteed.)

The tests are most accurate when modulating the aural subcarrier with the visual transmitter off.

This performance verification includes measurements of noise floor, distortion, frequency response, and separation.

If the 8185A fails to pass any of these tests, see Section 5 for troubleshooting information.

Follow these instructions in order without skipping steps.

NOTE: These instructions assume you are using the 8185A with the Orban 8182A Audio Processor, but are *not* using the 8182A/ST Studio Chassis. If you are, substitute "8182A/ST Studio Chassis' IN terminals" when the instructions read "8182A's AUDIO IN terminals".

If you are using the 8185A with another make of audio processor, follow the instructions by analogy. When you see a reference to the "audio input terminals of the 8182A", use the audio input terminals of the external audio processor instead.

Most broadcast-quality audio processors have some sort of "Proof" mode which you can invoke when requested to place the 8182A LIMITER PROOF/OPERATE and COMPRESSOR PROOF/OPERATE switches in PROOF.

Equipment required:

Low-distortion audio oscillator

With verified residual distortion below 0.0015%.
Sound Technology 1710B or equivalent preferred.

BTSC-standard stereo modulation monitor

THD test set

With verified residual distortion below 0.0015%.
Sound Technology 1710B or equivalent preferred.

Spectrum analyzer with tracking generator

Tektronix 5L4N plug-in with 5111 bistable storage mainframe, or equivalent. *Alternatively*, a sweep generator with 30–15,000Hz logarithmic sweep can be used with an oscilloscope in X/Y mode.

1) Set the 8182A's COMP and LIMITER switches to PROOF.

2) Connect modulation monitor.

Connect a BTSC-standard stereo modulation monitor to a point in the RF signal chain past the aural/visual combiner (to the notch diplexer, for example).

3) Measure the noise floor of the left and right stereo channels.

The noise floor will be measured with reference to 100% modulation of the Stereo Subchannel (±50kHz deviation without pilot).

A ☐ Set 8185A's N/R ENCODER switch to IN.

B ☐ Set the stereo modulation monitor's METER SELECTOR switch to LEFT.

C ☐ Turn on the stereo modulation monitor's noise reduction decoder.

D ☐ Short the 8182A's left and right inputs by connecting the AUDIO IN +, –, and ⏚ terminals together.

E ☐ Verify that the stereo modulation monitor meter reads at least 60dB below 100% modulation.

F ☐ Repeat the measurement for the right channel.

G ☐ Remove the jumper(s) shorting the 8182A's input.

4) Measure left and right channel distortion.

Single-channel total harmonic distortion (THD) should be measured at 50Hz, 100Hz, 400Hz, 1kHz, 2.5kHz, 5kHz, 7.5kHz, 10kHz, and 15kHz, and at 25% and 50% 75µs-equivalent modulation.

A☐ Verify that the 8185A's N/R ENCODER switch is set to IN.

B☐ Verify that the stereo modulation monitor's noise reduction decoder is on.

C☐ Connect a THD test set to the demodulated left-channel audio output of the stereo modulation monitor.

D☐ Connect an audio oscillator to the 8182A's AUDIO IN terminals.

The oscillator can be connected through your console, switcher, or patch panel — it is not necessary to connect it directly to the 8182A.

E☐ Set the audio oscillator to the desired frequency.

50Hz, 100Hz, 400Hz, 1kHz, 2.5kHz, 5kHz, 7.5kHz, 10kHz, and 15kHz.

F☐ Adjust the audio oscillator's output level to produce the desired percentage of modulation as read on the stereo modulation monitor in L+R position.

25% or 50%. Because of the 75µs pre-emphasis curve, it will be necessary to re-adjust the level as frequency is changed.

When only one channel is driven, 100% L+R modulation cannot be achieved through the 8182A because of headroom constraints. 100% L+R modulation is ordinarily produced from stereo material with both channels active (50% left + 50% right = 100% L+R).

G☐ Verify that demodulated left channel distortion in a 20kHz bandwidth is less than 0.5% from 30–15,000Hz.

These are standards from the BTSC Recommended Practice. The performance of the 8185A alone will ordinarily be at least 5–10 times better than this (see TABLE 4-1). Distortion within the system can be caused by STL limitations, by synchronous AM and ICPM (ordinarily caused by narrowband or mis-tuned RF amplifiers and diplexers), by exciter limitations, and, when monitoring remotely, by multipath distortion and/or noise induced into the monitor.

H☐ Reset the audio oscillator's frequency and output level and measure THD for each frequency and percentage of subcarrier modulation to be tested.

I☐ Repeat the measurement for the right channel.

J☐ Disconnect the THD test set and audio oscillator from the equipment.

5) Measure frequency response.

A☐ Verify that the 8185A's N/R ENCODER switch is set to IN.

B☐ Connect the output of a tracking or sweep generator to the 8182A's AUDIO IN terminals. Set the generator for a 30–15,000Hz logarithmic sweep.

C☐ Adjust the sweep generator's output level so that the L+R modulation never exceeds 50%.

Read the modulation level on your stereo modulation monitor with its selector set to L+R. (The maximum level will be seen at 15kHz, due to the effect of the 75µs pre-emphasis.)

D☐ Turn on the stereo modulation monitor's noise reduction decoder.

E☐ Connect the input of a spectrum analyzer or oscilloscope to the demodulated left-channel audio output of the stereo modulation monitor.

F☐ Verify that left channel frequency response is flat ±1.0dB from 50Hz to 15kHz.

This tolerance includes the entire transmission system. The guaranteed tolerance for the Orban 8182A and 8185A system is ±0.75dB, 30–15,000Hz.

G☐ Repeat the measurement for the right channel.

6) Measure swept-sinewave separation.

Swept-sinewave separation measurements verify that the system complies with the requirements in OET-60a. It does not necessarily predict system separation performance under program conditions.

At the end of **Section 4**, we have reprinted an Orban application note called "Evaluating BTSC Stereo Generators: Some Suggestions". This provides instructions for measuring separation by using broadband program material like pink noise for a test signal, and by employing a one-third-octave real-time analyzer or dual-channel FFT analyzer as the measuring instrument. This provides a more realistic assessment of separation performance under operating conditions.

A☐ Continue to drive the right channel input of the 8182A with the tracking generator or sweep generator.

B☐ Adjust the output level of the tracking generator or sweep generator so that 10% L+R modulation (±2.5kHz deviation) is produced by 100Hz.

C☐ Connect the scope or spectrum analyzer to the RIGHT AUDIO OUTPUT of your stereo modulation monitor.

This connection should already exist.

D☐ Measure the level at 1kHz. This level will be used as a "0dB" reference for the separation measurement.

The response at other frequencies should be flat ±0.5dB, as measured above.

E☐ Connect the scope or spectrum analyzer to the LEFT AUDIO OUTPUT of your stereo modulation monitor. Measure the swept output of the left channel. The difference (in dB) between this measurement and the reference measurement provides a good indication of the swept sinewave separation.

Strictly speaking, OET-60a requires that the "10% 75µs equivalent input" separation be measured. This requires you to connect a 75µs de-emphasis filter between the output of the generator and the input of the system, and a complementary 75µs pre-emphasis filter before the measuring instrument. While this is inconvenient, you may want to do it if you want the true "10% 75µs equivalent input" measurement.

F☐ Measure the left-into-right separation by repeating the above steps, but connecting the generator to the left input, using the left monitor output as the level reference, and reading the separation from the right output.

7) Disconnect test instruments from the 8185A.

8) Set the 8185A's COMP and LIMITER switches to OPERATE.

Field Audit of Performance

The following instructions enable TV Stereo Generator users to check the performance of their units on the bench 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.

Equipment required:

Audio Oscillator.

With verified residual distortion below 0.0015%. Sound Technology 1710B is suitable. Other suitable instruments are made by Audio Precision, Hewlett-Packard, and Tektronix, among others.

Noise and Distortion Test Set, including AC voltmeter.

Once again, a high-performance type like the Sound Technology 1710B is preferred, but not required.

General-Purpose Oscilloscope.

DC-Coupled, dual trace, with at least 5 MHz bandwidth.

Spectrum analyzer with tracking generator

Tektronix 5L4N plug-in with 5111 bistable storage mainframe, or equivalent. *Alternatively,* a sweep generator with 30–15,000Hz logarithmic sweep can be used, with an oscilloscope in X/Y mode as the indicating instrument.

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 capabilities 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. (This is called "75μs Equivalent Mode".)

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.

System Performance Tests

Many 8185As are used with the Orban 8182A Audio Processor. To test the performance of the 8185A TV Stereo Generator system independently, you must temporarily strap Card #2 in the 8185A for External Input, if it is not already so strapped. With power off, remove Card #2 from the card cage and set its jumpers as follows:

Jumper	Position
A	EXT
B	IN
C	EXT
D	EXT
E	IN
F	EXT

Connect the audio signal source to the left and right external audio inputs on the 8185A, and measure the left and right monitor outputs on the rear of the 8185A. Connect sync or composite video to the video input on the rear of the TV Stereo Generator. Be sure the stereo and sync lock LEDs are lit steadily.

Sync Card

1) Verify Sync Lock

A☐ 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.

B☐ Switch the front-panel STEREO/MONO switch to STEREO. The STEREO lamp should light.

2) Verify Operation of Bessel Null Tone

A☐ Switch the BESSEL NULL CAL switch to TONE.

B☐ Observe the rear-panel COMPOSITE OUTPUT with a scope. Verify that a 7.867kHz sinewave appears at the COMPOSITE OUTPUT.

C☐ *Optionally*, connect a distortion analyzer to the COMPOSITE OUTPUT, and verify that the harmonic distortion of the tone is less than 0.04%.

D☐ Return the BESSEL NULL CAL switch to OPERATE.

Test Audio Processing (Filters and N/R Encoder)

1) Measure Frequency Response

A☐ Set the N/R ENCODER and N/R DECODER switches in.

B☐ Set a manual oscillator, sweep oscillator, or tracking generator to feed 100Hz at −7dBu (0.346Vrms) into the left input of the 8185A.

If you have a tracking generator, observe the response on the matching spectrum analyzer.

If you are using the tracking generator in the Tektronix 5L4N, you will have to use an external amplifier after the tracking generator output to achieve the drive levels specified in the procedure.

If you have a sweep generator, use an oscilloscope with X/Y sweep. Connect the MONITOR OUT to the scope's Y input, and connect the sweep generator's RAMP OUT to the scope's X input.

If you are using a manually-tuned source, observe the response on an AC voltmeter.

C☐ Measure the level at the left monitor output of the TV Stereo Generator at several frequencies between 30Hz and 20kHz.

The response should be ±0.5 dB, 30–14,000Hz, <1dB down at 15kHz.

(**Note:** The frequency response falls off like a "brick wall" beyond 15kHz. If frequency response does not seem to extend to 15kHz, be sure that your oscillator is correctly calibrated.)

D☐ Measure the right channel frequency response similarly.

2) Measure Total Harmonic Distortion

A☐ Turn off power. Remove Card #2, and reset jumpers E and B to out. (This defeats pre-emphasis.) Replace Card #2 and restore power.

B☐ Set a low-distortion oscillator to feed 100Hz at +10dBu (2.45Vrms) into the left input of the 8185A.

C☐ Read distortion with the noise reduction encoder and decoder both in. With the noise reduction in, THD readings should be below 0.2%. Note that the output level will fall with frequency, following the 75µs de-emphasis curve, and that the distortion analyzer's SET LEVEL control must be readjusted at each frequency. Typical distortion figures are listed in Table 4-1.

D☐ Read distortion with the noise reduction encoder and decoder both out. With the noise reduction out, THD readings should be well below 0.1% at all frequencies. Typical distortion figures are listed in Table 4-1.

E☐ Measure the right channel similarly.

	N/R OUT		N/R IN	
FREQUENCY	LEFT	RIGHT	LEFT	RIGHT
50	0.015%	0.015%	0.060%	0.060%
100	0.015%	0.015%	0.050%	0.050%
400	0.014%	0.014%	0.032%	0.032%
1000	0.010%	0.010%	0.020%	0.020%
5000	0.018%	0.018%	0.050%	0.050%
10000	0.035%	0.035%	0.090%	0.090%
15000	0.050%	0.050%	0.130%	0.130%

Table 4.1: Typical Single-Channel Total Harmonic Distortion
100% 75µs Equivalent Input Modulation

3) Measure Noise

Short both inputs to the 8185A. 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.

4) Measure Swept-Sinewave 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% 75µs equivalent modulation, which means that the signal at the input to the Stereo Baseband Generator card will produce 10% modulation, independent of frequency, if the dbx N/R encoder is bypassed. This will occur automatically if a oscillator with flat frequency response is connected to the 8185A's EXTERNAL AUDIO INPUT at a level of −10dBu (0.245Vrms) because the pre-emphasis in Card #2 was defeated earlier in this test procedure.

Starting on page 4-44, we have reprinted an Orban application note called **Evaluating BTSC Stereo Generators: Some Suggestions.** This provides instructions for measuring separation by using broadband program material like pink noise for a test signal (instead of swept sinewave), and by employing a one-third-octave real-time analyzer or dual-channel FFT analyzer as the measuring instrument. This provides a more realistic assessment of separation performance under operating conditions.

A☐ Set a tracking generator, sweep generator, or sinewave oscillator to feed -10dBu (0.245Vrms) into the LEFT INPUT of the 8185A. If the source can be swept, set it for 30–14,000Hz. If it provides fixed frequencies, measure the separation at a minimum of 30Hz, 50Hz, 100Hz, 400Hz, 1kHz, 2.5kHz, 5kHz, 7.5kHz, 10kHz, and 14kHz.

Measuring other frequencies in between will provide a clearer picture of the separation performance, as will repeating the measurement at other levels like 30% modulation (-0.46dBu; 0.735Vrms) and 100% modulation (+10dBu; 2.45Vrms).

If you have a tracking generator, observe the response on the matching spectrum analyzer.

If you are using the tracking generator in the Tektronix 5L4N, you will have to use an external amplifier after the tracking generator output to achieve the drive levels specified in the procedure.

If you have a sweep generator, use an oscilloscope with X/Y sweep. Connect the MONITOR OUT to the scope's Y input, and connect the sweep generator's RAMP OUT to the scope's X input.

If you are using a manually-tuned source, observe the response on an AC voltmeter.

B☐ 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 (or their difference in dB) is the L into R separation.

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 very much better than this (see **SPECIFICATIONS** on page 6-2).

This concludes tests of the audio processing circuitry.

Test Stereo Baseband Generator

This procedure tests the performance of the stereo baseband generator and other circuitry on the stereo generator card (Card #7). This procedure requires only an audio oscillator, an oscilloscope and a TV Stereo Aural Monitor or baseband frequency spectrum analyzer such as a Tektronix 5L4N.

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 particularly 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.

It has been our experience that the 8185A Stereo Baseband Generator is more stable than most monitors. Therefore, accurate measurement and adjustment of 75µs equivalent separation 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.

1) Prepare the Test Setup

A☐ Turn off power. Remove Card # 2, and reset jumpers E and B to in. (This restores pre-emphasis.) Replace Card #2 and restore power.

B☐ Connect the oscillator to both the 8185A 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.

C☐ Set the oscillator frequency to 100Hz at 2.45Vrms. Observe the L+R position of the 8185A meter, and trim the oscillator level slightly if necessary to make the meter read "100%".

D☐ Adjust the stereo monitor input sensitivity to produce an indication of 100% on the sum channel, or adjust the input sensitivity on the spectrum analyzer (if used instead of the stereo monitor) to produce a reading of 6 dB below full scale for the 100 Hz sum channel signal.

2) Measure 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.

A☐ 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.

B☐ Measure the main-to sub crosstalk at 50, 500 and 15000 Hz.

Note that because of pre-emphasis, the oscillator level must be adjusted substantially to keep the modulation percentage constant as the frequency is varied.

C☐ Verify that the crosstalk does not exceed −40dB below 100% modulation at any frequency.

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.

3) Measure Sub-to-Main Crosstalk

A☐ 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.

B☐ Increase the oscillator output to +16dBu (4.887Vrms).

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 in the sum channel (the L+R meter position will pin the meter). For this reason the output level of the oscillator must be increased to perform this test.

C☐ Measure the sub-to-main crosstalk at 50, 500 and 15000 Hz. Verify that the crosstalk does not exceed −40dB below 100% modulation at any frequency.

Typically you will be measuring the performance of the stereo aural monitor in this test. The baseband spectrum analyzer will show that the crosstalk is typically more than 70dB below 100% sum channel modulation.

4) Measure 2H Suppression

A☐ Return the TEST SWITCH to OPERATE.

B☐ Set the oscillator to 7.5kHz and +4dBu (1.228Vrms). Use the stereo aural monitor or the baseband spectrum analyzer to verify that the 2H subcarrier suppression exceeds −40dB below 50kHz deviation.

5) Measure Separation of the Stereo Baseband Generator

A☐ 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.

B☐ Trigger the scope externally from the oscillator.

C☐ Turn the PILOT switch OFF.

D☐ Connect the oscillator to the left input of the TV Stereo Generator.

E☐ Set the scope's vertical sensitivity to 0.5V/div, and DC-couple the input.

F☐ Switch the TEST SWITCH on Card #7 to the SEPARATION position.

G☐ 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. 4-1 below.

Separation is measured by determining the flatness of the baseline. If the 8185A 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.

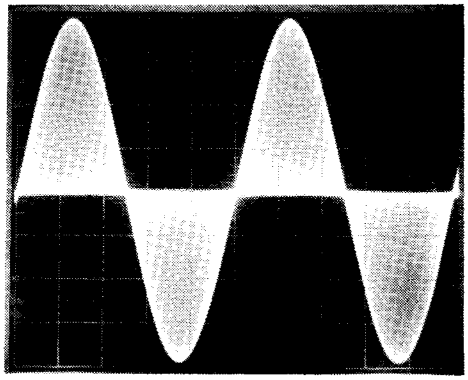


Fig. 4-1: Scope Pattern for Separation Test

The remaining steps describe how to numerically measure separation. They are optional.

H☐ Expand the scope vertical scale to 50mV/div.

I☐ Adjust the 8185A SEPARATION control to achieve the flattest possible baseline.

J☐ Calculate separation by the formula: $S= 20\log(D/P)$, 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, 30–15000Hz, and is typically better than -60dB. (60dB is the practical limit of resolution for the oscilloscope measurement technique.)

Test Remote Control and Logic

This procedure tests the operation of the rear-panel remote control terminals and also verifies that the stereo generator switching logic is responding correctly. To activate a remote control terminal, ground its "−" terminal to the ⏚ terminal on the rear panel barrier strip, and momentarily jumper its "+" terminal to the "+22V" terminal on the barrier strip.

1) Prepare the Setup

A☐ Connect the COMPOSITE OUT of the TV Stereo Generator to the stereo aural monitor or the baseband spectrum analyzer.

B☐ Turn the PILOT switch on and verify ±5kHz deviation. (This is 14dB below 100% sum-channel modulation, or 8dB below 50% sum-channel modulation.)

C☐ Switch the front panel STEREO/MONO switch on the 8185A to STEREO. Verify that the front panel STEREO light is lit.

D☐ Connect the oscillator to the 8185A LEFT INPUT.

E☐ Set the oscillator output level to +10dBu (2.45Vrms).

This produces 100% left-channel only modulation. The L+R meter on the stereo monitor should indicate ±12.5kHz deviation, or 50% L+R modulation.

2) Test MONO LEFT Mode

A☐ Switch the 8185A into MONO LEFT with the rear-panel remote control terminal.

B☐ Verify that the STEREO lamp on the front panel goes out, that the pilot disappears, and that the sum-channel modulation is now ±25kHz (100%).

C☐ 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%.

3) Test STEREO Mode

A☐ Switch the 8185A into stereo with the rear-panel remote control terminals.

B☐ Verify that the front panel STEREO lamp is on.

C☐ Verify that sum-channel modulation is ±12.5kHz (50%).

4) Test MONO RIGHT Mode

A☐ Switch the 8185A into MONO RIGHT with the rear panel remote control terminals.

B☐ Verify that the STEREO lamp on the front panel goes out, that the pilot disappears, and that the sum-channel modulation is 100%.

C☐ Disconnect the oscillator from the 8185A right input and reconnect it to the left input. Verify that the sum-channel modulation is 0%.

Individual Card Tests

The following provides moderately detailed tests that will let you isolate simple problems to an individual card.

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.

If you are using the 8185A with the 8182A Optimod-TV Audio Processor, disconnect the connecting cable between the two before performing the tests below.

1) Test Card #2

A☐ Strap Card #2 jumpers as follows:

Jumper	Position
A	EXT
B	IN
C	EXT
D	EXT
E	IN
F	EXT

This prepares the 8185A to accept external audio inputs.

B☐ Remove Card #3.

C☐ Inject a 0dBu at 400Hz signal at the 8185A'S LEFT INPUT. Verify flat frequency response at 0dBu at pin F of the card connector.

This verifies operation of the left input buffer and left phase corrector for the Six-Pole Filter.

D☐ Inject a 0dBu signal at TP3. Observe signal at pin 1, IC3a, and verify that it is pre-emphasized according to Table 4-2, ±0.5dB.

This verifies operating of the IC3a pre-emphasis circuit. Note that this circuit has −2.92dB gain, so the absolute gain from TP3 to IC3a, pin 1 is 2.92dB lower than the relative gain shown in Table 4-2.

E☐ Observe TP2, then TP4. In relation to the relative gain shown in Table 4-2, note that the signal at TP2 appears -8.94dB lower, and that the signal at TP4 appears -2.92dB lower.

This verifies the operation of the left phase corrector for the 11-Pole Filter IC3b, IC4, and the matrix, IC9.

F☐ Inject a 0dBu signal at the 8185A'S RIGHT INPUT. Verify flat frequency response at 0dBu at pin Y of the card connector.

This verifies operation of the right input buffer and right phase corrector for the Six-Pole Filter.

G☐ Inject a 0dBu signal at TP5. Observe signal at pin 1, IC7a, and verify that it is pre-emphasized according to Table 4-2, ±0.5dB.

> This verifies operation of the IC7a pre-emphasis circuit. Note that this circuit has −2.92dB gain, so the absolute gain from TP3 to IC3a, pin 1 is 2.92dB lower than the relative gain shown in Table 4-2.

H☐ Observe TP2, then TP4. In relation to the relative gain shown in Table 4-2, note that the signal at TP2 appears -8.94dB lower, and that the signal at TP4 appears -2.92dB lower.

> This verifies the operation of the matrix (IC9), and the right phase corrector for the 11-Pole Filter IC7b, IC8.

FREQUENCY(Hz)	RELATIVE GAIN(dB)
50	0.00
100	0.01
200	0.04
500	0.23
1K	0.87
2K	2.76
3K	4.77
5K	8.16
8K	11.82
10K	13.66
13K	15.86
15K	17.07

Table 4-2: 75μs Pre-emphasis

2) Test Card #3

A☐ To test the left channel, inject signal at TP4 and measure the frequency response at TP1. Fig. 4-2 shows a typical Card #3 frequency response measurement. The scale of Fig. 4-2 is 10dB/div vertical and 2kHz/div linear horizontal.

B☐ To test the right channel, inject signal at TP5 and measure the frequency response at TP2.

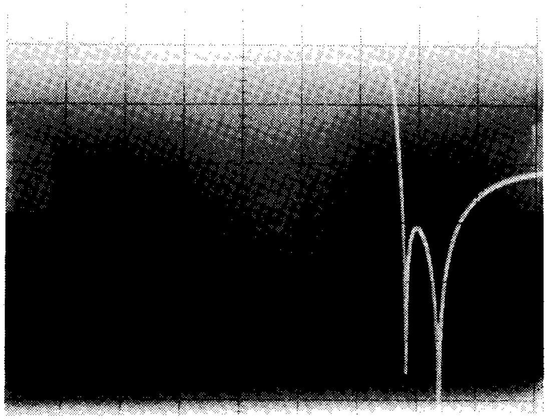


Fig. 4-2: Typical Card #3 Frequency Response

3) Test Card #5

A☐ Unplug Cards #4,#6 and #7.

B☐ To test the left channel, inject signal at TP4 and measure the frequency response at TP2.

Fig. 4-3 shows a typical Card #5 frequency response measurement. The scale of Fig. 4-3 is 10dB/div vertical and 2kHz/div linear horizontal.

C☐ To test the right channel, inject signal at TP3 and measure the frequency response at TP1.

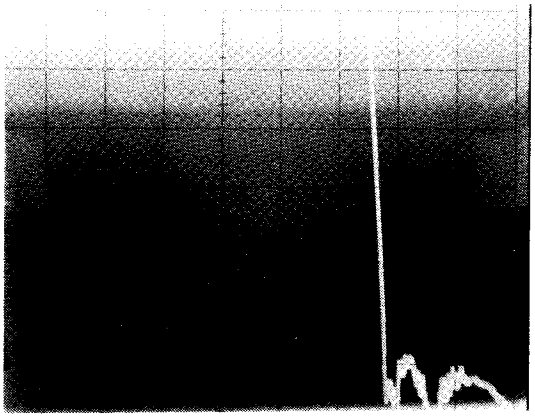


Fig. 4-3: Typical Card #5 Frequency Response

4) Test Card #8

A☐ Apply a 1V peak-to-peak composite video or sync signal to the VIDEO LOOP THROUGH IN on the rear panel.

B☐ Switch the TERMINATOR switch to 75 Ohms.

The SYNC LOCK light on the front panel should light.

C☐ Verify that a pulse wave at 15,734Hz, 15V peak, appears at pin F of the card.

D☐ Verify that a squarewave at 251.7kHz, 15V peak, appears at pin L of the card.

E☐ *(optional)* Verify that a sinewave at 15,734Hz, 2.08Vrms, appears at pin H. THD should be below 0.05%.

This output is not used in the 8185A.

5) Test Card #7

If the system passes the test procedure in **Test Stereo Baseband Generator** (on page 4-20) and **Test Remote Control and Logic** (on page 4-23), you can assume that Card #7 is operating correctly.

These tests require the earlier circuitry on Cards #2, #3, and #5 to be working to deliver a correct signal to the Card #7 L+R input port (TP1; pin #11 of the edge connector). If you doubt that this circuitry is working correctly, you can bypass it and still perform most of these tests. Unplug Card #5 and inject the test signal directly into TP1 on Card #7, using a low-source-impedance (<10Ω) signal generator. In this case, ground TP2 on Card #7.

The generator levels must be set differently if the generator is connected directly to TP1:

Test	Level (Vrms)	Level (dBu)
Main to Sub	1.768	+2.48
Sub to Main	3.536	+8.50
2H Suppression	0.884	-3.54

Table 4-3

6) Test Card #6

A☐ Unplug Cards #3, #4 and #5.

B☐ Switch the N/R IN/OUT switch to OUT.

C☐ 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 Fig. 4-4. The scale of Fig. 4-4 is 10dB/div vertical and 20kHz log scale horizontal.

D☐ 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.

E☐ The only field test which can be done on the dbx Noise Reduction Decoder card is to verify that it passes signal. No field alignment or calibration should be attempted. Proper gain/frequency response of the Decoder 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 (on Card #6) or the Noise Reduction Encoder (on Card #4).

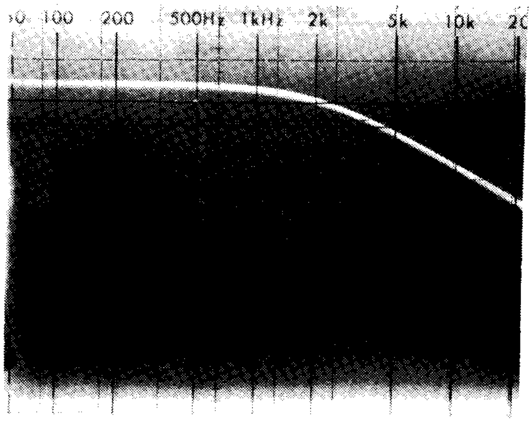


Fig. 4-4: Typical Card #6 Frequency Response

7) Test Card #4

This test requires a working Card #5.

A☐ Unplug Cards #3, #6 and #7.

B☐ Inject signal into the input side of resistor R1 (pin Y of the card edge connector). Verify that there is signal at the card output (pin X on the card edge connector).

C☐ The only field test which can be done on the dbx Noise Reduction Encoder card is to verify that it passes signal. No field alignment or calibration should be attempted. Proper gain/frequency response of the 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 (on Card #6) or the Noise Reduction Encoder (on Card #4).

Field Alignment and Comprehensive Card Test

These field alignment instructions are included primarily for reference — routine alignment is neither necessary nor desirable due to the high stability of the circuitry.

CAUTION

If calibration is necessary, we strongly recommend that the circuit card in question be returned to the factory for alignment by our experienced technicians. They have access to special test fixtures and a supply of exact-replacement spare parts. Only in an emergency should you attempt to align and calibrate the 8185A in the field.

Since the user does not have access to the special test fixtures, the 8185A must therefore be used as a test fixture, and the entire unit must be aligned as a system.

Follow these instructions in order, without skipping steps.

This procedure is organized on a card-by-card basis. Cards should be calibrated in the same order as their order in the signal path, from input to output. If a card later in the signal path is aligned while an earlier card is misaligned, the later card may not be correctly aligned, even if the instructions for that card are followed conscientiously. Note that no calibration is necessary for Cards #2, #4 and #6.

Refer to the drawings in **Section 6** for the locations of components and test points.

Equipment required:

Audio Oscillator.

With verified residual distortion below 0.0015%. Sound Technology 1710B is suitable. Other suitable instruments are made by Audio Precision, Hewlett-Packard, and Tektronix, among others.

Noise and Distortion Test Set, including AC voltmeter.

Once again, a high-performance type like the Sound Technology 1710B is preferred, but not required.

General-Purpose Oscilloscope.

DC-Coupled, dual trace, with at least 5 MHz bandwidth.

Spectrum analyzer with tracking generator

Tektronix 5L4N plug-in with 5111 bistable storage mainframe, or equivalent. *Alternatively*, a sweep generator with 30–15,000Hz logarithmic sweep can be used, with an oscilloscope in X/Y mode as the indicating instrument.

Frequency counter, accurate ±0.005%.

1) Prepare the unit.

A☐ Remove the 8185A from its rack and place it on a test bench away from RF fields.

B☐ Record the settings of all 8185A controls.

C☐ Connect the 8185A ⏚ and ▽ together.

D☐ Open up the 8185A's front panel and remove its subpanel. See page 4-4 for instructions.

E☐ Power the 8185A.

2) Calibrate 15-volt power supply on Card #PS

A☐ Observe the voltage at terminal post #6 on Card #PS (or at another convenient point on the +15-volt bus) with a well-calibrated digital voltmeter.

B☐ Adjust trimmer R106 until the digital voltmeter reads "+15.00-volts".

C☐ Verify that the voltage at terminal post #8 on Card #PS (or other convenient point on the −15-volt bus) is between −14.85 and −15.15 volts.

If not, see the troubleshooting information in Section 5.

IMPORTANT

Always turn off AC power to the 8185A before removing or installing circuit cards. Allow the 8185A to stabilize for two minutes after turning the power back on.

⚠

Comprehensive Test of Card #2

1) Prepare Card

A☐ Set jumpers A and D to EXTERNAL

B☐ Set jumpers B and E to OUT

C☐ Set jumpers C and F to EXTERNAL

2) Test signal path.

A☐ Drive the 8185A LEFT EXTERNAL INPUT with 400Hz at a level of 0dBu. Verify a level of -9.0dBu ±0.2dB at TP2.

B☐ Common-mode rejection test: Connect the high side of the oscillator to the "+" and "−" terminals of the 8185A LEFT EXTERNAL INPUT in parallel. Verify that the level is less than −59dBu at TP2.

C☐ Drive the 8185A RIGHT EXTERNAL INPUT with 400Hz at a level of 0dBu. Verify a level of -9.0dBu ±0.2dB at TP2.

D☐ Common-mode rejection test: Connect the high side of the oscillator to the "+" and "−" terminals of the 8185A RIGHT EXTERNAL INPUT in parallel. Verify that the level is less than −59dBu at TP2.

3) Test pre-emphasis.

A☐ Drive the 8185A LEFT EXTERNAL INPUT with 400Hz at a level of +2.92dBu and verify that the level at TP4 is 0dBu ±0.2dB.

B☐ Change the oscillator to 15kHz and verify that the level at TP4 is 0dBu ±0.2dB.

C☐ Move jumper B to IN and verify that the level at TP4 is +17.1dBu ±0.5dB.

D☐ Drive the 8185A RIGHT EXTERNAL INPUT with 400Hz at a level of +2.92dBu and verify that the level at TP4 is 0dBu ±0.2dB.

E☐ Change the oscillator to 15kHz and verify that the level at TP4 is 0dBu ±0.2dB.

F☐ Move jumper E to IN and verify that the level at TP4 is +17.1dBu ±0.5dB.

G☐ Return jumpers B and E to OUT.

4) Test noise and distortion

A☐ Drive the LEFT EXTERNAL INPUT with the oscillator set to +10dBu and monitor TP2.

B☐ Measure the THD at 20Hz, 400Hz, and 5kHz. Verify that the THD in a 20–20kHz bandwidth is below 0.015%. Measure the THD at 15kHz and verify that the distortion is below 0.025%.

C☐ Mute the signal and measure the residual noise. Verify that it is below -75dBu. Observe the oscilloscope to verify that no "popcorn noise" exists.

D☐ Drive the RIGHT EXTERNAL INPUT with the oscillator set to +10dBu and monitor TP2.

E☐ Measure the THD at 20Hz, 400Hz, and 5kHz. Verify that the THD in a 20–20kHz bandwidth is below 0.015%. Measure the THD at 15kHz and verify that the distortion is below 0.025%.

F☐ Mute the signal and measure the residual noise. Verify that it is below -75dBu. Observe the oscilloscope to verify that no "popcorn noise" exists.

G☐ Set the oscillator for 400Hz at a level of 0dBu. Drive the LEFT EXTERNAL INPUT and then the RIGHT EXTERNAL INPUT while monitoring TP2. Verify that the output remains exactly the same (±0.1dB)

H☐ Set the oscillator for 400Hz at a level of 0dBu. Drive the LEFT EXTERNAL INPUT and then the RIGHT EXTERNAL INPUT while monitoring TP4. Verify that the output remains exactly the same (±0.1dB)

5) Test the matrix.

A☐ Drive the LEFT EXTERNAL INPUT with 400Hz at a level of +2.92dBu. Monitor TP2 and verify that the level is 0dBu ±0.2dB.

B☐ Monitor the TP4 and verify that the level is +6.02dBu ±0.2dB.

C☐ Drive the LEFT EXTERNAL INPUT and RIGHT EXTERNAL INPUT in parallel and in phase and verify that the level at TP2 is +6.02dBu ±0.2dB.

D☐ Monitor TP4, and verify that the level is less than −46dBu.

Card #3 Calibration

1) Prepare test setup.

A☐ Remove Card #3 and plug the extender board into the Card #3 slot. Plug Card #3 into the extender board.

B☐ Unplug Card #7.

2) Calibrate left input filter

A☐ Connect the low distortion oscillator to the test point labeled TP4.

B☐ Connect the oscillator ground to TP3.

C☐ Set the oscillator frequency to 15,734 Hz (±20 Hz).

D☐ Set the oscillator amplitude to approximately 3 Volts rms.

E☐ Connect the AC VTVM to the output of the filter at TP1.

F☐ Connect the AC VTVM ground to TP3.

G☐ Adjust trimmer R13 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

3) Calibrate right input filter

A☐ Connect the low distortion oscillator to the test point labeled TP5.

B☐ Connect the oscillator ground to TP3.

C☐ Set the oscillator frequency to 15,734 Hz (±20 Hz). Verify the oscillator frequency with a frequency counter.

D☐ Set the oscillator amplitude to approximately 3 Volts rms.

E☐ Connect the AC VTVM to the output of the filter at TP2.

F☐ Connect the AC VTVM ground to TP3.

G☐ Adjust trimmer R38 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

H☐ Remove the oscillator from the filter input.

4) Calibrate sum phase balance control on Card #3 (optional)

This procedure requires a working and calibrated 8182A. Skip to step M below if you are not using the Orban 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.

A☐ Re-strap the jumpers on Card #2 of the 8185A as follows:

Jumper	Position
A	8182A
B	OUT
C	8182A
D	8182A
E	OUT
F	8182A

B☐ Strap the jumpers on Card #7 of the 8182A as follows:

Jumper	**Position**
A	OUT
B	OUT
C	SUM OUT
D	DIFFERENCE OUT

C☐ Connect the 8185A to the 8182A with the multi-conductor connecting cable.

D☐ 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.

E☐ 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 and in phase.

F☐ 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.)

G☐ 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.

H☐ 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.

I☐ 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.

J☐ Adjust trimmer R24 on the 8185A Card #3 to obtain a minimum output level (null) at high frequencies (around 15kHz). This null will typically be more than 35 dB below the sum signal.

K☐ It may be possible to improve the high frequency null by *slightly* adjusting trimmer R618 (RIGHT PRE-EMPHASIS TRIM) on Card #6 in the 8182A OPTIMOD-TV.

L☐ Disconnect the 8182A from the 8185A.

M☐ Re-strap Card #2 in the 8185A as follows:

Jumper	Position
A	EXT
B	IN
C	EXT
D	EXT
E	IN
F	EXT

N☐ Strap Card #7 in the 8182A as follows:

Jumper	Position
A	OUT
B	OUT
C	L
D	R

O☐ This completes the alignment of Card #3.

(Do not) calibrate Card #4 (dbx N/R 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 Field Audit of Performance (above) to determine if the encoder is faulty.

Calibrate Card #5 (11-Pole Filters)

WARNING

Changing the alignment of Card #5 according to this procedure will almost certainly require that sum compensator components on Card #5 be re-selected for best separation. This can only be done at the factory. NEVER perform this alignment in the field except in the most dire emergency. If you do, you will eventually need to return the matched set of Cards #4, #5. and #6 to the factory for recalibration. This recalibration is labor-intensive, expensive, and is not ordinarily covered under your warranty.

1) Prepare Test Setup

A☐ Remove Card #5 and plug the extender board into the Card #5 slot. Plug Card #5 into the extender board.

B☐ Unplug Card #2, #4, Card #6 and Card #7.

2) Calibrate Sum 11-Pole Filter

A☐ Connect the low distortion oscillator to the test point labeled TP4.

B☐ Connect the oscillator ground to TP5.

C☐ Set the oscillator frequency to 15,772 Hz (±20 Hz). Verify the oscillator frequency with a frequency counter.

D☐ Set the oscillator amplitude to approximately 3 Volts rms.

E☐ Connect the AC VTVM to TP2 (the output of the filter).

F☐ Connect the AC VTVM ground to TP5.

G☐ Adjust trimmer R17 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

H☐ Set the oscillator frequency to 16,135Hz (±20Hz).

Verify the oscillator frequency with the frequency counter.

I☐ 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.

J☐ Set the oscillator frequency to 15,000Hz (+0,−20Hz).

K☐ Adjust trimmer R15 for 0.00dB (±.03dB) gain from TP4 to TP2.

3) Calibrate Difference 11-Pole Filter

A☐ Connect the low distortion oscillator to the test point labeled TP3.

B☐ Connect the oscillator ground to TP5.

C☐ Set the oscillator frequency to 15,772 Hz (±20 Hz).

D☐ Set the oscillator amplitude to approximately 3 Volts rms.

E☐ Connect the AC VTVM to the output of the filter at TP1.

F☐ Connect the AC VTVM ground to TP5.

G☐ Adjust trimmer R67 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

H☐ Set the oscillator frequency to 16,135Hz (±20Hz).

I☐ Adjust trimmer R72 for a minimum reading (null) on the AC VTVM. The null will typically be better than 60 dB below the input level.

J☐ Set the oscillator frequency to 300Hz (±50Hz).

K☐ Adjust trimmer R80 for 0.00dB (±0.03dB) gain from TP3 to TP1.

L☐ Set the oscillator frequency to 15,000Hz (+0,-20Hz).

M☐ Adjust trimmer R65 for 0.00dB (±0.03dB) gain from TP3 to TP1.

4) Match the 11-Pole Filters for best separation

Note the **WARNING** above!

A☐ Plug in Cards #2, #3, #4, #6, and #7.

B☐ Connect the output of the tracking generator in the spectrum analyzer to the LEFT EXTERNAL INPUT of the 8185A.

C☐ Connect the spectrum analyzer input to the LEFT MONITOR OUTPUT on the rear panel of the TV STEREO GENERATOR.

D☐ Switch both N/R IN/OUT switches in the TV STEREO GENERATOR to IN.

E☐ Extend Card #5 in the TV STEREO GENERATOR with the extender card.

F☐ Set the output level of the tracking generator −10dBu. If the tracking generator cannot produce this large a level, set the level to maximum.

G☐ Set the spectrum analyzer for a 0–20kHz sweep. Set the vertical sensitivity to 10dB/division. Set the input sensitivity to achieve an on-screen trace.

You should see a flat frequency response.

H☐ 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.

I☐ Slightly adjust R80 (LOW FREQ GAIN TRIM) on Card #5 to get the maximum separation at low frequencies.

J☐ 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 14kHz.

K☐ This completes alignment of Card #5.

(Do Not) Calibrate Card #6 (dbx N/R 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 the **Field Audit of Performance** on page 4-16 to determine if the decoder is faulty.

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Calibrate and Test Card #7 (Stereo Baseband Generator)

1) Test +5-volt supply.

A☐ Measure the +5-volt supply with the DVM. Verify the presence of 5 volts (±0.5V).

The +5-volt supply appears across C22.

B☐ Measure the −5-volt supply with the DVM. Verify the presence of 5 volts (±0.5V).

The −5-volt supply appears across C23.

2) Null 6H.

A☐ Re-strap the jumpers on Card #2 as follows:

Jumper	Position
A	EXT
B	OUT
C	EXT
D	EXT
E	OUT
F	EXT

B☐ Plug in all circuit cards.

C☐ Connect a low-distortion audio oscillator to the LEFT EXTERNAL INPUT and RIGHT EXTERNAL INPUT of the 8185A in parallel and in-phase.

D☐ Set the oscillator for 5kHz ±500Hz and +10dBu (2.45Vrms) ±5%.

E☐ Place the TEST switch in the SEPARATION position.

F☐ Connect the spectrum analyzer to the 8185A's COMPOSITE OUTPUT. Adjust its span to 100kHz linear. Adjust its vertical scale to 10dB/division. Adjust its sensitivity so that the 5kHz spur is 6dB below the top of the screen.

The top of the screen now corresponds to 100% stereo modulation (±50kHz deviation).

G☐ Adjust trimmer R18 (6H NULL) for minimum 6H component. 6H is 6 times the horizontal line rate or 94,404Hz. The 6H component will typically be >70dB below the top of the screen.

3) Null Subchannel-to-Main Channel crosstalk.

A☐ Place the TEST switch in the SUB-TO-MAIN XTALK position.

B☐ The 5kHz component you see on the spectrum analyzer is sub- to-main crosstalk. Adjust trimmer R12 (SUB:MAIN XTALK) to null the 5kHz as much as possible (typically >-75dB)

Setting the spectrum analyzer to 5kHz per division will make the crosstalk easier to see.

4) Measure 2H null.

A☐ Mute the oscillator.

B☐ Place the TEST switch in the OPERATE position.

C☐ Verify that the 2H component is >−70dB.

(2H refers to twice the horizontal line rate, or 31,468Hz).

5) Test pilot tone.

A☐ Be sure that the oscillator is still muted.

B☐ Turn the PILOT ON/OFF switch ON, and verify that the unit is in STEREO.

C☐ Verify that the pilot component is 14dB below the top of the screen.

D☐ Monitor the composite output with the frequency meter and verify that the pilot frequency is 15,734Hz (±0Hz).

E☐ Monitor the composite output with the THD analyzer and verify that the THD of the pilot is below 0.25%.

6) Verify DC offset null.

A☐ Connect the COMPOSITE OUTPUT to a DC voltmeter.

B☐ Place the TEST switch in the MAIN-TO-SUB XTALK position.

C☐ Verify that the observed DC output voltage is 0.00V (±5mV.).

7) Calibrate high frequency separation.

A☐ Place the TEST switch in the SEPARATION position.

B☐ Turn the PILOT ON/OFF switch OFF.

C☐ Set the oscillator frequency to 14kHz (±150Hz) at 2.45Vrms (±0.1V).

D☐ Observe the COMPOSITE OUTPUT with the scope. Trigger the scope externally from the oscillator. Set the scope sensitivity to 0.5V/div, and input coupling to "DC". Set the horizontal timebase to 0.2ms/div.

E☐ Adjust R42 (8185A OUTPUT LEVEL control) until the composite output is 4V p-p.

F☐ Adjust R35 on Card #7 (HIGH FREQUENCY SEPARATION/TILT) and R14 (SEPARATION) to obtain the flattest baseline possible. Verify that these controls are approximately centered with a flat baseline. To make the final adjustment accurately, expand the vertical scale by a factor of ten and re-adjust R14 if necessary.

> Variation from horizontal will typically be undetectable by eye. It must be less than 1/2 of a minor division on the scope graticule.

8) Check low-frequency separation.

A☐ Adjust the oscillator to 400Hz.

B☐ Verify that the baseline is still flat.

9) Check composite meter.

A☐ Adjust the oscillator for 1kHz at 1.767 volts.

B☐ Switch the 8185A to STEREO with the front-panel switch.

C☐ If it is not already, turn the PILOT switch ON.

D☐ Switch the METER FUNCTION switch to COMPOSITE LEVEL and the TEST switch to SEPARATION. Verify that the meter reads "40%" (±5%).

Calibrate Card #8

CAUTION

It is very unlikely that this procedure will be required because the circuitry is very stable. The procedure calibrates the amplitude of the Bessel Null tone. If this calibration is incorrect, it is impossible to achieve optimum system separation. Do not perform this procedure unless you have access to an AC voltmeter that is known to be accurate ±0.05% at 7.5kHz. This implies a 4½-digit digital voltmeter recently calibrated at a reputable calibration laboratory.

1) Apply composite video or sync to the SYNC input on the 8185A's rear panel. Set the TERMINATION switch IN.

2) Extend Card #8. Plug in all other cards.

3) Apply power, and switch the 8185A to STEREO. Verify that the STEREO lamp is lit.

4) If there is a signal source connected to the 8185A's LEFT EXTERNAL INPUT or RIGHT EXTERNAL INPUT, disconnect it.

5) Switch the BESSEL NULL CAL switch to TONE.

6) Connect an AC voltmeter between TP2 and TP1 (ground).

   The AC voltmeter must have a verified accuracy of ±0.05% at 7.5kHz.

7) Adjust R48 on Card #8 (MOD CAL) until the meter reads 1.338Vrms ±0.1%.

8) Measure the harmonic distortion of the tone at TP2, and verify that it is less than 0.03%.

Calibrate Meter Card

1) Turn off power, and adjust the VU meter's mechanical zero control (the screw on the bezel below the meter face) so that the meter reads "0%".

2) Turn on power.

3) Using a recently-calibrated DVM accurate ±0.1%, measure the 8185A's +15-volt power supply. If the supply is not providing +15.00VDC ±0.1%, adjust R106 on Card #PS (mounted on the rear panel) to make it so.

   +15-volts can be measured from pin B (+15) to pin C (ground) at any circuit card's edge connector.

4) Set the METER GAIN switch to NORM.

5) Set the METER SELECTOR switch to "+15".

6) Adjust R24 (METER CAL) on the meter card so that the meter reads "100%".

> The meter card is located on the back of the hinge-down front panel. When you make the adjustment, keep the panel as vertical as possible so that the abnormal angle will not affect the meter's accuracy.

This concludes the Field Alignment.

APPENDIX: Evaluating BTSC Stereo Generators and Audio Processors: Some Suggestions

Stereo Generator

1) Evaluating Separation

The noise reduction system used in BTSC stereo compresses the dynamic range and high frequency content of the stereo difference signal (L–R) prior to its encoding in the stereo subchannel. This means that low-amplitude program material is increased in level by the compressor, and therefore the average modulation of the subchannel always remains high. At the receiver, an expander selectively reduces the level of the compressed program material to (ideally) restore the original program dynamics. Simultaneously, the expander reduces noise introduced during transmission.

There is one vital concept to remember when evaluating separation in BTSC: *BTSC stereo is a non-linear system.* The presence of the noise reduction compressor in the stereo generator and the expander in the receiver, both non-linear (although ideally complementary), makes this so.

The total system created by connecting the compressor and expander back-to-back appears to be linear if the compressor and expander have ideal performance (are completely complementary). However, as we shall see below, the intrinsic non-linearity of the compressor or expander can exaggerate imperfections in the signal path connecting the compressor output to the expander input.

Testing For Linearity:

You can test a system for linearity as follows.

1) Apply an input signal *a* to the system and measure its output. Let *x* be the output signal caused by input *a*.

2) Remove *a* from the input and apply another signal *b*. Let *y* be the output signal caused by the input *b*.

The system is linear if the following things happen:

3) If you multiply the input waveform by a factor *k* to scale it, the output waveform also becomes multiplied by a factor of *k*, but its shape is not distorted by this scaling process.

4) If you apply inputs *a* and *b* to the system simultaneously, the system's output is $x+y$ — nothing more or less. (This is called *superposition.*)

It is clear that the compressor, *when considered by itself,* is non-linear. The output is not scaled proportionally to the input; it is compressed. Similarly, when two signals are applied to the compressor, the output is not the same as the sum of the compressor's response to either signal individually — superposition does not hold. The expander is similarly non-linear.

Sinewave Measurements and Linearity:

When you predict a system's response to program material by measuring its response to individual sinewaves, you are making some assumptions. The first assumption is that you can adequately represent program material as a sum of sinewaves (Fourier analysis). The second assumption is that superposition holds, so that the response of the system to single sinewaves also applies when several sinewaves are summed together at the system's input. That way, you can extrapolate the sinewave results to program material.

Now we come to the payoff: *In the BTSC system, swept sinewave separation measurements do not accurately predict separation with broadband program material because superposition and scaling do not hold in the noise reduction compressor and expander.*

Sinewave vs. Broadband Separation Measurements:

Physically, the explanation is straightforward. A sinewave concentrates all the program energy at just one discrete frequency. When the system is measured with sinewave, any slight frequency response errors in the transmission channel cause the compressor and expander level detector to see different levels. Their action is no longer complementary. Thus, sinewave measurements can exaggerate channel frequency response errors by 2–3x (depending on frequency).

Errors in the level detectors themselves can make the measurements even worse. Yet these same frequency response and level detector errors are likely to "average-out" with broadband program material, because the average power seen by the level detectors is unlikely to be significantly affected by localized frequency response errors in the channel or the detectors themselves.

Upon de-matrixing into L and R, the errors introduced into the companded L–R signal translate into apparent loss of separation with swept sinewave. However, the separation may be very different (and usually better) with broadband, real-life program material.

If swept sinewaves represented a "worst-case" condition, we could probably forgive their exaggerating system errors unrealistically. However, there are important system errors to which swept sinewaves are completely insensitive! Because a sinewave has a constant envelope, it can't exercise the dynamic response of the RMS detectors in the compressor and expander. Yet our research has shown that dynamic mistracking between the compressor and expander time constants is the primary source of separation loss with broadband program material in BTSC stereo. *Sinewave tests are completely insensitive to this loss.*

Orban optimizes each Model 8185A Stereo Generator for best separation with pink noise, not swept sinewaves. In fact, we have found that the adjustments that optimize the system with pink noise are often substantially different than those that optimize it with sinewave. Further, we have shown by extensive experimentation that optimizing system separation with pink noise also optimizes it for actual speech or music material.

To reiterate the point: if you measure BTSC separation with swept sinewave, you will be measuring how well the system is able to keep a single sinewave out of the undesired audio channel, *nothing more*. You will *not* be measuring how well it keeps speech or music out of the undesired audio channel.

Decoder Accuracy — the "Separation Floor" in Measurement:

A measuring instrument must have about 10x less residual error than the system being measured to achieve accurate results. It is very difficult to create a BTSC *decoder* (containing the noise reduction expander) whose intrinsic separation, assuming an ideal input signal, exceeds 40dB. This means that it is very difficult to measure BTSC system separation greater than about 35dB even approximately. Measured results may be worse or better, depending on whether the decoder errors add to, or complement, the errors in the encoder being measured.

Fortunately, we can accurately measure the swept sinewave "separation floor" in a given BTSC decoder by using the RE Instruments Model 540 BTSC Test Generator. This instrument digitally synthesizes a BTSC-encoded sinewave signal with intrinsic separation of 60dB or better. It can thus measure a decoder to 40dB of separation with high confidence, and to 50dB of separation with moderate confidence.

Every Orban Stereo Generator includes a full monitor decoder, including noise reduction expander. We measure the performance of every decoder with the Model 540 at the Orban factory, and include a computer printout of the results with each Orban generator. Knowing the "separation floor" of the built-in decoder, you can readily judge whether your overall separation measurements accurately characterize the encoder, or if they are "in the noise". If you measure the separation of the Orban Stereo Generator with any other decoder, be sure that its separation floor is fully characterized. Otherwise, you don't know what you are measuring.

Please note that the Model 540 test set has several limitations: 1) Any residual phase or amplitude errors in its output will be exaggerated 2–3x by the expander, because of the intrinsic expander non-linearity, 2) because it only provides sinewave outputs, the Model 540 does not exercise the time constants in the RMS detectors of the expander and thus does not detect dynamic mistracking, and 3) the Model 540 does not synthesize the slight low-frequency distortion that is inherent in the official FCC description of the compressor in document OET-60A. The expander creates complementary distortion to cancel much of the compressor distortion. Because the Model 540 output is undistorted at low frequencies, this cancellation does not occur, and the distortion appearing at the expander output is unrealistically high at low frequencies.

Instrumentation to Measure Dynamic Separation:

Orban uses a dual-channel FFT analyzer (HP 3562A) to measure dynamic separation. For example, to measure left-into-right separation, we connect pink noise (or program material) to the left input of the stereo generator while grounding its right input. We adjust the output level of the pink noise generator to produce about 30% peak baseband modulation, because we feel this is a reasonable representation of the average modulation produced by processed program material in television. Of course, you can use any modulation level you desire: measuring dynamic separation at several modulation levels tells you how well the separation holds up as program dynamics vary.

The left channel output of an accurate BTSC decoder is connected to CHANNEL A input of the FFT analyzer; the right channel output of the decoder is connected to CHANNEL B input of the FFT analyzer.

The analyzer is set to measure the "transfer function" between its A and B inputs. Conceptually, this is the ratio between the B and A inputs (B÷A) as a function of frequency. So that all octaves contribute equally, it is displayed on a logarithmic frequency axis. (If a linear frequency scale is used, the highest frequency octave will occupy about half the screen, and it will be very difficult to see the separation in the midrange frequencies that are most crucial to the stereo effect, because these will be bunched-up to the left of the screen.) Averaged 10 times or so, the magnitude of this "log-frequency transfer function" measurement provides a well-smoothed separation vs. frequency curve.

Dual-channel FFT analyzers are still fairly exotic beasts (although a serious evaluation of BTSC separation may justify renting one for a day or two). A useful alternative measurement technique uses a 1/3-octave "real-time" analyzer.

Use a pink noise generator to drive the left channel of the stereo generator. To obtain a "0dB" reference on the analyzer, first observe the left channel output of the BTSC decoder with the 1/3-octave analyzer. Adjust the analyzer's input attenuator so that the various bands of the analyzer read "0dB". Because the readings will bounce around a bit, you will have to "eyeball" this. (The frequency response should be essentially flat to 15kHz.) Then measure the right channel output with the 1/3-octave analyzer. The analyzer will directly indicate separation vs. frequency on the desired log frequency scale.

Another potentially useful instrument for separation measurement is a spectrum analyzer with a 20–20kHz logarithmic sweep (the Tek 5L4N comes to mind). Again, use a pink noise generator to drive the left channel of the stereo generator. To obtain a "0dB" reference, first observe the left channel output of the BTSC decoder with the spectrum analyzer. The trace should be essentially flat, although a bit jagged, provided you are using a logarithmic frequency sweep. Then measure the right channel output with the spectrum analyzer. Make a separation vs. frequency measurement by measuring the distance (in dB) between the "0dB" reference and the right channel measurement.

(Aside: although we have seen the Tek 7L5 used for BTSC separation measurements more often than we would like, this instrument does not have log sweep, and therefore cannot make psychoacoustically meaningful separation measurements.)

5) Other Stereo Generator Measurements

Other measurements are less tricky. Noise, harmonic distortion, IM distortion, and frequency response can be measured in the conventional way, with due attention to possible ground loops between bench instruments and other well-understood measurement problems.

To most accurately evaluate the performance of the Orban 8185A Stereo Generator, measure it through its own monitor outputs. This technique prevents inaccuracies in the external BTSC decoder from affecting your results. Although this technique does not include Orban's stereo baseband encoder in the measurement loop, you can verify on a spectrum analyzer that the noise and distortion floor of Orban's Hadamard

Transform Stereo Encoder™ is substantially below that of the audio encoding which precedes it. Use the main-to-sub and sub-to-main crosstalk test modes in the 8185A. These respectively drive the main channel and subchannel inputs of the 8185A's baseband encoder with the L+R audio signal, eliminating and noise or distortion that might otherwise be introduced by the noise reduction encoder in the L–R channel.

Please note that the frequency response of an external BTSC decoder may begin to roll off at a lower frequency than the 8185A itself. So you may have to measure the 8185A's frequency response through its monitor output terminals to verify our ±0.5dB to 15kHz frequency response spec.

Audio Processor and Subjective Tests

Proof of Performance:

Subjective tests are tricky. Small differences in level and in setup can give misleading results in A/B comparisons between different audio processors, or between the processed audio and the source. It is therefore wise to make objective proof-of-performance tests of the entire test bed *before any subjective testing is done.* At least sweep the system for frequency response and gain (processor in proof mode), and spot-check THD at a few frequencies. This should be a full-system source-to-loudspeaker-input-terminals check. Don't risk invalid subjective results because of measurable problems in the test bed!

Be Realistic About Typical Viewing and Listening Conditions:

Orban's Optimod-TV® audio processing is optimized for real-world conditions. This means sound which, above all, must be intelligible on sets with under-powered amplifiers and tiny speakers, located in environments with substantial acoustic noise levels. Viewers almost never complain about compression. They do complain if they can't understand the dialog, or if excessive dynamic range causes the sound to blast at one moment, yet be reduced to inaudibility at the next.

Optimod-TV is artfully designed to produce a *highly consistent, comfortably listenable sound* from source to source. This aspect of the processing cannot be assessed with an A/B test: it can only be appreciated by listening to the processed audio for long periods of time, over transitions between various types and quality of program material — music and voice, entertainment, news, and commercials. It is easy to design a processor that sounds great on only one kind of program material. The difficult task is to design one that sounds very good on everything.

Don't get us wrong — Optimod-TV processing is very smooth and subtle, and sounds excellent on high-quality monitors. But the proof of the pudding is not how the processed audio sounds on high-quality studio monitors, or even on Auratones. It is how well the sound holds up on a 15" portable mono TV set (a majority of consumer sets are still mono), volume adjusted for 70–75dBA, with acoustic background noise at the 55–60dBA level. If you can't provide the viewer with intelligible sound in this situation, then you have irritated a substantial portion of your real-world audience. We feel that Optimod-TV is uniquely effective at processing sound to work under these adverse conditions, without introducing artifacts that would be objectionable to viewers with higher-quality sound systems.

Section 5
Troubleshooting

CAUTION

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

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Troubleshooting Technique

This section is the first place you should go to obtain information on what to do if the 8185A Stereo Generator develops a fault. Many problems experienced in the field can be resolved or conclusively diagnosed with the following diagnostic routines. Even if the repair cannot be done in the field, the information provided by these diagnostic routines can speed the work of the factory service department in making the repair.

Please perform these routines and make notes if you observe anything exceptional or unusual.

- See “Getting Inside the Chassis” on page 4-4 for instructions on opening up the unit, removing the subpanel, and getting to the less accessible parts of the interior. See the assembly drawings in **Section 6** for locations of components and test points.

IMPORTANT

Always turn off AC power to the 8185A before removing or installing circuit cards. Allow the 8185A to stabilize for two minutes after turning the power back on.

1) Use systematic troubleshooting techniques to positively determine that the problem is in fact being caused by the 8185A and not by other equipment.

A☐ Check the controls and connections.

Could the problem have been caused by someone changing the control settings? Are the controls in their normal operating positions? Have phone lines, patch bays, or other audio components of your chain, STL, or transmitter/antenna system been recently maintained or modified?

B☐ Check the audio signal going into the 8185A.

If a standby stereo generator is available, it should be substituted for the supposedly faulty unit to see if the problem vanishes. If a standby generator is *not* available, audio quality at the 8185A audio input terminals should be checked with a high-quality monitor system.

If the 8185A is being used with the Orban 8182 Optimod-TV, the "audio input terminals" are the audio input to the 8182A audio processor, because the processor and generator are tightly coupled. (If the input is driven by a processor other than the 8182A and this processor has a pre-emphasized output, be sure to apply de-emphasis to the processor's output signal when listening to it.)

Note that even slight distortion can be seriously exaggerated by "heavy" audio processing prior to the 8185A, and that this sort of processing can only be successful if the input audio is extremely clean. A relatively minor problem which develops in the station's audio chain or STL can therefore be magnified by the action of audio processor, even if the processor or stereo generator are in no way defective.

C☐ Check the audio signal coming out of the 8185A.

If the audio is clean going into the 8185A, problems can still arise in the aural exciter. If a standby exciter is available, it should be substituted to see if the problem vanishes. If no standby exciter is available, you can connect the baseband output of the 8185A directly into the baseband input of a BTSC stereo *monitor* to see if the problem can still be heard at the aural output of the monitor. If the problem vanishes, then the exciter (or phase-linear STL, if used) is strongly suspect.

If the problem can be heard at the aural output of the BTSC monitor, but not at the 8185A's rear-panel MONITOR OUTPUT terminals, then the 8185A's internal stereo baseband generator (Card #7) is probably faulty. However, before making a final determination, check to see that the 8185A is receiving a clean sync reference and that the BTSC *monitor* is working correctly.

D☐ Check grounding.

Changes in or deterioration of grounding and/or exterior lead dress can sometimes cause RFI or hum problems to appear in a correctly-operating 8185A. If the system has a tendency to buzz or hum, we recommend installing the Orban ACC-025 Composite Isolation Transformer ahead of the exciter. This transformer will usually cure even the most stubborn cases of ground-loop hum or buzz.

If it seems impossible to conclusively isolate the problem to the 8185A, yet no other definite cause is found, then performing the Field Audit-Of-Performance procedure in **Section 4** may help diagnose a problem.

If the fault has been positively isolated to the 8185A, the Problem Localization Routine described below should be performed to identify the faulty PC card.

2) About the Diagnostic "VU" Meter.

The VU meter on the front panel is electronically conditioned to be peak-, not average-reading. Although it no longer meets ANSI VU meter standards and cannot, strictly speaking, be called a "VU meter", this is nevertheless what we shall informally call it in the procedures below.

The meter driver circuitry is located on the meter resistor card on the 8185A's swing-down front panel. This circuitry is reasonably complex, and, like any electronic circuitry, is subject to failure. **Because the test techniques described below rely heavily on the meter, it is important to know that the meter is operating correctly.**

A☐ For the purposes of these tests, if the meter reads "100%" ±5% when switched to the +15V and −15V positions, then you can assume that the meter is operating correctly.

> If it does not read as expected, either the meter driving circuitry, the meter itself, or the power supply is faulty. If the +15 and −15V supplies read normally on an external voltmeter, yet the meter reads abnormally, you should diagnose and repair the meter before proceeding further with the diagnostic tests.
>
> The +15V supply can be measured from pin B to pin C of any circuit card; the −15V supply from pin E to pin C.

3) Power Supply Tests.

A☐ Gross changes in power supply voltage can be detected with the "+15VDC" and "−15VDC" positions on the VU meter. Normal readings are 0VU ±0.5VU.

> If normal readings are obtained, skip to the next section on VU Meter Techniques.
>
> If either "+" or "−" power supply output is significantly low, it could indicate a defect in the supply itself. But it is more likely to indicate a shorted IC or capacitor somewhere in the circuit that is overloading the supply and causing it to current-limit.

B☐ The power supply is electronically protected against excessive current demand by other parts of the circuitry. If a failure causes a high current demand on the power supply, its output voltage will drop as far as necessary to reduce output current to approximately 0.75A. If the power supply voltage is abnormally low, unplug each circuit card in turn and check if the power supply recovers by observing the "−15VDC" meter position.

(A normal "−15VDC" reading assures a normal "+15VDC" reading because the negative regulator tracks the +15V supply. So the −15V supply will go down if the +15V supply does, even if the −15V supply or load is completely normal.)

If recovery occurs, then troubleshoot the unplugged board. Ordinarily, the defective component will become very hot, and is easily detected by touch. (Wet your finger first to avoid burns!)

If all cards are removed and an undervoltage problem does not disappear, examine the meter card, motherboard, and chassis wiring before suspecting the supply itself. (A wiring problem will be indicated by an ohmmeter's indicating very low resistance between the "+15V" or "−15V" power busses with AC power OFF.)

c☐ Even if power supply voltages appear normal on the VU meter, the supply may still have subtle problems such as hum, noise, or oscillation. To check for this, test the regulated DC with a well-calibrated DVM, scope, and AC VTVM with 20-20kHz bandpass filter. Voltages should be +15.00V ±0.075V, −15.00V ±0.15V. Ripple must be less than 2mV r.m.s., 20-20,000Hz. There must be no high frequency oscillation.

The +15V supply can be measured from pin B to pin C of any circuit card; the −15V supply from pin E to pin C.

D☐ The +5V supply (on Card #7) is used as a reference to determine the pilot tone level in the Stereo Baseband Generator. If the +5V supply drifts, it will cause proportional drift in the pilot tone level. See step 1 on page 4-39 for a test procedure for the +5V supply.

4) Signal Tracing With the Diagnostic VU Meter.

General Principles:

The most powerful and general technique for localizing a problem within OPTIMOD-TV is *signal tracing*. This simply means that the signal is observed at various points as it passes from OPTIMOD-TV's input to its output. If the signal is normal at some point "A" in the circuit, and is abnormal at a point "B" further towards the output, then the problem clearly lies in circuitry between points "A" and "B".

Signal tracing in OPTIMOD-TV is facilitated by the fact that much of the circuitry is duplicated for stereo, either in discrete Left and Right form (L/R) or in Sum-and-Difference form (L+R/L−R). Often, the bad channel can be readily compared with the good one, which serves as a "normal" reference.

To create equal signals in the Left and Right channels, drive the 8185A (or 8182A Audio Processor, if used) LEFT INPUT and RIGHT INPUT with identical source material.

To create equal signals in the L+R and L−R channels, drive only the LEFT INPUT, short out the RIGHT INPUT, and operate the 8185A in 75µs equivalent mode (N/R ENCODER switch OUT).

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. The following instructions apply to a system consisting of the Orban 8185A and the

Orban 8182A Optimod-TV audio processor, as interconnected through a rear-panel cable according to the setup instructions in **Section 2** of this manual. [Instructions in brackets apply to an 8185A used with an **external audio processor** connected to the 8185A's left input and right input.]

A☐ If the signal is **normal at the 8182A's** L or R COMPR OUT **positions** [is normal at the left or right output of the external audio processor] but **abnormal at the 8185A's** L or R INPUT FILTER **positions**, then the fault is probably in the faulty channel's Phase Corrector for the Six-Pole Filters on Card #2, or in the Six-Pole Filters on Card #3. (The stereo/mono switching logic on Card #7 could also be faulty.)

B☐ If the signal is **normal at the 8182A's** R SYSTEM OUT position [is normal at the 8185A's L INPUT FILTER and R INPUT FILTER **positions**], but **abnormal at the 8185A's** N/R IN position, then the problem is probably in Card #4 (Noise Reduction Encoder) in the 8185A.

C☐ If the signal is **normal at the 8182A's** L SYSTEM OUT position [is normal at the 8185A's L INPUT FILTER and R INPUT FILTER **positions**], but **abnormal at the 8185A's** L+R position, then the fault is probably in Card #5 (11-Pole Filters) of the 8185A. (The stereo/mono switching logic on Card #7 could also be faulty.)

D☐ If the signal is normal at the 8185A's N/R IN position but abnormal at the 8185A'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).

E☐ If the signal is **normal at the 8185A's** L+R and L-R **positions**, but **abnormal at the 8185A'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.)

F☐ 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.

5) Card Swap Technique.

The instructions below provide more detailed information on troubleshooting at the "card exchange" level. Servicing at the "component replacement level" requires a more profound understanding of 8185A circuit operation. This is provided in **Section 6** of this manual. The block diagram on page 6-57 will clarify the techniques described below.

Unlike the 8182A Audio Processor, there are no card-swap techniques available per-se in the 8185A. However, Cards #3 (6-Pole Filter) and #5 (11-Pole Filter) have jumpers which enable their outputs to be individually reversed. This permits diagnosis by observing how the symptom moves. *Note that the system will not operate correctly with either card in the "output-reversed" state.*

The following instructions apply to a system consisting of the Orban 8185A and the **Orban 8182A Optimod-TV audio processor,** as interconnected through a rear-panel cable according to the setup instructions in **Section 2** of this manual. [Instructions in brackets apply to an 8185A used with an **external audio processor** connected to the 8185A's LEFT INPUT and RIGHT INPUT.]

A☐ If the problem **does not move** from one stereo channel to the other when Cards #3 and #4 in the 8182A are swapped [the left and right outputs of the external audio processor are swapped], but **does move** when Jumper "A" on Card #3 of the 8185A is placed in the reverse position, then Card #2 (Phase Corrector for Six-Pole Filters only) or Card #3 in the 8185A is probably faulty (Card #3 is most suspect).

> To perform a further test, note that 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 #2 or Card #3 in the 8185A is probably faulty (Card #3 is most suspect).

B☐ If the signal seems **normal emerging from the 8182A's line amplifiers** [normal at the output of the 8185A's Card #3], and if placing Jumper "A" on Card #5 of the 8185A 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), Card #5 (11-Pole Filter), or the Matrix on Card #2 of the 8185A is faulty. (Card #4 can only introduce faults into the difference channel, provided that Jumper "A" on Card #5 is in the NORMAL position.)

C☐ If the problem appears **equally in the sum and difference channels** and **does not move when jumper "A" on Card #5 is moved,** then the problem is probably with one of the Phase Correctors for the 11-Pole Filters on Card #2.

D☐ If the problem vanishes when the N/R ENCODER switch is set out, then the problem is in Card #4. Otherwise, the problem is probably in Card #5 or in the logic on Card #7.

E☐ Although quite unlikely, a problem with the **L+R signal only** could be due to the bessel null cal switch on Card #8, since the L+R signal is looped through this switch before it enters Card #5.

Problems and Possible Causes

This troubleshooting guide is a catalog of some possible failure modes in the 8185A. If you are using the Orban 8182A Audio Processor, it should be used in conjunction with the identically-titled section in your 8182A Operating Manual.

[Instructions in brackets apply to an 8185A used with an **external audio processor** connected to the 8185A's left input and right input.]

Poor separation

1) Separation is OK as observed at the 8185A's MONITOR OUTPUT TERMINALS. Possible trouble spots are:

A☐ Misadjustment of separation control on Stereo Baseband Generator. See **Stereo Baseband Generator Tests** in **Section 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 8185A'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 ±0.05dB. Deviation from linear phase over that frequency range must be less than 0.5°. 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 8185A'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 8185A's composite output atten control to achieve correct modulation gain. Check the adjustment in **Section 2** of this manual called **Match 8185A Stereo Generator to Exciter (Bessel Null)** on page 2-18. 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 8185A's MONITOR output terminals.

A☐ The N/R switches on the 8185A are set so that one is IN and the other is OUT.

B☐ N/R encoder or decoder has failed. See if separation is restored by switching both N/R switches out. (This will put the system in "75µs equivalent" mode.)

C☐ 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 **Section 4** in this manual for alignment instructions.

D☐ 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.

E☐ Matrix (on Card #2) has failed.

Excessive Main-to-Subchannel or Sub-to-Main Channel Crosstalk

1) The 6-Pole Filter or 11-Pole Filter Left and Right Phase Correctors on Card #2 (8185A) have become unmatched. This can cause a large relative phase shift between the left and right channels without necessarily changing the frequency response of the defective channel.

2) R12 or Q1 on Card #7 (8185A) may be defective.

Excessive Hum or Buzz

1) Ground loop in the transmitter plant. This can be a particular problem if the exciter input is unbalanced. Installation of the Orban ACC-025 Composite Isolation Transformer ahead of the exciter's composite input will usually cure even the most stubborn ground loops.

2) Excessive Incidental Carrier Phase Modulation (ICPM) in the aural transmitter. ICPM must be <5°, with <2°preferred.

Signal is distorted

1) 8182A's rear-panel STEREO GENERATOR IN/OUT switch (labeled N/R IN/OUT in some units) is set OUT. This switch must be IN when the 8185A is plugged into the 8182A.

2) IC opamp failure within one of the filters in the 8185A is causing distortion or severe offset without entirely preventing signal passage.

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 Section 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 8185A. If signal is clean at the LINE OUTPUT terminals of the 8182A (they are pre-emphasized, and in left and right form), but distorted at the 8185A's MONITOR OUTPUT, then the problem is within the audio circuitry of the 8185A. If the signal is clean at the 8185A's MONITOR OUTPUT but distorted at the output of a stereo demodulator connected directly to the 8185A's BASEBAND OUTPUT, then the 8185A's Card #7 (Stereo Baseband Generator) is probably faulty.

Lack of 31.468kHz subcarrier suppression

1) High relative DC offset between left and right channels prior to the Stereo Baseband Encoder that is beyond the range of DC servo IC21a to correct.

2) Failure of IC21a or IC21b DC servo circuits (on Card #7, 8185A).

3) Failure of analog switch IC7 (on Card #7, 8185A).

Separation unstable

(NOTE: All referenced components are on Card #7 of the 8185A.)

1) Drift or failure in Baseband Low-Pass Filter (L1, L2, C3-C9), or in Phase Corrector IC16.

2) R14 intermittent.

3) IC6 or IC16 defective.

4) See also **Poor Separation** above.

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) R18 (6H SIDEBAND NULL) on Card #7 (Stereo Baseband Generator) in 8185A is misadjusted, causing the Baseband Generator to produce excessive spurs at 6H.

4) Power supply oscillation.

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.

SYNC LOCK unachievable, or lamp flickers

1) 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.)

2) Faulty sync stripper and/or phase-lock-loop circuitry on Card #8 of 8185A.

Components: Fault Diagnosis, Replacement

If you want to troubleshoot on the component level instead of returning the unit to the factory for service, read the circuit description in **Section 6** before continuing. Servicing on the component level requires a deeper understanding of 8185A circuitry.

Here are some suggestions for component-level troubleshooting:

IC Opamps:

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

Exceptions are ICs used without feedback (as comparators) and ICs with outputs that have been saturated due to excessive input voltage because of a defect in an earlier stage. However, if an IC's + input is more positive than its − input, yet the output of the IC is sitting at −14 volts, the IC is almost certainly bad. The same holds true if the above polarities are reversed. Because the characteristics of the 8185A's circuitry are essentially independent of IC opamp characteristics, an opamp can usually replaced without recalibration.

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

Selecting Replacement Parts:

Before ordering parts, read the introduction to the parts list on page 6-41. Nearly all parts used in the 8185A have been very carefully chosen to make best use of both major and subtle characteristics. For this reason, parts should always be replaced with *exact duplicates* if so indicated in the parts list. It is very risky to make "close-equivalent" substitutions because of the possibility of altering performance and/or compliance with regulatory requirements.

Certain parts are selected to tighter than normal specifications (most such parts are noted in the parts list — but it is almost always wiser to return the defective card to the factory for service). The replacement of certain parts requires partial recalibration of the 8185A, and this may or may not be practical in the field (such parts are also noted in the parts list). Some cards have potted modules which must be replaced as a unit (ordinarily, this requires return of the entire card to the factory).

To replace a component:

It is important to use correct technique when replacing components mounted on printed circuit cards. Failure to do so may result in circuit damage and/or intermittent problems. Because solder flows well into the through-holes of the double-sided plated-through circuit boards used in the 8185A, a technique like the following is required.

1) Remove the old component.

It is sometimes easier to cut the offending components from its leads, then remove the leads as described below.

A☐ Clear each lead to be removed by melting the solder *on the solder side* (underneath) of the printed circuit card. When the solder melts, vacuum it away with a spring-actuated de-soldering tool (like the Edsyn Soldapullt®).

Use a **30-watt soldering iron** — do *not* use a soldering gun or a high-wattage iron! DO NOT OVERHEAT the card. Overheating will almost surely cause the conductive foil to separate from the card base.

B☐ Release the component by gently wiggling each of the leads to break solder webs, then lift the component out.

2) Install the new component.

A☐ Bend the leads of the replacement component so they will fit easily into the appropriate circuit card holes.

B☐ Solder each lead to the bottom side of the card.

Use a 30-watt soldering iron and a good brand of *rosin-core* solder. Make sure that the joint is smooth and shiny.

If no damage was done to the plated-through hole when the old component was removed, soldering of the top (component side) pad is not necessary. But if the removal procedure did not progress smoothly, it would be prudent to solder each lead on the component side of the hole to avoid potential problems.

C☐ Cut each lead of the replacement component close to the solder side of the circuit card with a pair of diagonal cutters.

D☐ Remove all residual flux with a swab moistened with solvent.

Suitable solvents include 99% isopropyl alcohol, 1,1,1-trichloroethane (sold as Energine® Fireproof Cleaning Fluid), and naphtha (sold as Energine® Regular Cleaning Fluid).

Make sure that the flux has actually been removed, and not just made less visible by smearing. While most rosin fluxes are not corrosive, they can slowly absorb moisture and become sufficiently conductive to degrade circuit performance.

Technical Support, Service

If the troubleshooting information in this manual doesn't help you solve your problem, contact Orban Customer Service. Be prepared to accurately describe the problem, including the results of diagnostic tests you have performed. Know the serial number (and "M" number, if any) of your 8185A — these are printed on a label attached to the rear panel of the 8185A.

Always contact Customer Service before returning a product to the factory for service. Often, a problem is due to misunderstanding, or is relatively simple and can be quickly fixed after telephone consultation. In any case, products will be accepted for factory service *only* after Customer Service has issued a Return Authorization number. This number flags the returned 8185A for priority treatment when it arrives on our dock, and ties it to the appropriate information file.

Telephone: (1) 510/351-3500

or Fax: (1) 510/351-1001

or Write:

Customer Service
Orban
1525 Alvarado Street
San Leandro, CA 94577 USA

To ship a circuit card, use the special carton in which Orban shipped you the loaner card. Do not use a "jiffy bag" or similar padded mailer — it will not provide sufficient protection.

To ship the complete 8185A, use the original packing material if it is available. If it is not, use a sturdy, double-wall carton no smaller than 22 × 15 × 12 inches (56 × 38 × 30 cm) with a minimum bursting test rating of 200 pounds (91 kg). Place the chassis in a plastic bag (or wrap it in plastic) to protect the finish, then wrap cushioning material around it. Do not pack the 8185A in crumpled newspaper — use bubble sheets, large foam beads, thick fiber blankets, or similar packing materials. Put at least 2 inches (5 cm) of cushioning on all sides of the 8185A, and tape the cushioning in place to prevent shifting during shipment. Close the carton without sealing it and shake it vigorously (if you can hear or feel the 8185A move, use more packing). Seal the carton with 3-inch (8cm) reinforced fiberglass or polyester sealing tape (narrow or paper tapes won't hold), top and bottom in an H pattern. Mark the package with the name of the shipper, and with these words in red:

DELICATE INSTRUMENT, FRAGILE!

Insure the package appropriately. Ship prepaid, *not collect.* Do not ship parcel post. Your Return Authorization number must be shown on the label, or the package will *not* be accepted.

The terms of the Orban Associates Limited One-Year Standard Warranty are detailed on a separate Warranty Certificate supplied with the 8185A. After expiration of the warranty, a reasonable charge will be made for parts, labor, and packing if you choose to use the factory service facility. The repaired 8185A will be returned C.O.D. In all cases, transportation charges (which are usually quite nominal) are paid by the customer.

Notes:

Section 6
Technical Data

Specifications

Performance

Performance meets or exceeds all specifications for the BTSC system, as defined by FCC *OET-60A* and EIA *Multichannel Television Sound: BTSC System Recommended Practices.* All measurements made with signal applied directly to 8185A audio inputs; dbx N/R IN unless otherwise noted.

Frequency response: ±0.5dB, 30–14,000Hz; <1dB down at 15kHz.

Noise: <–82dB, referenced to 100% modulation.

Total system distortion — BTSC mode (N/R in): <0.1% THD, 50–10,000Hz; <0.2% THD, 10–15kHz. <0.2% SMPTE IMD; 0.08% typical.

System BTSC separation — tone (10% 75µs equivalent-input modulation N/R in): >35dB, 50–10,000Hz; >30dB, 10–14kHz; >40dB, 50–10,000Hz typical.

BTSC separation of monitor decoder alone — tone (10% 75µs equivalent-input modulation, N/R in): >40dB, 50–10,000Hz; >35dB, 10-14kHz.

System group delay — 75µs equivalent mode: Constant ±5%, 50–12,000Hz.

Installation

Location

Immediately below 8182A OPTIMOD-TV Audio Processor, if used.

External Audio Input

For audio processors other than Orban 8182A OPTIMOD-TV.

Configuration: Left and right, flat or pre-emphasized.

Impedance: >10KΩ load impedance, electronically balanced by means of true instrumentation amplifier. Requires balanced source ≤600Ω. Common mode rejection >60dB at 60Hz.

Sensitivity: +10dBm at 100Hz applied in-phase to both inputs produces ±25kHz main channel deviation (100% modulation).

Connector: Barrier strip (#5 screw), EMI suppressed.

Interconnect to 8182A OPTIMOD-TV Audio Processor

Signals: Left and right 8182A compressor output to 8185A six-pole filter input; 8185A left and right six-pole filter output to 8182A HF limiter input; 8182A left and right pre-emphasized output to 8185A input.

Connector: 14 pin connector to mate with shielded jumper cable supplied with 8185A.

Sync Reference Input

Impedance: 20KΩ, balanced. Switchable 75Ω termination.

Level: Composite video or sync, 0.6 to 1.6Vp-p; 1V nominal.

Connector: Two BNC connectors, looped-thru, shell insulated from chassis.

SAP Subcarrier Input

Impedance: 10KΩ, unbalanced.

Sensitivity: 1.5Vp (3.0Vp-p) produced ±15kHz carrier deviation (100% modulation).

Connector: BNC; shell floating over chassis ground, capacitively coupled to chassis through approximately 500pF for EMI suppression.

Composite Output

Impedance: Voltage source (0Ω) or 75Ω source impedance (selectable with internal jumper), single-ended, impedance independent of OUTPUT LEVEL setting.

Level: Adjustable from 0 to 2.2Vp (4.4Vp-p) at 73kHz total deviation. 18-turn TOTAL BASEBAND OUTPUT LEVEL control.

Load: When jumpered for voltage source, will drive *two* 75Ω loads in parallel. Maximum permissible load capacitance 0.047uF.

Connector: BNC, floating over chassis ground. EMI suppressed.

Monitor Output

Configuration: Left and right, N/R decoded (or 75μs de-emphasized, depending on setting of internal MONITOR N/R IN/OUT switch).

Impedance: 600Ω source impedance, single ended.

Level: Fixed; 5V peak into open circuit corresponds to 100% modulation.

Connector: Barrier strip (#5 screw), EMI suppressed.

Remote Control

Function: Selects MONO LEFT/MONO RIGHT/STEREO, Pro Channel ON/OFF.

Voltage: 6 to 24V AC or DC, momentary or continuous, optically isolated. 22VDC supplied to facilitate use with contact closure.

Connector: Barrier strip (#5 screw).

Sync Lock Indicator

Configuration: Relay-controlled contact closure to indicate successful lock to sync or composite video. Limit applied voltage to 50V, total load to 10VA non-reactive, current to 0.5A.

Connector: Barrier strip (#5 screw).

Power

115/230VAC (switch-selectable), ±15%, 50–60Hz; 35VA. IEC mains connector with detachable 3-wire power cord supplied. Leakage to chassis <0.5mA. AC is EMI suppressed.

Ground: Circuit ground is independent of chassis ground; both appear on terminal strip on rear panel for strapping as required.

Weight

24 lbs (10.4kg) net; 34 lbs (15.4kg) shipping.

Environmental

Operating temperature range 0–50°C (32–122°F). Humidity 0–95% RH, non-condensing.

Circuitry

Filters

Filtering exceeds BTSC specifications, as stated in Section 2.4.1.1. and Section 2.4.1.2 of the EIA *Multichannel Television Sound: BTSC System Recommended Practices.*

Left and Right Low-pass Filters

Type: Six-pole filters with two high-Q notches.

Rejection: >–50dB at 15,734Hz.

Sum and Difference Low-pass Filters

Type: Eleven-pole elliptical filter.

Passband response: Typically +0.05, -0.1dB to 15,000Hz.

Stopband rejection: >60dB at 15,734Hz and above.

Stereo Baseband Encoder

Equivalent stereo separation: >55dB, 50–15,000Hz.

Crosstalk — Linear: <-70dB, 50–15,000Hz, main channel to subchannel, or subchannel to main channel, referenced to ±55kHz deviation.

Suppression of other spurious components: <-75dB, referenced to ±55kHz deviation.

Warranty

One year, parts and labor. Subject to limitations stated in our Standard Warranty.

All specifications subject to change without notice.

Circuit Description

On the following pages, a detailed description of each circuit's function is accompanied by a component-by-component description of that circuit. Keywords are highlighted throughout the circuit descriptions to help you quickly locate the information you need.

Each card is numbered. There is no Card #1. The Card #9 and Card #10 slots are reserved for the optional Pro Channel Cards described in a manual supplement supplied with those Cards. The number of the card containing the described circuitry is provided with its description.

Where circuitry is duplicated between the left and right, or between the L+R and L−R channels, we will only describe the L or L+R circuitry.

REFER ALSO TO THE MORE DETAILED BLOCK DIAGRAM (page 6-57).

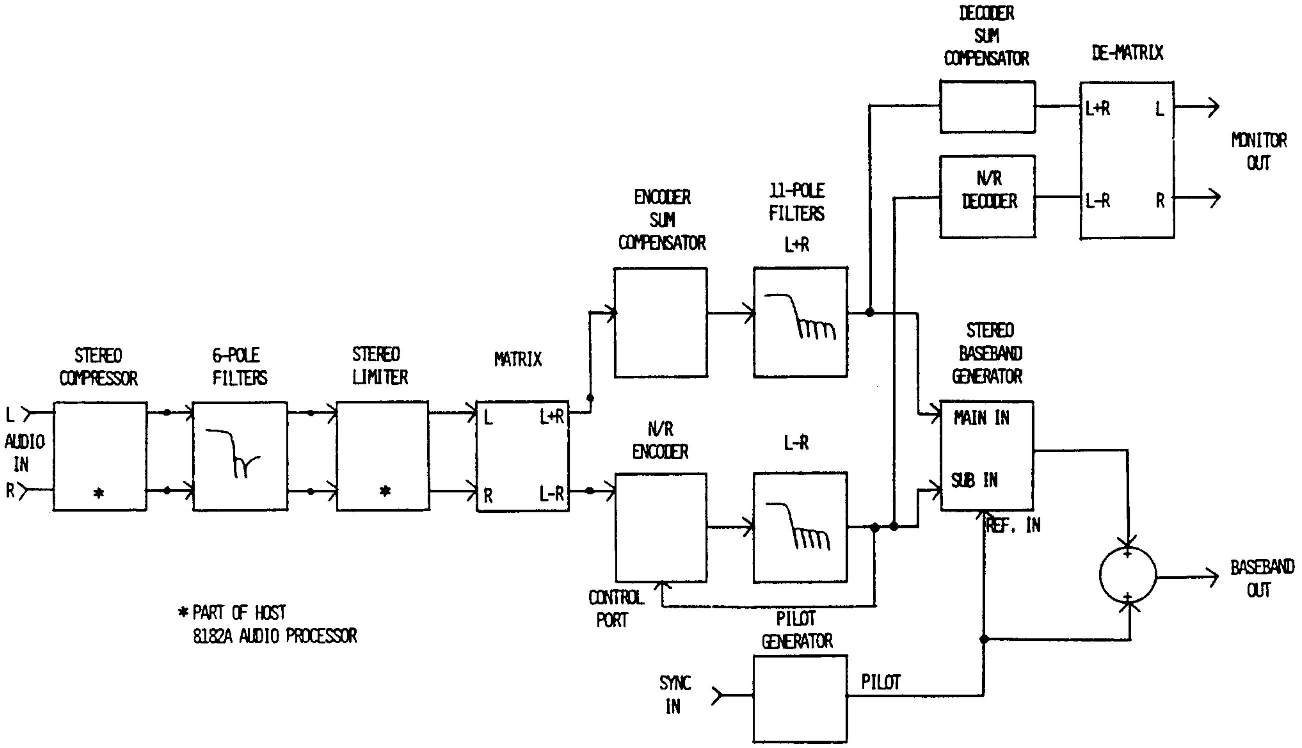


Fig. 6-1: Simplified Stereo Generator Block Diagram

1. Differential Input Amplifiers

Located on Card #2

The left and right input signals are applied to differential input amplifiers, which act like "active transformers": they respond with unity gain to the difference between the signals present at their + and – inputs, but reject signals that appear identically on these inputs, thus rejecting common-mode noise and hum.

Component-level description:

The differential amplifier is realized with the classic 3-amplifier "instrumentation amplifier" topology, configured for unity gain. R1, R2 provide bias current for buffers IC1a, IC1b. IC1a, IC1b drive differential amplifier IC2a, which provides high common-mode rejection because R3a-d are matched ±0.1%.

2. Pre-Emphasis Networks

Located on Card #2

IC3a provides 75µs pre-emphasis for external audio processors that can only provide a "flat" output. Pre-emphasis can be defeated with the pre-emphasis out/in jumper.

Component-level description:

IC3a and associated components create pre-emphasis by reducing the amount of feedback at high frequencies with C3. C4 causes a supersonic rolloff to prevent the pre-emphasis from increasing indefinitely with frequency.

The circuit is inverting. Its normal gain at 50Hz is –2.92dB. It is up 3dB (i.e., its gain is +0.09dB) at 2.12kHz.

3. Group Delay Correctors

Located on Card #2

The group-delay correctors are one or more cascaded allpass filters. The frequency response of these filters is very flat, but their phase response changes with frequency. The phase response is chosen to add frequency-dependent group delay to the signal such that the overall group delay of the allpass filter and the low-pass filter being equalized is more constant with frequency.

There are two group delay correctors. The first consists of one second-order allpass filter to equalize the six-pole filters on Card #3. The second consists of three cascaded second-order allpass filter to equalize the 11-pole filters on Card #5.

Component-level description:

IC2b and associated components are a second-order all-pass filter that equalizes the group delay of the six-pole filter on Card #6. The interaction of the components is complicated and best explained mathematically.

The frequency response of the filter is normally very flat (better than ±0.1dB, 50-15,000Hz). Faulty opamps may be replaced freely. If the filter becomes unflat due to a fault, first check the matching of R3f,g, since the flatness is very sensitive to this matching. Other faults due to component drift or failure are difficult to repair in the field, and should be repaired at the Orban factory. (See **Section 5, page 5-13** in this manual for details on how to obtain factory service.)

IC3b, IC4a, IC4b and associated components are a sixth-order all-pass filter that equalizes the group delay of the 11th-order low-pass filter on Card #5. Their topology is identical to IC2b's, and the troubleshooting comments above apply.

4. Matrix

Located on Card #2

From the L and R signals the matrix creates sum-and-difference signals for use by subsequent circuitry.

Component-level description:

The matrix is inverting. IC9a creates a very accurate −(L+R) signal by summing L and R with a high-precision (±0.1%) resistor array in an inverting amplifier. Similarly, IC9b creates a very accurate −(L−R) signal by subtracting L from R.

5. Six-Pole Filter

Located on Card #3

If the Orban Model 8182A Optimod-TV Audio Processor is used, the Six-Pole Filter and its associated stereo/mono switching and phase-matching functions are inserted between the output of the 8182A's Dual-Band Compressor and the input of its High-Frequency limiter.

If external processing is used, the Six-Pole Filter and its associated circuitry are inserted immediately after the differential input amplifiers in the 8185A.

The Six-Pole Filter's bandwidth is 15.0kHz. Its ideal frequency response in the passband and stopband is shown in Fig. 6-2. Note that the small (0.4dB) passband ripples are specifically designed to complement similar small ripples in the response of the 8182A OPTIMOD-TV Audio Processor 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.) .

Instructions on field alignment of the filters is provided in **Section 4: Maintenance** of this manual.

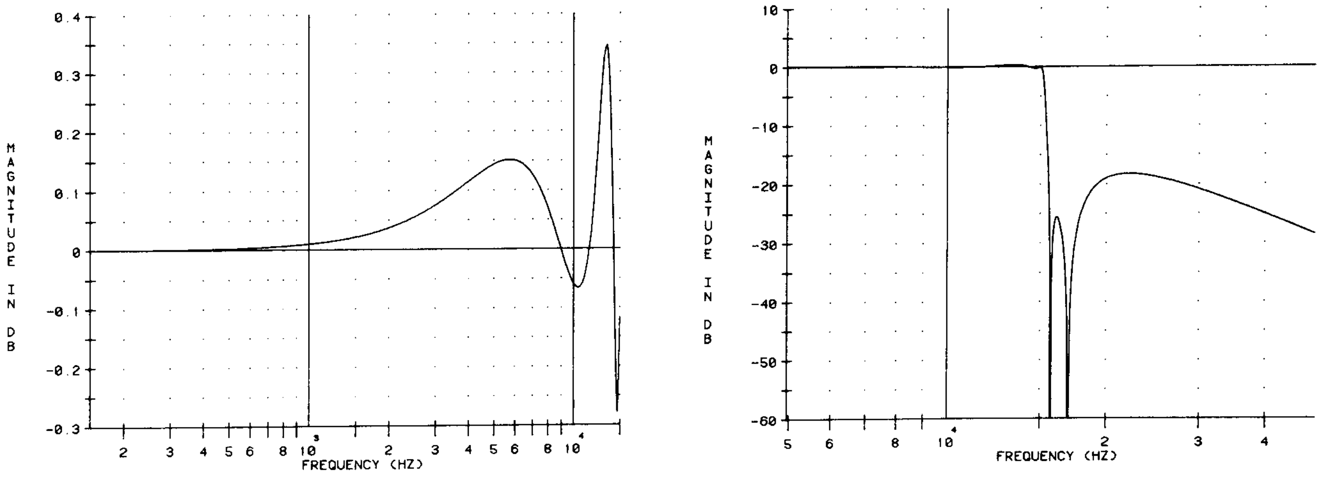
Component-level description:

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 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 (IC3) 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 R13 to produce a notch at precisely 15.734kHz to remove any 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 IC5b to restore unity gain at low frequencies.



Response of Six-Pole Filter in Passband

Response of Six-Pole Filter in Passband and Stopband

Fig. 6-2: Response of Six-Pole Filter

6. Stereo/Mono Switching

Located 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.

Component-level description:

JFET switch Q6 determines whether unity-gain follower IC5a will receive its input from the output of the Left or Right Six-Pole Filter. If Q6 is ON (gate pulled to the same voltage as its source through R45 because Q2 is OFF), then the left channel contribution from R20 will be swamped out by the low impedance drive from IC10b and the output of IC5a will contain the right channel. Conversely, if Q6 is OFF (gate at −15VDC because Q2 is ON), it looks like a very high impedance and the left channel will be applied to IC5a through R20.

Logic signals are supplied from Card #7. Refer to Fig. 6-4 on page 6-21 for a logic truth table.

7. Phase-Balance Circuit

Located on Card #3

The two signal paths of the 8182A Audio Processor 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. Other external audio processors could be similarly sensitive. 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.

Component Level Description:

IC4b and associated components form a first-order all-pass network: its magnitude response is flat, but its phase shift changes from 0°to 180°as a function of frequency. With R24 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 R24 changes the frequency at which 90°of phase shift is produced, without changing the (flat) magnitude response.

8. Eleven-Pole Filters

Located 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 Fig. 6-3 below .

The comments on page 6-7 regarding field repair of the Six-Pole Filter also apply to the Eleven-Pole Filters. The circuitry is designed to be insensitive to normal unit-to-unit variations in opamps. But if the filters cannot be repaired simply by replacing opamps, then they should be repaired by Orban Factory Service. Instructions for field alignment of the filters is provided in Part 4 of this manual. The Eleven-Pole Filters are realized using FDNR technology. The reader should refer to page 6-7 for a discussion.

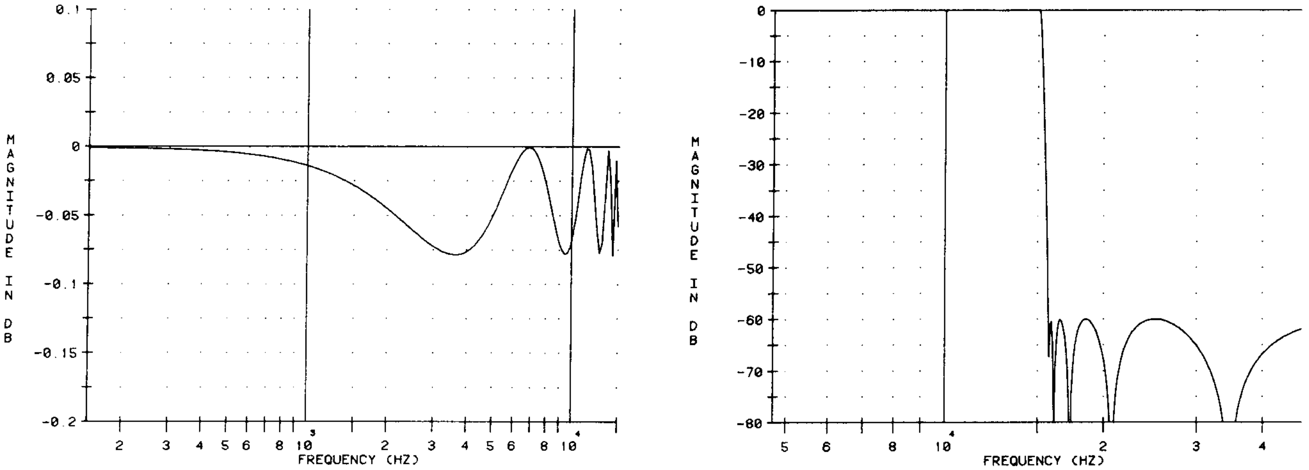
Unlike the Six-Pole Filters, all FDNR's in the eleven-pole filters create notches. There are five notches in the stopband. Trimmers are provided to tune the two notches closest to the passband to their correct frequencies, achieving highest filter accuracy. The notch frequencies are as follows:

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

Component-level description:

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 **5. Six-Pole Filter on page 6-7** above.



Response of Eleven-Pole Filter in Passband

Response of Eleven-Pole Filter in Passband and Stopband

Fig. 6-3: Response of Eleven-Pole Filter

9. Sum Compensator

Located on Card #5

The Sum Compensator is a low-pass 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 OET-60a 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.

In the 8185A, Cards #4, #5, and #6 are a matched set. 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, #5 or Card #6 to the factory for service.

Component-level description:

The sum compensator consists of IC9 and associated circuitry. 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. Each opamp can realize a wide variety of different filters depending on how the card is stuffed with components. The particular circuit to be used is chosen on factory test to best match the given dbx encoder card (on Card #4). Therefore, a given Card #4 (containing the dbx N/R Encoder) must be matched by a complementary 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.

10. Stereo/Mono Filter Bypass

Located 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 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.

Component-level description:

In MONO mode, the L+R Eleven-Pole Filter and N/R Encoder Sum Compensator should be bypassed. Q2, a JFET switch, does this. When Q2 is ON (gate pulled up to the voltage at its source through R35 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 (Stereo Baseband Generator).

11. Noise Reduction Encoder

Located on Card #4

Card #4 is devoted almost entirely to the dbx-manufactured N/R Encoder card. This card is described in the **Appendix** on page 6-26.

The N/R Encoder is fed by a precision 75µs de-emphasis network. This cancels the pre-emphasis produced by the 8182A audio processor (or by the pre-emphasis networks on Card #2 if other audio processing is used) 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 75µs de-emphasis curve as a function of frequency, and the audio processor must provide high-frequency limiting to compensate for the 75µs curve.

When the N/R ENCODER IN/OUT switch on Card #5 is switched OUT, all circuitry on Card #4 (including the 75µs 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 after the Eleven-Pole Filter to prevent N/R Encoder-induced noise from aliasing from the stereo Subchannel into the Main Channel, and to ensure 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 it is matched to its Sum Compensator circuit (on Card #5), and that Cards #4 and #5 must therefore be treated as a set. See **Sum Compensator** on page 6-11.

Component-level description:

Because the noise reduction cannot be repaired or aligned in the field, it should be treated as a component. No further component-level description is appropriate.

12. Sync Card–General Principles

Located 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 square wave at 16H which is used to drive the Stereo Baseband Generator; the second is a pulse waveform at 1H 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 16H. This output is divided by 16 to drive the Professional Channel Generator, and divided by 32 to drive the Bessel Null tone calibrator.

13. Sync Separator

Located on Card #8

The sync or composite video is tapped-off and amplified by 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. This output (as offset) is applied to the comparator and provides a reference voltage which tracks changes in average DC level of the video.

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.

Component-level description:

Sync or composite video is picked off the input line by 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 CR1 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 CR2 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 CR2. (The voltage on C2 in fact contains a positive DC offset because of CR2'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 due to current injected through R7. 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, 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.

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.

14. Phase-Locked-Loop (PLL)

Located 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 16H. This is divided down to 1H in a binary divider chip. The 1H output of the Binary Divider is used as one input to the phase detector; the other input is the 1H pulse train from the Sync Separator.

The output of the phase detector (consisting of pulses at 1H 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.

Component-level description:

The 1H pulses from IC5 provide a phase reference for the phase detector within IC9, which is triggered on positive-going edges. The output pulses of IC9a are integrated by IC8b and associated circuitry. When the loop is closed (by returning the 1H output of IC4 to phase detector IC9a), a second-order PLL is formed. R15 and C6 provide extra filtering of the high-frequency "garbage" which passes through IC8b.

IC9b and associated components form a Voltage-Controlled Oscillator (VCO). Its output is a square wave at 16H, which can be considered the output of the PLL.

If the loop loses lock (even very momentarily), pin 1 of IC9a (which is ordinarily at +15V) will produce pulses which go to ground. Ordinarily when lock is achieved, C9 is charged to +15V through R18 and this voltage is applied to IC8a's "+" input. IC8a operates as a comparator. A +14.0V reference voltage is applied to IC8a's "–" input through voltage divider R19, R20. If the voltage on IC8a's "+" input is +15V, IC8a 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 R21 and R22.

If lock is lost for any significant fraction of one field, the voltage across C9 will drop below +14V. IC8a'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.

15. Bessel Null Calibrator

Located on Card #8

The Bessel Null calibrator circuit generates a sinewave at 1/2 H (7.867kHz). It does so by dividing the 1H squarewave by 2, and then filtering the resulting 1/2 H squarewave to turn it into a very low-distortion sinewave (THD<0.025%). Most of the filtering is done by the L+R 11-pole low-pass filter (on Card #5). A servo closes an amplitude-sensing feedback loop around the filter to ensure that the output level of the calibration tone is very stable.

The tone's level is calibrated so that it produces a level at the input to the Stereo Baseband Generator of 1.3377Vrms. This is equivalent to ±18.918kHz carrier deviation, or 75.673% modulation with reference to 100% modulation=±25kHz deviation. When the tone produces this level of modulation (indicated by the RF aural carrier's nulling for the first time as the output level control is advanced from its fully counterclockwise position), then the ratio between carrier deviation and noise reduction encoder output level is set correctly. (See **page 2-18 in Section 2 – Installation** of this manual for detailed instructions on how to perform the Bessel null.)

When the BESSEL NULL CAL switch is in TONE, the following things happen: 1) the tone generator is turned on; 2) the L+R signal is disconnected from the input of the L+R 11-pole low-pass filter; 3) the output of the tone generator is connected to the input of the L+R 11-pole low-pass filter; 4) the Stereo Baseband Generator is forced into mono mode; and, 5) the 11-pole low-pass filter is forced to remain in the circuit path despite the system's being in mono mode.

Component-level description:

The 1H tone is divided by 2 in IC10b which produces a square wave. The square wave is applied to second-order low-pass filter IC11a and associated components, where it is preliminarily filtered prior to its being routed through the L+R 11-pole low-pass filter for final filtering.

The amplitude control servo works as follows. The peak output level of the L+R ll-pole low-pass filter is monitored by IC11b, acting as a comparator. If the peak level at pin 6 of IC11b exceeds the precisely-controlled reference voltage on pin 5, then the output of IC11b goes negative, and charges C19 negatively through CR9 and R45. Emitter follower Q3 follows the voltage on C19 and clamps the square wave input to IC11a to a voltage just sufficient to create the desired 1.3377Vrms level at the output of the L+R ll-pole low-pass filter.

16. Pilot Generator

Located on Card #8

(NOTE: The output of this circuit is not used in the 8185A Stereo Generator; it is only used when this card is used in the older 8182A/SG Stereo Generator.)

The Binary Divider is configured to produce pulse trains at 1H and 3H. 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 1H and 3H) are summed in proper proportion to cancel all lower-order harmonics of H. Higher-order harmonics are eliminated in a third-order low-pass filter. The resulting output of the low-pass filter is a sinewave at 1H with approximately 0.025% THD. This is used as the stereo pilot tone and also as a reference for the Stereo Baseband Generator.

Component-level description:

The output of the PLL's VCO (at 16H) 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 1H pulse of controlled duty-cycle appears at pin 5, and a 3H pulse of controlled duty-cycle appears at pin 11. The signal at pin 11 is inverted by IC2a, while the signal at pin 5 is passed without inversion through IC2b. The outputs of IC2a and IC2b are summed in R30 and R31 such that all lower harmonics of H are cancelled. Remaining harmonics are filtered-out in third-order inverting low-pass filter IC1a and associated components. The output of IC1a is a 1H sinewave with about 0.025% THD.

17. Pilot AGC

Located on Card #8

(NOTE: The output of this circuit is not used in the 8185A Stereo Generator; it is only used when this card is used in the older 8182A/SG Stereo Generator.)

To ensure that the pilot level remains stable, an AGC loop is employed. The peak level of the pilot is detected with 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.

Component-level description:

IC1b serves as a comparator. When the peak level of the 1H sinewave at the output of IC1a goes more positive than the voltage at the junction of R39 and R40 (i.e., +2.72V pk; 1.92Vrms), a negative-going pulse appears at the output of IC1b. Ordinarily, voltage divider R36, R37 holds C15 at approximately +7.5VDC. Output pulses from IC1b pass through CR6 and R38 and discharge C15 towards ground. This reduces the output level of IC1a until comparator IC1b is almost fully off.

The voltage on C15 affects the output level of IC1a as follows: C15 is buffered by emitter-follower Q2, 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 R39, R40 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. CR5 turns ON, clamping the control voltage output at the emitter of Q2 to approximately 0VDC. This removes power supply voltage from IC2, suppressing the stereo pilot tone.

18. Stereo Baseband Generator — General Principles

Located on Card #7

In the BTSC system, the L+R signal is passed through to the baseband output directly, while the L–R signal is multiplied by 2H, creating a double-sideband suppressed-carrier subchannel. The 8185A's Hadamard-Transform Stereo Baseband Generator™ closely approximates an ideal multiplier by a switching technique.

The L–R signal is passed through two analog switches whose outputs are summed together. These switches are driven by individual pulse trains, both synchronized to 2H, and shaped so that all harmonics of 2H prior to the 7th harmonic are cancelled. By comparison to a conventional switching modulator, performance requirements of the output low-pass filter (to remove harmonics above 7H) are greatly eased, and excellent separation and spurious rejection can be obtained from a relatively modest filter.

The stereo pilot tone is generated by multiplying a DC voltage by three individual pulse trains in three analog switches. Harmonics up to the 14th are canceled. The resulting waveform is passed through the same low-pass filter as the stereo subchannel, ensuring correct phasing between the pilot tone and stereo subcarrier.

Stereo/mono mode switching is provided by JFET switches driven by CMOS logic. In addition, there are three special "test" modes available. Each accepts the L+R signal from the preceding processing. 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 separation to be optimized using only an oscilloscope.

The block diagram shows the major subsystems in the Stereo Baseband Generator and should help clarify the discussion below.

19. Stereo Modulator

Located on Card #7

The L–R signal is applied to a buffer amplifier. This amplifier has a DC servo that eliminates virtually all the DC offset that might have accumulated in earlier circuitry. (DC offset must be eliminated because it otherwise translates into loss of subcarrier suppression after modulation.) The output of the buffer amplifier is applied to a pair of analog switches which perform the modulation of the L–R signal by the subcarrier.

Equal + and - DC voltages are applied in parallel to three pairs of analog switches to generate the pilot tone. The amplitude of the pilot tone is determined by the DC voltage level. The pilot tone is turned off by reducing the DC voltage to zero.

The L+R signal is applied to a buffer amplifier with DC servo. This servo forces the DC at the outputs of the analog switches to be equal to zero, further reducing any subcarrier leakage. The output of this amplifier is summed with the outputs of the various analog switches prior to the low-pass filter. A separation control adjusts the amplitude of the L+R signal, permitting the L+R and L–R to be mixed with exactly equal gains, thus maximizing separation.

The analog switches effectively multiply their inputs by either +1 or 0, depending on whether the switches are on or off respectively. Thus the L–R signal is multiplied not only by the stereo subcarrier, but also by an average DC voltage. Therefore, a substantial undesired baseband L–R component appears at the output of the analog switches. This is cancelled by mixing a precise amount of out-of-phase L–R audio into the output of the switches. Cancellation is maximized with the sub-to-main crosstalk trimmer.

High-order harmonics generated in the switching process are eliminated in a fifth-order passive elliptical filter followed by a group delay corrector. The group delay of the corrector can be adjusted with the 15kHz separation trimmer to minimize variations in the overall group delay as a function of frequency, thus maximizing overall separation. Equivalent 75µs separation of >70dB is theoretically possible with this filter design.

The output of the filter is applied to a power buffer capable of driving two 75Ω loads in parallel. The Professional Channel subcarrier (if used) is mixed into this buffer. There is also an input for an external SAP generator.

Component-level description:

The L–R signal is buffered by IC22a, which has gain of 0.713x. IC21a is a DC servo to remove DC offsets. CR1-CR6 are clamping diodes to protect the analog switches IC7 and IC8 from being driven beyond their ±5V input range.

IC9a and IC9b provide +0.943VDC and –0.943VDC reference voltages for the pilot tone generator. These voltages are applied to analog switches within IC7 and IC8. When mono mode is selected, the +5VDC voltage at the high side of R7 is reduced to 0V, removing the DC pilot reference voltages and suppressing the pilot generator. (The pilot switching waveforms applied to IC7 and IC8 are also removed in mono mode.)

The L–R signal is applied through the sub-to-main crosstalk null trimmer R12 and through switching FET Q1 to IC22b. The signal is inverted by IC22b and is then applied to the output of the analog switches to cancel crosstalk.

In mono mode, switching waveforms are removed from analog switch IC7, and Q1 is turned off (by applying −15VDC to its gate), preventing L−R from being applied to the generator's output.

The L+R signal is applied to IC22b through separation control R14. IC21b is a DC servo that essentially prevents any DC from appearing at the outputs of the analog switches IC7, IC8.

L1, L2, and C3-C9 form a passive fifth-order elliptical filter with a cutoff frequency of approximately 70kHz. This is buffered by non-inverting amplifier IC16 and applied to all-pass group-delay corrector IC17 (see **Group Delay Correctors** on page 6-6 for a general description of this circuit topology).

The output of the Stereo Modulator, along with the SAP, and Pro signals, are summed into composite opamp IC19, IC20, and associated components. IC20 is a special high-slew-rate power buffer which is located within the overall opamp feedback loop. It isolates IC19 from the destabilizing effects of capacitive loads and also permits 75Ω loads to be driven without degradation. This line driver will drive up 1.5V pk into 0.047μF in parallel with 37.5 ohms before significant 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 IC19, IC20 by means of R42, thus varying the gain to all baseband components, including the SAP and Pro subcarriers.

IC15 is an auxiliary summing amplifier to provide a reference signal, unaffected by the output level control, for the composite peak-reading meter.

20. Switching Waveform Generator

Located on Card #7

Switching waveforms for the analog switches IC7, IC8 are stored in a Read-Only Memory (ROM), and are clocked out in synchronism with the horizontal line frequency 1H.

Component-level description:

IC4 is a dual binary counter that is clocked from the 16H output of Card #8 to create a four-bit address word for ROM IC5. This word, which appears on pins 11-14 of IC4, constantly counts up until it reaches 1111B, at which point is resets to 0000B.

The counter only drives half of the bits in the ROM's address word. The other half of the bits in the ROM address are used to statically switch between various bit patterns stored in the ROM. For example, switching IC5 (address inputs A6 and A7) low causes the output waveform that drives the pilot switches in IC7, IC8 to become "0" at all times, suppressing the pilot. Similarly, driving IC5 (address input A4) low suppresses the stereo switching waveforms.

The output of IC5 is latched by octal D-flip-flop IC6. IC6 is clocked by the 16H signal to ensure that all switching waveforms change simultaneously and cleanly.

21. Mode Switching Logic

Located on Card #7

The 8185A 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.

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.

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 Pilot Generator and **Stereo Modulator** are suppressed (see **19. Stereo Modulator on page 6-18** above).

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 8185A may be obtained by studying this table.

Component-level description:

The three basic logic states – STEREO, MONO LEFT, and MONO RIGHT – are "remembered" by three CMOS NAND gates in IC13. The output of each gate is connected to an "output bus" through a 47K isolation resistor R51, R52, R53 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 R56, C16, and CR8 to hold a selected output line at -15 for a fraction of a second after power-up.

Failures in the mode-switching logic will almost certainly be due to failures of IC13, IC14, 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.

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 above, plus examination of the truth table (Fig. 6-4 below), should suffice to permit full understanding of the operation of the logic. (Some readers may be unfamiliar with the Exclusive-OR gate, IC14. 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.)

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 status
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. 6-4: System Logic Truth Table

22. Monitor Circuit

Located 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 75µs de-emphasis networks, a dbx N/R Decoder card, a decoder sum compensator, and a precision de-matrix which uses a resistor array with resistors matched to ±0.1%.

When the MONITOR N/R DECODER switch is OUT, de-emphasis is applied to both L+R and L–R inputs by precision-matched 75µs 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.

The Monitor Circuit has been designed to serve as a reference for testing and adjustment of the rest of the 8185A 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 the N/R ENCODER switch to 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 the N/R ENCODER to also be IN), then monitor card swept sinewave separation is limited by the performance of the dbx Decoder Card, and exceeds 40dB, 50-10,000Hz, at 10% equivalent input modulation.

Component-level description:

The L+R is applied to the card with a nominal level of 1.768Vrms for 100% modulation. The L–R is applied with a nominal level of 3.536Vrms for 100% modulation. The de-matrix 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 3.536Vrms (+8.751dBu) +1% at both Left and Right Monitor Outputs when loaded by 100K or greater. Output impedance is 600Ω unbalanced.

The dbx N/R Decoder Card is described in an **Appendix** on page 6-26.

23. Meter Peak Detector

Located on Meter Resistor Card

The VU meter on the front panel is electronically conditioned to be peak-reading. Jumper "A" selects an integration time that shows the true instantaneous maximum of every peak, no matter how low its energy ("0ms"), or an integration time that ignores most inconsequential, low-energy peaks while still clearly indicating the peak level of program energy ("1.5ms").

Component-level description:

The signal to be metered is applied to buffer amplifier IC1a, whose gain is switchable by the meter gain switch between 0dB and 20dB. The output of IC1a is applied to full-wave rectifier IC1b. R17 and DS1 clip the half-wave AC output of IC1b to avoid overloading the meter. The rectified signal is then applied to peak detector with delayed release IC2 (and associated circuitry).

The peak detector uses feedback around the peak-detector hold capacitors C1, C2 and buffer amplifier IC2b to accurately capture and hold peaks. The DC output of the peak detector appearing at pin 1 of IC2a is fed back to the "–" input of IC2b. If the voltage on the "+" input of IC2b exceeds the voltage on its "–" input, then IC2b charges C1 and C2 through diode- connected transistors Q1, Q4 until the peak detector's DC output is equal to the voltage on the "+" input of IC2b.

The R21, R22, R23 network is a bootstrapped release time circuit which interacts with a delayed release circuit. When C1, C2 are not being charged, C2 discharges through R21. However, C1 cannot discharge until C2 has fallen about 1.2VDC below C1 so that diode-connected transistors Q2 and Q3 can turn on. This provides a hold time – a delayed release – that allows the meter to reach the full value of the peak despite its mechanical inertia.

The output of IC2a is at the same voltage as C1. Thus the junction of R22 and R23 is held approximately 0.8V below the voltage on C1 by virtue of the negative current flow through R22, R23. This provides an approximation to a constant current flow through R21, and thus a constant-slope release of approximately 3.6V/sec for C2. (The presence of the delayed release circuit substantially complicates this simplistic explanation and causes the release to diverge from constant slope. Nevertheless, the essential bootstrap principle still applies.)

Diode-connected transistor Q5 prevents saturation of IC2b by actively clamping the output of IC2b to 0.7V below the output voltage of IC2a when IC2b is not charging C1, C2.

C7 and R16 are frequency-compensation components to prevent overshoot and oscillation of the circuit.

24. Power Supplies

Mostly located on Card #PS

Most power for 8185A circuitry comes from a highly regulated ±15-volt power supply. The main supply is +15 volts, created by a 723C IC regulator with current-boosted output, current limiting, and over-voltage protection using a zener diode and fast-blow fuse.

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

Component-level description:

The unregulated power supply (mounted inside the chassis, but outside of the RF-tight enclosure) is wholly conventional. It consists of dual-primary transformer T101, two full-wave rectifiers (CR101, CR102 and CR103, CR104), and two energy storage capacitors (C101 and C102).

T101's primary can be configured for 115-volt operation by paralleling its two primaries, or for 230-volt operation by connecting its two primaries in series (with a switch). RF filtering is provided on the AC line by FL101. In addition, C103, C104, C105, C106, C107, L101, L102 filter RF from the unregulated DC supply lines as they enter the chassis. The chassis is divided into three major sections to facilitate RF suppression. The section to the left (unregulated power supply chamber) contains the AC wiring and the unregulated power supply, and is assumed to contain some RF. The card cage, to the right, uses RF suppression on each line entering or leaving the area, and is thus free from RF. The RF shielding box on the rear panel, which interfaces the audio input and output lines with the outside world, contains the input pads — its connections to the main RF-tight compartment are all RF-filtered.

The +15-volt regulator (located on Card #PS) is the main reference for all other voltages in the 8185A. It employs 723C IC voltage regulator IC101 in conjunction with external series-pass transistor Q101. This transistor is mounted on the rear apron of the chassis, which serves as a heat sink.

IC101 contains a reference voltage source, an opamp (externally compensated by C109 to prevent oscillation), and a current-limiting transistor. The reference voltage (nominally +7.15V) is developed at pin 6. C108 filters high-frequency noise from the reference voltage, which is directly connected to the non-inverting input (pin 5) of the internal opamp. Voltage divider R105, R106, R107 develops a precise fraction of the output voltage of the regulator at the wiper of +15V ADJUST trimmer R106. The wiper of R106 is connected to the inverting input of IC101's internal opamp. Negative feedback forces the voltage at R106's wiper to be equal to the reference voltage, so the output voltage of the regulator is always the reference voltage divided by the voltage divider gain.

The output current flowing through Q101 develops a voltage drop across R103. When the current exceeds approximately 3/4-amp, the voltage drop is sufficient to turn on the current-limiting transistor inside IC101. Since this transistor's base-emitter junction is connected to pins 2 and 3 of IC101, it then shunts base drive current from the external series-pass transistor Q101 and prevents damage due to overheating.

If a catastrophic failure in the +15-volt regulator causes it to lose control over its output voltage, the rest of the circuitry must be protected against the full unregulated voltage, or the entire system will be severely damaged. This protection is provided by zener diode VR101, CR105, and 1-amp fast-blow fuse F102. If the regulator loses control of the output voltage, VR101 will conduct and limit the output voltage to approximately 16.5 volts (which will not damage the system). Extremely large amounts of current will flow in VR101. Ordinarily, this current will blow F102 and disconnect the circuitry from the unregulated supply before VR101 is damaged. VR101's clamping action will also prevent the negative tracking supply from exceeding −16.5 volts. When the regulator is operating properly, the current-limiting circuitry will prevent F102 from blowing even if the regulator output is short-circuited. (In certain unusual circumstances, the current-limiting circuit may still work, even though the regulator has lost control of its output voltage. If this occurs, F102 will not blow, and VR101 will overheat and burn out. Because its failure mode is a short-circuit, VR101 will still protect the 8185A circuitry even in this exceptional circumstance.)

The −15-volt regulator (located on Card #PS) is an opamp that contains a discrete power-booster output stage with current-limiting. It "amplifies" the output of the +15-volt regulator by −1 to produce a −15-volt tracking supply. Shutdown of the +15-volt supply (due to current-limiting conditions or to a fault which blows F102) will also result in shutdown of the −15-volt supply. The basic opamp is IC102. Its input resistor R109 and feedback resistor R108 are of equal valued, resulting in a gain of −1 ±2%. IC102's negative supply comes from the *unregulated* −22-volt supply. The common-mode range of IC102 includes its positive power supply, which permits operation with the chip's positive supply at ground. In normal operating conditions, the IC102's + input of IC102 is grounded, and its − input is within 10mV of ground.

Q103 and Q102 form a conjugate emitter-follower which can boost the output current of IC102 to more than ¾-amp. The basic emitter-follower is Q103. Q102 is connected in a 100% negative feedback configuration to boost the current output capability of Q103.

Q104 is a current-limiting transistor. If the −15-volt supply is called upon to deliver more than ¾-amp, a sufficient voltage drop (approximately 0.6 volts) will occur across R104 to turn on Q104, thus shunting drive current away from Q103 into the load and protecting Q102,Q103 from burn-out (IC102 is protected by internal current-limiting circuitry). C113 frequency-compensates the −15-volt supply to protect it against high-frequency oscillations. R102 increases the circuit's immunity to leakage in Q103.

Zener clamp VR102, CR106, and fuse F103 protect the rest of the circuitry from a catastrophic failure of the −15-volt regulator. The operation of this circuit is identical to the operation of the corresponding circuit in the +15-volt regulator.

This concludes the Circuit Description.

APPENDIX: dbx Noise Reduction Cards

The following data sheets were supplied by dbx, and describe the noise reduction encoder on Card #4 and the noise reduction decoder on Card #6.

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).

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.

dbx

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.

dbx Inc. • 71 Chapel Street • Newton, MA 02195 USA • (617) 964-3210

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 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.

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.

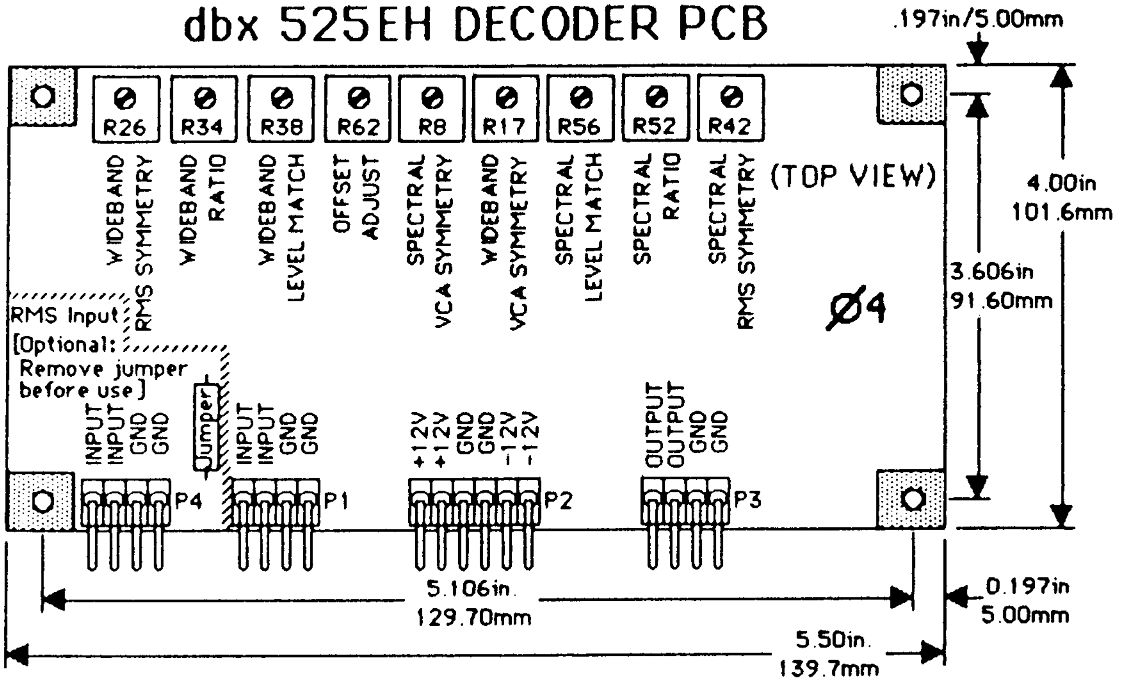
A consequence of the 525EH's deemphasis and the finite amount of time required by its rms detectors to respond to sharp increases in input level is that input signals with transient information will often cause the expander to undershoot. Transients will actually become dulled. Of course, since the compressor 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:

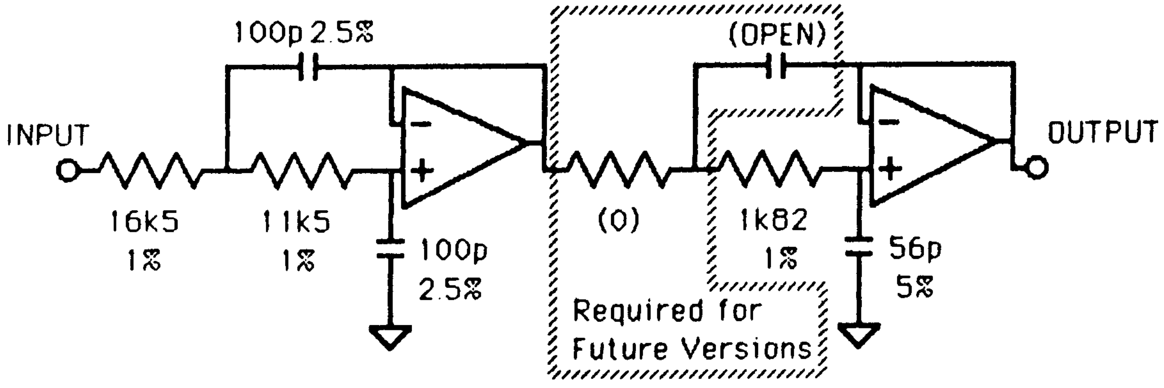
Input Frequency	Input Level	Desired Output Level
300 Hz	500 mVRMS	500 mVRMS
8 kHz	1.13 VRMS	136 mVRMS

For further information about the dbx 525EH card, please contact dbx OEM Products Division.

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

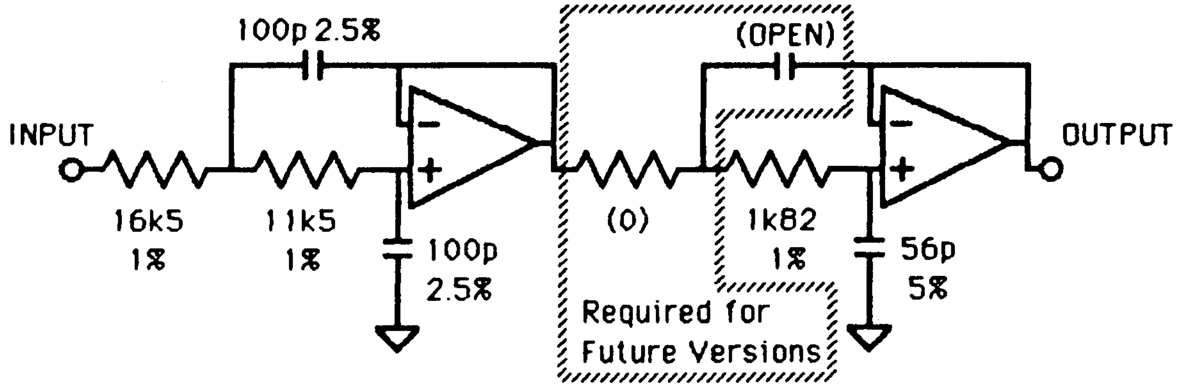
Operating Level:

100% Modulation = 10.000 V_{p-p}

525EH4 013185

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

dbx

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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dbx 525CH Operating Guide -- page 2

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 V_{DC}, 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 V_{P-P}. Operation at other levels is not recommended. Input levels up to 10 V_{P-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 <u>deemphasis</u> curve. As a result, the difference channel is unlikely to see 10 V_{P-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 V_{P-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.

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?"

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.

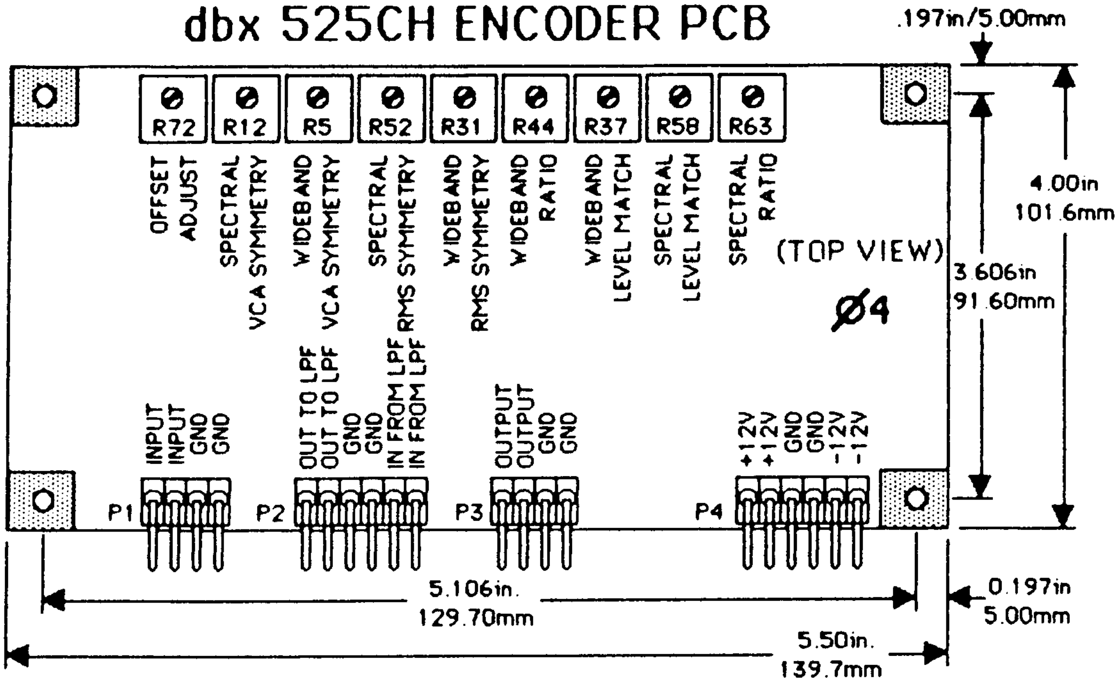
A consequence of the 525CH's preemphasis and the finite amount of time required by its rms detectors to respond to sharp increases in input level is that input signals with transient information will often cause the compressor to overshoot (though usually well below 100% modulation). Transients will 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:

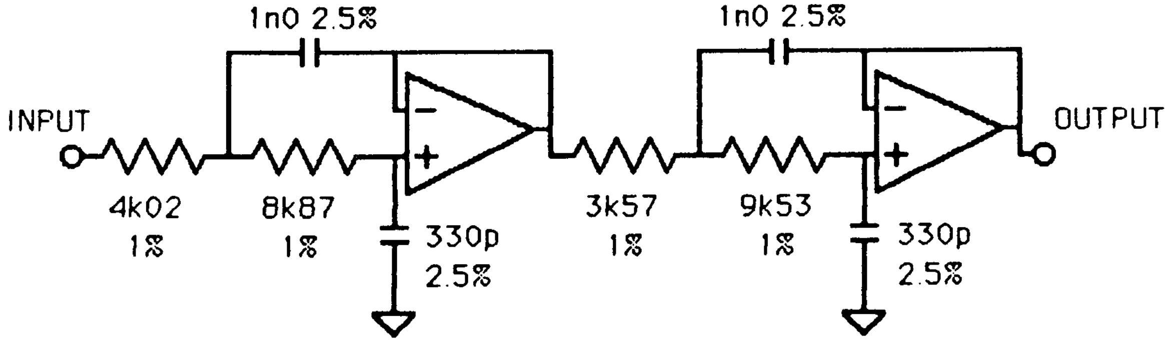
Input Frequency	Input Level	Desired Output Level
300 Hz	500 mVRMS	500 mVRMS
8 kHz	136 mVRMS	1.13 VRMS

For further information about the dbx 525CH card, please contact dbx OEM Products Division.

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

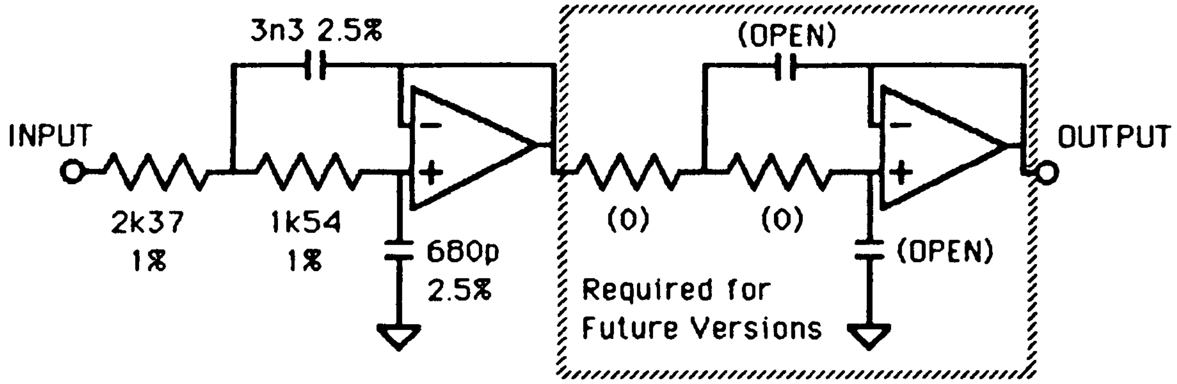
NOTE: OPAMPS ARE NE5532 OR EQUIVALENT

Operating Level:
100% Modulation = 10.000 V_{p-p}

525CH4 013185

525CH dbx-TV Encoder Sum-Channel Processors

[PHASE 3M & PHASE 4]

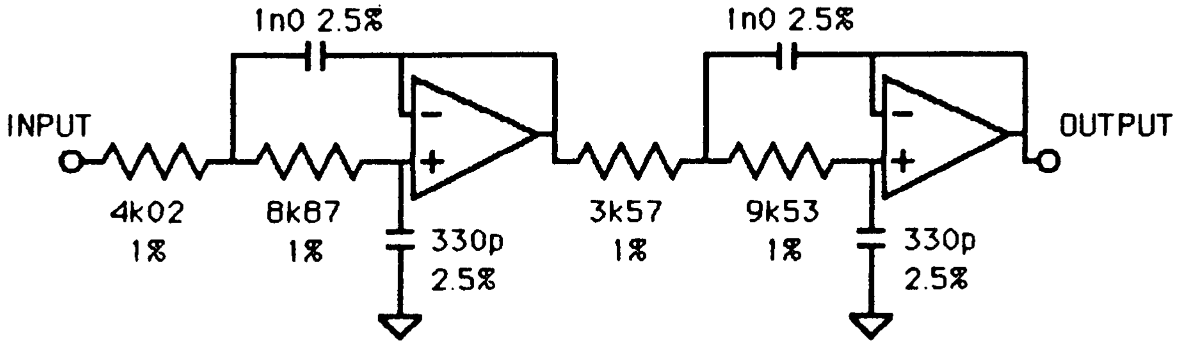


Phase-3M Compensation

[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

Parts List

Because special or subtle characteristics of certain components have been exploited to produce an elegant design at a reasonable cost, *it is unwise to make substitutions for listed parts*. Consult with Orban Customer Service (see page 5-13) if the parts list indicates that a part is specially selected, or that realignment is required when the part is replaced.

Orban maintains an inventory of tested, exact replacement parts that can be supplied quickly at nominal cost. Spare parts kits are also available. When ordering parts from Orban, please be ready to supply the following information:

Orban part number
Reference designator (e.g., C3, R78, IC14)
Description of part
Model, serial, and M number of unit — see rear-panel label
(not all units have M numbers)

Parts are listed by card or assembly (except for widely used common parts, which are described on the following page), and the parts on each card are grouped by type. See the assembly drawings for locations of components.

To facilitate future maintenance, we have used components from well-established manufacturers with worldwide distribution whenever possible. The abbreviations used for manufacturers are listed on page 6-54, along with their USA headquarters addresses.

Widely used common parts:

Diodes: Unless specified by reference designator in the following, all signal diodes are 1N4148 (Orban part number 22101-000). This is a silicon, small-signal diode with ultra-fast recovery and high conductance. It may also be replaced with 1N914 (BAY-61 in Europe). (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.)

Resistors: Resistors should only be replaced with the same style and with the *exact* value marked on the resistor body. If the value marking is not legible, check the schematic or contact Orban Customer Service (see page 5-13). Performance and stability will be compromised if you do not use exact replacements.

Unless specified by reference designator in the following, the resistors in this unit are:

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

Carbon film resistors with conformally-coated bodies, value identified with four color bands; rated 1/4-watt @ 70°C, with a tolerance of ±5%; Orban part numbers 20001-xxx, manufactured by R-Ohm (R-25), Piher, Beyschlag, Dale, Phillips, Spectrol, Matsushita.

Carbon composition resistors with molded phenolic bodies, value identified with four color bands; rated 1/4-watt for the 0.09 × 0.25-inch (2.3 × 6.4mm) size, and rated 1/8 watt for the 0.14 × 0.375-inch (3.6 × 9.5mm) size @ 70° C, with a tolerance of ±5%; Orban part numbers 2001x-xxx, USA Military Specification MIL-R-11 style RC-07 or RC-20, manufactured by Allen-Bradley, TRW/IRC, Matsushita.

Cermet trimmer resistors with 3/8-inch (9mm) square bodies, value printed on side; rated 1/2-watt @ 70°C, with a tolerance of ±10%, and a temperature coefficient of 100 PPM/ °C; Orban part numbers 20510-xxx and 20511-xxx, manufactured by Beckman (72P, 68W-series), Spectrol, Matsushita.

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
CARD #2						
Capacitors						
C1,11	Capacitor Pair, Polypro.; 0.01uF	28602-001	ORB			3
C2,12	Capacitor Pair, Polypro.; 0.01uF	28602-001	ORB			3
C3,13	Capacitor Pair, Polypro.; 0.022uF	28602-002	ORB			3
C4,14	Capacitor Pair, Mica; 33pF	28603-001	ORB			3
C5,15	Capacitor Pair, Polypro.; 0.01uF	28602-001	ORB			3
C6,16	Capacitor Pair, Polypro.; 0.01uF	28602-001	ORB			3
C7,17	Capacitor Pair, Polypro.; 0.01uF	28602-001	ORB			3
C8,18	Capacitor Pair, Polypro.; 0.01uF	28602-001	ORB			3
C9,19	Capacitor Pair, Polypro.; 0.01uF	28602-001	ORB			3
C10,20	Capacitor Pair, Polypro.; 0.01uF	28602-001	ORB			3
C21,22	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C23-32	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Integrated Circuits						
IC1-9	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
Resistors						
R3	Resistor Network, 8 POS., 2K	20201-503	BEK	698-3-R2KD		
R4,25	Resistor Pair, MF; 4.32K	28521-020	ORB			3
R5,30	Resistor Pair, MF; 1.18K	28521-010	ORB			3
R6,31	Resistor Pair, MF; 2.15K	28521-015	ORB			3
R7,32	Resistor Pair, MF; 16.9K	28521-013	ORB			3
R8,33	Resistor Pair, MF; 6.04K	28521-009	ORB			3
R9,34	Resistor Pair, MF; 348 OHM	28521-012	ORB			3
R10,35	Resistor Pair, MF; 6.04K	28521-009	ORB			3
R11	Resistor Network, 8 POS., 2K	20201-503	BEK	698-3-R2KD		
R12,37	Resistor Pair, MF; 10.20K	28521-022	ORB			3
R13,38	Resistor Pair, MF; 2.61K	28521-018	ORB			3
R14,39	Resistor Pair, MF; 5.11K	28521-021	ORB			3
R15,40	Resistor Pair, MF; 4.22K	28521-019	ORB			3
R16,41	Resistor Pair, MF; 2.43K	28521-016	ORB			3
R17,42	Resistor Pair, MF; 2.10K	28521-014	ORB			3
R18,43	Resistor Pair, MF; 2.55K	28521-017	ORB			3
R19,44	Resistor Pair, MF; 2.43K	28521-016	ORB			3
R20,45	Resistor Pair, MF; 1.27K	28521-011	ORB			3
R21	Resistor Network, 8 POS., 20K	20201-501	BEK	698-3-R20KD		
R24	Resistor Network, 8 POS., 2K	20201-503	BEK	698-3-R2KD		
R26-29	Not Used	---				
R36	Resistor Network, 8 POS., 2K	20201-503	BEK	698-3-R2KD		

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 8185A

Card 2 - Capacitors, IC's, Resistors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Integrated Circuits						
IC1-8	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC9	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
IC10-13	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
Resistors						
R5	Resistor Set, MF; 2.00K	28520-002	ORB			3
R9	Resistor Set, MF; 2.00K	28520-002	ORB			3
R12	Resistor, MF, 1/2W, 25ppM, 4.64K; 1%	20071-464	ROHM	CRB-14		
R13	Resistor Set, MF; 2.00K	28520-002	ORB			3
R16	Resistor, MF, 1/2W, 25ppM, 931 OHM; 1%	20070-931	ROHM	CRB-14		
R19	Resistor, MF, 1/2W, 25ppM, 3.74K; 1%	20071-374	ROHM	CRB-14		
R20	Resistor Set, MF; 2.00K	28520-002	ORB			3
R21	Resistor, MF, 1/2W, 25ppM, 1.10K; 1%	20071-110	ROHM	CRB-14		
R25	Resistor Set, MF; 2.00K	28520-002	ORB			3
R40-50	Not Used	---				
R55	Resistor Set, MF; 2.00K	28520-002	ORB			3
R59	Resistor Set, MF; 2.00K	28520-002	ORB			3
R62	Resistor, MF, 1/2W, 25ppM, 4.64K; 1%	20071-464	ROHM	CRB-14		
R63	Resistor Set, MF; 2.00K	28520-002	ORB			3
R66	Resistor, MF, 1/2W, 25ppM, 931 OHM; 1%	20070-931	ROHM	CRB-14		
R69	Resistor, MF, 1/2W, 25ppM, 3.74K; 1%	20071-374	ROHM	CRB-14		
R70	Resistor Set, MF; 2.00K	28520-002	ORB			3
R71	Resistor, MF, 1/2W, 25ppM, 1.10K; 1%	20071-110	ROHM	CRB-14		
R75	Resistor Set, MF; 2.00K	28520-002	ORB			3
Selected Components						
C13-18	To be determined during test	---	ORB			3
Switches						
S1	Switch, Toggle, Min., DPDT	26041-202	CK	7201SYA		
Transistors						
Q1	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
Q2	Transistor, JFET/N	23406-101	NAT	J113	SIL	

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 8185A
Card 2 - IC's, Resistors, Selected Components, Switches, Transistors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
CARD #3						
Capacitors						
C1	Polypropylene, 50V, 1%; 0.015uF	21701-315	NOB	CQ15P1H153FPP	WES	
C2	Mica, 500V, 5%; 2700pF	21024-227	CD	CD19-FD272J03	SAN	
C3,4	Polypropylene, 50V, 1%; 0.01uF	21701-310	NOB	CQ15P1H103FPP	WES	
C5,6	Polystyrene, 100V, 1%; 0.0047uF	21510-247	ORB			Special Tolerance
C7-9	Polypropylene, 50V, 1%; 0.01uF	21701-310	NOB	CQ15P1H103FPP	WES	
C10	Mica, 500V, 1%; 160pF	21018-116	CD	CD15-FD161F03	SAN	
C11	Polypropylene, 50V, 1%; 0.015uF	21701-315	NOB	CQ15P1H153FPP	WES	
C12	Mica, 500V, 5%; 2700pF	21024-227	CD	CD19-FD272J03	SAN	
C13,14	Polypropylene, 50V, 1%; 0.01uF	21701-310	NOB	CQ15P1H103FPP	WES	
C15,16	Polystyrene, 100V, 1%; 0.0047uF	21510-247	ORB			Special Tolerance
C17-19	Polypropylene, 50V, 1%; 0.01uF	21701-310	NOB	CQ15P1H103FPP	WES	
C20	Mica, 500V, 1%; 160pF	21018-116	CD	CD15-FD161F03	SAN	
C21,22	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C23-30	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Integrated Circuits						
IC1-10	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
Resistors						
R7	Resistor Set, MF; 2.00K	28520-002	ORB			3
R10	Resistor, MF, 1/2W, 25ppM, 1.37K; 1%	20071-137	ROHM	CRB-14		
R11	Resistor Set, MF; 2.00K	28520-002	ORB			3
R12	Resistor, MF, 1/2W, 25ppM, 3.16K; 1%	20071-316	ROHM	CRB-14		
R15	Resistor Set, MF; 2.00K	28520-002	ORB			3
R32	Resistor Set, MF; 2.00K	28520-002	ORB			3
R35	Resistor, MF, 1/2W, 25ppM, 1.37K; 1%	20071-137	ROHM	CRB-14		
R36	Resistor Set, MF; 2.00K	28520-002	ORB			3
R37	Resistor, MF, 1/2W, 25ppM, 3.16K; 1%	20071-316	ROHM	CRB-14		
R40	Resistor Set, MF; 2.00K	28520-002	ORB			3
Transistors						
Q1,2	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
Q3	Transistor, JFET/N	23406-101	NAT	J113	SIL	
Q4,5	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
Q6	Transistor, JFET/N	23406-101	NAT	J113	SIL	

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 8185A
Card 3 - Capacitors, IC's, Resistors, Transistors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
CARD #4						
Capacitors						
C1	See Selected Components	---				
C2,3	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C4,5	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C6,7	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C8,9	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Integrated Circuits						
IC1	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC2	D.C. Regulator, 12V Positive	24309-901	MOT	MC78M12CT		
IC3	D.C. Regulator, 12V Negative	24310-901	MOT	MC79M12CT		
Miscellaneous						
A1	Encoder Card, DBX, Phase IV	30925-000-xx*	ORB			*Add suffix printed on part
Resistors						
R1	See Selected Components	---				
Selected Components						
C1/R1	Matched Set, Capacitor/Resistor	28701-000	ORB			3
CARD #5						
Capacitors						
C1-5	Polypropylene, 50V, 1%; 4700pF	21701-247	NOB	CQ15P1H472FPP	WES	
C6-9	Polystyrene, 100V, 1%; 0.0047uF	21510-247	ORB			Special Tolerance
C10-12	Polypropylene, 50V, 1%; 4700pF	21701-247	NOB	CQ15P1H472FPP	WES	
C13-18	See Selected Components	---				
C19-50	Not Used	---				
C51-55	Polypropylene, 50V, 1%; 4700pF	21701-247	NOB	CQ15P1H472FPP	WES	
C56-59	Polystyrene, 100V, 1%; 0.0047uF	21510-247	ORB			Special Tolerance
C60-62	Polypropylene, 50V, 1%; 4700pF	21701-247	NOB	CQ15P1H472FPP	WES	
C63,64	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C65-82	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	

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
OPTMOD-TV Model 8185A
Card 4 - Capacitors, IC's, Misc., Resistors, Selected Components
Card 5 - Capacitors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
CARD #6						
Capacitors						
C1-5	See Selected Components	---				
C6,7	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C8-11	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C12,13	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C14,15	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Integrated Circuits						
IC1	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC2,3	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
IC4	D.C. Regulator, 12V Positive	24309-901	MOT	MC78M12CT		
IC5	D.C. Regulator, 12V Negative	24310-901	MOT	MC79M12CT		
Miscellaneous						
A1	Decoder Card, DBX, Phase IV	30930-000-xx*	ORB			*Add suffix printed on part
Resistors						
R1	See Selected Components	---				
R5	Resistor Network, 8 POS., 20K	20201-501	BEK	698-3-R20KD		
R8	Not Used	---				
R9	See Selected Components	---				
Selected Components						
C1/R1	Matched Set, Capacitor/Resistor	28701-000	ORB			3
C2-4	To be determined during test	---	ORB			3
C5/R9	Matched Set, Capacitor/Resistor	28701-000	ORB			3
Switches						
S1	Switch, Toggle, Min., DPDT	26041-202	CK	7201SYA		

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 8185A

Card 6 - Capacitors, IC's, Misc., Resistors, Selected Components, Switches

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
CARD #7						
	Capacitors					
C1	Not Used	---				
C2	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C3	Mica, 500V, 1%; 680pF	21022-168	CD	CD19-FD681F03	SAN	
C4	Mica, 500V, +1/2pF -1/2pF; 22pF	21017-022	CD	CD15-CD220D03	SAN	
C5	Mica, 500V, 1%; 1000pF	21022-210	CD	CD19-FD102F03	SAN	
C6	Mica, 500V, 1%; 390pF	21018-139	CD	CD15-FD391F03	SAN	
C7	Mica, 500V, 1%; 51pF	21018-051	CD	CD15-ED510F03	SAN	
C8	Mica, 500V, 1%; 560pF	21022-156	CD	CD19-FD561F03	SAN	
C9	Mica, 500V, 1%; 82pF	21018-082	CD	CD15-ED820F03	SAN	
C10,11	Mica, 500V, 1%; 1000pF	21022-210	CD	CD19-FD102F03	SAN	
C12	Mica, 500V, +1/2pF -1/2pF; 22pF	21017-022	CD	CD15-CD220D03	SAN	
C13	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C14,15	Not Used	---				
C16	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C17,18	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C19,20	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C21	Polypropylene, 50V, 2.5%; 0.01uF	21702-310	NOB	CQ15P1H103GPP	WES	
C22,23	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C24-47	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
	Diodes					
CR1-6	Diode, Signal, Hot Carrier	22102-001	HP	HP5082-2800		
	Inductors					
L1	Variable Inductor	29705-006	ORB			
L2	Variable Inductor	29705-007	ORB			

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 8185A
Card 7 - Capacitors, Diodes, Inductors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS(1)	NOTES
Integrated Circuits						
IC1	D.C. Regulator, 5V Negative	24308-901	NAT	LM79M05CP		
IC2	D.C. Regulator, 5V Positive	24307-901	NAT	LM78M05CP		
IC3	Digital, NAND Gate	24501-302	RCA	CD4011BE	MOT	
IC4	Digital, Up-Counter	24508-302	RCA	CD4520BE		
IC5	Digital, PROM	44001-000-01	ORB			
IC6	Digital, Flip-Flop	24553-302	NAT	74HC374	TI,RCA	
IC7,8	Triple 2-Channel Analog Multiplexer	24562-302	NAT	MM74HC4053		
IC9	Linear, Dual Opamp	24202-202	RAY	RC4558NB	MOT,FSC	
IC10-12	Optoisolator, NPN	25003-000	SIE	SFH-601-1		
IC13	Digital, NAND Gate	24501-302	RCA	CD4011BE	MOT	
IC14	Digital, XOR Gate	24504-302	RCA	CD4030BE	SIG	
IC15	Linear, Single Opamp	24013-202	TI	TL071CP		
IC16,17	Linear, Single Opamp	24008-202	TI	LM318N	NAT	
IC18	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC19	Linear, Single Opamp	24008-202	TI	LM318N	NAT	
IC20	Power Buffer	24707-102	LT	LT1010CH		
IC21	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC22	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
Resistors						
R9	Not Used	---				
R10a,b	Resistor Pair, MF; 10.0K	28520-004	ORB			3
R11	Not Used	---				
R14	Trimpot, Cermet, 20 Turn; 1K	20512-210	BEK	89PR1K	BRN	
R30a,b	Resistor Pair, MF; 2.00K	28520-002	ORB			3
R31	Not Used	---				
R42	Trimpot, Cermet, 20 Turn; 25K	20512-325	BEK	89PR25K	BRN	
Switches						
S1	Switch, Rotary, Min., 2P4T	26203-000	ELSW	73-9005		
S2	Switch, Toggle, Min., SPDT	26041-102	CK	7101SYA		
Transistors						
Q1	Transistor, JFET/N	23403-101	NAT	J111	INS	
Q2,3	Not Used	---				
Q4	Transistor, Signal, PNP	23002-101	MOT	2N4402	FSC	
Q5	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	

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 8185A
Card 7 - IC's, Resistors, Switches, Transistors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
CARD #8						
Capacitors						
C1	Mica, 500V, +1/2pF -1/2pF; 3pF	21017-003	CD	CD15-CD030D03	SAN	
C2	Polypropylene, 50V, 2.5%; 0.01uF	21702-310	NOB	CQ15P1H103GPP	WES	
C3	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C4	Mica, 500V, +1/2pF -1/2 pF; 33pF	21017-033	CD	CD15-CD330D03	SAN	
C5	Met. Polyester, 100V, 10%; 0.47uF	21441-447	WES	60F474K100	WIM,SIE	
C6	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C7	Ceramic Disc, 50V, 20%; 0.01uF	21107-310	CRL	UK50-103	MUR	
C8	Mica, 500V, 5%; 470pF	21024-147	CD	CD19-FD471J03	SAN	
C9	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C10	Met. Polyester, 100V, 10%; 0.47uF	21441-447	WES	60F474K100	WIM,SIE	
C11	Polypropylene, 50V, 2.5%; 0.01uF	21702-310	NOB	CQ15P1H103GPP	WES	
C12	Alum., Radial, 50V; 47uF	21208-647	SPR	502D 476G050CD1C	PAN	
C13	Polypropylene, 50V, 2.5%; 0.01uF	21702-310	NOB	CQ15P1H103GPP	WES	
C14	Mica, 500V, 5%; 100pF	21020-110	CD	CD15-FD101J03	SAN	
C15	Tantalum, 35V, 10%; 4.7uF	21307-547	SPR	196D 475X9035JA1	MANY	
C16	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C17	Mica, 500V, 1%; 1000pF	21022-210	CD	CD19-FD102F03	SAN	
C18	Mica, 500V, 1%; 150pF	21018-115	CD	CD15-FD151F03	SAN	
C19	Tantalum, 35V, 10%; 0.22uF	21307-422	SPR	196D 224X9035HA1	MANY	
C20	Met. Polyester, 100V, 5%; 0.047uF	21440-347	WES	60C 473J250	SIE,WIM	
C21,22	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C23-32	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Diodes						
CR1,2	Diode, Signal, Hot Carrier	22102-001	HP	HP5082-2800		
CR8	Diode, Volt. Reference, -1.2V	22081-112	NAT	LM385		
Integrated Circuits						
IC1	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC2	Digital, XOR Gate	24504-302	RCA	CD4030BE	SIG	
IC3	Digital, Quad 2-Input NAND	24509-302	RCA	CD4093BE		
IC4	Digital, Up-Counter	24508-302	RCA	CD4520BE		
IC5	Digital, Timer	24706-202	INS	ICM7555IPA		
IC6	Linear, Single Opamp	24011-205	RCA	CA3080E		
IC7	Linear, Single Opamp	24009-202	NAT	LF356N		
IC8	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC9	Digital, Phase Locked Loop	24507-302	RCA	CD4046BE		
IC10	Digital, Dual Flip-Flop	24502-302	RCA	CD4013BE		
IC11	Linear, Dual Opamp	24209-202	NAT	LF412CN		

FOOTNOTES:
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SPECIFICATIONS AND SOURCES FOR
REPLACEMENT PARTS

OPTIMOD-TV Model 8185A
Card 8 - Capacitors, Diodes, IC's

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Miscellaneous						
K1	Relay, Dip, 15V, 1xA	28022-011	PB	JWD-107-7		
Resistors						
R48	Trimpot, Cermet, 20 Turn; 1K	20512-210	BEK	89PR1K	BRN	
Switches						
S1	Switch, Toggle, Min., DPDT	26041-202	CK	7201SYA		
Transistors						
Q1	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
Q2	Transistor, Signal, PNP	23002-101	MOT	2N4402	FSC	
Q3,4	Transistor, Signal, PNP	23001-101	MOT	2N4125	FSC	
CHASSIS (FRONT PANEL)						
Diodes						
DS1-4	LED, Green	25104-000	GI	MV-5253		
Meters						
M1	Meter, VU, Brown/Buff	28002-007	DIX	330T	HOYT	
Switches						
S1	Switch, Toggle, Min., SPDT	26044-101	CK	7105P3		
S2	Switch, Toggle, Min., SPDT	26041-103	CK	7101		
CHASSIS (POWER SUPPLY)						
Capacitors						
C101,102	Alum., Electrolytic, 40V; 5000uF	21250-850	CD	FAH-5000-40-A2	MAL	
C103,104	Ceramic Disc, 50V, 20%; 0.05uF	21107-350	CRL	UK50-503	MUR	
C105-107	Ceramic, Feed-thru, 1000pF	21118-210	ERE	2404-000	MUR	
Diodes						
CR101-104	Diode, Rectifier, 400V, 3A	22203-400	MOT	MR504		

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SPECIFICATIONS AND SOURCES FOR
REPLACEMENT PARTS
OPTIMOD-TV Model 8185A
Card 8 - Misc., Resistors, Switches, Transistors
Chassis Front Panel
Chassis Power Supply - Capacitors, Diodes

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Inductors						
L101,102	Inductor, RF Choke, 7uH	29501-004	OHM	Z-50	(2)	
Miscellaneous						
F101	Fuse, 3AG, Slo-Blo, 1/2A	28004-150	LFE	313.500	BUS	
T101	Transformer, Power; 38VCT, 46VA	55002-000	ORB			
Switches						
S101	Switch, Rocker, Power, DPST	26003-001	MAR	1802-0111		
S102	Switch, Slide, Mains voltage selector	26140-000	SW	EPSI-SLI		
CHASSIS (REAR PANEL)						
Capacitors						
C1-18	Ceramic, Feed-thru, 1000pF	21118-210	ERE	2404-000	MUR	
C19	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
Inductors						
L1-6	Inductor, RF Choke, 7uH	29501-004	OHM	Z-50	(2)	
Miscellaneous						
NONE	Filter, Line, 3 Amp.	28015-000	COR	3EF1		
Switches						
NONE	Switch, Slide, DPDT (Gold)	26106-000	CW	GF326-0149		Special Plating
INPUT FILTER ASSEMBLY						
Inductors						
L1-6	Inductor, RF Choke, 1.2mH	29503-000	MIL	73F123AF		
L7	Inductor, RF Choke, 7uH	29501-004	OHM	Z-50	(2)	

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(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
OPTIMOD-TV Model 8185A
Chassis Power Supply - Inductors, Misc., Switches
Chassis Rear Panel
Imput Filter Assembly - Inductors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
METER RESISTOR BOARD						
Capacitors						
C1,2	Polypropylene, 50V, 1%; 0.01uF	21701-310	NOB	CQ15P1H103FPP	WES	
C3-6	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C7	Mica, 500V, +1/2pF -1/2pF; 22pF	21017-022	CD	CD15-CD220D03	SAN	
Diodes						
DS1	LED, Green	25104-000	GI	MV-5253		
Integrated Circuits						
IC1	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC2	Linear, Dual Opamp	24211-202	MOT	MC34082P		
Resistors						
R24	Trimpot, Cermet; 1K	20509-210	BEK	72XR1K	BRN	
Switches						
S1	Switch, Rotary, 1P12T	26078-306	CTS	212-Series		
Transistors						
Q1-5	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
OTHER						
Miscellaneous						
NONE	Line Cord, CEE	28102-002	BEL	17500	MANY	
NONE	PCB Extender Board Assy	30705-000	ORB			

FOOTNOTES:
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SPECIFICATIONS AND SOURCES FOR
REPLACEMENT PARTS

OPTIMOD-TV Model 8185A

Meter Risistor - Capacitors, Diodes, IC's, Resistors, Switches, Transistors, Misc.

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
POWER SUPPLY BOARD						
Capacitors						
C108	Tantalum, 10V, 10%; 33uF	21303-633	SPR	196D 336X9010KE3	MANY	
C109	Mica, 500V, 5%; 470pF	21024-147	CD	CD19-FD471J03	SAN	
C110	Not Used	---				
C111,112	Alum., Radial, 50V; 47uF	21208-647	SPR	502D 476G050CD1C	PAN	
C113	Mica, 500V, 5%; 100pF	21020-110	CD	CD15-FD101J03	SAN	
C114	Met. Polyester, 100V, 10%; 0.01uF	21441-310	WES	60C 103K630	SIE, WIM	
C114	Polyester, 100V, 10%; 0.01uF	21401-310	SPR	225P 10391WD3	PAN,PAK	
Diodes						
CR105,106	Diode, Rectifier, 400V, 1A	22201-400	MOT	1N4004	MANY	
VR101,102	Diode, Zener, 5W; 16V, 5%	22005-160	MOT	1N5353B	MANY	
Integrated Circuits						
IC101	D.C. Regulator	24301-302	NAT	LM723CN		
IC102	Linear, Single Opamp	24003-202	NAT	LM301AN	TI,RCA	
Miscellaneous						
F102,103	Fuse, Pico, 1A, Axial	28011-210	LFE	275.001	BUS	
Resistors						
R103,104	Resistor, Wirewound, 2W, 0.62 OHM; 5%	20028-862	IRC	BWF Series		
R106	Trimpot, Cermet, 18 Turn; 500 OHM	20508-150	BEK	68XR500	BRN	
R108,109	Resistor Set, MF; 20.5K	28521-008	ORB			3
Transistors						
Q101,102	Transistor, Power, NPN; TO-204MA	23601-501	RCA	2N3055	FSC	Located on Chassis Rear Panel
Q103,104	Transistor, Signal, PNP	23002-101	MOT	2N4402	FSC	

FOOTNOTES:
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SPECIFICATIONS AND SOURCES FOR
REPLACEMENT PARTS

OPTIMOD-TV Model 8185A

Power Supply - Capacitors, Diodes, IC's, Misc., Resistors, Transistors

Vendor Codes

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

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

AM Amphenol Corporation
358 Fall Avenue
Wallingford, CT 06492

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

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

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

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

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

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

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

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

CRL See Mepco/Centralab

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

CW CW Industries
130 James Way
Southampton, PA 18966

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

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

ELSW Electroswitch
180 King Avenue
Weymouth, MA 02188

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MOT Motorola Semiconductor
PO BOX 20912
Phoenix, AZ 85036

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

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

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

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

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

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

RCA RCA Solid State Division
Route 202
Somerville, NJ 08876

ROHM Rohm Corporation
8 Whatney
Irvine, CA 92718

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

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

SCH ITT Schadow
8081 Wallace Road
Eden Prairie, MN 55344

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

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

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

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

TI Texas Instruments
PO BOX 655012
Dallas, TX 75265

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

TRW TRW Electronic Components
Connector Division
1501 Morse Avenue
Elk Grove Village, IL 60007-57

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

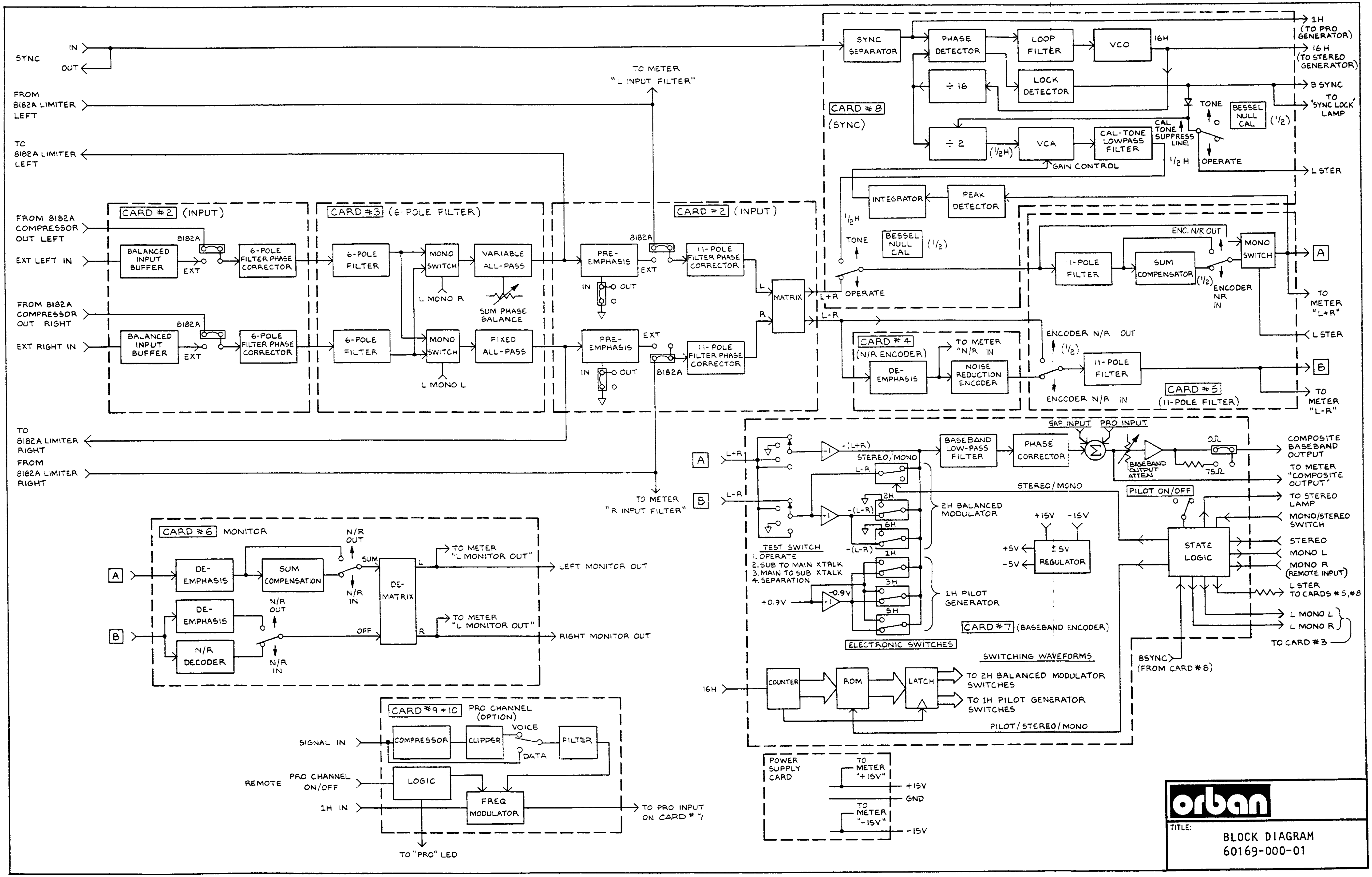
WES Westlake
5334 Sterling Ctr Drive
Westlake Village, CA 91361

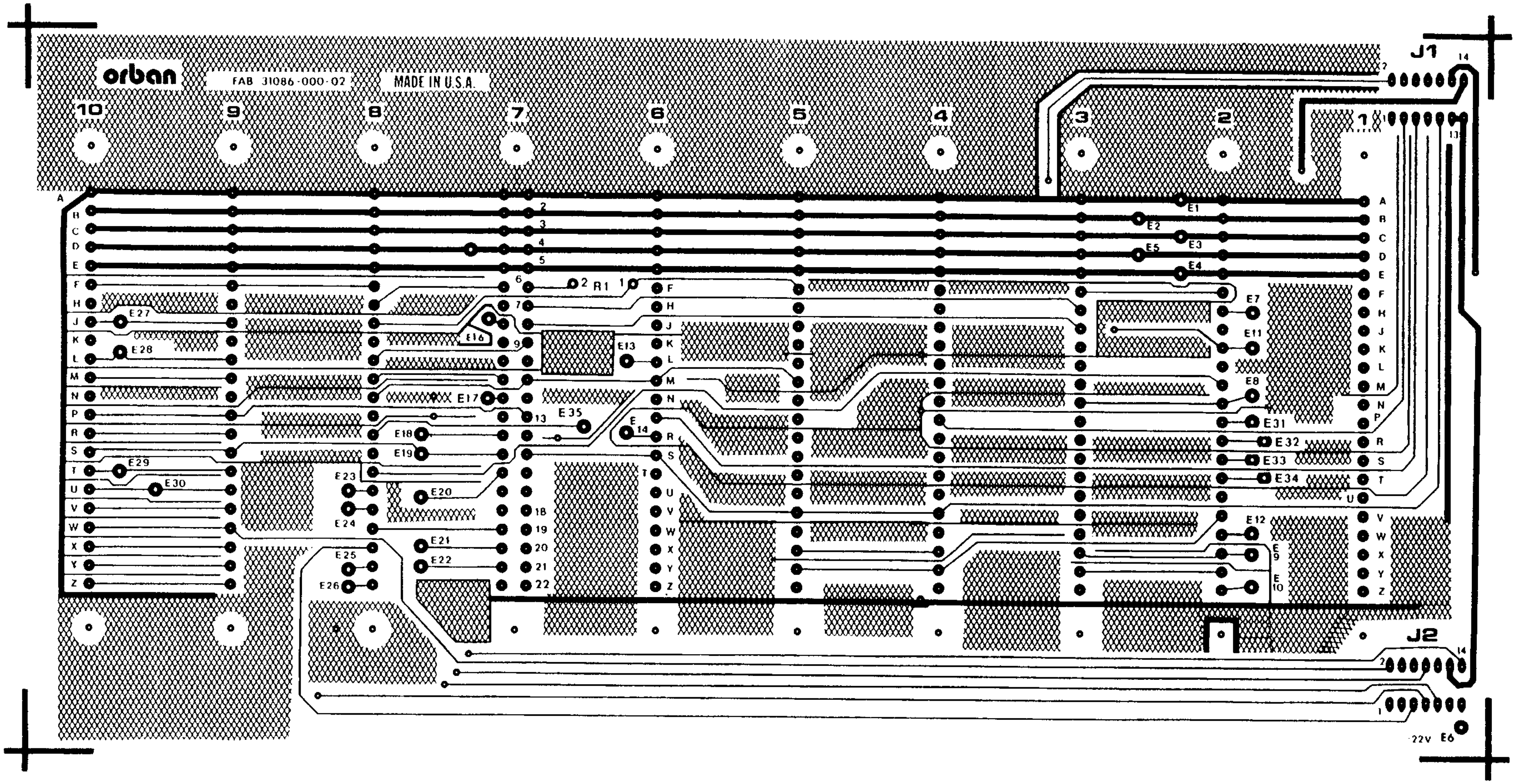
WIM The Inter-Technical Group Inc.
Wima Division
PO BOX 23
Irvington, NY 10533

Schematics, Assembly Drawings

The following drawings are included in this manual:

These drawings reflect the actual construction of your unit as accurately as possible. Any differences between the drawings and your unit are almost undoubtedly due to product improvements or production changes since the publication of this manual. Major changes are described in addenda located at the front of this manual. If you intend to replace parts, please read page 6-41.


SYNC
IN
OUT
FROM 8182A LIMITER LEFT
TO 8182A LIMITER LEFT
TO METER "L INPUT FILTER"
FROM 8182A COMPRESSOR OUT LEFT
EXT LEFT IN
FROM 8182A COMPRESSOR OUT RIGHT
EXT RIGHT IN
CARD #2 (INPUT)
BALANCED INPUT BUFFER
8182A
EXT
6-POLE FILTER PHASE CORRECTOR
CARD #3 (6-POLE FILTER)
6-POLE FILTER
MONO SWITCH
VARIABLE ALL-PASS
L MONO R
SUM PHASE BALANCE
FIXED ALL-PASS
L MONO L
CARD #2 (INPUT)
PRE-EMPHASIS
IN
OUT
11-POLE FILTER PHASE CORRECTOR
MATRIX
L
R
L+R
L-R
TO 8182A LIMITER RIGHT
FROM 8182A LIMITER RIGHT
TO METER "R INPUT FILTER"
SYNC SEPARATOR
PHASE DETECTOR
LOOP FILTER
VCO
16H
÷16
LOCK DETECTOR
÷2
(1/2H)
VCA
CAL-TONE LOWPASS FILTER
GAIN CONTROL
CAL TONE SUPPRESS LINE
TONE
OPERATE
BESSEL NULL CAL
(1/2)
1/2H
CARD #8
(SYNC)
1H (TO PRO GENERATOR)
16H (TO STEREO GENERATOR)
B SYNC
TO "SYNC LOCK" LAMP
L STER
INTEGRATOR
PEAK DETECTOR
ENC. N/R OUT
11-POLE FILTER
SUM COMPENSATOR
ENCODER NR IN
MONO SWITCH
A
TO METER "L+R"
L STER
CARD #4
(N/R ENCODER)
TO METER "N/R IN"
DE-EMPHASIS
NOISE REDUCTION ENCODER
ENCODER N/R OUT
ENCODER N/R IN
B
CARD #5 (11-POLE FILTER)
TO METER "L-R"
SAP INPUT
PRO INPUT
-(L+R)
STEREO/MONO
BASEBAND LOW-PASS FILTER
PHASE CORRECTOR
Σ
BASEBAND OUTPUT ATTEN
0Ω
75Ω
COMPOSITE BASEBAND OUTPUT
TO METER "COMPOSITE OUTPUT"
TO STEREO LAMP
MONO/STEREO SWITCH
STEREO
MONO L
MONO R (REMOTE INPUT)
L STER TO CARDS #5,#8
L MONO L
L MONO R
TO CARD #3
PILOT ON/OFF
STATE LOGIC
L-R
2H
6H
1H
3H
5H
-(L-R)
-0.9V
+0.9V
2H BALANCED MODULATOR
1H PILOT GENERATOR
+15V
-15V
+5V
-5V
±5V REGULATOR
TEST SWITCH
1. OPERATE
2. SUB TO MAIN XTALK
3. MAIN TO SUB XTALK
4. SEPARATION
ELECTRONIC SWITCHES
CARD #7 (BASEBAND ENCODER)
SWITCHING WAVEFORMS
16H
COUNTER
ROM
LATCH
TO 2H BALANCED MODULATOR SWITCHES
TO 1H PILOT GENERATOR SWITCHES
PILOT/STEREO/MONO
BSYNC (FROM CARD #8)
CARD #6 MONITOR
DE-EMPHASIS
SUM COMPENSATION
N/R OUT
N/R IN
SUM
OFF
DE-MATRIX
TO METER "L MONITOR OUT"
LEFT MONITOR OUT
TO METER "L MONITOR OUT"
RIGHT MONITOR OUT
N/R DECODER
CARD #9 + 10 PRO CHANNEL (OPTION)
SIGNAL IN
COMPRESSOR
CLIPPER
VOICE
DATA
FILTER
REMOTE
PRO CHANNEL ON/OFF
LOGIC
1H IN
FREQ MODULATOR
TO PRO INPUT ON CARD #7
TO "PRO" LED
POWER SUPPLY CARD
TO METER "+15V"
+15V
GND
TO METER "-15V"
-15V
orban
TITLE:
BLOCK DIAGRAM
60169-000-01



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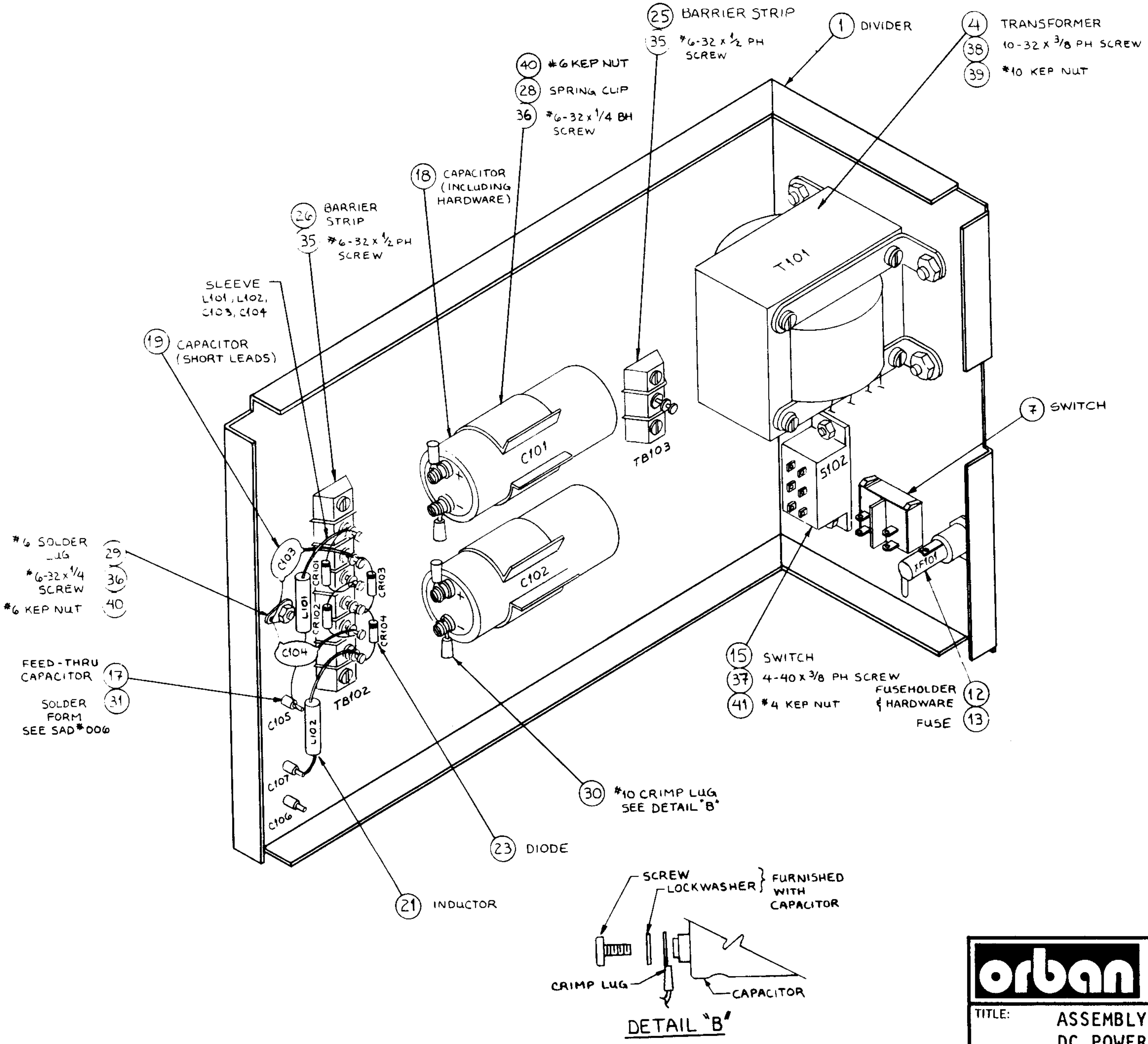
TITLE:

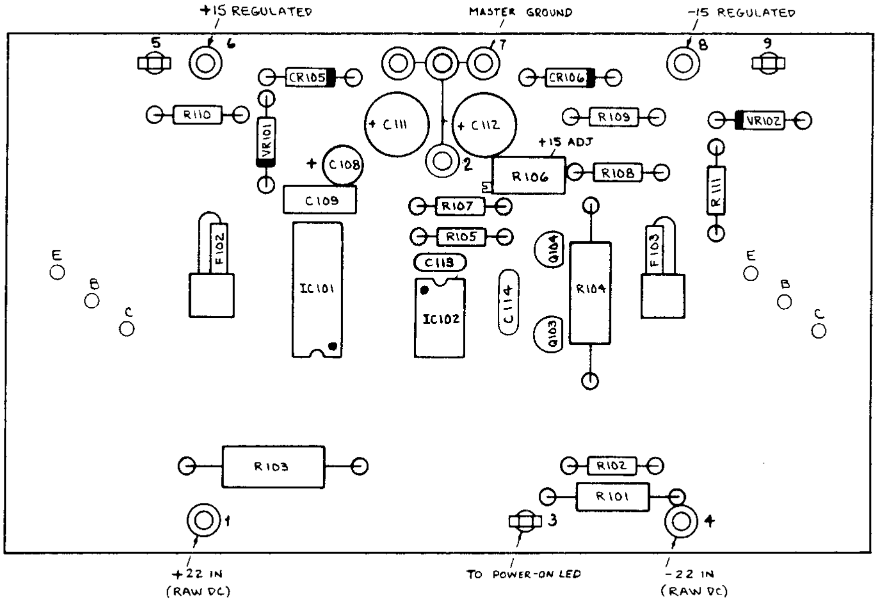
MOTHERBOARD
31087-000-02



DETAIL "B"

orban

TITLE: ASSEMBLY DRAWING
DC POWER SECTION
40017-000-07

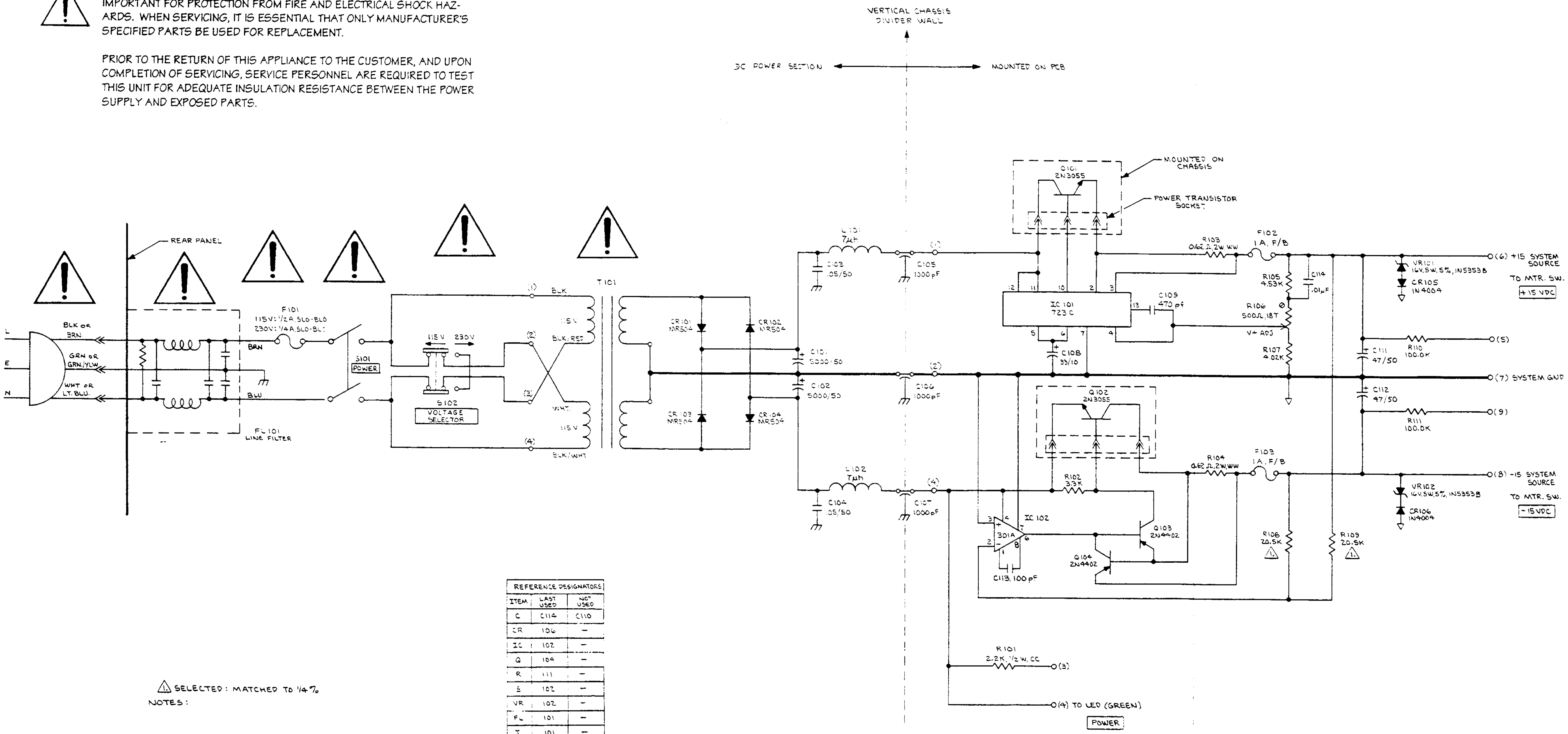


orban

TITLE: ASSEMBLY DRAWING
POWER SUPPLY
30310-000-07

⚠ COMPONENTS MARKED WITH THIS SYMBOL HAVE CRITICAL SPECIFICATIONS IMPORTANT FOR PROTECTION FROM FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING, IT IS ESSENTIAL THAT ONLY MANUFACTURER'S SPECIFIED PARTS BE USED FOR REPLACEMENT.

PRIOR TO THE RETURN OF THIS APPLIANCE TO THE CUSTOMER, AND UPON COMPLETION OF SERVICING, SERVICE PERSONNEL ARE REQUIRED TO TEST THIS UNIT FOR ADEQUATE INSULATION RESISTANCE BETWEEN THE POWER SUPPLY AND EXPOSED PARTS.



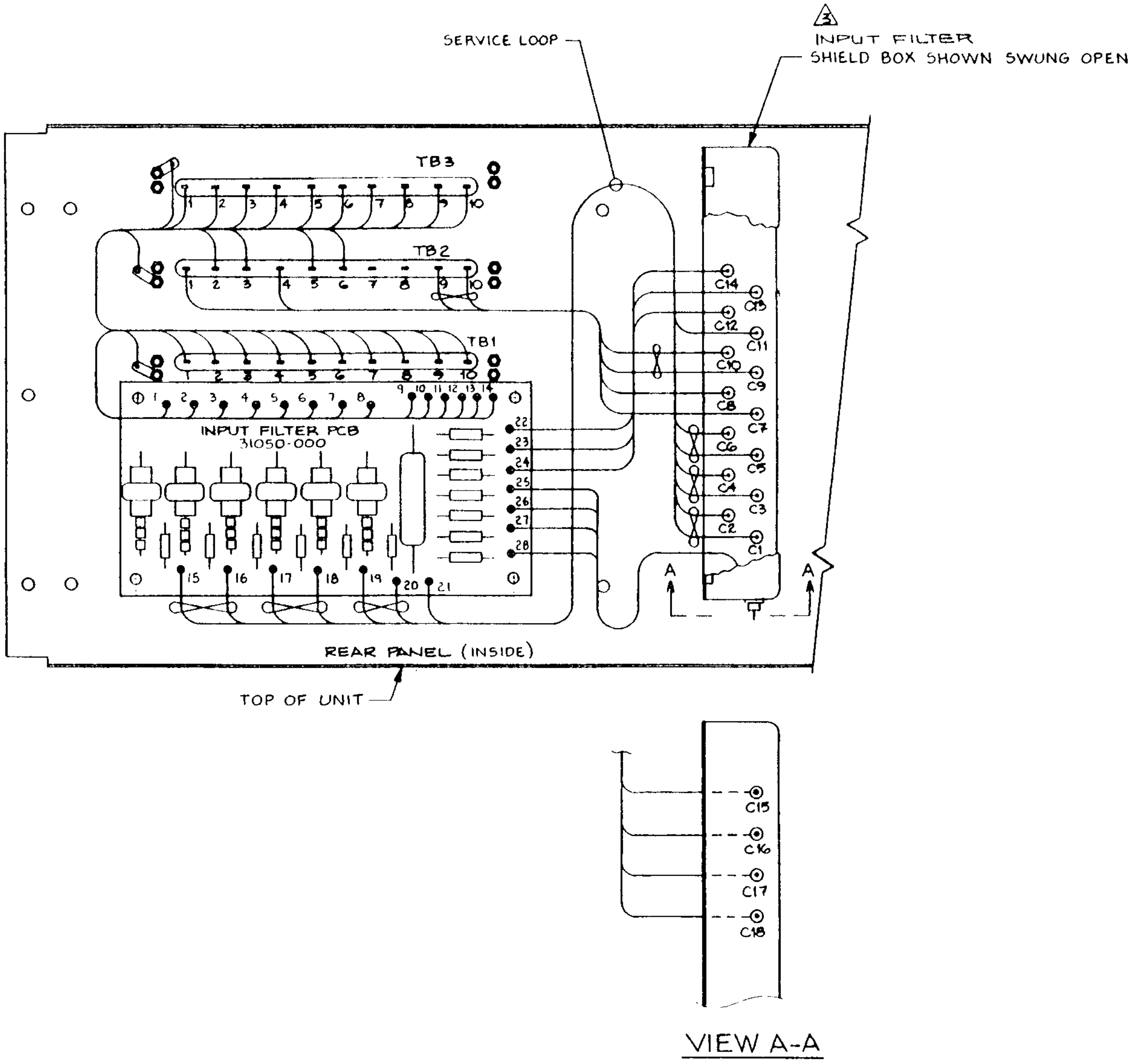
REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
C	C114	C110
CR	106	—
IC	102	—
Q	104	—
R	111	—
S	102	—
VR	102	—
FL	101	—
T	101	—
L	102	—
F	103	—

1. SELECTED: MATCHED TO 1/4%

NOTES:

orban

TITLE: SCHEMATIC
POWER SUPPLY
60021-000-08

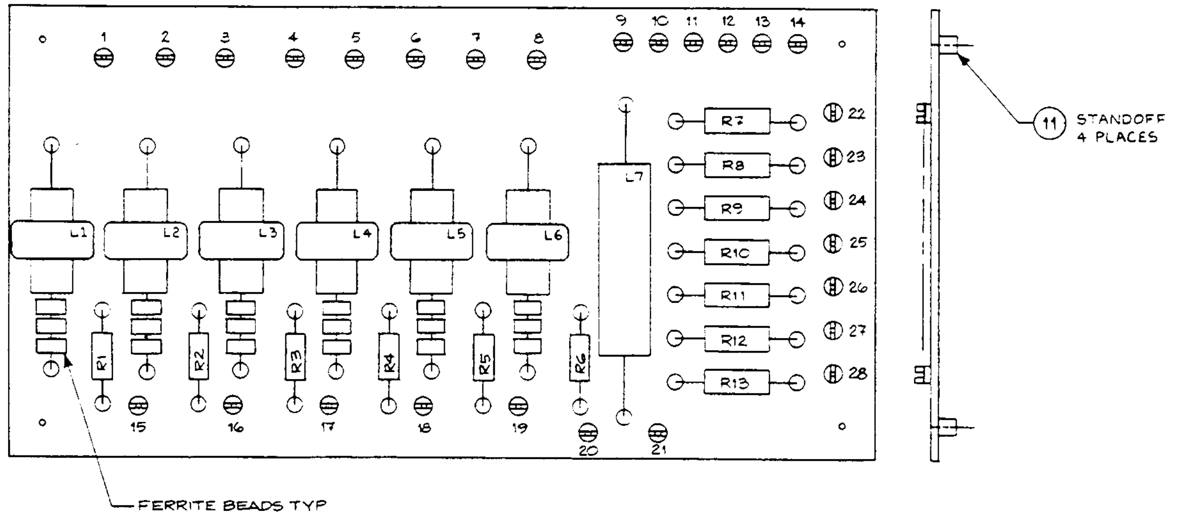


NOTES:

1. REF WIRE LIST 64030-000
2. ∞ MEANS TWISTED PAIR OF WIRES.
3. INPUT FILTER IS SHOWN ON ITS SIDE WITH A CUT-AWAY TO SHOW FEED THRU CAPACITORS AS THEY APPEAR ON INSIDE OF BOX.

orban

TITLE: WIRING DIAGRAM
INPUT FILTER
60163-000-01



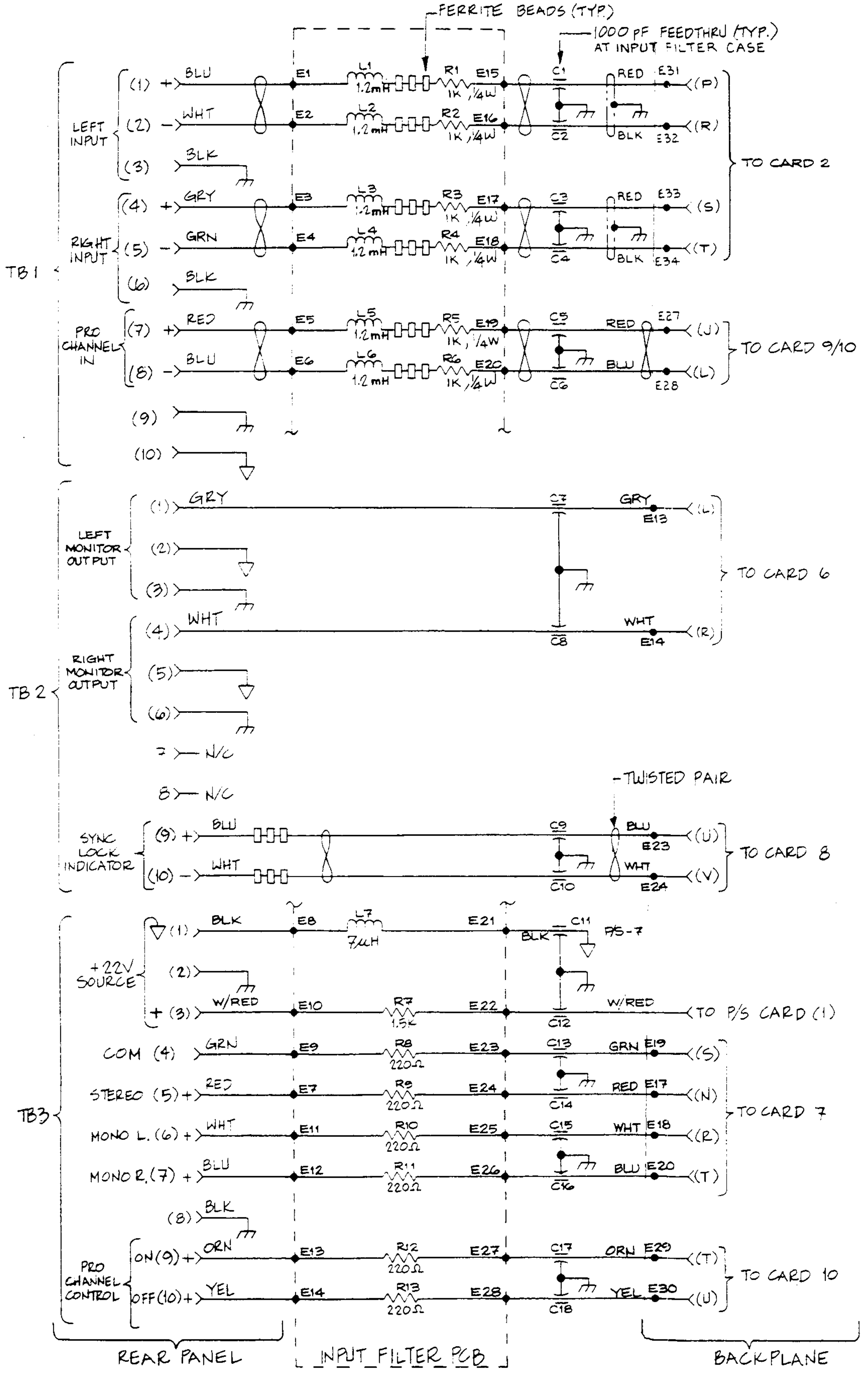
2. SOLDER ALL TERMINALS ON SOLDER SIDE BEFORE INSTALLING COMPONENTS (28 PLACES).

1. REFERENCE SCHEMATIC 61019-000

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban A Division of AKG Acoustics Inc.

TITLE: ASSEMBLY DRAWING
INPUT FILTER
31050-000-01



orban

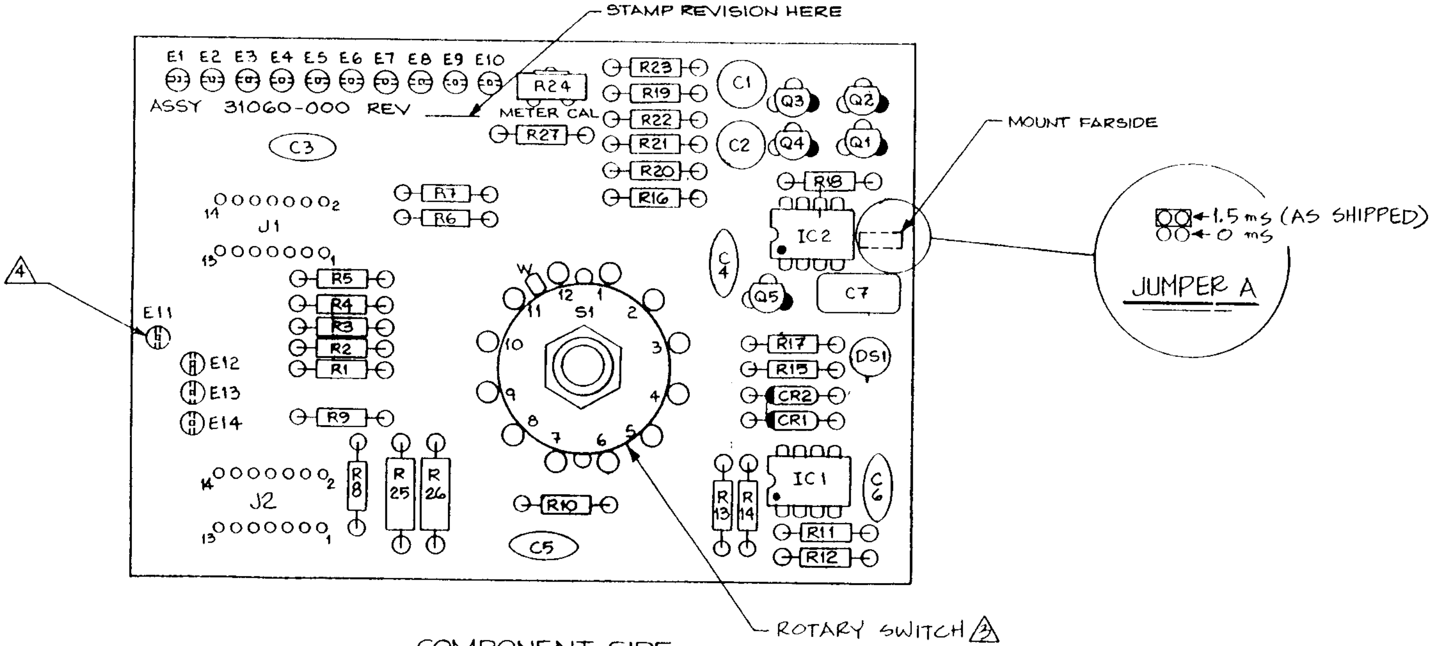
TITLE: SCHEMATIC
INPUT FILTER
61019-000-01

2. ALL CAPS ARE 1000pF FEEDTHRU SOLDERED TO CASE OF ASSEMBLY.

1. ALL RESISTORS ARE ½W, CC

NOTES: (UNLESS OTHERWISE SPECIFIED)

REF. DESIGNATORS		
ITEM	LAST USED	NOT USED
C	18	
R	13	
L	7	



COMPONENT SIDE

4 SOLDER ALL TERMINALS TO TRACES, 14 PLACES, FARSIDE

3 HAND INSTALL – DO NOT WASH MECHANISM.

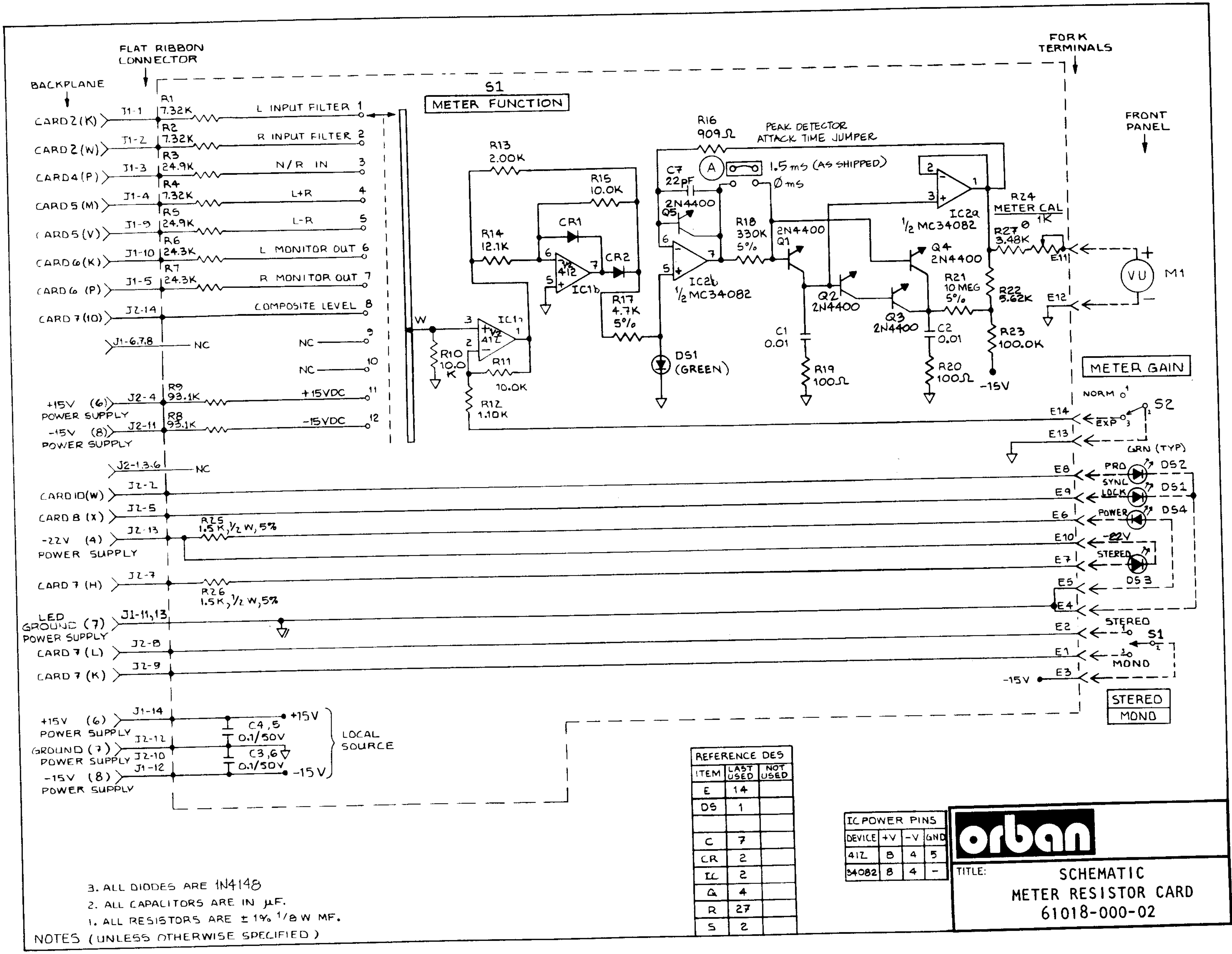
2. TIC MARKS INDICATE PIN #1 OF IC'S, PIN #1 OF CONNECTORS, CATHODE OF DIODES, EMITTER OF TRANSISTORS, PIN #1 OF SWITCH.

1. REFERENCE SCHEMATIC 61018-000

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban

TITLE:
ASSEMBLY DRAWING
METER RESISTOR
31060-000-03



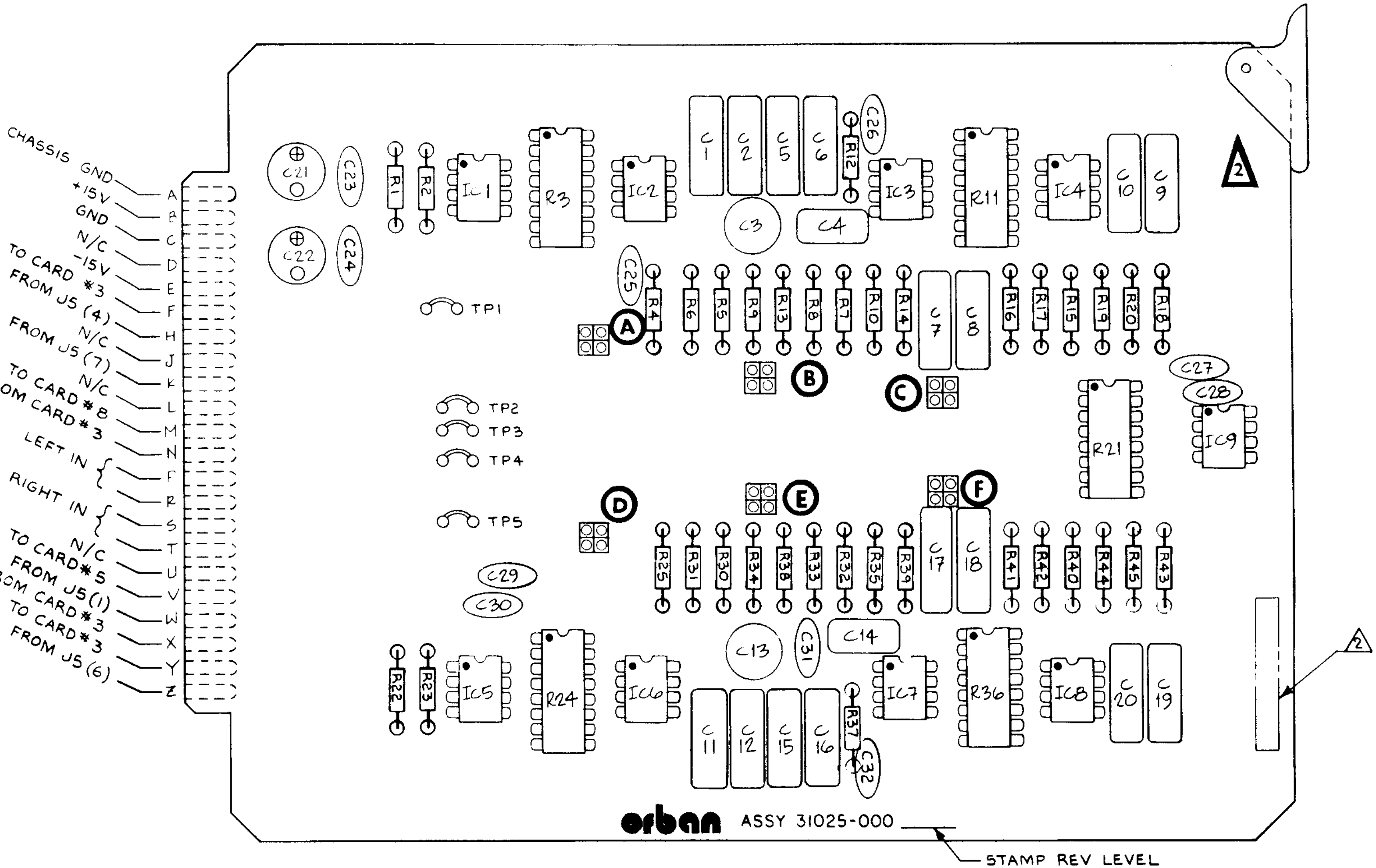
REFERENCE DES		
ITEM	LAST USED	NOT USED
E	14	
DS	1	
C	7	
CR	2	
IC	2	
Q	4	
R	27	
S	2	

IC POWER PINS			
DEVICE	+V	-V	GND
412	8	4	5
34082	8	4	-

orban

TITLE: SCHEMATIC
METER RESISTOR CARD
61018-000-02

3. ALL DIODES ARE 1N4148
2. ALL CAPACITORS ARE IN μF.
1. ALL RESISTORS ARE ± 1% 1/8 W MF.
NOTES (UNLESS OTHERWISE SPECIFIED)



LEFT PREEMPHASIS

Ⓐ
[■■] 8182A
○○ EXTERNAL

Ⓑ
[■■] OUT
○○ IN

Ⓒ
○○ EXTERNAL
[■■] 8182A

RIGHT PREEMPHASIS

Ⓓ
[■■] 8182A
○○ EXTERNAL

Ⓔ
[■■] OUT
○○ IN

Ⓕ
○○ EXTERNAL
[■■] 8182A

PROCESSOR JUMPERS

(SHOWN AS SHIPPED)

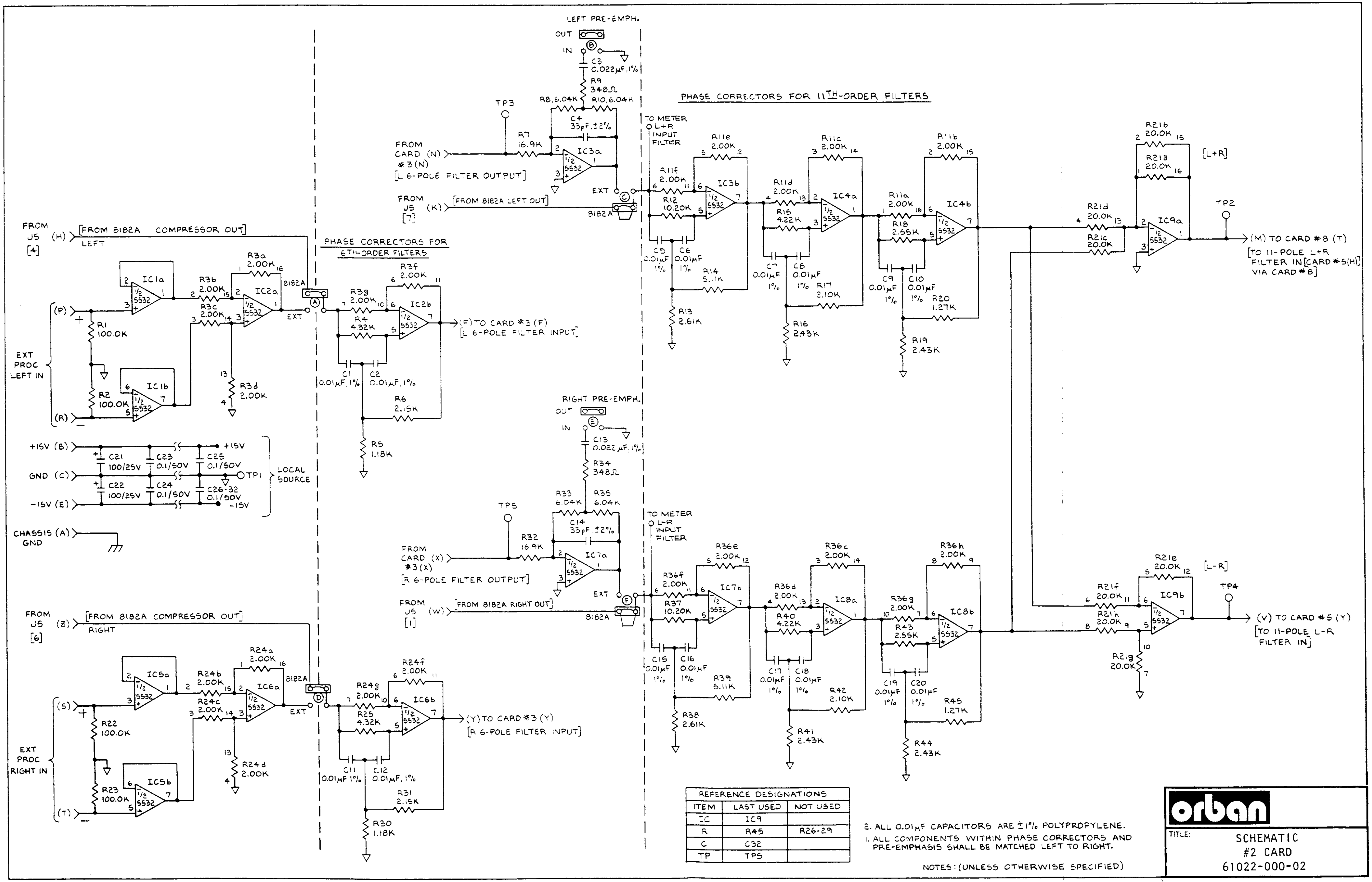
△2 ADD SERIAL NUMBER PER SAD 014.

1. TIC MARKS INDICATE PIN 1 OF IC'S & RESISTOR NETWORKS

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban

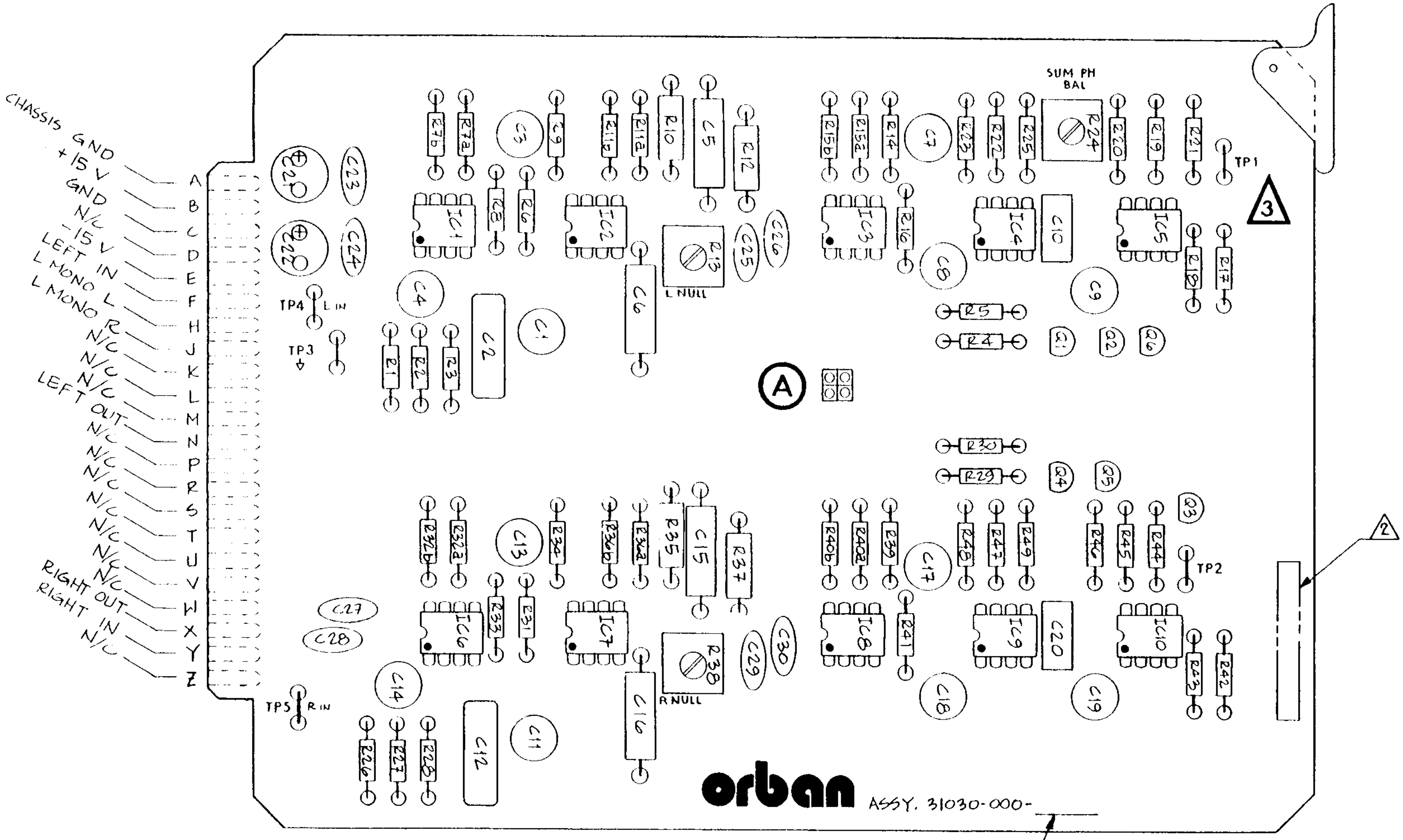
TITLE: ASSEMBLY DRAWING
#2 CARD
31025-000-02



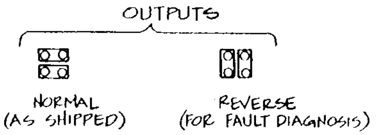
REFERENCE DESIGNATIONS		
ITEM	LAST USED	NOT USED
IC	IC9	
R	R45	R26-29
C	C32	
TP	TP5	

2. ALL 0.01µF CAPACITORS ARE ±1% POLYPROPYLENE.
1. ALL COMPONENTS WITHIN PHASE CORRECTORS AND PRE-EMPHASIS SHALL BE MATCHED LEFT TO RIGHT.
NOTES: (UNLESS OTHERWISE SPECIFIED)

orban
TITLE: SCHEMATIC
#2 CARD
61022-000-02



OUTPUTS



JUMPER A

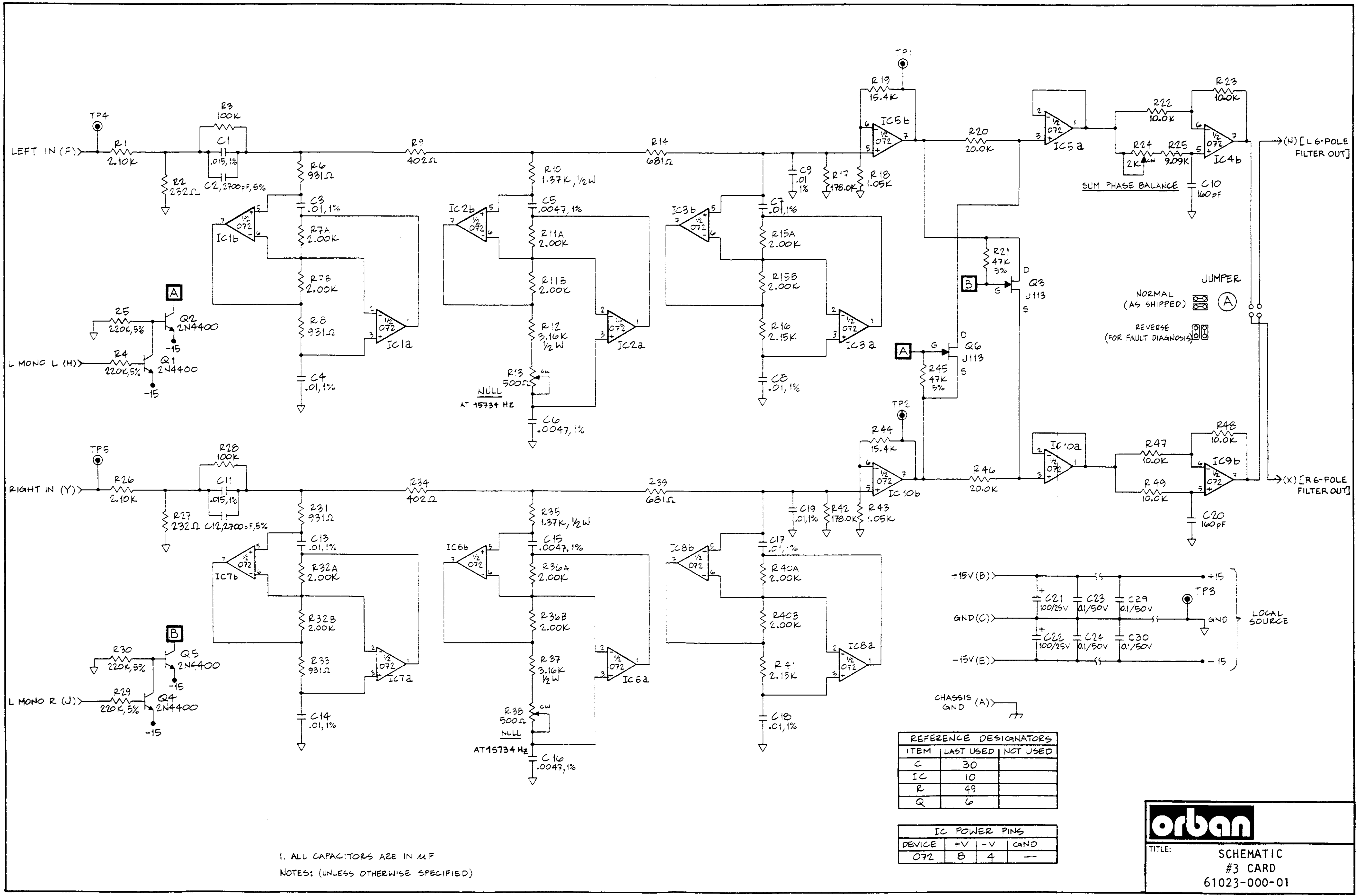
⚠2 ADD SERIAL NUMBER PER SAD 014 .

1. TIC MARKS INDICATE PIN 1 OF IC'S & POS. SIDE OF CAPS

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban

TITLE: ASSEMBLY DRAWING
#3 CARD
31030-000-02



REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
C	30	
IC	10	
R	49	
Q	6	

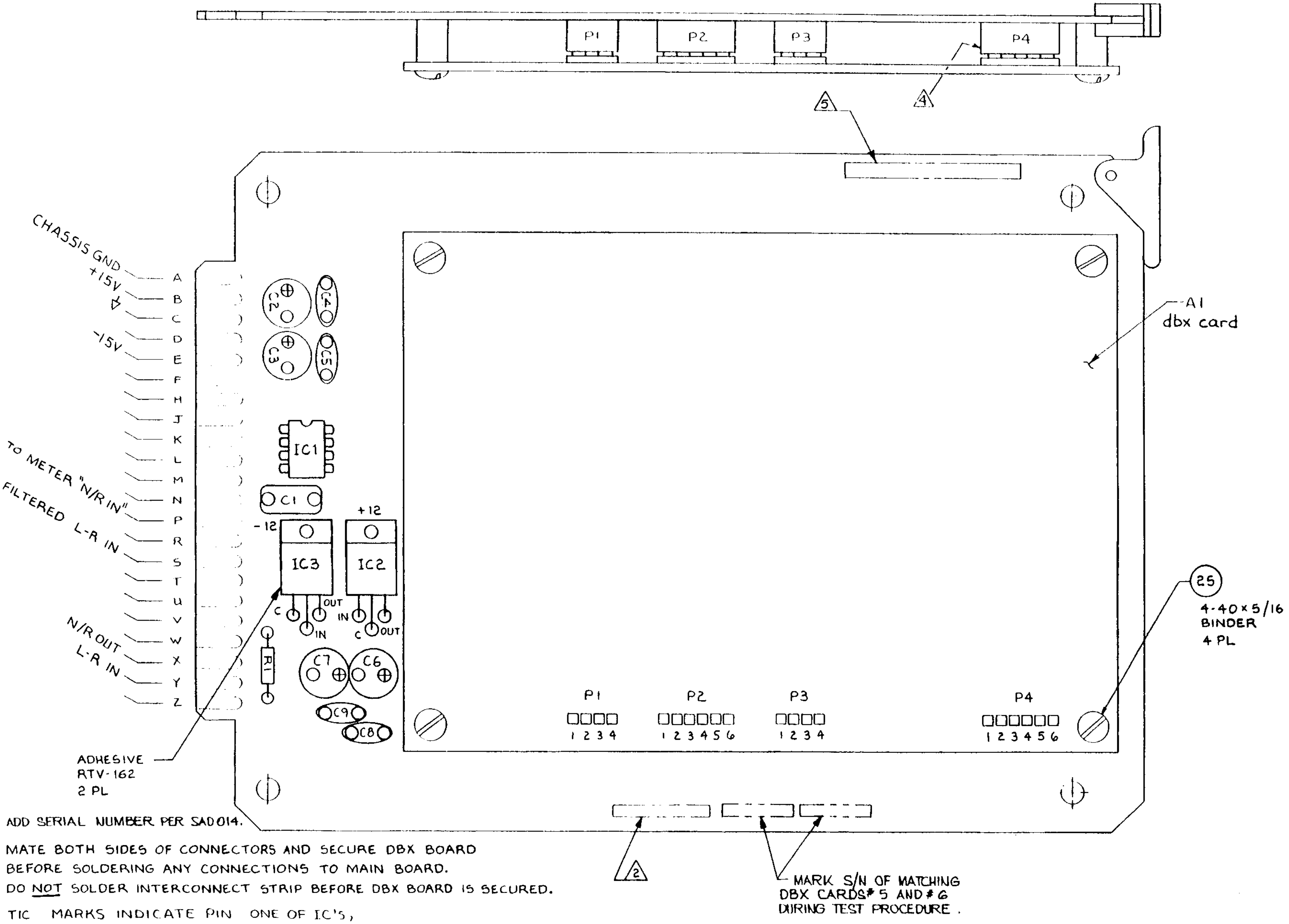
IC POWER PINS			
DEVICE	+V	-V	GND
072	8	4	—

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL CAPACITORS ARE IN μF

orban

TITLE: SCHEMATIC
#3 CARD
61023-000-01



5 ADD SERIAL NUMBER PER SAD014.

4 MATE BOTH SIDES OF CONNECTORS AND SECURE DBX BOARD BEFORE SOLDERING ANY CONNECTIONS TO MAIN BOARD. DO NOT SOLDER INTERCONNECT STRIP BEFORE DBX BOARD IS SECURED.

3. TIC MARKS INDICATE PIN ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.

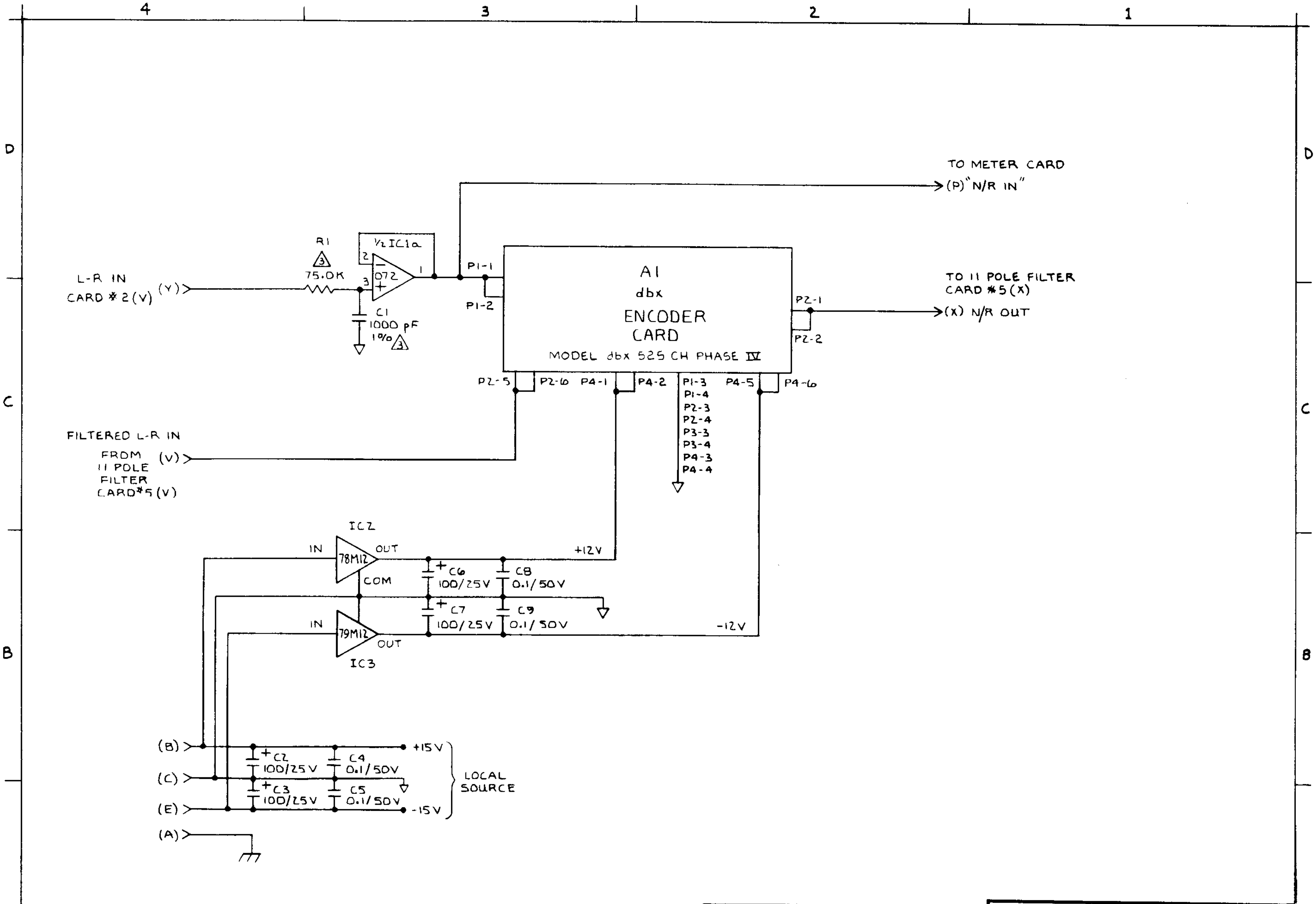
2 MARK PHASE NUMBER OF MOUNTED dbx CARD IN WHITE.

1. REFERENCE SCHEMATIC P/N 61024-000.

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban

TITLE: ASSEMBLY DRAWING
#4 CARD
31035-000-02



△3 - MATCHED SET (75 µS).

2- ALL CAPACITORS ARE IN MICROFARADS.

1- ALL RESISTORS ARE ⅛ W ± 1% MF.

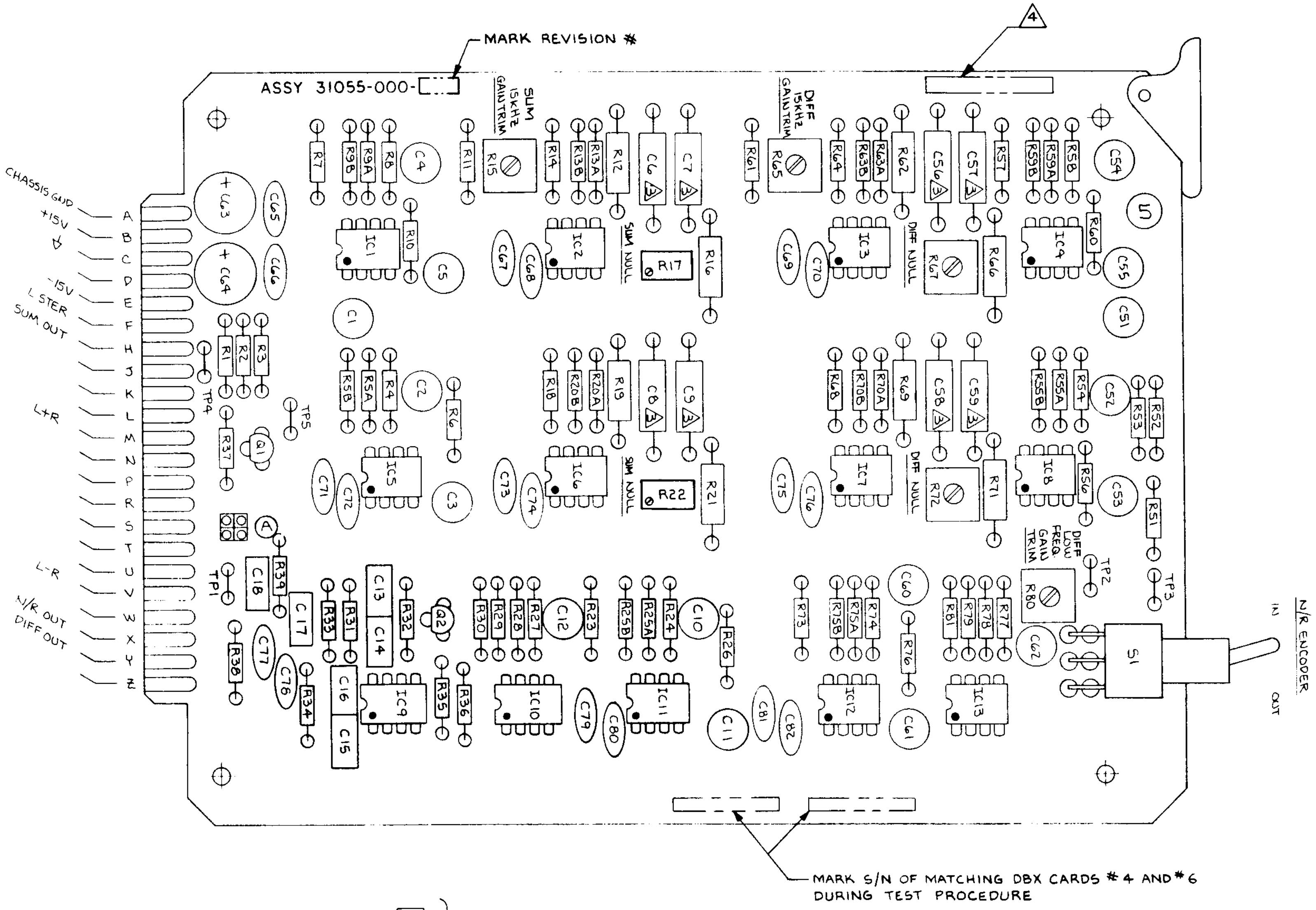
NOTES (UNLESS OTHERWISE SPECIFIED)

REFERENCE DES		
ITEM	LAST USED	NOT USED
A	1	
C	9	
IC	3	16
R	1	

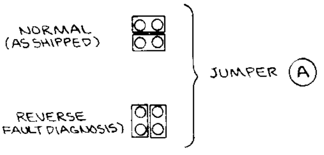
IC POWER PINS			
DEVICE	+V	-V	GND
072	8	4	-

orban

TITLE: SCHEMATIC
#4 CARD
61024-000-01



MARK S/N OF MATCHING DBX CARDS #4 AND #6 DURING TEST PROCEDURE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. REFERENCE SCHEMATIC P/N 61025-000.

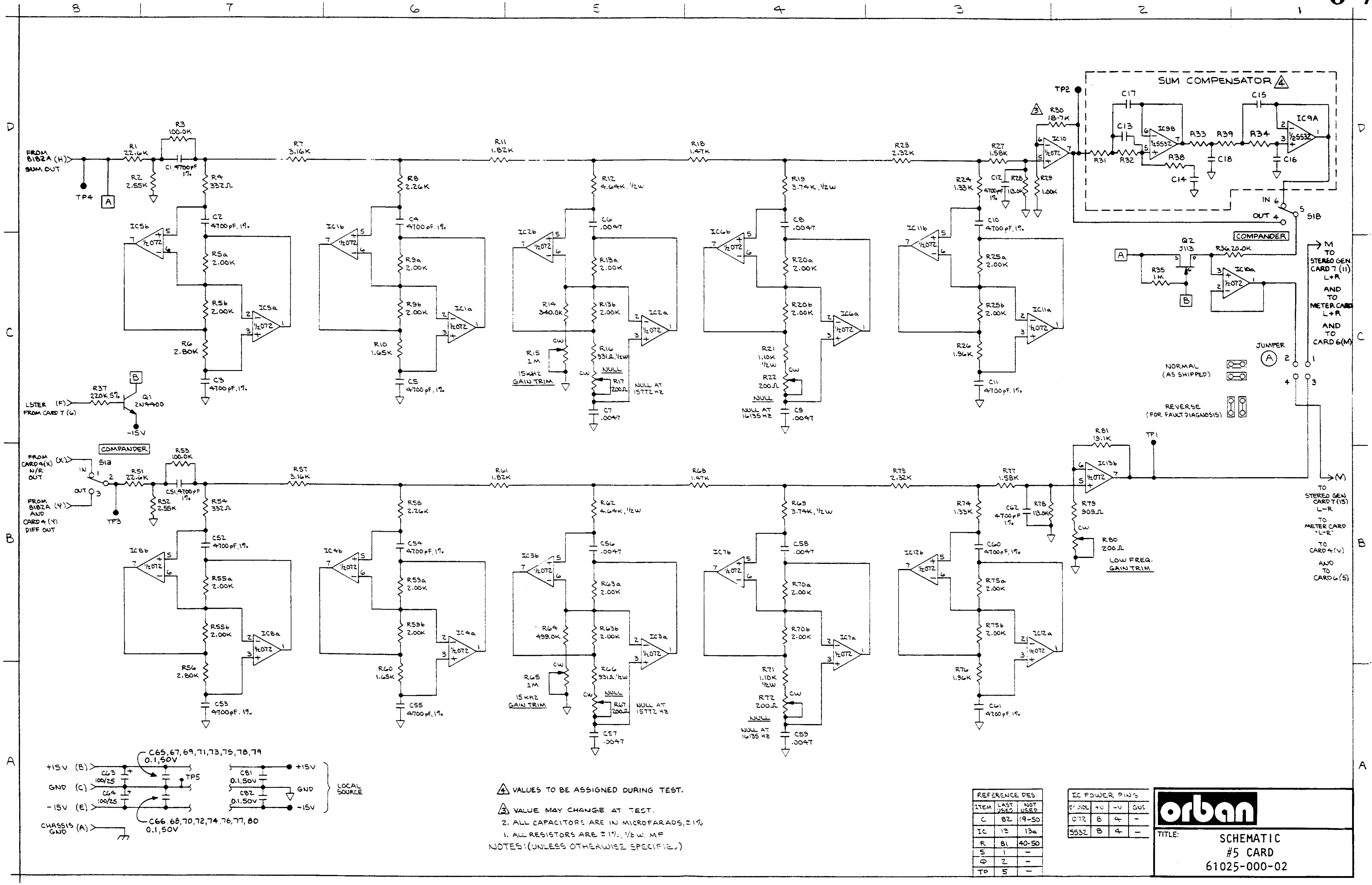
2 TICK MARKS INDICATE PIN ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.

3 C6-9 & C56-59 ARE TEMPERATURE SENSITIVE AND MUST NOT BE WAVESOLDERED.

4 ADD SERIAL NUMBER PER SAD 014.

orban

TITLE: ASSEMBLY DRAWING
#5 CARD
31055-000-02



4 VALUES TO BE ASSIGNED DURING TEST.

3 VALUE MAY CHANGE AT TEST.

2. ALL CAPACITORS ARE IN MICROFARADS, ±1%

1. ALL RESISTORS ARE ±1%, ⅛W, MF

NOTES: (UNLESS OTHERWISE SPECIFIED)

REFERENCE DES.

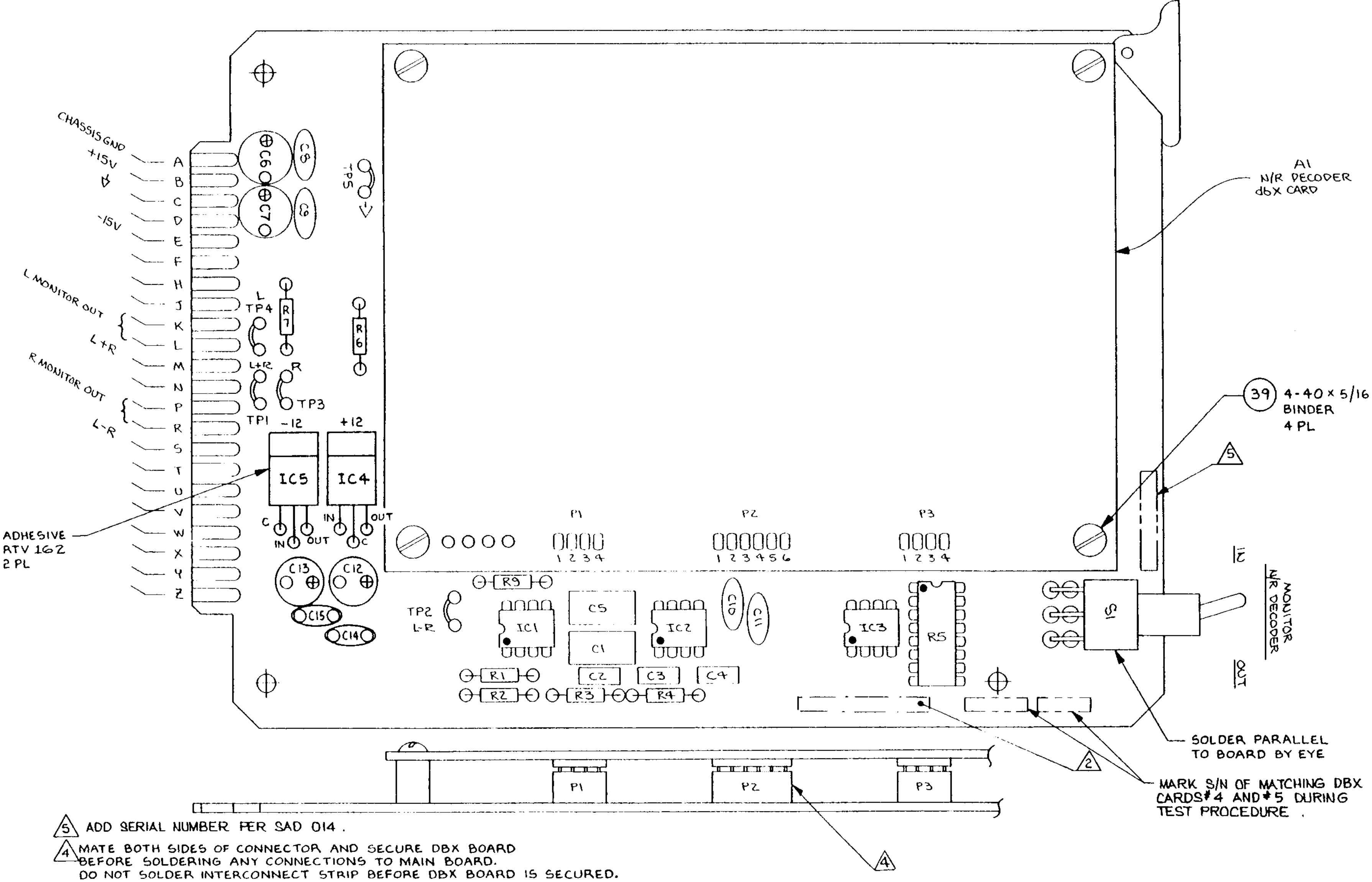
ITEM	LAST USED	NOT USED
C	82	19-50
IC	13	13a
R	81	40-50
S	1	−
Q	2	−
TP	5	−

IC POWER PINS

DEVICE	+V	−V	GND
072	8	4	−
5532	8	4	−

orban

TITLE: SCHEMATIC
#5 CARD
61025-000-02



⚠5 ADD SERIAL NUMBER PER SAD 014 .

⚠4 MATE BOTH SIDES OF CONNECTOR AND SECURE DBX BOARD BEFORE SOLDERING ANY CONNECTIONS TO MAIN BOARD. DO NOT SOLDER INTERCONNECT STRIP BEFORE DBX BOARD IS SECURED.

3. TIC MARKS INDICATE PIN ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDES OF CAPACITORS, EMITTER OF TRANSISTORS.

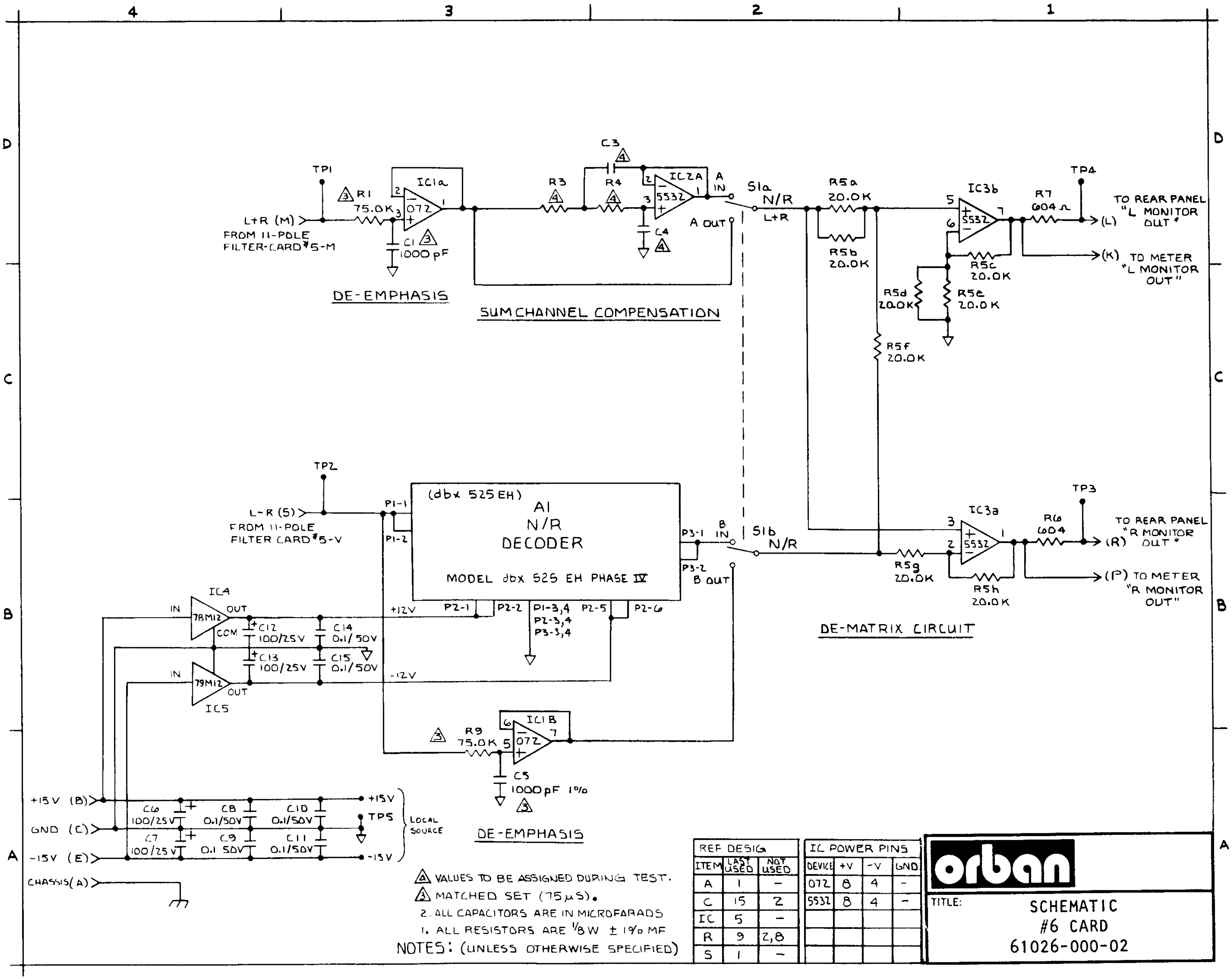
⚠2 MARK PHASE NUMBER OF MOUNTED dbx CARD IN WHITE.

1. REFERENCE SCHEMATIC P/N 61026-000.

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban

TITLE: ASSEMBLY DRAWING
#6 CARD
31045-000-02



4 VALUES TO BE ASSIGNED DURING TEST.

3 MATCHED SET (75µS).

2. ALL CAPACITORS ARE IN MICROFARADS

1. ALL RESISTORS ARE 1/8W ± 1% MF

NOTES: (UNLESS OTHERWISE SPECIFIED)

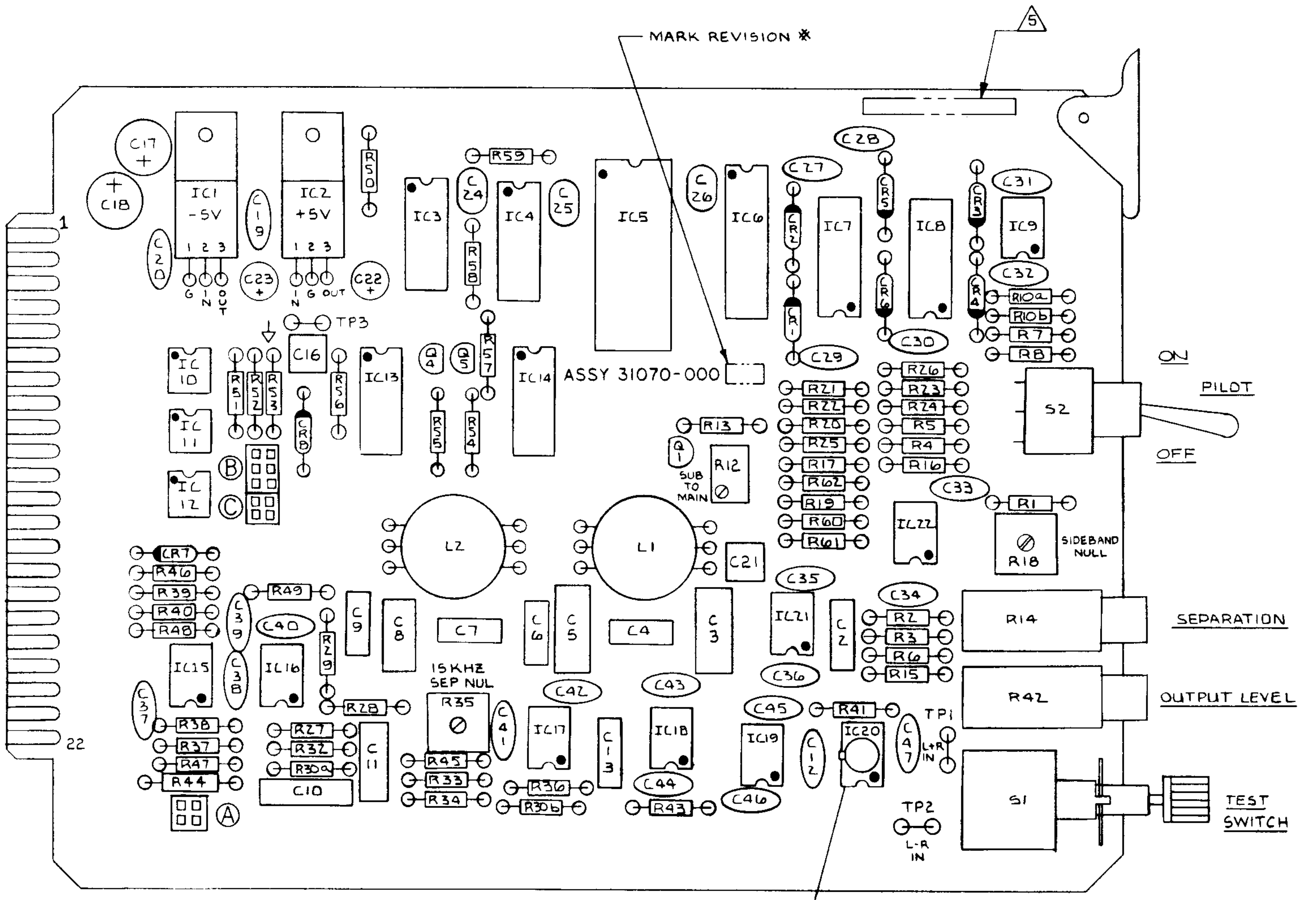
REF DESIG		
ITEM	LAST USED	NOT USED
A	1	–
C	15	2
IC	5	–
R	9	2,8
S	1	–

IC POWER PINS			
DEVICE	+V	-V	GND
072	8	4	–
5532	8	4	–

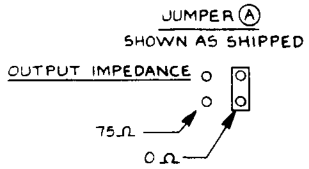
TITLE:
SCHEMATIC
#6 CARD
61026-000-02

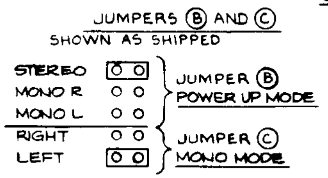
SIDES

SOLDER		COMPONENT	
A	CHASSIS	1	
B	+15 V	2	
C	GND	3	
D		4	
E	-15 V	5	
F		6	L STER
H	STEREO	7	L MONO L
J	OUT	8	L MONO R
K	MONO SW	9	16 H
L	STEREO SW	10	COMP LEVEL
M	GSTER	11	L+R
N	ST REMOTE	12	
P		13	PRO IN
R	ML REMOTE	14	
S	COM REMOTE	15	L-R
T	MR REMOTE	16	
U		17	
V		18	
W	B SYNC	19	
X	SAP IN	20	
Y	SAP IN GND	21	
Z		22	



COMPONENT SIDE





5. ADD SERIAL NUMBER PER SAD 014.

4. CLIP PIN 6 ON IC10, 11 AND 12.

3. REF SCHEMATIC 61027-000-01.

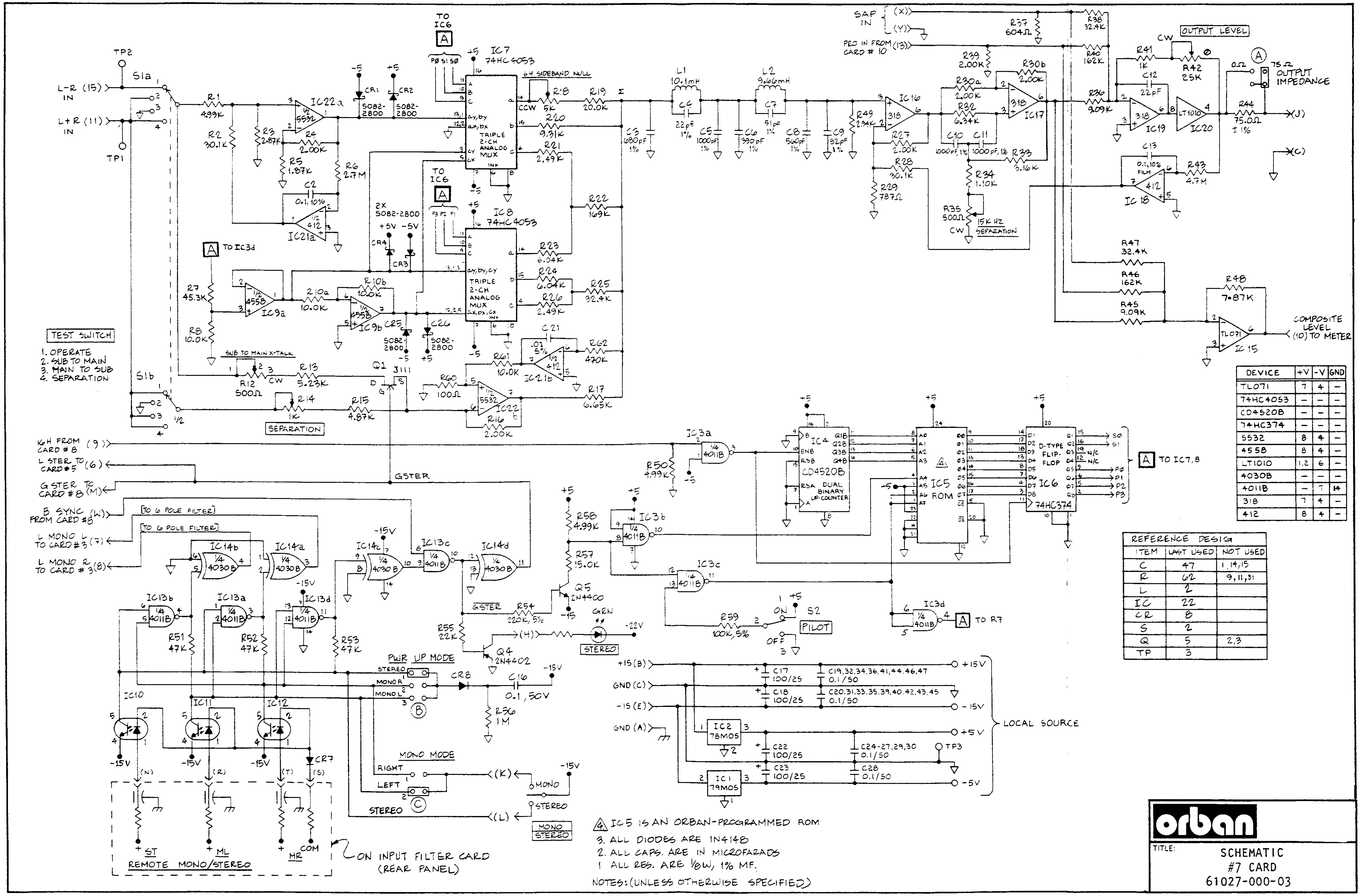
2. TIC MARKS INDICATE PIN ONE OF ICS, CATHODE OF DIODES, POS SIDE OF CAPACITORS, EMITTER OF TRANSISTORS.

1. USE COMPONENT MTG. PADS P/N 15051-000 FOR C21, C22.

NOTES :(UNLESS OTHERWISE SPECIFIED)

orban

TITLE: ASSEMBLY DRAWING
#7 CARD
31070-000-02



DEVICE	+V	-V	GND
TL071	7	4	–
74HC4053	–	–	–
CD4520B	–	–	–
74HC374	–	–	–
5532	8	4	–
4558	8	4	–
LT1010	1,2	6	–
4030B	–	–	–
4011B	–	7	14
318	7	4	–
412	8	4	–

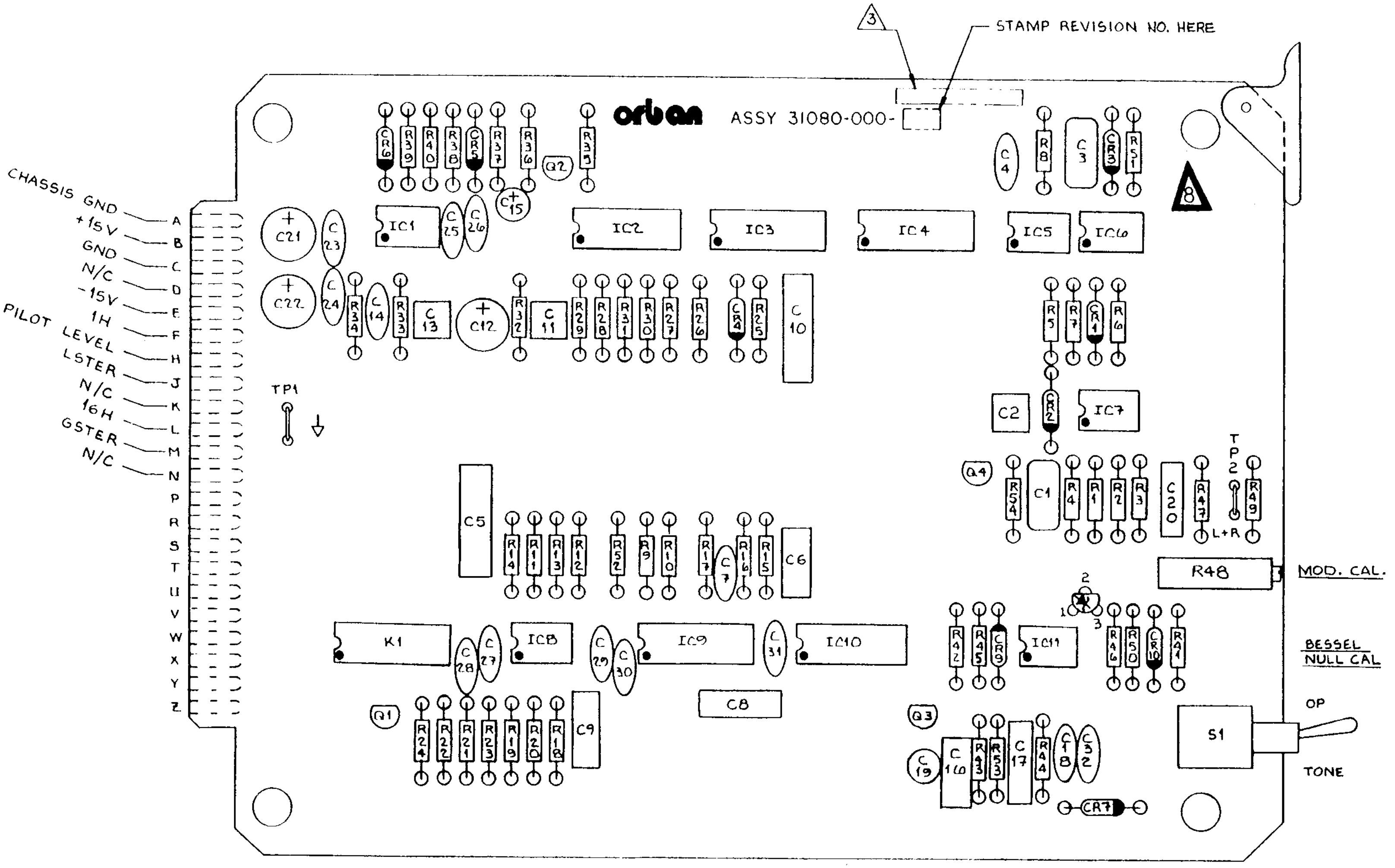
REFERENCE DESIG

ITEM	LAST USED	NOT USED
C	47	1,14,15
R	62	9,11,31
L	2	
IC	22	
CR	8	
S	2	
Q	5	2,3
TP	3	

4 IC5 IS AN ORBAN-PROGRAMMED ROM
3. ALL DIODES ARE 1N4148
2. ALL CAPS. ARE IN MICROFARADS
1 ALL RES. ARE 1/8W, 1% MF.
NOTES: (UNLESS OTHERWISE SPECIFIED)

orban

TITLE: SCHEMATIC
#7 CARD
61027-000-03



3 ADD SERIAL NUMBER PER SAD 014

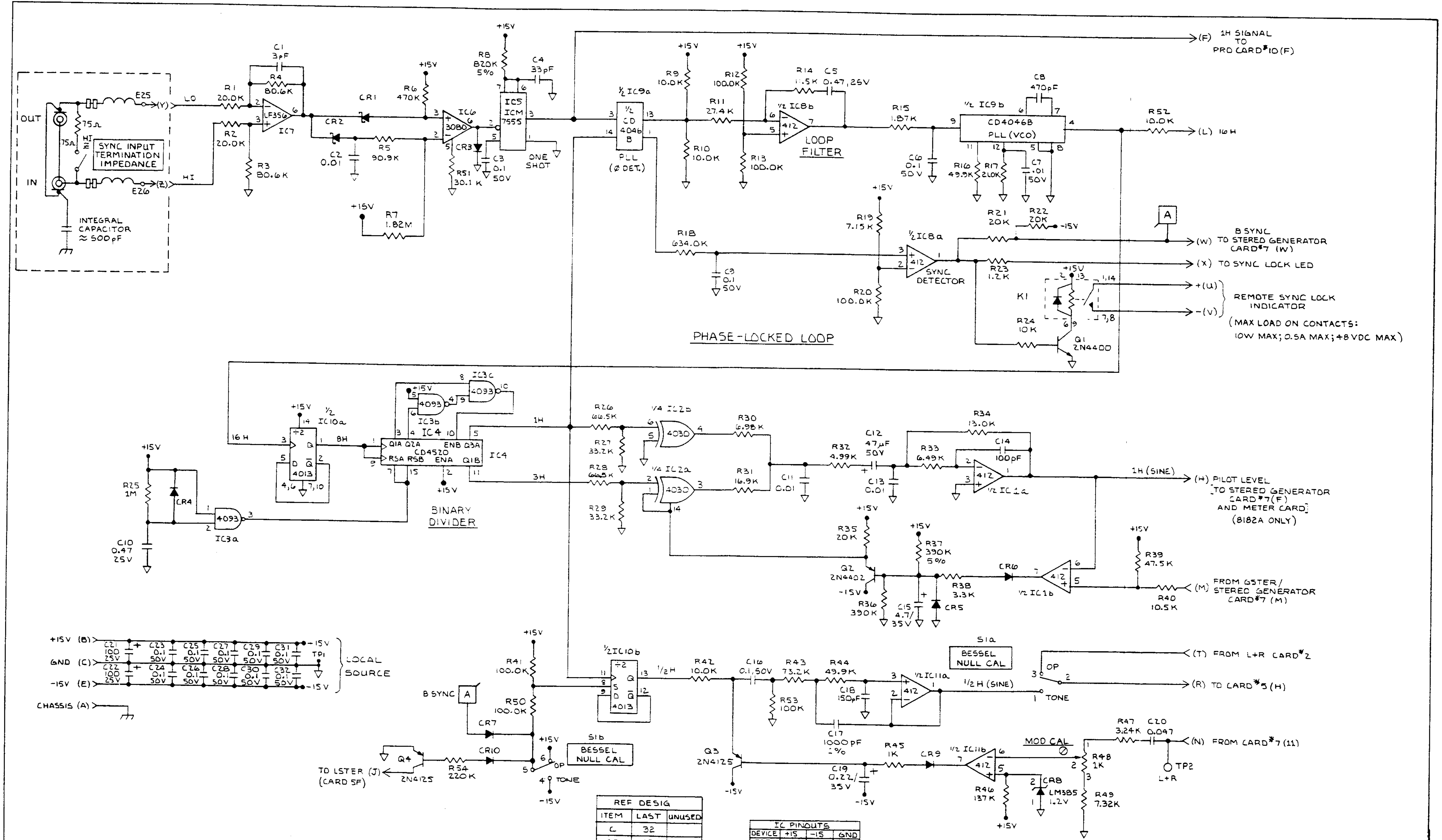
2. REF SCHEMATIC 61028-000

1. TIC MARKS INDICATE PIN ONE OF IC'S, CATHODE OF DIODES, POS SIDE OF CAPACITORS, EMITTER OF TRANSISTORS.

NOTES:(UNLESS OTHERWISE SPECIFIED)

orban

TITLE:
ASSEMBLY DRAWING
#8 SYNC CARD
31080-000-03



REF DESIG		
ITEM	LAST	UNUSED
C	32	
CR	10	4
IC	11	2c,d 3d
K	1	
Q	4	
R	54	
S	1	
TP	2	

IC PINOUTS			
DEVICE	+15	-15	GND
LF356	7	4	
412	8	4	
3080	7	4	
4013	14		4,6,7,10
4030	—	—	7,8,9,12
4046	16		4,5,8,10
4093	12,13,14		7
4520	16,2		8
7555	4,8		1

4. ALL SCHOTTKY DIODES ARE HP 5082-2800
3. ALL SIGNAL DIODES ARE IN4148.
2. ALL CAPACITORS ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/8W ±1% MF.
NOTES (UNLESS OTHERWISE SPECIFIED)

orban

TITLE: SCHEMATIC
#8 CARD
61028-000-02

Abbreviations

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

AGC	automatic gain control
CCIF	International Telephone Consultative Committee
CD	Compact disc
DAC	digital-to-analog converter
dBu	0dBu = 0.775Vrms. For this application, the dBm into 600Ω scale on voltmeters can be read as if it were calibrated in dBu.
DJ	disk jockey, an announcer who plays records in a club or on the air
EBS	Emergency Broadcasting System
EBU	European Broadcasting Union
EMI	electromagnetic interference
FCC	Federal Communications Commission (USA)
FET	field-effect transistor
G/R	gain reduction
HF	high-frequency
IC	integrated circuit
IEC	International Electrotechnical Commission
IF	intermediate frequency
IM	intermodulation (or "intermodulation distortion")
ips	inches per second
JFET	junction field-effect transistor
LED	light-emitting diode
LF	low-frequency
NAB	National Association of Broadcasters (USA)
N&D	noise and distortion
NRSC	National Radio Systems Committee
PM	pulse modulation
PPM	peak program meter
RF	radio frequency
RFI	radio-frequency interference
SCA	subsidiary communications authorization (FCC)
SID	slew-induced distortion
SMPTE	Society of Motion Picture and Television Engineers
S/N	signal-to-noise ratio
STL	studio-transmitter link
THD	total harmonic distortion
VCA	voltage-controlled amplifier

Warranty

United States Warranty

Limited Warranty

Valid only in the United States. We warrant Orban products against defects in material or workmanship for a period of one year from the date of original purchase for use, and agree to repair or, at our option, replace any defective item without charge for either parts or labor.

IMPORTANT: This warranty does not cover damage resulting from accident, misuse or abuse, lack of reasonable care, the affixing of any attachment not provided with the product, loss of parts, or connecting the product to any but the specified receptacles. This warranty is void unless service or repairs are performed by an authorized service center. No responsibility is assumed for any special, incidental or consequential damages. However, the limitation of any right or remedy shall not be effective where such is prohibited or restricted by law.

Simply take or ship your Orban product prepaid to our service department. Be sure to include your sales slip as proof of purchase date. (We will not repair transit damage under the no-charge terms of this warranty). Orban will pay return shipping.

NOTE: No other warranty, written or oral is authorized for Orban products.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. Some states do not allow the exclusion of limitations of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above exclusion and limitations may not apply to you.

International Warranty

Bedingungen

Orban gewährt 1 Jahr Garantie ab Verkaufsdatum auf nachweisbare Material- und Fabrikationsfehler. Der Garantieanspruch erlischt bei unsachgemäßer Handhabung, elecktrischer oder mechanischer Beschhädigung durch mißbräuchliche Anwendung sowie bei unsachgemäßer Reparatur durch nichtautorisierte Werkstätten. Voraussetzung für die Garantieleistung ist die Vorlage der ordnungsgemäß durch den Fachhändler ausgefüllten Garantiekarte sowie der Kaufrechnung. Transport- und Portospesen, welche aus der Einsendung des Gerätes zur Garantiereparatur erwachsen, können von Orban nicht übernommen werden, das Risiko der Zusendung trägt der Kunde. Die Garantie wird ausschließblich für den ursprünglichen Käufer geleistet.

Warranty Conditions

Orban warrants Orban products against evident defects in material and workmanship for a period of one year from the date of original purchase for use. This warranty does not cover damage resulting from misuse or abuse, or lack of reasonable care, and inadequate repairs performed by unauthorized service centers. Performance of repairs or replacements under this warranty is subject to submission of this Warranty/Registration Card, completed and signed by the dealer on the day of purchase, and the sales slip. Shipment of the defective item for repair under this warranty will be at the customer's own risk and expense. This warranty is valid for the original purchaser only.

Conditions de garantie

Pour toute mise en œvre de garantie ou de service après-vente, vous devez vous adresser à votre revendeur. Notre société assure au revendeur le remplacement gratuit des pièces détachées nécessaires à la réparation pendant un an, à partir de la date de votre facture, sauf en cas de non respect des prescritions d'utilsation ou lorsqu' une cause étrangère à l'appareil est responsable de la défaillance. Les dispositions stipulées ci-dessus ne sont pas exclusives du bénéfice au profit de l'acheteur de la garantie légale pour défaut et vice cachés qui s'applique, en tout état de cause, dans les conditions des articles 1641 et suivants du Code Civil.

Condizioni di garanzia

L'Orban presta garanzia per un anne dalla data della vendita per difetti di materiale e fabbriccazione che possono essere provati. Il diritto di garanzia cessa in caso di manipolazione impropria, danneggiamento electtrico o meccanico attraverso i'uso non approriato e riparazione inesperta eseguita da officine non autorizzate. E' indispensabile, per la prestazione della garanzia, presentare la carta di garanzia debitamente riempita dal rivenditore autorizzato e la fattura di vendita. Spese di trasporto che risultano dall'invio dell'implanto per la riparazione in garanzia, non possono essere assunte dall'Orban i'invio è a rischio e pericolo del cliente. La garanzia verrà data solo al primo acquirente.

Condiciones de garantia

Orban concede 1 añe de garantia por defectos comprobables de material o de fabricación a partir de la fecha de venta. El derecho de garantia caduca en caso de procederse a uno manipulación inadecuada en caso de producirse daño electrico o mecánico por uso indebido, asl como también en caso de reparaciones inadecuados por parte de talleres no autorizados. La prestación de la garantia está sujeta a la presentación de la Tarjeta de Garantia rellenada correctamente por el vendedor autorizado, y de la factura de compra. Orban no assume ningún gasto de transporte o correo incurrido por el envio del aparato defectuoso para la reparación bajo garantia; el riesgo del envio ha de ser asumido por el cliente. La garantia se concede única y exclusivamente al comprador original.