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Dear Orban Customer:

Thank you for purchasing the Orban 8182A/SG, TV Stereo Generator. At the time your unit left the factory, the formal Operating Manual was still being printed.

To avoid unnecessary delay, we have photocopied the essential portions of the printing masters for your immediate reference. If you return the Registration Card, you will receive your copy of the bound manual as soon as printing is completed. Please allow six weeks for its arrival.

We believe that the Preliminary Manual contains enough information to get you on the air satisfactorily. If, after reading this manual, you require factory consultation, please call Orban Customer Service at the numbers below or our toll free number (outside California) (800) 227-4498, between 8am-4:30pm Pacific Time.

Sincerely,

Dave Shantz

Dave Shantz
Customer Service Administrator

Orban Associates Inc. 645 Bryant Street San Francisco, CA 94107
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PLEASE READ THIS FIRST

MANUAL

The Operating Manual contains instructions to verify the proper operation of this unit and initialization of certain options. You will find these operations are most conveniently performed on the bench before you install the unit in the rack.

++ Please review the Manual, especially the Installation section, before unpacking the unit. You can save yourself much time.

TRIAL PERIOD PRECAUTIONS

If your unit has been provided on a trial basis:

You should observe the following precautions to avoid reconditioning charges in case you later wish to return the unit to your dealer:

1) Note the packing technique and save all packing materials. It is not wise to ship in other than the factory carton. (Replacements cost $8.00)

2) Avoid scratching the paint or plating. Set the unit on soft, clean surfaces.

3) Do not cut the grounding pin from the line cord; use the adapter supplied.

4) Use care and proper tools in removing and tightening screws to avoid burring the heads.

5) Use the nylon-washered rack screws supplied, if possible, to avoid damaging the panel. Support the unit when tightening the screws so that the threads do not scrape the paint inside the slotted holes.

TROUBLE

If you have problems with installation or operation:

FIRST: Check everything you have done so far against the instructions in the Manual. The wisdom contained therein is based on our years of experience with Optimod and broadcast stations.

SECOND: Check the other sections of the Manual (consult the Table of Contents) to see if there might be some suggestions regarding your problem.

THIRD: After reading the section on Factory Assistance, you may call Orban Customer Service for advice during normal California business hours. The number is in the Manual.

REPACKING

If you repack the unit for shipment:

Tighten all screws on the barrier strip(s) so they don't fall out from vibration.
Wrap the unit in its original plastic bag to avoid abrading the paint.
Use the two lengths of sealing tape supplied to seal the inner and outer cartons (they should be found at the bottom of the outer carton).

If you are returning the unit permanently (for credit), be sure to enclose:

1) The Manual(s)
2) The Registration Card
3) The line cord
4) All miscellaneous hardware, including the rack screws and keys
5) The card extender (normally stowed in card position #1)
6) The connecting cable

Your dealer may charge you for any missing items.

If you are returning a unit for repair, do not enclose any of the above items.

Further advice on proper packing and shipping is included in the Manual. (see Table of Contents)

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NOT FOR PUBLICATION

Revision 01
Feb. 5, 1985

QUALIFYING STATIONS WHO WANT TV STEREO
--- An Application note from Orban ---
for Dealers and their Clients

Unfortunately, TV Stereo is complicated technically and quite a bit more demanding of transmitter plant than FM Stereo. That, coupled with preexisting limits in stations with older or poorly designed equipment, can mean disappointment (or anger) if proper technical consulting does not occur prior to the order (and absolutely prior to the beginning of publicity).

Getting BTSC Specification stereo out of the antenna is tricky for every station -- much more so than mono.

There are some basic system requirements which cannot be overlooked. Most of these are exhaustively described in a lengthy (90+ pages) booklet entitled:

BTSC SYSTEM: TELEVISION MULTICHANNEL SOUND RECOMMENDED PRACTICES

which is in the process of being finalized by the Electronic Industries Association in Washington. It is not yet in print -- don't bother them yet. Maybe April.

Some of their recommendations have already been circulated and some station engineers have already qualified their plant or have properly upgraded. Others have never heard of it.

Please bear in mind that there is little experience available at this date and that some of the BTSC Recommendations are based in part on theoretical predictions. Also, we at Orban are NOT RF engineers and our opinions presented here should always be subordinated to those of appropriately qualified engineers. There are just too many variables. Everyone is learning.

So far, our experience has been that most plants can handle stereo at some level of performance as they stand. It will be considerably more vital that the BTSC recommendations be followed precisely if SAP is to be installed later. Since monitoring equipment is not yet commercially available, it is difficult to ascertain whether a given installation will meet specifications. It could be estimated that the F.C.C. would permit a grace period until commercial monitors are available.

It is not necessary to have a monitor or any other equipment to set up the Stereo Generator properly. However, instrumentation is necessary to reveal problems occurring after the Stereo Generator.

The quick and dirty way to see if the system is working is to try it, observing the results on a good quality consumer receiver. One can make gross separation measurements. If they exceed 20dB @ 1 kHz (both directions), and if there are no wretched noises or distortion with stereo program, one might assume that the system is working well enough to permit the commencement of programming.

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However, if there are problems, here is a VERY brief abstract of the most likely sources of problems.

Principal Requirements:

STL

Dual-channel, 15kHz bandwidth, clean, ±0.4dB gain tracking, or
Broadband STL with 110kHz bandwidth and essentially flat group delay 30-46,000 Hz. in which case the Stereo Generator goes at the studio end with the Audio Processor.

[Such Broadband STL's are not yet currently available; several STL manufacturers have them under development. Current "wideband" subcarriers have insufficiently flat group delay for stereo.]

Exciter

Deviation: ±55kHz min. for stereo
±73kHz min. for stereo + SAP

Total Harmonic Distortion: less than 0.5%
Bandwidth: 46kHz, flat within 0.05dB (yes, 0.05dB) for stereo; 110kHz for full services but with looser tolerances above 46kHz.

Phase Linearity: 1 degree

Newer mono exciters without baseband input ports might be modifiable by adding a port after the input transformer. The preemphasis must be disabled. Check the exciter's specs and ask the manufacturer.

Exciters employing phase modulators are absolutely not suitable for stereo. Dump them. Only Direct-FM exciters will work.

Diplexer

Bandwidth: 400kHz at 3dB points; group delay must be symmetrical, preferably constant.

The simple way to check for this is to install our Stereo Generator, modulate with 15kHz, and look at the baseband as taken from a demodulator or monitor. (See below.) If the baseband comes out fairly flat, (that is, 40dB equivalent separation or better) the diplexer probably works well enough for stereo. (See our Manual for procedure.)

The more precise way is to rent a network analyzer and sweep the diplexer. RF is out of our range of expertise.

Diplexers can sometimes be tweaked if they're close. Call the diplexer manufacturer. Internally diplexed transmitters are supposed to be more difficult to optimize for stereo and SAP.

Other Notes:

Excessive Incidental Carrier Phase Modulation (ICPM) is predicted to be a source of problems leading to severe buzzes in the decoded audio. However, this problem may be less prevalent at higher carrier frequencies. ICPM can sometimes be reduced by more careful neutralization.

Stations receiving program in a sum-and-difference mode (as in some state networks) must dematrix the audio to L and R for presentation to the Optimod-TV. This can be easily done with a resistive network at the output of a zero-impedance source (op-amp output). Orban Customer Service can supply a schematic if needed.

This is an general outline of technical pitfalls. The requirements MUST BE RESPONSIBLY MET to make the system work. BTSC TV Stereo is a lot like NTSC color in this respect. There is little room for 'fudging'. Failure to meet requirements can mean: Low or no separation, high distortion, crosstalk into the SAP or video, sync buzz, a stereo platform effect (image wandering back and forth), and as yet undiscovered other horrors.

Incidentally, the sets are getting a lot better with regard to sound quality, and defects in sound are emphasized in stereo. Dirty audio will become embarrassingly evident. FM audio quality is no longer hard to achieve. Does stereo TV deserve less? Stations can profit enormously by cleaning up their audio plant prior to publicizing stereo broadcasts. (Meeting the requirements of the old audio proof is by no means state-of-the-art audio by today's standards.)

About Monitors/Demodulators:

So far, there's not much out. Mono units are useless except for the sum channel. Tektronix offers an "Option 10" for their 1450 to achieve 50kHz aural — enough only for stereo. But rumor is that they have never installed one before in a 1450 and there is a suspicion that it won't meet specs anyway! You try to get some information out of Tek!

It is conceivable that some existing mono units could be modified to work for stereo. Those who want to do this must tend to baseband bandwidth, group delay equalization, and RF mixer bandwidth. Consult the monitor manufacturer. TFT, Belar, Scientific Atlanta and Tektronix may be cooking up new aural monitors, possibly others.

In many cases, a good consumer receiver will have to suffice for a while. While our Stereo Generator can be set up without reference to a monitor, there is no real way to tell how the exciter or diplexer behaving without one.

About Decoders:

Once the baseband is obtained, it must be processed through a decoder to extract the stereo (and SAP and Pro-channel) information. Fortunately, the accuracy requirements are not as great as for the monitor. Besides the in-set decoders, several stand-alone consumer units appear to be available now:
Sony MLV-1100; Zenith CV-524; Radio Shack?

We've used the Sony; they should be checked for unit to unit variations. We have not used the others. The Zenith unit appears to be connectorized for their sets. We know nothing about the Radio Shack.

If you attempt separation measurements through a consumer decoder, remember that the decoder could have poorer performance than your plant. It's the age of deregulation and other general sloppiness.

By the way, the consumer units are not equipped to decode the Pro-channel, but it is expected that all of them will decode the SAP.

The availability of decoders should increase since some set manufacturers have anticipated TV stereo only by providing a MUX jack. They'll have to make decoders available or be hanged.

Special Caution: An unconfirmed rumor is that at least one consumer manufacturer (don't know who) is doing everything possible to avoid the high cost of providing full BTSC standard decoding in their equipment. Don't assume otherwise when dealing with consumer equipment.

About Optimod-TV:

The Optimod-TV Stereo Generator works only in conjunction with the Model 8182A Audio Processor, not its predecessor the Model 8180A. However, we have developed a factory retrofit so that older units need not be made obsolete. It costs $995, takes up to six weeks, and is available though all Dealers. There are no loaner units available and the retrofit cannot be done in the field. All features of the Model 8182A (such as the CBS Loudness Controller and the Hilbert-Transform Clippers) are added.

The Stereo Generator chassis can be set up very quickly without instruments or monitors. The Stereo Generator chassis includes a built-in dbx decoder card so you can monitor the audio at the input to the baseband generator card, after all audio processing.

One Last Thought:

Viewers will notice a big difference when you switch between mono and stereo sources. This might be a useful effect for a while. However, you can transmit a truly remarkable "synthesized" stereo from any mono source whatever by use of Orban's 245F Stereo Synthesizer ($399). The effect is highly seductive, dialog will come from the center, no adjustments after initial setup are necessary.

You can readily and persuasively synthesize everything for maximum theatrical effect. And, it can be defeated with a front panel switch if you like.

Written by John Delantoni; Reviewed by Bob Orban for technical accuracy.

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APPLICATION NOTE

USING THE ORBAN 8182A/SG TELEVISION STEREO GENERATOR WITH NON-ORBAN AUDIO PROCESSING

We have had several requests for information on use of the 8182A/SG with audio processors other than the Orban 8182A OPTIMOD-TV. When any such request is made, we first suggest that the station in question consider use of the 8182A for the following reasons:

1) The 8182A is specifically matched to the 8182A/SG Stereo Generator. The 8182A/SG's Left and Right Six-Pole lowpass filters have been interleaved with the 8182A's circuitry to prevent stray energy at 15.734kHz and above from affecting the 8182A's High Frequency Limiting function and to prevent intermodulation between these out-of-band signals and in-band signals in the 8182A's peak limiting and clipping circuitry. An external audio processor would not be afforded the same protection.

2) The 8182A is designed to be connected to the 8182A/SG by means of a short, shielded cable. All external audio connections (except for the PRO channel input) are ordinarily made to the 8182A inputs, which are highly RF-suppressed. An external processor must be interfaced with the 8182A/SG's rear-panel multipin connector, which is not equipped with special RFI suppression. External RFI suppression may therefore be necessary.

3) The 8182A has proven to be the processor of choice for many major stations because it combines extremely natural sound with the ability to achieve consistent loudness from widely disparate source material. These goals tend to be mutually-exclusive in conventional processors. In addition, multiband compression prevents "pumping" and/or unnatural loudness variations when program material containing heavy bass is processed. Because the 8182A shares many design features with the most widely-accepted FM processor -- our OPTIMOD-FM Model 8100A -- it is capable of excellent modulation control without sounding over-processed. In almost all cases, you can't hear it working.

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Even so, interfacing the 8182A/SG to external processing is possible. The discussion below suggests how external processing might be used with the 8182A/SG. (See the Block Diagram in Fig. 1 below.)

The documentation for the 8182A/SG specifically assumes that the 8182A is connected as part of the system. Users of external processing will have to extrapolate setup and operating instructions.

PLEASE NOTE!

> While the application note below is correct to the best of our knowledge, Orban does not guarantee that processing other than the Orban OPTIMOD-TV Model 8180A or 8182A will operate satisfactorily with the 8182A/SG. If you choose to interface non-Orban processing, it is understood that you assume all risk. 8182A/SG published specifications are only applicable to a system consisting of an 8182A audio processor and the 8182A/SG, and are only guaranteed when the 8182A is used. (However, we would expect that all BTSC system specifications would be met if the external processing were competently interfaced by engineers who had a good understanding of the fundamentals of the BTSC system.)

Concept

When used with non-Orban audio processing, the 8182A/SG lacks two essential circuit functions, and those functions must be supplied externally. These functions are (1) 75us pre-emphasis networks for the Left and Right channels; and, (2) matrix circuits to produce L+R and L-R from Left and Right pre-emphasized signals. (Ordinarily, these functions are both provided within the 8182A audio processor.)

IMPORTANT!

> To avoid unstable stereo imaging, the external processing must be strapped so that the gains of the left and right channels track together.

Fig. 2 shows both pre-emphasis and matrix circuits. If the external audio processing can be configured to provide pre-emphasized outputs, then the pre-emphasis circuits in Fig. 2 can be omitted. (The differential amps provide rejection of common-mode noise, and should remain.)

It is assumed that any professional audio processor will have balanced outputs. (If

its outputs are unbalanced, they can still be connected to the differential amplifiers, but ground-loop-induced hum is more likely than with a fully-balanced system.)

These balanced outputs (in Left and Right form) are applied to the differential amplifiers. If the output of the external processing is not pre-emphasized, then it is necessary to strap the pre-emphasis circuits IN. The outputs of the pre-emphasis circuits are applied to the Left and Right Six-Pole Filters within the 8182A/SG. The outputs of these filters (still in Left and Right form) are brought out of the 8182A/SG and applied to the external matrixing circuitry to produce Sum-And-Difference (L+R/L-R) signals. Finally, the L+R/L-R signals are applied to the remainder of the 8182A/SG circuitry.

All signal connections can be made to J5 on the rear panel of the 8182A/SG. (This jack ordinarily connects to the 8182A audio processor by means of a short, appropriately-shielded cable.) The schematic diagram shows the appropriate pin numbers for the various connections. Note that a circuit ground connection must also exist between the 8182A/SG and the external circuitry. This is found on pin 8 of J5. J5 accepts a Cinch #57-30140 plug.

The 8182A/SG's power supply has sufficient surplus capacity to easily power all circuitry shown in Fig. 1, and you may wish to use it for this purpose. [The +15V, -15V, and ground terminals on the 8182A/SG's power supply regulator card (on the inside of the rear panel) should be used as source of power. See p. J-2 of the 8182A/SG Operating Manual for a diagram.]

The external circuitry could even be built within the 8182A/SG chassis. (There are several unused card slots.) In this case, it might be advisable to install a connector in the rear-panel cutout labeled "Accessory Port", and to bring the audio from the external processor in through this connector. (That way, J5 is not modified and the 8182A/SG can be easily restored to "stock" condition in the future.) The Accessory Port accepts a Cinch #DB-25S socket, which mates with a Cinch #DB-25P plug.

The schematic diagram also provides the numbers of the circuit card connector pins which are connected to given pins on J5. This information is useful if you choose to bypass J5 and install another connector or if you choose to build the circuitry within the 8182A/SG chassis.

Adjustment And Headroom Considerations

It is important to avoid clipping within the "External Processor Interface" circuitry. Please note that the pre-emphasis circuit has approximately 17dB gain at

15kHz. It is therefore necessary to monitor the output of the pre-emphasis circuit with an oscilloscope and to adjust the output level of the external processing such that clipping at the output of the pre-emphasis circuit in Fig. 2 is never observed, even on the most difficult program material.

Such "difficult" program material will typically be music with large amounts of high-frequency energy. Rock videos are probably worst-case. In addition, watch out for very sibilant voices. If the external processing is correctly designed, it will incorporate high frequency limiting and peak limiting to prevent significant overshoots even on difficult program material. But please be aware that not all processors perform this function as accurately as OPTIMOD-TV Model 8182A! In particular, if the external processor has no high-frequency limiting function, severe overmodulation and distortion can occur on program material rich in high frequencies.

Level Match, 8182A/SG To Exciter: Refer to p. 4-5 of your 8182A/SG Operating Manual, where this procedure is described with the assumption that the 8182A audio processor is incorporated in the system. Where the procedure refers to "8182A", read "external processor" instead. Where the procedure refers to the "8182A L OUTPUT ATTENuator", read "L+R Gain Control in Fig. 2 of this Application Note" instead. Similarly, where the procedure refers to the "8182A R OUTPUT ATTENuator", read "L-R Gain Control in Fig. 2 of this Application Note" instead.

Omit all references to the 8182A's VU meter. Instead, make sure that the 10,396Hz tone is applied to the Fig. 2 circuitry at a sufficiently low level to avoid clipping at the output of the pre-emphasis circuit. (Check it with a scope.)

Setting Modulation: Stereo-balance the Left and Right external processors according to their manufacturer's instructions. When you are finished, the audio outputs of the Left and Right external processors should be identical in level and phase.

IMPORTANT!

> In the discussion below, "L-R GAIN control" does <u>not</u> refer to the SEPARATION (L-R GAIN) control on the 8182A/SG's stereo baseband generator. Instead, it refers to the control labeled "L-R GAIN" in the schematic diagram (Fig. 2) attached to this Application Note.

Turn both L+R GAIN and L-R GAIN controls (on Fig. 2) all the way down. Switch the external processors to their normal OPERATE mode and drive them with a <u>mono</u> program signal, such that normal gain reduction is being produced. Enter

MONO mode on the 8182A/SG and advance the L+R GAIN control (on Fig. 2) until carrier deviation does not exceed ±25kHz on frequently-recurring peaks. Then temporarily remove signal from the Right channel. (You may do this anywhere in the signal path that is convenient.) Observe the R MONITOR OUT position on the 8182A/SG's VU meter, and adjust the L-R GAIN control (on Fig. 2) to secure a null. (Use the 8182A/SG's EXPANDED meter gain to see the null most clearly.)

The above procedure should get modulation in the ballpark. If you want to reset modulation DO NOT READJUST THE 8182A/SG's TOTAL BASEBAND OUTPUT CONTROL! (You will destroy the noise reduction calibration.) Instead, you must first readjust the L+R GAIN control (on Fig. 2), and then re-null separation with the L-R GAIN control, as in the instructions above.

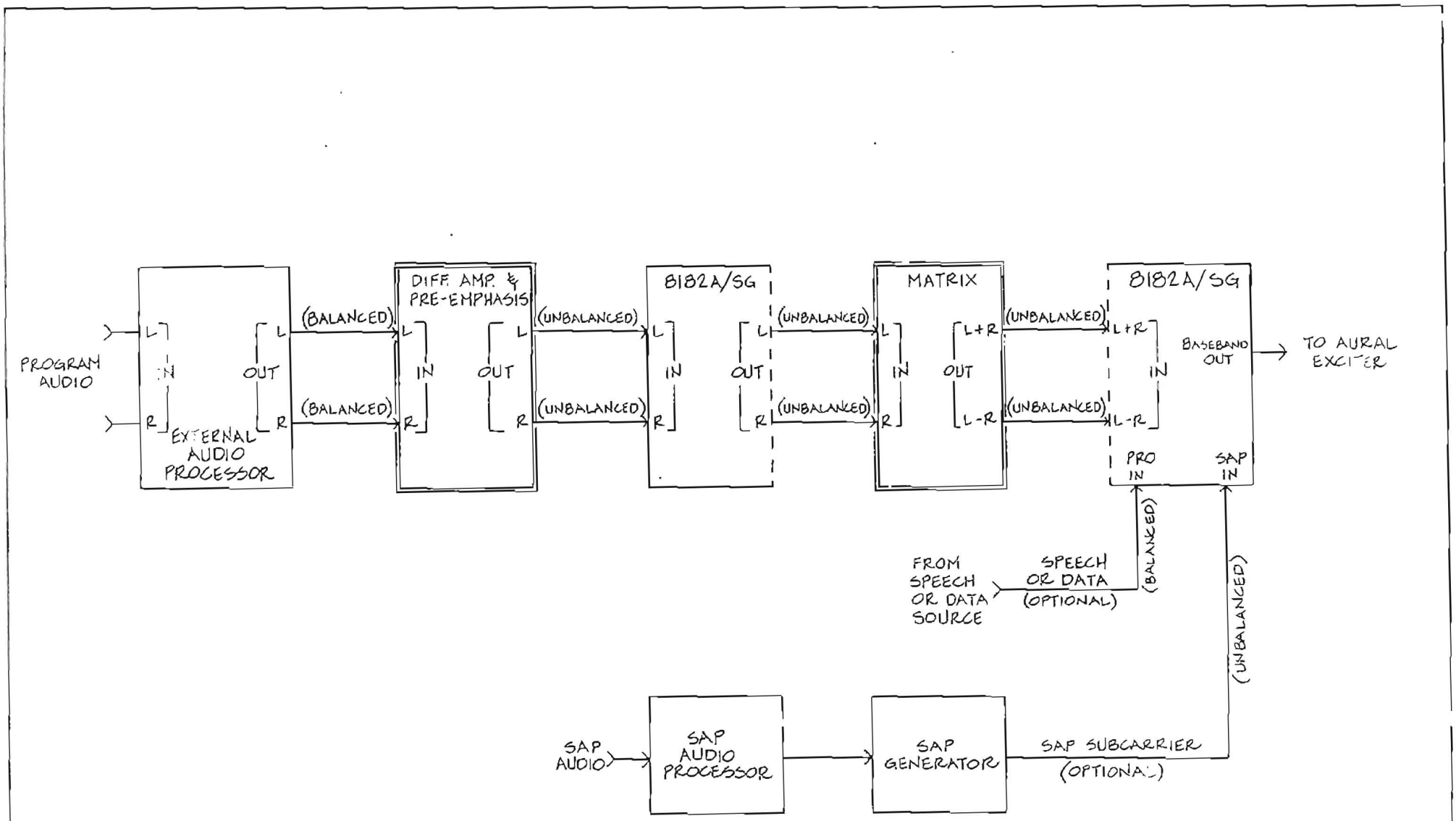
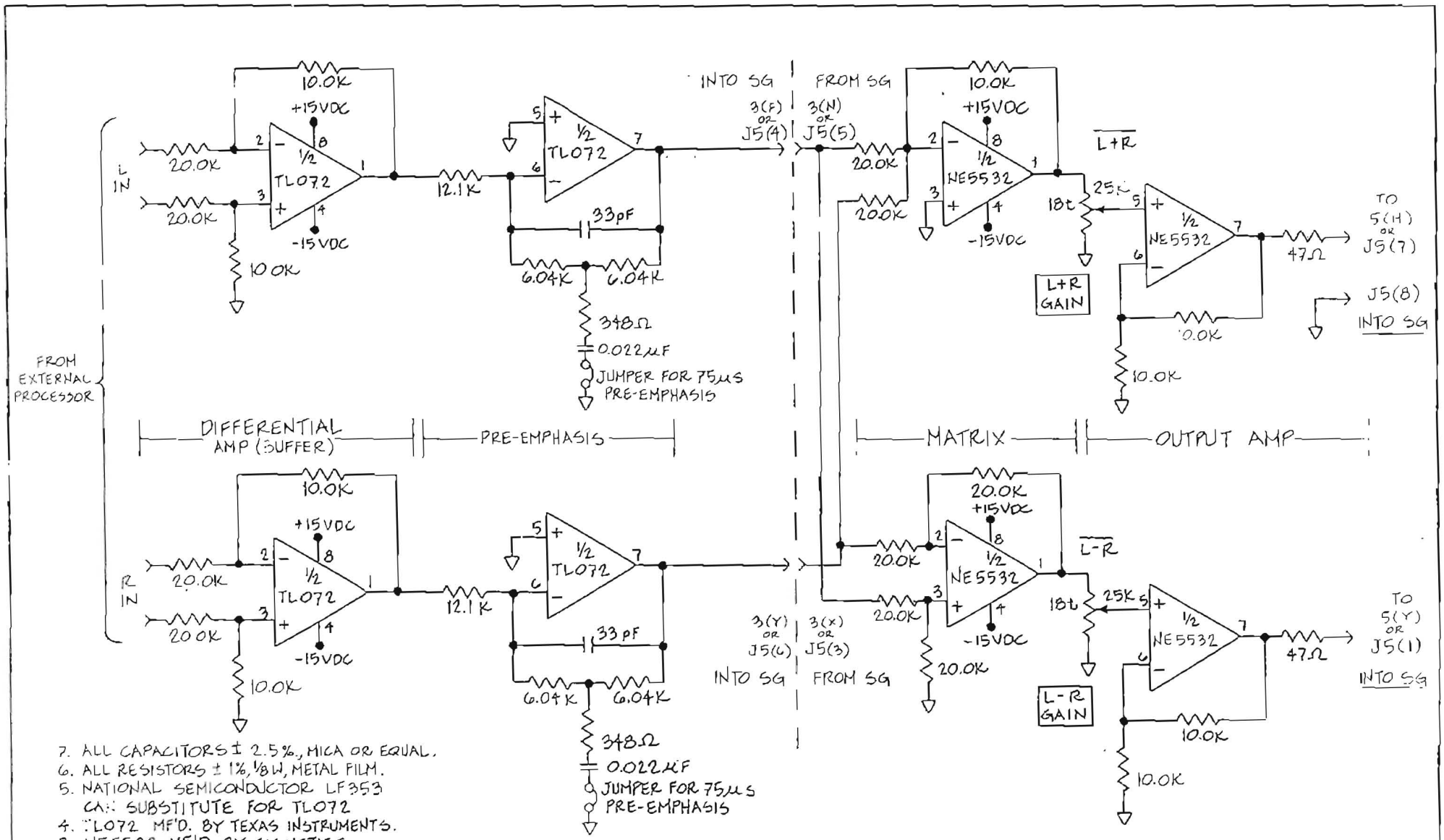


FIG. 1 – USE OF EXTERNAL AUDIO PROCESSING WITH ORBAN TV STEREO GENERATOR MODEL 8182A/SG

GCS 10.31.85



NOTES:

1. ALL IC'S OPERATED AT ±15VDC.
2. J5 IS THE ACCESSORY PORT AT THE REAR OF THE SG.
3. NE5532 MF'D. BY SIGNETICS.
4. TL072 MF'D. BY TEXAS INSTRUMENTS.
5. NATIONAL SEMICONDUCTOR LF353 CAN SUBSTITUTE FOR TL072
6. ALL RESISTORS ± 1%, 1/8W, METAL FILM.
7. ALL CAPACITORS ± 2.5%, MICA OR EQUAL.

FIG. 2 — EXTERNAL PROCESSOR INTERFACE TO 8182/SG

GCS 10.31.85

Operating Manual

OPTIMOD®-TV
STEREO GENERATOR

Model 8182A/SG

PRELIMINARY

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ORBAN 8182A/SG BTSC STEREO GENERATOR ACCESSORY CHASSIS FOR OPTIMOD-TV MODEL 8182A

OPERATING MANUAL

Registration Card

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

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

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

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

8182A/SG SEND MANUAL

Model # _____ Serial # _____

Name or Title _____

Organization _____

Street _____

City/State/Country _____

Zip or Mail Code _____

Purchased from _____ City _____ Date of Purchase _____

Nature of your application _____

How did you hear about it? _____

Comments: _____

Fig. A-1: REGISTRATION CARD

Warranty

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

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

Part 1: INTRODUCTION

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

Objective And Features: A full Orban system for BTSC television stereo consists of the following:

-- an 8182A Stereo Audio Processor
-- an 8182A/SG Stereo Generator (with Professional Channel option)
-- an 8182A/SAP Second Audio Program Generator.

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

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

Unique features include a built-in calibrated monitor card containing a dbx decoder card, as well as appropriate de-emphasis and dematrixing circuitry. This card permits closed-circuit verification of proper operation of all circuitry but the baseband generator, independent of the RF link and of the modulation monitor. (The performance of the baseband generator can be separately verified by means of several special test modes, conveniently switch-selectable.) Another special feature is a defeatable baseband clipper, whose threshold is continuously adjustable. This was designed to remove the most radical overshoots introduced by the extremely steep filters within the system. (When this clipper is defeated, we have observed short-duration overshoots as large as 250-300% modulation!)

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

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

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

The 8182A/SG can also be mated to the older OPTIMOD-TV (Model 8180A) by means of a factory update RET-25. This adds the Hilbert-Transform Clipper and Loudness Controller features. Please contact Orban Customer Service if you want this conversion.

System Configuration: The 8182A/SG is housed in a 7" (4-unit high) chassis which ordinarily resides directly below the 8182A. The two chassis are interconnected by means of a cable (supplied). The 8182A/SG contains its own power supply: only audio is passed between the two chassis.

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

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

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

The 8182A/SG requires a 1V p-p 75ohm sync or composite video signal to provide

a reference to frequency-lock the various baseband generators to the horizontal line frequency. A composite video "loop-thru" output permits this reference to be the same video signal that drives the visual transmitter.

The output of the 8182A/SG is either 0 or 75 ohms (jumper-selectable; unbalanced but floating over chassis ground), and is designed to directly drive the composite input of an aural exciter or a composite STL.

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

An optically-isolated transistor switch is provided in the 8182A/SG to remotely indicate if video lock has been achieved.

THE BTSC TELEVISION STEREO SYSTEM

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

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

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

emphasis is used.

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

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

Correct operation of the dbx noise-reduction depends on a precisely-controlled gain between the output of the encoder at the transmitter and the input of the decoder at the receiver. At the transmission end, this is assured by calibrating the gain to the exciter such that the exciter produces a given frequency deviation when a given voltage is present at the output of the dbx encoder. Detailed instructions for performing this calibration (which is aided by calibrated metering within the 8182A/SG) are found in **Part 4** of this manual.

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

While the SAP as described above is part of the Zenith/dbx standard, the FCC does not require that this standard be adhered to even if the 15.734kHz BTSC stereo pilot is being transmitted. Therefore, the EIA recommended standard suggests that if a non-BTSC SAP (or other subcarrier) is transmitted at $5F_h$,

it should be broadcast with an injection of less than ±7.5kHz main carrier deviation to avoid false triggering of SAP decoders in BTSC receivers.

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

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

SIMPLIFIED SYSTEM DESCRIPTION

This section provides an understanding of the 8182A/SG and its relationship with the 8182A sufficient to install and operate the units in an informed manner. Particular emphasis is placed on unusual features and possible pitfalls: we have tried to anticipate some of the more common questions in this part of the manual. More detailed discussions of the system from the point of view of troubleshooting and maintenance are found in **Appendix A (System Description)** and **Appendix B (Circuit Description).**

Relationship Between the 8182A/SG and the 8182A: (NOTE: This discussion assumes that the reader is reasonably familiar with the 8182A, which is fully described in its own **Operating Manual.**)

The 8182A/SG can be divided into two main sections, the first of which is embedded within the 8182A, and the second of which is driven by the 8182A outputs.

1) **Input Filters:** The first section consists of a pair of sharp 6-pole 15kHz filters for the Left and Right channels. These filters are placed between the output of the 8182A's Dual-Band Compressor and the input of its High-Frequency Limiter. The filters have two deep notches, one of which is located at the horizontal line frequency. This notch prevents stray 15.734kHz energy from being applied to later processing (the HF and peak limiters in the 8182A), or to the compandor input.

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

The signal is then returned to the 8182A for pre-emphasis, HF limiting, and peak limiting in Left and Right form (FM-stereo style).

After this processing, the signal is strictly peak-limited and fairly well bandlimited. The signal is then converted to sum-and-difference form in a matrix circuit located within the 8182A. The input to the 8182A/SG is thus in pre-emphasized sum-and-difference form.

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

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

To avoid unnecessarily disturbing the tightly-controlled peak levels at the 8182A output, both the sum compensator and sum 11-pole filter are automatically switched out of the signal path when MONO mode is selected on the 8182A/SG. In addition, a special TEST mode is available in which the N/R encoder and its matching sum compensator are switched out of the signal path, but the two (sum and difference) 11-pole filters remain to permit testing of "equivalent stereo separation" (which is affected by the matching of the two

filters) without the N/R encoder.

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

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

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

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

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

The third test mode applies the L+R audio to both the main and sub inputs of the generator simultaneously. Because the main and sub inputs are designed to have equal sensitivity, this produces the familiar "flat baseline" waveform seen in FM stereo and permits extremely accurate calibration of baseband generator separation using only an oscilloscope for instrumentation: no stereo demodulator is required. (The BTSC standards specify that 100% modulation of the

subchannel shall produce a carrier deviation of ±50kHz, while 100% modulation of the main channel shall produce ±25kHz: half as much. This 2:1 ratio is achieved by adjusting the audio gains before the stereo baseband generator such that the L+R channel has half the audio gain of the L-R channel.)

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

4) **Baseband Clipper:** The 11-pole filters have group delay which is extremely non-constant with frequency. Therefore, even though their input signals are bandlimited and tightly peak-controlled by the 8182A, their outputs can exhibit substantial overshoot and ringing.

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

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

As this is written, the situation is in flux, and we can offer no magic formula on how to set the clipper. We will generate field engineering bulletins on this (and other aspects) of TV stereo as the industry gains more experience with this

new technology. At present, intuition suggests that clipping thresholds between 125% and 150% modulation will eliminate the most extreme filter overshoots without seriously overstressing the exciter or, on the other hand, causing excessive non-linear main-channel to subchannel crosstalk and/or compandor mistracking due to the clipping of significant amounts of program energy in the baseband clipper itself. The optimum adjustment of clipping threshold will be dependent upon the performance of the individual transmitter and exciter, and upon whether the SAP is in use. Some experimentation will doubtless be necessary.

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

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

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

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

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

7) **Monitoring:** A card is supplied which contains precision-matched 75us de-emphasis networks, 0.1%-accurate dematrixing circuitry, plus a professional dbx decoder card. 600-ohm unbalanced Left and Right monitor outputs are available on the rear panel for listening or measuring. The purpose of the monitor card is to aid adjustment and verification of stereo generator operation independent of

the aural exciter, transmitter, diplexer, antenna, and modulation monitor. This makes it far easier to locate a fault in the system, since proper operation at the monitor output terminals combined with improper operation at the modulation monitor indicts equipment after the audio portion of the stereo generator.

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

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

This concludes the **Simplified System Description.**

PART 2: APPLICATION

Studio-Transmitter Links

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

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

Stations which may be using leased telephone lines to carry audio to the transmitter site can also benefit from this configuration because available S/N is increased. However, if the S/N of the lines is very favorable, it may be possible to apply unprocessed audio directly to the lines, in which case the 8182A/ST is unnecessary.

It is important to note that the 8182A's compressor section alone does not control peak levels accurately, and does not compensate for overloads caused by pre-emphasis. (Peak limiting, pre-emphasis, and high frequency limiting are found later in the system.) It is therefore necessary to allow headroom in the STL to accomodate compressor overshoots. If the STL is pre-emphasized at 50 or 75us (as is the case with many single-channel-per-subcarrier video STL's), further headroom must be allowed to accomodate the peak level increases caused by the pre-emphasis. Precise STL setup recommendations are found in **Part 4** of this manual.

Several manufacturers have proposed a system which is equivalent to the

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

Sync Reference

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

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

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

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

circuit.

The RF Plant

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

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

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

RF Amplifiers, Diplexers, And Antennas: The bandwidth of existing RF amplifiers, diplexers, and antennas may be insufficiently wide to achieve satisfactory stereo performance. RS-508 provides some guidance here. As this area is highly specialized, we recommend consultation with the manufacturer of the transmitter and/or diplexer to determine what, if any, modifications are required to make these parts of the system operate correctly in stereo.

Remote Control Functions

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

The MONO LEFT and MONO RIGHT functions are useful in the case of failure of

one channel of the STL or one channel of the 8182A audio processing. The good channel can be fed in mono, and programming can be continued by selecting the good channel and mono mode by remote control.

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

Difficult Environments

1. Where humidity is typically high, the environment should be controlled to prevent moisture from condensing on circuit cards of all plant equipment, including OPTIMOD-TV, as this can cause corrosion or degrade performance. Using some of the exhaust from the transmitter to heat the building slightly above ambient temperature is often sufficient to prevent problems.

2. If electrical storms are frequent, it may be advisable to add suitable varistors between each incoming wire (AC, remote control, and audio) and a solid earth ground as indicated by local experience.

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

Part 3: INSTALLATION

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

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

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

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

Various items are packed with the 8182A/SG:

(1) Line Cord
(4) 10-32x3/4" Rack Screws
(1) 3-wire AC Adapter
(1) This Operating Manual
(1) 5/64" Allen Wrench (for front panel screws)
(2) Keys For Access Door
(1) 14-pin jumper cable to connect to 8182A chassis
(1) Kit to rewire 8182A Accessory Port #1. (Applicable only to 8182A units prior to SN780000.)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

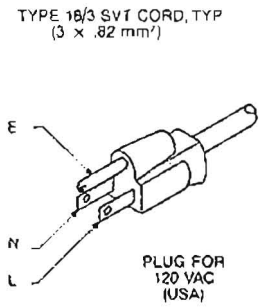
3) **Output Impedance:** The 8182A/SG is shipped from the factory with 0 ohms composite output impedance. Because coaxial cable does not behave as a transmission line at the low frequencies found in the stereo baseband, we recommend operation with 0 ohm output impedance. However, if you wish to strap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

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

Interconnection To Host Chassis

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

If you have an 8182A with a serial number below 780000, its Accessory Port #1



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

AC MAINS LINE CORD DETAIL

Fig. 3-1: POWER CORD COMPATIBILITY

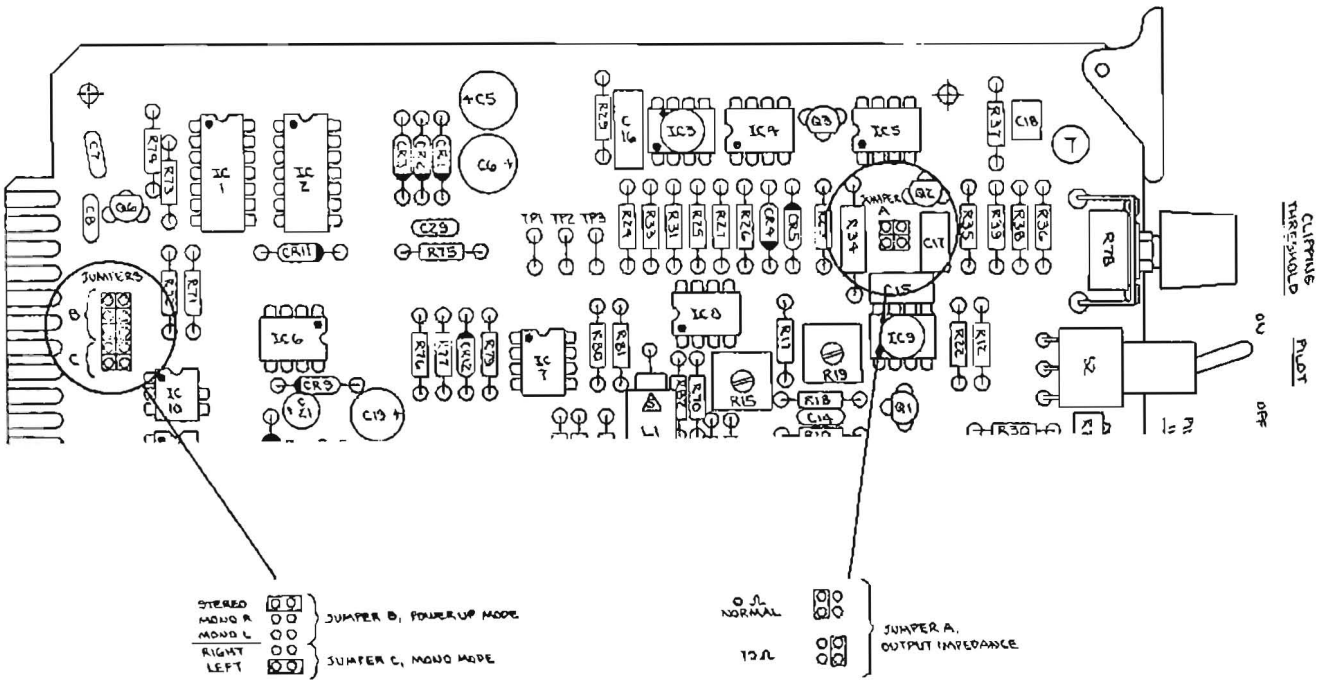


Fig. 3-2: STEREO/MONO INITIALIZATION JUMPERS

Fig. 3-3: COMPOSITE OUTPUT IMPEDANCE JUMPER

must be slightly rewired to accomodate the 8182A/SG, as the 8182A was designed before the BTSC system was defined. A kit for this rewiring (including instructions) is supplied with each 8182A/SG. The instructions are reproduced in **Appendix I.**

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

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

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

Return Card #7 to its slot and replace the subpanel.

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

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

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

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

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

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

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

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

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

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

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

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

The purpose of this arrangement is to enable unbalanced wideband exciter inputs to be driven without introducing hum-inducing ground loops. Different techniques

must be used for interconnection, depending on whether the exciter input is balanced or unbalanced.

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

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

NOTE

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

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

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

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

The load impedance of the SAP input is 15K. The gain between the SAP input and the Composite Output is affected by the setting of the BASEBAND OUTPUT

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

Final alignment of SAP injection to match the SAP generator to the exciter must be performed after the 8182A/SG's BASEBAND OUTPUT LEVEL control has been adjusted. This is because an absolute relationship between carrier deviation and the SAP noise reduction compressor's 100% modulation input level must be achieved to assure correct tracking of the noise reduction expander in receivers.

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

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

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

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

CAUTION!

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

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

WARNING!

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

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

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

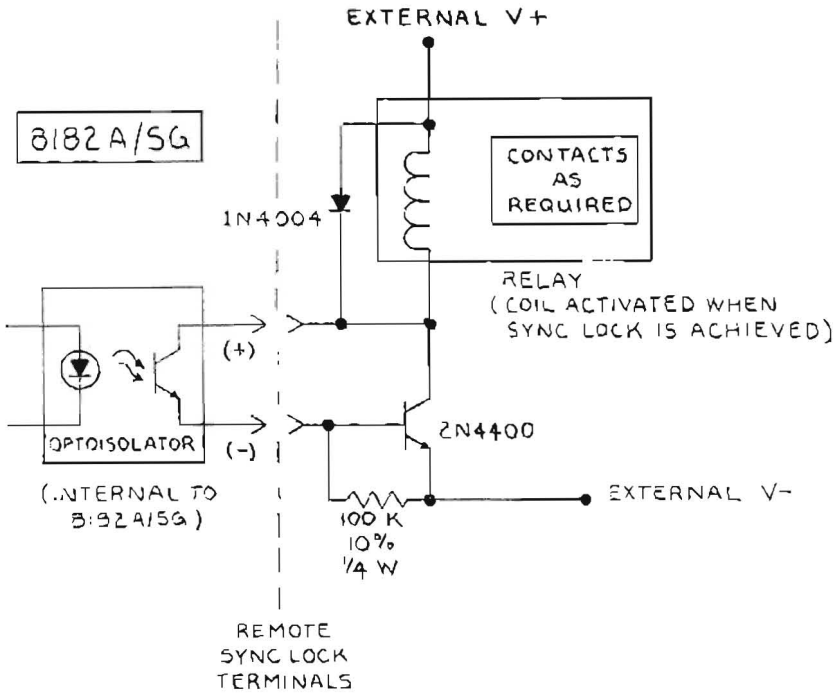


Fig. 3-4: Driving A Relay From The Remote Sync Lock Terminals

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

Part 4: INITIAL SETUP PROCEDURE

IMPORTANT!

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

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

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

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

I. DUAL-CHASSIS ALIGNMENT

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

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

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

There are three steps in this sequence:

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

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

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

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

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

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

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

3) Reconnect the oscillator to the LEFT Accessory Chassis input, and drive it with a 1kHz tone at a level which produces a "0" reading on the TOTAL MASTER G/R meter. Connect the output of the LEFT STL receiver to the

LEFT INPUT of the OPTIMOD-TV Main Chassis. Place the VU meter FUNCTION switch in L COMPR OUT. Adjust the LEFT INPUT ATTEN on the OPTIMOD-TV Main Chassis to make the VU meter read 100%.

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

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

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

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

II. Alignment Common To Single- And Dual-Chassis Installations

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

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

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

There are five steps in this sequence:

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

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

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

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

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

P is the peak-to-peak level of the total baseband signal (volts).

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

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

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

Problems with separation at 50Hz are usually caused by insufficient low frequency response in the exciter. (Apparent separation problems at 50Hz can be caused by poor low frequency response in the baseband demodulator.) Usually, larger coupling capacitor(s) will cure the difficulty. Problems with separation at 15kHz can be caused by insufficient bandwidth in the exciter, RF amplifier or diplexer. Separation problems at 1kHz are most often caused by misadjustment of the 8182A/SG's SEPARATION control, but can also be caused by severe bandwidth problems in the transmission path. If so, 15kHz performance will usually be substantially worse than 1kHz performance.

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

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

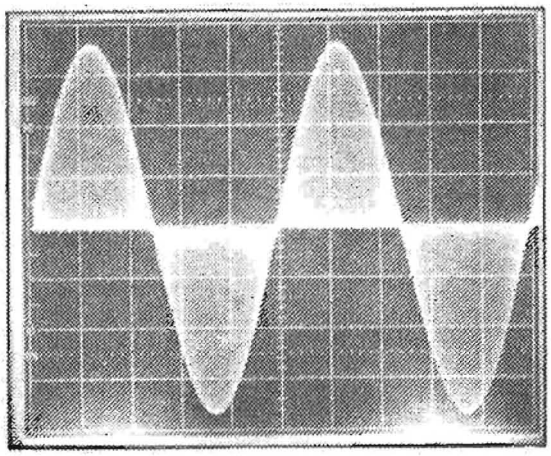


Fig. 4-1: SEPARATION SCOPE PATTERN

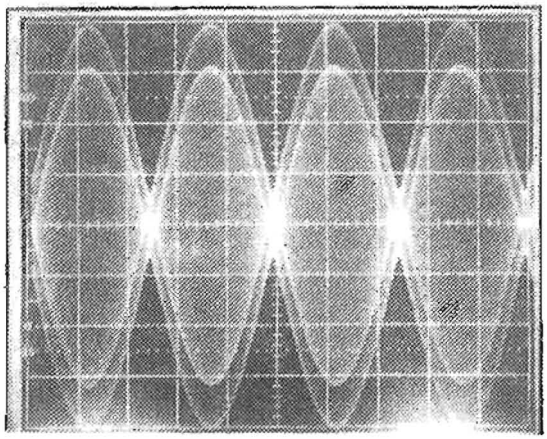


Fig. 4-2: PILOT PHASE TEST

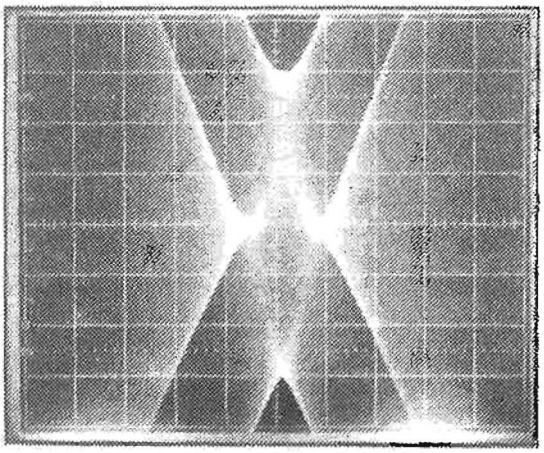


Fig. 4-3: PILOT PHASE TEST; x10

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

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

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

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

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

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

   Place the 8182A/SG's VU meter in the N/R IN position. Adjust the 8182A's R

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

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

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

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

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

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

Similarly, to gain access to R652, open the 8182A subpanel and extend Card

#6. R652 can be located by using the Card #6 Assembly Drawing in **Appendix** J of the **8182A Operating Manual.**

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

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

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

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

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

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

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

In a <u>single-chassis</u> installation, connect the program lines to the audio inputs of

the 8182A.

Proceed to **Program Tests** below.

III. PROGRAM TESTS

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

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

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

figure 4-4 NOT SAME AS 8100A OR 8180A!!!!

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

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

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

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

d) Place the console in STEREO mode. Observe the TOTAL MODULATION meter and peak flasher on your Aural Modulation Monitor. As this Manual is written, we expect the peak flashers of the new stereo monitors to be designed to ignore

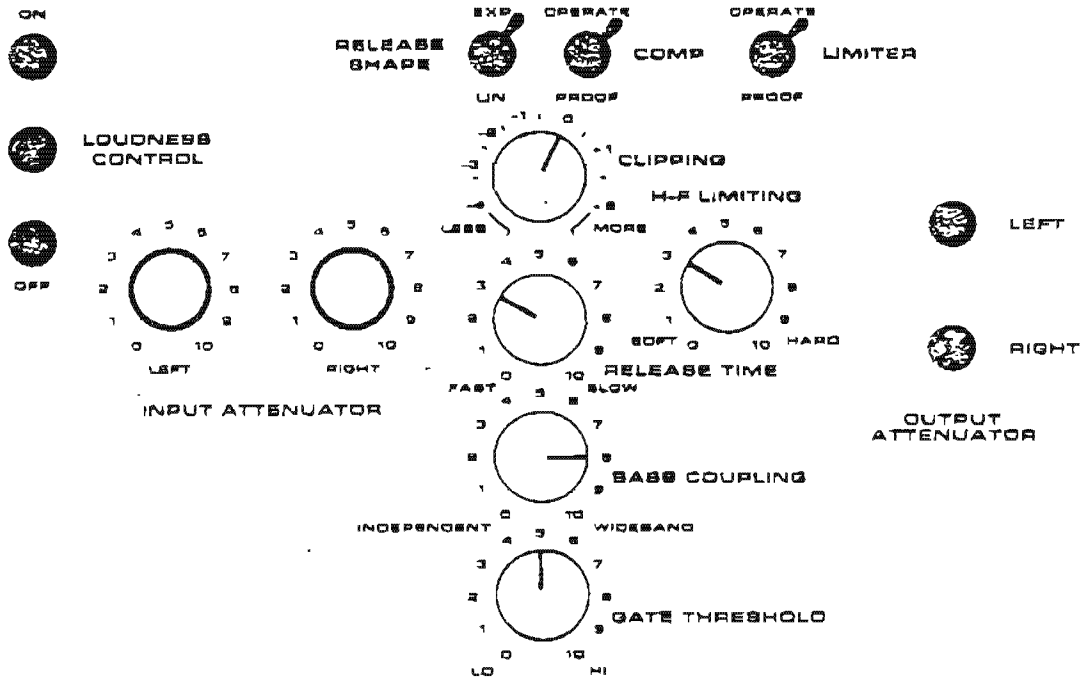


Fig. 4-4: RECOMMENDED INITIAL CONTROL SETTINGS FOR 8182A

brief overshoots caused by the 11-pole filters in the system. If you have carefully followed the setup instructions earlier in this **Part,** modulation should be correct ±5% without further adjustment, and the gain between the noise reduction encoder and the exciter should be accurate to better than 1%. However, if you wish to readjust modulation, this must be done with the 8182A OUTPUT ATTEN controls.

CAUTION!

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

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

The STEREO BASEBAND CLIPPER THRESHOLD control determines the approximate percentage modulation at which the stereo baseband is clipped. Its primary purpose is to prevent overdriving the exciter on overshoots, thus preventing IM between the stereo, the pilot, the SAP, and the PRO channels. (The clipper does not affect the pilot, SAP, or PRO channels.) We recommend setting the control between 125% and 150%, depending on the deviation capability of your aural exciter.

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

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

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

Part 5: OPERATING INSTRUCTIONS

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

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

FRONT PANEL FEATURES

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

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

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

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

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

because the special loss-of-lock mono mode sums both L and R channels instead of choosing one or the other.

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

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

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

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

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

FUNCTIONS OF THE SETUP CONTROLS

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

The section of the 8182A/SG which contains the 6-pole filters and which is inserted between the 8182A's Dual-Band Compressor and peak limiting circuitry contains a pair of phase shifters, one in the left channel and one in the right. Primarily, these phase shifters affect the very highest frequencies. The phase shifter in the right channel has a fixed phase shift as a function of frequency; the phase shift of the left-channel phase shifter is adjustable by means of the SUM PHASE-BALANCE control such that it can introduce either more or less

phase shift than the right-channel phase shifter. Because of this, it can be adjusted to either add or subtract relative phase shift between the left and right channels, thereby enabling you to partially compensate for interchannel differential phase shift in a given 8182A.

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

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

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

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

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

4) **Stereo Baseband Clipping Threshold:** This control determines the threshold of a clipper which processes the stereo portion of the baseband. The clipper limits peak modulation to a certain percentage re ±50kHz deviation, as determined by the setting of the control. Calibration of the control is approximate. The

purpose of the clipper is to remove filter overshoots to avoid overloading the aural exciter. Clipping occurs before the pilot, SAP, or PRO components of the baseband are summed. Thus only the stereo is clipped, and the clipper cannot introduce IM between the stereo and the other components. When the clipper is set at "300%", it is defeated and no clipping will occur.

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

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

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

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

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

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

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

   a) **SUB-TO-MAIN CROSSTALK:** Applies the L+R signal to the stereo baseband generator's subchannel (L-R) input only. Permits measurement of crosstalk into the main channel caused by a signal in the subchannel, and is also used to set pilot phase according to instructions in **Part 4** of this manual.
   b) **MAIN-TO-SUB CROSSTALK:** Applies the L+R signal to the stereo baseband generator's main channel (L+R) input only. Permits measurement of crosstalk into the subchannel caused by a signal in the main channel. Because the N/R encoder always produces a substantial noise output even with no signal at its input (which will modulate the subchannel), this test mode is useful if pure L+R is required, yet the circuit must stay in STEREO mode.
   c) **SEPARATION:** Applies the L+R signal to both the L+R and L-R inputs of the stereo baseband generator. It is useful in calibrating the SEPARATION (L-R GAIN) control according to instructions in **Part 4** of this manual.

   [**NOTE:** A single-channel input to the 8182A can produce only about 50% modulation in the various TEST modes because the L+R channel is only driven to 50% modulation. To achieve 100% modulation, drive both the L and R inputs of the 8182A in-phase. See **Part 6 (In-System Performance Verification)** of this manual for a more complete discussion.]

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

This concludes **Part 5 (Operating Instructions).**

Part 6: IN-SYSTEM PERFORMANCE VERIFICATION

NOTE

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

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

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

A Detailed Discussion Of Headroom In Proof Situations: Previous installation instructions have instructed you to set levels and percentages of modulation without explaining why. The following paragraph explains how clipping points within the audio processing restrict the percentage modulation which can be obtained in various test modes. The purpose of this discussion is to aid understanding when you are troubleshooting or making performance measurements.

The 8182A uses FM-stereo style processing. This means that greater of the Left or Right channels determines the gain reduction produced by the processor.

The Main Channel is the sum of the Left and Right channels (L+R). In worst case (when both channels are equal), Main Channel modulation must be constrained to 100% (±25kHz). It follows that if only one channel is present, Main Channel modulation will be 50% of maximum in OPERATE mode.

A few dB of headroom above 100% modulation is provided in the 8182A signal

electronics. However, to allow maximum S/N, a full 6dB is not available. In OPERATE mode, gain reduction would occur to prevent clipping. Headroom is thus a factor only in PROOF mode, and is insufficient to drive either the Main Channel (L+R) or the Subchannel (L-R) to 100% modulation when a test signal is applied to either Left or Right channel only. This is why both Left and Right channels must be driven to achieve 100% modulation of either Main Channel or Subchannel in PROOF mode: Neither Left or Right channel separately can drive the Main or Subchannels to much over 50% modulation.

A similar situation applies when you are using the three TEST modes on the stereo baseband generator (SUB-TO-MAIN CROSSTALK, MAIN-TO-SUB CROSSTALK, and SEPARATION). The Main Channel and Subchannel inputs of the stereo baseband generator have equal sensitivities. The three test modes all derive their input signals from the Main Channel audio. The double deviation in the Subchannel (±50kHz deviation as opposed to ±25kHz deviation for the Main Channel) is achieved by doubling the gain of the Subchannel audio before it is applied to the stereo baseband generator input. The Subchannel drive to the stereo baseband generator therefore has twice the headroom capability of the Main Channel drive. This has the following consequences when you are using the TEST modes:

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

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

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

The primary purpose of the SUB-TO-MAIN crosstalk mode is to make the adjustment of pilot phase and the nulling of linear sub-to-main crosstalk within the stereo baseband generator more convenient. Please note that it is impossible to achieve full 100% modulation (±50kHz) of the Subchannel in the SUB-TO-MAIN CROSSTALK test mode. To test non-linear sub-to-main crosstalk at 100% modulation, it is necessary to set the stereo baseband generator to its normal OPERATE mode, and to obtain L-R modulation by driving the Left and Right inputs of the 8182A out-of-phase, adjusting either 8182A INPUT ATTENuator to null L+R. (To null, use the L+R position on the 8182A/SG's VU meter with the

meter sensitivity switch in its high-gain position.)

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

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

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

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

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

shown in Fig. 6-1. The frequency response observed includes the response of all filters in the audio processing, any cancellation due to mismatches between Left and Right channels, and any errors in the dbx N/R encoder. You will also see any errors in the stereo monitor, including those caused by its dbx N/R decoder.

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

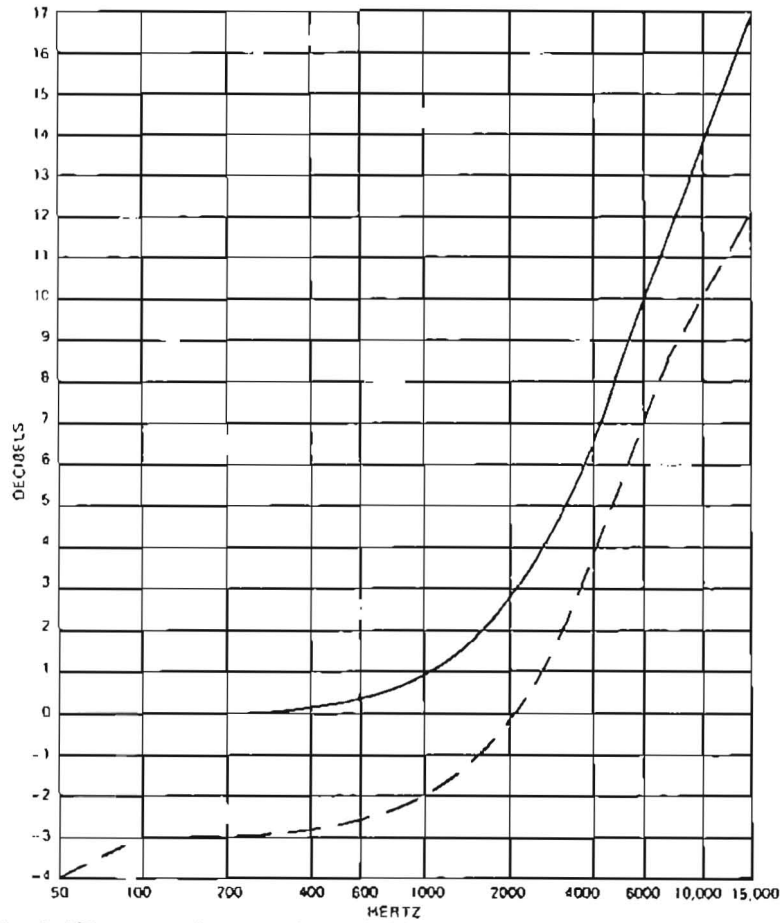
If you wish to measure the frequency response of the Left and Right channels individually, be sure not to exceed 50% Main Channel modulation to avoid clipping.

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

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

Because the BTSC system uses sum-and-difference transmission, any phase or amplitude mismatches between the Main (L+R) and Sub (L-R) channels can cause imperfect separation. Noise-reduction is inserted into the L-R channel only. Therefore, imperfect tracking between the noise-reduction encoder and decoder will adversely affect separation. In addition, there are other parts of the system which must be matched.

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



Standard 75-microsecond pre-emphasis curve (solid line) and tolerance limits (solid and dashed lines).

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

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

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

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

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

Switching the N/R IN not only adds the effects of the N/R encoder and decoder to the L-R channel. but also adds the encoder and decoder "sum compensator" circuits to the L+R channel. These are specially-tailored lowpass filters which add phase shift and high-frequency rolloff to the L+R channel to compensate for excess phase shift and high-frequency rolloff in the L-R channel. This excess rolloff and phase shift is produced by a real-world noise-reduction circuit which is trying to realize the theoretically-ideal N/R characteristic specified by means of tables in OST-60 (which is the Federal Communication Commission Office Of Science And Technology's official description of the BTSC system).

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

The success of this calibration depends upon correct factory calibration of the L-R 11-pole lowpass filter (R80 on Card #5), as well as upon correct factory calibration of the 8182A/SG's VU meter in the N/R IN position (using R15 on the Meter Card). If there is suspicion that either of these controls might be misadjusted, they may be checked by means of procedures found in **Appendix E (Field Alignment).** However, be warned that extremely accurate and well-calibrated test instruments are required, and that it is most unlikely that the calibration will have drifted or have otherwise become incorrect unless the trimmer controls have been casually adjusted in the field.

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

Main-Channel-To-Subchannel and Subchannel-To-Main-Channel Crosstalk: In general, non-linear crosstalk from main-to-sub and vice-versa will be caused entirely by non-linearities in the RF portion of the system, including the modulator in the exciter. Typical non-linear crosstalk is down 80dB below ±50kHz deviation at the baseband output of the 8182A/SG.

If you wish to measure crosstalk, please note the discussion at the beginning of

this **Part** regarding headroom. Full deviation (±25kHz) can be achieved in the MAIN-TO-SUB test mode, provided that both Left and Right channels are driven in parallel in-phase. However, note in particular that 100% modulation of the stereo Subchannel (±50kHz deviation) cannot be achieved in the stereo baseband generator's SUB-TO-MAIN CROSSTALK mode, and that the OPERATE mode must be used instead. (Drive the Left and Right audio inputs out-of-phase.)

The OPERATE mode will ordinarily introduce some linear sub-to-main crosstalk due to slight phase and amplitude mismatches between the Left and Right channels of the processing. A baseband spectrum analyzer should be used to identify any non-linear crosstalk products. (These will be any frequency components in the 50-15,000Hz region which do not represent modulation of the Main Channel by frequencies identical to those modulating the Subchannel.) Ignore any intermodulation products between the 15,734Hz pilot tone and other components in the baseband spectrum. (It is probably best to turn the pilot OFF for this measurement.)

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

SPECIFICATIONS (supplementary)

The following specifications refer to a system consisting of the 8182A/SG BTSC Stereo Generator and OPTIMOD-TV Model 8182A. If a specification is not found here, please refer to the Specifications for the 8182A. Definitions of various BTSC system terms used below are found in "BTSC System Television Multichannel Sound Recommended Practice", published by the EIA.

Frequency Response

Sum Channel: Follows standard 75us preemphasis curve ±0.75dB, 50-15,000Hz. **Difference Channel:** Follows BTSC standard dbx television noise reduction encoder characteristic with sufficient accuracy to meet system separation specifications (below). Uses genuine dbx-manufactured noise reduction encoder card. The N/R encoder can be switched out and replaced by standard 75us preemphasis to permit measurement of "equivalent stereo separation".

Noise

-75dB below 100% modulation, 50-15,000Hz maximum; -81dB typical. (Measured with 75us deemphasis in the sum channel and BTSC-standard dbx decoding in the difference channel.)

Total System Distortion

Less than 0.25% THD, 50-15,000Hz (deemphasized and decoded).

"Equivalent Stereo Separation" (no noise reduction)

Better than 40dB, 50-8,000Hz, smoothly declining to better than 26dB at 15kHz. (Exceeds requirements of BTSC recommended practice.)

Separation (10% "75us equivalent-input modulation"; N/R IN)

Better than 30dB, 100-8000Hz, smoothly declining to better than 20dB at 15kHz and better than 26dB at 50Hz. (Exceeds requirements of BTSC recommended practice.)

L and R Lowpass Filters (see text for location in system)

Type: 6-pole filters with two high-"Q" notches.
Rejection: Better than 50dB at 15734Hz.

L+R and L-R Lowpass Filters (see text for location in system)

Type: 11-pole Cauer.
Passband Response (50-15,000Hz): to permit System Frequency Response specification (see above) to be met over temperature. Typically +0.05, -0.1dB to 15kHz.
Stopband Rejection (15.374kHz and higher): greater than -60dB below Passband Response.
Matching: Supplied in matched pairs. Matching sufficient to permit Equivalent Stereo Separation (see above) specification to be met over temperature.

Stereo Baseband Generator

Noise And Distortion: substantially below other elements in the 8182A system. The System specifications apply.
Equivalent Stereo Separation (baseband generator only): better than 50dB, 50-15,000Hz.
Crosstalk (Main-Channel to Subchannel or Subchannel to Main-Channel; baseband generator only): better than -60dB (linear); -80dB (non-linear) referred to ±50kHz deviation.
31.468kHz Subcarrier Suppression: better than 50dB below ±50kHz deviation.
All Other Spurious: Better than -65dB below ±50kHz deviation.
Test Modes (see text):
SUB-TO-MAIN CROSSTALK
MAIN-TO-SUB CROSSTALK
SEPARATION

Inputs

Audio: Audio input located on 8182A chassis. See 8182A Specifications.
Sync Lock:
Connectors: Type BNC (2); shell insulated from chassis; looped-through.
Input Impedance: 20,000 ohms; balanced.
Required Level (sync or composite video): 0.6-1.6V p-p; 1V p-p nominal.
Termination: 75 ohms; switchable from rear panel.

SAP:

Connector: Type BNC; shell capacitively coupled to chassis through approximately 500pF for EMI suppression.

Sensitivity: 1.5V pk to produce ±15kHz carrier deviation.

Impedance: greater than 10K, unbalanced but floating over chassis ground.

Professional Subchannel (for optional plug-in Pro Channel card):

Connector: Barrier Strip (#5 screw). EMI-suppressed.

Nominal Input Level: -30 to +8dBm.

Impedance: Greater than 10K balanced bridging.

Remote Control (selects MONO LEFT, MONO RIGHT, STEREO modes; also PRO CHANNEL ON/OFF):

Connector: Barrier strip (#5 screw).

Voltage Required For Actuation: 6 to 24V AC or DC, momentary or continuous. 22VDC is supplied on barrier strip to permit use with contact closure.

Outputs

Composite:

Connector: Type BNC, floating over chassis ground.

Level: variable from 0 to greater than 2.2V pk into 75 ohms (for 73kHz total deviation) by means of 18-turn TOTAL BASEBAND OUTPUT LEVEL control.

Output Impedance: 0 or 75 ohms; internally strappable. When strapped for 0 ohms will drive up to 0.047uF in parallel with 75 ohms.

Sync Lock Indicator:

NPN transistor within optoisolator turns ON to indicate successful lock to sync or composite video. Will drive all common logic families with appropriate pullup. Appears on barrier strip (#5 screw).

Operating Controls

STEREO/MONO momentary mode switch

VU METER SELECTOR (see **Indicators** below)

METER GAIN switch (NORMAL/EXPANDED)

Setup Controls (front-panel, behind lockable swing-down door)

Sync Lock Card:

SYNC SENSITIVITY

SYNC SENSITIVITY CONTROL IN/OUT

Stereo Generator:

STEREO BASEBAND CLIPPING THRESHOLD
PILOT ON/OFF
PILOT INJECTION
TOTAL BASEBAND OUTPUT LEVEL
SEPARATION (L-R GAIN)
PILOT PHASE
TEST SWITCH
- Operate
- Sub-To-Main Crosstalk
- Main-To-Sub Crosstalk
- Separation

Indicators

SYNC LOCK
PRO CHANNEL ON
STEREO ON
POWER ON

VU METER SELECTOR — switches ASA standard VU meter to read:

- L Filter Out
- R Filter Out
- Noise Reduction In
- Stereo Generator L+R In
- Stereo Generator L-R In
- L Monitor Out
- R Monitor Out
- Pilot Level
- $2F_h$ AGC Control Voltage
- Pilot PLL Control Voltage
- Composite Output (True Peak-Reading)
- -15 Volt Power Supply

Power Requirement

115/230VAC, ±15%, 50-60Hz, 35VA. IEC mains connector with detachable 3-wire "U-Ground" power cord supplied. Leakage to chassis is less than 0.5mA. AC is EMI-suppressed.

Dimensions

19"(48.3cm)W x 7"(17.8cm)H x 12.5"(31.8cm)D -- 4 rack units.

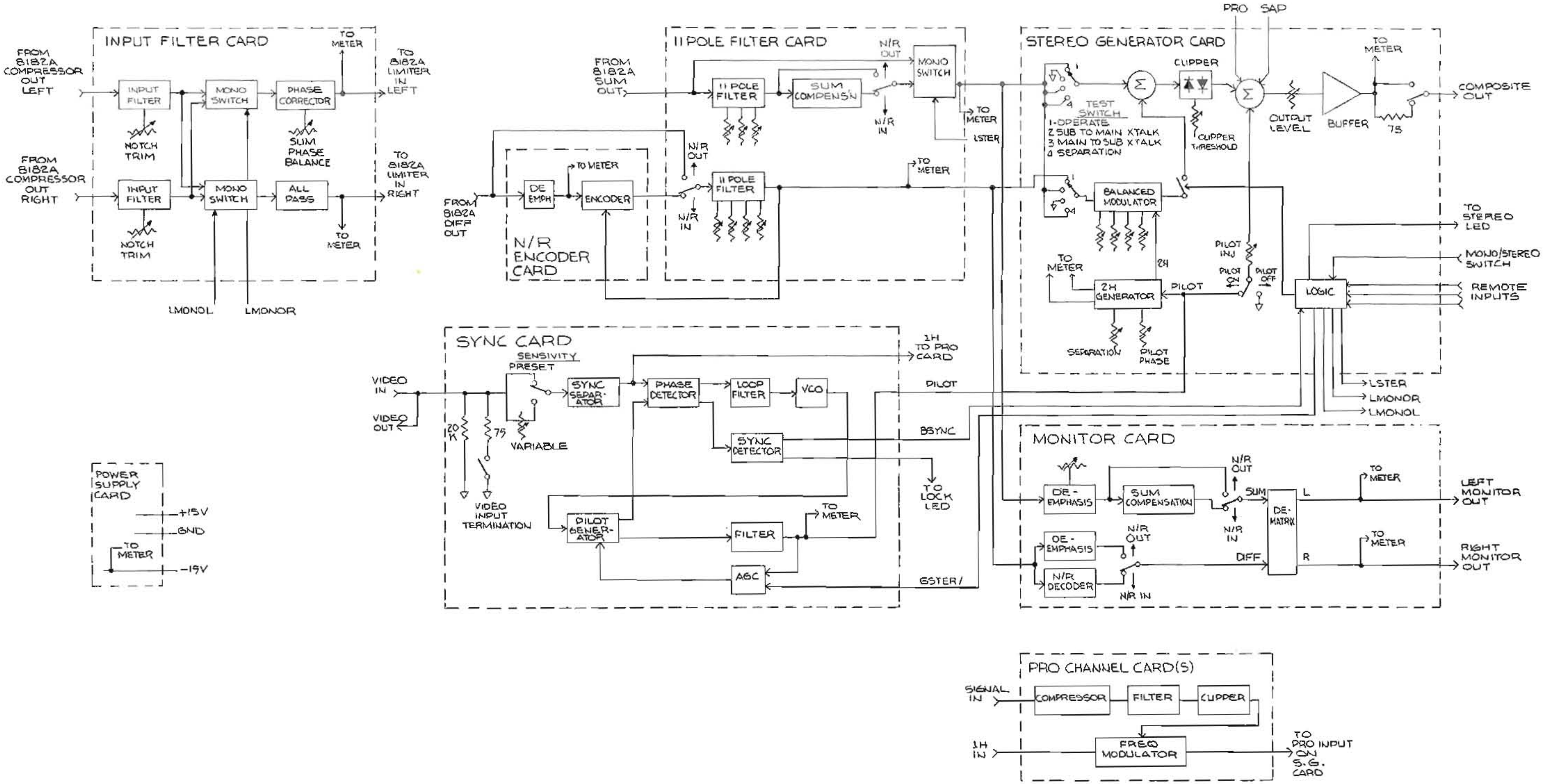
Environmental

Operating Temperature Range: 0-50°C (32-122°F).
Humidity: 0-95% R.H., non-condensing.

Warranty

One year, parts and labor. Subject to limitations set forth in our Standard Warranty.

All specifications subject to change without notice.



ECO NO	DATE	REV	DESCRIPTION	CHANGED	CHECKED

REVISIONS

UNLESS OTHERWISE SPECIFIED
ALL DIMS. IN INCHES
TOLERANCES
XX = ±
XXX = ±

Orban Associates Inc.

TITLE: TV STEREO GENERATOR
SYSTEM BLOCK DIAGRAM

DRAWN: [illegible] | CHECKED: [illegible] | APPROVED:

SCALE: — | DRAWING NO 60145 | VERSION 000 | REV B

DO NOT SCALE DRAWING | MODEL 8182A/SG | SHEET 1 OF 1