Operating Manual

OPTIMOD-TV®

Pro Channel Generator

Model 8182A/PRO and 8185A/PRO

An Accessory for the OPTIMOD-TV Stereo Generator (Model 8182A/SG or 8185A) (Cards #9 and #10)

orban®

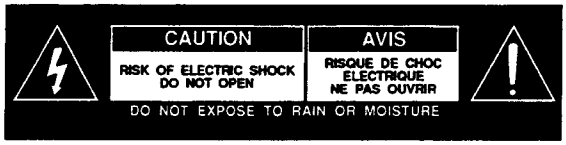
IMPORTANT NOTE: Refer to the unit's rear panel for your Model #.

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

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

OPTIONS AVAILABLE

Model #:	Manual References	Description:
ACC021	ACC-021	dbx Monitor Card for earlier 8182/SAP
RET025	RET-025	8180A to 8182A Factory Upgrade
SC4	ACC-014	Security Cover (CLEAR, BLUE or WHITE) for OPTIMOD TV units
SC2	ACC-012	Security Cover (CLEAR, BLUE or WHITE) for ST units



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

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

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

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

Operating Manual

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An Accessory for the OPTIMOD-TV Stereo Generator (Model 8182A/SG or 8185A) (Cards #9 and #10)

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orban
H A Harman International Company
1525 Alvarado Street, San Leandro, CA 94577 USA • Phone (1) 510/351-3500 Fax (1) 510/351-0500

Section 1
General Information

In this section:

1. HOW TO USE THIS MANUAL

This manual is divided into six sections:

1: GENERAL INFORMATION
2: INSTALLATION
3: OPERATING INSTRUCTIONS
4: MAINTENANCE AND CALIBRATION
5: TROUBLESHOOTING
6: TECHNICAL DATA

Each section has a Table of Contents. In addition, a comprehensive **INDEX** (on page 1-3) covers the entire manual.

This **GENERAL INFORMATION** section provides an **overview of the product** and its application. Complete **installation instructions** are contained in the **INSTALLATION** section.

Performance verification procedures are in the **MAINTENANCE AND CALIBRATION** section. See the **TROUBLESHOOTING** section for information on **technical support, factory service,** and **shipping.**

The **TECHNICAL DATA** section contains **specifications, schematics, parts lists,** and **circuit descriptions. Keywords are highlighted** throughout the circuit descriptions to help you quickly locate the information you need.

[This manual is intended to be used in conjunction with the Operating Manual for the 8182A/SG or 8185A OPTIMOD® Television Stereo Generator.]

2. REGISTRATION, WARRANTY, FEEDBACK

Registration Card

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

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

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

Registration Card

Model # _____ Serial # _____ Purchase Date _____

Your name _____ Title _____

Company _____ Telephone _____

Street _____

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

Nature of your product application _____

How did you hear about this product? _____ Purchased from _____

Comments _____

_____

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

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

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Warranty

The warranty, which can be enjoyed only by 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 **Section 5**.

User Feedback Form

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

3. INDEX

4. THE ORBAN PRO CHANNEL GENERATOR

The Professional Channel Generator (8182A/PRO or 8185A/PRO) augments the OPTIMOD Television Stereo Generator (8182A/SG or 8185A) by adding a **voice or data communications channel** to the composite baseband output of the Stereo Generator. The Pro Channel input signal is amplified, processed, then used to modulate a subcarrier generated in sync with the main carrier.

The 8182A/PRO and 8185A/PRO are identical, and are installed identically in the Orban 8182A/SG and 8185A TV Stereo Generators. Throughout this manual, any reference to the "8182A/PRO" applies to the 8185A/PRO as well.

Physically, 8182A/PRO consists of two additional plug-in circuit cards (#9 and #10) for the Stereo Generator, retrofit shielding for the 8182A/SG's Card #8, and a new control subpanel. Card #9 circuitry processes the input signal, and the subcarrier is generated on Card #10.

The 8182A/PRO conforms to specifications set by the Broadcast Television Systems Committee (BTSC) of the Electronic Industries Association (EIA).

5. APPLICATION

The Pro Channel is intended to be used for signaling between transmitter and studio, studio and remote vehicles, and similar intra-station communications. While it may be operated simultaneously with the SAP Channel, the Pro Channel may be subject to substantial interference from the SAP. (The SAP Channel should not normally be affected by the Pro Channel.) Operation of the Orban Pro Channel Generator has been optimized for intelligibility in the presence of noise.

When using the Pro Channel for voice, a more pleasing sound can sometimes be achieved by additional equalization at the output of the receiver to partially compensate for limitations in the receiver and in transducers. If equalization before the Pro channel cards is considered, the effect on the operation of the compressor should be evaluated. Proper shaping of the frequency response of the source can sometimes result in higher average modulation (and thus better intelligibility) in outlying areas. In most cases, setting the bass filter jumper on Card #9 to IN (see Section 2) will provide all of the frequency-contouring that is necessary.

> The response of the Pro Channel in DATA mode is similar to that of an accurately phase-equalized voice-grade telephone line. Thus, any modem designed for use with such a line should be usable with the Pro Channel, provided that the receiver is free from phase distortion and that its signal-to-noise ratio is sufficient to achieve reliable operation. State-of-the-art modulation schemes can achieve data rates as high as 14,400 baud; future developments may push this even higher.

6. THE PROFESSIONAL CHANNEL

The FCC's "modified marketplace" approval of the BTSC-recommended Multichannel Television Sound (MTS) system allows broadcasters to transmit non-program-related subcarriers in the aural baseband. Electrical performance standards and modulation techniques are not specified by the FCC; they are left to the discretion of the broadcaster. Subcarrier frequency and aural carrier deviation are specified by the BTSC as follows:

1) Subcarriers may be broadcast in the frequency range from 15kHz to 120kHz. Maximum aural carrier deviation in this range must not exceed ±50kHz.

2) When only the stereophonic subcarrier is being transmitted, the non-program-related subcarrier frequency must be between 47kHz and 120kHz.

3) When both the stereophonic subchannel and the Second Audio Program (SAP) channel are being transmitted, the non-program-related subcarrier frequency shall be 6.5H (6.5 times the horizontal line rate or 102.3kHz). Maximum aural carrier deviation is ±3kHz.

The Orban Professional Channel Generator provides a frequency-modulated subcarrier at 6.5H (102.3kHz). The audio bandwidth is 3.4kHz. The 6.5H subcarrier is frequency-modulated by the audio to ±3kHz deviation. This in turn modulates the aural carrier ±3kHz.

For a more detailed description of the Multichannel Television Sound system, see "The BTSC Television Stereo System" in **Part 1** of the **8182A/SG Operating Manual** or **Section 1** of the **8185A Operating Manual.**

7. BRIEF FUNCTIONAL DESCRIPTION

The BLOCK DIAGRAM in Section 6 illustrates the following overview of 8182A/PRO functions.

The Pro Channel input signal is routed from terminals on the rear panel of the 8182A/SG through an **RF suppression filter** to Card #9. There, the signal is attenuated by a -20dB **attenuating pad** (0dB attenuation is jumper-selectable) before being amplified by a low-noise true **instrumentation amplifier**. The INPUT ATTENuator control adjusts the gain of this amplifier over a 20dB range.

A switch on the subpanel selects either **VOICE or DATA mode**. In VOICE mode, the input signal is processed to achieve maximum intelligibility even in noisy reception conditions; in DATA mode, the input signal is processed to yield minimal waveform degradation.

Because no noise reduction is used in the Pro Channel, the VOICE signal is **pre-emphasized** at 150μs. The signal is then passed through a **phase scrambler** to make the highly asymmetrical waveforms typical of speech more symmetrical. This allows more efficient use of the symmetrical overload points of the Pro Channel subcarrier, resulting in increased loudness and intelligibility. The VOICE signal next passes through a **bass filter** which provides a 6dB/octave cut below approximately 1.2kHz, improving speech intelligibility in noisy environments (and avoiding transmission of energy that does not contribute to intelligibility). This filter can be defeated by repositioning a jumper.

The VOICE signal is **compressed** by a fast-attack variable gain circuit when the peaks of the signal exceed a preset threshold. G/R indicators on the subpanel specify whether NORMAL or HEAVY gain reduction is occurring. A **peak clipper** limits the signal to the 100% modulation level. To **prevent overshooting** and ringing in the low-pass filter which follows, a shelving cut of approximately 2.5 dB is included in the clipper (overall frequency response is not affected because a complementary shelving boost was added with the pre-emphasis). Both the compressor and the peak clipper are disabled when the **TEST switch** is set to

PROOF. (The TEST switch is used to defeat processing so that channel measurements may be made.)

Note that the compressor and clipper have been designed so that voice processed through the system may sound quite distorted, but is always very intelligible. This was necessary to maximize RMS modulation, and thus the usable coverage area of the Pro Channel (which suffers from *extremely* poor S/N in the Grade-B contour).

The VOICE signal goes from the clipper to a **low-pass filter**. The DATA signal bypasses the processing described in the preceding three paragraphs, and goes directly from the input amplifier to the low-pass filter. This filter limits the bandwidth of the Pro Channel to prevent crosstalk into other subcarriers. The output of the low-pass filter is **phase-corrected** by three cascaded all-pass filters to minimize degradation of digital data signals. When the peaks of the phase-corrected signal exceed 100% modulation level (greater than 3kHz deviation), an **overload detector** lights the **100% PEAK MODULATION** indicator on the subpanel.

On Card #10, the processed input **signal is summed** with a control signal (derived from the sync separator circuit on the Stereo Generator's Card #8) to drive a voltage-controlled oscillator (VCO). The square-wave output of the VCO is transformed into a sine-wave signal by summing pulse trains in a way that cancels all the lower harmonics of the subcarrier, and by eliminating the higher harmonics with a low-pass filter. The resulting **frequency-modulated subcarrier** is summed into the **composite baseband** output of the Stereo Generator on Card #7. Subcarrier amplitude can be adjusted with the subpanel **INJECTION control** (aural carrier deviation caused by the subcarrier will be within BTSC-specified range if INJECTION is set for 1.5V ±5% peak output from Card #10, as it is when shipped from the factory).

A **phase-locked loop (PLL)** governs acquisition of and locking to sync. The **AFC LOCK indicator** lights when sync lock is achieved. If sync is lost, the subcarrier will mute until it is restored.

The PLL controls the sync-derived signal which was summed with the processed audio signal. A **phase comparator** compares a reference signal (1H from the sync separator on Card #8) with the frequency-divided output of the VCO, and generates pulses with polarity and pulse width proportional to the phase difference between the two signals. These pulses are processed by a **loop filter** to provide a smooth control signal for the VCO. The control signal attempts to force the frequency divider output to be identical to the reference signal.

The PLL is controlled by a clocked, sequential logic circuit which uses flip-flops to remember the state of the loop. The circuit monitors the outputs of three status detectors and sets the loop operating state accordingly:

- In **Acquisition state** the loop has a **fast time-constant**, and both the processed Pro Channel input and the subcarrier output are **muted**. This enables the loop to quickly lock into sync "off-line", with no external disturbances. The PLL will enter the Acquisition state when the **Sync detector** indicates an interruption of the sync reference signal.
- In **Locked state** the loop has a **slow time-constant**, but the modulating input and the subcarrier output remain **muted**. The PLL enters the Locked state when the Sync

detector senses the presence of the sync reference signal *and* the **Acquisition detector** monitoring the phase comparator indicates the loop is locked. The **AFC LOCK indicator** lights when lock is detected.

- In the **Modulating state** the loop is operating with the **slow time-constant**, the VCO control signal is being modulated by the processed Pro Channel input, and the **modulated subcarrier is sent to Card #7**. The PLL will switch from the Locked to the Modulating state only when the **Lock detector** indicates that the VCO control signal is within a pre-defined range.

The Pro Channel subcarrier can also be muted with the **SUBCARRIER ON/OFF** switch on the subpanel, or via the **REMOTE PRO ON/OFF** terminals on the rear panel of the 8182A/SG. These remote control ports are easily interfaced with practically all commercial remote control systems. The **PRO indicator** on the main front panel of the 8182A/SG lights when the Pro Channel subcarrier generator is on.

For a more detailed description of 8182A/PRO circuitry, see Section 6.

Section 2
Installation

In this section:

Time required: 15 to 30 minutes

Equipment required: Oscilloscope

For more details on access to the 8182A/SG chassis, refer to **Appendix C** in the **8182A/SG Operating Manual** or for access the 8185A chassis, refer to **Section 4** of the **8185A Operating Manual** (relevant portions are included here).

CAUTION

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

CAUTION

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

INSTALLATION PROCEDURES

1) Unpack and inspect.

If you ever re-ship the 8182A/PRO cards (e.g., for servicing), it is best to ship them in the original packing materials since these have been carefully designed to protect the 8182A/PRO. Make a mental note of the method of packing and *save all packing materials.*

Packed with the 8182A/PRO are:

1) Card #9 (processing card)
2) Card #10 (modulator card)
3) Metal shield with four screws
4) New subpanel
5) This operating manual
6) 28-gauge solid wire

Perform a general inspection of the contents of the package 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.

Examine Cards #9 and #10 to be sure all components are securely seated in their sockets. Check with particular care to be sure that none of the ICs are held in their sockets by one row of leads only.

[If the serial number of your 8182A/SG Stereo Generator is above 826000, or you have an 8185A, you can perform the following procedures while the unit is in the rack. If not, you must remove the unit from the rack to a test bench.]

2) Remove existing subpanel.

a) Lower the 8182A/SG's front panel.

Using the 5/64" hex wrench supplied with the 8182A/SG chassis, remove the three hex-socket screws at the top of the panel and carefully swing the panel out and down.

b) Remove and discard the original subpanel.

Loosen the four DZUS fasteners on the subpanel by turning each one-quarter turn counterclockwise with a long 3/16" or 1/4" slotted-blade screwdriver. Taking care not to stress the flat cables beneath it, tilt the top of the subpanel outward and to the left to clear the upper chassis lip and the door support rail at the right.

3) Install shield on Card #8.

a) Remove Card #8 from its slot.

b) Attach the shield to the solder side of Card #8 with the four screws provided (orient the shield so that it does not cover the card edge-connector "fingers").

c) Insert the card back into the #8 slot.

4) Initialize and install Card #9.

a) Change input attenuation, if desired.

Card #9 is shipped with a 20dB pad ahead of the input buffer amplifier. This is suitable for nominal input levels from +10 to -10dBm. If lower input levels (-30 to -10dBm) are present, the pad must be defeated. To do this, reposition JUMPER A to the 0dB position.

b) Defeat bass filter, if desired.

The speech processing provides greatest intelligibility and modulation efficiency with a bass-cut. A defeatable 6dB/octave bass cut filter is provided. The bass filter jumper is shipped in the IN position. When the bass filter is removed, speech intelligibility will usually suffer. However, the processing will then conform to the recommended standard, which specifies 150μs pre-emphasis only. If you wish to remove the bass filter from the signal path, move JUMPER B to the OUT position.

c) Install Card #9 in the #9 slot.

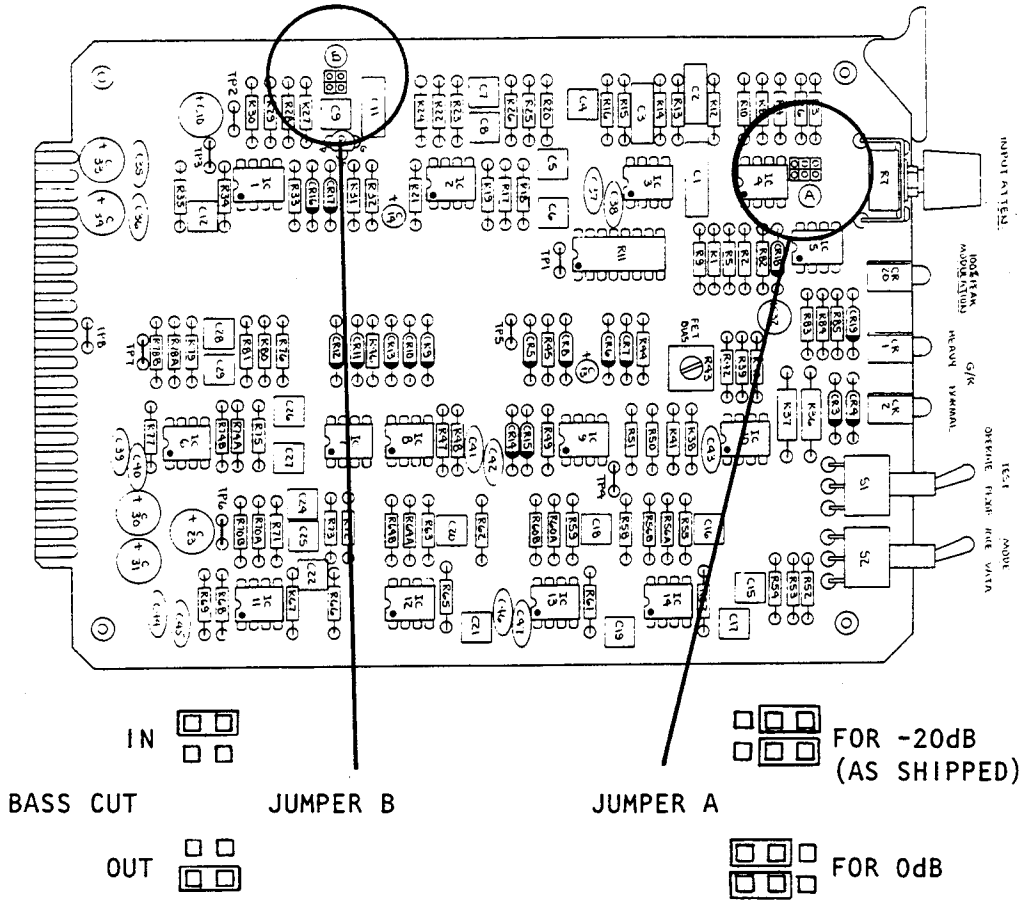


Figure 2-1: Jumper Positions, Card #9

5) Calibrate and install Card #10.

The AFC Control Voltage trim may need to be re-adjusted when the card is inserted into a new 8182A/SG. This procedure is only necessary if the AFC LOCK LED fails to light when the card is inserted into the chassis. (When installed cold, allow several minutes for the card to warm up. If the AFC LOCK LED *then* fails to light, proceed as below.)

a) Insert the extender board into slot #10. Insert Card #10 into the extender board.

b) Turn the power ON and allow the unit to warm up for about 5 minutes.

c) Observe TP1 with the oscilloscope. Be sure that the scope is DC-coupled.

d) Apply a video reference signal to the SYNC INput (J1) of the 8182A/SG. The SYNC LOCK indicator on the front panel should light.

e) Adjust R34 (AFC Control Voltage trim) until the voltage at TP1 is 0.50V ±0.10V. The AFC LOCK indicator on Card #10 should light.

f) Allow the unit to stabilize for 30 seconds, then readjust the trim if necessary.

g) Remove the extender board and install Card #10 in the #10 slot.

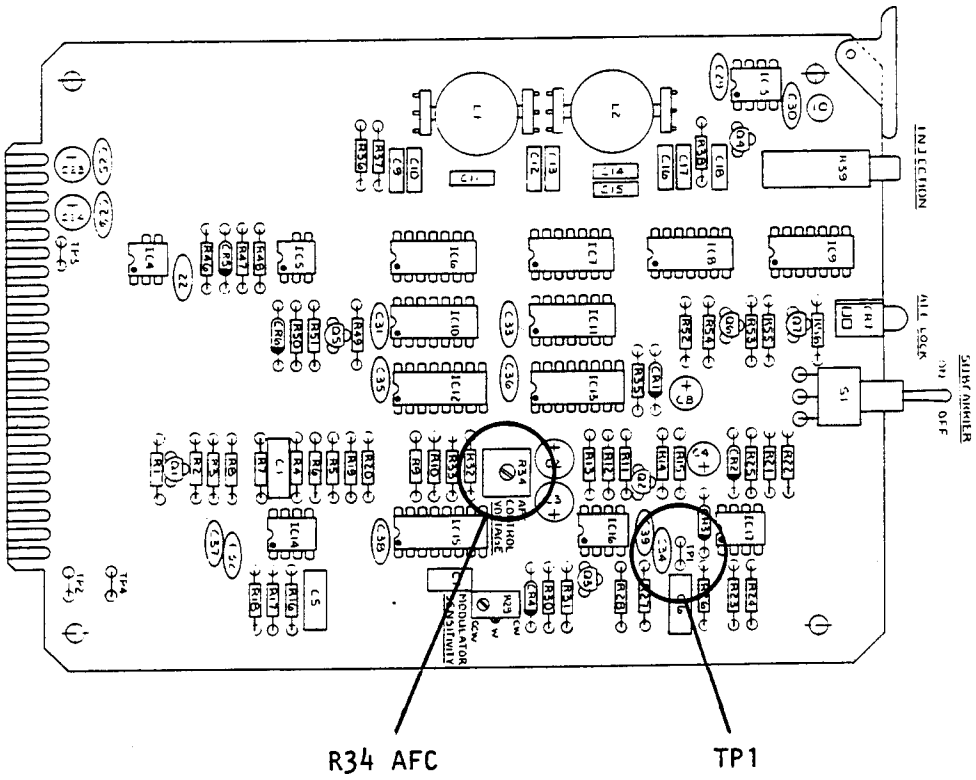


Figure 2-2: Test Points and Trimmer, Card #10

6) Install new subpanel.

The subpanel should always be replaced to protect the cards from RFI.

a) Position and fasten the new subpanel.

Taking care not to stress the flat cables beneath it, tilt the top of the subpanel inward and to the left to clear the upper chassis lip and the door support rail at the right. The DZUS fasteners turn only 1/4- turn. Don't force them, lest they be damaged in a way that is very time consuming to repair.

b) Raise the 8182A/SG's front panel and fasten the three screws that secure it in place.

7) Install REMOTE COMMON jumper.

[Skip this step if the serial number of your 8182A/SG is 826000 or greater or if you have an 8185A.]

The unit must be removed from the rack to install this jumper.

a) Unplug power cord. Remove the eight screws holding the top cover to the flange of the rear panel. Remove the corresponding eight screws from the bottom cover. The rear panel will remain solidly in place. (If the covers are still in place, they needn't be removed.)

b) Set the chassis, bottom cover down, on a pad on a table. Allow 6" (15cm) between the rear panel and the table edge.

c) Remove the three groups of three screws which are *circled in black* on the rear panel.

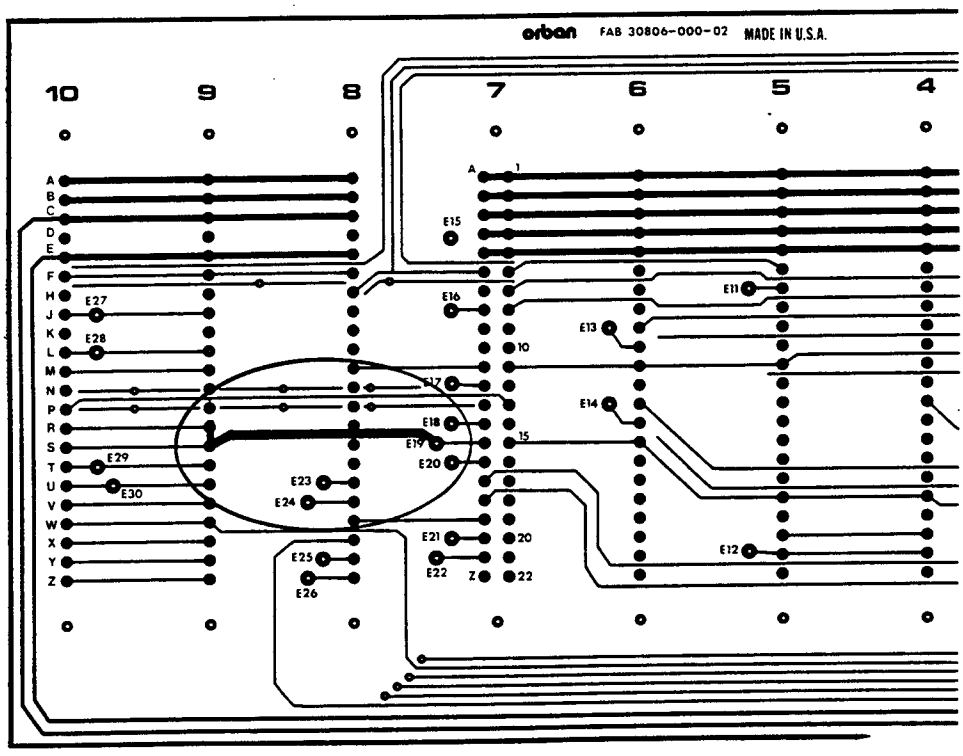


Figure 2-3: REMOTE COMMON Jumper Installation

d) *VERY* carefully and slowly pull the rear panel about 3/4" (2cm) toward you, and tilt the top edge down until the rear panel is horizontal and resting on the table.

CAUTION

Watch for snags in the internal wiring, and for any stress on the ceramic feedthrough capacitors on the divider wall or input filter box. These capacitors are very fragile and difficult to replace.

e) Solder the supplied 28-gauge solid wire to the back of the motherboard between card connector #9, pin S (9-S) and terminal E-19 (which is connected to 7-S). See Fig. 2-3. Remove flux residue with solvent and a cotton swab.

f) Replace the rear panel.

Perform steps a) through d) in reverse order. When positioning the rear panel over the corresponding holes, make sure that no wires are pinched under the flanges.

g) Permanently mark the back (outside) of the rear panel: REMOTE COMMON JUMPER INSTALLED.

8) Connect input.

Pro Channel input terminals are located on the rear panel barrier strip of the 8182A/SG chassis. The inputs are electronically balanced. Input impedance is 200K with the 20dB pad *defeated* and 11.2K with the 20dB pad *operative*. Input levels from -30dBm to +10dBm can be accommodated (see step 4).

In a *high-RF* field, the Pro Channel feed must be fully-balanced, and should be run in 100% foil-shielded cable (like Belden 8451). The shield should be connected to earth (chassis) ground at *both* ends.

In *low-RF* environments, the shield should be grounded at *one end only*. Audio may be run balanced for long distances, or unbalanced over distances of less than 20 feet (6m). (If the source signal is unbalanced, connect the "-" PRO INPUT to system ground.)

If a dial-up telephone line is used as the audio source, make sure it is isolated by a repeat coil (isolation transformer) or a standard telephone company hybrid.

9) Connect remote control (optional).

PRO ON/OFF terminals are located on the rear panel of the 8182A/SG. These are optically-isolated, RF-suppressed, and can be floated ±50V above ground. The "-" sides of all opto-isolators 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 in series with the COM terminal.

If the station's 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 connect "-" to the COMmon terminal.

If the remote control can provide only contact closures, you can use the +22V unregulated DC supplied on the 8182A/SG's 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 terminal to limit current to 10mA and avoid premature failure of the opto-isolators. (The internal current-limit resistor is 220 ohms.)

If you have not already done so, please fill out the **Registration Card** and mail it to the factory.

Section 3
Operating Instructions

In this section:

1. OPERATING INSTRUCTIONS

All Pro Channel controls and indicators are on the subpanel except the PRO (on/off) indicator, which is located on the 8182A/SG's main front panel.

The Pro Channel subcarrier generator is **activated** by setting the SUBCARRIER switch to ON. Setting that switch to the OFF position mutes the subcarrier generator. The subcarrier generator will mute itself if sync is lost. The AFC LOCK indicator will light when the generator is locked to sync. The PRO indicator lights when the subcarrier is on.

Two **operating modes** are available: a VOICE mode which processes the input signal to achieve maximum intelligibility, and a DATA mode which processes the input signal for minimum distortion of FSK data signals. A TEST switch defeats input signal compression and peak-clipping when the unit is operated in VOICE mode.

A detailed discussion of each control and indicator follows.

2. CONTROLS AND INDICATORS

PRO indicator (on main front panel)
Lights when the Pro Channel is on and locked to sync. This LED is controlled by the PRO ON/OFF switch on the subpanel. When the PRO indicator is off, the subcarrier is muted. This LED can also be controlled through the REMOTE PRO ON/OFF terminals on the rear panel of the 8182A/SG.

INPUT ATTENuator
Adjusts the input level over a 20dB range. In DATA mode, adjust for maximum modulation by turning the INPUT ATTEN control clockwise until the 100% PEAK MODULATION indicator lights, then backing off slightly. In VOICE mode, adjust so that the NORMAL G/R indicator is flashing frequently and the HEAVY G/R indicator flashes on peaks. (Low input levels may require repositioning of an internal input attenuation jumper – see Section 2.)

100% PEAK MODULATION indicator
Operates in both VOICE and DATA modes. Lights when the input to the modulator is at the 100% modulation level (i.e., ±3kHz subcarrier deviation). This is a fast- response peak indicator and may flash on infrequent transients of short duration (which is not cause for concern).

HEAVY G/R (GAIN REDUCTION) indicator
Operates only when the TEST switch is set to OPERATE. Relevant only in VOICE mode, it lights when compressor gain reduction exceeds approximately 20dB. (May flash spuriously in DATA mode unless the TEST switch is set to PROOF.)

NORMAL G/R (GAIN REDUCTION) indicator
Operates only when the TEST switch is set to OPERATE. Relevant only in VOICE mode, it lights when the compressor is applying gain reduction to the voice signal. (May flash spuriously in DATA mode unless the TEST switch is set to PROOF.)

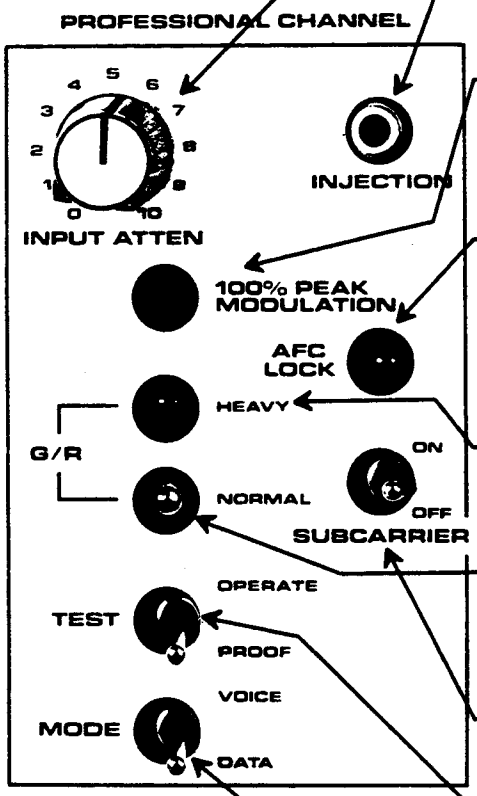
TEST switch
Affects the VOICE mode only. When this switch is set to PROOF, the compressor and clipper stages of audio processing are defeated for testing. In the OPERATE position, all processing functions operate normally.

MODE switch
Set this switch to the DATA position to transmit FSK-encoded digital data. Set it to the VOICE position to transmit speech. In VOICE mode, all of the processing features are included in the signal path (input buffer, 150μs pre-emphasis, phase scrambling, bass cut, compressor, peak clipper, and phase-corrected low-pass filter). In DATA mode, only the input buffer and the phase-corrected low-pass filter are included in the signal path. See Section 1 or 6 for further explanation.

INJECTION control
This control varies the level of the Pro Channel subcarrier. Since this is a frequency-modulated subcarrier, its amplitude is constant. The INJECTION control is adjusted at the factory to produce 1.5V peak at the output of Card #10. This level will drive the aural carrier to ±3kHz deviation when the TOTAL BASEBAND OUTPUT LEVEL on the Stereo Generator is adjusted according to the Bessel-null procedure described in **Part 4** of the **8182A/SG Operating Manual** or **Section 4** of the **8185A Operating Manual.** (If the exciter has a standard sensitivity of 1.5V peak = 75kHz deviation, then the Pro Channel level at the COMPOSITE OUTPUT of the Stereo Generator will be 60mV peak.) The INJECTION control should not need readjustment in the field.

AFC LOCK indicator
Lights when the Pro Channel subcarrier generator is locked to the horizontal frequency of the reference composite or sync. The Pro Channel output mutes when this LED is not lit. This LED will not light if there is no sync reference applied to the 8182A/SG's SYNC IN connector (J1).

SUBCARRIER ON/OFF switch
Switching this momentary-contact switch to OFF inhibits Pro Channel subcarrier output unequivocally. Switching to ON allows subcarrier output only when the Pro Channel is locked to sync (the Pro Channel will mute if sync is lost, but will "unmute" when sync is restored).



PRO indicator (on main front panel): Lights when Pro Channel subcarrier generator is on and locked to sync.

INPUT ATTEN control: Adjusts the input attenuation level over a 20dB range.

INJECTION control: Varies the output level of the Pro Channel subcarrier, determining the deviation of the main carrier caused by the Pro Channel subcarrier (the factory-set level should not need readjustment).

100% PEAK MODULATION indicator: Lights when the input to the frequency modulator is at the 100% modulation level (i.e., ±3kHz deviation).

AFC LOCK indicator: Lights when the Pro Channel subcarrier is locked to the horizontal frequency of the reference composite video or sync. The Pro Channel output mutes when this LED is not lit.

HEAVY G/R indicator: Lights when compressor gain reduction is approximately 20dB (gain reduction operates in VOICE mode only).

NORMAL G/R indicator: Lights when gain is being reduced by the compressor (VOICE mode only).

SUBCARRIER ON/OFF switch: Mutes the Pro Channel subcarrier.

TEST switch: In the PROOF position, the compressor and clipper are defeated for testing; in the OPERATE position, all processing functions operate normally. (The TEST switch has no effect in DATA mode.)

MODE switch: Selects VOICE or DATA mode. In DATA mode, the input signal bypasses audio processing.

Figure 3-1: Controls and Indicators

Section 4
Maintenance and Calibration

In this section:

No routine maintenance of this product is required.

See Section 6 for locations of test points.

To access circuit cards, remove the three hex screws at the top of the Stereo Generator's front panel with a 5/16" hex wrench. With the access door locked, carefully swing down the hinged front panel. Loosen each of the four DZUS fasteners holding the subpanel by turning them one-quarter turn clockwise with a 3/16" or 1/4" slotted-blade screwdriver. While taking care not to stress the flat cable beneath it, tilt the subpanel out and to the left to clear the upper chassis lip and the door support rail at the right. When reassembling the unit, turn DZUS fasteners only 1/4-turn (forcing them can cause damage requiring time-consuming repair). Always replace the subpanel – it is part of the RF shielding.

CAUTION

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

1. FIELD AUDIT OF PERFORMANCE: CARD #9

Use this procedure to verify performance of Card #9 (Pro Channel audio processing). It is also useful for detecting and diagnosing problems caused by Card #9.

NOTE: The 8182A/PRO must be used with the 8182A/SG Television Stereo Generator. The 8185A/PRO must be used with the 8185A Television Stereo Generator. Checking Card #9 requires only that the power supply in the Stereo Generator chassis be working.

Perform procedures in order without skipping steps.

Equipment required:

– Audio oscillator

An ultra-low-distortion type like the Sound Technology 1710B is preferred. However, a Heathkit or similar oscillator can be used to obtain approximate results, provided that the residual distortion has been verified to be below 0.1%.

– Noise and distortion test set

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

– General-purpose oscilloscope

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

– AC voltmeter

– Spectrum analyzer or sweep generator

Use of these devices will minimize the time required for frequency response sweeps.

Test Procedure:

1) **Set the MODE switch to DATA. Set the TEST switch to PROOF. Place JUMPER A on Card #9 in the 0dB input attenuation position** (see Section 2).

2) **Check signal continuity, input stage, and 100% PEAK MODULATION LED.**

   a) Apply 1kHz at approximately 1V RMS to the "+" PRO INPUT terminal on the rear panel of the Stereo Generator. Connect the "-" PRO INPUT to the circuit ground. Observe the Pro Channel output at TP7. Verify that there is signal present.

   b) Verify that the INPUT ATTENuator control varies the signal level over at least a 20dB range.

   c) Verify that the 100% PEAK MODULATION LED lights as the INPUT ATTENuator control is turned clockwise. Measure the signal level at TP7 when the INPUT ATTEN control reaches the position where the LED just lights. The level should be 3.5V RMS ±0.1V (100% ±3%).

d) Position JUMPER A for -20dB attenuation (see Section 2). Verify that the signal level decreases 20dB (±0.5dB). (Note: The level will only decrease 18.9dB if the generator has a 600-ohm, rather than 0-ohm, impedance.)

e) Return JUMPER A to 0dB attenuation position.

3) Check common mode rejection ratio.

a) Apply 3kHz at approximately 1V RMS to the "+" PRO INPUT. Connect the "-" PRO INPUT to the circuit ground. Adjust the INPUT ATTEN control for 100% modulation (the point at which the 100% MODULATION LED turns off).

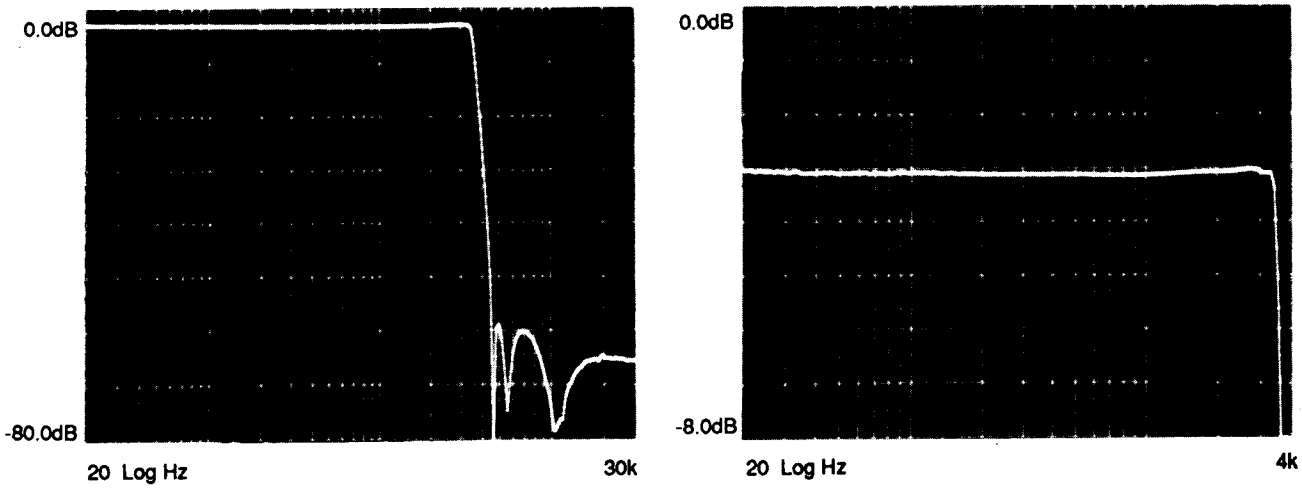
b) Measure the output level at TP7. Record this level as a 0dB reference.

c) Apply the 3kHz signal to both the "+" and "-" PRO INPUT terminals in parallel. Measure the level at TP7. The level should be at least 54dB below the reference recorded in the preceding step.

4) Check 3kHz filter frequency response.

a) Measure the frequency response from the "+" PRO INPUT to TP7 with an audio oscillator and AC voltmeter or a spectrum analyzer.

b) Verify flat (0dB ±0.1dB) frequency response to 3kHz. Verify stop-band attenuation of at least 55dB beyond 4.5kHz. Refer to Figure 4-1.



(a) 10dB per division (b) 1dB per division

Figure 4-1: 3kHz Filter Frequency Response

[The next two steps are an *optional* check of the 3kHz filter's square-wave response.]

c) Apply a 175Hz square wave at 5V p-p to the PRO INPUT (precision is not required). Observe the output at TP7. Adjust the INPUT ATTEN control to obtain approximately 5V p-p at the TP7.

d) The output signal should exhibit symmetrical overshoot on the rising edge of the square wave and symmetrical preshoot on the falling edge. Figure 4-2 shows a typical output waveform.

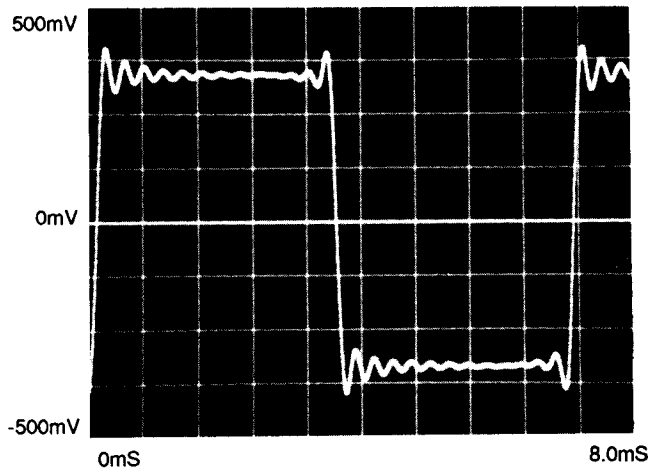


Figure 4-2: 3kHz Filter Square-Wave Response
(175Hz square wave shown)

5) Verify compressor performance.

a) Set the MODE switch to VOICE.

b) Set the TEST switch to OPERATE.

c) Move JUMPER B on Card #9 to the BASS FILTER OUT position (see Section 2).

d) Turn the INPUT ATTEN control fully counterclockwise.

e) Apply a 1kHz sine wave at approximately 0.5V RMS to the "+" PRO INPUT (precision is not required). Connect the "-" PRO INPUT to the circuit ground.

f) Slowly turn the INPUT ATTEN control clockwise. The NORMAL and then the HEAVY G/R (gain reduction) LEDs should come on as the level is increased. Once gain reduction starts, the output level at TP7 should stay essentially constant.

6) Verify clipper performance.

a) Verify that controls and jumpers are set as specified in steps 5a) through 5d).

b) Apply a 2kHz sine wave at approximately 0.1V RMS to the Pro Channel "+" input (precision is not required). Connect the "-" PRO INPUT to the circuit ground. Observe the output of the clipper at TP3 with the oscilloscope.

c) Turn the INPUT ATTEN control clockwise until peak clipping is observed on the sine wave. The clipping level should be 5.00V peak ±0.25V.

7) Check VOICE mode frequency response.

Verify that the MODE switch is set to VOICE and that JUMPER B is set for BASS FILTER OUT.

b) Set the TEST switch to OPERATE.

c) Connect the output of the spectrum analyzer's tracking generator to the "+" PRO INPUT. Connect the input of the spectrum analyzer to the output of the Pro Channel at TP7. Adjust the INPUT ATTEN control and the tracking generator output to achieve a full scale display. A typical frequency response is shown in Figure 4-3. (This measurement can also be made with an audio oscillator and an AC voltmeter.)

d) Move JUMPER B to the BASS FILTER IN position (see Section 3). A typical frequency response is shown in Figure 4-3.

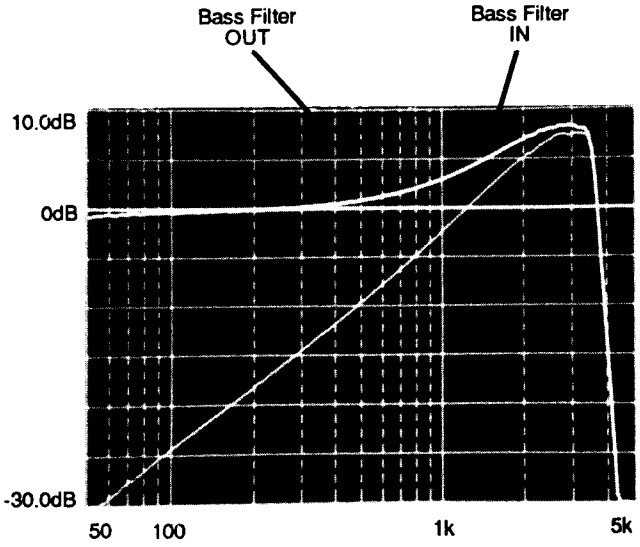


Figure 4-3: VOICE Mode Frequency Response

8) Check DATA mode THD and noise.

a) Set the MODE switch to DATA.

b) Set the TEST switch to PROOF.

c) Apply a sine-wave input to the "+" PRO INPUT. Connect the "-" PRO INPUT to the circuit ground. Set the level at the point at which the 100% PEAK MODULATION LED just goes out. Measure THD of the Pro Channel output at TP7 for these frequencies: 50Hz, 400Hz, 1kHz, 3kHz. THD should be less than 0.15% at 50Hz, falling to less than 0.05% at 3kHz.

d) Set the audio oscillator level as in step c). Remove the audio input and measure the residual noise in a 30kHz bandwidth. The noise should be at least 75dB below 100% modulation.

9) Check VOICE mode THD and noise.

a) Verify that JUMPER B is in the BASS FILTER OUT position.

b) Set the MODE switch to VOICE.

c) Set the TEST switch to OPERATE.

d) Apply a 2kHz sine wave at 0.5V RMS to the "+" PRO INPUT (precision is not necessary). Connect the "-" PRO INPUT to the circuit ground. Turn the INPUT ATTEN control fully clockwise. Observe the signal at the output of the compressor at TP2. Use the level at TP2 as a 0dB reference.

e) Measure the signal level at TP1. Adjust the INPUT ATTEN control until the level is 7.00dB ±0.25dB below the 0dB reference level measured at TP2 in step d). (The compressor has 17dB gain with no gain reduction; the 7.00dB gain set here corresponds to 10dB gain reduction.) Measure the THD at TP2. The THD should be around 0.1%, but not more than 0.2%.

f) Measure the level at the Pro Channel output at TP7. Set a 0dB reference. Remove the audio input and measure the residual noise in a 30kHz bandwidth. The noise should be at least 75dB below 100% modulation.

2. FIELD AUDIT OF PERFORMANCE: CARD #10

Use this procedure to verify performance of Pro Channel Generator Card #10. It is also useful for detecting and diagnosing problems caused by Card #10.

> **NOTE:** The 8182A/PRO must be used with the 8182A/SG Television Stereo Generator. The 8185A/PRO must be used with the 8185A Television Stereo Generator. Checking Card #10 requires that the Stereo Generator's Card #8 be functioning properly (refer to **Appendix D** in the **8182A/SG Operating Manual** or **Section 5** in the **8185A Operating Manual** if you suspect a problem with Card #8).

Perform procedures in order without skipping steps.

Equipment required:

– Stable source of composite video or sync

– Audio oscillator

An ultra-low-distortion type like the Sound Technology 1710B is preferred. However, a Heathkit or similar oscillator can be used to obtain approximate results, provided that the residual distortion has been verified to be below 0.1%.

– Noise and distortion test set

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

– General-purpose oscilloscope

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

– Pro Channel receiver or demodulator

If a Pro Channel monitor is not available, quantitative measurements of the Pro Channel frequency modulator will not be possible. However, it will still be possible to measure the entire Pro Channel Generator up to the frequency modulator. A spectrum analyzer with response to 110kHz can be used to verify operation of the frequency modulator.

– Spectrum analyzer or sweep generator

Use of these devices will minimize the time required for frequency response sweeps.

Test Procedure:

1) Connect sync signal and test instrument.

a) Apply a sync reference signal to the SYNC IN connector (J1) on the rear panel of the Stereo Generator.

b) Verify that the SYNC LOCK LED on the front panel is lit.

c) **If these checks are being performed with a BTSC-standard monitor**, connect the COMPOSITE OUTput (J3) on the rear panel of the Stereo Generator to the monitor's input (the Stereo Generator's Card #7 must be in place). **If a BTSC monitor is not available**, observe the Pro Channel output at TP3 on Card #10 with an oscilloscope or spectrum analyzer.

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

e) Short both audio inputs located on the rear panel of the 8182A ("main chassis" audio processor) to ground.

2) Check frequency modulator distortion.

[This check requires a BTSC-standard Pro Channel monitor or reference frequency demodulator – see 1), above.]

a) Remove Card #9 from the Stereo Generator.

b) Apply a 1kHz sine wave at 3.53V RMS (±0.20V) to TP2 on Card #10.

c) Measure the distortion on the Pro Channel output of the monitor. Distortion should be less than 0.5%.

3) Check frequency modulator frequency response.

[This check requires a BTSC-standard Pro Channel monitor or reference frequency demodulator – see 1), above.]

a) Apply a sine wave at 3.53V RMS (±0.20V) to TP2 on Card #10. Vary the input frequency from 50Hz to 3kHz.

b) Measure the amplitude at the Pro Channel output of the monitor. Frequency response should be flat to ±0.1dB.

4) Check SUBCARRIER ON/OFF switch and PRO LED.

a) Verify that the front panel PRO LED lights when the subpanel SUBCARRIER switch is switched to ON, and that it goes off when the switch is moved to OFF.

b) Using an oscilloscope connected to TP3, verify that the subcarrier mutes when the SUBCARRIER switch is switched to OFF.

5) Check REMOTE CONTROL PRO ON/OFF function.

[Skip this check if the rear-panel REMOTE PRO ON/OFF terminals are not connected to a remote control system.]

a) Repeat last step (steps 4a and b), using remote control instead of the SUBCARRIER switch.

6) Check automatic muting.

a) Switch the SUBCARRIER switch to ON.

b) Remove the sync reference signal.

c) Verify that the AFC LOCK LED goes off, and that the Pro Channel subcarrier mutes.

d) Restore the sync reference signal. Verify that the AFC LOCK LED lights and the subcarrier is restored.

3. FIELD ALIGNMENT OF CARD #9

This procedure is included primarily for purposes of reference since routine alignment is neither necessary nor desirable due to the high stability of the circuitry. (The card is aligned independently to a standard, so that all cards will be interchangeable.)

Equipment required:

[It is assumed that the technician is thoroughly familiar with this equipment.]

– Oscilloscope
DC-coupled, dual-trace, triggered sweep, with at least 5MHz vertical bandwidth.

– Low-distortion sine-wave oscillator
Sound Technology 1700B or 1710B, or equivalent.

Alignment Procedure:

1) Prepare unit for alignment.

The 8182A/SG's RF shielding is defeated during alignment. If high-RF fields are present, you may wish to remove the unit from its rack and place it on a test bench *away from RF fields*.

a) Connect the rear-panel chassis ground and circuit ground terminals to each other.

b) Extend Card #9.

2) Adjust FET bias.

a) Set the MODE switch to VOICE.

b) Set the TEST switch to PROOF.

c) Place Card #9's JUMPER A in the 0dB position (see Section 2).

d) Place Card #9's JUMPER B in the BASS FILTER OUT position (see Section 2).

e) Turn the INPUT ATTEN control fully counterclockwise.

f) Turn FET BIAS trim R43 fully counterclockwise (see Section 6 for location).

g) Apply a 1kHz sine wave at about 0.5V RMS to the "+" PRO INPUT (precision is not required). Connect the "-" PRO INPUT to the circuit ground. Observe the Pro Channel output at TP7 with the oscilloscope.

h) Slowly turn R43 clockwise until the maximum output signal level is achieved. Continue to turn R43 another 30° to set it slightly beyond pinch-off. If turning R43 seems to have no effect, set the TEST switch to OPERATE, and then back to PROOF again.

i) Reset controls and jumpers to normal operating positions.

4. FIELD ALIGNMENT OF CARD #10

This procedure is included primarily for purposes of reference since routine alignment is neither necessary nor desirable due to the high stability of the circuitry. (The card is aligned independently to a standard, so that all cards will be interchangeable.)

Equipment required:

[It is assumed that the technician is thoroughly familiar with this equipment.]

- Stable source of composite video or sync
- Oscilloscope
  DC-coupled, dual trace, triggered sweep, with at least 5MHz vertical bandwidth.
- Low-distortion sine-wave oscillator
  Sound Technology 1700B, 1710B, or equivalent.
- Digital voltmeter
  Accurate to ±0.1%, with a 4-digit readout.
- Low-frequency spectrum analyzer
  Tektronix 5L4N, 7L5, or equivalent.

Alignment Procedure:

1) Prepare unit for alignment.

The 8182A/SG's RF shielding is defeated during alignment. If high-RF fields are present, you may wish to remove the unit from its rack and place it on a test bench *away from RF fields.*

a) Connect the rear-panel chassis and circuit ground terminals to each other.

b) Remove Card #9.

c) Extend Card #10.

2) Trim AFC control voltage.

a) Apply a sync reference signal to the SYNC IN connector (J1) on the rear panel of the 8182A/SG. Verify that the SYNC LOCK LED on the 8182A/SG's main front panel lights.

b) Allow unit to warm up for 5 minutes.

c) Using the oscilloscope, observe TP1. (Be sure the oscilloscope is DC-coupled.)

d) Adjust R34 until the voltage at TP1 is +0.50V ±0.10V (see Section 6 for location of R34). Verify that the AFC LOCK LED on Card #10 lights.

3) Trim modulator sensitivity.

a) Observe the Pro Channel output at TP3 with the spectrum analyzer. If necessary, turn INJECTION control R39 to bring the subcarrier level near the top of the screen (precision is not required).

b) Apply 1248Hz ±5Hz to TP2. Adjust the oscillator for 3.53V RMS ±0.10V as measured at TP2. You should notice FM sidebands around the subcarrier.

c) Adjust R29 to null the subcarrier (Bessel null). Use the *first* null encountered above zero modulation. You should be able to achieve a 50dB null.

4) Adjust INJECTION control.

a) Observe the Pro Channel output at TP3 with the oscilloscope.

b) Adjust the INJECTION control until the signal is 1.500V peak ±0.025V (3V peak-peak; 1.06V RMS).

5) Recheck AFC control voltage (repeat steps 2c and 2d).

Section 5
Troubleshooting

In this section:

CAUTION

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

1. SYMPTOMS AND POSSIBLE CAUSES

Always check the power supply first (see **Appendix F** in **8182A** or **8182A/SG Operating Manuals**).

1) **Loss of sync lock.**

After sync lock has been established, the AFC LOCK indicator goes out.

This is most likely caused by not allowing the Card #10 to warm up prior to performing installation step 5. The voltage-controlled oscillator (VCO) employed as the frequency modulator is temperature sensitive. The AFC circuit compensates for this sensitivity by changing the VCO's control voltage as necessary to maintain the correct VCO frequency. However, if the AFC circuit is calibrated cold (instead of in its normal operating range), the AFC may run out of range when the unit warms up, resulting in loss of AFC lock.

Repeat step 5 of the installation procedure in Section 2, making sure you allow the board to warm up for at least 5 minutes.

2) **Highly distorted audio (in VOICE mode).**

Multipath at the receiver location can cause such distortion.

The FET that controls the compression circuitry may be misaligned. See "Field Alignment of Card #9" in Section 4.

If distortion persists when the FET is properly aligned, try to isolate the component causing the problem by comparing the input of each section of circuitry with its output. The field audit procedures in Section 4 may be useful in diagnosing the problem. Note that it is normal for noticeable clipping distortion to be exhibited on voice. The processing is optimized for intelligibility in the presence of noise, not for fidelity.

3) **Loss of data (in DATA mode).**

Data loss can be caused by multipath distortion at the receiver location.

It could also be due to drift in the 3kHz low-pass filter or in the three cascaded all-pass filters which provide phase correction of the low-pass filter's output. The square wave response test may be useful in diagnosing this problem (see step 4c of the field audit of Card #9 in Section 4).

Data may lost if the receiver is not phase-linear, has insufficient signal-to-noise ratio, or otherwise degrades channel quality.

Crosstalk into the Pro Channel from the stereo or SAP subcarriers can cause data loss. Check for non-linearities in exciter or inadequate RF bandwidth in the transmitter or diplexer.

4) **No output signal.**

Perform the field audits of Cards #9 and #10 (Section 4) to diagnose this problem.

2. TECHNICAL SUPPORT

If you need technical support, contact Orban Customer Service. Be prepared to accurately describe the problem. Know the serial number of your unit — this is printed on its rear panel.

Telephone:	(1) 510/351-3500	or Write:	Customer Service Orban
or Fax:	(1) 510/351-1001		1525 Alvarado Street San Leandro, CA 94577 USA

3. FACTORY SERVICE

Before you return a product to the factory for service, we recommend that you refer to this manual. Make sure you have correctly followed installation steps and operation procedures. If you are still unable to solve a problem, contact our Customer Service for consultation. Often, a problem is relatively simple and can be quickly fixed after telephone consultation.

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

Please refer to the terms of your Limited One-Year Standard Warranty, which extends to the first end-user. After expiration of the warranty, a reasonable charge will be made for parts, labor, and packing if you choose to use the factory service facility. Returned units will be returned C.O.D. if the unit is not under warranty. Orban will pay return shipping if the unit is still under warranty. In all cases, transportation charges to the factory (which are usually quite nominal) are paid by the customer.

4. SHIPPING INSTRUCTIONS

Use the original packing material if it is available. If not, sandwich the card between two 1" x 6.5" x 9" (3cm x 17cm x 23cm) pieces of soft foam, and package this "sandwich" in a rigid corrugated carton. DO NOT USE a "jiffy bag" or similar soft mailing bag, as these do not provide sufficient protection for the card.

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

DELICATE INSTRUMENT, FRAGILE!

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

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

Section 6
Technical Information

In this section:

1. SPECIFICATIONS

PERFORMANCE

VOICE MODE

Frequency response: Follows standard 150µs pre-emphasis curve ±0.5dB, 50-3000Hz. Defeatable 6dB/octave bass filter provides maximum intelligibility and modulation efficiency.

Noise (150µs de-emphasis): <-60dB referenced to 100% modulation.

Total system distortion (Proof mode, 150µs de-emphasis): <0.5% THD, 50-3000Hz.

DATA MODE

Frequency response: ±0.1dB, 5-3200Hz.

Group delay: Constant; ±2% or better, 5-3200Hz.

Total system distortion (no de-emphasis): <0.5% THD, 50-3000Hz.

CIRCUITRY

VOICE PROCESSING

Phase scrambler: All-pass network makes asymmetrical waveforms more symmetrical.

Compressor: Fast-attack, variable-gain circuit with a nearly infinite compression ratio. Uses delayed release time to minimize distortion on low-frequency signals. LEDs on the subpanel indicate NORMAL and HEAVY gain reduction.

Peak clipper: Limits the signal to 100% modulation.

Overshoot compensator: Prevents overmodulation after the 3.4kHz low-pass filter (US Patent #4,103,243).

PHASE-CORRECTED LOW-PASS FILTER

Type: Seventh-order elliptical filter with sixth-order phase correction. Cutoff frequency of 3.4kHz complies with BTSC system specification.

Stop-band rejection: >55dB above 4.5kHz.

SUBCARRIER GENERATOR

Residual FM noise: -60dB referenced to 100% modulation with 150µs de-emphasis; -50dB with no de-emphasis.

INSTALLATION

INPUT

Impedance: >10K-ohm load impedance, electronically balanced by means of true instrumentation amplifier. Balanced source ≤600 ohms recommended. Common mode rejection: >54dB @ 60Hz.

Sensitivity: -30dBm to +10dBm to produce 10dB gain reduction @ 1kHz (in VOICE mode), or 100% modulation (in DATA mode).

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

2. CIRCUIT DESCRIPTION

You may wish to refer to the schematics and block diagram in this section while reading the following circuit descriptions.

1) OVERVIEW

See Section 1.7 for an overview of the 8182A/PRO Pro Channel Generator's circuitry.

On the following pages, a detailed description of each circuit's function is accompanied by a component-by-component description of that circuit. **Keywords are highlighted** throughout the circuit descriptions to help you quickly locate the information you need.

2) INPUT AMPLIFICATION Card #9

The Pro Channel input signal is routed from terminals on the rear panel of the 8182A/SG through an **RF suppression filter** to Card #9. There, the signal is attenuated by an -20dB **attenuating pad** (0dB attenuation is jumper-selectable) before being amplified by a low-noise true instrumentation amplifier with symmetrical, high-impedance "+" and "-" inputs. The gain of this amplifier is adjustable from 0.88 to approximately 10.5 (a 21.5dB range) with the **INPUT ATTEN control**. If this range does not yield the desired signal levels through the system, the input pad may be restrapped to increase gain by 20dB.

Component-level description:

On Card #9 the Pro Channel input signal is attenuated by **attenuating pads** R1,R5 or R4,R6. Strapping R2 and R3 into the pads by means of Jumper A introduces a 20dB attenuation (the "as-shipped" condition of the pad).

The output of the pad is connected to a low-noise true **instrumentation amplifier** consisting of IC4A, IC4B, IC3A, and associated resistors. R5 and R6 provide bias current for IC3, which is a low-noise, bipolar-input dual IC opamp. R9 and R10 are feedback resistors for the two sections of IC4. The differential gain is controlled by the series resistance of R8 and **INPUT ATTEN control** R7. The common-mode gain of the IC4 pair is 1.

The differential output of IC4A and IC4B is converted to a single-ended output and the common-mode component of the output is nulled by means of differential amplifier IC3A and precision resistor array R11. Precision resistor matching within R11 assures excellent common-mode rejection.

3) PRE-EMPHASIS, PHASE SCRAMBLING Card #9 VOICE Mode Only

A subpanel switch selects either VOICE or DATA mode. In **VOICE mode**, the input signal is processed to achieve maximum intelligibility even in noisy reception conditions; in **DATA mode**, the input signal is processed to yield minimal waveform degradation.

Since no noise reduction is used in the Pro Channel, the VOICE signal is pre-emphasized with a 150μs curve, as recommended by the original Zenith specification for the Pro Channel. The **pre-emphasis** is up 3dB at 1.06kHz, then rises at 6dB per octave. It is rolled off above the Pro Channel pass band to avoid overloading the compressor with high frequency energy. A shelving **high frequency boost** is also incorporated in the pre- emphasis circuit as part of the clipper overshoot corrector (see the **Peak Clipping, Overshoot Compensation** circuit description).

The signal is then passed through a **phase scrambler** to make the highly asymmetrical waveforms typical of speech more symmetrical. This allows more efficient use of the symmetrical overload points of the Pro Channel subcarrier, resulting in increased loudness and intelligibility.

Component-level description:

IC3B and associated components form a 150μs **pre-emphasis network**. C1 is a DC-blocking capacitor. The pre-emphasis is implemented by means of a bridged-T feedback network around IC3B formed by R14, R15, R16, C3, and C4. C4 in conjunction with R14, R15 and R16 forms a shelving pre- emphasis function while C3 in conjunction with the same three resistors serves to roll off the response above the pass-band of the Pro Channel.

C2, R12, and R13 provide a 2.1dB shelving **high-frequency boost** which is part of the overshoot corrector function used with the peak clipper circuit.

The frequency response of the pre-emphasis network is shown in Figure 6-1.

The **phase scrambler** consists of a pair of second-order all-pass networks formed by IC2A, IC2B, and associated components. The phase response of each network varies from 0° to 360° as a function of frequency, while the amplitude response is flat.

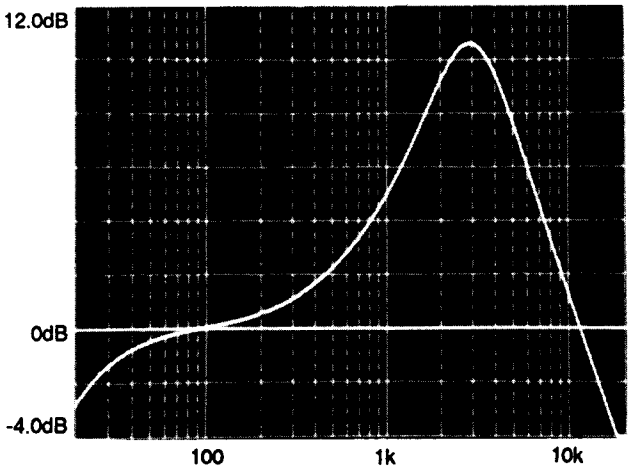


Figure 6-1: 150μs Pre-emphasis Stage Frequency Response

4) BASS FILTERING Card #9 VOICE Mode Only

The VOICE signal next passes through a **bass filter** which provides a 6dB/octave cut below approximately 1.2kHz, improving speech intelligibility in noisy environments (and avoiding transmission of energy that does not contribute to intelligibility). This filter can be defeated by repositioning a jumper.

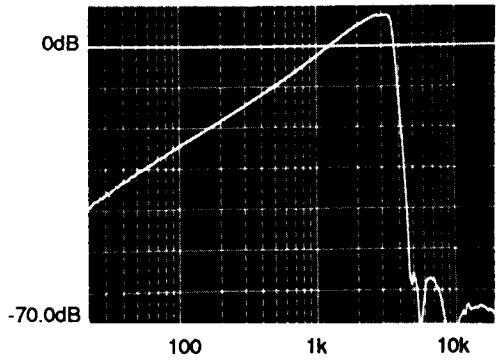


Figure 6-2: System Frequency Response with Bass Filter Inserted

Component-level description:

The **bass-cut filter** is achieved by inserting capacitor C9 in series with resistors R27 and R28. This yields a -3dB point of about 1.7kHz. System frequency response with the filter in-line is shown in Fig. 6-2.

5) COMPRESSION Card #9 VOICE Mode Only

The VOICE signal is compressed by a fast-attack variable gain circuit when the peaks of the signal exceed a preset threshold. **Compression** is controlled by **delayed-release circuitry** to minimize distortion of low-frequency signals.

Compressor operation has been designed to maximize loudness and intelligibility by maintaining a consistent output level for a wide range of input levels. The compression ratio is nearly infinite: after the threshold of compression is reached, there will be very little change in the compressor output level due to further increases in input level (for steady-state signals). The attack time of the compressor does permit voice signals to substantially overshoot the steady-state compression threshold, but these overshoots are removed by the peak clipper which follows.

The variable gain stage of the compressor uses a junction FET as a voltage-controlled resistor in the bottom leg of a resistive voltage divider. As the signal level increases past a preset threshold, the **compression control circuit** lowers the resistance of the JFET, thereby reducing the gain of the compressor circuit. A pair of comparators with fixed thresholds examine the peak level at the output of the compressor. Whenever a positive or negative peak exceeds the threshold, a pair of "hold" capacitors is charged with a pulse from the comparator output. The voltage on the first capacitor controls the resistance of the JFET while the second capacitor provides the delayed release function.

The initial voltage on the hold capacitors is set by the **FET BIAS trim**, which is adjusted so that the FET is just pinched off with no input from the comparators. Then, as the comparators charge the hold capacitors, the FET turns on and reduces the gain of the compressor.

When either comparator turns on, both capacitors are charged to almost the same voltage. The second capacitor in the delayed-release circuit has a relatively fast release time. The first capacitor discharges very slowly until the second capacitor has discharged to a diode drop below it. Then the first capacitor discharges at the same rate as the second capacitor. This results in a dual-time-constant release characteristic, where the release time is initially slow, and then becomes faster.

The FET control voltage is applied to a pair of comparators with fixed thresholds which drive the **NORMAL** and **HEAVY gain reduction LEDs**. As the control voltage increases, it progressively trips each comparator to light the corresponding LED.

When the **TEST switch** is set to **PROOF**, the threshold of the peak detector comparators is raised to approximately 14.4V, effectively disabling the compressor.

Component-level description:

The **compressor circuit** consists of IC1B and associated components. Compression is achieved by a variable voltage divider formed by R27, R28, and JFET Q1. C11, R31, R32, and C14 form a frequency-compensated voltage divider which feeds part of the compressor output signal back to the gate of Q1 to minimize distortion. The gain of the compressor stage is set by the combined action of the voltage divider formed by R27, R28, and Q1 and the amplifier gain which is set by R29 and R30. C10 prevents the DC level at the output of the compressor stage from varying as the compressor gain changes.

In the **compressor control circuit**, IC8 is a positive peak comparator and IC7 is a negative peak comparator. The positive peak comparator reference is set by R47, R48, R49, and CR15 to be about +5.0V in OPERATE mode. When the **TEST switch** is set to **PROOF**, the reference is raised to approximately +14.4V, which essentially defeats the compressor function. The negative peak **comparator threshold** is set by R46, CR13, and the clipper threshold circuit (see **Peak Clipping** circuit description) to about -5.0V. In PROOF mode the negative threshold is approximately -13.5V.

The outputs of comparators IC7 and IC8 are restricted to swings of about - 13V to 0V by diodes CR12 and CR10, respectively. Diodes CR9 and CR11 "OR" the comparator outputs while diodes CR7 and CR8 allow "hold" capacitors C14 and C13 to be charged by the comparators, but not discharged. R45 sets the **attack time** of the compressor by setting the rate at which the hold capacitors charge.

The voltage on hold capacitor C14 is applied to the gate of FET Q1 through R32. The voltage on the hold capacitor in the absence of compression is set by the **FET BIAS trim** R43. R43 is adjusted so that the FET is just off when no compression is occurring. Then, as the threshold of compression is reached, the comparators charge the hold capacitors, which turns on the FET and decreases the gain of IC1B. Diode CR5 clamps the gate voltage below about +0.4V to prevent the gate-channel junction from ever becoming forward-biased.

R40, together with FET BIAS trim R43 sets the discharge (release) rate of hold capacitor C13 to be relatively fast (about 30ms). The release rate of hold capacitor C14 is initially set by R44 to be very slow (about 10 seconds). After C13 discharges to a diode drop below C14, diode CR6 turns on and C14 discharges at the fast rate through R40 and R43.

IC10A and IC10B form a pair of comparators which look at the FET control voltage in order to drive the **NORMAL** and **HEAVY G/R LEDs** (CR2 and CR1). The reference for the comparators is derived from the FET bias voltage. R39 and R42 set the reference for the NORMAL G/R LED at about 2% higher than the bias voltage. In this way the NORMAL LED lights whenever *any* charge is added to the hold capacitors. R38 and R41 set the reference for the HEAVY G/R LED to light at about 20dB of gain reduction. R36 and R37 set the LED current. Diodes CR3 and CR4 prevent reverse breakdown of the LEDs when the LEDs are off.

6) PEAK CLIPPING, OVERSHOOT COMPENSATION Card #9 VOICE Mode only

A **peak clipper** limits the VOICE signal to the 100% modulation level (greater than 3kHz deviation). The clipper is a straightforward shunt clipper biased to clip at about 5.0V. The clipping threshold is set by a temperature-compensated voltage divider which eliminates first-order temperature-induced drift of the clipping level.

The sharp edges of the waveform caused by the clipping process will cause the low-pass filter which follows to overshoot and ring (due to the removal of the higher harmonics of the clipped signal by the filter and the fact that the fundamental of a square wave is 2.1dB higher than the peak level of the square wave). To **reduce the amount of overshoot**, a shelving cut of approximately 2.1dB is included in the clipper. A complementary shelving boost is built into the pre-emphasis circuit so that overall frequency response is not affected. (Note: this scheme is protected by U.S. Patent #4,103,243 and other international patents.)

When the **TEST switch** is set to **PROOF**, the clipping threshold is increased to approximately 13V, effectively defeating the clipper.

Component-level description:

Clipping is achieved by R33 and diodes CR16 and CR17. The clipped signal is buffered by amplifier IC1A and associated components. The circuit is set to clip at ±5.0V.

The clipper bias is set by IC9A, IC9B, and associated components. The voltage divider formed by R47, R48, and R49 is temperature compensated by diode CR15 in such a way that the clipping threshold at the non-inverting input of IC1A remains constant at 5.0V as the diode voltage drop changes with temperature. IC9A buffers the positive clipping bias voltage and IC9B, R50, and R51 form an inverter to generate the negative clipping bias.

When the **TEST switch** is set to **PROOF**, the R47, R48 divider is pulled to +14.4V by CR14, forcing IC9A and IC9B to the positive and negative supply rails, respectively, thereby raising the clipping threshold well above the level of the audio signal. In PROOF, the thresholds of the compressor comparators are also raised to well above the level of the audio signals.

C12, R34, and R35 cause amplifier IC1A to have a 2.1dB shelving cut characteristic in order to accomplish the **overshoot corrector** function.

7) LOW-PASS FILTERING, PEAK FLASHER Card #9

The VOICE signal goes from the clipper to a low-pass filter. The DATA signal bypasses the audio processing (pre-emphasis, phase scrambling, bass filtering, compression, and peak clipping) and goes directly from the input amplifier to the low-pass filter.

This **low-pass filter** limits the bandwidth of the Pro Channel to prevent crosstalk into other subcarriers. It is flat to 3.4kHz and phase- corrected to 3.2kHz, with stop-band attenuation better than 55dB beyond 4.5kHz. The output of the low-pass filter is **phase-corrected** by three cascaded all-pass filters to minimize degradation of digital data signals. When the peaks of the phase-corrected signal exceed 100% modulation level (greater than 3kHz deviation), an overload detector lights the **100% PEAK MODULATION indicator** on the subpanel.

Component-level description:

The **low-pass filter** is an active RC analog of a passive LC ladder filter. It is realized by means of resistors, capacitors, and frequency-dependent negative resistors (FDNRs). An FDNR is realized by means of a dual opamp, three resistors, and two capacitors. When the passive LC filter is transformed into an active RC filter, inductors become resistors, resistors become capacitors, and capacitors become FDNRs.

The three FDNRs each resonate with a series resistor to create a notch in the frequency response of the filters. This is analogous to an LC circuit to ground. The notches are located in the stop-band (above approximately 4.5kHz).

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

9558Hz	IC14
4810Hz	IC13
5672Hz	IC12

To avoid possible clipping, the signal is attenuated 20dB by means of R52 and R53 before being applied to the filter. This gain is made up in IC11A to restore unity gain at low frequencies.

IC11B, IC6A, and IC6B and associated components make up the three two-pole, all-pass networks in cascade that provide **phase correction** for the low-pass filter. The circuits are similar to the all-pass networks described in the **Pre-emphasis, Phase Scrambling** circuit description. Overall group delay is approximately constant to 3.2kHz.

IC5B and associated components form a positive **peak detector.** The peak voltage is stored on C32, which discharges through R82. Whenever the positive peak level of the signal at the output of IC6B exceeds the voltage on C32, IC5B charges C32 through CR18. The peak detected voltage is compared to 5.0V (the 100% modulation level) by comparator IC5A, and the **100% PEAK MODULATION LED** CR20 lights whenever the peak level exceeds 5.0V. R83 and R84 provide the 5.0V reference for IC5A, and R85 limits the LED current. CR19 prevents reverse breakdown of the LED when the LED is off.

8) SUBCARRIER MODULATION Card #10

On Card #10, **the processed input signal is summed with a control signal** (derived from the sync separator circuit on the 8182A/SG's Card #8 – see the **Phase-Locked Control Loop** circuit description) to drive a voltage-controlled oscillator (VCO). The **square-wave output** of the VCO **is transformed into a sine-wave signal** by 1) summing pulse trains in a way that cancels all the lower harmonics of the subcarrier, and 2) eliminating the higher harmonics with a low-pass filter. The resulting frequency-modulated subcarrier is summed into the **composite baseband output** of the 8182A/SG on Card #7.

Subcarrier amplitude can be adjusted with the subpanel **INJECTION control** (subcarrier deviation will be within BTSC-specified range if INJECTION is set for 1.5V ±5% peak output from Card #10, as it is when shipped from the factory).

The subcarrier generation technique used requires a square wave at 8 times the desired frequency. For a 6.5H subcarrier this means that the VCO must operate at 52 times the horizontal line rate (818kHz), and the frequency divider must divide the VCO output frequency by 52.

Component-level description:

The **phase-locked loop control voltage, a VCO bias voltage, and the processed modulating voltage are all summed** in amplifier IC16A and associated components. The VCO control voltage input is biased to a nominal 7.5V by R28 in conjunction with feedback resistor R31. This maintains the nominal **VCO control voltage** in the middle of its range, thus maximizing modulation capability before the onset of clipping. (The loop filter output is trimmed to 1.0V as described below to maintain this condition.)

The **modulating signal** is attenuated by **MODULATOR SENSITIVITY trim** R29 so that a 5.0V peak signal yields 3.0kHz deviation of the Pro Channel subcarrier. (The calibration procedure is described in the Card #10 field alignment procedure in Section 4.) JFET switch Q3 is used to **mute** the modulating signal during PLL acquisition and loss of lock.

The voltage controlled oscillator, IC15B and associated components, operates at 52 times the horizontal line rate. The frequency of oscillation is set by R32, R33, R34, C7 and is varied by the control voltage on pin 9. R33 and R34 set the oscillating frequency when the control voltage on pin 9 is 0V. R32 sets the sensitivity of the oscillator to the control voltage input. R34 is adjusted so that the loop filter output at TP1 is 0.50V (to maximize signal headroom as described above, and to allow the AFC loop to correct for temperature drift in the VCO).

The VCO output at 52 times the horizontal rate is used to clock binary counter IC13. The divide-by-four output of IC13 is used to clock presettable binary counter IC12, which is configured as a divide-by-13 circuit. The output of IC12 is at the horizontal line rate and is applied to the phase comparator IC15A as the PLL output signal.

The **subcarrier generator** takes a **square wave** at 8 times the subcarrier frequency and **converts it** to a **sine wave** at the subcarrier frequency. IC13, IC11A, IC11B, IC11C, IC10C, IC10D, and associated components form the subcarrier generator. A square wave at the subcarrier frequency is produced at pin 5 of IC13, and a pulse train at three times the subcarrier frequency is produced at pin 11 of IC13.

The pulse train is inverted by IC10C while the square wave is delayed the same amount by IC10D. The two signals are combined in the proper proportion to cancel all lower order harmonics by R36 and R37, and the sharp transitions that remain in the waveform are removed by the following low-pass filter.

IC11A and associated components form a power-up reset circuit that ensures that the two output signals from IC13 have the proper phase relation to produce the subcarrier.

The low-pass filter is a passive LC ladder implementation. It consists of L1, L2, C9-C17, and R38. The cutoff frequency is around 150 kHz. IC3 buffers the subcarrier to drive the composite summer on Card #7. C18 removes the DC component present in the digitally generated subcarrier. JFET switch Q4 **mutes** the subcarrier when the loop loses lock. **PRO INJECTION control** R39 varies the **subcarrier level.**

9) PHASE-LOCKED CONTROL LOOP Card #10

A **phase-locked loop (PLL)** governs the sync-derived signal which was summed with the processed audio signal. The PLL, which ensures that the Pro Channel subcarrier is locked to the horizontal line frequency, consists of a phase comparator, loop filter, voltage controlled oscillator, and frequency divider.

The **phase comparator** compares a reference signal (1H from the sync separator on Card #8) with the frequency-divided output of the VCO, and generates pulses with polarity and pulse width proportional to the phase difference between the two signals. These pulses are processed by a **loop filter** to provide a smooth control signal for the VCO. The control signal attempts to force the frequency divider output to be identical to the reference signal.

The PLL is controlled by a clocked (by the level-shifted 1H sync signal), sequential logic circuit which uses flip-flops to remember the state of the loop. The loop filter uses a **dual**

time-constant scheme to attain lock. During acquisition, the filter switches to a fast time-constant to allow rapid lock-up. After loop lock is detected, the filter switches to a much slower time-constant in order to maintain lock while being modulated. The circuit monitors the outputs of three status detectors and sets the loop operating state accordingly:

- In **Acquisition state** the loop has a **fast time-constant**, and the processed Pro Channel **input is muted** (so that the VCO is being controlled only by the loop filter), **as is the subcarrier output** (so that no "garbage" is output during the acquisition process). This enables the loop to quickly lock into sync "off-line", with no external disturbances. The PLL will enter the Acquisition state when the **Sync detector** indicates an interruption of the sync reference signal.

- In **Locked state** the loop has a **slow time-constant**, but the modulating **input and** the subcarrier **output remain muted**. The PLL enters the Locked state when the Sync detector senses the presence of the sync reference signal *and* the Acquisition detector monitoring the phase comparator indicates the loop is locked. The **Acquisition detector** monitors a phase difference output of the phase comparator; the output of this detector is valid only when the loop is not being modulated, and so is only used during the acquisition phase when the modulating input is muted. The subpanel **AFC LOCK indicator** lights when lock is detected.

- In the **Modulating state** the loop is operating with the **slow time-constant**, the VCO control signal is being modulated by the processed Pro Channel input, and the **modulated subcarrier is sent to Card #7**. The PLL will switch from Locked to the Modulating state only when the **Lock detector** indicates that the VCO control signal is within a pre-defined range of +1.00V ±3.50V. The **AFC CONTROL VOLTAGE trim** adjusts the voltage of VCO control signal. (The output of the Lock detector is valid whether or not the VCO is being modulated.)

Component-level description:

The **1H signal** from the sync separator on Card #8 is applied to the reference input of **phase comparator** IC15A. The phase-error pulses are applied to the dual time-constant **loop filter** formed by IC16B and associated components.

The **phase comparator** output is a bi-directional charge pump. The output is an open circuit when the two inputs are in phase, connected to the positive supply rail when the reference phase leads the output phase, or connected to ground when the reference phase lags the output phase. R9 and R10 bias the phase comparator output to 7.5V when the two inputs are in phase.

The **loop filter** is a second-order filter comprised of a lossy integrator followed by a passive RC stage. The integrator has switchable time-constants to permit fast acquisition and lockup and to maintain precise center frequency tracking during modulation. The **slow integrator time-constant** is set by R11 in conjunction with R13, C2, and C3. The **fast integrator time-constant** is set by R12 in conjunction with R13, C2, C3, and is switched in and out of the circuit by JFET switch Q2. The integrator is biased to 7.5V by R14, R15, C4 to handle the nominal 7.5V output of the phase comparator.

Additional smoothing of the loop control voltage is obtained from R26, R27 and C6.

IC7, IC8, IC9, and associated components form a CMOS sequential logic circuit which **controls the PLL lockup and acquisition sequence**. The logic circuits are powered by GND (Vcc) and -15V (Vss). Thus the outputs are level-shifted down from the voltages normally associated with CMOS logic: high outputs are 0V and low outputs are -15V.

The **truth table** and **state diagram** which define the operation of the logic circuit are shown in figures 6-3 and 6-4.

The output of IC9A is inverted and level-shifted by Q6, R52, R53, and R54 to produce signal BACQ which is +7.5V when high and -15V when low. This signal is used to **control the dual time-constant** loop filter described above.

The reset signal to IC9B (pin 10) is inverted by Q7 to drive the **AFC LOCK LED** on Card #10.

The **Sync detector** consists of IC14B and associated components. R4 and C1 integrate the sync pulses (the average value on C1 is around 10V). IC14B acts as a comparator with +12V reference generated by R5 and R6. When sync is present, the output of IC14B is high and the signal SYNC OK is level-shifted by R7 and R8 to 0V. If sync is lost, the 1H signal line goes to +15V. This drives the comparator low, and SYNC OK goes to -15V.

The **Acquisition detector** consists of IC14A and associated components. The Acquisition detector monitors the phase-difference output of the phase comparator, where the width of the output pulses is proportional to the phase difference between the inputs. R16 and C5 integrate the phase-difference pulses. IC14A acts as a comparator with reference set to +14.0V by R17 and R18. When lock has been achieved in the absence of modulation, the two phase comparator inputs are in phase and there are no pulses at the phase-difference output, which is normally high. The voltage on C5 is +15V and the comparator output is high. The comparator output is level-shifted by R19 and R20 to form the signal PHASEGOOD, which is 0V when lock has been achieved in the absence of modulation. When lock is lost, the voltage on C5 falls below +14V and PHASEGOOD goes to -15V.

The **Lock detector** is a window comparator which looks at the loop filter output voltage. This voltage is trimmed to +1.00V at room temperature, but may drift as far as -2.50V at 50°C. If the control voltage goes outside of a ±3.5V window, the loop is considered to have lost lock. The window comparator is formed by IC17A and IC17B. R21 and R22 form the positive reference and R23 and R24 form the negative reference. The outputs of IC17A and IC17B are "OR-ed" by diode OR-gate CR2, CR3, and R25. The signal MODLOCK is 0V when the loop is locked and -15V when the loop has lost lock.

	PRESENT STATE BACQ/	MUTE/	INPUTS SYNCOK	PHASEGOOD	MODLOCK	NEXT STATE BACQ/	MUTE/
ACQUIRE state	0	0	0	x	x	0	0
	0	0	1	0	x	0	0
	0	0	1	1	0	1	0
	0	0	1	1	1	1	0
EXCLUDED state	0	1	0	x	x	0	0
	0	1	1	x	0	0	0
	0	1	1	x	1	1	1
LOCKED, not modulating	1	0	0	x	x	0	0
	1	0	1	0	x	0	0
	1	0	1	1	0	1	0
	1	0	1	1	1	1	1
LOCKED, modulating	1	1	0	x	x	0	0
	1	1	1	x	0	0	0
	1	1	1	x	1	1	1

x = don't care; 0 = -15V; 1 = 0V

BACQ/ is pin 1 of IC8

Figure 6-3: Loop Control Logic Truth Table

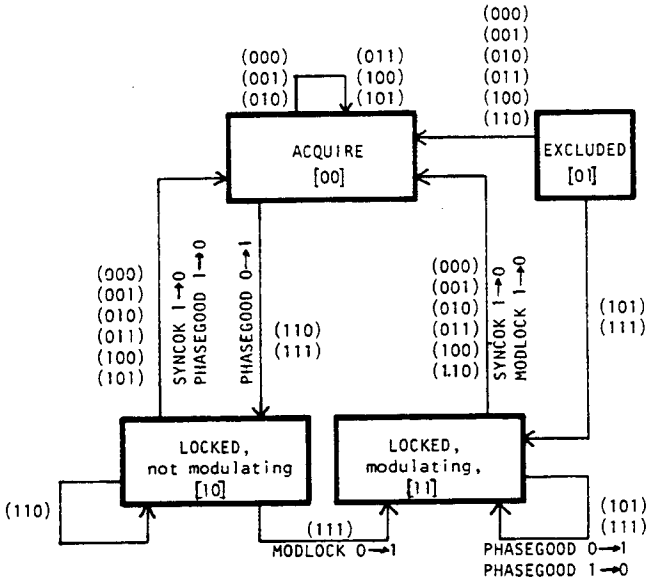


Figure 6-4: Loop Control Logic State Diagram

10) ON/OFF LOGIC Card #10

The Pro Channel subcarrier can also be muted with the **SUBCARRIER ON/OFF** switch on the subpanel, or via the **REMOTE PRO ON/OFF** terminals on the rear panel of the Stereo Generator. The SUBCARRIER ON/OFF switch drives a NAND-gate latch which remembers the ON/OFF state. The output of this latch is gated with the MUTE/ output from the logic circuit to control the switching FETs in the modulating input and the subcarrier output. The REMOTE PRO ON/OFF signals drive opto-isolators which drive the NAND-gate latch in the same way as the SUBCARRIER ON/OFF switch. The **PRO indicator** on the front panel of the Stereo Generator lights when the subcarrier generator is functioning.

Component-level description:

The **SUBCARRIER ON/OFF** logic consists of IC4, IC5, IC6, and associated components. IC6A and IC6D form a cross-coupled latch which remembers the current ON or OFF state, as controlled by the SUBCARRIER ON/OFF switch S1. The function of this switch can be duplicated through opto-isolators IC4 and IC5 by applying a positive voltage to the **REMOTE PRO ON or OFF** terminals on the rear panel of the 8182A/SG. C22, R46, and CR5 form a power-on circuit that forces the latch into the SUBCARRIER ON state on power-up.

The latch's output is gated with the signal MUTE/ from the sequential logic circuit to form the signal GMUTE/ at pin 4 of IC6B. GMUTE/ is used to **mute the modulating input and the subcarrier output** during acquisition or loss-of-lock conditions. The output of IC6C is inverted by Q5 and associated resistors to drive the **PRO LED** on the main front panel of the 8182A/SG.

3. PARTS LIST

Parts are listed by ASSEMBLY, then by TYPE, then by REFERENCE DESIGNATOR. See drawings in Section 6.4 for location of components. Widely used common parts are not listed; such parts are described generally below (examine the part to determine exact value).

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

Orban part number 22101-000, Fairchild (FSC) part number 1N4148, also available from many other vendors. This is a silicon, small-signal diode with ultra-fast recovery and high conductance. It may be replaced with 1N914 (BAY-61 in Europe).
(BV: 75V min. @I_r = 5µA; I_r: 25nA max. @ V_r = 20V; V_f: 1.0V max. @I_f = 100mA; trr: 4ns max.)

See Miscellaneous list for **ZENER DIODES** (reference designator VRxx).

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

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

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

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

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

Obtaining spare parts:

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

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

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

To facilitate future maintenance, most parts for this unit have been chosen from the catalogs of well-known manufacturers. Most of these manufacturers have extensive worldwide distribution and may be contacted through their local offices. The USA headquarters addresses are given at the end of this parts list.

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
CARD #9						
Capacitors						
C1	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C2	Mica, 500V, 5%; 680pF	21024-168	CD	CD19-FD681J03	SAN	
C3	Mica, 500V, 5%; 430pF	21024-143	CD	CD19-FD431J03	SAN	
C4-9	Polypropylene, 50V, 2.5%; 0.01uF	21702-310	NOB	CQ15P1H103GPP	WES	
C10	Alum., Radial, 50V; 47uF	21208-647	SPR	502D 476G050CD1C	PAN	
C11	Mica, 500V, 5%; 4300pF	21024-243	CD	CD19-FD432J03	SAN	
C12	Polypropylene, 50V, 2.5%; 0.01uF	21702-310	NOB	CQ15P1H103GPP	WES	
C13	Tantalum, 35V, 10%; 1uF	21307-510	SPR	196D 105X9035HA1	MANY	
C14	Tantalum, 35V, 10%; 1uF	21307-510	SPR	196D 105X9035HA1	MANY	
C15-22	Polypropylene, 50V, 2.5%; 0.01uF	21702-310	NOB	CQ15P1H103GPP	WES	
C23	Alum., Radial, 50V; 47uF	21208-647	SPR	502D 476G050CD1C	PAN	
C24-29	Polypropylene, 50V, 1%; 0.01uF	21701-310	NOB	CQ15P1H103FPP	WES	
C30	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C31	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C32	Alum., Radial, 63V; 4.7uF	21209-547	SPR	502D 475G063BB1C	PAN	
C33	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C34	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C35-47	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Diodes						
CR2	LED, Yellow	25105-000	GI	MV-5353		
CR5	Diode, Signal, Hot Carrier	22102-001	HP	HP5082-2800		
CR20	LED, Red	25103-000	GI	MV-5053		

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

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS
PRO CHANNEL GENERATOR
MODEL 8182A/PRO (ACC 20)
Card #9 - Capacitors, Diodes

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Integrated Circuits						
IC1	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
IC2	Linear, Dual Opamp	24202-202	RAY	RC4558NB	MOT,FSC	
IC3	Linear, Dual Opamp	24202-202	RAY	RC4558NB	MOT,FSC	
IC4	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
IC5	Linear, Dual Opamp	24202-202	RAY	RC4558NB	MOT,FSC	
IC6	Linear, Dual Opamp	24202-202	RAY	RC4558NB	MOT,FSC	
IC7	Linear, Single Opamp	24003-202	RCA	CA301CN	NAT,TI	
IC8	Linear, Single Opamp	24003-202	RCA	CA301CN	NAT,TI	
IC9	Linear, Dual Opamp	24202-202	RAY	RC4558NB	MOT,FSC	
IC10	Linear, Dual Opamp	24203-202	MOT	MC1458CPI	TI,RCA	
IC11	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC12	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC13	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC14	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
Resistors						
R7	Pot, Single; 25K (5010R)	20742-000	ORB			10% CCW Log
R11	Resistor Network, 8 POS., 20K	20201-501	BEK	698-3-R20KD		
R56	Resistor Set, MF, 2.00K	28520-002	ORB			
R60	Resistor Set, MF, 2.00K	28520-002	ORB			
R64	Resistor Set, MF, 2.00K	28520-002	ORB			
R70	Resistor Set, MF, 20.0K	28521-001	ORB			
R74	Resistor Set, MF, 20.0K	28521-001	ORB			
R78	Resistor Set, MF, 20.0K	28521-001	ORB			
Switches						
S1	Switch, Toggle, Min., SPDT	26037-009	CK	7101SYA		
S2	Switch, Toggle, Min., SPDT	26037-009	CK	7101SYA		
Transistors						
Q1	Transistor, JFET/N	23403-101	NAT	J111	INS	

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

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

PRO CHANNEL GENERATOR
MODEL 8182A/PRO (ACC 20)
Card #9 - IC's/Switches

CARD #10

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Capacitors						
C1	Met. Polyester, 100V, 5%; 0.1uF	21440-410	WES	60C 104J100	SIE,WIM	
C2	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C3	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C4	Tantalum, 20V, 10%; 10uF	21305-610	SPR	196D 106X9020JA1	MANY	
C5	Met. Polyester, 100V, 5%; 0.1uF	21440-410	WES	60C 104J100	SIE,WIM	
C6	Met. Polyester, 100V, 5%; 0.1uF	21440-410	WES	60C 104J100	SIE,WIM	
C7	Mica, 500V, 1%; 270pF	21018-127	CD	CD15-FD271F03	SAN	
C8	Tantalum, 35V, 10%; 0.47uF	21307-447	SPR	196D 474X9035HA1	MANY	
C9	Mica, 500V, 1%; 100pF	21018-110	CD	CD15-FD101F03	SAN	
C10	Mica, 500V, 2%; 33pF	21019-033	CD	CD15-ED330G03	SAN	
C11	Mica, 500V, +1/2pF -1/2pF; 3pF	21017-003	CD	CD15-CD030D03	SAN	
C12	Mica, 500V, 1%; 220pF	21018-122	CD	CD15-FD221F03	SAN	
C13	Mica, 500V, 2%; 33pF	21019-033	CD	CD15-ED330G03	SAN	
C14	Mica, 500V, +1/2pF -1/2pF; 5pF	21017-005	CD	CD15-CD050D03	SAN	
C15	Mica, 500V, +1/2pF -1/2pF; 3pF	21017-003	CD	CD15-CD030D03	SAN	
C16	Mica, 500V, 1%; 62pF	21018-062	CD	CD15-ED620F03	SAN	
C17	Mica, 500V, 1%; 62pF	21018-062	CD	CD15-ED620F03	SAN	
C18	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C22	Ceramic, 50V, 20%; 1.0uF	21119-510	CRL	CY30C105M	SPR	
C23	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C24	Alum., Radial, 25V; 100uF	21206-710	PAN	ECE-A1EV101S		
C25	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C26	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C29-39	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Diodes						
CR7	LED, Green	25104-000	GI	MV-5253		
Inductors						
L1	Inductor, Variable	29705-002	ORB			
L2	Inductor, Variable	29705-003	ORB			

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

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

PRO CHANNEL GENERATOR
MODEL 8182A/PRO (ACC 20)
Card #10 - Capacitors, Diodes, Inductors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
	Integrated Circuits					
IC3	Linear, Single Opamp	24013-202	TI	TL071CP		
IC4	Optoisolator, NPN	25003-000	SIE	SFH-601-1		
IC5	Optoisolator, NPN	25003-000	SIE	SFH-601-1		
IC6	Digital, Nand Gate	24501-302	RCA	CD4011BE	MOT	
IC7	Digital, Nand Gate	24501-302	RCA	CD4011BE	MOT	
IC8	Digital, Nand Gate	24501-302	RCA	CD4011BE	MOT	
IC9	Digital, Dual Flip-Flop	24502-302	RCA	CD4013BE		
IC10	Digital, XOR Gate	24504-302	RCA	CD4030BE	SIG	
IC11	Digital, Quad 2-Input NAND	24509-302	RCA	CD4093BE		
IC12	Digital, 4-Bit Counter	24511-302	RCA	CD40163BE		
IC13	Digital, Up-Counter	24508-302	RCA	CD4520BE		
IC14	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC15	Digital, Phase Locked Loop	24507-302	RCA	CD4036BE		
IC16	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC17	Linear, Dual Opamp	24202-202	RAY	RC4558NB	MOT,FSC	
	Resistors					
R39	Trimpot, Cermet, 20 Turn; 10K	20512-310	BEK	89P-R10K		
	Switches					
S1	Switch, Toggle, Min., SPDT	26037-012	CK	7105SYAQ		
	Transistors					
Q1	Transistor, Signal, PNP	23002-101	MOT	2N4402	FSC	
Q2	Transistor, JFET/N	23406-101	NAT	J113	SIL	
Q3	Transistor, JFET/N	23406-101	NAT	J113	SIL	
Q4	Transistor, JFET/N	23406-101	NAT	J113	SIL	
Q5	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
Q6	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
Q7	Transistor, Signal, PNP	23002-101	MOT	2N4402	FSC	

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

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

PRO CHANNEL GENERATOR
MODEL 8182A/PRO (ACC 20)
Card #10 - IC's/Transistors

Vendor Codes

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

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

AKG
AKG Acoustics, Inc.
1525 Alvarado Street
San Leandro, CA 94577

AM
Amphenol Corporation
358 Fall Avenue
Wallingford, CT 06492

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

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

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

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

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

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

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

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

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

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

CW
CW Industries
130 James Way
Southampton, PA 18966

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

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

ELSW
Electroswitch
180 King Avenue
Weymouth, MA 02188

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MOT
Motorola Semiconductor
PO BOX 20912
Phoenix, AZ 85036

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

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

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

ORB
Orban
A division of AKG Acoustics, Inc.
1525 Alvarado Street
San Leandro, CA 94577

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

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

RCA
Solid State Division
Route 202
Somerville, NJ 08876

ROHM
Rohm Corporation
8 Whatney
Irvine, CA 92718

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

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

SCH
ITT Schadow
8081 Wallace Road
Eden Prairie, MN 55344

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

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

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

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

TI
Texas Instruments
PO BOX 655012
Dallas, TX 75265

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

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

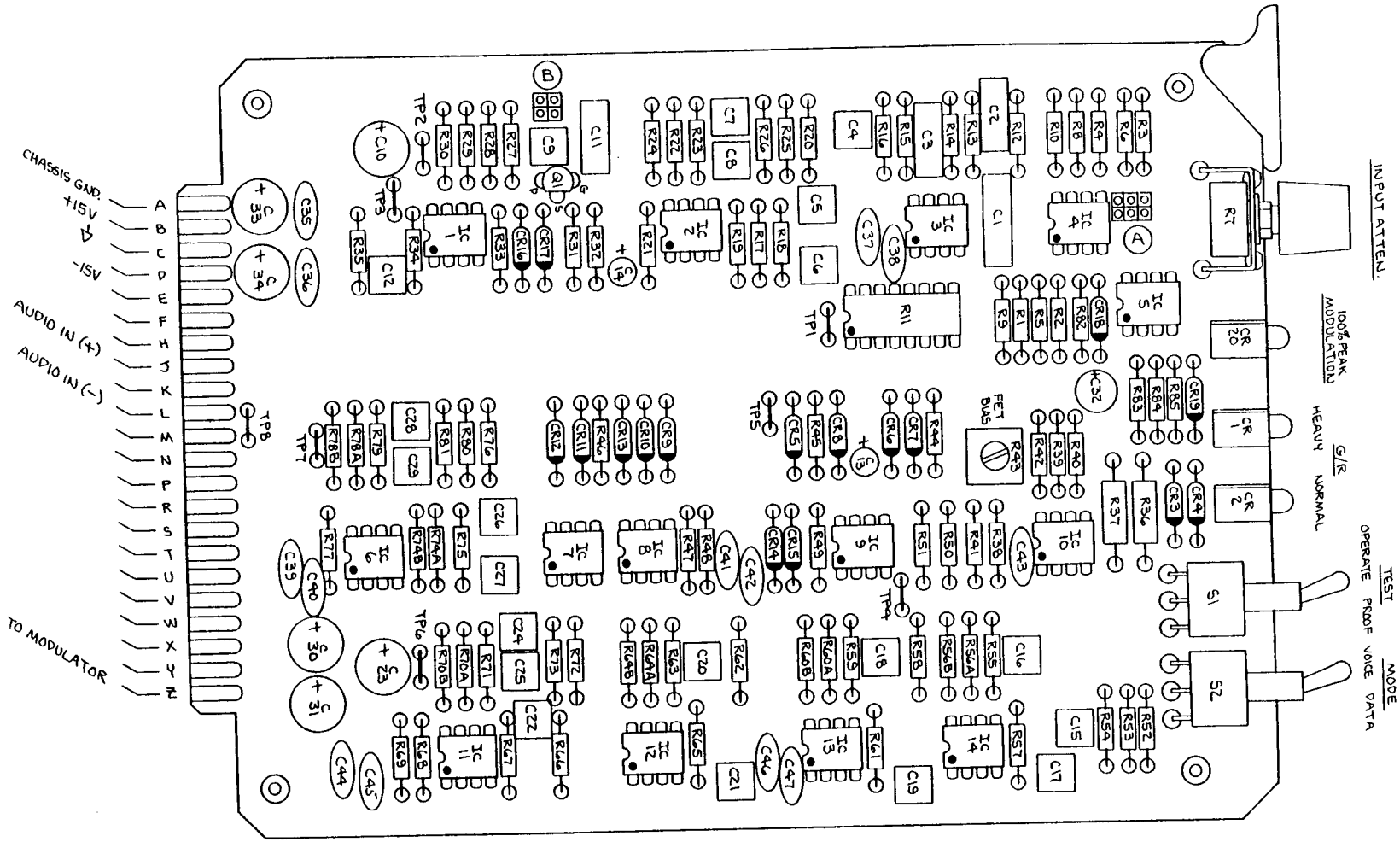
VARO
Varo Quality Semiconductor, Inc.
1000 North Shiloh Road
PO BOX 469013
Garland, TX 75046-9013

WES
Westlake
5334 Sterling Ctr. Drive
Westlake Village, CA 91361

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

4. SCHEMATICS, LOCATION OF COMPONENTS

The following drawings are included in this manual:

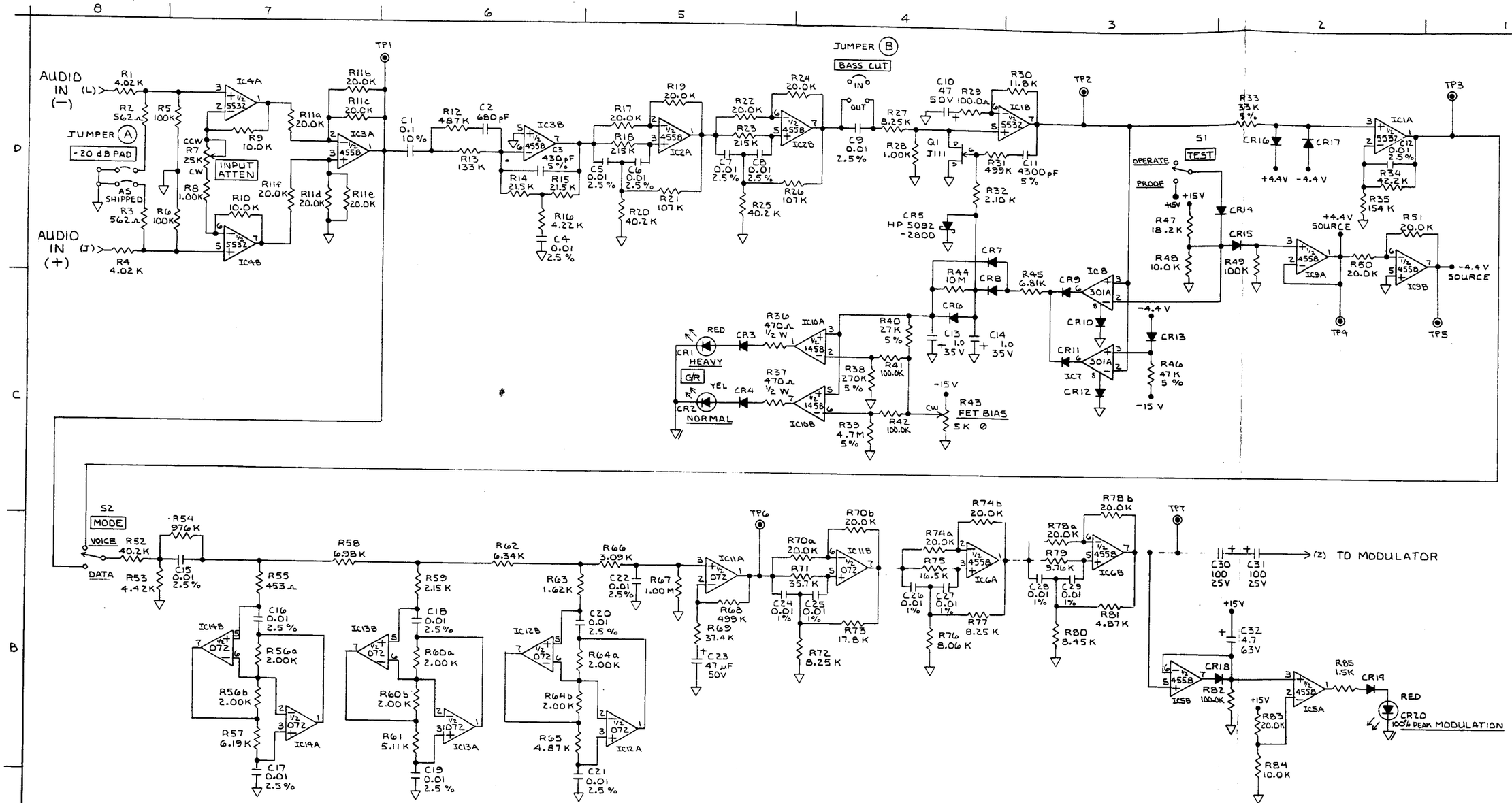


4. MOUNT PCB SHIELD ON SOLDER SIDE.
3. TICK MARKS INDICATE PIN ONE OF IC'S, CATHODE OF DIODES, POSITIVE SIDE OF CAPACITORS.
2. USE COMPONENT MTG. PADS, P/N 15051-000, FOR C23,30,31,33,34.
1. REFERENCE SCHEMATIC P/N 61003-000

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban®

TITLE:
PRINTED CIRCUIT ASSEMBLY
PRO CHANNEL PROCESSOR CARD #9
30890-000-01

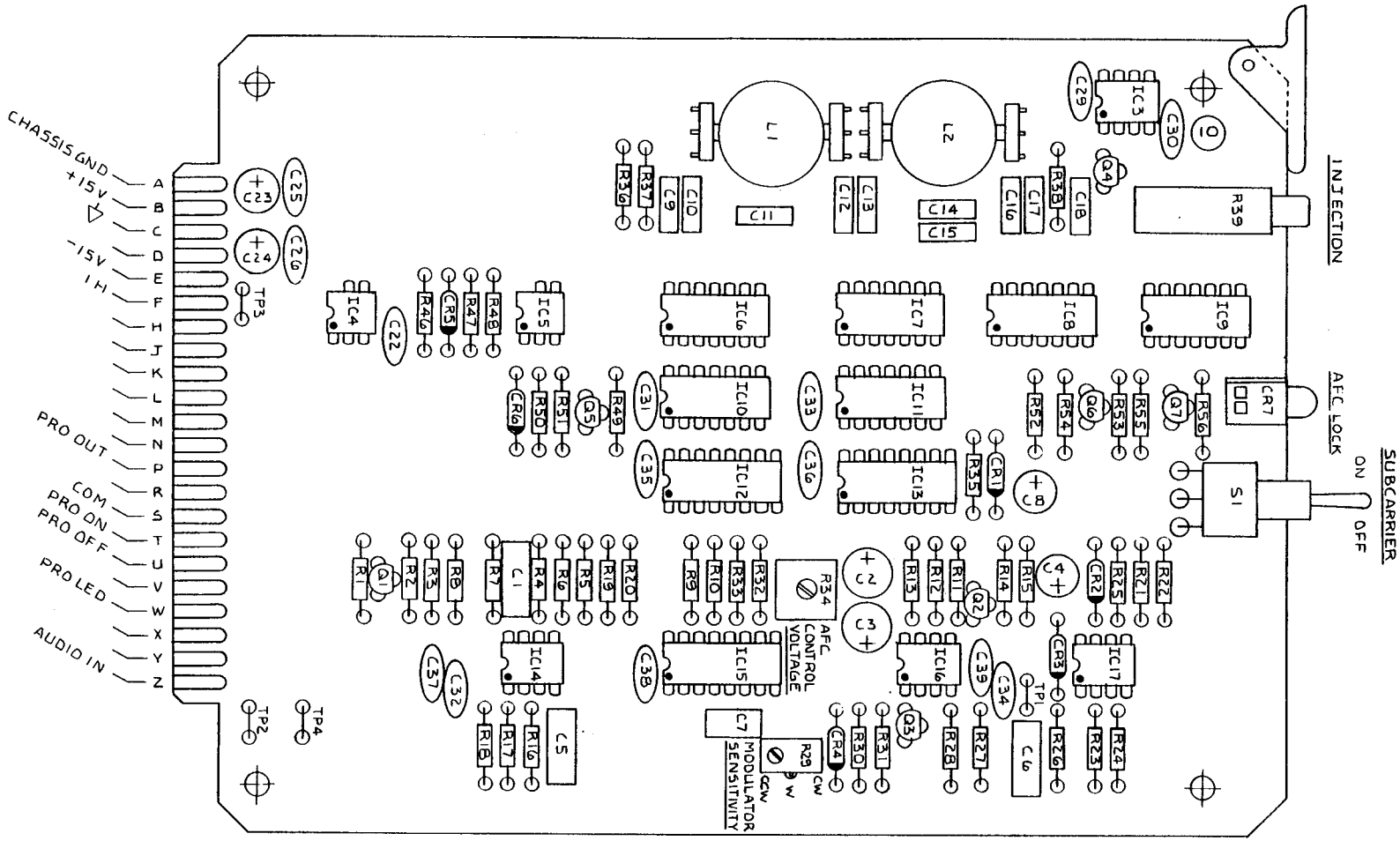


3. ALL DIODES ARE IN4148.
2. ALL CAPACITANCE IN MICROFARADS.
1. ALL RESISTORS ARE ±1%, ¼W, MF.

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban®

TITLE:
SCHEMATIC
PRO CHANNEL PROCESSOR CARD #9
61003-000-01

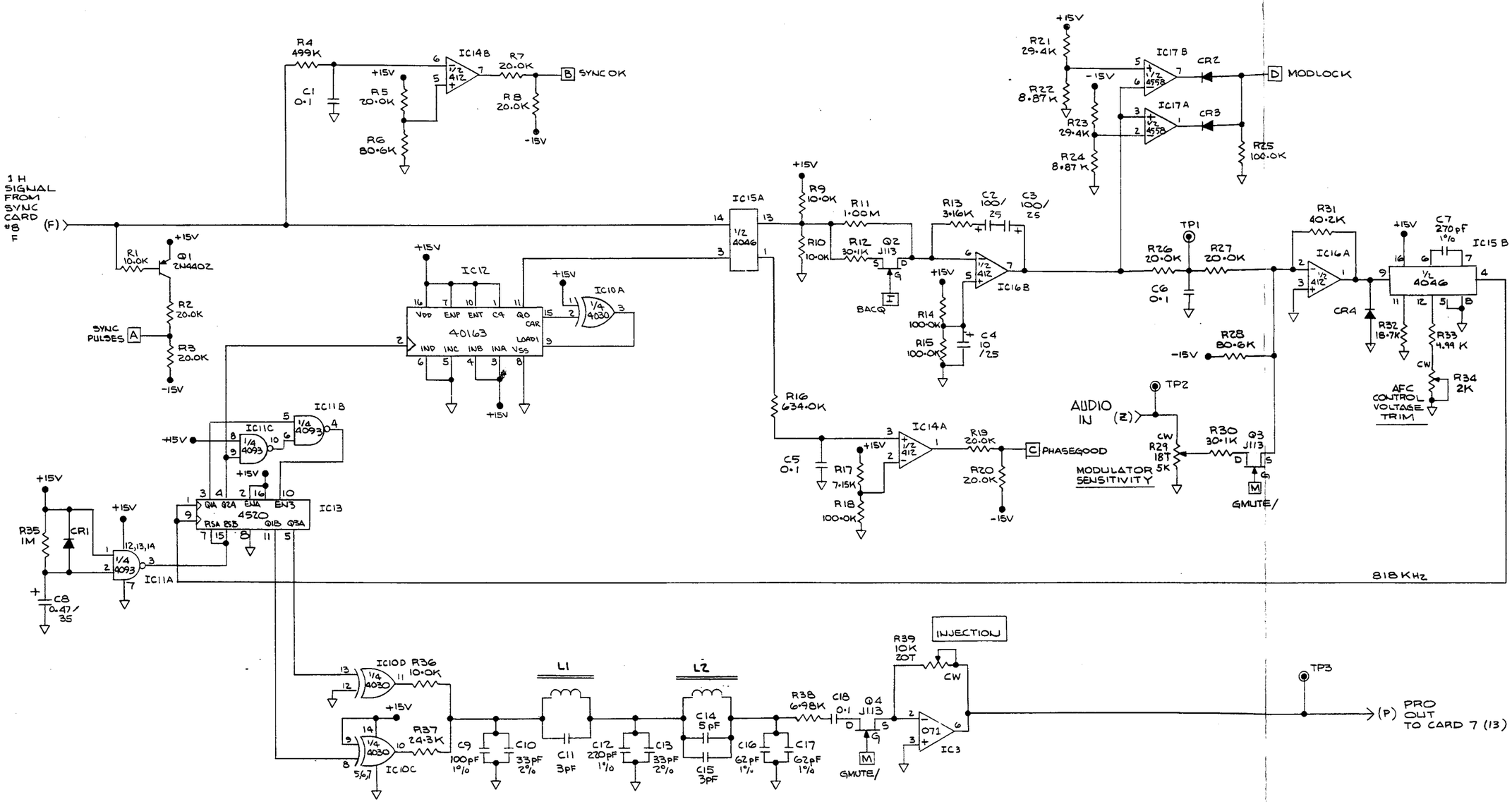


4. CUT OFF PIN #6 OF IC4 & 5 BEFORE INSERTING.
3. TIC MARKS INDICATE PIN 1 OF IC's, CATHODE OF DIODES, POSITIVE SIDE OF CAPACITORS, EMITTER OF TRANSISTORS.
2. USE COMPONENT MTG. PADS, P/N 15051-000 FOR C2, C3, C23, C24.
1. REFERENCE SCHEMATIC P/N 61004-000.

NOTES: (UNLESS OTHERWISE SPECIFIED)

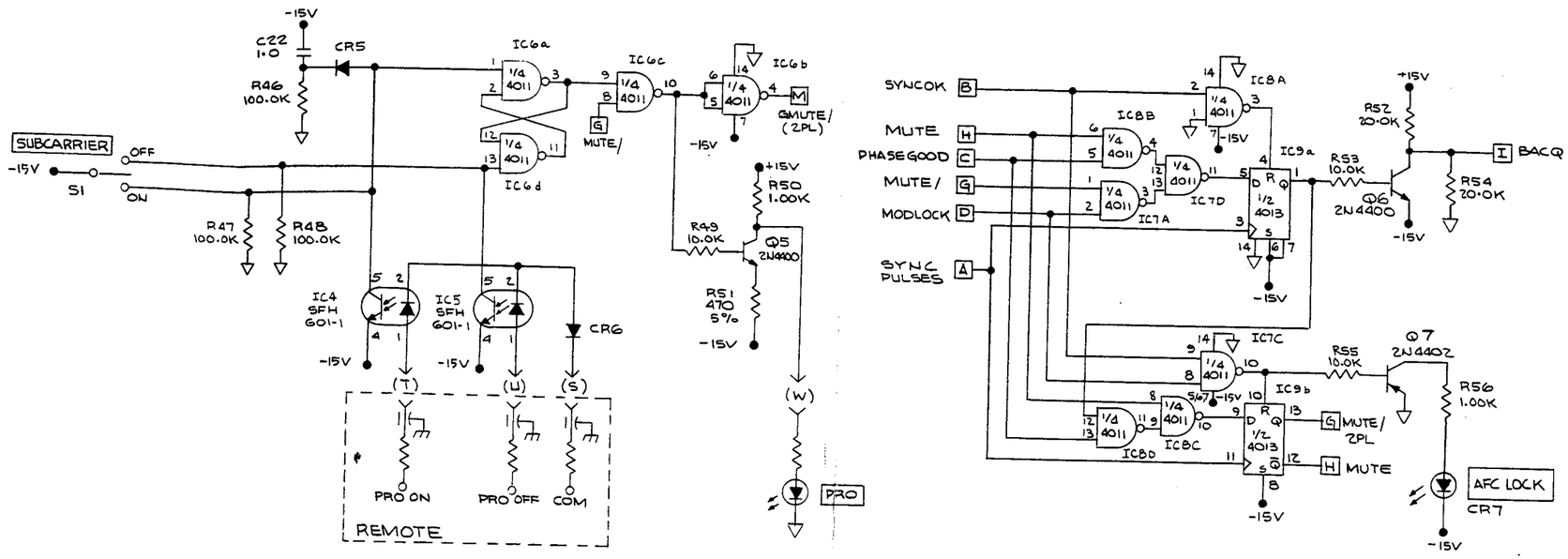
orban®

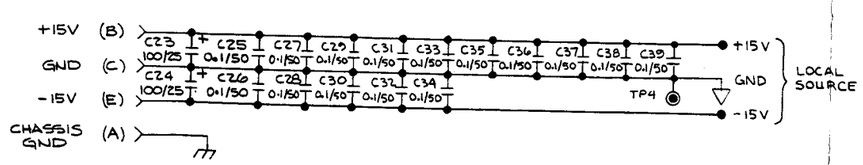
TITLE: PRINTED CIRCUIT ASSEMBLY
PRO CHANNEL MODULATOR CARD #10



orban®

TITLE:
SCHEMATIC
PRO MODULATOR CARD #10
61004-000-01, 1 OF 2





NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTORS ARE ± 1%, 1/8W, MF.
2. ALL CAPACITORS ARE IN MICROFARADS.
3. ALL DIODES ARE IN4148.

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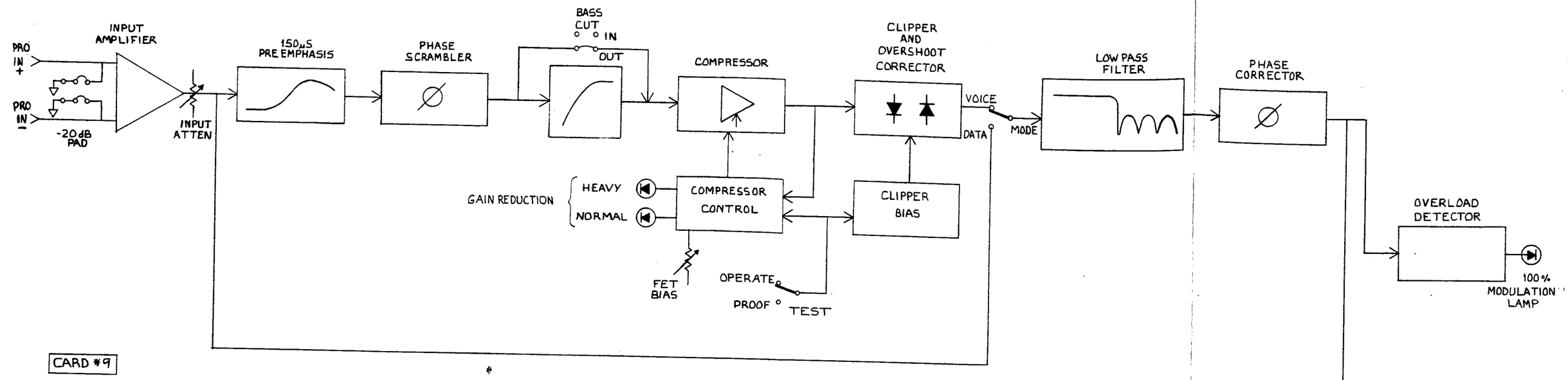
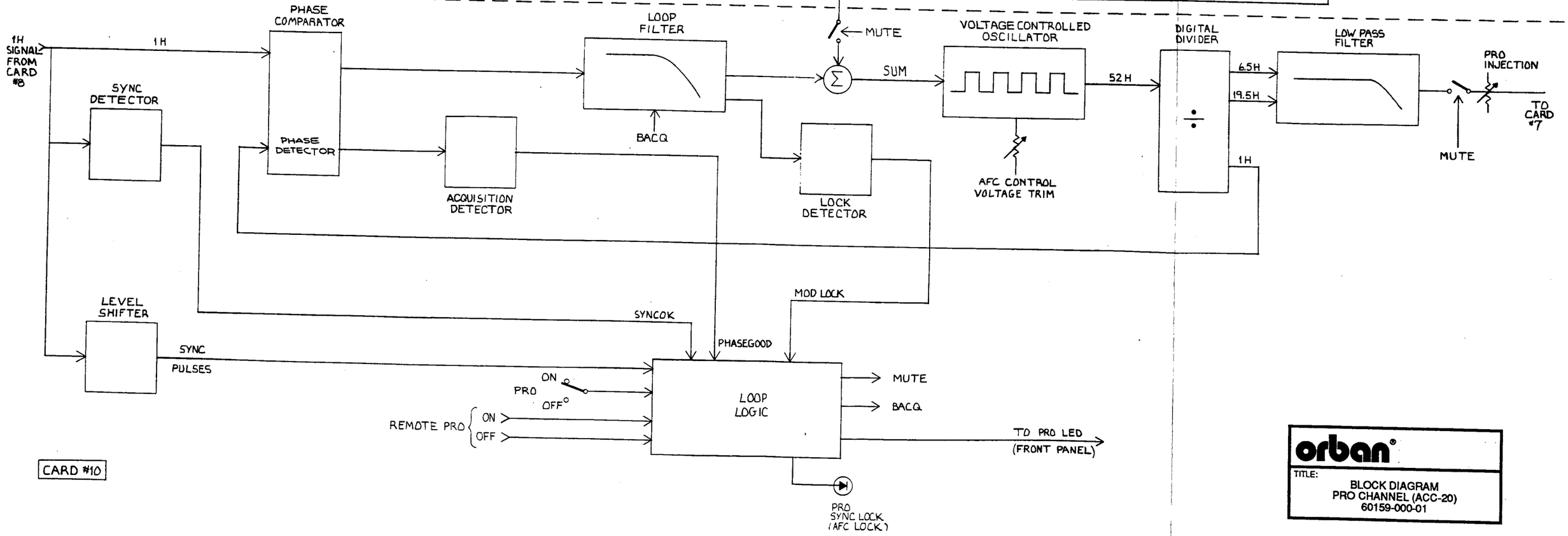
TITLE:
SCHEMATIC
PRO MODULATOR CARD #10
61004-000-02, 2 OF 2





orban®

TITLE:
BLOCK DIAGRAM
PRO CHANNEL (ACC-20)
60159-000-01

Warranty

United States Warranty

Limited Warranty

Valid only in the United States. We warrant Orban products against defects in material or workmanship for a period of one year from the date of original purchase for use, and agree to repair or, at our option, replace any defective item without charge for either parts or labor.

Important: This warranty does not cover damage resulting from accident, misuse or abuse, lack of reasonable care, the affixing of any attachment not provided with the product, loss of parts, or connecting the product to any but the specified receptacles. This warranty is void unless service or repairs are performed by an authorized service center. No responsibility is assumed for any special, incidental or consequential damages. However, the limitation of any right or remedy shall not be effective where such is prohibited or restricted by law.

Simply take or ship your Orban product prepaid to our service department. Be sure to include your sales slip as proof of purchase date. (We will not repair transit damage under the no-charge terms of this warranty). Orban will pay return shipping.

Note: No other warranty, written or oral is authorized for Orban products.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. Some states do not allow the exclusion of limitations of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above exclusion and limitations may not apply to you.

International Warranty

Bedingungen

Orban gewährt 1 Jahr Garantie ab Verkaufsdatum auf nachweisbare Material- und Fabrikationsfehler. Der Garantieanspruch erlischt bei unsachgemäßer Handhabung, elecktrischer oder mechanischer Beschhädigung durch mißbräuchliche Anwendung sowie bei unsachgemäßer Reparatur durch nichtautorisierte Werkstätten. Voraussetzung für die Garantieleistung ist die Vorlage der ordnungsgemäß durch den Fachhändler ausgefüllten Garantiekarte sowie der Kaufrechnung. Transport- und Portospesen, welche aus der Einsendung des Gerätes zur Garantiereparatur erwachsen, können von Orban nicht übernommen werden, das Risiko der Zusendung trägt der Kunde. Die Garantie wird ausschließblich für den ursprünglichen Käufer geleistet.

Warranty Conditions

Orban warrants Orban products against evident defects in material and workmanship for a period of one year from the date of original purchase for use. This warranty does not cover damage resulting from misuse or abuse, or lack of reasonable care, and inadequate repairs performed by unauthorized service centers. Performance of repairs or replacements under this warranty is subject to submission of this Warranty/Registration Card, completed and signed by the dealer on the day of purchase, and the sales slip. Shipment of the defective item for repair under this warranty will be at the customer's own risk and expense. This warranty is valid for the original purchaser only.

Conditions de garantie

Pour toute mise en œvre de garantie ou de service après-vente, vous devez vous adresser à votre revendeur. Notre société assure au revendeur le remplacement gratuit des pièces détachées nécessaires à la réparation pendant un an, à partir de la date de votre facture, sauf en cas de non respect des prescritions d'utilsation ou lorsqu' une cause étrangère à l'appareil est responsable de la défaillance. Les dispositions stipulées ci-dessus ne sont pas exclusives du bénéfice au profit de l'acheteur de la garantie légale pour défaut et vice cachés qui s'applique, en tout état de cause, dans les conditions des articles 1641 et suivants du Code Civil.

Condizioni di garanzia

L'Orban presta garanzia per un anne dalla data della vendita per difetti di materiale e fabbriccazione che possono essere provati. Il diritto di garanzia cessa in caso di manipolazione impropria, danneggiamento electtrico o meccanico attraverso i'uso non approriato e riparazione inesperta eseguita da officine non autorizzate. E' indispensabile, per la prestazione della garanzia, presentare la carta di garanzia debitamente riempita dal rivenditore autorizzato e la fattura di vendita. Spese di trasporto che risultano dall'invio dell'impianto per la riparazione in garanzia, non possono essere assunte dall'Orban i'invio è a rischio e pericolo del cliente. La garanzia verrà data solo al primo acquirente.

Condiciones de garantia

Orban concede 1 aňe de garantia por defectos comprobables de material o de fabricación a partir de la fecha de venta. El derecho de garantia caduca en caso de procederse a uno manipulación inadecuada en caso de producirse daño electrico o mecánico por uso indebido, así como también en caso de reparaciones inadecuados por parte de talleres no autorizados. La prestación de la garantia está sujeta a la presentación de la Tarjeta de Garantia rellenada correctamente por el vendedor autorizado, y de la factura de compra. Orban no assume ningún gasto de transporte o correo incurrido por el envio del aparato defectuoso para la reparación bajo garantia; el riesgo del envio ha de ser asumido por el cliente. La garantia se concede única y exclusivamente al comprador original.