Operating Manual

OPTIMOD-TV

Audio Processor

Model 8182A

orban®

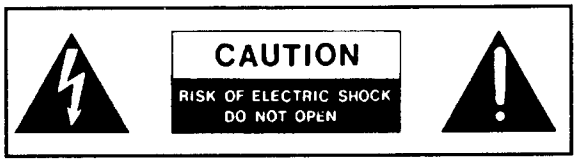
IMPORTANT NOTE: Refer to the unit's rear panel for your Model #.

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
8185A/UP	8185A + PRO Kit	BTSC TV Stereo Generator, 115V, Pro Channel Gen
8185A/EP	8185A + OPT-021 + PRO Kit	BTSC TV Stereo Generator, 230V, Pro Channel Gen
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
RET037	RET-037	8180 Connect Upgrade to accept SG
RET025	RET-025	8180A to 8182A Factory Upgrade
RET026	RET-026	8180/ST to 8182A/ST 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.

IMPORTANT SAFETY INSTRUCTIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Safety Instructions (European)

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

WARNING: THIS APPLIANCE MUST BE EARTHED.

The cores in the mains lead are coloured in accordance with the following code:

GREEN and YELLOW - Earth BLUE - Neutral BROWN - Live

As colours of the cores in the mains lead of this appliance may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The core which is coloured green and yellow must be connected to the terminal in the plug marked with the letter E, or with the earth symbol, (⏚), or coloured green, or green and yellow.

The core which is coloured blue must be connected to the terminal marked N or coloured black.

The core which is coloured brown must be connected to the terminal marked L or coloured red.

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

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

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

AC Power Cord Color Coding

Safety Instructions (German)

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

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

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

Gerät und Netzkabel keinen übertriebenen mechanischen Beaspruchungen aussetzen.

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

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

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

Safety Instructions (French)

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

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

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

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

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

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

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

Safety Instructions (Spanish)

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

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

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

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

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

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

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

Safety Instructions (Italian)

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

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

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

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

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

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

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

orban®

PLEASE READ THIS FIRST!

Manual

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

Please review the Manual, especially the installation section, before unpacking the unit.

Trial Period Precautions

If your unit has been provided on a trial basis:

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

1) Note the packing technique and save all packing materials. It is not wise to ship in other than the factory carton. (Replacements cost $35.00).
2) Avoid scratching the paint or plating. Set the unit on soft, clean surfaces.
3) Do not cut the grounding pin from the line cord.
4) Use care and proper tools in removing and tightening screws to avoid burring the heads.
5) Use the nylon-washered rack screws supplied, if possible, to avoid damaging the panel. Support the unit when tightening the screws so that the threads do not scrape the paint inside the slotted holes.

Packing

When you pack the unit for shipping:

Tighten all screws on any barrier strip(s) so the screws do not fall out from vibration. Wrap the unit in its original plastic bag to avoid abrading the paint. Seal the inner and outer cartons with tape.

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

- The Manual(s)
- The Registration/Warranty Card
- The Line Cord
- All Miscellaneous Hardware (including the Rack Screws and Keys)
- The Extender Card
- The Monitor Rolloff Filter(s) (OPTIMOD-AM only)
- The COAX Connecting Cable (OPTIMOD-FM and OPTIMOD-TV only)

Your dealer may charge you for any missing items.

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

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

Trouble

If you have problems with installation or operation:

1) Check everything you have done so far against the instructions in the Manual. The information contained therein is based on our years of experience with Optimod and broadcast stations.
2) Check the other sections of the Manual (consult the Table of Contents and Index) to see if there might be some suggestions regarding your problem.
3) After reading the section on Factory Assistance, you may call Orban Customer Service for advice during normal California business hours. The number is (1) 510/351-1001.

THIRD EDITION (January 1990)

This manual applies to OPTIMOD-TV Model 8182A having Serial Numbers of 780,000 or above. It is not directly applicable to the previous OPTIMOD-TV Model 8180A due to significant changes made to incorporate the Loudness Controller circuitry and the Hilbert-Transform Clipper.

This manual also incorporates minor changes and corrections to the First and Second Editions (November 1983; February 1986) of the OPTIMOD-TV Manual.

In addition, this Manual has been revised to explain the relationship between the 8182A and the other parts of the Orban BTSC Television Stereo system, including the 8185A Stereo Generator, the 8182A/SAP Separate Audio Program Generator, and the 8185A/PRO (previously called "ACC-020") Professional Channel Generator (which plugs into the 8185A mainframe). Separate manuals are provided with all of these products.

Note in particular that integrated setup instructions for OPTIMOD-TV Model 8182A and the Orban 8185A are provided in the manual for the Stereo Generator, not in this manual. If you are installing the 8182A and the 8185A, the instructions provided in Part 4 of this Manual (which are more general) should be ignored, and the instructions in Section 2 of the 8185A Manual should be followed instead.

If OPTIMOD-TV is installed in the "split" (sometimes called "dual-chassis") configuration using a Model 8182A/ST Accessory Chassis, please refer to the separate manual supplied with that unit, which carries basic service information. Setup instructions for the 8182A/ST are found in Part 4 of this 8182A Manual, and also in Section 2 of the 8185A Manual. The 8182A Manual is frequently referenced in the manual for the Accessory Chassis and should be at hand during installation and setup procedures.

orban®

8182A

Manual Update

LED Meter Display Upgrade

Note: We have redesigned the 8182A meter display, upgrading the analog meters to LED bar-graph meters. To do this upgrade, we have replaced the meter resistor card documented in the manual. Otherwise, all information provided in the 8182A manual is valid for your 8182A unit.

This document provides a Circuit Description, Parts List, Schematic and Assembly Drawing for the new 8182A meter display board.

Circuit Description of 8182 Bargraph

LED Bargraph GAIN REDUCTION Meters

The GAIN REDUCTION meters each consist of ten comparators with open collector outputs. The ten LEDs in the bargraph are connected in series, and a current source forces a constant current into the LED string. As the magnitude of the input voltage to the comparators decreases, they progressively shunt to the −15V rail the current that would ordinarily flow through the LEDs, turning off all LEDs closer to the −15V rail. The comparators are biased with equal voltage increments, producing a meter whose scale is linear. Because the gain control voltage is linear in dB, this produces a dB-linear meter scale.

A 250Hz "dither" signal is injected into the reference voltage string, modulating the turn-on threshold of each comparator and causing the LEDs to appear to smoothly fade on and off instead of switching abruptly.

Component-Level Description:

All four meters are electrically identical. However, the LIMITING meter has a different front-panel scale (0 to 5dB instead of +10 to −15dB) and is driven from a differential amplifier so it can indicate the difference between the slow component and the peak-held TOTAL component of the master gain reduction. We will describe Meter 1 (the TOTAL meter).

Current source Q1, R7, R5, R6, CR5 applies a constant current to the series-connected diodes in LED assembly CR1. A string of ten comparators IC1, IC2, IC4-A, IC4-B, receives the negative-going dB-linear gain reduction voltage. A voltage divider string biases the comparators with DC reference voltages from −0.0746 to −0.746VDC in 0.0746V steps. In meters 1, 2, and 4 each 0.0746V step corresponds to 2.5dB additional gain reduction. In meter 2, each 0.0746V step corresponds to 0.5dB additional gain reduction. When the gain reduction is less than the first step (2.5dB or 0.5dB, depending on meter), the gain reduction voltage is less than 0.0746V and the outputs of all comparators are active negative, shunting current from the series-connected LED string. As the gain reduction increases, the output of each comparator in turn becomes open collector and current is permitted to flow in the LED string until it encounters a comparator whose output is still active negative, at which point the active comparator shunts the current away from the rest of the LEDs.

A 250Hz triangle-wave "dither" signal is injected into the reference voltage string through R1. This AC signal modulates the turn-on threshold of each comparator, causing the LEDs to appear to smoothly fade on and off instead of switching abruptly.

IC6 is the 250Hz dither oscillator. IC6-B is an integrator charged from the output of IC6-A, which acts as a comparator. Positive feedback from the output of IC6-B through R2 causes the output of IC6-A to abruptly change state each time the output of IC6-B reaches approximately ±0.046V. The output of IC6-A is thus a square wave, and IC6-B integrates this square wave to form the desired triangle wave.

LED METER DISPLAY BOARD

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Capacitors						
C1,2	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C3	Met. Polyester, 63V, 5%; .01uF	21442-310	WIM	MKS2635.01		
C4,5	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C6	Alum., Radial, 63V, -20% +100%; 2.2uF	21209-522	SPR	502D 225G063BB1C	PAN	
C7	Ceramic Disc, 1kV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
Diodes						
CR1	LED Array, +7.5 TO -15.0	25160-002	ORB			
CR2	LED Array, -0.5 TO -5	25160-004	ORB			
CR3,4	LED Array, +7.5 TO -15.0	25160-002	ORB			
CR6	LED, Yellow	25106-001	HP	HLMP-1400	GI	
CR7	LED, Red	25106-003	HP	HLMP-1300	GI	
CR8	LED, Yellow	25106-001	HP	HLMP-1400	GI	
CR9	LED, Green	25106-002	HP	HLMP-1503	GI	
Integrated Circuits						
IC1-5	Quad Comparator	24710-302	NAT	LM339		
IC6	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC7-11	Quad Comparator	24710-302	NAT	LM339		
IC12	Linear, Single Opamp	24013-202	TI	TL071CP		
Miscellaneous						
J1	Cable Assy, Flat, 14 Pin, 18.5 inches	40010-004	ORB			
J2	Cable Assy, Flat, 14 Pin, 15 inches	40010-003	ORB			
Transistors						
Q1-4	Transistor, Signal, PNP	23002-101	MOT	2N4402	FSC	
Resistors						
R47,48	Trimpot, Cermet, 1 Turn; 2K	20509-220	BEK	72XR2K	BRN	
Switches						
S2	Switch, Rotary, 1P12T	26078-306	CTS	212-Series		

FOOTNOTES:
(1) See page J-39 of the Manual for Vendor 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

Orban Model 8182A

LED Meter Display Board - Capacitors, Diodes, Integrated Circuits, Miscellaneous, Transistors, Resistors, Switches.

BACKPLANE

METER RESISTOR PCB

FRONT PANEL

CARD #3 (W) → J1 1 → R45 3.57K 1%

CARD #4 (W) → J1 2 → R41 3.57K 1%

CARD #6 (K) → J1 3 → R46 2.32K 1% → R48 2K

CARD #6 (R) → J1 4 → R44 2.32K 1% → R43 9.76K 1% → R47 2K

CARD #8 (X) → J1 9 → R42 9.76K 1%

CARD #9 (X) → J1 10 → R36 31.6K 5%

CARD #7 (W) → J1 5 → R35 31.6K 1%

CARD #7 (H) → J1 7

CARD #7 (U) → J1 6

CARD #7 (V) → J1 8

+15V, POWER SUPPLY (6) → J2 14 → +15V → R22 100.0K 1%

-15V, POWER SUPPLY (8) → J2 11 → -15V → R21 100.0K 1%

GROUND, POWER SUPPLY (7) → J2 12

CARD #5 (W) → J2 4 → R29 499Ω 1% → METER 4

CARD #5 (X) → J2 3 → R30 10.5K 1% → METER 3

METER 2 -

CARD #5 (Y) → J2 1 → METER 2 +

R38 10.5K 1% → METER 1

CARD #5 (Z) → J2 2 → "GATE", RED → CR7 RED

CARD #6 (W) → J2 5 → CR6 AMBER → "L H-F LIMIT", YELLOW

CARD #6 (X) → J2 6 → CR8 AMBER → "R H-F LIMIT", YELLOW

-22 V, POWER SUPPLY (4) → J2 13 → R39 1.5K .5W, 5% → "POWER", GREEN → CR9 GREEN

CARD #7 (F) → J2 7

GROUND, POWER SUPPLY (7) → J2 10

CARD #7 (L) → J2 8

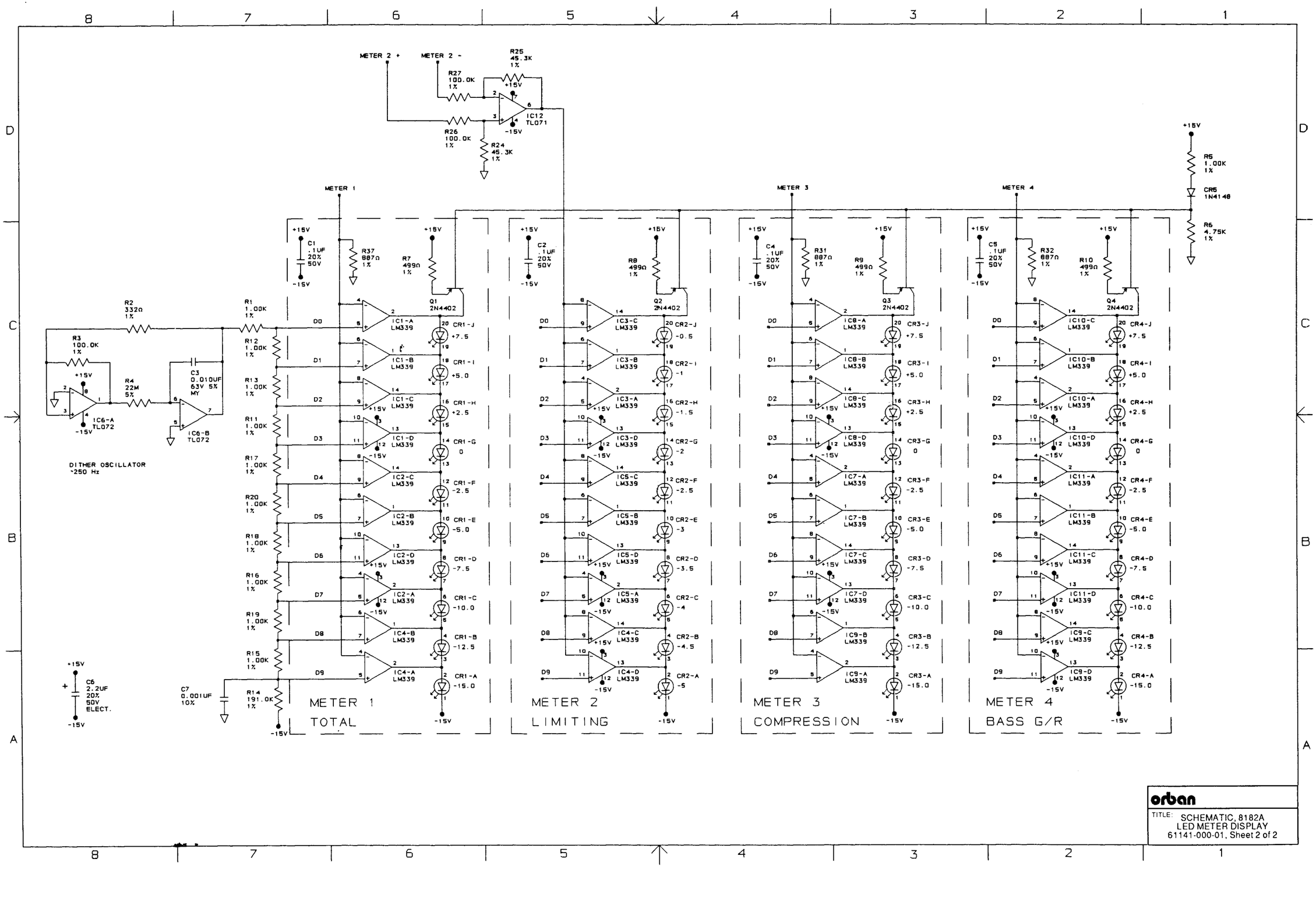
CARD #7 (K) → J2 9

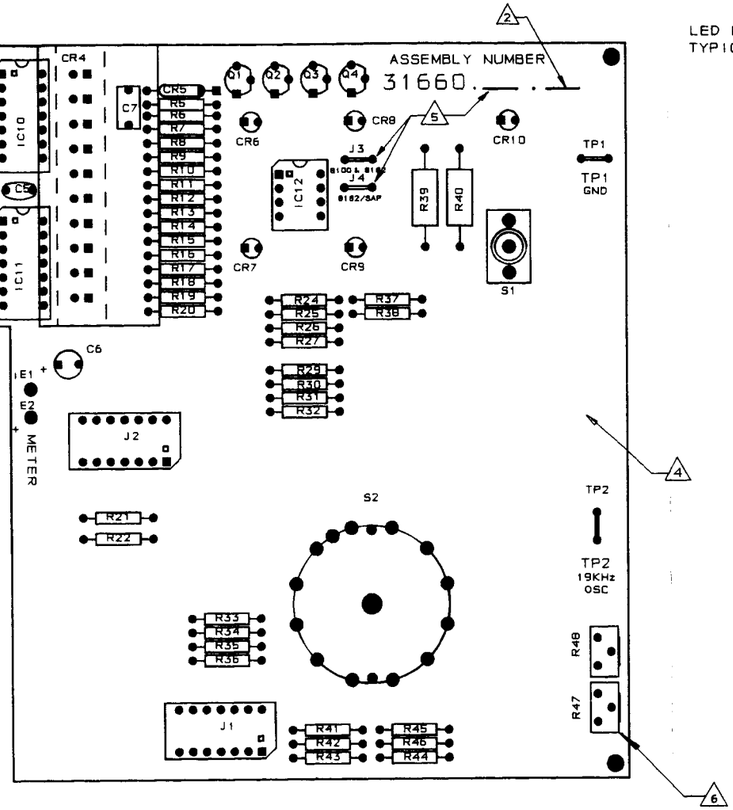
S2 (ROTARY) "METER FUNCTION"

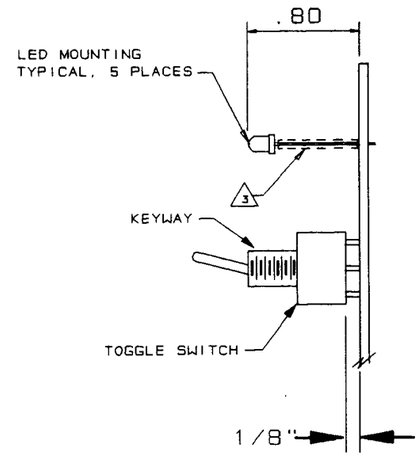
1 "L INPUT BUFFER"
2 "R INPUT BUFFER"
3 "L COMPRESSOR OUT"
4 "R COMPRESSOR OUT"
5 "L FILTER OUT"
6 "R FILTER OUT"
7 "L SYSTEM OUT"
8 "R SYSTEM OUT"
9
10
11 "+15 VDC"
12 "-15 VDC"
13 → E2 → + MS VU METER −

E1 → TP1 → GND

orban	
TITLE:	SCHEMATIC, 8182A LED METER DISPLAY 61141-000-01, Sheet 1 of 2


METER 2 +
METER 2 -
R25 45.3K 1%
R27 100.0K 1%
R26 100.0K 1%
R24 45.3K 1%
IC12 TL071
+15V
-15V
METER 1
METER 3
METER 4
R5 1.00K 1%
CR5 1N4148
R6 4.75K 1%
C1 .1UF 20% 50V
C2 .1UF 20% 50V
C4 .1UF 20% 50V
C5 .1UF 20% 50V
R37 887Ω 1%
R7 499Ω 1%
R8 499Ω 1%
R31 887Ω 1%
R9 499Ω 1%
R32 887Ω 1%
R10 499Ω 1%
Q1 2N4402
Q2 2N4402
Q3 2N4402
Q4 2N4402
R2 332Ω 1%
R1 1.00K 1%
R3 100.0K 1%
R4 22M 5%
C3 0.010UF 63V 5% MY
IC6-A TL072
IC6-B TL072
DITHER OSCILLATOR ~250 Hz
R12 1.00K 1%
R13 1.00K 1%
R11 1.00K 1%
R17 1.00K 1%
R20 1.00K 1%
R18 1.00K 1%
R16 1.00K 1%
R19 1.00K 1%
R15 1.00K 1%
R14 191.0K 1%
C7 0.001UF 10%
C6 2.2UF 20% 50V ELECT.
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
IC1-A LM339
IC1-B LM339
IC1-C LM339
IC1-D LM339
IC2-C LM339
IC2-B LM339
IC2-D LM339
IC2-A LM339
IC4-B LM339
IC4-A LM339
CR1-J +7.5
CR1-I +5.0
CR1-H +2.5
CR1-G 0
CR1-F -2.5
CR1-E -5.0
CR1-D -7.5
CR1-C -10.0
CR1-B -12.5
CR1-A -15.0
IC3-C LM339
IC3-B LM339
IC3-A LM339
IC3-D LM339
IC5-C LM339
IC5-B LM339
IC5-D LM339
IC5-A LM339
IC4-C LM339
IC4-D LM339
CR2-J -0.5
CR2-I -1
CR2-H -1.5
CR2-G -2
CR2-F -2.5
CR2-E -3
CR2-D -3.5
CR2-C -4
CR2-B -4.5
CR2-A -5
IC8-A LM339
IC8-B LM339
IC8-C LM339
IC8-D LM339
IC7-A LM339
IC7-B LM339
IC7-C LM339
IC7-D LM339
IC9-B LM339
IC9-A LM339
CR3-J +7.5
CR3-I +5.0
CR3-H +2.5
CR3-G 0
CR3-F -2.5
CR3-E -5.0
CR3-D -7.5
CR3-C -10.0
CR3-B -12.5
CR3-A -15.0
IC10-C LM339
IC10-B LM339
IC10-A LM339
IC10-D LM339
IC11-A LM339
IC11-B LM339
IC11-C LM339
IC11-D LM339
IC9-C LM339
IC9-D LM339
CR4-J +7.5
CR4-I +5.0
CR4-H +2.5
CR4-G 0
CR4-F -2.5
CR4-E -5.0
CR4-D -7.5
CR4-C -10.0
CR4-B -12.5
CR4-A -15.0
METER 1
TOTAL
METER 2
LIMITING
METER 3
COMPRESSION
METER 4
BASS G/R
orban
TITLE: SCHEMATIC, 8182A
LED METER DISPLAY
61141-000-01, Sheet 2 of 2





6 FOR -002 VERSION ONLY: ADD JUMPERS (TEST POINT WIRES) BETWEEN PADS 1 & 3 (THE "OUTSIDE" PADS) INSTEAD OF THE POTS, R47 & R48.

5 REFER TO TABLE FOR JUMPERS. J3 IS INSTALLED FOR THE 8100 & THE 8182. J4 IS INSTALLED FOR THE 8182/SAP ONLY. MARK VERSION NUMBER IN SPACE PROVIDED.

4 MARK MODEL NUMBER (8100A, 8182A, OR 8182A/SAP) ON SOLDER SIDE WHERE INDICATED.

3 USE TEFLON TUBING ON ALL LED LEADS.

2 MARK REVISION LEVEL IN SPACE PROVIDED.

1. SQUARE PADS INDICATE PIN 1 OF CONNECTORS, CATHODE OF DIODES, POS. SIDE OF CAPS., PIN 1 OF ICS & PIN 1 OF LED ARRAYS.

NOTES: (UNLESS OTHERWISE SPECIFIED)

COMPONENT SIDE

VERSION TABLE		
VERSION	MODEL NUMBER	JUMPER 5
000	8100A	J3
001	8182A	J3
002	8182A/SAP	J4 6

orban

TITLE: PCB ASSY, 8182A
LED METER DISPLAY
31660-001-02

Operating Manual

OPTIMOD-TV

Audio Processor

Model 8182A

orban®

This manual is part number 95035-000-05C
150 - FB - 3/95

orban
H A Harman International Company
1525 Alvarado Street, San Leandro, CA 94577 USA • Phone (1) 510/351-3500 Fax (1) 510/351-1001

Table of Contents

PART 1:
Introduction

Function of OPTIMOD-TV: OPTIMOD-TV is an integrated signal-processing system which replaces conventional compressors, limiters, and clippers. It is an adaptation of the OPTIMOD-FM Model 8100A to TV audio, and offers the TV broadcaster the same superb audio quality that has made the 8100A so popular among FM radio broadcasters.

Briefly, the OPTIMOD-TV system performs the following functions:

1. It rides gain over a range of as much as 25dB, compressing dynamic range and compensating for gain riding errors on the part of operators. The amount of dynamic range reduction ordinarily produced is adjustable. When OPTIMOD-TV is operated at its optimum release time setting, gain riding and compression are virtually undetectable because of advanced program-controlled time constants, level-dependent gating, and multiband compression.

2. It controls excessive perceived loudness by means of a complex loudness-estimating circuit that reduces the gain of the compressor VCA's when necessary. The loudness controller circuit can be activated and defeated by remote control or locally as required. This circuit is licensed from CBS Technology Center and incorporates the results of their second major loudness research project (1978-1980). On-air tests of the controller have indicated that it substantially reduces or eliminates viewer complaints regarding excessively loud commercials.

3. It controls potential interference to video and/or future stereo services by means of bandwidth-limiting 15kHz lowpass filters incorporating full overshoot compensation. OPTIMOD-TV thus provides extremely tight control over peak modulation, preventing overmodulation and controlling its output spectrum simultaneously.

4. The OPTIMOD-TV compressor is a dual-band design which can be operated with the bands independent of each other ("independent"), or such that the bands are coupled and ordinarily track each other ("wideband"). When operated in "independent" mode, OPTIMOD-TV makes audio quality more consistent by correcting frequency balances between bass and midrange material. When operated in "wideband" mode, it will preserve frequency balances and will produce an output which sounds like its input.

5. It prevents peak overload and overmodulation due to the effects of the preemphasis curve.

Each part of the OPTIMOD-TV system has been precisely engineered to be compatible with all other parts to achieve optimum performance. The basic OPTIMOD-TV is a stereo unit with active balanced +10dBm outputs. Internal jumpers determine if the output is to be flat or preemphasized.

In general, OPTIMOD-TV should be fed unprocessed audio. However, additional compression and/or other audio processing may be desirable if applied to individual microphone channels in a live production environment, or to other sources requiring special processing.

OPTIMOD-TV as ordinarily sold is fully equipped for stereo operation. Little cost would be saved by eliminating components for the second channel, and future conversion would be somewhat inconvenient. In addition, the second channel provides a certain measure of redundancy and permits utilization of card-swapping techniques to diagnose problems.

An accessory port is included standard to interface the unit with the Orban 8182A/SG BTSC Stereo Generator.

Comparison With OPTIMOD-FM: OPTIMOD-TV (Model 8182A) is conceptually similar to OPTIMOD-FM (Model 8100A). If you are familiar with the 8100A, this comparison may be of interest. Otherwise, skip to the next section.

The following characteristics are different:

-- The stereo generator (Card #7) has been replaced with a two-channel audio output buffer card to drive an external BTSC television stereo generator. While the 8182A can drive any stereo generator equipped with conventional Left/Right or Sum-And-Difference audio inputs, best results are obtained when the 8182A is mated with the Orban 8185A BTSC Stereo Generator. This is because the lowpass filters within the 8185A were specifically designed to complement the lowpass filters which already exist within the 8182A.

In addition, the 8185A interfaces to the 8182A by means of a special multipin rear-panel connector, placing the first part of the 8185A lowpass filtering before the 8182A's preemphasis, high frequency limiter, and Hilbert-Transform Clipper. This interleaving of stereo generator and audio processor circuitry prevents stray 15,734Hz which may be present on the program line from spuriously triggering the audio processor or causing intermodulation distortion within its peak limiting circuitry.

-- The output wiring (including the RFI filter card) has been changed to accomodate stereo audio.

-- Since the stereo generator is omitted, the STEREO/MONO mode switch and indicator lamp have been excluded. The rotary switch controlling the diagnostic VU meter excludes positions relating to the stereo generator but has new monitor points for the system outputs.

-- The compressor gating circuitry has been altered to prevent the compressor's gain from recovering beyond -10dB in absence of program. This prevents noise rush-up, especially when the audio source is 16mm optical film.

(The gain of the 8100A was permitted to slowly recover to 0dB since source material used in FM is typically much quieter.)

To avoid operator confusion, three of the four Gain Reduction meters (Total Master G/R, Compressor Master G/R, and Total Bass G/R) have new scales where 10dB gain reduction is represented as "0dB".

-- Both "linear" and "exponential" compressor release characteristics have been made available. (The release shape of the 8100A is essentially linear.)

In "linear" mode, the compressor releases at a constant number of dB per second. In "exponential" mode, the release starts slowly and speeds up as it progresses. This is useful when the "open" sound of slow release is desired, yet large input level changes must be followed quickly.

-- A sophisticated peak limiting circuit called the "Hilbert-Transform Clipper" has been developed specifically for TV applications (where voice material is dominant). This "clipper" replaces the simpler variable-threshold diode clipper used in the 8100A's distortion-cancelled clipper circuit.

The Hilbert-Transform Clipper circuit permits harmonic distortion to occur only on program material above 4kHz, substantially reducing audible clipping distortion on voice, particularly from optical sound tracks. Yet the 8100A's excellent performance on music is retained.

The left and right Hilbert-Transform Clipper cards reside in slots #0 and #1 respectively, which are not used in the 8100A.

-- Loudness control circuitry has been added. The loudness controller resides in slot #2, which is not used in the 8100A.

Comparison With OPTIMOD-TV Model 8180A: If you are familiar with the 8180A, this section may be of interest. Otherwise, skip to the next section.

Generally, the 8182A is very similar to the 8180A except for the added Loudness Controller, Hilbert-Transform Clippers, and the various minor changes and modifications necessary to implement these new features. Certain minor changes were made in response to new knowledge about TV stereo, especially with regard to companding requirements.

-- The Loudness Controller circuit has been added in card slot #2.

-- New Hilbert-Transform Clippers have been added in card slots #0 and #1 to replace the clipping circuitry formerly located on cards #8 and #9.

Further details are provided at the beginning of **Appendix A (System Description).**

Split Configuration: An alternate, dual-chassis system configuration permits the Dual-Band Compressor to be operated separately from the remainder of the circuitry. This permits placing the Dual-Band Compressor at the studio side of the STL (telephone line, dual microwave, or FM subcarrier on a video STL) to protect the STL from overmodulation.

This configuration consists of an OPTIMOD-TV Model 8182A in conjunction with an Accessory Chassis (with power supply) and two jumper cards. Cards #2, #3, #4, and #5 are removed from the 8182A (Main) Chassis and installed in the Accessory Chassis. Card slots #3 and #4 in the Main Chassis are then fitted with the jumper cards. The Accessory Chassis is known as the Model 8182A/ST.

If the gain between the output of the Accessory Chassis and the input of the Main Chassis cannot be maintained within a 0.75dB window, we recommend using the full single-chassis OPTIMOD-TV at the transmitter, and using an Orban Compressor/Limiter (such as the 424A) at the studio side of the STL to protect against STL overload. The studio compressor/limiter is adjusted so that gain reduction is not produced unless excessive levels are output from the switcher or console.

Simplified System Description: OPTIMOD-TV consists of seven basic blocks:

1. Input Conditioning Filter: This consists of an allpass phase scrambler to make peaks more symmetrical (thus reducing clipping distortion and permitting higher loudness), and a 30Hz 18dB/octave highpass filter to prevent subsonic information from disturbing the operation of the audio processing or exciters' AFC's. Even if an AFC doesn't unlock, it can attempt to "track" subsonic information, producing IM distortion. The 30Hz highpass filter can be defeated (although we have purposely made it slightly inconvenient to do so); the phase scrambler is an essential part of the system and is non-defeatable.

2. Dual-Band Compressor: This consists of two compressors in parallel: "Bass" which processes audio below below 200Hz (12dB/octave crossover), and "Master" which processes above 200Hz. A BASS COUPLING control adjustable by the user determines if the two bands will operate discriminately ("independent" mode), or if the "Bass" band will be forced to track the "Master" band ("wideband" mode), preserving frequency balances. Intermediate bass coupling settings are also available.

Even in "wideband" mode, the bass control loop is still active. Therefore, heavy bass will cause a momentary reduction in the gain of the "Bass" band rather than forcing gain reduction of the entire signal (as in a true wideband system), thus avoiding pumping.

Time constants and other parameters of the Dual-Band Compressor have been adjusted so that the summed and preemphasized output of the two bands can be directly applied to the peak limiting system. No further gain reduction is required for distortion control, and maximum naturalness is preserved.

The release time of the "Master" band only is adjusted with the RELEASE TIME control, thus permitting loudness/fatigue tradeoffs according to your needs.

Gain reduction in both "Master" and "Bass" compressors is metered by edgewise-reading meters calibrated with a dB-linear scale. To indicate that the normal gain reduction is 10dB, this point has been calibrated as "0dB gain reduction" on the meters, with the scale extending from +10 to -15dB gain reduction.

No attempt has been made to make these meters extremely accurate. Their readings may disagree with the actual gain reduction by as much as ±2dB. This accuracy is fully adequate for the purpose, since the amount of gain reduction varies widely with variations in program material and operator gain riding.

A GATING function is provided which prevents noise rush-up during program pauses (particularly with noisy 16mm optical sound tracks) and makes the 25dB gain reduction range usable. The GATING function is designed such that the gain does not get "stuck" forever in the 0 to 15dB gain reduction region, so low-level program material is eventually increased in level. Since gain recovery is slow in GATED mode, the gradual increase in level is essentially imperceptible.

In GATED mode (GATE lamp illuminated) it is normal for the meters to drift slowly to "0". The meters will recover towards "+10" when the program material is above the gate threshold but of a level insufficient to produce 10dB G/R.

The output level of the compressor is determined by the CLIPPING control. This control sets the drive level to the subsequent high-frequency limiter and clipper, thus determining the amount of limiting and clipping.

3. Preemphasis And High Frequency Limiter: The summed outputs of the two compressors are applied to a phase corrector, 24dB/octave 15kHz lowpass filter, preemphasis network, and high-frequency limiter. The purpose of the lowpass filter is to prevent out-of-band components from affecting the operation of the high-frequency limiter and to avoid intermodulation between out-of-band frequency components and in-band frequency components in the clipper. Phase correction reduces the peak level increase caused by filter ringing and preemphasis to the theoretical minimum, thus reducing the amount of clipping.

The high-frequency limiter is controlled by high frequencies only (rather than by the peak level of the preemphasized signal), thus eliminating any possibility of modulation of high frequency content by low frequency material.

The threshold of limiting of the high-frequency limiter is user-adjustable over a 3dB range, permitting brightness and high frequency distortion to be traded off according to your needs. Because the peak limiting system incorporates IM distortion cancellation, substantially more clipping can be accomplished without objectionable distortion than in conventional systems, and significantly improved high frequency power handling capability is achieved.

4. Loudness Controller: The concept of Loudness is different from the concept of Level. Loudness is subjective sound intensity. It has no physical reality; it is what the listener perceives in his mind. Level, on the other hand, can be measured in many objective ways: a VU meter and a PPM are two common level indicators in broadcast. No common level meter can provide a reading which correlates well with Loudness.

CBS Technology Center, in experiments over the course of some 20 years, has developed a technique of measuring Loudness by means of complex electronic circuitry. This technique provides results which correlate quite well to how loud a panel of listeners judges a sound to be.

Ordinarily, gain reduction in OPTIMOD-TV is determined by the compressor control circuitry. However, Loudness can be controlled by using the CBS measurement technique: If the loudness exceeds a preset threshold, then the loudness controller will activate a feedback loop to further reduce the gain as necessary. This is the technique used in OPTIMOD-TV; it is the most sophisticated known technique for measuring and controlling the loudness of broadcast audio.

To estimate the perceived loudness, the preemphasized outputs of OPTIMOD-TV are summed, deemphasized, and fed into seven parallel filters, covering the frequency range of approximately 250Hz to 15kHz. (Alternately, the unpreemphasized compressor outputs can be used to drive the Loudness Controller when the main processor outputs are unavailable -- in a split-chassis configuration, for example.)

The region below 250Hz is not treated because the ear is relatively insensitive to energy in this region, Also, if energy below 250Hz were dominant, gain would almost certainly be under the control of the compressor control circuitry.

The output of each filter is rectified and the DC output currents of the rectifiers are summed, applied to a threshold circuit (to determine where the loudness controller takes over from the compressor), and then fed into the master compressor control voltage integrator. The seven filters have different gains which are chosen so that if the filters' inputs were all driven from a swept sine wave, then the summation of the filters' rectified outputs would closely approximate the sensitivity of the ear as a function of frequency. In addition, the fact that the filters are summed together simulates a property of the ear called "loudness summation": If a given amount of energy in a complex sound is spread over several frequency bands, it will sound louder than if it is concentrated in one band only.

Because certain sounds in entertainment programming (pistol shots, explosions, or screeching tires, for example) are supposed to be loud for dramatic impact, we have made the loudness controller defeatable locally or by remote control. It may be activated or defeated manually or by means of the automation computer as desired.

5. "Hilbert-Transform Clipper": The Hilbert-Transform Clipper provides the peak limiting function, and contains filters to assure that the clipping does not introduce out-of-band frequency components above 19kHz.

The output of the high frequency limiter is applied to a feedforward analog computation circuit which develops control voltages for a pair of VCA's, one of which handles low frequencies and one of which handles high frequencies. The "clipping", which is characterized by essentially instantaneous attack and release times, is effected by the VCA's as controlled by the output of the analog computer. The control voltage on the VCA's is conditioned by means of a patented algorithm which permits no harmonic distortion to be introduced on frequencies below 4kHz, yet permits frequencies above 4kHz to produce harmonic distortion. Simultaneously, IM distortion below 2.2kHz is sharply cancelled by an adaptation of the patented Orban feedforward distortion-cancelling filter to this circuit topology.

The result is very low perceived distortion on both voice and music. Voice is most severely degraded by harmonic, not IM, distortion. No harmonic distortion is produced in the voice frequency range, keeping voice clean. Sibilance distortion is eliminated by the distortion-cancelling filter. In the frequency range in which music has substantial energy (particularly after preemphasis), IM distortion is minimized, optimizing music reproduction as well.

Since the operation of this circuit is complex, further details will be postponed until **Appendix A: System Description.**

6. Frequency-Contoured Sidechain (FCS) Overshoot Corrector: The output of the Hilbert-Transform Clipper contains overshoots due to the addition of the distortion-cancelling signal, and to unavoidable overshoots in its integral 15kHz lowpass filter. These overshoots must be eliminated without adding out-of-band frequency components. This is done in the FCS Overshoot Corrector.

The FCS circuit first derives that part of the signal exceeding the 100% modulation point by means of a "center-clipper". If these overshoots were then subtracted from the input signal, the overshoots would be cancelled -- in fact, doing so would be equivalent to simple clipping. Unfortunately, this can't be done because the overshoots contain out-of-band frequency components.

The overshoots are therefore lowpass filtered to eliminate out-of-band components. If the overshoot filter had a flat response to its cutoff frequency, this filtering action would reduce the amplitude of high-frequency overshoots (by removing out-of-band harmonics which make the overshoots "spikey"). This would result in incomplete cancellation of the overshoots after subtraction. The overshoot filter is therefore designed to have a rising response at 15kHz, effectively increasing the gain of the fundamentals of the higher-frequency overshoots and compensating for the fact that their harmonics have been removed. The overshoot extractor and this filter are the "Frequency-Contoured Sidechain".

The overshoot filter has phase shift. Phase shift networks are therefore included in the main path to make sure that the overshoot subtraction process works correctly, and that the overall FCS system has constant time delay.

The rising response of the overshoot filter means that essentially no extra subtraction gain (compared to the system operated without the filter as a simple differential clipper) is required. Any low frequency IM introduced by the FCS circuit is therefore no worse than the low-frequency IM caused by a simple clipper.

Because the FCS circuit is an instantaneous system and uses no gain reduction or dynamic filtering, it causes neither pumping nor dulling of program material.

7. Stereo Generator Interface Port And Line Amplifier/Deemphasis: A special rear-panel connector is provided to interface the 8182A to the Orban 8182A/SG BTSC Stereo Generator. This connector permits the output of the 8182A's Dual-Band Compressor (in L/R form) to be looped through a first set of lowpass filters in the 8182A/SG to protect subsequent 8182A processing from 15,734Hz contamination on the program line. If the 8182A is to be operated without the 8182A/SG (during bench tests or with stereo generators other than the Orban 8182A/SG, for example), this loopthrough connection can be bypassed by switching the 8182A's rear-panel STEREO GENERATOR IN/OUT switch OUT, thus restoring signal path continuity. When the 8182A is operated with the 8182A/SG, this switch must be IN.

After the signal is returned to the 8182A for preemphasis, HF limiting, and peak limiting (still in L/R form), it is applied to a matrix which produces either L+R/L-R or L/R outputs depending on jumper strapping.

The matrix drives the line amplifiers, which are balanced and transformerless. These amplifiers drive the 8182A's external audio output terminals, which are interfaced to the outside world through non-overshooting RFI filters effective from approximately 500kHz to 1GHz. The line amplifiers also drive the interface connector to the Orban 8182A/SG.

The signal which is applied to the output amplifiers is preemphasized. Jumpers determine whether the line amplifiers pass the signal in preemphasized form, or if deemphasis is applied (providing a "flat" output).

In general, best system peak control is obtained by defeating exciter preemphasis and applying the preemphasized signal from OPTIMOD-TV to the flat exciter. However, in some systems it is extremely inconvenient to defeat the exciter's preemphasis, and the exciter must be supplied with a "flat" (i.e., deemphasized) signal from OPTIMOD-TV.

The main part of the Orban 8182A/SG (following its first set of lowpass filters) is driven the by the 8182A line amplifiers and requires preemphasized L+R/L-R inputs. This is achieved by placing several sets of jumpers on the 8182A's Card #7 (Output Amplifier/Deemphasis) according to instructions provided in **Part 3 (Installation)** of the **8182A/SG Operating Manual.**

VU Meter: The front-panel VU meter can monitor the audio level at several different points in the circuitry as selected by the METER switch. (See **Block Diagram** in **Appendix J** for metering points.)

BTSC Stereo And The 8182A: The 8182A uses FM stereo-style processing. This means that the compressor gains track each other (to preserve stereo imaging), and that the peak output levels of the Left and Right channels are independently controlled so that neither exceeds 50% L+R modulation. It can be shown that this is conservative for modulation control in the BTSC system: When program material containing a large amount of stereo content (i.e., L-R energy) is processed, L+R modulation will be less than 100% and loudness may be slightly reduced on mono receivers. However, significant overmodulation of the overall composite signal will almost always be avoided.

(There is a slight uncertainty because of the presence of the dbx noise reduction encoder in the L-R channel following all other audio processing. The action of the N/R encoder can increase peak modulation. However, it has been specifically designed to prevent significant overmodulation.)

The 8182A is suited for driving any BTSC stereo generator with conventional +4 or +8dBm 600ohm (or balanced bridging) inputs. However, because the Orban 8185A has been specifically designed to complement the 8182A, the two units will perform synergistically to yield results of highest obtainable quality.

Summary: OPTIMOD-TV is an integrated "system approach" to ride gain, perform compression as desired, control excessive loudness, and control peaks by high-frequency limiting, distortion-cancelling "Hilbert-transform clipping", and bandlimited overshoot correction. An interface connector for the Orban 8185A BTSC Stereo Generator is provided.

This optimizes technical parameters to their practical limit while producing a sound at the viewer's ear which is perceived as natural, pleasant, and free from the processing artifacts that often plague other signal processing approaches.

This concludes the **Introduction and Simplified System Description.** The next part of this Manual **(Application)** should now be read carefully to assure that your installation produces optimum results.

PART 2:
Various Applications

This Part of the Manual provides essential information on how OPTIMOD-TV fits in with the rest of the equipment at your station.

Studio/Transmitter Links: There are five types of studio/transmitter links (STL's) in common use internationally in TV audio service, whether single- or multi-channel. These are:

1) Analog land-lines (telephone lines);
2) 50-15,000 Hz microwave STL's (single or dual);
3) Composite baseband microwave STL's (stereo service);
4) Composite video/audio microwave STL's; and
5) PCM (Pulse-Code Modulation) links.

All except (3) carry the audio either directly or in some encoded form other than the stereo baseband to be found in TV multiplex stereo service (once approved). These links are ordinarily fed audio in non-encoded form, and their receiver output is audio. In the case of (4), the audio in placed on an FM subcarrier above the video baseband.

The composite STL (3) carries the multiplexed stereo baseband, and is therefore fed from the output of a stereo generator. The receiver output of the composite STL is the stereo baseband signal, which is applied directly to wideband input of the TV transmitter's aural exciter.

In general, highest quality is obtained by use of a composite microwave STL (3) or video/audio microwave STL (4) provided that a line-of-sight transmission path of less than 10 miles or so exists between studio and transmitter. If not, RF signal-to-noise ratio, multipath distortion, and diffraction effects can cause serious quality problems.

The 50-15,000Hz microwave system (2) provides more noise immunity than composite systems. However, problems include gain- and phase-matching of the left and right channels in stereo service, preemphasis-induced overloads, and a requirement that the audio applied to the microwave transmitters be processed to prevent their overmodulation.

Land-line (1) quality is extremely variable, ranging from excellent to atrocious.

The decision on whether to employ land-lines depends a great deal on the line quality locally available. However, even the best land-lines tend to slightly veil audio quality due to line equalizer characteristics, phase shifts, and repeaters of indifferent quality.

PCM links (5) are generally unavailable in the USA as of this writing, although they are widely used in Europe. They achieve good noise performance and consistency at the expense of a very sharp high-frequency cutoff, rapid changes in group delay around cutoff (unless elaborate phase equalization is used), and quantization distortion. At the moment, there is considerable disagreement over how elaborate the coding must be to render quantization distortion inaudible to critical listeners, and no PCM system should be accepted without critical listening tests.

OPTIMOD-TV is available in either single- or dual-chassis configurations. The dual-chassis splits the system at a point between the output of the Dual-Band Compressor and the input of the high-frequency Limiter.

The dual-chassis (split) configuration is ordinarily used with STL's of types (1), (2), (4), and (5) of modest performance characteristics. By performing initial compression before the STL input, the dual-chassis version can prevent STL overload and can aid in achieving superior STL signal-to-noise ratio. (See the **Introduction** for further information.)

Locating the high-frequency limiter and peak limiting sections at the transmitter can minimize the potential for peak level increases caused by subsequent passage of the peak-limited signal through transformers, filters, and other devices with non-linear group delay. Modulation is thus more tightly controlled and higher average levels can be obtained, optimizing receiver signal-to-noise ratios and minimizing the audible effects of such problems as intercarrier buzz and incidental phase modulation in CATV and MATV systems.

The single-chassis configuration is suited for any microwave STL whose group delay is essentially constant from 50-15,000Hz, whose -3dB low frequency cutoff point is below 5Hz, and whose response above 15,000Hz rolls off in an approximately Gaussian manner. In many ways, the requirements are similar to the requirements for high-quality video transmission with the exceptions that much narrower bandwidth is required and more stringent limits are placed on noise and non-linear distortion.

While many audio frequency microwave STL's do not have these characteristics as delivered from their manufacturers, modifications to achieve them are often trivial, involving increasing the size of coupling capacitors and eliminating input and output transformers, replacing them with modern active input and output stages.

The single-chassis configuration is also suited for installations where studio and transmitter are at the same site or are connected by short, high-quality lines. Because it is less expensive than the dual-chassis version, the single-chassis version is also suited for use with any STL having extremely wide dynamic range (80dB or better) such that unprocessed audio can be passed to the compressor without danger of noise build-up when the compressor's gain increases towards its maximum.

It is important to note that the compressor section alone does not control peak levels accurately, and does not compensate for overloads caused by preemphasis. (Peak limiting and high frequency limiting are performed later in the system.) It is therefore necessary to allow headroom in the STL to accomodate compressor overshoots. If the STL is preemphasized at 50 or 75us (as is the case with many 50-15,000Hz microwave systems), further headroom must be allowed to accomodate the peak level increases caused by the preemphasis. Precise STL setup recommendations are provided in **Part 4 (Setup)** of this Manual.

If STL preemphasis can be readily modified, use of 25us preemphasis will match headroom to the typical spectral distribution of contemporary program material, thus achieving optimum STL signal-to-noise ratio.

Exciters: OPTIMOD-TV will interface with all TV aural exciters, whether direct-FM or phase modulation. However, it is important to realize that modern solid-state direct-FM aural exciters provide both vastly improved reliability and audible improvements in sound quality when compared to older designs (particularly phase modulators), and such older exciters should be retired if at all possible. In addition, phase-modulator exciters will almost certainly be unsuited to stereo TV broadcasting.

The discussion above regarding microwave STL performance requirements (to correctly handle the peak-limited OPTIMOD-TV output without increasing peak levels uncontrollably) applies also to aural exciters. While the output of OPTIMOD-TV is supplied strapped for "flat" (requiring use of the exciter's internal

preemphasis network), far more accurate results are obtained if the exciter's input transformer, preemphasis network, and any bandwidth-limiting filters are entirely bypassed, and the preemphasized output of OPTIMOD-TV is introduced as close to the modulator stage as practical. Some exciters have an auxiliary or "test" input available for this purpose.

Instructions on how to restrap the OPTIMOD-TV output for preemphasized operation are provided in **Part 3 (Installation)** of this Manual.

Additional Aural Subcarriers: OPTIMOD-TV operates well with subcarriers because OPTIMOD-TV provides excellent baseband spectrum control, thus protecting that part of the baseband occupied by the subcarrier. No special subcarrier precautions need be taken; the subcarrier should be implemented according to the instructions of the exciter manufacturer.

Older aural exciters may not have separate subcarrier inputs. In most cases, one can be added simply by passively summing into the modulated oscillator through a resistor and small capacitor. Note, however, that such older exciters often suffer from narrow RF bandwidths which may cause subcarrier "birdies" due to intermodulation.

Stereo: All OPTIMOD-TV mainframes are fully equipped for stereo. An explanation of the relationship between OPTIMOD-TV, the Orban 8182A/SG BTSC Stereo Generator, and other vendors' stereo generators is provided in **Part 1** of this Manual.

It is important to note that OPTIMOD-TV has only one control circuit which adjusts the gain reduction of both stereo channels based on the higher of the two. It is therefore unsuited for dual-mono operation (such as bilingual programming).

[In the BTSC system used in the United States, bilingual programming, if any, is provided on the Separate Audio Program (SAP) subcarrier. Orban manufactures a SAP subcarrier generator with integrated audio processing (Model 8182A/SAP) to provide this subcarrier.]

PART 3:
Installation

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

Unpacking And Initial Inspection: You are now ready to proceed with unpacking and installation of your OPTIMOD-TV.

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

Sage advice for repacking and reshipping your unit is contained at the end of **Appendix F.**

Various items are packed with OPTIMOD-TV:

(1) Line Cord
(4) 10-32x3/4" Rack Screws
(1) 3-wire AC Adapter
(1) This Operating Manual
(1) 5/64" Allen Wrench (for front panel screws)
(2) Keys For Access Door
(2) 620 ohm ±5% 1/4 watt carbon film resistors (for input termination if required)

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

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

Set the unit on a flat, soft surface. Remove the three hex-socket screws at the top of the front panel using the wrench provided. The front panel, which is hinged at the bottom, will then tilt downward and reveal the interior. Look for IC's or other loose parts which may have fallen out during shipment.

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

Various components are mounted in sockets for servicing convenience. It is possible that a component could be dislodged by heavy shocks in shipment.

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

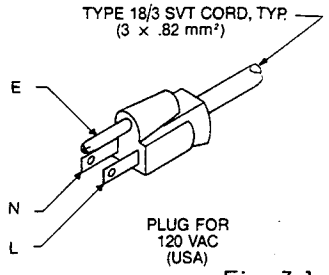
Power Considerations: OPTIMOD-TV will operate on 115/230V ±15% 50-60Hz AC power. Due to the conservative design of the power supply, it should also operate properly on 100 or 208 volt service.

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

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

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

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



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

Fig. 3-1: POWER CORD COMPATIBILITY

Initialization Options: The section describes how to change certain operating characteristics of OPTIMOD-TV to suit your needs. If your needs correspond to the "factory-standard" characteristics, then no modifications need to be made, and you may skip to **Reassembly** below.

All modifications are made on the plug-in circuit cards. If the steps above regarding physical inspection have been followed, the cards are now readily accessible.

1) **Output Preemphasis:** OPTIMOD-TV is shipped to provide a flat output, requiring use of the preemphasis network built into your aural exciter. As mentioned in **Exciters** in **Part 2 (Applications),** better peak control is obtained if the exciter's input transformer, preemphasis network, and any filtering are bypassed, since OPTIMOD-TV can provide these functions with greatly improved peak-control accuracy.

   Note that OPTIMOD-TV is shipped with either 75us or 50us internal preemphasis, depending on government requirements in the Region to which it is shipped unless ordered otherwise. Even if you are operating "flat" at the output, the HF limiter is still operating on the preemphasis curve, and a "flat" output is obtained by complementary deemphasis after the processing. Thus even with "flat" operation, this internal preemphasis and deemphasis must complement that used in the aural exciter.

   Changing preemphasis is non-trivial, and requires changing the values of a substantial number of components. If you wish to change preemphasis, please consult the factory.

   To restrap for preemphasized output, move jumpers on Card #7 according to Fig. 3-2. Card #7 contains two active balanced output amplifiers (for stereo); thus, two jumpers must be moved.

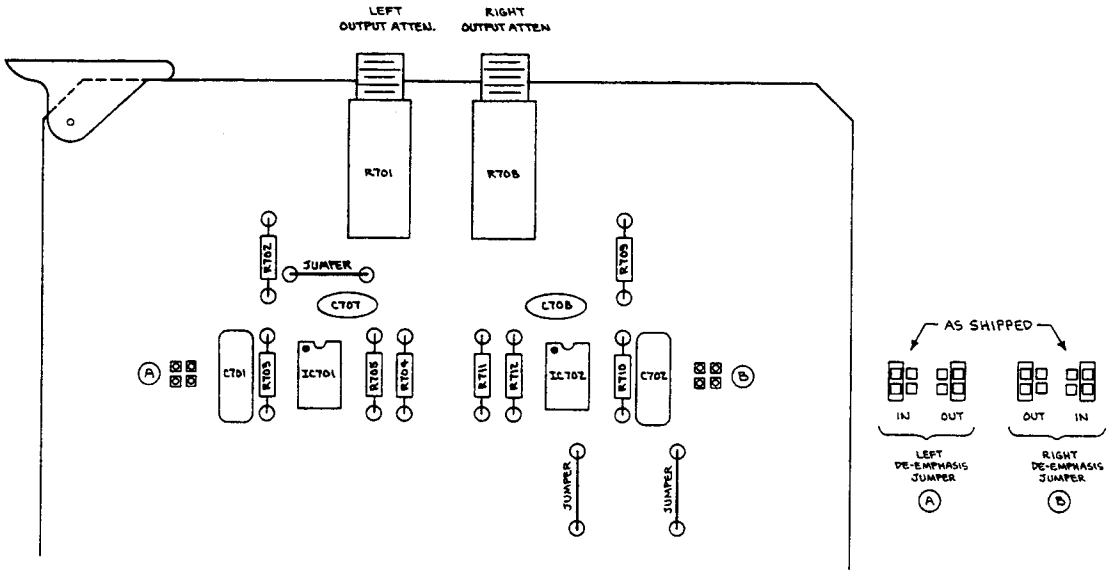


Fig. 3-2: CARD #7: OUTPUT PREEMPHASIS JUMPER

2) **Input Attenuator Pads:** OPTIMOD-TV is shipped with 20dB pads ahead of the input buffer amplifiers. These are located on Card #3 (left channel) and Card #4 (right channel), and are suited for nominal input levels from -10 to +10dBm. If lower input levels (from -30 to -10dBm) are present, the pads must be defeated. To do this, remove Cards #3 and #4. Reposition the jumper straps according to Fig. 3-3.

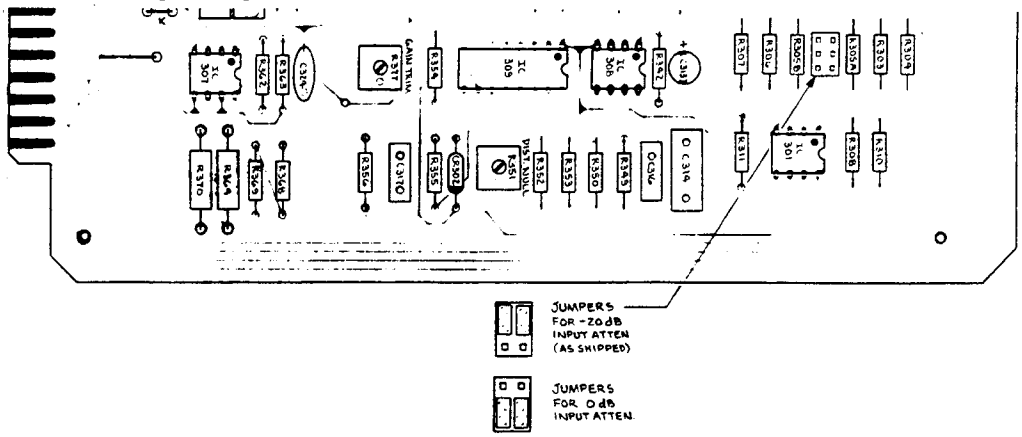


Fig. 3-3: CARDS #3 AND #4 INPUT ATTENUATOR JUMPERS

3) **Defeating The 30Hz Highpass Filters:** There is no jumper plug for defeating these filters because we feel that the overall broadcast system will work better with the filters operative for reasons discussed in detail in paragraphs **1.b** and **1.c** of **Appendix A.** Some may disagree. Those who wish to defeat the filters can do so by soldering a jumper wire between pins 3 and 7 of IC302 (Card #3) and IC402 (Card #4).

4) **L/R Or L+R/L-R Output Mode:** OPTIMOD-TV is shipped with the feed to the line amplifiers in the L/R mode (i.e., the two line amplifier outputs represent the left and right channels). If you are operating in mono, leave the line amplifiers in L/R mode. If you are operating in stereo, you can strap the line amplifiers to produce L/R or sum-and-difference (L+R/L-R) outputs as required by your installation. (If the Orban 8182A/SG Stereo Generator is in use, the outputs must be strapped for L+R/L-R.)

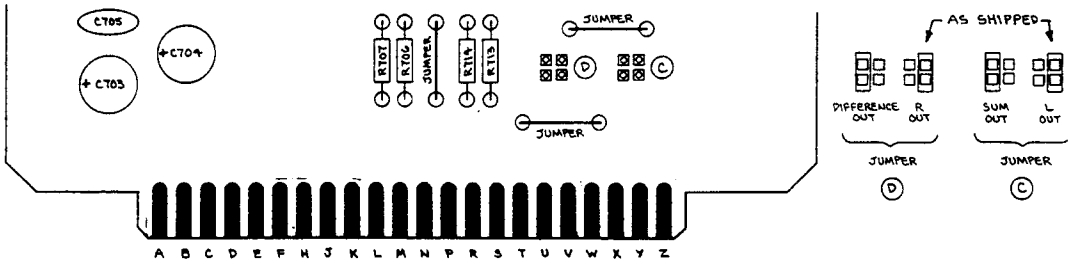


Fig. 3-4: CARD #7: OUTPUT FORMAT JUMPERS

5) **Loudness Controller:** Card #2 (the Loudness Controller) may be strapped to power-up either ON or OFF. As shipped, it powers-up ON. Move the jumper on Card #2 according to Fig. 3-5 below as necessary.

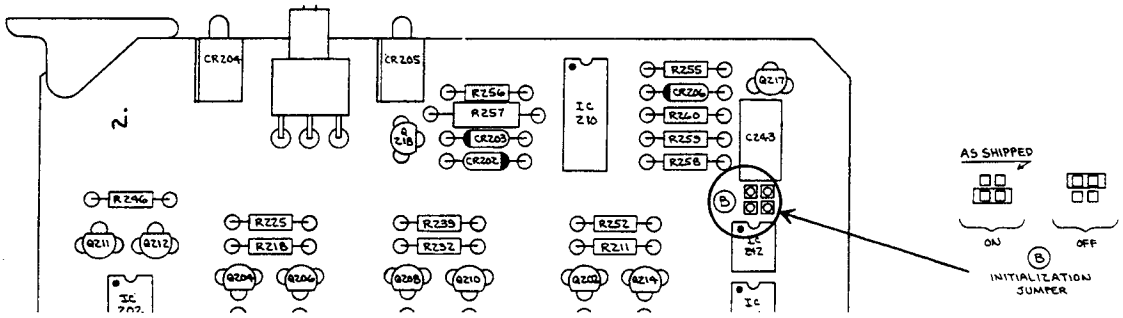


Fig. 3-5: CARD #2: POWER-UP JUMPER

The Loudness Controller has been designed to be fed either preemphasized audio (from Cards #8 and #9) or non-preemphasized audio (from Cards #3 and #4). When the Loudness Controller card is located in the main chassis (rather than the Accessory Chassis), it is supplied preemphasized audio from Cards #8 and #9. It is shipped strapped for this condition. When it is moved to an Accessory Chassis, it must be restrapped according to Fig. 3-6 below.

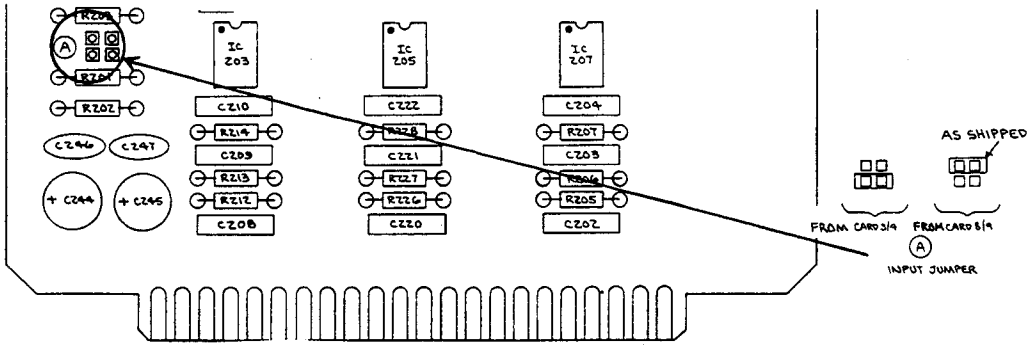


Fig. 3-6: CARD #2: DEEMPHASIS JUMPER

6) **Other Jumpers:** OPTIMOD-TV shares circuit cards with a number of other Orban products. Jumpers on Cards #6, 8, and 9 must be correctly strapped to configure these cards as OPTIMOD-TV cards. **Appendix H** summarizes the normal positions of these jumpers as used in OPTIMOD-TV, and should be consulted if the jumpers are accidentally moved.

Reassembly: When the physical examination, line voltage adjustment, and optional initialization procedures are completed, replace the subpanel. The subpanel, besides carrying knob identification and calibrations and holding the cards in place, also provides RF shielding for the cards. So, all four DZUS fasteners should be engaged by turning 1/4-turn clockwise.

The front panel may now be closed and fastened using the three hex-socket screws. Normally, all access required from now on can be achieved through the smaller access door (equipped with a key lock).

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

A) The green POWER LED is illuminated;
B) The red GATE LED is illuminated (provided that the COMPRESSOR PROOF/OPERATE switch is in OPERATE);
C) Both yellow HF LIMIT LED's are off;
D) The TOTAL MASTER G/R, COMPRESSION MASTER G/R, and TOTAL BASS G/R meters drift slowly to "0", while the LIMITING MASTER G/R meter reads "0" immediately.
E) All VU meter positions read "0%" except for "+15VDC" and "-15VDC", which read 100% ±5%.

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

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

Equipment Location: OPTIMOD-TV is supplied in either single-chassis or dual-chassis versions. The dual-chassis version splits the system at the output of the compressor. The studio chassis may be located in any convenient rack space in the studio. It is important to bear in mind that its RFI suppression is modest because it was assumed that the unit would be operated at a considerable distance from high-powered transmitters.

The main chassis, which is highly RFI-suppressed, is ordinarily located reasonably close to the transmitter's aural exciter or phase-linear STL transmitter. The chassis requires 4 units (7"/17.8cm) in a standard 19" rack.

Although a good monitoring loudspeaker system seems rare at transmitter sites, such a system which can be easily heard from the location in which OPTIMOD-TV is mounted will facilitate subjective adjustments.

Difficult Environments:

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

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

3. OPTIMOD-TV has been carefully designed to operate in high-energy VHF/UHF environments and no special placement precautions need be observed unless RFI is encountered in operation.

4. Please remember that the reliability of any electronic equipment is enhanced by maintaining moderate operating temperatures. OPTIMOD-TV should never be operated in ambient above 50 degrees C (122 degrees F).

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

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

Input Signal Connections: These instructions apply to the audio inputs of single-chassis OPTIMOD-TV's, and to the audio inputs of both Accessory and Main Chassis' in dual-chassis OPTIMOD-TV's.

If you are operating in mono, output signal connections may be made to the left or right channels since OPTIMOD-TV is symmetrical. However, use of the left channel is customary, and later setup instructions are written assuming that the left channel is used.

IMPORTANT

> Regardless of whether the left or right output is used, both inputs should be driven in parallel during mono operation, and both INPUT ATTEN controls should be set approximately equal. If this is not done, the range of the GATE THRESH control will be approximately 6dB higher than normal, compressor dynamic performance will suffer slightly, and the Loudness Controller threshold will be 6dB too high, making the Loudness Controller essentially useless.

It may be desirable to wire the unused output to a patch bay or even to a remote-controlled switching facility to make the unused channel available in case of a failure of the ordinarily-used channel, and to facilitate troubleshooting by the "card swap" method described in **Appendix F.**

In a high RF field, the audio input to OPTIMOD-TV 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 addition, you should make sure that the telephone line termination box or STL receiver is properly grounded to earth.

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).

OPTIMOD-TV should be operated with its integral 20dB input pad for levels between -10 and +10dBm, and without the pad for levels between -30 and -10dBm. Instructions for restrapping the pads are found above in **Initialization Options.**

The OPTIMOD-TV input is balanced bridging, and its impedance is 200K with the 20dB pad defeated and 11.2K with the 20dB pad operative. If the source requires a 600 ohm termination (such as a telephone line), connect a 620 ohm ±5% 1/4 watt carbon film resistor across each audio input. Two such resistors are provided for your convenience.

In stereo installations, it is important that both left and right audio inputs be in phase. This is ordinarily assured simply by connecting the red and black wires within all shielded cables symmetrically and consistently when wiring the two stereo channels. If a phasing error occurs, it will be indicated in on-air testing by the stereo monitor's indicating more L-R than L+R level.

Accessory Chassis Output Connections: In the dual-chassis configuration of OPTIMOD-TV, the output of the Accessory Chassis presents a 600 ohm pure-resistive source impedance, balanced to ground, with a nominal output level of +10dBm when loaded by 600 ohms. It is thus suited for driving a land-line directly, or for driving the balanced input of a microwave STL transmitter.

If you wish to drive an unbalanced input, connect such an input between the Accessory Chassis "+" output and circuit ground. **Do not ground the "-" output;** while no damage will occur, it will short the output of the "-" line amplifier to ground through a 300 ohm resistor, unnecessarily stressing the opamp.

Main Chassis Output Connections: The outputs of OPTIMOD-TV are balanced to ground from an active source. They are designed to be loaded by an essentially resistive load of 600 ohms ±10% to assure correct frequency and transient response. Some high-quality transformers are suitable. However, most transformers will degrade the pulse response of the system, and use of active input stages at the aural exciter or stereo generator is advised, as discussed in **Part 2** under **Exciters.** (The output RFI suppression network was designed to have no overshoot or ringing when properly terminated).

The output should be run in 100% foil-shielded cable (like Belden 8451). See the comments on grounding in **Input Signal Connections** above.

If bypassing the exciter's input transformer, preemphasis network, and any filtering (as recommended above for best peak level control) requires that the exciter be driven unbalanced, this driving signal should be taken between the (+) output and circuit ground on the rear-panel barrier strip. Total load impedance should be 300 ohms, ±10%. Usually, the exciter presents a reasonably high impedance when operated in this configuration, and the load must be provided by an external 300 ohm resistor (not supplied).

IMPORTANT

> Do not ground the (-) output in an attempt to get an unbalanced output; you will short the output of the (-) amplifier to ground through the RFI suppression filter. Just leave the (-) output floating.

If the exciter modification results in very high input sensitivity, then the input may have a tendency to pick up noise due to RFI. If this occurs, operate the OPTIMOD-TV output at a higher level, and build an "L" pad at the exciter. This "L" pad can be designed to have an input impedance of 300 ohms, correctly loading the OPTIMOD-TV output.

Interfacing A BTSC Stereo Generator: The Orban Model 8185A TV Stereo Generator connects to the 8182A through the 14-pin connector on the 8182A's rear panel. Appendix G of this manual contains a wiring diagram of the interface and a short explanation of how it works. Section 2 of the 8185A Operating Manual explains how to make the 8182A work with the 8185A.

You can also connect the 8182A to Orban's older-model stereo generator, the 8182A/SG. Part 3 of the 8182A/SG Operating Manual explains how to make the 8182A work with the 8182A/SG.

To interface another manufacturer's stereo generator to the 8182A, connect the 8182A's left and right main outputs to the audio inputs of the stereo generator. (The 8182A's main outputs appear on its rear-panel barrier strip.) Strap the 8182A's Card #7 Output Format Jumpers and De-Emphasis jumpers as required by the stereo generator. Most generators require L/R format and de-emphasis IN ("flat" output).

Remote Gain Reduction Meter: A negative DC voltage approximately proportional to the Total Master Gain Reduction is available between the OPTIMOD-TV rear-panel G/R terminal and circuit ground. The voltage scale is approximately -0.33V per dB of gain reduction, and the source impedance is 8.87K. A standard 0-25dB Orban gain reduction meter can be connected directly between this terminal (-) and ground (+).

The Orban meter has a sensitivity of 1mA f.s. and a DC resistance of about 950 ohms. Full-scale corresponds to 30dB G/R. Because only 25dB G/R can be achieved, the last 5dB of the scale is colored red. (The purpose of this is to match the scale to that of the BASS G/R meter, which is capable of, and fully calibrated to, 30dB G/R.)

If an external meter with different characteristics is used, it is easy to calculate the required additional multiplier resistor for a 0-30dB scale by the formula: $M=(9.75/F)-(8870+R)$, where

M is the required multiplier resistor in ohms,
F is the full scale meter sensitivity in amps, and
R is the internal DC resistance of the meter in ohms.

If M is negative, the meter you wish to use is not sensitive enough, or has too high an internal resistance.

If you wish to interface the G/R output to a remote control for telemetry, bear in mind that the input impedance of the remote control will load down the G/R output and reduce the voltage according to the gain factor: $G=X/(X+8870)$, where X is the input resistance of the remote control in ohms. The scaling of the remote control should therefore be -0.33xG volts per dB gain reduction.

PART 4:

Initial Setup Procedure

Instructions are provided for mono installations, and for stereo installations in which a BTSC (United States standard) stereo generator other than the Orban 8182A/SG is used. IF THE ORBAN 8182A/SG BTSC STEREO GENERATOR IS USED, IGNORE ALL INSTRUCTIONS IN **PART 4** OF THIS MANUAL AND REFER TO **PART 4** OF YOUR **8182A/SG OPERATING MANUAL** INSTEAD. (This provides integrated instructions for setup and adjustment of all parts of the system.)

If the 8182A OPTIMOD-TV is used with a stereo standard other than BTSC (such as the systems used in Japan or West Germany), set percentage modulation by adjusting the 8182A's LEFT and RIGHT OUTPUT ATTENUATORS according to common-sense principles.

IMPORTANT

1. The stereo setup instructions below will only work if the external stereo generator has already been set up and has been level-matched to the exciter using the instructions provided by the manufacturer of the stereo generator.

2. If the Orban 8182A/SG Stereo Generator is connected to Accessory Port #1, the rear-panel Stereo Generator IN/OUT switch on the 8182A must be IN. Otherwise, it must be OUT to provide signal continuity.

In normal mono operation, the left and right inputs must be driven in parallel (or by identical audio from redundant sources); the output may be taken from either the left or the right channel.

When driven with a 1kHz tone, the Loudness Controller causes no additional gain reduction. Therefore, it may be in either OPERATE or DEFEAT mode without affecting the accuracy of the procedure described below.

If you have a single-chassis OPTIMOD-TV, skip to **II. Single-Chassis Alignment** below.

If you have a dual-chassis OPTIMOD-TV, you must first align the gain of your STL and the Main (Transmitter) Chassis to a standard to assure that both STL and Main Chassis are driven at correct levels and are properly gain-matched. [The dual-chassis configuration is described in **Part 1 (Introduction).**]

1: DUAL CHASSIS ALIGNMENT

Before beginning the dual-chassis alignment, remove the #2, #3, #4, and #5 cards from the Main Chassis, and substitute the #3TX and #4TX cards per instructions supplied with the Accessory Chassis (8182A/ST). These instructions also describe installation of the #2, #3, #4, and #5 Cards in the Accessory Chassis.

In a mono installation, the procedure depends on whether a redundant STL is available. If a redundant STL is available, treat the two STL's as "LEFT" and "RIGHT" and follow the stereo instructions. If only one STL is available, follow the mono instructions. Do not parallel the left and right inputs until the procedure instructs you to do so.

In a stereo installation, the procedure is repeated twice, once for the left channel and once for the right.

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

There are four steps:

1) **Stereo Or Mono Installation:** Adjust the operating controls on the Accessory Chassis as follows:

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

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

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

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

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

Stereo Installation Only: Repeat Step (2) for the RIGHT CHANNEL of the Accessory Chassis, using the RIGHT CHANNEL STL.

Mono Installation Only: If you have two STL's for redundancy, repeat Step (2) using the RIGHT CHANNEL of the Accessory Chassis and the redundant STL. If you have only one STL, proceed to the next step.

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

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

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

Turn the Main Chassis LEFT OUTPUT ATTEN fully counterclockwise. Turn on the aural transmitter, and advance the Main Chassis LEFT OUTPUT ATTEN until your TV stereo monitor indicates a L+R modulation of 30%. Record the reading of the Main Chassis L SYSTEM OUT meter.

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

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

[**NOTE:** The instructions immediately below apply only if the output amplifiers are strapped in L/R mode -- see **(4)** in **Initialization Options** in **Part 3 (Installation).** If the output amplifiers are strapped in L+R/L-R mode and tone is applied to only one input channel of the 8182A, first set L+R modulation to 30% by adjusting the L+R OUTPUT ATTEN. Then optimize separation by observing the undriven channel on your stereo monitor and adjusting the L-R OUTPUT ATTEN until the undriven channel nulls.]

Advance the Main Chassis RIGHT OUTPUT ATTEN control until your TV Stereo Monitor indicates a L+R modulation of 30%.

Check the reading of the Main Chassis R SYSTEM OUT meter. It should be very close to the reading obtained on the L SYSTEM OUT meter immediately above. If not, there is a left/right gain imbalance in the system beyond OPTIMOD-TV which should be corrected.

(**NOTE:** The "30% modulation" figure is somewhat arbitrary, as the appropriate figure will depend upon the overshoot performance of the lowpass filters within the external stereo generator, upon the time constant of the peak flasher in the stereo monitor, and upon whether the external stereo generator is being used with or without its internal preemphasis. If the stereo generator's internal preemphasis is not used, modulation is better controlled and a higher percentage of modulation can be chosen when aligning with a 1kHz tone in the procedure above.

The "30% modulation" figure must therefore be modified in your individual installation according to experience.)

3.b) **Mono Installation Only:** Continue to drive the LEFT Accessory Chassis input with a 1kHz tone at a level which produces a "0" reading on the TOTAL MASTER G/R meter. Connect the output of the STL receiver to the LEFT AND RIGHT INPUTS of the OPTIMOD-TV Main Chassis in parallel. Place the VU meter FUNCTION switch in L COMPR OUT. Adjust the LEFT INPUT ATTEN on the OPTIMOD-TV Main Chassis to make the VU meter read 100%. Then place the VU meter FUNCTION SWITCH in R COMPR OUT and adjust the RIGHT INPUT ATTEN on the Main Chassis to make the VU meter read 100%.

Connect the LEFT Main Chassis output to the aural exciter. Turn on the aural transmitter, and advance the Main Chassis LEFT OUTPUT ATTEN until your Aural Modulation Monitor reads 60% modulation.

Turn off the aural transmitter, and connect its input to the Main Chassis' RIGHT OUTPUT. Turn on the aural transmitter, and advance the Main Chassis RIGHT OUTPUT ATTEN until your Aural Modulation Monitor reads 60%. (See the **NOTE** immediately above.)

The L SYSTEM OUT and R SYSTEM OUT meters on the Main Chassis should read identically.

4.a) **Stereo Installation Only:** Connect the LEFT and RIGHT program lines from the console or switcher to the LEFT and RIGHT inputs of the Accessory Chassis. Proceed to **Program Tests** below.

4.b) **Mono Installation Only:** Connect the program line to both LEFT and RIGHT Accessory Chassis inputs in parallel.

If your installation is fully redundant, you may wish to connect a redundant audio source to the Accessory Chassis RIGHT INPUT instead of paralleling. Be sure that both audio sources are at the same level, and are in-phase. Proceed to **Program Tests** below.

2: SINGLE CHASSIS ALIGNMENT

In a mono installation, do not parallel the left and right inputs until the procedure instructs you to do so.

In a stereo installation, the procedure is repeated twice, once for the left channel and once for the right.

There are three steps:

1) **Stereo Or Mono Installation:** Adjust the operating controls on the Main Chassis as follows:

Proof/Operate Switches:	OPERATE
L and R Input Attenuators:	0
Clipping:	+2
Release Time:	10
Bass Coupling:	10
Gate Threshold:	0
HF Limiting:	10
Output Attenuators:	fully counterclockwise

2.a) **Stereo Installation Only: [NOTE:** The instructions immediately below apply only if the output amplifiers are strapped in L/R mode -- see **(4)** in **Initialization Options** in **Part 3 (Installation).** If the output amplifiers are strapped in L+R/L-R mode and tone is applied to only one input channel of the 8182A, first set L+R modulation to 30% by adjusting the L+R OUTPUT ATTEN. Then optimize separation by observing the undriven channel on your stereo monitor and adjusting the L-R OUTPUT ATTEN until the undriven channel nulls.]

Connect an audio oscillator to the LEFT INPUT of OPTIMOD-TV. Set its frequency to 1kHz, and its output level to produce "0dB" ±3dB as indicated on the TOTAL MASTER G/R meter. Turn on the aural transmitter, and advance the LEFT OUTPUT ATTEN until your TV stereo monitor indicates a L+R modulation of 30%. Record the reading of the L SYSTEM OUT meter.

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

Advance the RIGHT OUTPUT ATTEN control until your TV Stereo Monitor indicates a L+R modulation of 30%.

Check the reading of the R SYSTEM OUT meter. It should be very close to the reading obtained on the L SYSTEM OUT meter immediately above. If not, there is a left/right gain imbalance in the system after OPTIMOD-TV which should be corrected.

(**NOTE:** The "30% modulation" figure is somewhat arbitrary, as the appropriate figure will depend upon the overshoot performance of the lowpass filters within the external stereo generator, upon the time constant of the peak flasher in the stereo monitor, and upon whether the external stereo generator is being used with or without its internal preemphasis. If the stereo generator's internal preemphasis is not used, modulation is better controlled and a higher percentage of modulation can be chosen when aligning with a 1kHz tone in the procedure above.

The "30% modulation" figure must therefore be modified in your individual installation according to experience.)

2.b) **Mono Installation Only:** Connect an audio oscillator to the LEFT INPUT of OPTIMOD-TV. Set its frequency to 1kHz, and its output level to produce "0dB" ±3dB as indicated on the TOTAL MASTER G/R meter. Connect the LEFT OPTIMOD-TV OUTPUT to the input of the aural exciter. Turn on the aural transmitter, and advance the LEFT OUTPUT ATTEN until your Aural Modulation Monitor indicates 60% modulation.

Turn off the aural transmitter. Disconnect the oscillator from the LEFT OPTIMOD-TV input, and connect it to the RIGHT input. The TOTAL MASTER G/R meter should still read "0".

Disconnect the LEFT OPTIMOD-TV OUTPUT from the aural exciter input, and connect the aural exciter input to the RIGHT OPTIMOD-TV OUTPUT. Turn on the aural transmitter.

Advance the RIGHT OUTPUT ATTEN control until your Aural Modulation Monitor indicates 60% modulation. (See the **NOTE** immediately above.)

The L SYSTEM OUT and R SYSTEM OUT meters on the Main Chassis should read identically.

3.a) **Stereo Installation Only:** Connect the LEFT and RIGHT program lines from the console or switcher to the LEFT and RIGHT inputs of OPTIMOD-TV. Proceed to **Program Tests** below.

3.b) **Mono Installation Only:** Connect the program line to both LEFT and RIGHT OPTIMOD-TV inputs in parallel.

If your installation is fully redundant, you may wish to connect a redundant audio source to the RIGHT INPUT instead of paralleling. Be sure that both audio sources are at the same level and are in-phase. Proceed to **Program Tests** below.

3: PROGRAM TESTS

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

These listening tests are made with OPTIMOD-TV set up according to our **Recommended Initial Control Settings** in Fig. 4-5. They are intended to detect obvious problems with audio quality which must be resolved before final adjustments are made. Once initial listening tests are passed, you can proceed to adjust OPTIMOD-TV setup controls according to subjective requirements.

These instructions apply to either a stereo or mono installation except as noted.

a) Adjust OPTIMOD-TV controls according to Fig. 4-5. Do not adjust the INPUT ATTEN or OUTPUT ATTEN controls at this time. If you have a dual-chassis system, DO NOT READJUST THE MAIN CHASSIS INPUT ATTEN CONTROLS UNDER ANY CIRCUMSTANCES!

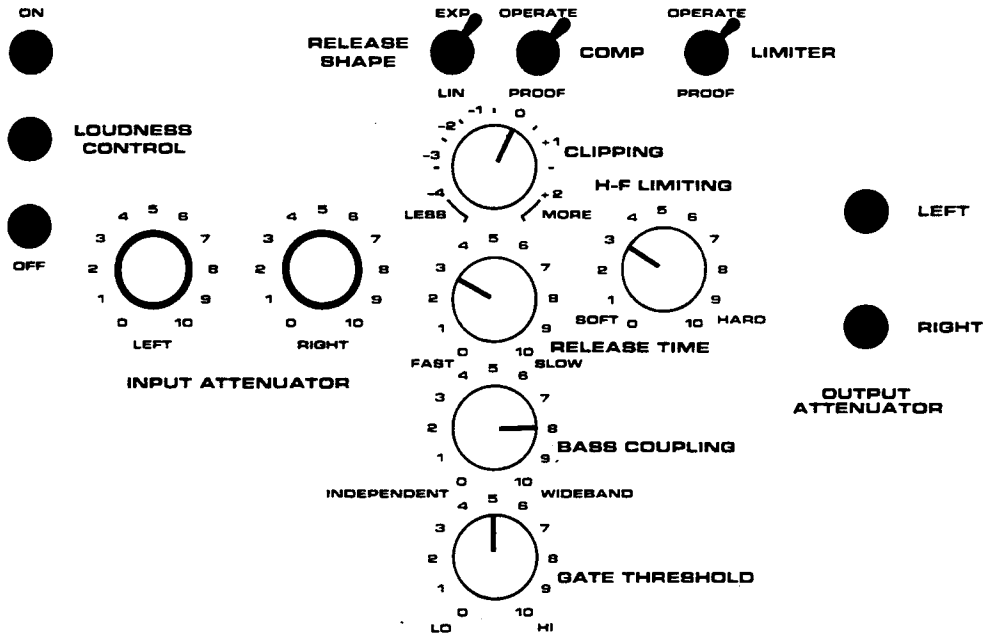


Fig. 4-5: RECOMMENDED INITIAL CONTROL SETTINGS

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

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

Stereo Installation Only: Observe the L-R meter on your stereo monitor and advance the OPTIMOD-TV RIGHT INPUT ATTEN until the meter nulls.

Mono Installation Only: (**NOTE:** The output amplifiers must be strapped in L/R mode.) Either load both outputs with equal impedances, or temporarily disconnect both outputs from the system. Connect a sensitive AC voltmeter between the OPTIMOD-TV (+) LEFT OUTPUT and (+) RIGHT OUTPUT. Advance the OPTIMOD-TV RIGHT INPUT ATTEN until the meter nulls. Reconnect the outputs to the system as necessary.

d) **Stereo Installation Only:** Place the console in STEREO mode. Observe the TOTAL MODULATION meter and peak flasher on your Aural Modulation Monitor. If you wish to adjust peak modulation levels, this must be done by adjusting the 8182A's LEFT and RIGHT OUTPUT ATTENUATORs -- NOT by adjusting the stereo generator's COMPOSITE OUTPUT ATTENUATOR. Adjustment of the latter control will destroy the tightly-controlled relationship between deviation and control voltages within the stereo generator's dbx noise reduction encoder, compromising separation at the receiver.

Mono Installation Only: Observe the TOTAL MODULATION meter and peak flasher on your Aural Modulation Monitor. Assuming that the OPTIMOD-TV LEFT OUTPUT is driving the aural exciter, make slight adjustments to the LEFT OUTPUT ATTEN as necessary to achieve desired modulation levels.

As in the step above, either load both outputs with equal impedances or temporarily disconnect both outputs from the system. Connect a sensitive AC voltmeter from the (+) LEFT OUTPUT to the (+) RIGHT OUTPUT, and adjust the OPTIMOD-TV RIGHT OUTPUT ATTEN until the meter nulls. Reconnect the outputs to the system as necessary.

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

f) You may now proceed to **Part 5 (Operating Instructions)** of this Manual, and adjust OPTIMOD-TV's setup controls to your specific requirements and tastes.

Part 5: Operating Instructions

page contents

8182A Audio Processor Controls

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

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

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

POWER Indicator lights when the unit is powered.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

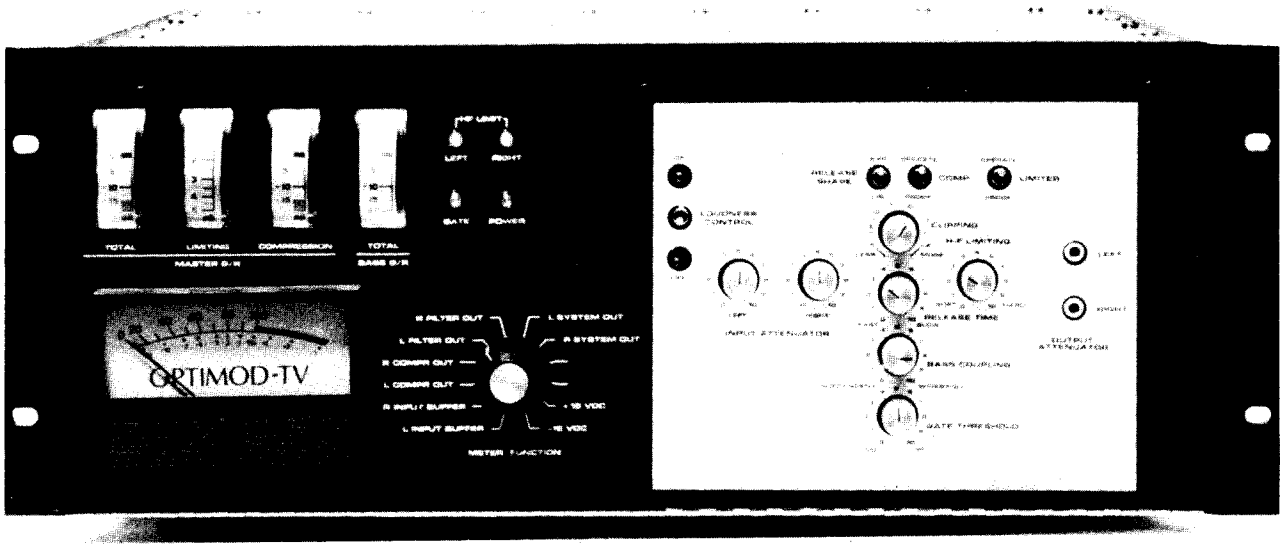


Fig. 1: 8182A Controls and Meters

Getting the Sound You Want

Control settings for various programming formats are given in Fig. 3-3. If you want to modify any control settings from those recommended, first read "**Understanding More About Audio Processing**", since it is important to understand the functions and interactions of the audio processing controls before attempting to customize them. "Understanding More About Audio Processing" provides the most thorough discussion of the functions of and interactions between OPTIMOD-TV controls. Read it if you really want to understand the operating controls in detail. However, there is no need to read that section if you will be using the recommended control settings.

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

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

Recommended Settings for the Best Sound

If your station has a specialized format, you may prefer to use one of the alternate settings given in Fig. 3-3. Each produces a different sound texture, and each incorporates a different set of trade-offs between openness, consistency, brightness, and distortion.

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

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

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

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

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

* See discussion on following page.

Fig. 2: Recommended Control Settings

Adjusting the GATE THRESHOLD control for fine arts programming.

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

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

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

Setting the LOUDNESS CONTROLLER switch for music videos.

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

Understanding More About Audio Processing

If you are using one of the sets of recommended control settings given in Fig. 3-3, there is no need to read this section. Read this section only if you really want to understand the operating controls in detail.

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

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

Some audio processing concepts.

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

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

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

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

Gating for unobtrusive processing.

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

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

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

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

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

Control of dynamic range — gain reduction and release time.

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

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

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

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

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

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

louder than another, television has been spared the "loudness wars" that plague radio audio quality.)

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

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

A note about gain reduction metering.

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

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

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

Excessive commercial loudness.

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

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

sounds louder than would a the same amount of sound energy in a narrower range, and 3) the time-constants of the individual spectral detectors in the ear affect the perceived loudness of a sound, as does 4) the overall duration of the sound.

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

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

Peak control.

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

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

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

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

High-frequency limiting to reduce distortion.

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

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

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

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

Spectral balance.

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

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

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

CATALOG OF OPERATING OBJECTIVES AND SOLUTIONS

ALWAYS START WITH OUR SUGGESTED INITIAL SETTINGS (BELOW) AND WORK FROM THERE.

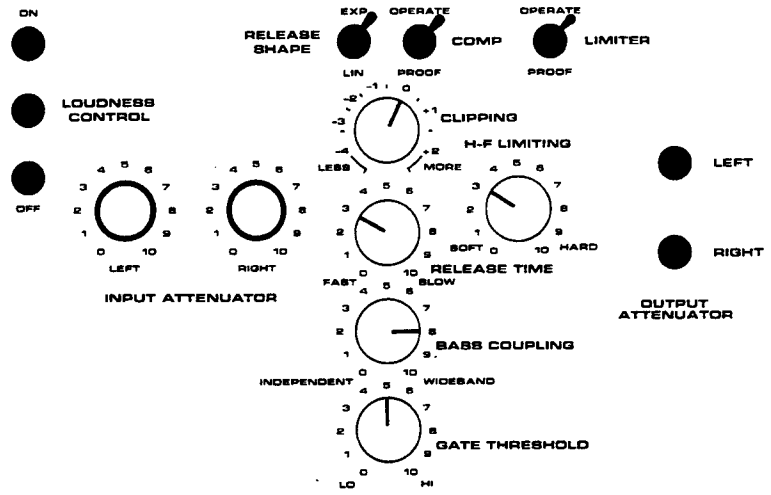


Fig. 5-3: RECOMMENDED INITIAL CONTROL SETTINGS

-- To adjust relative loudness

1. Adjust the CLIPPING control to obtain the loudness desired (vis-a-vis other stations). The INPUT ATTEN must then be slightly readjusted to achieve the desired amount of gain reduction.

-- To obtain more consistent levels

1. Operate "multiband" (BASS COUPLING at "0") with fast release times. Turn down CLIPPING and HF LIMITING as necessary to avoid objectionable distortion.
2. Clean up audio. Super-clean audio can be processed harder without objectionable side-effects.

-- To obtain more brightness

1. Turn the HF LIMITING CONTROL fully clockwise (full hard). To avoid objectionable distortion with fast release time, you may have to turn down the CLIPPING control. This will further increase brightness at the expense of loudness.
2. Be sure that program material is properly equalized, and that the STL is flat to 15kHz.

-- To obtain more bass (less bass compression)

1. Operate the BASS COUPLING control towards "0" (independent).

-- To obtain less bass (retaining original program material balance)

1. Operate the BASS COUPLING control towards "10" (wideband).

-- To make "Air" sound most like "Program"

1. Operate with the BASS COUPLING close to "10". (Adjust the control to make the BASS and COMPRESSION G/R meters track as closely as possible.)
2. Operate with the RELEASE TIME at "8" in LINear mode. (This may cause gain-riding to be too slow.)
3. Use approximately 10dB of gain reduction ("0" on the TOTAL MASTER G/R meter) by adjusting the INPUT ATTENUATOR as necessary.
4. Minimize the amount of clipping and HF limiting by operating HF LIMITING at "10" (full hard), and backing off the CLIPPING as far as required to avoid audible distortion on difficult material like male voice or piano.

-- To obtain "open" sound with no audible compression

1. Operate the RELEASE TIME control at "8".
2. Do not pre-compress program material in production.

-- To obtain a "heavily-processed" sound

1. Operate the RELEASE TIME control at "0" and the BASS COUPLING control at "0". (You may have to back off the CLIPPING and HF LIMITING controls to avoid objectionable distortion. Operator gain riding will also become more critical.)

-- To avoid "noise pump-up"

1. Operate with 10dB of gain reduction ("0" on the meter) with normal levels out of the console or switcher.
2. Adjust the GATE THRESHOLD more clockwise.
3. Use slower RELEASE TIME.

-- To achieve more subtle gain riding in wide-dynamic range material

1. Critically adjust the GATE THRESHOLD control so that medium- to low-level passages cause the GATE lamp to flash on and off, thus slowing down the release time as the program gets softer.

-- To avoid excessive sibilance (particularly on women's voices)

1. Use an Orban Dynamic Sibilance Controller on speech inputs only. (While OPTIMOD-TV will not distort sibilance, its excellent high frequency power handling capability will result in its passing high-energy sibilance present at its input instead of limiting it.)

PART 6:
In-System Performance Verification

NOTE

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

Mono Performance Verification: This is very straightforward. Switch both PROOF/OPERATE switches to PROOF, switch the loudness controller to DEFEAT (by means of its local OPERATE/DEFEAT switch), and drive the input with test signal. Sufficient headroom exists to modulate well beyond 100% at all frequencies, 50-15,000 Hz.

The PROOF mode turns the Gate ON, forcing the unit into 10dB gain reduction ("0" on the G/R meter). To avoid apparent frequency response errors due to the gain's changing between readings, wait at least two minutes after entering PROOF mode before making measurements.

With single-chassis units, the only potential difficulty involves STL signal-to-noise ratio. Because PROOF mode forces the unit into 10dB gain reduction, the measured signal-to-noise ratio should accurately reflect the noise performance of the system under normal operating conditions, provided that the system is normally adjusted to run with 10dB gain reduction. Only the poorest-quality STL links will cause a noise problem such that standards are not met under these conditions, and the OPTIMOD-TV Studio Accessory Chassis or a compandor-type noise reduction system may be required to achieve satisfactory results. (See **Studio/Transmitter Links** on p.2-1 for a complete discussion.)

NOTES

1. OPTIMOD-TV frequency response falls off extremely rapidly above 15.0kHz. If the test oscillator is miscalibrated, OPTIMOD-TV may appear not to meet proof at 15kHz. Before blaming OPTIMOD-TV, measure the output frequency of the oscillator with an accurate counter to make sure that it is actually producing 15.0kHz, and not some slightly higher frequency.

2. An artifact of the operation of the Hilbert-Transform Clipper in PROOF mode can cause falsely-high distortion readings under certain conditions. THD between 4 and 5kHz may measure as high as 0.25%. If SMPTE IM distortion is measured in PROOF mode, it may read as high as 1%.

While these readings are far below the level which could cause a problem in a Proof situation, they are nevertheless not representative of the distortion performance capabilities of the OPTIMOD-TV circuitry in OPERATE mode. In OPERATE mode, distortion is highly dependent on level and frequency such that audible distortion of the test signal is avoided. This illustrates how the OPTIMOD-TV system is "tuned" to the ear's psychoacoustic perception of distortion.

[If you are interested in an explanation of the mechanism causing the distortion increase in PROOF mode, refer to **5.b** of **Appendix B (Circuit Description).** The relevant paragraph begins: "PROOF mode...".]

Stereo Performance Verification: These measurements are usually made most meaningfully by defeating compression and limiting action while leaving all active circuitry unbypassed. The existing PROOF/OPERATE and LOUDNESS CONTROLLER OPERATE/DEFEAT switches provide this function. (See **Mono Proof** immediately above.)

Special attention should be paid to headroom. The clipping point of the VCA's in the Dual-Band Compressor is approximately 5dB above 100% modulation, although distortion will begin to rise substantially as clipping is approached. In the BTSC Stereo setup instructions in **Part 4** of this Manual, instructions were provided for adjusting the 8182A's OUTPUT ATTENUATORs such that 100% L+R modulation (i.e., ±25kHz deviation) is achieved when both Left and Right Channels are simultaneously driven. This means that only 50% L or R modulation is achievable when a single channel is driven alone unless the OUTPUT ATTENUATORs are temporarily turned up by 6dB. If this is done, 100% modulation of the Left and Right channels can be achieved.

There is no need to readjust the 8182A's OUTPUT ATTENUATORs to achieve 100% L+R or L-R: L+R at up to 100% modulation can be generated by driving both Left and Right channels in-phase, while L-R at up to 100% modulation can be generated by driving both Left and Right channels out-of-phase. (To make the out-of-phase connection, temporarily reverse the "+" and "-" input connections of one channel only.)

When trying to create pure L+R or L-R, null undesired L-R or L+R (respectively) by balancing the Left and Right channel gains as closely as possible. There will always be some residual linear crosstalk which cannot be nulled. This is caused by relative phase shifts between the Left and Right channels. Because this crosstalk is linear, it introduces no distortion products into the signal and has no audible significance unless it is large enough (perhaps -35dB or greater) to cause deterioration of stereo imaging.

Full assessment of crosstalk performance requires a baseband spectrum analyzer to separately measure the linear crosstalk (which is usually innocuous) and the non-linear crosstalk (which can cause audible distortion if large enough). In the BTSC system, if the frequency of the test tone is F and f_H=15.734kHz, then linear crosstalk is found at F (subchannel-to-main channel) and at $2f_H \pm F$ (main channel-to-subchannel). All other parts of the spectrum are non-linear crosstalk or other spurious signals except for the stereo pilot and the desired modulation.

PART 7:
Routine Maintenance

OPTIMOD-TV is a highly stable device which uses solid-state circuitry throughout. Recommended routine maintenance is minimal.

1) Particularly in humid or salt-spray environments, check periodically for corrosion around metal-to-metal contacts such as the audio and control wiring, and those places where the OPTIMOD-TV chassis contacts the rack. Check for loss of grounding due to corrosion or loosening of rack mounting screws.

2) Familiarize yourself with the normal VU meter readings, and with the normal performance of the G/R meters. If any meter reading becomes abnormal, refer to **Appendix F (Trouble Diagnosis).**

3) A good ear will pick up many failures. Familiarize yourself with the "sound" of OPTIMOD-TV as you have set it up, and be sensitive to changes or deteriorations. But if problems arise, please don't blame OPTIMOD-TV by reflex. Refer to **Appendix F** for systematic troubleshooting instructions which will also help you determine if the problem is in OPTIMOD-TV or is somewhere else in the station's equipment.

4) To clean the panel, wash it with a mild household detergent and water. Stronger solvents may damage plastic parts, paint, or the silkscreened lettering, and should not be used.

7

ROUTINE PERFORMANCE VERIFICATION

This procedure can be performed very quickly, and provides tests of some of the more important OPTIMOD-TV performance parameters. A much more thorough and rigorous procedure is provided in **Appendix D (Field Audit-of-Performance Procedure).**

Audio Processing: There are no effective, quick instrument tests that can be made using ordinary program material. Your ear is the best test instrument here.

If a minute or so can be spared from normal programming, the "standard level" test can be made using a sinewave input. This is done as follows:

1) Record the settings of the CLIPPING, BASS COUPLING, RELEASE TIME, and HF LIMITING controls so that they can be restored when you have completed the test.

2) Set the OPTIMOD-TV controls to the following "standard" settings:

PROOF/OPERATE SWITCHES:	OPERATE
CLIPPING:	+2
RELEASE TIME:	10
RELEASE SHAPE	LINear
BASS COUPLING:	10
HF LIMITING:	10
LOUDNESS CONTROLLER	DEFEAT

3) Drive the OPTIMOD-TV left channel (probably through a console input) with a 1kHz sinewave. Adjust the oscillator level until the OPTIMOD-TV TOTAL MASTER G/R meter reads "0".

4) Verify that the OPTIMOD-TV L COMPR OUT position on the VU meter switch causes the meter to read 0VU, ±0.5VU, and that the OPTIMOD-TV L FILTER OUT meter position causes the meter to read 0VU, ±1.0VU.

5) Repeat steps (3) and (4) for the RIGHT channel.

6) Restore the OPTIMOD-TV setup controls to their normal settings.

Failure to produce these standard levels indicates a failure somewhere within the audio processing circuitry. Refer to **Appendix F (Trouble Diagnosis).**

This concludes **ROUTINE MAINTENANCE.**