Operating Manual

OPTIMOD-TV 8282

Digital Audio Processor

Software V1.0

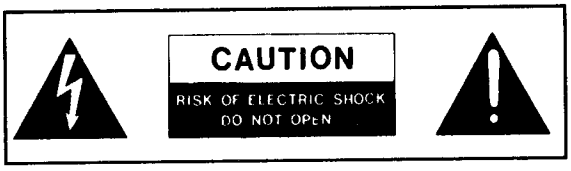
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IMPORTANT NOTE: Refer to the unit's rear panel for your Model #.

Model #:	Description:
8282/U4S	OPTIMOD-TV 8282 DIGITAL with four DSP cards, Protection Structure, Two-Band Structure with Loudness Controller, Multi-band Processing Structure, set to 115V (for 90-130V operation), switchable to 50μs or 75μs.
8282/E4S	OPTIMOD-TV 8282 DIGITAL with four DSP cards, Protection Structure, Two-Band Structure with Loudness Controller, Multi-band Processing Structure, set to 230V, (for 180-260V operation), switchable to 50μs or 75μs.

Options Available:

Model #:	Purpose:
CIT25	Composite Isolation Transformer.
8200D/32	Digital I/O Card, 32kHz
8200D/SRC	Digital I/O Card, 32kHz, 44.1kHz, or 48kHz
8282 PC	Remote Control Software for IBM PC compatible computers



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 cäble. Si un cäble est endommagé, le remplacer immédiatement.

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

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

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

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

Safety Instructions (Spanish)

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

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

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

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

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

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

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

Safety Instructions (Italian)

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

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

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

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

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

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

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

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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.

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).

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

(2) Do not cut the grounding pin from the line cord.

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

(4) 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 Card
- The Line Cord
- All Miscellaneous Hardware (including the Rack Screws)
- The Extender Card
- The COAX Connecting Cable

Your dealer may charge you for any missing items.

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

Further advice on proper packing and shipping is included in Section 5: Troubleshooting.

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) 510/351-3500.

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MAINTAINING 8282 SECURITY

Important: *Ensure 8282 security by making it standard policy for each 8282 user to manually re-enable lockout when finished with normal operation.*

If your 8282 uses security pascodes and TIMEOUT TO AUTO LOCK is OFF (as set in the SET PASCODE screen), the last successful pascode entry defines the current security level. Until lockout is re-enabled, subsequent users with a lower security level will have access to more functions than they should.

Therefore, we recommend that each user re-enable lockout mode when finished with normal operation. Re-enabling lockout ensures that each user is allowed to enter a pascode to have access to the correct amount of functions for which their pascode was previously assigned.

If a previous user does forget to re-enable lockout, simply complete the following steps:

1. If the IDLE G/R screen does not appear, press ESC repeatedly until you see it.

2. Hold down the ESC button, while pressing HELP button.

   With 8282 lockout now re-enabled, enter a valid pascode and continue with normal operation.

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8282 Software Update

Note: This Unit Shipped With V1.10 Software

Important: Your 8282 has been updated with Version 1.10 Software. V1.10 incorporates the following software changes:

No Audio Muting For 2-Band Presets When Switching Between Stereo and Dual Mode:

V1.10 eliminates audio muting previously present with 2-Band presets, when changing between stereo and dual channel mode.

Audio Mute Time Reduced When Switching Between Different Processing Structures:

V1.10 reduces audio muting time previously present when switching between different DSP processing structures. This includes switching between stereo and dual channel Protection and 5-Band structures.

Faster Screen Response:

V1.10 provides faster screen response scrolling, in particular for both 2-Band and 5-Band operation.

Improved Remote Control Port Switch Detection Speed:

The remote port detector time has been reduced to 2mS.

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OPTIMOD-TV 8282

Digital Audio Processor

Software V1.10

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WARNING

This equipment generates, uses, and can radiate radio-frequency energy. If it is not installed and used as directed by this manual, it may cause interference to radio communication. This equipment complies with the limits for a Class A computing device, as specified by FCC Rules, Part 15, Subpart J, which are designed to provide reasonable protection against such interference when this type of equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference. If it does, the user will be required to eliminate the interference at the user's expense.



WARNING

"This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications." "Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques (de las class A) prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada."

IMPORTANT

Perform the installation under static control conditions. Simply walking across a rug can generate a static charge of 20,000 volts. This is the spark or shock you may have felt when touching a doorknob or some other conductive item. A much smaller static discharge is likely to completely destroy one or more of the CMOS semiconductors employed in OPTIMOD-TV or the software module. Static damage will not be covered under warranty.

There are many common sources of static. Most involve some type of friction between two dissimilar materials. Some examples are combing your hair, sliding across a seat cover or rolling a cart across the floor. Since the threshold of human perception for a static discharge is 3000 volts, many damaging discharges will not even be noticed.

Basic damage prevention consists of minimizing generation, discharging any accumulated static charge on your body or work station and preventing that discharge from being sent to or through an electronic component. A static grounding strap (grounded through a protective resistor) and a static safe workbench with a conductive surface should be used. This will prevent any buildup of damaging static.

The OPTIMOD-TV 8282 Digital Audio Processor is protected by U.S. patents 4,249,042; 4,208,548; 4,460,871; and U.K. patent 2,001,495. Other patents pending.

Orban is a registered trademark.

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Section 1 Introduction

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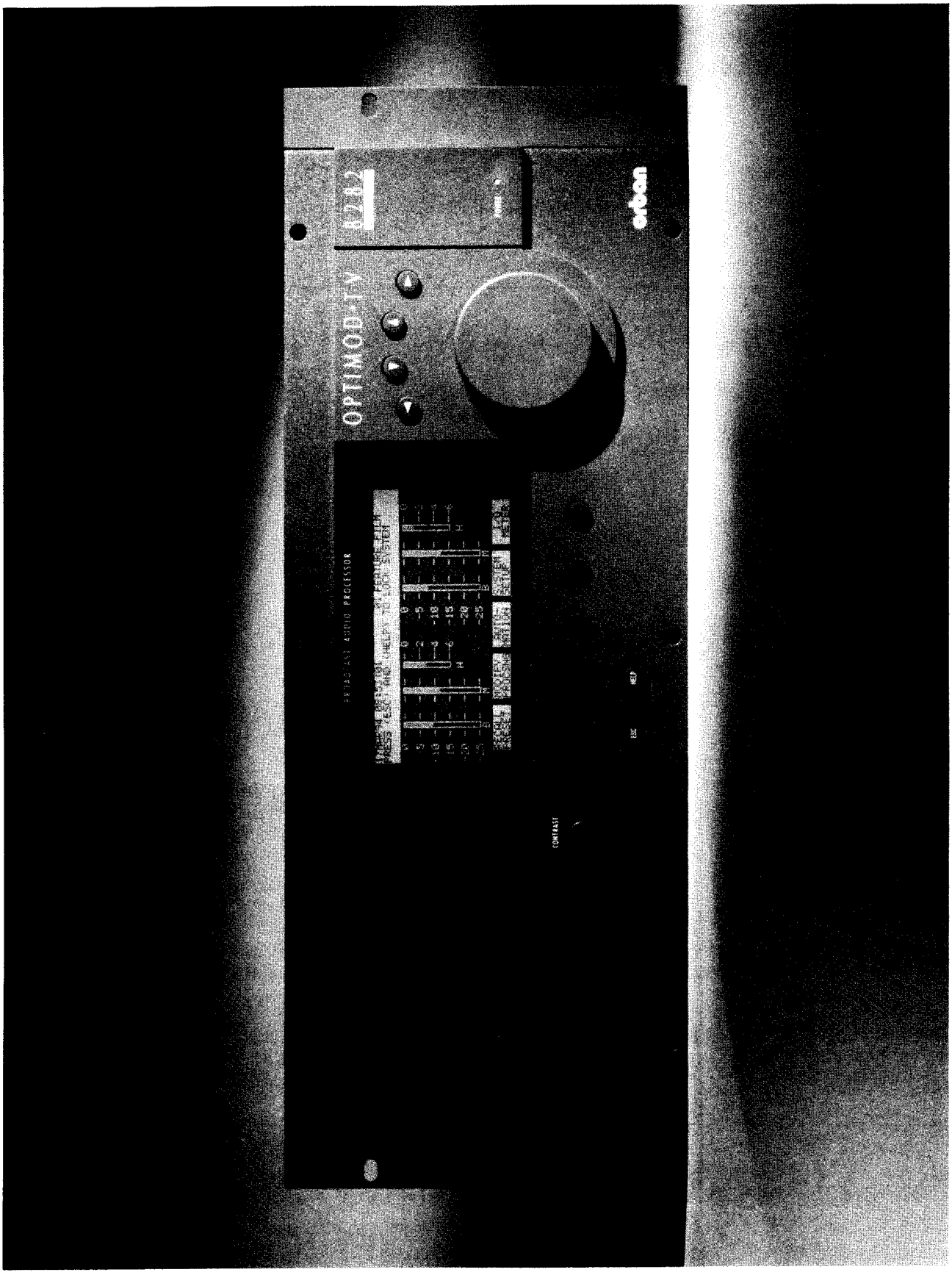
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OPTIMOD-TV
8282
orban
CONTRAST
ESC
HELP

OPTIMOD-TV 8282 DIGITAL Audio Processor

Orban's OPTIMOD-TV 8282 DIGITAL Audio Processor is a complete audio processing system for television broadcast.

User-Friendly Interface

- A large liquid-crystal display (LCD) makes setup, adjustment and programming of the 8282 easy. The screen clearly shows all metering functions of the processing structure in use.
- Push one of the clearly labeled soft keys to RECALL a preset, to MODIFY processing, to program AUTOMATION Preset Switching, or to access SYSTEM SETUP.
- HELP is always available at the push of a button. If you get lost, ESC will always bring you back home. If you desire, you don't even need this manual to adjust and program the 8282. Step-by-step instructions are on the screen.

Absolute Control of Peak Modulation

- The 8282 provides universal transmitter protection and audio processing for television broadcast. It can be configured to interface ideally with any commonly-found transmission system in the world.
- The 8282 Audio Processor provides pre-emphasis limiting for the internationally-used pre-emphasis curves of 50μs and 75μs. Its pre-emphasis control is almost never audibly apparent, producing a clean, open sound with subjective brightness matching the original program.
- The 8282 achieves extremely tight peak control; overshoot is limited to less than 0.3dB!
- The 8282 prevents aliasing distortion in subsequent stereo encoders or transmission links by providing bandwidth-limiting and overshoot-compensated 15kHz low-pass filters ahead of the 8282's audio outputs.

Flexible Configuration to Interface With Analog and Digital Systems

- The 8282 Audio Processor is designed to meet all applicable international safety standards.
- The 8282 Audio Processor can be configured for analog and digital inputs and outputs.
- All processing structures can be configured for stereo-coupled or dual-channel (dual-monophonic) operation.

- The analog inputs are transformerless, balanced and floating 10kΩ instrumentation-amplifier circuits, and the outputs are transformerless, balanced, and floating with 30Ω impedance to ensure highest transparency and accurate pulse response.
- The optional Digital I/O follows the AES/EBU standard, operating at 32kHz (8200D/32 I/O Card), or 32, 44.1, or 48kHz (8200D/SRC I/O Card).
- All input, output, and power connections are rigorously RFI-suppressed to Orban's traditional exacting standards, ensuring trouble-free installation.

Adaptability Through Switchable Audio Processing Structures

- A processing structure is a program that operates as a complete audio processing system. Only one processing structure can be active at a time. Just as there are many possible ways of configuring a processing system using analog components (such as equalizers, compressors, limiters, and clippers), there are many possible processing structures achievable by the 8282. The 8282 realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) chips.
- All processing structures can operate with stereo coupling or in dual-channel mode, making the 8282 appropriate for stereo or dual-language broadcasting.
- The Two-Band Normal Structure is an improved version of Orban's classic 8182A OPTIMOD-TV sound. It produces an open and natural sound, handling the wide range of general television programs — drama, news, talk, film and sports — always presenting comfortable, consistent levels to the viewer. It includes the CBS Loudness Controller, which automatically detects and controls program material that would otherwise seem annoyingly loud to the viewer.
- The Protection Structure is designed for stations wanting the highest possible fidelity to the source, such as a station broadcasting concert music, or broadcasting program material whose dynamic range has previously been carefully adjusted (by hand) to be suitable for television.
- The Five-Band Structure divides the spectrum into five bands, compressing each band independently to apply "automatic equalization" to the program. It can significantly improve the listenability and consistency of substandard program material, such as news actualities. The Five-Band Structure also has Five-Band single-ended dynamic noise reduction that can be applied to the program at the operator's discretion.
- The 8282 applies to digital processing a distillation of Orban's twenty years of market-leading analog processing experience; the unit builds and improves on the uniquely successful sound of Orban analog processors.
- All structures except the Protection Structure ride gain over a range of as much as 25dB, reducing dynamic range and compensating for gain riding errors on the part of operators. The amount of dynamic range reduction ordinarily produced is adjustable.

- The 8282 can be changed from one processing structure to another almost instantly.

Programmable

- The 8282 is supplied from the factory with factory-programmed presets for virtually all potential applications in television broadcast and satellite uplink protection. Presets specify both a processing structure and its control settings.
- Factory Presets can be user-modified and stored in 32 User Presets. They can be recalled either locally or by remote control.

Controllable

- The 8282 Audio Processor contains a versatile real-time clock, which permits presets to be recalled at pre-programmed times.
- All compression, limiting, and clipping can be defeated by remote control to permit broadcast system test and alignment or "proof of performance" tests.

  The 8282 Audio Processor is fully remote-controllable from an RS-232/RS-422 serial port (for computer or modem interface) using the optional 8282 PC Remote Control Software, and by optically-isolated terminals that can be operated with contact closures (to facilitate interfacing to older-technology remote controls). Orban's optional 8282 PC Remote Control Program for IBM PC compatibles lets you do everything from the remote computer that you can do from the 8282's front panel.
- The 8282 Audio Processor contains a built-in line-up tone generator, facilitating quick and accurate level setting in any system, as well as a Bessel-null tone for calibrating modulation.
- The 8282 Audio Processor can produce the standard EBS (U.S. standard Emergency Broadcast System) tones. It is FCC type accepted.

ESCape and HELP

The front-panel ESCape and HELP buttons are always there to aid you in your travels around the 8282's functions.

Use ESCape to get back to the previous screen. Pressing ESC repeatedly will get you back to the main gain reduction meter screen (`IDLE G/R`), no matter where you are.

The 8282 offers extensive on-screen help. Wherever you are, you can press the dedicated HELP button to give you a brief explanation of what that screen is showing you, and what it does. The names of the buttons of the screen being explained remain at the bottom. Press a button, and you will get a detailed explanation of what that button will do. Press ESCape to go back to the screen information. Press ESCape again to return to the screen from where you first requested HELP.

Presets in the 8282

There are three distinct kinds of presets in the 8282: Factory Processing Presets, Factory Test Presets, and User Presets.

Factory Processing Presets

Factory Processing Presets are various "factory recommended settings" for each processing structure. They are indicated on the RECALL PRESET list on the 8282 by a two-letter designation followed by a description, such as "AA PROTECTION 0dB" or "FD LIVE NEWS." The description indicates the processing structure and the type of processing.

Each Factory Processing Preset on the RECALL PRESET list is really a library of 20 separate presets, selected using the MODIFY LESS-MORE control to adjust the 8282 for more or less processing. In most cases, you use them to determine the nominal amount of dynamic range reduction that the processing produces.

Factory Processing Presets are stored in the 8282's non-volatile memory, and cannot be erased. You can change the settings of a Factory Processing Preset, but you must then store those settings as a User Preset, which you are free to name as you wish. The factory preset remains unchanged.

Factory Test Presets

Factory Test Presets include TO USER TONE and BY BYPASS. But unlike Factory Processing Presets, the settings of Factory Test Presets can be changed, and these changes are remembered in the Factory Test Preset. For example, you use the TO USER TONE preset in the same way that you use any normal oscillator. Set the frequency and level, and they remain that way until you change them.

User Presets

User Presets permit you to change a Factory Processing Preset or a Factory Test Preset to suit your requirements, and store those changes. You may store up to 32 User Presets. They are indicated on the RECALL PRESET list by a number designation from 01 to 32, followed by a description. You may enter in any description you wish, up to 16 characters.

User Presets cannot be created from "scratch." You must always start by recalling a Factory Preset. You can then immediately store this in a User Preset, give it whatever name you wish, then make changes to the settings. Or you can recall a Factory Preset, make the changes, then store this in a User Preset.

Either way, the Factory Preset remains for you to return to if you wish.

Stereo, Mono, and Dual-Channel Processing

The 8282's processing structures can be configured for stereo-coupled, dual-channel (dual-monophonic), or monophonic operation. You can use the SYSTEM SETUP `I/O CALIB` screen or the Remote Interface connector to set the MODULATION TYPE to match your program. Choose either STEREO or DUALCH (Dual-Channel), as appropriate (see below).

Stereo Operation

The 8282's STEREO setting switches the 8282's audio processing so that the gain reduction in the two channels is the same, to preserve stereo imaging.

NOTE: If your system is set up for stereo operation, it is ok to pass monophonic program through the 8282's processing, as long as program is present on both channels.

Dual-Channel Operation

The 8282 fully supports the German-standard switchable Stereo/Dual Carrier System. This system permits the transmission of stereo audio, or alternatively, two channels of non-correlated mono program, typically for two languages.

The 8282's processing can follow the stereo/dual-carrier status of your transmitter, using the 8282's Remote Interface Connector.

NOTE: In the 8282, the coupling (stereo or dual-channel) is controlled by the Remote Interface (or `I/O CALIB` screen); the processing presets control the way the processing performs on each of the channels. Switching between stereo and dual-channel is not available in the processing preset.

Monophonic Operation

The 8282 can be used for mono transmissions. Set the processing for DUALCH operation, then feed the audio into one input and take it out of the respective output. Or, if you're feeding the mono signal to both inputs, a monophonic signal can be taken from either output.

BTSC Operation

The BTSC standard (used in North and South America, the Philippines, and Taiwan) can transmit stereo program material and a separate channel (SAP) simultaneously. Use the 8282 for the main stereo program (set MODULATION TYPE to STEREO). For the separate channel, use the Orban 8182ASAP Processor/Generator, which contains full OPTIMOD-TV audio processing and the SAP subcarrier generator in one integral unit.

Input/Output Configurations

The OPTIMOD-TV 8282 DIGITAL is designed to simultaneously accommodate:

- Analog left/right inputs and outputs
- Digital AES/EBU left/right inputs and outputs.

Each of these is accomplished with a plug-in card. The standard configuration includes analog in/out. AES/EBU in/out is accommodated by a separate optional, user-installed card, available from your dealer.

Analog Left/Right Input/Output

The left and right analog inputs are on XLR-type female connectors on the rear panel. Input impedance is greater than 10kΩ; balanced and floating. Inputs can accommodate up to +27dBu (0dBu = 0.775Vrms). The left and right analog outputs are on XLR-type male connectors on the rear panel. Output impedance is 30Ω; balanced and floating. Outputs can drive up to +24dBm into 600Ω.

Level control of the analog inputs and outputs is via software control through SYSTEM SETUP. (See page 2-33 and 2-47.)

Provided that the Analog I/O Card is installed, the left and right analog outputs are always available regardless of whether the Digital I/O Card is installed.

Digital AES/EBU Left/Right Input/Output

The digital input and output follow the professional AES/EBU standard. The left/right digital input is on one XLR-type female connector on the rear panel; the left/right digital output is on one XLR-type male connector on the rear panel.

If digital AES/EBU left/right input or output is required and presently not installed, install the Digital I/O Card according to the instructions provided with it.

The 8282 is designed to simultaneously accommodate digital and analog inputs and outputs. You select whether the 8282 uses the digital or the analog input on the SYSTEM SETUP `I/O CALIB` screen or by the REMOTE INTERFACE connector.

Both analog and digital outputs are active continuously. Level control of the AES/EBU input is via software control through SYSTEM SETUP.

At the time of publication of this manual (April, 1994), there are two available versions of the optional Digital I/O Card. The less expensive version (8200D/32) operates at a 32kHz sample rate, the standard sample rate used for transmission of 15kHz bandwidth audio. Its output is pre-emphasized to the 50μs or 75μs curve selected for the processing. It cannot provide a "flat" output. The more advanced version (8200D/SRC) incorporates sample rate conversion for the input and output, permitting the input and output to operate at any combination of 32, 44.1, or 48kHz.

The advanced card also permits the sample rate of the output to be genlocked to the sample rate of the digital input, even if the analog inputs are being used. Further, the advanced card allows the digital output to be either pre-emphasized to the 50μs and 75μs curve selected for the processing; or flat. Separately, it can provide pre-emphasis to the J.17 standard, making it appropriate for driving systems (like NICAM) that use this pre-emphasis.

Please note that the AES/EBU standard is not the same as the S/P-DIF (Sony/Philips Digital Interface) standard used in consumer digital applications, such as the "digital outputs" of CD players. The AES/EBU interface will not work with S/P-DIF signals.

Provisions for Subcarriers

The correct peak level of the program applied to a transmitter sometimes depends on the number of subcarriers in use. Some regulatory authorities require that total baseband modulation be maintained within specified limits. Thus the main program modulation must sometimes be reduced when a subcarrier is turned on (depending on the regulatory standards of your country.)

The 8282's remote control feature allows you to reduce the main program modulation by connecting an on/off signal from your subcarrier generator (See page 2-13). You define the amount of reduction in % on the SYSTEM SETUP `I/O CALIB` screen (See page 2-52). See page 2-63 for information on programming the remote control interface.

Remote Control Interface

The Remote Control Interface is a set of eight optically-isolated inputs on a DB-25 connector that can be activated by 6-24V DC or 6-24V AC 50/60Hz signals. They can control various functions of the 8282:

1) Recall any Factory Processing Preset, Factory Test Preset, User Preset, or exit from a test preset to the previous processing preset.

2) Switch the 8282 to operate with its channels coupled for stereo tracking, or uncoupled for dual-channel operation.

3) Switch the 8282 to use either the analog input or the digital input.

4) Reduce the main program modulation to compensate for transmitter overshoot and subcarrier inputs.

   The remote control of overshoot compensation and subcarrier modulation (See page 2-52) is not latching. You must supply a continuous current to the remote to hold the gain at its compensated level. Use the status outputs of your transmitter and/or subcarrier generators to provide the switching signal, so the compensation will automatically follow the transmitter and/or subcarrier generator on the air.

5) Reset the 8282's internal clock to the nearest hour or to midnight.

The functions of the eight inputs can be re-configured by the user via SYSTEM SETUP. See page 2-63 for information on programming the remote control interface.

Computer Interface

Your Orban dealer can provide a program for any IBM-compatible PC (running DOS 3.0 or higher) that permits you to adjust any 8282 preset by remote control, or to do most anything else that you can do from the 8282's front panel controls. The program displays all of the 8282's "soft meters" on the computer screen to aid remote adjustment. It can run on systems using VGA graphics, and can drive a modem or create a direct connection between the computer and the 8282 through their RS-232 serial ports.

There are two serial connectors. One meets the RS-232 standard; you can connect it to any modem designed to interface with an IBM or compatible PC. You can also establish connection between the 8282 and an IBM PC or compatible by connecting the computer's COM port to the 8282's RS-232 port through a null modem cable. (The other connector meets the RS-422 standard.)

Location of OPTIMOD-TV

Optimal Control of Peak Modulation Levels

The audio processing circuitry in OPTIMOD-TV produces a signal that is pre-emphasized to either the 50μs or 75μs standard curve, is precisely and absolutely high frequency-controlled and peak-controlled to prevent over-modulation, and is filtered at 15kHz to prevent distortion caused by aliasing-related non-linear crosstalk in certain TV stereo systems, like BTSC (Region 2), EIAJ (Japan), and in 15kHz digital systems such as NICAM.

If this signal is fed directly into a transmitter or stereo encoder, peak modulation levels on the air will be precisely controlled. But if the audio processor's signal is fed to the transmitter or stereo encoder through any circuitry with frequency response errors and/or non-constant group delay, the peaks will be magnified. Peak modulation will increase, but average modulation will not. The modulation level must therefore be reduced to accommodate the larger peaks. Reduced average modulation level will result in reduced loudness, and a poorer signal-to-noise ratio at the receiver.

Frequency response errors and non-constant group delay are typically introduced by land line equalizers, transformers, and 15kHz low-pass filters and pre-emphasis networks in stereo encoders.

There are three criteria for preservation of peak levels through the audio system:

1) The system group delay must be essentially constant throughout the frequency range containing significant energy (30-15,000Hz). If low-pass filters are present, this may require the use of delay equalization. The deviation from linear phase must not exceed ±10° from 30-15,000Hz.

2) The low-frequency −3dB point of the system must be placed at 0.15Hz or lower (this is not a misprint!). This is necessary to ensure less than 1% overshoot in a 50Hz square wave and essentially constant group delay to 30Hz.

3) Any pre-emphasis used in the audio transmission system prior to the transmitter or stereo encoder must be canceled by a precisely complementary de-emphasis: Every pole and

zero in the pre-emphasis filter must be complemented by a zero and pole of identical complex frequency in the de-emphasis network (an all-pole de-emphasis network is not appropriate).

Low-pass filters (including anti-aliasing filters in digital links), high-pass filters, transformers, distribution amplifiers, and long transmission lines can all cause the above criteria to be violated, and must be tested and qualified.

It is clear that the above criteria for optimal control of peak modulation levels are most easily met when the audio processor directly feeds the transmitter or stereo encoder. In the 8282, no circuit elements that might distort the shape of the waveform are interposed between the audio processor and the transmitter or stereo encoder.

Best Location for OPTIMOD-TV

The best location for OPTIMOD-TV is as close as possible to the transmitter, so that its audio outputs can be connected to the transmitter or stereo encoder through a circuit path that introduces the least possible change in the shape of OPTIMOD-TV's carefully peak-limited waveform — a short length of shielded cable.

If the transmitter is not accessible:

All audio processing must be done at the studio, and you must tolerate any damage that occurs later.

In countries using the BTSC or EIAJ stereo systems, if you can obtain a broadband (0-75kHz) phase-linear link to the transmitter and the transmitter authority will accept the delivery of a baseband encoded signal, locate the system stereo encoder at the studio location to feed the STL. Then feed the output of the STL receiver directly into the transmitter's exciter with no intervening processing.

If only an audio link is available, use the 8282's left and right audio outputs and feed the audio, without pre-emphasis, directly into the link. If possible, request that any transmitter protection limiters be adjusted for minimum possible action — OPTIMOD-TV does most of that work. Transmitter protection limiters should respond only to signals caused by faults or by spurious peaks introduced by imperfections in the link.

To ensure maximum quality, all equipment in the signal path after the studio should be carefully aligned and qualified to meet the appropriate standards for bandwidth, distortion, group delay and gain stability, and such equipment should be re-qualified at reasonable intervals. (See Optimal Control of Peak Modulation Levels on page 1-10).

If the transmitter is accessible:

You can achieve the most accurate control of modulation peaks by locating OPTIMOD-TV at the transmitter site. You can usually also obtain good results by locating OPTIMOD-TV at the studio and connecting the baseband output of an external stereo encoder (if used) to the transmitter through a composite baseband STL (see next page). (As discussed further below, you can also use a composite baseband STL to pass monophonic audio with good accuracy.) However, many composite baseband STLs do not control peaks perfectly because of bounce (see next page), and locating OPTIMOD-TV at the transmitter site (where it can control peaks just prior to the transmitter's RF exciter) is thus likely to maximize signal-to-noise ratio by making most efficient use of the available peak carrier deviation.

Because OPTIMOD-TV controls peaks, it is irrelevant whether the audio link feeding OPTIMOD-TV's input terminals is phase-linear. However, the link should have low noise, the flattest possible frequency response from 30-15,000Hz, and low non-linear distortion.

If you use a stereo encoder, feed the encoder directly from the 8282's left and right analog outputs. If possible, bypass the pre-emphasis network and the input low-pass filters in the encoder so that they cannot introduce spurious peaks. Because of their special design, OPTIMOD-TV's pre-emphasis network and low-pass filters perform the same functions while retaining tight peak control. (In BTSC countries we recommend using Orban's 8185A BTSC Stereo Encoder, which is ideally matched to the 8282.)

Transmission from Studio to Transmitter

There are five types of studio-to-transmitter links (STLs) in common use in television audio service: composite baseband microwave, digital, video STLs with audio subcarriers, analog land line (telephone/post line), and dual microwave.

Except for the composite baseband microwave STL and certain digital links, all these links carry the left and right channels directly or in some encoded form other than the standard stereo baseband (BTSC or EIAJ). These links are normally fed both left and right audio channels in non-encoded form, and their output is in the form of left and right channels.

Composite baseband microwave:

The composite baseband microwave STL carries the standard stereo baseband (BTSC or EIAJ), and is therefore fed from the output of a stereo encoder located at the studio site. The receiver output of the composite STL is the stereo baseband signal, which is applied directly to the wideband input of the television broadcast transmitter's exciter. Thus, no stereo encoder is needed at the transmitter.

In general, a composite microwave STL provides high audio quality, as long as there is a line-of-sight transmission path from studio to transmitter of less than 10 miles (16 km). If not, RF signal-to-noise ratio, multipath distortion, and diffraction effects can cause serious quality problems.

Although a composite microwave STL exhibits satisfactory stereo separation, it is nevertheless not unusual for it to bounce because of a large infrasonic peak in its frequency response caused by an under-damped automatic frequency control (AFC) phase-locked loop. This bounce can increase the peak carrier deviation by as much as 1dB, reducing average modulation. Many commercial STLs (and television exciters as well) have this problem.

Some consultants presently offer modifications to minimize or eliminate this problem. If your exciter or STL has this problem, you may contact Orban Customer Service for the latest information on such services.

Digital links:

There are several types of digital links presently available. One type encodes the entire composite stereo baseband on the link, functionally replacing a composite microwave STL. This type of link should be driven by the system stereo encoder.

Other digital links pass the audio in left and right form, and may apply data-rate-reduction processing to the signal to reduce the number of bits per second required for transmission

through the digital link. Such processing may distort peak levels, and such links must therefore be carefully qualified before you use them to carry the peak-controlled output of the 8282 to the transmitter or stereo encoder.

Older-technology links may use straightforward PCM (pulse-code modulation) without data rate reduction. These can be very transparent and can exhibit accurate pulse response provided that their input anti-aliasing filters and output reconstruction filters are rigorously designed to achieve constant group delay over the frequency range that contains significant program energy. This is not particularly difficult to do with modern over-sampled converter technology.

Because the 8282's output spectrum contains virtually no power above 16kHz, you may bypass any anti-aliasing filters in digital links driven by the 8282. This ensures the most accurate possible transient response.

NICAM is a sort of hybrid between PCM and data-rate-reduced systems. It uses a block-companded floating point representation of the signal with J.17 pre-emphasis. If it is equipped with the optional advanced digital I/O card (8200D/SRC), the 8282 can supply an AES/EBU output that has been digitally pre-emphasized to J.17. (The NICAM encoder must take this PCM data stream and convert it to the NICAM representation.)

> The 8282's processing peak-controls this signal to 50 or 75 microseconds, depending on the setting in its SYSTEM SETUP screen. Therefore, after the NICAM decoder at the transmitter decodes and de-emphasizes the NICAM bitstream according to J.17, the NICAM decoder's analog output can be applied directly to a conventional transmitter using 50 or 75 microsecond pre-emphasis with the knowledge that the audio is appropriately limited for this transmitter.

Older-technology converters (including some older NICAM encoders) may exhibit quantization distortion unless they have been correctly dithered. Additionally, they can exhibit rapid changes in group delay around cut-off because their analog filters are ordinarily not group-delay equalized. The installing engineer should be aware of all of these potential problems when designing a transmission system.

Any problems can be minimized by driving a digital STL with the 8282's optional AES/EBU digital output, which will provide the most accurate interface to the STL. If your STL can accommodate a 32kHz sampling frequency, and you do not require J.17 pre-emphasis, use the 8282's (8200D/32) card; if your STL requires 44.1 or 48kHz, you must use the 8282's advanced digital interface, model 8200D/SRC.

Video microwave STLs with audio subcarriers:

Many video microwave STLs provide several audio subcarriers above the video baseband (typically between about 6 and 8 MHz). Some of these subcarriers have sufficient bandwidth to pass composite stereo, while others are only suited for 50-15,000Hz audio.

The performance of such audio subcarriers should be qualified in exactly the same way as composite and dual microwave STLs, respectively. Please refer to the discussions on composite and dual microwave STLs in this section of the manual.

Analog land line (PTT/post office line):

Analog land line quality is extremely variable, ranging from excellent to poor. Whether land lines should be used or not depends upon the quality of the lines locally available, and upon the availability of other alternatives. Even the best land lines tend to slightly veil audio quality, due to line equalizer characteristics and phase shifts. Slight frequency response irregularities and non-constant group delay characteristics will alter the peak-to-average ratio, and will thus reduce the effectiveness of any peak limiting performed prior to their inputs (see Optimal Control of Peak Modulation Levels on page 1-10).

Dual microwave STLs:

Dual microwave STLs offer greater noise immunity than composite microwave STLs. However, problems include gain- and phase-matching of the left and right channels, overloads induced by pre-emphasis, and requirements that the audio applied to the microwave transmitters be processed to prevent over-modulation of the microwave system. Unless carefully designed, dual microwave STLs can also introduce non-constant group delay in the audio spectrum, distorting peak levels.

Some left/right microwave links may be modified to meet the specification for frequency response and phase linearity stated in Optimal Control of Peak Modulation Levels on page 1-10. Many such links have been designed to be easily configured at the factory for composite operation, where the entire television stereo baseband (BTSC or EIAJ) is passed. The requirements for maintaining stereo separation in composite operation are similar to the requirements for high waveform fidelity with low overshoot. Therefore, most links have the potential for excellent waveform fidelity if they are configured for composite operation (even if a composite television stereo signal is not actually being applied to the link).

Nevertheless, in a dual-microwave system, the 8282 is usually located at the studio, and any overshoots induced by the link are tolerated. The 8282 can only be located at the transmitter if the signal-to-noise ratio of the link is good enough to pass unprocessed audio. The signal-to-noise ratio of the link can be used optimally if the link is protected from overload by an Orban 4000 Transmission Limiter.

If the 8282 is located at the transmitter and fed unprocessed audio from a dual-microwave STL, it may be useful to use a companding-type noise reduction system (like dbx Type 2 or Dolby SR) around the link. This will minimize any audible noise build-up caused by compression within the 8282.

Peak Control Before the STL

The Orban 4000 Transmission Limiter is a transmission system overload protection device. When the 8282 is located at the transmitter, the 4000 is normally connected between the unprocessed audio output of the studio plant and the input of the STL to protect it from overload. The 4000 is operated below threshold to protect a transmission system from overload induced by pre-emphasis or operator gain-riding errors. Because it cannot perform a loudness control function and because it is not programmable, it cannot replace the gain-riding section of the 8282's processing.

STL and Exciter Overshoot

Earlier in this section, we discussed at length what is required to prevent STLs from overshooting. There are similar requirements for aural exciters. Nevertheless, in some installations some overshoot is inevitable. If this is a problem in your installation, overshoot reduction can be selected on the SYSTEM SETUP `I/O CALIB` screen, or the 8282's remote control feature can be used to reduce the peak level of the 8282's audio output as necessary.

This way, you can still use the 8282's line-up tone to adjust the steady-state deviation to 100% modulation. Yet the reduced peak level of the audio emitted from the 8282 ensures that the carrier deviates no further than 100% modulation after overshoot.

About Transmission Levels and Metering

Meters

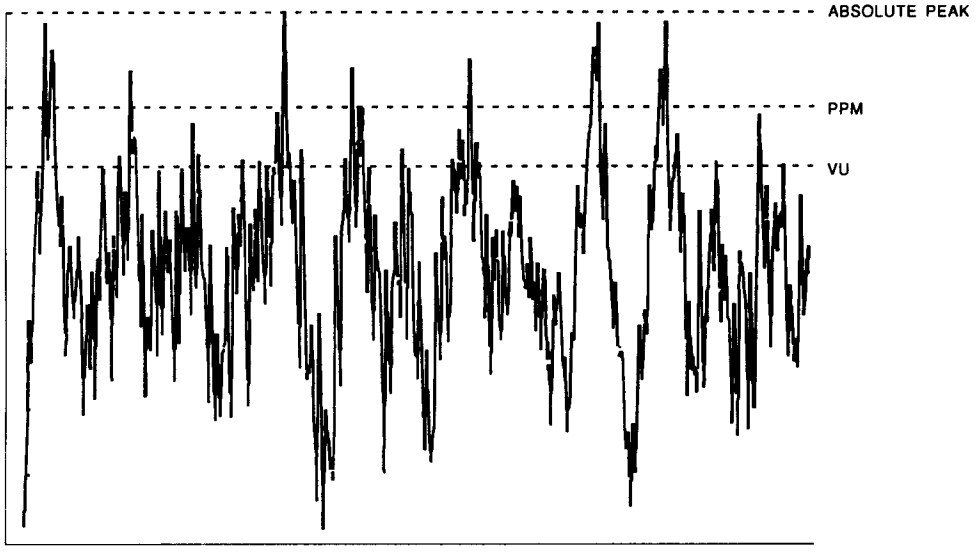


Figure 1-1: Absolute Peak Level, VU and PPM Reading
For a Few Milliseconds of Music Program

Studio engineers and transmission engineers consider audio levels and their measurements differently, so they typically use different methods of metering to monitor these levels.

The VU meter is an average-responding meter (measuring the approximate RMS level) with a 300ms rise time and decay time; the VU indication usually under-indicates the true peak level by 8 to 14dB.

The Peak Program Meter (PPM) indicates a level between RMS and the actual peak. The PPM has an attack time of 10ms, slow enough to cause the meter to ignore narrow peaks and under-indicate the true peak level by 5dB or more.

The absolute peak-sensing meter or LED indicator shows the true peak level. It has an instantaneous attack time, and a release time slow enough to allow the engineer to easily read the peak level.

Figure 1-1 shows the relative difference between the absolute peak level, and the indications of a VU meter and a PPM.

Studio Line-up Levels and Headroom

The studio engineer is primarily concerned with calibrating the equipment to provide the required input level for proper operation of each device, and so that all devices operate with the same input and output levels. This facilitates patching devices in and out without recalibration. For line-up, the studio engineer uses a calibration tone at a studio standard level, commonly called line-up level, reference level, or operating level.

Metering at the studio is by a VU meter or PPM (Peak Program Meter). As discussed above, the VU or PPM indication lags the true peak level. Most modern studio audio devices have a clipping level of no less than +21dBu, and often +24dBu or more. So the studio standardizes on a maximum program indication on the meter that is lower than the clipping level, so that peaks that the meter doesn't indicate will not be clipped. Line-up level is usually at this same maximum meter indication.

In facilities that use VU meters, this level is usually at 0VU, which corresponds to the studio standard level, typically +4 or +8dBu. For facilities using +4dBu standard level, instantaneous peaks can reach +18dBu or higher (particularly if the operator overdrives the console or desk). Older facilities with +8dBu standard level and equipment that clips at +18 or +21dBu will experience noticeable clipping on some program material.

In facilities that use the BBC-standard PPM, maximum program level is usually PPM4 for music, PPM6 for speech. Line-up level is usually PPM4, which corresponds to +4dBu. Instantaneous peaks will reach +17dBu or more on voice.

In facilities that use PPMs that indicate level directly in dBu, maximum program and line-up level is often +6dBu. Instantaneous peaks will reach +11dBu or more.

Transmission Levels

The transmission engineer is primarily concerned with the peak level of a program to prevent overloading or over-modulation of the transmission system. This peak overload level is defined differently, system to system. In television modulation (FM/VHF radio and television broadcast, microwave or analog satellite links), it is the maximum-permitted RF carrier frequency deviation. In AM modulation, it is negative carrier pinch-off. In analog telephone/post/PTT transmission, it is the level above which serious crosstalk into other channels occurs, or the level at which the amplifiers in the channel overload. In digital, it is the largest possible digital word.

For metering, the transmission engineer uses an oscilloscope, absolute peak-sensing meter, calibrated peak-sensing LED indicator, or a modulation meter. A modulation meter usually

has two components — a semi-peak reading meter (like a PPM), and a peak-indicating light which is calibrated to turn on whenever the instantaneous peak modulation exceeds the over-modulation threshold.

Line-Up Facilities

Metering of Levels

The I/O (Input/Output) METER screen on the 8282 shows left/right input and output levels.

Left/Right Input Level

Left and right input level is shown on a VU-type scale (−20 to +3dB), while the metering indicates *absolute instantaneous peak* (much faster than a standard PPM or VU meter).

Depending upon your requirements, you can operate the left/right input metering in one of two basic styles: METERS INDICATE CLIP or METERS INDICATE REFerence. You can choose between these styles on the SYSTEM SETUP I/O CALIB screen.

When METERS INDICATE CLIP is chosen, the input meter is scaled so that 0dB corresponds to the absolute maximum peak level that the 8282 can accept, at the current setting of its A-I (Analog Input) CLIP LeVeL control. If you are using the AES/EBU digital input, the maximum digital word at the input corresponds to the 0dB point on the 8282's input meter.

When METERS INDICATE REFerence is chosen, the left/right input meters are recalibrated to match your station's line-up or reference level, as set on the SYSTEM SETUP I/O CALIB screen. Program material produces frequent peaks that will read full-scale due to the absolute instantaneous peak response of the meters. Reference tone should be set to indicate 0dB on these meters.

Left/Right Output Level

Left and right output level is shown on a VU-type scale (−20 to +3dB), where the metering indicates absolute instantaneous peak (much faster than a standard PPM or VU meter).

The meter is scaled so that 0dB is calibrated to the highest left and right peak modulation level, before de-emphasis, that the processing will produce, under any program, processing, or setup condition (except when the processing is switched to bypass). The meter indication is not affected by the setting of the output level control.

Built-in Calibrated Line-up Tones

To facilitate matching the output level of the 8282 to the transmission system that it is driving, the 8282 contains an adjustable USER TONE that produces sinewaves at the 8282's left and right outputs. The frequency and modulation level of the line-up tones can be adjusted from the front panel.

When the 8282's left/right analog output (or the 8200D/SRC's AES/EBU output) is switched to FLAT, a de-emphasis filter is inserted between the output of the 8282's audio

processing and its line output. Thus, as the frequency of the tone preset is changed, the level at the 8282's line output will follow the selected de-emphasis curve.

In most cases the pre-emphasis filter in the driven equipment will undo the effect of the 8282's internal de-emphasis, and the 8282's output level should be adjusted so that the tone produces 100% modulation of the transmission link as measured after the link's pre-emphasis filter. At 100Hz, switching the de-emphasis out or in will have negligible effect on the level appearing at the 8282's left and right audio outputs.

You can adjust the frequency and modulation level of the built-in line-up tone, and then save this to a user preset, so that recalling this preset turns on the tone at the frequency and modulation level you preset. You can use the front panel, the serial port, or the opto-isolated remote control interface ports to recall the preset.

Built-in Calibrated BYPASS Preset

A bypass preset is available to transparently pass line-up tones generated earlier in the system. It will also pass program material, with no gain reduction or protection against overmodulation. It can transparently pass any line-up tone applied to its input up to about 130% output modulation, at which point clipping may occur.

Bypass does go through the pre-emphasis selected for the processing. Thus, it is possible to overload the digital circuitry with high frequencies at high input levels or with a large amount of gain.

Internal Clock

The 8282 contains an internal clock that is used to automatically change presets on a programmed time and date schedule.

The clock is designed to provide *short-term* and *long-term* accuracy sufficient for the application of changing the sound of the processing. It runs from the 8282's internal time base, which provides exceptionally good short-term stability, and is usually accurate to better than one second in 24 hours. At the same time, the clock monitors the AC mains frequency. In most developed countries, the power company maintains *long-term* accuracy of the mains to precisely 60Hz or 50Hz. Once each 24 hours, at approximately one minute after midnight, the 8282 resets its internal clock to the long-term (24 hour) average frequency of the mains.

For installations that require better accuracy, clock reset capability is provided at the Remote Control Interface connector. Using a pulse generated by your station's standard clock system, you can reset the 8282's clock to the nearest hour, or to 00:00:00 (midnight).

For installations where the power company does not maintain long-term accuracy of the main's frequency, the clock can be set to run only from the 8282's internal time base.

For more information, see page 2-63.

Future Updates

From time to time, Orban will introduce new features to the control system or the processing. As these features are introduced, you will be given the opportunity to purchase the new features. Some may only require software updating; some may require additional hardware.

To be assured of receiving notification of updates, stop now, complete the Registration Card that came with the unit, and mail it in to us.

Software updates will be distributed on a module that plugs into a socket on the Control Card. Instructions will be provided.