

# Operating Manual

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***OPTIMOD***

***6300***

Digital Multipurpose Audio Processor

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Version 4.1 Software



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

**Model Number:**

6300

**Description:**

OPTIMOD 6300 audio processor for digital audio transmission channels. Digital I/O, Protection Structure, 2-band Structure with CBS Loudness Controller, 5-band Structure. 85-250V operation at 50-60 Hz via universal switching power supply. Switchable to flat, 50µs or 75µs preemphasis.

**MANUAL:**

**Part Number:**

96119.200.01

**Description:**

6300 Operating Manual



**CAUTION**

**RISK OF ELECTRIC SHOCK  
DO NOT OPEN**



**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.

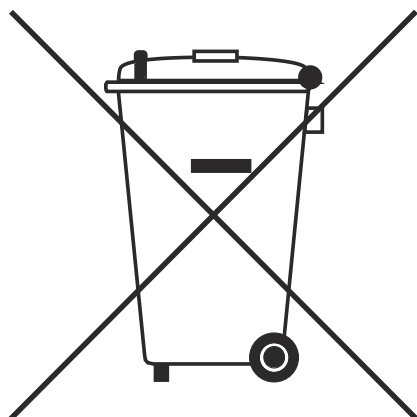
**WARNING:** TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.



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.



In accordance to the WEEE (waste electrical and electronic equipment) directive of the European Parliament, this product must not be discarded into the municipal waste stream in any of the Member States. This product may be sent back to your Orban dealer at end of life where it will be reused or recycled at no cost to you.

If this product is discarded into an approved municipal WEEE collection site or turned over to an approved WEEE recycler at end of life, your Orban dealer must be notified and supplied with model, serial number and the name and location of site/facility.

Please contact your Orban dealer for further assistance.

[www.orban.com](http://www.orban.com)

# 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 erfassen. Beschädigte Netzkabel sofort auswechseln.

Gerät und Netzkabel keinen übertriebenen mechanischen Beanspruchungen 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 à une contrainte mécanique excessive.

Pour éviter tout contact avec une tension électrique dangereuse, on n'ouvrira 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 de 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 après-vente 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.





## PLEASE READ BEFORE PROCEEDING!

### 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-washer 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:

- (1) Tighten all screws on any barrier strip(s) so the screws do not fall out from vibration.
- (2) Wrap the unit in its original plastic bag to avoid abrading the paint.
- (3) 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 (if applicable)
- The Monitor Rolloff Filter(s) (OPTIMOD-AM only)
- The COAX Connecting Cable (OPTIMOD 6300 and OPTIMOD 6300 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 +1 856.719.9900.



#### 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, subject 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 la 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 surface. A much smaller static discharge is likely to destroy one or more of the CMOS semiconductors employed in OPTIMOD 6300. 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, you will not even notice many damaging discharges.

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

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Orban Labs Inc., 7209 Browning Road, Pennsauken NJ 08110 USA  
Phone: +1 856.719.9900; E-Mail: [custserv@orban.com](mailto:custserv@orban.com); Site: [www.orban.com](http://www.orban.com)

# Operating Manual

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***OPTIMOD***

***6300***

Digital Multipurpose Audio Processor

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Version 4.1 Software



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# Section 1

## Introduction

### Crucial Information for Video Applications—Please Read!

To make automatic loudness control as straightforward and dependable as possible, the 6300 operates somewhat differently from other Optimods.

- **Dialnorm (Target Loudness):** The 6300 works very easily with Dolby Digital® transmission systems if you do one crucial thing: You must tell the 6300 what value of Dolby Digital Dialnorm metadata you are transmitting to your audience. This will prevent your transmission from being too loud or quiet compared to other correctly set up Dolby Digital transmissions. You set Dialnorm via the **BS 1770 TARGET LOUDNESS** controls. These can be set locally with a given processing preset, or globally for all presets whose local **TARGET LOUDNESS** control is set to **GLOBAL**.
- The 6300's *Quick Setup* wizard (page 2- 11) leads you through the process of setting Target Loudness on the 6300. Step 11 on page 2-27 explains how the 6300 uses its knowledge of transmitted Target Loudness to control loudness.
- **Your Dolby Digital transmission's loudness will automatically be correct if:**
  - you have set the mode of the 6300 peak limiter driving your transmitter to be **LIMIT NORM** (see step (I) on page 2- 27).

There are two peak limiters, each dedicated to one digital output. They can have different values of **TARGET LOUDNESS**. For example, you could set **Limiter #1's TARGET LOUDNESS** to -24 LUFS for on-air transmission and **Limiter #2's TARGET LOUDNESS** to -16 LUFS for streaming.

- you use a "TV" factory preset (Table 3-3 on page 3-31),
- you have adjusted the 6300's **input reference level** so that the processing operates with normal amounts of gain reduction (step 5 on page 2-23 or step 7 on page 2-24), and
- you have adjusted **relevant output's TARGET LOUDNESS** to match the Dialnorm you are transmitting (step 11 on page 2-27).

The 6300's **TARGET LOUDNESS** value can be set in two places: There are (1) system settings for each output in the active Setup, which can be over-

ridden by (2) a setting in the active Processing Preset, which is applied to both limiters. Except for the parameters in the analog TV (TVAXxxx) presets (see Table 3-3 on page 3-31), all factory Processing Presets are configured to use the global Target Loudness setting specified in the I/O CALIBRATE screen.

Note that setting the value of Target Loudness in the 6300 does not automatically convey this information to the downstream Dolby Digital encoder. Instead, you must manually set the 6300's TARGET LOUDNESS control to match the value of DIALNORM that the Dolby Digital encoder is transmitting to your audience.

- Setting Output Loudness: To set a given output's loudness, adjust its TARGET LOUDNESS value or adjust the MB LIMITER DRIVE control in the active Processing Preset. Both methods cause 6300's OUTPUT LEVEL meter indication to change. The MB LIMITER DRIVE control affects the loudness of both outputs equally.
- Adjusting TARGET LOUDNESS changes output loudness without changing the indication on the 6300's loudness meters or the amount of gain reduction in the loudness controller. The peak limiter's gain reduction will change. This is the preferred method if the 6300's loudness controller is active (as it is in most "TV" presets) because it has the smallest effect on the sonic texture of the 6300's audio processing.
- Adjusting MB LIMITER DRIVE changes the Loudness Level meter's indication and the amount of gain reduction in the loudness controller and peak limiter.

When a given output's source is set to LIMIT NORM, 6300's output level control (100% OUTPUT LEVEL) does not change output loudness. Its only

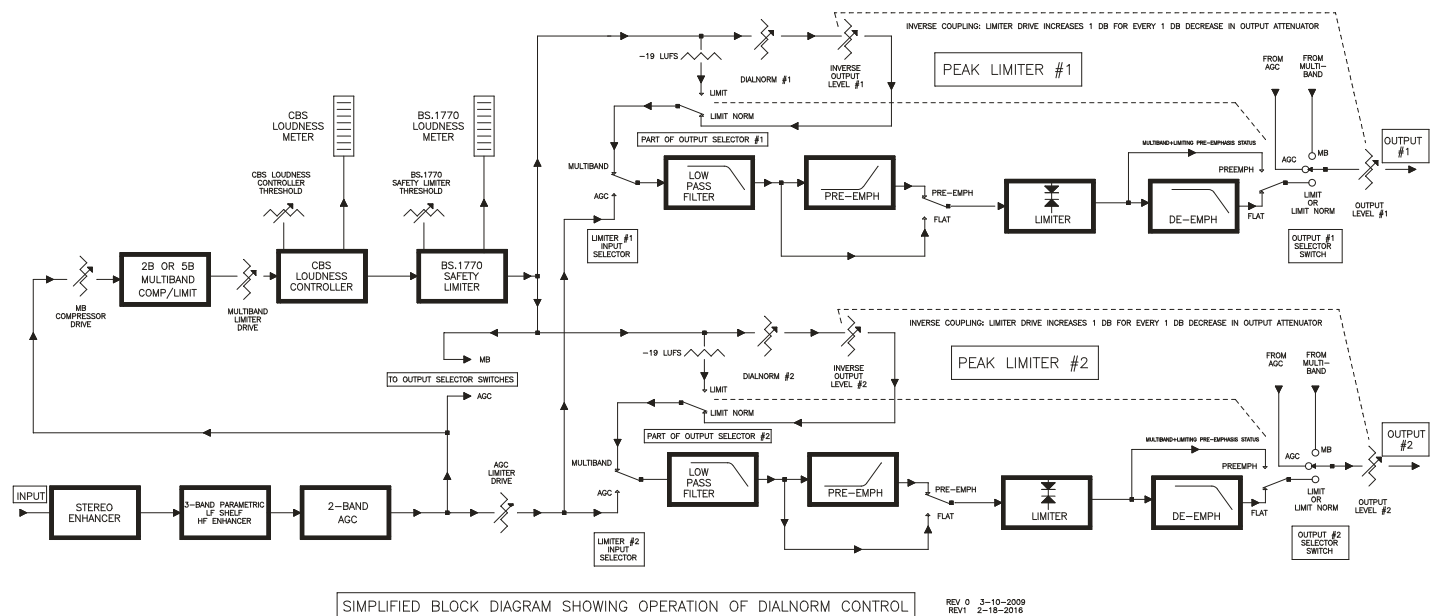


Figure 1-1: Simplified Block Diagram of Target Loudness Control

purpose is to set the 6300's **maximum peak output level with respect to 0 dBFS**, which allows you to compensate for transmission channels that introduce peak overshoots, which all lossy codecs do. For example, if you lower an **OUTPUT LEVEL** control from 0 dBFS to -2 dBFS, the 6300 automatically reduces the gain following its peak limiter by 2 dB and simultaneously increases the drive into the peak limiter by 2 dB. Hence, the average output level does not change but the maximum peak output level is constrained to -2 dBFS. This unconventional arrangement results from the 6300's **handling of Target Loudness**—if you have set **TARGET LOUDNESS** correctly on the 6300, you can change the 6300's **output level control** freely without causing your on-air loudness to be incorrect with respect to other transmissions.

If you are processing for a Dolby Digital distribution channel and wish to customize a factory preset, see *Setting Preset Loudness Correctly in Dolby Digital Transmission* on page 3-17.

- **BS.1770 Safety Limiter:** The 6300 includes a BS.1770 safety limiter function that will prevent a BS.1770-4 loudness meter with a 10-second integration time from indicating higher loudness than the setting of the **BS.1770 DELTA THRESHOLD** control. **This limiter is active in all “TV” factory presets.** See *BS.1770 Safety Limiter* on page 3-13 for a discussion of why we included this limiter and why we don't think you should use it.

## Using this Manual

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The Adobe pdf form of this manual contains numerous hyperlinks and bookmarks. A reference to a numbered step or a page number (except in the Index) is a live hyperlink; click on it to go immediately to that reference.

If the bookmarks are not visible, click the “Bookmarks” tab on the left side of the Acrobat Reader window.

This manual has a table of contents and index. To search for a specific word or phrase, you can also use the Adobe Acrobat Reader's text search function.

## The OPTIMOD 6300 Digital Audio Processor

---

Orban's all-digital Optimod 6300 Audio Processor can help you achieve the highest possible quality digital audio broadcast, digital television, and netcast audio processing. Thanks to versatile signal routing, the 6300 can also serve as a studio AGC with an all-digital signal path, and simultaneously as a talent headphone processor.

Because all processing is performed by high-speed mathematical calculations within digital signal processing (DSP) chips, the processing has cleanliness, quality, and stability over time and temperature that is unmatched by analog processors.

The 6300 is Target Loudness-aware. The two digital outputs can have independent Target Loudness settings. Loudness control is excellent when measured by the ITU BS.1770-4 standard (as specified in ATSC A/85:2011) or by the 6300's built-in CBS

Loudness Meters. When properly installed and set up, the 6300 will automatically make a station compliant with the CALM Act.

OPTIMOD 6300 is descended from the industry-standard OPTIMOD audio processors for radio and television. Thousands of these broadcast-specific processors are attracting and holding audiences all over the world. They have proven that the “OPTIMOD sound” can attract and keep an audience even in the most competitive commercial environment.

**Because OPTIMOD 6300 incorporates several audio processing innovations exclusive to Orban products, you should not assume that it can be operated in the same way as less sophisticated processors. If you do, you may get disappointing results.**

Take a little time now to familiarize yourself with OPTIMOD 6300. A small investment of your time now will yield large dividends in audio quality.

The rest of Chapter 1 explains how OPTIMOD 6300 fits into the DAB and DTV broadcast plants and how to use it for netcasting. Chapter 2 explains how to install it. Chapter 3 explains how to operate OPTIMOD 6300. Chapters 4 through 6 provide reference information.

OPTIMOD 6300 was designed to deliver a high quality sound while simultaneously increasing the average modulation of the channel substantially beyond that achievable by “recording studio”-style compressors and limiters. Because such processing can exaggerate flaws in the source material, it is very important that the **source audio be as clean as possible.**

For best results, **feed OPTIMOD 6300 unprocessed audio.** No other audio processing is necessary or desirable.

If you wish to place level protection prior to your studio/transmitter link (STL), use OPTIMOD-PC 1100V2 or another 6300. Either of these can substitute for the broadband AGC circuitry in OPTIMOD 6300, which is then defeated.

## User-Friendly Interface

- An **LCD** and **full-time LED meters** make setup, adjustment and programming of OPTIMOD 6300 easy—you can always see the metering while you are adjusting the processor. Navigation is by dedicated buttons, soft buttons (whose function is context-sensitive), and a large rotary knob. The LEDs show all metering functions of the processing structure (2-band or 5-band) in use.
- Push one of the dedicated buttons to “Recall” a preset, to “Modify” processing, or to access the system’s Setup controls.

## Absolute Control of Loudness and Peak Modulation

- The 6300 includes third-generation **CBS Loudness Controllers™** for DTV applications. **Loudness controllers** work with the both **Two-Band** and **Five-Band structures**. The third-generation improvements **reduce annoyance more than simple**



**loudness control alone**, doing so without audible gain pumping. Attack time is fast enough to prevent audible loudness overshoots, so the control is smooth and unobtrusive. Material processed by the CBS Loudness Controller has been shown to be well controlled when measured with a long-term loudness meter using the ITU-R BS.1770-4 standard. The 6300 also includes a “BS.1770 Safety Limiter” that follows the CBS Loudness Controller; use the BS.1770 if the BS.1770-4 meter reading must be constrained to a preset value. See *BS.1770 Safety Limiter* on page 3-13 and *Using the ITU BS.1770 and CBS Loudness Meters to Measure Loudness Controller Performance* starting on page 3-77 for a discussion of why we included this limiter.

- Starting with V2.2 software, the 6300 implements **“true peak” control** by oversampling the peak limiters’ sidechains at 192 kHz. This allows the 6300 to **prevent clipping in a playback device’s analog signal path** by predicting and controlling the analog peak level following the playback device’s reconstruction filter to an accuracy of better than 0.5 dB. For typical program material, accuracy is 0.2 dB

Without true peak control, analog clipping can occur even if all peak values of the digital samples are below 0 dBFS. This phenomenon has also been termed **“0 dBFS+.”**

Thanks to true peak control, **sample rate conversion**, unless it removes high frequency program energy or introduces group delay distortion, **cannot cause sample peaks to increase more than 0.5 dB**. For example, sample rate conversion from 48 kHz to 44.1 kHz is highly unlikely to cause sample peak clipping in the 44.1 kHz audio data.

- While **primarily oriented toward “flat” media**, the 6300 can also provide **preemphasis limiting** for the two standard preemphasis curves of 50µs and 75µs. This allows it to protect pre-emphasized microwave links, satellite uplinks and similar channels where protection limiting or light processing is required. It can also be used to process analog television FM aural carriers in television applications because these are usually processed lightly compared to FM radio.

Because its processing is configured to be most effective with “flat media,” the 6300 cannot provide extreme loudness for pre-emphasized radio channels. Use one of Orban’s Optimod-FM processors for this application.

## Flexible Configuration

- The 6300 includes **analog** and **dual AES3 digital** inputs and outputs. The digital input and digital outputs have sample-rate converters and can operate at 32 kHz, 44.1 kHz, 48, 88.2, and 96 kHz sample rates. The preemphasis status and output levels are separately adjustable for the analog and digital outputs. The two digital outputs can have independent Target Loudness settings.

Note that the 6300 cannot provide simultaneous, independent audio processing for flat and preemphasized channels. Even though one output may be pre-emphasized while other is flat, the only difference between the outputs is that the “flat” output has de-emphasis applied to it after the processing while the preemphasized output does not.

- OPTIMOD 6300’s outputs can be independently configured to emit the output of the **AGC** or the output of the **multiband compressor/limiter**, all configurable to use or bypass look-ahead limiting. So a 6300 can be configured to **drive an STL** with a peak-limited output from the **AGC** while also providing a **fully processed digital radio/netcast feed** and a **low delay, multiband compressed talent head-phone feed**.
- OPTIMOD 6300 **controls the audio bandwidth** as necessary to accommodate the transmitted sample frequency. OPTIMOD 6300’s high frequency bandwidth can be switched instantly (typically in 1 kHz increments) between 10 kHz and 20 kHz. 20 kHz is used for highest-quality systems. 15 kHz meets the requirements of any system that uses 32 kHz sample frequency, while 10 kHz is appropriate for 24 kHz sample frequency.
- The 6300’s **dual-mono** mode allows entirely separate mono programs to be processed, facilitating dual-language operation.

In this mode, both processing channels operate using the same processing parameters (like release time); you cannot adjust the two channels to provide different processing textures.

- OPTIMOD 6300 **supports Dolby Digital® Dialnorm metadata**, which simplifies setting up the 6300 to drive Dolby Digital channels.
- The analog inputs are **transformerless, balanced 10kΩ instrumentation-amplifier circuits** and the analog outputs are transformerless, balanced, and floating (with 50Ω impedance) to ensure highest transparency and accurate pulse response.
- All input, output, and power connections are **rigorously RFI-suppressed** to Orban’s traditional exacting standards, ensuring trouble-free installation.
- The 6300 is designed and certified to **meet all applicable international safety and emissions standards**.

## Adaptability through Multiple 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. OPTIMOD 6300 realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) chips.
- The 6300 features two processing structures: **5-band** for a spectrally consistent sound with good loudness control, and **2-band** for a transparent sound that pre-

serves the frequency balance of the original program material while also effectively controlling subjective loudness.

- Orban's **PreCode™** technology manipulates several aspects of the audio to minimize artifacts caused by low bitrate codecs, ensuring consistent loudness and texture from one source to the next. PreCode includes special audio band detection algorithms that are energy and spectrum aware. This can improve codec performance on some codecs by reducing audio processing induced codec artifacts, even with program material that has been preprocessed or mastered by other processing than Optimod. There are several factory presets tuned specifically for low bitrate codecs. These presets have "LBR" in their names.
- A special 2-band preset creates a no-compromise "Protect" function that is functionally similar to the "**Protect**" structures in earlier Orban digital processors. The 5-band and the 2-band structures can be switched via a mute-free crossfade.
- The 6300 includes third-generation **CBS Loudness Controllers™** for DTV applications. **Separate loudness controllers are available for the two channels in dual-mono mode.** The CBS algorithm has **proven its effectiveness** by processing millions of hours of on-air programming since the early 1980s. It smoothly limits subjectively perceived loudness to a broadcaster-set threshold, **preventing audience irritation.** The controller measures subjective loudness (as perceived by an average listener) and then closes a feedback loop to limit loudness to a preset level. It effectively controls loud commercials, which are the primary irritant in sound-for-picture applications. Third generation improvements **reduce annoyance more than simple loudness control alone**, doing so without audible gain pumping. **Attack time is adjustable** to trade off short-term loudness control against transient punch.
- The 6300's AGC **rides gain** over an adjustable range of up to 25dB, compressing dynamic range and compensating for both operator gain-riding errors and gain inconsistencies in automated systems. The AGC output is available to drive STLs, so the 6300 can be used as a studio AGC.
- The 6300's processing structures are all **phase-linear** to maximize audible transparency.
- The 6300's equalizers and crossovers use 48-bit arithmetic to ensure **mastering-quality noise and distortion performance.**

## Controllable

- The 6300 **can be remote-controlled** by 5-12V pulses applied to eight programmable, optically isolated "general-purpose interface" (GPI) ports.
- **6300 PC Remote software** is a graphical application that runs under Windows 2000 and XP. It communicates with a given 6300 **via TCP/IP over modem, direct serial, and Ethernet** connections. You can configure PC Remote to switch be-

tween many 6300s via a convenient organizer that supports giving any 6300 an alias and supports grouping multiple 6300s into folders. Clicking a 6300's icon causes PC Remote to connect to that 6300 through an Ethernet network or initiates a Windows Dial-Up or Direct Cable Connection if appropriate. The PC Remote software allows the user to access all 6300 features (including advanced controls not available from the 6300's front panel) and allows the user to archive and restore presets, automation lists, and system setups (containing I/O levels, digital word lengths, GPI functional assignments, etc.).

- The 6300 contains a versatile **real-time clock**, which allows automation of various events (including recalling presets) at pre-programmed times. To ensure accuracy, the clock can be synchronized to an Internet timeserver.
- Silence alarm and digital audio fault tally outputs are available.
- A Bypass Test Mode can be invoked locally, by remote control (from either the 6300's GPI port or the 6300 PC Remote application), or by automation to permit broadcast system **test and alignment** or "proof of performance" tests.
- The 6300 contains a built-in **line-up tone generator**, facilitating quick and accurate level setting in any system.
- The 6300's **software can be upgraded** by running Orban-supplied downloadable upgrade software on a PC. The upgrade can occur remotely through the 6300's Ethernet port or serial port (connected to an external modem), or locally (by connecting a Windows® computer to the 6300's serial port through the supplied null modem cable).

## Presets in OPTIMOD 6300

---

There are two distinct kinds of presets in OPTIMOD 6300: **factory presets** and **user presets**.

### Factory Presets

The Factory Presets are our "factory recommended settings" for various program formats or types. There are multiple Factory Presets for both radio-oriented and video oriented programming. Each Factory Preset on the Preset list is really a library of more than 20 separate presets, selected by navigating to MODIFY PROCESSING > LESS-MORE and using the LESS-MORE control to adjust OPTIMOD 6300 for less or more processing. The factory presets are listed and described starting on page 3-21. The description indicates the processing structure and the type of processing.

Factory Presets are stored in OPTIMOD 6300's non-volatile memory and cannot be erased. You can change the settings of a Factory 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.

---

## User Presets

User Presets permit you to change a Factory Preset to suit your requirements and then store those changes.

You can store more than 100 User Presets, limited only by available memory in your 6300 (which will vary depending on the version of your 6300's software). You can give your preset a name up to 18 characters long.

User Presets cannot be created from scratch. You must always start by recalling a Factory Preset. Make the changes, and then store your modified preset as a User Preset. You can also recall a previously created user preset, modify it, and save it again, either overwriting the old version or saving under a new name. In all cases, the original Factory Preset remains for you to return to if you wish.

User Presets inherit the structure of their parent Factory Presets (5-band or 2-band). The *only* way you can choose the structure of a factory preset is to edit it from a Factory preset having that structure (or to edit it from an older User Preset having the desired structure). You cannot change the structure that an existing User Preset uses.

User Presets are stored in non-volatile memory that does not require battery backup. *To Create or Save a User Preset* on page 3-19 has more about User Presets.

---

## Input/Output Configuration

OPTIMOD 6300 simultaneously accommodates:

- Digital AES3 left/right inputs and dual outputs.
- Analog left/right inputs and outputs.

OPTIMOD 6300 can be operated in either stereo or dual-mono mode. In dual-mono mode, processing parameters that determine the "sound" of the processor are the same on both channels.

Dual-mono or stereo mode is a global system parameter. You can change modes manually, via the 6300's GPI inputs, via 6300 PC Remote software, or via the 6300's built-in time-of-day automation. Further, the 6300 can be programmed to recognize the "stereo" and "dual-mono" flags in the AES input bitstream and to switch modes accordingly. It will also set these flags appropriately in its output AES bitstream.

## Digital AES3 Left/Right Input/Outputs

The digital input and outputs conform to the professional AES3 standard. They all have sample rate converters to allow operation at 32, 44.1, 48, 88.2, and 96 kHz sample frequency.

To ensure best control of peak modulation, operate the output at 48 kHz or higher.

The left/right digital input is on one XLR-type female connector on the rear panel; the left/right digital outputs are on two XLR-type male connector on the rear panel.

You select whether OPTIMOD 6300 uses the digital or analog input either locally or by remote interface. If OPTIMOD 6300 is set to accept a digital input and the feed fails, OPTIMOD 6300 will automatically switch back to the analog input.

In dual-mono mode, the two programs must be combined into one AES3 stream to be accepted by the 6300. However, you can configure the 6300 so that one digital output is dedicated to channel 1 and one output to channel 2 in dual-mono mode. You can also configure the outputs so that one or both outputs carry both channels.

Level control of the AES3 input is accomplished via software control through System Setup (see step 7 on page 2-24) or through PC Remote.

Both analog and digital outputs are active continuously.

The 6300's output sample rate can be locked to the 6300's internal crystal clock, the sample rate present at its AES3 input, the sample rate present at its AES11 sync input, or wordclock.

The 6300 can apply J.17 deemphasis to signals applied to its digital input and J.17 preemphasis to the processed signal emitted from its digital output. J.17 is a 6 dB/octave shelving preemphasis/deemphasis standard with break points at 400 Hz and 4 kHz. It is used mainly in older studio / transmitter links that use NICAM technology. The 6300's provisions for J.17 make it fully compatible with systems using this standard.

## 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 10k $\Omega$ ; 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 50 $\Omega$ ; balanced and floating. The outputs can drive 600 $\Omega$  or higher impedances, balanced or unbalanced. The peak output level is adjustable from -6dBu to +24dBu.

Level control of the analog inputs and outputs is accomplished via software control through System Setup (see step 5 on page 2-23 and step 8 on page 2-25) or through PC Remote.

## Remote Control Interface

The Remote Control Interface is a set of eight optically isolated GPI inputs on a DB-25 connector, which can be activated by 5-12V DC. They can control various functions of the 6300:

- Recall any Factory Preset, User Preset, Test Mode state (Bypass or Tone), or exit from a Test Mode to the previous processing preset.
- Switch the 6300 to use either the analog input or the digital input.
- Switch the 6300 between stereo and dual mono modes.
- Reset the 6300's **internal clock to the nearest hour or to midnight**.

You can reconfigure the functions of the GPI inputs via System Setup. For example, if you are not switching between stereo and mono, the inputs ordinarily dedicated to controlling the stereo/mono status can instead be re-configured to call additional presets.

See page 2-51 for information on programming the remote control interface.

## Computer Interface

On the rear panel of the 6300 are an RS-232 serial port and an Ethernet port for interfacing to IBM-compatible PCs either locally or through a TCP/IP network. These computer interfaces support remote control and metering, and allow downloading software upgrades.

Each 6300 package ships with 6300 PC Remote software, an application for any IBM-compatible PC running Microsoft Windows 2000 (Service Pack 3 or higher) or XP. 6300 PC Remote permits you to adjust any 6300 preset by remote control or to do virtually anything else that you can do from the 6300's front panel controls. The program displays all of the 6300's LCD meters on the computer screen to aid remote adjustment.

### RS-232 Serial Port

6300 PC Remote can communicate at up to 115 kbps via modem or direct connection between the computer and the 6300 through their RS-232 serial ports.

### RJ45 Ethernet Connector

The 6300 can be connected to any Ethernet network that supports the TCP/IP protocol.

See *Networking and Remote Control* on page 2-52 for more information.

## Location of OPTIMOD 6300

This section assumes that OPTIMOD 6300 will be used as a transmission processor. See the *Using OPTIMOD 6300 as a Studio Level Controller* on page 1-13 if OPTIMOD 6300 is to be used as a studio AGC.

At the transmitter is best

The best location for OPTIMOD 6300 is as close as possible to the transmitter or encoder so that OPTIMOD 6300's AES3 output can be connected to the transmitter or encoder through a circuit path that introduces no change in OPTIMOD 6300's output bitstream. A high-quality AES3 cable is ideal.

Where access to the transmitter is not possible

Sometimes it is not possible to locate OPTIMOD 6300 at the transmitter. Instead, it must be located on the studio side of the link connecting the audio plant to the transmitter. If the transmitter plant is not accessible, all audio processing must be done at the studio and you must tolerate any damage that occurs later.

If an uncompressed digital link is available, this is an ideal situation because such a link will pass OPTIMOD 6300's output with little or no degradation. However, such a link is not always available.

If only a 32 kHz sample rate link is available, the sample rate conversion necessary to downsample the audio will cause overshoots when OPTIMOD 6300 is operated at 20 kHz bandwidth because the sample rate converter removes spectral energy. In this case, you can minimize overshoot by operating OPTIMOD 6300 at 15 kHz bandwidth because the bandwidth limiting occurs before OPTIMOD 6300's **peak limiter**, which then accurately controls the peak level of the 15 kHz band-limited signal.

Unless the path is a digital path using no lossy compression, this situation will yield lower performance than if OPTIMOD 6300 is connected directly to the transmitter because artifacts that cannot be controlled by OPTIMOD 6300 will be introduced by the link to the transmitter. These artifacts can decrease average modulation by 2-4dB and can also add noise and audible non-linear distortion. With lossy digital compression, this deterioration will be directly related to the bit rate. For an analog path, the deterioration will depend on the amount of linear and non-linear distortion in the path. In addition, there will be up to 0.5 dB of overshoot caused by asynchronous re-sampling (see page 1-16).

One strategy is to apply to OPTIMOD 6300's output signal the same lossy compression that the DAB transmitter would apply. If a digital link is available with sufficient bit rate to pass this compressed signal, it can then be passed directly to the DAB transmitter without further processing if synchronization issues can be resolved. Consult with the manufacturer of your DAB transmitter to see if this can be done.

Where only an analog or lossy digital link is available, feed the audio output of OPTIMOD 6300 directly into the link. If present, the transmitter's protection limiter should be adjusted so that audio is normally just below the threshold of limiting. The transmitter protection limiter should respond only to signals caused by faults or by spurious peaks introduced by imperfections in the link.

Where maximum quality is desired, it is wise to request that all equipment in the signal path after the studio be carefully measured, aligned, and qualified to meet the appropriate standards for bandwidth, distortion group delay and gain stability. Such equipment should be measured at reasonable intervals.

OPTIMOD 6300 at the transmitter: gain control before the STL

The audio received at OPTIMOD 6300's input should have the highest possible quality. To achieve the full audible benefit of OPTIMOD 6300 processing, use a studio-transmitter link (STL) that is as flat as the bandwidth of OPTIMOD 6300 as used in your plant (usually 20 kHz). Ideally, you should use a 20-bit (or better) uncompressed digital link with at least 44.1 kHz sample frequency.



Because the audio processor controls peaks, it is not important that the audio link feeding OPTIMOD 6300's input terminals be phase-linear. However, the link should have low noise, the flattest possible frequency response from 20-20,000Hz, and low non-linear distortion.

If the audio link between the studio and the transmitter is noisy (or is limited to 16 bits or less, if digital), performing the AGC function at the studio site can minimize the audibility of this noise. AGC applied before the audio link improves the signal-to-noise ratio because the average level on the link will be greater. Further, many STLs require level control to prevent the STL from being overloaded.

To apply such level control and compression, we recommend an Orban AGC/Limiter/HF Limiter/Clipper before the STL transmitter. This performs the function of OPTIMOD 6300's internal broadband automatic gain control (AGC) while simultaneously protecting the STL. When using a studio AGC, defeat OPTIMOD 6300's broadband AGC.

## Using OPTIMOD 6300 as a Studio Level Controller

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*See page 6-43 for a block diagram of the 6300's signal processing and routing.*

Because of its versatile signal routing, OPTIMOD 6300 can be used as a combined studio AGC, digital radio/netcast processor, and low-delay talent headphone processor. Any output can emit any of the following signals:

- Stereo enhancement, equalization, and AGC without look-ahead peak limiting
- Stereo enhancement, equalization, and AGC with peak limiting
- Stereo enhancement, equalization, and multiband processing (2-band or 5-band, including AGC) without peak limiting
- Stereo enhancement, equalization, and multiband processing (2-band or 5-band, including AGC) with peak limiting

**In a typical application:**

- OPTIMOD 6300 substitutes for the AGC in an Optimod at the transmitter and provides protection limiting for the STL. Digital output #1 emits the peak-limited output of the AGC to drive the STL. The AGC is turned off in the transmitter-side Optimod.

*See Studio-Transmitter Link on page 1-15 for more about STLs.*

If the STL has at least 16 bits of dynamic range, it is often practical to drive it with the AGC alone, allowing additional headroom for the overshoots that the 6300's peak limiter would have otherwise removed. Defeating the peak limiter (by setting the output to **AGC** or **Multiband**) will remove about 16 milliseconds of delay from the signal path. Note that when the limiter is bypassed, the delay is minimum regardless of the setting of the **PROC DELAY** controls.

The 6300's AGC uses the same dual-band, window-gated, matrix technology as the AGCs in Orban's 2300, 5300, 8300, 8382, 8400, 8500, 9300, and 9400 Optimods. It can therefore accurately substitute for the AGCs in these devices and can help maintain an all-digital signal path throughout the facility. Because the 6300's AGC is more advanced than the AGCs in Orban's 2200, 8200, and 9200 Optimods, the 6300 can upgrade the performance of these older products when substituted for their AGCs.

Moreover, because the 6300 supports presets that be recalled by remote control, it can be automatically synchronized to the presets active at a transmitter-side Optimod when presets are dayparted.

The 6300's multiband processing is based on the technology used in Optimod-FM 8600's digital radio processing path and will sound similar. To help you match the sound of an 5700, 8400, 8500, 8500S, 8600, or 8600S, the 6300 provides presets with the same names as those in the Optimod-FM products listed previously. If you are using a factory preset at a transmitter-side Optimod-FM, you can recall a preset with the same name in the 6300 to ensure that the sound stays the same as it would if you were using an Optimod-FM with its internal AGC.

To achieve this match, you must adjust the transmitter-side Optimod's input reference level so that the Optimod performs the correct amount of multiband gain reduction (i.e., the same amount of GR that it would have performed if its internal AGC were active). This match will occur automatically if you use the 6300's tone generator to emit a 400 Hz tone and then use the tone to calibrate the transmitter-side Optimod. Step (E) on page 2-23 of this manual describes this procedure for a 6300 at the transmitter; the procedures for the 2300, 5300, 5500, 5700, 8300, 8382, 8400, 8500, 8500S, 8600, 8600S, 9300, and 9400 Optimods are virtually identical and are described in their manuals.

- Digital output #2 emits a peak-limited, multiband-processed signal to drive a **netcast encoder (like Orban's Opticodec-PC)** or a digital radio transmitter.
- The analog output emits a low-delay multiband-processed signal with no peak limiting to drive talent headphones at the studio.

The total input-to-output delay through this path is approximately 5 ms. While you could also use one of the digital outputs to emit this signal, this would add about 1 ms of delay because of the additional delay of the external D/A converter required before the headphone amplifier.

**The peak limiters can be switched to operate either "flat" or on a 50 $\mu$ s or 75 $\mu$ s pre-emphasis curve to protect a pre-emphasized path like a typical analog microwave STL.**

When operated in pre-emphasized mode, the peak limiters should only be used for light protection limiting with a low duty cycle. Otherwise, you may hear pumping on material with a lot of high frequency energy like sibilance.

Because the look-ahead peak limiting technology used in the 6300 performs optimally **with "flat"** transmission channels (like almost all digital channels), the 6300 cannot provide loudness processing for **pre-emphasized radio channels**. Use one of Orban's Optimod-FM processors for this application. For analog television with FM aural carrier(s), use Optimod-TV 8382.

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## Studio-Transmitter Link

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The following information is mainly relevant to digital radio and TV broadcasters who have their transmitters and studios at different locations. Most netcasters will not find the information in this section relevant because if netcasters need to ship audio beyond their LAN, they ordinarily ship it from one location to another in the form of encoded audio through low-capacity Telco-supplied digital links like ISDN or E-1/T-1.

### Transmission from Studio to Transmitter

There are five types of studio-transmitter links (STLs) in common use in broadcast service: uncompressed digital, digital with lossy compression (like MPEG, Dolby®, or APT-x®), microwave, analog landline (telephone/post line), and audio subcarrier on a video microwave STL.

STLs are used in two fundamentally different ways. Either they can pass unprocessed audio for application to OPTIMOD 6300's input or they can pass OPTIMOD 6300's peak-controlled output. The two applications have fundamentally different performance requirements.

- A link that passes unprocessed audio should have very low noise and low non-linear distortion, but its transient response is not important.
- A link that passes processed audio does not need as low a noise floor as a link passing unprocessed audio. However, its transient response is critical. In DAB applications, such a link *must* be uncompressed digital and *must* use digital inputs and outputs to achieve best results. We will elaborate below.

#### Digital links

Digital links may pass audio as straightforward PCM encoding or they may apply lossy data reduction processing to the signal to reduce the number of bits per second required for transmission through the digital link. Such lossy processing will almost invariably distort peak levels and such links must therefore be carefully qualified before you use them to carry the peak-controlled output of OPTIMOD 6300 to the transmitter. For example, the MPEG Layer 2 algorithm can increase peak levels up to 4dB at 160kb/sec by adding large amounts of quantization noise to the signal. While the desired program material may psychoacoustically mask this noise, it is nevertheless large enough to affect peak levels severely. For any lossy compression system the higher the data rate, the less the peak levels will be corrupted by added noise, so use the highest data rate practical in your system.

It is practical (though not ideal) to use lossy data reduction to pass unprocessed audio to OPTIMOD 6300's input. The data rate should be at least of "contribution quality"—the higher, the better. If any part of the studio chain is analog, we recommend using at least 20-bit A/D conversion before encoding.

Because OPTIMOD 6300 uses multiband limiting, it can dynamically change the frequency response of the channel. This can violate the psychoacoustic masking assumptions made in designing the lossy data reduction algorithm. Therefore, you

need to leave “headroom” in the algorithm so that OPTIMOD 6300’s multiband processing will not unmask quantization noise. This is also true of any lossy data reduction applied in the studio (such as hard disk digital delivery systems).

For MPEG Layer 2 encoding, we recommend 384kb/second or higher.

Some links may use straightforward PCM (pulse-code modulation) without lossy data reduction. If you connect to these through an AES3 digital interface, these can be very transparent if they do not truncate the digital words produced by the devices driving their inputs and they do not require downward sample rate conversion.

If the link does not have an AES3 input, you must drive its analog input from OPTIMOD 6300’s analog output. Starting with V2.2 software, peak control in OPTIMOD 6300 occurs at a 192 kHz sample frequency, which limits potential overshoot to 0.5 dB or less after D/A conversion or sample rate conversion.

Downward sample rate conversion can cause overshoot due to spectral truncation. To prevent this, always set the 6300’s lowpass filter cutoff frequency to complement the lowest sample frequency you are using in your transmission system. Use 20 kHz for sample frequencies of 44.1 kHz and above, and use 15 kHz for a sample rate of 32 kHz.

When using lossy digital compression, it is particularly important to minimize the amount of peak limiting in the 6300. Heavy peak limiting may introduce audible artifacts as a side effect of precisely controlling peak levels. It is pointless to introduce such artifacts if the lossy compression compromises the benefits of the limiting by adding overshoots. Instead, allow a generous amount of headroom when setting the drive level into the STL. Most lossy digital STLs have a noise floor that is low enough to make this practical. Using a reference level (Target Loudness setting) recommended in ATSC A/85 (–24 LKFS) or EBU R 128 (–23 LUFS) ensures that little, if any, peak limiting will occur.

The Dolby Digital transmission encoder is lossy and introduces overshoot. Hence, it is usually unwise to use substantial amounts of peak limiting when the 6300 is used as a final transmission processor to drive a Dolby Digital encoder. If a reasonable value of Target Loudness is used (–23 dB or lower), little or no peak limiting should be required in the 6300 because the Dolby Digital signal path will have a generous amount of headroom.

**NICAM** is a sort of hybrid between PCM and lossy data reduction systems. It uses a block-companded floating-point representation of the signal with J.17 preemphasis.

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.

You can minimize any problems by always driving a digital STL with OPTIMOD 6300’s AES3 digital output, which will provide the most accurate interface to the STL. The digital input and output accommodate sample rates of 32 kHz, 44.1 kHz, 48, 88.2, and 96 kHz.

#### Microwave STLs

In general, an analog 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. However, the noise and non-linear distortion characteristics of such links are likely to be notably poorer than 16-bit digital even if propagation conditions are ideal.

Lack of transparency in the analog path can cause overshoot. Unless carefully designed, microwave STLs can introduce non-constant group delay in the audio spectrum, distorting peak levels when used to pass processed audio. Nevertheless, in a system using a microwave STL OPTIMOD 6300 is sometimes located at the studio and any overshoots induced by the link are tolerated or removed by the transmitter's protection limiter (if any). OPTIMOD 6300 can only be located at the transmitter if the signal-to-noise ratio of the STL is good enough to pass unprocessed audio. The signal-to-noise ratio of the STL can be used optimally if an Orban Optimod-PC 1101, 8200ST Compressor / Limiter / HF Limiter / Clipper, a 4000 Transmission Limiter, or another 6300 protects the link from overload. Of these, the 1101 and 6300 are currently manufactured as of this writing and are the preferred choices because their AGCs are identical to the AGC in the 6300.

If OPTIMOD 6300 is located at the transmitter and receives unprocessed audio from a 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 buildup caused by compression within OPTIMOD 6300.

Some microwave links may be modified such that the deviation from linear phase is less than  $\pm 10^\circ$  20-20 kHz, and frequency response is less than 3dB down at 0.15Hz and less than 0.1dB down at 20 kHz. This specification results in less than 1% overshoot with processed audio. Many such links have been designed to be easily configured at the factory for composite operation, where an entire FM stereo baseband 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 FM stereo signal is not actually being applied to the link).

Further, it is common for a microwave STL 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 STL's peak carrier deviation by as much as 2dB, reducing average modulation. Many commercial STLs have this problem.

#### Analog landline (PTT/post office line)

Analog landline quality is extremely variable, ranging from excellent to poor. (Fortunately, they are largely obsolete, having been replaced by digital links.) Whether landlines should be used or not depends upon the quality of the lines locally available, and upon the availability of other alternatives. Due to line equalizer characteristics and phase shifts, even the best landlines tend to veil audio quality slightly. They will certainly be the weakest link in a DAB broadcast chain.

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.

## Using Lossy Data Reduction in the Audio Chain Before the 6300

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Many broadcasters are now using lossy data reduction algorithms like MPEG-1 Layer 2, Layer 3, or Dolby AC2 to increase the storage time of digital playback media. In addition, source material is often supplied through a lossy data reduction algorithm, whether from satellite or over landlines. Sometimes, several encode/decode cycles will be cascaded before the material is finally presented to OPTIMOD 6300's input.

All such algorithms operate by increasing the quantization noise in discrete frequency bands. If not psychoacoustically masked by the program material, this noise may be perceived as distortion, "gurgling," swishing, or other interference. Psychoacoustic calculations are used to ensure that the added noise is masked by the desired program material and not heard. Cascading several stages of such processing can raise the added quantization noise above the threshold of masking, making it audible.

In addition, at least one other mechanism can cause the noise to become audible at the radio. OPTIMOD 6300's multiband compressor performs an "automatic equalization" function that can radically change the frequency balance of the program (sometimes by more than 10 dB). This can cause noise that would otherwise have been masked to become unmasked because the psychoacoustic masking conditions under which the masking thresholds were originally computed have changed. Accordingly, if you use lossy data reduction in the studio, you should use the highest data rate possible. This maximizes the headroom between the added noise and the threshold where it will be heard. In addition, you should minimize the number of encode and decode cycles because each cycle moves the added noise closer to the threshold where the added noise is heard.

## Interfacing to the Transmitter

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### Sync Input

In the Eureka-147 system, several programs are combined into one "ensemble multiplex." This requires synchronization of the sample rates applied to the transmitter. DTV and HD Radio also require synchronization.

The 6300 provides a BNC connector that accepts "house sync" in AES11id (75Ω unbalanced) or wordclock (square wave at the sample frequency) format. A setup menu selection determines whether the 6300's output will be synchronized to wordclock, AES11, the 6300's internal clock, or the signal applied to its AES3 audio input. Because the 6300's digital input is equipped with a sample rate converter, an asynchronous digital input can be applied to the 6300 while its output is synchronized to a master sync generator.

#### AES User Bits

In Setup, you can configure the 6300 to either block or pass AES User Bits from its digital input to its digital output.

#### Sample Rate and Audio Bandwidth

Most DAB audio is at 48 kHz sample rate. However, the iBiquity™ HD-AM™ system operates at 32 kHz, requiring 15 kHz audio bandwidth. The Eureka-147 system offers a 24 kHz sample rate option, requiring 10 kHz audio bandwidth. The Digital Radio Mondiale (DRM) system also allows reduced audio bandwidths and sample rate for speech-grade services.

OPTIMOD 6300's bandwidth can be adjusted from 10 kHz to 20 kHz to provide correctly anti-aliased audio for any of these systems. As long as any anti-aliasing filters following OPTIMOD 6300's output are phase-linear, these filters will pass the band-limited OPTIMOD 6300 output without introducing overshoot because they remove no further spectrum and do not add group delay distortion.

The bandwidth-limiting filter is located before the processing, so it affects all outputs equally.

OPTIMOD 6300 always operates at 48 kHz sample rate internally, except for its peak limiters, which operate at 192 kHz to prevent overshoots following D/A conversion or sample rate conversion. The 6300's output is equipped with a sample rate converter that can output at 32 kHz, 44.1 kHz, 48, 88.2, or 96 kHz. These rates can be synchronized to the 6300's internal clock, its AES3 digital input, its AES11id input, or its wordclock input.

We expect that transmitters that transmit sample rates below 32 kHz will provide internal sample rate conversion, and that most will probably accept audio at 48 kHz sample rate regardless of the final sample rate of the transmission. To prevent overshoots due to spectral truncation, the 6300's lowpass filter cutoff frequency must be set to complement the frequency response of such links.

#### Subframe Delay

OPTIMOD 6300 provides an adjustable time delay of up to 96 milliseconds. This allows the installer to force the total delay through the processing to equal one frame (in sound-for-picture applications). The definition of "frame" depends on the system in which OPTIMOD 6300 is installed.

The selections are **MINIMUM** (approximately 24 ms delay), 30 fps (NTSC monochrome video), 29.97 fps (NTSC color video), 25 fps (most PAL video), and 24 fps (film). You can also adjust the delay in one-millisecond increments from 15 to 96 ms.

## About Transmission Levels and Metering

### Meters

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 5 dB or more. The absolute peak-sensing meter or LED indicator shows the actual peak level of the digital samples. It has an instantaneous attack time, and a release time slow enough to allow the engineer to read the peak level easily. Figure 1-3 on page 1-21 shows the relative difference between the absolute peak level, and the indications of a VU meter and a PPM for a few seconds of music program.

## 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 under-indicates 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 those peaks that the meter does not 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 digital transmission, the SMPTE standard line-up level is -20 dBFS and the EBU standard line-up level is -18 dBFS.

Facilities complying with the ATSC A/85 or EBU R 128 loudness standards will align their facilities by using an ITU-R BS.1770-4 compliant loudness meter, using the recommendations in these standards. For digital audio, BS.1770 also recommends using a true peak level meter that oversamples the audio by at least 4x before it is applied to the meter.

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 FM 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

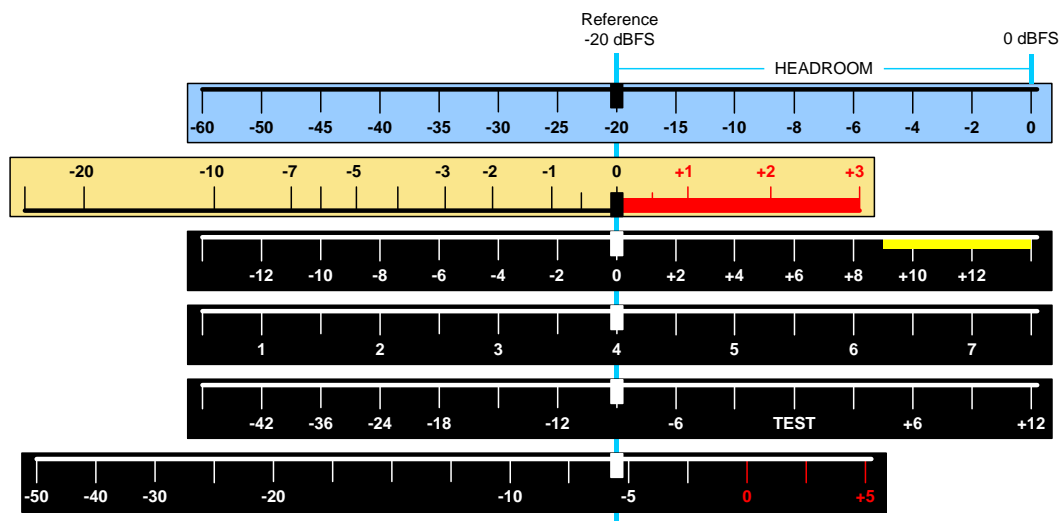


Figure 1-2: Common Audio Meter Scales, Aligned to the Same Reference Level

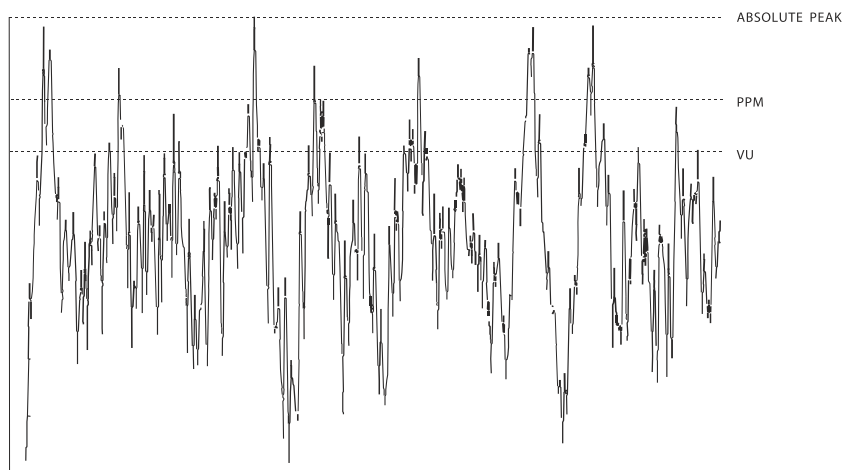


Figure 1-3: Absolute Peak Level, VU and PPM Indications

the level at which the amplifiers in the channel overload. In digital channels, 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 overmodulation threshold.

## Line-Up Facilities

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### Metering of Levels and Subjective Loudness

The meters on the 6300 show peak input levels, the peak output modulation, and subjective loudness.

- Input levels are displayed using a VU-type scale (0 to –40dB), but the metering indicates *absolute instantaneous peak* (much faster than a standard PPM or VU meter). The maximum digital word at the input corresponds to the 0 dB point on the 6300's **input meter**.
- The output meters indicate the values of the digital samples at the outputs of the 6300's two peak limiters, not at its digital outputs. For example, if the **DO1 100%** control is set to –3 dBFS and the meter indicates 0 dB, the peak level at the 6300's **digital output #1** is –3 dBFS.

0 dB on the meter also corresponds to the threshold of limiting of the 6300's **look-ahead peak limiters**, which prevent the processed audio's level from increasing beyond 0 dB.

If the output's sample rate is set to a rate other than 48 kHz and or passed through a D/A converter, the peak level of the output may increase by as much as 0.5 dB because the 6300's peak limiter is over-sampled at 192 kHz and not at infinite frequency . (See page 1-16).

- The subjective loudness meter, labeled **LOUDNESS LEVEL** on the 6300's **front panel**, displays long-term gated loudness measured by the ITU-R BS.1770-4<sup>1</sup> standard with a ten-second integration time where all samples in the previous ten seconds are weighted equally. In addition to BS.1770-4, 6300 PC Remote indicates short-term loudness measured using the CBS Technology Center algorithm developed by Jones and Torick<sup>2</sup>. These indications are relative to the active Target Loudness

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<sup>1</sup> Recommendation ITU-R BS.1770-4 (03/2011): "Algorithms to measure audio programme loudness and true-peak audio level"

<sup>2</sup> Bronwyn L. Jones and Emil L. Torick, "A New Loudness Indicator for Use in Broadcasting," J. SMPTE September 1981, pp. 772-777.

setting of the output you are using. Each of the two outputs can have a separate Target Loudness setting.

- The meter is scaled so that in Dolby Digital transmission channels, the loudness level at the **consumer's** receiver is correct when the 6300's **processing is adjusted to make dialog peak at "0 dB" on the 6300's Loudness Level meter**, and the Target Loudness value for the output you are using (which you must enter manually) in the active 6300 Setup is the same as the Dialnorm value being **transmitted to the consumer's** receiver.
- The **"neutral" setting of the TARGET LOUDNESS** control (i.e., the setting that matches the loudness of 6300 version 1.x processing) is **-19 dB**.
- Because loudness perception combines the contributions of all acoustic sources, there is only one Loudness Level meter indication regardless of the number of audio channels.

The BS.1770-4 meter is well described by its governing standards document. Based on our listening tests and feedback from mixing engineers involved with major network productions, we believe that the short-term (3-second integration time) meter can over-indicate the loudness of the **"anchor element" (usually speech) by as much as 5 dB in two important cases**. The first is where the material has a low peak-to-RMS ratio because **a large amount of "artistic compression" has been applied with the goal of adding color and excitement to promos and commercials**. The second is where the dialog passages contain substantial amounts of underscoring and/or effects, particularly if these have a large amount of energy between 100 and 300 Hz. These issues have caused frustration for producers and mixers who have had to compromise their mixes to prevent them from airing too quietly in broadcast processing chains that rely on automated use of the BS.1770 meter to set final on-air loudness.

To satisfy customers who rely on BS.1770-centric automated loudness quality control procedures, the 6300 has a **"BS.1770 safety limiter"** that prevents the long-term BS.1770-4 loudness from exceeding a user-adjustable threshold. It is set for a ten-second integration time. However, because the 6300's **CBS Loudness Controller is better able to lock onto the "anchor element" than is the BS.1770 meter**, we believe that the processed audio sound more naturally pleasing and consistent if the BS.1770 safety limiter is defeated. We offer one factory preset where this limiter is defeated: **TV 5B GP NO1770 LC**.

The CBS meter is a **"short-term"** loudness level meter that displays the details of moment-to-moment loudness with dynamics slightly faster than a VU meter. It can indicate the loudness of short-term sounds (like pistol shots) that may be annoying to TV viewers but that the BS.1770-4 meter, because of its longer integration time, may not take fully into account. Created using Orban-developed modeling software, the DSP implementation typically matches the original CBS analog meter within 0.5 dB on sinewaves, tone bursts and noise.

The Jones & Torick algorithm improves upon the original loudness measurement algorithm developed by CBS researchers in 1967. Its foundation is psychoacoustic studies done at CBS Laboratories over a two year period by Torick and the late Benjamin Bauer, **who built on S. S. Stevens' '50s-era work at Harvard University**.

After surveying existing equal-loudness contour curves (like the famous Fletcher-Munson set) and finding them inapplicable to measuring the loudness of broadcasts, Bauer and Torick organized listening tests that resulted in a new set of equal-loudness curves based on octave-wide noise reproduced by calibrated loudspeakers in a semireverberant 16 x 14 x 8 room, which is representative of a room in which broadcasts are normally heard. They published this work<sup>3</sup> along with results from other tests whose goal was to model the loudness integration time constants of human hearing. These studies concentrated on the moderate sound levels typically preferred by people listening to broadcasts (60 to 80 phons<sup>4</sup>) and did not attempt to characterize loudness perception at very low and high levels.

According to this research and its predecessors, the four most important factors that correlate to the subjective loudness of broadcasts are these:

1. The power of the sound.
2. The spectral distribution of the power. **The ear's sensitivity depends strongly on frequency.** It is most sensitive to frequencies between 2 and 8 kHz. Sensitivity falls off fastest below 200 Hz.
3. Whether the power is concentrated in a wide or narrow bandwidth. For a given total sound power, the sound becomes louder as the power is spread over a larger number of *critical bands* (about 1/3 octave). This is called *loudness summation*.
4. Temporal integration: As its duration increases, a sound at a given level appears progressively louder until its duration exceeds about 200 milliseconds, at which point no further loudness increase occurs.

Bauer and Torick used the results of this research to create a loudness level meter with eight octave-wide filters, each of which covers three critical bands. (B & T did not use one filter per critical band because this would have made the meter, which was realized using analog circuitry, prohibitively expensive.) Each filter feeds a full-wave rectifier and each rectifier feeds a nonlinear lowpass filter that has a 10 ms attack time and a 200 ms release time, somewhat like the sidechain filter in an AGC. This **models the "instantaneous loudness" perception mechanism in the ear.** Instantaneous loudness is not perceived directly but is an essential part of the total loudness model.

To map the instantaneous loudness to perceived short-term loudness, the outputs of each of the nonlinear lowpass filters are arithmetically summed with gains chosen to follow the 70 phon equal-loudness curves **of the ear as determined by Bauer and Torick's research.** The sum is applied to a second, slower nonlinear lowpass filter. This has an attack time of 120 ms and a release time of 730 ms. Along with the eight nonlinear lowpass filters following the individual filters, this filter models temporal

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<sup>3</sup> Benjamin B. Bauer and Emil L. Torick, "Researches in Loudness Measurement," IEEE Transactions on Audio and Electroacoustics, Volume AU-14, Number 3, September 1966, pp. 141-151

<sup>4</sup> The phon is a unit of perceived loudness, equal in number to the intensity in decibels of a 1 kHz tone judged to be as loud as the sound being measured.

integration and maps it to the visual display. Meanwhile, the arithmetic addition models loudness summation.

The internationally accepted unit of subjective loudness is the *sone*. With a sinewave, 40 phons = 1 sone. A doubling of sones corresponds to a doubling of loudness. However, because broadcasters were accustomed to working in decibel units, Jones and Torick chose to map loudness on a LED ladder display encompassing –20 to +5 dB in 0.5 dB increments, with the understanding that the perceived loudness doubles every 10 dB at loudness levels typically heard by broadcast audiences.

The J & T meter is monophonic. Psychoacoustic studies indicate that when multiple acoustic sources are present in a room, loudness is most accurately expressed by summing the power in the sources. For example, driving two loudspeakers with identical program produces 3 dB higher loudness than a single speaker produces. Therefore, to extend the J & T algorithm to multichannel reproduction, we implement one eight-filter filterbank for each channel and compute RMS sums of the outputs of corresponding filters in each channel before these sums are applied to the eight nonlinear lowpass filters. As in the monophonic J & T algorithm, the sum of these lowpass filters drives a second nonlinear filter, which drives the display.

## Test Modes

### Calibrated Bypass Test Mode

A BYPASS Test Mode is available to transparently pass line-up tones generated earlier in the system. It will also pass program material, applying 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 is not appropriate for normal on-air use because switching to and from it will usually cause clicks or other program disruptions and because it does not protect against inadvertent output clipping. To defeat the dynamics processing on-air (which might be desired when switching from a local to a network program, for example), use the PASS-THROUGH factory preset or a user preset derived from the PASS-THROUGH factory preset.

### Calibrated Line-up Tones

To facilitate matching the output level of the 6300 to the transmission system that it is driving, the 6300 contains a test tone oscillator that produces sine waves at 6300's outputs. You can adjust the frequency and modulation level of the built-in line-up tone via the front panel or PC Remote software, and you can specify which outputs emit the tone. You can use the front panel, the PC Remote software, or the opto-isolated remote control interface ports to activate the Test Tone.

## Setting Output/Modulation Levels

In a perfect world, one could set the peak level at OPTIMOD 6300's output to 0 dBFS. However, there are at several potential problems that may make it desirable to set the modulation level slightly lower.

First is asynchronous re-sampling, which we have discussed at length earlier in this chapter. (See page 1-16, for example.) If any digital processing that causes its output samples to be asynchronous to its input samples is used after OPTIMOD 6300's output, this can cause the peak levels of individual samples to increase above the nominal threshold of limiting. Because the 6300's peak limiters are oversampled at 192 kHz, this increase will be less than 0.5dB.

Second is additional processing, such as equalization. Equalization that applies boosts at certain frequencies is very likely to add peak level and thus cause clipping. However, equalization that attenuates certain frequencies can also cause overshoots because of added phase shifts. So be wary of any equalization and allow headroom to accommodate it.

Third is headroom in lossy data compression systems. A well-designed perceptual encoder will accept samples up to 0dBFS and will have enough internal headroom to avoid clipping. However, there is no guarantee that *receiver* manufacturers or *decoder* providers will implement perceptual decoders with sufficient headroom to avoid clipping overshoots. Such overshoots are the inevitable side effect of increasing the quantization noise in the channel, and can be as large as 3-4dB. Most perceptual encoder algorithms are designed to have unity gain from input to output. So if peak levels at the input frequently come up to 0dBFS, peak levels at the output will frequently exceed 0dBFS (and will be clipped) unless the decoder algorithm is adjusted to have less than unity gain.

Canny engineers familiarize themselves with the performance of real-world receivers and reduce the peak modulation of the transmissions if it turns out that most receivers are clipping due to perceptual encoding overshoots. Our experience to date suggests that allowing 3dB headroom will prevent audible overshoot-induced clipping in low bite-rate systems (e.g., 32 kbps streams), while 2dB is adequate for 128kbps and above. While some clipping may still occur, it will have a very low duty cycle and will almost certainly be inaudible.

## Monitoring on Loudspeakers and Headphones

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In live operations, highly processed audio often causes a problem with **the DJ or presenter's headphones**. The delay through OPTIMOD 6300 can be as much as 25ms (or more, if the installer purposely adds frame-makeup delay). This delay, although not usually audible as a distinct echo, can cause bone conduction comb filtering of the DJ/presenter's voice in his/her ears. This is almost always very uncomfortable to them.

OPTIMOD 6300's processing can emit the output of either the multiband compressor or AGC before peak limiting, which is where the majority of the delay occurs. The AGC and multiband pre-limiter signals can be routed to any output. The input/output delay of the pre-limiter signal is approximately 3 ms for the AGC or 5 ms at the multiband compressor. This delay can still be uncomfortable to some, but most DJ/presenters find it acceptable and almost anyone can get used to it.

See page 6-43 for a diagram of the signal routing.

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## Streaming and Netcasting Applications

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Because the state of the art in netcasting is changing with ferocious rapidity, we expect this section to become outdated quickly. Please check Orban's web site, [www.orban.com](http://www.orban.com), for newer information.

### Using OPTIMOD 6300 in Streaming Applications

You need an audio source connection (either analog, AES3 digital, or SPDIF digital). The digital input can accept any sample rate from 20 to 96 kHz. You can also use any stream available within the computer's internal WAVE audio system, such as a digital playout system. If you use the computer's WAVE audio system, you will need a sound card with full duplex capability and digital inputs and outputs. Connect the digital output of the sound card to the 6300's digital input and connect the 6300's digital output to the input of the sound card.

You will ordinarily connect the signal that the sound card receives to the input of an encoder application, like Modulation Index's StreamS or Orban's Opticodec-PC. You then apply the encoded output of the encoder to a netcast server application, which may operate on the same machine as the encoder, or on a different machine on your network. In the latter case, you will route the encoded audio to the netcast server application through your network.

See *Processing for Low Bit Rate Codecs* on page 3-5.

### Loudness

You can expect a significant increase in loudness from OPTIMOD 6300 processing by comparison to most unprocessed audio.

An exception is recently mastered CDs, which may have already been aggressively processed for loudness when they were mastered.

In radio broadcasting, it is generally believed that loudness relative to other stations attracts an audience that perceives the station as being more powerful than its competition. We expect that the same subliminal psychology will also hold true in netcasting.

### Choosing your Encoder

The state of the art in encoder technology is rapidly changing. At this writing, the best audio encoder technology widely available on player devices is MPEG HE-AACv2, also known by its trademarked name of AAC/aacPlus v2. HE-AAC can provide entertainment-quality stereo streams at 32 kbps. At 48 kbps, many listeners prefer the sound to that of FM. We expect the xHE-AAC (Extended HE-AAC; ISO/IEC 23003-3) codec to eventually replace HE-AAC.

Be aware that different encoders are optimized for different bit rates, and you should match your encoder to your potential audience. At 96 kbps and above, pure AAC is better than HE-AAC. This makes it necessary to use more than one algorithm to optimally serve audiences with these disparate connection speeds.

MPEG-1 Layer 3 has become a de-facto standard for distribution of non-streaming, high fidelity audio on the Internet, although HE-AAC and pure AAC are both more efficient.

OPTIMOD 6300 is well matched to HE-AAC / AAC and to MP3. It can effectively pre-process audio intended for playback from either format. If you decide to use MP3, choose your MP3 encoder wisely; different encoders may provide different levels of quality for a given bitrate.

## EAS Test

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For stations participating in the Emergency Alert System (EAS) in the United States, broadcast of EAS tones and data can be accomplished in three different ways:

1. Run EAS tones and data through the 6300.

Note that 6300 processing may not allow the full modulation level as required by EAS standards. It may therefore be necessary to temporarily defeat the 6300's processing during the broadcast of EAS tones and data. Placing the 6300 in its **BYPASS** Test Mode can defeat the processing. The **BYPASS GAIN** control sets a fixed gain through the 6300. See "Test Modes" on page 3-63 for more information.

2. Place the 6300 in Bypass mode locally.

- A) Navigate to **SETUP > MODE** and set **MODE** to **BYPASS**.

You can set the bypass gain with the **BYPASS GAIN** control located to the right of the **MODE** control.

- B) Begin EAS broadcast.

After the EAS broadcast, resume normal processing:

- C) Set the **MODE** to **OPERATE**.

This will restore the processing preset in use prior to the Test Mode.

3. Place the 6300 in Bypass mode by remote control. Then program any two **Remote Interface inputs for "Bypass" and "Exit Test," respectively**.

- A) Connect two outputs from your station remote control system to the **REMOTE INTERFACE** connector on the rear panel of the 6300, according to the wiring diagram in *Figure 2-2* on page 2-3.

- B) Program two GPI ports for **BYPASS** and **EXIT TEST** according to the instructions in *Remote Control Interface Programming* starting on page 2-51.

- C) Place the 6300 in bypass mode by remote control.

- a) Switch the 6300 into **BYPASS** mode by a momentary command from your station's remote control to the GPI port programmed as **BYPASS**.

- b) Begin EAS broadcast.



- c) When the EAS broadcast is finished, switch the 6300 from **BYPASS** mode by a momentary command from your station's remote control to the GPI port programmed as **EXIT TEST**.

You may also choose to insert EAS broadcast tones and data directly into the transmitter, thus bypassing the 6300 for the duration of the EAS tones and data broadcast.

## PC Control and Security Passcode

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PC software control provides access to OPTIMOD 6300 via network, modem or direct (null modem cable) connection, with IBM PC-compatible computers running Windows 2000 or XP. PC access is permitted only with a valid user-defined passcode.

PC remote control can be ended from the front panel; this feature effectively prevents simultaneous remote and local control.

See *Security and Passcode Programming* (starting on page 2-42) for more detail.

## Warranty, User Feedback

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### User Feedback

We are very interested in your comments about this product. We will carefully review your suggestions for improvements to either the product or the manual. Please email us at [custserv@orban.com](mailto:custserv@orban.com).

### LIMITED WARRANTY

*[Valid only for products purchased and used in the United States]*

Orban warrants Orban products against defects in material or workmanship for a period of five years from the date of original purchase for use, and agrees to repair or, at our option, replace any defective item without charge for either parts or labor.

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

Simply take or ship your Orban products prepaid to our service department. Be sure to include a copy of your sales slip as proof of purchase date. We will not repair transit damage under the no-charge terms of this warranty. Orban will pay return shipping. (See *Technical Support* on page 5-10.)

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No other warranty, written or oral, is authorized for Orban Products.

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

## **INTERNATIONAL WARRANTY**

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

# Section 2

## Installation

### Installing the 6300

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Allow about 2 hours for installation.

Installation consists of: (1) unpacking and inspecting the 6300, (2) mounting the 6300 in a rack, (3) connecting inputs, outputs and power, (4) optional connecting of remote control leads and (5) optional connecting of computer interface control leads.

When you have finished installing the 6300, proceed to "Quick Setup," on page 2-11.

#### 1. Unpack and inspect.

If you note obvious physical damage, contact the carrier immediately to make a damage claim. Packed with the 6300 are:

- 1ea. Operating Manual
- 2ea. Line Cords (domestic, European)
- 4ea. Rack-mounting screws, 10-32 x ½—with washers, #10
- 1ea. PC Remote Software CD

Save all packing materials! If you should ever have to ship the 6300 (e.g., for servicing), it is best to ship it in the original carton with its packing materials because both the carton and packing material have been carefully designed to protect the unit.

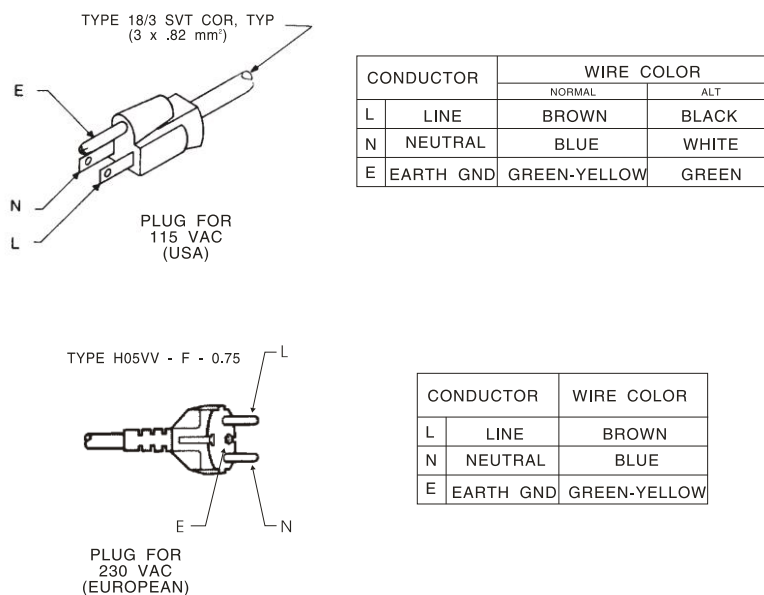
Complete the Registration Card and return it to Orban. (please)

The Registration Card enables us to inform you of new applications, performance improvements, software updates, and service aids that may be developed, and it helps us respond promptly to claims under warranty without our having to request a copy of your bill of sale or other proof of purchase. Please fill in the Registration Card and send it to us today. (The Registration Card is located after the cover page).

Customer names and information are confidential and are not sold to anyone.

#### 2. Install the appropriate power cord.

A) Check the power cord.



**Figure 2-1: AC Line Cord Wire Standard)**

AC power passes through an IEC-standard mains connector and an RF filter designed to meet the standards of all international safety authorities.

**The power cord is terminated in a “U-ground” plug (USA standard), or CEE7 / 7 plug (Continental Europe), as appropriate to your 6300’s Model Number. The green / yellow wire is connected directly to the 6300 chassis.**

**If you need to change the plug to meet your country’s standard and you are qualified to do so, see Figure 2-1. Otherwise, purchase a new mains cord with the correct line plug attached.**

### 3. Mount the 6300 in a rack.

The 6300 requires one standard rack unit (1 ¾ inches / 6.4 cm).

There should be a good ground connection between the rack and the 6300 chassis—check this with an ohmmeter to verify that the resistance is less than 0.5Ω.

It is wise to allow ventilation above and below the unit. Mounting the unit over large heat-producing devices (such as a vacuum-tube power amplifier) may shorten component life and is not recommended. Ambient temperature should not exceed 45°C (113°F) when equipment is powered.

Equipment life will be extended if the unit is mounted away from sources of vibration, such as large blowers and is operated as cool as possible.

### 4. Connect inputs and outputs.

See the hookup and grounding information on the following pages.

TOPIC	PAGE
Audio Input and Audio Output Connections.....	2-5
AES3 Digital Input and Output .....	2-7
Wordclock / AES11id Sync Input.....	2-7
Grounding .....	2-7

PIN ASSIGNMENT

- 1. DIGITAL GROUND
- 2. REMOTE 1+
- 3. REMOTE 2+
- 4. REMOTE 3+
- 5. REMOTE 4+
- 6. REMOTE 5+
- 7. REMOTE 6+
- 8. REMOTE 7+
- 9. REMOTE 8+
- 10. TALLY 1
- 11. TALLY 2
- 12. N/C
- 13. ANALOG GROUND
- 14. REMOTE 1-
- 15. REMOTE 2-
- 16. REMOTE 3-
- 17. REMOTE 4-
- 18. REMOTE 5-
- 19. REMOTE 6-
- 20. REMOTE 7-
- 21. REMOTE 8-
- 22-24. N/C
- 25. +12 VOLTS DC

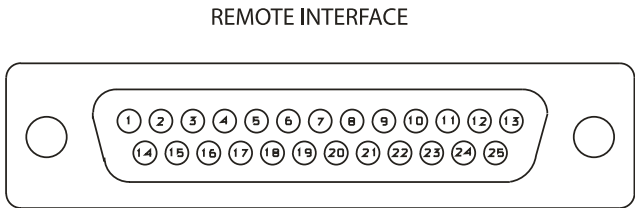


Figure 2-2: Wiring the 25-pin Remote Interface Connector

- 5. Connect remote control interface. (optional)

For a full listing of 6300’s **extensive remote control provisions**, refer to *Remote Control Interface Programming* on page 2-51.

Optically isolated remote control connections are terminated in a type DB-25 male connector located on the rear panel. It is wired according to *Figure 2-2*. To select the desired function, apply a 5-12V AC or DC pulse between the appropriate **REMOTE INTERFACE** terminals. The (–) terminals can be connected together and then connected to ground at pin 1 to create a Remote Common. A current-limited +12VDC source is available on pin 25. If you use 48V, connect a 2kΩ ±10%, 2-watt carbon composition resistor in series with the Remote Common or the (+) terminal to provide current limiting.

In a high-RF environment, these wires should be short and should be run through foil-shielded cable, with the shield connected to CHASSIS GROUND at both ends.

- 6. Connect tally outputs (optional)

See the schematic on page 6-28.

The 6300 supports two hardware tally outputs, which are NPN open-collector and operate with respect to pin 1 (common). Therefore, the voltage applied to the load (such as a relay or opto-isolator) must be positive. You can use the 12 VDC source on pin 25 to drive the high side of the load, taking into account the fact that the voltage on pin 25 is current limited by a 310  $\Omega$  resistor.

The tally outputs are protected against reverse polarity.

To avoid damaging the 6300, limit the current into a tally output to 30 mA. *DO NOT connect a tally output directly to a low-impedance voltage source!* The tally outputs are not protected against this abuse and the output transistors are likely to burn out. When driving a relay or other inductive load, connect a diode in reverse polarity across the relay coil to protect the driver transistors from reverse voltage caused by inductive kickback.

Note that the tally outputs have no special RFI protection. Therefore, it is wise to use shielded cable to make connections to them.

See step 21 on page 2-38 for instructions on programming the tally outputs.

#### 7. Connect to a computer

You can connect to a computer via the 6300's **serial connector** or via an **Ethernet** network. (See *Networking* on page 2-52.)

**You can connect to a computer via the 5500's serial connector** or via an Ethernet network. (See *Networking* on page 2-52.)

Procedures and instructions for connecting to a PC are subject to development and change. We advise you to download the latest version of this manual in pdf format from <ftp.orban.com/6300/Documentation>.

You can use Adobe's .pdf reader application to open and read this file. If you do not have the .pdf reader, it is available for free download from [www.adobe.com](http://www.adobe.com).

See *Installing 6300 PC Remote Control Software* on page 2-57 for more detail.

## 6300 Rear Panel

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*[Note: The 6300's front panel is described starting on page 3-1.]*

The **Power Cord** is detachable and is terminated in a "U-ground" plug (USA standard), or CEE7 / 7 plug (Continental Europe), as appropriate to your 6300's Model Number.

An **RS-232 (PC Remote) Computer Interface**, labeled SERIAL PORT, is provided to connect the 6300 to IBM PC-compatible computers, directly or via modem, for remote control, metering and software downloads.

A **Remote Interface Connector** (GPI connector) allows you to connect the 6300 to your existing transmitter remote control or other simple contact-closure control devices. The 6300 remote control supports user-programmable selection of up to eight

optically isolated inputs for any one of the following parameters: recalling any factory- or user presets, selecting tone or bypass modes, selecting stereo or dual-mono mode, selecting analog, digital, or digital+J.17 input, and clock synchronization. (See *Remote Control Interface Programming* on page 2-51.) The 6300 remote control accepts a DB-25 connector.

The **Ethernet Port** accepts a 10Mb/second or 100Mb/second Ethernet connection terminated with an RJ45 connector.

**Digital AES3 Input** and **AES3 dual Outputs** are provided to support two-channel AES3-standard digital audio signals through XLR-type connectors.

In dual-mono applications, digital outputs #1 and #2 can be dedicated to audio channel 1 (left) and channel 2 (right) respectively.

**Analog Inputs** and **Outputs** are provided to support left and right audio signals through XLR-type connectors.

**Wordclock / AES11id Sync Input** is provided on a female BNC connector.

The "id" refers to the fact that the connection is unbalanced and is designed to be interfaced with 75 $\Omega$  coaxial cable terminated in a male BNC connector. This input is not internally terminated and requires external 75 $\Omega$  termination if it is the last device on the cable.

## Input and Output Connections

### Cable

We recommend using two-conductor foil-shielded cable (such as Belden 8451 or equivalent) for the audio input and output connections because signal current flows through the two conductors only. The shield does not carry signal and is used only for shielding.

### Connectors

- Input and output connectors are XLR-type connectors.

In the XLR-type connectors, pin 1 is CHASSIS GROUND, while pin 2 and pin 3 are a balanced, floating pair. This wiring scheme is compatible with any studio-wiring standard: If pin 2 or 3 is considered LOW, the other pin is automatically HIGH.

### Analog Audio Input

- Nominal input level between -14dBu and +8dBu will result in normal operation of the 6300.

(0dBu = 0.775Vrms. For this application, the dBm @600 $\Omega$  scale on voltmeters can be read as if it were calibrated in dBu.)

- The peak input level that causes overload is +27.0dBu.

- The electronically balanced input uses an ultra low noise and distortion differential amplifier for best common mode rejection and is compatible with most professional and semi-professional audio equipment, balanced or unbalanced, having a source impedance of  $600\Omega$  or less. The input is EMI suppressed.
- Input connections are the same whether the driving source is balanced or unbalanced.
- Connect the red (or white) wire to the pin on the XLR-type connector (#2 or #3) that is considered HIGH by the standards of your organization. Connect the black wire to the pin on the XLR-type connector (#3 or #2) that is considered LOW by the standards of your organization.
- In low RF fields (like a studio site not co-located with an RF transmitter), connect the cable shield at 6300 input only—it should not be connected at the source end. In high RF fields (like a transmitter site), also connect the shield to pin 1 of the male XLR-type connector at the 6300 input.
- If the output of the driving unit is unbalanced and does not have separate CHASSIS GROUND and (–) (or LOW) output terminals, connect both the shield and the black wire to the common (–) or ground terminal of the driving unit.

### Analog Audio Output

- Electronically balanced and floating outputs simulate a true transformer output. The source impedance is  $50\Omega$ . The output is capable of driving loads of  $600\Omega$  or higher; the 100% modulation level is adjustable with the AO 100% control over a  $-6\text{dBu}$  to  $+24\text{dBu}$  range. The outputs are EMI suppressed.
- If an unbalanced output is required (to drive unbalanced inputs of other equipment), it should be taken between pin 2 and pin 3 of the XLR-type connector. Connect the LOW pin of the XLR-type connector (#3 or #2, depending on your organization's standards) to ground; take the HIGH output from the remaining pin. No special precautions are required even though one side of the output is grounded.
- Use two-conductor foil-shielded cable (Belden 8451, or equivalent).
- At the 6300's output (and at the output of other equipment in the system), do not connect the cable's shield to the CHASSIS GROUND terminal (pin 1) on the XLR-type connector. Instead, connect the shield to the chassis ground at the input destination. Connect the red (or white) wire to the pin on the XLR-type connector (#2 or #3) that is considered HIGH by the standards of your organization. Connect the black wire to the pin on the XLR-type connector (#3 or #2) that is considered LOW by the standards of your organization.



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## AES3 Digital Input and Output

There is one AES3 and two AES3 outputs. The program input and outputs are all equipped with sample rate converters and can operate at 32, 44.1, 48, 88.2, and 96 kHz. You can force the output sample rate to be genlocked to signal appearing at either the wordclock / AES11id input or the audio input. The output can also synchronize to the 6300's internal clock.

Per the AES3 standard, each digital input or output line carries both the left and right stereo channels. The connection is 110 $\Omega$  balanced. The AES3 standard specifies a maximum cable length of 100 meters. While almost any balanced, shielded cable will work for relatively short runs (5 meters or less), longer runs require use of 110 $\Omega$  balanced cable like Belden 1800B, 1801B (plenum rated), multi-pair 180xF, 185xF, or 78xxA. Single-pair category 5, 5e, and 6 Ethernet cable will also work well if you do not require shielding. (In most cases, the tight balance of Category 5/5e/6 cable makes shielding unnecessary.)

The AES3id standard is best for very long cable runs (up to 1000 meters). This specifies 75 $\Omega$  unbalanced coaxial cable, terminated in male BNC connectors. A 110 $\Omega$ /75 $\Omega$  balun transformer is required to interface an AES3id connection to your Optimod's digital program input or output. Conversely, the wordclock / AES11id sync input is designed for 75 $\Omega$  operation.

The digital input clip level is fixed at 0 dB relative to the maximum digital word. The maximum digital input will make the 6300 input meters display 0dB. The reference level is adjustable using the **DI REF** control.

The sample rate of the 6300's peak limiters is 192 kHz. **Because of "asynchronous resampling," any output sample rate other than 48 or 96 kHz / internal sync can introduce overshoots as large as 0.5 dB.**

If you need to use an STL with 32 kHz sample rate (because that is all that is available), you will achieve lowest overshoot by setting the 6300's internal bandwidth to 15 kHz. That way, the 6300's peak limiter operates on a signal with 15 kHz bandwidth and subsequent sample rate conversion will not add overshoot caused by spectral truncation.

## Wordclock / AES11id Sync Input

The sync input accepts a standard 5V p-p squarewave wordclock signal or an AES11id (75 $\Omega$ ) signal, selected in software. A menu item allows you to synchronize the output sample frequency to the frequency present at the sync. The connector is a female BNC with the shell grounded to chassis.

To permit daisy-chaining sync signals, the input impedance is greater than 1 K $\Omega$ . If the 6300 is the last device driven by the sync coaxial cable, you should terminate it by using a BNC Tee connector and a 75 $\Omega$  BNC terminator. This will prevent performance-degrading reflections in the cable. This is required for both wordclock and AES11id operation.

## Grounding

Very often, grounding is approached in a "hit or miss" manner. However, with care it is possible to wire an audio studio so that it provides maximum protection from

power faults and is free from ground loops (which induce hum and can cause oscillation).

In an ideal system:

- All units in the system should have balanced inputs. In a modern system with low output impedances and high input impedances, a balanced input will provide common-mode rejection and prevent ground loops—regardless of whether it is driven from a balanced or unbalanced source.

The 6300 has balanced inputs.

- All equipment circuit grounds must be connected to each other; all equipment chassis grounds must be connected together.
- In a low RF field, cable shields should be connected at one end only—preferably the destination (input) end.
- In a high RF field, audio cable shields should be connected to a solid earth ground at both ends to achieve best shielding against RFI.

### Power Ground



- Ground the 6300 chassis through the third wire in the power cord. Proper grounding techniques never leave equipment chassis unconnected to power / earth ground. A proper power ground is essential for safe operation. Lifting a chassis from power ground creates a potential safety hazard.

### Circuit Ground

- To maintain the same potential in all equipment, the circuit (audio) grounds must be connected together.

The 6300's circuit and chassis ground are internally connected; there is no "ground lift" switch. This should never cause a problem with noise or ground loop hum if the 6300's is connected to other equipment via balanced connections.

- In high RF fields, the system is usually grounded through the equipment rack in which the 6300 is mounted. The rack should be connected to a solid earth ground by a wide copper strap—wire is completely ineffective at VHF because of the wire's self-inductance.

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## Studio Level Controller Installation (optional)

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*[Skip this section if you are not using a studio level controller ahead of the 6300. Continue with "Quick Setup" on page 2-11. Note that this section has nothing to do with using the 6300 itself as a studio level controller. If you are doing this, see Using OPTIMOD 6300 as a Studio Level Controller on page 1-13.]*

- As of this writing, the currently manufactured Orban products that can be used as external AGCs are Optimod-PC 1101, Optimod-PCn 1600, and Optimod 6300. Their manuals contain instructions on how to use them in this application. They are the preferred choices because their AGCs are similar to the AGC in the 6300. (The 1600's AGC is improved over the others but will work well when driving a 6300.)
- Discontinued Orban products usable as external AGCs include the 8200ST, 464A "Co-Operator," 8100AST, and 1100 OPTIMOD-PC. Except for the 8200ST, we do not provide systematic instructions for setting up all of these older products in this manual, although it should be easy to extrapolate from the instructions we do provide.

### If you are using Orban 8200ST Studio Level Controller

If the STL uses preemphasis, its input preemphasis network will probably introduce overshoots that will increase peak modulation without any increase in average modulation. We therefore strongly recommend that the STL transmitter's preemphasis be defeated (freeing the STL from such potential overshoot), and that the 8200ST be used to provide the necessary preemphasis.

If the STL transmitter's preemphasis cannot be defeated, then configure the 8200ST for flat output. In this case, average modulation levels of the STL may have to be reduced to accommodate the overshoots. These issues are extensively discussed starting on page 1-11.

1. **Install the 8200ST in the rack. Connect the 8200ST's audio input and output.**

Refer to the *8200ST Operating Manual* if you require information about installation, audio input, and audio output connections to the 8200ST.

2. Set 8200ST Output Level with tone.

A) Press the TONE button on the 8200ST.

The TONE lamp should light and the modulation meters should indicate "0." If they do not, re-strap jumpers JB and JC to "peak." (Refer to *Figure 2-3* on page 2-10.)

The 8200ST is now producing a 400Hz sine wave at each output. The peak level of this tone corresponds to 100% modulation.

- B) **Adjust the 8200ST's L OUT and R OUT** controls so that the STL transmitter is being driven to 100% modulation.

The **L Out** and **R Out** controls are now correctly calibrated to the transmitter. If no significant overshoot occurs in the transmitter, the **MODULATION** meter will now give an accurate indication of peak modulation of the STL.

C) Turn off the tone by pressing the **TONE** button.

If the STL transmitter suffers from bounce or overshoot, you may have to reduce the **L Out** and **R Out** control settings to avoid peak over-modulation caused by overshoots on certain audio signals.

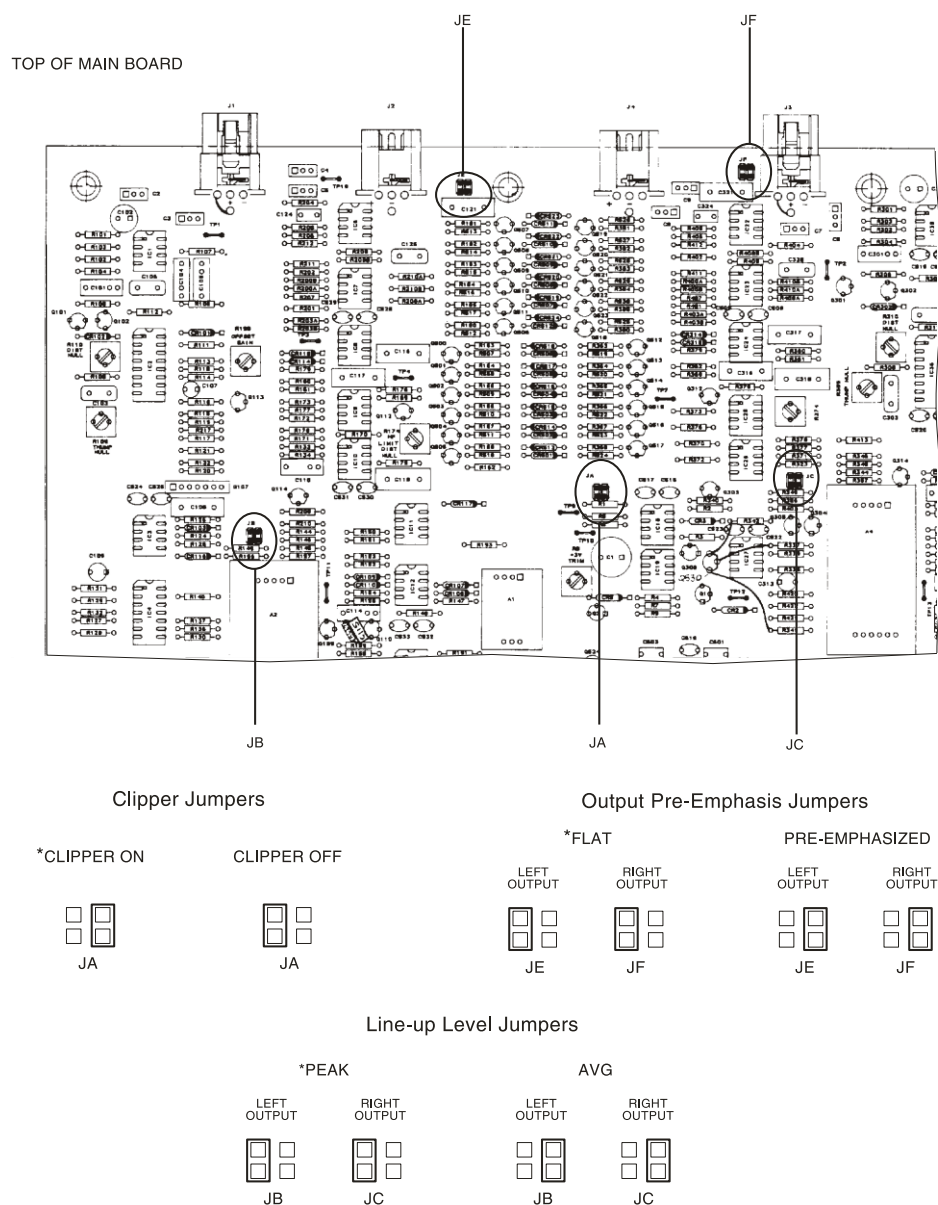


Figure 2-3: 8200ST Jumper Settings (\*Factory Configuration)

### 3. Set controls for normal operation with program material.

The following assumes that a VU meter is used to determine 8200ST line drive levels with program material.

#### A) Set the controls as follows:

HF LIMITER....	Set to match the preemphasis of the transmission system
L&R Out .....	do not change
GATE .....	12:00
RELEASE .....	12:00
VOICE .....	OFF
AGC .....	ON
COUPLE .....	ON

#### B) Feed the 8200ST either with tone at your system reference level (0VU), or with typical program material at normal levels.

#### C) Adjust the **GAIN REDUCTION** control for the desired amount of gain reduction.

If the STL uses preemphasis, its input preemphasis network will probably introduce overshoots that will increase peak modulation without any increase in average modulation. We therefore strongly recommend that **the STL transmitter's** preemphasis be defeated (freeing the STL from such potential overshoot), and that the 464A be used to provide the necessary preemphasis.

We recommend 8-15 dB gain reduction for most formats.

If the STL transmitter's preemphasis cannot be defeated, configure the 8200ST for flat output. In this case, average modulation levels of the STL may have to be reduced to accommodate the overshoots.

## Quick Setup

Quick Setup guides you through 6300 setup. It is appropriate for users without special or esoteric requirements. It does not cover setting TARGET LOUDNESS in Dolby Digital applications. Following this section, you can find more detailed information regarding setup beyond the Quick Setup screens, including how to set up the 6300 to drive a Dolby Digital channel. In most cases, you will not need this extra information.

Quick Setup assumes that your 6300 will be driving flat channels because this is the most common scenario. If you need it, you can turn on pre-emphasis after you complete Quick Setup. If you are setting up the 6300 to process for analog television preemphasized at 50 $\mu$ s or 75 $\mu$ s, please refer to the complete setup instructions found in *Analog and Digital I/O Setup* starting on page 2-22.

For the following adjustments, use the appropriately labeled soft button to choose the parameter you wish to adjust. To change a parameter (like an output level), it is usually necessary to hold down the soft button while turning the knob. However, if there is only one parameter on a screen, you can change this with the knob alone.

(You do not have to hold down a button.) Let the text on the screen guide you through the process.

1. Press the front-panel Setup button.
2. Press the Quick Setup soft button when its label appears on the display.

Quick Setup presents a guided sequence of screens into which you must insert information about your particular requirements. In general, the screens are self-explanatory.

Use the **NEXT** and **PREV** buttons to navigate between screens. These buttons will flash to indicate that they are active.

3. Set the time.
  - A) Press the **NEXT** button.  
The set time screen appears.
  - B) Hold down the appropriate soft button while turning the knob to enter the hour, minute, and seconds. Enter seconds slightly ahead of the correct time.
  - C) Wait until the entered time agrees with the correct time. Then press the **ENTER TIME** button to set the clock.

4. Set the date.  
Hold down the appropriate soft button while turning the knob to enter the day, month, and year.
5. Set up Daylight Saving Time (Summer Time).
  - A) Turn the knob to specify the date at which Daylight Saving Time begins in your area.
  - B) Press the **NEXT** button.
  - C) Turn the knob to specify the date at which Daylight Saving Time ends in your area.

1. Set the Limiter #1 and #2 MAX LPF frequencies.

[10.0 kHz] to [20.0 kHz]

The 6300 has two peak limiters, hard-wired to Analog Output / Digital Output #1, and Digital Output #2 source selectors respectively. The two limiters allow the two outputs to have separate Target Loudness values. Depending on the setting of its **INPUT SOURCE** control, a given limiter is driven by either the AGC or Multi-band Compressor. See *Figure 1-1: Simplified Block Diagram of Target Loudness Control* on page 1-2.

A lowpass filter precedes each limiter, so each limiter can have its own lowpass filter setting.

The audio bandwidth applied to a given output can be set in three places: (1) in Setup, (2) in the EQ page of the Modify screen, and (3) by remote control. The

**6300's bandwidth is always the *lowest*** of these three settings. The two frequencies in Setup are technical parameters that determine the *highest* bandwidth available for that output. The installing engineer should set them to be congruent with the sample rate of the digital system being driven by the 6300. For example, if the Output #1 of the 6300 is driving a system with a 32kHz sample rate, set the **LIMITER #1 LPF** to **15.0 KHZ**. That way, a setting of 20 kHz elsewhere will not cause excessive bandwidth and aliasing because the 6300 will automatically override it with the **MAX LPF** setting.

D) Press the **NEXT** button.

E) Set the **LIMITER #1 AND LIMITER #2 MAX LPF** frequencies.

6. Set the Limiter #1 and #2 Source.

[AGC, Multiband]

A) Press the **NEXT** button.

B) Select the desired source for Limiter #1 and Limiter #2. Refer to the discussion in step 1 above.

7. Set Limiter #1 and #2 Target Loudness.

A) Press the **NEXT** button.

B) Set the Limiter #1 and Limiter #2 Target Loudness values.

While it is unnecessary to do this if you do not intend to feed a given output from the **LIMITER NORM** source, note that you can use the **LIMITER #1 TARGET LOUDNESS control to calibrate the 6300's loudness meters when DIGITAL OUTPUT #1 SOURCE is LIMITER**.

8. Set the peak limiter preemphasis.

The 6300 has two peak limiters: Limiter #1 can drive the analog output and Digital Output #1, while Limiter # 2 can drive Digital Output # 2. These outputs can also be driven by the output of the AGC or multiband compressor (without limiting) to achieve lower delay.

A) Press the **NEXT** button.

B) Select the desired preemphasis (50μS or 75μS) applied to Limiter #1 by turning the knob.

This control is only relevant if you are using the **LIMITER** or **LIMIT NORM** feed at one or more 6300 outputs. The control determines whether the look-ahead limiter after the 2-band or 5-band compressor operates on a flat or preemphasized signal. If at least one of the limiters is preemphasized, it also preemphasizes the five-band compressor sidechain to make it preemphasis-aware.

50μS and 75μS preemphasis are only useful if the 6300 is protecting a transmission link that uses preemphasis (like certain satellite uplinks) or if you are using a TVxxx preset to drive an analog aural transmitter (i.e., one that produces a preemphasized FM aural carrier in analog television transmission). Use **FLAT** preemphasis for DAB+, DRM, HD Radio, digital

television, netcasts, and any other channel that uses a lossy codec. When in doubt, use **FLAT** preemphasis.

When operated pre-emphasized, the 6300's look-ahead limiter should only for light protection limiting. If you use too much gain reduction in the look-ahead limiter, you will hear pumping on material rich in high frequency energy. The 6300 cannot process for high loudness on pre-emphasized radio channels. Use an Orban Optimod-FM for such applications.

C) Repeat for **LIM2 PRE-E**.

#### 9. Set external AGC mode.

Most of the processing structures in the 6300 control level with a preliminary AGC (Automatic Gain Control). If you are using a suitable Automatic Gain Control at the studio (such as an Orban 8200ST OPTIMOD-Studio or 464A Co-Operator), the AGC in the 6300 should be defeated. This is so that the two AGCs **do not "fight" each other, and so they do not simultaneously increase gain**, resulting in increased noise.

A) Press the **NEXT** button.

B) Set external AGC mode by turning the knob.

a) Set the field to **YES** if you have an external AGC (such as an Orban 1100, 1101, 6300, 8200ST OPTIMOD-Studio, Orban 464A Co-Operator, or similar AGC) installed at your studio feeding the studio-to-transmitter link. This **setting appropriately defeats the 6300's AGC for all presets**.

b) Set the field to **No** if you do not have an external AGC installed; this setting enables the 6300 AGC status to be determined by the selected preset.

If you are using an Orban 4000 Transmission Limiter, set field to **No** (so that the AGC function in the 6300 continues to work). The Orban 4000 is intended for transmission system overload protection; it is normally operated below threshold. It is not designed to perform an AGC or gain-riding function and it cannot substitute for the AGC function in the 6300.

#### 10. Select your primary input (analog or digital).

A) Press the **NEXT** button.

B) If your main input source is digital, turn the knob to select **DIGITAL** or **DIGITAL+J17**. Otherwise, select **ANALOG**.

The only digital encoding that typically uses J.17 preemphasis (of which we are aware) is NICAM. **DIGITAL**, not **DIGITAL+J17**, is appropriate for almost anyone using the digital input.

#### 11. Set operating levels.

You will set the operating levels of the 6300 to match the input levels it is receiving so the 6300's **AGC can operate in the range for which it was designed**. There are separate settings for the analog and digital inputs. If you provide both analog and digital inputs to the 6300, optimum adjustment is achieved when the gain reduction meters show the same amount of processing for both analog and digital inputs.



This will allow you to switch between analog and digital inputs without sudden level changes.

- A) Press the **NEXT** button.
- B) Feed normal program material to the 6300.
- C) Play program material from your studio, peaking at normal program levels (typically 0VU if your console uses VU meters).
- D) [Skip this step if you are not using the analog input.]

Hold down the **ANALOG** soft button and adjust the knob so that the **AGC** meter indicates an average of 10 dB gain reduction.

- E) [Skip this step if you are not using the digital input.]

Hold down the **DIGITAL** soft button and adjust the knob so that the **AGC** meter indicates an average of 10 dB gain reduction.

## 12. Set the analog output source.

The analog output is commonly used to drive headphones for monitoring, although it can also be used to drive a transmission medium.

The analog output does not introduce additional peak overshoot because its magnitude and phase response obey the requirements set forth in *Microwave STLs* on page 1-17. However, as discussed there, the signal path **following the 6300's analog output must meet the same requirements. It is easier to achieve this by using one of the 6300's digital outputs followed by an uncompressed digital path.**

- A) Press the **NEXT** button.
- B) [Skip this step if you will not be using the analog output.]

Turn the knob to choose one of the following processing chains for the analog output. For more about these selections, see the notes in step 13 on page 2-16.

- **AGC:** stereo enhancement, equalization, and AGC without peak limiting
- **MULTIBAND:** stereo enhancement, equalization, AGC, 2-Band or 5-Band compression, and loudness controller without peak limiting
- **LIMITER:** This selection feeds the analog output with the output of Limiter #1, whose output signal follows its input selector: **AGC** or **MULTIBAND**.

If you use the low-delay output to drive your studio monitor speakers as well as talent headphones (which may be necessary if your facility has only one monitor input for both), then we recommend connecting a **loss-of-carrier alarm to one of the 6300's GPI inputs. Program this input to mute the monitor output in the event that carrier is lost. This simulates normal "off air" monitor functionality and immediately alerts the staff if the transmitter goes off the air unexpectedly.**

You can program any GPI input for Monitor Mute functionality. See *Remote Control Interface Programming* on page 2-51 for instructions on how to program a GPI input.

## 13. Set the digital output #1 and #2 source.

There are two peak limiters, one for **DIGITAL OUTPUT #1** and one for **DIGITAL OUTPUT #2**. This allows you to set the target loudness (**DIALNORM**) individually for each output.

Because of its versatile signal routing (see page 6-43), OPTIMOD 6300 can be used as a combined studio AGC, digital radio/netcast processor, and low-delay talent headphone processor. If you use a given output to drive headphones for talent speaking live, it is best to drive that output from the AGC or Multiband source without limiting. This makes the input/output delay approximately 3 ms for the AGC source or 9 ms for the multiband compressor source. Even though normal 6300 presets have a delay of about 20 ms (which most talent can learn to use without discomfort, although they may need some time to become accustomed to it), bypassing the limiter will reduce bone conduction comb filtering.

The delay of the internal D/A converter that drives the 6300's analog output is approximately equal to the delay of the sample rate converters that drive the 6300's digital outputs. Compared to using the 6300's analog output, using a digital output to drive a headphone monitoring chain will typically add about 1 ms of additional delay because the signal must pass through an external D/A converter before being applied to the headphones. To achieve lowest delay, we recommend using the 6300's analog output for headphone monitoring.

A) Press the **NEXT** button.

B) [Skip this step if you will not be using digital output #1.]

Turn the knob to choose one of the following sources to drive the output:

- **AGC**: stereo enhancement, equalization, and AGC without peak limiting.

If you set **EXT AGC** to **YES** in System Setup, this defeats the AGC. In this case, this source provides only stereo enhancement and equalization/

- **MULTIBAND**: stereo enhancement, equalization, AGC, 2-Band or 5-Band compression, and loudness controller without peak limiting.

The **MB FINAL LIMITER DRIVE** control varies this source's loudness, as does a given output's **100% OUTPUT LEVEL** control. Output clipping will not occur if the **MB FINAL LIMITER DRIVE** control is set to produce sensible amounts of peak limiting from the **LIMITER** and **LIMITER NORM** outputs.

**CAUTION:** If the outputs are configured for no peak limiting, they are usually unsuited for driving a transmitter. An exception is an STL having 16 bits of dynamic range or more. In this case, it is often practical to drive it with the AGC alone, allowing additional headroom for the overshoots that the 6300's peak limiter would have otherwise removed.

- **LIMITER**: Limiter #1's output signal follows its input selector: **AGC** or **MULTIBAND**, so this output can provide a peak-limited multiband or AGC feed. Refer to *Figure 1-1: Simplified Block Diagram of Target Loudness Control* on page 1-2.)

Use the **MB FINAL LIMITER DRIVE** control to set loudness after you have adjusted the Digital Output #1 **100% OUTPUT LEVEL** control, which sets the output headroom and loudness proportionally. For example, setting the **100% OUTPUT LEVEL** control to  $-2$  dBFS constrains the peak level to  $-2$  dBFS and decreases loudness by 2 dB compared to setting the control at 0 dBFS.

Although the Limiter #1 Target Loudness control does not affect loudness, it calibrates the BS.1770 loudness meter so that 0 corresponds to the **TARGET LOUDNESS** setting. You can use this control to make the loudness meters read on-scale.

- **LIMITER NORM:** This output follows the entire multiband processing chain and provides calibrated loudness if you select **MULTIBAND** as the Limiter #1 source. Refer to *Figure 1-1* on page 1-2.

Use **LIMITER NORM** if you need to calibrate the output loudness to a desired target value as measured on a BS.1770 loudness meter. **LIMITER NORM** is typically used to comply with a loudness recommendation like EBU R 128 or ATSC A/85, both of which rely on the BS.1770 loudness meter.

When you set the input to a given limiter to **MULTIBAND**, you can use that output's **TARGET LOUDNESS** control to set the loudness at the output. This aligns the output's loudness with the loudness controller and BS.1770 loudness meter: 0 on the meter corresponds to the **TARGET LOUDNESS** setting (for example,  $-24$  LUFS), and setting the **BS.1770 SAFETY LIMITER THRESHOLD** control to 0 dB makes the threshold of the BS.1770 safety limiter the same as the **TARGET LOUDNESS** setting.

There is only one loudness controller and loudness meter for both outputs. The **MB FINAL LIMIT DRIVE** control sets the drive level into the loudness controllers, and adjusting it varies the loudness of both limiter outputs.

The loudness controller thresholds are fixed with respect to the output of the **MB FINAL LIMIT DRIVE** control; this uncouples the amount of loudness controller gain reduction from the setting of the **TARGET LOUDNESS** controls.

Internally, the **TARGET LOUDNESS** controls set the loudness of each output by adjusting the gain between the output of the loudness controller and the input of the corresponding output's peak limiter. Setting a **TARGET LOUDNESS** control for higher loudness increases the amount of peak limiting, although if the loudness is around  $-24$  LUFS, the peak limiter will rarely produce gain reduction.

To use **LIMITER NORM** to provide a calibrated, loudness-controlled AGC output, defeat the multiband compressor by setting its **B1-B5 THRESHOLD** controls **OFF**, and save the result as a user preset. The multiband compressor will then be unavailable for the remaining outputs.

If you set **EXT AGC** to **YES** in System Setup, this defeats the AGC. In this case, choosing:

- **AGC** causes the input signal to be passed to the analog output with no dynamics processing (just stereo enhancement and equalization).
- **MULTIBAND** results in stereo enhancement, equalization, and 2-Band or 5-Band compression without AGC.

- **LIMITER** or **LIMITER NORM** with **MULTIBAND** Input results in stereo enhancement, equalization, and 2-Band or 5-Band compression with look-ahead limiting but without AGC. With **AGC INPUT**, it results in look-ahead limiting of the 6300's input signal.

C) [Skip this step if you will not be using digital output #2.]

Set the digital output #2 source. Refer to the notes in step (B) above.

14. Set the digital output #1 and #2 sample rate.

A) Press the **NEXT** button.

B) [Skip this step if you will not be using digital output #1.]

Turn the knob to set the Digital **OUTPUT #1 SAMPLE RATE** to 32, 44.1, 48, 88.2, or 96 kHz.

The internal sample rate converter sets the rate at the 6300's digital output. This adjustment allows you to set the output sample rate to ensure compatibility with equipment requiring a fixed sample rate. In all cases, the 6300's internal processing sample rate is 48 kHz.

C) [Skip this step if you will not be using digital output #2.]

Set the digital output #2 sample rate to 32, 44.1, 48, 88.2, or 96 kHz.

15. Prepare to set output levels.

A) Press the **NEXT** button.

You can use either program material or tone to set the output level (and thus, the modulation).

- To use tone, press the **YES** button. Be careful—the 6300 will emit a loud tone that could be disturbing to listeners.
- To use program material, press the **NO** button.

16. Set the analog output level.

A) Press the **NEXT** button.

B) [Skip this step if you are not using the analog output.]

Turn the knob to set the desired analog output level corresponding to 100% modulation, in units of dBu (0 dBu = 0.776 Vrms).

Refer to *Setting Output/Modulation Levels* on page 1-25.

If you have set the output source to **AGC** or **MULTIBAND** in step 12 on page 2-15, the peak level will not be well controlled because no peak limiting has been applied.

If you are using **LIMITER** as the analog output source and set the Digital Output #1 Source to **LIMIT NORM** in step 12 above, the **LIMITER #1 TARGET LOUDNESS** control (set in step 7 on page 2-13) will affect the analog loudness.

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### 17. Set the digital #1 and #2 output levels.

Note that if a given output source is **LIMITER NORM**, its output level control only sets headroom but does not affect loudness. This permits you to allow headroom for overshoots in the downstream signal path (typically caused by a lossy codec like HE-AAC) while retaining calibrated loudness.

For HE-AAC, allowing 1.5 dB of headroom will prevent audible clipping distortion in player devices whose analog signal paths have no headroom above 0 dBFS. While low bit-rate HE-AAC can introduce overshoots higher than 1.5 dB, these have low energy and can be clipped inaudibly.

A) Press the **NEXT** button.

B) [Skip this step if you are not using digital output #1.]

Turn the knob to set the desired digital output #1 level corresponding to 100% modulation, in units of dB below full-scale.

C) [Skip this step if you are not using digital output #2.]

Turn the knob to set the desired digital output level #2 corresponding to 100% modulation, in units of dB below full-scale.

D) Press the **NEXT** button.

If you activated the modulation setup tone in step (15.A) on page 2-18, the tone will turn off automatically.

E) Press the **NEXT** button.

### 18. Choose a processing preset.

A) Turn the knob until your desired preset is visible in the lower line of the display.

B) Press the **RECALL NEXT** button to make your desired preset active.

This step selects the processing to complement various program formats. There are presets for radio-style and video style applications.

After this step, you can always select a different processing preset, program the 6300 to automatically change presets on a time / date schedule, use a GPI input to trigger preset changes, modify presets to customize your sound, and store these presets as User Presets.

Preset names are *just suggestions*. Feel free to audition different presets and to choose those whose sound you prefer.

You can easily modify a preset later with the 6300's one-knob **LESS-MORE** feature. Refer to Section 3.

Congratulations! You are now on the air with your initial sound. Feel free to read the material in Section 3 of this manual, which describes the various presets and how you can customize them to achieve your desired signature sound.

### 19. Complete Station ID (optional).

The Station ID is an optional setting that you can provide to name a given 6300. The name can be up to eight characters long. It is used to identify your 6300 to

Orban's 6300 PC Remote application and appears on the Main Screen when PC Remote is controlling the 6300.

- A) Navigate to **SETUP > NEXT > TIME DATE AND ID > STATION ID**.
- B) Use the knob to set the each character in the ID. Use the **NEXT** and **PREV** buttons to control the cursor position.
- C) When finished entering your name, press the **SAVE** button. If you escape to the main screen from Setup, you can now see the station name toggle on the main screen.

## 20. Set up response to AES3 status bits (optional).

The default behavior of the 6300 is to ignore AES status bits because many pieces of external equipment handle these incorrectly. However, the 6300 allows the **AES3 "channel mode"** determine its operating mode (stereo or dual-mono). The **AES3 channel mode specification provides for "two-channel mode"** (corresponding to 6300 dual-mono mode) with bits 1-4 in byte 1 in the pattern "0001," and **"stereophonic mode"** (corresponding to 6300 stereo mode) with these bits in the pattern "0100."

The 6300 can also emit these status bits at its digital output to control downstream equipment.

- A) Navigate to **SETUP > IO CALIB > DIG OUT CALIB** and set the **DIGITAL FORMAT** to **AES**.

SPDIF cannot be used to handle status bit because the specification does not allow it.

- B) To enable the 6300 to change its operating mode in response to AES status bits received at its AES input:

- Navigate to **SETUP > NETWORK&REMOTE > AES STAT BITS**.
- Set **IN>MODE** to **ON**.

Unless you are sure that upstream equipment will correctly format these bits, set **IN>MODE** to **OFF**.

- Make sure that the equipment driving the 6300 is formatting its output as AES3. SPDIF will not work.

- C) To send **"two-channel mode"** and **"stereophonic mode"** bits indicating the 6300's current operating mode, set **MODE>OUT** to **ON**.

If this parameter is set to **OFF**, then the 6300 will output "0000" ("mode not indicated"). This is probably the safest available mode if you are uncertain whether downstream equipment can respond appropriately to these bits.

## 21. Set up response to AES3 user bits (optional).

The 6300 can pass AES user bits from its input to digital output #1. The default behavior is to block these bits because they may cause downstream equipment to respond in unexpected ways. Because the vast majority of audio applications make no use of User Bits, we recommend keeping the 6300's **USER BITS** control

set to **BLOCK** (default setting), which configures the User Bit channels of both Digital Out 1 and Digital Out 2 to contain all zeros.

Setting the 6300's **USER BITS** control to **PASS DO1** will cause the User Bit channel of Digital Out 1 to be filled with the bits received from the User Bit channel of the signal feeding the 6300's Digital In. We recommend such setting only if your facility requires it *and* all three of the following conditions are met:

- The sample rate of your digital source (feeding 6300's Digital In) is no higher than 48kHz
- 6300 **DO1 SYNC** setting = **INPUT**
- 6300 **IN>MODE** setting = **OFF**

Unless all of the above conditions are met, the user bit pass-through may lose data.

To enable the 6300 to pass user bits from its digital input to its digital output, navigate to **SETUP > NETWORK&REMOTE > AES STAT BITS > AES USER BITS** and set the field to **PASS** or **BLOCK** as desired.

Unless you are sure that downstream equipment will correctly format these bits, set **AES USER BITS** to **BLOCK**.

User bits can only be passed if the 6300's digital output is set to **AES**, not **SPDIF**.

## 22. Set the Processing Delay for a given signal path (optional).

[minimum], [30 fps], [29.97 fps], [25 fps], [24 fps], [33-50 ms in 1 ms increments]

This control is useful in sound-for-picture applications to add time delay so that the input/output delay through a given processing path is exactly one frame, using a variety of different standards. The selections are **MINIMUM** (depends on processing structure in use; typically between 20 and 23 ms), 30 fps, 29.97 fps (NTSC color video), 25 fps (most PAL video), and 24 fps (film). You can also set the delay in 1 millisecond increments.

Navigate to **SETUP > I/O CALIB > PROC DELAY** and set the delay as required using the **MB+LIMIT** button.

Note that this control does not affect the delay to a given output if that output is in **AGC** or **MULTIBAND** mode.

## 23. Set the main display mode (optional).

You can choose how the main display indicates active operating parameters by navigating to **SETUP > SHOW DATE**. Choose **YES** to make the display toggle automatically once every two seconds, displaying the largest range of information. Choose **No** to make the display static, showing the time, the active preset, the active input, and whether the stereo or dual-mono mode is active.

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*The following material provides detailed instructions on how to set up the 6300, including how to set it up to drive a Dolby Digital channel. If **QUICK SETUP** does not*

*fully address your setup needs or if you wish to customize your system beyond those provided with QUICK SETUP, then you may need the additional information in the sections below. However, for most users, this material is only for reference because QUICK SETUP has enabled them to set up the 6300 correctly.*

## Analog and Digital I/O Setup

For the following adjustments, use the appropriately labeled soft button to choose the parameter to be adjusted. To change a parameter (like an output level), it is usually necessary to hold down the soft button while turning the knob.

1. Set the MAX LPF frequencies as appropriate to your application.

[10.0 kHz] to [20.0 kHz]; 1 kHz steps

The 6300 has two independently adjustable lowpass filters, one for Limiter #1 / Output #1 and the other for Limiter #2 / Output #2.

The 6300's audio bandwidth can be set in three places: (1) in Setup, (2) by remote control, and (3) in the EQ page of the Modify screen. (The latter allows the active preset to determine the bandwidth so you can change the bandwidth by recalling a User Preset.)

The 6300's bandwidth is always the *lowest* of these settings. The frequencies in Setup are technical parameters that determine the *highest* bandwidth available from a given output. The installing engineer should set it to complement the sample rate of the digital system that the 6300 is driving. For example, if the 6300 is driving a system with a 32 kHz sample rate, set the MAX LPF to **15.0 KHZ**. That way, a setting of 20 kHz elsewhere will not cause excessive bandwidth and aliasing because the 6300 will automatically override it with the MAX LPF setting.

A) Navigate to **SETUP > MAX LPF #1**

B) Set the maximum bandwidth for digital output #1 as desired.

C) Repeat for **MAX LPF #2**, which affects Digital Output #2.

2. Temporarily set the external AGC mode to **"No."**

Navigate to **SETUP > NEXT > NEXT > EXT AGC** and set **EXT AGC** to **NO**.

If you are using an external AGC like the Orban 8200ST, you should restore this setting to **YES** after the setup procedure is complete.

3. Adjust Input selector.

A) Navigate to **SETUP > IO CALIB > INPUT**.

B) Set the **INPUT** to **ANALOG**.

The 6300 will automatically switch to analog input if signal lock is unavailable at the AES3 input.



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4. Choose Input Mode.

*[STEREO, MONO FROM LEFT, MONO FROM RIGHT, MONO FROM SUM, ONLY L, ONLY R.]*

**INPUT MODE** determines how the 6300 will route its left and right input channels of the left and right channels of the 6300's audio processing. This control is found in **SETUP** on the 6300 unit and in the **INPUT** tab of 6300 PC Remote's I/O SETUP.

5. Adjust Analog Input Reference Level.

*[-9dBu to +13dBu (VU), or -2 to +20dBu (PPM)] in 0.5 dB steps*

The reference level VU and PPM (Peak) settings track each other with an offset of 8dB. This compensates for the typical indications with program material of a VU meter versus the higher indications on a PPM.

This step sets the center of the 6300's gain reduction range to the level to which your studio operators peak their program material on the studio meters. This assures that the 6300's **processing presets will operate in their preferred range.**

You may adjust this level with a standard reference / line-up level tone from your studio or with program material.

Note that in this step, you are calibrating to the normal indication of the studio meters; this is quite different from the actual peak level.

If you know the reference VU or PPM level that will be presented to the 6300, set the reference level to this level, but please verify it with the steps shown directly below.

A) Press the **RECALL** button.

B) Turn the knob until **5B GENERAL PURP** appears in the lower line of the display.

C) Press the **RECALL NEXT** button.

D) Navigate to **SETUP > ANALOG CALIB > AI REF (VU or PPM, depending on which metering system you use).**

E) Calibrate using tone.

*[Skip to step (F) if you are using Program material to calibrate the 6300 to your standard studio level.]*

a) Verify Ext AGC is set to No.

Refer to step 2 on page 2-22.

b) Feed a tone at your reference level to the 6300

If you are not using a studio level controller, feed a tone through your console at normal program levels (typically 0VU if your console uses VU meters).

If you are using a studio level controller that performs an AGC function, such as an Orban 8200ST OPTIMOD-Studio, adjust it for normal operation.

c) Adjust the **AI REF** (VU or PPM) control to make the 6300's **AGC** meter indicate 10 dB gain reduction.

d) Skip to step (G).

F) Calibrate using program.

*[Skip this step if you are using Tone to calibrate the 6300 to your standard studio level—see step (E) above.]*

a) Verify **EXT AGC** is set to **NO**.

Refer to step 2 on page 2-22.

b) Feed normal program material to the 6300

Play program material from your studio, peaking at the level to which you normally peak program material (typically 0VU if your console uses VU meters).

c) Adjust the **AI REF** (VU or PPM) control to make the 6300's **AGC** meters indicate an average of 10 dB **gain reduction when the console's VU meter** or PPM is peaking at its normal level.

If the **AGC** gain reduction meter averages less than 10 dB gain reduction (higher on the meter), re-adjust the **AI REF** (VU or PPM) to a lower level.

If the **AGC** gain reduction meter averages more gain reduction (lower on the meter), re-adjust the **AI REF** (VU or PPM) to a higher level.

G) When finished, reset **EXT AGC** to **YES**, if required (e.g., if that was its setting prior to setting **AI REF** (VU or PPM) level).

Refer to step 2 on page 2-22.

6. Adjust Right Channel Balance.

*[Skip this step if the channels are already satisfactorily balanced.]*

[−3 dB to +3dB] on right channel only, 0.1 dB steps

Adjust the **R CH BAL** control (**SETUP > IO CALIB > ANALOG CALIB > R CH BAL**) to achieve correct left/right channel balance.

This is not a balance control like those found in consumer audio products. This control changes gain of the right channel only. Use this control if the right analog input to the 6300 is not at exactly the same level as the left input. Be certain that the imbalance is not caused by one program source, but instead is introduced through distribution between the console output and 6300 input. This adjustment is best accomplished by playing program material that is known to be monophonic or by setting the mixing console into mono mode (if available).

7. Adjust the Digital Input Reference Level and Right Balance controls.

*[Skip this step if you will not be using the digital input.]*

A) Navigate to **SETUP > IO CALIB > INPUT** and set the input to Digital.

B) Repeat steps 2 through 6 (starting on page 2-22), but use the **DI REF (VU OR PPM)** and **R CH BAL** controls for the digital section.

## 8. Set the peak limiter preemphasis.

The 6300 has two peak limiters: Limiter #1 can drive the analog output and Digital Output #1, while Limiter # 2 can drive Digital Output # 2. These outputs can also be driven by the output of the AGC or multiband compressor (without limiting) to achieve lower delay.

A) Navigate to **SETUP > NEXT > NEXT > LIM1 PRE-E**.

B) Select the desired preemphasis (50µS or 75µS) applied to Limiter #1 by turning the knob.

This control is only relevant if you are using the **LIMITER** or **LIMIT NORM** feed at one or more 6300 outputs. The control determines whether the look-ahead limiter after the 2-band or 5-band compressor operates on a flat or preemphasized signal. If at least one of the limiters is preemphasized, it also preemphasizes the five-band compressor sidechain to make it preemphasis-aware.

50µS and 75µS preemphasis are only useful if the 6300 is protecting a transmission link that uses preemphasis (like certain satellite uplinks) or if you are using a TVAxxx preset to drive an analog aural transmitter (i.e., one that produces a preemphasized FM aural carrier in analog television transmission). Use **FLAT** preemphasis for DAB+, DRM, HD Radio, digital television, netcasts, and any other channel that uses a lossy codec. When in doubt, use **FLAT** preemphasis.

When operated pre-emphasized, the **6300's** look-ahead limiter should only for light protection limiting. If you use too much gain reduction in the look-ahead limiter, you will hear pumping on material rich in high frequency energy. The 6300 cannot process for high loudness on pre-emphasized radio channels. Use an Orban Optimod-FM for such applications.

C) Repeat for **LIM2 PRE-E**.

## 9. Set the Limiter #1 and #2 Source.

The 6300 has two peak limiters, hard-wired to Analog Output / Digital Output #1, and Digital Output #2 source selectors respectively. The two limiters allow the two outputs to have separate Target Loudness values. Depending on the setting of its **INPUT SOURCE** control, a given limiter is driven by either the AGC or Multiband Compressor. If you require a loudness-calibrated output, you must use **MULTIBAND**. See *Figure 1-1: Simplified Block Diagram of Target Loudness Control* on page 1-2.

Navigate to **SETUP > DIGITAL CALIB > DOX CALIB > SOURCE** and set the **LIMITER #1 SOURCE** and **LIMITER #2 SOURCE** controls as required.

## 10. Set digital configuration and output level for applications that do not require calibrated loudness.

*[Skip this step if you will not be using the digital outputs.]*

*[See the notes in step (12.D) on page 2-33.]*

A) *Skip this step if you do not plan to sync the 6300's digital output(s) to an external AES11 or wordclock signal.*

Navigate to **SETUP > IO CALIB > DIGITAL CALIB**. If the Ext Sync control is not visible, press Next until the control appears. Set the control for AES or Wordclock, as required.

B) Navigate to **SETUP > IO CALIB > DIGITAL CALIB > DO1 CALIB**.

C) Set the **DO1 PRE-E** control to **PRE-E** (for a 50 or 75µs pre-emphasized output), **J.17** (for a J.17 pre-emphasized output), **PRE+J17** (for 50 or 75µs preemphasis cascaded with J.17 preemphasis), or **FLAT**.

See the notes in step (12.B) on page 2-32.

J.17 preemphasis is rarely used anymore. Its most common application is NICAM links.

D) Set the **DO1 RATE** to 32, 44.1, 48, 88.2, or 96 kHz.

- Selecting a 32 kHz output sample rate will automatically set the highest available audio bandwidth to 15 kHz.
- **DO RATE** will also affect the available range of test tone frequencies. When **DO RATE** is set to 32 kHz, the highest tone frequency setting is 15 kHz. When **DO RATE** is set to 44.1 or above, the tone frequency range extends to 20 kHz.

E) Set the **DO1 SYNC**. Choose:

- **INTERNAL** (the output sample rate is synchronized to the 6300's internal crystal-controlled clock),
- **INPUT** (the output sample rate is synchronized to the sample rate appearing at the 6300's AES3 input), or
- **EXTERNAL** (the output sample rate is synchronized to the sample rate appearing at the 6300's BNC sync input when an AES11 signal or a wordclock drives it). (See step (A) above.)

F) Press **NEXT**. Then set the desired output **DO1 WORD** (word length).

[14], [16], [18], [20], or [24], in bits

The largest valid word length in the 6300 is 24 bits

The 6300 can also truncate its output word length to 20, 18, 16 or 14 bits.

The 6300 can add dither (see the next step).

G) Adjust **DO1 DITH** (dither) to **IN** or **OUT**, as desired.

[In] or [Out]

When set to In, the 6300 adds "high-pass" dither before any truncation of the output word. The amount of dither automatically tracks the setting of the **WORD LEN** control. This first-order noise shaped dither considerably reduces added noise in the midrange by comparison to white PDF dither. However, unlike extreme noise shaping, it adds a maximum of 3 dB of excess total noise power when compared to white PDF dither. Thus, it is a good compromise between white PDF dither and extreme noise shaping.

To ensure maximum system linearity, it is wise to set this control to **IN**.

H) Set **DO1 FRMT** to **AES** or **SPDIF**

I) Using the **DO1 SOURCE** button, set the digital 1 output source to:

- **AGC**
- **MULTIBAND**
- **LIMITER**
- **LIMIT NORM**

See the notes in step 12 on page 2-15. If you choose **LIMIT NORM**, the **TARGET LOUDNESS #1** control will affect loudness but the **DO1 100%** control will not. If you choose **LIMITER**, loudness will be roughly -19 LUFS, although this will vary depending on the settings of other controls affecting loudness, including **MULTIBAND DRIVE**, **MB FINAL LIMITER DRIVE**, and **DO1 100%**.

You may find it convenient to use **LIMIT NORM** because you can then read the loudness from the 6300's **BS.1770** meter. **0** on the meter corresponds to the setting of the **TARGET LOUDNESS** control for the output you are using.

If the Limiter Source is **AGC**, the output loudness will not be calibrated even if you choose **LIMITER NORM**, so we recommend using **LIMITER** instead. To set loudness with an **AGC** source, adjust the **AGC LIMITER DRIVE** control. As shown in *Figure 1-1* on page 1-2, the loudness controllers and loudness meter are not in the **AGC** limiter feed path, so if you want to measure the output loudness, you must use an external loudness meter like the free Orban Loudness Meter ([www.orban.com/meter](http://www.orban.com/meter)).

J) Press **NEXT**. Then set the **DO1 EMITS** parameter to **STEREO/DUAL** or **MONO L**.

**STEREO/DUAL** is the normal setting. **MONO L** is for convenience if you are using the 6300 to process two independent mono programs and you wish assign each program to a separate digital output. In this case, both channels of **DO1** emit the mono material processed in the 6300's left channel and both channels of **DO2** emit the right channel material.

K) Press **NEXT**. Then adjust **DO1 100%** set the desired digital output level corresponding to 100% modulation, in units of dB below full-scale.

See the notes in step (12.D) on page 2-33.

L) Navigate to **SETUP > IO CALIB > DIGITAL CALIB > DO2 CALIB** and repeat steps (A) through (K) for Digital Output 2.

M) Skip to step 14.

11. Set digital configuration and output level when driving a channel requiring calibrated loudness.

*[Skip this step if you are not driving a channel requiring calibrated loudness, such as a Dolby Digital channel.]*

The **TARGET LOUDNESS** parameters you set below are relevant to applications where the 6300 is driving a transmission channel requiring calibrated loudness, such as an ATSC A/85 or EBU R 128-compliant channel. Setting **TARGET LOUDNESS** allow you to ensure that your audio has the correct loudness. You can set different target loudness for each of the two peak limiter outputs.

The 6300 works very easily with Dolby Digital® transmission systems if you do one crucial thing: **Via the 6300's TARGET LOUDNESS** controls, you must tell it what value of Dolby Digital Dialnorm metadata you are transmitting to your audience. This will prevent your transmission from being too loud or quiet compared to other correctly set up Dolby Digital transmissions.

The 6300 is designed to work smoothly with Dolby Digital and other transmission channels that convey target loudness metadata. In essence, the Dolby Digital Dialnorm metadata sets an invisible volume control that is cascaded with the volume control in **the consumer's receiver**. **To produce the same loudness as other** properly set up transmission channels, the 6300 needs to be aware of the Dialnorm value you are transmitting to the consumer. The 6300 uses this value in two ways:

- It calibrates the 6300's **Loudness Level meters** (CBS and BS.1770) so that when the meters are indicating 0 LU on speech material, loudness is correct at the receiver.

This means that you can use the 6300's **Loudness Level meter** as a reference if you are modifying a factory preset and want to ensure correct **loudness at the consumer's receiver**. See *Figure 1-1: Simplified Block Diagram of Target Loudness Control* on page 1-2. This is only true if the 6300 limiter for the output you are using is receiving the **MULTIBAND** feed and the output selector is set to **LIMITER NORM**.

- It scales the output level of the 6300's **presets so that the level** will be correct for the Dialnorm value you are transmitting to the consumer.

To do this, it sets the gain of a hidden level control cascaded with the 6300's **LIMITER DRIVE** control. This gain adjustment is before the 6300's look-ahead limiters and **OUTPUT LEVEL** controls. This arrangement allows you to use the full headroom of the Dolby Digital transmission channel regardless of the Target Loudness setting. Note that the CBS **LOUDNESS THRESHOLD** and **BS.1770 DELTA THRESHOLD controls' displayed settings** are with reference to the current value of **TARGET LOUDNESS**, which ensures that the CBS loudness controller's and BS.1770 safety limiter's gain reductions do not change when **TARGET LOUDNESS** is changed

Assuming that the 6300's peak limiters are used lightly so that they do not affect perceived loudness, **the loudness of the consumer's receiver** is the same regardless of the settings of the 6300's **OUTPUT 100%** controls, whose only purpose is to set the 6300's **maximum peak output level** with respect to 0 dBFS. This allows you to compensate for transmission channels that introduce peak overshoots. For example, if you change an **OUTPUT 100%** control from 0 dBFS to -6 dBFS, the drive level into its associated peak limiter automatically increases by 6 dB and the output of the peak limiter is attenuated by 6 dB. The RMS drive level into the Dolby Digital encoder stays the same, the loudness controllers produce the

same amount of gain reduction, and the BS.1770 loudness meter continues to peak at 0 dB.

To change the 6300's **output** loudness, adjust the **TARGET LOUDNESS** value for the output you are using or adjust the **MB LIMITER DRIVE** control in the active Processing Preset. Adjusting **TARGET LOUDNESS** changes loudness without changing the indication on the 6300's **Loudness Level meter** and without changing the amount of gain reduction in the loudness controller. Adjusting **MB LIMITER DRIVE** changes both the **Loudness Level meter's** indication and the amount of gain reduction in the loudness controller. The **MB LIMITER DRIVE** control affects both limiter outputs equally; only the two **TARGET LOUDNESS** controls can adjust **the outputs'** loudness individually.

Both **TARGET LOUDNESS** controls, and both local **TARGET LOUDNESS** controls are available from the 6300's **front panel**. The global controls are available by hitting the **Setup** button and scrolling until the **1700 GTL1** and **1700 GTL2** controls appear. The local controls are available from **Modify > FULL CONTROL**. Scroll until the **1770 TL1** and **1700 TL2** controls appear.

The **MB LIMITER DRIVE** control is available only from 6300 PC Remote software.

**Your Dolby Digital transmission's loudness will automatically be correct if:**

- for the output you are using, its limiter source is **MULTIBAND** and its output selector is set to **LIMITER NORM**,
- you use a "TV" factory preset (Table 3-3 on page 3-31),
- you have adjusted the **AI REF** or **DI REF** controls so that the processing operates with normal amounts of gain reduction (step 5 on page 2-23 and step 7 on page 2-24), and
- you have adjusted a **given output's TARGET LOUDNESS** to match the Dialnorm you are transmitting (step (B)a) below).

The 6300's **TARGET LOUDNESS** value can be set in two places: For each limiter, there is a global setting in **SETUP**, which will be overridden by the **TARGET LOUDNESS** setting in the active processing preset if this is not set to **GLOBAL**. Except for the analog TV presets, all factory processing presets are configured to use the global Target Loudness setting specified in the **CONFIGURATION** tab.

The following steps assume that you are driving a Dolby Digital encoder with the **6300's Digital Output 1**.

Digital Output # 2 has its own **TARGET LOUDNESS** control but it is otherwise analogous to Digital Output # 1.

- A) If your Dolby Digital encoder is receiving metadata from an upstream source, you must ensure that the following metadata is set according to the steps below:
  - a) Set **ac3\_dynrng** metadata to "0," This forces the AC3 encoder to reauthor the line-mode DRC metadata, following **the encoder's active** Line-Mode level compression profile.

- b) Set `ac3_compre` metadata to "0," This forces the AC3 encoder to reauthor the RF-mode DRC metadata, following the encoder's active RF-Mode level compression profile.
- B) Navigate to **SETUP > GLOBAL TARGET LOUDNESS**. (If the **GLOBAL TARGET LOUDNESS** controls do not appear after you press Setup, use the **Next** button to scroll the display horizontally until you find them.)
  - a) Set the **TARGET LOUDNESS** control for the output you are using so it is the same as the Dialnorm value in the Dolby Digital metadata you are transmitting to consumers.

Refer to the manufacturer's instructions for the Dolby Digital encoder you are using for information on how to set the value of Dialnorm in your transmitted metadata.

Most broadcasting organizations have standardized on -23 or -24 dB. Paragraph H.7 of ATSC Recommended Practice A/85:2011 recommends -24 LKFS. EBU R128 recommends -23 LUFS. (LKFS and LUFS are the same. Both are a unit of measure for loudness when the ITU-R BS.1770-4 meter is used for loudness measurement.)

If you are not driving a Dolby Digital system (in a netcasting application, for example), follow the recommendations in ATSC A/85 2011a Annex K, EBU – TECH 3344, or AES TD1004.1.15-10.

As you set Target Loudness closer to -11 dB, loudness increases. Eventually, you will start to see significant limiter gain reduction as the 6300's look-ahead limiters work harder and harder prevent peak overload. Above a certain Target Loudness value, the limiters will start to create audible side effects as they create more and more gain reduction. Allowing up to 6 dB of limiter gain reduction on isolated transients is usually safe, but the best sounding limiter gain reduction is no gain reduction at all, so we advise taking advantage of any available headroom in your transmission channel to minimize the amount of look-ahead limiter gain reduction.

- C) *Skip this step if you do not plan to sync the 6300's digital output(s) to an external AES11 or wordclock signal.*

If the Ext Sync control is not visible, press **Next** until the control appears. Set the control for AES or Wordclock, as required.

- D) Navigate to **SETUP > IO CALIB > DIGITAL CALIB > DO1 CALIB**.
- E) Set the **DO1 PRE-E** control to **FLAT**.
- F) Set the **DO1 RATE** to 48 kHz, which is the standard Dolby Digital sample rate.
- G) Set the **DO1 SYNC**. Choose:
  - **INTERNAL** (the output sample rate is synchronized to the 6300's internal crystal-controlled clock), or
  - **INPUT** (the output sample rate is synchronized to the sample rate appearing at the 6300's AES3 input), or



- **EXTERNAL** (the output sample rate is synchronized to the sample rate appearing at the 6300's BNC sync input when an AES11 signal or a wordclock drives it).

H) Press **NEXT**. Then set the desired output **DO1 WORD** (word length).

[14], [16], [18], [20], or [24], in bits

The largest valid word length in the 6300 is 24 bits, which is the recommended setting for driving a Dolby Digital encoder.

The 6300 can also truncate its output word length to 20, 18, 16 or 14 bits. The 6300 can add dither (see the next step).

I) Adjust **DO1 DITH** (dither) to **IN** or **OUT**, as desired.

[In] or [Out]

When set to **In**, the 6300 adds "high-pass" dither before any truncation of the output word. The amount of dither automatically tracks the setting of the **WORD LEN** control. This first-order noise shaped dither considerably reduces added noise in the midrange by comparison to white PDF dither. However, unlike extreme noise shaping, it adds a maximum of 3 dB of excess total noise power when compared to white PDF dither. Thus, it is a good compromise between white PDF dither and extreme noise shaping.

To ensure maximum system linearity, it is wise to set this control to **IN**.

J) Set **DO1 FRMT** to **AES**.

K) Using the **DO1 SOURCE** button, set the digital 1 output source to **LIMIT NORM** (stereo enhancement, equalization, AGC, 2-Band or 5-Band compression, and look-ahead peak limiting).

No other output source will work correctly when Target Loudness control is active.

L) Press **NEXT**. Then set the **DO1 EMITS** parameter to **STEREO/DUAL**.

**STEREO/DUAL** is the normal setting. When the 6300 is in **DUAL MONO** mode, it emits both mono signals from a single AES3 output.

M) Press **NEXT**. Then adjust **DO1 100%** set the desired peak headroom in units of dB below full-scale.

When you set a given output's source to **LIMITER NORM**, the **DO 100%** control for that output no longer adjusts loudness. Instead, it sets the 6300's maximum peak output level with respect to 0 dBFS, which allows you to compensate for transmission channels that introduce peak overshoots. For example, if you lower an output control from 0 dBFS to -2 dBFS, the 6300 automatically reduces the gain following its peak limiter by 2 dB and simultaneously increases the drive into the look-ahead limiter by 2 dB. Hence, the average output level does not change but the maximum peak output level is constrained to -2 dBFS. This unconventional arrangement results from the 6300's handling of target loudness—once you have set the 6300 to achieve your target loudness, you can change the output level control freely without changing loudness.

Large amounts of gain reduction in the look-ahead limiter can decrease loudness. However, this will only happen with pathologically high set-

tings of Target Loudness and will never happen at the settings of Target Loudness typically used in broadcasts (–23 or –24 dB).

- N) (Optional) If **you are not using a “TV” factory preset, you may need to** tweak the 6300 to achieve your target loudness. Adjust the **MB DRIVE** control, which affects the loudness of both outputs proportionally, **so that the 6300’s BS.1770 meter indicates “0” on average.**

**“0” on this meter corresponds to the active** Target Loudness value for each output. Because the meter is located before the two **TARGET LOUDNESS** controls, the meter’s indication is valid for both outputs even if the two controls are set differently. See *Figure 1-1: Simplified Block Diagram of Target Loudness Control* on page 1-2.

Adjusting the **MB LIMITER DRIVE** changes the Loudness Level meter’s indication and the amount of gain reduction in the loudness controller and peak limiter. Adjusting either **TARGET LOUDNESS** control affects only the gain reduction in the peak limiter.

- O) Navigate to **SETUP > IO CALIB > DIGITAL CALIB > DO2 CALIB**, and repeat the steps above for Digital Output 2.

You can freely set the **DO2** controls to achieve whatever goals you want without compromising the calibration of digital output 1.

## 12. Set analog output and configuration level.

- A) Navigate to **SETUP > IO CALIB > ANALOG CALIB > ANLG OUT > AO SOURCE** and set the analog output source to:

- **AGC:** stereo enhancement, equalization, and AGC without peak limiting
- **MULTIBAND:** stereo enhancement, equalization, AGC, 2-Band or 5-Band compression, and loudness controller without peak limiting
- **LIMITER #1:** Limiter #1’s output signal follows its input selector: **AGC** or **MULTIBAND**. The **ANALOG 100% OUTPUT LEVEL** control also affects loudness.

See step 12 on page 2-15.

- B) Navigate to **SETUP > IO CALIB > ANALOG CALIB > ANLG OUT > AO PRE-E**. Set the analog output preemphasis to **PRE-E** (for preemphasis) or **FLAT**.

When in doubt, choose **FLAT**. This is correct for a great majority of 6300 applications. However, if you are using a TVAxXX preset (see Table 3-3 on page 3-31) and driving an analog TV transmitter (i.e., one transmitting an FM analog aural carrier using 50µs or 75µs preemphasis), it is best to **defeat the transmitter’s built-in preemphasis** and to allow the 6300 to produce the preemphasis instead. By minimizing the number of preemphasis and deemphasis stages in the transmission path, this minimizes peak overshoot and controls peak modulation more tightly. See step 13 below for more about driving an analog television transmitter.

If you are sending the analog output of the 6300 through a digital link that uses a lossy codec like MPEG, APT-X, or Dolby, set the output **FLAT**. Lossy codecs cannot handle pre-emphasized signals.

If you intend to use the analog output for headphones, set the output **FLAT**.

If you choose **LIMITER #1** in this step, you must configure the analog output to emit the **LIMITER #1** signal [see step (A) above]. If you emit the **LIMITER #1** signal, peak levels will only be controlled if you set the multi-band preemphasis to 50µs or 75µs in step 8 on page 2-25.

If you are driving a pre-emphasized channel and can bypass the channel's internal preemphasis filter, use **PRE**. However, if you cannot defeat the channel's preemphasis filter or if you will use the analog output for monitoring, set the output **FLAT**.

- C) You can use either program material or tone to set your output level (and thus, your modulation). If you want to use tone, turn on the 400Hz calibration tone. To do this:
- a) Navigate to **SETUP > TEST**.
  - b) Set the **MODE** to **TONE**.
  - c) Set **TONE FREQ** to **400 HZ**.
  - d) Set **TONE LVL** to **100%**.
  - e) Press the **NEXT** key.
  - f) Set **TONE CHAN** to **L+R**.
  - g) When you have finished with the tone, set the **MODE** to **OPERATE**.
- D) Using the **AO 100%** button, set the desired analog output level corresponding to 100% modulation, using units of dBu (0 dBu = 0.776 V rms).

Refer to *Setting Output/Modulation Levels* on page 1-25.

If you have chosen **AGC** or **MULTIBAND** in step (A) above, the peak level will not be well controlled because no peak limiting has been applied to this signal.

If you are using program material, make sure that the program material is loud enough to produce peaks of frequent recurrence that cause the **6300's** look-ahead limiters to produce gain reduction, thereby defining the maximum peak level that the 6300 will produce.

If you use a TVAxxx preset (intended to process audio for analog preemphasized FM aural carriers), loudness will be correct compared to an Orban processor for analog TV (like Optimod 8282 or 8382) if you set **the 6300's AO 100%** level so that the 6300's test tone generator, when set to 100 Hz and 100%, produces 100% modulation of the aural carrier. (For systematic instructions, see step 13.M) on page 2-35.)

The analog output shares Limiter # 1 with Digital Output #1. To use the analog output for calibrated loudness control in analog television, you must set the) and set the **DO1 100%** control to 0.0 dB. This will cause the processing to scale the look-ahead limiter drive and loudness controller threshold appropriately so that on-air loudness is the same as other stations using an Optimod-TV for analog television if these stations are using a factory preset. Moreover, it will scale the loudness meter so that it **peaks at "0" on dialog** when on-air loudness is correct. This allows you to use the meter as a reference for customizing presets.

If overshoot in the transmission path following the 6300 causes peak modulation with program material to be significantly higher than it is

when you set up modulation with the 6300's test tone oscillator, correct the peak modulation by turning down the **AO 100%** control and then turning up **TARGET LOUDNESS** by the same amount. This will drive the look-ahead limiter harder but will cause the loudness controller and loudness meter to be calibrated correctly.

If the loudness in your market is different from that produced by an Optimod-TV using a factory preset, match this loudness to the on-air loudness produced by the 6300 by editing the **TARGET LOUDNESS** setting of the active preset. This ensures that the loudness controller and loudness meter operate correctly.

13. Set digital configuration and output level when driving an analog television transmitter (optional).

*[Skip this step if you are not driving an analog television transmitter.]*

We recommend using **5-Band "TVA" presets (or User Presets derived from them)** when the **OUTPUT PREEMPHASIS** control (step 8 on page 2-25) is set to 50 $\mu$ s or 75 $\mu$ s, which will be true when the 6300 is correctly set up to drive an analog television transmitter. **"TVA"** processing is designed to feed an analog TV aural channel using 50 $\mu$ s or 75 $\mu$ s preemphasis. To simplify setup, the **"TVA" presets** have local values of **TARGET LOUDNESS** (-17 dB), **LOWPASS** (15 kHz), and **HIGHPASS** (20 Hz). These values override the corresponding global values in the active Transmission Preset.

The filter settings complement analog aural carriers, while the value of **TARGET LOUDNESS** matches the loudness of the processing to the loudness of an Optimod-TV designed for analog television (like Optimod-TV 8282 and 8382) when the peak output levels of the two processors are the same and when the **OUTPUT 100%** control is set to 0.0 dBFS.

The following steps assume that you are driving the analog television transmitter from the 6300's Digital Output 1, although either output will work.

- A) Navigate to **SETUP > DO 1**.
- B) *Skip this step if you do not plan to sync the 6300's digital output(s) to an external AES11 or wordclock signal.*

If the Ext Sync control is not visible, press **Next** until the control appears. Set the control for AES or Wordclock, as required.

- C) Navigate to **SETUP > IO CALIB > DIGITAL CALIB > DO1 CALIB**.
- D) Set the **DO1 PRE-E** control to **FLAT**.

This applies de-emphasis that complements the setting of the **OUTPUT PREEMPHASIS** control.

- E) Set the **DO1 RATE** to match your transmission system.
- F) Set the **DO1 SYNC**. Choose:
  - **INTERNAL** (the output sample rate is synchronized to the 6300's internal crystal-controlled clock), or

- **INPUT** (the output sample rate is synchronized to the sample rate appearing at the 6300's AES3 input), or
- **EXTERNAL** (the output sample rate is synchronized to the sample rate appearing at the 6300's BNC sync input when an AES11 signal or a wordclock drives it).

G) Press **NEXT**. Then set the desired output **DO1 WORD** (word length).

[14], [16], [18], [20], or [24], in bits

The largest valid word length in the 6300 is 24 bits, which is the recommended setting for driving a Dolby Digital encoder.

The 6300 can also truncate its output word length to 20, 18, 16 or 14 bits. The 6300 can add dither (see the next step).

H) Adjust **DO1 DITH** (dither) to **IN** or **OUT**, as desired.

[In] or [Out]

When set to **In**, the 6300 adds "high-pass" dither before any truncation of the output word. The amount of dither automatically tracks the setting of the **WORD LEN** control. This first-order noise shaped dither considerably reduces added noise in the midrange by comparison to white PDF dither. However, unlike extreme noise shaping, it adds a maximum of 3 dB of excess total noise power when compared to white PDF dither. Thus, it is a good compromise between white PDF dither and extreme noise shaping.

To ensure maximum system linearity, it is wise to set this control to **IN**.

I) Set **DO1 FRMT** as appropriate for your transmission system.

J) Using the **DO1 SOURCE** button, set the digital #1 output source to **LIMITER NORM** (stereo enhancement, equalization, AGC, 2-Band or 5-Band compression, and look-ahead peak limiting).

No other output source will work correctly with Target Loudness control active.

K) Press **NEXT**. Then set the **DO1 EMITS** parameter to **STEREO/DUAL**.

**STEREO/DUAL** is the normal setting. When the 6300 is in **DUAL MONO** mode, it emits both mono signals from a single AES3 output.

L) Press **NEXT**. Then adjust **DO1 100%** to 0.0 dBFS.

M) Set your transmitter's modulation with tone.

- Navigate to **SETUP > TEST**.
- Hold down the **MODE** button and choose **TONE**.
- Set **TONE FREQ** to 100 HZ and **TONE LVL** to 100%.
- If you are driving your transmitter with the 6300's analog output:* Use the 6300's **AO 100%** control (**SETUP > I/O CALIB > ANALOG CALIB > ANLG OUT**) to produce 100% modulation of your transmitter as measured by the peak modulation instrument specified by your country's regulatory authority.

- e) *If you are driving your transmitter with a 6300 digital output:* Use a gain control following the 6300 output (typically, your analog transmitter's sensitivity control) to produce 100% modulation of your transmitter as **measured by the peak modulation instrument specified by your country's regulatory authority.**

Achieving correct on-air loudness and proper operation of the 6300's loudness meter requires you to align the transmission system following the 6300 so that 0.0 dBFS at the 6300's **output corresponds to 100% peak** modulation of the transmitter. When the **TARGET LOUDNESS REF OUT = DO1**, using the 6300's **DO1 100%** control to set the gain between the 6300 and the transmitter will not produce correct loudness controller and loudness meter calibration and on-air loudness because this control only sets the maximum peak level while attempting to maintain the average modulation constant when adjusted. It does this by driving the look-ahead limiter 1 dB harder for every 1 dB that the **2.0 OUTPUT LEVEL** is turned down.

- N) Test modulation with program material to determine the overshoot in your transmission system.
- a) Navigate to **SETUP > TEST** and choose **OPERATE**
  - b) Recall the **TVA 5B GEN PURPOSE** preset.
  - c) Apply typical program material to the **6300's** input. Verify that the **LIMITER GR** meters are indicating gain reduction on peaks, which ensures that the 6300 is producing 100% peak modulation on program material.
  - d) Measure **your transmitter's peak modulation. If this exceeds 100%, turn down the 6300's DO1 100% control** until the modulation of peaks of frequent recurrence is constrained to 100% deviation.

Turning down the **DO1 100%** control reduces the peak modulation without significantly affecting the average modulation. Hence, using this technique keeps the 6300's **LOUDNESS LEVEL** meter correctly calibrated and provides correct on-air loudness.

- O) Check loudness with respect to other stations in your market and correct your average modulation if necessary.

You have just adjusted on-air loudness to match the loudness that an Optimod-TV 8382 would produce when set up normally. However, because there is no standard value for the average modulation in analog TV transmission, the loudness of your analog transmission might be different from other stations in your area. If this is so, match the 6300's **loudness** to the other stations by adjusting the **active output's TARGET LOUDNESS** control in the on-air preset. In PC Remote, this control is located in the **LESS-MORE** tab; on the 6300's **front panel, the control is located in ADVANCED MODIFY**. For example, changing **TARGET LOUDNESS** from -17 dB to -15 dB makes the transmission 2 dB louder. Adjusting **TARGET LOUDNESS** is the *only* correct way to adjust on-air loudness after the system has been calibrated according to steps (M) and (N) above; this technique will retain correct calibration of the 6300's **loudness level meter and loudness controller**.

Note that increasing the loudness in this way will increase the likelihood that the 6300's look-ahead limiter will create audible "pumping" or "gulping" artifacts on program material that is rich in high frequencies because the look-ahead limiter is operating on a preemphasized signal and turning up **TARGET LOUDNESS** drives the look-ahead limiter harder. If you hear such artifacts, we recommend that you use a 5-Band **TVA** preset if you are not doing so already. This allows you to use the Band 5 compressor/limiter as a high-frequency limiter. If you hear audible pumping on material rich in high frequencies, turn down the **B5 THRESHOLD** control until you find the most subjectively pleasing trade-off between high frequency loss and look-ahead limiter pumping. You can also try speeding up the **B5 ATTACK** control by setting it to a lower number, or adjusting the both controls to taste.

When you use a 2-Band "TVA" preset, some material rich in high frequencies may cause subtle pumping even with **TARGET LOUDNESS** set to its nominal -17 dB value. This is because the 2-band compressor cannot produce high frequency limiting, so preemphasis control must be performed by the loudness controller and look-ahead limiter. We have tuned the 5-Band factory "TVA" presets to produce appropriate amounts of high-frequency limiting. We therefore recommend that if you need to use a "TVA" preset, use a 5-Band preset unless you have a very good reason not to.

- P) Navigate to **SETUP > IO CALIB > DIGITAL CALIB > DO2 CALIB** and execute steps (10.A) through (10.K) for Digital Output 2.

You can freely set the **DO2** controls to achieve whatever goals you want without compromising the calibration of digital output 1. If you assign **DO2** to **LIMITER NORM** and set the **DO2 100%** control to be the same as the **DO1 100%** control, **DO2** will also emit a signal properly calibrated to drive a Dolby Digital encoder.

#### 14. Set the 6300's response to AES3 status bits.

See step (B) on page 2-20.

#### 15. Choose whether the 6300 digital output will emit status bits depending on whether the 6300 is in stereo or dual mono modes.

See step (C) on page 2-20.

#### 16. Choose whether the 6300's will pass or block AES3 user bits.

See step 21 on page 2-20.

#### 17. Set the sensitivity of the Loudness Level meter when you are not driving a Dolby Digital channel [optional].

In radio-style and netcasting applications, you can adjust the **GLOBAL TARGET LOUDNESS 1** control to make the loudness meters read in a useful part of their scales (typically around "0"). You can then use the loudness meters to compare the loudness produced by different factory presets and to measure the effect of any customizations you make to them.

If the Limiter # 1 source is not **LIMIT NORM**, the **GLOBAL TARGET LOUDNESS 1** control still scales the CBS and BS.1770 Loudness Meters, but it does not change the drive

into the peak limiters (see *Figure 1-1* on page 1-2). Hence, the absolute output loudness is only correctly calibrated to the loudness meters if that output's **OUTPUT LEVEL** control is set to 0 dB.

To access the **TARGET LOUDNESS** control, navigate to **SETUP > TARGET LOUDNESS**.

#### 18. End Analog and Digital I/O setup.

If you are using a external AGC and you temporarily set the **EXT AGC** to **NO** in step 2 on page 2-22, set the **EXT AGC** to **YES**.

#### 19. Select a processing preset.

See step (17.D) on page 2-19.

#### 20. Program Silence Sense (optional)

You can program the 6300 to switch automatically from its digital input to its analog inputs if the **INPUT SOURCE** is set to **DIGITAL** and the signal at the digital input falls silent.

There are two silence detectors, one for the analog input and one for the digital input. The silence sense parameters apply to both simultaneously. Both detectors are available to drive the 6300's tally outputs but only the "**digital input**" silence detector is used for automatic input switching. (See step 21 below.)

Silence sense will be activated if either channel falls silent, thus also protecting against "loss-of-one-stereo-channel" faults.

If silence is detected at the analog input as well as the digital input (as in the case of a studio operational fault), automatic switching will not occur.

When an active signal is restored to the digital input, the 6300 will automatically switch back to that input.

This feature is unavailable in the 6300's audio processing mode.

- A) Navigate to **SETUP > TALLY > SILENCE THRESHOLD** and set the Silence Threshold to the level below which the 6300 will interpret the input as being silent.

This setting is with respect to the current analog reference level and digital reference level.

- B) Press **NEXT** as necessary to see the **SILENCE DELAY** control. Set it to the amount of time that the input must be below the Silence Threshold before the 6300 automatically switches to the analog input.

- C) Press **NEXT** as necessary to see the **ANALOG FALLBACK** control. Set it to **YES** if you wish the 6300 to switch automatically from the digital to analog input when silence is detected. Set the control to **NO** to defeat automatic switching.

#### 21. Program Tally Outputs.

*[Skip this step if you do not wish to use the tally outputs.]*

See step 6 on page 2-3 for wiring instructions.



You can program the two tally outputs to indicate a number of different operational and fault conditions.

A) Navigate to **SETUP > TALLY > TALLY OUT1**.

B) Program tally output #1.

To program a given tally output, press and hold the soft button associated with the output you are programming. As you turn the control knob, the functions listed below will appear in the highlighted field.

- **Input: Analog:** Indicates that the 6300 is processing audio from its analog input.
  - **Input: Digital:** Indicates that the 6300 is processing audio from its AES3 digital input.
  - **Analog Input Silent:** Indicates that the level at either or both analog input channels is below the threshold set in step 16 on page 2-28.
  - **AES Input Silent:** Indicates that the level at either or both digital input channels is below the threshold set in step 16 on page 2-28.
  - **AES Input Error:** Indicates that the 6300's AES input receiver chip has detected that the input data is unusable. When the chip detects such an error, it automatically switches the input to ANALOG.
  - **No Function:** Tally output is disabled.
- C) Program tally output #2 if you wish, following the procedure in step (B) above with the **TALLY OUT2** button.

## Automation Using the 6300's Internal Clock

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1. If you have not already done so, set the system clock.

[You can also set the clock automatically via PC Remote or the Internet. See *Synchronizing Optimod to a Network Time Server* starting on page 2-54.]

A) Navigate to **SETUP > NEXT > TIME DATE AND ID > SET TIME**.

- a) Set hours and minutes.
- b) Enter seconds slightly ahead of the correct time.
- c) Wait until the entered time agrees with the correct time. Then press the **ENTER TIME** button to set the clock.

B) Press the **SET DATE** button.

- a) **Set today's date, using the days, month, and year buttons.**
- b) Press the **ENTER DATE** button.

C) Press the **DAYLIGHT TIME** button.

- a) Using the Daylight Saving (**DT MONTH** and **DT WEEK**) buttons, set the month and week when Daylight Saving Time (Summer Time) begins, or **OFF**.
- b) Using the Standard Time (**ST MONTH** and **ST WEEK**) buttons, set the month and week when Daylight Saving Time (Summer Time) ends.

Note that setting **DT MONTH**, **DT WEEK**, **ST MONTH**, or **ST WEEK** to **OFF** will defeat Daylight Time functionality.

- c) Press the **Escape** key to back out of the daylight saving screen.
- D) (Optional) Press the **STATION ID** button to specify your station's identifier (call sign or call letters).
  - a) Use the knob to select characters. Use the **PREV** and **NEXT** buttons to move the cursor.
  - b) When you are finished, press **SAVE**.

## 2. Navigate to Setup > Next > Automation.

If the **AUTOMATION** button reads **DISABLED**, hold it down and turn the knob to enable automation.

This button allows you to easily enable or disable all automation events without having to edit individual automation events.

## 3. To add an automation event:

- A) Push the **ADD EVENT** button.
- B) Choose whether you wish to program an event that occurs only once or an event that follows a daily or weekly schedule.
- C) For events that occur only once:
  - a) Use the **PREV** and **NEXT** buttons to move the cursor over the word "**DAILY:**" and turn the knob so that it reads "**DATE:**" instead.
  - b) Use the **PREV** and **NEXT** buttons to move the cursor to the day, month, and year when the automation event will occur. Set the desired values with the knob.
  - c) Use the **PREV** and **NEXT** buttons to move the cursor set the hour, minute, and second (in 24-hour format) when the automation event is to occur. Set the desired values with the knob.
- D) For events that occur on a daily or weekly schedule:
  - a) Use the **PREV** and **NEXT** buttons to move the cursor the each day of the week in turn, and use the rotary encoder to turn the day on or off.
 

You can program the event to occur on as many days of the week as you wish.
  - b) Use the **PREV** and **NEXT** buttons to move the cursor set the hour, minute, and second (in 24-hour format—e.g., 18:00:00 for 6:00 PM) when the automation event is to occur. Set the desired values with the knob.

Automation events have a “start” time but no “stop” time. The 6300 will indefinitely remain in the state specified by an existing automation event until its state is changed by another automation event or by another action (such as a user’s interacting with the front panel or PC Remote software).

E) For all events:

a) Press the **SELECT EVENT** button.

b) Turn the knob to set the desired event. The available events are:

- Recall factory preset
- Recall user preset
- stereo mode
- dual-mono (**DUALMONO**) mode

This mode processes the two input channels independently.

- bypass mode
- exit test (restores the operating preset that was active before a test mode was invoked)

F) When you have programmed an event to your satisfaction, press the **SAVE EVENT** button.

You will return to the automation menu.

4. To edit an existing event:

A) Press the **VIEW > EDIT EVENT** button.

B) Turn the knob until you see the event you wish to edit.

C) Press the **EDIT EVENT** button.

D) Edit the event as desired. Use the same technique as adding an event.

See step 3 on page 2-40.

E) Press the **SAVE EVENT** button to store your edits.

5. To delete an event:

A) Press the **DELETE EVENT** button.

B) Choose the event to delete with the knob.

You can search by date or by event (i.e., recalling a given preset). Use the **NEXT** button to navigate from one type of search to the other type.

C) When you have located the event you want to remove, press the **DELETE EVENT** button.

This action will immediately delete the event. There is no “are you sure” warning message. To abort the deletion, press the **Esc** button, not the **DELETE EVENT** button.

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## Security and Passcode Programming

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*[Skip this step if you do not plan to use PC Remote software or do not plan to lock out the front panel locally.]*

Your Optimod has several levels of security to prevent unauthorized people from changing its programming or operating state. Security controls access to the front panel and to anyone connecting to the Optimod through a direct serial connection, dial-up networking (through modems), or its Ethernet port.

The security levels are:

1. All Screens (i.e., administrator level)
2. All Screens except Security
3. All screens except Modify and Security
4. Presets, Modify, Save, Memory, and Automation
5. Presets and Automation
6. Presets

There is no default passcode. The Optimod's front panel cannot be locked out unless the Optimod has been assigned at least one All Access passcode.

Your Optimod secures User Presets by encrypting them (using the Advanced Encryption Standard algorithm with the session passcode as its key) when PC Remote fetches them. Hence, a packet sniffer cannot intercept User Presets in plaintext form. PC Remote then writes the fetched User Presets in encrypted form on your hard drive, where they remain for the duration of your PC Remote session.

If PC Remote exits normally, it will erase these temporary User Preset files from your computer's hard disk. If it does not exit normally, these files will remain in encrypted form. However, the next time that PC Remote starts up, it will automatically clean up any orphaned files.

### To Create a Passcode:

- A) Navigate to **SETUP > SECURITY > ADD PASSCODES**.

If the front panel is already password protected, you can only access this screen by entering a passcode with All Access privileges.

- B) Use the four soft buttons, labeled "1," "2," "3," and "4," to create a passcode.

Passcodes can be up to eight characters long but can only contain the characters "1," "2," "3," and "4." This limitation makes it easy to enter a passcode using the four available soft buttons.

- C) When you have finished entering your new passcode, write it down so you do not forget it. Then press the **NEXT** button.

If you wish to discard the passcode you just entered, press the **Esc** button instead. Then return to step (B).

- D) The **PERMISSIONS** screen appears. Turn the knob to choose the permission level for the passcode you just created.

If you wish to discard the passcode you just entered, press the **PREV** button to return to the Enter Passcode screen or **Esc** to return to the Security screen.

- E) Press the **NEXT** button to save your new passcode.

### To Edit a Passcode:

- A) Navigate to **SETUP > SECURITY > VIEW-EDIT PASSCODES**.

If the front panel is already password protected, you can only access this screen by entering a passcode with **ALL ACCESS** privileges.

- B) Turn the knob until you see the passcode you want to edit.
- C) Press the **NEXT** button. The Permissions screen appears.
- D) Turn the knob to set the desired permission level for the passcode you are editing.
- E) Press the **NEXT** button to confirm your choice.

Your new permission level is stored and the Security menu appears.

### To Delete a Passcode:

- A) Navigate to **SETUP > SECURITY > DELETE PASSCODES**.

If the front panel is already password protected, you can only access this screen by entering a passcode with All Access privileges.

- B) Turn the knob until you see the passcode you want to delete.
- C) Press the **NEXT** button. The Confirm Delete screen appears.
- D) Press the **YES** soft button to delete the passcode. Press the **NO** or **ESCAPE** buttons to abort deleting the passcode.

### To Lock the Front Panel Immediately:

After you have adjusted the processor, to maximize security you will often want to lock it immediately without waiting for the timeout. To do so:

- A) Press the **SETUP** button.
- B) Press the **LOCK NOW** soft button.

### To Program local lockout:

- A) Navigate to **SETUP > SECURITY**.

If the front panel is already password protected, you can only access this screen by entering a passcode with **ALL ACCESS** privileges.

- B) Hold down the **AUTOLOCK** soft button and turn the knob to set the desired lockout time (if any).

You can program the lockout delay time (in hours:minutes) from 15 minutes to 8 hours, or **OFF**. This is the time delay between the last access to a local front panel control and when the front panel automatically locks itself out, requiring entering a passcode to obtain front panel control of the 6300.

Autolock can only be turned on if at least one passcode exists with **ALL ACCESS** privileges because an **ALL ACCESS** passcode is required to fully unlock the panel or to turn off the Autolock function.

- C) Press the **ESCAPE** button to leave the Security menu.

### To Unlock the Front Panel:

- A) On the 6300 front panel, operate any button or the knob.

The **PASSCODE** screen will appear.

- B) Enter a passcode using the four soft buttons.

The 6300 functionality that you can access depends on the security level of the passcode that you entered.

After you have finished working, the panel will automatically re-lock after the time delay you set in **SETUP > SECURITY > AUTOLOCK**. (You can set a new delay at any time if you have an **ALL ACCESS** passcode.)

### Dial-up Networking and the Passcode

When you make a Windows Dial-up Networking connection, Windows will ask you for your passcode. To allow the connection to occur, enter any passcode that you set at the 6300's front panel. Once your PC is connected to the 6300, you will be able to access the 6300 functionality corresponding to the security level of your passcode.

### If You Have Forgotten Your Passcode

You can reset factory defaults and wipe out security passcodes (in case you forgot your **ALL ACCESS** passcode).

- A) Remove power from the 6300.

- B) While pressing both the **ESCAPE** and **SETUP** buttons, restore power.

The Restore Defaults screen appears.

- C) To gain access to the 6300, press the **ERASE ALL PASSCODES** soft button.

- D) Reprogram passcodes as necessary; see *To Create a Passcode* on page 2-42.



The **RESTORE DEFAULTS** button (in the Restore Defaults screen) restores all System Setup and Input/output parameters to their factory default settings. It also erases all passcodes. You should never need to use this button in an existing installation, although it is a convenient way to make the 6300 “factory fresh” if it is being installed in a different facility.

The **RESTORE DEFAULTS** button takes you to a screen that allows you to keep or erase any user presets that exist in your unit.

## Administering via Serial Port or Ethernet

### Connecting to the 6300's Ethernet Port or Serial Port via a Terminal Program on a PC

You can connect a terminal emulation application to the 6300's Ethernet or Serial ports via TCP/IP, port 23 (which is the standard Telnet port and the 6300 factory default). When connected like this, you can:

- recall presets (step 1 on page 2-49)
- Select the analog or digital input as the audio source (step 2 on page 2-49)
- Fetch real-time operational status information from the Optimod (step 3 on page 2-49)
- Fetch information about the active processing preset (step 4 on page 2-50)
- Fetch diagnostic information from the 6300 (step 5 on page 2-50)

This interface can be used to allow custom third-party applications (including automation systems) to recall presets, view status and set the controls listed above. However, you cannot restore defaults, set security passcodes and change networking controls via Ethernet or the serial port. You can set those controls by using 6300 PC Remote software. (See *Installing 6300 PC Remote Control Software* on page 2-57.)

- The serial port connection uses the PPP protocol.
- To set a different port number:

A) From the main menu, navigate to **Setup > NETWORK&REMOTE > NETWORK**.

B) Press the **TERMINAL PORT** soft button.

The current setting of the Terminal Port appears.

If the **TERMINAL PORT** soft button is not visible, press the **Next/Prev** buttons until it is.

- Use the **Next** and **Prev** keys to move the cursor in turn to each digit in the terminal port number. Use the knob to set the digit to the desired value. Repeat until you have selected all the numbers in the IP address assigned by your network administrator
- Press the **SAVE** soft button to confirm your setting.

- The IP address for this Ethernet connection is the same as the IP address set in step (1.B) on page 2-52 and is visible in the **Setup > NETWORK&REMOTE > NETWORK** screen. A serial connection uses a fixed IP address: 192.168.168.101.

To control the 6300 directly through its Serial or Ethernet port, you can use the freeware terminal emulation application PuTTY. If you wish to automate control, download Plink. Both of these applications are available for free download. Search "PuTTY" with Google to find a download site.

Note that Windows 7 does not install a Telnet Client by default, so you must do this manually if you wish to initiate a Telnet connection between a Windows 7 machine and your Optimod. Refer to:

[http://technet.microsoft.com/en-us/library/cc771275\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc771275(WS.10).aspx)

#### Direct Control Using PuTTY

- A) If you are using a serial connection, establish a Direct Serial Connection between your computer and the Optimod. See *Setting Up Serial Communications* starting on page 2-61.

A connection through the serial port uses a fixed IP address:  
192.168.168.101

- B) Start PuTTY.

The **SESSION** window appears.

- C) Click the **RAW** button, and set the Port to 23, or whatever terminal port you have set at the Optimod.

The **Terminal Port** is visible in the Optimod's **SYSTEM SETUP > NETWORK REMOTE > NETWORK** screen.

- D) In the **TERMINAL** category, check "Implicit CR in every LF."

You should not have to change any other PuTTY Terminal, Window, or Connection defaults

- E) Specify the host name or IP address:

- If you are connecting through the serial port, type 192.168.168.101 into the "Host Name (or IP address)" field.
- If you are connecting through the 6300's Ethernet interface, type the 6300's IP address into the "Host Name (or IP address)" field.

The IP address for this connection is the same as the IP address set in step (1.B) on page 2-52 and is visible in the **SYSTEM SETUP > NETWORK REMOTE > NETWORK** screen.

- F) Name and save the Session if you wish.

- G) Click **OPEN**.

- H) Activate the **CAPS LOCK** on your computer to ensure that you type in upper-case.

You can now perform the operations described in steps 1 through 5 starting on page 2-49.



To automate control of the 6300 externally, establish a Telnet/SSH connection and issue commands and parameters, either by typing them directly into a Telnet/SSH client or by placing them within batch files. Then process them with a scriptable Telnet/SSH client that supports this operation, such as PuTTY, along with its companion command-line interpreter, Plink. You can also use netcat.exe. Below, we provide instructions for both PuTTY/Plink and Netcat.

Custom third party applications can be developed to use this protocol. Additionally, you can include this protocol in an existing application by using small subsets of the standards-based Telnet/SSH protocols directly, or for simplicity, by using scripting or by calling batch files with a Telnet/SSH client such as PuTTY along with its companion command-line interpreter, Plink.

Automating control changes is possible using the Windows Task Scheduler to launch batch files at the desired time.

CAUTION: Because of the powerful features and potential security risks of Netcat, many virus programs may detect this software as a threat. If Netcat is detected as such, configure virus software to allow, and use the software with the normal security precautions. The outbound configurations shown here do not provide any security risks. Inbound connections, if used for other applications, require careful security configuration.

In the examples below, replace "123.45.67.89" with the IP address of the 6300 you are controlling. Replace "23" with the terminal port you specified using the method described on page 2-45. Port 23 is the factory default.

#### Automated Control Using PuTTY/Plink

This method is scripted with a .cmd file and calls a .txt file. Via plink.exe, the .cmd file calls putty.exe, which then makes the network connection between the computer executing putty.exe and 6300, and specifies the .txt file to use.

The .txt file contains the 6300 commands.

The following two examples recall the presets JAZZ and ROCK-OPEN respectively.

The file "6300\_P1\_Jazz.cmd" contains:

```
plink -raw -P 23 123.45.67.89 < 6300_P1_JAZZ.txt
```

The file "6300\_P1\_JAZZ.txt" contains:

```
RP JAZZ [PASSWORD]  
disconnect
```

The file "6300\_P2\_Rock-Open.cmd" contains:

```
plink -raw -P 23 123.45.67.89 < 6300_P2_ROCK-OPEN.txt
```

The file "6300\_P2\_Rock-Open.txt" contains

```
RP ROCK-OPEN [PASSWORD]
disconnect
```

#### Automated Control Using Netcat

Only one utility is required to use this method: netcat.exe. This is available as a free download. Google "netcat."

This method is scripted with a .cmd file and calls a .txt file.

- The .cmd file calls netcat.exe to make the network connection between the computer executing netcat.exe and 6300, and specifies the .txt file to use.
- The .txt file contains the 6300 commands.

The following two examples recall the presets JAZZ and ROCK-OPEN respectively.

The file "6300\_P1\_JAZZ.cmd" contains:

```
nc.exe -v -n -w 1 123.45.67.89 23 < 6300_P1_JAZZ.txt
```

The file "6300\_P1\_JAZZ.txt" contains:

```
RP JAZZ [PASSWORD]
disconnect
```

The file "6300\_P2\_ROCK-OPEN.cmd" contains:

```
nc.exe -v -n -w 1 123.45.67.89 23 < 6300_P2_ROCK-OPEN.txt
```

The file "6300\_P2\_GreggOpen.txt" contains:

```
RP ROCK-OPEN [PASSWORD]
disconnect
```

#### Administrative Operations Available via the Serial Port

In the following tables of commands and responses:

- Text that the user enters appears in **MONOSPACED BOLD**.
- Responses that the 6300 transmits appear in monospaced normal.
- The symbol "↵" means CR (for received commands) and CR+LF (for transmitted responses from 6300).

#### Available Commands

1. To recall a preset:

Command	Response
RP <b>XXXXXXX</b> [PASSCODE] ↵	(valid passcode and preset name) ON AIR: XXXXXXXX (invalid passcode) [no error message is issued]

*In the above table:*    **XXXXXXX** = the preset name;  
                              **PASSCODE** = any valid passcode.

- If a non-existent control value and/or an invalid passcode is entered, the 6300 will ignore the command. If a non-existent preset name is entered, your Optimod will return an error message to indicate that the preset you entered does not exist.
  - You can apply this command anytime after the 6300 boots up.
  - This command is useful in interfacing automation systems to the 6300.
2. To select the analog or digital input as the audio source:

Note: When the input is set to **DIGITAL** and no valid digital signal is present at the input, the setting of the **DI ANALOG FALLBACK** control will determine whether the Optimod automatically switches to its analog input. See step 20.C) on page 2-38.

Command	Response
IN <b>X</b> [PASSCODE]	(valid passcode and argument) INPUT: [ANALOG, DIGITAL, DIGITAL J17] (for each output) (invalid passcode) [no error message is issued]
IN [PASSCODE]? ↵	Returns active Input.

*In the above table:*    **X = A, D, J17**  
                              where A = analog input, D = digital input, and J17 = Digital J.17.

**PASSCODE = ANY VALID PASSCODE.**

- ? returns the active input setting.
  - If a non-existent control value and/or an invalid passcode is entered, the 6300 will ignore the command.
3. To fetch real-time operational status information from the Optimod:

This provides a real-time status report including the following information:

Command	Response
<b>RT</b> [PASSCODE] ↵	6300 Status: digital input 1 lock [active][inactive] remote contact closure 1 [active][inactive] remote contact closure 2 [active][inactive] remote contact closure 3 [active][inactive] remote contact closure 4 [active][inactive] remote contact closure 5 [active][inactive] remote contact closure 6 [active][inactive] remote contact closure 7 [active][inactive] remote contact closure 8 [active][inactive] tally out 1 [active][inactive] tally out 2 [active][inactive]

4. To fetch information about the active processing preset:

Command	Response
<b>AP</b> [PASSCODE] ? ↵	Returns active processing preset name
<b>AP</b> [PASSCODE] ?? ↵	Returns active processing preset control settings
<b>LP</b> [PASSCODE] ↵	Returns a list of all available processing presets

5. To fetch diagnostic information from the 6300:

This provides a status report indicating technical parameters:

Command	Response
<b>ST</b> [PASSCODE] ↵	6300 Status: 6300 V 1.2.4.156 Station Name: XXXX Access Level: 0: all access Bootup: Thu Nov 21 23:17:40 2013 MAC Address: 00-0E-EC-E8-0B-99 Memory Available: 11086976 Available Space: 8578 Kbytes i/o board version: 5.00 SNMP active

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## Remote Control Interface Programming

---

*[Skip this step if you do not wish to program the GPI (contact closure) remote control interface.]*

1. Navigate to **SETUP > NEXT > NETWORK & REMOTE > REMOTE INTERFACE**.
2. Program one or more remote control interfaces.
  - A) Navigate to the desired Remote Interface button (1 through 4) by repeatedly pressing the **NEXT** button.
  - B) Hold down the button while turning the knob to select the desired function for the interface.

Use either button below the appropriate graphics; both work the same.

A momentary pulse of voltage will switch most functions, except as noted.

- **Preset Name:** switches the named preset on the air. The control interface can recall any factory or user preset.
- **Input: Analog:** selects the analog inputs.
- **Input: Digital:** selects the digital input and but does not apply deemphasis to it.
- **Input: Digital+J.17:** selects the digital input and applies J.17 deemphasis to it.
- **Bypass:** switches the Bypass Test Mode on the air.
- **Tone:** switches the Tone Test Mode preset on the air.
- **Exit Test:** If a test preset is presently on the air, EXIT TEST reverts to the previous processing preset.
- **Stereo:** connects the 6300's left and right inputs to the left and right inputs of the processing and stereo-couples the processing.
- **Dual Mono:** connects the 6300's **left and right inputs to the left and right** inputs of the processing and removes all stereo coupling from the processing so that the two channels of the processing operate as independent processors, sharing only the active preset.

Both channels of the processing use the same preset.

- **Pass User Bits:** When triggered, causes the 6300 to pass AES user bits from its digital input to its digital output. See step 21 on page 2-20.
- **Block User Bits:** When triggered, prevents the 6300 from passing AES user bits from its digital input to its digital output.

- **Reset Clock To Hour:** resets the internal clock to the nearest hour. For example, 3:03:10 would be reset to 3:00:00, while 3:53:40 would be reset to 4:00:00. Use this function to periodically re-sync the 6300's **internal clock to your station's master clock**.
- **Reset Clock to Midnight:** Resets the clock to 0:00:00. You can use this function to periodically re-sync the 6300's **internal clock to your station's master clock**.
- **Mute Analog Output:** When voltage is applied, the analog output mutes. **One could use this as an "off-the-air alert" by driving this output with an external loss-of-carrier or loss-of-audio alarm system to mute the talent headphones or monitor speakers.**
- **Mute Digital Out 1:** When voltage is applied, digital output #1 mutes.
- **Mute Digital Out 2:** When voltage is applied, digital output #2 mutes.
- **No Function:** remote input is disabled.

3. End remote control interface programming.

When you are finished programming the remote control interface, press the Escape button to return to higher menu levels.

## Networking and Remote Control

---

*[Skip this step if you do not wish to connect to your 6300 remotely, either for downloading software upgrades or for PC Remote Control.]*

The 6300 has a built-in Ethernet connector that can be used with 10 Mbps or 100 Mbps networks using the TCP/IP protocol. You can also connect a PC to the 6300 through the 6300's RS-232 serial port, either by modem or directly through a null modem cable.

1. Prepare the 6300 for an Ethernet network connection:

*[Skip this step if you will not be using an Ethernet connection.]*

- See your network administrator to get the data required in the following procedure.
- Note that if you wish to do this from the 6300 PC Remote software, then you must first be able to connect to the 6300. Therefore, you will usually perform this procedure from the 6300's **front panel to prepare it for connection**.

A) Navigate to **SETUP > NETWORK & REMOTE > NEXT**.

B) Press the **SET IP ADDRESS** soft button.

The IP Address Screen appears.

- 
- a) Use the **NEXT** and **PREV** keys to move the cursor in turn to each digit in the IP address. Use the knob to set the digit to the desired value. Repeat until you have selected all the numbers in the IP address assigned by your network administrator
  - b) Press the **SAVE** soft button to confirm your setting.
  - C) Set the Subnet Mask assigned by your network administrator if necessary:
    - a) Press the **SET SUBNET MASK** soft button.
    - b) Use the **NEXT** and **PREV** keys to move the cursor in turn to each digit in the subnet mask. Use the knob to set the digit to the desired value. Repeat until you have selected all the numbers in the subnet mask assigned by your network administrator
    - c) Press the **SAVE** soft button to confirm your setting.
  - D) Set the Gateway assigned by your network administrator if necessary:
    - a) Press the **GATEWAY** soft button.
    - b) Use the **NEXT** and **PREV** keys to move the cursor in turn to each digit in the gateway. Use the knob to set the digit to the desired value. Repeat until you have selected all the numbers in the gateway assigned by your network administrator
    - c) Press the **SAVE** soft button to confirm your setting.
  - E) Set the IP Port assigned by your network administrator if necessary:
    - a) Press the **IP PORT** soft button.
    - b) Use the **NEXT** and **PREV** keys to move the cursor in turn to each digit in the IP port. Use the knob to set the digit to the desired value. Repeat until you have selected all the numbers in the IP port assigned by your network administrator
    - c) Press the **SAVE** soft button to confirm your setting.
  - F) Connect your Ethernet network to the RJ45 jack on the rear panel of your 6300.
    - If you are connecting to a hub or router, use a standard Ethernet cable.
    - If you are connecting directly to the Ethernet jack on a computer, use a "crossover" or "reverse" Ethernet cable.
  - G) Press the **NEXT** button.
2. Prepare the 6300 for modem connection through the serial port:
- [Skip this step if you will not be using a modem connection.]*
- A) Navigate to **SETUP > NETWORK & REMOTE**.
  - B) Hold down the **PC CONNECT** soft button and turn the knob until you see **MODEM** on the display.

- C) Press the **MODEM INIT** soft button.
- D) If the string that appears in the display is **S0=4**, this is correct. Press the **ESCAPE** button and skip steps (E) and (F) below.

**S0=4** is the 6300 default setting. This activates auto-answer functionality in the modem.

- E) Set the **INIT STRING** to **S0=4**. Use the **NEXT** and **PREV KEYS** to move the cursor in turn to each character in the modem initialization string. Use the knob to set the character to the desired value. Repeat until you have set all the characters in the initialization string.

- F) Press the **SAVE** soft button to confirm your setting.

### 3. Modem setup:

You will need two modems and two available phone lines, one of each for your PC and your 6300. Orban Customer Service supports only the 3Com / U.S. Robotics® 56kbps fax modem EXT on the 6300 side of your connection, although other 56kbps modems will often work OK.

You can use either an internal or an external modem with your PC.

- A) Connect the telephone line from the wall phone jack to the wall connection icon on the back of the modem (modem in).
- B) Connect the modem to the 6300's **serial port with a standard (not null) modem cable**.
- C) Set the modem to **AUTO ANSWER** and turn it on.

For 3Com / U.S. Robotics® 56kbps fax modem EXT, set dipswitches 3, 5, and 8 in the down position to activate the **AUTO ANSWER** setting. All other dipswitches should be set to the up position.

### 4. Prepare the 6300 for direct serial connection through the serial port:

*[Skip this step if you will not be using a modem connection.]*

- A) Navigate to **SETUP > NETWORK & REMOTE**.
- B) Hold down the **PC CONNECT** soft button and turn the knob until you see **DIRECT** on the display.

You are now ready to connect your computer to your 6300 through a null **modem cable connected to your computer's serial port**. Refer to *Installing 6300 PC Remote Control Software* on page 2-57.

## Synchronizing Optimod to a Network Time Server

*[Skip this section if you do not wish to automatically synchronize your Optimod's internal clock to a network timeserver, which may be part of your local network or located on the Internet.]*



---

1. Navigate to **SETUP > NEXT > TIME DATE AND ID > NEXT > TIME SYNC**.

A) Use the **PROTOCOL** control to choose either **TIME PROT** or **SNTP**.

- Select **TIME PROT** if the Optimod is behind a firewall that does not pass UDP packets. **TIME PROT** selects the Time Protocol as described in the standard RFC868. This method uses TCP on port 37.
- Select **SNTP** if your network timeserver supports the Simple Network Time Protocol as described in standard RFC1769. This method uses UDP on port 123.

Ask your network administrator which protocols are available. **SNTP** is slightly more accurate.

B) Using **SYNC PERIOD**, choose how often your Optimod will automatically update its internal clock to the timeserver you selected.

The choices are **OFF**, **8 HOURS**, and **24 HOURS**.

If the connection to the timeserver fails (due to network overload or other problems), your Optimod will try once per hour to synchronize until it is successful.

C) Set the **OFFSET** to the difference (in hours) between your time zone and Universal Time (UTC).

UTC is also known as GMT, or Greenwich Mean Time.

- The value can range between -12 and +12 hours. If this value is set to 0, your **Optimod's time will be the same as UTC**.
- You can empirically adjust this value until the correct time for your location is displayed after you synchronize your Optimod to a timeserver.

2. Choose a timeserver.

As of August 2011, <http://tf.nist.gov/tf-cgi/servers.cgi#> provides a current list of timeservers available on the Internet. Your network may also have a local timeserver; ask your network administrator.

3. Press the **NEXT** button to set up timeserver parameters.

The **TIME SERVER** button is located on the second page of the **TIME SYNC** functions. (You can access this function from anywhere in the Optimod menu tree by navigating to **SETUP > NEXT > TIME DATE AND ID > NEXT > TIME SYNC > NEXT**.)

You can specify the timeserver either from your Optimod's front panel or from its PC Remote software. From the front panel, you can only enter the timeserver's IP address (for example, 192.43.244.18). If you specify the timeserver from PC Remote, you can specify either its named address (for example, time.nist.gov) or its IP address.

4. Specify the time sync parameters **from your Optimod's front panel**:

*[Skip this step if you wish to specify the timeserver and time sync parameters from your Windows XP computer.]*

A) Press the **TIME SERVER** button.

The timeserver IP Address Screen appears.

a) Use the **NEXT** and **PREV** keys to move the cursor in turn to each digit in the IP address. Use the knob to set the digit to the desired value. Repeat until you have selected all the numbers in the desired IP address.

b) Press the **SAVE** soft button to confirm your setting.

B) Press the **SYNC NOW** soft button to test your settings. Your Optimod's display should indicate that it is connecting to the IP address that you specified. When the connection is **successful**, the Optimod's clock will automatically synchronize to the timeserver.

- If the connection is not successful within five seconds, the display will indicate that the connection failed. This means either that the timeserver is too busy or that your setup cannot connect to the timeserver. Double-check the IP address. If you are behind a firewall, make sure that port 123 is open.
- If your connection failed, the gateway might not be set correctly on your Optimod. The gateway for the timeserver connection is the same gateway that you set in step (1.D) on page 2-53. If you do not know the correct gateway, you can often discover it by connecting a Windows computer to the same Ethernet cable that is ordinarily plugged into your Optimod. Ascertain that the computer can connect to the Internet. At the command prompt, type `ip-config`. The computer will return the "Default Gateway."

5. Specify the time sync from the Optimod PC Remote software:

*[Skip this step if you wish to specify the timeserver and time sync parameters from your Optimod's front panel.]*

Optimod PC Remote software can automatically set your Optimod's local time, **OFFSET**, and **TIME SERVER** to reflect the Windows settings in the machine running PC Remote software.

If you are running Windows 2000, you cannot specify the timeserver from your computer. However, you can still set your Optimod's clock and offset.

A) In Windows, navigate to the **CONTROL PANEL > DATE AND TIME > TIME ZONE** tab.

B) Set time zone to correspond to your local time zone.

C) In Windows, navigate to the **CONTROL PANEL > DATE AND TIME > INTERNET TIME** tab.

D) If you are running Windows XP:

a) Check "Automatically synchronize with an Internet time server" to set your Optimod's **SYNC PERIOD** to "24."

b) Set "Server" to the desired timeserver.

- c) Click the "Update Now" button to synchronize your computer's clock to the selected timeserver. If this is successful, this means that you can connect to the selected timeserver over your network.
- The **INTERNET TIME** tab is not available in Windows 2000. If you are running Optimod PC Remote on Windows 2000, you must enter the timeserver from your Optimod's front panel as an IP address (step 4 on page 2-55).
  - If the timeserver you selected in Windows is a named address instead of an IP address, your Optimod will resolve it correctly but the IP address that appears in your Optimod's display will be 0.0.0.0.
  - To use PC Remote to turn off your Optimod's automatic synchronization, uncheck "Automatically synchronize with an Internet time server" on your PC. Then click the "Update Now" button on PC Remote.
- E) Navigate to Optimod PC Remote's **SETUP/ UTILITY** tab and click the **SET 6300 CLOCK** button.
- If you are running Windows XP, PC Remote will download your computer's currently specified timeserver into your Optimod.
  - PC Remote will adjust your Optimod's **OFFSET** setting to correspond to your computer's time zone setting.
  - PC Remote will synchronize your Optimod's clock with your computer's clock.
- F) It is wise to disconnect from PC Remote and then to press the **SYNC NOW** button on your Optimod [step (4.B) on page 2-56]. This is to test the ability of your Optimod to synchronize to the selected timeserver and to ensure that your Optimod's clock is set accurately.

*NOTE: Manually setting your Optimod's clock via Set Time, Set Date, Daylight Time, and the remote contact closure Reset to Hour and Reset to Midnight will not work when the automatic synchronization function is active. To inactivate this function (thereby permitting manual setting to work), set the **SYNC PERIOD** to OFF.*

## Installing 6300 PC Remote Control Software

This section briefly summarizes the procedure for installing 6300 PC Remote software on existing 6300s. If required, you will find more detailed instructions in the .pdf file automatically installed on your computer by Orban's installer program, `Setup6300_x.x.x.x.exe`, where "x.x.x.x" represents the software version you are installing. (For example, for version 1.0 software, this would be 1.0.0.0.)

The PC Remote software is supplied on a CD shipped with your 6300. You can also download it from [ftp.orban.com/6300](http://ftp.orban.com/6300).

Instructions for using the PC Remote software are found starting on page 3-63.

## Installing the Necessary Windows Services

The 6300 PC Remote application uses Windows' built-in communications and networking services to deal with the low-level details necessary to communicate with the 6300's serial port. (These services are also used to upgrade your 6300's firmware when updates are available from Orban.) The exact process will vary, depending on how you wish to set up the communications. That is:

- If you want to communicate through a local PC, you have two choices:
  - Establish a connection between a serial (COM) port of the PC and the COM port of your 9300 through a null modem cable and use Windows Direct Serial Connect to make the basic connection.
  - Use a crossover Ethernet cable to communicate to your PC through its Ethernet port.
- If you want to communicate through a pair of modems, you will use the Windows Dial-Up networking service to make the connection.

You must install the appropriate communications services in Windows (if they are not already installed) before you can run 6300 Remote software. *You may therefore need to have access to the Windows install disk(s)—or have their image copied onto your computer's hard drive—before you attempt to use the 6300 PC Remote application.*

In all cases, regardless of whether your PC communicates to the 6300 through its serial port or Ethernet connector, it uses the ppp and the TCP/IP protocols to communicate with the 6300.

## Check Hardware Requirements

To connect your PC to your 6300, regardless of the method you choose, you will need the following:

- Orban 6300 OPTIMOD 6300.
- *If connecting by serial cable:* a null modem cable (also called a "reverse" cable). This cable has DB9 female connectors at both ends for connecting the 6300 to the serial port on your computer. If your computer has a DB25 connector, you must obtain an adapter.
- *If connecting by modem:* a 3Com / U.S. Robotics® 56kbps fax modem EXT and normal (not null) modem cable for the 6300 side of the connection. Note that Orban Customer Service does not support any other type of modem for connecting to the 6300.
- *If connecting by network:* a standard Ethernet cable (with RJ45 connectors) to connect to a network hub or router, or a crossover Ethernet cable to connect directly to your PC's Ethernet jack.
- PC running Windows 2000 (SP3 or higher) or XP.

6300 PC Remote will not run on older Windows versions.

Recommended Components

Computer .....	Pentium II or higher
Available Disk Space .....	25MB
RAM .....	256MB
Display.....	SVGA or higher
Microsoft Windows .....	2000 SP3 (or higher) or XP (Home or Pro)
COM Port .....	16550 (or compatible) UART



**WARNING!**

When connecting your 6300, use shielded cable to protect the pins in the RS-232 connector from electrostatic discharge.

The following subsections provide steps for connecting to your Optimod 6300 software using the Windows 2000 / XP Direct Cable Connect or via modem connection.

**Running the Orban Installer Program**

Insert the installer CD into your computer's CD drive.

The installer should start up and ask you if you wish to install the PC Remote application on your computer. If it fails to do so, navigate to Start \ Run on your computer, and type `X:setup` (where "X" is the drive letter of your CD drive).

Follow the prompts on your screen to install the PC Remote software automatically on your computer.

- You might have obtained the automatic installer application from some other source than Orban's CD, like Orban's ftp site or another computer on your network. If so, just run the application and follow the on-screen instructions.
- This program installs the necessary files and adds an Orban / Optimod 6300 folder to your computer's Start Menu. This folder contains shortcuts to the PC Remote application and to the documentation. If you accepted the option during installation, there is also a shortcut to the PC Remote application on your desktop.

You have now installed all files necessary to use the PC Remote software. If you are using a direct serial or a modem connection, the next step is to install and configure the Windows communications services that allow your computer to communicate with your 6300. *Setting Up Serial Communications* on page 2-61 provides details.

**Setting Up Ethernet, LAN, and VPN Connections**

If you are using an Ethernet connection and your computer can successfully connect to the Internet through its Ethernet port, it already has the correct (TCP/IP) networking set up to communicate with the 6300. In most cases, all you need is your 6300's IP address, Port, and Gateway number, as set in step 1 on page 2-52. You will enter

these when you create a “connection” to your 6300 from the 6300 PC Remote application—see step (E) on page 3-64. If your computer does not have a working Ethernet port, you must add one and then following the instructions provided by Microsoft to set it up to enable TCP/IP networking.

If you are using a crossover Ethernet cable to connect your Optimod directly to your computer, you must set your Windows networking to provide a static IP address for your computer because your Optimod does not contain a DHCP server.

If you wish to connect to your 6300 through your LAN or VPN (through a WAN or the Internet), consult your network administrator. Note that to cross subnets, you must specify a gateway. If the PC and 6300 are on the same subnet, then it is unnecessary to specify a gateway (although you will still need to specify one if you want your Optimod to synchronize to an Internet timeserver — see *Synchronizing Optimod to a Network Time Server* on page 2-54).

If you are behind a firewall, you must open the port you specified in step (1.E) on page 2-53. If the gateway and firewall (if used) are configured correctly, it is possible to connect 6300 PC Remote to a 6300 via a VPN.

## Conclusion

By carefully following the instructions in the Appendix, you should have successfully installed the necessary Windows services and connected to your 6300. However, if you experience any problems with this process, or have any other 6300 questions, please contact Orban Customer Service:

phone: +1 856.719.9900

email: [custserv@orban.com](mailto:custserv@orban.com)

For details on your new 6300 software, from new features to operational suggestions, refer to our FTP site (<ftp.orban.com/6300>).

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## Appendix: Setting Up Serial Communications

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This appendix provides instructions for setting up a direct serial connection from your 6300 to your PC. You must do this when you define a new connection from the 6300 PC Remote application. The appendix provides the Direct Serial Connect procedure for Windows 7. To set up modem communications with Windows 7, use the instructions that Microsoft provides for this operating system. (Note that the screen shots were prepared for Orban's Optimod-FM 8300 and refer to that product. They are directly applicable to the 6300 too.)

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### Preparing for Communication through Null Modem Cable

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1. Configure your 6300.
  - A) On your 6300's front panel, navigate to **SETUP > NETWORK & REMOTE**.
  - B) Hold down the **PC CONNECT** soft button and turn the knob until you see **DIRECT** on the display.
2. Connect the cable.
  - A) Connect one end of a null modem cable to the DB9 serial connector on the 6300's rear panel.

Be sure to use a null modem cable. A normal serial cable will not work.
  - B) Connect the other end of the cable to your computer's COM port.

### Connecting Using Windows 7 Direct Serial Connection:

Ordinarily, a direct serial connection through a null modem cable is used only when you are controlling one 6300 per available COM port on your computer. If you wish to control multiple local 6300s, it is better to use an Ethernet network connection. However, in principle you could control multiple 6300s serially from one COM port, using a hardware serial switch to select the 6300 you wish to control. In this case, you should set up a separate 6300 "connection" for each 6300 to be controlled, following the instructions below. All connections should reference the same COM port.

This connection is used both for upgrading your 6300 and for connecting the 6300 PC Remote application to your 6300.

**Important:** The Direct Serial Connection must have exclusive access to the PC COM port that connects to your 6300. Make sure than any software that monitors this COM port (such as HotSync manager, etc) is disabled before running Direct Serial Connection.

If you cannot access the Internet after making a Direct connection, you will have to reconfigure certain networking parameters in Windows. Please see *You Cannot Access the Internet After Making a Direct or Modem Connection of the 6300* on page 5-9.

You must install the Windows 7 direct serial connection as a modem device using the Modem setup procedures as shown in the steps below.

1. Add and configure a Direct Connection for Windows 7.

- A) Go to the Control Panel. Find the Modem applet. This is normally under the Phone and Modem section.

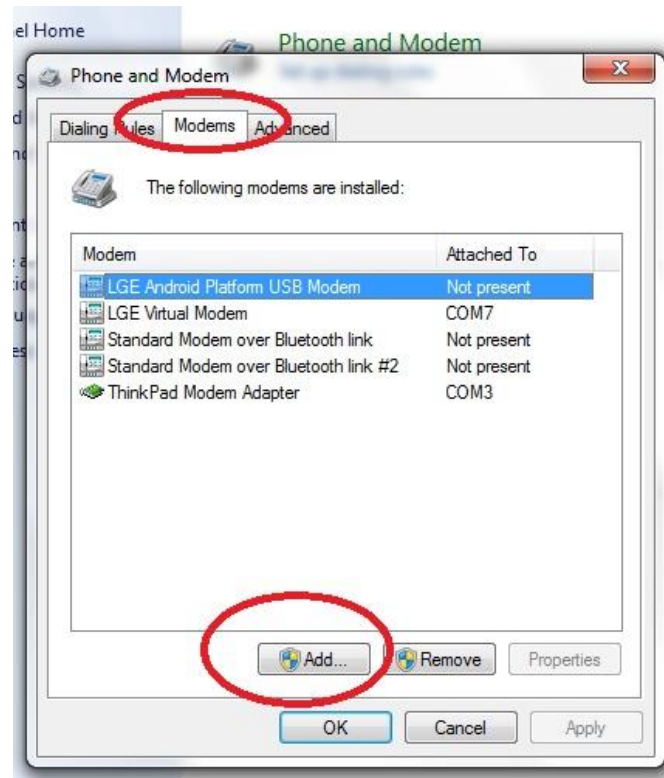
Click on it to start the Phone and Modem applet.





- B) In the Phone and Modem applet, click on the Modems tab and click "Add."

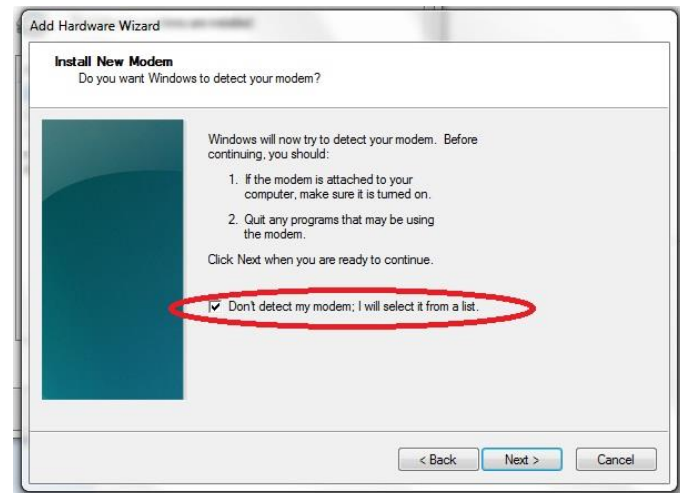
You need administrator's rights to do this. If UAC comes up, provide the relevant credentials and proceed.



- C) The Add Hardware Wizard will appear.

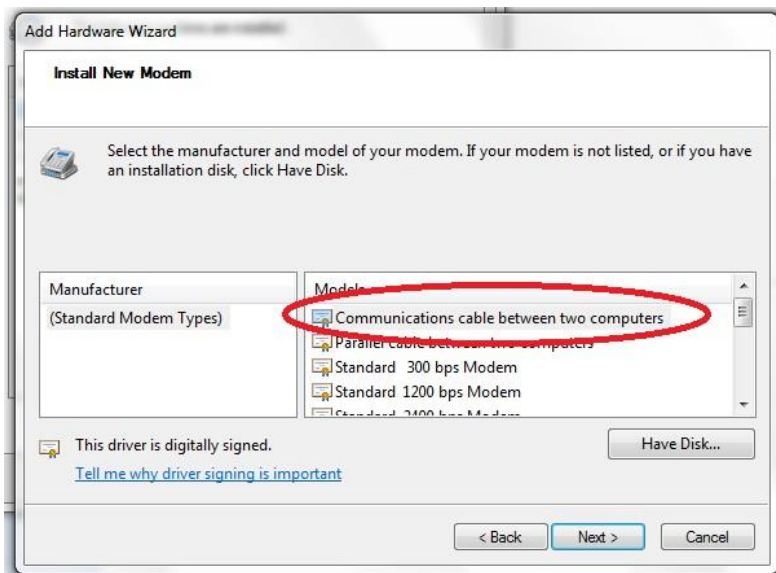
a) Tick "Don't detect my modem; I will select it from a list."

b) Proceed to next step by clicking on the NEXT button.



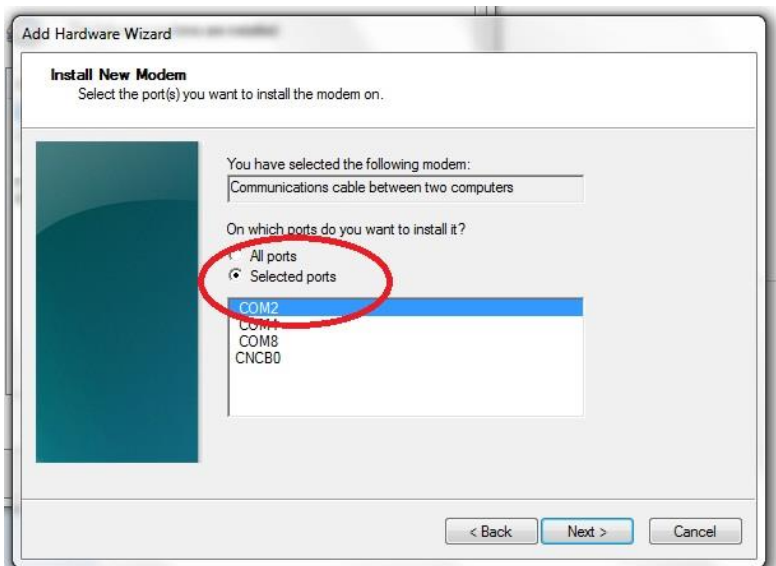
D) The *Install New Modem* window will appear.

- a) Select Communications cable between two computers.
- b) Proceed to next step by clicking on the NEXT button.

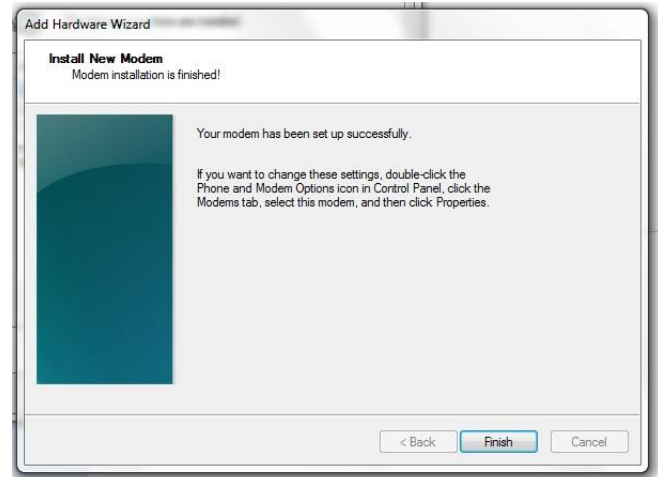


E) Select the Serial com port to which the NULL cable is connected.

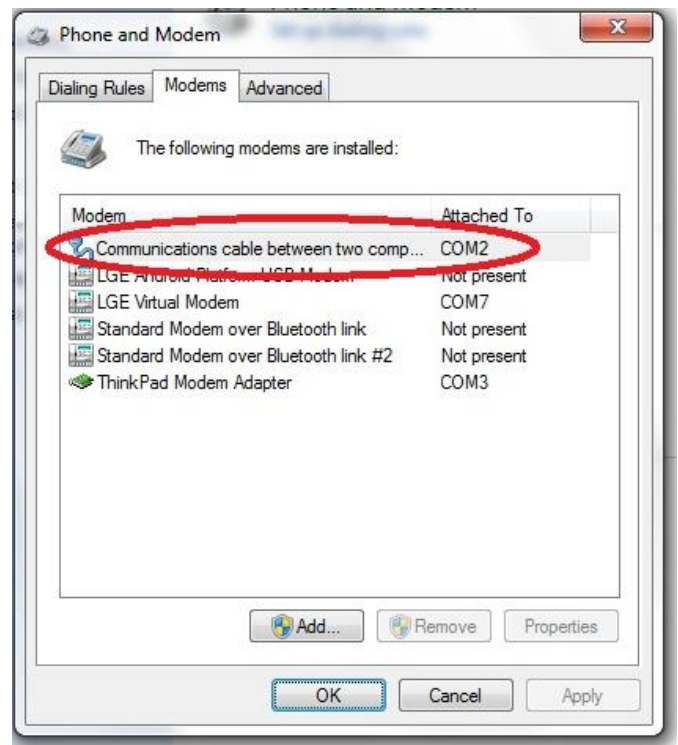
Proceed to next step by clicking on the NEXT button.



F) At the *Modem installation is finished* window, click FINISH to complete the installation.



G) Once you are back at the *Phone and Modem* window, you will see your newly installed communication cable attached to the serial com port that you specified earlier.



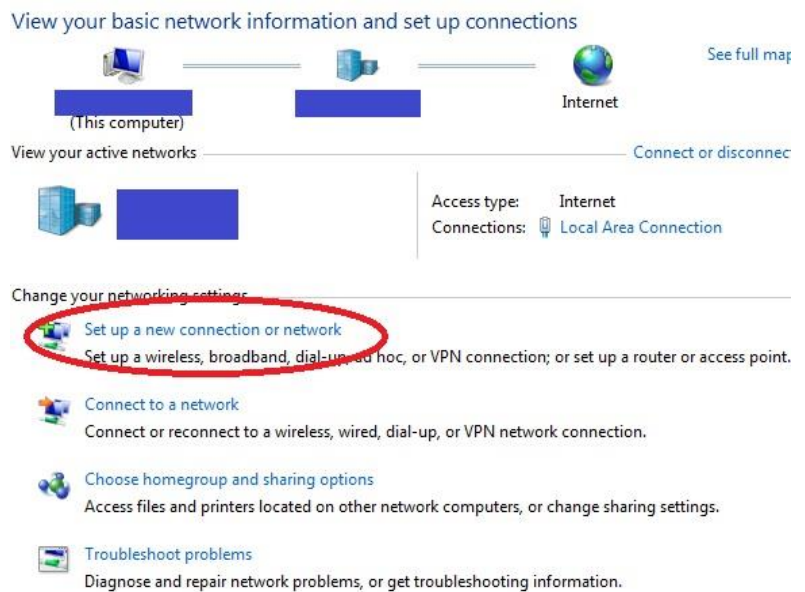
This completes the installation of the device driver for the device "Communications cable between two computers." This configuration is also commonly known as "Direct Cable Communications."

2. Set up the Network for the Direct Cable Connection.

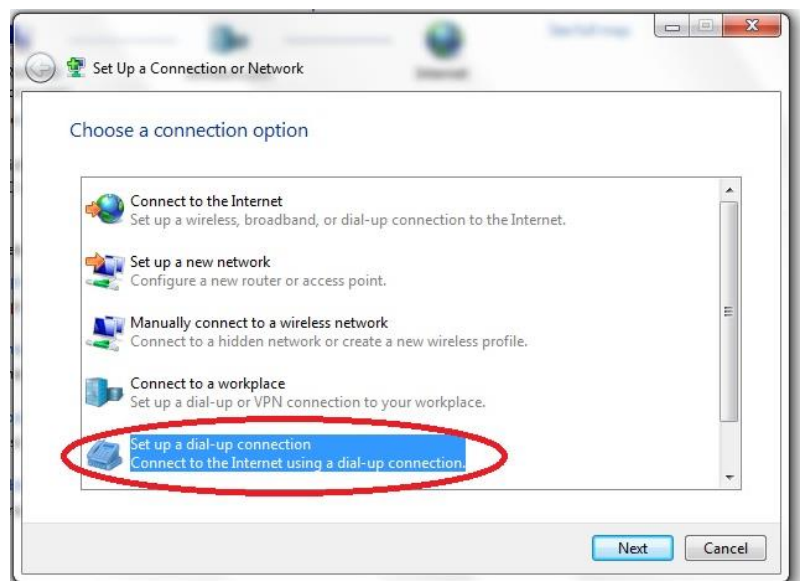
You must next bind the Direct Cable Connection driver to a particular Network. This is where Microsoft will make this connection using the PPP protocol.

It will do this for you automatically. Previous Windows version requires you to install the PPP protocol separately.

- A) Go to the Network and Sharing Center and click on Set up a new connection or network link.

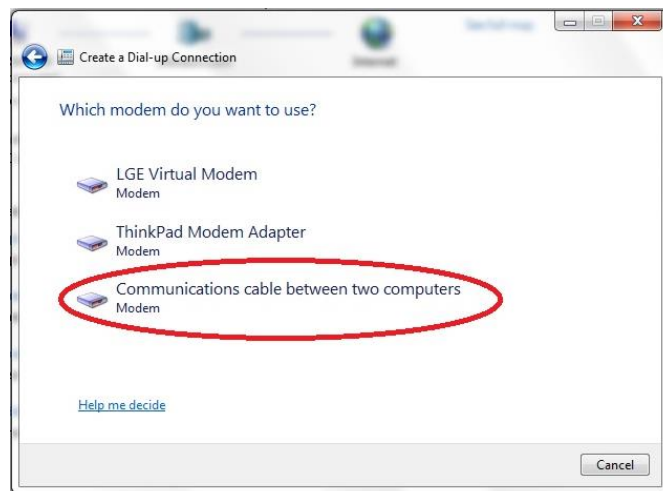


- B) In the Choose a connection option window, select Set up a dial-up connection.



- C) If you are asked Which modem do you want to use?, select Communications cable between two computers/modem.

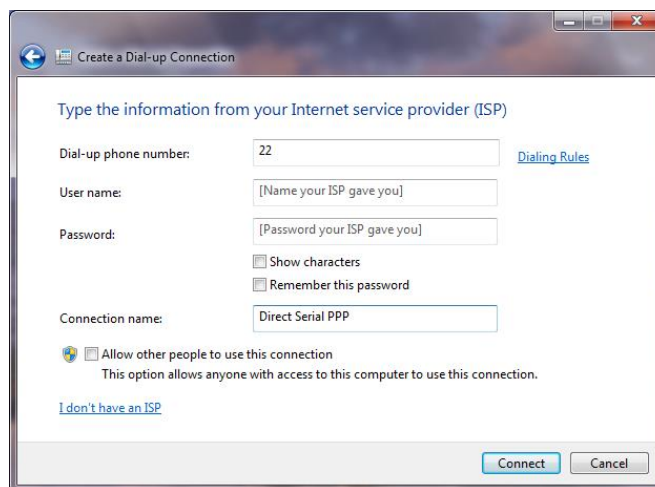
This only query will open appear if you have configured more than one modem device.



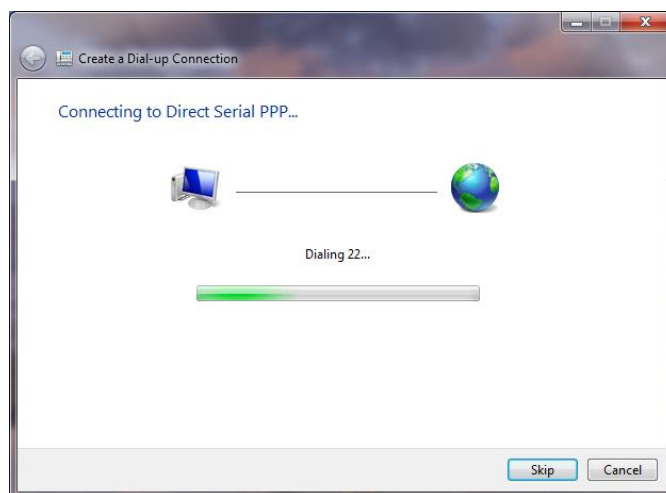
- D) When prompted to "Type the information from your Internet Service Provider," enter a dummy number to the phone number field; Windows will not use it.

- E) Choose a name for your connection and enter it into the *Connection name:* box. Choose a name that will remind you that **this is a PPP connection, such as "Direct Serial PPP."**

- F) Proceed to next step by clicking on the **CONNECT** button.

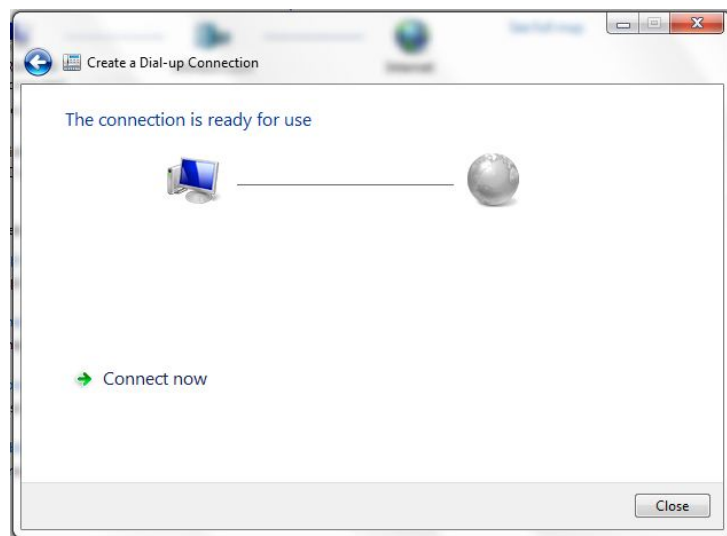


- G) Click the **SKIP** button.



Windows will emit a message stating *The connection is ready for use*. However, you must to configure some of the PPP settings before you can make a connection to your Optimod

Although you did not specifically install anything that states "PPP," the PPP protocol has nevertheless been installed.



3. Configure the Direct Cable Connection adapter.

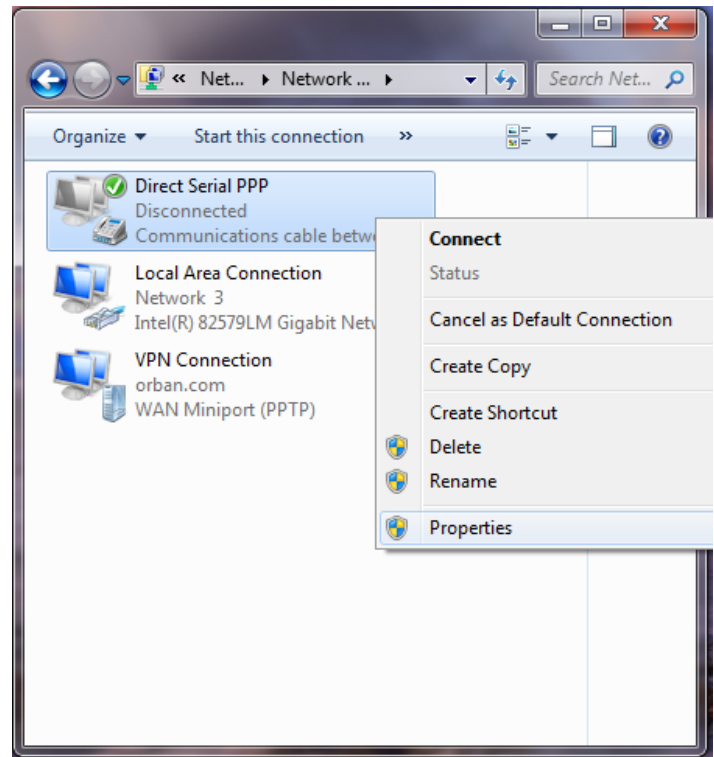
In this step, you will customize the PPP settings on Windows 7 so that it can talk to your Optimod.

- A) Go to the Windows 7 Network and Sharing Center and click the *change adapter settings* link. This is on the left side of the window.

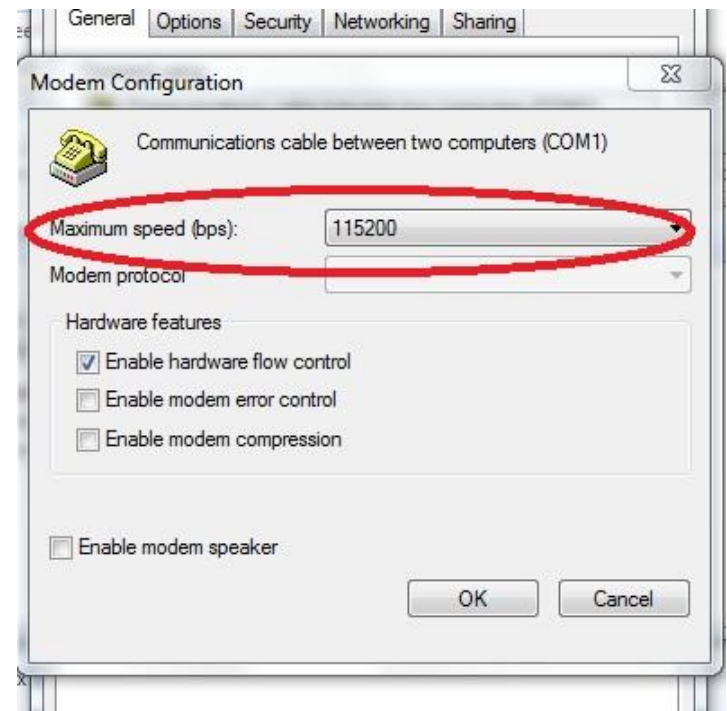


- B) In the *Network adapter* window, right-click the *Direct Serial PPP* icon and click on the properties.

You need administrator rights to proceed from here. If UAC comes up, provide the relevant credentials and continue.



- C) In the Direct Serial PPP Properties window, select the General tab.
- D) Click the Configure button and select 115200 bps.
- E) Click OK to close the window.
- F) Make sure your bps settings saves correctly:
- Dismiss the Direct Serial PPP Properties window by selecting OK.



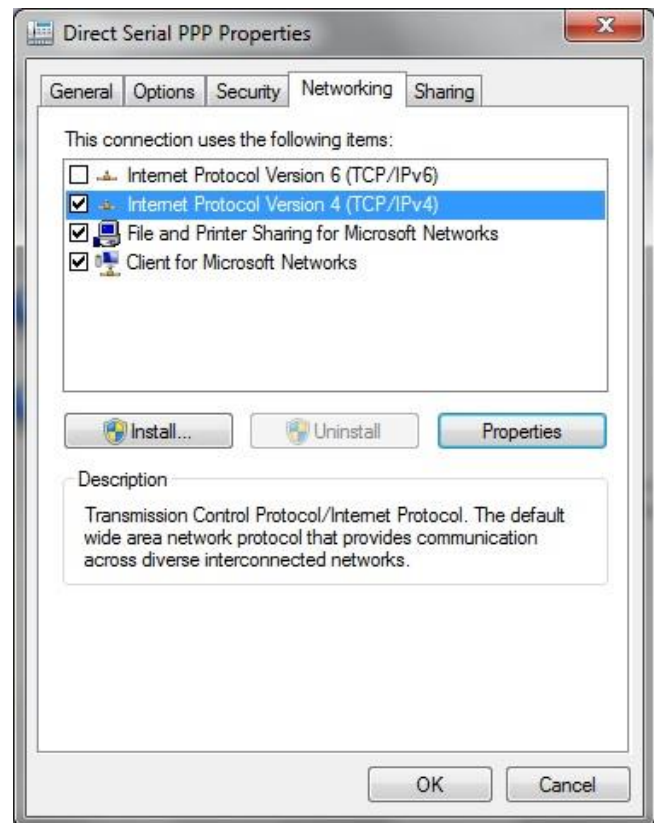
- Reopen the Properties window and select the General tab again. If your bps setting is correct, the value has saved and you may skip to step (G) below.
- If it is not correct, reset it to 115200 bps.



- d) Click OK to close the window.
- e) Click OK to dismiss the Properties window.
- f) Restart your computer.

Restarting should ensure that the bps setting is saved.

- G) Select the Networking tab.
  - a) Unselect the Internet Protocol Version 6.
  - b) Click on the Internet Protocol Version 4.
  - c) Click the *Properties* button.





H) In the *Advanced TCP/IP Settings* window, click on the *Advance* button.

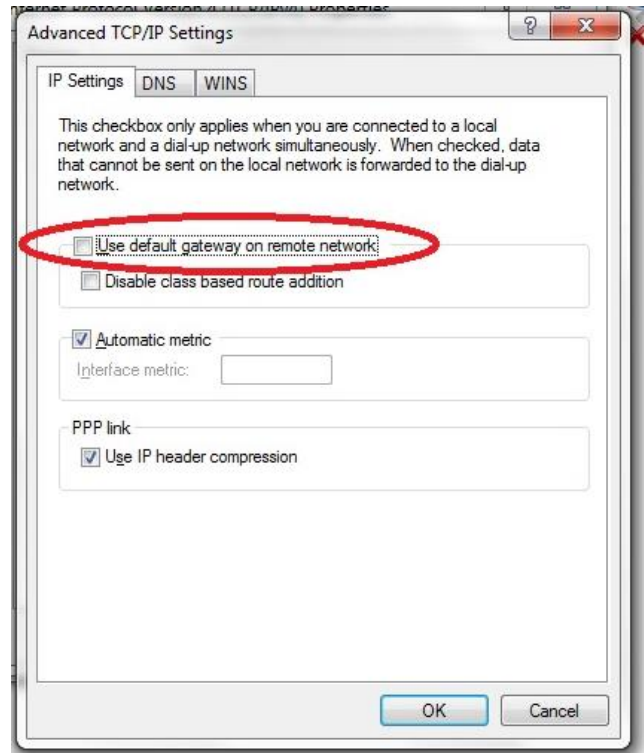
a) Unselect *Use default gateway on remote network*.

b) Click OK to close this window.

This prevents Windows 7 from routing all network-ing requests to your Optimod.

c) Click OK to close the *Internet Protocol version 4 Properties* window.

d) Click OK at the *Direct Serial PPP Properties* window to save the *Direct Serial PPP* settings.



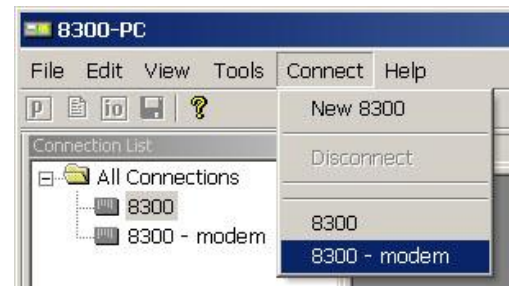
4. Launch an existing Windows 7 Direct connection.

Once you have set up a "connection" specifying Direct Connect in the 6300 PC Remote application (see *To set up a new connection* on page 3-64), choosing this connection from 6300 PC Remote automatically opens a Windows Direct Connection to your 6300.

You can connect by selecting the desired connection from the drop-down list in the **CONNECT** menu.

You can also connect by double-clicking the connection in the **"Connection List" window**.

A dialog bubble will appear on the bottom right hand corner of the screen verifying your connection if the connection is successful.



If you have trouble making a connection, double-check step (3.F) on page 2-69. If you have trouble the first time after creating a connection according to the instructions above, try restarting your computer to clear its serial port.

5. To change the properties of an existing connection:

Right-click the connection in the "connection List" window and choose "Properties." The "Connection properties" window opens (see page 2-Error! Bookmark not defined.).

---

## Updating your 6300's Software

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The software version number of PC Remote must be the same as the version number of the software running within your 6300. If the software version of PC Remote is higher than the version running in your 6300, PC Remote will automatically detect this and will offer to update your 6300's software automatically.

1. If you have not already done so, prepare your computer and the 6300 for a direct serial, modem, or Ethernet connection.

See *Networking and Remote Control* starting on page 2-52.

2. Install the latest version of 6300 PC Remote software on your computer.

This is available from

<ftp://orban.com/6300>

See *Installing 6300 PC Remote Control Software* on page 2-57.

See the readme6300\_x.x.x.x.htm file (where x.x.x.x is the version number) for details about the upgrade not given in this manual. The PC Remote installer will **install this file on your computer's hard drive**.

3. If you have not previously done so, start 6300 PC Remote and set up a **"connection" to the 6300 you will be updating**.

See *To set up a new connection* on page 3-64.

4. Update your 6300.

A) Attempt to initiate communication to your 6300 via your connection.

See *To initiate communication* on page 3-65.

6300 PC Remote will automatically detect that the 6300 software version on your 6300 is not the same as the version of 6300 PC Remote. PC Remote will then offer to update your 6300 automatically.

This procedure will only **work for a connection using an "all-screens" (administrator) passcode**.

- B) Choose YES and wait for the update to complete. Note that this will cause an interruption in the audio of approximately 3 seconds when your 6300 automatically reboots after the update is complete. If you cannot tolerate such an interruption, choose NO or CANCEL to abort the update.

Please be patient; this will take several minutes. (The exact time will depend on whether the 6300 has to do any "housekeeping" to its flash memory as part of the update.)

Completion will be indicated by the updater's command-line window's closing automatically and your 6300's rebooting.

Your 6300 will continue to pass audio normally while the update is occurring. *However, the audio will be interrupted for approximately 3 seconds when your 6300 reboots.*

*Do not interrupt power to your 6300 or your computer, close PC Remote or the update application's command-line window, or reboot your computer during this time.* While doing any of these things is unlikely to damage your 6300 (because of extensive backup and error-checking provisions in your 6300), they will certainly cause the update to fail.

- C) When the 6300 screen display returns after its automatic reboot, the 6300 will be running with the updated software.

If the update fails for some reason, try repeating the procedure in steps (A) through (C) again.

- D) If the 6300 screen remains blank for more than one minute after the update has completed, manually reboot the 6300 by removing AC power from the 6300 for at least ten seconds and then powering the 6300 back up.
- E) The 6300 software update is now complete. You should now be able to connect to your 6300 via PC Remote.

NOTE: If you cannot make a connection after a software upgrade, manually reboot the 6300 with a normal "power-off/power-on" sequence.

## SNMP Support

The SNMP (Simple Network Management Protocol) features allow you to monitor your Optimod's status and to send Alarm notifications via your Optimod's Ethernet connection to your network. It is beyond the scope of this manual to provide a general explanation of how SNMP works. The text below provides sufficient information to use your Optimod in your specific SNMP setup if you are already familiar with the general principles of setting up SNMP.

### SNMP Network Setup

- **SNMP (Enable/Disable):** enables or disables the SNMP feature. Select "enable" and disconnect from the PC remote to update the unit and allow SNMP access.

If you wish to disable SNMP access after it has been enabled, select "disable" and then reboot your Optimod.

- F) From the main menu, navigate to **Setup > NETWORK&REMOTE > NETWORK > SNMP ENABLE**.

If the **SNMP ENABLE** soft button is not visible, press the **Next/Prev** buttons until it is.

- G) While holding down the **SNMP ENABLE** soft button, turn the knob to set the **SNMP ENABLE** field to YES.

*The controls below are only available from Optimod PC Remote.*

---

In the I/O menu, select the **NETWORK** tab to access the **SNMP** configuration controls.

- Primary Manager Address: (255.255.255.255) sets the address of the Primary SNMP Manager.
- Primary Manager Port: (162) sets the port of the Primary SNMP Manager.
- Secondary Manger Address: (255.255.255.255) sets the address of a Secondary SNMP Manager.
- Secondary Manger Port: (162) sets the address of a Secondary SNMP Port.

SNMP Mib file

The orban6300.mib file is in the location where you installed your PC Remote application.

The default 6300 install location is:

Program Files\Orban\Optimod 6300 PC Remote  
or  
Program Files(x86)\Orban\Optimod 6300 PC Remote

SNMP Default Settings

- SNMP Agent: Disabled
- Primary Manager(Alarm) Address: 255.255.255.255
- Primary Manager (Alarm) Port: 162
- Secondary Manger (Alarm) Address: 255.255.255.255
- Secondary Manger (Alarm) Port: 162

SNMP Features

***Get/Query:***

- Station Name
- System Diagnostics Orban (walks through all of the "get" commands and displays their status.)
- Primary and Secondary Manager IP
- Primary and Secondary Manager Port

- 
- Analog Input Silent
  - Analog Input Active (The analog input is selected as the input source)
  - AES Input Silent
  - AES Error
  - Digital Input Active (The digital input is selected as the input source)
  - syncInputError (The signal at the sync input is invalid or missing)

***Set/Control:***

- Primary and Secondary Manager IP
- Primary and Secondary Manager Port
- Station Name

***Traps/Alert:***

- Analog Input Silent
- Analog Input Active (selected as input source)
- AES Input Silent
- AES Error
- Digital Input Active (The digital input is selected as the input source)
- syncInputError

***SNMP Community String:***

The "SNMP Community string" is like a user id or password that allows access to a router's or other device's statistics. It is set at Optimod PC Remote to implement SNMP security. PRTG sends the community string along with all SNMP requests. If the community string is correct, the device responds with the requested information. If the community string is incorrect, the device simply discards the request and does not respond.

- Read String allows users to set a password for SNMP to retrieve information from the Optimod. Default is PUBLIC.
- Write String allows users to set a password for SNMP to write (set) information from the Optimod. Default is PRIVATE.

Network Settings	SNMP Settings
Changes to Network Settings take effect upon disconnect	
<input checked="" type="radio"/> Direct (Null Modem) <input type="radio"/> Modem	
Initialization String: <input type="text" value="S0=4"/>	
Ethernet Only:	
IP Address	<input type="text" value="127 . 0 . 0 . 1"/>
Subnet Mask	<input type="text" value="255 . 255 . 255 . 0"/>
Gateway	<input type="text" value="0 . 0 . 0 . 0"/>
IP Port	<input type="text" value="6201"/>
Terminal Port	<input type="text" value="23"/>
Changes to SNMP Settings take effect upon disconnect	
<input type="radio"/> Enable SNMP <input checked="" type="radio"/> Disable SNMP on boot-up	
Primary Manager	
Address	<input type="text" value="255 . 255 . 255 . 255"/>
Port	<input type="text" value="162"/>
Secondary Manager	
Address	<input type="text" value="255 . 255 . 255 . 255"/>
Port	<input type="text" value="162"/>
Community Strings	
Read String	<input type="text" value="xxxxxx"/>
Confirm	<input type="text" value="xxxxxx"/>
Write String	<input type="text" value="xxxxxx"/>
Confirm	<input type="text" value="xxxxxx"/>

# Section 3

## Operation

### 6300 Front Panel

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6300 PC Remote software displays all meters simultaneously and provides easy access to setup and processing controls, so we recommend using PC Remote if you want to do anything more with the 6300 than just set it up and use a factory preset. See *Using the 6300 PC Remote Control Software* starting on page 3-63.

On the 6300's front panel:

- **Screen Display** labels the four soft buttons and provides control-setting information.
- Screen **Contrast** button adjusts the optimum viewing angle of the screen display.
- Four **Soft buttons** provide access to all 6300 functions and controls. The functions of the soft buttons change with each screen, according to the labels at the bottom of each screen
- **Next** and **Prev** (← and →) buttons scroll the screen horizontally to accommodate menus that cannot fit in the available space. They also allow you to move from one character to the next when you enter data into your 6300.

These buttons flash when a scrolling menu is in use. Otherwise, they are dark.

- **Control Knob** changes the setting that is selected by the soft buttons. To change a value, you usually have to hold down a soft button while you are turning the control knob.
- **Recall** button allows you to recall a Factory or User Preset.

Selecting the **RECALL** button does not immediately recall a preset. See step D) on page 2-19 for instructions on recalling a preset.

- **Modify** button brings you to list of controls that you can use to edit a Factory or User Preset.

If you edit a Factory Preset, you must save it as a new User Preset to retain your edit.

- **Setup** button accesses the technical parameters necessary to match the 6300 to your transmission system.
- **Escape** button provides an escape from current screen and returns user to the next higher-level screen. Repeatedly pressing *Escape* will always return you to the Idle screen, which is at the top level of the screen hierarchy.
- **Input** meters show the peak input level applied to the 6300's analog or digital inputs with reference to 0 = digital full-scale. If the input meter's red segment lights up, you are overdriving the 6300's analog to digital converter, which is a very common cause of audible distortion.
- **AGC** meter shows the gain reduction of the slow, 2-band AGC processing that precedes the multiband compressor. Full-scale is 25 dB gain reduction. You can switch the meter (within the Full Modify screen) so that it either reads the gain reduction of the Master (above-200 Hz) band, the gain reduction of the Bass band, or the difference between the gain reduction in the Master and Bass bands. This control is located in MODIFY > FULL MODIFY. *The meter mode always reverts to MASTER when the user leaves Full Modify.*

The latter reading is useful for assessing the dynamic bass equalization that the AGC produces and it helps you set the **AGC BASS COUPLING** control.

- **Gate** LED indicates gate activity, lighting when the input audio falls below the threshold set by the multiband gate threshold. When this happens, the multiband compressor's recovery time is slowed drastically to prevent noise rush-up during low-level passages.
- **Gain Reduction** meters show the gain reduction in the multiband compressor. Full-scale is 25 dB gain reduction.

When the 5-band structure is operating, all five meters indicate gain reduction.

When the 2-band structure is operating, the B1 meter indicates gain reduction in the Master band and the B2 meter indicates the gain reduction in the Bass band.

When the processing is in dual-mono mode, the gain reduction meters can be toggled between channel 1 or channel 2 via **SETUP/METER MODE**. Meanwhile, the PC Remote application displays both channels' gain reductions simultaneously.

- **Multimeters** (The rightmost pair of meters) can be switched via **SETUP/MULTIMETER** to display:
  - the gain reduction of the Output #1 look-ahead limiter in units of dB (see page 6-43 for a block diagram of the processing);

When the 6300 is in dual-mono mode and displaying **LIM #1 GR**, both **CHANNEL 1** and **CHANNEL 2** are shown in the multimeters.



- the gain reduction of the Output #2 look-ahead limiter output channel's look-ahead limiters in units of dB;
- the action of the High Frequency Enhancer and Stereo Enhancer processing, in arbitrary units.

Newer 6300s have redesigned front-panel graphics that do not show scales for the Enhancers. (These graphics were replaced scales for the Loudness Meter and Loudness Gain Reduction.) The High Frequency Enhancer displays on the left; the Stereo Enhancer on the right.

- The loudness controller gain reduction and loudness level.

When the 6300 is in dual-mono mode and is displaying the loudness GR and level meters, you can use **SETUP/METER MODE** to choose which channel is displayed.

**LOUDNESS LEVEL** meter shows the subjective loudness of the output, measured by the ITU-R BS.1770-4 algorithm using a 10-second integration interval with gating. If the value of **TARGET LOUDNESS** in the active processing preset is **GLOBAL**, the meter is calibrated relative to both the Output #1 and Output #2 **TARGET LOUDNESS** values that you specify in I/O Setup. (Because the meter is located before the two **TARGET LOUDNESS controls**, the meter's indication is valid for both outputs even if the two controls are set differently.) Otherwise, it the value of **TARGET LOUDNESS** in the active processing preset. For example, if **TARGET LOUDNESS** is set to **-24 dB**, then **"0 LU"** on the **Loudness Level** meter corresponds to **-24 LUFS / LKFS** (See step (B) on page 2-30.)

**LOUDNESS GAIN REDUCTION** shows the sum of the gain reductions produced by the CBS Loudness Controller and BS.1770 Safety Limiter. For the 6300's **"TV xxxx"** factory presets, this meter will typically indicate **1 to 3 dB** of gain reduction on dialog.

PC Remote has a dual-color meter showing the contribution of the BS.1770 limiter in cyan and the CBS Loudness Controller in dark blue. These two readings are stacked so that the total loudness controller gain reduction is indicated by the end of the dark blue bar.

If you adjust the processing so that the Loudness Level meter peaks at 0 dB on dialog and you set up your Dolby Digital encoder so that that you are transmitting this same Dialnorm value to consumer receivers, your transmission will have the correct loudness compared to other correctly set up transmission channels.

All of the 6300's **"TV xxxx"** factory presets will automatically produce the correct loudness if the **active output's** Target Loudness value matches the Dialnorm value you are transmitting to consumer receivers.

6300 PC Remote shows the BS.1770-4 meter and also shows short-term loudness (200 ms integration time) as measured by the 1981 Jones & Torick CBS Technology Center algorithm. (See page 1-22 for a discussion of

the J&T algorithm and *Using the ITU BS.1770 and CBS Loudness Meters to Measure Loudness Controller Performance* on page 3-77.)

See also *Figure 1-1: Simplified Block Diagram of Target Loudness Control* on page 1-2.

To avoid having to toggle the meters between functions, we recommend using PC Remote for doing serious setup and tuning.

## Introduction to Processing

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### Some Audio Processing Concepts

Reducing the peak-to-average ratio of the audio increases loudness. If peaks are reduced, the average level can be increased within the permitted modulation limits. The effectiveness with which this can be accomplished without introducing objectionable side effects (such as pumping or intermodulation distortion) is the single best measure of audio processing effectiveness.

**Compression** reduces the difference in level between the soft and loud sounds to make more efficient use of permitted peak level limits, resulting in a subjective increase in the loudness of soft sounds. It cannot make loud sounds seem louder. Compression reduces dynamic range relatively slowly in a manner similar to riding the gain. Limiting and clipping, on the other hand, reduce the short-term peak-to-average ratio of the audio.

**Limiting** increases audio density. Increasing density can make loud sounds seem louder, 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 that affect the density of the processed sound.

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

**Look-ahead limiting** is limiting that prevents overshoots by examining a few milliseconds of the unprocessed sound before it is limited. This way the limiter can anticipate and control peaks that are coming up.

In Dolby Digital transmission channels, appropriate setting of the DIALNORM metadata parameter will allow enough headroom to keep peak levels below the threshold of the 6300's look-ahead peak limiters. The best sounding limiting is no limiting at all.

### Distortion in Processing

In a competently designed processor, distortion occurs only when the processor is controlling peaks to prevent the audio from exceeding the peak modulation limits of the transmission channel. The less peak control that occurs, the less likely that the listener will hear distortion. However, to reduce the amount of peak control, you must decrease the drive level to the peak limiter, which causes the average level (and thus, the loudness) to decrease proportionally.

### Loudness and Distortion

In processing, there is a direct trade-off between loudness and distortion. You can improve one only at the expense of one or both of the other two. Thanks to Orban's psychoacoustically optimized designs, this is less true of Orban processors than of any others. Nevertheless, all intelligent processor designers must acknowledge and work within the laws of physics as they apply to this trade-off.

In AM and FM processing, we have long said that there is a direct trade-off between loudness, *brightness*, and distortion. However, because DAB and netcasting systems don't use preemphasis, there is no problem getting the audio to sound bright and the trade-off is only between loudness and distortion.

Perhaps the most difficult part of adjusting a processor is determining the best trade-off for a given situation. We feel that it is usually wiser to give up ultimate loudness to achieve low distortion. A listener can compensate for loudness by simply adjusting the volume control. However, a listener cannot make an excessively compressed or peak-limited signal sound clean again.

If processing for high quality is done carefully, the sound will also be excellent on small radios. Although such a signal might fall slightly short of ultimate loudness, it will tend to compensate with an openness, depth, and punch (even on small speakers) that cannot be obtained when the signal is excessively squashed.

If women form a significant portion of the station's audience, bear in mind that women are more sensitive to distortion and listening fatigue than men are. In any format requiring long-term listening to achieve market share, great care should be taken not to alienate women by excessive stridency, harshness, or distortion.

### Processing for Low Bit Rate Codecs

6300's 5-band processing includes PreCode™ technology to minimize codec artifacts. To exploit PreCode technology fully (minimizing "phasey" and "underwater" artifacts in low bit rate codecs), do not set up OPTIMOD 6300 for very bright sound (with large amounts of high frequency energy) because this is likely to exacerbate artifacts. Some appropriate presets include JAZZ, SMOOTH JAZZ, GOLD, ROCK SOFT, and the CLASSICAL presets. Avoid presets like CRISP and EDGE; these are very bright-sounding presets and are more appropriate for uncompressed channels or compressed channels with relatively high bit rates (64 kbps or higher for the AAC Plus V2 codec used in OpticoDec-PC, for example).

The 6300 has several controls whose settings determine brightness. To minimize brightness when using the 5-band structure:

- Use little or no high frequency boost in the equalization section.
- Set Band 4>5 coupling to 100%.
- Set the band 5 compression threshold to match the codec. Adjust the threshold until you find a good compromise between presence and high frequency codec artifacts. We find the range from -6.0 to +6.0 dB to be useful.
- Use a moderate Band 5 attack time. 25 ms works well.

- If necessary, lower the Band 4 compression threshold.

Starting with one of our suggested presets will help keep you out of trouble when you edit them to create user presets.

We have supplied several presets tuned for the Microsoft WMA (V9) at 32 kbps. This codec has severe artifacts at this bitrate and no preprocessing can mask them completely. The 6300's WMA presets strictly limit the amount of high frequency energy applied to the codec. To prevent the processing from adding L-R energy, these presets operate with full stereo coupling and without stereo enhancement.

The 6300's ability to maintain source-to-source spectral consistency is also an important advantage. Once you have set up the processing to minimize codec artifacts caused by a given piece of program material, the 6300 will automatically minimize codec artifacts with any program material.

#### Speech/Music Detector

The Speech/Music Detector allows the 6300 to change its processing parameters depending on whether the input program material is speech or other material (usually music).

The algorithm is straightforward: Speech is detected if (1) the input is mono, and (2) there are syllabic pauses at least once every 1.5 seconds. Speech with a stereo music background will usually be detected as "music," or the detector may switch back and forth randomly if the stereo content is very close to the stereo / mono detector's threshold. Mono music with a "speech-like" envelope may be incorrectly detected as "speech." Music incorrectly detected as "speech" will exhibit a slight loss of loudness and punch, but misdetection will never cause objectionable distortion on music.

Speech that is not located in the center of the stereo sound field will always be detected as "music" because the detector always identifies stereo material as "music."

### Optimod 6300 in Radio-Oriented Applications: From Bach to Rock

The 6300 can be adjusted so that the output sounds:

- as close as possible to the input at all times (using the 2-band Protection Limiter preset)
- open but more uniform in frequency balance (and often more dramatic) than the input (using the 2-band structure or running the 5-band Structure with slow release time)
- dense, quite squashed, and very loud (using the 5-band Structure with faster release times)

The dense, loud setup will make the audio seem to jump out of car and table radios, but may be fatiguing and invite tune-outs on higher quality home receivers. The loudness/distortion trade-off explained above applies to any of these setups.

In professional broadcasting environments, you will achieve best results if Engineering, Programming, and Management go out of their way to communicate and cooperate with each other. It is important that Engineering understand the sound that Programming desires, and that Management fully understands the trade-offs involved in optimizing one parameter (such as loudness) at the expense of others (such as distortion or excessive density).

Never lose sight of the fact that, while the listener can easily control loudness, he or she cannot make a distorted signal clean again. If such excessive processing is permitted to audibly degrade the sound of the original program material, the signal is irrevocably contaminated and the original quality can never be recovered.

### **Sound-for-Picture Applications: Controlling Dynamic Range**

The most crucial commandment in sound for picture is this: *dialog must always be intelligible*. Sound for picture is usually heard under less-than-ideal conditions and its dynamic range must be controlled accordingly. Apartment-dwellers must set their volume controls to avoid disturbing neighbors or even other members of the family. At the quiet side, intelligibility of dialog is often impacted by environmental noise such as children playing or a dishwasher going in the kitchen. When one considers that the hearing acuity of a significant portion of the audience is somewhat impaired compared to that of a healthy 20-year-old, one concludes that *the dynamic range of dialog must not exceed 15dB* if it is to be intelligible to 99% of viewers under common domestic viewing conditions. Feature-film dynamic range is inappropriate for home viewing (except in dedicated home theaters) and the dynamic range of a significant portion of the audio from video source material must be compressed to best serve the audience. The challenge (which Optimod-PC effectively meets) is to compress dynamic range unobtrusively.

The 6300 can be adjusted so that the output sounds as close as possible to the input at all times (using the Two-Band Protection Limiter preset), *or* so that it sounds open but more uniform in frequency balance than the input (using the Two-Band structure or running the Five-band structure with slow release time), *or* so that it sounds dense, quite squashed, and very loud (using the Five-band structure with faster release times).

In television audio, inconsistent loudness between channels or program elements is annoying, so the dense, loud setup is never appropriate. The 6300 offers two-band and five-band presets (whose names begin with "TV") that exploit the AGC's and multiband compressor's compression ratio controls to subtly control dynamic range in sound for picture applications. These presets effectively and unobtrusively maintain dialog intelligibility while retaining a sense of dynamic range, allowing low-level elements to be heard easily. Meanwhile, the CBS Loudness Controller prevents subjective loudness from exceeding a preset ceiling.

The preset tuning controls on the 6300 give you the flexibility to adapt the processing to individual program segments. In most cases, your goal should be to choose the type of processing that best optimizes dynamic range while controlling the loudness of the loudest sounds so that they are not irritating and are consistent with the loudness of other stations or sources. When the 6300 is otherwise set up correctly (so that it is cognizant of the DIALNORM metadata you are transmitting to

viewers), its TVxxxx presets achieve this goal most precisely by exploiting the loudness controller.

If you want more consistent loudness from a “radio-style” preset, set its **LOUDNESS CONTROLLER THRESH** control to -10 dB, turn up its **MB LIMITER DRIVE** control until the loudness controller gain reduction meter indicates about 3 dB of gain reduction with typical program material, and save the result as a user preset. Also, please refer to *Setting Preset Loudness Correctly in Dolby Digital Transmission* on page 3-17.

## About the 6300's Signal Processing Features

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### Signal Flow

The signal flows through the 6300 through the following blocks (see page 6-43):

- Input Conditioning, including sample rate conversion, defeatable highpass filtering, and defeatable phase rotation
- Stereo Enhancement
- 2-band Gated AGC, with target-zone window gating and silence gating
- Equalization, including high-frequency enhancement
- Multiband Compression in either two or five bands, depending on the processing structure
- Automatic Loudness Control using Orban's third-generation CBS Loudness Controller™ algorithm plus a BS.1770 Safety Limiter
- Look-Ahead Limiting

A sample rate converter converts the sample rate at the digital input to the 6300's internal 48 kHz rate. This 48 kHz rate accommodates a 20 kHz audio bandwidth with a comfortably wide 4 kHz transition band for the anti-aliasing filter. We are aware of no bias-controlled double-blind studies that have ever demonstrated that sample rates higher than 48 kHz are audibly superior to 48 kHz (or even that there is any audible difference at all). Moreover, the noise and distortion produced by a given digital filter at 48 kHz is about 6 dB lower than the N&D produced by a filter having the same frequency response but operating at 96 kHz. The 6300 uses many digital filters, both in its equalizer section and for the crossovers in the multiband compressor. Hence, we believe that 48 kHz is the ideal rate for the 6300's audio processing.

A sweepable 18 dB/octave highpass filter and a defeatable phase rotator complete the input-conditioning block. The highpass filter is useful for production applications where it is necessary to remove low frequency rumble from a recording. The phase rotator makes speech more symmetrical, reducing its peak-to-average ratio by as much as 6 dB without adding nonlinear distortion. Hence, phase rotation can be very useful for loudness processing of speech.

**Stereo Enhancement:** The 6300 provides two different stereo enhancement algorithms. The first, called L-R DELAY, is based on Orban's patented analog 222 Stereo Enhancer, which increases the energy in the stereo difference signal (L-R) whenever a transient is detected in the stereo sum signal (L+R). By operating only on transients, the 222 increases width, brightness, and punch without unnaturally increasing reverb (which is usually predominantly in the L-R channel).

Gating circuitry detects "mono" material with slight channel or phase imbalances and suppresses enhancement so this built-in imbalance is not exaggerated. It also allows you to set a "width limit" to prevent over-enhancement of material with significant stereo content, and will always limit the ratio of L-R / L+R to unity or less.

The second stereo enhancement algorithm is based on the well-known "Max" technique. This passes the L-R signal through a delay line and adds this decorrelated signal to the unenhanced L-R signal. Gating circuitry similar to that used in the "222-style" algorithm prevents over-enhancement and undesired enhancement on slightly unbalanced mono material.

**2-band Gated AGC:** The AGC is a 2-band device, using Orban's patented "master / bass" band coupling. It has an additional important feature: target-zone gating. If the input program material's level falls within a user-settable window (typically 3dB), then the release time slows to a user-determined level. It can be slow enough (0.5 dB/second) to effectively freeze the operation of the AGC. This prevents the AGC from applying additional, audible gain control to material that is already well controlled. It also lets you run the AGC with fast release times without adding excessive density to material that is already dense.

The AGC contains a compression ratio control that allows you to vary to ratio between 2:1 and essentially  $\infty$ :1. Lower ratios can make gain riding subtler on critical formats like classical and jazz.

The AGC has its own silence-gating detector whose threshold can be set independently of the silence gating applied to the multiband compressor.

**Equalization:** The 6300 has steep-slope bass shelving equalizer and three bands of fully parametric bell-shaped EQ.

You can set the slope of the bass shelving EQ to 6, 12, or 18 dB/octave and adjust the shelving frequency.

The 6300's bass, midrange, and high frequency parametric equalizers have curves that were modeled on the curves of Orban's classic analog parametrics (like the 622B), using a sophisticated, proprietary optimization program. The curves are matched to better than 0.15dB. This means that their sound is very close to the sound of an Orban analog parametric. They also use very high quality filter algorithms to ensure low noise and distortion.

The 6300 HF Enhancer is a program-controlled HF shelving equalizer that intelligently and continuously analyzes the ratio between broadband and HF energy in the input program material. It can equalize excessively dull material without over-

enhancing bright material. It interacts synergistically with the 5-band compressor to produce sound that is bright and present without being excessively shrill.

**Multiband Compression:** The multiband compressor can be operated in 5-band or 2-band mode. In 5-band mode, each band compressor has a KNEE and RATIO control. A soft knee and gentle ratio are particularly useful in production and mastering applications, allowing subtle compression that retains as much of the dynamics of the input program material as the operator desires.

Several band-coupling controls allow the gain reduction of a given band's compressor to be partially controlled by the gain reduction in its neighboring band's compressor. These coupling controls allow anything from quasi-wideband compression to fully independent multiband compression.

A clipper, embedded in the crossover, protects bands 1 and 2 from transient overshoot. This clipper has a shape control, allowing you to vary the "knee" of its input/output transfer curve from hard (0) to soft (10).

**Low-IM Look-Ahead Limiter:** The 6300's peak limiters prevent overshoots by examining a few milliseconds of the unprocessed sound before it is limited. This way, the limiter can anticipate peaks that are coming up.

It is important to minimize audible peak-limiter-induced distortion when one is driving a low bitrate codec because one does not want to waste precious bits encoding the distortion. Look-ahead limiting can achieve this goal; hard clipping cannot.

One can model any peak limiter as a multiplier that multiplies its input signal by a gain control signal. This is a form of amplitude modulation. **Amplitude modulation produces sidebands around the "carrier" signal.** In a peak limiter, each Fourier component of the input signal is a separate "carrier" and the peak limiting process produces modulation sidebands around each Fourier component.

Considered this way, a hard clipper has a wideband gain control signal and thus introduces sidebands that are far removed in frequency from their associated Fourier "carriers." Hence, the "carriers" have little ability to mask the resulting sidebands psychoacoustically. Conversely, a look-ahead limiter's gain control signal has a much lower bandwidth and produces modulation sidebands that are less likely to be audible.

Simple wideband look-ahead limiting can still produce audible intermodulation distortion between heavy bass and midrange material. The look-ahead limiter in your Optimod uses sophisticated techniques to reduce such IM distortion without compromising loudness capability.

*Dialnorm and Limiting:* The 6300 supports the concept of "target loudness," as used in ATSC Recommendation A/85 and EBU Recommendation R 128. When used to process a Dolby Digital transmission, the 6300 can be easily set up to ensure that the loudness of your transmission is identical to that of other properly set up Dolby Digital transmissions. To be consistent with modern EBU R128, ATSC A/85, and AES TD.1004 nomenclature, the 6300's target loudness controls are called **TARGET LOUDNESS** controls. There is one such control for each of the two peak limiters, which drive digital output #1 / analog output and output #2 re-



spectively. (See *Figure 1-1: Simplified Block Diagram of Target Loudness Control* on page 1-2.)

Unlike some familiar compressors and limiters (whose gain reduction is adjusted via threshold controls), the 6300 limiter's threshold is fixed with respect to the input of the 6300's digital output level control so the limiter's drive level solely determines the gain reduction. Three gain controls set this drive level. The first is **MB LIMIT DRIVE** (which is located before the loudness controller and affects both outputs identically); the second is a "hidden" control whose gain is set by the **TARGET LOUDNESS** value for a given output; the third is a control that applies a gain equal to the loss in the **100% OUTPUT LEVEL** control and holds loudness constant when this control is adjusted. For a given output, the second and third gain controls are only active when that output's source is set to **LIMITER NORM**.

In the transmitted Dolby Digital bitstream, setting **DIALNORM** to a less negative value automatically turns down the home receiver's volume control, so the 6300's output level must be turned up by the same amount to maintain a constant loudness at the receiver. Because it is placed before the 6300's look-ahead limiter, the 6300's hidden **TARGET LOUDNESS** gain control achieves this while allowing the 6300's look-ahead limiter to prevent digital clipping in the downstream transmission chain regardless of the 6300's **TARGET LOUDNESS** setting. This arrangement allows the user to set the correct loudness at the 6300's output solely by adjusting the 6300's active **TARGET LOUDNESS** value—it is unnecessary to adjust any other controls within a preset, so all TV presets automatically adapt to the 6300's current **TARGET LOUDNESS** value.

Only the "TV" presets are set up to produce correct loudness at the consumer's receiver automatically. However, you can readily adjust other presets to produce correct loudness in Dolby Digital transmissions by adjusting a preset's **MB DRIVE** control to make the 6300's **BS.1770** loudness meter indicate 0 LU on average. Then save the result as a User Preset.

**Loudness Control:** Useful in sound-for-picture applications, the 6300's third-generation CBS Loudness Controller and **BS.1770** Safety Limiter cooperatively and automatically control subjective loudness. Their thresholds are set (via the **LOUDNESS THRESHOLD** and **BS.1770 SAFETY LIMIT THRESHOLD** controls respectively) relative to a fixed, internal loudness level. Because the output of the loudness controller block drives the two peak limiters in parallel, and because each limiter's **TARGET LOUDNESS** control scales the limiter's drive level following the loudness controller block, a single loudness controller works correctly for both outputs even when the outputs have different **TARGET LOUDNESS** values.

The CBS Loudness Controller constrains the loudness of most commercials well enough to eliminate viewer annoyance. It works by constantly monitoring the subjective loudness of the 6300's output. The subjective loudness is a single value that represents the listener's impression of the loudness in the listening room. It takes into account the contribution of both stereo channels.

When subjective loudness would otherwise exceed the threshold set by the **LOUDNESS THRESHOLD** control, the CBS Loudness Controller reduces the gain of material above 200 Hz, preventing loudness from exceeding the threshold. To prevent the loudness controller from causing too much dynamic bass boost, you can use the **LOUDNESS CONTROLLER BASS COUPLE** control to limit the maximum difference be-

tween the gain of the band below 200 Hz and the band above 200Hz. For example, when this control is set to 3 dB and the loudness controller's gain reduction is 10 dB, the gain reduction below 200 Hz will be 7 dB. However, if the loudness controller's gain reduction is 2 dB, the gain reduction below 200 Hz will be 0 dB because the difference is now less than 3 dB.

The loudness controller is triggered mainly by program material that has a lot of energy between 1 and 7 kHz, which is the ear's most sensitive range. If you are using the two-band structure and you find that the loudness controller is producing audible artifacts because the program forces it to do a great deal of gain reduction, we suggest that you use the five-band structure instead. This will automatically re-equalize such program material and will de-ess extremely sibilant program material before the loudness controller receives it.

The CBS Loudness Controller's attack and release times are tuned to match the loudness integration times of the ear and are program-adaptive. Only the attack time is user-adjustable.

If you feel that the Loudness Controller is not controlling the loudness of commercials or other subjectively loud program material sufficiently well, you may wish to set the threshold lower, forcing the Loudness Controller to do more work. Conversely, if the loudness controller is doing more gain reduction than you would like, you can set the LOUDNESS THRESHOLD control higher.

The Loudness Controller produces both fast and slow loudness control; the fast control rides on top of the slow control. You can easily see this dual-speed operation on the LOUDNESS GR meter. The LOUDNESS ATTACK control determines how much fast control the Loudness Controller produces. As the control is turned down toward 0%, it allows longer and longer loudness peaks to pass through.

The 6300's ITU-R BS.1770-4 loudness level meter monitors the output of the peak limiter and hence takes into account both the fast and slow components of the CBS loudness controller's gain reduction. The Loudness Level meter on the 6300's front panel indicates BS.1770-4 loudness. This is the meter specified in ATSC Recommendation A/85 and EBU R 128 and is the meter used to verify that the 6300 is controlling loudness in compliance with the CALM Act.

The 6300's CBS Loudness meter is only visible from PC Remote software, which displays the BS.1770-4 meter beside the CBS meter. Because of the system topology, the 6300's CBS loudness level meter always reads as it would if the LOUDNESS ATTACK control were set to 100% and does not indicate the effect of lower settings. As long as the control is set to 50% or higher, this limitation should not have any significant effect on the CBS loudness level meter's accuracy.

The Loudness Controller may reduce the dramatic effect of certain sounds in entertainment programming, like gunshots, explosions, or screeching tires. Operators may therefore want to turn the Loudness Controller on during commercial breaks and off during normal programming. All sound-for-picture presets have the Loudness Controller on. The easiest way to handle this situation is to start with your preferred preset, turn the Loudness Controller off, and then save the result as a User Preset.

Using one of the 6300's remote control mechanisms (like its GPI inputs), recall the "with loudness controller" and "without loudness controller" presets as desired.

Turning down the LOUDNESS ATTACK control provides another way to maintain the dramatic impact of loudness transients in dramatic programming; it can let gunshots and the like through while still constraining long-term loudness to a fixed threshold. While this is an easy solution that does not require your automation system to tell the 6300 when to recall presets, it is not ideal because there are some short-term loudness events, like sibilance, applause, and whistles, that can be annoying to audiences. You can use the Speech-Mode B4 and B5 compressor threshold controls to accomplish the same goal.

Another loudness control strategy is this: Instead of using two presets with and without loudness control (as described above), you can create presets with different settings of the LOUDNESS ATTACK control (and possibly different settings of the LOUDNESS THRESHOLD control as well). Try a slow attack (50% or below) for dramatic programming and a faster attack (70%) for commercial breaks. This will maintain some automatic loudness control for dramatic programming while controlling the loudness of commercial breaks more rigorously.

Note that the Loudness Controller operates with reference to an absolute subjective loudness threshold that does not adapt to program context. This means that if there is a transition between very quiet program material (like footfalls through rustling leaves) and a commercial, the commercial may *still* seem offensively loud even though the Loudness Controller is controlling its loudness correctly with reference to other sounds that reach full-scale loudness. Philosophically, this is inevitable; the Loudness Controller cannot reduce the level of the commercial to the level of rustling leaves without destroying the effectiveness of the commercial and angering the sponsor!

#### BS.1770 Safety Limiter

Following the CBS Loudness Controller is a BS.1770 Safety Limiter that will prevent a BS.1770-4 loudness meter with 10-second integration time from indicating higher than the setting of the BS.1770 DELTA THRESHOLD control, which is available on the front panel when the *Modify* button is pressed. The BS.1770 DELTA THRESHOLD control is part of the on-air Processing Preset, so if you change the setting of this control from its default value (which we recommend doing), you should save your work as a User Preset.

Because some organizations will disqualify an automatic loudness controller if it causes a BS.1770 meter to read higher than a specified threshold, all of the "TV" factory presets have this controller active with the BS.1770 DELTA THRESHOLD control set to 0 LU. If your organization does not have a strict policy about processing for the BS.1770 meter, we recommend that you edit your preferred preset by setting this control anywhere from +2 to OFF and then saving the result as a User Preset.

The total amount of loudness control-induced gain reduction is the sum of the gain reduction produced by the CBS Loudness Controller and the gain reduction produced by the BS.1770 safety limiter. The gain reduction produced by the BS.1770 safety limiter changes slowly, seldom exceeds 2 dB, and is indicated by the amber section of the LOUDNESS GR

meter in 6300 PC Remote. The gain reduction produced by the CBS Loudness Controller may change slowly or quickly (depending on the nature of the program material), appears in cyan, and rides on top of the BS.1770 gain reduction. The peak reading of the meter thus shows the total gain reduction that both controllers produce.

On the 6300's front panel, the total loudness controller gain reduction is shown in blue on the **LOUDNESS GR** LED bargraph.

We included this safety limiter for customers whose policies require the BS.1770 loudness meter reading to be constrained below a specified threshold regardless of how loud human listeners perceive the program to be. Our experience suggests that the BS.1770-4 meter will often over-read material with unusually low peak-to-average ratios, like highly produced commercials and promos. Strict reliance on the BS.1770 meter can therefore make such material sound unnaturally quiet compared to surrounding material, so we prefer the sound when the CBS Loudness Controller is used exclusively for loudness control.

For a more detailed discussion of this issue, refer to *Using the ITU BS.1770 and CBS Loudness Meters to Measure Loudness Controller Performance*, starting on page 3-77.

## 2-band Purist Processing

The 6300's 2-band algorithm can be set to be phase-linear. We believe that this is the ideal processing for classical music and jazz programming because it does not dynamically re-equalize high frequencies; the subtle HF limiter only acts to reduce high frequency energy when it would otherwise cause overload because of the TV preemphasis curve. The 6300's 2-band phase-linear structure therefore keeps the musical spectrum coherent and natural.

## Input/output Delay

When using the AGC+LIMIT or MB+LIMIT processing chains, input/output time delay is typically 25 ms—about three-quarters of an NTSC frame. To make intelligent decisions about how to process, the 6300 needs to look ahead at the next part of the program waveform. As digital transmission processing advances further and further from its analog roots, this is the inevitable price of progress.

To avoid AV sync problems in sound-for-picture applications, the 6300 allows you to pad the delay to one full frame of 24, 25, or 29.97 fps video, which makes matching audio and video delays convenient. See step 22 on page 2-21.

You can configure any of the 6300's outputs to supply a low-delay monitor signal to drive talent headphones only, which is useful if talent monitors off-air through headphones. (See step 12 on page 2-15.)

## Customizing the 6300's Sound

The subjective setup controls on the 6300 give you the flexibility to customize your station's sound. Nevertheless, as with any audio processing system, proper adjustment of these controls consists of balancing the trade-offs between loudness, densi-

ty, and audible distortion. The following pages provide the information you need to adjust the 6300 controls to suit your format, taste, and competitive situation.

When you start with one of our Factory Presets, there are two levels of subjective adjustment available to you to let you customize the Factory Preset to your requirements: Basic Modify and Full Modify. A third level, *Advanced Modify*, is accessible *only from the 6300's PC Remote software*.

See page 6-43 for a block diagram of the processing.

## Basic Modify

BASIC MODIFY allows you to control three important elements of 6300 processing: the stereo enhancer, the equalizer, and the dynamics section (multiband compression, limiting, and clipping). At this level, there is only one control for the dynamics section: LESS-MORE, which changes several different subjective setup control settings simultaneously according to a table that we have created in the 6300's permanent ROM (Read-Only Memory). In this table are sets of subjective setup control settings that provide, in our opinion, the most favorable trade-off between loudness, density, and audible distortion for a given amount of processing. We believe that most 6300 users will never need to go beyond the LESS-MORE level of control because the combinations of subjective setup control settings produced by this control have been optimized by Orban's audio processing experts on the basis of years of experience designing audio processing and upon hundred of hours of listening tests.

The LESS-MORE control has a different effect in the "radio" presets than it does in the "sound-for-picture" presets. In the "radio" presets, the air sound will become louder as you go from less to more, but (as with any processor) processing artifacts will increase. In the "sound-for-picture" presets (except for those few based on "radio" presets), the LESS-MORE control sets the average amount of dynamic range control provided by the processing. As you go from less to more, the loudness of loud sounds will stay about the same but the loudness of quieter sounds will increase. Because of the 6300's sophisticated gating circuits, very quiet material like background sounds, quiet underscoring, hiss, and hum will not be pumped up.

Please note that, in the "radio" presets, the highest LESS-MORE setting is purposely designed to cause unpleasant distortion and processing artifacts! This helps assure you that you have chosen the optimum setting of the LESS-MORE control, because turning the control up to this point will cause the sound quality to become obviously unacceptable.

You need not (in fact, cannot) create a sound entirely from scratch. All User Presets are created by modifying Factory Presets, or by further modifying Factory Presets that have been previously modified with a LESS-MORE adjustment. It is wise to set the LESS-MORE control to achieve a sound as close as possible to your desired sound before you make further modifications at the Advanced Modify level. This is because the LESS-MORE control gets you close to an optimum trade-off between loudness and artifacts, so any changes you make are likely to be smaller and to require resetting fewer controls.

In the 6300, LESS-MORE affects only the dynamics processing (compression, limiting, and clipping). Unlike some of Orban's older digital processors, the 6300's equalization and stereo enhancement are decoupled from LESS-MORE. You can therefore change EQ or stereo enhancement and not lose the ability to use LESS-MORE. When you create a user preset, the 6300 will automatically save your EQ and stereo enhancement settings along with your LESS-MORE setting. When you recall the user preset, you will still be able to edit your LESS-MORE setting if you wish.

## Full Modify

Full Modify is the most detailed control level available from the 6300's front panel. It allows you to adjust the dynamics section at approximately the level of "full control" available in Orban's 6200 processor. Because of improvements in the 6300's signal processing by comparison to the 6200, these controls are not extremely dangerous (although you can still get into trouble if you try hard enough). Most people will never have any reason to go beyond Full Modify.

Note: Full Modify does not provide LESS-MORE control. Furthermore, once you have edited a preset's dynamics parameters in Full Modify, LESS-MORE control is no longer available in Basic Modify and will be grayed-out if you access its screen. As noted above, we recommend using the Basic Modify LESS-MORE control to achieve a sound as close as possible to your desired sound before you make further modifications at the Full Modify level.

## Advanced Modify

If you want to create a signature sound for your broadcast that is far out of the ordinary, if your taste differs from the people who programmed the LESS-MORE tables, or if you are using the 6300 in mastering or production applications, you will find Advanced Modify useful. Advanced Modify is available to you from the 6300 PC Remote software *only* (not from the 6300's front panel). At this level, you can customize or modify any subjective setup control setting to create a sound exactly to your taste. You can then save the settings in a User Preset and recall it whenever you wish. This sort of customization is usually unnecessary and inappropriate for sound for picture but can be very useful for radio and production applications.

Compressor attack time, knee, ratio, and threshold controls are available. These controls can be dangerous in inexperienced hands, leading you to create presets that sound great on some program material but overdrive the look-ahead peak limiter on other material, causing objectionable pumping or distortion. We therefore recommend that you create custom presets at the Advanced Modify level only if you are experienced with transmission processor sound design and if you are willing to take the time to double-check your work on many different types of program material.

In production and mastering applications, you will usually be working with one piece of program material at a time. Here, you can use all of Advanced Modify's power to get the sound you want without being concerned about how your settings will sound with other material.

The PC Remote software organizes its controls in tabbed screens. The first three tabs (EQUALIZATION, STEREO ENHANCER, and LESS-MORE) access the Basic Modify controls. The remaining tabs combine the Full Modify and Advanced Modify controls, logically organized by functionality.

Important Note: Once you have edited a preset's dynamics parameters in Full or Advanced Modify, LESS-MORE control is no longer available in Basic Modify. As noted above, we strongly recommend using the LESS-MORE control to achieve a sound as close as possible to your desired sound before you make further modifications at the Full or Advanced Modify levels.

## Gain Reduction Metering

Unlike the metering on some processors, when any OPTIMOD 6300 gain reduction meter indicates full-scale (at its bottom), it means that its associated compressor has run out of gain reduction range, that the circuitry is being overloaded, and that various nastinesses are likely to commence.

Because the various compressors have 25 dB of gain reduction range, the meter should never come close to 25 dB gain reduction if OPTIMOD 6300 has been set up for a sane amount of gain reduction under ordinary program conditions.

Further, be aware of the different peak factors on voice and music—if voice and music are peaked identically on a VU meter, voice may cause up to 10 dB more peak gain reduction than does music! (A PPM will indicate relative peak levels much more accurately.)

The AGC meter can be switched (within the Full Control screens) so that it either reads the gain reduction of the Master (above-200 Hz) band, or the difference between the gain reduction in the Master and Bass bands.

The latter reading is useful for assessing the dynamic bass equalization that the AGC produces and it helps you set the AGC BASS COUPLING control.

## Setting Preset Loudness Correctly in Dolby Digital Transmissions

*Factory presets beginning with "TV" already have their loudness set correctly and you do not need to use the information in this section.*

The instructions below describe how to correctly set the loudness of user presets that you create. You must use 6300 PC Remote for these adjustments. See *To Create or Save a User Preset* on page 2-19.

There are two major philosophies of loudness control, one presented in ATSC Recommendation A/85 and the other in EBU Recommendation R 128.

**ATSC A/85:** If you wish to ensure that dialog levels are consistent from one program segment to the next, use the 1101's CBS loudness meter as a reference for adjusting a user preset's loudness. In this case, we prefer relying on the CBS Loudness Control-

ler to do final loudness control and turning the BS.1770 Safety Limiter off. Consistent loudness of the “anchor element” (usually dialog) is the goal suggested in ATSC Recommendation A/85, which is the basis for CALM Act compliance, and we prefer this goal to strictly relying on the BS.1770-4 loudness meter.

**EBU R 128:** If you wish to ensure that integrated loudness as measured on a BS.1770-4 meter is consistent from one piece of program material to the next, use your Optimod’s BS.1770-4 loudness meter as a reference. In this case, you may wish to active your Optimod’s BS.1770 Safety Limiter, which will constrain BS.1770-4 loudness with a 10-second integration time from exceeding the setting of the BS.1770 DELTA THRESHOLD control. However, note that R128 encourages mixing to achieve a wide dynamic range, where some material may considerably exceed the target loudness when measured on a “short-term” (three-second integration time; ungated) BS.1770-4 meter. Moreover, R 128 requires online loudness control to be defeated if upstream material is known to be pre-processed such that the integrated loudness of each program segment (per BS.1770-4) is identical to the active Target Loudness value with a  $\pm 1$  dB window. Use your Optimod’s PASS-THROUGH preset to defeat loudness processing.

In sound-for-picture applications that use a Dolby Digital transmission channel to the consumer’s receiver, you can use the 6300’s LOUDNESS LEVEL meters (CBS and Bs.1770-4) as a reference for adjusting a user preset’s loudness. (See *Using the ITU BS.1770 and CBS Loudness Meters to Measure Loudness Controller Performance* starting on page 3-77.) These meters’ calibrations track the 6300’s active TARGET LOUDNESS value, which is either a given output’s GLOBAL TARGET LOUDNESS value in the active Setup (which applies to any preset whose TARGET LOUDNESS value is set to GLOBAL) or the TARGET LOUDNESS value in the active Processing Preset if this value is not set to GLOBAL. Each digital output has an independent TARGET LOUDNESS value, but if the TARGET LOUDNESS value in the processing preset is not GLOBAL, it will override these global values and set both outputs to have the same TARGET LOUDNESS value as that in the processing preset.

The controls to which the following procedure refers are described later in Section 3.

- A) Make sure that the source for output you are using is **LIMITER NORM** (step 11.K) on page 2-31) and that the input selector of output’s associated peak limiter is set to **MULTIBAND** (step 9 on page 2-25).
- B) For a given output, make sure that the **TARGET LOUDNESS** value is the same as the **Dialnorm** value you are transmitting to consumers’ receivers (step 11.B)a) on page 2-30).
- C) If the AGC is turned on in the preset, adjust the **AGC DRIVE** control so that the AGC is producing the desired amount of compression. We recommend 10 dB or less with normal levels.
- D) If the AGC’s idle gain (i.e. the gain reduction produced by the AGC when its silence gate is on) is inappropriate, adjust it with the **AGC IDLE GAIN** control.

If you are using a factory processing preset and you have adjusted the input reference level correctly, there is no need to adjust the **AGC DRIVE** or **AGC IDLE GAIN** controls.



- E) Adjust the **MULTIBAND DRIVE** or **2-BAND DRIVE** control (depending on whether the five-band or two-band structure is active) to produce the desired amount of multiband gain reduction. We recommend about 5 dB for dialog at normal levels.
- F) *If you wish to use the CBS Loudness Controller:* Set the **LOUDNESS THRESHOLD** control to 0 dB, **which matches the CBS Loudness Controller's** threshold to the active **TARGET LOUDNESS** value. Then set the **MB LIMIT DRIVE** control so that the **CBS** segment of the **LOUDNESS GR** meter indicates 3 dB of gain reduction with **dialog at normal levels**. (The CBS Loudness Controller's gain reduction appears in blue on the **LOUDNESS GR** meter in PC Remote.)

You should see the **LOUDNESS LEVEL** meter peaking around 0 dB when the **LOUDNESS GR** meter shows that gain reduction is occurring

- G) *If you wish to use the BS.1770 Safety Limiter:* Set the **BS1770 LDNS THR** control to your preferred level. 0 LU provides the tightest control as indicated on a BS.1770 meter, but this is likely to cause program material with an usually low peak to RMS ratio to sound too quiet. Most natural sound is produced when the **BS1770 LDNS THR** control is set to +2 LK or higher.
- H) *If you do not wish to use the Loudness Controller:* Set the **LOUDNESS THRESHOLD** and **BS1770 LDNS THR** controls to **OFF**. Then adjust the **MB LIMITER DRIVE** control to produce 0 dB peak indications on the CBS loudness meter with dialog at normal levels.

Presets with the loudness controller off will produce wider source-to-source loudness variation (as indicated on the **LOUDNESS LEVEL** meter) than presets with the loudness controller on. When the loudness controller is off, the five-band structure will control loudness better than the two-band structure. When the loudness controller is on, both structures have comparable loudness control.

If you chose an appropriate **TARGET LOUDNESS** value for your transmission, the 6300's limiting meters should rarely indicate any gain reduction.

## To Create or Save a User Preset

Once you have edited a preset, you can save it as a user preset. The 6300 can store more than 100 user presets, limited only by available memory.

The 6300 will offer to save any edited, unsaved preset when the main screen is visible. To save a preset:

- A) Press the **ESC** button repeatedly until you see the main screen, which shows the current time and the preset presently active.

If there is an unsaved preset active, the rightmost button will be labeled **SAVE PRESET**.

- B) Press the **SAVE PRESET** button.

The Save Preset screen appears.

- C) Choose a name for your preset.

Some non-alphanumeric characters (such as < and >) are reserved and cannot be used in preset names.

D) Use the knob to set each character in the preset name. Use the **NEXT** and **PREV** buttons to control the cursor position.

E) Press the **SAVE CHANGES** button.

- If the name that you have selected duplicates the name of a factory preset, the 6300 will suggest an alternate name.

You cannot give a user preset the same name as a factory preset.

- If the name you have selected duplicates the name of an existing user preset, the 6300 warns you that you are about to overwrite that preset. Answer YES if you wish to overwrite the preset and No otherwise. If you answer No, the 6300 will give you an opportunity to choose a new name for the preset you are saving.

You can save user presets from the 6300 PC Remote application. (See *Using the 6300 PC Remote Control Software* on page 3-63.) Please note that when you save presets from the PC Remote application, you save them in the 6300's **memory** (as if you had saved them from the 6300's front panel). The PC Remote application also allows you to *archive* presets to your **computer's hard drive (or other storage device)** and to restore them. However, archiving a preset is not the same as saving it. Archived presets reside on a storage medium supported by your computer, while saved presets reside in the 6300's **local** non-volatile memory. You cannot archive a preset until you have saved it. (See *To back up User Presets, system files, and automation files onto your computer's hard drive* on page 3-66.)

Note that if, for some reason, you wish to save an unmodified preset (either Factory or user) under a new name, you must temporarily make an arbitrary edit to that preset in order to make the **SAVE PRESET** button appear. After you have saved the preset, reverse the edit and save the preset again.

## About the Processing Structures

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If you want to create your own User Presets, the following detailed discussion of the processing structures is important to understand. If you only use Factory Presets or if you only modify them with LESS-MORE, you may still find the material interesting but you do not need to understand it to get excellent sound from the 6300. We have carefully designed the 6300's factory presets and most users will not need to go beyond these.

In the 6300, 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 (like equalizers, compressors, limiters, and clippers), the 6300's DSP hardware could realize several possible processing structures that. Unlike an analog system, where creating a complete processing system involves physically wiring its various components together, the 6300 realizes its processing structures as a series of

high-speed mathematical computations made by Digital Signal Processing (DSP) integrated circuit chips.

There are two basic structures: **2-band** and **5-band**. To select a structure, choose a factory preset having the desired structure, and, if you wish, edit it to create a user preset. To put a given structure on the air, recall a factory or user preset associated with that structure.

Both structures have a loudness controller block available (see *Loudness Control* on page 3-11).

**5-band:** The 5-band structure is very flexible, enabling you to fine-tune your sound. There are several basic Factory Presets for the 5-band structure. Each of these presets can be edited with the LESS-MORE control.

This control affects the sound-for-picture-oriented presets differently than it does the music presets. When a sound-for-picture-oriented preset is on the air, the LESS-MORE control adjusts the average amount of gain reduction by adjusting the drive level to the 5-band structure's input. This also adjusts the *idle gain*—the amount of gain reduction in the AGC section when the structure is gated. (It gates whenever the input level to the structure is below the user-adjustable threshold of gating.)

When a music preset is on the air, the LESS-MORE control sets the amount of overall processing, making optimum tradeoffs between loudness, brightness, and distortion. In sound for picture, there are no loudness wars; for music presets, there is probably never a need to advance the LESS-MORE control beyond 5.

The stereo enhancer, AGC, equalizer, and look-ahead limiter are common to both 2-band and 5-band processing and therefore stay the same when the 6300 switches between 2-band and 5-band operation. However, different controls appear in the screens containing dynamics processing controls, as appropriate for 2-band or 5-band multiband compression. The meters also change functionality to display the 2-band or 5-band gain reduction.

Both the 2-band and 5-band multiband compressors always operate in the background. Switching between 2-band and 5-band therefore occurs with a seamless cross-fade, although switching can still sound obtrusive if the loudness normally produced by the 2-band and 5-band presets are very different. It is usually possible to eliminate audibly obtrusive switching artifacts by tweaking one (or both) of the presets to make them sound closer to each other and saving the results as user presets.

**2-band:** The 2-band structure consists of a slow 2-band gated AGC (Automatic Gain Control) for gain riding, followed by a gated 2-band compressor and a look-ahead limiter. By choosing the crossover mode correctly, the 2-band Structure can be made phase-linear throughout to maximize sonic transparency.

The 2-band structure has an open, easy-to-listen-to sound that is similar to the source material if the source material is of good quality. However, if the spectral balance between the bass and high frequency energy of the program material is in-

correct, the 2-band structure (when its B2-B1 COUPLE control is operated toward 0%) can gently correct it without introducing obvious coloration.

In radio-oriented applications, the 2-band structure is mainly useful for classical or “fine arts” programming that demands high fidelity to the original program source. The PROTECTION preset is a 2-band preset that provides the highest fidelity; other 2-band presets provide more processing.

The 2-band structure preserves the frequency balance between midrange and high frequency elements in the programming while permitting gentle automatic re-equalization of the balance between these elements (in the “master” band, which is above 200 Hz) and elements in the “bass” band (below 200 Hz).

The AGC crossover can be configured to be either phase-linear (i.e., constant-delay) or “allpass.” “Allpass” provides minimum time delay along with a frequency response that is free from peaking or dipping when band gains are unequal. “Allpass” also helps make speech waveforms more symmetrical. The delay-line derived phase-linear crossover has the same desirable smoothness in its frequency response as “allpass,” while adding 4 ms of delay to the processing. Most 2-band presets use the delay-line derived phase-linear crossover configuration.

Unlike version 1.0 software, in version 2.0 software and above the 2-band crossover is always phase-linear.

## Factory Programming Presets

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Factory Programming Presets are our “factory recommended settings” for various program formats or types. The Factory Programming Presets are starting points to help you get on the air quickly without having to understand anything about adjusting the 6300’s sound.

You can easily edit any of these presets with the LESS-MORE control to optimize the trade-off between loudness and distortion according to the needs of your format, although this is often unnecessary. It is OK to use unmodified factory presets on the air. These represent the best efforts of some very experienced transmission processing sound designers. We are sometimes asked about unpublished “programming secrets” for Optimods. In fact, there are no “secrets” that we withhold from users. This manual reveals our “secrets” and the presets embody all of our craft as processing experts. The presets are editable because other sound designers may have different preferences from ours, not because the presets are somehow mediocre or improvable by those with special, arcane knowledge that we withhold from most of our customers.

Start with one of these presets. Spend some time listening critically to your sound. Listen to a wide range of program material typical of your format and listen on several types of audio systems (not just on your studio monitors). Then, if you wish, customize your sound using the information in the Protection Limiter, 2-band and 5-band sections that follow.

Each factory preset has full LESS-MORE capability. The table shows the presets, including the source presets from which they were taken and the nominal LESS-MORE setting of each preset. Some of the 5-band presets appear several times under different names because we felt that these presets were appropriate for more than one format; these can be identified by a shared source preset name.

Important! If you are dissatisfied with the sound available from the factory presets, please understand that each named preset is actually 19 presets that can be accessed via the **LESS-MORE** control. Try using this control to trade off the amount of dynamic range reduction against processing artifacts and side effects. Once you have used **LESS-MORE**, save your edited preset as a User Preset.

Do not be afraid to choose a preset other than the one named for your programming if you believe this other preset has a more appropriate sound. Also, if you want to fine-tune the frequency balance of the programming, feel free to use Basic Modify and make small changes to the Bass, Mid EQ, and HF EQ controls. The 6300 lets you make changes in EQ (and stereo enhancement) without losing the ability to use Less-More settings.

Of course, **LESS-MORE** is still available for the unedited preset if you want to go back to it. There is no way you can erase or otherwise damage the Factory Presets. So, feel free to experiment.

If a preset has "2B" or "2BAND" in its name, it will activate the 2-band structure. (The Protection presets are 2-band as well.) Other presets use the 5-band structure.

## Protection and AGC Presets

**LOOK-AHEAD LIMITER:** The LOOK-AHEAD LIMITER preset is a 2-band preset that turns off the stereo enhancer, AGC, equalizer, and 2-band compressor so that you can use the processing as a fast look-ahead protection limiter.

This preset's LESS-MORE control is set to 1.0. With this setting, the threshold of the look-ahead limiter is 18 dB above reference level. For most program material, LESS-MORE = 1.0 will produce no look-ahead limiter gain reduction.

This assumes that the 6300's AI REF and DI REF controls have been adjusted to produce 10 dB of AGC Master Band gain reduction when the **Rock-GENERAL** preset is active and the 6300's inputs are driven by a 400 Hz tone at your facility's reference level.

To produce look-ahead limiter gain reduction, turn up the LESS-MORE control. Each step of the LESS-MORE control increases the drive level to the look-ahead limiter by 1 dB and increases the input/output gain by 1 dB for signals below the limiter threshold. At LESS-MORE = 10, the processor's gain below threshold has increased to 9 dB.

Instead of adjusting LESS-MORE, you can adjust the FINAL LIMIT DRIVE control (which what LESS-MORE actually does). Do not set the FINAL LIMIT DRIVE control below "0" with this preset; doing so will compromise system headroom.

Adjusting the LESS-MORE or FINAL LIMIT DRIVE controls is equivalent to simultaneously decreasing the threshold and increasing the make-up gain in a protection limiter having threshold and output make-up gain controls.

**AGC+[FLAT, 50  $\mu$ s, 75  $\mu$ s] LIMITER:** These presets allow the 6300 to serve as a studio AGC, substituting for the AGC in an Optimod at a radio or television transmitter and providing protection limiting for the STL that links the output of the 6300 to the input of the Optimod at the transmitter.

Choose the preset that matches the 6300's preemphasis setting (see step 8 on page 2-25). This step explains how to choose the 6300's preemphasis setting to match your STL.

The 50  $\mu$ s and 75  $\mu$ s presets have been tuned so that the 5-band compressor serves only as a subtle high frequency limiter that uses bands 4 and 5 to perform a few dB of fast gain reduction with program material having strong high frequency content. Band 5 operates without stereo coupling. This way, HF limiting triggered by high frequency energy in one audio channel will not modulate high frequencies in the opposite channel.

The FLAT preset is tuned so that it does not normally trigger gain reduction in the 6300's 5-band compressor — the Optimod at the transmitter should be the processor that performs this multiband compression.

All AGC presets use the look-ahead limiter to prevent overloading the STL on peaks. Compared to FLAT, the 50  $\mu$ s and 75  $\mu$ s presets progressively reduce the drive level to the look-ahead limiter to prevent strong high frequency energy from triggering audible gain pumping or ducking. The high frequency limiting action in the 5-band compressor also helps prevent this artifact.

**PROTECT:** This is a 2-band preset designed to produce no gain reduction unless it encounters unusually high input levels caused by operator error. It uses the 2B compressor to control excessive levels, so it more forgiving than the LOOKAHEAD presets, which offer only peak limiting.

**SOFT KNEE 5B; SOFT KNEE 2B:** These presets are "zeroed-out" starting points for *mastering applications*, particularly where soft knee compression is desired. *These presets are not designed to be used without being manually tweaked to comple-*

FACTORY PROGRAMMING PRESETS (PROTECTION; AGC)		
Preset Names	Source Preset	Normal Less-More
AGC+50us LIMITER	AGC+50us LIMITER	5.0
AGC+75us LIMITER	AGC+75us LIMITER	5.0
AGC+FLAT LIMITER	AGC+FLAT LIMITER	5.0
LOOK-AHEAD LIMITER	LOOK-AHEAD LIMITER	1.0
PROTECT	PROTECT	1.0
SOFT KNEE 2B	SOFT KNEE 2B	5.0
SOFT KNEE 5B	SOFT KNEE 5B	5.0

Table 3-1: Protection and AGC Presets

*ment the program material being processed.*

*See Using the 6300 for Production and Mastering starting on page 3-72.*

*We strongly recommend using 6300 PC Remote to adjust these presets. Many of the important controls (like the KNEE and RATIO controls) are accessible only from PC Remote and not from the 6300's front panel.*

These presets are phase-linear. They set all equalization flat and turn off the AGC. The multiband compressor (2-band or 5-band) is set to supply a very soft-knee compression characteristic with approximately 5-10 dB of gain reduction. The ratio for a given compressor starts out at 1:1 and ends up at infinity:1 when the input level is 20 dB above threshold.

Mastering engineers will certainly want to adjust the compression thresholds and band coupling to complement the program material. The ratio and knee controls are separately adjustable for each band's compressor. For example, one might want to use a low ratio and soft knee in bands 1-4 while using a higher ratio and/or harder knee in band 5 (for de-essing).

The 6300's powerful equalization section is, of course, also available. Additionally, these presets set the look-ahead limiter drive control conservatively, which ensures highest quality. However, the 6300's look-ahead limiter can be driven quite hard without objectionable side effects, so the 6300 can create competitively loud masters.

## Radio-Style Presets

The presets (*Table 3-2* on page 3-26) have been named similarly to their radio counterparts in Orban's OPTIMOD-FM 8400 and 8500. The basic audio texture of corresponding 6300 and 8500 presets (heard through the 8500's digital radio output) is similar, although the 6300 will tend to have 1-2 dB more bass. In addition, all 6300 presets have the stereo enhancer turned off to reduce potential codec stereo encoding artifacts.

If you wish to reduce the bass, set the Band 1 and/or Band 2 compression thresholds lower to taste. Then save your work as a User Preset.

The texture of the corresponding 6300 and Optimod-FM 8500 presets is quite similar, although the 6300 presets will usually have a less restricted high frequency sound because the 6300 performs no high frequency limiting other than that created by gain reduction in Band 5 in the 5-band presets.

Unlike the presets in Orban's FM processors, no 6300 preset uses phase rotation. Therefore, if you use the 6300 to process the main digital channel in HD Radio, some care must be applied in cross fading to avoid momentary audible comb filtering because of the different phase responses of the analog and digital channels. In practice, this means that the cross-fade should be quite fast—perhaps 50 milliseconds.

Broadcasters using Orban's Optimod-FM 8300, 8400, or 8500 will ordinarily use these processors' HD FM digital outputs to feed the digital channel in an IBOC transmission. This eliminates any potential comb filtering be-

cause both analog and digital outputs have identical amounts of phase rotation.

Of course, if the 6300 is used to process a secondary channel in HD Radio, there is no need to worry about smoothness of crossfades. This is an excellent application for this product.

**CLASSICAL:** As their names imply, the **CLASSICAL 5-BAND** and **CLASSICAL 2-BAND** presets are optimized for classical music, gracefully handling recordings with very wide dynamic range and sudden shifts in dynamics. The 5-band version uses heavy inter-band coupling to prevent large amounts of automatic re-equalization, which could otherwise cause unnatural stridency and brightness in strings and horns and which could

RADIO-STYLE PRESETS		
Preset Names	Source Preset	Normal Less-More
CLASSICAL-2 BAND	CLASSICAL-2 BAND	5.0
CLASSICAL-2B SFTKN	CLASSICAL-2B SFTKN	5.0
CLASSICAL-2B+AGC	CLASSICAL-2B+AGC	5.0
CLASSICAL-5 BAND	CLASSICAL-5 BAND	5.0
CLASSICAL-5B+AGC	CLASSICAL-5B+AGC	5.0
COUNTRY-LIGHT	ROCK-LIGHT	7.0
COUNTRY-MEDIUM	ROCK-SMOOTH	7.0
CRISP	CRISP	9.5
DANCE ENERGY	DANCE ENERGY	9.0
EDGE	EDGE	10.0
FOLK-TRADITIONAL	ROCK-SOFT	7.0
GOLD	GOLD	9.5
GREGG	GREGG	9.5
GREGG OPEN	GREGG OPEN	9.5
IMPACT	IMPACT	9.5
INSTRUMENTAL	JAZZ	7.0
JAZZ	JAZZ	7.0
LOUD+SLAM	LOUD+SLAM	9.0
LOUD-BIG	LOUD-BIG	9.0
LOUD-FAT	LOUD-FAT	7.0
LOUD-HOT	LOUD-HOT	8.5
LOUD-HOT+BASS	LOUD-HOT+BASS	9.5
LOUD-PUNCHY	LOUD-PUNCHY	9.0
NEWS-TALK	NEWS-TALK	7.0
ROCK-DENSE	ROCK-DENSE	7.0
ROCK-LIGHT	ROCK-LIGHT	7.0
ROCK-MEDIUM	ROCK-MEDIUM	7.0
ROCK-MEDIUM+LOW BASS	ROCK-MEDIUM+LOW BASS	7.0
ROCK-MEDIUM+MID-BASS	ROCK-MEDIUM+MID-BASS	7.0
ROCK-OPEN	ROCK-OPEN	7.0
ROCK-SOFT	ROCK-SOFT	8.5
SMOOTH JAZZ	SMOOTH JAZZ	9.0
SPORTS	SPORTS	7.0
URBAN-HEAVY	URBAN-HEAVY	7.0
URBAN-LIGHT	URBAN-LIGHT	7.0
WMA MUSIC	WMA MUSIC	9.5
WMA NEWS-TALK	WMA NEWS-TALK	7.0

Table 3-2: Radio-Style Presets



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pump up very low frequency rumble in live recording venues.

The 5-band preset defeats the AGC, using only the 5-band compressor for gain reduction. It also defeats phase rotation to ensure the most transparent 5-band sound available.

CLASSICAL-5B+AGC uses the AGC set for 2:1 compression ratio. Because of the AGC, it affects more of the total dynamic range of the recording than does the CLASSICAL-5 BAND preset. However, the AGC provides extremely smooth and unobtrusive compression because of the gentle ratio and window gating. This preset uses the 5-band compressor very lightly with a fast release time as a peak limiter. The AGC does almost all of the compression.

There is also a corresponding 2-band preset called CLASSICAL-2B+AGC. Even more transparent, “purist” classical processing is available from this preset, which is phase-linear and which preserves the spectral balance of the original material as much as possible. However, if you need a bit more automatic re-equalization than the CLASSICAL 2-BAND preset provides, use the CLASSICAL 5-BAND preset.

CLASSICAL-2B SFTKN (Classical using 2-Band Soft-Knee Compression) defeats the AGC and exploits the 6300’s soft-knee 2-band compression. Quiet material is gently compressed with a very low compression ratio. The compression ratio increases as the source material gets louder (see Figure 3-2 on page 3-53). Very quiet material is typically amplified by 10 dB. This level-dependent compression ratio provides very smooth, subtle compression.

Because the CLASSICAL presets preserve a significant amount of the dynamic range present in the source material (including speech), it is wise to use a separate microphone processor to ensure appropriate voice/music balance.

**COUNTRY:** The COUNTRY-MEDIUM preset uses the ROCK-SMOOTH source preset. It has a gentle bass lift and a mellow, easy-to-listen-to high end, along with enough presence energy to help vocals to stand out. The COUNTRY-LIGHT preset uses the ROCK-LIGHT source preset. Modern country broadcasters might also find ROCK-MEDIUM or ROCK-OPEN useful if they want a brighter, more up-front sound.

**CRISP:** CRISP provides a bright upper midrange sound by emphasizing frequencies around 6 kHz. It is a loud preset that is appropriate for mass-appeal music formats. It has the same bass texture as the IMPACT presets.

**DANCE ENERGY:** This preset is designed to preserve the punch and slam in dance music percussion (such as the beater click in kick drums). It is loud and has a bright high frequency texture. As LESS-MORE is turned down, this preset get quieter, yet punchier.

**EDGE:** This preset is designed for hit music broadcasters who prefer extremely punchy bass to fastidious distortion control. It is loud and has a bright high frequency texture.

**FOLK / TRADITIONAL:** FOLK / TRADITIONAL is an alias for the ROCK-SOFT preset. It assumes that the recordings are of relatively recent vintage and require relatively subtle processing.

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If the recordings you play are inconsistent in texture and equalization, you may prefer the ROCK-SMOOTH or ROCK-LIGHT presets.

**GOLD:** GOLD is loud and “hi-fi”-sounding while still respecting the limitations and basic flavor of the recordings from the era of the 1950s through 1970s.

For example, we do not attempt to exaggerate high frequency energy in the GOLD preset. The highs in recordings of this era are often noisy, distorted, or have other technical problems that make them unpleasant sounding when the processor over-equalizes them in an attempt to emulate the high frequency balance of recently recorded material.

**GREGG:** GREGG and GREGG OPEN all use a 200 Hz band1/band2 crossover frequency to achieve a bass sound similar to the classic 5-band Gregg Labs FM processors designed by Orban’s Vice President of New Product Development, Greg Ogonowski. Dynamically, these presets produce a slight increase in bass energy below 100 Hz and a decrease of bass energy centered at 160 Hz. This bass sound works particularly well with speakers having good bass response.

In terms of loudness, midrange texture, and HF texture, these presets are similar to the LOUD-HOT+BASS presets.

**IMPACT:** IMPACT is intended for CHR and similar formats where attracting a large audience (maximizing cume) is more important than ensuring long time-spent-listening. This is a loud, bright, “major-market” preset that has a great deal of presence energy to cut through on lower-quality speakers.

Its sound changes substantially as the LESS-MORE control is turned down—fast peak limiting decreases while bass punch and transparency improve. Therefore, exploring various Less-More settings is worthwhile with IMPACT, because, for many circumstances, this preset will be “over the top” if it is not turned down with Less-More.

**INSTRUMENTAL:** An alias for the JAZZ preset.

**JAZZ:** JAZZ is specifically tailored toward broadcasters that play mostly instrumental music, particularly classic “hard” jazz (Coltrane, Mingus, Monk, etc.). It is a quiet preset with a very clean, mellow high end to prevent stridency on saxes and other horns. It preserves much of the qualities of the original recordings, doing light re-equalization. The preset produces very low listening fatigue, so it is a good choice for broadcasters that want listeners to stay all day. Note that broadcasters programming “smooth jazz” should investigate the SMOOTH JAZZ preset, which is much louder and more “commercial”-sounding.

**LOUD:** There are several LOUD presets.

LOUD-HOT is very bright and present, with up-front vocals. Release time is medium.

LOUD-HOT+BASS is based on LOUD-HOT. It is tuned for the maximum amount of bass we could add without creating objectionable artifacts on some program material. For maximum punch, it uses the HARD bass clipper at higher LESS-MORE settings.

This amount of bass may be excessive with certain consumer systems (particularly “boom-boxes”) that already have substantial bass boost. Use it with care.

LOUD+SLAM is similar to LOUD-HOT+BASS, but uses HARD bass clipping mode with a SHAPE of 7.6, a BASS SLOPE of 18 dB/octave. It has modified tuning in the band-1 compressor (to control bass clipping distortion that could otherwise be introduced by Hard bass clipping). This preset provides slamming bass punch, which it trades off against bass cleanliness on certain program material. Because of the 18 dB/octave BASS SLOPE, its advantages will be appreciated most through radios with good low bass response.

LOUD-PUNCHY is the quietest of the “loud” preset family. It is designed for a bright, sizzling top end and very punchy lows. It is a good choice for broadcasters that feel that the LOUD-HOT presets are too aggressive, but that think that the ROCK presets are insufficiently loud for their market position.

LOUD-BIG compromises between LOUD-HOT and LOUD-HOT+BASS. It uses a 12 dB/octave bass equalizer slope to achieve punchy bass that still has enough mid-bass boost to help smaller radios.

LOUD-FAT has dramatic punch on percussive material and a very fat-sounding low end. It avoids overt bass distortion despite the full bass sound. It is slightly quieter than the loudest of the “loud” preset family.

**NEWS-TALK:** This preset is quite different from the others. It is based on the fast multiband release time setting so it can quickly perform automatic equalization of substandard program material, including telephone. It is useful for creating a uniform, intelligible sound from widely varying source material, particularly source material that is “hot from the field” with uncontrolled quality.

**SPORTS:** Similar to NEWS-TALK except the AGC Release (AGC Release Time) is slower and the Gate Thresh (Gate Threshold) is higher. This recognizes that most sports programming has very low signal-to-noise ratio due to crowd noise and other on-field sounds, so the preset does not pump this up as the NEWS-TALK preset would tend to do.

**ROCK:** ROCK-DENSE, ROCK-MEDIUM, and ROCK-OPEN are appropriate for general rock and contemporary programming. They provide a bright high end and punchy low end (although not as exaggerated as the URBAN presets). A midrange boost provides enough presence energy to ensure that vocals stand out. A modest amount of high frequency coupling (determined by the Band 3>4 Coupling setting) allows reasonable amounts of automatic HF equalization (to correct dull program material), while still preventing exaggerated frequency balances and excessive HF density. Dense, medium, and open refer to the compression density, which is determined by the release time settings in the AGC and multiband compressor sections.

ROCK-LIGHT has an open sound with little audible compression and less brightness than the first three presets. It is a compromise between ROCK-OPEN and ROCK-SOFT.

ROCK-SOFT has a mellow, easy-to-listen-to high frequency quality that is designed for female-skewing formats. It is also a candidate for "Quiet Storm" and "Love Songs" light rock or light urban formats.

ROCK-SMOOTH has the same mellow, easy-to-listen-to high frequency quality as ROCK-SOFT, but with more density. Again, it is a good choice for female-skewing formats, but where you need more compression and density than you get with ROCK-SOFT.

For Contemporary Hit Radio (CHR) we recommend the ROCK-DENSE or ROCK-MEDIUM versions. In competitive situations, you may need to use LOUD-HOT (you can use LESS-MORE to get it even louder) or even LOUD-HOT+BASS or IMPACT. However, the "rock" presets are somewhat cleaner and are therefore more likely to encourage longer times spent listening than are the "loud" presets.

For Album-Oriented Rock (AOR) we recommend the ROCK-MEDIUM or ROCK-OPEN versions, although you might prefer the more conservative ROCK-LIGHT or ROCK-SMOOTH versions.

ROCK-MEDIUM+LOWBASS is an open-sounding preset with a lot of bass punch. Its 5-band Release control is set to Slow2 so that the sound is relaxed and not at all busy. At the same time, the preset is competitively loud. It is an excellent choice for "adult contemporary" and "soft rock" formats where long time-spent-listening is desired.

**SMOOTH JAZZ:** This preset is designed for commercial broadcasters playing smooth jazz (Kenny G., etc.). It is a loud preset that is designed to prevent stridency with saxes and other horns. This preset is based on a custom 8400 preset that has been used successfully by a major-market smooth jazz station with very good ratings. However, if the loudness/density tradeoff is not to your taste, use LESS-MORE to turn it down, producing lower loudness with less density.

**WMA MUSIC:** This preset is based on GREGG SLOW but has been edited to minimize artifacts in the Windows Media Audio V9 codec when operated at bitrates below 64 kbps. See *Processing for Low Bit Rate Codecs* on page 3-5.

**WMA NEWS-TALK:** This preset is based on NEWS-TALK but has been edited to minimize artifacts in the Windows Media Audio V9 codec when operated at bitrates below 64 kbps.

**URBAN:** There are two URBAN (Rap) presets: HEAVY and LIGHT. These are similar to ROCK-MEDIUM and ROCK-OPEN but with a different bass sound. They use the 3-pole (18 dB/octave) shape on the bass equalizer. URBAN-HEAVY is appropriate for Urban, Rap, Hip-Hop, Black, R&B, Dance and other similar formats. URBAN-LIGHT is appropriate for light R&B formats. Highly competitive Urban broadcasters might also use LOUD-HOT+BASS or LOUD+SLAM, modified versions of LOUD-HOT that maximize bass punch.

## Sound-for-Picture Presets

Sound-for-picture preset names all begin with “TV” or “TVA.” Most of these presets have the CBS Loudness Controller’s threshold set to 0 dB and the BS.1770 safety limiter’s threshold set to 0 LU. These settings constrain loudness to a level consistent with the active TARGET LOUDNESS value (see *Loudness Control* on page 3-11). As discussed in *Loudness Control*, a BS1770 LDNS THR of 0 LU can make some material too quiet because of limitations in the BS.1770 algorithm. We recommend setting BS1770 LDNS THR to +2 LU or higher. This requires editing the factory preset and saving it as a User Preset.

- The TVxxx presets are tuned to work harmoniously with Dolby Dialnorm metadata in Dolby Digital transmission channels. See step 11 on page 2-27.
- The TVAxxx are tuned to produce the same loudness as the general purpose TV presets in Orban’s processors for analog aural carriers, such as Optimod-TV 8282 and 8382. Target Loudness is set to –17 dB, which facilitates this loudness match. See step (12.D) on page 2-33.

**TV 2B-GEN PURPOSE (TV Two-Band General Purpose):** This preset accommodates most dramatic programming (particularly older material), providing gentle gain control that limits dynamic range to a level that provides the general audience with consistently intelligible dialog. It sounds very similar to Orban’s analog OPTIMOD-TV (Model 8182A) when that unit is adjusted for “General” programming according to the instructions in its operating manual. This preset retains the spectral balance of its input as much as possible. TV 2B-GEN PURPOSE is not the best choice for live news, sports, or films with optical soundtracks. The Five-Band presets (see below) can au-

Preset Names	Normal Less-More
TV 2B-GEN PURP -LC	5.0
TV 2B-GEN PURPOSE	5.0
TV 5B-GEN PUR W NR	5.0
TV 5B-GEN PURPOSE	5.0
TV 5B-GEN PURP -LC	5.0
TV 2B-DRAMA	5.0
TV 5B-DRAMA	5.0
TV 5B-DRAMA COUPLD	5.0
TV 5B-NEWS	5.0
TV 5B-OPTICAL FILM	5.0
TV 5B-SPORTS	5.0
TVA 2B-GEN PURP -LC	5.0
TVA 2B-GEN PURPOSE	5.0
TVA 5B-GEN PUR W NR	5.0
TVA 5B-GEN PURPOSE	5.0
TVA 5B-GEN PURP -LC	5.0
TVA 2B-DRAMA	5.0
TVA 5B-DRAMA	5.0
TVA 5B-DRAMA COUPLD	5.0
TVA 5B-NEWS	5.0
TVA 5B-OPTICAL FILM	5.0
TVA 5B-SPORTS	5.0

Table 3-3: Factory Programming Presets (Sound-for-picture)

tomatically equalize such program material when its spectral balance is inappropriate and can also apply single-ended dynamic noise reduction.

These presets defeat the AGC and do all gain riding with the two-band compressor, which is set for reverse exponential release. This release characteristic does not significantly increase the density of material whose level is well controlled while still performing fast correction of levels that are too low. The Loudness Controller is active, so this preset controls loudness tightly.

For modern dramatic programming, you may prefer the TV 5B-DRAMA preset, which preserves more of the mixes' original dynamic range.

**TV 2B GEN PURP –LC** (TV Two-Band General Purpose without Loudness Controller): This preset is the same as TV 2B-GEN PURPOSE except the Loudness Controller is turned off and the MB DRIVE control is backed off by 3 dB to achieve approximately the same loudness as TV 2B-GEN PURPOSE. Because the Loudness Controller is inactive, this preset has more dynamic punch than TV 2B-GEN PURPOSE, but the loudness of highly processed material (like commercials with a lot of midrange boost) may be objectionably loud.

**TV 5B-GEN PUR W/NR** (TV Five-Band General Purpose with Noise Reduction): provides effective dynamic range control and "automatic re-equalization" of most dramatic material. It uses the Loudness Controller to control loudness tightly. It applies single-ended noise reduction to the material, which will reduce unwanted noise like hiss, hum, or stage rumble. However, it will also reduce ambience. If the program material is carefully produced (as are most contemporary feature-film soundtracks), you may wish to use TV 5B-GEN PURPOSE (which does not apply noise reduction), or, if the material is so well produced that it would not benefit from "automatic re-equalization," use TV 2B-GEN PURPOSE.

**TV 5B-GEN PURPOSE** (TV Five-Band General Purpose without Noise Reduction): is identical to TV 5B-GEN PUR W/NR except that the single-ended dynamic noise reduction system is off.

**TV 5B GEN PURP –LC** (TV Five-Band General Purpose Without Loudness Controller): This preset is the same as TV 5B-GEN PURPOSE except the Loudness Controller is turned off and the MB DRIVE control is backed off by 3 dB to achieve approximately the same loudness as TV 5B-GEN PURPOSE. Because the Loudness Controller is inactive, this preset has more dynamic punch than TV 5B-GEN PURPOSE. The five-band processing makes the audio spectrum more consistent than does TV 2B-GEN PURP –LC, so TV 5B-GEN PURP –LC controls loudness better than TV 2B-GEN PURP –LC even though the Loudness Controller is inactive.

**TV 2B-DRAMA** (TV Two-Band Drama): uses the 8585's soft knee compression and AGC RATIO control to regulate loudness while still preserving some of the dynamic range of the original mix. This preset sounds very smooth and natural with modern sound mixes for scripted dramas. The 8585's Loudness Controller is exploited to limit loudness to a maximum level. Typically, the Loudness Controller will produce 1 to 3 dB of gain reduction with dialog at normal levels and may produce as much as 12 dB of gain reduction with very loud sound effects or commercials.

Because it preserves some dynamic range, it is important that the input level to the 8585 not be too far awry. Usually, network feeds will meet this requirement but local playout of older material that has not been checked for loudness by a long-term Loudness Level meter like ITU-R BS.1770 may not work well. Use one of the general-purpose presets for this kind of material.

**TV 5B-DRAMA** (TV Five-Band Drama): like its 2B counterpart, uses the 8585's soft knee compression and AGC RATIO control to regulate loudness while still preserving some of the dynamic range of the original mix. In addition, the five-band compressor automatically re-equalizes material that may otherwise sound spectrally unbalanced. The center channel compressor effectively de-esses dialog without punching holes in the remaining channels. Coupling between the center channel and remaining channels allows the center channel's level to be boosted automatically by as much as 3 dB with respect to the other channels if this is needed to help intelligibility.

We prefer this preset to TV 2B-DRAMA because of its effective, unobtrusive de-essing and because it is more resistant to spectral gain intermodulation, which is program material in one frequency range's audibly pumping material in a different range.

Like its two-band counterpart, this preset is sensitive to input levels because its compression ratio is finite. It also fully exploits the Loudness Controller, which usually shows slight gain reduction with dialog at normal levels.

**TV 5B-DRAMA COUPLD** (TV Five-Band Drama Coupled): is similar to TV 5B DRAMA but uses more interband band coupling in the five-band compressor and a slower multi-band compressor release time so it performs less automatic re-equalization of the program material. This is an alternative to TV 2B DRAMA that de-esses more effectively.

**TV 5B-NEWS** (TV Five-Band News): rides gain more quickly than the general-purpose presets. Its AGC release time is faster, so it will bring up low-level material more quickly. It is designed for live news programs where input levels may be quite unpredictable. It also automatically re-equalizes substandard audio (which is quite common in live news broadcasts). The dynamic single-ended noise reduction is turned on.

**TV 5B-SPORTS** (TV Five-Band Sports): is similar to TV 5B-NEWS, except the AGC release time is slower to resist pumping up crowd noise.

**TV 5B-OPTICAL FILM** (TV Five-Band Optical Film): is designed to make the best of the low-quality audio provided with optical film sound tracks (particularly 16mm). The gate threshold is quite high to avoid pumping up hiss, thumps, and other optical artifacts. The threshold of the single-ended dynamic noise reduction system is also high so that this system can reduce artifacts as far as possible. Release times are slow, because we assumed that material encoded on optical film has already been carefully level-controlled to accommodate the very limited dynamic range of the medium, so little gain riding is therefore required from the 8585.

## Equalizer Controls

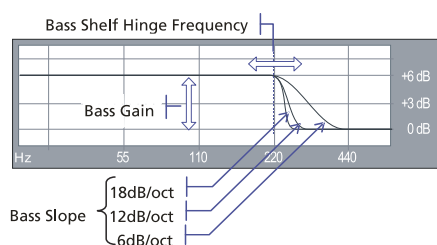
The table summarizes the equalization controls available for the 5-band structure. (Note that “advanced” controls are accessible only from 6300 PC Remote software.)

Except for BRILLIANCE and DJ BASS, these equalization controls are common to both the 2-band and 5-band structures. The equalizer is located between the AGC and multiband compressor sections of both structures.

Any equalization that you set will be automatically stored in any User Preset that you create and save. For example, you can use a User Preset to combine an unmodified Factory Programming Preset with your custom equalization. Of course, you can also modify the Factory Preset (with Basic Modify, Full Modify, or Advanced Modify) before you create your User Preset.

In general, you should be conservative when equalizing modern, well-recorded program material. This is particularly true with general-purpose video programming.

Except for BASS GAIN, most of the factory presets use less than 3 dB of equalization.



**Bass Shelf Controls**, the 5-band structure's low bass equalization controls, are designed to add punch and slam to rock and urban music. They provide a parametric shelving equalizer with control over gain, hinge frequency, and slope (in dB/octave).

**BASS FREQ** sets the frequency where shelving starts to take effect.

**BASS GAIN** sets the amount of bass boost (dB) at the top of the shelf.

**BASS SLOPE** sets the slope (dB/octave) of the transition between the top and bottom of the shelf.

The moderate-slope (12 dB/octave) shelving boost achieves a bass boost that is more audible on smaller receivers, but which can sound boomier on high-quality receivers and home theater systems. The steep-slope (18 dB/octave) shelving boost creates a solid, punchy bass from the better consumer receivers and home theater systems with decent bass response. The 6 dB/octave shelving boost is like a conventional tone control and creates the most mid-bass boost, yielding a “warmer” sound. Because it affects the mid-bass frequency range, where the ear is more sensitive than it is to very low bass, the 6 dB/octave slope can create more apparent bass level at the cost of bass “punch.”

There are no easy choices here; you must choose the characteristic you want by identifying your target audience and the receivers they are most likely to be using. Often, you will not want to use any boost at all for general-purpose sound-for-picture programming because this can exaggerate rumble and other low frequency noise. Additionally, large amounts of boost will increase the gain reduction in the lowest band of the multiband compressor, which may have the effect of reducing some



frequencies below 100 or 200 Hz (depending on the setting of the B1/B2 XOVER control). So be aware the large fixed bass boosts may have a different effect than you expect because of the way that they interact with the multiband compressor.

On the other hand, stations specializing in pop music programming will usually want to employ some bass boost to maintain the punch of this programming, particularly if urban or rap music is a significant part of the music mix.

**Low Frequency Parametric Equalizer** is a specially designed equalizer whose boost and cut curves closely emulate those of a classic Orban analog parametric equalizer with conventional bell-shaped curves (within  $\pm 0.15$  dB worst-case). This provides warm, smooth, "analog-sounding" equalization.

LF FREQ determines the center frequency of the equalization, in Hertz. Range is 20-500Hz.

LF GAIN determines the amount of peak boost or cut (in dB) over a  $\pm 10$  dB range.

LF WIDTH determines the bandwidth of the equalization, in octaves. The range is 0.8-4.0 octaves. If you are unfamiliar with using a parametric

Equalizer Controls			
Group	Basic / Full Modify Name	Advanced Name	Range
Bass Shelf	BASS FREQ	Bass Frequency	80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 270, 290, 310, 330, 350, 380, 410, 440, 470, 500Hz
	BASS GAIN	Bass Gain	0 ... 12 dB
	BASS SLOPE	Bass Slope	6,12,18 dB / Oct
Low	LF FREQ	Low Frequency	20 ... 500 Hz
	LF GAIN	Low Gain	-10.0 ... +10.0 dB
	LF WIDT	Low Width	0.8 ... 4 octaves
Mid	MID FREQ	Mid Frequency	250 ... 6000 Hz
	MID GAIN	Mid Gain	-10.0 ... +10.0 dB
	MID WIDTH	Mid Width	0.8 ... 4 octaves
High	HIGH FREQ	High Frequency	1.0 ... 15.0 kHz
	HIGH GAIN	High Gain	-10.0 ... +10.0 dB
	HIGH WIDTH	High Width	0.8 ... 4 octaves
Brilliance	BRILLIANCE	BRILLIANCE	0.0 ... +6.0 dB
HF Enhancer	HF ENH	High Frequency Enhancer	0 ... 15
DJ Bass	DJ BASS	DJ Bass Boost	Off, 1... +10 dB
Highpass Filter	HIGHPASS	Highpass Filter	Off, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 170, 200 Hz
Lowpass Filter	LOWPASS	Lowpass Filter	10 ... 20 kHz; 1 kHz steps
Phase Rotate	PH ROTATE	Phase Rotator	In, Out

Table 3-4: 5-band Equalization Controls

equalizer, 1.5 octaves is a good starting point. These curves are relatively broad because they are designed to provide overall tonal coloration, instead of notching out small areas of the spectrum.

The LF parametric can be used in the mid-bass region (100-300Hz) to add “warmth” and “mellowness” to the sound when boosting. When cutting, it can remove a “woody” or “boxy” sound.

The equalizer, like the classic Orban analog parametrics such as the 622B, has constant “Q” curves. This means that the cut curves are narrower than the boost curves. The width (in octaves) is calibrated with reference to 10 dB boost. As you decrease the amount of EQ gain (or start to cut), the width in octaves will decrease. However, the “Q” will stay constant.

“Q” is a mathematical parameter that relates to how fast ringing damps out. (Technically, we are referring to the “Q” of the poles of the equalizer transfer function, which does not change as you adjust the amount of boost or cut.)

The curves in the 6300’s equalizer were created by a so-called “minimax” (“minimize the maximum error” or “equal-ripple”) IIR digital approximation to the curves provided by the Orban 622B analog parametric equalizer. Therefore, unlike less sophisticated digital equalizers that use the “bilinear transformation” to generate EQ curves, the shapes of the 6300’s curves are not distorted at high frequencies.

**Midrange Parametric Equalizer** is a parametric equalizer whose boost and cut curves closely emulate those of an analog parametric equalizer with conventional bell-shaped curves.

MID\_FREQ determines the center frequency of the equalization, in Hertz. Range is 250-6000Hz.

MID\_GAIN determines the amount of peak boost or cut (in dB) over a  $\pm 10$  dB range.

MID\_WIDTH determines the bandwidth of the equalization, in octaves. The range is 0.8-4.0 octaves. If you are unfamiliar with using a parametric equalizer, 1 octave is a good starting point.

With 5-band presets, the audible effect of the midrange equalizer is closely associated with the amount of gain reduction in the midrange bands. With small amounts of gain reduction, it boosts power in the presence region. This can increase the loudness of such material substantially. As you increase the gain reduction in the midrange bands (by turning the MULTIBAND DRIVE (Multiband Drive) control up), the MID GAIN control will have progressively less audible effect. The compressor for the midrange bands will tend to reduce the effect of the MID frequency boost (in an attempt to keep the gain constant) to prevent excessive stridency in program material that already has a great deal of presence power. Therefore, with large amounts of gain reduction, the density of presence region energy will be increased more than will the level of energy in that region. Because the 3.7 kHz band compressor is partially coupled to the gain reduction in the 6.2 kHz band in most presets, tuning MID\_FREQ to 2-4 kHz and turning up the MID GAIN control will decrease energy in the 6.2 kHz band—you will be increasing the gain reduction in both the 3.7 kHz and 6.2 kHz

bands. You may wish to compensate for this effect by turning up the BRILLIANCE control.

With 2-band presets, the midrange equalizer will behave much more as you might expect because the 2-band structure cannot automatically re-equalize midrange energy. Instead, increasing midrange energy will moderately increase the Master band's gain reduction.

Use the mid frequency equalizer with caution. Excessive presence boost tends to be audibly strident and fatiguing. Moreover, the sound quality, although loud, can be very irritating. We suggest a maximum of 3 dB boost, although 10 dB is achievable. In some of our factory music presets, we use a 3 dB boost at 2.6 kHz to bring vocals more up-front.

**High Frequency Parametric Equalizer** is an equalizer whose boost and cut curves closely emulate those of an analog parametric equalizer with conventional bell-shaped curves.

HIGH FREQ determines the center frequency of the equalization, in Hertz. The range is 1-15 kHz

HIGH GAIN determines the amount of peak boost or cut over a  $\pm 10$  dB range.

HIGH WIDTH determines the bandwidth of the equalization, in octaves. The range is 0.8-4.0 octaves. If you are unfamiliar with using a parametric equalizer, one octave is a good starting point.

Excessive high frequency boost can exaggerate hiss and distortion in program material that is less than perfectly clean. We suggest no more than 4 dB boost as a practical maximum, unless source material is primarily from high-quality digital sources. In several of our presets, we use this equalizer to boost the upper presence band (4.4 kHz) slightly, leaving broadband HF boost to the BRILLIANCE and/or HF ENHANCE controls.

**Brilliance** controls the drive to Band 5 in the 5-Band structure only. (This control is nonfunctional in the 2-Band structure.) The Band 5 compressor/limiter dynamically controls this boost, protecting the final limiter from excessive HF drive. We recommend a maximum of 4 dB of BRILLIANCE boost and most people will prefer substantially less.

**DJ Bass** ("DJ Bass Boost") control determines the amount of bass boost produced on some male voices. In its default OFF position, it causes the gain reduction of the lowest frequency band to move quickly to the same gain reduction as its nearest neighbor when gated. This fights any tendency of the lowest frequency band to develop significantly more gain than its neighbor when processing voice because voice will activate the gate frequently. Each time it does so, it will reset the gain of the lowest frequency band so that the gains of the two bottom bands are equal and the response in this frequency range is flat. The result is natural-sounding bass on male voice. This is particularly desirable for most sound-for-picture programming.

If you like a larger-than-life, “chesty” sound on male voice, set this control away from OFF. When so set, gating causes the gain reduction of the lowest frequency band to move to the same gain reduction (minus a gain offset equal to the numerical setting of the control) as its nearest neighbor when gated. You can therefore set the maximum gain difference between the two low frequency bands, producing considerable dynamic bass boost on voice. This setting might be appropriate for news and sports.

The difference will never exceed the difference that would have otherwise occurred if the lowest frequency band were gated independently. If you are familiar with older Orban processors like the 8282, this is the maximum amount of boost that would have occurred if you had set their **DJ BASS BOOST** controls to ON.

The amount of bass boost will be highly dependent on the fundamental frequency of a given voice. If the fundamental frequency is far above 100Hz, there will be little voice energy in the bottom band and little or no audio bass boost can occur even if the gain of the bottom band is higher than the gain of its neighbor. As the fundamental frequency moves lower, more of this energy leaks into the bottom band, and you hear more bass. If the fundamental frequency is very low (a rarity), there will be enough energy in the bottom band to force significant gain reduction, and you will hear less bass than if the fundamental frequency were a bit higher.

This control is only available in the 5-band structure.

If the **GATE THRESH** (Gate Threshold) control is turned OFF, the **DJ BASS** boost setting is disabled.

**HF Enhance** (“High Frequency Enhancer”) is a program-adaptive 6 dB/octave shelving equalizer with a 4 kHz turnover frequency. It constantly monitors the ratio between high frequency and broadband energy and adjusts the amount of equalization in an attempt to make this ratio constant as the program material changes. It can therefore create a bright, present sound without over-equalizing material that is already bright.

**Highpass Filter** determines if a sweepable 18 dB/octave highpass filter will be placed in-circuit before other processing. This filter is useful for reducing low frequency noise, particularly when the 6300 is being used for production or mastering.

**Lowpass Filter** control sets the bandwidth (and therefore the amount of high frequency signal the 6300 passes) from 10 kHz to 20 kHz. The lowpass filter can replace any anti-aliasing filters in downstream equipment. Set the filter to 20 kHz (full bandwidth) for downstream equipment with sample rates of 44.1 or 48 kHz. Set the filter to 15 kHz for 32 kHz sample rate. For other sample rates, set the filter so that it is as close as possible to 45% of the sample rate without exceeding 45%.

This setting is unique to the preset in which it resides. Regardless of its setting, the 6300 will not permit the system bandwidth to exceed the bandwidth set by the **MAX LOWPASS FILTER** parameter located I/O Setup.

**Phase Rotator** determines if the phase rotator will be in-circuit. The purpose of the phase rotator is to make voice waveforms more symmetrical. Because it can slightly reduce the clarity and definition of program material, we recommend leaving it OUT

unless program material is mainly speech, where it may result in cleaner sound because it can substantially reduce the amount of gain reduction that the 6300's look-ahead limiter produces on speech waveforms.

## Stereo Enhancer Controls

You can operate the stereo enhancer in one of two modes or "styles." The first is called L-R EXPAND and emulates the Orban 222 analog stereo enhancer, while the second mode, called DELAY, emulates a popular enhancer from another manufacturer that adds a delayed version of the L-R signal to the original L-R to create stereo enhancement. (See *Stereo Enhancement* on page 3-9 for more information.)

Both modes have gating that operates under two conditions.

- The two stereo channels are close to identical in magnitude and phase.  
In this case, the enhancer assumes that the program material is actually mono and thus suppresses enhancement to prevent the enhancement from exaggerating the undesired channel imbalance.
- The ratio of L-R / L+R of the enhanced signal tries to exceed the threshold set by the L-R / L+R Ratio Limit control.  
In this case, the enhancer prevents further enhancement in order to prevent excess L-R energy, which can increase multipath distortion.

The stereo enhancer has the following controls:

**Amount** sets the maximum spatial enhancement.

**Enhancer In / Out** bypasses the stereo enhancer. OUT is equivalent to setting the AMOUNT to 0.

**L-R / L+R Ratio Limit** sets the maximum amount of enhancement to prevent multipath distortion. However, if the original program material exceeds this limit with no enhancement, the enhancer will not reduce it.

**Diffusion** applies only to the DELAY enhancer. This control determines the amount of delayed L-R added to the original signal.

**Style** sets one of two stereo enhancer types: 222 or DELAY.

Stereo Enhancer Controls		
Basic / Full Modify Name	Advanced Name	Range
DEPTH	Depth	0 ... 10
DIFFUSION	Diffusion	Off, 0.3 ... 10.0
ENH AMT	Amount	0.0 ... 10.0
ENHANCER	In / Out	Out / In
RATIO LMT	Ratio Lim	70 ... 100%
STYLE	Style	L-R Expand / Delay

Table 3-5: Stereo Enhancer Controls

**Depth** sets the delay in the delay line. It applies only to the DELAY enhancer.

## AGC Controls

The AGC is common to the 2-band and 5-band structures.

Five of the AGC controls are common to the Full Modify and Advanced Modify screens, with additional AGC controls available in the Advance Modify screen, as noted in the following table. (Note that "advanced" controls are accessible only from 6300 PC Remote software.)

These controls are explained in detail below.

Each Factory Preset has a LESS-MORE control that adjusts loudness by altering the amount of dynamics processing. LESS-MORE simultaneously adjusts several of the dynamics processing controls to optimize the trade-offs between unwanted side effects.

If you wish, you may adjust the Advanced Modify parameters to your own taste. Always start with LESS-MORE to get as close to your desired sound as possible. Then edit the Advanced Modify parameters using the Advanced Modify screen, and save those edits to a User Preset.

**AGC** ("AGC Off / On") control activates or defeats the AGC.

It is usually used to defeat the AGC when you want to create a preset with minimal

AGC Controls		
Full Modify Name	Advanced Name	Range
AGC	AGC Off / On	Off / On
AGC B CPL	AGC Bass Coupling	Off, -12...0 dB
AGC DRIVE	AGC Drive	-10 ... 25 dB
AGC GATE	AGC Gate Threshold	Off, -44 ... -15 dB
AGC Matrix	AGC Matrix	L/R, sum/diff
AGC METR	AGC Meter Display	Master, Delta
AGC REL	AGC Master Release	0.5, 1.0, 1.5, 2 ... 20 dB / S
BassDeltaThr	Master Delta Threshold	-6.0 ... +6.0 dB
MaxDelta GR	Maximum Delta GR	0.0 ... 24.0, Off dB
MstrDeltaThr	AGC Crossover	Allpass, LinearNoDelay,
---	AGC Bass Attack	1 ... 10
---	AGC Bass Release	1 ... 10 dB/sec
---	AGC Bass Threshold	-12.0 ... 2.5 dB
---	AGC Idle Gain	-10 ... +10 dB
---	AGC Master Attack	0.2 ... 6
---	AGC Ratio	$\infty$ :1, 4:1, 3:1, 2:1
---	AGC Window Release	0.5 ... 20 dB
---	AGC Window Size	-25 ... 0 dB
---	Bass Delta Threshold	-6/0 ... +6.0 dB

Table 3-6: AGC Controls

processing (such as a CLASSICAL preset). The AGC is also ordinarily defeated if you are using a studio level controller (like Orban's 8200ST). However, in this case it is better to defeat the AGC globally in System Setup.

**AGC DRIVE** control adjusts signal level going into the slow dual-band AGC, therefore determining the amount of gain reduction in the AGC. This control also adjusts the "idle gain"—the amount of gain reduction in the AGC section when the structure is gated. (It gates whenever the input level to the structure is below the threshold of gating.)

The total amount of gain reduction in the 5-band structure is the sum of the gain reduction in the AGC and the gain reduction in the multiband compressor. The total system gain reduction determines how much the loudness of quiet passages will be increased (and, therefore, how consistent overall loudness will be). It is determined by the setting of the AGC DRIVE control, by the level at which the console VU meter or PPM is peaked, and by the setting of the MULTIBAND DRIVE (compressor) control.

**AGC REL** ("AGC Master Release") control provides an adjustable range from 0.5 dB/second (slow) to 20 dB/second (fast). The increase in density caused by setting the AGC RELEASE control to fast settings sounds different from the increase in density caused by setting the Multiband's MULTIBAND RELEASE control to FAST. You can trade the two off to produce different effects.

Unless it is purposely speeded-up (with the AGC RELEASE control), the automatic gain control (AGC) that occurs in the AGC prior to the multiband compressor makes audio levels more consistent without significantly altering texture. Then the multiband compression and associated bass clipper audibly change the density of the sound and dynamically re-equalize it as necessary (booming bass is tightened; weak, thin bass is brought up; highs are always present and consistent in level).

The various combinations of AGC and compression offer great flexibility:

- Light AGC + light compression yields a wide sense of dynamics, with a small amount of automatic re-equalization.
- Moderate AGC + light compression produces an open, natural quality with automatic re-equalization and increased consistency of frequency balance.
- Moderate AGC + moderate compression gives a more dense sound, particularly as the release time of the multiband compressor is sped up.
- Moderate AGC + heavy compression (particularly with a **FAST** multiband release time) results in a "wall of sound" effect, which may cause listener fatigue.
- Adjust the AGC (with the **AGC DRIVE** control) to produce the desired amount of AGC action, and then fine-tune the compression with the 5-band **structure's** controls.

**AGC GATE** ("AGC Gate Threshold") control determines the lowest input level that will be recognized as program by OPTIMOD 6300; lower levels are considered to be noise or background sounds and cause the AGC or multiband compressor to gate, effectively freezing gain to prevent noise breathing.

In sound for picture, the setting of the gate threshold controls are quite critical if you want the processing to be undetectable to the audience. If this control is set too low, then the 6300 will pump up quiet sounds such as ambience and underscoring to unnaturally high levels.

There are two independent silence-gating circuits in the 6300. The first affects the **AGC** and the second affects the **multiband compressor**. Each has its own threshold control.

*AGC Idle Gain* on page 3-43 explains how the AGC gate's no-signal gain is determined.

The multiband silence gate causes the gain reduction in bands 2 and 3 of the multiband compressor to move quickly to the average gain reduction occurring in those bands when the gate first turns on. This prevents obvious midrange coloration under gated conditions, because bands 2 and 3 have the same gain.

The multiband gate also independently freezes the gain of the two highest frequency bands (forcing the gain of the highest frequency band to be identical to its lower neighbor), and independently sets the gain of the lowest frequency band according to the setting of the DJ BASS boost control (in the Equalization screen). Thus, without introducing obvious coloration, the gating smoothly preserves the average overall frequency response "tilt" of the multiband compressor, broadly maintaining the "automatic equalization" curve it generates for a given piece of program material.

If the MB GATE THR (Gate Threshold) control is turned OFF, the DJ BASS control is disabled.

**AGC B CPL** ("AGC Bass Coupling") control clamps the amount of dynamic bass boost (in units of dB) that the AGC can provide. (In V1.0, the unit of measure was percent.)

The AGC processes audio in a master band for all audio above approximately 200 Hz and a bass band for audio below approximately 200 Hz. Starting with V1.1 software, the AGC Master and Bass compressor sidechains operate without internal coupling. The gain reduction in the Bass audio path is either the output of the Bass compressor sidechain or the output of the Master band sidechain. The AGC BASS COUPLING control sets the switching threshold. For example, if the AGC BASS COUPLING control is set to 4 dB and the master gain reduction is 10 dB, the bass gain reduction cannot decrease below 6 dB even if the gain reduction signal from the Bass compressor sidechain is lower. However, the audio path bass gain reduction can be larger than the master gain reduction without limit. In the previous example, the bass gain reduction could be 25 dB

The normal setting of the AGC BASS COUPLING control is 0 dB, which allows the AGC bass band to correct excessive bass as necessary but does not permit it to provide a dynamic bass boost.

Note that the operation of this control was changed in 6300 V1.1 software to work as explained above. You may have to tweak this control to achieve the same bass balance that you had previously with V1.0 software.



**AGC METR (“AGC Meter Display”)** determines what signal the front-panel AGC meter displays. MASTER displays the gain reduction of the Master (above-200 Hz) band. DELTA displays the difference between the gain reduction in the Master and Bass bands. Full-scale is 25 dB gain reduction.

Although it is located in the Full Modify screen (to make it easy for a preset developer to switch meter modes), this control is *not* part of the active preset and its setting is not saved in User Presets, unlike the other controls in the Full Modify screens. The meter mode always reverts to MASTER when the user leaves Full Modify.

## Advanced AGC Controls

The following AGC controls are available only in the 6300 PC Remote software.

**AGC Window Size** determines the size of the “target zone” window in the AGC. If the input level falls within this target zone, the AGC release time is set to the number specified by the AGC WINDOW RELEASE control. This is usually much slower than the normal AGC release; it essentially freezes the AGC gain. This prevents the AGC from building up density in material whose level is already well controlled. If the level goes outside the window, then the AGC switches to the release rate specified by AGC MASTER RELEASE so the AGC can still correct large gain variations quickly.

The normal setting for the AGC WINDOW SIZE is 3dB.

**AGC Window Release** (see AGC WINDOW SIZE above.)

**AGC Ratio** determines the compression ratio of the AGC. The compression ratio is the ratio between the change in input level and the resulting change in output level, both measured in units of dB.

The 6300 compressor can be operated at a compression ratio as low as 2:1. This can add a sense of dynamic range and is mostly useful for subtle fine arts formats like classical and jazz.

**AGC Bass Threshold** determines the compression threshold of the bass band in the AGC. It can be used to set the target spectral balance of the AGC.

As the AGC B CPL control is moved towards “100%,” the AGC BASS THRESHOLD control affects the sound less and less.

The interaction between the AGC BASS THRESHOLD control and the AGC B CPL control is a bit complex, so we recommend leaving the AGC BASS THRESHOLD control at its factory setting unless you have a good reason for readjusting it.

**AGC Idle Gain.** The “idle gain” is the target gain of the AGC when the silence gate is active. Whenever the silence gate turns on, the gain of the AGC slowly moves towards the idle gain.

The idle gain is primarily determined by the AGC DRIVE setting—a setting of 10 dB will ordinarily produce an idle gain of -10 dB (i.e., 10 dB of gain reduction). However, sometimes you may not want the idle gain to be the same as the AGC DRIVE set-

ting. The AGC IDLE GAIN control allows you to add or subtract gain from the idle gain setting determined by the AGC DRIVE setting.

You might want to do this if you make a custom preset that otherwise causes the gain to increase or decrease unnaturally when the AGC is gated. For example, to make the idle gain track the setting of the AGC DRIVE control, set the AGC IDLE GAIN control to zero. To make the idle gain 2 dB lower than the setting of the AGC DRIVE control, set the AGC IDLE GAIN control to -2.

**AGC Bass Attack** sets the attack time of the AGC bass compressor (below 200Hz).

**AGC Master Attack** sets the attack time of the AGC master compressor (above 200Hz).

**AGC Bass Release** sets the release time of the AGC bass compressor.

**AGC Matrix** allows you to operate the AGC in left/right mode or in sum / difference mode. Usually you will operate in left/right mode. However, sum / difference mode can give a type of stereo enhancement that is different from the enhancement modes offered in the 6300's built-in stereo enhancer. This will only work if you allow the two channels of the AGC to have different gains. To do this, set the AGC MAXDELTA GR control greater than zero.

**AGC Max Delta GR** determines the maximum gain difference permitted between the two channels of the AGC. Set it to "0" for perfect stereo coupling.

This control works the same regardless of whether the AGC operates in left/right or sum / difference **MATRIX** modes, in both cases controlling the maximum gain difference between the "channels." Depending on the Matrix mode setting, the "channels" will handle left and right signals or will handle sum and difference signals. When the AGC operates in sum / difference **MATRIX** mode, this control determines the maximum amount of width change in the stereo soundfield.

**Master Delta Threshold** allows you to set the difference between the compression thresholds of the sum and difference channels. (This control is only useful when you set the AGC MATRIX to SUM/DIF.) By setting the threshold of the difference channel lower than the sum channel, you can have the AGC automatically produce more gain reduction in the difference channel. This will reduce the separation of material with an excessively wide stereo image (like old Beatles records). To make this work, you must set the MAX DELTA GR control away from zero. For example, to limit an excessively wide image while preventing more than 3 dB difference in gain between the sum and difference channels, set the MAX DELTA GR control to 3.0 and the MASTER DELTA THRESHOLD control to some positive number, depending on how much automatic width control you want the 6300 to perform

**Bass Delta Threshold** works the same as MASTER DELTA THRESHOLD, but applies to the bass band. You will usually set it the same as MASTER DELTA THRESHOLD.

**AGC Crossover** allows you to choose ALLPASS or LINEARNODELAY modes.

ALLPASS is a phase-rotating crossover that introduces one pole of phase rotation at 200 Hz. The overall frequency response remains smooth as the two bands take different amounts of gain reduction—the response is a smooth shelf without extra peaks or dips around the crossover frequency. The two bands are down 3 dB at the crossover frequency. However, this mode adds group delay distortion and is therefore subtly less transparent-sounding than the LINEARNODELAY mode.

LINEARNODELAY (Linear-Phase; no delay) is a phase-linear crossover whose upper band is derived by subtracting its lower band from the crossover's input. When the upper and lower bands have the same gain, their sum is perfectly flat with no phase rotation. However, when the upper and lower bands have different gains, peaks and dips appear in the frequency response close to the crossover frequency. It is useful if you need a crossover with low delay and no phase distortion when flat. Its downside is the possibility of coloration when the gains of the two bands are widely disparate.

## Distortion Control

The distortion control adjustments are common to the 2-band and 5-band structures except as noted in the descriptions on the following pages.

**Bass Clip** threshold controls Orban's patented embedded bass clipper. Note that The SPEECH BASS CLIP THRESHOLD control overrides the BASS CLIP THRESHOLD control when OPTIMOD-PC automatically detects speech (see *Speech/Music Detector* on page 3-6).

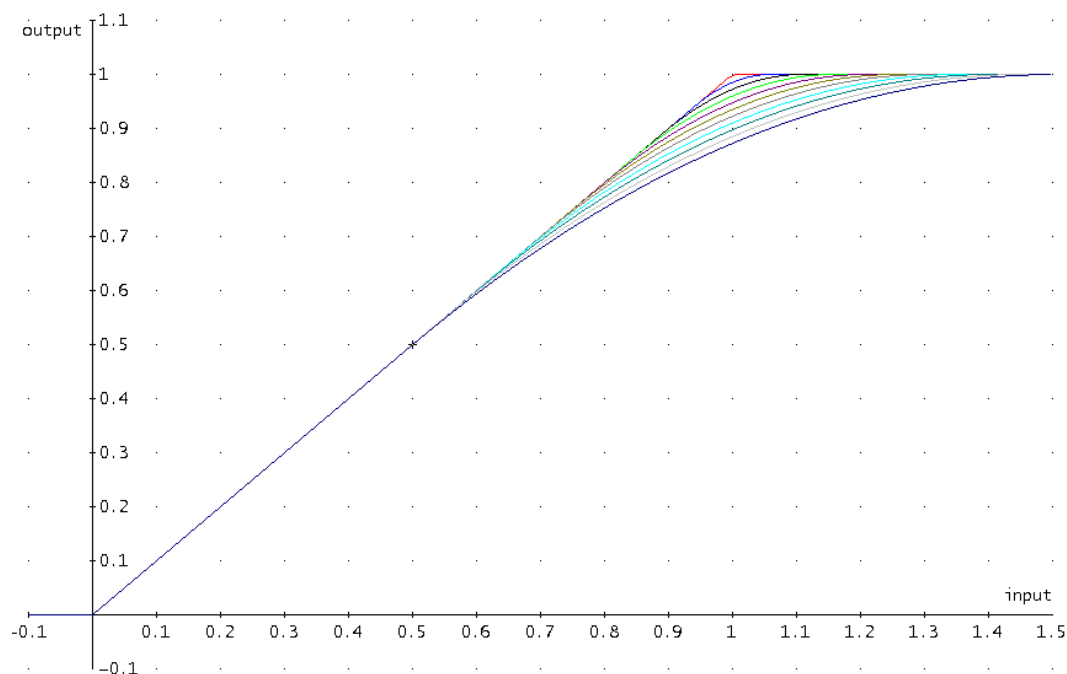


Figure 3-1: Bass Clipper Input/Output Transfer Curves as Bass Clip Shape Control is Var-  
ied from 0.0 (Hard) to 10.0 (Soft)

The bass  
clipper is  
embedded

in the multiband crossover so that harmonics created by clipping are rolled off by part of the crossover filters. The threshold of this clipper is ordinarily set between 4dB and 6dB below the threshold of the look-ahead limiter, depending on the setting of the LESS-MORE control in the parent preset upon which you are basing your Advanced Control adjustments. This provides headroom for contributions from the other four bands so that bass transients don't smash against the look-ahead limiter, causing audible intermodulation distortion between the bass and higher frequency program material.

Some 6300 users feel that the bass clipper unnecessarily reduces bass punch at its factory settings. To accommodate these users, the threshold of the bass clipper is user-adjustable. The range (with reference to the look-ahead limiter threshold) is -10 to +10dB (and OFF). As you raise the threshold of the clipper, you will get more bass but also more distortion and pumping. Be careful when setting this control; do not adjust it casually. Listen to program material with heavy bass combined with spectrally sparse midrange material (like a singer) and listen for IM distortion induced by the bass' pushing the midrange into the look-ahead limiter. Although the low-IM technology in the 6300's look-ahead limiter substantially reduces this distortion, overdriving the limiter hard enough can still cause problems.

In the 5-band structure, band 1 drives the clipper. In the 2-band structure, the Bass band drives the clipper.

**Bass Clip Shape** allows you to change the knee of the input/output gain curve of the bass clipper. It allows you to control the shape of the "knee"—the transition between no clipping and flat topping. "0" provides the hardest knee, where the transition between linear operation and flat topping occurs abruptly as the clipper's input level is changed. "10" is the softest knee, where the transition starts 6 dB below BASSCLIPTHRESH setting and occurs gradually. The factory default setting is "7.6."

**Final Limit Drive** controls (AGC and MB) adjust the level of the audio driving the low-IM look-ahead limiters that OPTIMOD-PC uses to control fast peaks, thereby adjusting the peak-to-average ratio of the processed audio. The FINAL LIMIT DRIVE controls primarily determine the loudness/distortion trade-off. See the block diagram on page 6-43. Note that the MB FINAL LIMIT DRIVE control feeds the loudness controller and loudness meters, so it also affects the loudness controller's gain reduction.

Turning up the FINAL LIMIT DRIVE control drives the look-ahead limiter harder, reduc-

Distortion Control Adjustments	
Name	Range
AGC Final Limit Drive	-20.0 ... +12.0 dB
Bass Clip Shape	0.0 ... 10.0
Bass Clip Threshold	-10.0 ... +10.00 dB, OFF
Multiband Final Limit Drive	-20.0 ... +12.0 dB
Speech Bass Clip Threshold	-10.0 ... +10.00 dB, OFF

Table 3-7: Distortion Control Adjustments

ing the peak-to-average ratio, and increasing loudness. When the amount of limiting is increased, the audible intermodulation distortion caused by limiting increases, even though special algorithms minimize the increase compared to less sophisticated designs. Lower settings reduce loudness, of course, but result in a cleaner sound.

When you use OPTIMOD-PC in a preemphasized mode (step 8 on page 2-25), this inserts a frequency-dependent high frequency boost before the look-ahead limiter. This boost can be as large as 20 dB at 20 kHz. When using preemphasis, you must turn down the FINAL LIMIT DRIVE control to prevent the look-ahead limiter from causing audible gain pumping.

You may find it illuminating to recall several Factory Presets, adjust LESS-MORE to several points in its range, and then open the Full Control screen to examine the trade-offs between the release time and FINAL LIMIT drive made by the factory programmers. However, note that all Factory Presets were created to complement FLAT preemphasis. As explained above, you must turn down the FINAL LIMIT DRIVE control when using preemphasis.

## The 2-band Structure

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The 2-band structure consists of a stereo enhancer, a slow 2-band gated AGC for gain riding, an equalization section, a gated 2-band compressor, and a low-IM look-ahead limiter. A CBS Loudness Controller, which is primarily useful for sound-for-picture applications, can be activated to control subjectively perceived loudness.

The 6300's 2-band Structure can be made phase-linear throughout to maximize sonic transparency. However, you can also choose an allpass crossover structure (see AGC CROSSOVER on page 3-44).

The 2-band structure has an open, easy-to-listen-to sound that is similar to the source material if the source material is of good quality. We recommend using it when you want to preserve the spectral balance of the source material while not significantly increasing program density. Hence, it is mainly useful for unobtrusive gain riding in sound-for-picture applications (where its loudness controller can be useful) and in fine arts programming.

If you need processing for loudness and/or processing that automatically corrects spectral balance inconsistency in the source material, we recommend using the 5-band structure instead.

There are several 2-band presets. These are listed in *Table 3-2: Radio-Style Presets* on page 3-26.

The Protection presets have the same Intermediate and Advanced Modify controls available as the 2-band structure and use the same DSP configuration but with the stereo enhancer, AGC, and equalizer defeated.

### Customizing the Settings

Each 2-band Factory Preset has a LESS-MORE control (located in the Basic Modify screen) that adjusts loudness. LESS-MORE simultaneously adjusts all of the processing

controls to optimize the trade-offs between unwanted side effects as processing levels are decreased or increased.

If you wish, you may adjust the Modify parameters to your own taste. Always start with LESS-MORE to get as close to your desired sound as possible. Then edit the Modify parameters using the Basic, Intermediate or Advanced Modify screen, and save those edits to a User Preset.

## The 2-band Structure's Full and Advanced Setup Controls

The tables below show a summary of the 2-band controls in the dynamics section.

AGC, Equalizer, Stereo Enhancer, and look-ahead limiter controls are common to both 2-band and 5-band structures and are described in the pages above.

Some of the 2-band controls are common to the Full Modify and Advanced Modify screens, with additional 2-band controls available in the Advanced Modify screen. (Note that "advanced" controls are accessible only from 6300 PC Remote software.)

**2B DRIVE** control adjusts signal level going into the 2-band compressor, determining

2-band Controls		
Full Modify Name	Advanced Name	Range
2B BASS CLIP	2B Bass Clip Threshold	-6.0 ... 0.0 dB
2B BASS CPL	2B Bass Coupling	0 ... 100 %
2B DRIVE	2B Drive	-10 ... 25 dB
2B GATE	2B Gate Threshold	Off, -44 ... -15 dB
2B REL	2B Release	0.5 ... 20 dB / S
2B REL SHAPE	2B Release Shape	Linear, Exponential
LOUD THR	Loudness Controller Threshold	Off, 0.0 ... -12.0 dB
	Loudness Controller Attack	0 ... 100%
	Loudness Controller Bass Couple	0...12 dB, Off
PARENT PRESET		[read-only]
BS.1770 LIM THR	BS.1770 Limiter Threshold	0...6 LK, Off
Less-More	Less-More Index	[read-only]; 1.0 ... 10.0
---	2B Master Knee	0 ... 50 dB
---	2B Bass Knee	0 ... 50 dB
---	2B Master Ratio	1:1 ... ∞:1
---	2B Bass Ratio	1:1 ... ∞:1
---	2B Master Break(point)	1 ... 50 dB
---	2B Bass Break(point)	1 ... 50 dB
---	2B Master Attack	4 ... 50, Off
---	2B Bass Attack	4 ... 50, Off
---	2B Master Compression Threshold	-15 ... 0, Off
---	2B Bass Compression Threshold	-10.0 ... 5.0 dB, Off
---	2B Speech Master Compression Threshold	-15 ... 0, Off
---	2B Speech Bass Compression Threshold	-10.0 ... 5.0 dB, Off

Table 3-8: 2-band Controls

the amount of gain reduction in the 2-band compressor.

Regardless of the release time setting, we feel that the optimal amount of gain reduction in the 2-band compressor for sound-for-picture applications is 10-15dB. For fine arts formats, operating with 0-10 dB of gain reduction (with the gain riding AGC set to OFF) maintains a sense of dynamic range while still controlling levels effectively.

**2B REL** ("2B Release") control determines how fast the 2-band compressor releases (and therefore how quickly loudness increases) when the level of the program material decreases. This release time only applies when the silence gate does not gate the 2-band Compressor.

The control can be adjusted from 0.5 dB/second (slow) to 20 dB/second (fast). Settings toward 20 dB/second result in a more consistently loud output, while settings toward 0.5 dB/second allow a wider variation of dynamic range. Both the setting of the 2B REL control and the dynamics and level of the program material determine the actual release time of the compressor.

With faster 2B REL control settings (above 8 dB/second), the sound will change substantially with the amount of gain reduction in the 2-band compressor. This means that you should activate the gain-riding AGC to ensure that the 2-band compressor is always being driven at the level that produces the amount of gain reduction desired. Decide based on listening tests how much gain reduction gives you the density that you want without creating a feeling of over-compression and fatigue. For most applications, we recommend using slower release rates because applications that could use faster 2-band release rates are usually better suited to 5-band processing. 5-band processing minimizes the undesirable artifacts that fast release rates can produce.

The release rate (in dB/second) in the 2-band compressor automatically becomes faster as more gain reduction occurs. This makes the program progressively denser, creating a sense of increasing loudness although peaks are not actually increasing. At the gain reduction values set by the 2B MASTER BREAKPOINT and 2B BASS BREAKPOINT controls, the release rate for these bands becomes constant and density does not increase with additional amounts of gain reduction.

**2B REL SHAPE** ("2B Release Shape") selects a LINear or EXPonential release shape.

Linear causes the 2-band compressor to release at a constant number of dB per second above the 2B BREAKPOINT setting and proportionally to the amount of gain reduction otherwise.

Despite its name, EXPONENTIAL actually offers a reverse-exponential characteristic: It causes the release to commence slowly and then speed up as it progresses. The EXPONENTIAL shape allows you to create the open sound of a slow release time with program material that is well controlled in level, while permitting the processing to quickly correct excessively low input levels. We recommend using Exponential for general-purpose sound-for-picture programming. For program material dominated by music, LINEAR may be a better choice because Exponential may create unnatural

side effects. (If the 2B Release control is set between about 0.5 and 2 dB/second, an Exponential release shape should cause no problems even with music.)

**Note:** The BREAKPOINT controls do nothing when EXPONENTIAL release is chosen.

**2B GATE** ("2B Gate Threshold") threshold control determines the lowest input level that will be recognized as program material by OPTIMOD 6300; lower levels are considered to be noise or background sounds and will cause the AGC or 2-band compressor to gate, effectively freezing gain to prevent noise breathing.

There are two independent gating circuits in the 6300 2-band structure. The first affects the AGC and the second affects the *2-band compressor*. Each has its own threshold control.

The 2-band gain reduction will eventually recover to 0 dB (when the RELEASE SHAPE is set to LINEAR) or to the setting of the 2B DRIVE control (when the RELEASE SHAPE is set to EXP). However, recovery is slow enough to be imperceptible. This avoids OPTIMOD 6300's getting stuck with a large amount of gain reduction on a long, low-level musical passage immediately following a loud passage.

In EXP release mode, the 2-band gate's gated gain reduction is the same as the setting of the 2B DRIVE CONTROL, which is similar to the behavior of the AGC gate. This is because EXP release is mainly useful in sound-for-picture processing and is used in the TV 2B GEN PURPOSE and TV 2B GEN PURP+LC presets. In these presets, the AGC is defeated so that all gain riding can occur in the 2-band compressor. See *AGC Idle Gain* on page 3-43 for a more complete discussion.

It is common to set the 2B GATE control between approximately -35 dB and -25 dB. Higher values are useful in sound-for-picture processing to prevent background sounds and underscoring from being pumped up, while lower settings are more common with musical programming.

**BASS CPL** ("2B Bass Coupling") is used to set the balance between bass and the rest of the frequency spectrum.

The 2-band compressor processes audio in a master band for all audio above approximately 200Hz, and a bass band for audio below approximately 200Hz. The BASS CPL control determines how closely the balance of material below 200Hz matches that of the program material above 200Hz.

Bass coupling is set to 100% on all of the 2-band presets because these presets are designed to do gentle gain riding without increasing program density or significantly modifying the spectral balance of the program. When bass coupling is set to 100%, the bass band will usually have the same amount of gain reduction as the master band. Only with material having unusually heavy bass will you see additional gain reduction in the bass band.

**Bass Clip** ("Bass Clip Threshold"): See page 3-45.

**Loudness Threshold** sets the maximum subjective loudness allowed by the processing with reference to the active TARGET LOUDNESS value for the output you are using. It



is most useful in 2-band mode because the 5-band compressor creates more uniform loudness than does the 2-band compressor/limiter.

The loudness controller is designed to follow 2-band or 5-band compression, which prevents it from being overdriven. It is in the signal path for a given output unless that output's source is AGC.

The **LOUDNESS THRESHOLD** control sets the subjective loudness level at which the loudness controller will add further gain reduction to the gain reduction that the multiband compressor produces. To minimize spectral gain modulation artifacts, the loudness controller applies gain reduction to the Master band only in 2-band mode, and in bands 2-5 in 5-band mode. In 2-band mode, the 2B Master gain reduction meter shows the sum of the compressor-induced gain reduction and the loudness controller-induced gain reduction. In 5-band mode, the band 2-5 gain reduction meters indicate the sum of the gain reduction in the band in question and the loudness control gain reduction.

The loudness controller's attack and release times are tuned to match the loudness integration times of the ear, are program-adaptive, and are not user-adjustable.

The loudness controller responds almost entirely to program material that has dominant energy between 1 and 7 kHz, which is the ear's most sensitive range. If you find that the loudness controller is producing audible artifacts in 2-band mode because the program forces it to do more than approximately 6 dB of extra gain reduction, we suggest using 5-band mode instead. This will automatically re-equalize such program material and will de-ess extremely sibilant program material less obtrusively than the loudness controller will. The 5-band compressor will typically control loudness within a 2 dB window even with the loudness controller defeated. Although the loudness controller is available in 5-band mode, you may find that you prefer the more open sound of the 5-band compressor without additional loudness control.

The loudness controller is aware of all 6300 audio processing except look-ahead limiting, which is a peak limiting process whose gain reduction does not significantly affect subject loudness.

If you feel that the Loudness Controller is not controlling the loudness of commercials or other subjectively loud program material sufficiently well, you may wish to set the threshold lower, forcing the Loudness Controller to do more work. Conversely, if the loudness controller is doing more gain reduction than you would like, you can set the **LOUDNESS THRESHOLD** control higher.

Note that the Loudness Controller operates with reference to an absolute subjective loudness threshold that does not adapt to program context. This means that if there is a transition between very quiet program material (like footfalls through rustling leaves) and a commercial, the commercial may *still* seem offensively loud even though the Loudness Controller is controlling its loudness correctly with reference to other sounds that reach full-scale loudness. Philosophically, this is inevitable; the Loudness Controller cannot reduce the level of the commercial to the level of rustling leaves without destroying the effectiveness of the commercial and angering the sponsor!

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**FINAL LIMIT** ("Final Limit Drive"): See page 3-46.

**PARENT PRESET** and **Less-More INDEX** are read-only fields.

The 6300's front-panel LCD display does not show all of the parameters in a given User Preset; only the PC Remote software can display the Advanced Controls that set all the parameters. PARENT PRESET shows the preset that was edited to produce the current User Preset. The LESS-MORE INDEX shows the Parent Preset's Less-More setting when it was edited. This information is needed because two different User Presets can appear to be the same when you view only the parameters that the 6300's front panel exposes.

Please note that if a User Preset was created by in the PC Remote software by editing Advanced controls, an asterisk will appear in front of the displayed parent preset. This asterisk means that you cannot duplicate a given user preset by starting with its parent preset and then setting a target 6300's front panel controls to correspond to the user preset you want to duplicate. The only way to duplicate such a user preset accurately is via the PC Remote software's backup and restore features, or by opening the preset in the PC Remote software and manually duplicating each control setting you see.

#### Advanced 2-band Controls

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The following 2-band controls are only accessible from the 6300 PC Remote software:

**BS.1770 Limiter Threshold** sets the threshold of the BS.1770 safety limiter (in units of LK or LU) with respect to the active TARGET LOUDNESS value. See *BS.1770 Safety Limiter* on page 3-13.

**2B Master Compression Threshold** sets the level where gain reduction starts to occur in the Master (above 200Hz) band of the 2-band Compressor. There is one control for music mode and one for speech mode, as determined by the automatic speech/music detector.

**2B Bass Threshold** determines the compression threshold of the bass band (below 200 Hz) in the 2-band Compressor. It can be used to set the target spectral balance of the 2-band Compressor. There is one control for music mode and one for speech mode.

As the 2-band Compressor BASS CPL control is moved towards "100%," the 2B BASS THRESHOLD control affects the sound less and less.

**2B Master Attack** sets the attack time of the 2-band Compressor master compressor (above 200Hz).

**2B Bass Attack** sets the attack time of the 2-band Compressor bass compressor (below 200Hz).

**2B Master Comp Ratio** and **2B Bass Comp Ratio** set the compression ratio of the Master compressor and Bass compressor respectively at their thresholds of compression. Beyond threshold, the ratio increases with increased gain reduction until it becomes  $\infty:1$  at the amount of gain reduction (in dB) set by the 2B MASTER KNEE control. When you adjust these controls, the thresholds of the multiband compressors automatically change so that the total amount of gain reduction stays approximately the same. (This automatic adjustment is internal to the 6300's DSP; the displayed settings of the MB THRESH controls do not show it.)

To achieve a classic soft knee characteristic, set the 2B MASTER COMP RATIO control to 1:1 and set the KNEE control to the gain reduction in dB at which you wish the compression ratio to level off to  $\infty:1$ . The maximum setting produces the softest knee. Setting the KNEE to 0 dB produces a classic hard knee curve with  $\infty:1$  compression ratio regardless of the setting of the 2B MASTER COMP RATIO control.

See *Figure 3-2* on page 3-53 for the curves of output level vs. input level for various

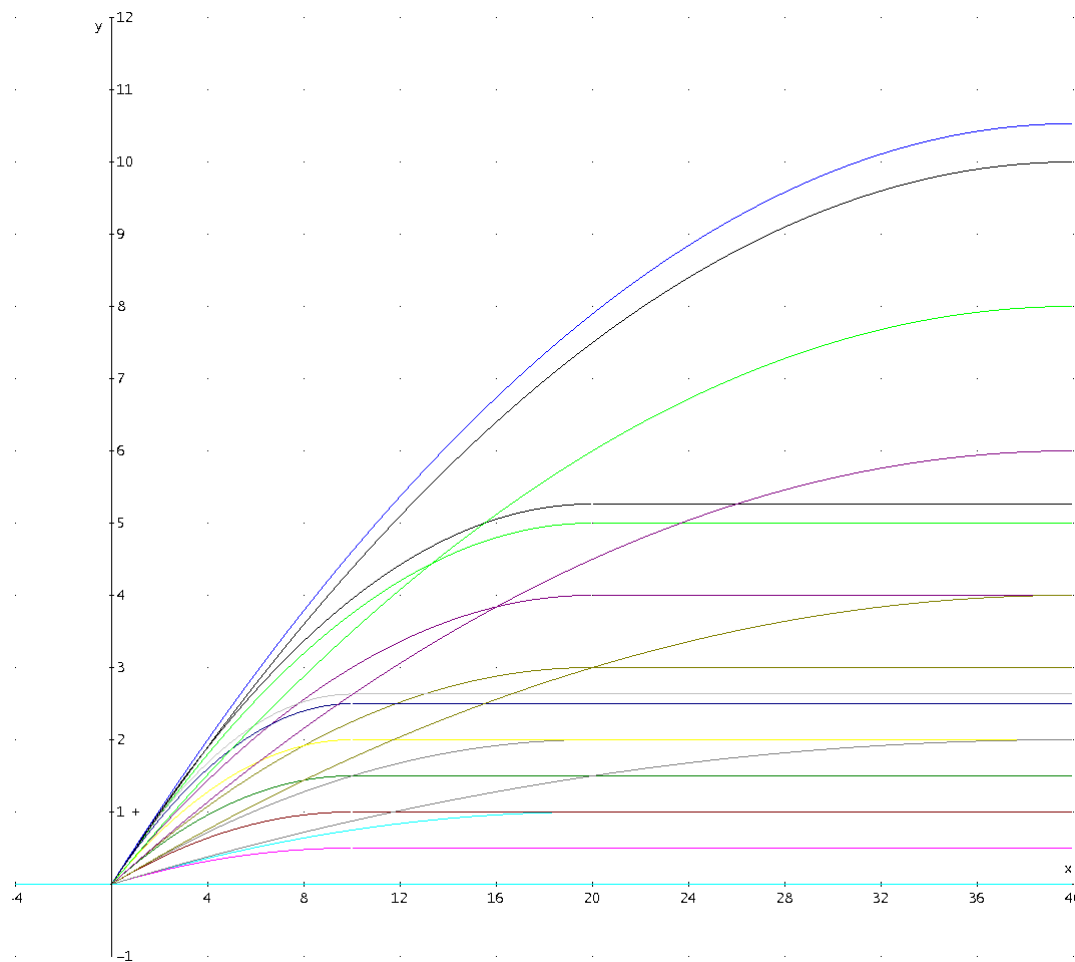


Figure 3-2: Output level in dB (y) for a given input level in dB (x) at various settings of the KNEE and RATIO control

settings of the KNEE and RATIO controls.

**2B Knee** (see 2B MASTER COMP RATIO above).

**2B Breakpoint** The release rate (measured in dB/second) in the 6300's compressors is constant when the gain reduction is higher than the control's setting, and exponential when the gain reduction is lower than the control's setting.

When the release is exponential, the release rate is proportional to the amount of gain reduction. Do not confuse this with the reverse exponential characteristic triggered by setting the 2B REL SHAPE control to EXPONENTIAL. In this case, release commences slowly and then speeds up as it progresses.

The 2B BREAKPOINT control is only active when the 2B RELEASE SHAPE control is set to LINEAR.

Compression-induced audio density remains constant when the gain reduction is above the 2B BREAKPOINT setting. When the gain reduction is below the 2B BREAKPOINT setting, density decreases proportionally to the amount of gain reduction.

For example, if the 2B BREAKPOINT is set to 10 dB, the release rate (in dB/second) will be constant when the gain reduction is above 10 dB. Between 10 dB and 0 dB gain reduction, the release rate will slow down more and more.

The calibration of the BREAKPOINT controls is only accurate when KNEE = 0 dB and/or RATIO = infinity:1 — i.e., when the compression ratio is essentially infinite. When the ratio is less than infinite, the effective breakpoint of the compressor will be lower than 2B BREAKPOINT setting.

The main use of the 2B BREAKPOINT control is to prevent the compressor from objectionably increasing audio density when using low compression ratios and a significant amount of gain reduction—for example, 10 dB. The 2B BREAKPOINT control is best adjusted by ear. If you find that density increases too much as gain reduction increases, lower the 2B BREAKPOINT control's setting. If you would like to have more density at high amounts of gain reduction, increase the 2B BREAKPOINT control's setting. 10 dB is a good starting point for setting this control.

**2B Crossover** sets the structure of the 2-band crossover to Allpass or Linear. See AGC CROSSOVER on page 3-44 for more detail about these modes.

**Loudness Controller Attack:** See *Loudness Control* on page 3- 11.

**Loudness Controller Bass Couple:** See *Loudness Control* on page 3- 11.

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## The 5-band Structure

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The 5-band structure consists of a stereo enhancer, a slow gain-riding 2-band AGC, an equalization section, a 5-band compressor, a dynamic single-ended noise reduction system, an output mixer (for the five bands), and a low-IM look-ahead limiter.

Unlike the 2-band structure, whose 2-band compressor has a continuously variable release time, the release time of the 5-band compressor is switchable to seven increments between slow and fast. Each setting makes a significant difference in the overall flavor and quality of the sound.

When the input is noisy, you can sometimes reduce the noise by activating the single-ended noise reduction system. Functionally, the single-ended noise reduction system combines a broadband downward expander with a program-dependent low-pass filter. This noise reduction can be valuable in reducing audible hiss, rumble, or ambient studio noise. We use it for the news and sports factory presets.

The 5-band structure does not have a separate Loudness Controller because its 5-band compressor automatically re-equalizes the spectral balance of various pieces of program material in a way that tends to make their loudness more consistent.

### Putting the 5-band Structure on the Air

The 5-band structure is very flexible, enabling you to fine-tune your sound for your target audience and desired market position. There are several basic Factory Presets for the 5-band structure. Each of these presets can be edited with the LESS-MORE control. This control affects the sound-for-picture-oriented presets differently than it does the music presets (presets with “music” in their names). When a sound-for-picture-oriented preset is on the air, the LESS-MORE control adjusts the average amount of gain reduction by adjusting the drive level to the 5-band structure's input. This also adjusts the idle gain—the amount of gain reduction in the AGC section when the structure is gated. (It gates whenever the input level to the structure is below the threshold of gating.)

When a music preset is on the air, the LESS-MORE control sets the amount of overall processing, making optimum tradeoffs between loudness, brightness, and distortion. In sound for picture, there are no loudness wars; for music presets, there is no need to advance the LESS-MORE control beyond its setting in the Factory Presets.

### Customizing the Settings

The controls in the 5-band structure give you the flexibility to customize your station sound. However, as with any audio processing system, proper adjustment of these controls requires proper balancing of the trade-offs explained above. The following provides the information you need to adjust the 5-band structure controls to suit your programming and taste.

## The 5-band Structure's Full and Advanced Setup Controls

The tables below summarize the Multiband and Band Mix controls in the dynamics section. The AGC, Equalizer, Stereo Enhancer, and look-ahead limiter controls are common to both the 2-band and 5-band structures and are discussed in their own sections in Section 3. (Note that "advanced" controls are accessible only from 6300 PC Remote software.)

**MB DRIVE** ("Multiband Drive") control adjusts the signal level going into the multiband compressor, and therefore determines the average amount of gain reduction in the multiband compressor. Range is 25dB.

Adjust the MULTIBAND DRIVE control to your taste and programming requirements. Used lightly with a slow or medium release time, the 5-band compressor produces an open, re-equalized sound that is appropriate for most sound-for-picture programming. The 5-band compressor can increase audio density when operated at a fast or medium-fast release because it acts more and more like a fast limiter (not a compressor) as the release time is shortened. With fast and medium-fast release times, density also increases when you increase the drive level into the 5-band compressor because these faster release times produce more limiting action. Increasing density can make loud sounds seem louder, but can also result in an unattractive busier, flatter, or denser sound. It is very important to be aware of the many negative subjective side effects of excessive density when setting controls that affect the density of the processed sound.

Because the 6300's AGC algorithm uses sophisticated window gating, it is preferable to make the AGC do most of the gain riding (instead of the multiband compressor),

Multiband Controls		
Full Name	Advanced Name	Range
DWNEXP CPL	Downward Expander Stereo Couple	On, Off
DWNEXP THR	Downward Expander	Off, -18.0 ... 12.0 dB
B5 DWNEXP THR	B5 Down Exp Delta Thresh	-18.0 ... +12.0 dB
MB DRIVE	Multiband Drive	0 ... 25
MB GATE	Multiband Gate Threshold	Off, -44 ... -15 dB
LESS-MORE	Less-More Index	[read-only]; 1.0 ... 10.0
LOUD THR	Loudness Controller Threshold	Off, 0.0 ... -12.0 dB
	Loudness Controller Attack	0 ... 100%
	Loudness Controller Bass Couple	0...12 dB, Off
PARENT PRESET	Parent Preset	[read-only]
BS.1770 LIM THR	BS.1770 Limiter Threshold	0...6 LK, Off
---	Lookahead	In, Out, Auto
---	B1/B2 XOVER	100 Hz, 200 Hz
---	B1 MaxDeltGr	0 ... 24 dB, Off
---	B2 MaxDeltGr	0 ... 24 dB, Off
---	B3 MaxDeltGr	0 ... 24 dB, Off
---	B4 MaxDeltGr	0 ... 24 dB, Off
---	B5 MaxDeltGr	0 ... 24 dB, Off
1770 TL 1	BS.1770 Target Loudness 1	-11...-31 LUFS, GLOBAL
1770 TL 2	BS.1770 Target Loudness 2	-11...-31 LUFS, GLOBAL

Table 3-9: Multiband Controls

because the AGC can ride gain quickly without adding excessive density to program material that is already well controlled. Use the multiband compressor lightly, so it can achieve automatic re-equalization of material that the AGC has already controlled without adding excessive density to the audio or re-equalizing to an unnatural extent.

The MULTIBAND DRIVE interacts with the MULTIBAND RELEASE. With slower release time settings, increasing the MULTIBAND DRIVE control scarcely affects density. Instead, the primary danger is that the excessive drive will cause noise to be increased excessively when the program material becomes quiet. You can minimize this effect by activating the single-ended noise reduction and/or by carefully setting the MULTIBAND GATE THRESHOLD control to freeze the gain when the input gets quiet.

When the release time of the 5-band compressor is set towards fast, the setting of the MULTIBAND DRIVE control becomes much more critical to sound quality because density increases as the control is turned up. Listen carefully as you adjust it. With these fast release times, there is a point beyond which increasing the 5-band compressor drive will no longer yield more loudness, and will simply degrade the punch and definition of the sound. Instead, let the AGC do most of the work.

Because excessive loudness is an irritant in sound for picture, there is almost never any reason to push processing to the point where it degrades the audio. We recommend no more than 10dB gain reduction as shown on the meters for Band 3. More than 10dB, particularly with the fast release time, will often create a wall of sound effect that many find fatiguing.

To avoid excessive density with fast 5-band release time, we recommend using no more than 5dB gain reduction in band 3, compensating for any lost loudness by speeding up the AGC RELEASE instead.

**MB REL** ("Multiband Release") control can be switched to any of seven settings. To understand how to adjust this control for sound-for-picture programming, please see the discussion above under MB DRIVE.

The SPEECH MB RELEASE control overrides the MB RELEASE control when OPTIMOD-PC automatically detects speech (page 3-6). You may wish to set the SPEECH MB RELEASE control faster for speech (to maximize smoothness and uniformity) and slower on music (to prevent excessive build-up of density).

**Compression Threshold; Speech Compression Threshold** controls set the compression threshold for music and speech in each band (following OPTIMOD-PC's automatic speech/music discriminator), in units of dB. We recommend making small changes around the factory settings to preserve the internal headroom built into the processing chain. These controls will affect the spectral balance of the processing above threshold, but are also risky because they can significantly affect the amount of distortion produced by the look-ahead limiter.

You can use these controls to set independent frequency balances for music and speech (page 3-6).

**1700 TL x** (BS.1770 Target Loudness 1 or 2) sets the target loudness of a specified 6300 output whose LIMITER OUTPUT SOURCE is set to MULTIBAND and whose OUTPUT SOURCE is set to LIMITER NORM. If the BS.1770 TARGET LOUDNESS control is set to GLOBAL, the BS.1770 GLOBAL TARGET LOUDNESS control (in I/O > MISC) sets the target loudness instead.

**MB GATE** ("Multiband Gate Threshold") control determines the lowest input level that will be recognized as program by OPTIMOD 6300; lower levels are considered to be noise or background sounds and cause the AGC or multiband compressor to gate, effectively freezing gain to prevent noise breathing.

The multiband gate only works appropriately when the KNEE and RATIO controls of all bands are set identically, which is typically the case in broadcast applications. We recommend turning off the multiband gate if the individual KNEE and RATIO settings are unequal.

There are two independent gating circuits in the 6300. The first affects the AGC and the second affects the multiband compressor. Each has its own threshold control.

The multiband silence gate causes the gain reduction in bands 2 and 3 of the multiband compressor to move quickly to the average gain reduction occurring in those bands when the gate first turns on. This prevents obvious midrange coloration under gated conditions, because bands 2 and 3 have the same gain.

The gate also independently freezes the gain of the two highest frequency bands (forcing the gain of the highest frequency band to be identical to its lower neighbor), and independently sets the gain of the lowest frequency band according to the setting of the DJ BASS boost control (in the Equalization screen). Thus, without introducing obvious coloration, the gating smoothly preserves the average overall frequency response "tilt" of the multiband compressor, broadly maintaining the "automatic equalization" curve it generates for a given piece of program material.

If the MB GATE control is turned OFF, the DJ Bass control (in the Equaliza-

MB Attack / Release / Threshold		
Full Name	Advanced Name	Range
MB REL	Multiband Release	Slow, Slow2, Med, Med2, MFast, MFast2, Fast
---	Speech Multiband Release	Slow, Slow2, Med, Med2, MFast, MFast2, Fast
Bx (1-5) THR	Bx Compression Threshold	-16.00 ... 0.0, Off
---	Bx Speech Compression Thresh	-16.00 ... 0.0, Off
---	Bx Attack	4.0 ... 50.0 ms, Off
---	Bx Speech Attack	4.0 ... 50.0 ms, Off
---	Bx Limiter Attack	0 ... 100%
---	Bx Delta Release	-6 ... 6
---	Bx Compression Ratio	1:1 ... ∞:1
---	Bx Knee	0 ... 50 dB
---	Transient Enhance	0 ... 10 ms

Table 3-10: MB Attack / Release Controls



tion screen) is disabled.

**DwnExp Thr** ("Downward Expander Threshold") determines the level below which the single-ended noise reduction system's downward expander begins to decrease system gain and below which the high frequencies begin to become low-pass filtered to reduce perceived noise. There are two controls: the MB DOWN EXPANDER control sets the expansion threshold in Bands 1-4, while the B5 DOWN EXPANDER DELTA THRESH control (first introduced as part of V1.1 software) allows you to fine-tune the Band 5 downward expander's threshold by adding or subtracting an offset from the setting of the MB DOWN EXPANDER control. Activate the single-ended dynamic noise reduction by setting these controls to a setting other than OFF.

The single-ended noise reduction system combines a broadband downward expander with a program-dependent low-pass filter. These functions are achieved by causing extra gain reduction in the multiband compressor. You can see the effect of this extra gain reduction on the gain reduction meters.

Ordinarily, the gating on the AGC and multiband limiter will prevent objectionable build-up of noise and you will want to use the single-ended noise reduction only on unusually noisy program material. Modern commercial recordings will almost never need it. We expect that its main use will be in talk-oriented programming, including sports.

Please note that it is impossible to design such a system to handle all program material without audible side effects. You will get best results if you set the MB DOWN EXPANDER control of the noise reduction system to complement the program material you are processing. The MB DOWN EXPANDER should be set higher when the input is noisy and lower when the input is relatively quiet. The best way to adjust the MB DOWN EXPANDER control is to start with the control set very high. Reduce the control setting while watching the gain reduction meters. Eventually, you will see the gain increase in sync with the program. Go further until you begin to hear noise modulation—a puffing or breathing sound (the input noise) in sync with the input program material. Set the MB DOWN EXPANDER control higher until you can no longer hear the noise modulation. This is the best setting.

Obviously, the correct setting will be different for a sporting event than for classical music. It may be wise to define several presets with different settings of the MB DOWN EXPANDER control and to recall the preset that complements the program material of the moment.

Note also that it is virtually impossible to achieve undetectable dynamic noise reduction of program material that is extremely noisy to begin with, because the program never masks the noise. It is probably wiser to defeat the dynamic noise reduction with this sort of material (traffic reports from helicopters and the like) to avoid objectionable side effects. You must let your ears guide you.

Band 5 is particularly critical for noise reduction because much of the Downward Expander's utility lies in hiss reduction. Hiss has most of its energy in band 5, while program material typically has less energy in this band, so the B5 DOWN EXPANDER DELTA THRESHOLD control's setting is critical to removing hiss while minimizing removal of desired program energy.

Starting in V1.1, the Downward Expander's dynamic frequency response is no longer constrained to being strictly lowpass—Band 5 is now uncoupled from the lower bands, so the band 5 downward expander can produce less gain reduction than other bands. This can help prevent loss of desired high frequency material in the program.

**B3>B4 CPL** ("Band 3>4 Coupling") control determines the extent to which the gains of bands 4 (centered at 3.7 kHz) and 5 (above 6.2 kHz) are determined by and follows the gain of band 3 (centered at 1 kHz). Set towards 100% (fully coupled) this control reduces the amount of dynamic upper midrange boost, preventing unnatural upper midrange boost. The gain of band 5 is further affected by the B4>B5 CPL control.

The COUPLING controls use an "OR" algorithm: the final gain reduction in a given band is the higher of (1) the gain reduction that would have been produced in that band with no coupling, OR (2) the gain reduction in the adjacent coupled band multiplied by the setting of the COUPLING control.

For example, assume that Band 4 would produce 10 dB of gain reduction with no B3>B4 coupling. If the B3>B4 CPL control is set to 50%, Band 3 will not affect Band 4's gain reduction unless Band 4 is producing more than 20 dB of gain reduction. At this point, every 2 dB increase in Band 4's gain reduction will cause a 1 dB increase in Band 3's gain reduction.

**B4>B5 CPL** ("Band 4>5 Coupling") controls the extent to which the gain of band 5 (6.2 kHz and above) is determined by and follows the gain of band 4.

The sum of the high frequency limiter control signal and the output of the B4>B5 CPL CONTROL determines the gain reduction in band 5. The B4>B5 CPL control receives the independent left and right band 4 gain control signal. Range is 0 to 100% coupling.

**B3>B2 CPL** and **B2>B3 CPL** controls determine the extent to which the gains of bands 2 and 3 track each other.

When combined with the other coupling controls, these controls can adjust the

Band Mix		
Full Name	Advanced Name	Range
B2>B1 CPL	B2>B1 Coupling	0 ... 100 %
B2>B3 CPL	B2>B3 Coupling	0 ... 100 %
B3>B2 CPL	B3>B2 Coupling	0 ... 100 %
B3>B4 CPL	B3>B4 Coupling	0 ... 100 %
B4>B5 CPL	B4>B5 Coupling	0 ... 100 %
B1 OUT	B1 Output Mix	−6.0 ... +6.0 dB
B2 OUT	B2 Output Mix	−6.0 ... +6.0 dB
B3 OUT	B3 Output Mix	−6.0 ... +6.0 dB
B4 OUT	B4 Output Mix	−6.0 ... +6.0 dB
B5 OUT	B5 Output Mix	−6.0 ... +6.0 dB

Table 3-11: MB Band Mix Controls

multiband processing to be anything from fully independent operation to quasi-wideband processing.

**B2>B1 CPL** control determines the extent to which the gain of band 1 (below 100Hz or 200Hz, depending on crossover setting) is determined by and follows the gain of band 2 (centered at 400Hz). Set towards 100% (fully coupled), it reduces the amount of dynamic bass boost, preventing unnatural bass boost. Set towards 0% (independent), it permits frequencies below 100Hz (the “slam” region) to have maximum impact in modern rock, urban, dance, rap, and other music where bass punch is crucial. Accordingly, it can be useful in music video oriented formats.

**Bx Out** (“Band x Output Mix”) controls determine the relative balance of the bands in the multiband compressor. Because these controls mix *after* the band compressors, they do not affect the compressors’ gain reductions and can be used as a graphic equalizer to fine-tune the spectral balance of the program material over a  $\pm 3$  dB range.

Their range has been purposely limited because the only gain control element after these controls is the back-end look-ahead limiter, which can produce audible distortion if overdriven. The thresholds of the individual compressors have been tuned to prevent audible distortion with almost any program material. Large changes in the frequency balance of the compressor outputs will change this tuning, leaving the 6300 more vulnerable to unexpected audible distortion with certain program material. Therefore, you should make large changes in EQ with the bass and parametric equalizers and the HF enhancer, because these are located *before* the compressors. The compressors will thus protect the system from unusual overloads caused the chosen equalization. Use the multiband mix controls only for fine-tuning.

You can also get a similar effect by adjusting the compression threshold of the individual bands. This is comparably risky with reference to look-ahead limiter overload, but unlike the MB BAND MIX controls, the threshold adjustments do not affect the frequency response when a given band is below threshold and is thus producing no gain reduction.

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### Advanced 5-band Controls

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The following Advanced Multiband controls are available only from 6300 PC Remote software.

**B1-B5 Attack (Time); Speech B1-B5 Attack** controls set the speed with which the gain reduction in each band responds to level changes at the input to a given band’s compressor for music and speech respectively, following the 6300’s automatic speech/music detector. These controls are risky and difficult to adjust appropriately. They affect the sound of the processor in many subtle ways. The main trade-off is “punch” (achieved with slower attack times) versus distortion and/or pumping produced in the look-ahead limiter (because slower attack times increase overshoots that the look-ahead limit must eliminate). The results are strongly program-dependent and must be verified with listening tests to a wide variety of program material.

Because there are separate controls for music and speech (page 3-6), you can set attack times faster for speech (to minimize look-ahead limiter artifacts) and slower for music (to maximize punch and transient definition).

The ATTACK time controls are calibrated in arbitrary units that very approximately correspond to milliseconds. Higher numbers correspond to slower attacks.

**Limiter Attack** controls allow you to set the limiter attack anywhere from 0 to 100% of normal in the 5-band compressor / limiters. (This control affects the fast “limiting” component of the multiband compressor and has nothing to do with the final look-ahead peak limiters.) Because the limiter and compressor characteristics interact, you will usually get best audible results when you set these controls in the range of 70% to 100%. Below 70%, you will usually hear pumping because the compressor function is trying to create some of the gain reduction that the faster limiting function would have otherwise achieved. If you hear pumping in a band and you still wish to adjust the limiter attack to a low setting, you can sometimes ameliorate or eliminate the pumping by slowing down the compressor attack time in that band.

**Delta Release** controls are differential controls. They allow you to vary the release time in any band of the 5-band compressor/limiter by setting an offset between the MULTIBAND RELEASE setting and the actual release time you achieve in a given band. For example, if you set the MULTIBAND RELEASE control to medium-fast and the BAND 3 DELTA GR control to -2, then the band 3 release time will be the same as if you had set the MULTIBAND RELEASE control to medium and set the BAND 3 DELTA GR control to 0. Thus, your settings automatically track any changes you make in the MULTIBAND RELEASE control. In our example, the release time in band 3 will always be two “click stops” slower than the setting of the MULTIBAND RELEASE control.

If your setting of a given DELTA RELEASE control would otherwise create a release slower than “slow” or faster than “fast” (the two end-stops of the MULTIBAND RELEASE control), the band in question will instead set its release time at the appropriate end-stop.

**Bx Compression Ratio:** See page 3-53.

Note that the multiband gate only works appropriately when the KNEE and RATIO controls of all bands are set identically, which is typically the case in broadcast applications. We recommend turning off the multiband gate if the individual KNEE and RATIO settings are unequal.

**Bx Knee:** See page 3-54.

**Bx Breakpoint:** See page 3-54.

**B1/B2 Crossover** (Band 1 to Band 2 Crossover Frequency) sets the crossover frequency between bands 1 and 2 to either 100 Hz or 200 Hz. It significantly affects the bass texture and the best way to understand the differences between the two crossover frequencies is to listen.

**Transient Enhance** is mainly useful in mastering. This control allows you to insert an audio delay in the sidechain of the 5-band compressor. By delaying the gain control

signal, this allows attack transients to pass through the multiband compressor, which can increase punch. There is a tradeoff between this control and the activity of the look-ahead limiter, which will have to eliminate attack transients exceeding the look-ahead limiter's threshold. For any material, there will be an optimum setting for the TRANSIENT ENHANCE control that provides the most punch without triggering look-ahead limiter artifacts.

**Loudness Threshold** See page 3-50.

**Loudness Controller Attack:** See *Loudness Control* on page 3- 11.

**Loudness Controller Bass Couple:** See *Loudness Control* on page 3- 11.

## Test Modes

Setup: Test				
Parameter Labels	Units	Default	Range (CCW to CW)	Step
MODE	---	Operate	Operate, Bypass, Tone	---
BYPASS GAIN	dB	0.0	-18 ... +25	1
TONE FREQ	Hz	400	16, 20, 25, 31.5, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1000, 1250, 1600, 2000, 2500, 3150, 4000, 5000, 6300, 8000, 9500, 10000, 12500, 13586.76, 15000, 20000* [*44.1 kHz and higher output SR only]	LOG
TONE LVL	%	91	0 ... 121	1
TONE CHAN	---	L+R	L+R, L-R, LEFT; RIGHT	---

Table 3-12: Test Modes

The Test Modes screen allows you to switch between OPERATE, BYPASS, and TONE. When you switch to BYPASS or TONE, the 6300 saves the preset you had active and will restore it when you switch back to OPERATE. Even if you had been editing a preset and did not yet save these changes as a User preset, you will not lose the edits you made.

*Table 3-12: Test Modes* shows the facilities available, which should be largely self-explanatory. The test modes function identically in stereo and dual-mono modes. For example, in dual mono mode, setting TONE CHAN to LEFT applies signal to channel 1 but not to channel 2.

## Using the 6300 PC Remote Control Software

6300 PC Remote control software allows you to access any front-panel 6300 control remotely. Moreover, you can access all of the Advanced Modify controls that are unavailable from the 6300's front panel. The software also gives you the ability to backup user presets, system files, and automation files to your computer's storage devices (hard drives, etc.) and to restore them later to your 6300.

The 6300 PC Remote software can connect to your 6300 via modem, direct serial cable connection, or Ethernet network. It communicates with your 6300 via the TCP/IP protocol, regardless of how it is connected to your 6300.

PC Remote works best on displays of 1024x768 pel or higher. Scroll bars will appear when using lower resolutions.

Before running 6300 PC Remote, you must have installed the appropriate Windows communications services on your computer. By default, the installer installs a shortcut to 6300PC.exe on your desktop and in your Start Menu under Orban\Optimod 6300.

6300 PC Remote can control only one 6300 at a time, but it can readily switch between several 6300s. 6300 PC Remote has a built-in "address book" that allows it to select and connect to:

- any 6300 on the same network as the PC,
- any 6300 that can be accessed through a modem connected to the PC via dial-up networking, and,
- any 6300 that is connected directly to one of the PC's serial ports.

Before your PC can communicate with a given 6300, you must first set up a "connection," which is information that allows PC Remote to locate and communicate with the 6300.

### To set up a new connection:

- A) Launch 6300PC.exe.
- B) Create a new 6300 connection by choosing **NEW 6300** from the **CONNECT** file menu or by right clicking on the **ALL CONNECTIONS** icon in the Connections List and selecting **NEW 6300**.

The Connection Properties dialog box opens.

- C) Enter an Alias name for your 6300 (like "KABC").
- D) Leave the password field blank to prompt the user to enter a password when initiating a connection.

Refer to *Security and Passcode Programming* on page 2-42.

Otherwise, enter a password to allow PC Remote to connect to your 6300 without requiring a password when the connection is initiated.

For successful connection, a password must have already been entered into your 6300 unit.

- E) If you are communicating with your 6300 through a network, select the Ethernet radio button and enter the appropriate IP address, subnet mask, port, and gateway data. These data must agree with the values you set in step 1 on page 2-52. See also *Setting Up Ethernet, LAN, and VPN Connections* on page 2-59.

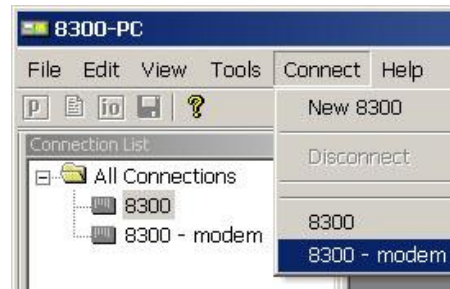
F) If you are communicating via a direct serial cable connection or a modem connection, follow the appropriate procedure described in *Appendix: Setting up Serial Communications*, starting on page 2-61.

G) Click OK after entering all required information.

### To initiate communication:

Initiate communication by double-clicking on the desired 6300 alias in the Connections List, or by selecting the desired 6300 alias from the **CONNECT** drop down menu.

If the connection is successful, a dialog bubble will appear on the bottom right hand corner of the screen verifying your connection.



- If a warning message appears stating: **"No password is set at the 6300..."** go to your 6300 unit and create a passcode.
- If an Enter Passcode dialog box appears, enter a valid passcode and the 6300 PC Remote software will initiate a connection to the 6300 unit.

**A window will appear saying, "Connecting to the 6300, please wait." A few moments later, a new message will appear: "Loading system files, please wait."**

When run, the Orban PC Remote software installer makes copies of all 6300 factory preset files on your local hard drive. The PC Remote software reads these files to speed up its initialization. If any of these files have been deleted or damaged, the PC Remote software will refresh them by downloading them from the 6300. If the PC Remote software needs to do this, it can substantially increase the time required for the software to initialize, particularly through a slow modem connection.

When this download is finished, the main meters will appear.

- A wheel mouse is the quickest and easiest interface to use—you will rarely (if ever) have to use the keyboard.
- The help box at the bottom of the screen always presents a short help message for the function you have selected.

### To modify a control setting:

- Choose **PROCESSING PARAMETERS** from the **EDIT** menu or click the second-to-the-left button on the button bar.
- Select menu tabs for **LESS-MORE**, **STEREO ENHANCER**, and **EQ** to access Basic Modify controls. All other menu tabs contain Full or Advanced Modify controls.

You can reset any Basic Modify Control without losing **LESS-MORE** functionality; Full and Advanced modify control adjustments will cause **LESS-MORE** to be grayed-out.

To set a control, click it (it will become highlighted) and then adjust it by dragging it with the mouse or moving the wheel on the mouse.

You can also use the + and – keys on the numeric keypad to adjust any control.

### To recall a preset:

- A) Choose **RECALL PRESET** from the **FILE** menu to bring up the **OPEN PRESET FILE** dialog box. You can also click the leftmost button on the button bar.
- B) Click the desired preset within the dialog box to select it.
- C) Double-click the desired preset or select it and click the **RECALL PRESET** button to make it active.

Continually clicking the **RECALL PRESET** button will toggle between the current and previous active presets.

- D) Click **DONE** to dismiss the **OPEN PRESET FILE** dialog box.

The folder on your hard drive containing the preset files (both Factory and User) is automatically synchronized to the contents of its associated 6300's non-volatile memory each time 6300 PC Remote connects to that 6300. The 6300's memory is the "master." This means that if you delete a user preset from the 6300's memory (whether locally via its front panel or via 6300 PC Remote), 6300 PC Remote will automatically erase this preset from this folder on your computer. *To archive a preset permanently, you must use the Backup function (see page 3- 66).*

### To save a user preset you have created:

- A) Select **SAVE PRESET AS** from the **FILE** menu to bring up the **SAVE AS** Dialog Box. The current preset name will appear in the File Name field.
- B) Click in the field, and edit it.
- C) Click **SAVE** to save the preset to the 6300's internal memory as a User Preset.

If you have made edits to a previously existing user preset, you can select **SAVE PRESET** from the **FILE** menu to overwrite the pre-existing user preset automatically.

### To back up User Presets, system files, and automation files onto your computer's hard drive:

- A) Select **BACKUP TO PC** from the **FILE** Menu.
- B) Click **OK**.

PC Remote will offer three options:



- Save User Presets, system files, and automation in plain text.

This allows the presets and files to be read with any text editor program and to be readily exchanged between Optimod users.

- Save User Presets, system files, and automation files using the session passcode to encrypt them.
- Save User Presets, system files, and automation files using the password of your choice to encrypt them.

The encryption options prevent archived presets, system files, and automation files from being restored if the user does not have the password used for the encryption. ***There is no “back door”—Orban cannot help you to decrypt a preset whose password is unknown.***

All User Preset, system, and automation files are copied from your Optimod’s internal memory to a folder called **“backup”** on your PC. This folder is a subfolder of the folder named the same as the alias of the Optimod that you are backing up.

This folder name (**“backup”**) and location are hard-coded into the software. If you wish to move the backup files somewhere else later, use a file manager (like Explorer) on your computer.

Starting with version 1.2 software, the folder into which PC Remote saves user preset files has been changed. Previously, PC Remote saved these files in the path C:\Program Files\Orban\Optimod 6300 PC Remote\presets\[Optimod 6300 serial number]. This is inconvenient in Windows 7 because it is difficult for Windows 7 users to modify and access files within the Program Files folder.

The new default is:

.. \Documents \Orban\Optimod 6300 PC Remote\

The actual folder location in Windows XP is:

C:\Documents and Settings\All User\ Shared Documents\Orban\Optimod 6300 PC Remote

The actual folder location in Windows 7 is:

C:\Users\Public\Documents\Orban\Optimod 6300 PC Remote

To make more than one backup archive, rename the current backup folder (**for example, to “Backup1”**). 6300 PC Remote will create a new backup folder the next time you do a backup, leaving your renamed backup folder untouched. Later, you will be able to restore from any folder—the Restore dialog box allows you to choose the folder containing the files to be restored

If you attempt to back up a preset with the same name as a preset existing in the Backup folder, but with a different date, 6300 PC Remote will warn you and will allow you to overwrite the preset in the Backup folder or to cancel the operation. If you wish to keep the existing archived preset, you can first use a file manager to move the existing user preset in the Backup folder to another folder and then repeat the backup operation.

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**To restore archived presets, system files, and automation files:**

In addition to restoring archived presets, system files, and automation files to their original Optimod, you can also copy these archived files from one Optimod to another. The Optimod whose connection is active will receive the file.

If the preset, system file, or automation file was encrypted when it was originally saved, PC Remote will request the password under which it was encrypted.

All User Presets are compatible with all 6300 software versions. If Orban adds new controls to a software version, the new software will assign a reasonable default value to any control missing in an old User Preset. If you archive such a User Preset after restoring it, the newly written archive file will now include the new controls (with the default values, unless you edit any of these values before you re-archive the preset).

A) Select **RESTORE FROM PC** from the **FILE** menu.

A standard Windows dialog box will open.

B) Select the type of files you want to restore using the **FILES OF TYPE** field at the bottom of the dialog box.

You can select to restore all user presets (\*.orb63user), 6300 user presets (\*.orb63user), system files (\*.orb63setup), and automation files (\*.orb63autom).

If you want to restore files from a different directory (i.e., that might have been created on a different 6300), navigate to that directory from within the dialog box.

C) To restore a single user preset:

- a) Set the **FILES OF TYPE** field to a user preset file type (\*.orb63user).
- b) Select the desired preset in the dialog box.
- c) Click the **RESTORE** button.

D) To restore all the user presets from a specific location:

- a) Set the **FILES OF TYPE** field to a user preset file type (\*.orb63user)
- b) Highlight all the user presets in the dialog window
- c) Click the **RESTORE** button.

E) To restore a system file:

- a) Set the **FILES OF TYPE** field to the System Setup file type (\*.orb63setup).
- b) Select the desired system file in the dialog box.
- c) Click the **RESTORE** button.

F) To restore an automation file:

- a) Set the **FILES OF TYPE** field to the Automation file type (\*.orb63autom)
- b) Select the desired automation file in the dialog box

- c) Click the **RESTORE** button.
- G) Click **DONE** to dismiss the **RESTORE** dialog box.

### **To modify INPUT/OUTPUT and SYSTEM SETUP:**

Choose **SETUP** from the **TOOLS** menu or click the third-from-the-left button on the button bar.

To set a control, click it (it will become highlighted) and then use the wheel on the mouse to adjust it. You can also use the + and – keys on the numeric keypad to adjust any control.

### **To modify AUTOMATION:**

- A) Choose **AUTOMATION** from the **TOOLS** menu.  
An Automation Dialog box will open.
- B) Click the **NEW EVENT** to create a new event  
Controls to set the event type and time are available on the right hand side of the dialog box.
- C) Check the **ENABLE AUTOMATION** check box at the top of the dialog box to enable automation.

### **To group multiple 6300s:**

Right-click **ALL CONNECTIONS** in the Connections List and select **NEW GROUP**.

You can add multiple 6300 to a single group to help organize a network of 6300. However, only one 6300 from within a group can be connected to 6300 PC Remote at any one time.

### **Navigation Using the Keyboard**

In general, PC Remote uses standard Windows conventions for navigation.

Navigate around the screens using the **TAB** key. Use **CTRL-TAB** to move to the next tabbed screen in PC Remote.

Use the + and – keys or the left and right arrow keys on the numeric keypad to adjust control settings.

### **To Quit the Program**

Use standard Windows conventions: Press **ALT-F4** on the keyboard, or click the X on the upper right corner with the mouse.

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## About Aliases created by Optimod 6300 PC Remote Software

When you ADD A NEW 6300 using Optimod 6300 PC Remote, your 6300 automatically receives a 6300 Alias name to differentiate it from other 6300s. You can change the name anytime in the 6300 Properties window inside 6300 PC Remote.

When you add a new 6300 or change the name of an existing 6300 Alias, an Alias folder is created in the same location as the executable for Optimod 6300 PC Remote (usually \Program Files\Orban\Optimod 6300). The folder has the same name as the Alias name. Once you establish the initial connection to the 6300, all presets for that 6300 are automatically copied to the Alias folder; thus, the folder contains all the preset files for that 6300, both Factory and User. If you have backed up the 6300 using 6300 PC Remote, these will appear in a "backup" subfolder located within the Alias folder.

Archived user preset files are text files and can be opened in a text editor (like Notepad) if you want to examine their contents. Of course, you will only see a meaningful display if the files were archived in plaintext (i.e., not encrypted).

Alias folders and their associated backup subfolders are registered in your PC's Registry. This prevents folders from being accidentally deleted or moved. If you move or delete Alias folders from the PC, the Alias folders recreate themselves in the previous location and restore their contents by copying it from their associated 6300s when 6300 PC Remote connects to such a 6300.

## Multiple Installations of Optimod 6300 PC Remote

Rarely, you may want to have more than one installation of 6300 PC Remote on your computer. There are a few extra things to know if you have multiple installations.

If you install a new version of the Optimod 6300 PC Remote software on your PC, any Alias folders and backup subfolders created in an earlier software version still remain in their original location on your PC (and in its registry).

The version of 6300 PC Remote must match the version of the software in the 6300 controlled by it. Therefore, you will only need multiple installations of PC Remote (having separate version numbers) if:

- you are controlling multiple 6300s, and
- not all of your 6300s are running the same version of 6300 software, and
- you do not want to upgrade at least one controlled 6300 to the latest version of 6300 PC Remote software.

Each version of 6300 PC Remote has its own top-level folder, normally under \Program Files\Orban. (The default folder is \Program Files\Orban\Optimod 6300.) When you install a new version of 6300 PC Remote, the default behavior is to overwrite the old version, which is usually the desired behavior. To prevent the installer from overwriting the old version, you must specify a different installation folder

when you install the new version (for example, \Program Files\Orban\Optimod 6300v2).

Each version of 6300 PC Remote will display *all* 6300 Aliases, even those pointing to 6300s with incompatible version numbers. If you attempt to connect to an older version of 6300 from a newer version of 6300 PC Remote, 6300 PC Remote will offer to upgrade the software in the target 6300 so that it corresponds to the version of 6300 PC Remote that is active. If you attempt to connect to newer version of 6300 from an older version of 6300 PC Remote, it will refuse to connect and will emit an error message regarding incompatible versions.

If you decide to install the new software to a different location on your PC, new Aliases created using the new software will not be located in the same place as the old Aliases.

#### **To Move Alias Folders:**

Even though each version of 6300 PC Remote can see all aliases, you may wish to move the corresponding folders so they are under the folder corresponding to the highest version of 6300 PC Remote that is currently installed on your computer (although this is not required). If your Alias folders reside in different locations, you can move all the Alias folders to the same location by using the PC Remote software. *Do not use an external file manager (like Windows Explorer) to do this.* The old Alias folders need to be re-created under the Optimod 6300 PC Remote software you wish to use (so that the registry entries can be correctly updated). You can do this two different ways.

- **Rename the Alias (preferred):** Start the Optimod 6300 PC Remote executable you wish to use and rename your old Aliases with a slightly different name. A new Alias folder with the new name will be created in the same location as the Optimod 6300 PC Remote executable.
- **Delete and Recreate the Alias:** Start the Optimod 6300 PC Remote executable you wish to use. Delete the old 6300 Aliases and create new ones to replace them. New Alias folders will be created in the same location as the Optimod 6300 PC Remote executable.

*Important:* The deletion process will automatically erase its associated folder, including the Backup directory. If you have anything in the Backup directory that you wish to keep, you should therefore move that directory elsewhere (or transfer the desired files to another, active backup directory).

Ordinarily, the erasure process will move the Backup directory to your computer's Recycle Bin, so you can recover a Backup directory that you have accidentally deleted in this way.

#### **To share an archived User Preset between 6300s:**

- A) Navigate to the directory containing the desired User Preset from within the RESTORE FROM PC dialog box

B) Click the **RESTORE** button.

This User Preset will be downloaded to the 6300 to which 6300 PC Remote is currently connected.

If the User Preset is encrypted, PC Remote will request its password.

## Using the 6300 for Production and Mastering

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The 6300 can be a useful tool for mastering and production applications in the professional audio industry, such as preparation of equalized, level-controlled, peak limited CD masters. We have frequently used the 6300 in this context, achieving excellent results.

Because of their broadcast origins, most of the 6300's presets provide more processing than would ordinarily be required for mastering. In addition, we would expect that the mastering engineer would want to tweak a preset carefully to complement the program material being mastered. The 6300 provides important tools to allow a mastering engineer to fine-tune the processing to complement the program material:

- A stereo enhancer with two operating modes. (See page 3-39.) Used subtly, this can add transient punch and definition to a mix.
- Three bands of parametric equalization with low-noise filter structures and curves modeled after classic second-order analog bell-shaped EQ. (See *Equalizer Controls* on page 3-34.)
- A powerful, low-noise parametric bass shelving equalizer with sweepable frequency and a choice of 6, 12, or 18 dB/octave slopes.
- A program-adaptive high-frequency enhancer. This is a program-adaptive 6dB/octave shelving equalizer with a 4 kHz turnover frequency. It constantly monitors the ratio between high frequency and broadband energy and adjusts the amount of equalization in an attempt to make this ratio constant as the program material changes. It can therefore create a bright, present sound without over-equalizing material that is already bright.
- 2-band and 5-band compressor/limiters with phase-linear crossovers and powerful controls, including attack time, release time, threshold, knee, and ratio for each band. These compressor/limiters also offer user-adjustable inter-band coupling, allowing the user to operate them anywhere from quasi-wideband to fully independent.
- A look-ahead peak limiter with advanced, proprietary distortion reduction algorithms.

You cannot create a user preset "from scratch"; you must create it by modifying an existing preset, factory or user. Each preset has an "easy adjustment" facility called

LESS-MORE, which is a one-knob provision for turning the amount of processing up or down.

The following systematic procedure is a good method for creating mastering presets. It assumes that you are using the Digital #1 output.

- A) Connect to the 6300 via 6300 PC Remote software. This gives you access to **advanced controls that are not available from the 6300's front panel**. These controls are crucial to fine-tuning the 6300 for mastering.

Note that by selecting **groups of controls with your computer's mouse, you can temporarily couple them so you can adjust several bands' controls simultaneously**. You can either CTRL-click the controls you wish to couple or create a selection box (sometimes called a marquee) around adjacent controls by clicking and dragging. To ungroup controls, click on any control outside the group.

- B) Set target loudness (Dialnorm).
- a) Set the **LIMITER #1 SOURCE** to Multiband. (I/O **SETUP>MISC**).
  - b) Set the **GLOBAL TARGET LOUDNESS** value (I/O **SETUP>MISC**) to the target loudness in LUFS. If the output medium uses Dolby Digital, match the **Dialnorm value to be authored into the medium's Dolby Digital metadata**. (Refer to step 11.B)a) on page 2-30.)
  - c) Set the **DIGITAL OUTPUT #1 SOURCE** to LIMIT NORM (I/O **SETUP>OUTPUT 1**).
- C) Decide whether you are going to use 2-band or 5-band processing.

2-band processing retains any fixed equalization originally applied to the program (except for a mild amount of dynamic adjustment to bass below 200 Hz); 5-band **processing performs an "automatic re-equalization"** function. Both flavors of processing can be extremely smooth and unobtrusive. Because the 5-band compressor/limiter offers user-adjustable **interband coupling that determines the "discreteness" of the multiband compression**, it is usually the best choice.

- If you are going to use 2-band processing, recall the **2B SOFT KNEE** preset.
- If you are going to use 5-band processing, recall the **5B SOFT KNEE** preset.
- If you want to do look-ahead peak limiting without any other dynamics processing, recall the **LOOK-AHEAD LIMITER** preset.

See *Protection and AGC Presets* on page 3-23 for a description of these presets.

- D) If you have started with one of the **SOFT KNEE** presets, the AGC will already be **OFF**. If you need a very large amount of compression for an application like processing material intended for in-flight entertainment systems, you can either edit the preset to turn the AGC on or start with a preset other than **SOFT KNEE**.

You can turn the AGC off globally for all presets, which is convenient if **you don't expect to use it in the future**. (See step 2 on page 2-22.)

For applications like in-flight entertainment, instead of continuing with the steps below you may wish to use a factory TVxxxx preset, which uses both the AGC and the Loudness Controller to reduce dynamic range by a large amount with few audible side effects.

- E) The purpose of the MB gate is to prevent background noise from being pumped up when the program material is very quiet. (See page 3-57.) Unless you will be using more than approximately 6dB of compression for special applications, set the **MB GATE THRESHOLD** to **OFF**.

In the **SOFT KNEE** and **LOOK-AHEAD LIMITER** presets, this is already done.

The multiband gate only works appropriately when the **KNEE** and **RATIO** controls of all bands are set identically, which is typically true in broadcast applications. We recommend turning off the multiband gate if the individual **KNEE** and **RATIO** settings are unequal.

- F) If you are using the 5-band structure, choose the crossover frequency between bands 1 and 2 via the **B1/B2 CROSSOVER** control. The available settings are 100 Hz and 200 Hz.

The crossover frequency significantly affects the bass texture and the best way to understand the differences between the two crossover frequencies is to listen. We prefer 100 Hz for most mastering applications because it puts most of low instrumental bass energy (typically kick drum and bass) in band 1 and most vocal fundamentals in band 2, allowing these crucial mix elements to be adjusted more independently.

- G) Adjust the **2B DRIVE** control (2-band) or **MB DRIVE** control (5-band) to achieve the desired amount of multiband gain reduction.
- H) Adjust the release time control (**2B RELEASE** or **MB RELEASE**) to achieve the desired compression density.

If you are using the 5-band structure, you can use the **DELTA RELEASE** controls to fine-tune the release time of each band independently.

The release characteristic is always "automatic" (i.e., multiple time constant), and the **RELEASE** control simply scales this process. This, combined with multiband operation, makes the compression remarkably resistant to the usual compressor pumping and squashing.

- I) Adjust the **ATTACK TIME** controls on the individual compressors to trade off overshoot control against transient punch.
- J) Adjust the **RATIO** and **KNEE** controls in each band to taste.

The **RATIO** control sets the compression ratio at the threshold of compression. To achieve a classic soft knee characteristic, set the **RATIO** to 1:1 and adjust the softness of the knee with the **KNEE** control.

The **KNEE control's** setting is the gain reduction in dB at which the compression ratio reaches  $\infty$ :1. (See page 3-53 for a description of the **RATIO**, **KNEE**, and **BREAKPOINT** controls.)

- K) After you adjust the **RATIO** and **KNEE** controls, adjust the **THRESHOLD** controls in the individual bands to achieve the desired amount of gain reduction.

The **KNEE** control automatically and invisibly changes a given band's internal compression threshold to keep the compressor's output level con-



stant whenever the drive level is high enough to move the gain reduction into the  $\infty$ :1 range. This means that the internal threshold automatically decreases with softer knee settings (higher settings of the **KNEE** control). However, the indicated threshold the 6300's **user interface** does not change. This behavior ensures that the **THRESHOLD** control alone determines the maximum output level of the compressor, regardless the **KNEE control's setting**.

L) Adjust equalization as necessary.

As discussed above, there is a versatile program equalizer available between the AGC and multiband compressor. In 5-band mode, there is also a 5-band mix control (functioning as a phase-linear graphic equalizer) after the 5-band compressor. In 5-band mode, any fixed equalization will **be partially "undone" by the dynamic re-equalization effect of the 5-band compression**, so 2-band mode is most useful when you are relying on the 6300's **fixed EQ or on external EQ earlier in the signal path**.

Note also that you can use the **BASS COUPLING** control, the **HF COUPLING** control, and the individual band compression threshold controls to affect the amount of automatic re-equalization performed by the 5-band compression. As you set these controls closer to 100%, they permit progressively less dynamic LF and HF program-adaptive boost. If you feel that the dynamic re-equalization is not producing enough brightness when the program material lacks high frequencies, you should turn the **BAND 3>4** and **BAND 4>5 COUPLING** closer to 0%. Similarly, if weak bass is not sufficiently boosted, turn the **BAND 2>1 COUPLING** closer to 0%.

M) Adjust the **LIMITER ATTACK TIME** controls to taste.

These controls affect the multiband compressor and are unrelated to the final look-ahead peak limiter. They allow you to set the limiter attack anywhere from 0 to 100% of normal in the 5-band compressors, each of whose gain reduction has a fast-release (limiter) and slow-release (compressor) component. Because the limiter and compressor characteristics interact, you will usually get best audible results when you set these controls in the range of 50% to 100%. Below 50%, you will usually hear pumping because the compressor function is trying to create some of the gain reduction that the faster limiting function would have otherwise achieved. If you hear pumping in a band and you still wish to adjust the limiter attack to a low setting, you can sometimes ameliorate or eliminate the pumping by slowing down the compressor attack time in that band.

Of course, sometimes pumping is desired for certain styles of music and/or recording. The **LIMITER ATTACK TIME** controls can help achieve this sound.

N) Adjust the **TRANSIENT ENHANCE** control to taste.

This control allows you to insert an audio delay of up to 10 ms in the sidechain of the five-band compressor. Delaying the gain control signal, allows attack transients to pass through the multiband compressor uncompressed, which can increase punch. There is a tradeoff between this control and the amount of gain reduction in the look-ahead limiter, which will have to eliminate attack transients exceeding the look-ahead **limiter's threshold**.

O) Set the amount of peak limiting with the **FINAL LIMIT** control.

In general, the less peak limiting you use, the better sounding the result **will be**. However, if your client demands a “loud” result, the 6300’s look-ahead peak limiter is a powerful tool for achieving this with minimum distortion or other side effects. Nevertheless, be aware that this function **is not like some familiar “look-ahead” limiters**. The release time is in the order of a few milliseconds and is not user adjustable. The purpose of the limiter is *only* to limit peaks that pass through the earlier compressors because of their finite attack times. Functionally it is used like a peak clipper, but has vastly reduced “crunchy” distortion by comparison to a clipper, whether “soft knee” or “hard knee.”

The main potential side effects of the look-ahead limiter are gain breathing and a “warbling” sound in the midrange when heavy bass is simultaneously present. Listen carefully for this intermodulation effect (particularly on vocals) when you are adjusting the **FINAL LIMIT** control.

- P) Adjust the **BASS CLIP THRESHOLD** and **BASS CLIP SHAPE** controls to complement the amount of final limiting. (See page 3-45.)

For most mastering applications, you can set the **BASS CLIP THRESHOLD** to **OFF**. However, if you hear pumping or “warbling” distortion in the look-ahead limiter caused by heavy bass transients, you can reduce this effect by setting the **BASS CLIP** to a lower level. (The **BASS CLIP** control is calibrated in “dB below the look-ahead limiter threshold.”) It is most effective when the **B1/B2 CROSSOVER** control is set to 100 Hz, as this setting prevents intermodulation between vocals and instrumental bass in the clipper.

- Q) If you wish to compare your processed sound to the unprocessed original, recall the **LOOK AHEAD LIMITER** preset and toggle between it and your processing preset. If there is a gross loudness disparity, you may wish to edit the gain within the **LOOK AHEAD LIMITER** preset and save this as a user preset. However, be careful not to clip the output if you set the bypass for gain.

You can determine whether you are clipping by observing the level meter in the **OUTPUT** page of the mixer.

- R) Save your preset using File/Save Preset.

Once you have created one “mastering” preset, you can edit it to create others and save them under different names.

- S) If the output will never be applied to a transmission path that uses a lossy codec, set the digital output level to -0.1dBFS.

If your mastered audio is intended for transmission via a lossy codec like AAC, MP3 or WMA, **be aware that the codec’s decoder may overshoot** and cause audible clipping distortion. See *Setting Output/Modulation Levels* on page 1-25. If the 6300’s output is applied directly to a lossy codec, decrease the setting of the 6300’s output level control to allow the necessary headroom. 1.5 dB is sufficient for low bit-rate codecs like HE-AAC, and 1.0 dB is sufficient for high bit-rate codecs like AAC and MP3.

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## Appendix A: Using the ITU BS.1770 and CBS Loudness Meters to Measure Loudness Controller Performance

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[**Note:** This Appendix is a reprint of a stand-alone white paper. For this reason, it contains some explanatory material regarding the CBS and BS.1770 meters that is also found elsewhere in this manual.]

### ITU-R BS.1770

In 2009, the ATSC released a Recommended Practice: *Techniques for Establishing and Maintaining Audio Loudness for Digital Television* (A/85:2009). This was later updated as A/85:2011. A/85 specifies use of a long-term loudness meter based on the ITU BS.1770 algorithm for measuring the loudness of DTV broadcasts.

In December 2011, the FCC adopted rules implementing the CALM Act<sup>1</sup>, which, by law, forbids commercials from being louder than non-commercial program material. The new FCC rules incorporated ATSC A/85 (and, by implication, the BS.1770 meter) as an objective means of verifying that the rule was being obeyed.

Because loudness measurement per BS.1770 uniformly integrates all program material, quiet passages tend to lower the measured value. To prevent this, the ITU added gating to the BS.1770 standard, which was revised as BS.1770-4 in March 2011. The gating causes the meter to ignore silence and to integrate only program material whose loudness falls within a floating window extending from the loudest sounds within the specified integration period to sounds that are 10 dB quieter than the loudest sounds. This is because humans tend to assess loudness based on the louder sounds in a given program. As of this writing, ATSC A/85 has not been updated to incorporate the BS.1770-4 standard.

The ATSC A/85 2011, ITU-R BS.1770-4, and EBU R 128 documents are available as free downloads and can easily be located with a search engine.

### CBS Loudness Meter

For many years, Orban has used the Jones & Torick loudness controller and loudness measuring technology<sup>2</sup> in its products for loudness control of sound for picture. Developed after 15 years of psychoacoustic research at CBS Laboratories, the CBS loudness controller accurately estimates the amount of perceived loudness in a given

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<sup>1</sup> The CALM Act applies only to U.S. broadcasters and cable providers.

<sup>2</sup> Jones, Bronwyn L.; Torick, Emil L., "A New Loudness Indicator for Use in Broadcasting," J. SMPTE September 1981, pp. 772-777.

piece of program material. If the loudness exceeds a preset threshold, the controller automatically reduces it to that threshold. The CBS algorithm has proven its effectiveness by processing millions of hours of on-air programming and greatly reducing viewer complaints caused by loud commercials.

Since first licensing the CBS algorithm and using it in its Optimod-TV 8182 in the early 1980s, Orban has continually refined and developed this technology. In the last 30+ years, audio processors from Orban and CRL using the CBS loudness controller have processed millions of hours of on-air television programming — an unsurpassed track record that no other subjective loudness controller technology can claim.

#### Comparing the Meters

Because the ATSC recommends the BS.1770 algorithm, many broadcast and cable engineers facing the problem of controlling broadcast loudness have wondered how the CBS and BS.1770 technologies compare. An earlier version of this Orban white paper compared the CBS and BS.1770-1 (non-gated) meter. The paper you are now reading was revised in March 2012 to incorporate results from tests using the BS.1770-4 algorithm and EBU – TECH 3342 “Loudness Range” algorithm. The new measurements were performed using Version 2 of the Orban Loudness Meter<sup>3</sup>. This revision compares the CBS and BS.1770-4 meters because we expect that the ATSC will eventually update A/85 to specify BS.1770-4, which will more closely harmonize A/85 with its European counterpart, EBU R 128.

A/85 and R 128 differ significantly in their philosophy and recommendations. Probably most important difference is that A/85 asserts that the loudness of a so-called “anchor element” (which is typically dialog except in programs emphasizing music, like live concert recordings) is most important, while R 128 asserts that the integrated loudness of the entire program is most important<sup>4</sup> and therefore, program loudness should be normalized based on an integrated BS.1770-4 measurement. The philosophy behind A/85 is similar to that of Dolby Laboratories, which for many years has asserted that dialog anchors most film and television programs and that listeners set their volume controls to make dialog comfortably intelligible<sup>5</sup>. (We agree more with A/85 than with R 128).

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<sup>3</sup> This software is available for free download at <http://orban.com/meter/>.

<sup>4</sup> EBU – TECH 3343, “Practical guidelines for Production and Implementation in accordance with EBU R 128,” version 1 (February 2011), p. 29

<sup>5</sup> Riedmiller, J., Lyman, S., Robinson, C., “Intelligent program loudness measurement and control: what satisfies listeners?” AES Convention Paper 5900, 115<sup>th</sup> Convention (October 2003)

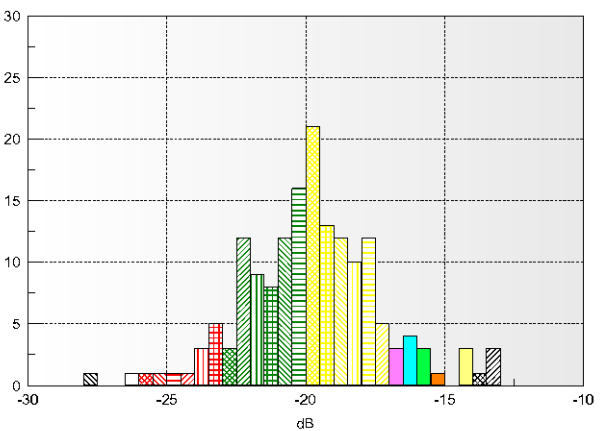
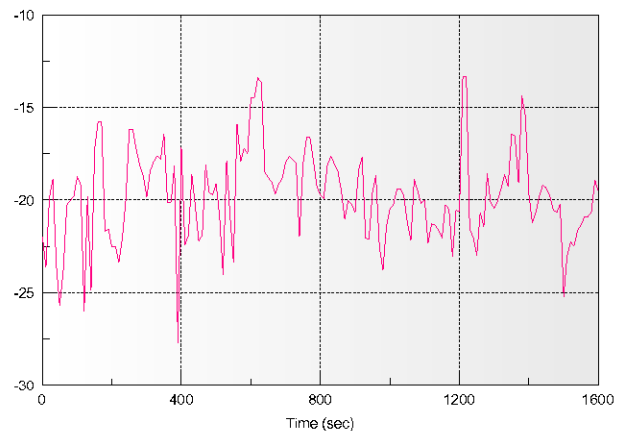
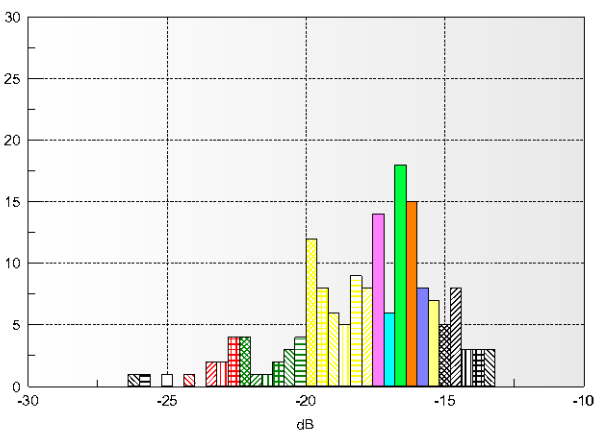
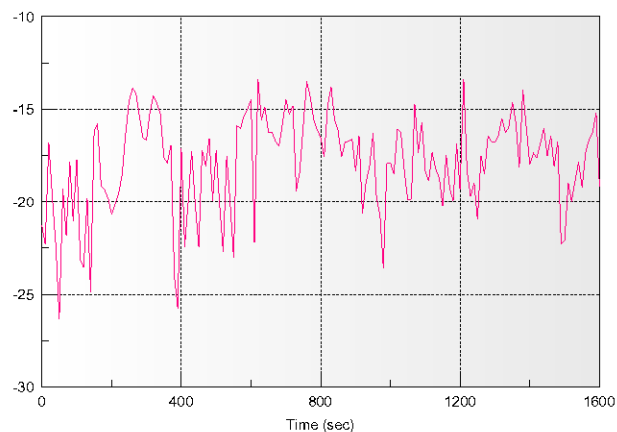
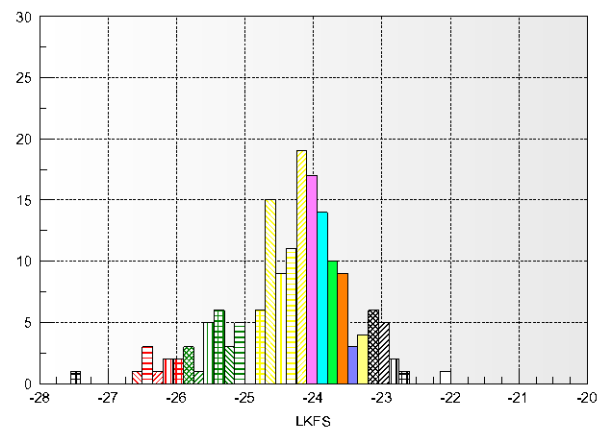
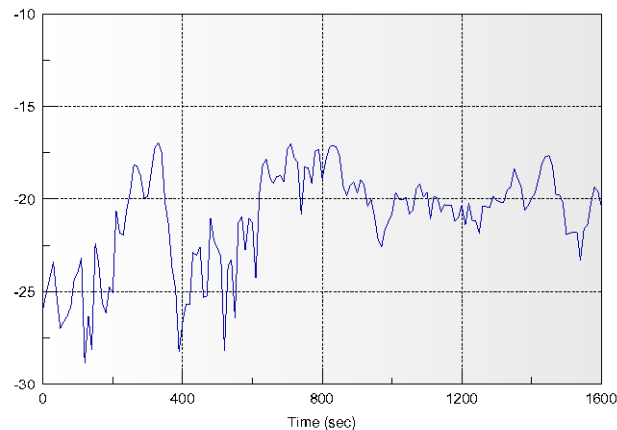


Figure 3-3: Unprocessed Input—  
Peak Output of the BS.1770 and CBS Loudness Meters in each 10-second Interval as a Function of Time

Figure 3-4: Unprocessed Input—  
Histograms sorting loudness measurements into 0.25 dB bins.

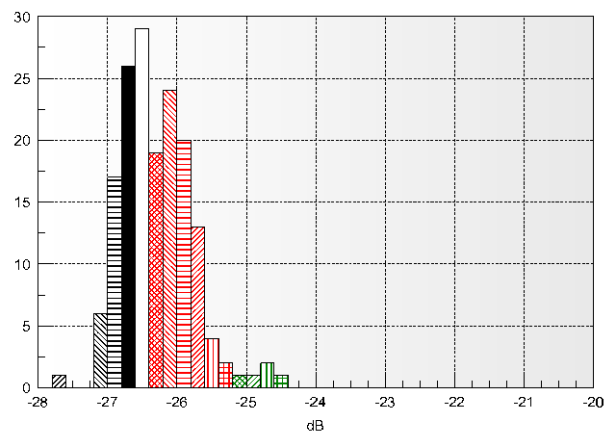
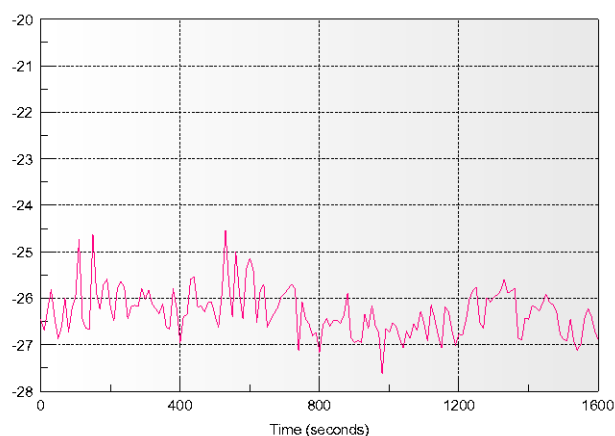
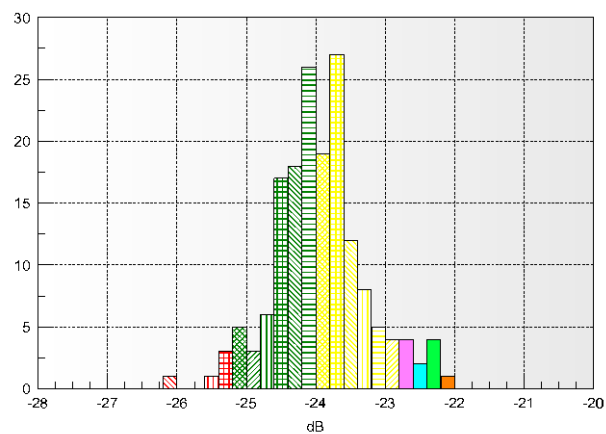
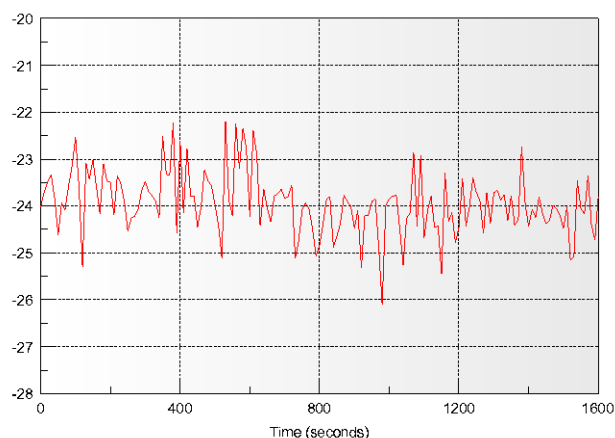
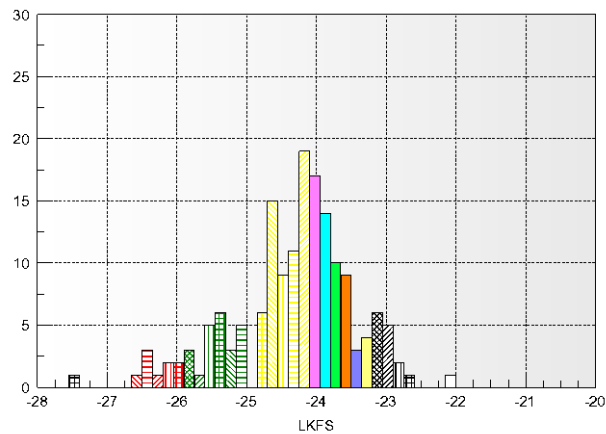
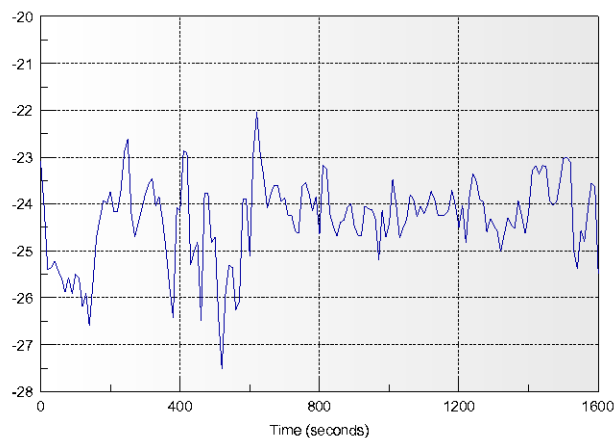


Figure 3-5: Loudness-Controlled Audio—  
Peak Output of the CBS and BS.1770 Loudness Meters in each 10-second Interval vs. Time

Figure 3-6: Loudness-Controlled Audio—  
Histograms sorting loudness measurements into 0.25 dB bins

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### Test Setup

A stereo recording of approximately 30 minutes of unprocessed audio from the output of the master control of a San Francisco network station was applied to the 2.0 processing chain of an Optimod-Surround 8685 processor, set for normal operation using its TV 5B GEN PURPOSE preset. The digital output of the processor was applied to the digital input of an Orban 1101 soundcard, which was adjusted to pass the audio without further processing and to apply it to an Orban software-based loudness meter that simultaneously computes the BS.1770-4 Integrated loudness and CBS loudness. The first 750-second segment of the program material was a daytime drama with commercial and promotional breaks, while the remainder was local news, also with commercial and promotional breaks.

The BS.1770-4 meter was adjusted to produce a 10-second integration window in which, per the BS.1770 standard, all data are equally weighted. The CBS Loudness Gain control was set to  $-3.12$  dB. Data were logged every 10 seconds and included the maximum meter indication produced by both the BS.1770 and CBS meters in each 10-second interval. This produced 165 data points, which were imported into a scientific plotting application<sup>6</sup>.

Orban's experimental long-term loudness measurement, based on the CBS meter and first published in 2008, was also included in the measurements and is shown in the bottommost charts. This algorithm attempts to mimic a skilled operator's mental integration of the peak swings of a meter with "VU-like" dynamics. The operator will concentrate most on the highest indications but will tend to ignore a single high peak that is atypical of the others. This algorithm can be seen to share certain characteristics with the floating gate first introduced in EBU R 128 and later adopted in BS.1770-4.

The Orban algorithm displays the average of the peak indications of the meter over a user-determined period: 10 seconds for these measurements. The average is performed before dB conversion. All peak indications within the period are weighted equally with the following exceptions:

- If the maximum peak in the window is more than 3 dB higher than the second highest peak, it is discarded.
- All peaks more than 6 dB below the maximum (or second-to-maximum, if the maximum peak was discarded) are discarded.

Because the CBS long-term measurement discards a single peak if it is more than 3 dB higher than the second highest peak, the CBS long-term measurement tends to be biased about 3 dB lower than a measurement that shows the maximum peak indication of the CBS meter in a 10-second period. This depends on whether or not the loudness applied to the meter's input is well controlled. This bias can be seen in the figures in the paper. Because the Orban meter allows control of the level applied to the CBS algorithm via the "CBS Gain" control, setting it 3 dB higher could better

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<sup>6</sup> PSI Plot: <http://www.polysoftware.com/plot.htm>

match the CBS long-term measurement to the BS.1770-4 Integrated measurement at the expense of moving the “maximum peak loudness” indication 3 dB higher.

#### Results

*Unprocessed Audio Input:* To provide a baseline for discussion of the loudness-controlled results, we measured the unprocessed audio that was applied to the Optimod 8685’s input. Figure 3-3 and Figure 3-4 on page 3-79 show the loudness of the unprocessed audio both as a function of time and as a histogram. The histogram sorts the meter outputs into 0.25 dB or 0.25 LK<sup>7</sup>-wide slices and shows the number of measurements that fit into each of these slices. The histogram thus portrays loudness consistency — when the histogram is clustered tightly within a few bins, the loudness is more consistent than it is when the histogram is spread out into a larger number of bins.

With all meters, the histogram of the unprocessed audio shows a wide spread. This is consistent with the EBU Loudness Range measurement for the entire clip, which was 16.5 LK, while the LRA for the daytime drama alone was 19.2 LK (including commercials). The BS.1770-4 Integrated loudness was –20 LUFS, integrated over the entire measurement period, although the inconsistencies between the loudness of program material and commercials are large enough to make this 30-minute measurement essentially meaningless.

In general, the loudest parts of the unprocessed audio are commercials and promos, both network and local. These are anywhere from 5 to 10 dB (or LK) louder than the rest of the program material. This inconsistency was not a problem because the station in question was using an Orban automatic loudness controller on-air, which smoothed out loudness differences before its input.

While the general shapes of the CBS and BS.1770 loudness vs. time curves are similar, there were some significant differences. For example at approximately 1250 seconds, the CBS measurement shows a sharp loudness spike that was caused by a network news report that was equalized to emphasize frequencies around 2 to 3 kHz, where the ear is most sensitive. The BS.1770-4 measurement did not indicate this as being louder than the surrounding program material although to our ears, it clearly was.

*Loudness-Controlled Audio:* Figure 3-5 and Figure 3-6 on page 3-80 show the results after automatic loudness control. (To present the data with optimum graphic resolution, we made the loudness scales of Figure 3-5 and Figure 3-6 narrower than the scales in Figure 3-3 and Figure 3-4.)

Both the loudness vs. time graphs and the histograms show the Orban 8685 controls loudness well, although the details of the meters’ indications are different. Both the BS.1770 and CBS measurements indicate that most of the data points are in a  $\pm 1$  dB/LK window.

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<sup>7</sup> Unfortunately, two terms for the same loudness units have been used in different standards documents. For convenience, we will use LK and LKFS (as used in ATSC A/85); these units are the same as LU and LUFS (used in EBU R 128 and BS.1770) respectively.



The peak CBS readings fit within a  $\pm 2$  dB window. The BS.1770 readings also fit within a  $\pm 2$  LK window except for four short intervals, which appear as low-probability outliers in the left side of the histogram. These intervals correspond to dialog without background music and in the author's opinion illustrate a weakness in BS.1770-4: based on our extensive listening tests, we have concluded that the meter does not effectively lock onto the A/85 "anchor element" (almost entirely dialog in the test material used to prepare this paper) and instead indicates that loudness increases when dialog level is held constant while underscoring or effects are added to the mix.<sup>8</sup>

#### Problems with Low Peak-to-RMS Ratio Material

In the subjective testing to validate the BS.1770 meter, there were outliers as large as 6 dB (i.e., the meter disagreed with human subjective perception by as much as 6 dB<sup>9</sup>.) The subjective testing to validate the CBS meter found outliers up to 3 dB, although fewer items were used in this testing. We hypothesize that the fact that the worst-case error of the BS.1770 meter was substantially larger than that of the CBS meter is caused by the BS.1770's meter's not modeling loudness summation or the loudness integration time constants of human hearing.

BS.1770-4 states: "It should be noted that while this algorithm has been shown to be effective for use on audio programmes that are typical of broadcast content, the algorithm is not, in general, suitable for use to estimate the subjective loudness of pure tones." We have noted that the meter tends to over-indicate the loudness of program material that had been subject to large amounts of "artistic" dynamic compression, as is often done for commercials and promotional material — in other words, the meter over-indicates the loudness of program material having an unusually low peak-to-average ratio, which, at the limit, approaches the peak-to-average ratio of a pure tone. We have encountered heated complaints by mixers<sup>10</sup> and producers who stated that such material, when "matched" to the loudness of the surrounding program material via the BS.1770 meter, is considerably quieter in subjective terms. In turn, this has constrained the ability of producers to specify the type of audio processing they had previously used to give this material excitement and punch. We hypothesize that this problem is related to the fact that BS.1770 does not accurately indicate the loudness of pure tones.

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<sup>8</sup> In the first published version of the paper, we observed the similar dips in the BS.1770-1 (ungated) loudness and hypothesized that they were caused by lack of gating on silence and low-level material. For this reason, we were surprised that BS.1770-4 gating made little difference in the measurements of this material.

<sup>9</sup> Refer to the scatter plots in Figs. 11, 12, and 13 of the ITU-R BS.1770-4 standard.

<sup>10</sup> For example: "I did a -24 [LKFS] piece for Fox that was wall to wall singing and music for two minutes. Because of the overall loudness and continued full audio signal I had to bring it down and when it aired, it was 3 db too quiet even though it matched the magic LKFS number. I have no problem using these meters or meeting specs but they are faulty."

—"wheresmyfroggy," AVID board, 3-28-2011

Some studies have indicated that when people are asked to assess the loudness of a given piece of material, they state that it sounds louder when underscoring or effects are added to constant-level dialog. The EBU has used these studies to justify the position taken in R 128 that a listener's impression of total loudness is more important than dialog level<sup>11</sup>. In our opinion, this misses the point. A more relevant question is whether viewers would want to turn down their volume controls to make dialog quieter when underscoring and effects appear. (In other words, whether effective TV commercial loudness control requires nothing more than applying gain control to commercials such that the BS.1770-4 "short-term" loudness<sup>12</sup> is always limited to 0 LU.) Regarding this, Orban and Dolby Labs hold similar views. We believe that dialog is the most important element in most television audio and that listeners do not want to turn down their volume controls every time that underscoring or effects appear under the dialog. The popular Dolby LM100 Loudness Meter<sup>13</sup> in its current revision uses the same Leq(RLB) algorithm as BS.1770 but adds gating to eliminate non-speech material, including silence. The author has used the Dolby LM100 to measure the output of the Orban 8685 with a wide variety of speech material, and has observed that this material is almost always controlled within a  $\pm 1$  dB window as measured on the LM100. In the author's opinion, this demonstrates the benefits of a dialog-centric measurement. Moreover, the author believes it is unwise to rely on a BS.1770 measurement to set the on-air loudness of unadorned dialog because this can cause the dialog to be too loud with respect to other material. The author has experimented with "inverse short-term BS.1770 loudness control" and believes that it sounds unnatural, pumping dialog loudness up and down in a subtly inartistic way as underscoring and effects come and go.<sup>14</sup>

Studies indicating that BS.1770 is inaccurate at very low frequencies

Another weakness of BS.1770 is that, unlike the CBS loudness controller and meter as implemented in Orban products, the BS.1770 algorithm does not take into account the loudness contributed by the LFE channel, for good reason. Nacross and

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<sup>11</sup> Dash, Ian; Bassett, Mark; Cabrera, Densil, "Relative Importance of Speech and Non-Speech Components in Program Loudness Assessment," AES Convention Paper 8043, 128th AES Convention (May 2010).

<sup>12</sup> EBU R 128 specifies short-term loudness as a BS-1770-1 (ungated) measurement with a three-second integration time.

<sup>13</sup> <http://www.dolby.com/professional/products/broadcast/test-and-measurement/lm100.html>

<sup>14</sup> See Begnert, Fabian; Ekman, Håkan; Berg, Jan, "Difference between the EBU R-128 Meter Recommendation and Human Subjective Loudness Perception," AES Convention Paper 8489, 131<sup>st</sup> AES Convention, (October 2011). This paper states, "These loudness-equalized signals gave rise to a perceived maximum loudness difference of 2.8 dB." This is very close to the 3 dB number that has come up in other discussions (such as the one quoted in footnote 10 on page 3-85). While the authors of this paper consider 3 dB to be insignificant, others do not necessarily share this view, particularly advertisers who hear their expensive commercials aired 3 dB quieter than surrounding program material!

Lavoie<sup>15</sup> tried to extend the BS.1770 algorithm to include the LFE channel by summing the K-weighted LFE channel's power into the current BS.1770 algorithm, where the gain is weighted for the fact that LFE channel receives a 10 dB gain boost on playback, per Dolby's standards. This modified BS.1770 algorithm failed to agree with the judgments of a subjective listening panel unless a 10 dB attenuation "fudge factor" was applied to the LFE channel prior to its power summation with the other channels. Nacross and Lavoie concluded:

A problem exists however, should ITU-R BS.1770 be modified to simply include an attenuated version of the LFE channel. Because the LFE channel receives a 10 dB boost on playback, the low-frequencies on this channel would contribute differently to a loudness measure if they were moved to one of the other main channels, even though the perceived loudness would not appreciably change. This suggests that while LFE content does contribute to the perceived loudness, Equation (2)<sup>16</sup> does not sufficiently predict how that content should be included.

An Australian study may shed light on the failure of BS.1770 when program material contains considerable energy at very low frequencies.<sup>17</sup> The authors used octave-band noise in subjective listening tests with the goal of verifying the K-weighting curve used in BS.1770. The authors state:

Comparison of the test results with an image of the filter curve currently specified in ITU-R Recommendation BS.1770 (Figure 13) shows good agreement at 250 Hz and above 500 Hz, reasonable agreement at 500 Hz, but marked difference in the bottom two octaves.

The relatively good performance of the BS.1770 algorithm in ITU trials suggests that, in partial loudness terms, there was probably not much test content in the 125 Hz band or below. While the existing BS.1770 filter curve is probably a good choice in applications where the program is dominated by speech, and it is certainly an improvement on the A and B curves in that application, it is likely to give significant errors in measuring the loudness of other programs with more partial loudness in the lower frequencies, such as movie soundtracks and popular music. It is therefore desirable to improve on this filter for more general measurement of program loudness.

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<sup>15</sup> Norcross, Scott G; Lavoie, Michel C., "Investigations on the Inclusion of the LFE Channel in the ITU-R BS.1770-1 Loudness Algorithm," AES Convention Paper 7829, 127<sup>th</sup> AES Convention (October 2009)

$${}_{16} Leq(w) = \left[ \frac{1}{T} G_{LFE} \int_T^0 \frac{x_w^2}{x_{ref}^2} dt + \sum_i \frac{1}{T} \int_0^T \frac{x_{w,i}^2}{x_{ref}^2} dt \right], dB$$

$$i = L, R, C, L_s, R_s$$

<sup>17</sup> Cabrera, Densil; Dash, Ian; Miranda, Luis, "Multichannel Loudness Listening Test," AES Convention Paper 7451, 124<sup>th</sup> AES Convention (May 2008)

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Discussion and Conclusions

Several studies have shown that the loudness “comfort range” for typical television listening is +2, –5 dB<sup>18</sup>. Beyond this range, a viewer is likely to become annoyed, eventually reaching for the remote control to change volume (or worse from the broadcaster’s point of view, to mute a commercial). Whether measured via the CBS or BS.1770 algorithms, the CBS loudness controller algorithm in Orban’s current products effectively controls subjective loudness to much better than this +2, –5 dB window.

In the original version of this paper, we had assumed that results using BS.1770 metering would be more consistent if that algorithm employed gating to prevent undrained dialog from reading low compared to music and dialog with substantial background music or effects. However, this did not prove to be true with the program material we used for testing—the results from the BS.1770-1 (ungated) and BS.1770-4 (gated) measurements were similar when measuring material that had been processed by the CBS Loudness Controller. It is likely that the loudness-controlled material seldom caused the gate to act. (The CBS algorithm does not need silence gating because it is a “short-term” loudness measurement that incorporates cascaded models of the “instantaneous” and “short-term” loudness time constants of human hearing<sup>19</sup>, which the BS.1770 algorithm does not.)

Controlling loudness to a standard such as BS.1770 says nothing about the subjective acceptability of the loudness controller’s action. We have found that a simple loudness controller that uses the inverse of the BS.1770 short-term meter’s output to control loudness by gain reduction can cause unnatural-sounding gain pumping of dialog when underscoring and effects appear under the dialog. More complex automatic loudness controllers can produce all of the well-known artifacts of dynamics processing, including noise breathing, spectral inconsistency, gain pumping, and harshness. Improperly designed multiband compressors can reduce dialog intelligibility<sup>20</sup>. This is why it is important to carefully assess the audio quality and side effects that an automatic loudness controller produces so that one can choose a device that controls loudness effectively without producing objectionable and unnatural artifacts that can fatigue audiences. Different loudness controllers do not provide equally good subjective results even if they produce identical measurements on a loudness meter.

Based on extensive experimentation with typical broadcast material, we believe that the CBS loudness meter locks onto dialog more effectively than does BS.1770, particularly when the dialog is accompanied by underscoring and/or effects. According-

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<sup>18</sup> ATSC A/85:2009 Annex E, “Loudness Ranges”

<sup>19</sup> For example, see Glasberg, B.R. & Moore, B.C.J. (2002) “A Model of Loudness Applicable to Time-Varying Sounds,” J.AES, vol.50:5, pp.331-342, May 2002.

<sup>20</sup> Stone, Michael A.; Moore, Brian C. J.; Füllgrabe, Christian; Hinton, Andrew C., “Multichannel Fast-Acting Dynamic Range Compression Hinders Performance by Young, Normal-Hearing Listeners in a Two-Talker Separation Task,” J. AES Volume 57 Issue 7/8 pp. 532-546; July 2009

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ly, the CBS Loudness Controller in Orban products, which uses the CBS loudness metering algorithm as its core loudness reference, produces consistent and naturally balanced dialog levels regardless of the program material and mixing style. Unlike the BS.1770 meter, the CBS technology does not unnaturally penalize material having a low peak-to-RMS ratio, so it allows mixers and producers to freely use “artistic compression”<sup>21</sup> and other well-established production techniques with the knowledge that such material will be neither too loud nor too quiet when compared to the surrounding program.

—Robert Orban, revised March 2012

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<sup>21</sup> It appears that the group that created R 128 may be biased against this style of production: “Again, this does NOT mean that within a programme the loudness level has to be constant, on the contrary! It also does NOT mean that individual components of a programme (for example, pre-mixes or stem-mixes, a Music & Effects version or an isolated voice-over track) have all to be at the same loudness level! Loudness variation is an artistic tool, and the concept of loudness normalisation according to R 128 actually encourages more dynamic mixing!” EBU TECH 3343, op. cit., p. 17



# Section 4

## Maintenance

### Routine Maintenance

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The Optimod 6300 Audio Processor uses highly stable analog and digital circuitry throughout. Recommended routine maintenance is minimal.

1. Periodically check audio level and gain reduction meter readings.

Become familiar with normal audio level meter readings, and with the normal performance of the G / R metering. If any meter reading is abnormal, see Section 5 for troubleshooting information.

2. Listen to the 6300's output.

**A good ear will pick up many faults. Familiarize yourself with the "sound" of the 6300 as you have set it up, and be sensitive to changes or deterioration. However, if problems arise, please do not jump to the conclusion that the 6300 is at fault. The troubleshooting information in Section 5 will help you determine if the problem is with OPTIMOD 6300 or is somewhere else in the station's equipment.**

3. Periodically check for corrosion.

Particularly in humid or salt-spray environments, check for corrosion at the input and output connectors and at those places where the 6300 chassis contacts the rack.

4. Periodically check for loss of grounding.

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

5. Clean the front panel when it is soiled.

Wash the front panel with a mild household detergent and a damp cloth. Do not use stronger solvents; they may damage plastic parts, paint, or the silk-screened lettering. Do not use paper-based cleaning towels or use cleaning agents containing ammonia, or alcohol. An **acceptable cleaning product is "Glass Plus."** For best results when cleaning the lens, use a clean, lint-free cloth.

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## Subassembly Removal and Replacement

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See page 6-23 for the *Circuit Board Locator and Basic Interconnections* diagram.

### 1. Removing the Top Cover:

To access any internal board (including the display assembly), you must remove the top cover.

#### A) Disconnect the 6300 and remove it from the rack.

Be sure power is disconnected before removing the cover.

Warning: Hazardous voltage is exposed with the unit open and the power ON. Parts of the power supply that are shielded by an insulating cover are hot to the AC line. These parts are labeled with a warning symbol like the one to the left of this paragraph. The insulating cover should always be in place when the 6300 is connected to the AC line.



#### B) Set the unit upright on a padded surface with the front panel facing you.

#### C) Remove all screws holding the top cover in place and lift the top cover off.

Use a #1 Phillips screwdriver.

### 2. Removing the Front Panel Assembly:

#### A) Detach the cables that connect the display board assembly to the control board. Avoid bending or breaking the pins. Note the lead dress so you can re-assemble the unit correctly.

#### B) Detach the front panel from the unit.

a) On each side of the chassis, remove the three screws close to the front panel.

b) Remove the front panel by sliding it out.

#### C) Set the front panel, face down, on a soft cloth to prevent scratches.

#### D) Using a 3/16-inch hex nut driver, remove the four hex nuts holding the two side brackets and central shield to the front panel. Remove the brackets and shield and set them aside.

#### E) Using a #1 Philips screwdriver, remove and reserve the eight screws and spacers that fasten the display board assembly to the front panel.

#### F) Lift the display board assembly off its supporting standoffs.

#### G) Separate the two boards in the display board assembly by carefully unplugging the top board from the bottom board. Note that there are four plugs and jacks.

### 3. Removing the Control board:

#### A) If you have not done so yet, remove the top cover (step 1, above).



- B) Using a 3/16-inch hex nut driver, remove the four hex nuts holding the DB-25 and DB-9 connectors to the rear panel of the chassis.
  - C) If you have not done so yet, remove the cables that connect the display assembly to the control board (step 2 on page 4-2).
  - D) Disconnect the ribbon cable connecting the control board to the I/O+DSP board.
  - E) Using a #1 Philips screwdriver, remove the four corner screws holding the control board to the chassis standoffs.
  - F) The control board is now free and can be removed from the chassis.
4. Removing the I/O+DSP (Input/Output+DSP) Board:
- A) If you have not done so yet, remove the top cover (step 1, above).
  - B) Unlock all XLR connectors, using a jeweler's screwdriver: engage the locking mechanism (in the center of the triangle formed by the three contact pins) and turn counterclockwise until the XLR connector is no longer attached.
  - C) Using a deep hex nut driver (preferred), a small crescent wrench, or a pair of slip-joint pliers (in an emergency), remove the nut and lockwasher fastening the BNC connector to the chassis.
  - D) Remove the ribbon cable that connects the I/O+DSP board to the control board.
  - E) Remove the short two-conductor cable that connects the I/O+DSP board to the control board.
  - F) Disconnect the cable connecting the power supply to the control board. There are two connectors; unplug both. Note the lead dress so you can reassemble the unit correctly.
  - G) Remove the twelve #1 Phillips screws (and their washers) that connect the I/O+DSP board to the chassis.
  - H) Carefully pull the I/O+DSP board toward the front panel to clear the XLRs from their housings. Then lift the board out of the chassis.
5. Removing the Power Supply:

**IMPORTANT:** The power supply has no user serviceable components because replacing components with other than exact replacements could cause the supply to become unsafe and/or to generate unacceptable EMI. If the power supply fails, please contact Orban Customer Service (custserv@orban.com) to obtain an exact replacement.



- A) Verify that the 6300 is disconnected from the AC line.
- B) If you have not done so yet, remove the top cover (step 1, above).
- C) **Remove the screw holding the power supply's insulating cover and remove the cover.** For safety, this cover must always be in place when the 6300 is connected to the AC line.

- D) Remove the plug that connects the power supply to the AC line socket.
- E) Unplug the cable connecting the output of the power supply to the I/O+DSP board.
- F) Using a hex nutdriver, remove the threaded standoff that supports the power **supply's insulating cover.**
- G) Remove the three Phillips screws holding the power supply to the main chassis.
- H) Carefully lift the power supply up to remove it.

6. Reattaching the Power Supply:

- A) Set power supply into main chassis, so that it aligns with its associated stand-offs.
- B) Thread, but do not tighten, the three Phillips screws that hold the power supply board to the main chassis.
- C) Thread the long threaded standoff in the remaining mounting hole. Tighten it firmly.
- D) Tighten the three Phillips screws that hold the power supply board to the main chassis.
- E) Reattach the plug that connects the power supply to the AC line socket.
- F) Reattach the cable that connects the power supply board to the I/O+DSP board.
- G) Secure the insulating cover to the long standoff. This cover must be replaced for safety.



7. Replacing the Control board and I/O Board+DSP board:

Referring to steps 3 and 4, follow the instructions in reverse.

8. Replacing the Front Panel Assembly:

- A) Set the front panel, face down, on a soft cloth to prevent scratches.
- B) Lightly reattach the bottom and top circuit boards by mating the four plugs and jacks. Use care to align the pins with the jacks so that all pins are correctly aligned and no pins are bent. Do not push the pins all the way into the jacks yet; leave room between the upper and lower boards for spacers.
- C) Reattach the board assembly to the front panel using the eight #1 Philips-head screws and spacers removed in step (2.E) on page 4-2:
  - a) Thread each screw through a spacer placed between the upper and lower circuit boards.
  - b) Push down the top board until it rests on the spacers.
  - c) Align the screws with the threaded standoffs on the front panel.
  - d) Evenly tighten all eight screws to reattach the board assembly to the panel.

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- D) Place the two side brackets over the captive screws located on each side of the front panel. Be sure that the large side of each bracket is oriented toward the rack-screw cutouts in the panel.
- E) Place the metal shield over the captive screws on each side of the front panel. Align the shield so that its cutouts are aligned with the cables attached to the **circuit board assembly**. Using a 3/16" nut driver, screw four hex nuts onto the captive screws.
- F) Attach the front panel assembly to the unit:
- a) Verify that all cables are dressed through cutouts in the shield.
  - b) Slide the front panel assembly into the front of the chassis so that the three threaded holes in the side brackets line up with the holes in the sides of the chassis.
  - c) Attach the front panel assembly by screwing the six screws removed in step 2.B)a) on page 4-2 into the holes in the sides of the chassis.
- G) Reattach the four cables that connect the display board to the base board. Each cable has a different type or size of connector, so it is obvious which cable mates with which jack on the base board.

Carefully align the cables and connectors to avoid bending the pins.

9. Replacing the Top Cover:

Place the cover on the unit and reinstall the Phillips screws. (Be careful not to pinch any cables.)

## Field Audit of Performance

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### Required Equipment:

- Ultra-low distortion sine-wave oscillator / THD analyzer / audio voltmeter
- With verified residual distortion below 0.01%. Audio Precision System One, or similar high-performance system.
- The *NAB Broadcast and Audio System Test CD* is an excellent source of test signals when used with a high-quality CD player.
- Digital voltmeter
- Accurate to  $\pm 0.1\%$ .
- Oscilloscope
- DC-coupled, triggered sweep, with 5M Hz or greater vertical bandwidth.
- Two  $620\Omega \pm 5\%$  resistors.

- Optional: Audio Precision System X

It is assumed that the technician is thoroughly familiar with the operation of this equipment.

This procedure is useful for detecting and diagnosing problems with the 6300's performance. It includes checks of frequency response, noise and distortion performance, and output level capability.

This performance audit assesses the performance of the analog-to-digital and digital-to-analog converters and verifies that the digital signal processing section (DSP) is passing signal correctly. If it is doing so, there is a high probability that the DSP is performing the dynamic signal processing correctly. There is therefore no need to measure such things as attack and release times—these are defined by software and will automatically be correct if the DSP is otherwise operating normally.

It is often more convenient to make measurements on the bench away from high RF fields which could affect results. For example, in a high RF field it is very difficult to accurately measure the very low THD produced by a properly operating 6300 at most frequencies. However, in an emergency it is usually possible to detect many of the more severe faults that could develop in the 6300 circuitry even in high-RF environments.

See the assembly drawings in Section 6 for component locations. Be sure to turn the power off before removing or installing circuit boards.

**Follow these instructions in order without skipping steps.**

**Note:** To obtain an unbalanced output, connect pin 1 (ground) to pin 3, and measure between pin 1 (ground) and pin 2 (hot).

**Note:** All analog output measurements are taken with a  $620\Omega \pm 5\%$  resistor tied between pin 2 and 3 of the XLR connector.

1. Prepare the unit.

A) Use the front panel controls to set the 6300's software controls to their default settings, as follows. *Be sure to write down the old settings so you can restore them later.*

a) Navigate to **SETUP > IO CALIB > ANALOG CALIB**. Set controls as follows:

INPUT .....	ANALOG
AI REF VU.....	+4.0 DBU
R CH BAL.....	0.0 DB

b) Navigate to **SETUP > IO CALIB > ANALOG CALIB > ANLG OUT**. Set controls as follows:

AO 100% .....	+10.0 DBU
AO PRE-E .....	FLAT
AO FEEDS.....	MB+LIMIT

- c) Navigate to **SETUP > IO CALIB > DIGITAL CALIB**. Set controls as follows:

DI REF VU.....-15.0 DBFS  
R CH BAL..... 0.0 DB

- d) Navigate to **SETUP > IO CALIB > DIGITAL CALIB > DO1 CALIB**. Set controls as follows. Use the **NEXT** button as necessary to scroll the screen horizontally:

DO1 100% ..... -2.8 dBFS  
DO1 PRE-E ..... FLAT  
DO1 RATE ..... 48 kHz  
DO1 SYNC ..... INTERNAL  
DO1 WORD ..... 20  
DO1 DITH ..... Out  
DO1 FRMT ..... AES  
DO1 SOURCE ..... LIMIT  
LIMIT 1 SOURCE ..... MULTBAND

- e) Repeat step (d) for Digital Output #2 (DO2).

- f) Navigate to **SETUP > TEST**. Set controls as follows, using the **NEXT** button to access controls as necessary:

MODE ..... Bypass

NOTE: Bypass defeats all compression, limiting, and program equalization, but retains the selected preemphasis (either flat, 50µs or 75µs).

BYPASS GAIN.....0 dB  
TONE FREQ ..... 400 Hz  
TONE LVL ..... 100%  
TONE CHAN ..... L+R

- g) Navigate to **SETUP** and set controls as follows. Scroll the display by using the **NEXT** and **PREV** buttons access the following controls:

PRE-E ..... Flat  
LIMITER 1 PRE-E ..... Flat  
LIMITER 2 PRE-E ..... Flat

## 2. Test the power supply

The power supply is a module. In case of any power supply failure, the entire supply must be replaced by an exact replacement (available from Orban Service). Attempts to repair the supply on a component level and/or to replace the supply with a non-**approved supply may compromise your Optimod's compliance with the EMI and safety regulations in your country.**

The +3.3V and +2.5V supplies are locally regulated on the DSP and control boards (see Section 6).

**Measure the power supply's regulated voltages at the DVM and observe the ripple with an oscilloscope, AC-coupled.** Convenient sources of these voltages are the inductors adjacent to power supply connectors on the I/O+DSP board. Con-

nect your probe to the sides of the inductors away from the power supply connectors. The results in Table 4-1 are typical.

Power Supply Rail	DC Voltage (volts)	AC Ripple (mV p-p)
+15VDC	+15 $\pm$ 0.5	<20
-15VDC	-15 $\pm$ 0.5	<20
+5VDC	+5 $\pm$ 0.25	<20

Table 4-1: Typical Power Supply Voltages and AC Ripple

3. Adjust Analog Output Level Trim.
  - A) Verify 6300 software controls are set to their default settings. [Refer to step (1.A) on page 4-6.]
  - A) Feed the 6300 output with the built-in 400 Hz test tone:
    - a) Navigate to **SETUP > TEST**.
    - b) Set the **MODE** to **TONE**.
  - B) Connect the audio voltmeter to the Left Analog Output.
  - C) Adjust output trim VR200 to make the meter read +10.0 dBu. (0 dBu = 0.775V rms.) Verify a frequency reading of 400 Hz.
  - D) Verify THD+N reading of <0.05% (0.02% typical) using a 22 kHz low pass filter in the distortion analyzer.
  - E) Set the **MODE** to **BYPASS**.
 

**BYPASS** defeats all compression, limiting, and program equalization but retains preemphasis.
  - F) Verify a reading (noise) of <-80 dBu at the output of the unit.
  - G) Using VR201, repeat steps (B) through (F) for the Right Analog Output.
4. Check frequency response of Analog I/O.
  - A) Verify 6300 software controls are set to their default settings. [Refer to step (1.A) on page 4-6.]
  - B) Be sure you are still in **BYPASS** mode [see step (3.E)].
  - C) Connect the oscillator to the Left Analog Input XLR connector.
  - D) Inject the Analog Input XLR connector with a level of 0 dBu with the oscillator set to 100 Hz.
  - E) Connect the audio analyzer to the 6300's Left Analog Output XLR connector.
  - F) Verify a level of 0 dBu  $\pm$ 1 dB. Use this level as the reference level.
  - G) Verify that frequency response at 50 Hz, 100 Hz, 400 Hz, 5 kHz, and 20 kHz is within  $\pm$ 0.1 dB of the reference level.

This procedure tests the analog input circuitry, the A/D converter, the DSP, the DAC, and the analog output circuitry.

- H) Repeat steps (C) through (G) for the right channel.
5. Check distortion performance of Analog I/O.
- A) Verify 6300 software controls are set to their default settings. (Refer to page 4-6.)
- B) Be sure you are still in **BYPASS** mode [see step (3.E)].
- C) Connect a THD analyzer to the Left Analog Output XLR connector. Set the THD analyzer's bandwidth to 22 kHz.
- D) Connect the oscillator to the Left Analog Input XLR connector.
- E) For each frequency used to measure THD, adjust the output level of the oscillator to make the **OUTPUT** meter on the 6300 read **0 dB**.
- You will have to reduce the output level of the oscillator at higher frequencies to compensate for the preemphasis boost in the 6300.
- F) Measure the THD+N at the frequency levels listed below.

Frequency	THD+N Typical	THD+N Maximum
50 Hz	0.015%	0.03%
100 Hz	0.015%	0.03%
400 Hz	0.015%	0.03%
1 kHz	0.015%	0.03%
2.5 kHz	0.015%	0.03%
5 kHz	0.015%	0.03%
7.5 kHz	0.015%	0.03%
10 kHz	0.015%	0.03%
20 kHz	0.015%	0.03%

- G) Repeat the above measurements for the right channel. Connect the oscillator to the right analog input and the distortion analyzer to the right analog output.
- H) Disconnect the oscillator and THD analyzer from the 6300.
6. Test Digital Sample Rate Converter (Receiver).
- A) Verify 6300 software controls are set to their default settings. (Refer to page 4-6.)
- B) Be sure you are still in **BYPASS** mode [see step (3.E)].
- C) Navigate to **SETUP > I/O CALIB** and set the **INPUT** to **DIGITAL**.
- D) Connect the digital source generator to the AES3 DIGITAL IN XLR connector of the 6300.
- E) Set the frequency of the digital source generator to 400 Hz and its output level to 6 dB below full scale.
- F) Set the word length of the digital source generator to 24-bit. In turn, set the generator to emit 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, and 96 kHz sample

rates. Listen to the analog outputs of the 6300 and verify that the output sounds clean and glitch-free regardless of the source sample rate.

G) Leave the digital source generator connected to the 6300.

7. Test Digital Sample Rate Converter (Transmitter).

A) Connect an AES3 analyzer (like the Audio Precision System 2) to the 6300's AES3 DIGITAL OUT 1.

B) Set the sample rate of the digital source generator to 48 kHz.

C) On the 6300, navigate to **SETUP > I/O CALIB > DIGITAL CALIB > DO1 OUT CALIB**.

D) Change the **6300's DO1 RATE** to 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, and 96 kHz, and verify that the frequencies measured at the 6300's AES3 output follow the values in the chart below within given tolerances:

Sample Rate	Tolerance (PPM)	Tolerance ( Hz)
32.0 kHz	100 PPM	±1.60 Hz
44.1 kHz	100 PPM	±4.41 Hz
48.0 kHz	100 PPM	±2.40 Hz
88.2 kHz	100 PPM	±8.82 Hz
96.0 kHz	100 PPM	±4.80 Hz

E) Disconnect the digital source generator from the 6300.

8. Repeat step 7 for Digital Out #2.

9. Optional tests.

A) You can test each GPI (Remote Interface) input for functionality in the obvious way, by programming a function for it and then verifying that the function executes when you activate the input. To program a GPI input, see *Remote Control Interface Programming* on page 2-51.

B) You can test the RS-232 Port for functionality by verifying that you can connect to a PC through a null modem cable. See *Networking and Remote Control* starting on page 2-52 (in particular, step 4 on page 2-54).

10. Return OPTIMOD 6300 to service.

A) Remove the 620Ω resistors connected across the outputs.

B) Restore your normal operating parameters, using the notes you made in step (1.A) on page 4-6.

C) Navigate to **SETUP > TEST > MODE** and choose **OPERATE**.

D) Recall your normal operating preset.



# Section 5

## Troubleshooting

### Problems and Potential Solutions

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Always verify that the problem is not the source material being fed to the 6300, or in other parts of the system.

RFI, Hum, Clicks, or Buzzes

For good RFI resistance, always use balanced inputs and outputs.

Review the information on grounding on page 2-7. The 6300 has been designed with very substantial RFI suppression on its analog and digital input and output ports, and on the AC line input. It will usually operate adjacent to high-powered transmitters without difficulty. In the most unusual circumstances, it may be necessary to reposition the unit to reduce RF interference, and/or to reposition its input and output cables to reduce RF pickup on their shields.

The AES/EBU inputs and output are transformer-coupled and have very good resistance to RFI. If you have RFI problems and are using analog connections on either the input or output, using digital connections will almost certainly eliminate the RFI.

Poor Peak Modulation Control

The 6300 ordinarily controls peak modulation to an accuracy of  $\pm 1\%$  when operated with 48 or 96 kHz output sample rate. As explained in Section 1, output sample rate conversion will slightly compromise this control because the peak control occurs with reference to individual sample values at 192 kHz. The converted samples no longer have the same peak values as the 192 kHz samples; some values can be slightly higher. However, the overshoot of the converted signal never exceeds 0.5dB and is therefore not a significant problem.

Using the analog output will cause similar amounts of overshoot because the samples in the transmitter are not synchronous with the peak-controlled samples in the 6300. Further, analog connections can cause analog-domain overshoot if the connection is not phase linear and has a  $-3\text{dB}$  low-frequency cutoff of greater than 0.15Hz.

A lossy codec (like Dolby AC3) will always introduce some peak overshoot. You can compensate for this without compromising the 6300's loudness control calibration by turning down the 100% OUTPUT LEVEL control. See *Figure 1-1: Simplified Block Diagram of Target Loudness Control* on page 1-2.

### Audible Distortion

Make sure that the problem can be observed on more than one monitoring system and at several locations.

Verify that the source material at the 6300's audio inputs is clean. Heavy processing can exaggerate even slightly distorted material, pushing it over the edge into unacceptability.

The subjective adjustments available to the user have enough range to cause audible distortion at their extreme settings. Advancing the FINAL LIMIT control too far will invariably cause distortion. Setting the LESS-MORE control beyond "9" can cause audible distortion of some program material with all but the Classical and Protect presets.

If you are using analog inputs, the peak input level must not exceed +27 dBu or the 6300's A/D converter will clip and distort.

Unlike earlier digital Optimods, there is no input peak clipping level adjustment for the A/D converter. Instead, we have provided adequate headroom for virtually any facility. This is possible because the A/D converter in the 6300 has higher dynamic range than older designs. Without compromising the 6300's noise level, we could thus eliminate a control that was frequently misadjusted.

If you are using an external processor ahead of the 6300, be sure it is not clipping or otherwise causing problems.

### Audible Noise

(See also "RFI, Hums, Clicks, or Buzzes" on page 5-1.)

Excessive compression will always exaggerate noise in the source material. The 6300 has two systems that fight this problem. The *silence gate* freezes the gain of the AGC and compressor systems whenever the input noise drops below a level set by the threshold control for the processing section in question, preventing noise below this level from being further increased.

There are two independent silence gate circuits in the 6300. The first affects the AGC and the second affects the Multiband Compressor. Each has its own threshold control. (See MB GATE on page 3-57.)

In sound for picture, the setting of the GATE THRESHOLD control is quite critical if you want the processing to be undetectable to the audience. If this control is set too low, then the 6300 will pump up quiet sounds such as ambiance and underscoring to unnaturally high levels. Refer to Section 3 of this manual for a further discussion.

In the 5-band Structure, *dynamic single-ended noise reduction* (see DWNEXP THR on page 3-59) can be used to reduce the level of the noise below the level at which it appears at the input.

If you are using the 6300's analog input, the overall noise performance of the system is usually limited by the overload-to-noise ratio of the analog-to-digital converter used by the 6300 to digitize the input. (This ratio is better than 108 dB.) It is im-

portant to drive the 6300 with professional levels (more than 0 dBu reference level) to achieve adequately low noise. (Clipping occurs at +27 dBu.)

The 6300's AES3 input is capable of receiving words of up to 24 bits. A 24-bit word has a dynamic range of approximately 144 dB. The 6300's digital input will thus never limit the unit's noise performance even with very high amounts of compression.

If an analog studio-to-transmitter link (STL) is used to pass unprocessed audio to the 6300, the STL's noise level can severely limit the overall noise performance of the system because compression in the 6300 can exaggerate the STL noise. For example, the overload-to-noise ratio of a typical analog microwave STL may only be 70-75 dB. In this case, it is wise to use an Orban Studio AGC to perform the AGC function prior to the STL transmitter and to control the STL's peak modulation. This will optimize the signal-to-noise ratio of the entire transmission system. An uncompressed digital STL will perform much better than any analog STL. (See *Studio-Transmitter Link*, starting on page 1-15.)

Gain pumping when high frequency energy is present

This will occur with most OPTIMOD-PC factory presets when the 6300's preemphasis is set to 50  $\mu$ s or 75 $\mu$ s. [See step (10.C) on page 2-26.] The gain pumping happens because the preemphasis creates a large high frequency boost before the look-ahead limiter, so the look-ahead limiter must produce large amounts of gain reduction to control peak levels.

To correct this problem, turn down the FINAL LIMIT DRIVE control (page 3-46) until the pumping is no longer audible. It may also be helpful to adjust band 5 so that it produces some high frequency limiting. Then save your work as a User Preset.

Shrill, Harsh Sound

This problem can be caused by excessive HF boost in the HF Equalizer and HF Enhancer. It could also be caused by an excessively high setting of the band 4 or band 5 compression threshold control (if you are using the 5-band Structure), or by excessively high settings of the BAND 4 MIX and BAND 5 MIX controls (located in Full and Advanced Modify).

In applications where you are protecting a pre-emphasized link, you must set the 6300's output to FLAT in the SYSTEM SETUP > OUTPUT screen to prevent double preemphasis, which will cause very shrill sound (and very poor peak modulation control). Note, however, that it is always preferable to defeat the preemphasis filter in the link and to set the 6300's output to PRE-EMPH. This will optimize peak control.

Dull Sound

If you are using the 2-band structure, dull-sounding source material will sound dull on the air. The 5-band Structure will automatically re-equalize such dull-sounding program material to make its spectral balance more consistent with other program material.

In applications where you are protecting a pre-emphasized link, if the 6300's output is set to FLAT in SYSTEM SETUP > OUTPUT, there will be no preemphasis unless it is supplied somewhere else in the system. This will cause very dull sound.

## Excessive Sibilance ("ess" sounds)

If "ess" sounds in speech (particularly with women's voices) seem too pronounced, set the B5 THRESHOLD control more negative. (Note that this will also reduce the brightness of music, so a careful compromise is usually required.)

## System Will Not Pass Line-Up Tones at 100% Modulation

This is normal. Sine waves have a very low peak-to-average ratio by comparison to program material. The processing thus automatically reduces their peak level to bring their average level closer to program material, promoting a more consistent and well-balanced sound quality.

The 6300 can generate test tones itself. The 6300 can also be put into Bypass mode (locally or by remote control) to enable it to pass externally generated tones at any desired level. (See *Test Modes* on page 3-63.)

## System Will Not Pass Emergency Alert System ("EAS" USA Standard) Tones at the Legally Required Modulation Level

See *System Will Not Pass Line-Up Tones at 100% Modulation* (directly above) for an explanation. These tones should be injected into the transmitter after the 6300, or the 6300 should be temporarily switched to BYPASS to pass the tones.

## System Receiving 6300's Digital Output Will Not Lock

Be sure that the sample rate at the 6300's output is set to match the sample rate that the driven system expects. (Use the DO1 RATE or DO2 RATE control as appropriate.) Be sure that the 6300's output mode (AES3 or SPDIF) is set to match the standard expected by the driven system.

## AES Channel Status Bits Will Not Set the 6300 to Stereo or Dual-Mono Mode

Be sure that the equipment driving the 6300 is set in AES3 or AES/EBU mode. (SPDIF will not work.) Similarly, you must set the 6300's digital output mode (via the DO1 FORMAT or DO2 FORMAT control) to AES in order to send AES channel status bits to downstream equipment.

## Equipment Receiving the 6300's AES Output Changes Operation Mode Unexpectedly

Some equipment will respond incorrectly to AES Channel Status and/or User Bits. Try turning both of these off in the 6300. (See step 20 on page 2-20 and step 21 on page 2-20.)

## Loudness Does Not Change When you adjust the 100% Peak Level Control

The OUTPUT SOURCE control for the output you are trying to adjust is set to LIMITER NORM. For "traditional" operation of the 100% PEAK LEVEL control, set the OUTPUT SOURCE to LIMITER.

## Loudness Meters Show Unexpected Readings

Only the factory "TV" presets have calibrated loudness, and are only calibrated when you use a digital output whose OUTPUT SOURCE CONTROL is set to LIMITER NORM. If you want to use a radio-style preset to achieve a target loudness, you may have to tweak it.

Set the **TARGET LOUDNESS 1** control to your target loudness. Then adjust the **MB FINAL LIMIT DRIVE** control so that **BS.1770** loudness meter (the rightmost **LOUDNESS LEVEL** meter on **PC Remote**) is centered around 0.

In v4.0 software and above, the **TARGET LOUDNESS 1** control replaces the **LOUDNESS METER SENSITIVITY** control found in earlier software versions. If the **OUTPUT SOURCE #1** is **LIMITER** or **LIMITER NORM**, the **GLOBAL TARGET LOUDNESS 1** setting calibrates the loudness meters with respect to Digital Output #1. "0" on the loudness meters corresponds to the **GLOBAL TARGET LOUDNESS 1** setting.

The loudness meters are correctly calibrated for *both* digital outputs if their **OUTPUT SOURCES** are **LIMITER NORM**. Additionally, the loudness meters are correctly calibrated for both outputs if both **OUTPUT SOURCES** are **LIMITER** and both outputs' **100% PEAK LEVEL** controls are set identically.

Sound is Unexpectedly Quiet

The **CBS Loudness Controller** and/or **BS.1770 Safety Limiter** may be turned on accidentally. Their threshold controls are located in the **MULTIBAND** page of the active processing preset. To defeat them, set their threshold controls to **OFF**.

In the factory presets, the loudness controllers are turned on in the "TV" and "TVA" presets and are turned off in the remaining presets.

If the source for the active output is set to **LIMIT NORM**, the **TARGET LOUDNESS** control affects the loudness. If this control is set to **-24 dB** (the default), the output will be quieter than required for most streaming and radio-style applications.

General Dissatisfaction with Subjective Sound Quality

The 6300 is a complex processor that can be adjusted for many different tastes. For most users, the factory presets, as augmented by the gamut offered by the **LESS-MORE** control for each preset, are sufficient to find a satisfactory "sound." However, some users will not be satisfied until they have accessed other Modify Processing controls and have adjusted the subjective setup controls in detail to their satisfaction. Such users *must* fully understand the material in Section 3 of this manual to achieve the best results from this exercise.

Section 1 of this manual provides a thorough discussion of system engineering considerations, particularly with regard to minimizing overshoot and noise.

Security Passcode Lost (When Unit is Locked Out)

Please see *If You Have Forgotten Your Passcode* on page 2-44.

## Problems Specific to Sound for Picture Applications

Dialog is muffled

- Use the five-band structure and set the **B3>B4 COUPLING** and **B4>B5 COUPLING** controls to a higher value. This will allow the processing to apply more dynamic high frequency boost.
- Set the **B4 COMPRESSOR THRESHOLD** control to a higher value (i.e., closer to 0 dB). This will produce less gain reduction in the presence region.

- Try using the 6300's **HF Enhancer**. To do so, *Locate* to the **EQUALIZER** screen and set the **HF ENHANCE** control to taste. For most TV programming, very low settings (like 0.25) are appropriate because they minimize the possibility of increasing noise.

Transient loudness events (like essses in speech) sound obtrusively loud

- Set the **LOUDNESS ATTACK** control closer to 100%. This will allow the loudness controller to do more de-essing but may decrease transient impact as a side effect.
- Set the **TRANSIENT ENHANCE** control to 0 ms.
- If "ess" sounds in speech (particularly with women's voices) seem too pronounced, one solution is to use the five-band structure and tune it for de-essing (which we have done already in the TVxxx presets). Set the **SPEECH B5 THRESHOLD** control more negative.

Commercials too loud in sound for picture applications

- Make sure that the Loudness Controller is activated on the preset that you are using—the **LOUDNESS CONTROLLER THRESH** control must not be set **OFF** (see page 3-50) and is normally set to -10 dB.
- If the Loudness Controller is active but based on its gain reduction meter, you do not believe it is working hard enough, set its threshold lower using the **LOUDNESS CONTROLLER THRESH** control.

Note that the Loudness Controller controls subjective loudness to an absolute threshold and does not understand the context of the program. Therefore, if a commercial follows a piece of very quiet program material, the commercial may still seem loud even though the Loudness Controller is working properly.

See *Loudness Control* on page 3-11.

Commercials too quiet

- This can be a side effect of your Optimod's **BS.1770** safety limiter and is caused by the tendency of the **BS.1770** algorithm to over-indicate the loudness of material with an unusually low peak-to-average ratio. In this case, the **BS.1770** safety limiter is making the **BS.1770** meter read "correctly" even if the material sounds quieter to your ear. To reduce this effect, set the **BS.1770 LIMIT THRESHOLD** control to +2 LK or above See *BS.1770 Safety Limiter* on page 3-13 for a more detailed discussion.

Loudness incorrect compared to other Dolby Digital Transmissions

- Review *Setting Preset Loudness Correctly in Dolby Digital Transmission* on page 3-17.
- Be sure that the 6300 output (DO1 or DO2) driving your Dolby Digital encoder is fed by the **LIMIT NORM** source.
- Be sure that the **active output's TARGET LOUDNESS** setting in the 6300 is the same as the **DIALNORM** setting you are transmitting to consumers (see step 11.B)a) on

page 2-30). Use a device like the Dolby LM100 Loudness Meter to read out the Dialnorm you are transmitting to your audience (or simply check the Dialnorm setting of your Dolby Digital encoder).

- Make sure that the **AI REF** or **DI REF** control (depending on whether you are using the analog or digital input) is set up correctly (step 5 on page 2-23 or step 7 on page 2-24).

**Note that only “TV” presets are designed to produce calibrated loudness when used with the 6300’s Target Loudness support. Any radio-style preset can be edited to activate the Loudness Controller.**

- If the CBS loudness controller is on, be sure that the **LOUDNESS THRESHOLD** control is set to 0 dB.

**This matches the loudness controller’s threshold to the 6300’s active TARGET LOUDNESS value.**

- Once **TARGET LOUDNESS** is correct, be sure that your active preset is causing the **6300’s LOUDNESS GAIN REDUCTION** meter to indicate approximately 3 dB of gain reduction on normal dialog. Adjust its **MB LIMIT DRIVE** control if it does not. **When the loudness controller is operating normally, the 6300’s LOUDNESS LEVEL meter should be peaking around 0 dB on dialog.** If it is not and you are using a custom preset, you might get better loudness control by slightly tweaking the **LOUDNESS THRESHOLD** control to make the **LOUDNESS LEVEL** meter peak around 0, bearing in mind that the correct setting is –10 dB for typical sound-for-picture processing. A maximum variation of  $\pm 1$  dB will typically suffice.

**If the 6300’s active TARGET LOUDNESS setting is not the same as the DIALNORM setting you are transmitting to your audience, the 6300’s Loudness Level meter will be calibrated incorrectly, so even if the meter is peaking at 0 dB, loudness at the consumer’s receiver will not be correct.**

**Note that because the 6300’s Loudness Level meter shares the loudness controller’s filterbank, the meter does not show the effect of the LOUDNESS ATTACK control, which shapes the loudness controller’s gain reduction signal outside the loudness controller’s feedback loop. Therefore, if you are using values of LOUDNESS ATTACK below about 50%, the loudness of transient events may be significantly higher than the Loudness Level meter indicates.**

This issue does not affect the 6300’s **BS.1770-4** Loudness Level Meter.

A **BS.1770** loudness meter indicates higher loudness than expected with some program material

- Set the **BS.1770 LDNS THR** control closer to 0 LU. This control is in the active Processing Preset and is available from the 6300’s **front panel (in the Modify menu)**. Using the **BS.1770** safety limiter will prevent the meter from reading above the preset threshold but may cause subtle loudness pumping because of limitations in the **BS.1770** algorithm. See *BS.1770 Safety Limiter* on page 3-13 for a more detailed discussion.

Your Optimod has a built-in **BS.1770-4** long-term (gated) meter with a 10-second integration time. This should agree with an external **BS.1770-4** meter that is set

up with a 10-second gated integration time, a "Relative" scale (i.e. LU), and a reference level equal to your Optimod's active value.

CBS Loudness Controller reduces transient punch of programming

- Reduce the amount of fast gain reduction in the loudness controller by setting the **LOUDNESS ATTACK** control closer to 0 %. This will allow more short loudness peaks to pass through without attenuation by the loudness controller. We believe that the range from 50% to 70% offers the most useful tradeoffs between reducing punch and allowing irritating short-term loudness bursts to pass through uncontrolled.

Unexpected gain pumping

- The BS.1770 safety limiter can produce subtle gain pumping because of limitations in the BS.1770 algorithm. BS.1770 safety limiter-induced gain reduction is visible as the yellow section of the **LOUDNESS GR METER**. See *BS.1770 Safety Limiter* on page 3-13 for a more detailed discussion.

## Connection Issues between the 6300 and a PC, Modem, or Network

- **Quick Setup:** On the Station ID screen (Quick Setup 9): Use Escape in place of Cancel. The Cancel button will not work.
- **Software Updates:** Close any running Windows programs before attempting to update.
- **Interrupted Software Updates:** If you canceled an update before it completed, wait at least one minute before attempting your next update.
- **Software Updates via Modem:** If you are updating via the modem, do not change the "connection type" parameter on the 6300 while the modem is connected or attempting to connect.
- **Security Passcode:** An ALL SCREENS (administrator) security passcode is required for upgrading, regardless of whether you are using a Direct, Modem, or Ethernet connection.
- **Passcode Format:** The passcode is case-sensitive. When entering it into Windows' Dial-up Connection dialog box, it must be typed exactly as it was originally entered into the Security screen.

## Troubleshooting Connections

- If you get an error message such as "the specified port is not connected" or "There is no answer"...

You may have the wrong interface type set on your 6300. Navigate to **SETUP > NETWORK & REMOTE > PC CONNEC** and check the interface setting.

If you are connecting via Direct Serial Connection or modem, review the Properties you have set on that connection. Double-check to ensure that you have set



Windows parameters as described in *Appendix: Setting Up Serial Communications* on page 2- 61.

- If your Direct Connect does not work:
  - A) Check to make sure that the cables are connected properly.
  - B) Check that you are using a null modem cable.
  - C) Ensure that the null modem cable is connected to the 6300's **serial connector**.
- If your Modem Connect does not work:
  - A) Ensure that the modem cables and phone lines are connected properly.
  - B) Check that you have entered the correct phone number for connection.
  - C) Check that you have entered the passcode correctly on the 6300, and the passcode has also been entered correctly on your PC.
  - D) Ensure that you enabled the correct PC modem port settings.
  - E) Ensure that the external modem attached to your 6300 is set to **AUTO ANSWER**.
  - F) Make sure that **the only "Allowed Network Protocol" is TCP/IP. "NetBUI" and "IPX / SPX Compatible" must not be checked.**
- If you cannot connect to your computer through a crossover Ethernet cable:

You must set your Windows networking to provide a static IP address for your computer because your Optimod does not contain a DHCP server.

### **You Cannot Access the Internet After Making a Direct or Modem Connection to the 6300:**

If you are connected to the 6300 via modem or direct connect, *you cannot access any other TCP/IP connection*. The PPP connection becomes the default protocol and the default gateway defaults to the 6300 **unit's IP address**. **This means that all existing network connections point to the 6300 unit**. To correct this:

- A) In Start / Settings / Network and Dialup Connections, open the direct or modem connection you are using to connect to 6300.
- B) Select "Properties."
- C) Click the tab that reads "Networking."
- D) Highlight "Internet protocol (TCP/IP)."
- E) Select "Properties."
- F) Select "Advanced."
- G) Uncheck the "Use default gateway on remote network" box.
- H) Select "OK."

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If this "Use default gateway on remote network" box is not selected, the gateway will not point to the 6300 unit when you establish a direct or modem connection.

## Troubleshooting IC Opamps

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IC opamps are operated such that the characteristics of their associated circuits are essentially independent of IC characteristics and dependent only on external feedback components. The feedback forces the voltage at the (–) input terminal to be extremely close to the voltage at the (+) input terminal. Therefore, if you measure more than a few millivolts difference between these two terminals, the IC is probably bad.

Exceptions are opamps used without feedback (as comparators) and opamps with outputs that have been saturated due to excessive input voltage because of a defect in an earlier stage. However, if an opamp's (+) input is more positive than its (–) input, yet the output of the IC is sitting at –14 volts, the IC is almost certainly bad.

The same holds true if the above polarities are reversed. Because the characteristics of the 6300's circuitry are essentially independent of IC opamp characteristics, an opamp can usually be replaced without recalibration.

A defective opamp may appear to work, yet have extreme temperature sensitivity. If parameters appear to drift excessively, freeze-spray may aid in diagnosing the problem. Freeze-spray is also invaluable in tracking down intermittent problems. But *use it sparingly*, because it can cause resistive short circuits due to moisture condensation on cold surfaces.

## Technical Support

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If you require technical support, contact Orban customer service. Be prepared to describe the problem accurately. Know the serial number of your 6300 — this is printed on the rear panel of the unit. Current contact information is found at <http://www.orban.com/contact/>.

Please check Orban's website, [www.orban.com](http://www.orban.com), for Frequently Asked Questions and other technical tips about 6300 that we may post from time to time. Manuals (in .pdf form) and 6300 software upgrades will be posted there too—click "Downloads" from the home page.

## Factory Service

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

If you must return a product for factory service, please notify Customer Service by telephone, *before* you ship the product; this helps us to be prepared to service your unit upon arrival. Also, when you return a product to the factory for service, we recommend you include a letter describing the problem.

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

## Shipping Instructions

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Use the original packing material if it is available. If it is not, use a sturdy, double-walled carton no smaller than 7" (H) x 15.5" (D) x 22" (W) — 18 cm (H) x 40 cm (D) x 56 cm (W), with a minimum bursting test rating of 200 pounds (91 kg). Place the chassis in a plastic bag (or wrap it in plastic) to protect the finish, then pack it in the carton with at least 1.5 inches (4 cm) of cushioning on all sides of the unit. "Bubble" packing sheets, thick fiber blankets, and the like are acceptable cushioning materials; foam "popcorn" and crumpled newspaper are not. Wrap cushioning materials tightly around the unit and tape them in place to prevent the unit from shifting out of its packing.

Close the carton without sealing it and shake it vigorously. If you can hear or feel the unit move, use more packing. Seal the carton with 3-inch (8 cm) reinforced fiberglass or polyester sealing tape, top and bottom in an "H" pattern. Narrower or parcel-post type tapes will not withstand the stresses applied to commercial shipments.

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

**DELICATE INSTRUMENT, FRAGILE!**

Insure the package properly. Ship prepaid, not collect. Do not ship parcel post. Your **Return Authorization Number** must be shown on the label, or the package will *not* be accepted.



# Section 6

## Technical Data

### Specifications

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It is impossible to characterize the listening quality of even the simplest limiter or compressor based on specifications, because such specifications cannot adequately describe the crucial dynamic processes that occur under program conditions. Therefore, the only way to evaluate the sound of an audio processor meaningfully is by subjective listening tests.

Certain specifications are presented here to assure the engineer that they are reasonable, to help plan the installation, and make certain comparisons with other processing equipment.

### Performance

*Specifications apply for measurements from analog left/right input to analog left/right output.*

**Frequency Response (Bypass Mode):** Depending on settings, is flat or follows standard 50 $\mu$ s or 75 $\mu$ s preemphasis curve  $\pm 0.10$  dB, 20 Hz–20 kHz. (At 32 kHz input sample rate, the pass-band is reduced to approximately 14.7 kHz.) Analog left/right output and digital output can be user-configured for flat or pre-emphasized output.

**Noise:** Output noise floor will depend upon how much gain the processor is set for (Limit Drive, AGC Drive, 2-band Drive, and/or Multiband Drive), gating level, equalization, noise reduction, etc. The dynamic range of the A/D Converter, which has a specified overload-to-noise ratio of 110 dB, primarily governs it. The dynamic range of the digital signal processing is 144 dB.

**Total System L/R Channel Separation:** >70 dB, 20 Hz – 20 kHz; 90 dB typical (analog I/O). Digital I/O separation is essentially infinite.

**Polarity** (Bypass Mode; Operate Mode when processing chain is configured for linear phase): Absolute polarity maintained. Positive-going signal on input will result in positive-going signal on output.

**Internal Processing Sample Rate:** 48 kHz. We believe this provides maximum audible transparency by minimizing numerical “noise” in the equalizers and filters while still preserving a pure, transparent sound. The double-precision equalizers and crossover filters used throughout the 6300 produce at least 6 dB lower noise and nonlinear distortion than they would at 96 kHz.

**Processing Resolution:** Internal processing has 24 bit (fixed point) or higher resolution; uses Freescale (formerly Motorola) DSP56367 DSP chips.

**Delay:** The minimum available input/output delay is approximately 20 ms with look-ahead limiting active and 6 ms with look-ahead limiting bypassed. This can be padded to exactly one frame of 24, 25, 29.97, or 30 frames / second video up to a maximum delay of 50 ms.

**Operating mode:** Stereo or dual-mono. In dual-mono mode, both processing channels have the same subjective adjustments (as determined by the active preset) but are otherwise independent, making this mode appropriate for dual-language transmissions. Operating mode can be set via GPI, Ethernet and serial connections, internal clock-based automation, and AES3 Status Bits.

**Loudness Level Meter (x2):** One meter for stereo-mode processing or two meters for dual-mono mode processing channels, all meters realized in software. For a given processing chain, two meters operate simultaneously: a long-term loudness meter displays loudness over an ungated 3-second integration time or 10-second integration time using the ITU-R BS.1770-4 algorithm (per ATSC A/85 and EBU R 128) and a short-term loudness meter uses the Jones & Torick algorithm developed at CBS Technology Center. The Jones & Torick meter's display time constants are matched to the psychoacoustic loudness integration time of the human ear, reaching steady-state level in approximately 200 ms and having a decay time constant of approximately 300 ms. Hence, this meter can indicate the momentary loudness of transient events like gunshots, which may be annoying to viewers but which the BS.1770-4 meter ignores because of its longer integration time. (B. L. Jones & E. L. Torick: "A New Loudness Indicator for Use in Broadcasting," J. SMPTE, September 1981, pp 772-777.)

One ITU BS.1770-4 meter is always displayed on the 6300's front-panel; it indicates the stereo loudness when the 6300 is in Stereo mode and it indicates the loudness of one of the two mono processing channels (user selected) when the 6300 is in Dual-Mono Mode. In 6300 PC Remote software, all loudness meters are displayed simultaneously.

**Peak Control:** As recommended in ITU-R BS.1770-4, the peak limiter is oversampled at 192 kHz, yielding a worst-case overshoot of 0.5 dB at the analog output and for all output sample rates. (To achieve this performance at 32 kHz output sample rate, it is necessary to set the 6300's lowpass filter cutoff frequency to 15 kHz.)

## Installation

### *Analog Audio Input*

**Configuration:** Stereo / Dual-Mono.

**Impedance:** >10k $\Omega$  load impedance, electronically balanced<sup>1</sup>.

**Nominal Input Level:** Software adjustable from -4.0 to +13.0 dBu (VU).

**Maximum Input Level:** +27 dBu.

**Connectors:** Two XLR-type, female, EMI-suppressed. Pin 1 chassis ground, Pins 2 (+) and 3 electronically balanced, floating and symmetrical.

**A/D Conversion:** 24 bit 128x oversampled delta sigma converter with linear-phase anti-aliasing filter.

**Filtering:** RFI filtered, with high-pass filter at 0.15 Hz (-3 dB).

### *Analog Audio Output*

**Configuration:** Stereo. Flat or pre-emphasized (at 50 $\mu$ s or 75 $\mu$ s), software-selectable.

**Source Impedance:** 50 $\Omega$ , electronically balanced and floating.

**Load Impedance:** 600 $\Omega$  or greater, balanced or unbalanced. Termination not required or recommended.

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<sup>1</sup> No jumper selection available for 600 $\Omega$ . Through-hole pads are available on I/O circuit board for user-installed 600 $\Omega$  termination.

**Output Level** (100% peak modulation): Adjustable from  $-6$  dBu to  $+24$  dBu peak, into  $600\Omega$  or greater load, software-adjustable.

**Signal-to-Noise:**  $\geq 100$  dB unweighted (Bypass mode, 20 Hz–20 kHz bandwidth, referenced to 100% modulation).

**Distortion:**  $\leq 0.01\%$  THD (Bypass mode, de-emphasized) 20 Hz–20 kHz bandwidth.

**Connectors:** Two XLR-type, male, EMI-suppressed. Pin 1 chassis ground, Pins 2 (+) and 3 electronically balanced, floating and symmetrical.

**D/A Conversion:** 24 bit 128x oversampled.

**Filtering:** RFI filtered.

#### Digital Audio Input

**Configuration:** Stereo or Two-Channel (dual-mono) per AES3 standard, 24 bit resolution, software selection of stereo or dual-mono. Unit can detect Stereo or Two-Channel status bits and switch modes appropriately.

**User Bits:** Unit can pass AES3 User Bits from its AES input to AES Output #1.

**Sampling Rate:** 32, 44.1, 48, 88.2, or 96 kHz, automatically selected.

**Connector:** XLR-type, female, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating,  $110\Omega$  impedance.

**Input Reference Level:** Variable within the range of  $-30$  dBFS to  $-10$  dBFS.

**J.17 Deemphasis:** Software-selectable.

**Filtering:** RFI filtered.

#### Digital Audio Outputs (x2)

**Configuration:** Stereo or Two-Channel per AES3 standard. Output configured in software as flat or pre-emphasized to the chosen processing preemphasis ( $50\mu\text{s}$  or  $75\mu\text{s}$ ), with or without J.17 preemphasis.

**Sample Rate:** Internal free running at 32, 44.1, 48, 88.1 or 96 kHz, selected in software. Can also be synced to the AES3 digital, AES11id, or Wordclock input at 32, 44.1, 48, 88.1 or 96 kHz, as configured in software. (Passband is limited to approximately 14.7 kHz when using 32 kHz output sample rate.)

**Word Length:** Software selected for 24, 20, 18, 16 or 14-bit resolution. First-order highpass noise-shaped dither can be optionally added, Dither level automatically adjusted appropriately for the word length.

**Connector:** XLR-type, male, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating,  $110\Omega$  impedance.

**Output Level** (100% peak modulation):  $-20.0$  to  $0.0$  dBFS software controlled.

**Filtering:** RFI filtered.

#### Sync Input

**Configuration:** Can accept wordclock or AES11id ( $75\Omega$ ) sync, selectable in software.

**Connector:** Female BNC.

**Termination:** Unterminated. For wordclock, use an external  $75\Omega$  terminator if the 6300 is the last item in the chain. For AES11id, always use a  $75\Omega$  terminator.

#### Remote Computer Interface

**Configuration:** TCP/IP protocol via direct cable connect, modem, or Ethernet interface. Modem is not supplied.

**Serial Port:** 115 kbps RS-232 port DB-9 male, EMI-suppressed.

**Ethernet Port:** 100 Mbit / sec on RJ45 female connector.

#### Remote Control (GPI) Interface

**Configuration:** Eight (8) inputs, opto-isolated and floating.

**Voltage:** 6–15V AC or DC, momentary or continuous. 12 VDC provided to facilitate use with contact closure.

**Connector:** DB–25 male, EMI-suppressed.

**Control:** User-programmable for any eight of user presets, factory presets, bypass, test tone, stereo or mono modes, analog input, digital input.

**Filtering:** RFI filtered.

#### Tally Outputs

**Circuit Configuration:** Two NPN open-collector outputs.

**Voltage:** +15 volts maximum. Do not apply negative voltage. When driving a relay or other inductive load, connect a diode in reverse polarity across the relay coil to protect the driver transistors from reverse voltage caused by inductive kickback.

**Current:** 30 mA maximum

**Indications:** Tally outputs can be programmed to indicate a number of different operational and fault conditions, including Input: Analog, Input: Digital, Analog Input Silent, AES Input Silent, and AES Input Error.

#### Power

**Voltage:** 85–264 VAC, 50–60 Hz, 30 VA.

**Connector:** IEC, EMI-suppressed. Detachable 3-wire power cord supplied.

**Fuse:** 2.5A 20mm Quick Acting HBC, mounted on the power supply circuit board.

**Grounding:** Circuit ground is independent of chassis ground, and can be isolated or connected with a rear panel switch.

**Safety Standards:** ETL listed to UL standards, CE marked.

#### Environmental

**Operating Temperature:** 32° to 122° F / 0° to 50° C for all operating voltage ranges.

**Humidity:** 0–95% RH, non-condensing.

**Dimensions (W x H x D):** 19" x 1.75" x 14.25" / 48.3 cm x 4.5 cm x 36.2 cm. One rack unit high.

**Humidity:** 0–95% RH, non-condensing.

**RFI / EMI:** Tested according to Cenelec procedures. FCC Part 15 Class A device.

**Shipping Weight:** 10 lbs. / 4.6 kg.

## Warranty

**Five Years, Parts and Service:** Subject to the limitations set forth in Orban's Standard Warranty Agreement.

*Because engineering improvements are ongoing, specifications are subject to change without notice.*

## Circuit Description

This section provides a detailed description of user-serviceable circuits used in the 6300. We do not provide detailed descriptions of the digital circuitry because most of this is built with surface-mount components that cannot be removed or replaced with typical tools available in the field. Field repair ordinarily consists of swapping entire PC boards.



The section starts with an overview of the 6300 system, identifying circuit sections and describing their purpose. Then each user-repairable section is treated in detail by first giving an overview of the circuits followed by a component-by-component description.

The drawing on page 6-23 shows circuit board locations.

## Overview

- The Control Circuits control the DSP, display, and input/output sections of the 6300 system.
- The Input Circuits include the connectors and RF filtering for the analog and digital audio inputs, the digital sync input, and the circuitry to interface these inputs to the digital processing.
- The Output Circuits include the connectors and RF filtering for the analog and digital audio outputs, and the circuitry to interface the digital processing to these outputs.
- The DSP Circuits implement the bypass, test tone, and audio processing using digital signal processing.
- A block diagram of the DSP signal processing appears on page 6-43.
- The Power Supply provides power for all 6300 circuit sections. It is a modular switching supply and is not user-serviceable.

## Control Circuits

The control circuit is based on an AMD Elan SC520 microprocessor, which is a 586-class processor running an Orban executable program over a third-party real-time operating system. A flash memory emulates a hard drive. The memory is non-volatile and does not rely on a battery to retain information when mains power is off.

The flash memory holds the operating system, the Orban executable program, and all preset files, both factory and user. It also contains a write-protected "boot segment" that functions as a boot ROM.

The control circuits process and execute user-initiated requests to the system. The source of these requests is the front panel buttons and rotary encoder, the rear panel RS-232 port, Ethernet port, and the remote contact closures. These changes affect hardware function and/or DSP processing. The control circuits also send information to the LCD display, the LED bar graphs, and the control status indicators.

The control circuit communicates with the DSP and display circuitry through the SC520's General Purpose bus.

The SC520 periodically refreshes a watchdog timer. If the timer times out without being refreshed, it assumes that the control program has crashed and automatically

reboots the SC520. The DSP chips will continue to process audio until the time comes to reload DSP program code into them. At this point, the audio will mute for about a second until the DSP code download has finished. If you hear a short audio mute, this may be because the 6300 has rebooted for some reason. (Of course, it could also be caused by the 6300's audio feed's being interrupted.) Be prepared to convey this fact to Orban customer service if you call for technical assistance.

The control board contains interface circuitry, the CPU, the Ethernet interface chip, the flash memory, the DRAM, the RS-232 serial interface circuitry, the GPI/O interface circuitry, and the real-time clock, which keeps time for the 6300's automation functions. The real-time clock is backed up by a DL2032 battery so that it keeps accurate time even when the 6300 is powered down. The battery is socketed and can be readily accessed by removing the 6300's top cover; the battery is located on the control board.

## User Control Interface and LCD Display Circuits

The user control interface enables the user to control the 6300's functionality. A rear panel GPI connector allows optically isolated remote control of certain functions, such as recalling presets, via contact closure. An RS-232 serial port and an Ethernet port allow you to connect a modem or computer to the 6300. Front panel pushbutton switches select between various operational modes and functions. A rotary encoder allows the user to adjust parameters and enter data.

### 1. Remote Interface and RS-232 Interfaces

---

#### Located on control board

A remote interface connector and circuitry implements remote control of certain operating modes; Optimod 6300 has eight remote contact closure inputs.

A valid remote signal is a momentary pulse of current flowing through remote signal pins. Current must flow consistently for 50msec for the signal to be interpreted as valid. Generally, the 6300 will respond to the most recent control operation, regardless of whether it came from the front panel, remote interface, or RS-232.

#### Component-Level Description:

After being current limited by resistors, the GPI control signals are applied to two quad optoisolators, U17, 19, and then to the control circuitry.

U12 is the RS232 port interface chip. It is socketed for easy field replacement in the event of overload, lightning damage, etc. All other circuitry is surface-mount and is not field-repairable.

### 2. Switch Matrix and LED Indicators

---

#### Located on display board

Eleven front panel pushbutton switches are arranged in a matrix, configured as three columns and four rows. These switches are the primary element of the physical user interface to the 6300 control software. The host microprocessor

controls the system setup and function of the DSP according to the switch / rotary encoder entered commands, the AES status bits from the digital input signal, the RS-232, and the remote control interface status. The microprocessor updates the LED control status indicators accordingly.

#### Component-Level Description:

S1-S11 are the front panel pushbutton switches. CR11-CR15 are the front panel LED control status indicators. The control microprocessor communicates with these components through the General Purpose bus, which is buffered via IC3.

### 3. LED Meter Circuits

---

#### Located on display board

The meter LEDs are arranged in an 8x16 matrix, in rows and columns.

Each row of LEDs in the matrix has a 1/8 duty cycle ON time. The rows are multiplexed at a fast rate so that the meters appear continuously illuminated. Via the General Purpose bus, the DSP sends meter data values to the control microprocessor, which sends the appropriate LED control words (eight bits at a time) to the data latches that drive the LEDs directly.

#### Component-Level Description:

The meter LED matrix consists of ten 10-segment LED bar graph assemblies (CR1-CR9, CR16) and one discrete LED (CR10). Row selector latches IC4, IC5, IC6, and IC9 are controlled by the host microprocessor and alternately sink current through the LEDs selected by column selector latches IC1 and IC2, which are also controlled by the SC520. IC1 and IC2 drive the selected row of LEDs through current limiting resistor packs RP1 and RP2.

## Input Circuits

This circuitry interfaces the analog and digital inputs to the DSP. The analog input stages scale and buffer the input audio level to match it to the analog-to-digital (A/D) converter. The A/D converts the analog input audio to digital audio. The digital input receiver accepts AES3-format digital audio signals from the digital input connector and sample rate-converts them as necessary. The digital audio from the A/D and SRC is transmitted to the DSP.

### 1. Analog Input Stages

---

#### Located on input/output/DSP board

The RF-filtered left and right analog input signals are each applied to a floating, balanced amplifier that has an adjustable (digitally controlled) gain. Analog switches set the gain. The outputs of a latch set the state of the switches. By writing data to the latch, the control circuits preset the gain. This circuit feeds an RC low-pass filter that applies the balanced signal to the analog-to-digital (A/D) converter.

The digitally controlled gain circuitry was included on the circuit board for possible use in future products. In the 6300, its gain is preset so that the A/D will clip at +27 dBu with respect to the 6300's analog inputs.

**Note that the small RFI “tee” filter assemblies connected to the input and output connectors are socketed and user-replaceable.**

### Component-Level Description:

The left channel balanced audio input signal is applied to the filter / load network made up of L100-103 and associated resistors and capacitors. (There are solder pads available in the PC board to accept an optional 600 $\Omega$  termination load [R106] on the input signal if the user wishes to install one.) A conventional three-opamp instrumentation amplifier (IC100 and associated circuitry) receives the input signal. R110-114 and quad analog switch IC101 make up the circuit that sets the gain of IC100. The switches in IC101 set the gain of the instrumentation amplifier by switching resistors in parallel with R104. (Smaller total resistances produce larger gains.)

IC100 feeds IC104 and associated components. This stage balances, DC-biases, and scales the signal to the proper level for the analog-to-digital (A/D) converter IC107. IC105A and associated components comprise a servo amp to correctly DC-bias the signal feeding the A/D converter. R137-139, C109, C110 make an attenuator / RC filter necessary to filter high frequency energy that would otherwise cause aliasing distortion in the A/D converter.

The corresponding right channel circuitry is functionally identical to that just described.

IC100, 102 are socketed for easy field replacement. All other circuitry is surface-mounted and is not field-replaceable.

## 2. Stereo Analog-to-Digital (A/D) Converter

---

**Located on input/output/DSP board**

The A/D converter, IC107, is a stereo 24-bit sigma-delta converter. (This is a surface-mount part and is not field-replaceable.)

The A/D oversamples the audio, applies noise shaping, and emits a bitstream at 48 kHz sample rate.

## 3. Digital Input Receiver and Sample Rate Converter (SRC)

---

**Located on input/output/DSP board**

The receiver IC300 accepts digital audio signals using the AES3 interface format (AES3-1992). It applies its output to sample rate converter IC302. This accepts and sample-rate converts any of the “standard” 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, and 96 kHz rates in addition to any digital audio sample rate within the range of 32 kHz and 96 kHz. The SRC converts the input sample rate to 48 kHz for processing by the DSP.

Receiver IC301 accepts sync signals in either AES11 or wordclock formats and generate a reference sample rate for the 6300's output sample rate converters. Relay IC304 determines if the 6300's sync input will accept AES11 or wordclock.

These chips are surface-mounted and not field-replaceable.

## Output Circuits

This circuitry interfaces the DSP to the analog and digital audio outputs. The digital audio from the DSP is transmitted to the digital-to-analog converter (D/A) and output sample rate converter (SRC). The digital-to-analog (D/A) converter converts the digital audio words generated by the DSP to analog audio. The analog output stages scale and buffer the D/A output signal to drive the analog output XLR connectors with a low impedance balanced output. The digital output transmitter accepts the digital audio words from the output sample rate converter (SRC) and transmits them as AES3-format digital audio signals on the digital output connector.

### 1. Stereo Digital-to-Analog (D/A) Converter

---

Located on input/output/DSP board

The D/A, IC211, is a stereo, 24-bit delta-sigma converter. It receives the serial left and right audio data samples from the DSP at 48 kHz sample rate and converts them into audio signals requiring further, relatively undemanding analog filtering. IC211 is surface-mounted and is not field-replaceable.

### 2. Analog Output Stages

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Located on input/output/DSP board

The left and right analog signals emerging from IC211 are each filtered, amplified, and applied to a floating-balanced integrated line driver, which has a 50 $\Omega$  output impedance. The line driver outputs are applied to the RF-filtered left and right analog output connectors. These analog signals can represent either the transmitter or monitor output of audio processing.

#### Component-Level Description:

IC201 and associated components filter the left channel signal emerging from IC211. The purpose of these stages is to reduce the out-of-band noise energy resulting from the delta-sigma D/A's **noise**-shaping filter and to translate the differential output of the D/A converter into single-ended form. These components apply a 3<sup>rd</sup> order low-pass filter to the differential signal from the D/A. This filter does not induce significant overshoot of the processed audio, which would otherwise waste modulation.

IC212 and associated components form a low-frequency servo amplifier to remove residual DC from the signal. The 0.1Hz –3 dB frequency prevents tilt-induced overshoot in the processed audio.

The buffered output of IC201 is applied to IC213, a balanced output line driver. This driver emulates a floating transformer; its differential output level is independent of whether one side of its output is floating or grounded. IC213

and its right channel counterpart IC214 are socketed for easy field replacement. All other circuitry is surface-mounted.

The corresponding right channel circuitry is functionally identical to that just described.

### 3. Digital Sample Rate Converter (SRC) and Output Transmitter

#### Located on input/output/DSP board

Output sample rate converter (SRC) chips IC400 and IC402 convert the 48 kHz 6300 system sample rate to any of the standard 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, and 96 kHz rates for the 6300's Digital Out 1 and Digital Out 2 respectively. The sample rate converters drive digital audio interface transmitters IC403, IC404, which encode digital audio signals using the AES3 interface format (AES3-1992). These chips are surface-mounted and are not field-replaceable.

## DSP Circuit

The DSP circuit consists of four Motorola DSP56367 24-bit fixed-point DSP chips, which execute DSP software code to implement digital signal processing algorithms.

The algorithms filter, compress, and limit the audio signal. The four DSP chips, each operating at approximately 150 million instructions per second (MIPS), for a total of 600 MIPS, provide the necessary signal processing. A sampling rate of 48 kHz is used.

System initialization normally occurs when power is first applied to the 6300 and can occur abnormally if the 6300's watchdog timer forces the SC520 to reboot. Upon initialization, the SC520 CPU downloads the DSP executable code stored in the flash memory. This typically takes about 7 seconds. Once a DSP chip begins executing its program, execution is continuous. The SC520 provides the DSP program with parameter data (representing information like the settings of various processing controls), and extracts the front panel metering data from the DSP chips.

During system initialization, the SC520 queries the DSP hardware about its operational status and will display an error message on-screen if the DSP fails to initialize normally. Please note any such messages and be ready to report them to Orban Customer Service.

The DSP chips are located on the I/O+DSP board—see the drawings starting on page 6-31.

## Power Supply



**Warning!** Hazardous voltages are present in the power supply when it is connected to the AC line. Several parts, including the heat sink, are hot to the AC power line. Except for servicing, do not remove the insulating shield from the power supply.

The power supply is a modular switching supply to minimize heat buildup and power consumption. It converts an AC line voltage input to +15, -15, and +5 volts. All other supply voltages are derived from these three voltages via local regulation. The supply accepts inputs from 95 to 264 VAC, 50 – 60 Hz.

The only fuse in your Optimod is a 2.5A 20mm Quick Acting HBC fuse mounted on the power supply's circuit board. Because the supply's outputs are automatically current-limited, the fuse will usually open only if the power supply fails. *Be sure to disconnect your Optimod from AC power before replacing the fuse!*

Because of safety and EMI suppression requirements in the power supply, there are no user-serviceable parts in it. In case of failure, replace the entire supply with an Orban-supplied replacement (Orban part number 29270.000.01.1), which ensures that your Optimod will continue to meet all regulatory requirements for safety and emissions.

## Abbreviations

Some of the abbreviations used in this manual may not be familiar to all readers:

A/D (or A to D)	analog-to-digital converter
AES	Audio Engineering Society
AGC	automatic gain control
A-I	analog input
A-O	analog output
BAL	balanced (refers to an audio connection with two active conductors and one shield surrounding them).
BBC	British Broadcasting Corporation
BNC	a type of RF connector
CALIB	calibrate
CIT	composite isolation transformer
CMOS	complementary metal-oxide semiconductor
COFDM	Coded Orthogonal Frequency Division Multiplex—a robust type of digital modulation using many narrow-bandwidth, low data rate, mutually non-interfering carriers to achieve an aggregate high data rate with excellent multipath rejection.
COM	serial data communications port
D/A (or D to A)	digital-to-analog converter
dBm	decibel power measurement. 0 dBm = 1mW applied to a specified load. In audio, the load is usually 600Ω. In this case only, 0 dBm = 0.775V rms.
dBu	decibel voltage measurement. 0 dBu = 0.775V RMS. For this application, the dBm-into-600Ω scale on voltmeters can be read as if it were calibrated in dBu.
DI	digital input
DJ	disk jockey, an announcer who plays records in a club or on the air
DO	digital output
DOS	Microsoft disk operating system for IBM-compatible PC
DSP	digital signal processor (or processing). May also refer to a special type of microprocessor optimized for efficiently executing arithmetic.
EBU	European Broadcasting Union
EBS	Emergency Broadcasting System (U.S.A.)
EMI	electromagnetic interference

ESC	escape
FCC	Federal Communications Commission (USA regulatory agency)
FDNR	frequency-dependent negative resistor—an element used in RC-active filters
FET	field effect transistor
FFT	fast Fourier transform
FIFO	first-in, first-out
G / R	gain reduction
HD Radio	See <i>IBOC</i>
HF	high-frequency
HP	high-pass
IBOC	"In-Band On-Channel"—a form of digital radio commercialized by iBiquity Corporation where the digital carriers use a form of COFDM modulation and share the frequency allocation of the analog carriers. Also known by its trademarked name of "HD Radio."
IC	integrated circuit
IM	intermodulation (or "intermodulation distortion")
I/O	input/output
ITU	International Telecommunications Union (formerly CCIR). ITU-R is the arm of the ITU dedicated to radio.
JFET	junction field effect transistor
LC	inductor / capacitor
LCD	liquid crystal display
LED	light-emitting diode
LF	low-frequency
LP	low-pass
LVL	level
MHF	midrange / high-frequency
MLF	midrange / low-frequency
MOD	modulation
N&D	noise and distortion
N / C	no connection
OSHOOT	overshoot
PC	IBM-compatible personal computer
PCM	pulse code modulation
PPM	peak program meter
RAM	random-access memory
RC	resistor / capacitor
RDS / RBDS	Radio (Broadcasting) Data Service—a narrowband digital subcarrier centered at 57 kHz in the TV baseband that usually provides program or network-related data to the consumer in the form of text that is displayed on the radio. Occupied bandwidth is $\pm 2500$ Hz.
REF	reference
RF	radio frequency
RFI	radio-frequency interference
RMS	root-mean-square
ROM	read-only memory
SC	subcarrier
SCA	subsidiary communications authorization — a non program-related subcarrier in the TV baseband above 23 kHz (monophonic) or 57 kHz (stereophonic)
S / PDIF	Sony / Philips digital interface
TRS	tip-ring-sleeve (2-circuit phone jack)
THD	total harmonic distortion
TX	transmitter
$\mu$ s	Microseconds. For TV preemphasis, the +3 dB frequency is $1 / (2 \pi \tau)$ , where $\tau$ is the preemphasis time constant, measured in seconds.



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VCA	voltage-controlled amplifier
VU	volume unit (meter)
XLR	a common style of 3-conductor audio connector
XTAL	crystal

## Parts List

Many parts used in the 6300 are surface-mount devices ("SMT") and are not intended for field replacement because specialized equipment and skills are necessary to remove and replace them. The list below includes substantially all of the parts used in the 6300 (including surface-mount devices), and inclusion of a part in this list does not imply that the part is field-replaceable.

The input amplifiers, output amplifiers, and tee-filters (used for EMI suppression) are socketed and easily replaceable. These are the components most vulnerable to damage caused by severe EM surges, such as those caused by lightning strikes at a broadcast transmitter site.

See the parts locator drawings for locations of components.

## Obtaining Spare Parts

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

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

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

To facilitate future maintenance, parts for this unit have been chosen from the catalogs of well-known manufacturers whenever possible. Most of these manufacturers have extensive worldwide distribution and may be contacted through their web sites.

## Control Board

Control Board		
PART #	DESCRIPTION	COMPONENT IDENTIFIER
20128.000.01	RESISTOR, 0 $\Omega$ , 0805	R21, R46
20128.010.01	RESISTOR, 10 $\Omega$ , 0805	R31, R34, R86, R89
20128.022.01	RESISTOR 22 $\Omega$ 1% 0805	R5, R6
20128.332.01	RESISTOR, 33.2 $\Omega$ , 0805	R10, R11
20128.499.01	RESISTOR 49.9 $\Omega$ 1% 0805	R19, R20, R22, R23
20129.301.01	RESISTOR, 301 $\Omega$ , 0805	R24, R25, R47, R66
20130.100.01	RESISTOR, 1.00K 1% 0805	R17, R35
20130.200.01	RESISTOR, 2.00K, 0805	R71, R79, R84, R88, R3, R4, R7, R8, R26, R27, R28, R29, R30, R32
20130.475.01	RESISTOR, 4.75K, 0805	(R36, NO, STUFF), R205, R207, R209, R211, R213, R215, R217

Control Board		
PART #	DESCRIPTION	COMPONENT IDENTIFIER
20130.562.01	RESISTOR, 1/8W, 1%, 5.62K, 0805	R74
20131.100.01	RESISTOR, 10K, 0805	R1, R2, R9, R33, R37, R38, R39, R72
20131.113.01	RESISTOR, 1/8W, 1%, 11.3K, 0805	R87
20131.147.01	RESISTOR, 1/8W, 1%, 14.7K, 0805	R18, R73
20132.100.01	RESISTOR, 100K, 0805	R40, R41, R42, R43, R44, R45, R50, R54, R57, R59
		R65, R70, R78, R83, R85
20135.002.01	RESISTOR, 0805, 5%, 2Ω	R63, R67, R75
20136.000.01	RESISTOR 300 Ω 5% 1/2W 2010	R81
20233.472.01	RESISTOR NETWORK 4.7K CTS745C 8R BUS	RN1, RN2, RN3, RN4
20237.472.01	RESISTOR NETWORK 8R, ISO, 5%	RN5
21136.010.01	CAPACITOR-SURFACE MOUNT 1206-10PF-5	C5
21139.000.01	CAPACITOR, X7R, 0.1UF, 10%, 0805	C6, C7, C8, C9, C19, C20, C21, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C39, C43, C45, C177, C179, C182, C184, C186, C187, C188, C200
21141.000.01	CAPACITOR, NPO, 1000PF, 1%, 0805	C11
21142.000.01	CAPACITOR, NPO, 100PF, 1%, 0805	C22, C34, C40, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C58, C59, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72
21146.310.01	CAPACITOR, .01uf, 0805, 10%	C10, C126, C127, C133, C134, C156, C158, C160, C162, C180, C185
21167.047.01	CAPACITOR 4.7pf 50V X7R 0805	C1
21170.018.01	CAPACITOR 18pf 1% 50V COG 0805	C3, C4
21171.105.01	CAPACITOR 1uf X7R 0805	C14, C17, C36, C37, C38, C125, C132, C151, C153, C155, C157, C159, C161, C175, C176, C178, C181, C183, (C201, NO, STUFF)
21322.547.01	CAPACITOR, 4.7uf, TANTALUM, 3528 10%	C12
21325.610.01	CAPACITOR 10UF 10% TANTALUM 3528	C13, C15, C16, C18, C35, C42, C44, C202
22101.001.01	DIODE, 1N4148WT/R	CR1, CR2, CR3, CR4, CR5
22209.000.01	DIODE, SHOT 1A, 60V, SMD	CR6, CR7, CR8, CR9
24331.025.01	IC VOLTAGE REGULATOR LT1963-2.5 SOT223	U14
24331.033.01	IC VOLTAGE REGULATOR LT1963-3.3 SOT223	U15
24417.000.01	IC OCT D-TYPE FLIPFLOP W/	U20
24541.000.01	IC SDRAM MT48LC16 TSOP54P	U2, U3
24638.000.01	IC, OCTAL BUS TRANS W/3	U22
24654.000.01	IC, PWRST MIC8115	U5
24656.475.01	IC, PWRST MCP120 SOT-23	U16
24900.000.01	IC, HEX INVERTER, SURFACE MOUNT	U23, U24
24965.000.01	IC, 74ALVC164245DGG	U7, U8, U9
24968.000.01	IC, MAX208ECNG	U12
24972.520.01	IC MICROPROCESSOR ELANSC520 BGA388	U1

Control Board		
PART #	DESCRIPTION	COMPONENT IDENTIFIER
24979.000.01	IC, BAT54C-7	CR11, CR12
24983.000.01	IC, 7064STC100-10	U6
25008.000.01	IC, PS2506-4 *	U17, U19
27017.009.01	CONNECTOR, RT AGL, PC MNT, 9P	J5
27017.025.01	CONNECTOR, RT AGL, PC MNT, 25P	J9
27147.124.01	IC, SCKT, DIP, 24 PIN, DUAL	SU12
27306.000.01	CONNECTOR RJ45 PCMT W/MAGS	J1
27406.014.01	CONNECTOR, SOCKET, STRIP, 14 PIN	JP1
27421.004.01	CONNECTOR, HDR, DBL RW, 4P, 2 X 2	J8, J10, J13
27421.006.01	CONNECTOR, HDR, DBL RW, 6P, 2 X 3	J14
27421.010.01	CONNECTOR, HDR, DBL RW, 23", 2 X 5	J3
27421.016.01	CONNECTOR, HDR, STR, .23", 2 X 8	(J6, NO, STUFF)
27451.005.01	CONNECTOR, STR, DBL ROW, 26 PIN	J11
27630.001.01	JUMPER, PC MNT, TEST POINT	TP100
28031.000.01	HOLDER, BATTERY, LITH CELL	BT1, HLDR
28041.000.01	CELL, COIN, BATTERY, LITHIUM, 3V	BT1
28089.000.01	OSCILLATOR 33MHZ SG636PCE 4P SMD	X1
28090.000.01	IC TCXO DS32KHZ 36P BGA	U13
28091.000.01	XTAL 25MHZ RXD MP35L SMD	Y1
44099.100.01	FIRMWARE 8300 U4 28F128	U4
20129.604.01.1	R0805 604Ω 1% 1/8W	R48, R49, R51, R53, R55, R56, R58, R60, R62, R64, R68, R69, R76, R77, R80, R82
20238.000.01.1	RESISTOR NET 100K 8RESISTOR 2512	RN52, RN61
22210.000.01.1	DIODE MBR530 SOD123	CR10
23216.000.01.1	TRANSISTOR MMBT4400 SOT23	Q1, Q2, Q3
24646.000.01.1	IC 74ACT244 OCTAL TSSOP	U18
24674.000.01.1	IC 10/100BT ETHERNET CONTROLLER (NATIONAL SEMICONDUCTOR)	U10
24761.000.01.1	IC LO POWER DC/DC CONVERT	U21
27374.000.01.1	HEADER, 2MM 2 X 10	(J4, NO, STUFF)
27375.000.01.1	HEADER, 2MM 2 X 6	J7
27479.002.01.1	CONNECTOR HEADER .156 CENTER 2 PIN	J12
29535.000.01.1	INDUCTOR 3.9uH CHIP 1008	L1, L2, L3
29536.000.01.1	INDUCTOR SURFACE MOUNT 10uH 10%	L4
43050.014.01.1	SASY CBL IDC 60PIN 1.4"	J2

## Combined Input/Output and DSP (I/O+DSP) Board

I/O+DSP BOARD		
PART #	DESCRIPTION	COMONENT IDENTIFIER
20040.604.01	RESISTOR, MF, 1/8W, 1%, 604 Ω	(R106, R119, NO, STUFF)
20128.000.01	RESISTOR, 0Ω, 0805	(R600, R601, R602, R603, NO STUFF)
20128.022.01	RESISTOR 22 Ω 1% 0805	R806, R807, R808, R809, R810, R811, R813, R820
20128.075.01	RESISTOR, 75Ω, 1%, 0805	R158, R303
20129.100.01	RESISTOR, 100 Ω, 0805	R257, R258, R259, R260

I/O+DSP BOARD		
PART #	DESCRIPTION	COMONENT IDENTIFIER
20129.110.01	RESISTOR 110Ω 0805 1%	R249, R250, R300, R400
20129.150.01	RESISTOR, 1/8W, 1%, 150Ω, 0805	R138, R151, R815
20129.249.01	RESISTOR, 1/8W, 1%, 249Ω, 0805	R137, R139, R149, R150, R155
20129.768.01	RESISTOR, 1/8W, 1%, 768Ω, 0805	R111, R126
20130.150.01	RESISTOR, MF 1/8W 1% 1.50K SMT	R131, R134, R140, R141, R144, R146, R159, R160, R161, R162
20130.162.01	RESISTOR, 1/8W, 1%, 1.62K, 0805	R132, R153, R156, R157, R302
20130.210.01	RESISTOR, 1/8W, 1%, 2.10K, 0805	R112, R127, R902, R905
20130.348.01	RESISTOR, 1/8W, 1%, 3.48K, 0805	R204, R210, R217, R220, R245, R246
20130.499.01	RESISTOR 4.99K 1% 0805	R103, R105, R118, R124, R725, R800, R903
20130.562.01	RESISTOR, 1/8W, 1%, 5.62K, 0805	R113, R128
20130.845.01	RESISTOR, 1/8W, 1%, 8.45K, 0805	R201, R202, R205, R207, R208, R211, R212, R214, R215, R218
20131.100.01	RESISTOR, 10K, 0805	R237, R251, R252, R406, R407, R703
20131.113.01	RESISTOR, 1/8W, 1%, 11.3K, 0805	R206, R219, R233, R234
20131.147.01	RESISTOR, 1/8W, 1%, 14.7K, 0805	R114, R129
20131.499.01	RESISTOR, 1/8W, 1%, 49.9K, 0805	R301, R304, R310, R311, R317, R318, R401, R402, R700, R706, R707, R900, R901, R904
20131.825.01	RESISTOR, 1/8W, 1%, 82.5K, 0805	R104, R123, R203, R209, R213, R216
20132.100.01	RESISTOR, 100K, 0805	R704, R705, R816, R817, R818
20135.100.01	RESISTOR MF 1/8W 1% 1.00M SMT	R142, R152, R247, R248
20151.365.01	RESISTOR, 0.1% 3.65K, 0805	R101, R108, R116, R121, R130, R133, R135, R136, R143, R145, R147, R148
20151.536.01	RESISTOR, 0.1%, 5.36K, 0805	R102, R109, R117, R122
20221.101.01	RESISTOR, NET, SIP, 2%, 100K, 10PIN	RN701
20511.310.01	TRMPTS, 10K, 20%, TOP ADJ	VR200, VR201
21137.447.01	CAPACITOR 0.47UF 25V 10% 1206	C113, C117, C234, C235, C502, C504, C506, C508
21138.247.01	CAPACITOR, SMD1206, 4700PF, 50V, 5%	C109, C110, C115, C116, C306
21139.000.01	CAPACITOR, X7R, 0.1UF, 10%, 0805	C111, C118, C119, C120, C121, C123, C124, C125, C126, C127, C128, C202, C203, C233, C300, C301, C302, C309, C400, C700, C802, C803, C805, C809, C916, C932, C933, C934, C935, C936, C937, C938, C939, C940, C941, C942, C943, C944, C945, C947, C948, C949, C950, C951, C952, C953, C954, C955, C956, C957, C958, C959, C960, C961, C962, C963, C964, C965, C967, C968, C969, C970, C971, C972, C973, C974, C975, C976, C977, C978, C979, C988, C996, C1003, C1004, C1012, C1013
21140.000.01	CAPACITOR, NPO, 470PF, 1%, 0805	C217, C218, C219, C220
21141.000.01	CAPACITOR, NPO, 1000PF, 1%, 0805	C236, C237, C238, C239, C305
21142.000.01	CAPACITOR, NPO, 100PF, 1%, 0805	C989
21143.000.01	CAPACITOR, NPO, 1500PF, 1%, 0805	C221, C222, C240, C241, C242,

I/O+DSP BOARD		
PART #	DESCRIPTION	COMONENT IDENTIFIER
		C243, C987, C990, C993
21144.000.01	CAPACITOR, 5%, 100V, 47PF, 1206	C101, C103, C105, C107, C108, C114, C136
21146.310.01	CAPACITOR, .01uf, 0805, 10%	C900, C901, C902, C903, C904, C905, C906, C907, C908, C909, C910, C911, C912, C913, C914, C915
21154.433.01	CAPACITOR, .33uf, 0805, 20%	C303
21171.105.01	CAPACITOR 1uf X7R 0805	C200, C201, C232, C701, C985, C986, C991, C992, C1011, C1014
21175.000.01	CAPACITOR 6800pF 10% X7R 0805	C501, C503, C505, C507
21227.747.01	CAPACITOR RADIAL LEADS 470UF 16V HFS	C994
21319.610.01	CAPACITOR, 10uf, TANT, SMT	C112, C122, C129, C130, C131, C804, C917, C918, C919, C920, C922, C923, C946, C995, C1010
22083.068.01	DIODE, VOLTAGE SUPPRESSOR, 6.8 VLT	CR902
22101.001.01	DIODE, 1N4148WT/R	CR900, CR901
22102.001.01	DIODE, SIGNAL, 1N5711TR	CR700
22104.000.01	DIODE, RECTIFIER 1N5818	CR903, CR904
22106.000.01	DIODE, SMCJ26C, TRANZORB	CR100, CR103, CR104, CR105, CR202, CR203, CR204, CR205
23214.000.01	TRANSISTOR NPN MMBT3904	Q900
24024.000.01	IC, OPA2134PA	IC100, IC102
24307.901.01	IC, LINEAR, DC REG, 5V POS	IC902
24334.000.01	IC 1.5A SWITCH REG 1.8V	IC901
24417.000.01	IC OCT D-TYPE FLIPFLOP W/	IC108, IC406, IC700
24753.000.01	IC AD1895 SRC 192KHZ	IC302, IC400
24757.000.01	IC, DSPB56367PV150 150MHZ	IC501, IC502, IC503, IC504
24858.000.01	IC, SO/14, SMT	IC804
24945.000.01	IC 74AHC541 OCTLBUF SOL20	IC701
24946.000.01	IC-8 BIT-DUAL TRANSVR W/3	IC702
24951.000.01	IC HC151 8CH MUX SOIC16	IC407
24958.000.01	IC, DRV134PA-DIP	IC213, IC214
24960.000.01	IC, OPA2134UA	IC104, IC105, IC106, IC201, IC202, IC212
24963.000.01	IC, 5383 VS	IC107
24980.000.01	IC, 74ACT32D	IC410, IC704
24994.000.01	IC, 74ACT04, SOIC 14P	IC409, IC807
24997.000.01	IC, DAC AK4393 SSOP28	IC211
27053.003.01	CONNECTOR, MALE, INSERT, RT ANGL	J201, J202, J400
27054.003.01	CONNECTOR, FEM, INSERT, RT ANGLE	J100, J103, J300
27147.008.01	IC, SCKT, DIP, 8 PINS, DUAL	SIC100, SIC102, SIC213, SIC214
27174.044.01	IC, SCKT, 44 PIN, LOW PROFIL	SIC703
27408.003.01	CONNECTOR, 3P SCKT STRIP	SL100, SL102, SL104, SL106, SL200, SL201, SL202, SL203
27421.002.01	CONNECTOR, HEADER, DBL RW, 2P, 2 X 1	J700
27421.010.01	CONNECTOR, HEADER, DBL RW, 23", 2 X 5	J800, J903
27426.003.01	CONNECTOR, HEADER, 3 PIN, SINGLE RV	J801

I/O+DSP BOARD		
PART #	DESCRIPTION	COMONENT IDENTIFIER
27451.009.01	HEADER STR DBLRW 60P PCMT	J701
27630.001.01	JUMPER, PC MNT, TEST POINT	TP900, TP903, (TP901, TP902, TP904, NO, STUFF)
28083.000.01	OSC-XTAL CLOCK-27MHZ-3 VO	IC805
29015.000.01	XF-SMT- SCIENTI	T300, T400
29506.001.01	BEAD- FERRITE- ON WIRE	L300, L301, L400, L401
29508.210.01	FLTR-EMI SUPPRESSION-50V-	L100, L102, L104, L106, L200, L201, L202, L203
29522.000.01	INDUCTOR, 1200UH, 5%, 1-M-10-22	L101, L103, L105, L107, L208, L209, L210, L211
29527.000.01	INDUCTOR, FIT44-4	L900
44110.100.01	FIRMWARE PIC16C IC703	IC703
24672.000.011	IC DIG INTERFACE TRANSMIT	IC403
20128.499.01.1	R0805 49.9Ω 1%	R253, R254, R255, R256
20129.301.01.1	R0805 301Ω 1% 1/8W	R100, R107, R115, R120
20129.475.01.1	R0805 475Ω 1% 1/8W	R261, R262, R263, R264
20129.604.01.1	R0805 604Ω 1% 1/8W	R306
20130.100.01.1	R0805 1K 1%	R702
21170.282.01.1	CCC 0805 .0082U 50 5% COG	C132, C133, C134, C135
21170.310.01.1	CCC 0805 .01U 50 5% COG	C100, C102, C104, C106
24676.000.01.1	IC TRANS CS8427 28 PIN	IC300
24760.000.01.1	IC QUAD CMOS SPST SWITCH	IC101, IC103
24762.000.01.1	IC QUAD BUFFER 3-STATE OUTP	IC401
24763.000.01.1	IC EPM7064AETC100-10	IC800
24766.000.01.1	IC, PLL1707DBQ	IC801
27479.002.01.1	CONNECTOR HEADER .156CTR 2 PIN	J901
27479.004.01.1	CONNECTOR HEADER .156CTR 4 PIN	J902
27479.006.01.1	CONNECTOR HEADER .156CTR 6 PIN	J900
29537.102.01.1	INDUCTOR 0805 FERRITE 1000 Ω	L800, L801, L802
32296.000.03.1	PCB I/O + DSP BOARD	

**Display Board (Front)**

DISPLAY BOARD (FRONT)		
PART #	DESCRIPTION	COMPONENT IDENTIFIER
15057.010.01	SPACER, .100" HIGH	CR1, CR2, CR3, CR4, CR5, CR6, CR7, CR8, CR9, CR16

DISPLAY BOARD (FRONT)		
PART #	DESCRIPTION	COMPONENT IDENTIFIER
15061.005.01	LED MNT, 1 POS'N, .240"HIGH	MNTCR10
25106.001.01	LED, YELLOW, T-1, HIGH EFFICIENCY LMP	CR11, CR12, CR13, CR14, CR15
25106.003.01	LED, RED, T-1, HIGH EFFICIENCY LMP	CR10
25167.000.01	LED, ARRAY, 1 RED, 1 YEL, 8 GRN	CR7, CR16
25168.000.01	LED, ARRAY, 9 YELLOW, 1 RED	CR1, CR2, CR3, CR4, CR5, CR6
27368.000.01	CONNECTOR, 100 SCKT, 5X2 LOPRO	J1
27369.000.01	CONNECTOR, 100 SCKT, 8X2, LOPRO	J2, J3, J4
25172.000.01.1	LED ARRAY ALL YELLOW	CR8, CR9

## Display Board (Back)

PART #	DESCRIPTION	COMPONENT IDENTIFIER
42007.100	FLAT CABLE 26P 10"	JP203
15065.355.01	LED-MNT-1 POS-0.355	FOR, CR1 USE 2
20122.110.01	RESISTOR, TF, 1/8W, 1%, 110 ohm	R17, R18, R19, R20, R21, R22, R23, R24
20124.100.01	RESISTOR TF 1/8W 1% 1206 10K	R29, R30
20125.100.01	RESISTOR, TF, 1/8W, 1%, 100K	R25, R26, R27, R28
20226.000.01	RESISTOR, NETWORK, DIL, 2%, 100 OHM	RP1, RP2
21131.410.01	CAPACITOR, SURFACE MOUNT 1206, .1UF, 50V, 20%	C2, C3, C4, C5, C6, C7, C8
21144.000.01	CAPACITOR, 5%, 100V, 47PF, 1206	C9, C10, C11, C12, C13, (C14, NO, STUFF)
21313.568.01	CAPACITOR, TANT, 6.8UF, 25V, 10%	C1
24635.000.01	IC 74HCT374	IC3
24636.000.01	IC 74ACT574	IC1, IC2
24900.000.01	IC, HEX INVERTER, SURFACE MOUNT	IC7
24905.000.01	IC, CMOS OCTAL D REG. 3 ST	IC4, IC5, IC6, IC9
24967.000.01	IC, 74ACT245DW	IC8
25112.001.01	LED, RED/GREEN, BI-COLOR/POLAR	CR1
26085.000.01	SWITCH, ROT, VERTICAL MOUNT, 2 BIT	S12
27366.000.01	CONNECTOR, 100 POSTS, 5X2 MLE	P1
27367.000.01	CONNECTOR, 100 POSTS, 8X2	P2, P3, P4
27404.000.01	CONNECTOR, PLUG, POLAR, WHITE, NYL	P5-6
27420.002.01	CONNECTOR 2 PIN RIGHT ANGLE	J1
43008.501.01	ASSEMBLY-WIRE-BLK-12	
43008.503.01	ASSEMBLY-WIRE-RED-12	



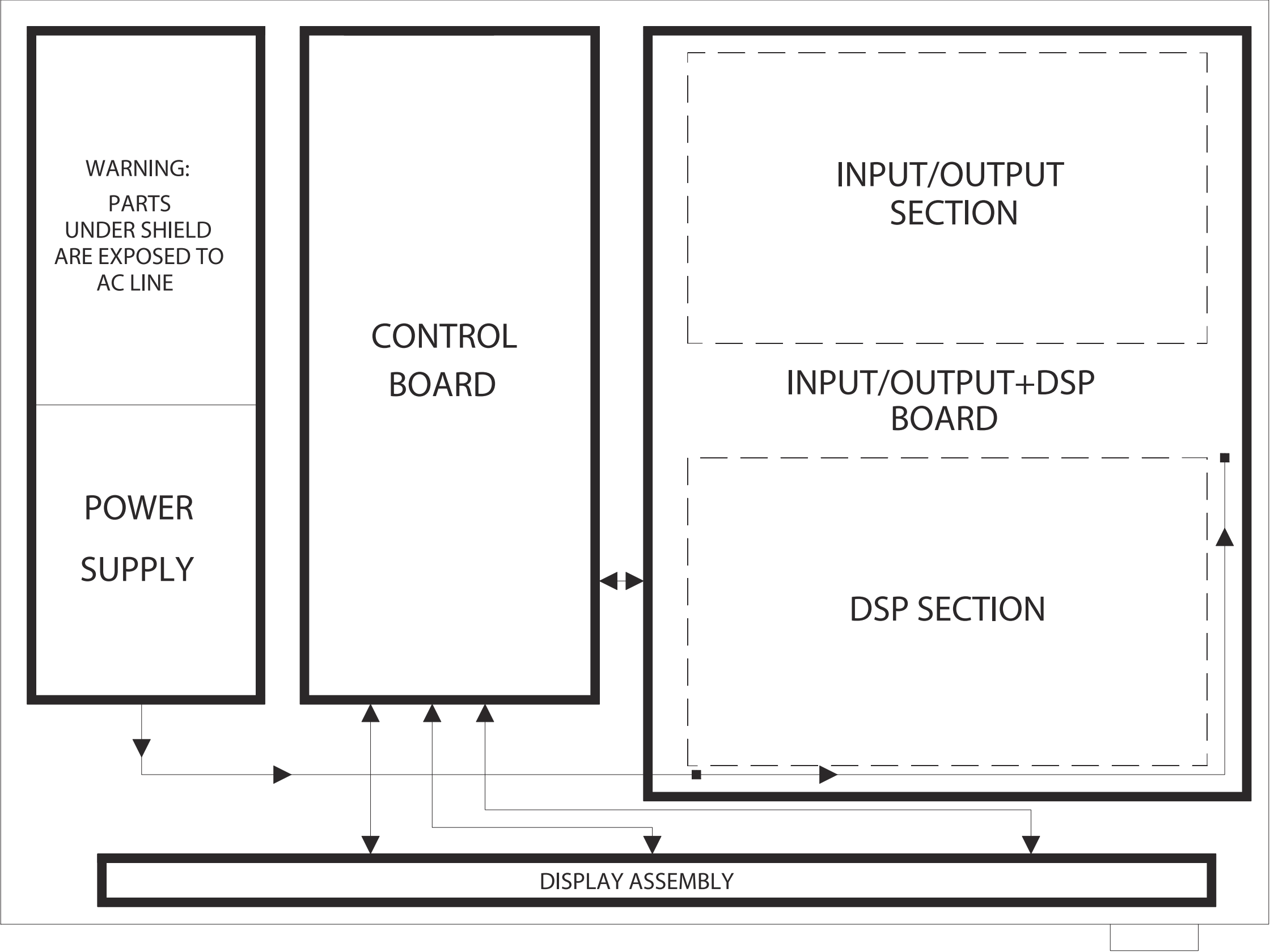
## Schematics and Parts Locator Drawings

These drawings reflect the actual construction of your unit as accurately as possible. Any differences between the drawings and your unit are probably due to product improvements or production changes since the publication of this manual.

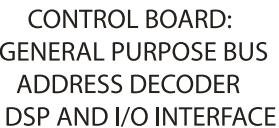
If you intend to replace parts, please read page 6-14. Please note that because surface-mount parts are used extensively in the 6300, few parts are field-replaceable. Servicing ordinarily occurs by swapping circuit board assemblies. However, the most vulnerable parts connected to the outside world are socketed and can be readily replaced in the field. These include the analog input amplifiers, the analog output amplifiers, and the tee-filters used for EMI suppression.

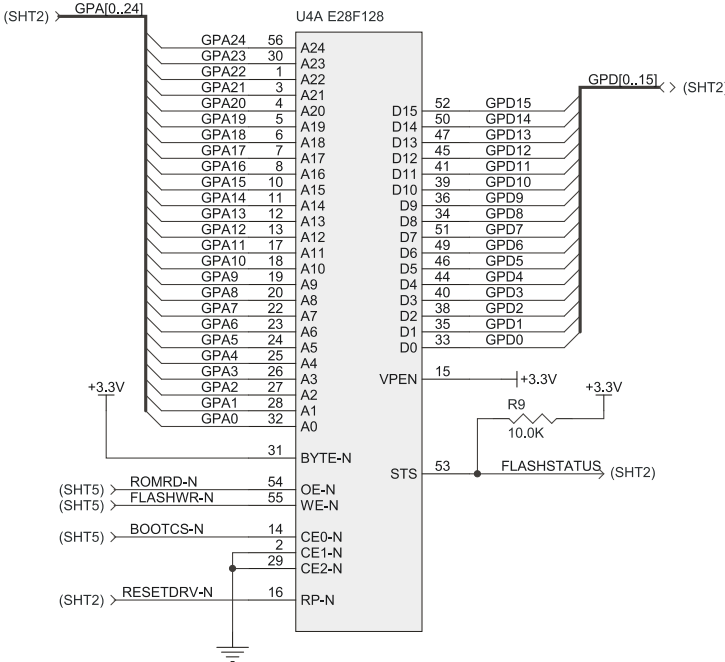
Function	Description	Drawing	Page
<b>Chassis</b>	Circuit Board Locator and Basic Interconnections	Top view (not to scale)	6-23
<b>Control board</b>	Control microprocessor. Services front panel, serial port, Ethernet, and DSP+I/O board. <b>Contains:</b>	Parts Locator Drawing	6-24
	General Purpose bus, address decoder, DSP, and I/O interface	Schematic 1 of 5	6-25
	Memory and clock generation	Schematic 2 of 5	6-26
	Ethernet	Schematic 3 of 5	6-27
	Miscellaneous input/output	Schematic 4 of 5	6-28
	Power and Ground	Schematic 5 of 5	6-29
<b>I/O+DSP Board</b>	Analog Input/output AES3 Input/output DSP Chips; Local regulators. <b>Contains:</b>	Parts Locator Drawing	6-30
	L and R Analog Inputs	Schematic 1 of 9	6-31
	L and R Analog Outputs	Schematic 2 of 9	6-32
	Digital Input and Sync Input	Schematic 3 of 9	6-33
	Digital Outputs	Schematic 4 of 9	6-34
	DSP Extended Serial Audio Interface (ESAI) and Host Interface	Schematic 5 of 9	6-35
	DSP Serial Peripheral Interface, Power, and Ground	Schematic 6 of 9	6-36
	General Purpose bus 8-bit I/O	Schematic 7 of 9	6-37
	Serial Audio Interface and Clock Generation	Schematic 8 of 9	6-38
	Power Distribution	Schematic 9 of 9	6-39
<b>Display Board</b>	Front-Panel LCD, LEDs, Buttons, and Rotary Encoder <b>Contains:</b>	Parts Locator Drawing	6-40
	Front of board	Schematic 1 of 2	6-41

Function	Description	Drawing	Page
	Rear of board		6-42
DSP Block Diagram	Shows signal processing		6-43

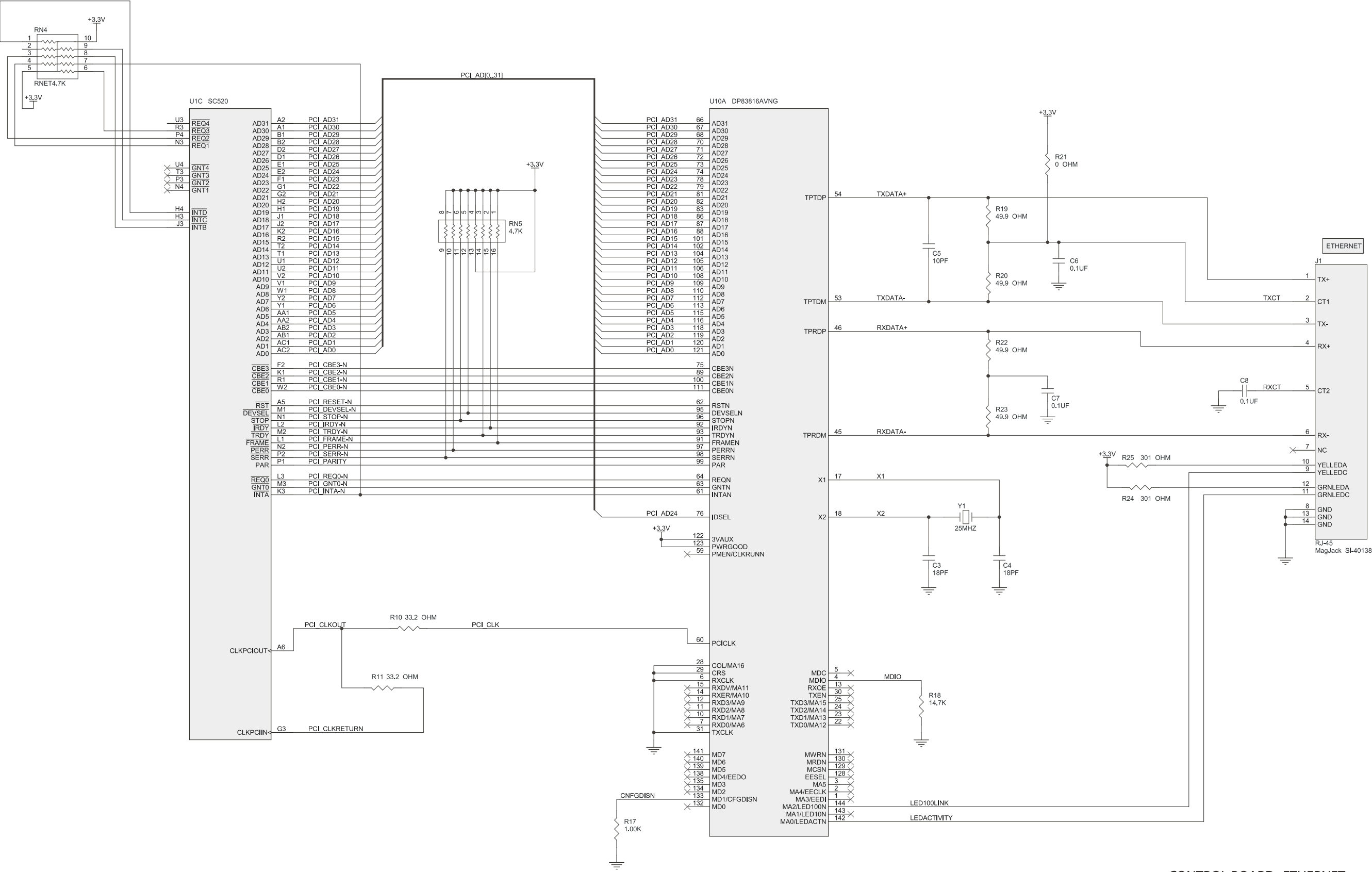




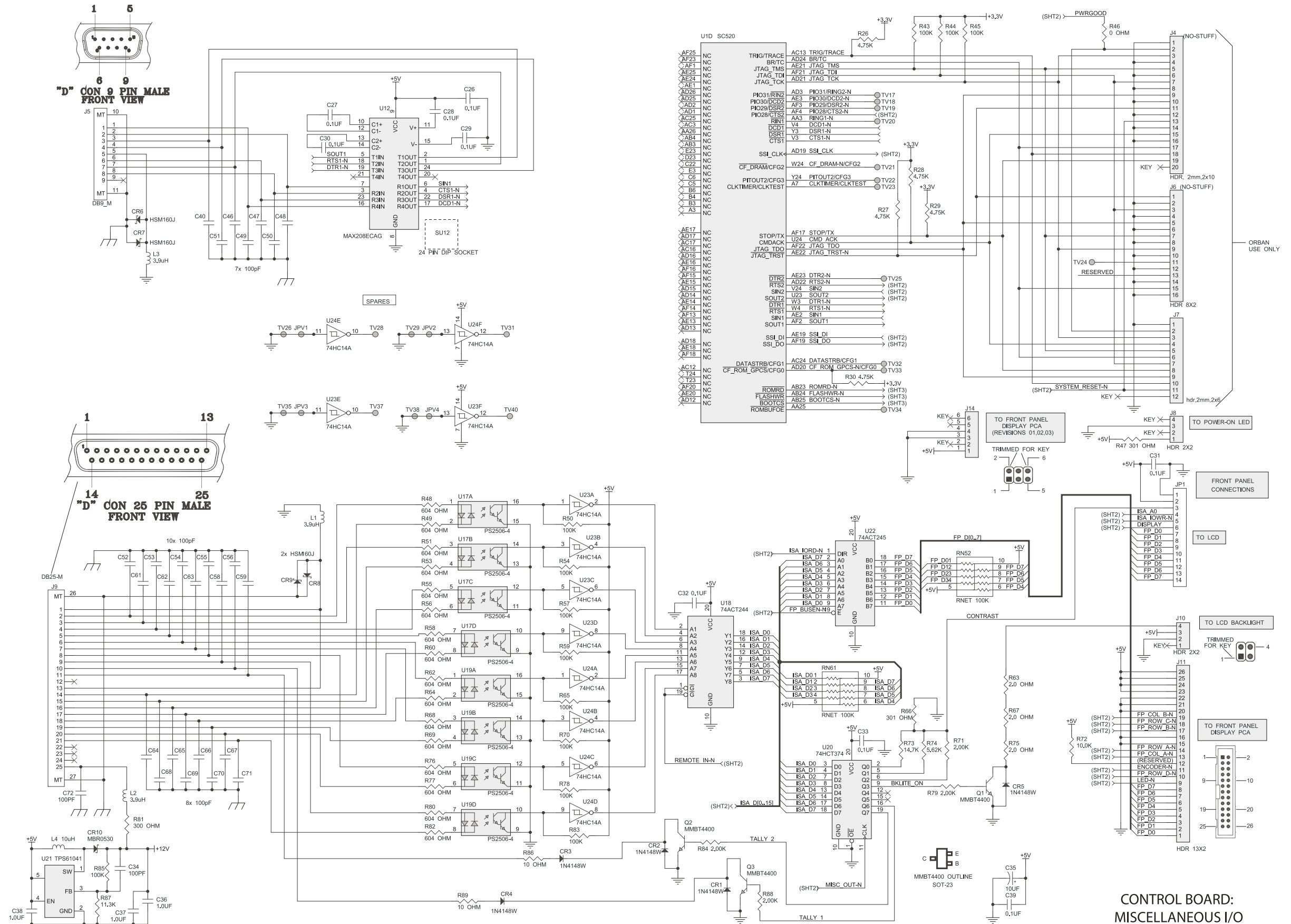




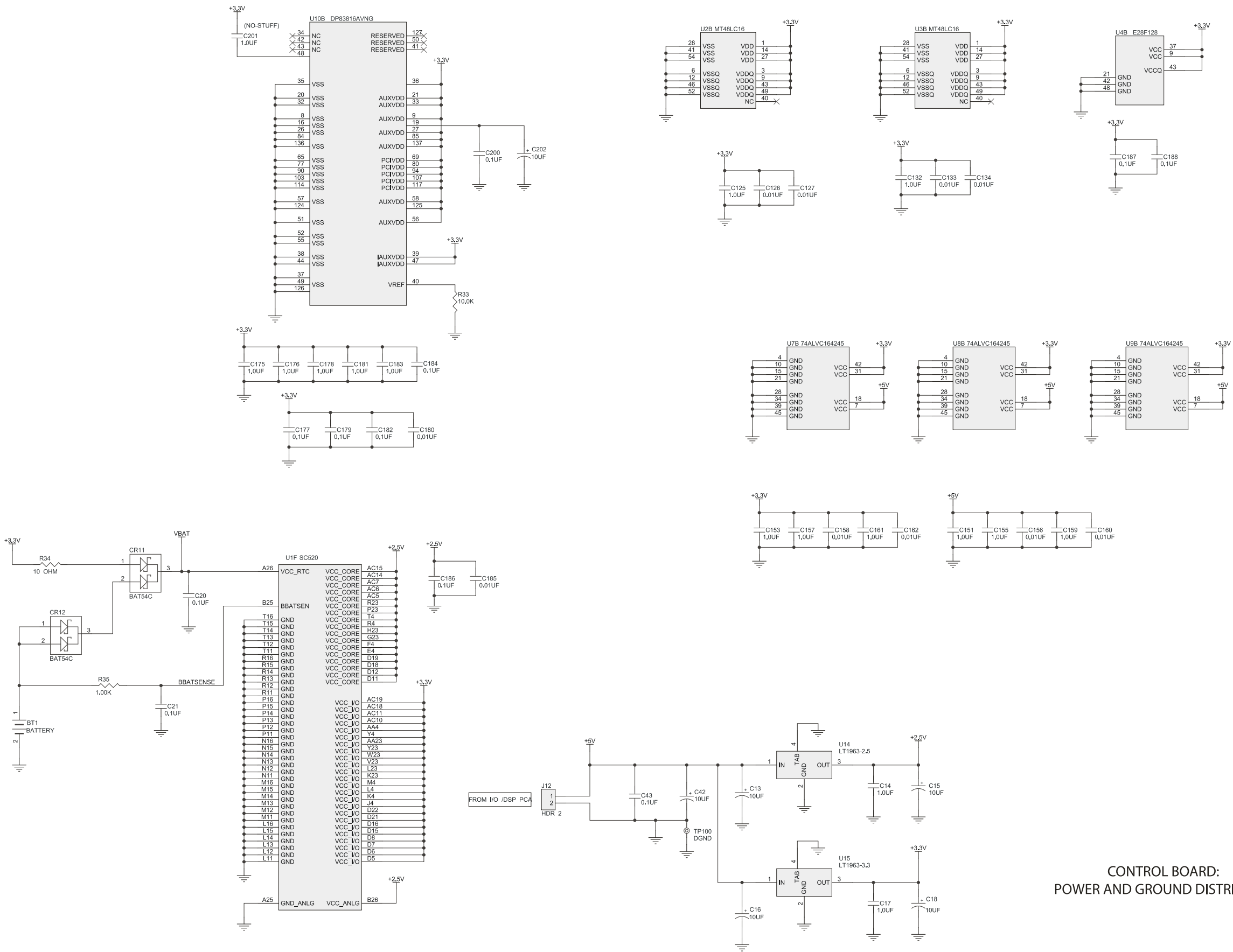
## CONTROL BOARD: MEMORY AND CLOCK GENERATION

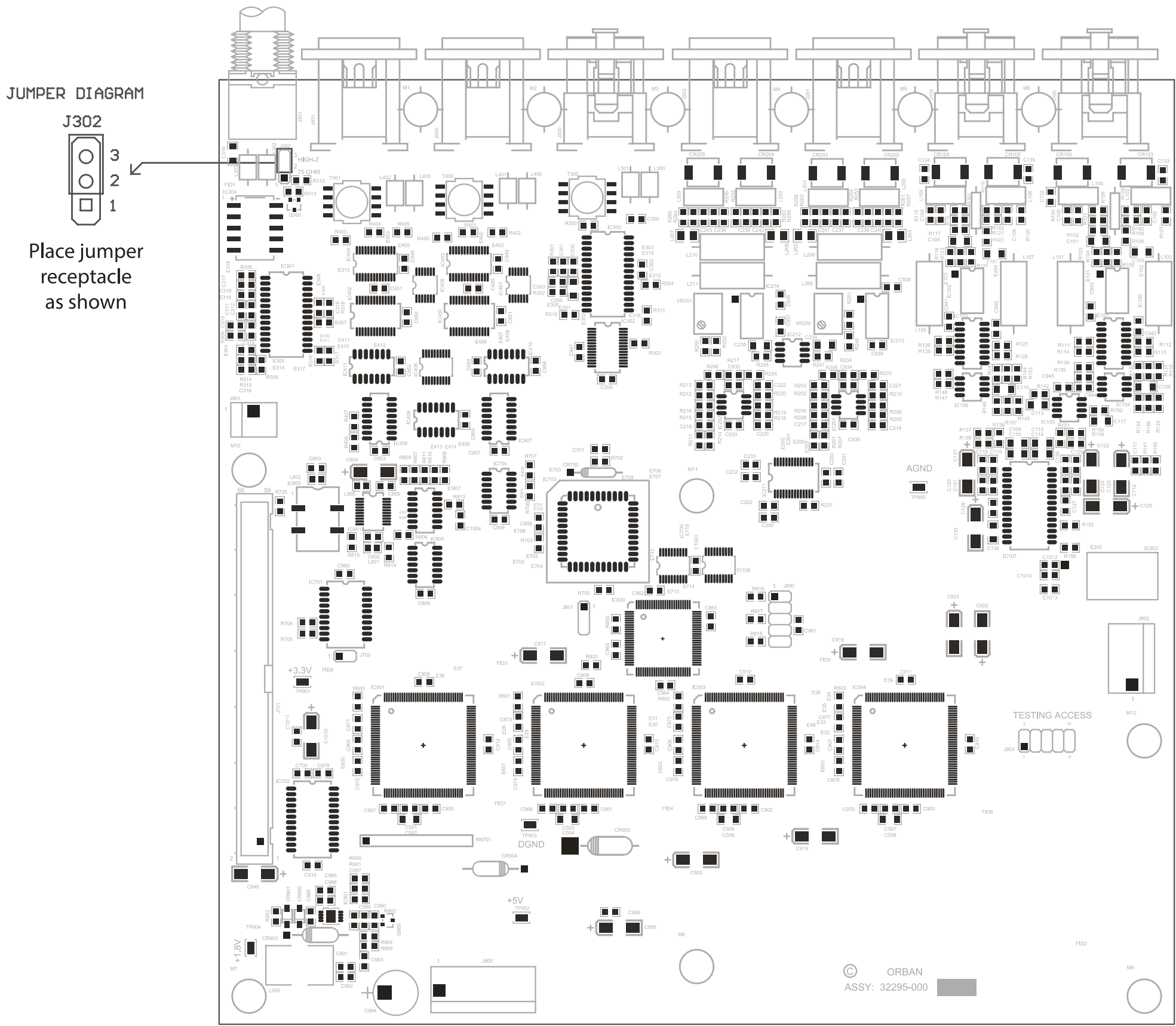


CONTROL BOARD: ETHERNET



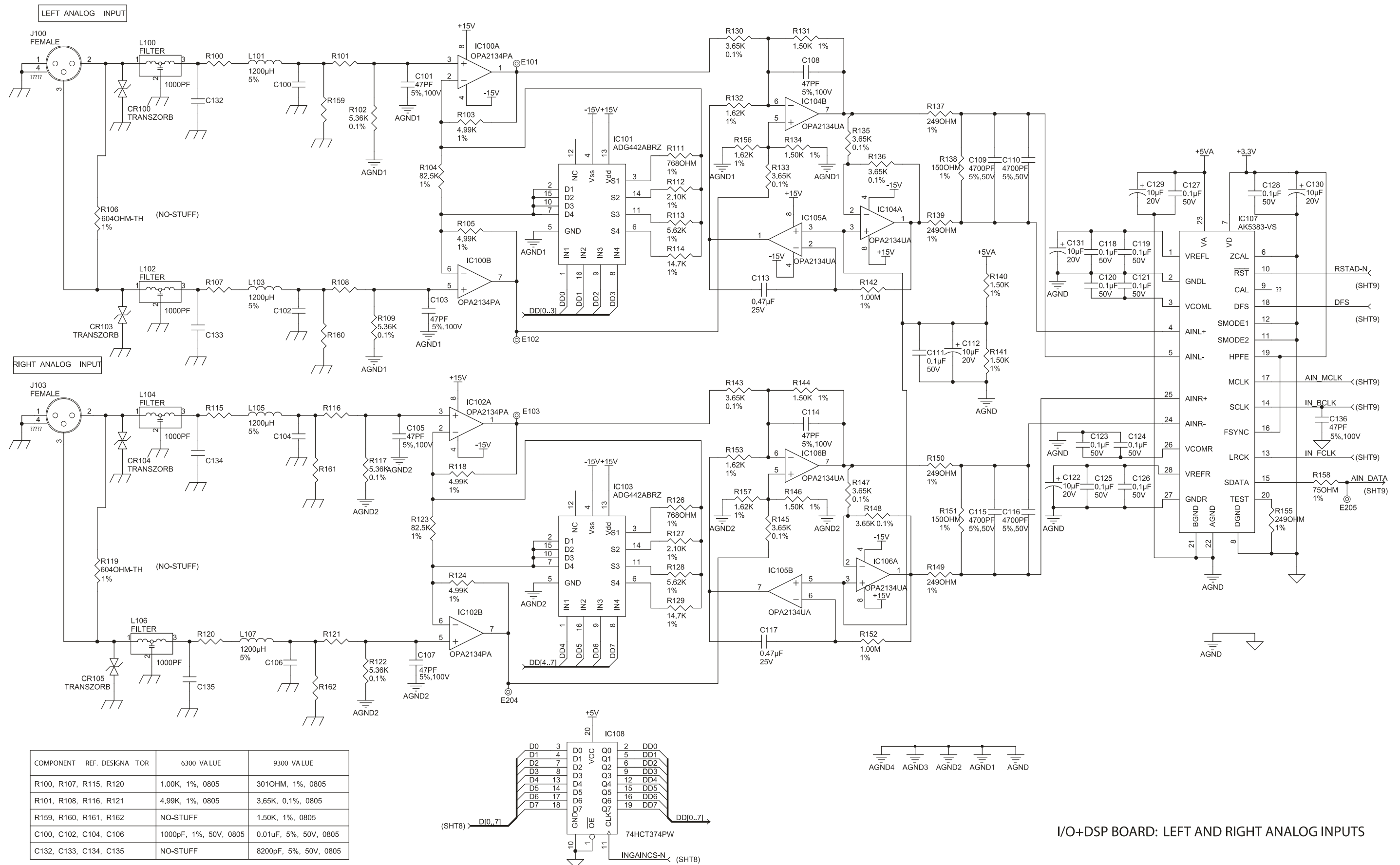




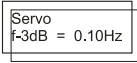


NO-STUFF		
COMPONENT REF. DESIGNATOR	FOR 6300	FOR 9300
R159, R160, R161, R162	NO-STUFF	
C132, C133, C134, C135	NO-STUFF	
L204, L205, L206, L207		NO-STUFF
L208, L209, L210, L211	NO-STUFF	
R253, R254, R255, R256	NO-STUFF	
R257, R258, R259, R260	NO-STUFF	
R261, R262, R263, R264	NO-STUFF	
C236, C237, C238, C239	NO-STUFF	
C240, C241, C242, C243	NO-STUFF	
J301, J302, J401		NO-STUFF
C311, C312, C313, C314, C315		NO-STUFF
C317, C318, C319, C401		NO-STUFF
R305, R306, R307, R309		NO-STUFF
R312, R313, R314, R315, R316		NO-STUFF
R403, R404, R405		NO-STUFF
Q300		NO-STUFF
IC301, IC304, IC402, IC404		NO-STUFF
IC405, IC408, IC411		NO-STUFF
T401		NO-STUFF
L302, L303, L402, L403		NO-STUFF
R106, R119	NO-STUFF	NO-STUFF
C316	NO-STUFF	NO-STUFF
R600, R601, R602, R603	NO-STUFF	NO-STUFF
TP901, TP902, TP904	NO-STUFF	NO-STUFF

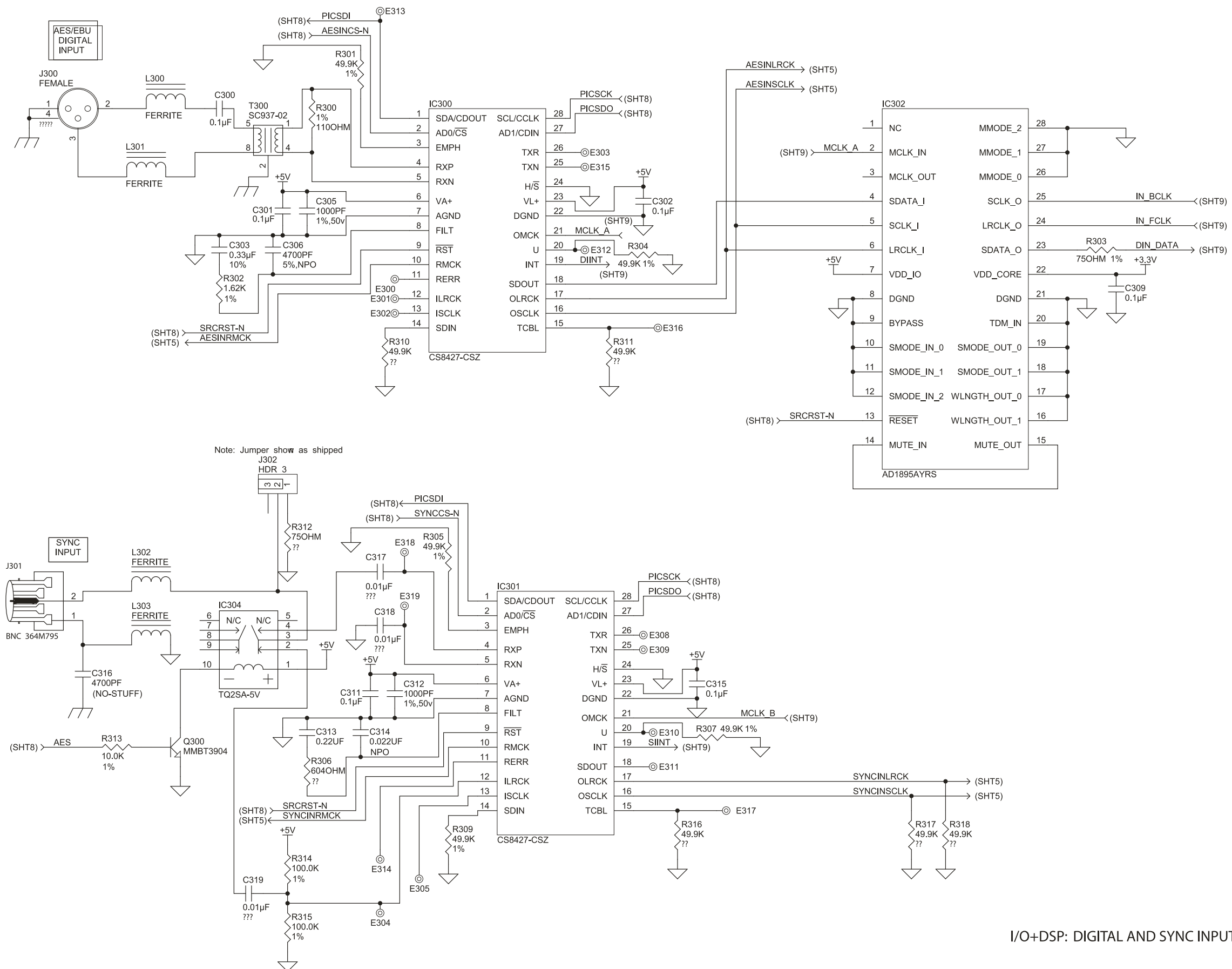
I/O DSP Parts Locator

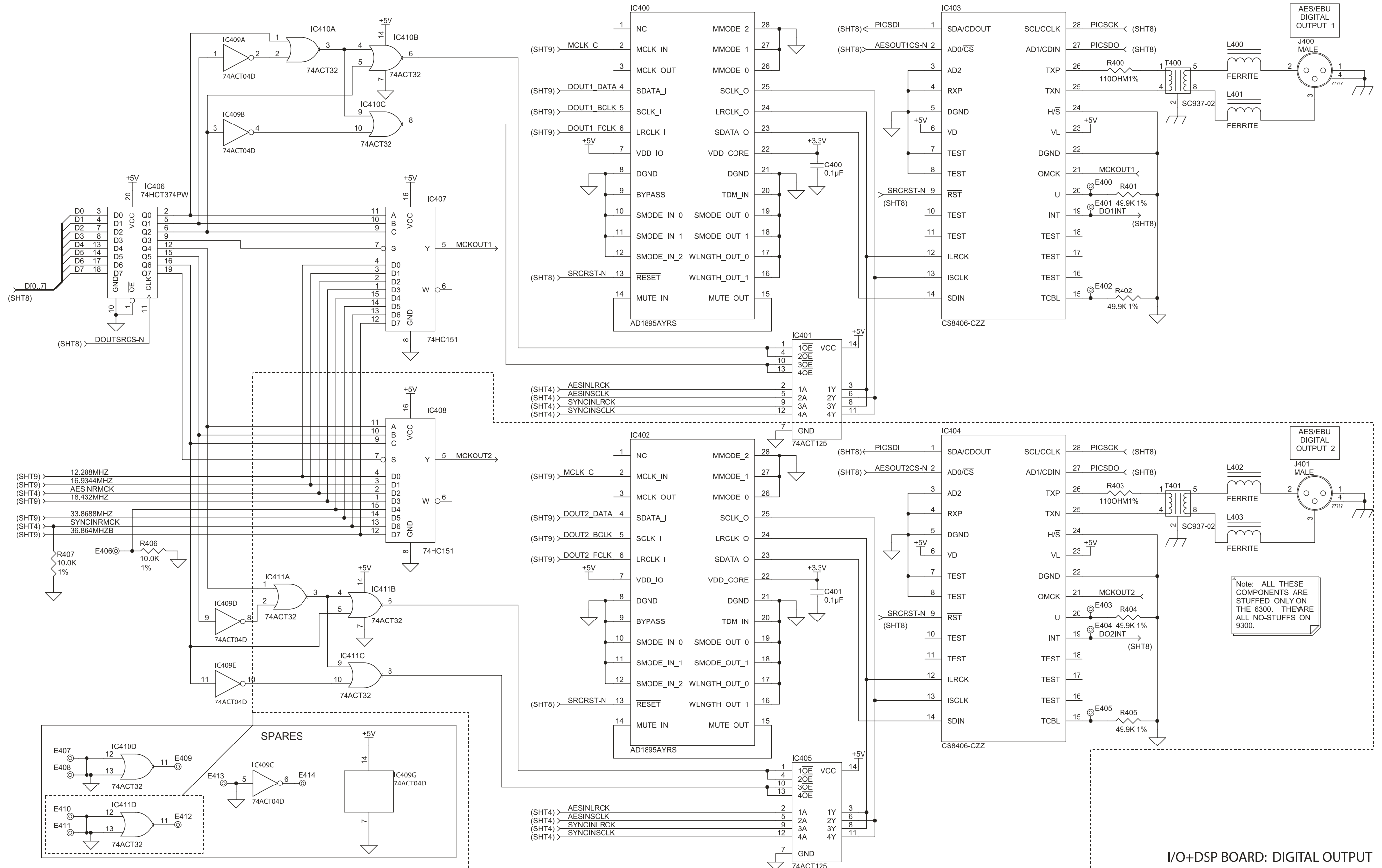


### I/O+DSP BOARD: LEFT AND RIGHT ANALOG INPUTS

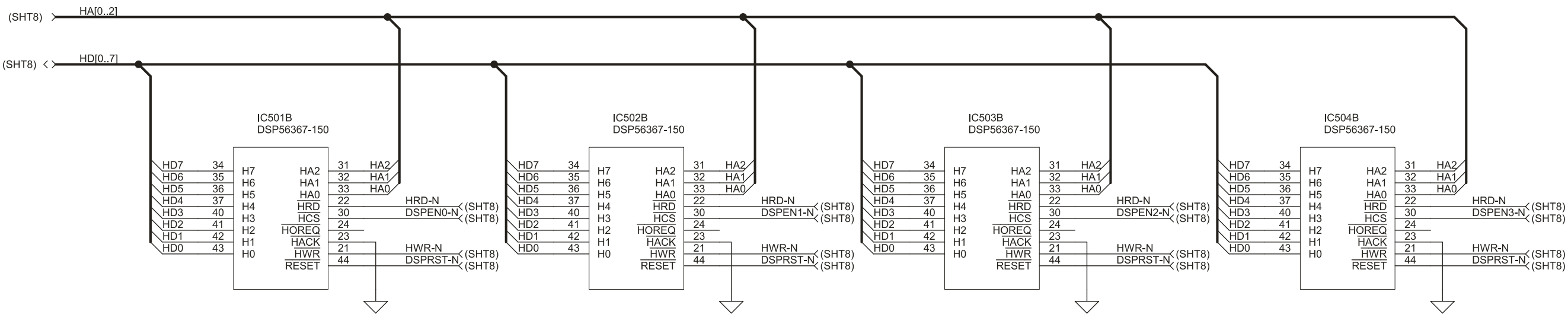
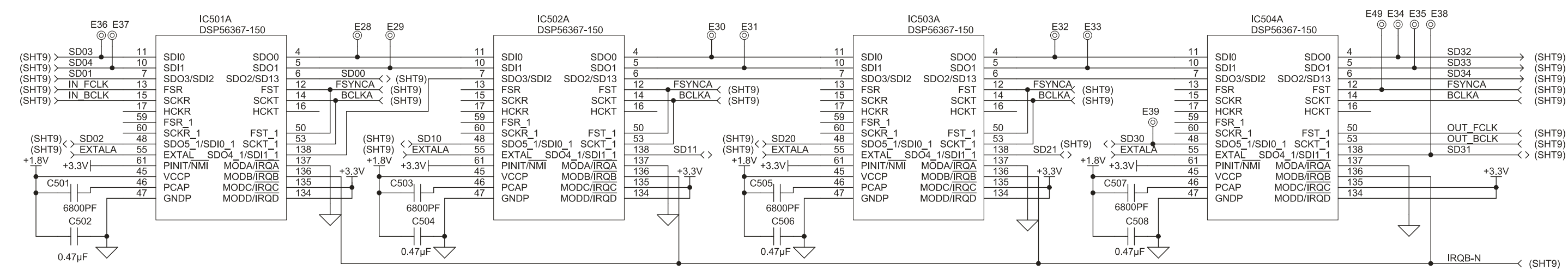


## I/O+DSP BOARD: ANALOG OUTPUTS

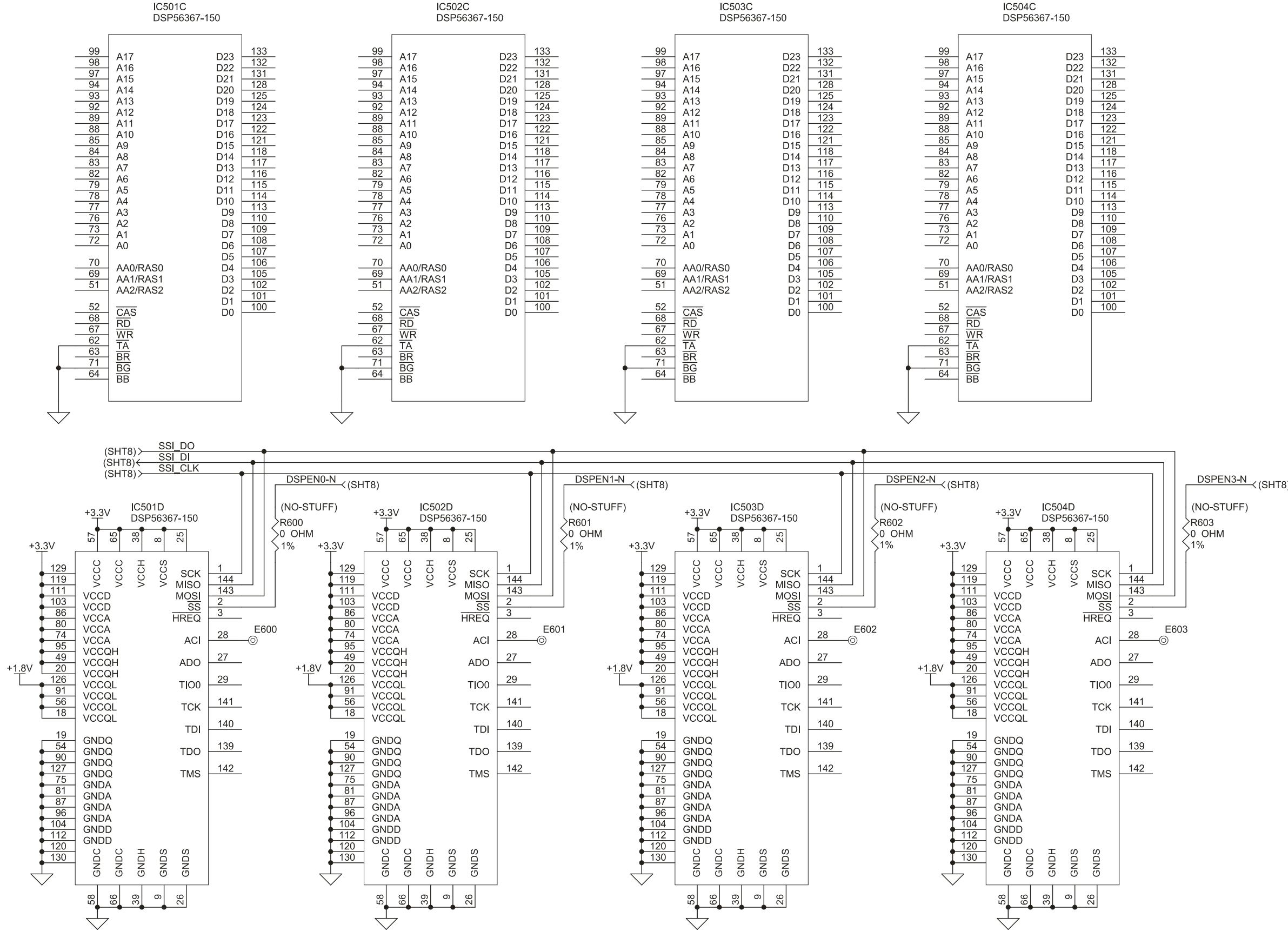






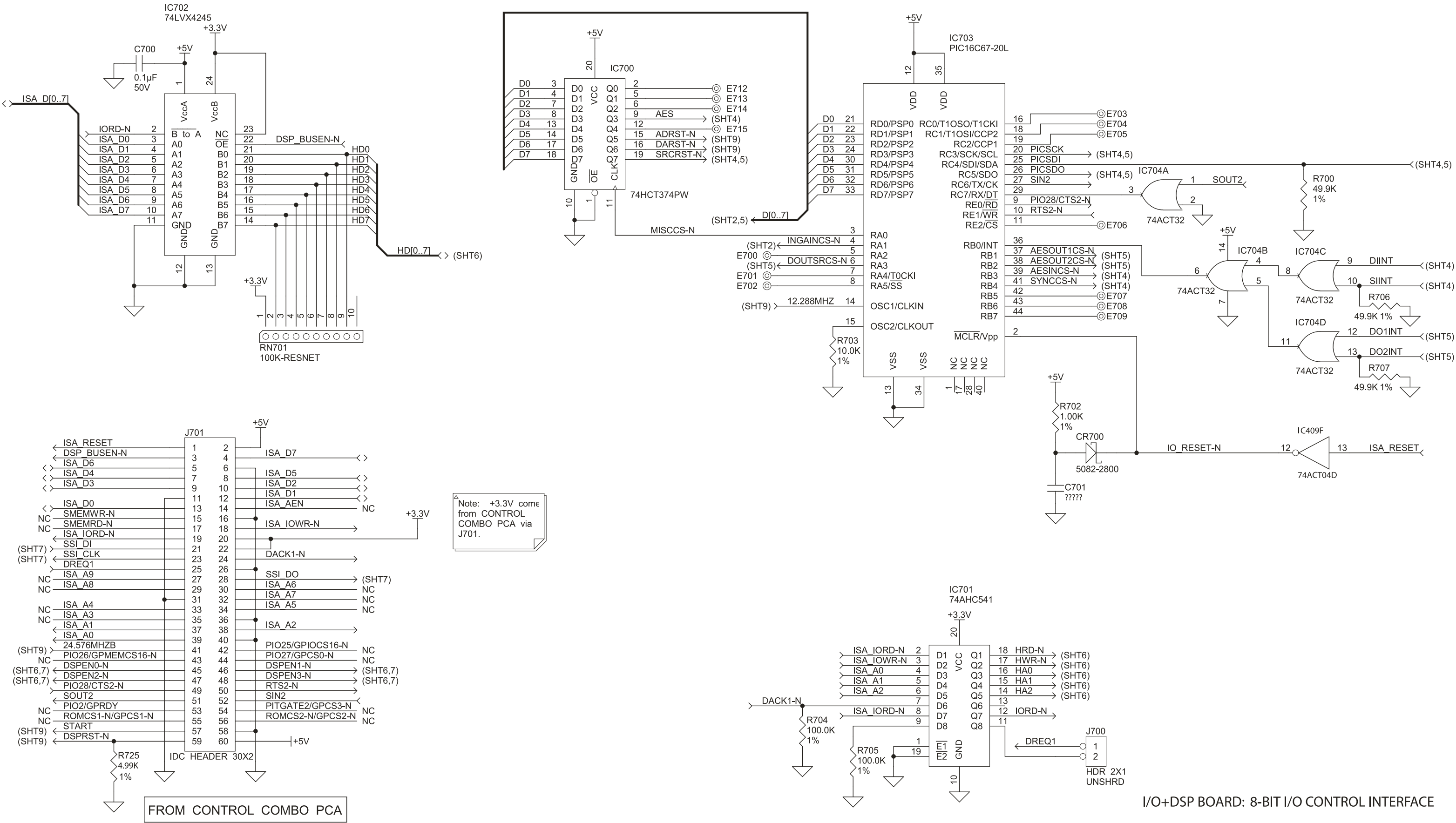


I/O+DSP BOARD: DSP ESAI AND HOST INTERFACE

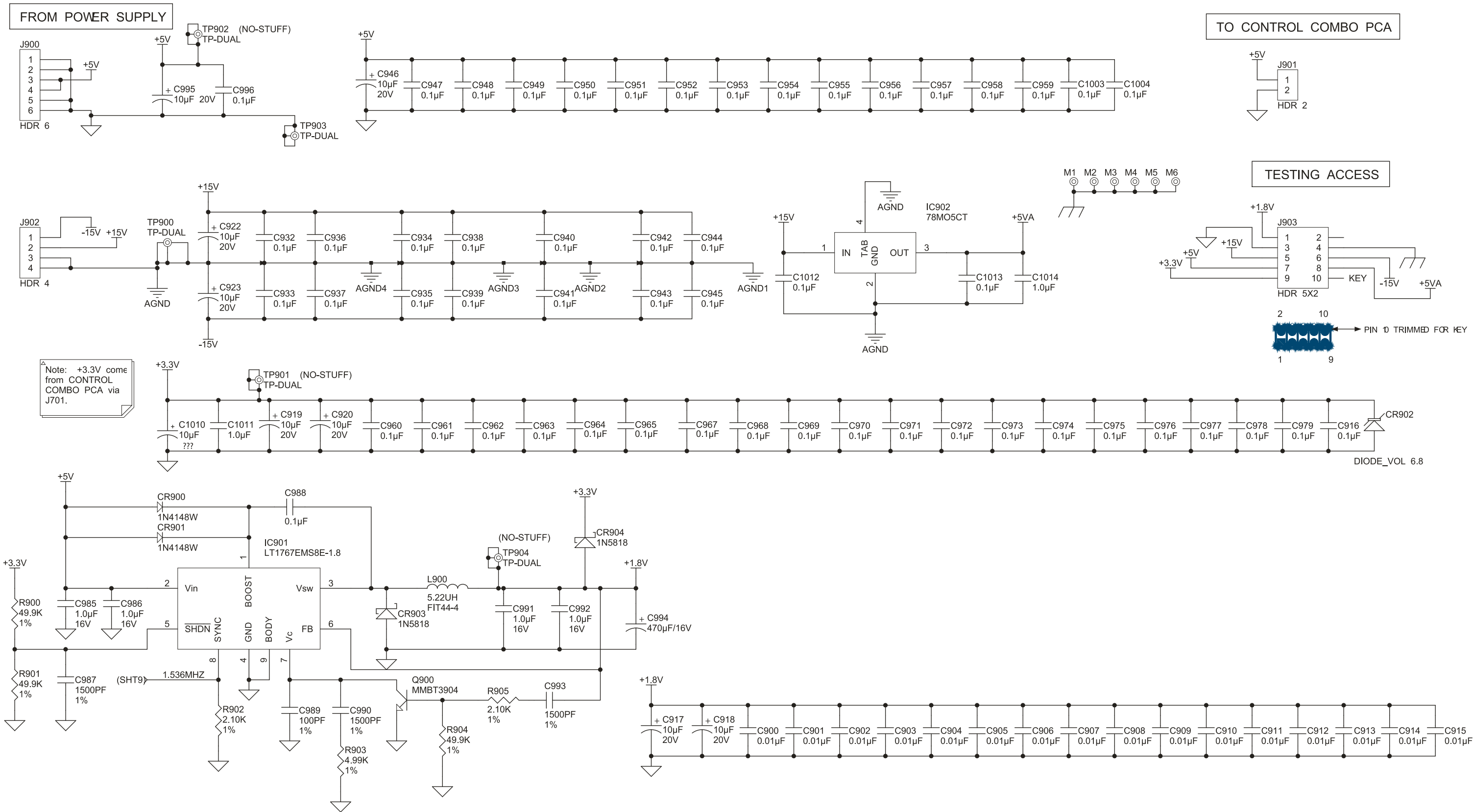


I/O+DSP BOARD: DSP, SPI, POWER, GROUND & NC

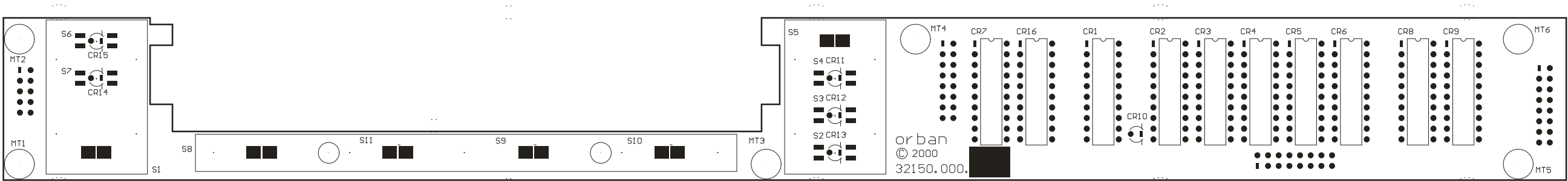




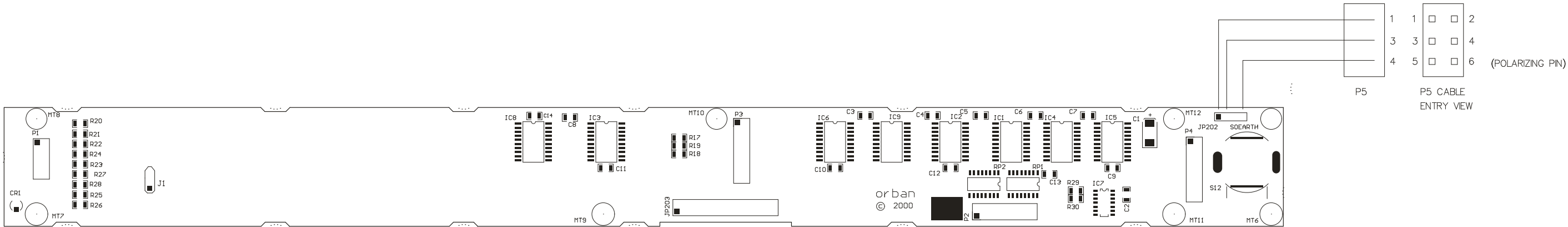




I/O+DSP BOARD: POWER DISTRIBUTION

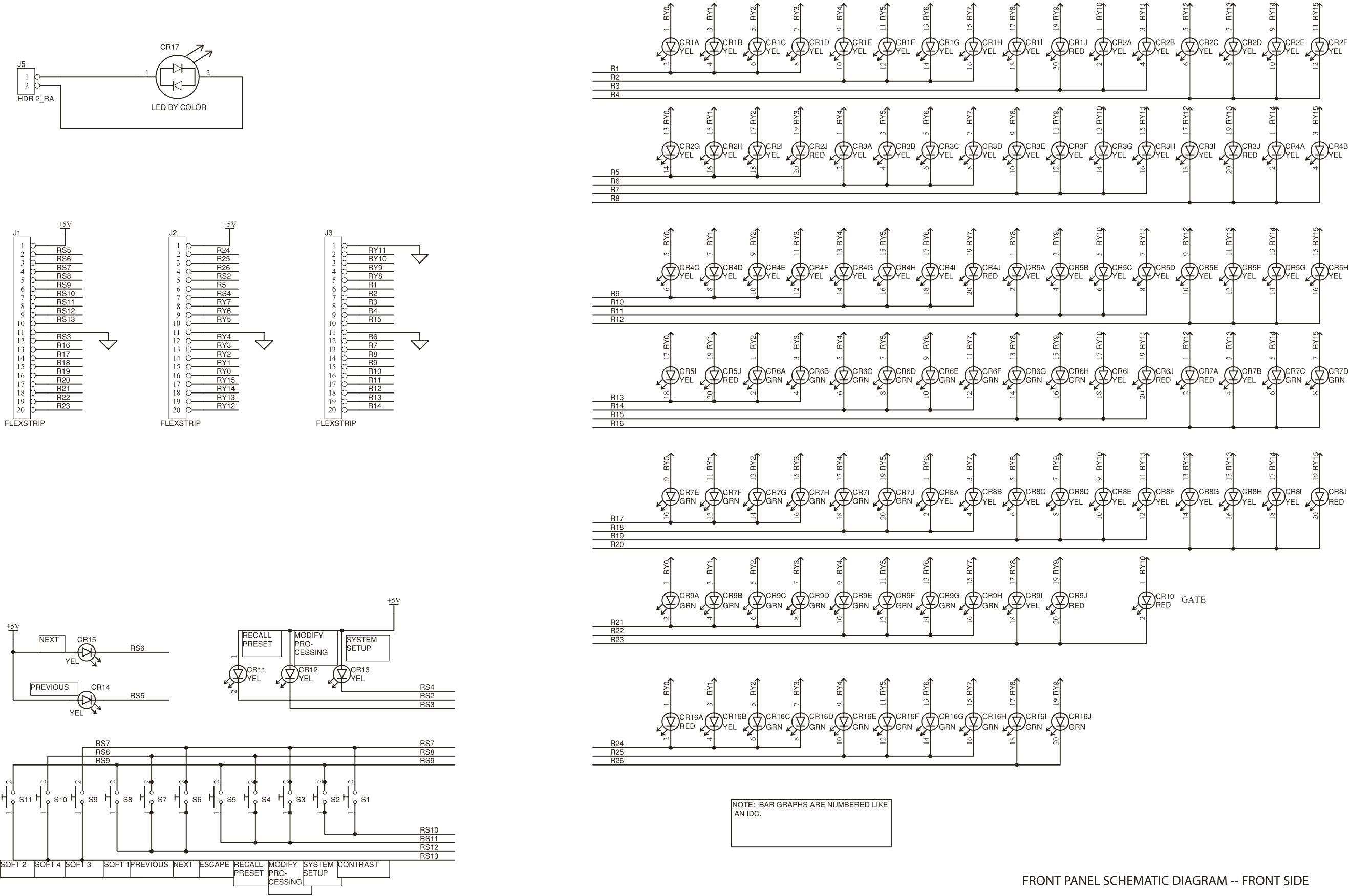


FRONT VIEW



REAR VIEW

FRONT PANEL PARTS LOCATOR DIAGRAM



FRONT PANEL SCHEMATIC DIAGRAM -- FRONT SIDE

