# Operating Manual

# *OPTIMOD-FM*

# *8300*

***Digital Audio Processor***

**Version 2.1 Software**

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

| **Model Number:** | **Description:** |
|---|---|
| 8300 | OPTIMOD 8300, Stereo Encoder, Digital I/O, Protection Structure, Two-Band Structure, Multi-Band Structure, 115V (for 90-130V operation) or 230V (for 200-250V operation), switchable to 50µs or 75µs. |
| 8300J | As above, but for 90-117V operation. |

**MANUAL:**

| **Part Number:** | **Description:** |
|---|---|
| 96116.210.03 | 8300 Operating Manual |




**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.

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# IMPORTANT SAFETY INSTRUCTIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## Safety Instructions (European)

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

**WARNING: THIS APPLIANCE MUST BE EARTHED.**

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

GREEN and YELLOW - Earth BLUE - Neutral BROWN - Live

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

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

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

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

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

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



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

**AC Power Cord Color Coding**

**Safety Instructions (German)**

Gerät nur an der am Leistungsschild vermerkten Spannung und Stromart betreiben.
Sicherungen nur durch solche, gleicher Stromstärke und gleichen Abschaltverhaltens ersetzen. Sicherungen nie überbrücken.
Jedwede Beschädigung des Netzkabels vermeiden. Netzkabel nicht knicken oder quetschen. Beim Abziehen des Netzkabels den Stecker und nicht das Kabel enfassen. Beschädigte Netzkabel sofort auswechseln.
Gerät und Netzkabel keinen übertriebenen mechanischen Beaspruchungen aussetzen.
Um Berührung gefährlicher elektrischer Spannungen zu vermeiden, darf das Gerät nicht geöffnet werden. Im Fall von Betriebsstörungen darf das Gerät nur Von befugten Servicestellen instandgesetzt werden. Im Gerät befinden sich keine, durch den Benutzer reparierbare Teile.
Zur Vermeidung von elektrischen Schlägen und Feuer ist das Gerät vor Nässe zu schützen. Eindringen von Feuchtigkeit und Flüssigkeiten in das Gerät vermeiden.
Bei Betriebsstörungen bzw. nach Eindringen von Flüssigkeiten oder anderen Gegenständen, das Gerät sofort vom Netz trennen und eine qualifizierte Servicestelle kontaktieren.

**Safety Instructions (French)**

On s'assurera toujours que la tension et la nature du courant utilisé correspondent bien à ceux indiqués sur la plaque de l'appareil.
N'utiliser que des fusibles de même intensité et du même principe de mise hors circuit que les fusibles d'origine. Ne jamais shunter les fusibles.
Eviter tout ce qui risque d'endommager le câble seceur. On ne devra ni le plier, ni l'aplatir. Lorsqu'on débranche l'appareil, tirer la fiche et non le câble. Si un câble est endommagé, le remplacer immédiatement.
Ne jamais exposer l'appareil ou le câble ä une contrainte mécanique excessive.
Pour éviter tout contact averc une tension électrique dangereuse, on n'oouvrira jamais l'appareil. En cas de dysfonctionnement, l'appareil ne peut être réparé que dans un atelier autorisé. Aucun élément de cet appareil ne peut être réparé par l'utilisateur.
Pour éviter les risques de décharge électrique et d'incendie, protéger l'appareil de l'humidité. Eviter toute pénétration d'humidité ou fr liquide dans l'appareil.
En cas de dysfonctionnement ou si un liquide ou tout autre objet a pénétré dans l'appareil couper aussitôt l'appareil de son alimentation et s'adresser à un point de service aprésvente autorisé.

**Safety Instructions (Spanish)**

Hacer funcionar el aparato sólo con la tensión y clase de corriente señaladas en la placa indicadora de características.
Reemplazar los fusibles sólo por otros de la misma intensidad de corriente y sistema de desconexión. No poner nunca los fusibles en puente.
Proteger el cable de alimentación contra toda clase de daños. No doblar o apretar el cable. Al desenchufar, asir el enchufe y no el cable. Sustituir inmediatamente cables dañados.
No someter el aparato y el cable de alimentación a esfuerzo mecánico excesivo.
Para evitar el contacto con tensiones eléctricas peligrosas, el aparato no debe abrirse. En caso de producirse fallos de funcionamiento, debe ser reparado sólo por talleres de servicio autorizados. En el aparato no se encuentra ninguna pieza que pudiera ser reparada por el usuario.
Para evitar descargas eléctricas e incendios, el aparato debe protegerse contra la humedad, impidiendo que penetren ésta o líquidos en el mismo.
En caso de producirse fallas de funcionamiento como consecuencia de la penetración de líquidos u otros objetos en el aparato, hay que desconectarlo inmediatamente de la red y ponerse en contacto con un taller de servicio autorizado.

**Safety Instructions (Italian)**

Far funzionare l'apparecchio solo con la tensione e il tipo di corrente indicati sulla targa riportante i dati sulle prestazioni.
Sostituire i dispositivi di protezione (valvole, fusibili ecc.) solo con dispositivi aventi lo stesso amperaggio e lo stesso comportamento di interruzione. Non cavallottare mai i dispositivi di protezione.
Evitare qualsiasi danno al cavo di collegamento alla rete. Non piegare o schiacciare il cavo. Per staccare il cavo, tirare la presa e mai il cavo. Sostituire subito i cavi danneggiati.
Non esporre l'apparecchio e il cavo ad esagerate sollecitazioni meccaniche.
Per evitare il contatto con le tensioni elettriche pericolose, l'apparecchio non deve venir aperto. In caso di anomalie di funzionamento l'apparecchio deve venir riparato solo da centri di servizio autorizzati. Nell'apparecchio non si trovano parti che possano essere riparate dall'utente.
Per evitare scosse elettriche o incendi, l'apparecchio va protetto dall'umidità. Evitare che umidità o liquidi entrino nell'apparecchio.
In caso di anomalie di funzionamento rispettivamente dopo la penetrazione di liquidi o oggetti nell'apparecchio, staccare immediatamente l'apparecchio dalla rete e contattare un centro di servizio qualificato.

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

## Packing

When you pack the unit for shipping:

(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-FM and OPTIMOD-TV only)

Your dealer may charge you for any missing items.

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

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

## Trouble

If you have problems with installation or operation:

(1) Check everything you have done so far against the instructions in the Manual. The information contained therein is based on our years of experience with OPTIMOD and broadcast stations.

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

(3) After reading the section on Factory Assistance, you may call Orban Customer Service for advice during normal California business hours. The number is (1) 510 / 351-3500.

**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 las class A] prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.)

**IMPORTANT**



Perform the installation under static control conditions. Simply walking across a rug can generate a static charge of 20,000 volts. This is the spark or shock you may have felt when touching a doorknob or some other conductive surface. A much smaller static discharge is likely to destroy one or more of the CMOS semiconductors employed in OPTIMOD-FM. 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 of damaging static.

U.S. patents 208,548, 4,460,871, 5,737,434, 6,337,999, 6,434,241, 6,618,486, and 6,937,912 protect OPTIMOD 8300. Other patents pending.

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# Operating Manual

# *OPTIMOD-FM*

# *8300*

***Digital Audio Processor***

**Version 2.1 Software**

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# Section 1 Introduction

## About this Manual

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-FM 8300 Digital Audio Processor

Orban's all-digital OPTIMOD-FM 8300 Audio Processor can help you achieve excellent audio quality in FM stereo broadcasting. Because all processing is performed by high-speed mathematical calculations within Motorola DSP56362 Digital Signal Processing chips, the processing has cleanliness, quality, and stability over time and temperature that is unmatched by analog processors.

OPTIMOD-FM 8300 is descended from the industry-standard OPTIMOD-FM audio processors. Thousands of these processors are on the air all over the world. They have proven that the "OPTIMOD sound" attracts and keeps an audience even in the most competitive commercial environment.

**Because OPTIMOD-FM 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-FM. A small investment of your time now will yield large dividends in audio quality.

The rest of Section 1 explains how OPTIMOD-FM fits into the FM broadcast facility. Section 2 explains how to install it and set it up. Section 3 tells how to operate OPTIMOD-FM. Sections 4 through 6 provide reference information.

OPTIMOD-FM 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-FM 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 an Orban studio level control system expressly designed for this purpose. (At the time of this writing, this is the Orban 8200ST OPTIMOD-Studio Compressor / Limiter / HF Limiter / Clipper.) The 8200ST can be adjusted so that it substitutes for the broadband AGC circuitry in OPTIMOD-FM, which is then defeated.

## User-Friendly Interface

- An **LCD** and **full-time LED meters** make setup, adjustment and programming of OPTIMOD-FM easy — you can always see the metering while you're adjusting the processor. Navigation is by dedicated buttons, soft buttons (whose functions are context-sensitive), and a large rotary knob. The LEDs show all metering functions of the processing structure (Two-Band or Five-Band) in use.

## Absolute Control of Peak Modulation

- The 8300 provides **universal transmitter protection and audio processing** for FM broadcast. It can be configured to interface ideally with any commonly found transmission system in the world.

- The 8300 provides **pre-emphasis limiting** for the two standard pre-emphasis curves of 50μs and 75μs. Its pre-emphasis control is seldom audibly apparent, producing a clean, open sound with subjective brightness matching the original program.

- By integrating the **stereo encoder** with the audio processing, the 8300 eliminates the overshoot problems that waste valuable modulation in traditional external encoders. The stereo encoder has **two outputs with independent level controls**, each capable of driving 75Ω in parallel with 47,000pF, (100ft / 30m of coaxial cable).

- The 8300 prevents aliasing distortion in subsequent stereo encoders or transmission links by providing **bandwidth-limiting and overshoot-compensated** 15 kHz low-pass filters ahead of the 8300's audio outputs and stereo encoder.

- **Anti-aliased clippers** running at 256 kHz sample rate prevent any trace of "digital clipper" sound.

## Flexible Configuration

- The 8300 includes **analog** and **AES3 digital** inputs and outputs. Both digital input and digital output are equipped with sample-rate converters and can operate at 32 kHz, 44.1 kHz, 48, 88.2, and 96 kHz sample rates. The pre-emphasis status and output levels are separately adjustable for the analog and digital outputs.

- The 8300 has an **internal, DSP-based stereo encoder** (with a patented **"half-cosine interpolation" composite limiter** operating at 512 kHz sample rate) to generate the pilot tone stereo baseband signal and control its peak level. The composite limiter is a unique, "you can only do this in DSP" process that beats composite clippers by **preserving stereo imaging** while **fully protecting the stereo pilot tone, RDS / RBDS, and subcarriers**.

- The 8300's digital output can be switched to emit processed audio suitable for **HD Radio, digital radio, and netcasts.** Meanwhile, the analog output and composite output continue to emit audio processed for the analog FM channel. To do this, the output of the multiband compressor (5-band or 2-band) splits into two paths. The FM path feeds an advanced, distortion-canceling clipper and overshoot compensator, while the HD path is de-emphasized and then feeds a look-ahead limiter.

  > Note that the "UL" [ultra-low-latency] presets do not offer HD processing. If a UL preset is put on-air, the HD output will emit a de-emphasized, FM-processed signal.

- 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.

- The 8300 has **two independent composite baseband outputs** with digitally programmable output levels. Robust line drivers enable them to drive 100 feet of RG-59 coaxial cable without audible performance degradation.

- The 8300 has two **subcarrier inputs** that are mixed with the output of OPTIMOD-FM's stereo encoder before application to the composite output connectors. One input can be re-jumpered to provide a 19 kHz pilot reference output. The other input has an internal level trim to accommodate subcarrier generators with output levels as low as 220 mV.

- The 8300 precisely **controls the audio bandwidth** to 15 kHz. This prevents overshoots in uncompressed digital links operating at a 32 kHz-sample rate and prevents interference to the pilot tone and RDS (or RBDS) subcarrier.

- The 8300 has a defeatable **multiplex power limiter** that controls the multiplex power to ITU-R BS412 standards. An adjustable threshold allows a station to achieve maximum legal multiplex power even if the downstream transmission

system introduces peak overshoots into the 8300-processed signal. Because this limiter closes a feedback loop around the audio processing, it allows the user **to adjust the processor's subjective setup controls freely** without violating BS412 limits, regardless of program material. The multiplex power limiter acts on all outputs (not just the composite output). It reduces clipper drive when it reduces power, simultaneously reducing clipping distortion.

- All input, output, and power connections are **rigorously RFI-suppressed** to Orban's traditional exacting standards, ensuring trouble-free installation.

- The 8300 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 on-air at a time. OPTIMOD-FM realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) chips.

- The 8300 features three processing structures: **Optimum Five-Band** (or "Multiband"; 15 or 20 ms delay) for a consistent, "processed" sound, free from undesirable side effects, **Ultra-Low-Latency Five-Band** (5 ms delay) for environments where talent monitors live off-air and they object to the delay of Optimum Five-Band, and **Two-Band** for a transparent sound that preserves the frequency balance of the original program material. A special Two-Band preset creates a no-compromise "Protect" function that is functionally similar to the "**Protect**" structures in earlier Orban digital processors. The Optimum Five-Band and the Two-Band structures can be switched via a mute-free crossfade; the Low Latency Five-Band structure causes a very brief audio mute when activated.

- The 8300 **can increase the density and loudness** of the program material by multiband compression, limiting, and clipping. This improves the consistency of the station's sound and increasing loudness and definition remarkably, without producing unpleasant side effects.

- The 8300 **rides gain** over an adjustable range of up to 25 dB, compressing dynamic range and compensating for both operator gain-riding errors and gain inconsistencies in automated systems.

- The 8300's Two-Band processing structure is **phase-linear** to maximize audible transparency.

- The 8300 can **import and run any 8400 or 8500 user preset** via the 8300 PC Remote application. (Certain 8400 and 8500 features are not available and will be reinterpreted.) See *To Import Archived 8400 and 8500 Presets into Your 8300* on page *3*-70 for details.)

### Controllable

- The 8300 **can be remote-controlled** by 5-12V pulses applied to eight programmable, optically isolated "general-purpose interface" (GPI) ports.

- **8300 PC Remote software** is a highly graphical application that runs under Windows 2000 and XP. It communicates with a given 8300 **via TCP/IP** over **modem, direct serial,** and **Ethernet** connections. You can configure PC Remote to switch between many 8300s via a convenient organizer that supports giving any 8300 an alias and grouping multiple 8300s into folders. Clicking an 8300's icon causes PC Remote to connect to that 8300 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 8300 features (including advanced controls not available from the 8300'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.).

- OPTIMOD-FM contains a versatile **real-time clock**, which allows automation of various events (including recalling presets) at pre-programmed times. The clock can be set automatically from an Internet timeserver.

- A Bypass Test Mode can be invoked locally, by remote control (from either the 8300's GPI port or the 8300 PC Remote application), or by automation to permit broadcast system **test and alignment** or "proof of performance" tests.

- OPTIMOD-FM contains a built-in **line-up tone generator**, facilitating quick and accurate level setting in any system.

- OPTIMOD-FM's **software can be upgraded** by running Orban-supplied downloadable upgrade software on a PC. The upgrade can occur remotely through the 8300's Ethernet port or serial port (connected to an external modem), or locally (by connecting a Windows® computer to the 8300's serial port through the supplied null modem cable).

## Presets in OPTIMOD-FM

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

### Factory Presets

The Factory Presets are our "factory recommended settings" for various program formats or types. The description indicates the processing structure and the type of processing. 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 us-

ing the LESS-MORE control to adjust OPTIMOD-FM for less or more processing. The factory presets are listed and described starting on page 3-16.

Factory Presets are stored in OPTIMOD-FM'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 8300 (which will vary depending on the version of your 8300'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 (Five-Band, Two-Band, or Ultra-Low-Latency Five-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 3-13 has more about User Presets.

## Input/Output Configuration

OPTIMOD-FM simultaneously accommodates:

- Digital AES3 left/right inputs and outputs.
- Analog left/right inputs and outputs.
- Composite stereo outputs.
- Subcarrier (SCA and RDS / RBDS) inputs.

## Digital AES3 Left/Right Input/Output

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

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

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

Level control of the AES3 input is accomplished via software control through System Setup (see step 5 on page 2-26) or through PC Remote.

Both analog and digital outputs are active continuously.

The 8300's output sample rate can be locked either to the 8300's internal crystal clock or to the sample rate present at its AES3 input.

The 8300 can apply J.17 de-emphasis to signals applied to its digital input and J.17 pre-emphasis to the processed signal emitted from its digital output. J.17 is a 6 dB/octave shelving pre-emphasis / de-emphasis standard with break points at 400 Hz and 4 kHz. It is mainly used in older studio / transmitter links that use NICAM technology. The 8300'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 10kΩ; balanced and floating. Inputs can accommodate up to +27 dBu (0 dBu = 0.775Vrms).

The left and right analog outputs are on XLR-type male connectors on the rear panel. Output impedance is 50Ω; balanced and floating. The outputs can drive 600Ω or higher impedances, balanced or unbalanced. The peak output level is adjustable from –6 dBu to +24 dBu.

Level control of the analog inputs and outputs is accomplished via software control through System Setup (see step 3 on page 2-24 and step 7 on page 2-27) or through PC Remote.

## Stereo Analog Baseband Composite Output

The stereo encoder has two unbalanced analog baseband outputs on two BNC connectors on the rear panel. Each output can be strapped for 0 or 75Ω source imped-

ance and can drive up to 8V peak-to-peak into 75Ω in parallel with up to 0.047μF (100ft / 30m of RG-59 / U cable) before any significant audible performance degradation occurs.

See the footnote on page 1-12 and refer to Figure 2-3 on page 2-9.

Independent level control of each output is via software (see step 6 on page 2-26). A ground lift switch is available on the rear panel. This is useful to prevent ground loops between the 8300 and the transmitter.

## Subcarriers

The stereo encoder has two unbalanced 600Ω subcarrier (SCA) inputs with rear-panel BNC connectors to accept any subcarrier at or above 23 kHz. The subcarriers are mixed into each composite output and their level is not affected by the composite level control for that output.

The 8300 does not digitize subcarriers; the mixing occurs after D/A conversion and is analog.

Subcarrier inputs sum into composite baseband outputs before digitally controlled composite attenuator. The sensitivity of the SCA 1 input is variable from 220 mV p-p to >10 V p-p to produce 10% injection. Sensitivity is adjustable by an internal PC-board-mounted trim pot. The sensitivity of the SCA 2 input is fixed at 772 mV p-p to produce 10% injection.

The correct peak level of the stereo program applied to the stereo encoder sometimes depends on the number of subcarriers in use. Some regulatory authorities require that total baseband peak modulation be maintained within specified limits. Thus, the level of the stereo main and subchannel must be reduced when a subcarrier is turned on. The 8300's remote control feature allows you to reduce the stereo main and subchannel level by connecting an on/off signal from your subcarrier generator (See page 2-8). You define the amount of reduction in percent using the procedure in step 21 on page 2-23. See page 2-36 for information on programming the remote control.

A jumper on the circuit board can reconfigure the SCA 2 input to provide the stereo pilot tone only, which can provide a pilot reference for an RDS subcarrier generator.

## 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 8300:

- 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 stereo encoder to stereo, mono-from-left, mono-from-right, or

mono-from-sum audio input. This also determines the feed to the entire processing chain so that facilities that do not use the 8300's stereo encoder can change stereo/mono mode and select the source when in mono mode.

- Switch the 8300 to use either the analog input or the digital input.
- Reduce the stereo main and subchannel modulation to compensate for transmitter overshoot and subcarrier inputs (SCAs).

  The remote control of overshoot compensation and SCA modulation (see page 2-36) is not latching. You must supply a continuous current to the programmed remote input to hold the gain at its compensated level. Use the status outputs of your transmitter and/or SCA generators to provide the switching signal so the compensation will automatically follow the transmitter and/or subcarrier generator on the air.

- Reset the 8300's internal clock to the nearest hour or to midnight.

  You can reconfigure the functions of the eight inputs via System Setup. For example, if you are not using the stereo encoder, the three inputs ordinarily dedicated to controlling the state of the stereo encoder can instead be re-configured to call three additional presets.

See page 2-36 for information on programming the remote control interface.

## Computer Interface

On the rear panel of the 8300 are an RS-232 serial port and an Ethernet port for interfacing to IBM-compatible PCs. These computer interfaces support remote control and metering, and allow downloading software upgrades.

Each 8300 package ships with 8300 PC Remote software, an application for any IBM-compatible PC running Microsoft Windows 2000 (Service Pack 3) or XP. 8300 PC Remote permits you to adjust any 8300 preset by remote control or to do virtually anything else that you can do from the 8300's front panel controls. The program displays all of the 8300's LCD meters on the computer screen to aid remote adjustment.

### RS-232 Serial Port

8300 PC Remote can communicate at up to 115 kbps via modem or direct connection between the computer and the 8300 through their RS-232 serial ports.

### RJ45 Ethernet Connector

The 8300 can be connected to any Ethernet network that supports the TCP/IP protocol.

See *Networking and Remote Control* on page 2-37 for more information.

# Location of OPTIMOD-FM

## Optimal Control of Peak Modulation Levels

The audio processing circuitry in OPTIMOD-FM produces a signal that is pre-emphasized to either the 50μs or 75μs standard pre-emphasis curve. It is precisely and absolutely high-frequency-controlled and peak-controlled to prevent over-modulation, and is filtered at 15 kHz to protect the 19 kHz pilot and prevent distortion caused by aliasing-related non-linear crosstalk. If this signal is fed directly into a stereo encoder, peak modulation levels on the air will be precisely controlled. However, if the audio processor's signal is fed to the stereo encoder through any circuitry with frequency response errors and/or non-constant group delay, the peaks will be magnified. Peak modulation will increase, but average modulation will not. The modulation level must therefore be reduced to accommodate the larger peaks. Reduced average modulation level will cause reduced loudness and a poorer signal-to-noise ratio at the receiver.

Landline equalizers, transformers, and 15 kHz low-pass filters and pre-emphasis networks in stereo encoders typically introduce frequency response errors and non-constant group delay. There are three criteria for preservation of peak levels through the audio system:

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

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

3) Any pre-emphasis used in the audio transmission system prior to the stereo encoder must be canceled by a precisely complementary de-emphasis: Every pole and zero in the pre-emphasis filter must be complemented by a zero and pole of identical complex frequency in the de-emphasis network. An all-pole de-emphasis network (like the classic series resistor feeding a grounded capacitor) is not appropriate.

In this example, the network could be fixed by adding a second resistor between ground and the capacitor, which would introduce a zero.

Low-pass filters (including anti-aliasing filters in digital links), high-pass filters, transformers, distribution amplifiers, and long transmission lines can all cause the above criteria to be violated, and must be tested and qualified. It is clear that the above criteria for optimal control of peak modulation levels are most easily met when the audio processor directly feeds the stereo encoder. In the 8300, no circuit elements that might distort the shape of the waveform are interposed between the audio

processor and the stereo encoder. We therefore recommend using the 8300 with its built-in stereo encoder whenever practical.

## Best Location for OPTIMOD-FM

The best location for OPTIMOD-FM is as close as possible to the transmitter, so that its stereo encoder output can be connected to the transmitter through a circuit path that introduces the least possible change in the shape of OPTIMOD-FM's carefully peak-limited waveform — a short length of coaxial cable. If this is impossible, the next best arrangement is to feed the 8300's AES3 digital output through an all-digital, uncompressed path to the transmitter's exciter.

Use the 8300's left and right analog audio outputs in situations where the stereo encoder and exciter are under the jurisdiction of an independent transmission authority, and where the programming agency's jurisdiction ends at the interface between the audio facility and the link connecting the audio facility to the transmitter. (The link might be telephone / post lines, analog microwave radio, or various types of digital paths.) This situation is not ideal because artifacts that cannot be controlled by the audio processor can be introduced by the link to the transmitter, by transmitter peak limiters, or by the external stereo encoder.

**If the transmitter is not accessible:**

All audio processing must be done at the studio and you must tolerate any damage that occurs later. If you can obtain a broadband (0-75 kHz) phase-linear link to the transmitter, and the transmitter authority will accept the delivery of a baseband encoded signal, use the 8300's internal stereo encoder at the studio location to feed the STL. Then feed the output of the STL receiver directly into the transmitter's exciter with no intervening processing.

If an uncompressed AES3 digital link is available to the transmitter, this is also an excellent means of transmission, although it will not pass the effects of the 8300's composite processor (if you are using it). However, if the digital link employs lossy compression, it will disturb peak levels.

If only an audio link is available, use the 8300's left and right audio outputs and feed the audio, without pre-emphasis, directly into the link. If possible, request that any transmitter protection limiters be adjusted for minimum possible action — OPTIMOD-FM does most of that work. Transmitter protection limiters should respond only to signals caused by faults or by spurious peaks introduced by imperfections in the link. To ensure maximum quality, all equipment in the signal path after the studio should be carefully aligned and qualified to meet the appropriate standards for bandwidth, distortion, group delay and gain stability, and such equipment should be re-qualified at reasonable intervals. (See *Optimal Control of Peak Modulation Levels* on page 1-10).

**If the transmitter is accessible:**

You can achieve the most accurate control of modulation peaks by locating OPTIMOD-FM at the transmitter site and then using its stereo encoder to drive the transmitter. You can usually also obtain good results by locating OPTIMOD-FM at the

studio and connecting the baseband output of its stereo encoder to the transmitter through a composite baseband STL (see page 1-14). However, many composite baseband STLs do not control peaks perfectly because of bounce (see page 1-15), and locating OPTIMOD-FM at the transmitter site (where it can control peaks just prior to the transmitter's RF exciter) is thus likely to maximize loudness.

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

We strongly recommend that you use the 8300's internal stereo encoder to feed the output of the encoder directly to the baseband input of the exciter through less than 100 feet (30 meters) of coaxial cable. 100 feet of coaxial cable (assuming 30pF / foot capacitance) will reduce measured separation at 15 kHz (worst case) to approximately 60 dB. This separation is comfortably above the separation (approximately 20 dB) that starts to cause perceptible changes in the stereo image.[1]

You will achieve a louder sound on the air, with better control of peak modulation, than if you use most external stereo encoders.

An exception is Orban's 8218 stereo encoder, which does not add overshoot, and, in fact, contains its own overshoot limiter. However, because it accepts audio in left/right form, the 8218 will not let you exploit the 8300's composite limiter.

The shorter the baseband cable from OPTIMOD-FM to exciter, the less likely that ground loops or other noise problems will occur in the installation. If you require a long cable run, you can use Orban's CIT25 Composite Isolation Transformer to break any ground loops. This transformer will ordinarily cure even the most stubborn hum or noise caused by the composite connection between OPTIMOD-FM and the exciter. Its instruction manual contains complete information on its installation and application.

If a separate stereo encoder must be used, feed the encoder directly from the 8300's left and right analog outputs. If possible, bypass the pre-emphasis network and the input low-pass filters in the encoder so that they cannot introduce spurious peaks.

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[1] Julie M. Adkins and Robert D. Sorkin: "Effect of Channel Separation on Earphone-Presented Tones, Noise, and Stereophonic Material," *J. Audio Engineering Society*, vol. 33 pp. 234-239, 1985.

Subjects listened to 500-Hz tones, broadband noise, and stereophonic program material through earphones and adjusted the channel separation, via a manual control, until the degradation of the spatial effect became detectable. Mean channel separations ranged from 10 to 15.9 dB for the musical selections employed and from 13.7 to 16.8 dB for the noise and tonal stimuli. The results are discussed in terms of existing data on detectable stereo separation and on the discrimination of interaural time differences. [Abstract ©Audio Engineering Society, Inc.]

Because of their special design, OPTIMOD-FM's pre-emphasis network and low-pass filters perform the same functions while retaining tight peak control.

# Studio-Transmitter Link

## 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 three fundamentally different ways. They can either (1) pass unprocessed audio for application to the 8300's input, (2) they can pass the 8300's peak-controlled analog or digital left and right audio outputs, or (3) they can pass the 8300's peak-controlled composite stereo baseband output. The three applications have different performance requirements. In general, 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 doesn't need as low a noise floor as a link passing unprocessed audio. However, its transient response is critical. At the current state of the art, an uncompressed digital link using digital inputs and outputs to pass audio in left/right format achieves 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 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 the 8300 to the transmitter. For example, the MPEG Layer 2 algorithm can increase peak levels up to 4 dB 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 the 8300'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 the 8300 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 the 8300'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 384 kB/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 provided they do not truncate the digital words produced by the devices driving their inputs. Because the 8300's output is tightly band-limited to 15 kHz, it can be passed without additional overshoot by equally well by any link with 32 kHz or higher sample frequency.

Currently available sample rate converters use phase-linear filters (which have constant group delay at all frequencies). If they do not remove spectral energy from the original signal, the sample rate conversion, whether upward or downward, will not add overshoot to the signal. This is not true of systems that are not strictly band-limited to 15 kHz, where downward sample rate conversion will remove spectral energy and will therefore introduce overshoot.

If the link does not have an AES3 input, you must drive its analog input from the 8300's analog output. This is less desirable because the link's analog input circuitry may not meet all requirements for passing processed audio without overshoot.

**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 pre-emphasis.

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

Any problems can be minimized by always driving a digital STL with the 8300'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 kHz, 88.2 kHz, and 96 kHz.

### Composite Baseband Microwave STLs

The composite baseband microwave STL carries the standard pilot-tone stereo baseband, and therefore receives the output of a stereo encoder located at the studio site. The receiver output of the composite STL is the stereo baseband signal, which is applied directly to the wideband input of the FM broadcast transmitter's exciter. Thus, no stereo encoder is needed at the transmitter.

In general, a composite microwave STL provides good 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. Where a composite STL is used, use the 8300's stereo encoder to drive the composite STL transmitter.

### Dual Microwave STLs

Dual microwaves STLs use two separate transmitters and receivers to pass the left and right channels in discrete form. Dual microwave STLs offer greater noise immu-

nity than composite microwave STLs. However, problems include gain- and phase-matching of the left and right channels, overloads induced by pre-emphasis, and requirements that the audio applied to the microwave transmitters be processed to prevent over-modulation of the microwave system.

Lack of transparency in the path will cause overshoot. Unless carefully designed, dual 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, the 8300 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). The 8300 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, Optimod 6300, 8200ST Compressor / Limiter / HF Limiter / Clipper or an 4000 Transmission Limiter 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 8300.

If the 8300 is located at the transmitter and fed 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 the 8300.

Some microwave links can be modified such that the deviation from linear phase is less than $\pm 10^\circ$ from 20 Hz to 15 kHz and frequency response is less than 3 dB down at 0.15Hz and less than 0.1 dB 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).

Nevertheless, in a dual-microwave system, the 8300 is usually located at the main FM transmitter and is driven by the microwave receivers. One of Orban's studio level control systems, such as the 8200ST, protects the microwave transmitters at the studio from overload. These units also perform the gain riding function ordinarily executed by the AGC section of the 8300's processing, and optimize the signal-to-noise ratio obtainable from the dual-microwave link.

If the STL microwave uses pre-emphasis, its input pre-emphasis filter will probably introduce overshoots that will increase peak modulation without any increases in average modulation. If the studio level control system is capable of producing a pre-emphasized output, we strongly recommend that the microwave STL's pre-emphasis be defeated, and pre-emphasis performed in the studio level control system. This frees the system from potential overshoot. (The Orban 8200ST can be readily configured to produce a pre-emphasized output.)

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 2 dB, reducing average modulation. Many commercial STLs have this problem.

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

#### Analog Landline (PTT / Post Office Line)

Analog landline quality is extremely variable, ranging from excellent to poor. 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 FM 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 the Orban 8100AST (or 8100A/ST) External AGC with the 8300

If you have an OPTIMOD-FM 8100A1 (or 8100A or 8100A/1) installation that uses an Orban 8100AST (or 8100A/ST) external AGC at the studio to protect an STL (with the main 8100A, 8100A1 or 8100A/1 chassis at the transmitter), you may wish to continue to use the external AGC to protect the STL when you install the 8300 at the transmitter.

If you are keeping your analog OPTIMOD-FM as a standby processor, you will probably want to use the external AGC to drive both the 8300 and the 8100A1 (also called 8100A/1) transmitter chassis in parallel. This is usually practical. However, complications will occur if you are not using an Orban 8100AXT2 (also called 8100A/XT2) Six-Band Limiter Accessory with your 8100A1, because, to correctly drive an 8300, the external AGC must be strapped as if it were driving an 8100A1 (or 8100A/1) + 8100AXT2 (or 8100A/XT2) system. Therefore, if you have only an 8100A1 (or 8100A/1), you will have to re-strap the external AGC for operation *without* the XT2 before you can put the standby 8100A1 (or 8100A/1) on the air.

## STL and Exciter Overshoot

Earlier in this section, we discussed at length what is required to prevent STLs from overshooting. There are similar requirements for FM exciters. Nevertheless, in some installations some overshoot is inevitable. If this is a problem in your installation, the 8300's remote control feature offers the means to reduce the peak level of the 8300's audio output as necessary. This way, you can still use the 8300's line-up tone to adjust the steady-state deviation to ±75 kHz. Yet, the reduced peak level of the audio emitted from the 8300 ensures that the carrier deviates no further than ±75 kHz after overshoot. This overshoot reduction can be selected on the input/output

screen, and the remote operation can be selected in System Setup: Network / Remote.

# Using Lossy Data Reduction in the Studio

Many stations are now using lossy data reduction algorithms like MPEG-1 Layer 2 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-FM'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," 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, such that it is heard. In addition, at least one other mechanism can cause the noise to become audible at the radio. OPTIMOD-FM's multiband limiter performs an "automatic equalization" function that can radically change the frequency balance of the program. 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. Also, 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.

# 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 14 dB. 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 true peak level. It has an instantaneous attack time, and a release time slow enough to allow the engineer to read the peak level easily. Fig. 1-1 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 +21 dBu, and often +24 dBu 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 +8 dBu.

For facilities using +4 dBu standard level, instantaneous peaks can reach +18 dBu or higher (particularly if the operator overdrives the console or desk). Older facilities with +8 dBu standard level and equipment that clips at +18 or +21 dBu 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 +4 dBu. Instantaneous peaks will reach +17 dBu or more on voice.

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

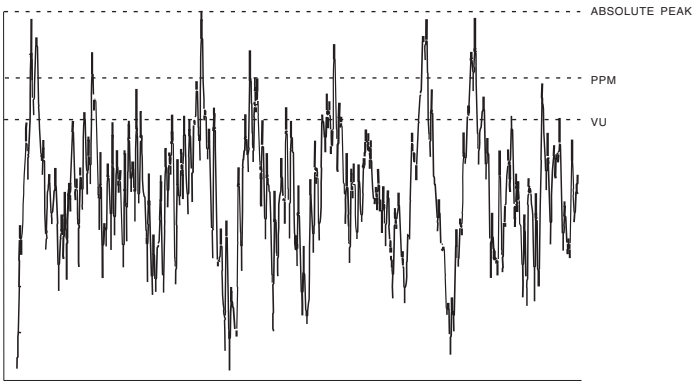



Fig. 1-1: Absolute Peak Level, VU and PPM Reading

## 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 the level at which the amplifiers in the channel overload. In digital, it is the largest possible digital word.

For metering, the transmission engineer uses an oscilloscope, absolute peak-sensing meter, calibrated peak-sensing LED indicator, or a modulation meter. A modulation meter usually has two components — a semi-peak reading meter (like a PPM), and a peak-indicating light, which is calibrated to turn on whenever the instantaneous peak modulation exceeds the overmodulation threshold.

# Line-Up Facilities

## Metering of Levels

The meters on the 8300 show left/right input levels and composite modulation. Left and right input level is shown on a VU-type scale (0 to –40 dB), while the metering indicates *absolute instantaneous peak* (much faster than a standard PPM or VU meter). The input meter is scaled so that 0 dB corresponds to the absolute maximum peak level that the 8300 can accept (+26 dBu). If you are using the AES3 digital input, the maximum digital word at the input corresponds to the 0 dB point on the 8300's input meter.

### Composite Output Level

The Orban 8300 Audio Processor controls instantaneous, absolute peak levels to a tolerance of approximately ±0.1 dB. Composite modulation is indicated in percentage modulation, absolute instantaneous peak indicating. 100% is calibrated to the highest composite peak modulation level that the processing will produce, including the pilot tone, under any program, processing, or setup condition (except when the processing is switched to BYPASS). 100% ordinarily corresponds to ±75 kHz-carrier deviation.

Note that if the 8300's subcarrier inputs are used, the meter will not indicate the subcarriers' effect on composite modulation because the subcarriers are mixed into the composite signal in the analog domain, after it is metered. Therefore, you must mentally add the subcarriers to the meter indication, or refer to an external, calibrated modulation monitor.

### Built-in Calibrated Line-up Tones

To facilitate matching the output level of the 8300 to the transmission system that it is driving, the 8300 contains an adjustable test tone oscillator that produces sine waves at 8300's (analog or digital) left, right and composite outputs. The frequency and modulation level of the line-up tones can be adjusted from the front panel (as described in Section 3).

The stereo encoder is calibrated so that 100% left or right modulation will provide 100% modulation of the stereo composite signal, including pilot tone but excluding any SCA subcarriers.

The pilot tone stereo system has an *interleaving* property, which means that the stereo composite modulation is approximately equal to the *higher* of the left or right channels. Because the pilot tone is phase-synchronous with the stereo subcarrier, the composite modulation will actually increase about 2.7% when the modulation is changed from pure single-channel to L+R modulation while the peak audio level is held constant.

When the 8300's left/right analog output is switched to FLAT, a de-emphasis filter is inserted between output of the 8300's audio processing and its line output. Thus, as the frequency of the Test Tone is changed, the level at the 8300's line output will follow the selected de-emphasis curve. In most cases, the pre-emphasis filter in the driven equipment will undo the effect of the 8300's internal de-emphasis, so the 8300's output level should be adjusted such that the tone produces 100% modulation of the transmission link as measured after the link's pre-emphasis filter. At 100Hz, switching the de-emphasis out or in will have negligible effect on the level appearing at the 8300's left and right audio outputs.

You can adjust the frequency and modulation level of the built-in line-up tone. You can use the front panel, the PC Control software, or the opto-isolated remote control interface ports to activate the Test Tone.

### Built-in 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, with no gain reduction or protection against overmodulation. It can transparently pass any line-up tone applied to its input up to about 130% output modulation, at which point clipping may occur.

## Monitoring on Loudspeakers and Headphones

In live operations, highly processed audio often causes a problem with **the DJ or presenter's headphones.** Some talent moving from an analog processing chain will require a learning period to become accustomed to the voice coloration caused by "bone-conduction" comb filtering. This is caused by the delayed headphone sound's mixing with the live voice sound and introducing notches in the spectrum that the talent hears as a "hollow" sound when he or she talks. All digital processors induce this coloration to a greater or lesser extent. Fortunately, it does not cause

confusion or hesitation in the talent's performance unless the delay is above the psychoacoustic "echo fusion" (Haas) threshold of approximately 20 ms and the talent starts to hear slap echo in addition to frequency response colorations.

The normal delay through the 8300 is about 15 ms. A 15 ms delay is comfortable for most talent because they do not hear echoes of their own voices in their headphones. Further, the 8300 offers a second, ultra-low-latency multiband structure with a delay of about 5 ms. Although this does not offer the same favorable tradeoff between loudness, presence, and low distortion as the optimum multiband structure, it is available for use in situations where a given individual cannot tolerate the 15 ms delay of the optimum structure. (However, management should carefully consider whether compromising the sound of the radio station for its entire audience is an acceptable price for indulging a given personality's demands.)

Because of the availability of both optimum and low latency structures, customers can confidently replace an older, low-delay processor with the 8300 with no studio wiring changes. Moreover, off-air cueing of remote talent is routine.

A better solution to the monitoring conundrum is this: The 8300's analog outputs can be switched to provide a low-delay monitoring feed while still keeping the optimum multiband structure on-air (by using the digital or composite output to drive the transmitter). The monitor feed has no peak limiting and thus cannot drive a transmitter, but its 5 ms delay is likely to be more comfortable to talent than the 15 ms delay of the optimum processing chain because of less acoustic comb filtering.

If the talent relies principally on headphones to determine whether the station is on the air, simple loss-of-carrier and loss-of-audio alarms should be added to the system when the 8300's monitor output is used. The 8300 can be interfaced to such alarms through any of its eight its GPI remote control inputs, cutting off the low-delay audio to the talent's phones when an audio or carrier failure occurs.

## EAS Test

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 8300.**

   Note that 8300 processing may not allow the full modulation level as required by EAS standards. It may therefore be necessary to temporarily defeat the 8300's processing during the broadcast of EAS tones and data. Placing the 8300 in its BYPASS Test Mode can defeat the processing. The BYPASS GAIN control allows a fixed gain trim through the 8300. See "Test Modes," on page 3-55 for more information.

2. **Place the 8300 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 8300 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 8300, according to the wiring diagram in Figure 2-2 on page 2-4.

B) Program two GPI ports for BYPASS and EXIT TEST according to the instructions in *Remote Control Interface Programming* starting on page 2-36.

C) Place the 8300 in bypass mode by remote control.

a) Switch the 8300 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 8300 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 8300 for the duration of the EAS tones and data broadcast.

## PC Control and Security Passcode

PC software control provides access to OPTIMOD-FM via network, modem or direct (null modem cable) connection, with IBM PC-compatible computers running Windows. 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 2-33) for more detail.

# Warranty, User Feedback

## 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.

## 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 two 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 5-13.)

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 two 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.

## EXTENDED WARRANTY

Any time during the initial two-year Warranty period (but not thereafter), you may purchase a three-year extension to the Warranty (yielding a total Warranty period of five years) by remitting to Orban ten percent of the gross purchase price of your Orban product. This offer applies only to new Orban products purchased from an authorized Orban Dealer. To accept the extended five-year warranty, please sign and date below, and fax this copy along with a copy of your original invoice (showing date of purchase) to Gareth Paredes at (510) 351-0500.

I ACCEPT THE EXTENDED FIVE-YEAR WARRANTY

_____

DATE_____

MODEL NUMBER: 8300

SERIAL NUMBER_____

# Section 2 Installation

## Installing the 8300

Allow about 2 hours for installation.

Installation consists of: (1) unpacking and inspecting the 8300, (2) checking the line voltage setting, fuse, and power cord, (3) setting the Ground Lift switch, (4) mounting the 8300 in a rack, (5) connecting inputs, outputs and power, (6) optional connecting of remote control leads and (7) optional connecting of computer interface control leads.

When you have finished installing the 8300, proceed to "Quick Setup," on page 2-16.

**DO NOT connect power to the unit yet!**

**1. Unpack and inspect.**

A) If you note obvious physical damage, contact the carrier immediately to make a damage claim. Packed with the 8300 are:

| Quantity | Item |
|---|---|
| 1 | Operating Manual |
| 2 | Line Cords (domestic, European) |
| 2 | Fuses (½ A-250V Slow-Blow for 115V; 250 mA-250V for 230V) |
| 2 | Fuse holders (gray for 115V fuses and black for 230V fuses) |
| 4 | Rack-mounting screws, 10-32 x ¾—with washers, #10 |
| 1 | Null modem cable (for software upgrades and PC Remote connection) |
| 1 | PC Remote Software CD |

B) Save all packing materials! If you should ever have to ship the 8300 (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.

C) 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. Check the line voltage, fuse and power cord.**

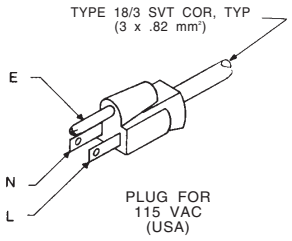
DO NOT connect power to the unit yet!

A) Check the VOLTAGE SELECT switch. This is on the rear panel.

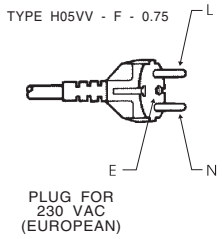
The 8300 is shipped from the factory with the VOLTAGE SELECT switch set to the 230V position. Check and set the VOLTAGE SELECT switch to your local voltage requirements. To change the operating voltage, set the VOLTAGE SELECT to 115V (for 90-130V) or 230V (for 200-250V) as appropriate.

B) Install the proper fuse and fuse holder, per your country's standards.

The 8300 is shipped from the factory with the fuse, and fuse holder removed. Select the appropriate fuse holder and fuse from the supplied parts in the accessory kit. Use the gray fuse holder for domestic / 115V operation, or the black fuse holder for European / 230V operation. For safety, use ½-A-250V Slow-Blow for 115V, or 250mA-250V for 230V.




| CONDUCTOR | | WIRE COLOR | |
|---|---|---|---|
| | | NORMAL | ALT |
| L | LINE | BROWN | BLACK |
| N | NEUTRAL | BLUE | WHITE |
| E | EARTH GND | GREEN-YELLOW | GREEN |




| CONDUCTOR | | WIRE COLOR |
|---|---|---|
| L | LINE | BROWN |
| N | NEUTRAL | BLUE |
| E | EARTH GND | GREEN-YELLOW |

Figure 2-1: AC Line Cord Wire Standard

C) Check the power cord.

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 8300's Model Number. The green / yellow wire is connected directly to the 8300 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. Set Ground Lift switch.**

The GROUND LIFT switch is located on the rear panel.

The GROUND LIFT switch is shipped from the factory in the GROUND position, (to connect the 8300's circuit ground to its chassis ground). If you are using the 8300's composite output to drive an exciter with an unbalanced output, set the switch to LIFT.

This will break most potential ground loops. If you have an installation that does not respond to use of the GROUND LIFT switch, you can always break a ground loop by using Orban's CIT25 Composite Isolation Transformer. If the CIT25 is in use, the GROUND LIFT switch will usually be set to GROUND.

**4. Mount the 8300 in a rack.**

The 8300 requires two standard rack units (3 ½ inches / 12.7 cm).

There should be a good ground connection between the rack and the 8300 chassis — check this with an ohmmeter to verify that the resistance is less than 0.5Ω.

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.

**5. Connect inputs and outputs.**

See the hookup and grounding information on the following pages.


| TOPIC | PAGE |
|---|---|
| Audio Input and Audio Output Connections | 2-6 |
| AES3 Digital Input and Output | 2-7 |
| Composite Output and Subcarrier Inputs | 2-8 |
| Grounding | 2-10 |


**6. Connect remote control interface. (optional)**

For a full listing of 8300's extensive remote control provisions, refer to *Remote Control Interface Programming* on page 2-36.

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.

PIN ASSIGNMENT

| | | |
|---|---|---|
| 1. | DIGITAL GOUND | |
| 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 | |

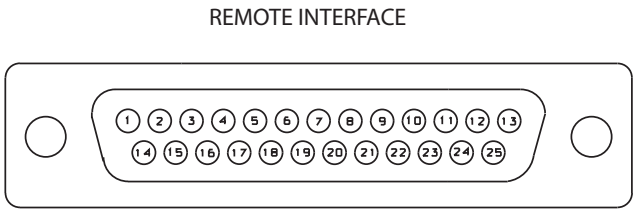



Figure 2-2: Wiring the 25-pin Remote Interface Connector

### 7. Connect to a computer

You can connect to a computer via the 8300's serial connector or via an Ethernet network. (See *Networking* on page 2-37.)

Because procedures and instructions for connecting to a PC are subject to development and change, we have placed these instructions in a file called `8300_Vxxx_installation.pdf` (where `xxx` represents the version number of the software). You can access this file from the Orban / Optimod 8300 folder in your computer's Start Menu after you have run Orban's PC Remote installer software.

> You must have the 8300 PC Remote application installed on your computer before you upgrade your 8300's firmware because 8300 PC Remote manages the upgrade.

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`.

See *Installing 8300 PC Remote Control Software* on page 2-43 for more detail.

This file is also available from the / 8300 / Documentation / Vxxx folder at Orban's ftp site, ftp.orban.com.

## 8300 Rear Panel

The **Ground Lift Switch** can be set to connect the 8300's circuit ground to its chassis ground (in the GROUND position). In the LIFT position, it breaks that connection. (See *Set Ground Lift switch* on page 2-3.)

The **Voltage Select switch** can be set to 115V (for 90-130V operation) or 230V (for 180-260V operation).

**Fuse** values can be changed to support 115V or 230V operation. For safety, use ½-A 250V Slow-Blow for 115V, or 250mA-250V for 230V.

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 8300's Model Number.

An **RS-232 (PC Remote) Computer Interface,** labeled SERIAL PORT, is provided to connect the 8300 to IBM PC-compatible computers, directly or via modem, for remote control, metering and software downloads.

A **Remote Interface Connector** allows you to connect the 8300 to your existing transmitter remote control or other simple contact-closure control devices. The 8300 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, tone or bypass modes, selecting stereo encoder modes (stereo, mono-left, mono-right, mono-sum), selecting analog, digital or digital+J.17 input, overshoot compensation, SCA modulation compensation, and clock synchronization. (See *Remote Control Interface Programming* on page 2-36.) The 8300 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 **Output** are provided to support two-channel AES3-standard digital audio signals through XLR-type connectors.

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

Two **Composite Baseband Outputs** are provided, each with independent output level control. Each output uses a BNC connector.

Two **SCA Inputs** are provided for stations that use additional subcarriers (SCAs). Each input uses a BNC connector. The second SCA input can be reconfigured via an internal hardware jumper as a Pilot Reference Output useful for RDS (RBDS) subcarrier generators that require an external sync reference.

# 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 –14 dBu and +8 dBu will result in normal operation of the 8300.

  (0 dBu = 0.775Vrms. For this application, the dBm @600Ω scale on volt-meters can be read as if it were calibrated in dBu.)

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

- 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 600Ω 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 8300 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 8300 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 50Ω. The output is capable of driving loads of 600Ω or higher; the 100% modulation level is adjustable with the AO 100% control over a –6 dBu to +24 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 circuit 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 8300'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 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.

## AES3 Digital Input and Output

There is one AES3 input and one AES3 output. The program input and output are both equipped with sample rate converters and can operate at 32, 44.1, 48, 88.2, and 96 kHz. The AES3 output can be switched to emit either the FM processed or HD (digital radio/netcast) processing signal. (See step (8.J) on page 2-29.)

> Per the AES3 standard, each digital input or output line carries both the left and right stereo channels. The connection is 110Ω 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 used of 110Ω 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 75Ω unbalanced coaxial cable, terminated in BNC connectors. A 110Ω/75Ω balun transformer is required to interface an AES3id connection to your Optimod's digital input or output.

The digital input clip level is fixed at 0 dB relative to the maximum digital word. The maximum digital input will make the 8300 input meters display 0 dB. The reference level is adjustable using the DI REF control.

The 8300 is a "multirate" system and its internal sample rate is 32 kHz and multiples thereof (up to 512 kHz). The output is strictly band-limited to 16 kHz. Therefore, the output can pass through a 32 kHz uncompressed link with bit-for-bit transparency. Because sample rate conversion is a phase-linear process that does not add bandwidth, the 8300's output signal will continue to be compatible with 32 kHz links even if it undergoes intermediate sample rate conversions (for example, 32 kHz to 48 kHz to 32 kHz).

## Composite Output and Subcarrier Input

There are two **composite outputs**. These carry the encoded stereo signal, the stereo pilot tone, and any subcarriers that may have been applied to the 8300's subcarrier inputs.

Each output's level is independently adjustable from –12.3 dBu to +12.0 dBu.

The output impedance of composite output #1 and composite output #2 can be set to 0Ω or 75Ω via jumpers J2 and J3 respectively (located on the I/O Board). As shipped, the link is on pins 3 and 4, yielding 0Ω impedance. To reset a given output to 75Ω, place the link on pins 1 and 2 of its associated jumper. (See the schematic on page 6-49 and the parts locator diagram on page 6-46.)

Each output can drive up to 75Ω in parallel with 0.047μF before performance deteriorates significantly (see Figure 2-3 on page 2-9). A GROUND LIFT switch is available on the rear panel. This is useful to prevent ground loops between the 8300 and the transmitter.

Connect the 8300's composite output to the exciter input with up to 100 feet (30.5m) of RG-58 / U or RG-59 / U coaxial cable terminated in BNC connectors.

Longer runs of coax may increase problems with noise, hum, and RF pickup at the exciter. In general, the least troublesome installations place the 8300 close to the exciter and limit the length of the composite cable to less than 6 feet (1.8m).

We do not recommend terminating the exciter input by 50Ω or 75Ω unless this is unavoidable. The frequencies in the stereo baseband are low by comparison to RF and video, and the characteristic impedance of coaxial cable is not constant at very low frequencies. Therefore, the transmission system will usually have more accurate amplitude and phase response (and thus, better stereo separation) if the coax is driven by a very low impedance source and is terminated by greater than 1kΩ at the exciter end. This also eases thermal stresses on the output amplifier in the stereo encoder, and can thus extend equipment life.

If the Orban CIT25 Composite Isolation Transformer is used, the exciter *must* present a 1kΩ or greater load to the transformer for proper transformer operation.

Designed to be installed adjacent to each exciter, the CIT25 Composite Isolation Transformer provides ground loop isolation between the 8300 composite output and the exciter's input, and presents the 8300 with a balanced, floating load.

Even when its composite limiter is being used heavily, the 8300 will always protect the stereo pilot tone by at least 60 dB (±250Hz from 19 kHz) and will protect the region from 55 kHz to 100 kHz by at least 75 dB (re 100% modulation).

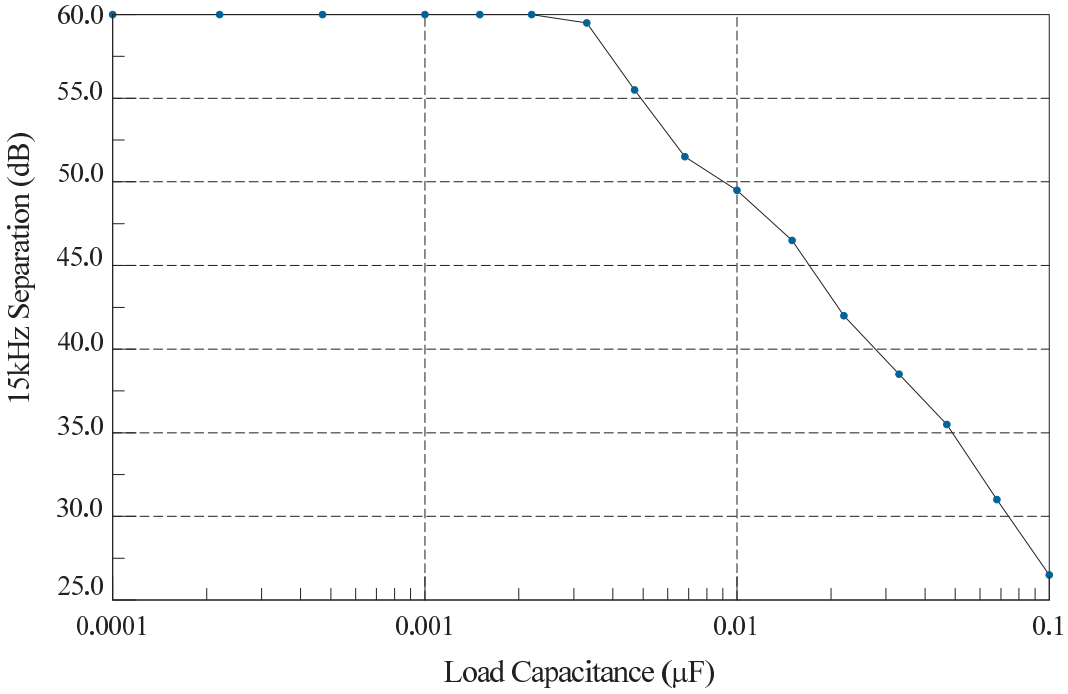



Figure 2-3: Separation vs. load capacitance

The **subcarrier inputs** are provided for convenience in summing subcarriers into the baseband prior to their presentation to the FM exciter.

The subcarrier inputs will accept any subcarrier (or combinations of subcarriers) above 23 kHz. Below 5 kHz, sensitivity rolls off at 6 dB/octave to suppress hum that might otherwise be introduced into the subcarrier inputs, which are unbalanced.

The subcarrier inputs are mixed into the 8300's composite output in the analog domain, after D/A conversion of the 8300 stereo encoder's output but before the digitally controlled attenuators that set the composite output levels.

As shipped from the factory, the second SCA connector emits a **stereo pilot tone reference** for RDS or RBDS subcarrier generators. If you wish to reconfigure it to accept an SCA signal, move the link on jumper J400 (on the I/O board) from pins 3 and 4 to pins 1 and 2.

To access J400, remove the 8300's top cover according to the instructions in step 1 on page 4-2. To find J400, see page 6-46 for the I/O board parts

locator drawing. To find the I/O board, see the circuit board locator drawing on page 6-29. The schematic showing J400 is on page 6-49.

Connect your subcarrier generator(s) to the 8300's subcarrier input(s) with coaxial cable terminated with BNC connectors.

The subcarrier inputs have greater than 600Ω load impedance and are unbalanced. The two SCA inputs have different behaviors. SCA1's sensitivity is variable from 220 mV p-p to >10 V p-p to produce 10% injection, while SCA2's sensitivity is fixed at 772 mV p-p to produce 10% injection.

VR400 on the I/O board sets SCA1's sensitivity. To access VR400, remove the top cover according to the instructions in step 1 on page 4-2. To find VR400, see page 6-46 for the I/O board parts locator drawing.

A special variant of the I/O board is available having an added trimmer (VR401) to set the gain of SCA2. This variant should be specified at time of order. Please contact Orban customer service (see page 5-13) for more information.

You can use the 19K REF control in SETUP to determine whether the 19 kHz pilot reference output will be in-phase (0 DEG) with the pilot tone present in the composite output or will lead it by 90 degrees (90 DEG). 0 DEG is correct for most installations. Use 90 DEG only if your RDS/RBDS generator's 19 kHz reference input specifically requires this phase relationship.

## 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 8300 has balanced inputs. Its subcarrier inputs are unbalanced, but frequency response is rolled off at low frequencies to reject hum.

- 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 source (output) 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.

- Whenever coaxial cable is used, shields are automatically grounded at both ends through the terminating BNC connectors.

### Power Ground

- Ground the 8300 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:

- Circuit and chassis ground should always be connected by setting the 8300's GROUND LIFT switch to its GROUND connect position, *except* when the 8300's stereo encoder is driving an **unbalanced exciter input**. (Many older exciters have unbalanced inputs.) This is an unbalanced-to-unbalanced connection, so set the 8300's GROUND LIFT switch to LIFT to break the ground loop that would otherwise occur.

  Alternately, you can balance and float the exciter input with the Orban CIT25 Composite Isolation Transformer — see page 2-8.

- In high RF fields, the system is usually grounded through the equipment rack in which the 8300 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.

## 8300 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 8300 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 8300.

These flash when such a menu is in use. Otherwise, they are inactive.

- **Control Knob** is used to change the setting that is selected by the soft buttons. To change a value, you ordinarily have to hold down a soft button while you are turning the control knob.

- **Recall** button allows you recall a Factory or User Preset.

  Selecting the Recall button does not immediately recall a preset. See step 18 on page 2-21 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 8300 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 8300'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 8300's analog to digital converter, which is a very common cause of audible distortion.

- **AGC** meter shows the gain reduction of the slow two-band AGC processing that precedes the multi-band compressor. Full-scale is 25 dB gain reduction. You can switch the meter 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.

- **Gate** LED indicates gate activity, lighting when the input audio falls below the threshold set by the AGC gate threshold control (via the Full Modify screen's AGC GATE control). When this happens, the AGC's recovery time is slowed to prevent noise rush-up during low-level passages.

  There is also an independent gate for the multiband compressor (2-band and 5-band). You can only see its action from the Optimod PC Remote software.

- **Gain Reduction** meters show the gain reduction in the multi-band compressor. Full-scale is 25 dB gain reduction.

  When the Multi-Band structure is operating, all the meters indicate gain reduction. When the Two-Band structure is operating, the two leftmost meters indicate gain reduction in the Master and Bass bands, while the

rightmost meters indicate the gain reduction in the two-band high frequency limiter.

- **Multiplex Power / HD Gain Reduction** meter is switchable via the METER FUNCTION control in SETUP. In MULTIPLEX POWER mode, it indicates the action of the ITU412 Multiplex Power controller. It shows how much the MPX Power Controller has reduced the clipper drive, thereby reducing the average power in the processed audio. It will show no gain reduction unless the MPX Power Controller is turned on. In HD GR mode, the meter indicates the larger of the gain reductions in the left and right channel look-ahead limiters for the HD Radio / digital radio / netcast processing chain.

- **Composite** meter shows the output level of the stereo encoder before the composite output attenuators. The meter's reading is calibrated in percent modulation.

# Studio Level Controller Installation (optional)

*[Skip this section if you are not using a studio level controller ahead of the 8300. Continue with "Quick Setup" on page 2-16.]*

- As of this writing, the currently manufactured Orban products that can be used as external AGCs are Optimod-PC 1101 and Optimod 6300. Their manuals contain instructions on how to use them in this application. They are the preferred choices because their AGCs are identical to the AGC in the 8300.

- Discontinued Orban products usable as external AGCs include the 8200ST, 464A "Co-Operator," 8100AST, and 1100 OPTIMOD-PC. In this manual, we do not provide step-by-step instructions for setting up all of these older products, although it should be easy to extrapolate from the instructions we do provide.

If you are using an Orban 8100AST (or 8100A/ST) external AGC, refer to page 1-16.

## If you are using Orban 8200ST external AGC

If the STL uses pre-emphasis, its input pre-emphasis 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 pre-emphasis be defeated (freeing the STL from such potential overshoot), and that the 8200ST be used to provide the necessary pre-emphasis.

If the STL transmitter's pre-emphasis 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.

**8. Configure the 8200ST's internal jumpers.**

A) Remove all screws holding the 8200ST's cover in place; then lift it off.

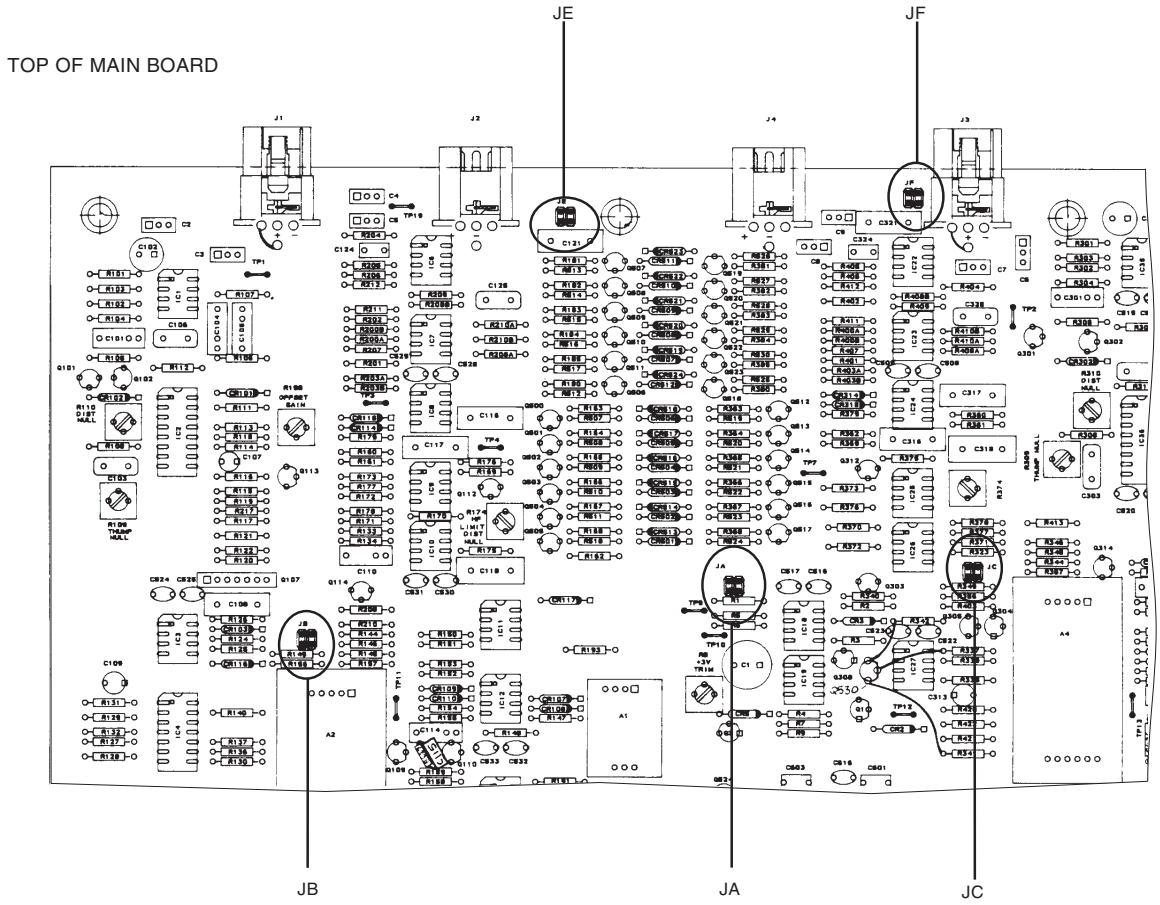



Figure 2-4: 8200ST Jumper Settings (*Factory Configuration)

Refer to Figure 2-4 on page 2-14.

A) Place jumper JA in the CLIPPER ON position.

B) If you have defeated the STL transmitter's pre-emphasis, place jumpers JE and JF in the PRE-EMPHASIZED position.

C) If you cannot defeat the STL transmitter's pre-emphasis, place jumpers JE and JF in the FLAT position.

D) Replace the top cover, and then replace all screws snugly. (Be careful not to strip the threads by fastening the screws too tightly.)

**2. 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.

**3. 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 2-4 on page 2-14.)

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 overmodulation caused by overshoots on certain audio signals.

**4. 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 controls as follows:

HF LIMITER... Set to match the pre-emphasis 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.

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

If the STL uses pre-emphasis, its input pre-emphasis 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 pre-emphasis be defeated (freeing the STL from such potential overshoot), and that the 464A be used to provide the necessary pre-emphasis.

If the STL transmitter's pre-emphasis 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 8300 setup. It is appropriate for users without special or esoteric requirements. Following this section, you can find more detailed information regarding setup beyond the Quick Setup screens. In most cases, you will not need this extra information.

*Quick Setup configures the 8300 for an analog-FM facility only.* If you are setting up an digital radio facility (HD Radio or Eureka 147), you must use the detailed instructions found after this Quick Setup section.

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 (like choosing 50 or 75µs pre-emphasis), 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.

**6. Set pre-emphasis.**

A) Press the NEXT button.

B) Select the pre-emphasis (either 75μS or 50μS) used in your country by turning the knob.

**7. Set external AGC mode.**

Most of the processing structures in the 8300 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 8300 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.

- 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 8300's AGC for all presets.
- Set the field to No If you do not have a external AGC installed; this setting enables the 8300 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 8300 continues to work). The Orban 4000 is a transmission system overload protection device; 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 8300.

**8. 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 pre-emphasis (of which we are aware) is NICAM. DIGITAL, not DIGITAL+J17, is appropriate for almost anyone using the digital input.

**9. Set operating levels.**

You will set the operating levels of the 8300 to match the input levels it is receiving so the 8300'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 8300, 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 8300.

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.

**10. Set the analog output source.**

If you do not need the 8300's analog output to drive a transmitter, you can configure it to receive the output of a special low-delay version of the multiband compressor. This signal is suited for driving headphones. The input/output delay is approximately five milliseconds. Even though normal 8300 presets have a delay of about 15 ms (which most DJs, announcers, and presenters can learn to use without discomfort, although they may need some time to become accustomed to it), the low-delay output will cause less bone conduction comb filtering. However, in most cases, the low-delay output will not be necessary to ensure adequate talent comfort.

The 8300 offers several low-latency ("UL") presets having 5 ms delay and the ability to drive a transmitter. However, the audio performance of

these presets is not as good as the normal 8300 "optimum latency" presets. It is therefore preferable to set up a separate headphone monitoring chain as described below and to use the low latency presets only if necessary.

A) Press the NEXT button.

B) *[Skip this step if you will not be using the analog output.]*

To configure the Analog Output for low-delay monitoring, turn the knob to choose MONITOR. Otherwise, choose XMITTER.

If you configured the Analog Output for low-delay monitoring, sure that you set the analog output pre-emphasis control to FLAT in step 11 above.

**CAUTION:** The low-delay output has no peak limiting and is therefore not suited for driving a transmitter. If you use the low delay output, you must drive your transmitter with the AES3 digital output or with the composite output.



If you use the low-delay output to drive your studio monitor speakers as well as talent headphones (which may be necessary if your console has only one monitor input for both), then we recommend connecting a loss-of-carrier alarm to one of the 8300'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 step (21.C) on page 2-23 for information on how to program a GPI input.

Note that the low delay output, as processed by a look-ahead limiter with about 4 ms of delay, creates the HD-processed signal that the digital output can emit. See step (8.J) on page 2-29.

**11. Set analog output to be flat or pre-emphasized.**

A) Press the NEXT button.

B) *[Skip this step if you will not be using the analog output.]*

Turn the knob to choose PRE-E (for pre-emphasis) or FLAT.

If you will use the analog output to drive a stereo encoder, PRE provides the best performance because the stereo encoder that receives the analog output does not have to restore the pre-emphasis. However, if you cannot defeat the pre-emphasis in your stereo encoder, or if you will use the analog output for monitoring, set the output Flat**.**

If you are sending the analog output of the 8300 through a digital link that uses lossy compression (like MPEG, APT-X, or Dolby), set the output FLAT. Lossy codecs cannot handle pre-emphasized signals.

If you are going to use the analog output for headphone monitoring (see step 10 below), set the output FLAT.

**12. Set digital output to be flat or pre-emphasized.**

(See the notes in step 11 on page 2-19.)

A) Press the NEXT button.

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

Turn the knob to choose 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 pre-emphasis cascaded with J.17 pre-emphasis), or FLAT (which applies 50 or 75µs de-emphasis after the processing).

> Regardless of the setting of this control, the processing is always internally pre-emphasized and thus always controls peaks to follow the 50 or 75µs pre-emphasis curve.

**13. Set the digital output sample rate.**

A) Press the NEXT button.

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

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

> The internal sample rate converter sets the rate at the 8300'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 8300's fundamental sample rate is 32 kHz, ensuring that the output bandwidth is always strictly limited to 16 kHz and that the processed signal can be passed through a 32 kHz uncompressed STL without addition of overshoot.

**14. 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 on-air modulation).

- To use tone, press the YES button.
- To use program material, press the NO button.

**15. Set the composite output level.**

*[Skip this step if you will not be using the composite output(s).]*

A) Observe the modulation produced by the 8300's COMPOSITE OUTPUT 1 on a modulation monitor or modulation analyzer. Turn the knob to make the modulation monitor read 100% modulation (usually ±75 kHz deviation).

> If you are using program material, make sure that the program material is loud enough to produce peaks of frequent recurrence that hit the 8300's peak limiting system, thereby defining the maximum peak level that the 8300 will produce. In the U.S., we recommend using 900µs peak weighting on the peak modulation indicator, as permitted by F.C.C. rules. This will cause the monitor to ignore very low energy overshoots and will result in the highest peak modulation permitted by law.

In other countries, use a peak-indicating instrument as specified by the regulatory authority in your country.

If you are required to implement the average modulation limits specified by ITU-R 412-9, you may seldom see peaks hitting ±75 kHz deviation. In this case, we advise you to set the output level using the 8300's reference 400Hz tone.

B) Press the NEXT button and repeat for COMPOSITE OUTPUT 2.

**16. Set the digital output level.**

A) Press the NEXT button.

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

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

The most accurate way to set this control is by observing a modulation analyzer connected to your transmitter.

**17. 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).

The most accurate way to set this control is by observing a modulation monitor or analyzer connected to your transmitter.

If you have set Analog Output Feeds: Monitor in step 10 on page 2-18, the peak level will not be well controlled because no peak limiting has been applied to this signal.

C) Press the NEXT button.

If you activated the modulation setup tone in step (14.A) on page 2-20, the tone will turn off automatically.

D) Press the NEXT button.

You have now completed the guided Quick Setup procedure and are in the normal RECALL PRESET screen. However, if your country requires you to comply with the multiplex power ceiling specified in ITU-R 412-9, you will also need to set up the 8300's Multiplex Power Controller by following the instructions in step 20 on page 2-22.

**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 put your desired preset on-air.

This step selects the processing to complement the program format of

your station.

After this step, you can always select a different processing preset, program the 8300 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 the one whose sound you prefer. This preset may have a very different name than the name of your format. This is OK.

You can easily modify a preset later with the 8300'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 associate the 8300 with the station providing the program material (e.g., "Z-100"). The name can be up to eight characters long. It is used to identify your 8300 to Orban's PC Remote application, and it appears on the Main Screen when the 8300 is being controlled by the PC Remote application.

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. Activate the 8300's ITU-R 412 controller (optional).**

*[Skip this step if ITU-R 412 is not enforced in your country. At the time of this writing, it is only enforced in certain European countries. If your country does not enforce ITU-R 412, set the ITU412-9 control to OFF.]*

A) Navigate to SETUP / STEREO ENCODER / NEXT / ITU412-9.

B) Set the multiplex power threshold by holding the ITU412-9 button down and turning the knob so that the display indicates 0.0 dB.

If your transmission system introduces overshoot in the signal path after the 8300 (including the transmitter), set the multiplex power threshold so that it equals the amount of peak overshoot (in dB) in the transmission system. If you do not do this, the 8300's ITU-R 412-9 controller will set the average multiplex power too low.

The easiest way to measure system overshoot is to turn the multiplex power controller off temporarily. Then set the 8300's output level (using its built-in 400Hz reference tone) so that the transmitter produces ±75 kHz deviation. Finally, play program material with lots of high frequency energy and bass transients (like bright rock music with heavy kick drum)

and observe the peak deviation produced by the program material. The overshoot is the amount (in dB) by which the deviation with program material exceeds ±75 kHz deviation.

See the notes on the MPX POWER OFFSET control on page 3-35.

**21. Set up modulation reduction to compensate for subcarriers, if needed.**

In the United States, F.C.C. Rules permit you to add 0.5% modulation for every 1% increase in subcarrier injection. For example, if your subcarrier injection totals 20%, you can set the total modulation to 110% (±82.5 kHz deviation). The 8300 has the ability to reduce audio modulation to compensate for subcarriers.

The advantage of using the modulation reduction function is that the pilot injection stays constant when the audio modulation is reduced. However, using the modulation reduction function is slightly inconvenient because it requires programming and activating at least one 8300 GPI input. *If you have the same subcarrier injection at all times*, a more convenient alternative is to set the desired modulation level by using the COMPOSITE LEVEL control(s). Then turn up the pilot injection control until the injection equals 9% modulation.

*If you wish to use the modulation reduction function anyway:*

A) Navigate to SETUP / NEXT / MODULATION REDUCTION.

B) Hold down the appropriate MODULATION REDUCTION button and turn the knob to set the amount of modulation reduction produced by the MODULATION REDUCTION 1 and MODULATION REDUCTION 2 functions.

You can program these to be activated via any rear-panel GPI input, or by the 8300's clock-based automation.

When both modulation reduction functions are active, the modulation reduction is the sum of their settings.

To comply with FCC Rules, set the modulation reduction to one-half the injection of the associated subcarrier. For example, if your subcarrier injection totals 20% from two 10% subcarriers, set MODULATION REDUCTION 1 TO "5%" and MODULATION REDUCTION 2 to 5%. This will reduce your audio modulation to 90% (100% – 5% – 5%). When you add back the 20% modulation due to the subcarriers, you get the required 110% total modulation.

The Modulation Reduction function is active as long as signal is applied to its associated GPI input.

C) Program the GPI input(s).

a) Navigate to SETUP / NEXT / NETWORK&REMOTE / REMOTE INTERFACE.

b) Using the NEXT button, scroll the screen until you see the button corresponding to the GPI terminal you wish to program.

c) Hold down this button and turn the knob until you see MOD. REDUCTION 1 or MOD. REDUCTION 2 as desired.

To program clock-based automation to activate modulation reduction, follow the instructions found in "Using Clock-Based Automation" on page 2-30.

---

*The following material provides detailed instructions on how to set up the 8300. 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 8300 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. Temporarily set the external AGC mode to "No."**

A) Navigate to SETUP / NEXT / NEXT / EXT AGC and set EXT AGC to NO.

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

**2. Adjust Input selector.**

A) Navigate to SETUP / IO CALIB / ANLG IN CALIB / INPUT.

B) Set the INPUT to Analog.

The 8300 will automatically switch to analog input if signal lock is unavailable at the AES3 input.

**3. Adjust Analog Input Reference Level.**

*[–9 dBu to +13 dBu (VU), or –1 to +21 dBu (PPM)] in 0.5 dB steps*

The reference level VU and PPM (Peak) settings track each other with an offset of 8 dB. 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 8300's gain reduction range to the level to which your studio operators peak their program material on the studio meters. This assures that the 8300'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 8300, 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 ROCK-MEDIUM appears in the lower line of the display.

C) Press the RECALL NEXT button.

D) Navigate to SETUP / IO CALIB / ANLG IN 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 8300 to your standard studio level.]*

a) Verify EXT AGC is set to NO.

Refer to step 1 on page 2-24.

b) Feed a tone at your reference level to the 8300

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 8300'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 8300 to your standard studio level — see step (D) above.]*

a) Verify EXT AGC is set to NO.

Refer to step 1 on page 2-24.

b) Feed normal program material to the 8300

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 8300'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 1 on page 2-24.

**4. Adjust Right Channel Balance.**

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

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

Adjust the R CH BAL control 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 8300 is not at exactly the same level as the left input. Be certain that the imbalance is not caused by one program source, but is instead introduced through distribution between the console output and 8300 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).

**5. 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 / DIG IN CALIB / INPUT and set the input to Digital.

B) Repeat steps 1 through 4 (starting on page 2-24), but use the DI REF (VU OR PPM) and R CH BAL controls for the digital section.

**6. Configure Composite Outputs**

A) Navigate to SETUP / STEREO ENCODER / NEXT / PRE-EMPH. Set the pre-emphasis to 50μs or 75μs, depending on your country's standard.

B) Set PILOT LVL to 9%.

> If you have to reduce the setting of the COMPOSITE LEVEL control to accommodate overshoots in the transmission path following the 8300 (including the transmitter), you may have to increase the setting of the PILOT LEVEL so that the pilot is still at 9% modulation.

C) Press the NEXT button. Be sure that MODE is set to STEREO and XTALK TEST is set to OPERATE. Reset these parameters if necessary.

D) Using the COMP1 LVL and COMP2 LVL controls, adjust the level for each composite output to produce 100% modulation of the FM carrier on modulation peaks.

Alternately, you can use the 8300's built-in calibration tone oscillator. 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) Verify that PILOT is ON.

h) When you have finished with the tone, set the MODE to OPERATE.

E) If you are required to meet the requirements of ITU-R 412-9 in your country, activate the 8300's ITU-R 412 controller. See step 20 on page 2-22.

F) You can specify the amount by which the 8300 automatically reduces main and stereo subchannel modulation to accommodate subcarriers within the modulation limits specified by the governing authority. See step 21 on page 2-23.

**7. Set analog output and configuration level.**

A) Navigate to SETUP / IO CALIB / ANLG OUT CALIB / AO PRE-E. Set the analog output pre-emphasis to PRE-E (for pre-emphasis) or FLAT.

> If you will use the analog output to drive a stereo encoder, PRE-E provides the best performance because the stereo encoder does not have to restore the pre-emphasis. However, if you cannot defeat the pre-emphasis in your stereo encoder or if you will use the analog output for monitoring, set the output FLAT.
>
> If you are sending the analog output of the 8300 through a digital link that uses lossy compression (like MPEG, APT-X, or Dolby), set the output Flat. Lossy codecs cannot handle pre-emphasized signals.
>
> If you are going to use the analog output for headphone monitoring [see step (C) below], set the output FLAT.

B) You can use either program material or tone to set your output level (and thus, your on-air modulation). If you want to use tone, turn on the 400Hz calibration tone.

> See step (6.D) on page 2-26 for instructions on how to turn on the calibration tone.

C) Using the AO FEEDS button, set the analog output source to XMITTER or MONITOR.

> See step 10 on page 2-18.
>
> If have set the source to Monitor, be sure to set analog pre-emphasis to Flat. See step (A).

D) Using the AO 100% button, set the desired analog output level corresponding to 100% modulation, using units of dBu (0 dBu = 0.776 Vrms).

> The most accurate way to set this control is by observing a modulation analyzer connected to your transmitter.
>
> If you have (inappropriately) set AO FEEDS: MONITOR in step (C) 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 hit the 8300's peak limiting system, thereby defining the maximum peak level that the 8300 will produce. In the U.S., we recommend using 900μs peak weighting on the peak modulation indicator, as permitted by F.C.C. rules. This will cause the monitor to ignore very low energy overshoots and will result in the highest peak modulation permitted by law.

In other countries, use a peak-indicating instrument as specified by the regulatory authority in your country.

If you are required to implement the average modulation limits specified by ITU-R 412-9, you may seldom see peaks hitting ±75 kHz deviation. In this case, we advise you to set the output level by using the 8300's reference 400Hz tone.

In the United States, F.C.C. Rules permit you to add 0.5% modulation for every 1% increase in subcarrier injection. For example, if your subcarrier injection totals 20%, you can set the total modulation to 110% (±82.5 kHz deviation). This implies that you must set the 8300's composite output level for the equivalent of 90% modulation, not counting the subcarriers. (90% + 20% = 110%.) The pilot injection will thus be about 8% modulation instead of the desired 9%. Adjust the SETUP / STEREO ENCODER / NEXT / PILOT LVL control as necessary to produce 9% modulation (±6.75 kHz deviation). This will ordinarily require you to set the PILOT LVL parameter to "10%."

**8. Set digital output and configuration level.**

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

*[See the notes immediately above.]*

A) Navigate to SETUP / IO CALIB / DIG OUT CALIB.

B) Set the DO PRE-E control to PRE-E (for pre-emphasis), PRE+J17, J.17 or FLAT.

C) Set the DO RATE to 32, 44.1, 48, 88.2, or 96 kHz.

The 8300's fundamental sample rate is always 32 kHz, ensuring that the output bandwidth is always strictly limited to 16 kHz and that the processed signal can be passed through a 32 kHz uncompressed STL without addition of overshoot. However, the internal sample rate converter sets the rate at the 8300's digital output. This adjustment allows you to set the output sample rate to ensure compatibility with equipment requiring a fixed sample rate.

D) Set the DO SYNC.

You can choose INTERNAL (the output sample rate is synchronized to the 8300's internal crystal-controlled clock) or EXTERNAL (the output sample rate is synchronized to the sample rate appearing at the 8300's AES3 input).

E) Press NEXT. Then set the desired output WORD LEN (word length).

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

The largest valid word length in the 8300 is 24 bits

The 8300 can also truncate its output word length to 20, 18, 16 or 14 bits. The 8300 can add dither for input material that is insufficiently dithered for these lower word lengths (see the next step).

F) Adjust DITHER to IN or OUT, as desired.

[In] or [Out]

When set to In, the 8300 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 is first-order noise shaped dither that 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.

If the source material has already been correctly dithered (as is true for virtually all commercially recorded material), you may set this control to OUT. However, particularly if you use the Noise Reduction feature, the processing can sometimes attenuate input dither so that it is insufficient to dither the output correctly. In this case, you should add dither within the 8300.

G) Set DIGITAL FORMAT to AES or SPDIF

H) Set the OUT SOURCE to FM or HD.

I) Press the PREV button.

J) Set the DO 100% control.

- If the OUT SOURCE is set to FM: Using a modulation monitor or modulation analyzer, adjust the DO 100% control to make the modulation monitor read 100% modulation (usually ±75 kHz deviation).

  See the notes in step (7.D) on page 2-27

- If the OUT SOURCE is set to HD: Adjust the DO 100% control so that the peak modulation of the digital channel does not exceed 0 dB. Note that the look-ahead limiter may exhibit up to 2 dB of overshoot on certain program material, so set the level conservatively. You must use a preset without "UL" in its name to make this adjustment.

  This should not cause any problems because matching the loudness of the FM and digital channels at the HD receiver permits the digital peak limiting to be much lighter than the analog peak limiting, thanks to the fact that receiver has 5 dB higher gain on the HD channel than on the analog channel.

**9. 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 1 on page 2-24, set the EXT AGC to YES.

**10. Select a processing preset.**

See step 18 on page 2-21.

## Automation Using the 8300's Internal Clock

**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 2-39.]

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 is 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 8300 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
- mono-from-left-channel (MONO-L) mode
- mono-from-right-channel (MONO-R) mode
- mono-from-sum-of-channels (MONO-SUM)
- bypass mode

- exit test (restores the operating preset that was on-air before a test mode was invoked)
- mod. reduction 1
- mod. reduction 2
- exit mod. reduction

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 2-31.

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.

## Security and Passcode Programming

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

The 8300 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 8300 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 8300.

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 8300 front panel, operate any button or the knob.

The PASSCODE screen will appear.

B) Enter a passcode using the four soft buttons.

The 8300 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 8300's front panel. Once your PC is connected to the 8300, you will be able to access the 8300 functionality corresponding to the security level of your passcode.

If you have not set a passcode, leave the Windows dialog box blank.

## 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 8300.

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

The Restore Defaults screen appears.

C) To gain access to the 8300, press the ERASE ALL PASSCODES soft button.

D) Reprogram passcodes as necessary; see *To Create a Passcode* on page 2-33.



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 8300 "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.

# 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 8) 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 de-emphasis to it.
- **Input**: **Digital+J.17**: selects the digital input and applies J.17 de-emphasis 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**: switches the 8300's stereo encoder on. In conjunction with mono mode controls (below), iIt also determines the operating mode of the audio processing (STEREO, MONO-FROM-LEFT, MONO-FROM-RIGHT, or MONO-FROM-SUM.)
- **Mono from Left, Mono from Right, or Mono from Sum**: switches the 8300's stereo encoder off, using the Left, Right, or Sum (L+R) respectively as the program source. This also determines the feed to the entire processing chain so that facilities that do not use the 8300's stereo encoder can change stereo/mono mode and select the source when in mono mode.
- **Mod Reduction 1, or Mod Reduction 2**: reduces the program modulation by the percentage programmed in SETUP / NEXT / MODULATION REDUCTION (see step 21 on page 2-23). When voltage is removed, these functions are deactivated.

- **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 8300'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 8300's internal clock to your station's master clock.
    - **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 8300 remotely, either for downloading software upgrades or for PC Remote Control.]*

The 8300 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 8300 through the 8300's RS-232 serial port, either by modem or directly through a null modem cable.

**1. Prepare the 8300 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 8300 PC Remote software, then you must first be able to connect to the 8300. Therefore, you will usually perform this procedure from the 8300'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 Address assigned by your network administrator if necessary:

a) Press the GATEWAY ADDRESS soft button.

b) Use the NEXT and PREV keys to move the cursor in turn to each digit in the gateway address. Use the knob to set the digit to the desired value. Repeat until you have selected all the numbers in the gateway address 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 8300.

- 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 8300 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 8300 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 8300. Orban Customer Service supports only the 3Com / U.S. Robotics® 56kbps fax modem EXT on the 8300 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 8300's serial port with a standard (not null) modem cable.

> The cable provided with your 8300 is a null modem cable and will not work.

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 8300 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 8300 through a null modem cable connected to your computer's serial port. Refer to *Installing 8300 PC Remote Control Software on page 2-*43.

# 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.**

http://www.boulder.nist.gov/timefreq/service/time-servers.html provides a current list of timeservers available on the Internet. You network may also have a local timeserver; ask your network administrator.

As of April 2004, NIST's list was as shown in Table 2-1.

| Name | IP Address | Location |
|---|---|---|
| time-a.nist.gov | 129.6.15.28 | NIST, Gaithersburg, Maryland |
| time-b.nist.gov | 129.6.15.29 | NIST, Gaithersburg, Maryland |
| time-a.timefreq.bldrdoc.gov | 132.163.4.101 | NIST, Boulder, Colorado |
| time-b.timefreq.bldrdoc.gov | 132.163.4.102 | NIST, Boulder, Colorado |
| time-c.timefreq.bldrdoc.gov | 132.163.4.103 | NIST, Boulder, Colorado |
| utcnist.colorado.edu | 128.138.140.44 | University of Colorado, Boulder |
| time.nist.gov | 192.43.244.18 | NCAR, Boulder, Colorado |
| time-nw.nist.gov | 131.107.1.10 | Microsoft, Redmond, Washington |
| nist1.datum.com | 66.243.43.21 | Datum, San Jose, California |
| nist1-dc.glassey.com | 216.200.93.8 | Abovenet, Virginia |
| nist1-ny.glassey.com | 208.184.49.9 | Abovenet, New York City |
| nist1-sj.glassey.com | 207.126.98.204 | Abovenet, San Jose, California |
| nist1.aol-ca.truetime.com | 207.200.81.113 | TrueTime, AOL facility, Sunnyvale, California |
| nist1.aol-va.truetime.com | 205.188.185.33 | TrueTime, AOL facility, Virginia |

Table 2-1: NIST-referenced timeservers

**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 address might not be set correctly on your Optimod. The gateway address for the timeserver connection is the same gateway address that you set in step (1.D) on page 2-38. If you do not know the correct gateway address, 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 `ipconfig`. 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 2-41).
- If the timeserver you selected in Windows is a named address not an IP address the 8300 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 8300 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 2-41]. 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 8300 PC Remote Control Software

This section briefly summarizes the procedure for installing 8300 PC Remote software on existing 8300s. If required, you will find more detailed instructions in the .pdf file automatically installed on your computer by Orban's installer program, `Setup8300_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 8300. You can also download it from `ftp.orban.com/8300`.

Instructions for using the PC Remote software begin on page 3-60.

## Installing the Necessary Windows Services

The 8300 PC Remote application uses Windows' built-in communications and networking services to deal with the low-level details necessary to communicate with the 8300's serial port. (These services are also used to upgrade your 8300'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 will need to establish a connection between a serial (COM) port of the PC and the COM port of your 8300 through a null modem cable (supplied with your 8300). You will then use Windows Direct Serial Connect to make the basic connection.

- 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 8300 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 8300 PC Remote application*.

  > In all cases, regardless of whether your PC communicates to the 8300 through its serial port or Ethernet connector, it uses the ppp and the TCP/IP protocols to communicate with the 8300.

## Check Hardware Requirements

To connect your PC to your 8300, regardless of the method you choose, you will need the following:

- Orban 8300 OPTIMOD-FM.

- *If connecting by serial cable:* a null modem cable (also called a "reverse" cable), supplied by Orban with your 8300 when it was shipped. This cable has DB9 fe-

male connectors at both ends for connecting the 8300 to the serial port on your computer. If your computer has a DB25 connector, you will need to obtain an adapter.

- *If connecting by modem:* a 3Com / U.S. Robotics® 56kbps fax modem EXT and normal (not null) modem cable for the 8300 side of the connection. Note that Orban Customer Service does not support any other type of modem for connecting to the 8300.

- *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.

  8300 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 8300, use shielded cable to protect the pins in the RS-232 connector from electrostatic discharge.

The following subsections provide steps for connecting to your 8300 OPTIMOD-FM 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 8300 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 8300. *Appendix: Setting Up Serial Communications* on page 2-47 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 8300. In most cases, all you need is your 8300's IP address, Port, and Gateway number, as set in step 1 on page 2-37. You will enter these when you create a "connection" to your 8300 from the 8300 PC Remote application — see step (E) on page 3-63. If your computer does not have a working Ethernet port, you will need to add one and then following the instructions provided by Microsoft to set it up to enable TCP/IP networking.

If you wish to connect to your 8300 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 8300 are on the same subnet, then it is unnecessary to specify a gateway.

If you are behind a firewall, you must open the port you specified in step (1.E) on page 2-38. If the gateway, port, and firewall (if used) are configured correctly, it is possible to connect 8300 PC Remote to a 8300 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 8300. However, if you experience any problems with this process, or have any other 8300 questions, please contact Orban Customer Service:

phone: +1 510 351-3500

email: custserv@orban.com

For details on your new 8300 software, from new features to operational suggestions, refer to our FTP site (ftp.orban.com/8300).

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# Appendix: Setting Up Serial Communications

This appendix provides instructions for setting up both direct serial and modem connections from your 8300 to your PC. You must do this when you define a new connection from the 8300 PC Remote application. The appendix provides procedures for both the Windows 2000 and Windows XP operating systems.

## Preparing for Communication through Null Modem Cable

1. **Configure your 8300.**

   A) On your 8300'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 the null modem cable that we supplied with your 8300 to the DB9 serial connector on the 8300'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 2000 Direct Serial Connection:

Ordinarily, a direct serial connection through a null modem cable is used only when you are controlling one 8300 per available COM port on your computer. If you wish to control multiple local 8300s, it is better to use an Ethernet network connection. However, in principle you could control multiple 8300s serially from one COM port, using a hardware serial switch to select the 8300 you wish to control. In this case, you should set up a separate 8300 "connection" for each 8300 to be controlled, following the instructions below. All connections should reference the same COM port.

This connection is used both for upgrading your 8300 and for connecting the 8300 PC Remote application to your 8300.

**Important**: The Direct Serial Connection must have exclusive access to the PC COM port that connects to your 8300. Make sure than any software that monitors this COM port (such as HotSync manager, etc) is disabled before running Direct Serial Connection.

*If you have already configured your direct serial cable connection, skip to step 2 on page 2-52.*

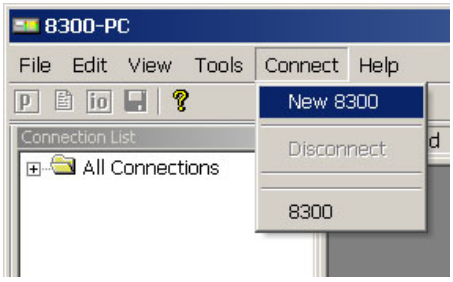
If you cannot access the Internet after making a Direct or Modem connection, you will have to reconfigure certain networking parameters in Windows. Please see *You Cannot Access the Internet After Making a Direct or Modem Connection of the 8300* on page 5-7.

**1. Add and configure a Direct Connection for Windows 2000:**

A) Create a New Windows 2000 Direct Connection:

a) Launch 8300 PC Remote.

b) Choose "Connect / New 8300"

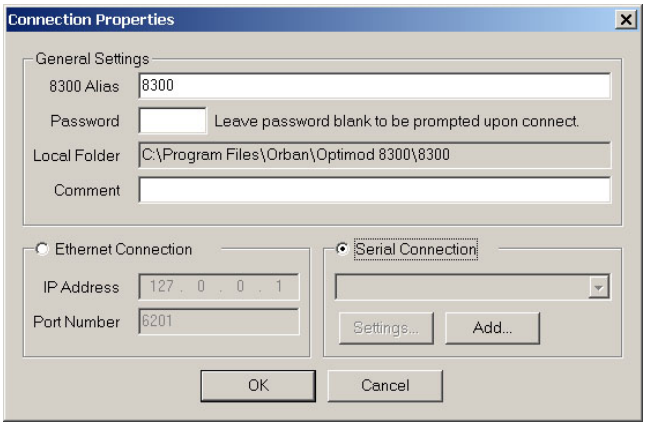



c) Give your 8300 a name (e.g., "KABC") by entering this name in the "8300 Alias" field.

d) If you wish to have 8300 PC Remote remember the password for this Optimod, enter the pass-word in the "Password" field.

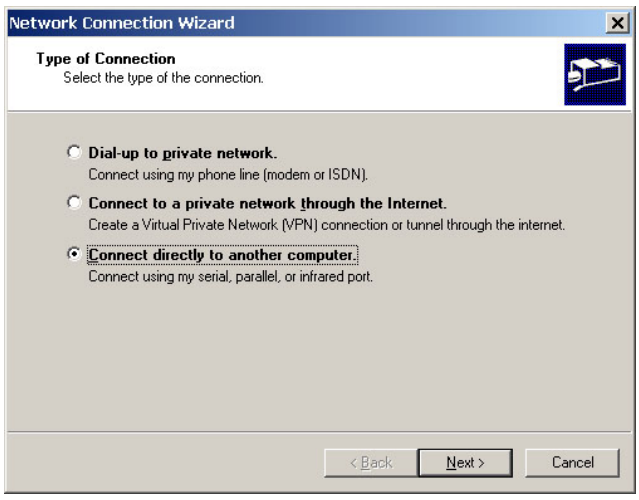
e) Select "Serial Connection."

f) Click "Add."



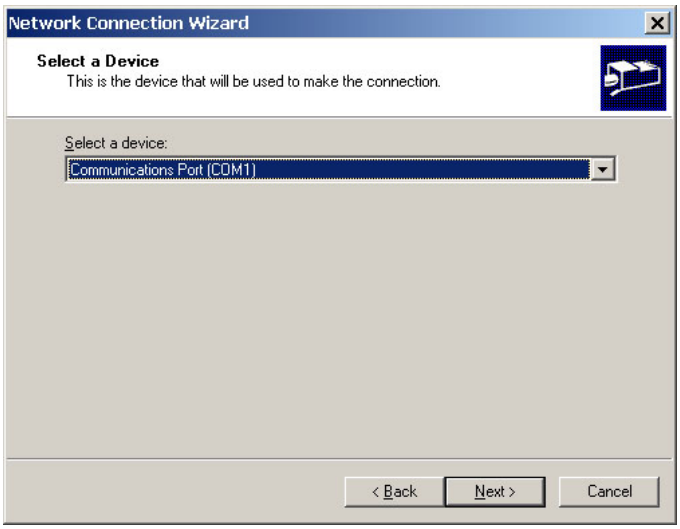

g) Select "Connect Directly to another computer."

h) Click "Next."



i) In the drop-down box, select the serial port you will be using to make the connection.

j) Click "Next."

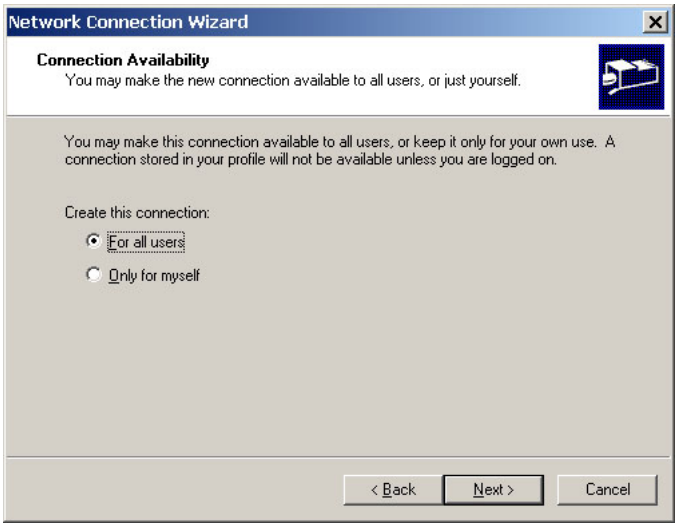



k) Select either "For all users" or "Only for myself."

The correct setting depends on how your network and security are configured.

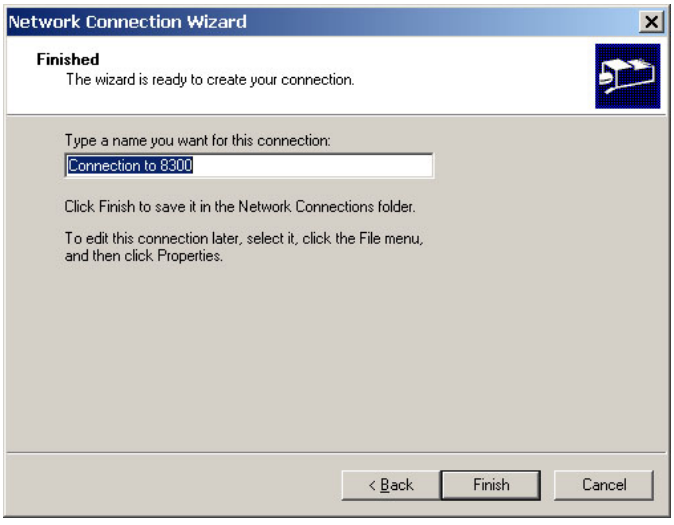
Your wizard may not display this field if your computer is set up for a single user only.

l) Click "Next."

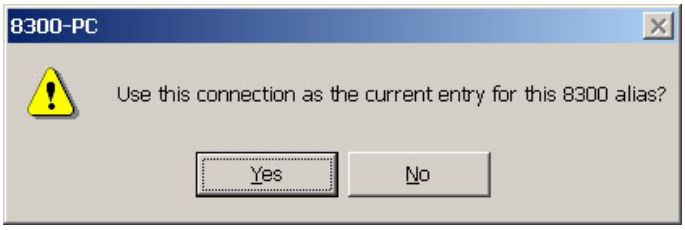



m) Enter a name for your Connection such as: "Connection to 8300."

n) Click "Finish."

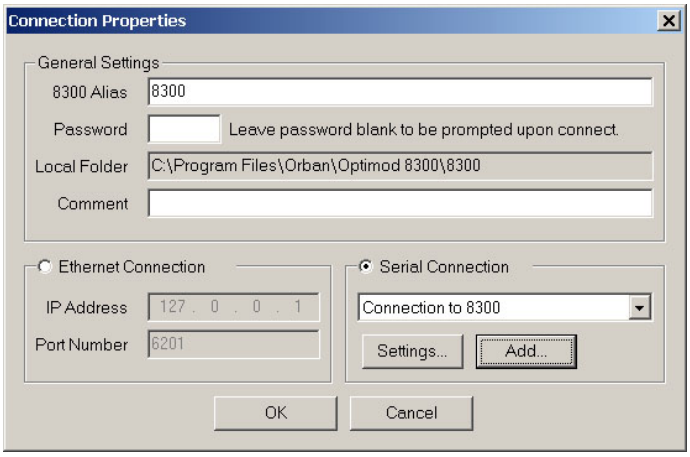


o) Click "Yes."




B) Edit your new Direct Connection properties:

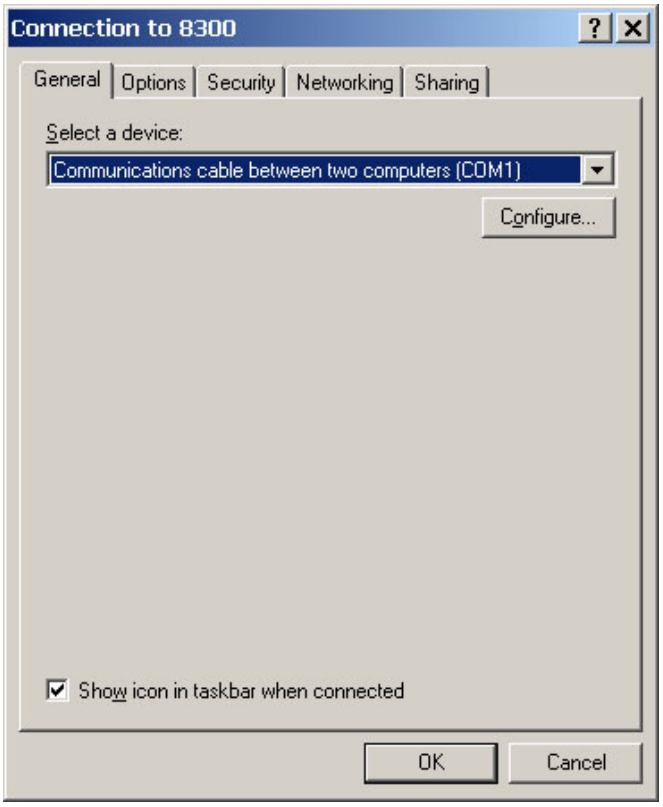
a) Click "Settings."




b) Click the "General" tab.

c) Select the device you set up in step (i) on page 2-49. This will usually be "Communications cable between two computers (COM1)."

d) Click "Configure."

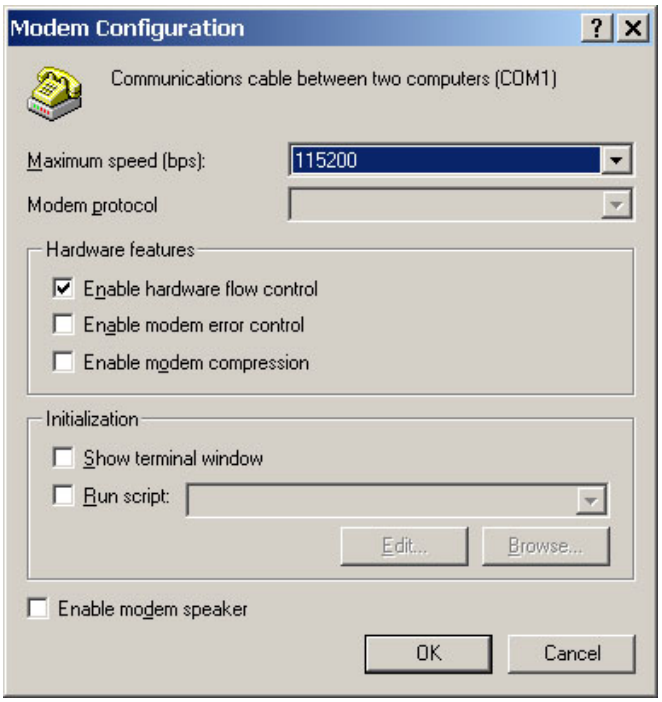


e) Set "Maximum speed (bps)" to "115200."

f) Check "Enable hardware flow control."

g) Make sure that all other boxes are not checked.

h) Click "OK."



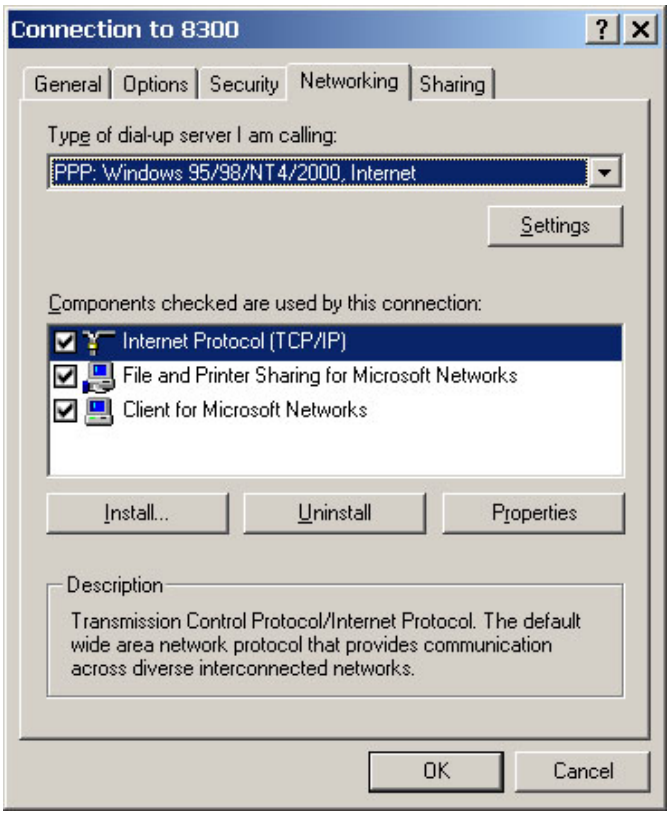

i) Select the Networking tab.

j) Make sure that "PPP: Windows 95 / 98 / NT 4 / 2000, Internet" appears in the "Type of dial-up server I am calling" field.

k) Make sure that "Internet Protocol (TCP/IP) is checked.

> You may leave "File and Printer Sharing for Microsoft Networks" and "Client for Microsoft Networks" checked if you like.

l) Click "OK."




m) When the "Connection properties" window appears, click "OK."

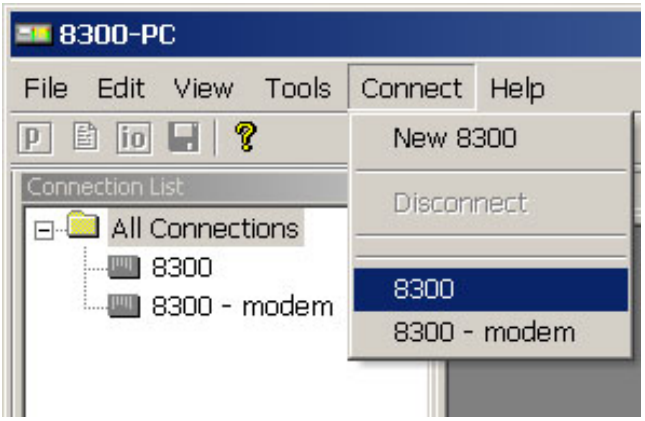
**2. Launch an existing Windows 2000 Direct connection.**

Once you have set up a "connection" specifying Direct Connect in the 8300 PC Remote application (see *To set up a new connection* on page 3-63), choosing this connection from 8300 PC Remote automatically opens a Windows Direct Connection to your 8300.

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, refer to *OS Specific Troubleshooting Advice: Troubleshooting Windows 2000 Direct Connect* on page 5-8. 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.

**3. 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 2-48).

## Connecting Using Windows XP Direct Serial Connection

*If you have already configured your direct serial cable connection, skip to step 2 on page 2-56.*

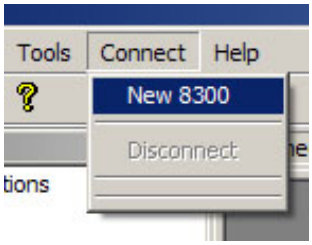
> If you cannot access the Internet after making a Direct or Modem connection, you will have to reconfigure certain networking parameters in Windows. Please see *You Cannot Access the Internet After Making a Direct or Modem Connection to the 8300* on page 5-7.

**1. Add and configure a Direct Connection for Windows XP:**

A) Create a New Windows XP Direct Connection:

a) Launch 8300 PC Remote.

b) Choose "Connect / New 8300"

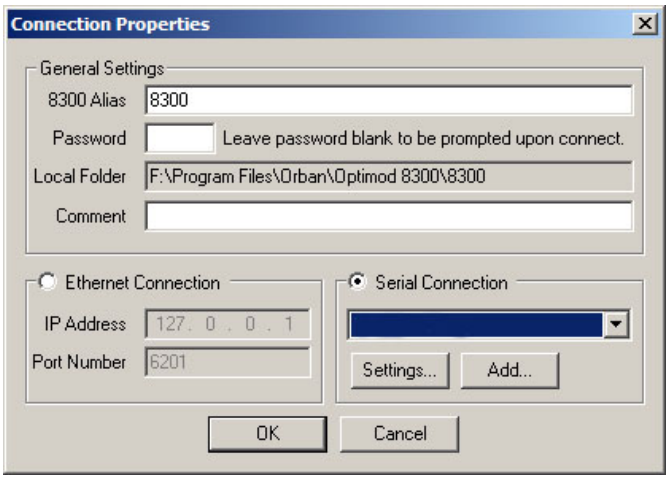


c) Give your 8300 a name (e.g., "KABC") by entering this name in the "8300 Alias" field.

d) If you wish to have 8300 PC Remote remember the password for this Optimod, enter the password in the "Password" field.

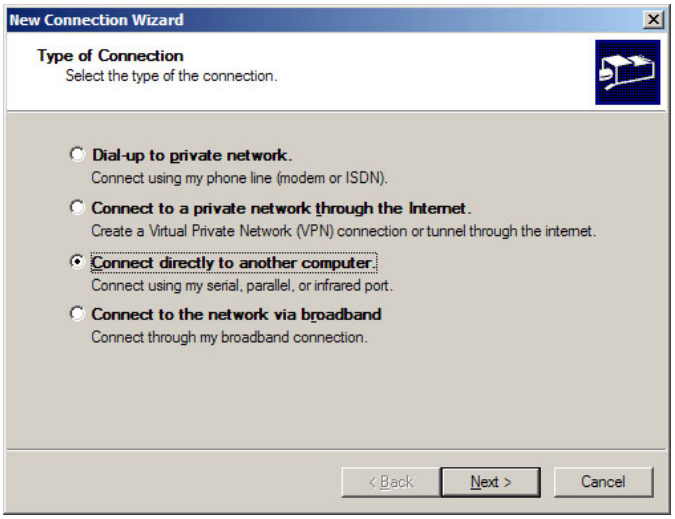
e) Select "Serial Connection."

f) Click the "Add" button.



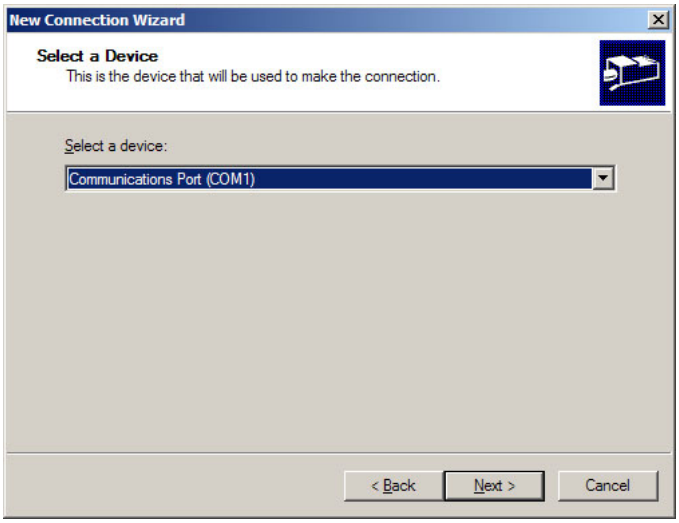

g) Choose "Connect directly to another computer."

h) Click "Next."



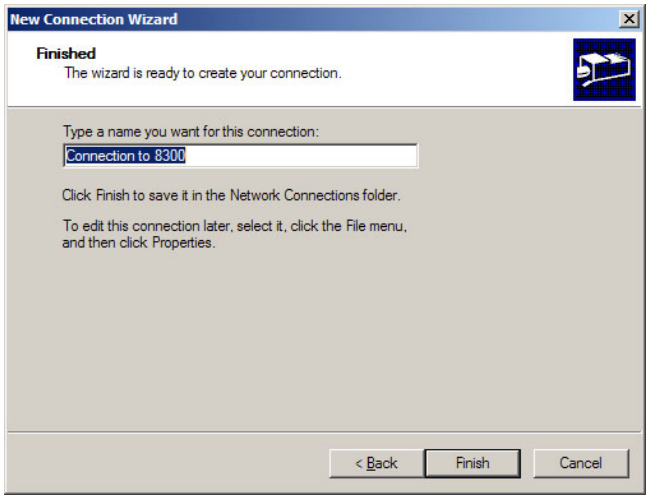

i) In the drop-down box, select the serial port you will be using to make the connection.

j) Click "Next."

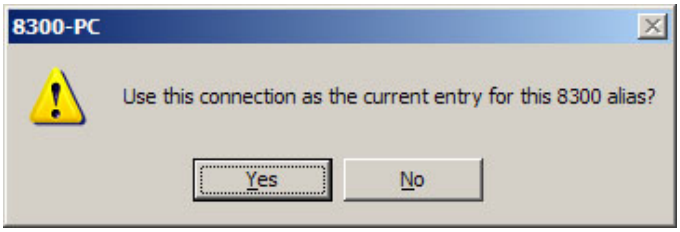


k) Type in a name for your Connection such as: "Connection to 8300."

l) Click "Finish."

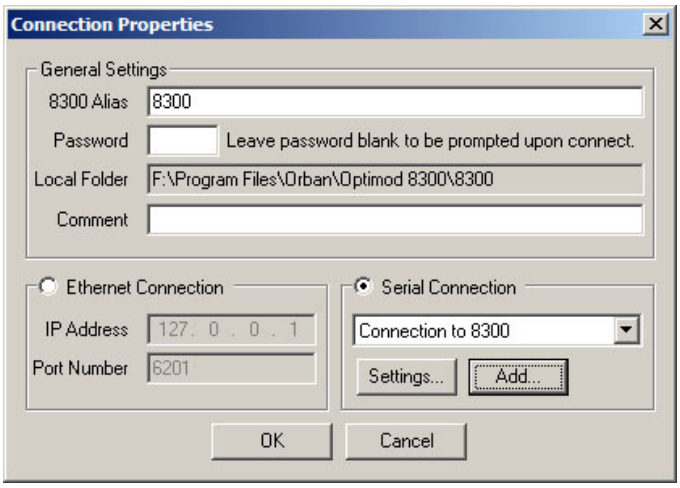



m)Click "Yes."




B) Edit your new Direct Connection properties:

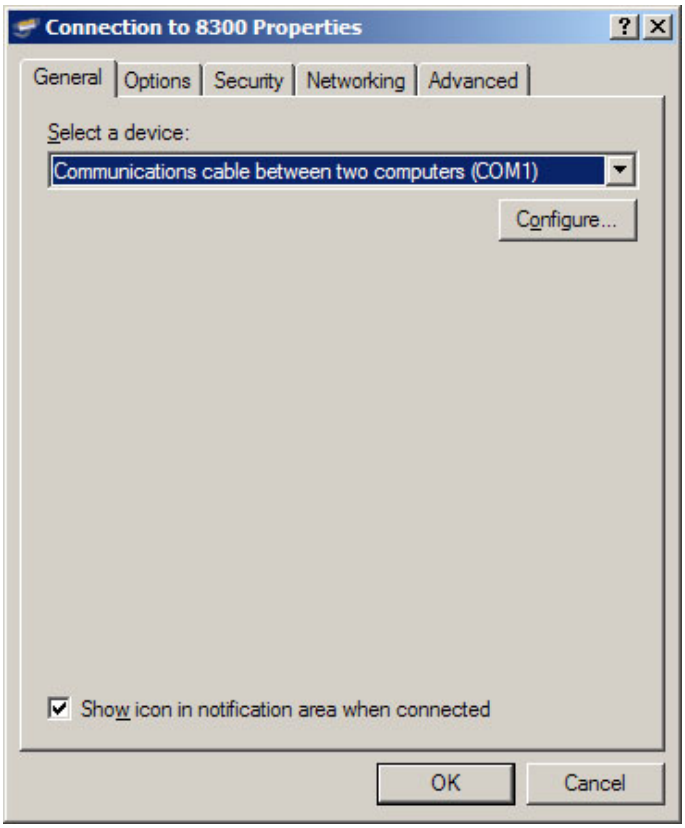
a) Click "Settings."



b) Click the "General" tab.

c) Select the device you set up in step (i) on page 2-53. This will usually be "Communications cable between two computers (COM1)."

d) Click "Configure."

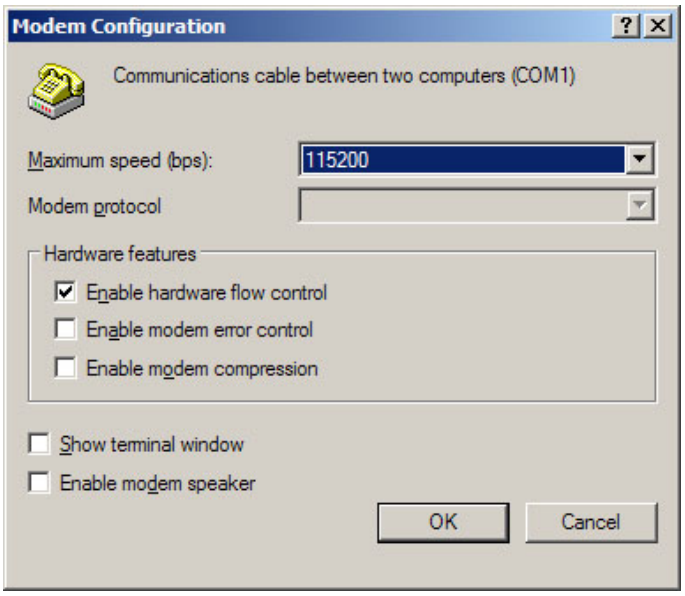



e) Set the "Maximum Speed (bps)" to 115200.

f) Check "Enable hardware flow control."

g) Make sure all other hardware features are unchecked.

h) Click "OK."



i) Select the Networking tab.

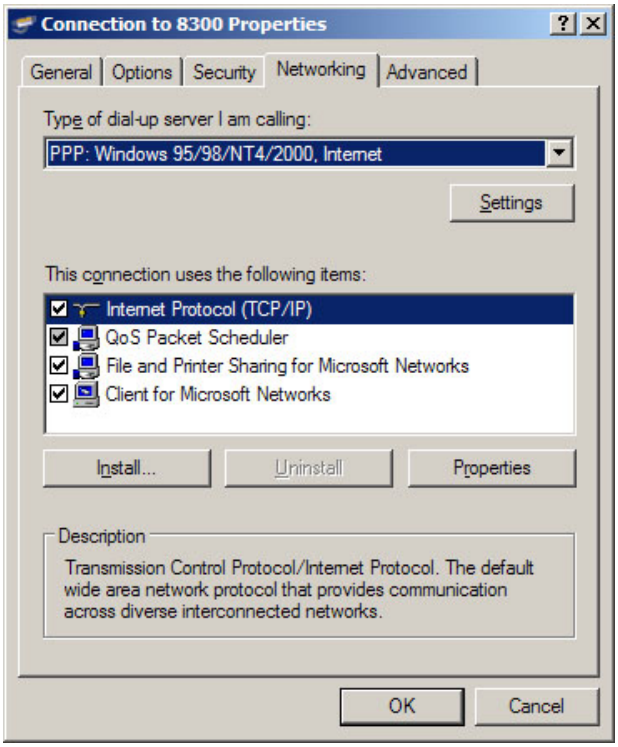
j) Make sure that "PPP: Windows 95 / 98 / NT 4 / 2000, Internet" appears in the "Type of dial-up server I am calling" field.

k) Make sure that "Internet Protocol (TCP/IP) is checked.

> You may leave "File and Printer Sharing for Microsoft Networks" and "Client for Microsoft Networks" checked if you like

l) Click "OK."

m) When the "Connection properties" window appears, click "OK."



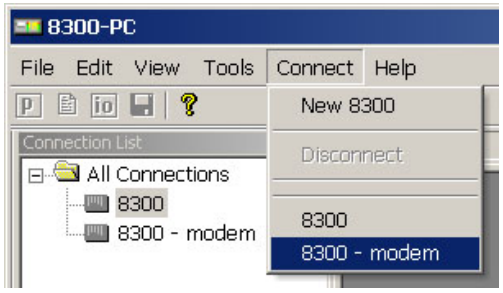

**2. Launch an existing Windows XP Direct connection.**

Once you have set up a "connection" specifying Direct Connect in the 8300 PC Remote application (see *To set up a new connection* on page 3-63), choosing this connection from 8300 PC Remote automatically opens a Windows Direct Connection to your 8300.

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, refer to *Troubleshooting Windows XP Direct Connect* on page 5-11. 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.

**3. 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 2-48).

### Preparing for Communication through Modems

**1. Prepare your 8300 for a modem connection through its serial port.**

See step 2 on page 2-38.

**2. If you have not already done so, create an 8300 passcode.**

See *To Create a Passcode* on page 2-33.

**3. Modem setup:**

You will need two modems and two available phone lines, one of each for your PC and your 8300.

> Reminder: Orban supports only the 3Com / U.S. Robotics® 56kbps fax modem EXT on the 8300 side (although other 56kbps modems will often work OK).

Connect the modem to the 8300's serial port with a standard (not null) modem cable. The cable provided with your 8300 is a null modem cable and will not work.

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 cable from the modem to the serial port of the 8300.

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.

## Connecting Using Windows 2000 Modem Connection

This connection is used both for upgrading your 8300 and for connecting the 8300 PC Remote application to your 8300.

**1. Add and configure modem for Windows 2000:**

If your modem is already installed, skip to *Launch a Windows 2000 Modem connection* on page 2-63.

A) Install Windows 2000 modem:

Use either an internal modem or external modem with your computer.

a) If you are using an external modem, connect the modem to a serial port on your PC and make sure the modem is connected to a working phone line.

b) On your PC, click "Start / Settings / Control Panel / Phone and Modem Options."

c) Click the "Modems" tab.

d) Verify that your modem appears in the list available under "The following Modems are installed."

e) Verify that your modem is "Attached to" the correct port.

If your modem is unavailable or not attached to the correct port, you will need to Add it. See your Windows documentation.

f) If your modem is available in the list available under "The following Modems are installed" and it is attached to the correct port, then click "Properties" for that modem.

g) Make sure the port speed is set at 115200.

h) Click "OK."

B) Create a New Windows 2000 Dial-Up Connection:

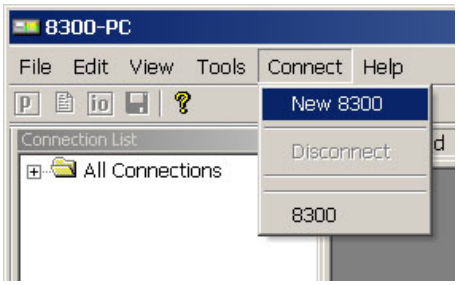
a) Click "Start / Settings / Network and Dial-up Connections / Make New Connection."

b) Once the New Connection Wizard has opened, Click "Next."

C) Create a New Windows 2000 Direct Connection:

a) Launch 8300 PC Remote.

b) Choose "Connect / New 8300"

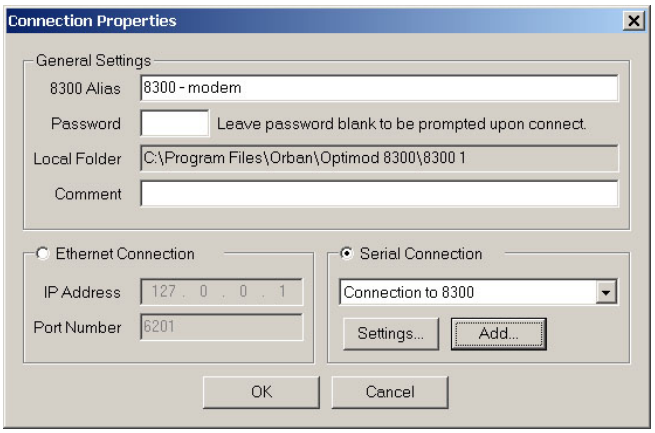


c) Give your 8300 a name (e.g., "KABC") by entering this name in the "8300 Alias" field.

d) If you wish to have 8300 PC Remote remember the password for this Optimod, enter the password in the "Password" field.

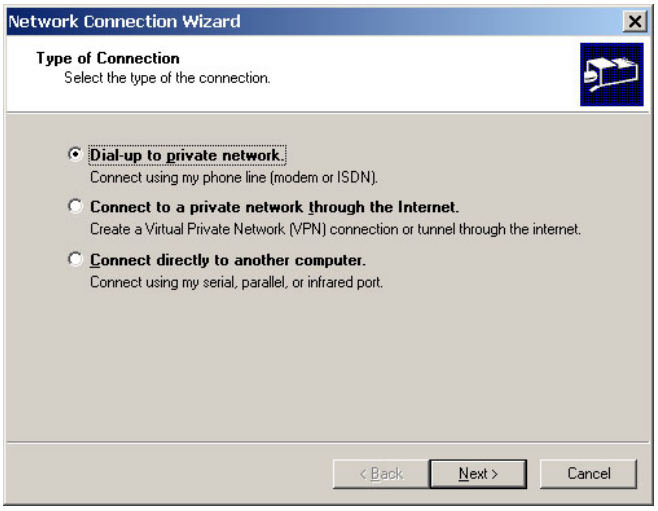
e) Select "Serial Connection."

f) Click the "Add" button.



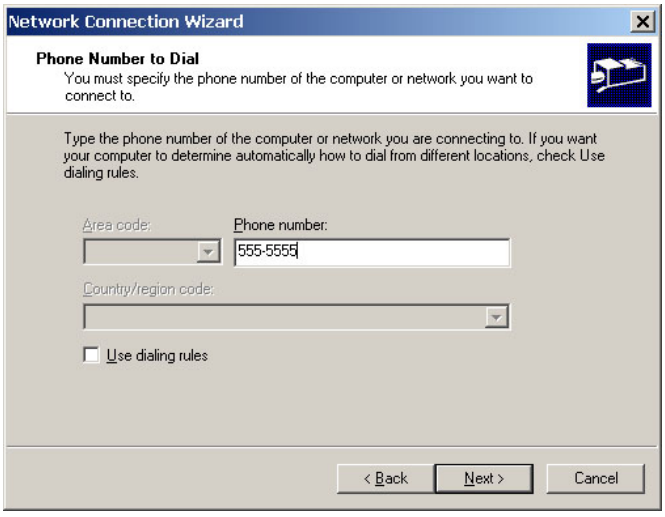

g) Select "Dial-up to private network."

h) Click "Next."




i) Enter the phone number of the modem connected to the 8300 that you are setting up.

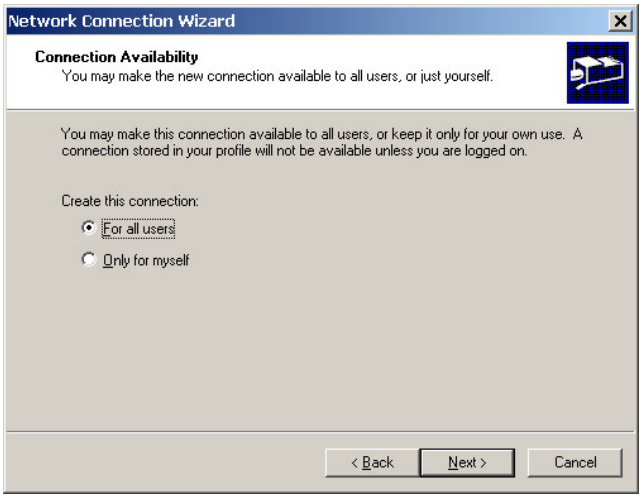
j) Click the "Next" button.



k) Select either "For all users" or "Only for myself."

The correct setting depends on how your network and security are configured.

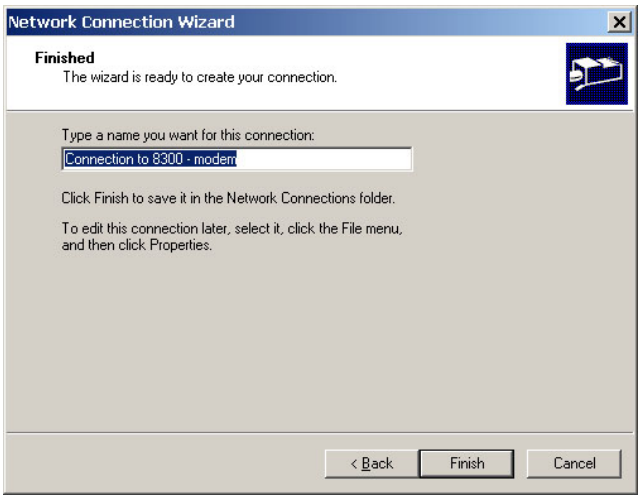
This screen may not appear in computers set up for single users.



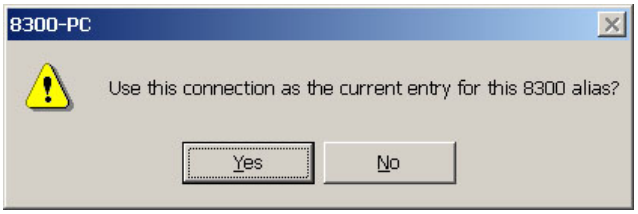

l) Click the "Next" button.

m) Type in a name for your Connection such as: "Connection to 8300–Modem."

n) Click the "Finish" button.

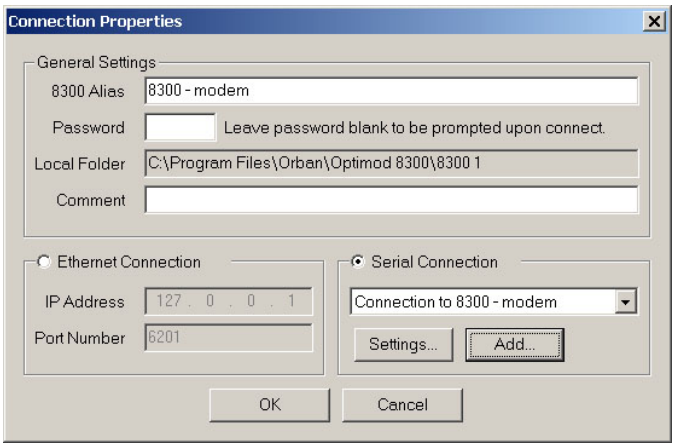



o) Click "Yes."



D) Edit your new Direct Connection properties:

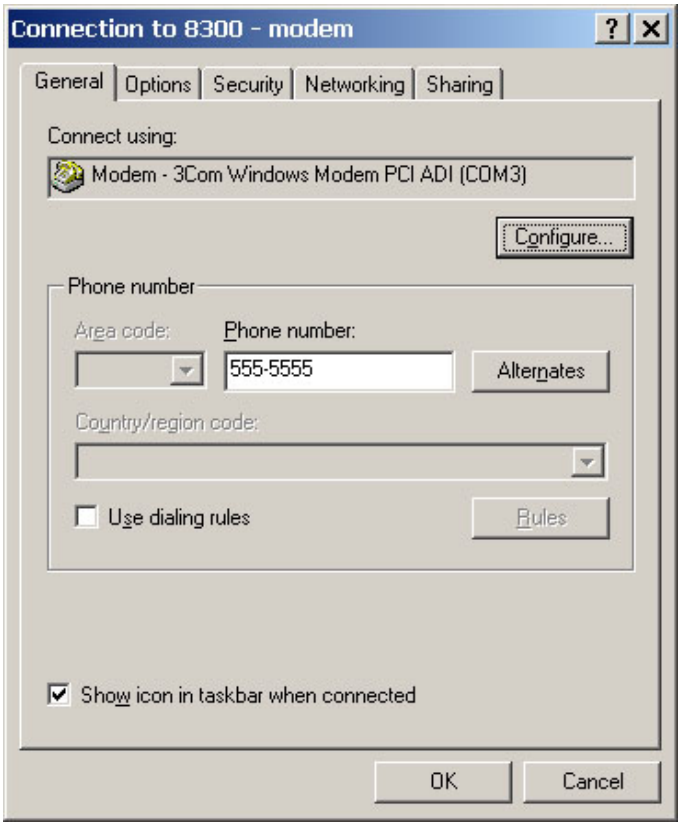
a) Click “Settings.”




b) Click the “General” tab.

c) In the “Connect using” field, select the modem you will be using to make the connection on the PC side.

d) Click “Configure.”



e) Set "Maximum speed (bps)" to "115200."

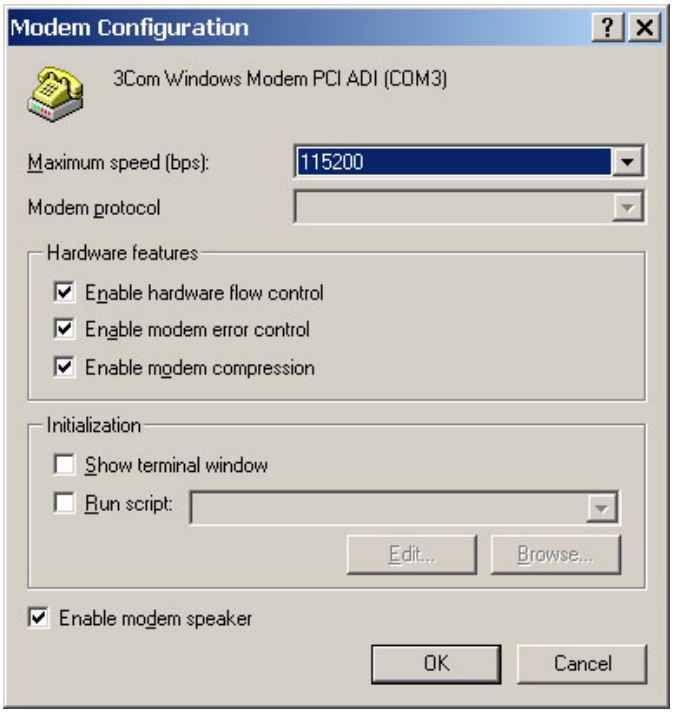
f) Check "Enable hardware flow control."

g) Check "Enable modem error control."

h) Check "Enable mcdem compression."

i) Make sure that all other boxes are not checked.

j) Click "OK."




k) Select the Networking tab.

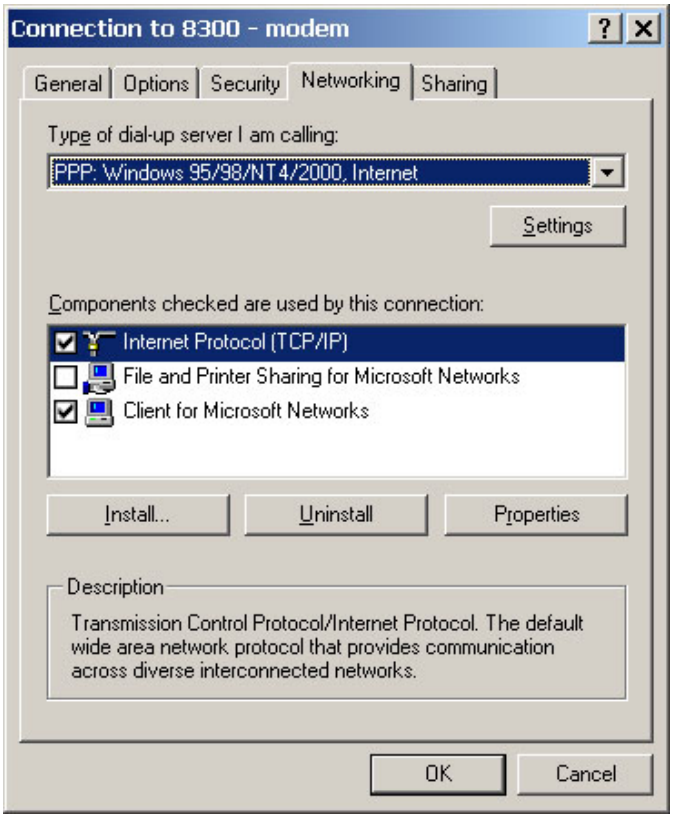
l) Make sure that "PPP: Windows 95 / 98 / NT 4 / 2000, Internet" appears in the "Type of dial-up server I am calling" field.

m) Make sure that "Internet Protocol (TCP/IP) is checked.

You may leave "Client for Microsoft Neworks" checked if you like.

n) Click "OK."

o) When the "Connection properties" window appears, click "OK."



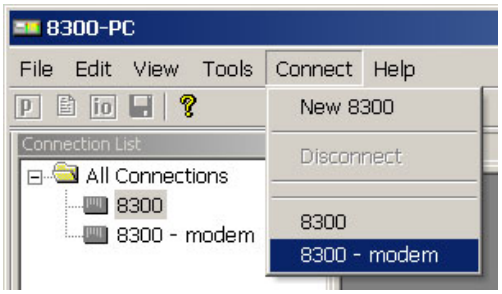
2. **Launch a Windows 2000 Modem connection.**

   Once you have set up a "connection" specifying a modem connection in the 8300 PC Remote application (see *To set up a new connection* on page 3-63), choosing this connection from 8300 PC Remote automatically opens a Windows modem connection to your 8300.

   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.

   If the connection is successful, a dialog bubble will appear on the bottom right hand corner of the screen verifying your connection.




   If you have trouble making a connection, refer to *OS Specific Troubleshooting Advice: Troubleshooting Windows 2000 Modem Connect* on page 5-10. 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.

3. **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 2-59).

## Connecting using Windows XP Modem Connection

1. **Add and configure modem for Windows XP:**

   *Skip this step if your modem is already configured and working.*

   A) Configure the Windows XP PC ports:

      Use either an internal modem or external modem with your computer.

   a) If you are using an external modem, connect the modem to a serial port on your PC.

   b) Make sure the modem is connected to a working phone line.

   c) Click "Start / Control Panel / Systems."

   d) Go to the "Hardware" tab and click "Device Manager."

   e) In the Device Manager dialog box click the "+" next to the "Ports (COM and LPT)" icon.

      A list will branch off, showing your available ports.

   f) Double-click "Communications Port (COM1) or (COM2)," depending on how you set up your system.

      The "Communications Port (Comx) Properties" dialog box opens.

Not all PCs have a COM2.

**IMPORTANT**: The COM port you choose at this point *must* match the COM port to which you connected your modem.

g) From the tabs at the top, choose "Port Settings" and configure the settings to match your PC modem.

If you are using a U.S. Robotics® external modem, the settings will be: Bits per second= 115200, Data bits = 8, Parity = None, Stop bits = 1, Flow Control = None.

h) When you are finished, click the OK button to close the "Communications Port (Comx) Properties" dialog box.

i) Click the OK button in the "Systems Properties" dialog window.

j) Close the "Control Panel" window.

*If your modem is already installed, skip to* Launch an existing Windows XP modem connection *on page 2-68.*

B) Install the Windows XP modem:

a) Use either an internal modem or external modem with your computer.

If you are using an external modem, connect the modem to a serial port on your PC and make sure the modem is connected to a working phone line.

b) On your PC, click "Start / Settings / Control Panel / Phone and Modem Options."

c) Click the "Modems" tab.

d) Verify that your modem appears in the list available under "The following Modems are installed."

e) Verify that your modem is "Attached to" the correct port.

If your modem is unavailable or not attached to the correct port, you will need to Add it. See your Windows documentation.

f) If your modem is available in the list available under "The following Modems are installed" and it is attached to the correct port, then click "Properties" for that modem.

g) Make sure the port speed is set at 115200.

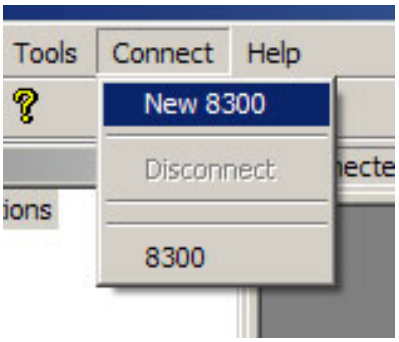
h) Click "OK."

C) Create a new Windows XP modem connection:

a) Launch 8300 PC Remote.

b) Choose "Connect / New 8300."

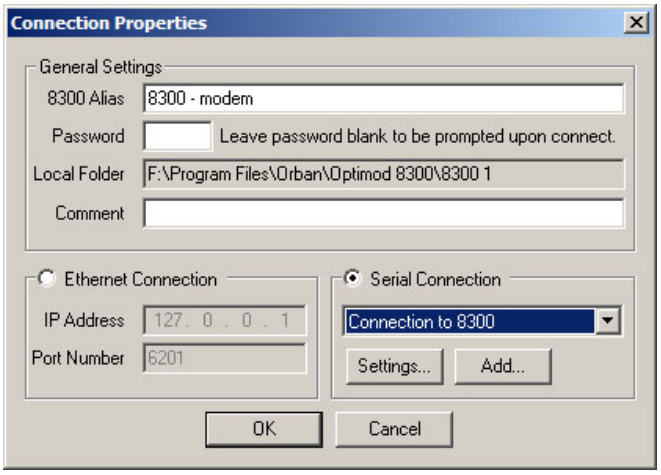
The Connection Properties window opens.




c) Give your 8300 a name (e.g., "KABC") by entering this name in the "8300 Alias" field.

d) If you wish to have 8300 PC Remote remember the password for this Optimod, enter the password in the "Password" field.

You must enter a valid password to connect. This means that at least one 8300 passcode must have been assigned via the 8300's front panel. (See *To Create a Passcode* on page 2-33.)




e) Click "Add."

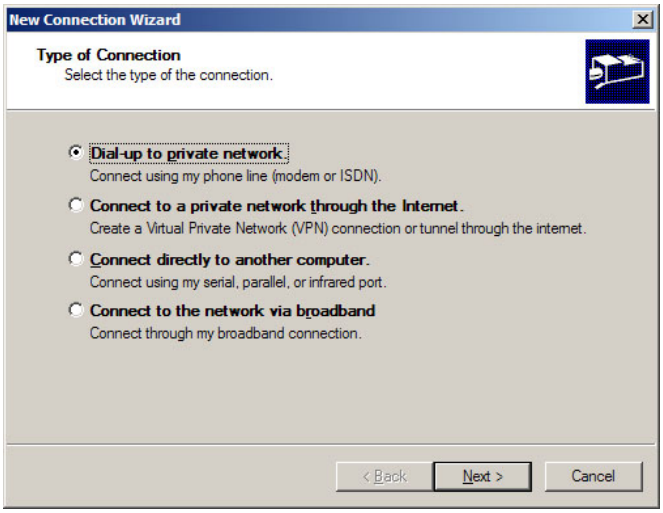
The Windows New Connection Wizard starts up.

f) Select "Serial Connection."

g) Click the "Add" button.

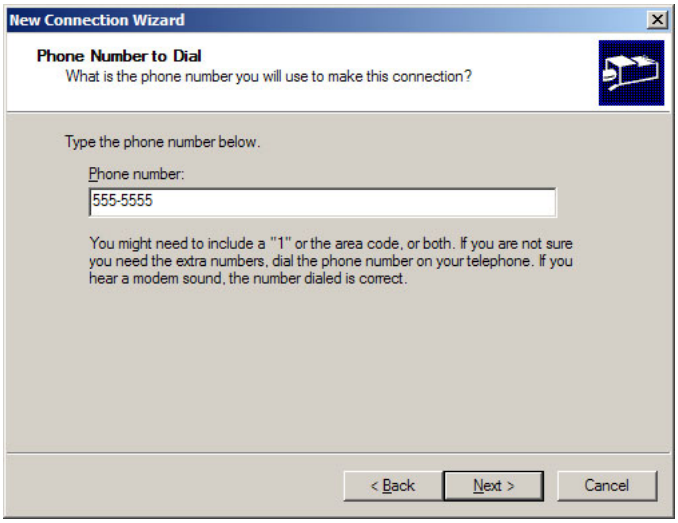
h) Select "Dial-up to private network."

i) Click "Next."



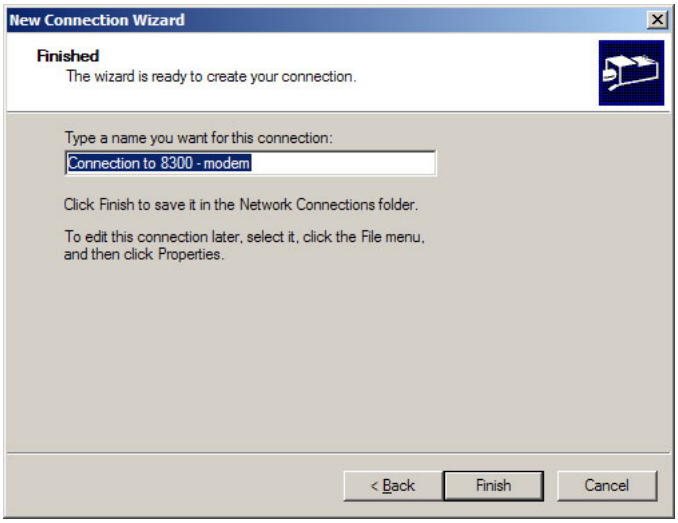
j) Enter the phone number of the modem connected to the 8300 you are setting up.

k) Click "Next."

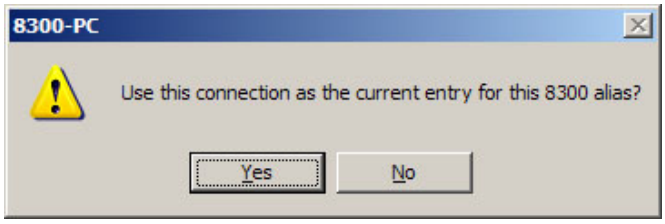



l) Type in a name for your Connection such as: "Connection to 8300 – Modem"

m) Click the "Finish" button.

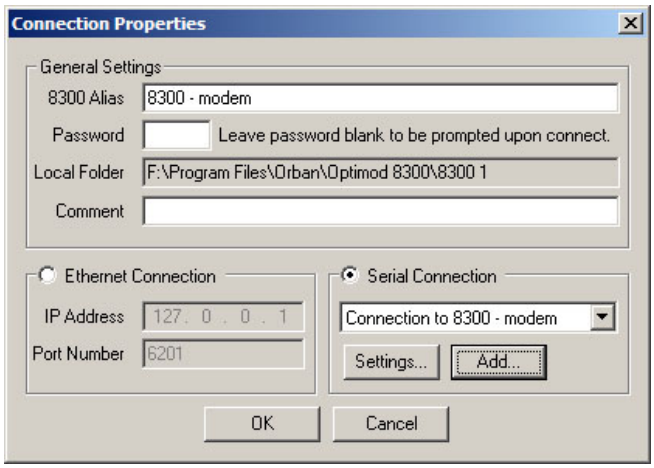



n) Click "Yes."



D) Edit your new Direct Connection properties:

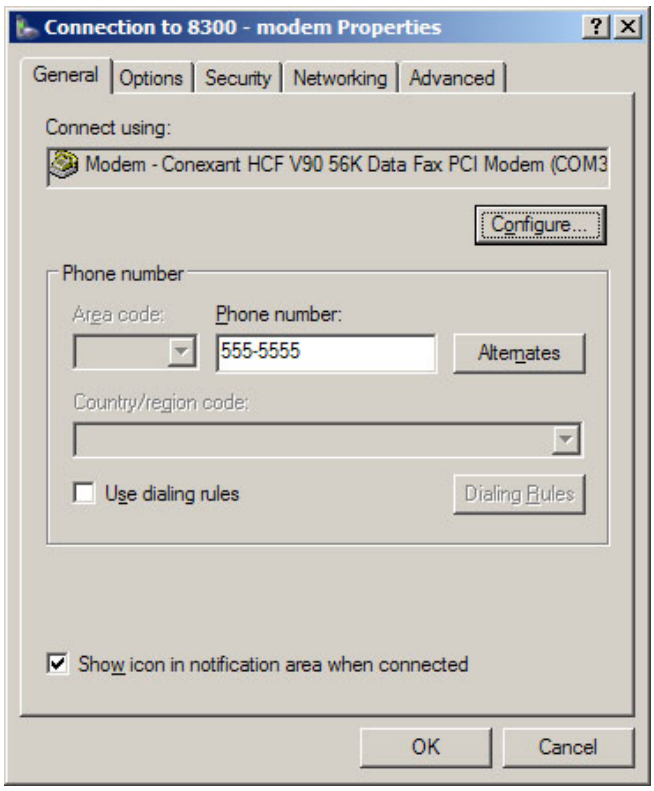
a) Click “Settings.”




b) Click the “General” tab.

c) Select the modem you will be using to make the connection on the PC side.

d) Click “Configure.”



e) Set "Maximum speed (bps)" to "115200."

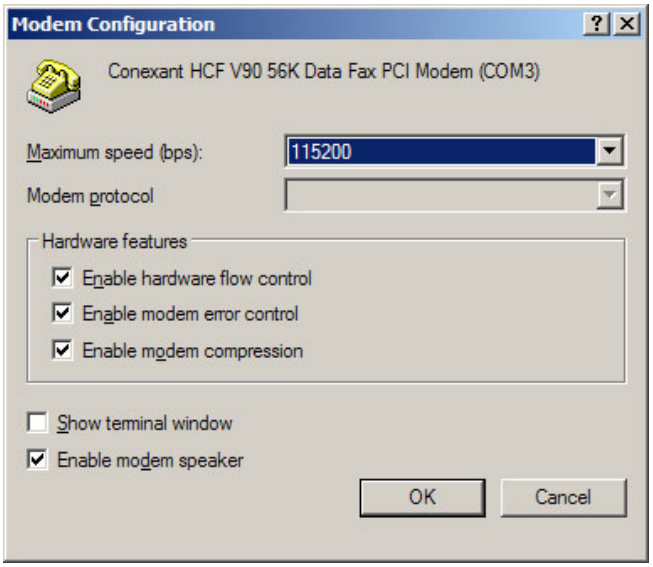
f) Check "Enable hardware flow control."

g) Check "Enable modem error control."

h) Check "Enable mcdem compression."

i) Make sure that no other box is checked.

j) Click "OK."




k) Select the Networking tab.

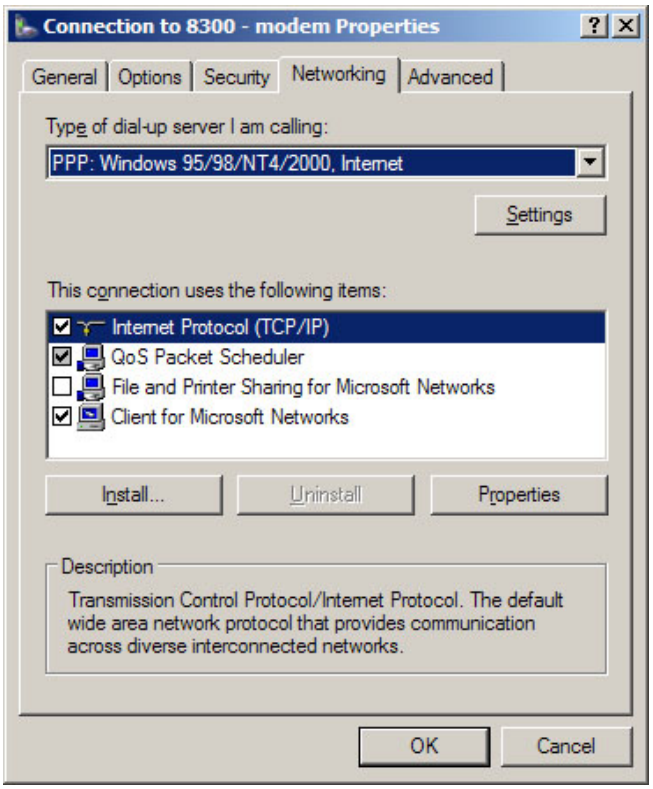
l) Make sure that "PPP: Windows 95 / 98 / NT4 / 2000, Internet" ap–pears in the "Type of dial-up server I am calling" field.

m) Make sure that "Inter-net Protocol (TCP/IP) is checked.

> You may leave "Cli-ent for Microsoft Networks" checked if you like.

n) Click "OK."

o) When the "Connection properties" window ap-pears, click "OK."



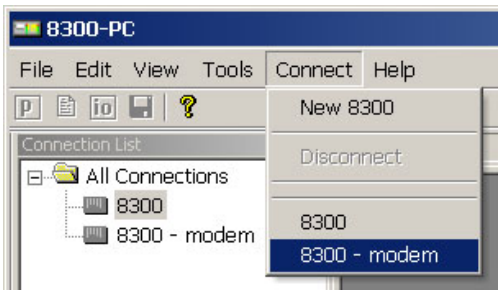

**2. Launch an existing Windows XP modem connection.**

Once you have set up a "connection" specifying a modem connection in the 8300 PC Remote application (see *To set up a new connection* on page 3-63), choosing this connection from 8300 PC Remote automatically opens a Windows modem connection to your 8300.

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.

If the connection is successful, a dialog bubble will appear on the bottom right hand corner of the screen verifying your connection.




If you have trouble making a connection, refer to *Troubleshooting Windows XP Modem Connect* on page 5-11. 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.

3. **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 2-59).

## Updating your 8300's Software

The software version number of PC Remote must be the same as the version number of the software running within your 8300. If the software version of PC Remote is higher than the version running in your 8300, PC Remote will automatically detect this and will offer to update your 8300's software automatically.

1. **If you have not already done so, prepare your computer and the 8300 for a direct serial, modem, or Ethernet connection.**

   See *Networking and Remote Control* starting on page 2-37.

2. **Install the latest version of 8300 PC Remote software on your computer.**

   This is available from

   ftp://orban.com/8300

   See *Installing* 8300 PC Remote Control Software on page 2-43.

   See the readme8300_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 8300 PC Remote and set up a "connection" to the 8300 you will be updating.**

   See *To set up a new connection* on page 3-63.

**4. Update your 8300.**

A) Attempt to initiate communication to your 8300 via your connection.

See *To initiate communication* on page 3-63.

8300 PC Remote will automatically detect that the 8300 software version on your 8300 is not the same as the version of 8300 PC Remote. PC Remote will then offer to update your 8300 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 8300 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 8300 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 8300's rebooting.

Your 8300 will continue to pass audio normally while the update is occurring. *However, the audio will be interrupted for approximately 3 seconds when your 8300 reboots.*

*Do not interrupt power to your 8300 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 8300 (because of extensive backup and error-checking provisions in your 8300), they will certainly cause the update to fail.

C) When the 8300 screen display returns after its automatic reboot, the 8300 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 8300 screen remains blank for more than one minute after the update has completed, manually reboot the 8300 by removing AC power from the 8300 for at least ten seconds and then powering the 8300 back up.

E) The 8300 software update is now complete. You should now be able to connect to your 8300 via PC Remote.

NOTE: If you cannot make a connection after a software upgrade, manually reboot the 8300 with a normal "power-off/power-on" sequence.

# Section 3
# Operation

## 8300 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 8300 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 8300.

  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 18 on page 2-21 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 8300 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 8300'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 8300's analog to digital converter, which is a very common cause of audible distortion.

- **AGC** meter shows the gain reduction of the slow two-band AGC processing that precedes the multi-band compressor. Full-scale is 25 dB gain reduction. You can switch the meter so that it reads the gain reduction of the Master (above-200 Hz) band, the Bass (below-200Hz) band, or the difference between the gain reductions in the Master and Bass bands. *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 AGC gate threshold control (via the Full Modify screen's AGC GATE control). When this happens, the AGC's recovery time is slowed to prevent noise rush-up during low-level passages.

- **Gain Reduction** meters show the gain reduction in the multi-band compressor. Full-scale is 25 dB gain reduction.

  When the Multi-Band structure is operating, all the meters indicate gain reduction. When the Two-Band structure is operating, the two leftmost meters indicate gain reduction in the Master and Bass bands, while the rightmost meters indicate the gain reduction in the two-band high frequency limiter.

- **Multiplex Power / HD Gain Reduction** meter is switchable via the METER FUNCTION control in SETUP. In MULTIPLEX POWER mode, it indicates the action of the ITU412 Multiplex Power controller. It shows how much the MPX Power Controller has reduced the clipper drive, thereby reducing the average power in the processed audio. It will show no gain reduction unless the MPX Power Controller is turned on. In HD GR mode, the meter indicates the larger of the gain reductions in the left and right channel look-ahead limiters for the HD Radio / digital radio / netcast processing chain.

- **Composite** meter shows the output level of the stereo encoder before the composite output attenuators. The meter's reading is calibrated in percent modulation.

# Introduction to Processing

### 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. Listeners will perceive excessive clipping 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 peaks that are coming up.

The 8300 uses look-ahead techniques in several parts of the processing to minimize overshoot for a given level of processing artifacts (among other things).

### 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 FM processing, there is a direct trade-off between loudness, brightness, and distortion. You can improve one only at the expense of one or both of the others. 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.

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, there is nothing the listener can do to 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 radios) 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.

## OPTIMOD-FM — from Bach to Rock

OPTIMOD-FM can be adjusted so that the output sounds:

- as close as possible to the input at all times (using the Two-Band structure)
- open but more uniform in frequency balance (and often more dramatic) than the input (using the Five-Band structure with slow release times)
- dense, quite squashed, and very loud (using the Five-Band structure with fast or medium-fast 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.

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.

## Fundamental Requirements: High-Quality Source Material and Accurate Monitoring

A major potential cause of distortion is excess peak limiting. Another cause is poor-quality source material, including the effects of the station's playback machines, electronics, and studio-to-transmitter link. If the source material is even slightly distorted, that distortion can be greatly exaggerated by OPTIMOD-FM — particularly if a large amount of gain reduction is used. Very clean audio can be processed harder without producing objectionable distortion. A high-quality monitor system is essen-

tial. To modify your air sound effectively, you must be able to hear the results of your adjustments. In too many stations, the best monitor is significantly inferior to the receivers found in many listeners' homes!

At this writing, there has been a very disturbing trend in CD mastering to apply levels of audio processing to CDs formerly only used by "aggressively-processed" radio stations. These CDs are audibly distorted (sometimes blatantly so) before any further OPTIMOD processing. The result of 8300 processing can be to exaggerate this distortion and make these recordings noticeably unpleasant to listen to over the air.

There is very little that a radio station can do with these CDs other than to use conservative 8300 presets, which will cause loudness loss that may be undesired in competitive markets. There is a myth in the record industry that applying "radio-style" processing to CDs in mastering will cause them to be louder or will reduce the audible effects of on-air processing. In fact, the opposite is true: these CDs will not be louder on air, but they will be audibly distorted and unpleasant to listen to, lacking punch and clarity.

Another unfortunate trend is the tendency to put so much high frequency energy on the CDs that this energy cannot possibly survive the FM pre-emphasis / de-emphasis process. Although the 8300 loses less high frequency energy than any previous Orban processor (due to improvements in high frequency limiting and clipping technology), it is nevertheless no match for CDs that are mastered so bright that they will curl the vinyl off car dashboards.

We hope that the record industry will come to its senses when it hears the consequences of these practices on the air.

# About the 8300's Signal Processing Features

## Signal Flow

The signal flows through the 8300 through the following blocks (see page 6-62):

- **Input Conditioning**, including sample rate conversion, defeatable 30Hz high-pass filtering, and defeatable phase rotation
- **Stereo Enhancement**
- **Two-Band Gated AGC**, with target-zone window gating and silence gating
- **Equalization**, including high-frequency enhancement
- **Multiband Compression** with embedded HF clipping and additional HF limiter
- **HD Processing**, which runs in parallel with the remaining blocks below
- "**Intelligent" Clipping** with distortion control, distortion cancellation, and anti-aliasing

- **Overshoot Compensation**
- **DSP-derived Stereo Encoder** (stereo generator)
- **Composite Level Control Processor**

**Input Conditioning:** The 8300 operates at 32 kHz sample rate and power-of-two multiples thereof (up to 512 kHz in the stereo encoder). No commercial A/D converters or sample rate converter chips convert to 32 kHz while maintaining the standards we demanded for this product. Therefore, to ensure high quality A/D and sample rate conversion, we operate both the SRC and A/D chips at 64 kHz-output sample rate and then downsample to 32 kHz in DSP. By designing and implementing our own downsampler, we can ensure full frequency response to 15 kHz with very low spurious images.

Despite myths circulating in the marketplace regarding the alleged superiority of higher sample rates in FM stereo processors, 32 kHz is, in fact, an efficient and excellent-sounding choice for a basic sample rate. 32 kHz allows us to use DSP horsepower more efficiently, adding features that *really* improve the sound. By strictly limiting the output bandwidth to 16 kHz, it also makes it easier to protect the stereo pilot tone and RDS subcarriers spectrally. Although a 16 kHz bandwidth limitation is more than is strictly needed to protect the pilot tone, the RDS requires protection over a substantially wider bandwidth (±2 kHz), and 16 kHz provides this protection.

The 8300's output spectral control is immaculate, ensuring maximum stereo and RDS coverage. Moreover, the 8300's digital output will pass through any uncompressed digital STL (including those operating at 32 kHz sample rate) without added overshoot and without the need for distortion-producing overshoot compensation schemes.

A defeatable 30Hz 18 dB/octave highpass filter and a defeatable phase rotator complete the input-conditioning block. These have both been features in Orban FM processors for many years. Most users will defeat the 30Hz filter and leave the phase rotator in-circuit, although the choice is always yours.

**Stereo Enhancement:** The 8300 provides a stereo enhancement algorithm 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.

**Two-Band Gated AGC:** The AGC is a two-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 3 dB), 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 ∞: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 8300 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 8300'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 0.15 dB. 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 8300 HF Enhancer is a program-controlled HF shelving equalizer that was originally introduced in Orban's 2200 OPTIMOD-FM. It intelligently and continuously analyzes the ratio between broadband and HF energy in the input program material, and can equalize excessively dull material without over-enhancing bright material. It interacts synergistically with the five-band compressor to produce sound that is bright and present without being excessively shrill.

**Multiband Compression:** The multiband compressor can be operated in five-band or two-band mode. In addition to using a special high-frequency limiter, we control high frequencies with distortion-canceled clipping. The clipper in the 8300 operates at 256 kHz-sample rate and is full anti-aliased.

Ordinarily, the gain reduction in band 5 follows the gain reduction in band 4 (as determined by the setting of the B4>B5 COUPLE control); these bands are only independent from the viewpoint of the downward expander and multiband clippers. However, a high frequency limiter causes additional gain reduction in band 5 when band 5 multiband clipping alone would be insufficient to prevent HF distortion. The HF limiter uses a sophisticated analysis of the signal conditions in the 8300's clipping system to do this.

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).

**Digital Radio Processing:** After multiband compression, the signal path splits into two branches. The FM analog processing branch applies high frequency limiting and clipping, while the digital radio branch applies look-ahead limiting to the audio. To

achieve cleanest sound, the digital radio branch is unaffected by the bass clipper embedded in the multiband limiter's crossover.

**"Intelligent" Clipping:** The 8300 prevents excess clipping distortion by dynamically reducing the drive level to the clippers as required, using an intelligent analysis of the clipping distortion produced in the final clipper and overshoot compensator.

**DSP-derived Stereo Encoder:** The 8300's stereo encoder is derived from algorithms first developed for the high-performance Orban 8218 stand-alone encoder. The 8300's stereo encoder operates at 512 kHz-sample rate to ease the performance requirements of the D/A converter's reconstruction filter, making it possible to achieve excellent stereo separation that is stable over time and temperature.

The 8300 has two independent composite outputs, whose levels are both software-settable. For convenience, two SCA inputs sum into the 8300's analog composite output amplifier. The second input can be configured to provide a 19 kHz-reference output for subcarrier generators that need it.

The 8300 does not digitize SCAs.

**Composite Limiter:** Orban has traditionally opposed composite clipping because of its tendency to interfere with the stereo pilot tone and with subcarriers, and because it causes inharmonic aliasing distortion, particularly between the stereo main and subchannels. Protecting the pilot tone and subcarrier regions is particularly difficult with a conventional composite clipper because appropriate filters will not only add overshoot but also compromise stereo separation — filtering causes the single-channel composite waveform to "lift off the baseline."

Nevertheless, we are aware that many engineers are fond of composite clipping. We therefore undertook a research project to find a way to peak-control the composite waveform without significantly compromising separation, pilot protection, or subcarrier protection, and without adding the pumping typical of simple gain-control "look-ahead" solutions.

We succeeded in our effort. The 8300 offers a patented "Half-Cosine Interpolation" composite limiter that provides excellent spectral protection of the pilot tone and SCAs (including RDS), while still providing approximately 60 dB of separation when a single-channel composite waveform is clipped to 3 dB depth. To ensure accurate peak control, the limiter operates at 512 kHz sample rate.

Like conventional composite clipping, the new algorithm can still cause aliasing distortion between the stereo main and subchannels. However, this is the inevitable cost of increasing the power-handling capability beyond 100% modulation above 5 kHz — the characteristic that makes some people like composite clipping. This exploits the fact that the fundamental frequency in a square wave has a higher peak level than the square wave itself. However, any process that makes squared-off waveforms above 5 kHz creates higher harmonics that end up in the stereo subchannel region (23-53 kHz). The receiver then decodes these harmonics as if they were L–R information, and the decoded harmonics appear at new frequencies not harmonically related to the original frequency that generated them.

While the processing never clips the pilot tone, the extra spectrum generated by the processing can fall into the 19 kHz region, compromising the ability of receivers to recover the pilot tone cleanly. Therefore, the 8300's composite processor has a 19 kHz notch filter to protect the pilot tone. This filter does not compromise stereo separation in any way.

We still prefer to use the 8300's main clipping system to do the vast majority of the work because of its sophisticated distortion-controlling mechanisms. This means that the 8300 does *not* rely on composite processing to get loud. Consequently, people using its left/right-domain AES3 digital output can enjoy the loudness benefits of the 8300's processing — the 8300 gets *very* loud without composite clipping.

## ITU-R 412 Compliance

ITU-R 412 requires the "average multiplex power" to be limited to a standard value. The 8300 contains a patented, defeatable feedback multiplex power limiter that constantly monitors the multiplex power according to ITU-R 412 standards. The power controller automatically reduces the average modulation to ensure compliance. It allows you to set the "texture" of the processing freely, using any preset. If a given processing setting would otherwise exceed the multiplex power limit, the power controller automatically reduces the drive to the peak limiting system by increasing the amount of multiband compression. This action retains the processing texture but reduces distortion while controlling multiplex power.

The 8300 gives you control over the multiplex power threshold. This allows you to compensate for overshoots in the signal path upstream from the 8300, preventing excessive reduction of the multiplex power.

The ITU412 control is found in the Modify / Stereo Encoder screen.

Power control is applied to all outputs, not just the composite output.

Patents are pending on this system.

## Two-Band Purist Processing

In addition to five-band processing, suitable for pop music and talk formats, the 8300 offers a very high-quality two-band algorithm. This is phase-linear and features the same AGC as the five-band processor, followed by a two-band processor. Sophisticated multiband high frequency limiting and distortion-controlled clipping complete the chain.

We believe that this is the ideal processing for classical music 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 FM preemphasis curve. We have heard four-band, allegedly "purist" processing that caused dynamic HF lift. This created a strident, unnatural sound in strings and brass. In contrast, the 8300's two-band phase-linear structure keeps the musical spectrum coherent and natural.

### Input/Output Delay

The algorithmic improvements in the 8300 over earlier generations of Orban DSP-based processing (8200 and 2200) have one significant cost — the input/output time delay is typically 15 ms. To make intelligent decisions about how to process, the 8300 needs to look ahead at the next part of the program waveform. As digital on-air processing advances further and further from its analog roots, this is the inevitable price of progress.

15 ms is comfortably below the psychoacoustic "echo fusion threshold," which means that talent will not hear discrete slap echoes in their headphones. This means that they can monitor comfortably off-air without being distracted or confused.

Some talent moving from an analog processing chain will require a learning period to become accustomed to the voice coloration caused by "bone-conduction" comb filtering. This is caused by the delayed headphone sound's mixing with the live voice sound, which introduces notches in the spectrum that the talent hears when he or she talks. All digital processors induce this coloration to a greater or lesser extent. Fortunately, it does not cause confusion or hesitation in the talent's performance unless the delay is above the psychoacoustic "echo fusion" (Haas) threshold of approximately 20 ms, where the talent starts to hear slap echo in addition to frequency response colorations.

If talent cannot live with 15 ms delay yet needs to monitor off-air, you can use one of several ultra-low latency ("UL") presets, which have 5 ms delay. These provide a poorer tradeoff between loudness, brightness, and distortion than the optimum latency presets because they do not use the 8300's intelligent look-ahead distortion control mechanism. We therefore recommend their use only when necessary.

If the talent is in the same location as the 8300, you can configure the 8300's analog outputs to supply a special low-latency monitor signal to drive headphones only. (See step 10 on page 2-18.)

## Customizing the 8300's Sound

The subjective setup controls on the 8300 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, density, and audible distortion. The following pages provide the information you need to adjust the 8300 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 8300's PC Remote software*.

See page 6-62 for a block diagram of the processing.

## Basic Modify

BASIC MODIFY allows you to control three important elements of 8300 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 8300'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 dynamics processing. We believe that most 8300 users will never need to go beyond the Basic level of control. 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.

As you increase the setting of the LESS-MORE control, the air sound will become louder, but (as with any processor) processing artifacts will increase. Please note that 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 8300, LESS-MORE affects only the dynamics processing (compression, limiting, and clipping). Unlike Orban's OPTIMOD-FM 8200, the 8300 has equalization and stereo enhancement that 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 8300 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 8300's front panel. It allows you to adjust the dynamics section at approximately the level of "full control" available in Orban's 8200 processor. Because of improvements in the 8300's signal processing by comparison to the 8200, 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, even if they want to create a "signature sound" for their station.

**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 station that is far out of the ordinary, or if your taste differs from the people who programmed the LESS-MORE tables, Advanced Modify is available to you from the 8300 PC Remote software *only* (not from the 8300'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.

Compressor attack times and thresholds are available, along with settings affecting the automatic clipping distortion control. These controls can be exceedingly dangerous in inexperienced hands, leading you to create presets that sound great on some program material and fall apart embarrassingly on other material. We therefore recommend that you create custom presets at the Advanced Modify level only if you are experienced with on-air sound design, and if you are willing to take the time to double-check your work on many different types of program 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-FM 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-FM has been set up for a sane amount of gain reduction under ordinary program conditions.

> To accommodate the FM pre-emphasis curve, Band 5 of the Five-Band Structure is capable of 30 dB of gain reduction.

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.

## To Create or Save a User Preset

Once you have edited a preset, you can save it as a user preset. The 8300 can store an indefinite number of user presets, limited only by available memory.

The 8300 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 on air.

If there is an unsaved preset on air, 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 the 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 8300 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 8300 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 8300 will give you an opportunity to choose a new name for the preset you are saving.

You can save user presets from the 8300 PC Remote application. (See *Using the 8300 PC Remote Control Software* on page 3-62.) Please note that when you save presets from the PC Remote application, you save them in the 8300's memory (as if you had saved them from the 8300'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 8300'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 3-65.)

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

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, then you may still find the material interesting, but you do not need to understand it to get excellent sound from the 8300.

In the 8300, 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 8300's DSP hardware could realize several possible processing structures. Unlike an analog system, where creating a complete processing system involves physically wiring its various components together, the 8300 realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) integrated circuit chips.

There are three basic structures: **Two-Band**, **Normal Five-Band**, and **Ultra-Low-Latency Five-Band**. To select a structure, choose a factory preset having the desired structure, and, if you wish, edit it to create a user preset.

**Two-Band** is a purist, phase-linear structure. When correctly configured, it can be used for protection limiting and we provide a preset that uses it for this. It is also the basis for the CLASSICAL-2 BAND presets. It can have higher latency than the five-band presets (up to 23 ms).

**Optimum Five-Band** is the basic structure used for popular music in its many variations. Because it provides effective automatic re-equalization of program material, it is also used for news, talk, and sports.

The stereo enhancer, AGC, equalizer, and "back end" clippers are common to both Two-Band and Five-Band processing and therefore stay the same when the 8300 switches between two-band and five-band operation. However, different controls appear in the screens containing dynamics processing controls, as appropriate for Two-Band or Five-Band multiband compression. The meters also change functionality to display the Two-Band or Five-Band gain reduction.

Both the Two-Band and Five-Band multiband compressors always operate in the background. So switching between Two-Band and Five-Band occurs with a seamless cross-fade. Unlike older Orban processors like the 8200, no DSP code is reloaded and no audio mute is necessary.

**Maximum-Performance Five Band (MX)** presets are new with version 2.0 software. They use the Normal 5-Band structure, exploiting version 2.0's compressor look-ahead processing and MEDIUM bass clipping to achieve a better loudness/distortion tradeoff than the original 8300 version 1 presets, which also use the Normal 5-Band structure. Version 1 presets retain their existing performance and are identified by having neither "UL" nor "MX" at the end of their names. If you are presently using an original version 1 factory preset on-air, you can usually increase your competitiveness by switching to an "MX" preset. The only downside is that they have 5 ms more latency than non-MX optimum 5-band presets.

**Ultra-Low-Latency Five-Band (UL)** reduces the input-to-output delay of the processor to about 5 ms at the cost of a less favorable tradeoff between loudness, brightness, and distortion than the other presets. It is comparable in performance to Optimod-FM 8200 version 3.0 except that the clippers are anti-aliased and it offers the same stereo enhancement, equalization section, advanced-technology AGC, composite limiter, and multiplex power controller as the other 8300 structures. Ultra-Low-Latency presets have "UL" at the end of their names.

> UL Presets do not support full HD processing. If you are using the 8300's HD output with a UL preset, the HD output will emit the de-emphasized, FM-processed signal. Because HD Radio requires an eight second diversity delay in the analog channel, we do not expect that UL presets would be useful in HD operation.
>
> If you like the audio texture of UL presets and want to achieve this texture in HD operation, you can closely approximate it by recalling a normal five-band preset (not an MX preset) and setting MULTIBAND LIMIT THRESHOLD to OFF. You will usually have to lower the MULTIBAND LIMIT DRIVE control and decrease the BASS CLIP THRESHOLD, setting these controls very carefully to prevent distortion with critical program material—spend some time listening with different sources! For equal amounts of distortion, this mode of operation can safely achieve about 2.5 dB lower loudness than an MX preset.

The Normal Five-Band (i.e., the structure that supports non-"UL" 5-band presets) and the Two-Band structures can be switched via a mute-free crossfade (because they are both active simultaneously); the Ultra-Low Latency Five-Band structure causes a very brief audio mute when activated (because DSP code must be reloaded).

To put a given structure on the air, recall a factory or user preset associated with that structure.

## Factory Programming Presets

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 8300's sound. You can 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. Because it is so easy to fine-tune the sound at the LESS-MORE level, we believe that many users will quickly want to customize their chosen preset to complement their market and competitive position after they had time to familiarize themselves with the 8300's programming facilities.

It is OK to use unmodified factory presets on the air. These represent the best efforts of some very experienced on-air sound designers.

We are sometimes asked about unpublished "programming secrets" for Optimods. In fact, there are no "secrets" that we withhold from users. Our "secrets" are revealed in this manual 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 on-air sound. Listen to a wide range of program material typical of your format, and listen on several types of radios (not just on your studio monitors). Then, if you wish, customize your sound using the information in the Protection Limiter, Two-Band and Five-Band sections that follow.

Each Orban 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 Five-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.

| 8300 V2 FACTORY | PROGRAMMING | Presets |
|---|---|---|
| **Preset Names** | **Source Preset** | **Normal Less-More** |
| PROTECTION | PROTECTION | 7.0 |
| CLASSICAL-2 BAND | CLASSICAL-2 BAND | 7.0 |
| CLASSICAL-2B+AGC | CLASSICAL-2B+AGC | 7.0 |
| CLASSICAL-5 BAND | CLASSICAL-5 BAND | 7.0 |
| CLASSICAL-5B+AGC | CLASSICAL-5B+AGC | 5.0 |
| BASS-PUNCH MX | BASS-PUNCH MX | 9.5 |
| BASS-PUNCH | BASS-PUNCH | 9.5 |
| COUNTRY-LIGHT MX | ROCK-LIGHT MX | 7.0 |
| COUNTRY-LIGHT | ROCK-LIGHT | 7.0 |
| COUNTRY UL | COUNTRY UL | 7.0 |
| COUNTRY-MED MX | ROCK-SMOOTH MX | 7.0 |
| COUNTRY-MED | ROCK-SMOOTH | 7.0 |

| 8300 V2 FACTORY | PROGRAMMING | Presets |
|---|---|---|
| EXTREME MX | EXTREME MX | 9.5 |
| EXTREME | EXTREME | 9.5 |
| JAZZ MX | JAZZ MX | 7.0 |
| JAZZ | JAZZ | 7.0 |
| NEWS-TALK MX | NEWS-TALK MX | 7.0 |
| NEWS-TALK | NEWS-TALK | 7.0 |
| OLDIES MX | OLDIES MX | 9.5 |
| OLDIES | OLDIES | 9.5 |
| ROCK-GEN MX | ROCK-GEN MX | 7.0 |
| ROCK-GENERAL | ROCK-GENERAL | 7.0 |
| ROCK-GEN UL | ROCK-GEN UL | 9.0 |
| ROCK-LIGHT MX | ROCK-LIGHT MX | 7.0 |
| ROCK-LIGHT | ROCK-LIGHT | 7.0 |
| ROCK-LOUD MX | ROCK LOUD MX | 8.5 |
| ROCK-LOUD | ROCK LOUD | 9.5 |
| ROCK-MEDIUM MX | ROCK-MED MX | 7.0 |
| ROCK-MEDIUM | ROCK-MEDIUM | 7.0 |
| ROCK-OPEN MX | ROCK-OPEN MX | 9.0 |
| ROCK-OPEN | ROCK-OPEN | 9.0 |
| ROCK-SMOOTH MX | ROCK-SMOOTH MX | 7.0 |
| ROCK-SMOOTH | ROCK-SMOOTH | 7.0 |
| ROCK-SOFT MX | ROCK-SOFT MX | 8.5 |
| ROCK-SOFT | ROCK-SOFT | 8.5 |
| SPORTS MX | SPORTS MX | 7.0 |
| SPORTS | SPORTS | 7.0 |
| URBAN MX | URBAN MX | 7.0 |
| URBAN | URBAN | 7.0 |
| URBAN UL | URBAN UL | 9.0 |
| URBAN-LOUD MX | URBAN MX | 9.5 |
| URBAN-LOUD | URBAN | 9.5 |

Table 3-1: Factory Programming Presets

Some of the presets come in several "flavors," like "medium" and "open." These refer to the density produced by the processing. "Open" uses a slow multiband release time and "Medium" uses a medium-slow release. Only the NEWS-TALK and SPORTS presets use fast release.

> **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 loudness 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 format 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. Unlike some earlier Orban's processors, the 8300 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 2-Band in its name, it will activate the Two-Band structure.

Switching between the Two-Band and Five-Structures occurs via a smooth cross-fade.

If the preset has "UL" in its name, it will load the Ultra-Low Latency Five-Band structure. Note that if you switch between an "UL" preset and any other preset, the audio will mute for about 100 ms to allow time for new DSP code to load into the DSP chips and to initialize. "UL" presets are not as competitive as other presets and should only be used if you absolutely need the low delay (for off-air cueing of finicky talent, for example).

**PROTECTION**: PROTECTION is a two-band preset with a high amount of band coupling. It is intended for use below threshold most of the time, to provide protection limiting in the highest quality applications such as serious classical music intended for an attentive audience. Its LESS-MORE control determines the normal amount of gain reduction but does not increase distortion or other processing artifacts when turned up.

**CLASSICAL**: As their names imply, the CLASSICAL-FIVE-BAND and CLASSICAL-TWO-BAND presets are optimized for classical music, gracefully handling recordings with very wide dynamic range and sudden shifts in dynamics. The Five-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 pump up very low frequency rumble in live recording venues.

The Five-Band preset defeats the AGC, using only the multiband compressor for gain reduction. It also defeats phase rotation to ensure the most transparent Five-Band sound available.

Even more transparent, "purist" classical processing is available from the CLASSICAL-TWO-BAND preset. This 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-TWO-BAND preset provides, use the CLASSICAL-FIVE-BAND preset.

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 Five-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 two-band preset called CLASSICAL-2B+AGC. In our opinion, this provides an ideal combination of unobtrusive compression and low coloration, typically raising low-level material about 10 dB.

**BASS-PUNCH** produces 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 radios having good bass response, such as many auto radios today.

In terms of loudness, midrange texture, and HF texture, BASS-PUNCH similar to the URBAN-LOUD preset.

**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 stations might also find ROCK-MEDIUM or ROCK-OPEN useful if they want a brighter, more up-front sound.

**EXTREME:** EXTREME 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 is competitive with other processors that are not as scrupulous as the 8300 about controlling audible distortion with certain program material. It also has a great deal of presence energy to cut through on lower-quality radios.

> Its sound changes substantially as the LESS-MORE control is turned down — distortion decreases while bass punch and transparency improve. Therefore, exploring various Less-More settings is very worthwhile with EXTREME, because, for many markets, this preset will be "over the top" unless it is turned down with LESS-MORE.

**JAZZ:** JAZZ is specifically tailored toward stations that play mostly instrumental music. It is a quiet preset with a very clean, mellow high end to prevent stridency on the saxophone solos so often heard in "light jazz" programming. The preset produces very low listening fatigue, so it is a good choice for stations that want listeners to stay all day.

**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 very useful for creating a uniform, intelligible sound from widely varying source material, particularly source material that is "hot from the field" with uncontrolled quality. It extensively exploits distortion control to achieve a very clean, highly compressed, but unclipped sound quality.

**OLDIES:** OLDIES 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 OLDIES 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 emu-

late the high frequency balance of recently recorded material.

**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:** There are several ROCK presets:

ROCK-LOUD is very bright and present, with up-front vocals. Release time is medium.

> In order to get the punchiest and loudest sound, beyond LESS-MORE=7.0 we progressively reduce the protection provided by the distortion-controlling mechanism. So LESS-MORE settings beyond 7.0 are progressively more risky and can exhibit audible distortion (as can the competing product!). Speech will nevertheless be cleaner than with competing products and the bass is never permitted to "shut down" the main clipper on bass waveform peaks.

ROCK-GENERAL provides a bright high end and punchy low end (although not as exaggerated as URBAN). A midrange boost provides enough presence energy to ensure that vocals stand out. A modest amount of high frequency coupling (determined by the BAND CLIPPING 3>4 setting) allows reasonable amounts of automatic HF equalization (to correct dull program material), while still preventing exaggerated frequency balances and excessive HF density.

The ROCK-MEDIUM and ROCK-OPEN variations refer to the compression density, which is determined by the release time settings in the AGC and multiband limiter sections.

These three presets are appropriate for general rock and contemporary programming. All of these presets have distortion control implemented at their nominal levels of LESS-MORE to ensure clean speech. At high LESS-MORE levels the distortion control may be relaxed somewhat to increase bass punch.

There are also several more ROCK presets that are intended for gentler formats:

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 BASS-SLAM, ROCK-LOUD, URBAN-LOUD or EXTREME. However, the "rock" presets are noticeably cleaner, and are therefore more likely to encourage longer times spent listening than are these "loud" presets.

For Album-Oriented Rock (AOR) we recommend the ROCK-LOUD or BASS-SLAM with LESS-MORE turned down somewhat (depending on your market and competitive situation). A LESS-MORE setting of 5.0 will yield reasonable loudness along with very clean sound.

**URBAN-LOUD** was derived by modifying ROCK-LOUD. URBAN LOUD is tuned for the maximum amount of bass we could add without creating obvious distortion on some program material.

> This amount of bass may be excessive with certain consumer radios (particularly "boom-boxes") that already have substantial bass boost. Use it with care.

**URBAN:** This is identical to URBAN-LOUD but with a lower LESS-MORE setting.

## Equalizer Controls

Table 3-2 summarizes the equalization controls available for the Five-Band structure. (Note that "advanced" controls are accessible only from 8300 PC Remote software.)

Most equalization controls are common to both the Two-Band and Five-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.

Except for BASS GAIN, most of the factory presets use less than 3 dB of equalization.

**Bass Shelf Controls**, the Five-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.

Because the Five-Band structure often increases the brightness of program material, some bass boost is usually desirable to keep the sound spectrally well balanced. Adjustment of bass equalization must be determined by individual taste and by the requirements of your format. Be sure to listen on a wide variety of radios — it is possible to create severe distortion on poor quality speakers by over-equalizing the bass. Be careful!

The moderate-slope (12 dB/octave) shelving boost achieves a bass boost that is more audible on smaller radios, but which can sound boomier on high-quality receivers. The steep-slope (18 dB/octave) shelving boost creates a solid, punchy bass from the better consumer radios 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. Regardless of which curve you use, we recommend a +2 to +5 dB boost for most

| 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** | BRILLNCE | 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 |
| **30HZ HPF** | 30HZ HPF | 30 Hz High Pass Filter | Off / On |
| **Phase Rotate** | PH-ROTATE | Phase Rotator | Out / In |

Table 3-2: Five-Band Equalization Controls

formats. Larger 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. 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.

**Low Frequency Parametric Equalizer** is a specially designed parametric equalizer whose boost and cut curves closely emulate those of a classic Orban analog parametric equalizer with conventional bell-shaped curves (within ±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 ±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, 1.5 octaves is a good starting point. These curves are relatively broad because they are designed to provide overall tonal coloration, rather than to notch 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. In our presets, we tend to use it very sparingly (in the order of 1 dB boost) to add a bit of extra bass warmth.

One formula for producing a very "big" bass sound on the air is to use a peaking boost at 100Hz in combination with a Bass Shelf boost at 6 dB/octave.

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 8300'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 8300'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 ±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.

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.

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 presets, we use 3 dB boost at 2.6 kHz to bring vocals more upfront.

**High Frequency Parametric Equalizer** is a parametric 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 ±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 tape 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 compact discs of recently recorded material. 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.

**BRILLNCE** ("Brilliance") controls the drive to Band 5. The high frequency limiter and Band 5 clipper dynamically control these boosts, protecting the final clipper from ex-

cessive HF drive. We recommend a maximum of 4 dB of BRILLNCE 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.

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.

The difference will never exceed the difference that would have otherwise occurred if the lowest frequency band was independently gated. If you are familiar with older Orban processors like the 8200, 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 boost. 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 boost than if the fundamental frequency were a bit higher.

This control is only available in the Five-Band structure.

If the GATE THRESH (Gate Threshold) control is turned OFF, the DJ BASS boost setting is disabled.

**HF ENH** ("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.

**30HZ HPF** ("30 Hz High Pass Filter") determines if a 30Hz 18 dB/octave highpass filter is placed in-circuit before other processing..

**PH-ROTATE** ("Phase Rotator") is not a stereo enhancer control. It determines if the phase rotator will be in-circuit. The purpose of the phase rotator is to make voice

waveforms more symmetrical. This can substantially reduce distortion when they are peak limited by the 8300's back end processing.

In most cases, we recommend that the phase rotator be left active. However, because it can slightly reduce the clarity and definition of program material, you can defeat it if you are operating the 8300 conservatively and not attempting to achieve very high on-air loudness.

You have somewhat more leeway than you do in older Orban FM processors like the 8200 because the 8300's new distortion control will work to help prevent audible speech distortion even when the phase rotator is switched out.

## Stereo Enhancer Controls

The stereo enhancer emulates the Orban 222 analog stereo enhancer. The enhancer has 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 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. Note that "advanced" controls are accessible only from 8300 PC Remote software.

| Stereo Enhancer Controls | | |
|---|---|---|
| **Basic / Full Modify Name** | **Advanced Name** | **Range** |
| ENH AMT | Stereo Enhancer Amount | 0.0 ... 10.0 |
| RATIO LMT | L–R / L+R Ratio Limit | 70 … 100% |

Table 3-3: Stereo Enhancer Controls

**ENH AMT** sets the maximum spatial enhancement. When set to OUT, it bypasses the stereo enhancer.

**RATIO LMT** ("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.

# AGC Controls

The AGC is common to the Two-Band and Five-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 8300 PC Remote software.)

These controls are explained in detail below.

Each Factory Preset has a LESS-MORE control that adjusts on-air loudness by altering the amount of processing. LESS-MORE simultaneously adjusts all of the 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 DRIVE | AGC Drive | –10 ... 25 dB |
| AGC REL | AGC Master Release | 0.5, 1.0, 1.5, 2 … 20 dB/s |
| AGC GATE | AGC Gate Threshold | Off, –44 ... –15 dB |
| AGC B CPL | AGC Bass Coupling | Off, –12…0 dB |
| AGC METR | AGC Meter Display | Master, Delta |
| --- | AGC Maximum Delta Gain Reduction | 0 … 24 dB, Off |
| --- | AGC Window Size | –25 … 0 dB |
| --- | AGC Window Release | 0.5 … 20 dB |
| --- | AGC Matrix | L / R, sum/difference |
| --- | AGC Ratio | ∞1, 4:1, 3:1, 2:1 |
| --- | AGC Bass Threshold | –12.0 … 2.5 dB |
| --- | AGC Idle Gain | –10 … +10 dB |
| --- | AGC Bass Attack | 1 … 10 |
| --- | AGC Master Attack | 0.2 … 6 |
| --- | AGC Bass Release | 1 … 10 dB/sec |
| --- | AGC Master Delta Threshold | –6 … +6 dB |
| --- | AGC Bass Delta Threshold | –6 … +6 dB |
| --- | AGC Crossover | Allpass, LinearNoDelay, Linear |

Table 3-4: 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, and therefore determines the amount of gain reduction in the AGC. 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.)

The total amount of gain reduction in the Five-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, and 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 multiband 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 and clipping with the Five-Band structure's controls.

**AGC GATE** ("AGC Gate Threshold") control determines the lowest input level that will be recognized as program by OPTIMOD-FM; 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.

There are two independent gating circuits in the 8300. The first affects the **AGC** and the second affects the **multiband compressor**. Each has its own threshold control.

The multiband compressor gate causes the gain reduction in bands 2 and 3 of the multiband compressor to quickly move 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 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 V2.0, 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 V2.1 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 8300 V2.1 software to work as explained above. You may have to tweak this control to achieve the same bass balance that you had previously with V2.0 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 8300 PC Remote software.

**AGC Maximum Delta Gain Reduction** 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.

**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, and 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 3 dB.

**AGC Window Release** (see AGC WINDOW SIZE above.)

**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 8300'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 MAXIMUM DELTA GAIN REDUCTION control greater than zero.

It is unwise to set this control beyond 3 dB. Multipath distortion could increase because the amount of L–R energy builds up excessively. We prefer using the 8300's stereo enhancer because its built-in gating circuits prevent over-enhancement.

**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.

Previous Orban AGCs had compression ratios very close to ∞:1, which produces the most consistent and uniform sound. However, the 8300 compressor can reduce this

ratio to as low as 2:1. This can add a sense of dynamic range and is mostly useful for subtle formats like classical and jazz.

This control reduces the available range of AGC gain reduction because it acts by attenuating the gain control signal produced by the AGC sidechain. The range is 25 dB at ∞:1 and 12 dB at 2:1. However, the range of input levels that the AGC can handle is unaffected, remaining at 25 dB.

**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 setting. 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 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/DIFFERENCE.) If you set the threshold of the difference channel lower than the sum channel, the AGC will 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 AGC MAXIMUM DELTA GAIN REDUCTION 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 AGC

MAXIMUM DELTA GAIN REDUCTION control to 3.0 and the AGC MASTER DELTA THRESHOLD control to some positive number, depending on how much automatic width control you want the 8300 to perform.

**AGC Bass Delta Threshold** works the same as AGC MASTER DELTA THRESHOLD, but applies to the bass band. You will usually set it the same as AGC MASTER DELTA THRESHOLD.

**AGC Crossover** allows you to choose ALLPASS, LINEARNODELAY, or LINEAR modes.

ALLPASS is a phase-rotating crossover like the one used in the 8200's two-band AGC. It introduces one pole of phase rotation at 200 Hz. The overall frequency response remains smooth as the two bands take different degrees 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.

All Five-Band factory presets automatically use ALLPASS because of its smooth, shelving behavior and low delay. Its allpass characteristic complements the existing phase rotator that reduces voice distortion. Because the Five-Band structure uses phase-rotating crossovers in the five-band compressor / limiter, there is little or nothing to be gained by using a phase-linear crossover in the Five-Band structure's AGC.

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.

LINEARNODELAY is available in Two-Band presets only. 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.

LINEAR is a phase-linear crossover whose upper band is derived by subtracting its lower band from the crossover's input, as passed through a delay equal to the group delay of the lowpass crossover filter. The overall frequency response remains smooth as the two bands take different degrees of gain reduction — the response is a smooth shelf without extra peaks or dips around the crossover frequency. The two bands are each down 6 dB at the crossover frequency. This crossover has constant delay even when the two bands have unequal gains.

LINEAR is available for Two-Band presets only. While it has the ideal combination of no phase distortion (even when non-flat) and smooth shelving behavior, it adds about 4 ms to the overall delay (compared to ALLPASS and LINEARNODELAY), so it is not a good choice if you need to drive talent headphones.

## Clipper Controls

The clipper controls are common to the Two-Band and Five-Band structures, except as noted in the control descriptions on the following pages.

All of the clipper controls are common to the Full Modify and Advanced Modify, except OVERSHOOT COMPENSATOR DRIVE, which is only available in the Advanced Modify screen. (Note that "advanced" controls are accessible only from 8300 PC Remote software.)

**Bass Clip** ("Bass Clip Threshold") sets the threshold of Orban's patented embedded bass clipper with reference to the final clipper. The bass clipper is embedded in the multiband crossover so that any distortion created by clipping is rolled off by part of the crossover filters. The threshold of this clipper is usually set between 2 dB and 5 dB below the threshold of the final limiter in the processing chain, depending on the setting of the LESS-MORE control in the parent preset on which you are basing your Modify adjustments. This provides headroom for contributions from the other three bands, so that bass transients don't smash against the back-end clipping system, causing overt intermodulation distortion between the bass and higher frequency program material.

Some 8300 users feel that the bass clipper unnecessarily reduces bass punch at its factory settings. Therefore, we made the threshold of the bass clipper user-adjustable. The range (with reference to the final clipper threshold) is 0 to –6 dB. 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 accompanied by a bass guitar) and listen for IM distortion induced by the bass' pushing the midrange into the clipping system. In general, unless you have a very good reason to set the control elsewhere, we recommend leaving it at the factory settings, which were determined following extensive listening tests with many types of critical program material.

In the Five-Band structure, the clipper is located after bands 1 and 2 are summed. In the Two-Band structure, the clipper is located after the Bass band.

**Speech Bass Clip** set the threshold of the bass clipper when the 8300 detects the presence of speech. It is usually set to "0" to prevent the bass clipper from adding distortion on speech.

**CLIP SHAPE** ("Bass Clip Shape") allows you to change shape of the knee of the input/output gain curve of the bass clipper. The "knee" is the transition between no clipping and flat topping. A setting of "0" provides the hardest knee. "10" is the softest knee, where the transition starts 6 dB below BASS CLIP THRESHOLD setting and occurs gradually. The factory default setting is "7.6."

**FINAL CLIP** ("Final Clip Drive") adjusts the level of the audio driving the back end clipping system that OPTIMOD-FM uses to control fast peaks. This control primarily determines the loudness / distortion trade-off.

Turning up the FINAL CLIP control drives the final clipper and overshoot compensator harder, reducing the peak-to-average ratio, and increasing the loudness on the air. When the amount of clipping is increased, the audible distortion caused by clipping also increases. Although lower settings of the FINAL CLIP control reduce loudness, they make the sound cleaner.

If the RELEASE control is set to its faster settings, the distortion produced by the back-end clipping system will increase as the MULTIBAND DRIVE control is advanced. The FINAL CLIP DRIVE and/or the MULTIBAND LIMIT THRESHOLD controls may have to be turned down to compensate. To best understand how to make loudness / distortion trade-offs, perhaps the wisest thing to do is to recall a factory multiband preset, and then to adjust the LESS-MORE control to several settings throughout its range. At each setting of the LESS-MORE control, examine the settings of the MULTIBAND DRIVE and MULTIBAND LIMIT THRESHOLD controls. This way, you can see how the factory programmers made the trade-offs between the settings of the various distortion-determining controls at various levels of processing.

> The 8300's multiband clipping and distortion control system works to help prevent audible distortion in the final clipper. As factory programmers, we prefer to adjust the FINAL CLIP control through a very narrow range (typically –0.5 dB to –1.0 dB) and to determine almost all of the loudness / distortion trade-off by the setting of the Multiband Clipping control.
>
> The final clipper operates at 256 kHz sample rate and is fully anti-aliased.

**COMP DRV** ("Composite Limiter Drive") sets the drive level, in dB, into the 8300's composite limiter.

This control has no effect on the 8300's left and right analog or digital outputs.

> The COMP DRV control is set to "0 dB" for most factory presets. At this setting, it removes a few tenths of a dB of residual overshoot from the audio processing without affecting audio quality. We prefer to use the audio-domain overshoot compensation to do most of the work because it operates at a 256 kHz sample rate and is fully anti-aliased, whereas the composite limiter will inevitably introduce aliasing around 38 kHz upon demodulation in the receiver. This is because it introduces spectrum in the stereo subchannel area when it clips material in the 0 to 15 kHz area.

| **Clipper Controls** | | |
|---|---|---|
| **Full Modify Name** | **Advanced Name** | **Range** |
| --- | Overshoot Compensator Drive | –2.0 … +2.0 |
| BASS CLIP | Bass Clip Threshold | –6.0 … 0.00 |
| --- | Bass Clip Shape | 0 … 10 |
| BCL MODE | Bass Clip Mode | Soft, Med, Hard, LLHard |
| FINAL CLIP | Final Clip Drive | –3.0 … +5.0 |
| COMP DRV | Composite Limiter Drive | Off, 0 ... 3 dB |
| --- | Speech Bass Clip | –6.0 … 0.00 |
| MPX OFFSET | MPX Power Offset | 0 … –10dB |

Table 3-5: Clipper Controls

The receiver will "see" this as stereo material, and will demodulate it as if it were part of the stereo subchannel. Accordingly, harmonics of L+R material will be frequency-shifted upon demodulation, and will no longer bear a harmonic relationship to the material that produced them. Mathematically, these harmonics will be located at the same frequencies as harmonics caused by clipping in a simple digital-domain clipper (with no anti-aliasing) operating at 38 kHz sample rate.

If you want to use the composite limiter more heavily, one option is to trade off composite limiting against left/right domain overshoot compensation. To do this, reduce the OVERSHOOT COMPENSATOR DRIVE control and increase the COMP DRV control setting proportionately. (The OVERSHOOT COMPENSATOR DRIVE control is accessible only from the 8300 PC Remote software.)

**MPX POWER OFFSET** operates only when the ITU-412 multiplex power controller is active (and is thus irrelevant to users in countries that do not enforce this standard). The control introduces a fixed loss before the FM analog peak limiting chain. If the MULTIPLEX POWER THRESHOLD control (in the INPUT/OUTPUT / UTILITIES screen) is set to 0, the MPX POWER OFFSET control produces the same amount of loss (in dB) as this control's setting. Resetting the MULTIPLEX POWER THRESHOLD control away from 0 will change the loss. (For example, setting the MULTIPLEX POWER THRESHOLD control to +3 will cause the loss to decrease by 3 dB.)

The MULTIPLEX POWER THRESHOLD control can only introduce loss, never gain.

Regardless of the setting of the MULTIPLEX POWER THRESHOLD and MPX POWER OFFSET controls, the resulting gain offset can never be larger than 0 dB.

The MPX POWER OFFSET control's purpose is to reduce unnatural loudness variations that the multiplex power controller might produce. These can occur because the ITU specification does not call for psychoacoustic weighting. The Optimod does not force the multiplex power controller to dynamically produce all of the required gain reduction (which could vary widely, depending on the program material). Instead, the MPX POWER OFFSET control produces most of the gain reduction. The gain reduction produced by the control is, of course, unchanging and cannot introduce audible artifacts.

The ideal dynamic gain reduction for the multiplex power controller is 2 to 3 dB with typical program material. However, the actual gain reduction will vary widely depending on whether the underlying processing preset is "loud" or "quiet." Therefore, the appropriate setting of the MPX POWER OFFSET control depends strongly on what preset is in use. Accordingly, each preset has its own setting of the MPX POWER OFFSET, which is a processing parameter like any other in a given preset. Hence, adjustments that affect the multiplex power controller appear in two independent places in the Optimod: The MULTIPLEX POWER THRESHOLD control is a *system setup* control, while the MPX POWER OFFSET is *part of the on-air preset*.

Depending on the preset, the MPX POWER OFFSET control's setting can vary from 0 dB (no effect) to as much as –9 dB. If you customize a preset in any way (including using LESS-MORE), you may wish to trim the MPX POWER OFFSET for that preset so that the multiplex power controller produces 2-3 dB of indicated gain reduction with typical program material. This will achieve the maximum on-air loudness that

complies with the ITU standard while minimizing the potential for unnatural and audibly disturbing loudness inconsistencies caused by the operation of the multiplex power controller.

**BCL MODE** (Bass Clip Mode) sets the operation of the bass clipper to HARD, LL HARD, MEDIUM, or SOFT.

- HARD operates the clipper like the clipper in the 8200. It produces the most harmonic distortion.

  This can be useful if you want maximum bass punch, because this setting allows bass transients (like kick drums) to make square waves. The peak level of the fundamental component of a square wave is 2.1 dB *higher* than the peak level of the flat top in the square wave. Therefore, this allows you to get low bass that is actually higher than 100% modulation—the harmonics produced by the clipping work to hold down the peak level.

  The square waves produced by this clipper are filtered through a 6 dB/octave lowpass filter that is down 3 dB at 400 Hz. This greatly reduces the audibility of the higher clipper-generated harmonics. Nevertheless, the downside is that material with sustained bass (including speech) will sound substantially less clean than it will with the Medium or Soft settings.

  Note that the CLIP SHAPE control determines how squared-off the clipped bass waveforms become. (See **CLIP SHAPE** on page 3-33.)

- LLHARD differs in two ways from the normal HARD mode of the bass clipper:

  - LLHARD automatically defeats the compressor lookahead. This action is functionally equivalent to setting the LOOKAHEAD control to OUT, except that it reduces input/output delay by 5 ms).

  - LLHARD prevents the bass clipper from switching to MEDIUM mode whenever speech is detected. By constraining the system in these ways, it ensures that the delay is always 13 ms.

  To minimize speech distortion, the speech/music detector automatically switches the bass clipper to MEDIUM when speech is detected, provided that the Five-Band structure is active, LATENCY is HIGH, and the BASS CLIP MODE is set to HARD. (See "Lookahead" on page 3-53 for more about the speech/music detector.) If the bass clipper is set to LLHARD, the speech/music detector will reset the clipper threshold to the setting specified by the SPEECHBCTHR control. The default setting is "0 dB," which results in very little bass clipper action during speech. This prevents audible speech distortion that this clipper might otherwise introduce.

  Switching the BASSCLIPMODE to LLHARD (from any other mode) removes five milliseconds of delay from the signal path. Switching can cause audible clicks, pops, or thumps (due to waveform discontinuity) if it occurs during program material. If you have some presets with LLHARD bass clipper mode and some without, switching between these presets is likely to cause clicks unless you do it during silence. However, these clicks will

never cause modulation to exceed 100%.

One of the essential differences between the HARD and LLHARD bass clipper modes is that switching between Hard and Med does not change delay and is therefore less likely to cause audible clicks.

The CLIP SHAPE control (in Advanced Control) offers further control over the sound of the HARD and LLHARD modes. (See page 3-33.).

- MEDIUM uses more sophisticated signal processing than HARD to reduce distortion substantially.
- SOFT uses the most sophisticated look-ahead signal processing to reduce distortion further. Using SOFT adds an additional 18 ms of delay to the processing (so that the total is approximately 36 ms).

MEDIUM and SOFT are not available in Low Latency mode. The bass clipping is always HARD, but the HARD CLIP SHAPE control is still available to "soften" the clipping.

### Advanced Clipper Controls

**Overshoot Compensator Drive** sets the drive level into the overshoot compensator with reference to the final clip threshold, in units of dB. The normal setting is "0 dB."

The overshoot compensator can produce audible distortion on material with strong high frequency content (like bell trees), and this control lets you trade off this distortion against loudness. (Such material can cause strong overshoots, forcing the overshoot compensator to work hard to eliminate them.) We do not recommend operating this control above "0" because this would reduce the effectiveness of the distortion cancellation used in earlier processing. However, you can reduce it below "0" if you value the last bit of high frequency cleanliness over loudness.

The overshoot compensator works at 256 kHz sample rate and is fully anti-aliased.

## The Two-Band Structure

The Two-Band structure consists of a slow two-band gated AGC (Automatic Gain Control) for gain riding, followed by an equalization section, a gated two-band compressor, a high-frequency limiter, and a complex peak limiting system similar to the one used in the Five-Band structure. Like the "Two-Band Purist" structure in Orban's OPTIMOD-FM 8200, the 8300's Two-Band Structure is phase-linear throughout to maximize sonic transparency.

The Two-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 incorrect, the Two-Band structure (when its BAND COUPLING 2>1 control is operated toward 0%) can gently correct it without introducing obvious coloration.

The Two-Band structure is mainly useful for classical or "fine arts" programming that demands high fidelity to the original program source.

## The Protection Presets

There are two Protection Factory Presets. Both use the same DSP code as the Two-Band Purist structure, but the AGC is defeated.

PROTECTION 0DB sets the limiting threshold so that limiting almost never occurs, while PROTECTION 5DB sets the limiting threshold so that program material at the maximum normal input level (as determined by a PPM or VU meter monitoring the input program line) produces an average limiting of 5 dB.

To set up the Protection Limiter, recall preset PROTECTION 0DB if you want limiting to occur only when the program level *exceeds* the maximum normal input level as determined by a PPM or VU meter monitoring the input program line. Recall preset PROTECTION 5DB if you want about 5 dB of limiting to occur at the maximum normal input level.

The LESS-MORE control affects only the input drive, and you can use it to set a nominal limiting level different from 0 dB or 5 dB.

The Protection presets have the same Intermediate and Advanced Modify controls available as the Two-Band structure.

## Setting Up the Two-Band Structure for Classical Music

To set up the Two-Band structure, recall preset CLASSICAL-2 BAND or CLASSICAL-2B+AGC.

These are the only two-band presets (other than the PROTECTION presets).

Classical music is traditionally broadcast with a wide dynamic range. However, with many recordings and live performances, the dynamic range is so great that the quiet passages disappear into the noise on most car, portable, and table radios. Consequently, the listener either hears nothing, or must turn up the volume control to hear all the music. Then, when the music gets loud, the radio blasts and distorts, making listening unpleasant.

The Two-Band structure is well suited for classical formats during daytime hours when most people in the audience are likely to be listening in autos or to be using the station for background music. This audience is best served when the dynamic range of the program material is reduced by 10-15 dB so that quiet passages in the music never fade into inaudibility under these less-favorable listening conditions. OPTIMOD-FM controls the level of the music in ways that are, for all practical purposes, inaudible to the listener. Low-level passages are increased in level by up to 10 dB, while the dynamics of crescendos are maintained.

The CLASSICAL-2 BAND preset is a two-band preset with the AGC turned off. It uses considerable bass coupling to preserve the spectral balance of the input as well as possible. Its LESS-MORE control primarily affects the amount of compression, rather than maximum loudness. It sounds essentially identical to the Protection structure.

CLASSICAL-2B+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 that does the CLASSICAL-2 BAND preset. However, the AGC provides extremely smooth and unobtrusive compression because of the gentle ratio and window gating. In this preset, the Two-Band compressor is used very lightly with a fast release time as a peak limiter. The AGC does almost of the compression.

During the evening hours when the audience is more likely to listen critically, a classical station may wish to switch to a custom preset (derived from the CLASSICAL-2 BAND preset) that performs less gain reduction. You can create such a preset by modifying the CLASSICAL-2 BAND preset with the LESS-MORE control — turn it down to taste.

There are also two five-band classical presets. The CLASSICAL-5 BAND preset uses the five-band structure with AGC defeated. It uses substantial interband coupling to retain much of the frequency balance of the original source, but is capable of somewhat more "automatic equalization" than is CLASSICAL-2 BAND. It can therefore reequalize older program material, but there is also more risk that it will cause coloration that might offend the classical purist.

CLASSICAL-5B+AGC, like its two-band counterpart, uses the AGC set for 2:1 compression ratio.

The five-band structure is not phase-linear, so the CLASSICAL-5 BAND preset is likely to have slightly less audible transparency than the CLASSICAL TWO-BAND structure.

## Customizing the Settings

Each Two-Band Factory Preset has a LESS-MORE control (located in the Basic Modify screen) that adjusts on-air 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 Two-Band Structure's Full and Advanced Setup Controls

Table 3-6 on page 3-40 shows a summary of the Two-Band controls in the dynamics section.

AGC, Equalizer, Stereo Enhancer, and Clipper controls are common to both Two-Band and Five-Band structures and are described in their own sections earlier in Section 3.

Some of the Two-Band controls are common to the Full Modify and Advanced Modify screens, with additional Two-Band controls available in the Advanced Modify screen. (Note that "advanced" controls are accessible only from 8300 PC Remote software.)

**2B DRIVE** control adjusts signal level going into the two-band compressor, and therefore controls the density of output audio by determining the amount of gain reduction in the two-band compressor. The resulting sound texture can be open and transparent, solid and dense, or somewhere in between. The range is 0-25 dB.

Regardless of the release time setting, we feel that the optimal amount of gain reduction in the two-band compressor for popular music and talk formats is 10-15 dB. If less gain reduction is used, loudness can be lost. For classical 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. Because OPTIMOD-FM's density gently increases between 0 and 10 dB of compression, 10 dB of com-

| Two-Band Controls | | |
|---|---|---|
| **Full Modify Name** | **Advanced Name** | **Range** |
| 2B DRIVE | 2B Drive | –10 … 25 dB |
| 2B REL | 2B Release | 0.5 … 20 dB/s |
| 2B GATE | 2B Gate Threshold | Off, –44 … –15 dB |
| BASS CPL | 2B Bass Coupling | 0 … 100 % |
| BASS CLIP | 2B Bass Clip | –6.0 … 0.0 dB |
| 2B CLIP | 2B Clipping | –4 … +5 |
| --- | Maximum Distortion Control | 0 … +18 dB |
| --- | MB Limit Speech Thresh | –3.0 … +6.0 dB |
| HF LIMIT | 2B High Frequency Limiting | –4.0 … +2.0 |
| 6K+HF LIM | 2B 6-15kHz HF Limiter | Off, –23.8 ... 0.0 dB |
| FINAL CLIP | Final Clip | -3.0 … 5.0 dB |
| | 2B HF Clip Thresh | –16.0 … – 0.2, Off |
| COMP DRIVE | Composite Limit Drive | Off, 0.0 … 3.0 dB |
| PARENT PRESET | | [read-only] |
| LESS-MORE | Less-More Index | [read-only]; 1.0 … 10.0 |
| --- | 2B Master Compression Threshold | –15 … 0, Off |
| --- | 2B Bass Compression Threshold | -10.0 … 5.0 dB, Off |
| --- | 2B Master Attack | 4 … 50, Off |
| --- | 2B Bass Attack | 4 … 50, Off |
| --- | 2B Lookahead | 0 … 5.0 ms |
| --- | 2B Clipping | –4 … +5 |
| --- | 2B Crossover | LinearNoDelay, Linear |

Table 3-6: Two-Band Controls

pression sounds very natural, even on classical music.

**2B REL** ("2B Release") control determines how fast the two-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 Two-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. In general, you should use faster release times for mass-appeal pop or rock formats oriented toward younger audiences, and slower release times for more conservative, adult-oriented formats (particularly if women are an important part of your target audience).

> We expect that the Two-Band structure will be rarely used for pop music formats because the Five-Band structure gives better results in almost all cases.

The action of the 2B REL control has been optimized for resolution and adjustability. But its setting is critical to sound quality — listen carefully as you adjust it. There is a point beyond which increasing density (with faster settings of the 2B REL control) will no longer yield more loudness, and will simply degrade the punch and definition of the sound.

When the 2B REL control is set between 8 and 1 dB/second (the slowest settings), the amount of gain reduction is surprisingly non-critical. Gating prevents noise from being brought up during short pauses and pumping does not occur at high levels of gain reduction. Therefore, the primary danger of using large amounts of gain reduction is that the level of quiet passages in input material with wide dynamic range may eventually be increased unnaturally. Accordingly, when you operate the 2B REL control between 8 and 2 dB/second, it may be wise to defeat the gain-riding AGC and to permit the two-band compressor to perform all of the gain riding. This will prevent excessive reduction of dynamic range, and will produce the most natural sound achievable from the Two-Band structures.

With faster 2B REL control settings (above 8 dB/second), the sound will change substantially with the amount of gain reduction in the two-band compressor. This means that you should activate the gain-riding AGC to ensure that the two-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.

Release in the two-band compressor automatically becomes faster as more gain reduction is applied (up to about 10 dB). This makes the program progressively denser, creating a sense of increasing loudness although peaks are not actually increasing. If the gain-riding AGC is defeated (with the AGC on / off control), you can use this characteristic to preserve some feeling of dynamic range. Once 10 dB of gain reduction is exceeded, full loudness is achieved — no further increase in short-term density occurs as more gain reduction is applied. This avoids the unnatural, fatiguing

sound often produced by processors at high gain reduction levels, and makes OPTIMOD-FM remarkably resistant to operator gain-riding errors.

**2B GATE** ("2B Gate Threshold") threshold control determines the lowest input level that will be recognized as program by OPTIMOD-FM; lower levels are considered to be noise or background sounds and will cause the AGC or two-band compressor to gate, effectively freezing gain to prevent noise breathing.

There are two independent gating circuits in the 8300 Two-Band structure. The first affects the *AGC* and the second affects the *two-band compressor*. Each has its own threshold control.

The two-band gain reduction will eventually recover to 0 dB and the AGC gain reduction will eventually recover to –10 dB even when the compressor gate is gated. However, recovery is slow enough to be imperceptible. This avoids OPTIMOD-FM's getting stuck with a large amount of gain reduction on a long, low-level musical passage immediately following a loud passage.

It is common to set the 2B GATE control to –40. Higher settings are primarily useful for radio drama, outside sports broadcasts, and other non-musical programming that contain ambiance, low-level crowd noise and the like. Slightly higher settings may increase the musicality of the compression by slowing down recovery on moderate-level to low-level musical passages. When such passages cause the gate to cycle on and off, recovery time will be slowed down by the ratio of the "on-time" to the "off time." This effectively slows down the release time as the input gets quieter and quieter, thus preserving musical values in material with wide dynamic range (classical music for example).

**BASS CPL** ("2B Bass Coupling") is used to set the balance between bass and the rest of the frequency spectrum.

The two-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 on-air balance of material below 200Hz matches that of the program material above 200Hz.

Settings toward 100% (wideband) make the output sound most like the input. Because setting the BASS CPL control at 100% will sometimes cause bass loss, the most accurate frequency balance will often be obtained with this control between 70% and 90%. The optimal setting depends on the amount of gain reduction applied. Adjust the BASS CPL control until the band 1 and band 2 Gain Reduction meters track as closely as possible.

With the 2B REL (2B Release) control set to 2 dB/second, setting the BASS CPL control toward 0% (independent) will produce a sound that is very open, natural, and non-fatiguing, even with large amounts of gain reduction. Such settings will provide a bass boost on some program material that lacks bass.

With fast release times, settings of the BASS CPL toward 100% (wideband) do not sound good. Instead, set the BASS CPL control toward 0% (independent). This combination of fast release and independent operation of the bands provides the

maximum loudness and density on small radios achievable by the Two-Band structure. However, such processing may fatigue listeners with high-quality receivers, and requires you to activate the AGC to control the average drive level into the two-band compressor, preventing uncontrolled build-up of program density. Instead of operating the Two-Band structure like this, you should choose a Five-Band preset instead.

**Bass Clip** ("Bass Clip Threshold"): See page 3-33.

**2B Clip** is a compression threshold control that equally affects the bass and master bands. It sets the drive level to the high frequency limiting and multiband distortion-controlling processing that precedes the final clipping section. The distortion-controlling section uses a combination of distortion-cancelled clipping and look-ahead processing to anticipate and prevent excessive clipping distortion in the final clipper.

**2B High Frequency Limiting** sets the threshold of the high frequency limiter in the Two-Band structure. When this control is set lower, gain reduction does more high frequency limiting. When this control is set higher, distortion-cancelled clipping does more high frequency limiting. This control controls the tradeoff between loss of high frequencies (due to high frequency limiting) and excessive distortion (due to clipping).

**2B 6-15 kHz Frequency Limiter** sets the amount of additional gain reduction occurring in 6-15 kHz band of the 2-band high frequency limiter. This extra gain reduction is triggered whenever high frequency energy would otherwise cause excessive distortion in the final clipper. The algorithm uses an analysis of the activity in the final clipper to make this determination.

Functionally, this control is a mix control that adds a HF limiter gain reduction signal to higher of the two bands of the 2-band high frequency limiter. Higher settings produce more extra HF limiting in this band. The control therefore allows you to trade off reduced high frequency distortion against HF loss.

**FINAL CLIP** ("Final Clip Drive"): See page 3-33.

**COMP DRV** ("Composite Limiter Drive"): See page 3-34.

**PARENT PRESET** and **LESS-MORE INDEX** are read-only fields.

The 8300'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 8300'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 8300'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.

The asterisk feature is not included in version 1.0 software.

## Advanced Two-Band Controls

The following Two-Band controls are only accessible from the 8300 PC Remote software.

**2B Master Compression Threshold** sets the level where gain reduction starts to occur in the Master (above 200Hz) band of the Two-Band Compressor.

**2B Bass Threshold** determines the compression threshold of the bass band in the Two-Band Compressor. It can be used to set the target spectral balance of the Two-Band Compressor. As the Two-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 Two-Band Compressor master compressor (above 200Hz).

**2B Bass Attack** sets the attack time of the Two-Band Compressor bass compressor (below 200Hz).

*The relationship and interaction between 2B Clip, 2B High Frequency Limiting, and the next two controls is complicated and is best appreciated by listening and experimenting:*

**Lookahead** determines the lookahead time (in milliseconds) in the two-band compressor. 3.6 milliseconds give minimum overshoot for the factory preset attack time of 11.0. If you adjust LOOKAHEAD for less delay, you will get progressively more overshoot. This will cause more voice distortion but will create more transient impact on percussion because transients will hit the clippers harder instead of being controlled inaudibly by the lookahead compressor.)

This control does not affect the HD processing chain.

**2B High Frequency Clip Threshold** sets the threshold of the multiband, distortion-cancelled clipper in the Two-Band structure's high frequency limiter. Higher numbers yield more brightness, but also cause more high frequency distortion.

**2B Crossover** sets the structure of the two-band crossover to Linear or Linear with No Delay. See AGC CROSSOVER on page 3-32 for more detail about these modes.

**Maximum Distortion Control**. See page 3-54.

**MB Limit Speech Threshold** lets you set the increment (in dB) by which the setting of the MB LIMIT THR control is reduced when speech is detected. This control allows

the main clipping distortion controller to work harder on speech while preserving punch in music.

## The Five-Band Structure

The Five-Band structure consists of a stereo enhancer, a slow gain-riding two-band AGC, an equalization section, a five-band compressor, a dynamic single-ended noise reduction system, an output mixer (for the five bands), and a complex peak limiting system.

Unlike the Two-Band structure, whose two-band compressor has a continuously variable release time, the release time of the Five-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 on-air.

### Putting the Five-Band Structure on the Air

The Five-Band structure is very flexible, enabling you to fine-tune your on-air sound to complement your programming. There are numerous Factory Programming Presets. They offer considerable variety, with various combinations of release time, equalization, low frequency coupling, and high frequency coupling.

Start with one of these presets. Spend some time listening critically to your on-air sound. Listen to a wide range of program material typical of your format, and listen on several types of radios (not just on your studio monitors). Then, if you wish, customize your sound using the information in "Customizing the Settings," which follows.

### Customizing the Settings

The LESS-MORE control can edit each of these presets to optimize the trade-off between loudness and distortion according to the needs of the format. The presets can be further edited with Basic, Full Modify, or Advanced Modify to fine-tune them.

The controls in the Five-Band structure give you the flexibility to customize your station sound. Nevertheless, as with any audio processing system, proper adjustment of these controls requires proper balancing of the trade-offs between loudness, density, and audible distortion. The following provides the information you need to adjust the Five-Band structure controls to suit your format, taste, and competitive situation.

## The Five-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 Clipper controls are common to both the Two-Band and Five-Band structures and are discussed in their own sections in Section 3. (Note that "advanced" controls are accessible only from 8300 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 25 dB.

Adjust the MULTIBAND DRIVE control to your taste and format requirements. Used lightly with slower multiband release times, the multiband compressor produces an open, re-equalized sound. The multiband compressor can increase audio density when operated at faster release times because it acts increasingly like a fast limiter (not a compressor) as the release time is shortened. With faster release times, density also increases when you increase the drive level into the multiband compressor because these faster release times produce more limiting action. Increasing density can make 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.

The MULTIBAND DRIVE interacts with the MULTIBAND RELEASE setting. 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 carefully setting the MULTIBAND GATE THRESHOLD control to "freeze" the gain when the input gets quiet and/or by activating the single-

| Multiband Controls | | |
|---|---|---|
| **Full Name** | **Advanced Name** | **Range** |
| MB DRIVE | Multiband Drive | 0 ... 25 |
| MB GATE | Multiband Gate Threshold | Off, –44 ... –15 dB |
| MB LIM DR | Multiband Limiter Drive | –4.0 ... +5.0 dB |
| DWNEXP THR | Downward Expander | Off, –18.0 … 12.0 dB |
| B5 DWNEXP THR | B5 Down Exp Delta Thresh | –18.0 … +12.0 dB |
| MB LIM THR | Multiband Limit Threshold | –3.0 … +6.0, Off |
| HF CLIP | High Frequency Clip Threshold | –16.00 … 0.0, Off |
| LESS-MORE | Less-More Index | [read-only]; 1.0 … 10.0 |
| PARENT PRESET | Parent Preset | [read-only] |
| --- | Lookahead | In, Out, Auto |
| --- | MB Limit Speech Thresh | –3.0 +6.0 dB |
| --- | Maximum Distortion Control | 0 … 18 dB |
| --- | High Frequency Limiter | Off, –23.8 ... 0.0 dB |
| --- | B1/B2 XOVER | 100 Hz, 200 Hz |

Table 3-7: Multiband Controls

ended noise reduction.

When the release time of the multiband compressor is set to its faster settings, 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 multiband compressor drive will no longer yield more loudness, and will simply degrade the punch and definition of the sound.

We recommend no more than 10 dB gain reduction as shown on the meters for band 3. More than 10 dB, particularly with the FAST release time, will often create a "wall of sound" effect that many find fatiguing.

To avoid excessive density with the FAST multiband release time, we recommend using no more than 5 dB gain reduction in band 3, and compensating for any lost loudness by speeding up the MULTIBAND RELEASE instead. This is what we did in the factory LESS-MORE presets for the FAST multiband release time.

**MB REL** ("Multiband Release") control can be switched to any one of seven settings:

> The **Slow** settings produce a very punchy, clean, open sound that is ideal for Adult Contemporary, Soft Rock, Soft Urban, New Age, and other adult-oriented formats whose success depends on attracting and holding audiences for very long periods. The SLOW and SLOW2 settings produce an unprocessed sound with a nice sense of dynamic range. With these settings, the Five-Band structure provides gentle automatic equalization

| MB Attack / Release / Threshold | | |
|---|---|---|
| **Full Name** | **Advanced Name** | **Range** |
| MB REL | Multiband Release | Slow, Slow2, Med, Med2, MFast, MFast2, Fast |
| B1 THR | B1 Compression Threshold | –16.00 … 0.0, Off |
| B2 THR | B2 Compression Threshold | –16.00 … 0.0, Off |
| B3 THR | B3 Compression Threshold | –16.00 … 0.0, Off |
| B4 THR | B4 Compression Threshold | –16.00 … 0.0, Off |
| --- | B1 Attack | 4.0 … 50.0 ms, Off |
| --- | B2 Attack | 4.0 … 50.0 ms, Off |
| --- | B3 Attack | 4.0 … 50.0 ms, Off |
| --- | B4 / 5 Attack | 4.0 … 50.0 ms, Off |
| --- | B1 Limiter Attack | 0 … 100% |
| --- | B2 Limiter Attack | 0 … 100% |
| --- | B3 Limiter Attack | 0 … 100% |
| --- | B4 / 5 Limiter Attack | 0 … 100% |
| --- | B1 Delta Release | –6 … 6 |
| --- | B2 Delta Release | –6 … 6 |
| --- | B3 Delta Release | –6 … 6 |
| --- | B4 / 5 Delta Release | –6 … 6 |

Table 3-8: MB Attack / Release Controls

to keep the frequency balance consistent from record to record (especially those recorded in different eras). In addition, for background music formats, these settings ensure that your sound doesn't lose its highs and lows. Because it creates a more consistent frequency balance between different pieces of source material than does the Two-Band structure, SLOW is almost always preferable to the Two-Band structure for any popular music format.

The **Medium Slow** settings (MED and MED2) are appropriate for more adult-oriented formats that need a glossy show-business sound, yet whose ratings depend on maintaining a longer time spent listening than do conventional Contemporary Hit Radio (CHR) formats. With the single-ended noise reduction activated, it is also appropriate for Talk and News formats. This is the sound texture for the station that values a clean, easy-to-listen-to sound with a tasteful amount of punch, presence, and brightness added when appropriate. This is an unprocessed sound that sounds just right on music and voice when listened to on small table radios, car radios, portables, or home hi-fi systems.

The **Medium Fast** settings (MFAST and MFAST2) are ideal for a highly competitive Contemporary Hit Radio (CHR) format whose ratings depend on attracting a large number of listeners (high "cume") but which does not assume that a listener will listen to the station for hours at a time. This is the major market competitive sound, emphasizing loudness as well as clean audio. The sound from cut to cut and announcer to announcer is remarkably consistent as the texture of music is noticeably altered to a standard. Bass has an ever-present punch, there is always a sense of presence, and highs are in perfect balance to the mids, no matter what was on the original recording.

The **Fast** setting is used only for the TALK and SPORTS factory programming formats. Processing for this sound keeps the levels of an-

| **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 | –3.0 … +3.0 |
| B2 OUT | B2 Output Mix | –3.0 … +3.0 |
| B3 OUT | B3 Output Mix | –3.0 … +3.0 |
| B4 OUT | B4 Output Mix | –3.0 … +3.0 |
| B5 OUT | B5 Output Mix | –3.0 … +3.0 |
| --- | B1 On / Off | Band On, Band Off |
| --- | B2 On / Off | Band On, Band Off |
| --- | B3 On / Off | Band On, Band Off |
| --- | B4 On / Off | Band On, Band Off |
| --- | B5 On / Off | Band On, Band Off |

Table 3-9: MB Band Mix Controls

nouncers and guests consistent, pulls low-grade telephone calls out of the mud, and keeps a proper balance between voice and commercials. Voice is the most difficult audio to process, but these settings result in a favorable trade-off between consistency, presence, and distortion.

The Factory Presets for this sound are quite different from the other three release time settings. The amount of gain reduction in the multiband compressor is substantially lower (so that it operates more like a limiter than like a compressor), and the release time of the gain-riding AGC is speeded up (so that it provides compression and some increase of density). We made these trade-offs to prevent excessive build-up of density.

It is possible to experiment with this sound for music-oriented programming as well. However, even with these settings, your sound is getting farther away from the balance and texture of the input. We think that this is as far as processing can go without causing unacceptable listener fatigue. However, this sound may be quite useful for stations that are ordinarily heard very softly in the background because it improves intelligibility under these quiet listening conditions. Stations that are ordinarily played louder will probably prefer one of the slower release times, where the multiband compressor takes more gain reduction and where the AGC is operated slowly for gentle gain riding only. These slower sounds are less consistent than those produced by the FAST setting. Using SLOW preserves more of the source's frequency balance, making the sound less dense and fatiguing when the radio is played loudly.

**Bx THR** ("Band x Compression Threshold") controls set the compression threshold in each band, in units of dB below the final clipper threshold. We recommend making small changes around the factory settings to avoid changing the range over which the MB CLIPPING control operates. These controls will affect the spectral balance of the processing above threshold, but are also risky because they can strongly affect the amount of distortion produced by the back-end clipping system.

**MB GATE** ("Multiband Gate Threshold") control determines the lowest input level that will be recognized as program by OPTIMOD-FM; 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.

There are two independent gating circuits in the 8300. The first affects the AGC and the second affects the multiband compressor. Each has its own threshold control.

The multiband compressor 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 Equalization screen) is disabled.

**MB LIM DR** ("Multiband Limiter Drive") sets the drive level to the multiband distortion controlling processing that precedes the final clipping section. The distortion-controlling section uses a combination of distortion-cancelled clipping and look-ahead processing to anticipate and prevent excessive clipping distortion in the final clipper.

Like any other dynamics processing, the distortion-controlling section can produce artifacts of its own when overdriven. These artifacts can include loss of definition, smeared high frequencies, a sound similar to excessive compression, and, when operated at extreme settings, audible intermodulation distortion. You can adjust the MB LIM DR control to prevent such artifacts or to use them for coloration in "highly processed" formats.

**MB LIM THR** ("Multiband Limit Threshold") sets the threshold of the clipping distortion controller with reference to the threshold of the final clipper, in dB.

The most effective setting for this control is "0 dB" for almost all program material. However, the loudest and most intense-sounding presets rely on considerable clipping to achieve their loudness and brightness. For these presets, we found it necessary to set the MB LIM THR control substantially higher than "0" to permit more clipping depth. In some cases, this results in substantially objectionable distortion artifacts with isolated program material. However, this is the price to be paid for this extreme level of on-air loudness.

> For the NEWS-TALK and SPORTS presets, we set the MB LIM THR control slightly below "0." This ensures the cleanest possible speech quality at the cost of highest loudness. If you want higher loudness in these presets, you can edit them to increase the setting of the MB LIM THR control.
>
> In the UL presets only, this control sets the threshold of the Band-4 multiband clipper. (Unlike the normal latency presets, the UL presets do not have a program-adaptive clipping distortion controller, so repurposing the control does not cause a conflict.) Because the Band-4 multiband clipper helps control distortion in the final clipper, its setting is relatively critical and it is usually unwise to set it away from the default found in the source factory UL preset you are editing.

**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 V2.1 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 Expand 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 V2.1, 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 unnatu-

ral upper midrange boost in light pop and instrumental formats. The gain of band 5 is further affected by the B4>B5 CPL control.

**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 signals; this feed is unaffected by the band 4 MAX DELTA G / R control. 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 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 in light pop and talk formats. 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. The default setting is 30%.

**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 ±3 dB range.

Their range has been purposely limited because the only gain control element after these controls is the back-end clipping system (including the multiband clipper / distortion controller), which can produce considerable audible distortion if overdriven. The thresholds of the individual compressors have been carefully 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 8300 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 therefore 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 clipper overload, but unlike the MB BAND MIX controls, does not affect the frequency response when a given band is below threshold and is thus producing no gain reduction.

**HF CLIP** ("High Frequency Clipper Threshold") sets the threshold of the multiband clipper in band 5 with reference to the final clipper threshold, in dB. This clipper

helps prevent distortion in the final clipper when the input program material contains excessive energy above 6 kHz.

The Band 5 multiband clipper operates at 256 kHz and is fully anti-aliased.

## Advanced Multiband Controls

The following Advanced Multiband controls are available only from 8300 PC Remote software.

**Bx On / Off** switches allow you to listen to any band (or any combination of bands) independently. This is a feature designed for intermediate or advanced users and developers when they are creating new 8300 presets.

Please note that a single band will interact with the back-end clipping system quite differently than will that band when combined with all of the other bands. Therefore, do not assume that you can tune each band independently and have it sound the same when the clipping system is processing all bands simultaneously.

**Lookahead** activates or defeats the look-ahead functionality in the multiband compressor / limiter. Defeating look-ahead improves transient impact at the expense of distortion, particularly on speech. To mitigate this tradeoff, a selectable "auto" mode turns look-ahead on for speech material and off for music, using an automatic speech/music detector. Switching is seamless and click-free because we change the delay in the compressor control sidechains; this is not a way to reduce the 8300's throughput delay.

Choices are LOOKAHEAD IN, OUT, and AUTO.

> 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 right at 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." This can increase clipping distortion on such speech.
>
> If the BASS CLIP MODE is set to HARD, the speech/music detector will automatically set it to MEDIUM when speech is detected and HARD otherwise (unless LATENCY is LOW, in which case MEDIUM bass clipping is unavailable and bass clipping will stay HARD).
>
> Speech always sounds cleaner with MEDIUM bass clipping and the increased bass "punch" supplied by HARD is irrelevant to speech.
>
> This control does not affect the HD processing chain.

**B1-B4 Attack (Time)** 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. These

controls, which have never previously been available in an Orban processor, 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 clipping system (because slower attack times increase overshoots that must be eliminated in the clipping system). The results are strongly program-dependent, and must be verified with listening tests to a wide variety of program material.

The ATTACK time controls are calibrated in arbitrary units. Higher numbers correspond to slower attacks.

The look-ahead delay time in bands 3, 4, and 5 automatically tracks the setting of the ATTACK time controls to minimize overshoot for any attack time setting.

**MB Limit Speech Threshold**. See page 3-44.

**Maximum Distortion Control** limits the maximum amount of final clipper drive reduction (in dB) that the 8300's clipping distortion controller can apply, preventing over-control of transient material by the distortion controller. Instead, the final clipper is permitted to control some of the transient material (to increase "punch"), even though, technically, such clipping introduces "distortion." A setting of 4 to 5 dB works best in most cases. Factory default is 5 dB for virtually all presets.

**High Frequency Limiter** sets the amount of additional gain reduction occurring in band 5 when high frequency energy would otherwise cause excessive distortion in the final clipper. It uses an analysis of the activity in the final clipper to make this determination, and works in close cooperation with the band-5 multiband clipper. Functionally, this control is a mix control that adds a HF limiter gain reduction signal to the band 4 gain reduction signal to determine the total gain reduction in band 5. Higher settings produce more HF limiting. A setting of "–18" provides a good tradeoff between brightness and distortion at high frequencies.

**Limiter Attack** controls allow you to set the limiter attack anywhere from 0 to 100% of normal in the Five-Band compressor / 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 Five-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.

**B1/B2 Xover** (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.

## About the 8300's HD / Digital Radio Processing

The 8300 HD ("High Definition Digital Radio") output is designed to feed streaming, netcasting, and digital radio channels, either Eureka 147 or the iBiquity® High Definition Radio system (formerly known as "IBOC"—"In-Band On-Channel") approved for use in the United States.

The signal at the HD AES3 output is processed by a look-ahead limiter that operates in parallel with the analog FM peak limiting chain. The look-ahead limiter (which receives the 8300's "monitor" signal) is optimized to make the most of the limited bit-rate codec used in the High Definition Radio system's digital channel. By eschewing any clipping, the digital-channel output prevents the codec from wasting precious bits encoding clipping distortion products, instead allowing the codec to use its entire bit budget to encode the desired program material.

The look-ahead limiter is fed by a parametric high frequency shelving equalizer. You can use it to equalize texture disparities between the analog and digital channels and to reduce codec artifacts at high frequencies.

The HD output is designed to feed digital channels without pre-emphasis, which include almost all such channels. The only high-quality digital channels using pre-emphasis of which we are aware are NICAM channels (which use J.17 pre-emphasis) and some older CDs (which use EIAJ—50µs / 15µs shelving pre-emphasis). If you use the HD output to feed a digital channel with pre-emphasis, you must allow extra headroom to compensate for the unpredictable peak level changes that the pre-emphasis induces.

If the HD output is driving a channel without pre-emphasis, it will control peak levels with an uncertainty of approximately 2 dB. However, you may want to allow headroom to compensate for data reduction-induced peak overshoots at the receiver, which might otherwise cause clipping. In our experience, 2 dB is typically adequate for this task.

The ultra-low latency structure does not support HD processing. If an ultra-low-latency preset ("UL") is put on-air, the HD output will emit the de-emphasized, FM-processed output. Because of the diversity delay that is a part of the HD Radio system, ultra-low-latency processing has no advantages in this context and we would expect stations transmitting HD FM to always use a normal latency 5-band or a 2-band preset.

## Delay Difference between Digital-Channel and FM Outputs

To make the receiver analog/digital crossfade free from comb filtering, the time delays in the HD Radio's analog and digital channels must have a fixed and predictable offset, correctly implementing the HD Radio receiver's "time diversity" processing. The 8300's HD output has a constant time offset with respect to the FM output, regardless of the FM output's latency (which can vary depending on processing settings). This fixed time offset is approximately 3 ms. Therefore, the HD Radio exciter should be preset to compensate for this 3 ms offset between the FM output and HD output. You must then fine-tune the exciter's delay by ear to minimize comb filtering during analog/digital crossfades. Once you have done this, the time diversity delay will always be correct even if you choose a different 8300 preset.

> The ultra-low-latency structure does not support this feature and will have a different delay offset from the optimum 5-band and 2-band structures.

## HD I/O Setup Controls

- **Multiplex Power / HD Gain Reduction** meter is switchable via the METER FUNCTION control in SETUP. In MULTIPLEX POWER mode, it indicates the action of the ITU412 Multiplex Power controller. It shows how much the MPX Power Controller has reduced the clipper drive, thereby reducing the average power in the processed audio. It will show no gain reduction unless the MPX Power Controller is turned on. In HD GR mode, the meter indicates the larger of the gain reductions in the left and right channel look-ahead limiters for the HD Radio / digital radio / netcast processing chain .

  The PC Remote application shows all meters simultaneously and shows the left and right HD gain reduction meters separately.

  > The HD look-ahead limiter is not stereo-coupled. This prevents limiting on one channel from causing audible modulation effects on the other channel.

- **Digital Output:** You must use the AES digital output to drive the digital transmitter. All of its associated setup controls (output level, sample rate, format, word length, and dither) work the same as they do when this output is emitting the FM-processed signal.

## HD Audio Controls

*Included with each preset in Full Control on the 8300 unit and also in the "HD Proc-*

| Function | Control Name | Values |
|---|---|---|
| **HF Shelving Filter** | HD EQ Gain | 0…–6 dB; 0.5 dB steps |
| | HD EQ Freq | 2…– 20 kHz; 1 / 6-octave steps |
| **Look-Ahead Limiter** | HD Limiter Drive | 0…+12 dB; 1.0 dB steps |

Table 3-10: HD Audio Controls

*essing" page in PC Remote.*

**HD Eq Gain** determines the depth of high frequency shelving equalization produced by the parametric HF shelving equalizer, which is located before the look-ahead limiter.

This equalizer is sometimes useful for reducing the audible disparity between the FM and digital-channel outputs. The digital-channel output receives no high frequency limiting or clipping and may therefore be as much as 6 dB brighter than the FM output. If you wish to reduce this difference to smooth out the audible difference between the two channels during a receiver crossfade, you can apply HF rolloff to the digital-channel channel by ear. Another reason you might want to do this is if the digital-channel channel sounds excessively bright after you have optimized the 8300's tuning for FM..

Yet another reason to use HF rolloff in the digital-channel channel is to reduce codec artifacts at the high frequencies—the familiar "watery" sound.

The parametric HF shelving equalizer can only produce HF rolloff. It cannot boost.

**HD Eq Freq** sets the corner frequency of the parametric HF shelving equalizer.

**HD Limiter Dr** sets the drive level to the digital-channel look-ahead limiter.

The factory default is +4.

Because its loudness must match the FM channel, there is no need to over-process the digital channel. HD "loudness wars" will not only reduce quality but will also cause unbalanced, obtrusive crossfades between the analog and digital channels in the radio. To brand your station's sound, you can choose the precise coloration you want on the digital channel. You can still take advantage of all of the artistic choices implicit in stereo enhancer, equalization, and multiband compression / limiting settings. Yet you do not need to use excessive peak limiting, which can only reduce quality.

# ITU-R Multiplex Power Controller

The ITU-R recommends that the power in the composite baseband signal (including the pilot tone), integrated over any 60-second interval, not exceed the power in a sinewave that modulates the FM carrier to ±19 kHz (25.3% modulation re ±75 kHz deviation). Many European countries are now enforcing this recommendation. (See *ITU-R 412 Compliance* on page 3-9 for more information.)

### Multiplex Power Threshold

Your Optimod provides a means to limit the integrated multiplex power to the ITU standard by a closed-loop technique that allows you to use any preset and to create customized presets freely. The multiplex power controller is adjusted via the ITU412-9 control (see step 20 on page 2-22). Set it OFF if your country does not enforce the standard.

The control is located in the SETUP / STEREO ENCODER screen because the regulation applies to all operation of the processor in a given installation.

If your country enforces the standard, you should set the control to complement the amount of peak overshoot in the transmission system following your Optimod. Setting the control at "0" will correctly control the multiplex power when there is no overshoot after the 8300. This will typically be true when you are using your Optimod's built-in stereo encoder to drive the transmitter directly.

Section 1 of this manual has an extensive discussion of overshoot in transmission paths. See page 1-13 and following pages.

Many paths have overshoot. This forces you to reduce the average modulation to avoid overmodulating the transmitter. Reducing average modulation will reduce the multiplex power by the same amount, forcing the multiplex power below the ITU requirement.

To compensate for this, match the ITU412-9 control to the peak overshoot of the transmission system following the 8300. For example, if RF peak deviation exceeds the peak deviation produced by the 8300's sinewave oscillator (set for 100% modu-

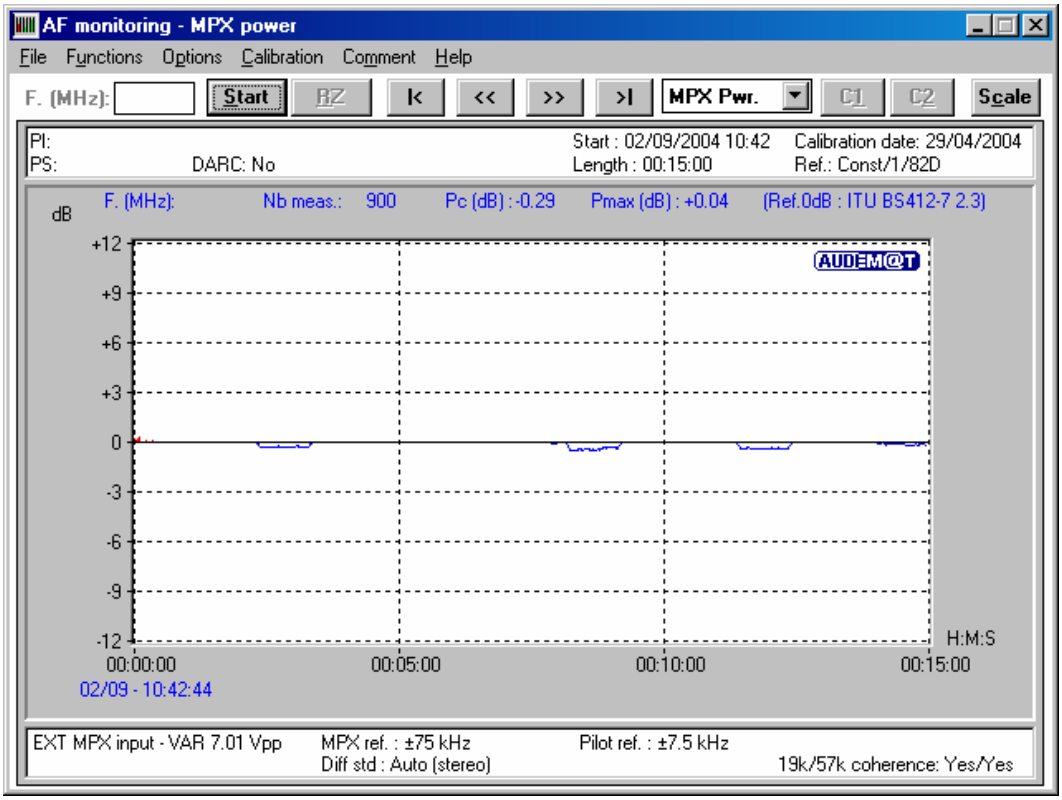



Figure 3-1: Multiplex Power over 15 Minute Observation Interval
with MPX Power Controller Active, measured at Optimod's Composite Output

lation) by 3 dB, set the MULTIPLEX POWER THRESHOLD to "+3."

### Audio Processing and the Multiplex Power Threshold Control

The multiplex power controller reduces multiplex power by applying gain reduction before the Optimod's FM peak limiting, thereby reducing the drive into the clippers.

With no power control, some of the louder 8300 presets can exceed the ITU standard by as much as 9 dB. This means that the clipper drive must be reduced by as much as 9 dB, and this will vary according to the dynamics and spectral content of the input program material. To prevent unnatural loudness variations, your Optimod applies a static loss (set by the MPX POWER OFFSET control) when the multiplex power controller is activated. This complements the dynamic gain reduction produced by the multiplex power controller. See the notes on the MPX POWER OFFSET control on page 3-35.

The multiplex power controller is operational with all of the Two-Band and Five-Band processing structures. *It is not operational in Test mode and will not prevent the 8300's test oscillator from producing illegal modulation.* It is the responsibility of the operator to make sure that the test oscillator does not violate the ITU requirements. (To ensure this, never modulate the carrier with a single L+R tone that produces total carrier modulation, including pilot tone, of more than 24%.)

| **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 | LOG |
| TONE LVL | % | 91 | 0 … 121 | 1 |
| TONE CHAN | --- | L+R | L+R, L–R, LEFT; RIGHT | --- |
| PILOT | --- | ON | ON, OFF | --- |

Table 3-11: Test Modes

## Test Modes

The Test Modes screen allows you to switch between OPERATE, BYPASS, and TONE. When you switch to BYPASS or TONE, the preset you have on air is saved and will be restored when you switch back to OPERATE.

Table 3-11: Test Modes on page 3-59 shows the facilities available, which should be self-explanatory.

## Getting the Bass Sound You Want

Probably the most frequently asked question we get regarding 8300 setup is "How do I get a (such-and-such) bass sound?" It seems that individual preference varies in this area more than anywhere else.

There are no magic formulas. The 8300 has extremely versatile controls affecting bass sound and will allow you to get almost any sound you want as long as that sound respects the laws of physics—or, in this case, the laws of psychoacoustics.

The ear is far less sensitive to bass than to midrange sounds. You can see this for yourself by examining the classic Fletcher-Munson "equal-loudness" curves. This means that if you want robust bass, this will take up a great deal of room in your modulation waveform. This room could otherwise be used for midrange, where far smaller amounts of energy yield the same amount of loudness. Accordingly, there is an important tradeoff between loudness and bass—if you want more bass, you will have to accept either less loudness or noticeably more distortion, which occurs when the bass waveforms push the midrange and high frequency material into the 8300's final clipper.

There is one psychoacoustic trick you can use to create more apparent bass while using modulation headroom efficiently. For hundreds of years, pipe organ makers have tricked the ear into hearing non-existent fundamental tones (which would require huge, expensive pipes) by replacing them with several, smaller pipes tuned to the lower harmonics of the missing fundamental. In the 8300, you can use the bass clipper to make harmonic distortion for this purpose. As explained above, the bass clipper has three settings—SOFT, MEDIUM, AND HARD—that determine the amount of distortion the clipper makes when its clips bands 1 and 2. SOFT provides the purest sound, but MEDIUM and HARD create progressively more distortion on bass. Because HARD can make noticeable IM distortion, the factory programmers prefer MEDIUM for most presets.

However, if you are willing to trade off IM distortion against bass punch, then you could also use HARD. HARD is particularly effective in increasing bass punch because it flattops bass transients and this allows the waveform to accommodate fundamentals that have a larger peak level (by up to 2 dB) than the peak level of the flat-top. (The fundamental of a square wave has a peak level 2.1 dB higher than the peak level of the square wave.) In essence, by doing this, your bass fundamentals can exceed 100% modulation without having the composite stereo waveform itself exceed this level. In HARD mode, you can use the BASS CLIP SHAPE control to determine if the knee of the transfer curve is more abrupt (BASS CLIP SHAPE set toward 0) or gentle (BASS CLIP SHAPE set toward 10). Abrupt curves make more high-order harmonic distortion but less IM distortion; gentle curves make more IM and low-order harmonic distortion.

The attack time of the band 1 compressor also affects bass punch by determining the amount of bass transient material that is allowed to pass through the compressor before the attack clamps down the rest of the waveform. Any transient that passes through the band 1 compressor will hit the bass clipper, so slower attack times on band 1 will increase bass punch at the expense of distortion (particularly on

voice that is mixed with music and thus not automatically detected as speech). The BAND 1 ATTACK TIME settings in the factory presets have been adjusted with this tradeoff in mind, but you might prefer to make a different one. Also, compared to HARD bass clipping, MEDIUM or SOFT bass clipping allow you to drive the bass clipper much harder for a given amount of audible bass distortion.

The threshold of the band 1 compressor will also affect bass punch. We recommend that you carefully study the setting of this control (and the BAND 1 ATTACK TIME control) in the various 8300 factory presets before making your own adjustments, so you can get a feel for how we made the tradeoff between punch and distortion at the factory. If you set the threshold much above –6 dB, you will typically get some distortion even on steady-state waveforms (depending on where you have set the BASS CLIPPER THRESH control).

This control is the primary means of trading off bass punch against IM distortion caused the bass' pushing non-bass material into the final clippers. Set it more negative for less punch but less IM distortion.

Note that when you use HARD bass clipping, this will automatically switch to MEDIUM when speech is detected by the 8300's speech/music detector. This allows you more freedom to seek bass punch without introducing distortion on speech.

There are two bass equalizer sections—the **low bass shelving equalizer** and the **bass parametric equalizer**. The main thing to remember about these sections is that they are static tone controls that apply coloration equally to all program material entering the main dynamics processing section of the 8300. (They do not affect the AGC section, being located after it in the signal flow.) Accordingly, the five-band compressor in the 8300 will attempt to undo any coloration added in the equalizer setting and will automatically re-equalize the sound to the standard established by the band threshold controls.

Therefore, to get bass to survive the dynamics processing in the 8300, it is usually necessary to apply substantial bass boost to the input by using the equalizer controls. (A small amount of boost will just be "automatically re-equalized" away; check the factory presets to see what we mean by "substantial.") Bear in mind that using large amounts of shelving bass boost (particularly with 12- or 18 dB/octave slopes) can cause an effective loss of mid-bass because the band 2 compressor will be forced to produce additional gain reduction.

Another important control that affects bass is the BAND 1 OUTPUT MIX control. Because this is located after the dynamics processing, the dynamics processing will not fight any adjustments you make to this control. However, the downside is that the bass compressor will not act to prevent excessive drive to the clipping system (and consequent distortion), so be very careful when boosting this control.

The crossover between band 1 and band 2 is adjustable to 100 Hz or 200 Hz by the B1 / B2 XOVER control. When the crossover is set to 100 Hz, band 1 affects extreme low bass (the kind of bass that small clock and portable radios do *not* reproduce), while band 2 affects the mid-bass and lower midrange. Setting the crossover at 200 Hz will cause more gain reduction to occur below 200 Hz because more energy is applied to the band 1 compressor. If you now increase the fixed bass boost by using

the LOW BASS equalizer with an 18 dB/octave slope and 120 Hz tuning, the net result will be a dynamic reduction of bass power, typically centered around 160 Hz. If you use enough low bass boost, there will also be a slight increase in the bass power below 100 Hz or so. This 160 Hz suck-out can give an extremely solid, punchy bass sound on radios with good bass response (particularly on radios with subwoofers) but may cause smaller radios to sound thin. (This is the bass formula used in the two GREGG presets.) The rest of the presets use the 100 Hz crossover and have more mid-bass.

To summarize: Bass is a matter of preference, but the canny broadcast engineer will be aware of the variability of radios out there and will not apply excessive bass boost that can sound *awful* on "boom-boxes" and other consumer radios with bass boost already built-in. It is usually wise to emulate the bass balance of hit CDs, because very experienced people who make these trade-offs every day have mastered these. The 8300 provides enormous flexibility to get the bass sound you want, but this flexibility comes at a price—you have to familiarize yourself with the relevant controls and truly understand what you are doing. This manual is there to help and it is worthwhile to reserve some time with if you want to become an 8300 bass expert.

## Using the 8300 PC Remote Control Software

8300 PC Remote control software allows you to access any front-panel 8300 control. In addition, you can access all of the Advanced Modify controls that are unavailable from the 8300's front panel. The software also gives you the ability to backup user presets, system files, and automation files on your computer's storage devices (hard drives, floppy drives, etc.) and to restore them later to your 8300.

The 8300 PC Remote software can connect to your 8300 via modem, direct serial cable connection, or Ethernet network. It communicates with your 8300 via the TCP/IP protocol, regardless of how it is connected to your 8300.

> PC Remote works best on displays of 1024x768 pel or higher. Scroll bars will appear when using lower resolutions.

Before running 8300 PC Remote, you must have installed the appropriate Windows communications services on your computer. By default, the installer installs a shortcut to 8300PC.exe on your desktop and in your Start Menu under Orban\Optimod 8300.

8300 PC Remote can control only one 8300 at a time, but it can readily switch between several 8300s. 8300 PC Remote has a built-in "address book" that allows it to select and connect to:

- any 8300 on the same network as the PC,
- an 8300 that can be accessed through a modem connected to the PC via dial-up networking, and,
- an 8300 that is connected directly to the PC's serial port.

Before your PC can communicate with a given 8300, you must first set up a "connection," which is information that allows PC Remote to locate and communicate with the 8300.

## To set up a new connection:

A) Launch 8300PC.exe.

B) Create a new 8300 connection by choosing NEW 8300 from the CONNECT file menu or by right-clicking on the ALL CONNECTIONS icon in the Connections List and selecting NEW 8300.

The Connection Properties dialog box opens.

C) Enter an Alias name for your 8300 (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 2-33.

Otherwise, enter a password to allow PC Remote to connect to your 8300 without requiring a password when the connection is initiated.

> To initiate a successful connection, a password must have already been entered into your 8300 unit.

E) If you are communicating with your 8300 through a network, select the Ethernet radio button and enter the appropriate IP address, subnet mask, port, and gateway data. Note that these values must agree with the values that you set in your 8300 (see step 1 on page 2-37). See also *Setting Up Ethernet, LAN, and VPN Connections* on page 2-45.

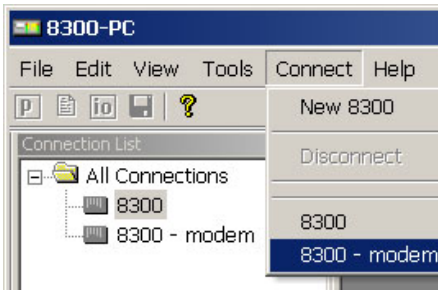
If you are communicating via a direct serial cable connection or a modem connection, follow the appropriate procedure described in *Appendix: Setting up Serial Communications,* starting on page 2-47.

F) Click OK after entering all required information.

## To initiate communication:

Initiate communication by double-clicking on the desired 8300 alias in the Connections List, or by selecting the desired 8300 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 8300…" go to your 8300 unit and enter a passcode.

- If an Enter Passcode dialog box appears, enter a valid passcode and the 8300 PC Remote software will initiate a connection to the 8300 unit.

A window will appear saying, "Connecting to the 8300, 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 8300 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 8300. 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:

A) Choose PROCESSING PARAMETERS from the EDIT menu.

B) 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.

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 put it on-air.

> Continually clicking the RECALL PRESET button will toggle between the current and previous on-air 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 8300's memory each time 8300 PC Remote connects to that 8300. The 8300's memory is the "master." This means that if you delete a user preset from the 8300's memory (whether locally via its front panel or via 8300 PC Remote), 8300 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- 65.)

## 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 8300 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.

To make more than one backup archive, rename the current backup folder (for example, to "Backup1"). 8300 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, 8300 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.

## To restore archived presets, system files, and automation files:

In addition to restoring an archived preset to its original Optimod, you can also copy archived presets from one Optimod to another. The Optimod whose connection is active will receive the preset.

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 8300 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 elect to restore all user presets (*.orb83user, *.orbu, *.orb85user), 8300 user presets (*.orb83user), 8400 user presets (*.orbu), 8500 user presets (*.orb85user), system files (*.orb83setup), and automation files (*.orb83autom).

If you want to restore files from a different directory (i.e., that might have been created on a different 8300), 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 (*.orb83user, *.orbu, *.orb85user).

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 (*.orb83user, *.orbu, *.orb85user)

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 (*.orb83setup).

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 (*.orb83autom)

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 share an archived User Preset between 8300s:**

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 8300 to which 8300 PC Remote is currently connected.

If the User Preset is encrypted, PC Remote will request its password.

## To modify INPUT/OUTPUT and SYSTEM SETUP:

Choose SETUP from the TOOLS menu.

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 8300s:

Right-click ALL CONNECTIONS in the Connections List and select NEW GROUP.

You can add multiple 8300 to a single group to help organize a network of 8300. However, only one 8300 from within a group can be connected to 8300 PC Remote at any one time.

## Operation 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.

Also, please note the following behavior:

- If you close the PC Remote connection from the PC, you will be given the choice of staying connected through the ppp or disconnecting.
- If you close the connection from PC Remote but choose not to close the ppp connection, the END PC REMOTE button will remain displayed on the 8300's front panel. If you then select that button, the ppp connection will close.

  This behavior ensures that a user can tell from the 8300's front panel if a remote connection is active. A user can disconnect the PC connection at the 8300 if he or she wishes. This minimizes the likelihood of someone's leaving a connection open while someone else tries to access that 8300.

## About Aliases created by Optimod 8300 PC Remote Software

When you ADD A NEW 8300 using Optimod 8300 PC Remote, your 8300 is automatically given an 8300 Alias name to differentiate it from other 8300s. You can change the name anytime in the 8300 Properties window inside 8300 PC Remote.

When you add a new 8300 or change the name of an existing 8300 Alias, an Alias folder is created in the same location as the executable for Optimod 8300 PC Remote (usually \Program Files\Orban\Optimod 8300). The folder has the same name as the Alias name. Once you establish the initial connection to the 8300, all presets for that 8300 are automatically copied to the Alias folder; thus, the folder contains all the preset files for that 8300, both Factory and User. If you have backed up the 8300

using 8300 PC Remote, there will also be 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.

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 8300s when 8300 PC Remote connects to such an 8300.

## Multiple Installations of Optimod 8300 PC Remote

Rarely, you may want to have more than one installation of 8300 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 8300 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 8300 PC Remote must match the version of the software in the 8300 controlled by it. Therefore, you will only need multiple installations of PC Remote (having separate version numbers) if:

- you are controlling multiple 8300s, and
- not all of your 8300s are running the same version of 8300 software, and
- you do not want to upgrade at least one controlled 8300 to the latest version of 8300 PC Remote software.

Each version of 8300 PC Remote has its own top-level folder, normally under \Program Files\Orban. (The default folder is \Program Files\Orban\Optimod 8300.) When you install a new version of 8300 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 8300v2).

Each version of 8300 PC Remote will display *all* 8300 Aliases, even those pointing to 8300s with incompatible version numbers. If you attempt to connect to an older version of 8300 from a newer version of 8300 PC Remote, 8300 PC Remote will offer to upgrade the software in the target 8300 so that it corresponds to the version of 8300 PC Remote that is active. If you attempt to connect to newer version of 8300 from an older version of 8300 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 8300 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 8300 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 to do this.* The old Alias folders need to be recreated under the Optimod 8300 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 8300 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 8300 PC Remote executable.

- **Delete and Recreate the Alias:** Start the Optimod 8300 PC Remote executable you wish to use. Delete the old 8300 Aliases and create new ones to replace them. New Alias folders will be created in the same location as the Optimod 8300 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 Import Archived 8400 and 8500 Presets into Your 8300

See *To restore archived presets, system files, and automation files* on page 3-66 for step by step instructions.

The 8300 shares some signal processing technology with Orban's Optimod-FM 8400 and 8500. However, the 8300 has fewer features. Using 8300 PC Remote software, you can import into the 8300 any 8400 and 8500 User Presets that you archived using the 8400 or 8500 PC Remote software. If you try to import an 8400/8500 preset using 8400/8500 features that 8300 does not support, the 8300 will interpret the preset as best it can using 8300 features:

- The 8300's stereo enhancer offers only "Orban 222-style" enhancement. Therefore, the 8300 will always interpret the 8400 STYLE parameter as set to 222. It will ignore the DIFFUSION and DEPTH parameters.
- The 8300's multiband compressor / limiter cannot be operated in dual-mono or partially coupled mode. It is always fully stereo-coupled.

A) The 8300 will always interpret the 8400 MB DOWNEXPSTCPL parameter as set to COUPLE.

B) The 8300 will always interpret the 8400 BXMAXIMUM DELTA GAIN REDUCTION parameter as set to "0" (i.e., fully coupled).

The 8300's AGC is capable of dual-mono mode, so, unlike the multiband compressor / limiter coupling parameters, the 8300 interprets all 8400 AGC coupling parameters normally.

- The 8300's 19 kHz protection filter is always ON. Therefore, the 8300 will always interpret the 8400 PILOT PROTECT parameter as set to ON.

The following differences between the 8300 and 8400/8500 do not affect the 8300's ability to import 8400 presets, but are included here for reference.

- The 8300's "ultra-low latency" processing uses 8200 clipping technology, updated with anti-aliased clippers operating at 256 kHz sample rate. This mode is available on the 8500 but not on the 8400. It is available on the 8300 because one application of the 8300 is to replace the 8200 in installations requiring the very low delay (in the range of the 8200's delay).
- Switching between an "optimum" or "two-band" preset and an "ultra-low latency" preset requires re-loading DSP code, which causes a brief audio mute in the 8300. However, no mute occurs when switching between an "optimum" and "two-band" preset. In the 8400 and 8500, all processing structures are simultaneously active and no audio mute occurs when switching between them.

# Section 4
# Maintenance

## Routine Maintenance

The 8300 OPTIMOD-FM 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 8300's output.**

   A good ear will pick up many faults. Familiarize yourself with the "sound" of the 8300 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 8300 is at fault. The troubleshooting information in Section 5 will help you determine if the problem is with OPTIMOD-FM 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 8300 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.

# Subassembly Removal and Replacement

See page 6-29 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 8300 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.

B) Set the unit upright on a padded surface with the front panel facing you.

C) Remove all eighteen 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 three ribbon cables that connect the display board assembly to the base board. Gently lift each cable up from where it connects to its jumper, so that the jumper pins unseat without bending or breaking.

B) Detach the front panel from the unit.

a) Disconnect the three-wire cable at the back of the encoder.

b) Detach the ground lug that connects the panel's ground wire to the chassis.

Use a ¼-inch nut driver or needle-nose pliers.

c) Remove the front panel.

The front panel is held in place by four ball studs at each corner. The panel should snap away from the chassis if you apply a little force.

C) Using a screwdriver, remove the ten gold-colored screws and washers that connect the display board to the front of the chassis.

D) Remove the display board assembly by removing the tape from the top front edge of the chassis, so that the white ribbon cables are no longer attached to the chassis and the display panel is free.

Do not remove the tape from the white ribbon cables.

**3. Removing the RS-232 Connector 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 two hex nuts holding the RS-232 connector to the chassis.

C) Unplug the RS-232 interface assembly from the base board.

**4. Removing the CPU Module:**

A) Remove the four screws holding the CPU module to the standoffs that support it on the base board.

B) Applying gentle upward pressure, unplug the CPU module from the base board.

**5. Removing the Base Board:**

A) If you have not done so yet, remove the top cover (step 1, above).

B) If you have not done so yet, remove the CPU module (step 4, above).

C) Using a 3/16-inch hex nut driver, remove the two hex nuts holding the DB-25 connector to the rear panel of the chassis.

D) If you have not done so yet, remove the RS-232 connector board (step 3, above).

E) If you have not done so yet, remove the five cables that connect the display assembly to the base board.

F) If you have not already done so, remove the RS-232 interface assembly from the base board (step 3 on page 4-2).

G) Disconnect the ribbon cable connecting the base board to the I/O board.

H) Disconnect the ribbon cable connecting the base board to the DSP board.

I) Disconnect the ribbon cable connecting the power supply to the base board.

J) Using a #1 Philips screwdriver, remove the four corner screws holding the base board to the chassis standoffs.

K) Using a 3/16-inch hex nut driver, remove the four hex standoffs on which the CPU module was mounted

L) The base board is now free and can be removed from the chassis.

**6. Removing the I/O (Input/Output) Board:**

A) If you have not done so yet, remove the top cover (step 1, above).

B) Unlock all six 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 four nuts and lockwashers fastening the four BNC connectors to the chassis.

Use great care not to scrape the paint, particularly if you are using pliers.

D) Remove the ribbon cable that connects the I/O board to the base board.

E) Remove the ribbon cable that connects the I/O board to the DSP board.

F) Remove the ribbon cable connecting the power supply to the I/O board.

G) Remove the three #1 Phillips screws (and their washers) that connect the I/O board to the chassis.

H) Carefully pull the I/O board forward to clear the XLRs from their housings, and then lift the board out of the chassis.

**7. Removing the DSP Board:**

A) If you have not done so yet, remove the top cover (step 1, above).

B) Remove the ribbon cable that connects the I/O board to the DSP board.

C) Remove the ribbon cable that connects the base board to the DSP board.

D) Remove the plug connecting the power supply wiring harness to the DSP board.

E) Remove the five #1 Phillips screws (and their washers) that connect the DSP board to the chassis.

F) Lift the DSP board out of the chassis.

**8. Removing the Power Supply Board:**

A) If you have not done so yet, remove the top cover (step 1, above).

B) Remove the two plugs that connect the power supply board to the power transformer.

> If present, remove the white fasteners that tie the two cables to the power supply board.

C) Remove the ribbon cable connecting the power supply to the base board, DSP board, and I/O board.

D) Remove the nine #1 Phillips screws (and their washers) fastening the heat sink to the side of the chassis.

E) Remove the nut and star washer from the ground wire with a ¼-inch nut driver.

F) Remove the two Phillips screws (and matching washers) that hold the IEC (line cord) connector to the chassis.

G) Remove the three Phillips screws holding the power supply board to the main chassis.

> Note that one screw is located under the safety cover close to the line voltage selector switch. Lift the cover up to expose the screw.

H) Carefully lift the power supply board up.

**9. Reattaching the Power Supply Board:**

A) Set power supply board into main chassis, so that it aligns with its mounting holes.

B) Replace the two Phillips screws that hold the IEC connector.

C) Replace the nine #1 Phillips screws that hold the heat sink to the side of the chassis. If necessary, add additional heat sink compound to ensure a reliable thermal connection between the heat sink and the chassis.

D) Replace the ground wire nut.

E) Replace the three Phillips screws that hold the power supply board to the main chassis.

F) Reattach the two plugs that connect the power supply board to the transformer.

G) Reattach the two plugs for the power distribution wiring harnesses.

**10. Replacing the Base Board, I/O Board, and DSP board:**

Referring to steps 5 – 7, follow the instructions in reverse.

Note that you cannot replace the RS-232 board and the CPU board until you have replaced the base board.

**11. Replacing the CPU Board:**

Referring to step 4, follow the instructions in reverse.

**12. Replacing the RS-232 Board:**

Referring to step 3, follow the instructions in reverse.

**13. Replacing the Front Panel Assembly:**

A) Set the display assembly in place so that it aligns with its mounting holes.

B) Replace the ten gold-colored screws that connect the display board to the front of the chassis.

C) Reattach the five 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.

D) Attach the front panel assembly to the unit.

a) Line up the plastic front panel and snap it back on, making sure each key pad button feeds through its respective hole properly.

b) Reattach the ground lug that connects the panel's ground wire to the chassis.

Use a ¼-inch nut driver or needle-nose pliers.

c) Reconnect the three-wire cable at the back of the encoder.

**14. Replacing the Top Cover:**

A) Place top on unit and reattach the eighteen Phillips screws. (Be careful not to pinch any cables.)

# Field Audit of Performance

**Required Equipment:**

- Ultra-low distortion sine-wave oscillator / THD analyzer / audio voltmeter

  With verified residual distortion below 0.01%. Sound Technology 1710B; 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.

- Spectrum analyzer with tracking generator

  Stanford Research Systems SR760 or equivalent. Alternatively, a sweep generator with 50-15,000 Hz logarithmic sweep can be used with an oscilloscope in X/Y mode, or you can use a computer-controlled test set like the Audio Precision System One.

- Digital voltmeter

  Accurate to ±0.1%.

- Oscilloscope

  DC-coupled, triggered sweep, with 5 MHz or greater vertical bandwidth.

- Two 620Ω ±5% resistors.

- Optional: Audio Precision System 1 (without digital option) or System 2 (for digital tests).

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 8300'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. Ordinarily, 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 8300 at most frequencies. However, in an emergency it is usually possible to detect many of the more severe faults that could develop in the 8300 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, jumper 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 620Ω ±5% resistor tied between pin 2 and 3 of the XLR connector.

**1. Prepare the unit.**

A) Set the GND LIFT switch to the earth ground symbol setting (left position) to connect chassis ground to circuit ground.

B) Use the front panel controls to set the 8300's software controls to their default settings, as follows:

a) Navigate to SETUP / IO CALIB / ANLG IN CALIB. After writing down the old settings (so you can restore them later), set controls as follows:

Input ..... analog
AI Ref VU ..... +4.0 dBu
R CH BAL.....0.0 dB

b) Navigate to SETUP / IO CALIB / DIG IN CALIB. Set controls as follows:

DI Ref VU .....–15.0 dBFS
R CH BAL.....0.0 dB

c) Navigate to Setup / Io Calib / Anlg Out Calib. Set controls as follows:

AO 100% ..... +10.0 dBu
AO Pre-E .....Flat
AO FEEDS.....xmitter

d) Navigate to SETUP / IO CALIB / DIG OUT CALIB. Set controls as follows:

DO 100% .....–2.8 dBFS
DO Pre-E ..... flat
DO RATE .....32 kHz
DO SYNC.....internal

e) Press the NEXT button. Set controls as follows:

Word Len.....20
Dither.....Out
FORMAT .....AES3

f) Navigate to SETUP / STEREO ENCODER. Set the ITU412-9 control to OFF.

g) Navigate to SETUP / TEST. Set controls as follows:

MODE .....Bypass

**NOTE:** Bypass defeats all compression, limiting, and program equalization, but retains the selected pre-emphasis (either 50μs or 75μs).

BYPASS GAIN .....0 dB
TONE FREQ.....400 Hz
TONE LVL..... 100%

h) Press the NEXT button.

i) Set controls as follows:

TONE CHAN.....L+R
PILOT.....ON

**2. Test the power supply**

A) If the power supply is entirely dead and the fuse is not blown, verify that the primary winding of the power transformer is intact by measuring the resistance of the power supply at the IEC AC line connector.

For 115-volt operation, the resistance should be approximately 7.6Ω.

For 230-volt operation, the resistance should be approximately 27Ω.

| Number of Red Flashes | Problem With |
|---|---|
| 1 | + unregulated supply |
| 2 | +15V or –15V |
| 3 | +5V or –5V |
| 4 | +5V Digital |
| 5 | Analog ↔Digital ground connection broken |
| 6 | DSP A +3.3V supply |
| 7 | DSP B +3.3V supply |
| 8 | CPU +3.3V supply |
| 9 | CPU +2.5V supply |

Table 4-1: Decoder Chart for Power Supervisor

B) The green LED power indicator on the lower left of the front panel monitors the DC power supply outputs. If one or more power supply voltages are out of tolerance, red flashes will report them according to Table 4-1. If there are multiple values out of tolerance, they are reported one after another in a continuous loop, with one green flash indicating the beginning of each count.

You can monitor power supply voltages at connector J7 on the power supply board (see Section 6 for schematic and parts locator drawing). When one faces the connector, the voltages can be found on the pins in

the following pattern:

| | | | | |
|---|---|---|---|---|
| (1) + unreg. | (3) digital gnd | (5) +15V | (7) +5 V digital | (9) –5V analog |
| (2) - unreg | (4) chassis gnd | (6) -15V | (8) +5V analog | (10) NC |

Table 4-2: Layout Diagram of J7, with expected voltages on each pin

The +3.3V and +2.5V supplies are locally regulated on the DSP and base boards (see Section 6).

C) Measure the regulated voltages at J7 with the DVM and observe the ripple with an oscilloscope, AC-coupled. The following results are typical:

| Power Supply Rail | DC Voltage (volts) | AC Ripple (mV p-p) |
|---|---|---|
| +15VDC | +15 ± 0.5 | <20 |
| –15VDC | –15 ± 0.5 | <20 |
| +5VDC | +5 ± 0.25 | <20 |
| –5VDC | –5 ± 0.25 | <20 |
| Digital +5VDC | +5 ± 0.25 | [Obscured by noise] |

Table 4-3: Typical Power Supply Voltages and AC Ripple

**3. Adjust Analog Output Level Trim.**

A) Verify 8300 software controls are set to their default settings. [Refer to step (1.B) on page 4-7.]

B) Feed the 8300 output with the built-in 400 Hz test tone:

a) Navigate to SETUP / TEST.

b) Set the MODE to TONE.

C) Connect the audio voltmeter to the Left Analog Output.

D) Adjust output trim VR200 to make the meter read +10.0 dBu. (0 dBu = 0.775V rms.) Verify a frequency reading of 400 Hz.

E) Verify THD+N reading of <0.05% (0.02% typical) using a 22 kHz low pass filter in the distortion analyzer.

F) Set the MODE to BYPASS.

> BYPASS defeats all compression, limiting, and program equalization but retains pre-emphasis.

G) Verify a reading (noise) of <–80 dBu at the output of the unit.

H) Using VR201, repeat steps (C) through (G) for the Right Analog Output.

**4. Check frequency response of Analog I/O.**

A) Verify 8300 software controls are set to their default settings. [Refer to step (1.B) on page 4-7.]

B) Be sure you are still in BYPASS mode [see step (3.F)].

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.

This is 20 dB below the clip level, which allows headroom for pre-emphasis. (75μs pre-emphasis will cause 17 dB of boost at 15 kHz.)

E) Connect the audio analyzer to the 8300's Left Analog Output XLR connector.

F) Verify a level of 0 dBu ±1 dB. Use this level as the reference level.

G) Verify that frequency response at 50 Hz, 100 Hz, 400 Hz, 5 kHz, and 15 kHz is within ±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 8300 software controls are set to their default settings. (Refer to page 4-7.)

B) Be sure you are still in BYPASS mode [see step (3.F)].

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 COMP meter on the 8300 read 100.

You will have to reduce the output level of the oscillator at higher frequencies to compensate for the pre-emphasis boost in the 8300.

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% |
| 15 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 8300.

**6. Test Digital Sample Rate Converter (Receiver).**

A) Verify 8300 software controls are set to their default settings. (Refer to page 4-7.)

B) Be sure you are still in BYPASS mode [see step (3.F)].

C) Navigate to SETUP / DIG IN CALIB.

D) Set the INPUT to DIGITAL.

E) Connect the digital source generator to the AES3 Digital Input XLR connector of the 8300.

F) Set the frequency of the digital source generator to 400 Hz and its output level to 6 dB below full scale.

G) Inject the Digital Input with a sample rate of 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, and 96 kHz. Use 24-bit words.

H) Listen to the analog outputs of the 8300 and verify that the output sounds clean and glitch-free regardless of the input sample rate.

I) Leave the digital source generator connected to the 8300.

**7. Test Digital Sample Rate Converter (Transmitter).**

A) Connect an AES3 analyzer (like the Audio Precision System 2) to the 8300's AES3 digital output.

B) Set the sample rate of the digital source generator to 48 kHz.

C) Navigate to SETUP / DIG OUT CALIB.

D) Change the DO RATE to 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, and 96 kHz, and verify that the frequencies measured at the 8300's AES3 output follow the values in the chart below within given tolerances:

| Sample Rate | Tolerance (PPM) | Tolerance ( Hz) |
|---|---|---|
| 32.0 kHz | 100 PPM | ±3.20 Hz |
| 44.1 kHz | 100 PPM | ±4.41 Hz |
| 48.0 kHz | 100 PPM | ±4.80 Hz |
| 88.2 kHz | 100 PPM | ±8.82 Hz |
| 96.0 kHz | 100 PPM | ±9.60 Hz |

E) Disconnect the digital source generator from the 8300.

**8. Test the 8300's stereo encoder.**

A) Connect an accurate stereo monitor like the Belar FMMS-1 ("Wizard") stereo demodulator to the 8300's COMPOSITE OUTPUT 1.

This is labeled COMPOSITE OUT and appears on a BNC connector on the 8300's rear panel.

**NOTE:** The recommended Belar monitor is the only instrument we have encountered that can accurately measure the performance of the 8300's stereo encoder. With most older-technology monitors, you will be measuring the performance of the monitor, not the 8300's encoder. (Of course, we have not evaluated every monitor on the market.)

B) On the 8300, navigate to SETUP / TEST.

C) Set the MODE to TONE.

D) Set the test tone parameters as follows:

Tone Freq.....400 Hz
Tone Lvl..... 91%
Tone Chan .....L+R
Pilot..... On

You will have to press the NEXT button to access all of these parameters.

E) Navigate to SETUP / STEREO ENCODER.

F) Set the COMP1 LVL control to make the stereo monitor read 100% total modulation.

G) Navigate to SETUP / TEST to access the 8300's tone oscillator parameters.

H) Measure the L–R level on the stereo monitor at several frequencies, in units of dB below 100% modulation. This is the main channel to subchannel crosstalk. It should not exceed –70 dB, 50-15,000 Hz.

I) Set the TONE CHAN to L–R. (You will have to press the NEXT button to access this setting and then the PREV button to return to the TONE FREQ control.) Measure the L+R level on the stereo monitor at several frequencies, in units of dB below 100% modulation. This is the subchannel to main channel crosstalk. It should not exceed –70 dB, 50-15,000 Hz.

J) Set the TONE CHAN to LEFT. Measure the Right level on the stereo monitor at several frequencies, in units of dB below 100% modulation. This is left-into-right stereo separation. It should not exceed –60 dB, 50-15,000 Hz.

K) Set the TONE CHAN to RIGHT. Measure the Left level on the stereo monitor at several frequencies, in units of dB below 100% modulation. This is right-into-left stereo separation. It should not exceed –60 dB, 50-15,000 Hz.

L) Set the TONE CHAN to L–R and the TONE FREQ to 5000.0 HZ. Measure the 38 kHz subcarrier suppression on the stereo monitor. It should not exceed –60 dB.

M) Measure the Pilot Modulation on the stereo monitor. It should read 0%.

N) Set SETUP / STEREO ENCODER / COMP1 LVL to 0.0%. Measure the de-emphasized noise at the left and right outputs of the stereo monitor. It should not exceed –80 dB below 100% modulation.

O) Repeat steps (D) through (N) for the 8300's COMPOSITE OUTPUT 2. (Use the COMP2 LVL control instead of the COMP1 LVL control.)

P) Using the stereo monitor, verify that pilot tone injection is between 8% and 10% modulation. If it is outside these parameters, adjust it to 9% via SETUP / STEREO ENCODER / NEXT / PILOT LVL.

> If the measured pilot level varies by more than a few tenths of percent from the pilot level indicated, this indicates there may be a problem elsewhere — either in your measuring setup, or with the 8300.

Q) With the COMP2 LVL still set to 0.0%, connect a frequency counter to either of the 8300's composite outputs. Verify that the pilot tone frequency is 19,000 Hz ±1 Hz.

**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 2-36.

B) You can test the RS-232 Port 1 for functionality by verifying that you can connect to a PC through a null modem cable. See *Networking and Remote Control* starting on page 2-37 (in particular, step 4 on page 2-39).

**10. Return OPTIMOD-FM to service.**

A) Remove the 600Ω resistors connected across the outputs.

B) Restore your normal operating parameters, using the notes you made in step (1.B) on page 4-7.

C) Navigate to SETUP / TEST / MODE and choose OPERATE.

D) Recall your normal operating preset.

# Section 5 Troubleshooting

## Problems and Potential Solutions

Always verify that the problem is not the source material being fed to the 8300, or in other parts of the system.

**RFI, Hum, Clicks, or Buzzes**

A grounding problem is likely. Review the information on grounding on page 2-10. The 8300 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.

Particularly if you are using a long run of coaxial cable between the 8300 and the exciter, a ground loop may inject noise into the exciter's composite input — especially if the exciter's input is unbalanced. The Orban CIT25 Composite Isolation Transformer can almost always cure this problem.

The AES3 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.

**Unexpectedly Quiet On-Air Levels**

The ITU412 multiplex power controller may have been turned on accidentally. See step 20 on page 2-22.

**Poor Peak Modulation Control**

The 8300 ordinarily controls peak modulation to an accuracy of ±2%. This accuracy will be destroyed if the signal path following the 8300 has poor transient response. Almost any link can cause problems. Even the FM exciter can have insufficient flatness of response and phase-linearity (particularly at low frequencies) to disturb peak levels. Section 1 of this manual contains a complete discussion of the various things that can go wrong.

Digital STLs using lossy compression algorithms (including MPEG1 Layer 2, MPEG1 Layer 3, Dolby AC2, and APT-X) will overshoot severely (up to 3 dB) on some program material. The amount of overshoot will depend on data rate — the higher the rate, the lower the overshoot.

Even if the transmission system is operating properly, the FM modulation monitor or reference receiver can falsely indicate peak program modulation higher than that actually being transmitted if the monitor overshoots at high and low frequencies. Many commercial monitors have this problem, but most of these problem units can be modified to indicate peak levels accurately.

Orban uses the Belar "Wizard" series of DSP-based monitors internally for testing, because these units do not have this difficulty.

### Audible Distortion On-Air

Make sure that the problem can be observed on more than one receiver and at several locations. Multipath distortion at the monitoring site can be mistaken for real distortion (and will also cause falsely high modulation readings).

Verify that the source material at the 8300'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. There are many controls that can cause distortion, including MULTIBAND CLIPPING, FINAL CLIP DRIVE, and COMPOSITE CLIP DRIVE Setting the LESS-MORE control beyond "9" will cause audible distortion of some program material with all but the Classical and Protect presets. Further, the "Loud" family of presets can sometimes cause audible distortion with certain program material; this is the price to be paid for "competitive" loudness as it is defined in certain markets.

If you are using analog inputs, the peak input level must not exceed +27 dBu or the 8300's A/D converter will clip and distort.

> Unlike earlier digital Optimods, there is no input peak level adjustment for the A/D converter. Instead, we have provided adequate headroom for virtually any plant. This is possible because the A/D converter in the 8300 has higher dynamic range than older designs. Therefore, without compromising the 8300's noise level, we could eliminate a control that was frequently misadjusted.

If you are using the 8300's stereo enhancer (which most "pop music"-oriented presets do), then this can exaggerate multipath distortion in high multipath environments. You may want to reduce the setting of the stereo enhancer's RATIO LIMIT control. A similar problem can occur if you are using sum-and-difference processing in the 8300's AGC. In this case, reduce the setting of the AGC's MAXDELTAGR controls.

If you are using an external processor ahead of the 8300, be sure it is not clipping or otherwise causing problems.

### Audible Noise on Air

(See also "RFI, Hums, Clicks, or Buzzes" on page 5-1.)

Excessive compression will always exaggerate noise in the source material.

The 8300 has two systems that fight this problem. The *compressor 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 compressor gate circuits in the 8300. The first affects the AGC and the second affects the Multiband Compressor. Each has its own threshold control. (See MB GATE on page 3-49.)

In the Multiband structure, *dynamic single-ended noise reduction* (see DWNEXP THR on page 3-50) 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 8300'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 8300 to digitize the input. (This ratio is better than 108 dB.) It is important to drive the 8300 with professional levels (more than 0 dBu reference level) to achieve adequately low noise. (Clipping occurs at +27 dBu.)

The 8300'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 8300'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 8300, the STL's noise level can severely limit the overall noise performance of the system because compression in the 8300 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 the Orban 8200ST 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 1-13.)

### Whistle on Air, Perhaps Only in Stereo Reception

The most likely cause is oscillation in the analog input or output circuitry. If the oscillation is in the output circuitry and is between 23 and 53 kHz, it will be detected in a receiver’s stereo decoder and translated down into the audible range.

If you encounter this problem, check the analog or digital outputs with a spectrum analyzer to see if the spurious tone can be detected here. If it appears at both outputs, it is probably an input problem. If it only appears at the analog output, then it is likely a problem with the left/right DACs or other analog circuitry. If it appears only when you use the composite output, then it is likely a problem in the composite DACs or output amplifiers.

A whistle could also be caused by power supply oscillation, STL problems, or exciter problems.

### Interference from stereo into SCA

A properly operating 8300 generates an immaculately clean baseband, with program-correlated noise below –80 dB above 57 kHz even when the composite limiter is used aggressively. If the 8300 and the rest of the transmission system are operating correctly, subcarriers should experience no interference.

Interference from the stereo into a subcarrier is best diagnosed with a spectrum analyzer. First examine the spectrum of the 8300's composite output to verify that program correlated noise is less than –80 dB below 100% modulation from 57 to 100 kHz. Any inadvertent composite clipping will dramatically degrade this protection. Make sure that the link between the 8300's composite output and the transmitter has sufficient headroom.

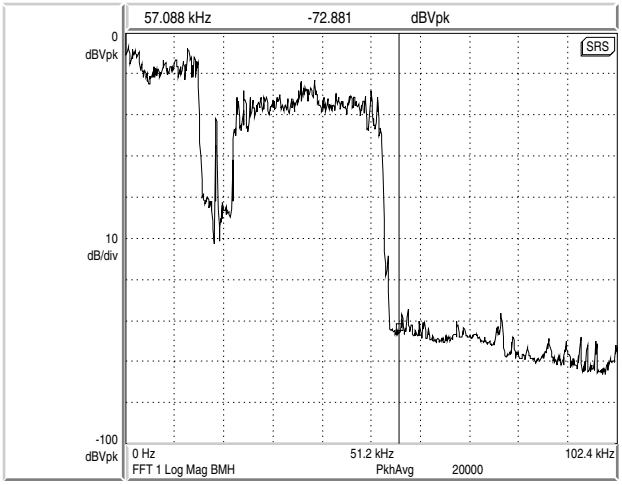



Fig. 5-1: Typical 8300 baseband spectrum with heavy processing, 0-100 kHz.

If the exciter is nonlinear, this can cause crosstalk. In general, a properly operating exciter should have less than 0.1% THD at high frequencies to achieve correct operation with subcarriers.

To prevent truncation of the higher-order Bessel sidebands of the FM modulation, the RF system following the exciter must be wideband (better than ±500 kHz) and must have symmetrical group delay around the carrier frequency. An incorrectly tuned transmitter can exhibit an asymmetrical passband that will greatly increase crosstalk into subcarriers.

Amplitude modulation of the carrier that is synchronous with the program ("synchronous AM") can cause program-related crosstalk into subcarriers. Synchronous AM should be better than 35 dB below 100% modulation as measured on a synchronous AM detector with standard FM de-emphasis (50μs or 75μs).

The subcarrier receiver itself must receive a multipath-free signal, and must have a wide and symmetrical IF passband and a linear, low-distortion FM demodulator to prevent program-related crosstalk into subcarriers.

### Shrill, Harsh Sound

If you are using the Multi-Band structure, 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 THRESH control, or by excessively high settings of the BAND 4 MIX and BAND 5 MIX controls (located in Intermediate and Advanced Modify).

If you are driving an external stereo encoder with built-in pre-emphasis, you must set the 8300's output to Flat in the System Setup / Output screen to prevent double pre-emphasis, which will cause very shrill sound (and very poor peak modulation control).

You will *always* achieve better peak control by defeating the pre-emphasis and input filters of an external stereo encoder, permitting the 8300 to perform these functions without overshoot. Section 1 of this manual contains a detailed explanation of these, and other, system design considerations.

### Dull Sound

If you are using the Two-Band structure, dull-sounding source material will sound dull on the air. The Multi-Band structure will automatically re-equalize such dull-sounding program material to make its spectral balance more consistent with other program material.

If the 8300's output is set to Flat in System Setup / Output, there will be no pre-emphasis unless it is supplied somewhere else in the system. This will cause very dull sound.

### 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 8300 can generate test tones itself. The 8300 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 3-55.)

### 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 8300, or the 8300 should be temporarily switched to BYPASS to pass the tones.

### System Receiving 8300's Digital Output Will Not Lock

Be sure that the 8300's output sample rate is set match the sample rate that the driven system expects. Be sure that the 8300's output mode (AES3 or SPDIF) is set to match the standard expected by the driven system.

### 19 kHz Frequency Out-of-Tolerance

First, verify that a problem really exists by using a second frequency-measuring device and/or verifying the problem with a monitoring service. If the problem is real, contact Orban Customer Service for a crystal replacement; there is no frequency trim available.

**L–R (Stereo Difference Channel) Will Not Null With Monophonic Input**

This problem is often caused by relative phase shifts between the left and right channels prior to the 8300's input. This will cause innocuous linear crosstalk between the stereo main and subchannels. Such crosstalk does not cause subjective quality problems unless it is very severe.

**General Dissatisfaction with Subjective Sound Quality**

The 8300 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.

By comparison to competitive processors, the 8300 offers a uniquely favorable set of trade-offs between loudness, brightness, distortion, and build-up of program density. If your radio station does not seem to be competitive with others in your market, the cause is usually source material (including excess use of lossy digital compression), overshoot in the transmission link (including the FM exciter) following the 8300, or an inaccurate modulation monitor that is causing you to under-modulate the carrier. A station may suffer from any combination of these problems, and they can have a remarkable effect on the overall competitiveness of a station's sound.

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 2-35.

## Connection Issues between the 8300 and a PC, Modem, or Network

- **User Interface Slowdown**: The more user presets you make, the more slowly the 8300 will respond to front-panel commands. Delete any user presets you do not need.
- **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 8300 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.

- **MAC Address**: To see the MAC address of your Optimod's Ethernet hardware, hold down the SETUP button until the address appears.

## 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 8300. 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- 47.

- 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 8300'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 8300, 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 8300 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.

## You Cannot Access the Internet After Making a Direct or Modem Connection to the 8300:

If you are connected to the 8300 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 8300 unit's IP address. This means that all existing network connections point to the 8300 unit. To correct this:

A) In Start / Settings / Network and Dialup Connections, open the direct or modem connection you are using to connect to 8300.

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."

If this "Use default gateway on remote network" box is not selected, the gateway will not point to the 8300 unit when you establish a direct or modem connection.

## OS-Specific Troubleshooting Advice

### Troubleshooting Windows 2000 Direct Connect:

If you are having trouble establishing a connection, check your New Connection's properties to make sure they are set up correctly:

A) Click "Start / Programs / Accessories / Communications / Network and Dialup Connections" to bring up the Network Connections screen.

B) In the "Network Connections" window, right-click "Optimod 8300 - Direct" and choose "Properties."

C) The "Properties" window opens for "Optimod 8300 - Direct

D) Click the "Networking" tab.

E) Set "Type of dial-up server I am calling" to "PPP: Windows 95 / 98 / NT4 / 2000, Internet."

F) Select the "Settings" button and make sure all PPP settings are unchecked. Then click "OK."

G) In "Components checked are used by this connection," uncheck all except for "Internet Protocol (TCP/IP)."

H) Select "Internet Protocol (TCP/IP)" and then click the "Properties" button. The "Internet Protocol (TCP/IP) Properties" window opens.

I) Choose "Obtain an IP address automatically" and "Obtain DNS server address automatically"

J) Click the "Advanced…" button on the "Internet Protocol (TCP/IP)" Window.

K) In the "Advanced TCP/IP Settings" select the "General" Tab; make sure that no check boxes are checked.

L) In the "Advanced TCP/IP Settings," select the "DNS" Tab.

M) In the "Advanced TCP/IP Settings," select the "WINS" Tab.

N) Click "OK" to dismiss the "Advanced TCP/IP Settings" window.

O) Click "OK" to dismiss the "Internet Protocol (TCP/IP) Properties" window.

P) Click "OK" to dismiss the window whose name is your new connection.

Q) Click "Cancel" to dismiss the "Connect [nnnn]" dialog box

R) Restart your computer. (This resets the serial port and reduces the likelihood that you will encounter problems connecting to the 8300.)

S) If you see: "Error 777: The connection failed because the modem (or other connecting device) on the remote computer is out of order":

The "remote computer" is actually the 8300 and it is not out of order; you just need to set the Maximum Speed (Bits per second) to 115200. If you already set this speed when you configured your PC ports, you shouldn't have this problem.

> The 8300 communicates at 115200 bps. COM ports on some older PCs are incapable of communications at this rate and may not work reliably. Most newer PCs use 16550-compatible UARTS, which support the 115200 bps rate.

If you do see this warning message, you can reset the Maximum BPS Speed by accessing PROPERTIES for the connection:

a) Click START / PROGRAMS / ACCESSORIES / COMMUNICATIONS / NETWORK AND DIAL-UP CONNECTIONS.

b) Right click the name of your connection and access "PROPERTIES."

c) Go to the "GENERALS" TAB and select the "CONFIGURE" button.

d) Set the MAXIMUM SPEED (BPS) to 115200.

e) Select OK and try your connection again.

T) If you see: "Error 619: The specified port is not connected."

Make sure the INTERFACE TYPE on the 8300 is correct:

a) On the 8300, go to SETUP / NETWORK & REMOTE / PC CONNEC.

b) Set PC CONNECT to DIRECT.

c) Try your connection again.

## Troubleshooting Windows 2000 Modem Connect:

If you are having trouble establishing a connection, check your New Connection's properties to make sure they are set up correctly:

A) Click "Start / Programs / Accessories / Communications / Network and Dialup Connections" to bring up the Network Connections screen.

B) In the "Network Connections" window, right-click "Optimod 8300 - Modem" and choose "Properties."

C) The "Properties" window opens for "Optimod 8300 – Modem".

D) Click the "Properties" button.

E) Select the "General" tab and make sure that "Connect Using" displays the correct modem and port.

F) Click the "Configure…" button.

G) Set the "Maximum Speed (bps) to 115200.

H) Check the "Enable hardware flow control," make sure all other hardware features are unchecked. Then click "OK."

I) Click the "Networking" tab on the "Properties" window.

J) Set "Type of dial-up server I am calling" to "PPP: Windows 95 / 98 / NT4 / 2000, Internet."

K) Select the "Settings" button and make sure all PPP settings are unchecked. Then click "OK."

L) In "Components checked are used by this connection," uncheck all except for "Internet Protocol (TCP/IP)."

M) Select "Internet Protocol (TCP/IP)" and then click the "Properties" button. The "Internet Protocol (TCP/IP) Properties" window opens.

N) Choose "Obtain an IP address automatically" and "Obtain DNS server address automatically"

O) Click the "Advanced…" button on the "Internet Protocol (TCP/IP)" Window.

P) In the "Advanced TCP/IP Settings" select the "General" Tab; make sure that no check boxes are checked.

Q) Click "OK" to dismiss the "Advanced TCP/IP Settings" window.

R) Click "OK" to dismiss the "Internet Protocol (TCP/IP) Properties" window.

S) Click "OK" to dismiss the window whose name is your new connection.

T) Click "Cancel" to dismiss the "Connect [nnnn]" dialog box

U) Restart your computer.

Although not strictly necessary, this resets the serial port and reduces the likelihood that you will encounter problems connecting to the 8300.

## Troubleshooting Windows XP Direct Connect:

If you are having trouble establishing a connection, check your New Connection's properties to make sure they are set up correctly:

A) Click "Start / Programs / Accessories / Communications / Network Connections" to bring up the Network Connections screen.

B) In the "Network Connections" window, right-click "Optimod 8300 - Direct" and choose "Properties."

C) The "Properties" window opens for "Optimod 8300 - Direct."

D) Click the "Networking" tab.

E) Set "Type of dial-up server I am calling" to "PPP: Windows 95 / 98 / NT4 / 2000, Internet"

F) Select the "Settings" button and make sure all PPP settings are unchecked, then click "OK."

G) In "This connection uses the following items," uncheck all except for "Internet Protocol (TCP/IP)." You can also leave "QoS Packet Scheduler" checked if you like.

H) In "This connection uses the following items," select "Internet Protocol (TCP/IP)" and then click the "Properties" button. The "Internet Protocol (TCP/IP) Properties" window opens.

I) Choose "Obtain an IP address automatically" and "Obtain DNS server address automatically."

J) Click the "Advanced…" button on the "Internet Protocol (TCP/IP)" Window.

K) In the "Advanced TCP/IP Settings" select the "General" Tab; make sure that no check boxes are checked.

L) Click "OK" to dismiss the "Advanced TCP/IP Settings" window.

M) On the "Properties" window for "Optimod 8300 – Modem" click the "Advanced" tab.

N) Click "OK" to dismiss the window whose name is your new connection.

O) Click "Cancel" to dismiss the "Connect [nnnn]" dialog box.

P) Restart your computer.

This resets the serial port and reduces the likelihood that you will encounter problems connecting to the 8300.

## Troubleshooting Windows XP Modem Connect:

If you are having trouble establishing a connection, check your New Connection's properties to make sure they are set up correctly.

A) Click "Start / Programs / Accessories / Communications / Network Connections" to bring up the Network Connections screen.

B) In the "Network Connections" window, right-click "Optimod 8300 - Modem" and choose "Properties."

The "Properties" window opens for "Optimod 8300 - Modem."

C) Click the "Networking" tab.

D) Set "Type of dial-up server I am calling" to "PPP: Windows 95 / 98 / NT4 / 2000, Internet"

E) Select the "Settings" button. Make sure all PPP settings are unchecked, and then click "OK."

F) In "This connection uses the following items," uncheck all except for "Internet Protocol (TCP/IP)." You can also leave "QoS Packet Scheduler" checked if you like.

G) In "This connection uses the following items," select "Internet Protocol (TCP/IP)" and then click the "Properties" button.

The "Internet Protocol (TCP/IP) Properties" window opens.

H) Choose "Obtain an IP address automatically" and "Obtain DNS server address automatically."

I) Click the "Advanced…" button on the "Internet Protocol (TCP/IP)" Window.

J) In the "Advanced TCP/IP Settings," select the "General" Tab; make sure that no check boxes are checked.

K) Click "OK" to dismiss the "Advanced TCP/IP Settings" window.

L) Click "OK" to dismiss the window whose name is your new connection.

M) Restart your computer. (This resets the serial port and reduces the likelihood that you will encounter problems connecting to the 8300.)

## Troubleshooting IC Opamps

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 8300'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

If you require technical support, contact Orban customer service. Be prepared to describe the problem accurately. Know the serial number of your 8300 — this is printed on the rear panel of the unit.

| | |
|---|---|
| Telephone: | (1) 510 / 351-3500 |
| Write: | Customer Service<br>Orban<br>1525 Alvarado Street<br>San Leandro, CA 94577 USA |
| Fax: | (1) 510 / 351-0500 |
| E-Mail | custserv@orban.com |

Please check Orban's website, www.orban.com, for Frequently Asked Questions and other technical tips about 8300 that we may post from time to time. Manuals (in .pdf form) and 8300 software upgrades will be posted there too — click "Downloads" from the home page.

## Factory Service

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

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

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

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 stereo composite output and to FM analog left/right output.*

**Frequency Response (Bypass Mode):** Follows standard 50μs or 75μs pre-emphasis curve ±0.10 dB, 2.0 Hz–15 kHz. Analog left/right output and digital output can be user-configured for flat or pre-emphasized output. When configured to emit the digital radio processed signal, the digital output is flat.

**Noise:** Output noise floor will depend upon how much gain the processor is set for (Limit Drive, AGC Drive, Two-Band Drive, and/or Multi-Band 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 Distortion** (de-emphasized, 100% modulation): <0.01% THD, 20 Hz–1 kHz, rising to <0.05% at 15 kHz. <0.02% SMPTE IM Distortion.

**Total System L / R Channel Separation:** >50 dB, 20 Hz – 15 kHz; 60 dB typical.

**Polarity** (Two-Band and Bypass Modes): Absolute polarity maintained. Positive-going signal on input will result in positive-going signal on output.

**Processing Sample Rate:** The 8300 is a “multirate” system, using internal rates from 32 kHz to 512 kHz as appropriate for the processing being performed. Audio clippers operate at 256 kHz (and are anti-aliased), while the composite limiter operates at 512 kHz.

**Processing Resolution:** Internal processing has 24 bit (fixed point) or higher resolution; uses Motorola DSP56362 DSP chips.

## Installation

### *Delay*

**Minimum Processing Delay:** Processing structure dependent. Typically 20 ms for optimum 5-band using "MX" presets, 15 ms for optimum 5-band using non-MX presets, 3.7 ms for ultra-low-latency 5-band, and 17 or 22 ms for 2-band, depending on crossover structure chosen.

**Relative Delay Between HD and FM Analog Processing Chains:** Constant number of samples. HD has approximately 3 ms longer delay than analog.

### *Analog Audio Input*

**Configuration:** Stereo.

**Impedance:** >10kΩ load impedance, electronically balanced[1].

**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. Converter outputs 64 kHz sample rate, which the 8300 then decimates to 32 kHz in DSP using an ultra-high-quality image-free synchronous sample rate converter.

**Filtering:** RFI filtered.

### *Analog Audio Output*

**Configuration:** Stereo. Flat or pre-emphasized (at 50μs or 75μs), software-selectable.

**Source Impedance:** 50Ω, electronically balanced and floating.

**Load Impedance:** 600Ω or greater, balanced or unbalanced. Termination not required or recommended.

**Output Level** (100% peak modulation): Adjustable from –6 dBu to +24 dBu peak, into 600Ω or greater load, software-adjustable.

**Signal-to-Noise:** >= 90 dB unweighted (Bypass mode, de-emphasized, 20 Hz–15 kHz bandwidth, referenced to 100% modulation).

**L / R Crosstalk:** <= –70 dB, 20 Hz–15 kHz.

**Distortion:** <= 0.01% THD (Bypass mode, de-emphasized) 20 Hz–15 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, with high-pass filter at 0.15 Hz (–3 dB).

**Filtering:** RFI filtered.

### *Digital Audio Input*

**Configuration:** Stereo per AES3 standard, 24 bit resolution, software selection of stereo, mono from left, mono from right or mono from sum.

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[1] No jumper selection available for 600Ω. Through-hole pads are available on I/O module for user-installed 600Ω termination.

**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, 110Ω impedance.

**Input Reference Level**: Variable within the range of –30 dBFS to –10 dBFS.

**J.17 De-emphasis:** Software-selectable.

**Filtering:** RFI filtered.

### *Digital Audio Output*

**Configuration:** Stereo per AES3 standard. Can emit the analog FM or digital radio processed signal. When emitting the FM analog processing signal, the output can be configured in software as flat or pre-emphasized to the chosen processing pre-emphasis (50μs or 75μs), with or without J.17 pre-emphasis.

**Sample Rate:** Internal free running at 32, 44.1, 48, 88.2 or 96 kHz, selected in software. Can also be synced to the AES3 digital input at 32, 44.1, 48, 88.2 or 96 kHz, as configured in software.

**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, 110Ω impedance.

**Output Level** (100% peak modulation): –20.0 to 0.0 dBFS software controlled.

**Filtering:** RFI filtered.

### *Composite Baseband Output*

**Configuration:** Two outputs, each with an independent software-controlled output level control, output amplifier and connector.

**Source Impedance:** 0Ω voltage source or 75Ω, jumper-selectable. Single-ended, floating over chassis ground.

**Load Impedance:** 37Ω or greater. Termination not required or recommended.

**Maximum Output Level:** +12.0 dBu (8.72 Vp-p).

**Minimum Output Level:** –12 dBu (0.55 Vp-p) for 0.5 dB adjustment resolution.

**Pilot Level:** Adjustable from 6.0% to 12.0%, software controlled.

**Pilot Stability:** 19 kHz, ±0.5 Hz (10 degrees to 40 degrees C).

**D/A Conversion:** 24-bit

**Signal-to-Noise Ratio:** <= –85 dB (Bypass mode, de-emphasized, 20 Hz – 15 kHz bandwidth, referenced to 100% modulation, unweighted).

**Distortion:** <= 0.02% THD (Bypass mode, de-emphasized, 20 Hz – 15 kHz bandwidth, referenced to 100% modulation, unweighted).

**Stereo Separation:** At 100% modulation = 3.5Vp-p, > 60 dB, 30 Hz - 15 kHz. At 100% modulation = 1.0 - 8.0 Vp-p, > 55 dB, 30 Hz - 15 kHz.

**Crosstalk-Linear:** <= –80 dB, main channel to sub-channel or sub-channel to main channel (referenced to 100% modulation).

**Crosstalk-Non-Linear:** <= –80 dB, main channel to sub-channel or sub-channel to main channel (referenced to 100% modulation).

**38 kHz Suppression:** >= 70 dB (referenced to 100% modulation).

**76 kHz & Sideband Suppression:** >= 80 dB (referenced to 100% modulation).

**Pilot Protection:** –60 dB relative to 9% pilot injection, ±250 Hz (up to 2 dB composite processing drive).

**Subcarrier Protection (60-100 kHz**): >= 70 dB (referenced to 100% modulation; with up to 2 dB composite limiting drive; measured with 800 line FFT analyzer using "maximum peak hold" display).

**57 kHz (RDS / RBDS) Protection:** –50 dB relative to 4% subcarrier injection, ±2.0 kHz (up to 2 dB composite processing drive).

**Connectors:** Two BNC, floating over chassis ground, EMI suppressed.

**Maximum Load Capacitance:** 0.047 microfarad (0Ω source impedance). Maximum cable length of 100 feet / 30 meters RG–58A / U.

**Filtering:** RFI filtered.

### *Subcarrier (SCA) Inputs*

**Configuration:** Subcarrier inputs sum into composite baseband outputs before digitally controlled composite attenuator.

**Impedance:** >600Ω

**SCA1 Sensitivity:** Variable from 220 mV p-p to >10 V p-p to produce 10% injection. Sensitivity is adjustable by an internal PC-board-mounted trim pot.

**SCA2 Sensitivity:** Fixed at 772 mV p-p to produce 10% injection.

**Connectors:** Two BNC, unbalanced and floating over chassis ground, EMI suppressed.

**19 kHz Pilot Reference:** SCA2 input can be re-jumpered to provide a 19 kHz pilot reference output.

### *Remote Computer Interface*

**Supported Computer and Operating System:** IBM-compatible PC running Microsoft Windows® 2000 (SP3 or higher) or XP.

**Configuration:** TCP/IP protocol via direct cable connect, modem, or Ethernet interface. Suitable null modem cable for direct connect is supplied. Modem and other external equipment is not supplied.

**Serial Connector:** RS–232 on DB–9 male connector, EMI-suppressed. Uses PPP to provide for direct or modem connection to the 8500 PC Remote application.

**Ethernet Connector:** Female RJ45 connector for 10-100 Mbps networks using CAT5 cabling. Native rate is 100 Mbps. Provides for connection to the 8500 PC Remote application through either a network, or, using a crossover Ethernet cable, directly to a computer.

**Ethernet Networking Standard:** TCP/IP.

### *Remote Control (GPI) Interface*

**Configuration:** Eight (8) inputs, opto-isolated and floating.

**Voltage:** 6–15V AC or DC, momentary or continuous. 9VDC 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.

### *Power*

**Voltage:** 100–132 VAC or 200–264 VAC, switch-selected on the rear panel, 50–60 Hz, 40 VA.

**Connector:** IEC, EMI-suppressed. Detachable 3-wire power cord supplied.

**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 3.5” x 14.25” / 48.3 cm x 8.9 cm x 36.2 cm. Two rack units high.

**Humidity:** 0–95% RH, non-condensing.

**RFI / EMI:** Tested according to Cenelec procedures. FCC Part 15 Class A device.

**Shipping Weight:** 19 lbs / 8.7 kg

### *Warranty*

**Two 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 8300. 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 8300 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 6-29 shows circuit board locations.

## Overview

The Control Circuits control the DSP, display, and input/output sections of the 8300 system.

The Input Circuits include the connectors and RF filtering for the analog and digital audio inputs, as well as 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.

The Power Supply provides power for all 8300 circuit sections.

A block diagram of the DSP signal processing appears on page 6-62.

## 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 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 30 seconds until the DSP code download has finished. If you hear a 30-second audio mute on air, you can assume that the 8300 has rebooted for some reason. Be prepared to convey this fact to Orban customer service if you call for technical assistance.

The control board is divided into two assemblies: a "base board," which has interface circuitry, and a "CPU controller module," which plugs into the base board and which contains the CPU, the Ethernet interface chip, the flash memory, the DRAM, and the real-time clock, which keeps time for the 8300's automation functions. The real-time clock is backed up by a DL2032 battery so that it keeps accurate time even when the 8300 is powered down. The battery is socketed and can be readily accessed by removing the 8300's top cover; the battery is located on the foil (top) side of the CPU controller module.

# User Control Interface and LCD Display Circuits

The user control interface enables the user to control the 8300'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 8300. 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 base board

A remote interface connector and circuitry implements remote control of certain operating modes; Model 8300 OPTIMOD-FM 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 8300 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, U10, 12, and then to the control circuitry.

Octal driver U1 buffers the RS-232 port, which is located on a small daughter board.

U10, 12 and U1 are 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 8300 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.

### 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 board

The RF-filtered left and right analog input signals are each applied to a floating, balanced amplifier. The amplifier's output feeds a circuit that scales, balances, and DC-biases the signal. This circuit feeds an RC low-pass filter that applies the balanced signal to the analog-to-digital (A/D) converter.

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 600Ω 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, 101, 102, 103 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 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 filters and decimates to 64 kHz sample rate. (An Orban-designed synchronous sample rate converter in the 8300's DSP performs the final decimation to 32 kHz. This ensures the flattest frequency response to 15 kHz without aliasing.)

### 3. Digital Input Receiver and Sample Rate Converter (SRC)

Located on Input/Output board

The integrated receiver and input sample rate converter, IC500, accepts digital audio signals using the AES3 interface format (AES3-1992). The built-in sample rate converter (SRC) 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 64 kHz. The final, high-quality decimation to the 8300 system sample rate is done in the system DSP, as was done for the analog input.

This chip is 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. High-speed D/A converters do the same for the composite outputs, each of whose outputs is smoothed by a passive LC reconstruction filter. The analog output stages scale and buffer the D/A output signal to drive the analog output XLR connectors with a low impedance bal-

anced output. The digital output transmitter accepts the digital audio words from the output sample rate converter (SRC) and transmits them in AES3-format digital audio signals on the digital output connector.

## 1. Stereo Digital-to-Analog (D/A) Converter

Located on Input/Output 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 64 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

Located on Input/Output 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 50Ω 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 3rd 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.

IC203 is used to set the analog output level. It is a digitally controlled gain block that sets its gain according to signals on its three digital input lines.

IC204B and associated components form a low-frequency servo amplifier to remove residual DC from the signal. The 0.15Hz −3 dB frequency prevents tilt-induced overshoot in the processed audio.

IC204A buffers the output of IC203 and implements de-emphasis if desired. FET switches Q200 and Q201 implement 75μs and 50μs de-emphasis respectively. This analog de-emphasis rolls off any digital noise produced by earlier circuitry and also helps implement independent de-emphasis settings between the analog and digital outputs.

The buffered and optionally de-emphasized output of IC204 is applied to IC207, 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. IC207 and its right channel counterpart IC208 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 board

An integrated output sample rate converter (SRC) and AES3 line driver chip, IC502, converts the 32 kHz 8300 system sample rate to any of the standard 32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, and 96 kHz rates, and also contains a digital audio interface transmitter to encode digital audio signals using the AES3 interface format (AES3-1992). This chip is surface-mounted and is not field-replaceable.

## 4. Composite Output Circuit

Located on the Input/Output board

A composite D/A converter and reconstruction filter drive two digitally controlled attenuators that permit the levels of the two composite outputs to be set independently. The SCA inputs are summed with the composite output before the digitally controlled attenuators, so the attenuator adjusts the level of the entire composite signal, attenuating the SCA and stereo signals to the same extent.

The second SCA input can be jumpered to serve as a pilot reference source for RDS generators, which is how it is shipped from the factory.

### Component-Level Description:

We will describe composite output #1. IC300 is a high-speed D/A converter chip that receives the digital composite signal at a 512 kHz sample rate. It drives buffer amplifier IC308A. IC308A drives a fifth-order passive LC reconstruction filter C336-C339, L300-L301, R301-303. (This filter is equalized and phase-corrected in DSP to obtain excellent flatness and phase-linearity. This achieves high stereo separation.)

IC302A buffers the output of the anti-imaging filter. IC302B is a servo amplifier to remove DC offset at the output of IC302A. IC401B accepts the SCA inputs, summing them with the composite stereo output of IC302A. Any contribution from the SCA inputs is therefore are not indicated on the COMPOSITE LEVEL meter displayed by the 8300, because this meter indicates only the composite signal generated by the DSP.

Digitally controlled attenuator IC402B receives the output of IC401B and sets the composite output level. IC3B and IC1, a composite high-current buffer amplifier, receives the output of IC402B and drives the composite output connector J4B through an RFI attenuator network and optional 75Ω build-out resistor R411.

The pilot reference D/A converter IC400 receives serial data from the DSP circuitry. After being buffered and low-pass filtered by IC401A, the resulting 19 kHz sine wave signal can be connected to J5A through jumper J400.

The composite line driver amplifiers are socketed for easy field replacement; all other components are surface-mounted and are not field-replaceable.

## DSP Circuit

The DSP circuit consists of eight Motorola DSP56362 24-bit fixed-point DSP chips that execute DSP software code to implement digital signal processing algorithms.

The algorithms filter, compress, and limit the audio signal. The eight DSP chips, each operating at approximately 100 million instructions per second (MIPS), for a total of 800MIPS, provide the necessary signal processing. A sampling rate of 32 kHz and power-of-two multiples thereof, up to 512 kHz, is used.

System initialization normally occurs when power is first applied to the 8300 and can occur abnormally if the 8300'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 DSP board — see the drawings starting on page 6-52. IC703 is a local voltage regulator on the DSP board that derives the +3.3V supply for the DSP chips from the +RAW unregulated system voltage.

## Power Supply

**Warning!** Hazardous voltages are present in the power supply when it is connected to the AC line.

The power supply converts an AC line voltage input to various power sources used by the 8300. To ensure lowest possible noise, four linear regulators provide ±15VDC and ±5VDC for the analog circuits. A switching regulator provides high current +5VDC for the digital circuits. An unregulated voltage powers the fan and feeds local regulators.

The power supply circuits are straightforward and no explanation is required beyond the schematic itself. Be aware that C1, C4, C5, and C12 in the switching regulator are premium-quality low-ESR capacitors and must be replaced with equivalent types to ensure proper operation of the switching supply.

The output of the power supply is monitored by the power-indicator LED circuit, which causes the power LED to flash according to a preset code to diagnose problems with the various power supplies in the 8300. See step (2.B) on page 4-8.

# 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 IBOC* |
| 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 FM 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 ±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 FM baseband above 23 kHz (monophonic) or 57 kHz (stereophonic) |
| S/PDIF | Sony / Philips digital interface (standardized as IEC958) |
| TRS | tip-ring-sleeve (2-circuit phone jack) |
| THD | total harmonic distortion |
| TX | transmitter |
| μs | Microseconds. For FM pre-emphasis, the +3 dB frequency is 1 / (2 π τ), where τ is the pre-emphasis time constant, measured in seconds. |
| 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 8300 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 8300 (including surface-mount devices), and inclusion of a part in this list does not imply that the part is field-replaceable.

See the following assembly 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.

### Base Board

| *PART #* | *DESCRIPTION* | *COMPONENT IDENTIFIER* |
|---|---|---|
| 42008.020Q | SUBASSEMBLY FLAT CABLE-40P- 2"" | J7 |
| 16013.000.01 | HEATSINK, CLIP ON TO 220 | H1 |
| 20040.604.01 | RESISTOR, METALFIM, 1/8W, 1%, 604 Ω | R28, 30, 33, 35, 37, 39, 44, 46, 48, 49, 50, 51, 52, 53, 54, 55 |
| 20080.301.01 | RESISTOR, METALFIM, 1/2W, 1%, 301 Ω | R47 |
| 20121.100.01 | RESISTOR, METALFIM, 1/8W, 1%, 10Ω, 1206 | R43, 45 |
| 20121.750.01 | RESISTOR, THIN FILM, 1/8W, 1%, 75 Ω | R82, 83, 84 |
| 20128.002.01 | RESISTOR 2.0 Ω 1% 0805 | R22, R23, R24, R25 |
| 20129.301.01 | RESISTOR, 301Ω, 0805 | R59, R77 |
| 20130.100.01 | RESISTOR, 1.00K 1% 0805 | R79 |
| 20130.162.01 | RESISTOR, 1/8W, 1%, 1.62K, 0805 | R41, 42 |
| 20130.200.01 | RESISTOR, 2.00K, 0805 | R4, R56, R62 |
| 20130.249.01 | RESISTOR, 1/8W, 1%, 2.49K, 0805 | R76 |
| 20130.562.01 | RESISTOR, 1/8W, 1%, 5.62K, 0805 | R57 |
| 20131.100.01 | RESISTOR, 10K, 0805 | R5, 6, 15, 16, 17, 26, 60, 61, 63, 65, 67, 68, 69, 70, 71, 73, 74, 75, 80, 81, 102, 103, 104 |
| 20131.140.01 | RESISTOR, 14.0K, 0805 | R58, 64 |
| 20131.301.01 | RESISTOR, 30.1K, 0805 | R72 |

| *PART #* | *DESCRIPTION* | *COMPONENT IDENTIFIER* |
|---|---|---|
| 20132.100.01 | RESISTOR, 100K, 0805 | R1, 2, 3, 7, 8, 9, 10, 11, 12, 13, 14, 20, 27, 29, 31, 32, 34, 36, 38, 40, 66, 85, 86, 87, 88, 89, 90, 91, 92, 93 |
| 20132.332.01 | RESISTOR, 332K, 0805 | R78 |
| 21139.000.01 | CAPACITOR, X7R, 0.1UF, 10%, 0805 | C3, 6, 7, 8, 9, 10, 11, 12, 13, 18, 21, 24, 30, 32, 33, 34, 35, 38, 39, 43 |
| 21147.022.01 | CAPACITOR, 22pf, 0805, 1% | C40, 41 |
| 21319.610.01 | CAPACITOR, 10uf, TANT, SMT | C1, 4, 14, 15, 17, 19, 22, 36, 37 |
| 21322.547.01 | CAPACITOR, 4.7uf, TANT, 6032B | C2, 5, 20, 23 |
| 22016.000.01 | DIODE, MMSZ5231B, SOD-123 | D12 |
| 22083.015.01 | DIODE, VOLTAGE SUPPRESSOR, 15 VOLT | D11 |
| 22101.001.01 | DIODE, 1N4148WT/R | D1, 3, 4, 5, 6, 9, 10 |
| 22209.000.01 | DIODE, SCHOTTKY 1A, 60V, SMD | REF, , NO, STUFF, D7, D8 |
| 23214.000.01 | TRANSISTOR NPN MMBT3904 | Q1, Q3, Q4, Q5 |
| 23606.201.01 | TRANSISTOR, PWR, NPN | Q2 |
| 24635.000.01 | IC 74HCT374 | U4 |
| 24900.000.01 | IC, HEX INVERTER, SMT | U11, U13 |
| 24967.000.01 | IC, 74ACT245DW | U3, U5 |
| 24978.000.01 | IC, 74ACT244SC | U14, 15 |
| 24979.000.01 | IC, BAT54C-7 | D13, 14, 15, 16, 17 |
| 24982.000.01 | IC, 74HC4051M | U19 |
| 24983.000.01 | IC, 7064STC100-10 | U1 |
| 24984.000.01 | IC, LP2987IM-5.0 | U20 |
| 25008.000.01 | IC, PS2506-4 | U10, 12 |
| 25112.001.01 | LED, RED/GREEN, BI-CLR/POLR | |
| 27017.025.01 | CONNECTOR, RIGHT ANGLE, PC BOARD MOUNT, 25P | J10 |
| 27147.018.01 | IC, SOCKET, DIP, 18 PIN, DUAL | SU18 |
| 27223.002.01 | CABLE, FLAT, 2 LONG, 14 CONDUCTOR | J8 |
| 27371.040.01 | CONNECTOR HEADER PC104 STACK 40P | HEADER2 |
| 27371.064.01 | CONNECTOR HEADER PC104 STACK 64P | HEADER1, HEADER3 |
| 27406.014.01 | CONNECTOR, SOCKET, STRIP, 14 PIN | J2 |
| 27421.004.01 | CONNECTOR, HEADER, DOUBLE ROW, 4P, 2 X 2 | J3B, J6 |
| 27421.006.01 | CONNECTOR, HEADER, DOUBLE ROW, 6P, 2 X 3 | J5 |
| 27421.010.01 | CONNECTOR, HEADER, DOUBLE ROW, 23", 2 X 5 | J12 |
| 27421.050.01 | CONNECTOR HEADER STR .23 2x25 | J9 |
| 27426.003.01 | CONNECTOR, HEADER, 3 | J11 |

| PART # | DESCRIPTION | COMPONENT IDENTIFIER |
|---|---|---|
| | PIN, SINGLE RW | |
| 27451.005.01 | CONNECTOR, STR, DBL ROW, 26 PIN | J4 |
| 27451.024.01 | HEADER, STR, DBLROW, PCMOUNT | J1 |
| 27500.000.01 | CONNECTOR MOL53047-0510 5PIN | J14 |
| 28086.000.01 | CRYSTAL, 4.0 MHz, HC49US | X1 |
| 29521.000.01 | INDUCTOR, 3.9UH, JM391K | L1, L2, L3 |
| 32166.000.06 | CIRCUIT BOARD, BASE BOARD | |
| 44093.100.01 | SOFTWARE PIC 8300 U18 | U18 |
| 47010.016.01 | SUBASSEMBLY RECPTL-W/SHRINK | J3A |
| 47010.017.01 | SUBASSEMBLY RECPTL-W/SHRINK | J3A |

## CPU Module

| PART # | DESCRIPTION | COMPONENT, IDENTIFIER |
|---|---|---|
| 20128.010.01 | RESISTOR, 10 OHM,0805 | R31, R34 |
| 20128.022.01 | RESISTOR, 22 OHM 1% 0805 | R5, R6 |
| 20128.332.01 | RESISTOR, 33.2 OHM,0805 | R10, R11, R14 |
| 20128.499.01 | RESISTOR, 49.9 OHM 1% 0805 | R19, R20, R21, R22, R23 |
| 20129.160.01 | RESISTOR, 160 OHM 1% 0805 | R24, R25 |
| 20129.330.01 | RESISTOR, 330 OHM 1% 0805 | R12, R16 |
| 20129.470.01 | RESISTOR, 470 OHM 1% 0805 | R13, R15 |
| 20130.100.01 | RESISTOR, 1.00K 1% 0805 | R17, R35 |
| 20130.475.01 | RESISTOR, 4.75K,0805 | R3, R4, R7, R8, R26, R27, R28, R29, R30, R32 |
| 20130.931.01 | RESISTOR, 9.31K, 1%, 0805 | R33 |
| 20131.100.01 | RESISTOR, 10K,0805 | R1, R2, R9 |
| 20131.147.01 | RESISTOR, 1/8W,1%,14.7K,0805 | R18 |
| 20233.102.01 | RESISTOR NETWORK 1K CTS745C 8R BUSSED | RN1 |
| 20233.472.01 | RESISTOR NETWORK 4.7K CTS745C 8R BUSS | RN2, RN3, RN4 |
| 20237.472.01 | RESISTOR NETWORK 8R, ISO, 5% | RN5 |
| 21139.000.01 | CAPACITOR, X7R,0.1uF,10%,0805 | C8, C9, C20, C21, C177, C179, C182 |
| 21141.000.01 | CAPACITOR, NPO,1000pF,1%,0805 | C10 |
| 21142.000.01 | CAPACITOR, NPO,100pF,1%,0805 | C2 |
| 21146.310.01 | CAPACITOR, .01uF,0805,10% | C11, 126, 127, 133, 134, 150, 152, 154, 156, 158,160, 162, 180 |
| 21167.047.01 | CAPACITOR, 4.7pF 50V X7R 0805 | C1 |
| 21170.018.01 | CAPACITOR, 18pF 1% 50V COG 0805 | C3, C4, C5, C6, C7 |
| 21171.105.01 | CAPACITOR, 1uF X7R 0805 | C14, 17, 125, 132, 151, 153, 155, 157, 159, |

| *PART #* | *DESCRIPTION* | *COMPONENT, IDENTIFIER* |
|---|---|---|
| | | 161, 175, 176, 178, 181, 183 |
| 21322.547.01 | CAPACITOR, 4.7uF,TANT,6032B | C12 |
| 21325.610.01 | CAPACITOR, 10uF 10% TANT 6032-B | C13, C15, C16, C18 |
| 22101.001.01 | DIODE,1N4148WT / R | D1, D2, D3 |
| 24331.025.01 | IC VOLTAGE REGULATOR LT1963-2.5 SOT223 | U14 |
| 24331.033.01 | IC VOLTAGE REGULATOR LT1963-3.3 SOT223 | U15 |
| 24541.000.01 | IC SDRAM MT48LC16 TSOP54P | U2, U3 |
| 24542.000.01 | IC FLASH MEMORY E28F128 TSOP56 | U4 |
| 24543.000.01 | IC CY2305 0DLYBuF 8P | U11 |
| 24544.000.01 | IC NM93C46 SEEPROM TSSOP | U12 |
| 24653.000.01 | IC PWRST MIC8114 SOT143 | U5 |
| 24670.000.01 | IC 10 / 100BT NIC NATIONAL | U10 |
| 24965.000.01 | IC,74ALVC164245DGG | U7, U8, U9 |
| 24972.520.01 | IC MICROPROCESSOR ELANSC520 BGA388 | U1 |
| 27306.000.01 | CONN RJ45 PCMT W / MAGS | J1 |
| 27370.040.01 | CONN SCKT PC104 40PIN | P2 |
| 27370.064.01 | CONN SCKT PC104 64PIN | P1, P3 |
| 28031.000.01 | HOLDER,BATTERY,LITH CELL | BT1HLDR |
| 28041.000.01 | CELL,COIN,BATTERY,LITH,3V | BT1 |
| 28089.000.01 | OSC 33MHZ SG636 4P SMD | X1 |
| 28090.000.01 | IC TCXO DS32KHZ 36P BGA | U13 |
| 28091.000.01 | CRYSTAL 25MHZ RXD MP35L SMD | Y1 |
| 32200.000.02 | CONTROL MODULE ASSEMBLY DRAWING | |
| 32201.000.02 | PCB CONTROL MODULE 8300 | |
| 44094.100.01 | FIRMWARE 8300 U6 20LV8D | |
| 62200.000.02 | SCHEMATIC, CONTROL MODULE 8300 | |

## RS-232 Board

| *PART #* | *DESCRIPTION* | *COMPONENT IDENTIFIER* |
|---|---|---|
| 21139.000.01 | CAPACITOR, X7R, 0.1uF, 10%, 0805 | C1, C2, C3, C4, C5, C6 |
| 22209.000.01 | DIODE, SHOTTKY 1A, 60V, SMD | D1, D2, (NO STUFF) |
| 24968.000.01 | IC, MAX208ECNG | U1 |
| 27017.009.01 | CONNECTOR, RIGHT ANGLE, PC MOUNT, 9-PIN | J2 |
| 27147.124.01 | IC, SOCKET, DIP, 24-PIN, DUAL | SU1 |
| 27489.016.01 | CONNECTOR, SOCKET 2X8 STACKER | J1 |
| 29521.000.01 | INDUCTOR, 3.9UH, JM391K | L1 |

## Power Supply

| *PART #* | *DESCRIPTION* | *COMPONENT IDENTIFIER* |
|---|---|---|
| 10012.404.01 | SCREW MS SEM P / P 4-40 X ¼ | |
| 15025.000.01 | TRANSISTOR, MOUNTING KIT, TO 220 | HW1, HW2, HW3, HW4, HW5 |
| 15061.005.01 | LED MOUNT, 1 POSITION, 0.240" HIGH | H1, H2, H3, H4 |
| 20020.025.01 | RESISTOR, ¼W, 0 OHM, (JUMPER) | R1 |
| 21129.410.01 | CAPACITOR, AXIAL LEADS, 0.1uF, 50V, 20% | C6, C10, C11, C12, C15, C19, C20, C21 |
| 21227.710.01 | CAPACITOR, RADIAL LEADS 100uF 16V HFS | C1 |
| 21227.747.01 | CAPACITOR, RADIAL LEADS 470uF 16V HFS | C4, C5 |
| 21230.710.01 | CAPACITOR, RADIAL LEADS 100uF 50V HFS | C22 |
| 21255.000.01 | CAPACITOR, SNAP-IN, 6800uF, 16V, 20% | C13, C14 |
| 21256.000.01 | CAPACITOR, RADIAL LEADS, 1000uF, 35V, 20% | C17, C18 |
| 21263.710.01 | CAPACITOR, RADIAL LEADS, 100uF, 25V, 10% | C2, C3, C8, C9 |
| 21307.522.01 | CAPACITOR, RADIAL LEADS, 2.2uF, 35V, 10% | C7, C16 |
| 22004.056.01 | ZENER-DIODE-1W-5%-5.6V-1N | CR19, CR20 |
| 22015.000.01 | DIODE-SHOTTKY RECTIFIER-SBL | CR21, CR22, CR23 |
| 22083.022.01 | DIODE, VOLTAGE SUPPRESSOR, 22 VOLT | CR2, CR13, CR14 |
| 22083.033.01 | DIODE, VOLTAGE SUPPRESSOR, 33 VOLT | CR9, CR10 |
| 22083.068.01 | DIODE, VOLTAGE SUPPRESSOR, 6.8 VOLT | CR4, CR17, CR18 |
| 22201.400.01 | DIODE, RECTIFIER IN4004 PRV400V | CR5, CR6, CR7, CR8, CR11, CR12, CR15, CR16 |
| 22208.040.01 | DIODE, SHOTTKY-31DQ04-3.3 | CR3 |
| 22500.271.01 | ZENER, TRANSORB, VARISTOR | V1, V2 |
| 24303.901.01 | IC, LINEAR, DC REGULATOR, 15V NEG | U2 |
| 24304.901.01 | IC, REGULATOR | U1 |
| 24307.901.01 | IC, LINEAR, DC REGULATOR, 5V POS | U3 |
| 24308.901.01 | IC, LINEAR, DC REGULATOR, 5V NEG | U4 |
| 24323.000.01 | IC, SIMPLE SWITCH, 0 TO 220 | U5 |
| 26143.000.01 | SWITCH, SLIDE, VOLT, 115 / 230 | SW1 |
| 26146.000.01 | SWITCH, SLIDE, SPDT, VERTICAL MOUNT | SW2 |
| 27060.000.01 | CONNECTOR, VERTICAL HEADER | J1 |
| 27421.010.01 | CONNECTOR, HEADER, DOUBLE ROW , 23", 2 X 5 | J7 |
| 27426.003.01 | CONNECTOR, HEADER, 3-PIN, SINGLE ROW | J6 (OPTIONAL FAN CONNECTOR) |
| 27451.003.01 | HEADER, STR, DOUBLE ROW, PCMOUNT | J3 |

| PART # | DESCRIPTION | COMPONENT IDENTIFIER |
|---|---|---|
| 27451.004.01 | HEADER, STR, DOUBLE ROW, PCMOUNT | J4 |
| 27451.024.01 | HEADER, STR, DOUBLE ROW, PCMOUNT | J5 |
| 27493.000.01 | CONNECTOR, VERTICAL, HEADER, 6 POS. | J2 |
| 27711.206.01 | TERM, CRIMP, RING, INSULATED, 6R | LUG |
| 28004.150.01 | FUSE, 3AG, SLOBLO, ½ AMP | F1 |
| 28112.003.01 | KNOB-FUSE-DOM-GRY-FOR 281 | H7 |
| 28112.005.01 | BODY-FUSEHOLDER-PC MNT | H6 |
| 29262.000.01 | LINE FILTER, PC MOUNT, 1A | A1 |
| 29519.000.01 | INDUCTOR-TORODIAL- 7.7UH | L2 |
| 29526.000.01 | INDUCTOR, PE92108K | L1 |
| 50286.000.02 | HEATBAR POWER SPLY 8300 | HS1 |

## Input/Output (I/O) Board

| PART # | DESCRIPTION | COMPONENT IDENTIFIER |
|---|---|---|
| 20039.750.01 | RESISTOR, METAL-FILM, 1/8W, 1%, 75.0 OHM | R411, R420 |
| 20040.604.01 | RESISTOR, METAL-FILM, 1/8W, 1%, 604 OHM | R401, R412, R421 (REF NO STUFF R106, R119) |
| 20041.100.01 | RESISTOR, METAL-FILM, 1/8W, 1%, 1.00 k OHM | R100, R107, R115, R120, R400 |
| 20058.187.01 | RESISTOR, METAL-FILM, 1/8W, 0.1%, 1.87K | R301 |
| 20058.205.01 | RESISTOR, 1/8W.1%, 2.05K | R302 |
| 20121.100.01 | RESISTOR, RF, 1/8W, 1%, 10 OHM, 1206 | R154, R200, R232, R522, R531 |
| 20121.750.01 | RESISTOR, TF, 1/8W, 1%, 75 OHM | R416, R158, R530 |
| 20122.110.01 | RESISTOR, TF, 1/8W, 1%, 110 OHM | R238, R330, R500, R514, R517 |
| 20123.100.01 | RESISTOR, TF, 1/8W, 1%, 1.00K | R304, R521, R600, R601, R602, R603 |
| 20123.150.01 | RESISTOR, TF, 1.8W, 1%, 1.50K, SURFACE-MOUNT 1 | R131, R134, R140, R141, R144, R146 |
| 20123.249.01 | RESISTOR, TF, 1.8W, 1%, 2.49K, SURFACE-MOUNT 1 | R403 |
| 20123.499.01 | RESISTOR, TF, 1/8W, 1%, 4.99K | R101, R103, R105, R108, R116, R118, R121, R124, R502, R515 |
| 20124.100.01 | RESISTOR, TF, 1/8W, 1%, 10.0K, SURFACE-MOUNT | R110, R125, R237, R243, R244, R406, R407, R409, R413, R414, R519, R527, R528, R529 |
| 20124.200.01 | RESISTOR, TF, 1/8W, 1%, 20.0K | R402, R404, R417, R418 |
| 20124.249.01 | RESISTOR, TF, 1/8W, 1%, 24.9K | R405 |
| 20126.100.01 | RESISTOR, TF, 1/8W, 1%, 1.00M | R142, R152, R225, R231, R306 |
| 20129.150.01 | RESISTOR, 1/8W, 1%, 150 OHM, 0805 | R138, R151, R235, R236 |
| 20129.249.01 | RESISTOR, 1/8W, 1%, 249 OHM, 0805 | R137, R139, R149, R150, R155 |

| *PART #* | *DESCRIPTION* | *COMPONENT IDENTIFIER* |
|---|---|---|
| 20129.768.01 | RESISTOR, 1/8W, 1%, 768 OHM, 0805 | R111, R126 |
| 20130.162.01 | RESISTOR, 1/8W, 1%, 1.62K, 0805 | R132, R153, R156, R157 |
| 20130.210.01 | RESISTOR, 1/8W, 1%, 2.10K, 0805 | R112, R127 |
| 20130.249.01 | RESISTOR, 1/8W, 1%, 2.49K, 0805 | R300 |
| 20130.348.01 | RESISTOR, 1/8W, 1%, 3.48K, 0805 | R204, R210, R217, R220 |
| 20130.562.01 | RESISTOR, 1/8W, 1%, 5.62K, 0805 | R113, 128 |
| 20130.845.01 | RESISTOR, 1/8W, 1%, 8.45K, 0805 | R201, R202, R205, R207, R208, R211, R212, R214, R215, R218 |
| 20131.113.01 | RESISTOR, 1/8W, 1%, 11.3K, 0805 | R206, R219, R233, R234 |
| 20131.143.01 | RESISTOR, 1/8W, 1%, 14.3K, 0805 | R221, R224, R227, R230 |
| 20131.147.01 | RESISTOR, 1/8W, 1%, 14.7K, 0805 | R114, R129 |
| 20131.249.01 | RESISTOR, 1%, 24.9K 0805 | R203, R209, R213, R216 |
| 20131.499.01 | RESISTOR, 1/8W, 1%, 49.9K, 0805 | R222, R223, R228, R229, R239, R240, R241, R242, R501, R504, R513, R520, R524, R526 |
| 20131.825.01 | RESISTOR, 1/8W, 1%, 82.5K, 0805 | R104, R123, R303, R408, R415 |
| 20132.154.01 | RESISTOR, 1/8W, 1%, 154K, 0805 | R328 |
| 20151.365.01 | RESISTOR, 0.1%, 3.65K, 0805 | R130, R133, R135, R136, R143, R145, R147, R148 |
| 20151.536.01 | RESISTOR, 0.1%, 5.36K, 0805 | R102, R109, R117, R122 |
| 20511.310.01 | TRIM POTS, 10K, 20%, TOP-ADJUSTABLE | VR200, VR201, VR400 |
| 21112.210.01 | CAPACITOR, CERAMIC, 0.001uF, 1KV, 10% | C100, C102, C104, C106 |
| 21123.510.01 | CAPACITOR, RADIAL LEADS, 1.0uF, 50V, 20% | C224, C230 |
| 21137.447.01 | CAPACITOR, 0.47uF 25V 10% 1206 | C113, C117, C340 |
| 21138.247.01 | CAPACITOR, SMD1206, 4700pF, 50V, 5% | C109, C110, C115, C116, C411, C412 |
| 21139.000.01 | CAPACITOR, X7R, 0.1uF, 10%, 0805 | C111, C118, C119, C120, C121, C123, C124, C125, C126, C127, C128, C202, C203, C211, C212, C214, C215, C233, C302, C303, C306, C309, C404, C407, C410, C500, C501, C502, C510, C513, C600, C601, C602, C603, C604, C605, C606, C607, C608, C609, C610, C612, C613, C616, C617, C618, C619, C620, C621, C622, C623, C624, C625, C626, C628, C629, C632, C633, C634, C635, C636, C637, C638, C639, C640, C641, C642, C643, C644, C648, C649, C650, C651 |
| 21140.000.01 | CAPACITOR, NPO, 470pF, 1%, 0805 | C217, 218, 219, 220, 336, 339 |
| 21141.000.01 | CAPACITOR, NPO, 1000pF, 1%, 0805 | C1, C2, C226, C228, C337, C517, C521, C652, C653 |
| 21142.000.01 | CAPACITOR, NPO, 100pF, 1%, 0805 | C338 |
| 21143.000.01 | CAPACITOR, NPO, 1500pF, 1%, 0805 | C221, C222, C225, C227, C401, C408 |
| 21144.000.01 | CAPACITOR, 5%, 100V, 47pF, 1206 | C101, C103, C105, C107, C108, C114, C333 |

| *PART #* | *DESCRIPTION* | *COMPONENT IDENTIFIER* |
|---|---|---|
| 21145.000.01 | CAPACITOR, NPO, 5%, 100V, 33pF-1206 | C231, C335, C351, C406 |
| 21156.020.01 | CAPACITOR, 12pF, 1206 | C223, C229, C334, C402 |
| 21172.222.01 | CAPACITOR, 2200pF 50V NPO 1206 | C512, C518 |
| 21172.103.01 | CAPACITOR, 0.01uF 50V NPO 1206 | C400 |
| 21173.823.01 | CAPACITOR, 0.082uF 50V X7R 1206 | C503, C511 |
| 21263.710.01 | CAPACITOR, RADIAL LEADS, 100uF, 25V, 10% | C304, C305, C308 |
| 21318.510.01 | CAPACITOR, TANTALUM, 1.0uF, 35V, B-CASE | C200, C201, C232, C515, C516 |
| 21319.610.01 | CAPACITOR, 10uF, TANTALUM, SURFACE-MOUNT | C112, C122, C129, C130, C131, C210, C213, C216, C300, C301, C307, C310, C403, C405, C409, C645, C646, C647 |
| 22101.001.01 | DIODE, 1N4148WT / R | CR101, 102, 106, 107 |
| 22102.001.01 | DIODE 1N5711TR | CR500 |
| 22106.000.01 | DIODE, SMCJ26C, TRAN20RB | CR100, 103, 104, 105, 202, 203, 204, 205 |
| 23415.000.01 | TRANSISTOR, JFET SST113 SURFACE-MOUNT | Q200, 201, 202, 203 |
| 24024.000.01 | IC, OPA2134PA | IC3, IC100, IC102 |
| 24025.000.01 | IC, BuF634P, DIP8 | IC1, IC2 |
| 24538.000.01 | IC PCM1744 D/A SOIC14 | IC400 |
| 24634.000.01 | IC, OCTAL 3 STATE NONINVR | IC504 |
| 24652.450.01 | IC MCP809 / 4.5 PRST SOT23 | IC509 |
| 24728.302.01 | IC, QUAD, SPST SWITCH, DIP / 16 | IC101, IC103 |
| 24748.000.01 | IC, LM339M S014 | IC210 |
| 24752.000.01 | IC DIGIPOT DS1267 SO1C16 | IC402 |
| 24857.000.01 | IC 74HC374 DLATCH SOL20 | IC108, IC209 |
| 24858.000.01 | IC, SO / 14, SURFACE-MOUNT | IC604 |
| 24900.000.01 | IC, HEX INVERTER, SURFACE-MOUNT | IC603 |
| 24924.000.01 | IC CSS3310KS | IC203 |
| 24938.000.01 | IC, SINGLE 2 INPUT, SURFACE-MOUNT | IC508 |
| 24951.000.01 | IC HC151 8CH MUX SOIC16 | IC507 |
| 24957.000.01 | IC, PCM1704U | IC300 |
| 24958.000.01 | IC, DRV134PA-DIP | IC207, IC208 |
| 24960.000.01 | IC, OPA2134UA | IC104, IC105, IC106, IC201, IC202, IC204, IC206, IC302, IC401 |
| 24961.000.01 | IC, OPA627AP | IC308 |
| 24962.000.01 | IC CS8420CS REV D | IC500, IC502 |
| 24963.000.01 | IC, 5383 VS | IC107 |
| 24992.000.01 | IC, 74AHCT244 SOIC | IC601 |
| 24997.000.01 | IC, DAC AK4393 SSOP28 | IC211 |
| 27053.003.01 | CONNECTOR, MALE, INSERT, RIGHT ANGLE | J201, 202, 502 |
| 27054.003.01 | CONNECTOR, FEMALE, INSERT, RIGHT ANGLE | J100, 103, 500 |
| 27055.000.01 | CONNECTOR, DOUBLE BNC, VERTICAL PC-MOUNT BOMAR | J4, J5 |

| PART # | DESCRIPTION | COMPONENT IDENTIFIER |
|---|---|---|
| 27147.008.01 | IC, SOCKET, DIP, 8-PINS, DUAL | IC100, IC102, IC207, IC208, IC1, IC2, IC3 |
| 27147.016.01 | IC, SOCKET, DIP, 16-PIN, DUAL | IC101, 103 |
| 27147.020.01 | IC, SOCKET, DIP, 20-PIN, DUAL | IC602 |
| 27174.044.01 | IC, SOCKET, 44-PIN, LOW PROFILE | IC503 |
| 27401.000.01 | CONNECTOR, JUMPER, RECPT, BLACK | JJ2, JJ3 |
| 27406.014.01 | CONNECTOR, SOCKET, STRIP, 14-PIN | JP600 |
| 27408.003.01 | CONNECTOR, 3P SOCKET STRIP | L1, L2, L3, L4, L100, L102, L104, L106, L200, L201, L202, L203, L500, L501, L504, L505 |
| 27421.002.01 | CONNECTOR, HEADER, DOUBLE ROW , 2P, 2 X 1 | J400 |
| 27421.004.01 | CONNECTOR, HEADER, DOUBLE ROW , 4P, 2 X 2 | J2, J3, J400, J505 |
| 27426.005.01 | HEADER, UNSHRD | REF, J504 |
| 27451.004.01 | HEADER, STR, DOUBLE ROW, PCMOUNT | J601 |
| 27451.005.01 | CONNECTOR, STR, DOUBLE ROW, 26-PIN | J600 |
| 27630.001.01 | JUMPER, PC MOUNT, TEST POINT | TP600, 607 |
| 29015.000.01 | AES3 TRANSFORMER, SURFACE-MOUNT | T500, 502 |
| 29508.210.01 | FILTER, EMI SUPPRESSION, 50V | L1, L2, L3, L100, L102, L104, L106, L200, L201, L202, L203, L500, L501, L504, L505, L400, L401, L402 |
| 29521.000.01 | INDUCTOR, 3.9UH, JM391K | L5, L6, L7, L204, L205, L206, L207, L403, L404, L405 |
| 29522.000.01 | INDUCTOR, 1200UH, 5%, 1-M-10-22 | L101, L103, L105, L107 |
| 29707.002.01 | INDUCTOR, 3.501 mH | L300 |
| 29707.003.01 | INDUCTOR, 3.39 mH | L301 |
| 44092.100.01 | FIRMWARE, FM I/O IC503 8300 | IC503 |

## DSP Board

| PART # | DESCRIPTION | COMPONENT IDENTIFIER |
|---|---|---|
| 42007.030 | SUBASSEMBLY, FLAT CBL-26P- 3 | J601 |
| 16021.000.01 | HEATSINK, VERTICAL MOUNT, BLACK ANODIZED | HS700 |
| 20128.075.01 | RESISTOR, 75OHM, 1%, 0805 | R505, R506, R508, R604, R605, R606, R607, R608, R609, R610, R611, R612, R705, R806, R807, R808, R809, R810, R811 |
| 20131.100.01 | RESISTOR, 10K, 0805 | R301, R302, R303, R304, R305, R306, R307, R308, R507, R510, R801, R802, R803, R804, R805 |
| 20132.100.01 | RESISTOR, 100K, 0805 | R101, R102, R103, R104, R502, R503, R504, R509, R601, R602, R603 |
| 20221.101.01 | RESISTOR NETWORK, SIP, 2%, 100K, 10PIN | RN501 |

| *PART #* | *DESCRIPTION* | *COMPONENT IDENTIFIER* |
|---|---|---|
| 21137.282.01 | CAPACITOR, 8200pF, ±15%, 1206, 50V | C101, C103, C105, C107, C109, C111, C113, C115 |
| 21137.447.01 | CAPACITOR, 0.47uF 25V 10% 1206 | C102, C104, C106, C108, C110, C112, C114, C116 |
| 21139.000.01 | CAPACITOR, X7R, 0.1uF, 10%, 0805 | C701, C702, C703, C704, C705, C706, C707, C708, C709, C710, C711, C712, C713, C714, C715, C716, C718, C719, C720, C723, C724, C725, C726, C727, C728, C729, C732, C733, C734, C739, C740, C741, C742, C743, C744, C749, C751, C752, C753, C754, C755, C756, C757, C758, C759, C760, C761, C762, C764, C765, C768, C769, C802, C803, C805, C806, C808, C809 |
| 21141.000.01 | CAPACITOR, NPO, 1000pF, 1%, 0805 | C771, C772, C773, C774 |
| 21309.622.01 | CAPACITOR, 22uF , TANTALUM, SURFACE-MOUNT | C736 |
| 21319.610.01 | CAPACITOR, 10uF, TANTALUM, SURFACE-MOUNT | C763, C766, C767, C770, C801, C804, C807 |
| 22083.068.01 | DIODE, VOLTAGE SUPPRESSOR, 6.8 VOLT | CR700, CR701 |
| 24326.000.01 | IC, REG, 1086, 3.3V | IC701, IC702 |
| 24857.000.01 | IC 74HC374 DLATCH SOL20 | IC504 |
| 24944.000.01 | IC, EPM 7064AETC44-10, SURFACE-MOUNT | IC503 |
| 24945.000.01 | IC 74AHC541 OCTAL BUFFER SOL20 | IC501 |
| 24946.000.01 | IC-8 BIT-DUAL TRANSCEIVER W / 3 | IC502 |
| 24948.000.01 | IC 74LVC2244 OCTAL BUFFER, SOL20 | IC601, IC602 |
| 24955.000.01 | IC, SURFACE-MOUNT, PLL1700, SSOP / 20 | IC801, IC802 |
| 24991.000.01 | IC, DSP 56362PV100 | IC101, IC102, IC103, IC104, IC105, IC106, IC107, IC108 |
| 24993.000.01 | IC, EPM7256AETC100-10 | IC603 |
| 24994.000.01 | IC, 74ACT04, SOIC 14P | IC807 |
| 27421.002.01 | CONNECTOR, HEADER, DOUBLE ROW , 2P, 2 X 1 | J500 |
| 27421.004.01 | CONNECTOR, HEADER, DOUBLE ROW , 4P, 2 X 2 | J101 |
| 27421.010.01 | CONNECTOR, HEADER, DOUBLE ROW , 23", 2 X 5 | J603 |
| 27451.003.01 | HEADER, STR, DRLROW, PCMOUNT | J701 |
| 27451.007.01 | CONNECTOR, DOUBLE ROW , PC MNT, 40-PIN | J504 |
| 27630.001.01 | JUMPER, PC-MOUNT, TEST POINT | TP702, TP703 |
| 28083.000.01 | OSC, CRYSTAL CLOCK, 27MHz, 3 VOLT | U804 |

### Display Board

| *PART #* | *DESCRIPTION* | *COMPONENT IDENTIFIER* |
|---|---|---|
| 42007.080 | SUBASSEMBLY, FLAT CABLE-26P- 8" | |
| 15062.390.01 | LED SPACER, 390 HIGH | |
| 20122.110.01 | RESISTOR, TF, 1/8W, 1%, 110 OHM | R17-R24 |
| 20124.100.01 | RESISTOR, TF, 1/8W, 1%, SURFACE-MOUNT 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 | |
| 21131.410.01 | CAPACITOR, SURFACE MOUNT, 1206, 0.1uF, 50V, 20% | C2-C10 |
| 21313.568.01 | CAPACITOR, TANTALUM, 6.8uF, 25V, 10% | C1 |
| 24851.000.01 | IC, SOL20, SURFACE-MOUNT | IC8 |
| 24857.000.01 | IC 74HC374 DLATCH, SOL20 | IC3 |
| 24900.000.01 | IC, HEX INVERTER, SURFACE-MOUNT | IC7 |
| 24905.000.01 | IC, CMOS OCTAL D REG. 3 ST | IC4, IC5, IC6, IC9 |
| 24908.000.01 | IC, OCTAL, D TYP, FLIP / FLOP | IC1, IC2 |
| 25106.001.01 | LED, YELLOW, T-1, HIGH-EFFICIENCY LAMP | CR11, CR12, CR13, CR14, CR15 |
| 25119.003.01 | LED, T-3 FLAT TP FLNGL, RED | |
| 25167.000.01 | LED, ARRAY, 10 -POSITION, 1 RED, 1 YEL, 8 GRN | CR7, CR16 |
| 25168.000.01 | LED, ARRAY, 10 -POSITION, 9 YEL, 1 RED | CR1, CR2, CR3, CR4, CR5, CR6, CR8, CR9 |
| 27216.012.01 | CBL FLEXSTRIP 4P 12" | |
| 27421.004.01 | CONNECTOR, HEADER, DOUBLE ROW , 4P, 2 X 2 | J1 |

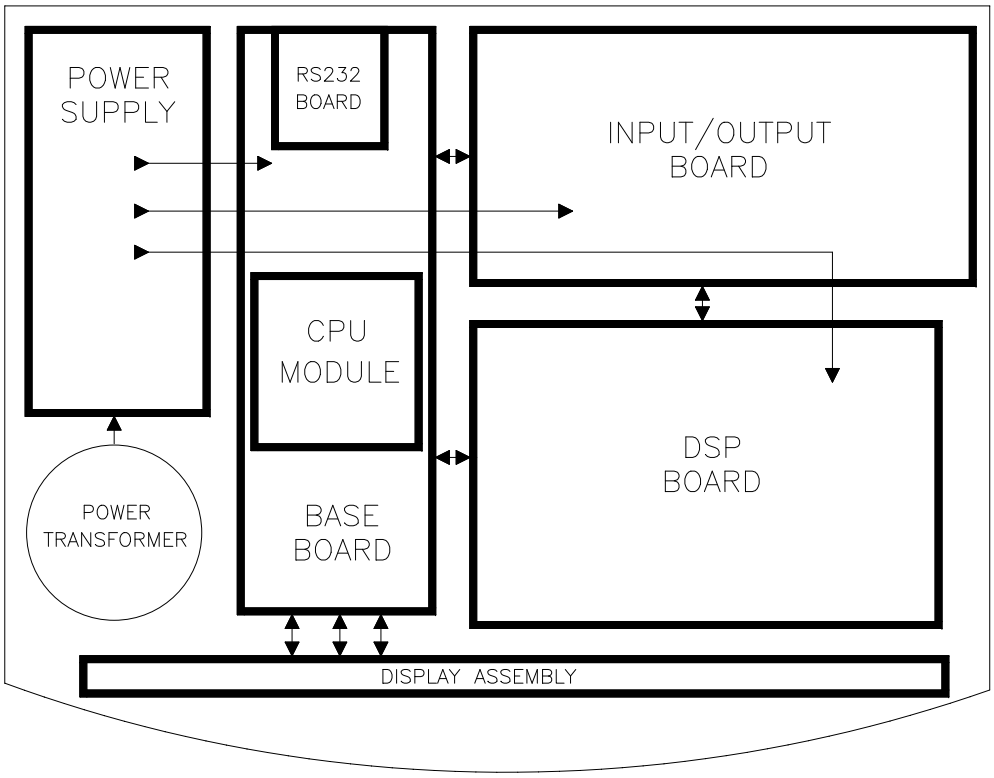
## Schematics and Parts Locator Drawings

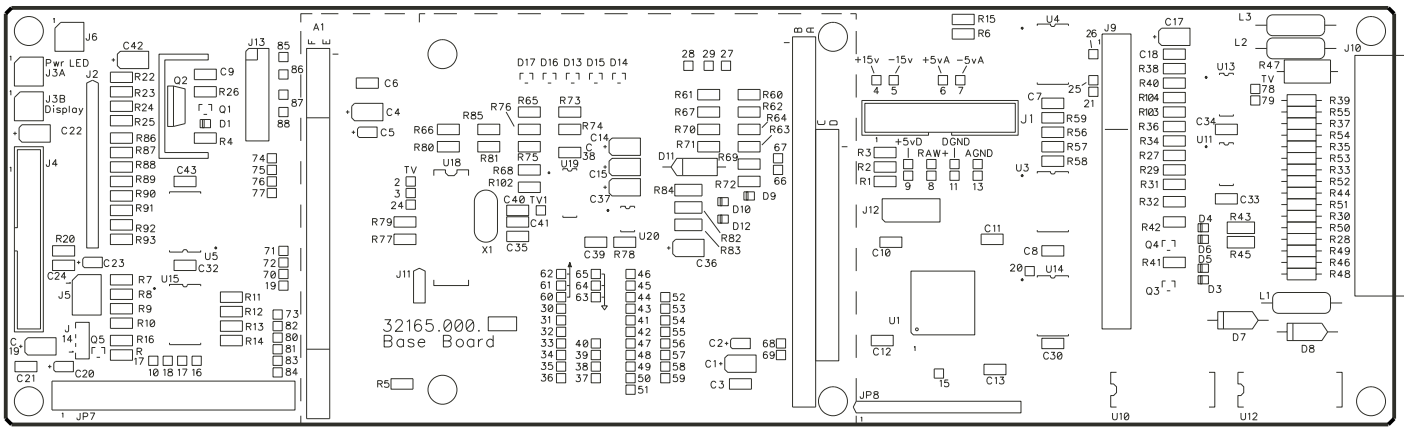
These drawings reflect the actual construction of your unit as accurately as possible. Any differences between the drawings and your unit are probably due to product improvements or production changes since the publication of this manual.

If you intend to replace parts, please read page 6-14. Please note that because surface-mount parts are used extensively in the 8300, few parts are field-replaceable. Servicing ordinarily occurs by swapping circuit board assemblies. However, many vulnerable parts connected to the outside world are socketed and can be readily replaced in the field.

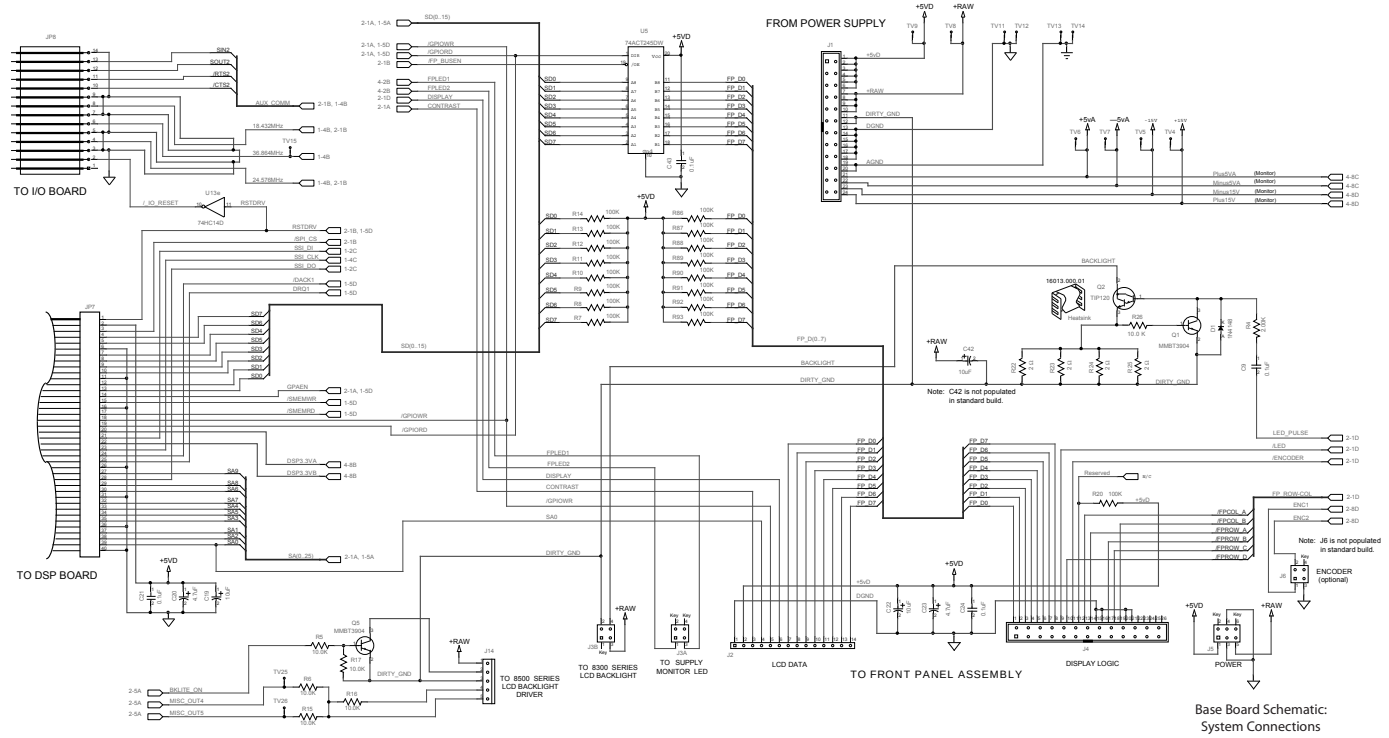
| Function | Description | Drawing | Page |
|---|---|---|---|
| **Chassis** | Circuit Board Locator and Basic Interconnections | Top view (not to scale) | 6-29 |
| **Base Board** | Glue logic; supports CPU module and RS-232 daughterboard. ***Contains**:* | Parts Locator Drawing | 6-30 |
| | System Connections | Schematic 1 of 4 | 6-31 |
| | CPU module interface | Schematic 2 of 4 | 6-32 |
| | CPU module interface (ver. .06) | Schematic 2 of 4 | 6-33 |
| | Power Supply Monitor | Schematic 3 of 4 | 6-34 |
| | CPLD, General Purpose Interface, and Remotes | Schematic 4 of 4 | 6-35 |
| **CPU Module** | Control microprocessor. Services front panel, serial port, Ethernet, DSP board, and control board. Resides on base board. ***Contains**:* | Parts Locator Drawing | 6-36 |
| | Ethernet | Schematic 1 of 5 | 6-37 |
| | General Purpose Bus | Schematic 2 of 5 | 6-38 |
| | Memory | Schematic 3 of 5 | 6-39 |
| | Miscellaneous Functions | Schematic 4 of 5 | 6-40 |
| | Power and Ground Distribution | Schematic 5 of 5 | 6-41 |
| **RS-232 Board** | Supports Serial Port | Parts Locator Drawing | 6-42 |
| | | Schematic 1 of 1 | 6-43 |
| **Power Supply** | ±15V analog supply; ±5V analog supply; +5V digital supply | Parts Locator Drawing | 6-44 |
| | | Schematic 1 of 1 | 6-45 |
| **I/O Board** | Analog Input/Output<br>AES3 Input/Output<br>Composite Output<br>SCA Input.<br>***Contains:*** | Parts Locator Drawing | 6-46 |
| | L and R Analog Inputs | Schematic 1 of 5 | 6-47 |
| | L and R Analog Outputs | Schematic 2 of 5 | 6-48 |
| | Composite / SCA | Schematic 3 of 5 | 6-49 |
| | Control and Digital I/O | Schematic 4 of 5 | 6-50 |
| | Interface and Power Distribution | Schematic 5 of 5 | 6-51 |
| **DSP Board** | DSP Chips; Local +3.3V regulator. ***Contains:*** | Parts Locator Drawing | 6-52 |
| | DSP Extended Serial Audio Interface (ESAI) | Schematic 1 of 7 | 6-53 |
| | DSP Host Interface | Schematic 2 of 7 | 6-54 |
| | DSP Serial Peripheral Interface, Power, and Ground | Schematic 3 of 7 | 6-55 |
| | ISA Bus 8-bit I/O | Schematic 4 of 7 | 6-56 |
| | Serial Audio Interface and Clock Generation | Schematic 5 of 7 | 6-57 |

| | | | |
|---|---|---|---|
| | Power Distribution | Schematic 6 of 7 | 6-58 |
| | No-Connects | Schematic 7 of 7 | 6-59 |
| **Display Board** | Front-Panel LCD, LEDs, Buttons, and Rotary Encoder | Parts Locator Drawing | 6-60 |
| | | Schematic 1 of 1 | 6-61 |
| **DSP Block Diagram** | Shows signal processing | | 6-62 |

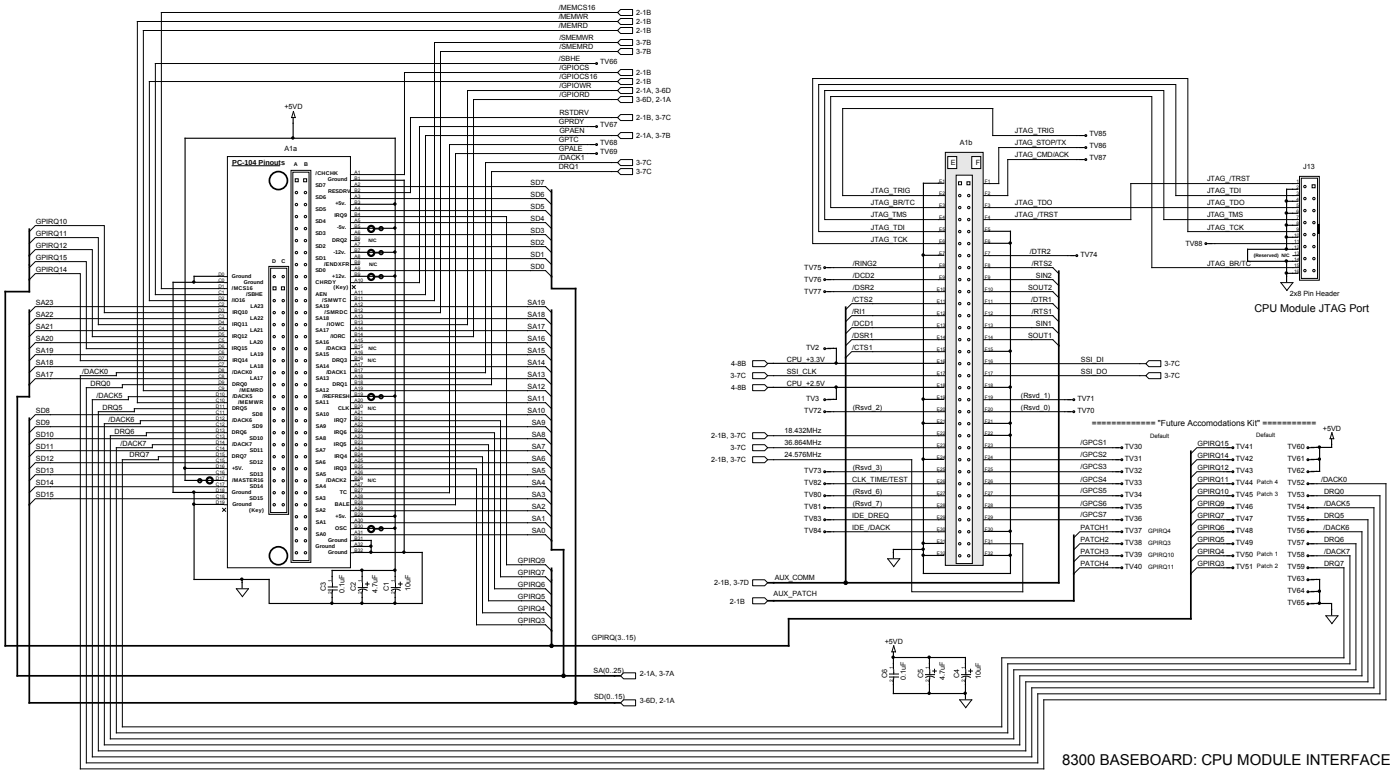

POWER
SUPPLY
RS232
BOARD
INPUT/OUTPUT
BOARD
CPU
MODULE
DSP
BOARD
POWER
TRANSFORMER
BASE
BOARD
DISPLAY ASSEMBLY



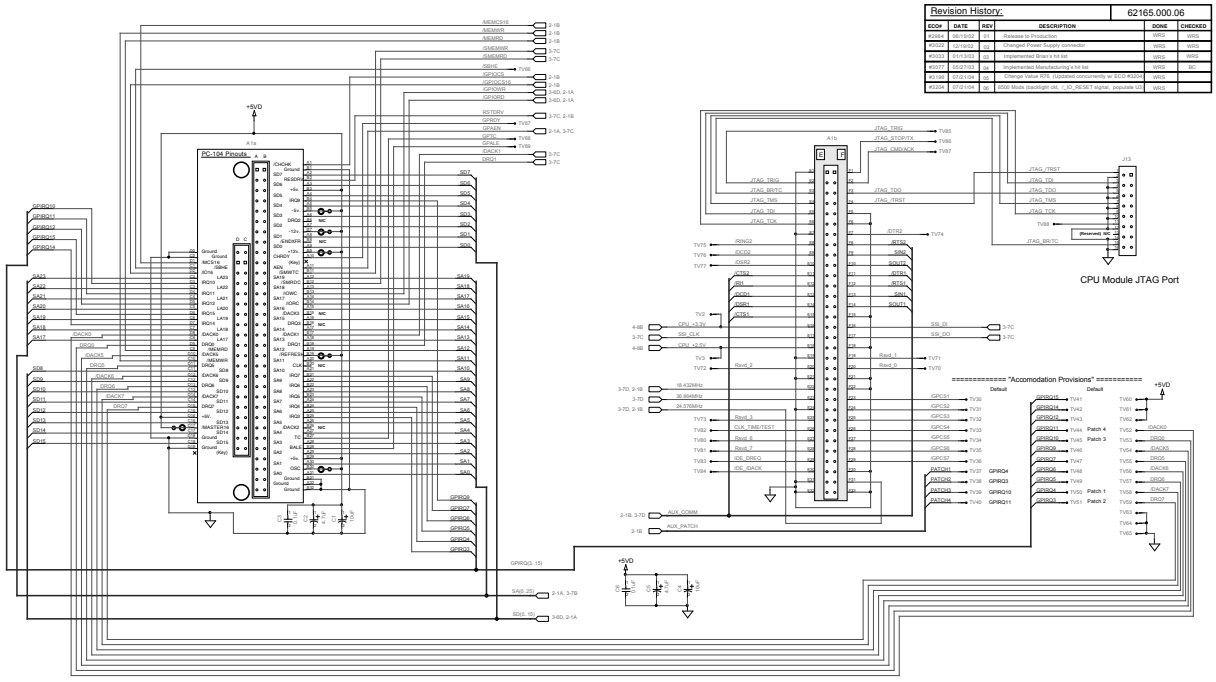

Base Board Parts Locator Drawing
(for schematic 62165.000.06)



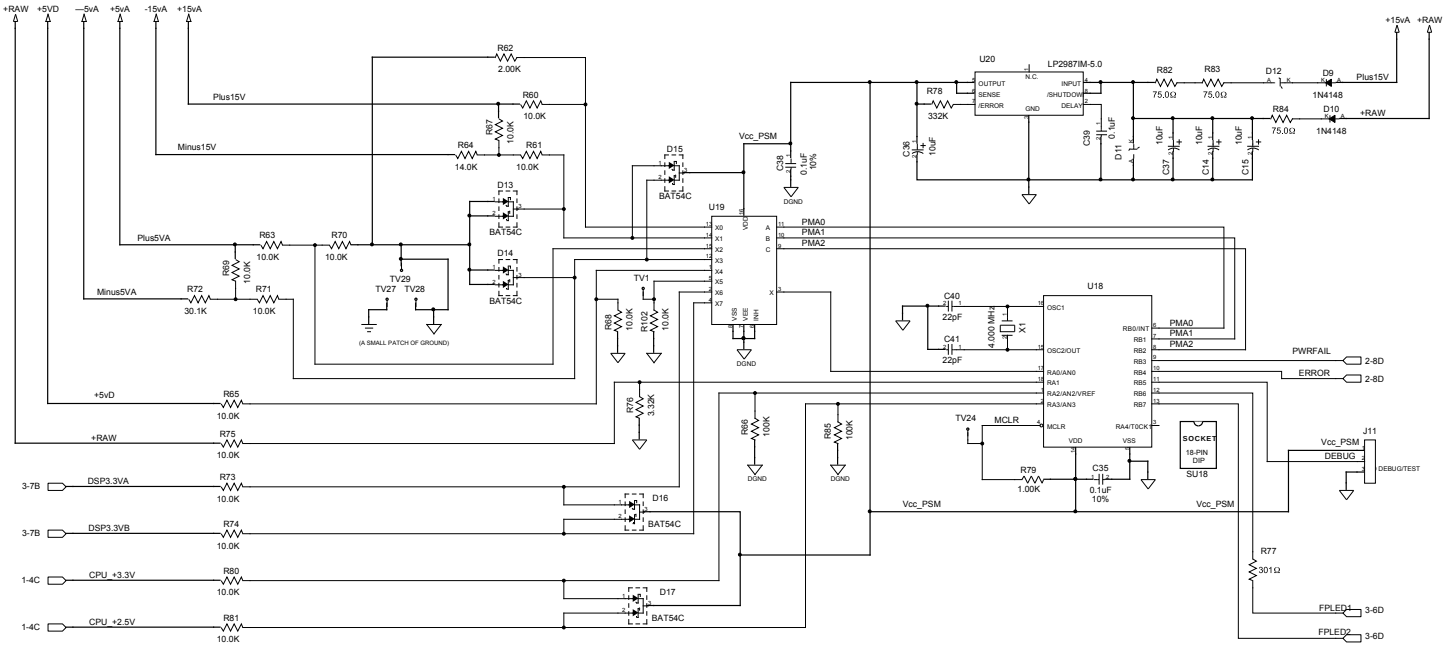

Base Board Schematic:
System Connections
(version 62165.000.06)
Sheet 1 of 4


/MEMCS16
/MEMWR
/MEMRD
/SMEMWR
/SMEMRD
/SBHE
/GPIOCS
/GPIOCS16
/GPIOWR
/GPIORD
RSTDRV
GPRDY
GPAEN
GPTC
GPALE
/DACK1
DRQ1
PC-104 Pinouts
A1a
A1b
J13
JTAG_TRIG
JTAG_STOPITX
JTAG_CMDIACK
JTAG_BR/TC
JTAG_TMS
JTAG_TDI
JTAG_TCK
JTAG_TDO
JTAG_/TRST
/DTR2
/RTS2
SIN2
SOUT2
/DTR1
/RTS1
SIN1
SOUT1
/RING2
/DCD2
/DSR2
/CTS2
/RI1
/DCD1
/DSR1
/CTS1
SSI_DI
SSI_DO
CPU_+3.3V
SSI_CLK
CPU_+2.5V
18.432MHz
36.864MHz
24.576MHz
AUX_COMM
AUX_PATCH
/GPCS1
/GPCS2
/GPCS3
/GPCS4
/GPCS5
/GPCS6
/GPCS7
PATCH1
PATCH2
PATCH3
PATCH4
"Future Accomodations Kit"
GPIRQ15
GPIRQ14
GPIRQ12
GPIRQ11
GPIRQ10
GPIRQ9
GPIRQ7
GPIRQ6
GPIRQ5
GPIRQ4
GPIRQ3
GPIRQ(3..15)
SA(0..25)
SD(0..15)
CPU Module JTAG Port
2x8 Pin Header
8300 BASEBOARD: CPU MODULE INTERFACE

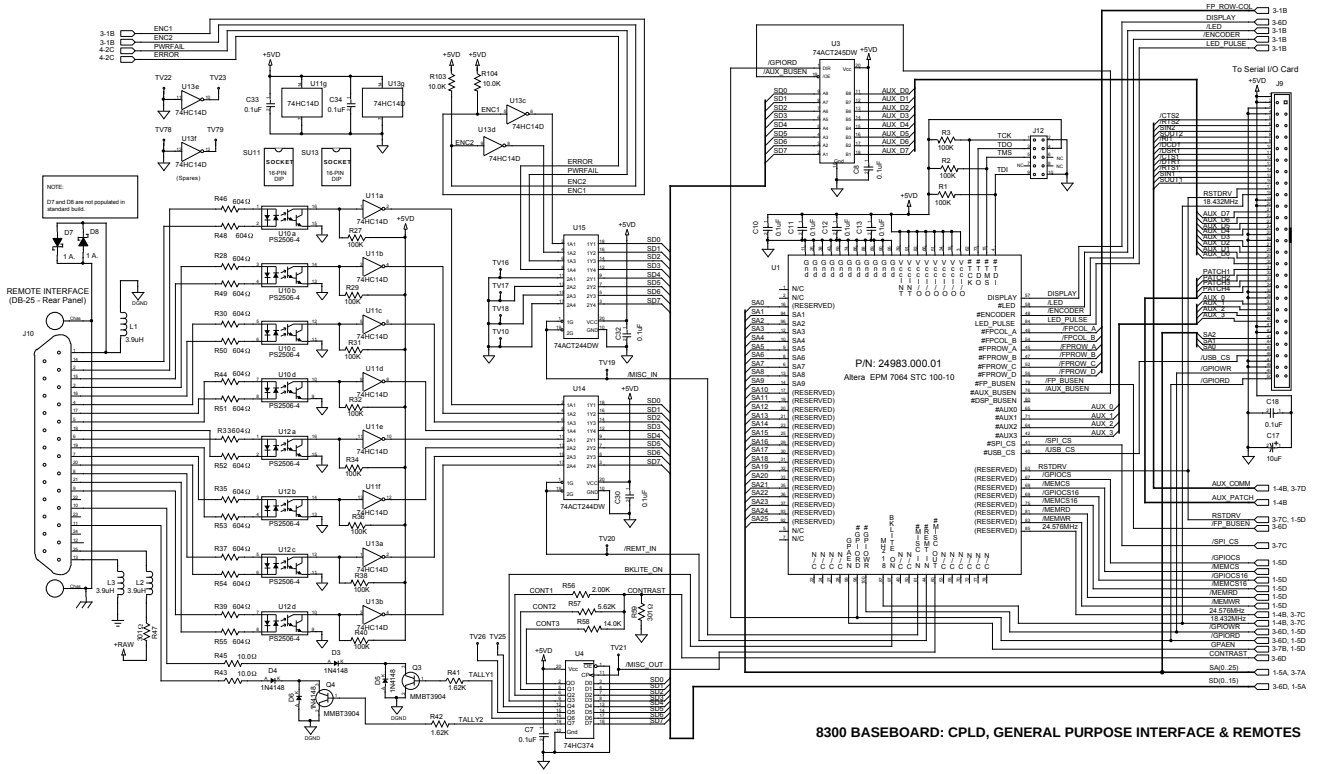
| Revision History: | | | | 62165.000.06 | |
|---|---|---|---|---|---|
| ECO# | DATE | REV | DESCRIPTION | DONE | CHECKED |
| #3064 | 06/19/02 | 01 | Release to Production | WRS | WRS |
| #3222 | 10/10/02 | 02 | Changed Power Supply connector | WRS | WRS |
| #3332 | 01/13/03 | 03 | Implemented Brian's hit list | WRS | WRS |
| #3377 | 05/27/03 | 04 | Implemented Manufacturing's hit list | WRS | BC |
| #3199 | 07/21/04 | 05 | Change Value R76 (Updated concurrently w/ ECO #3204) | WRS | |
| #3204 | 07/21/04 | 06 | 6500 Mode (backlight ckt. (_PO_RESET signal, populate U3) | WRS | |

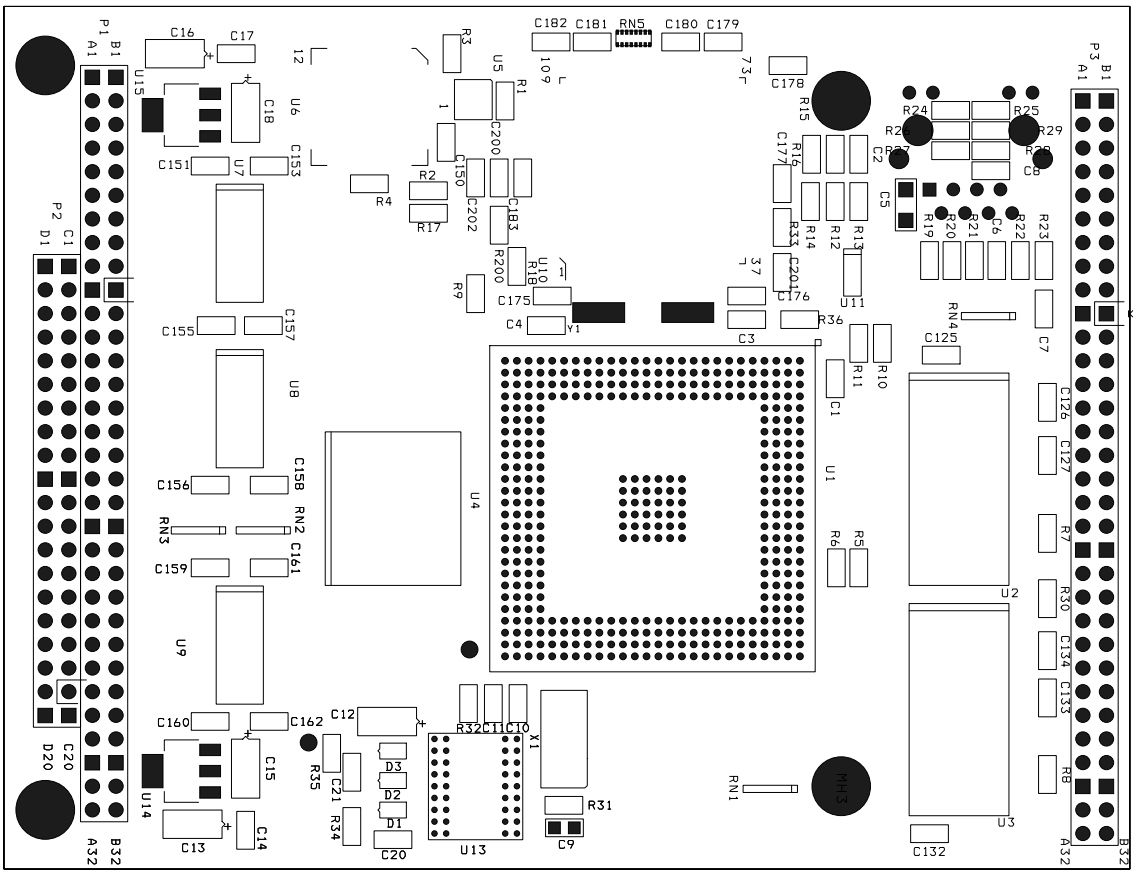



Base Board Schematic:
CPU Module Interface
(version 62165.000.06)
Sheet 2 of 4

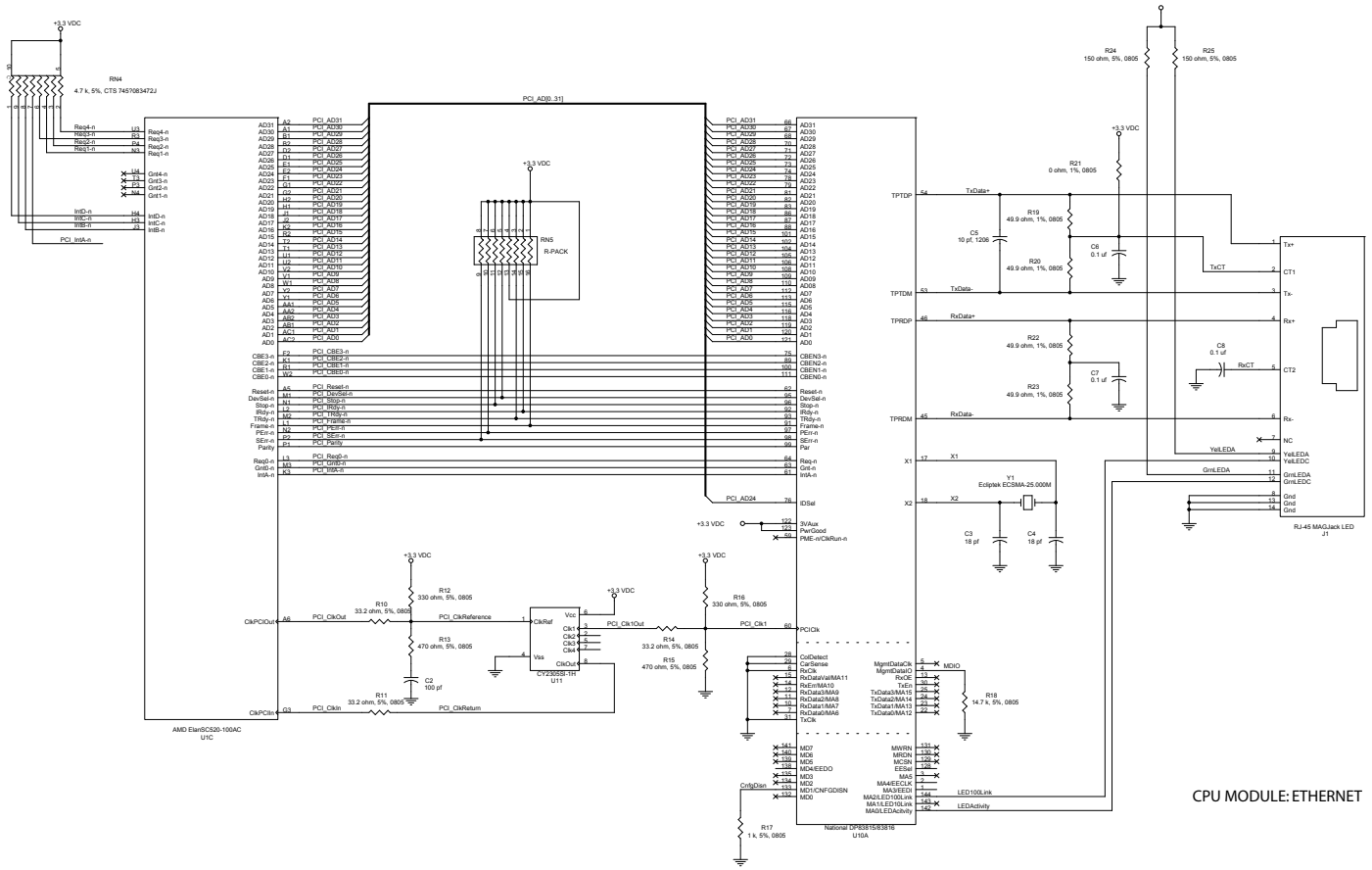



8300 BASEBOARD: POWER SUPPLY MONITOR

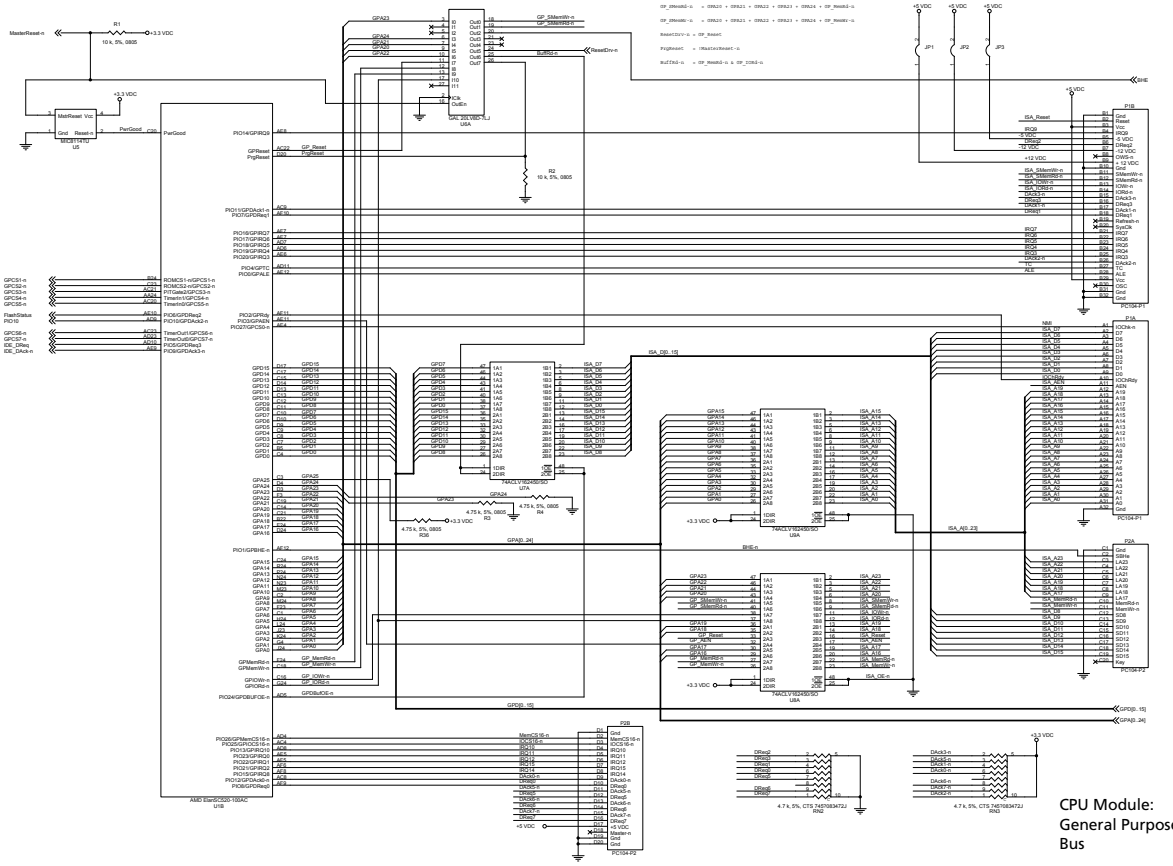

P/N: 24983.000.01
Altera EPM 7064 STC 100-10
REMOTE INTERFACE
(DB-25 - Rear Panel)
NOTE:
D7 and D8 are not populated in standard build.
(Spares)
74HC14D
74ACT245DW
74ACT244DW
74HC374
PS2506-4
MMBT3904
1N4148
SOCKET
16-PIN DIP
To Serial I/O Card
DISPLAY
/ENCODER
LED_PULSE
/FPCOL_A
/FPCOL_B
/FPROW_A
/FPROW_B
/FPROW_C
/FPROW_D
/FP_BUSEN
/AUX_BUSEN
/SPI_CS
/USB_CS
/GPIOWR
/GPIORD
/MISC_IN
/REMT_IN
BKLITE_ON
/MISC_OUT
CONTRAST
TALLY1
TALLY2
AUX_COMM
AUX_PATCH
RSTDRV
/GPIOCS
/MEMCS
/GPIOCS16
/MEMCS16
/MEMRD
/MEMWR
24.576MHz
18.432MHz
/GPAEN
/GPIOPWR
SA(0..25)
SD(0..15)
8300 BASEBOARD: CPLD, GENERAL PURPOSE INTERFACE & REMOTES


P1
P2
P3
KEY
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U13
U14
U15
Y1
X1
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C20
C125
C126
C127
C132
C133
C134
C150
C151
C153
C155
C156
C157
C158
C159
C160
C161
C162
C175
C176
C177
C178
C179
C180
C181
C182
C183
C200
C201
C202
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R29
R30
R31
R32
R33
R35
R36
R200
RN1
RN2
RN3
RN4
RN5
D1
D2
D3
D20
MH3

CPU Module

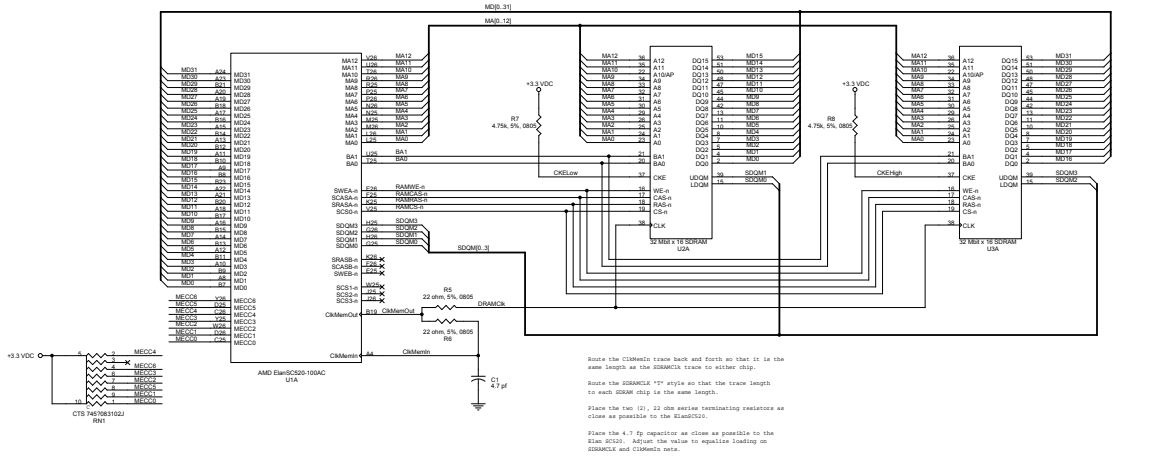



CPU MODULE: ETHERNET

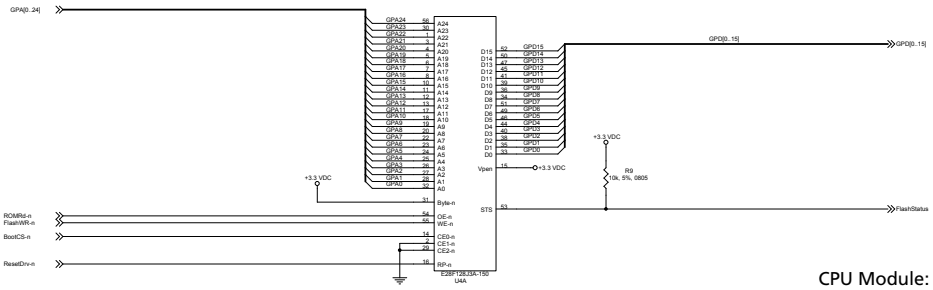


CPU Module: General Purpose Bus

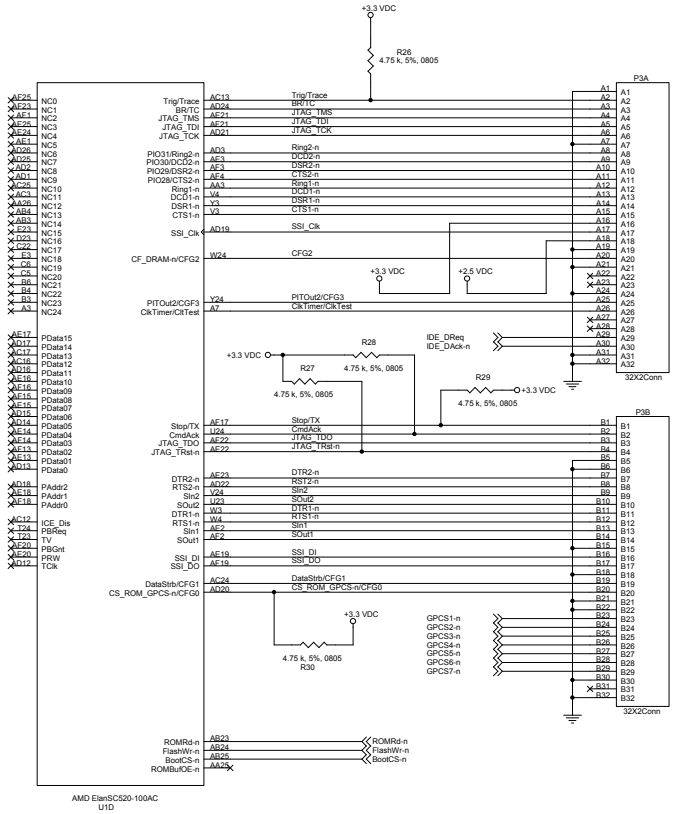
## DRAM Circuitry

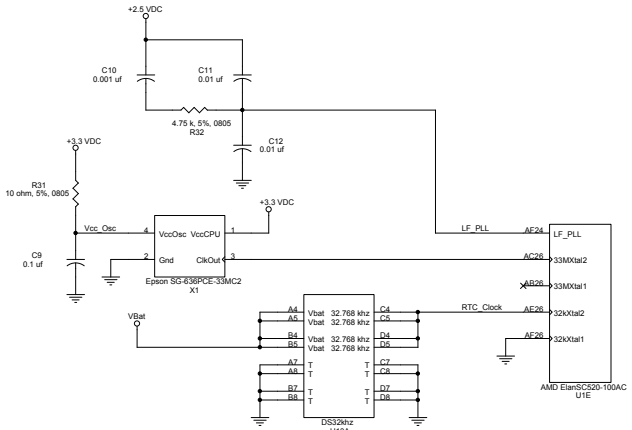



## Flash Circuitry

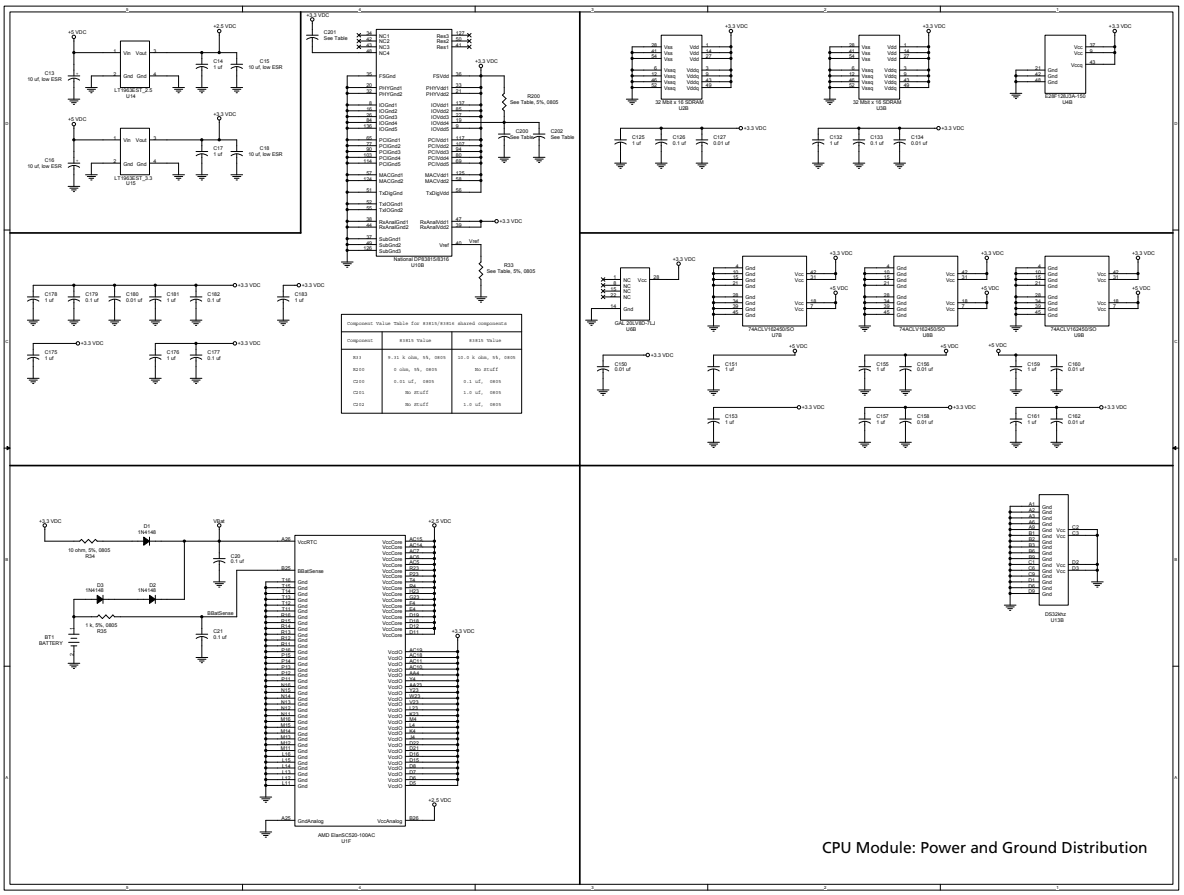


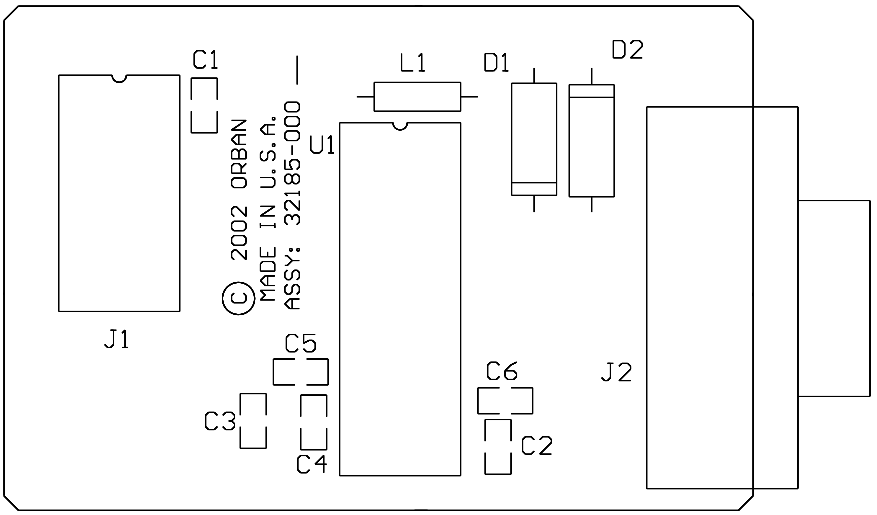

CPU Module: Memory



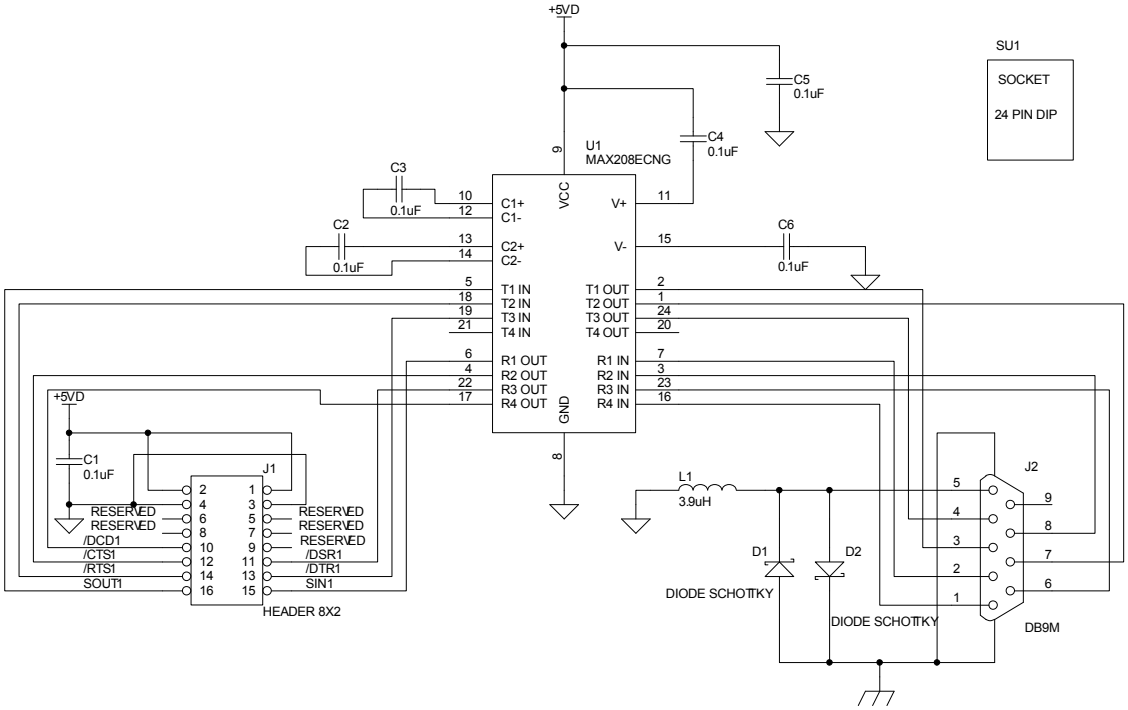




CPU Module: Miscellaneous Connections

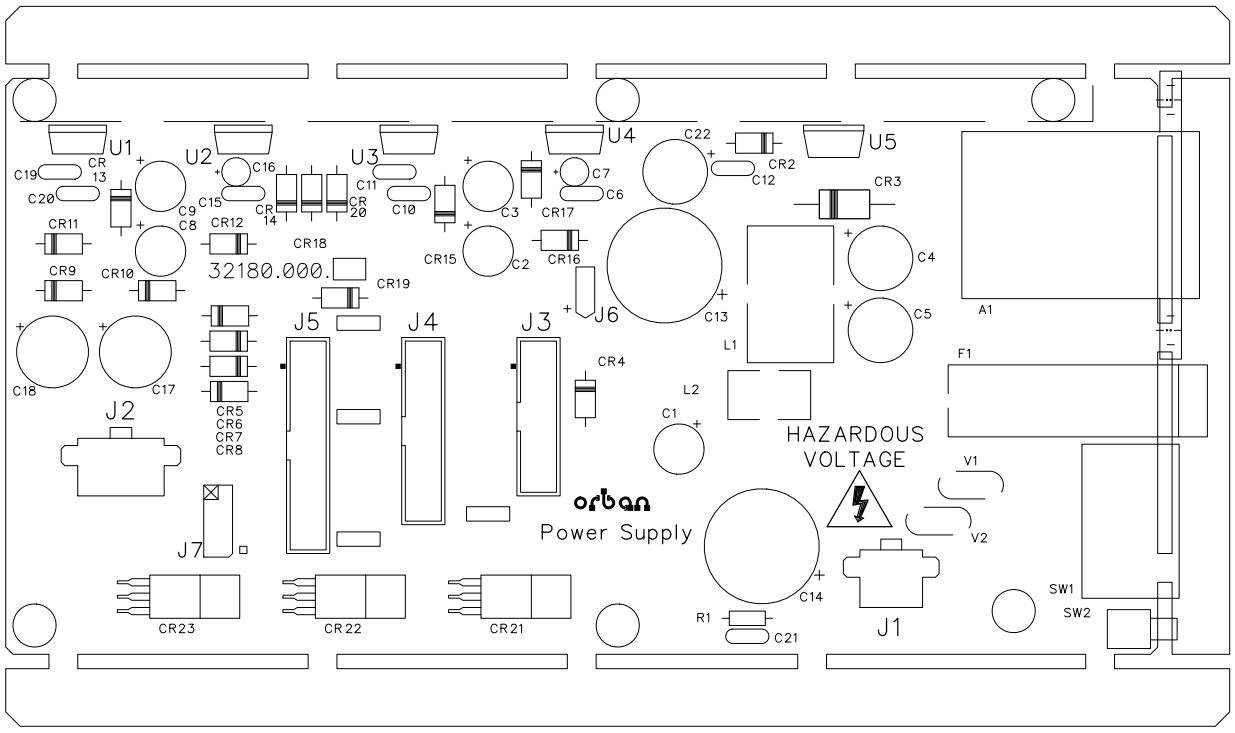

Component Value Table for 83815/83816 shared components
Component
83815 Value
83816 Value
R33
9.31 k ohm, 1%, 0805
10.0 k ohm, 1%, 0805
R200
0 ohm, 5%, 0805
No stuff
C200
0.01 uf, 0805
0.1 uf, 0805
C201
No stuff
1.0 uf, 0805
C202
No stuff
1.0 uf, 0805
CPU Module: Power and Ground Distribution



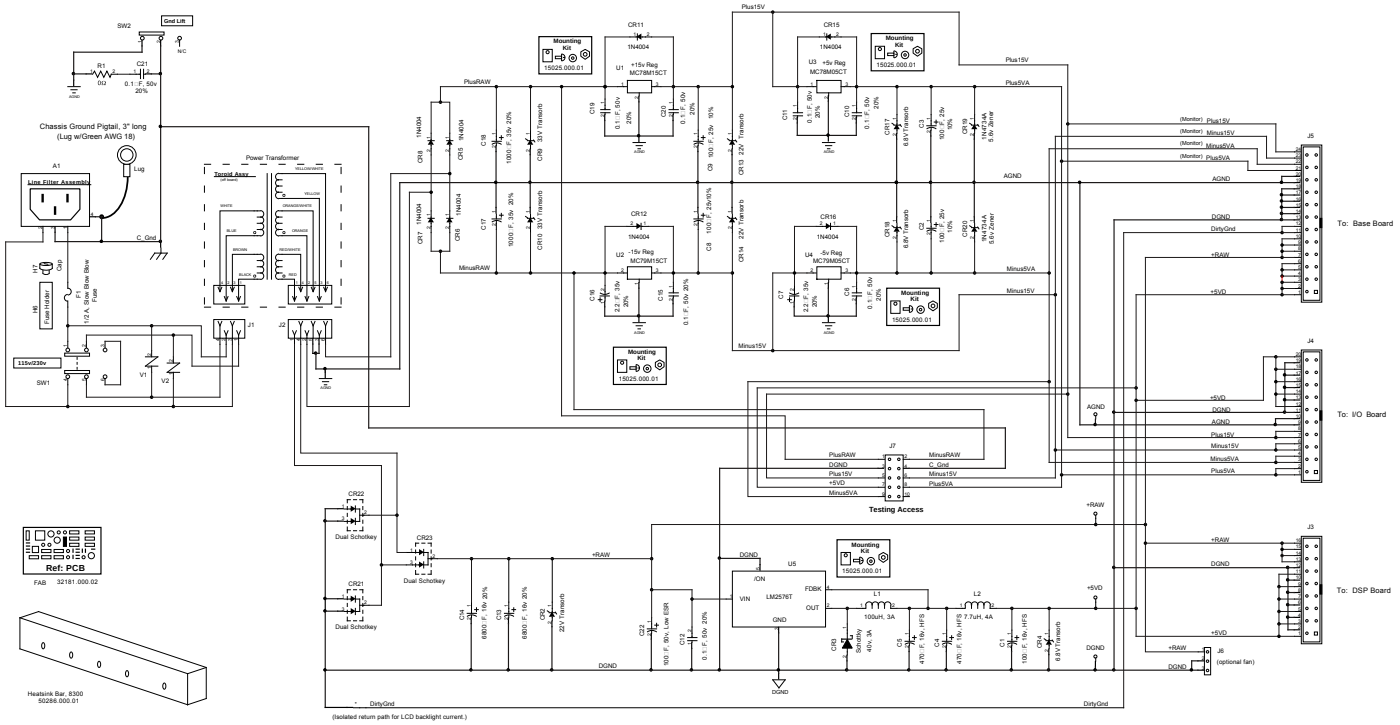

**8300 RS232 BOARD PARTS LOCATOR**



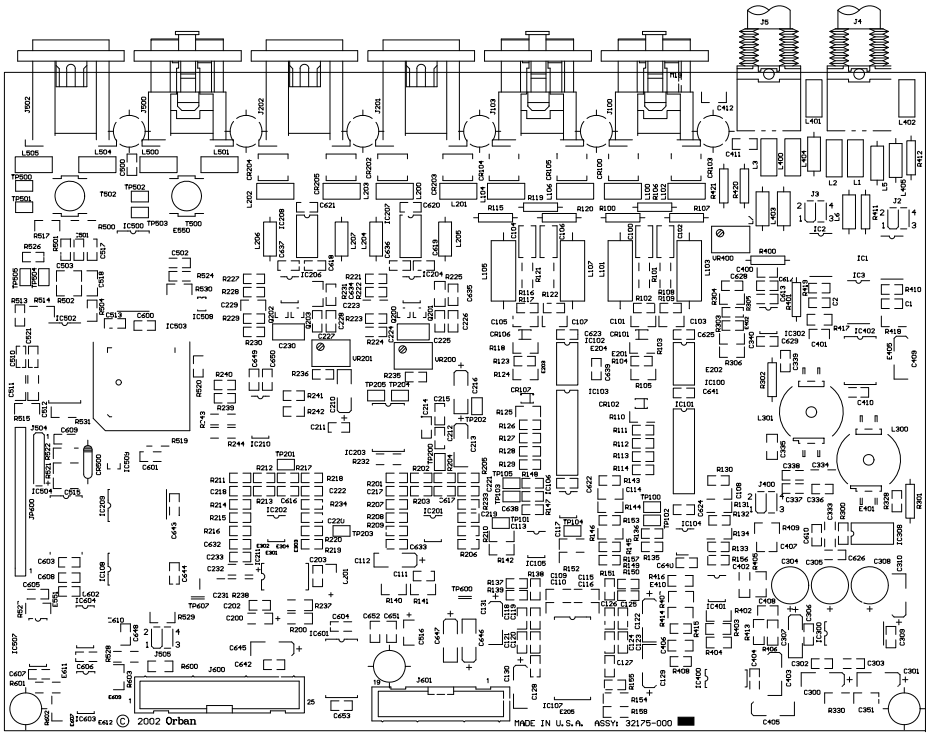

**RS232 DAUGHTER BOARD**



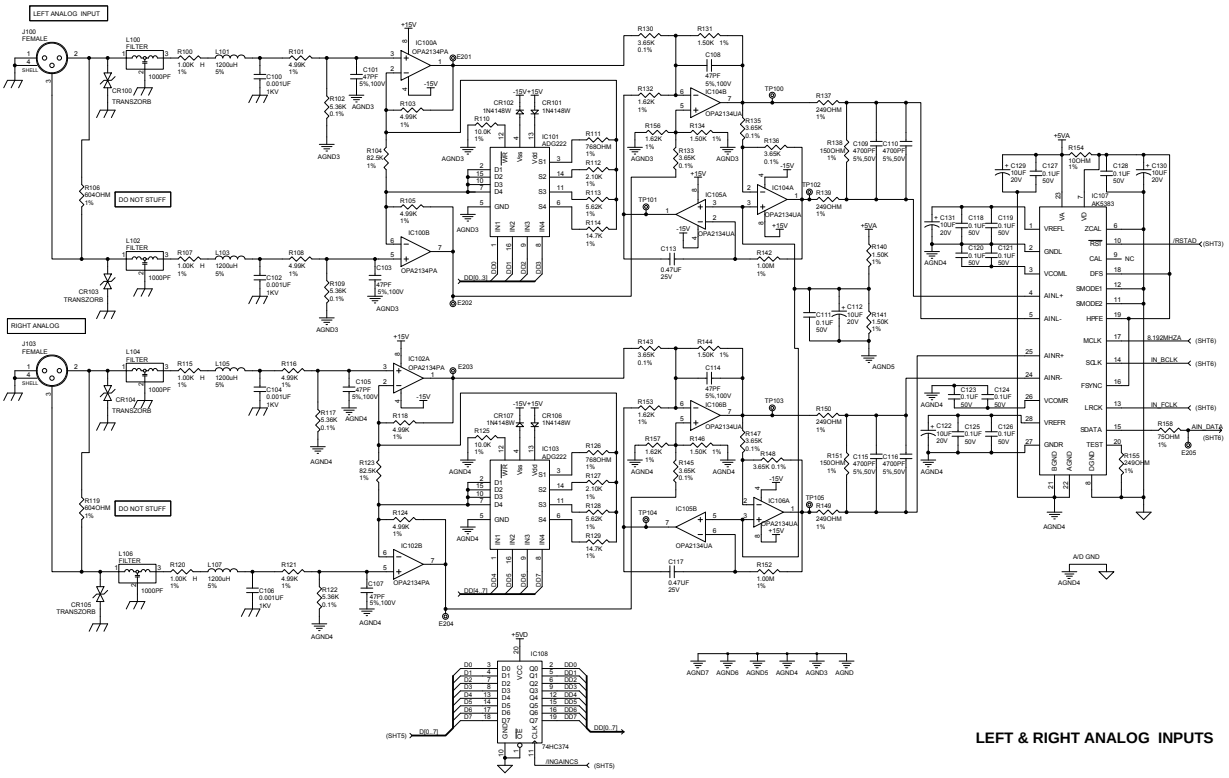

**8300 POWER SUPPLY PARTS LOCATOR**



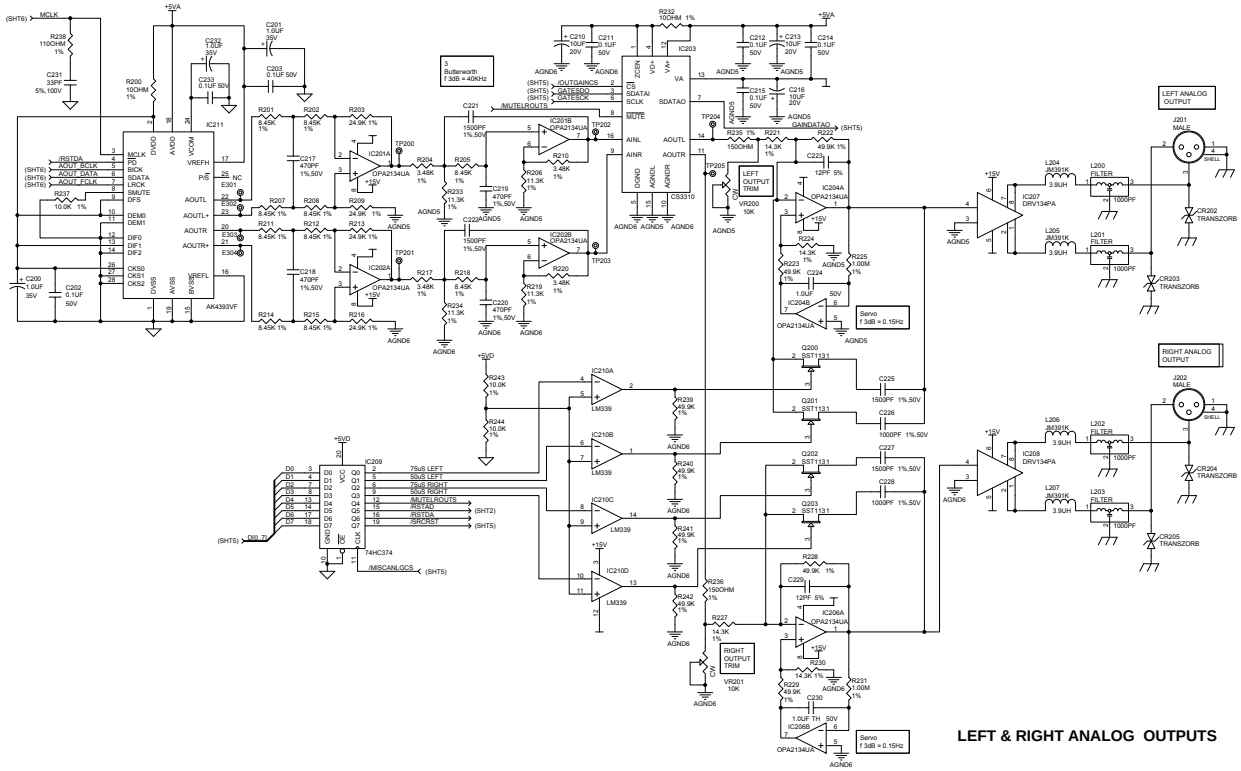

## POWER SUPPLY

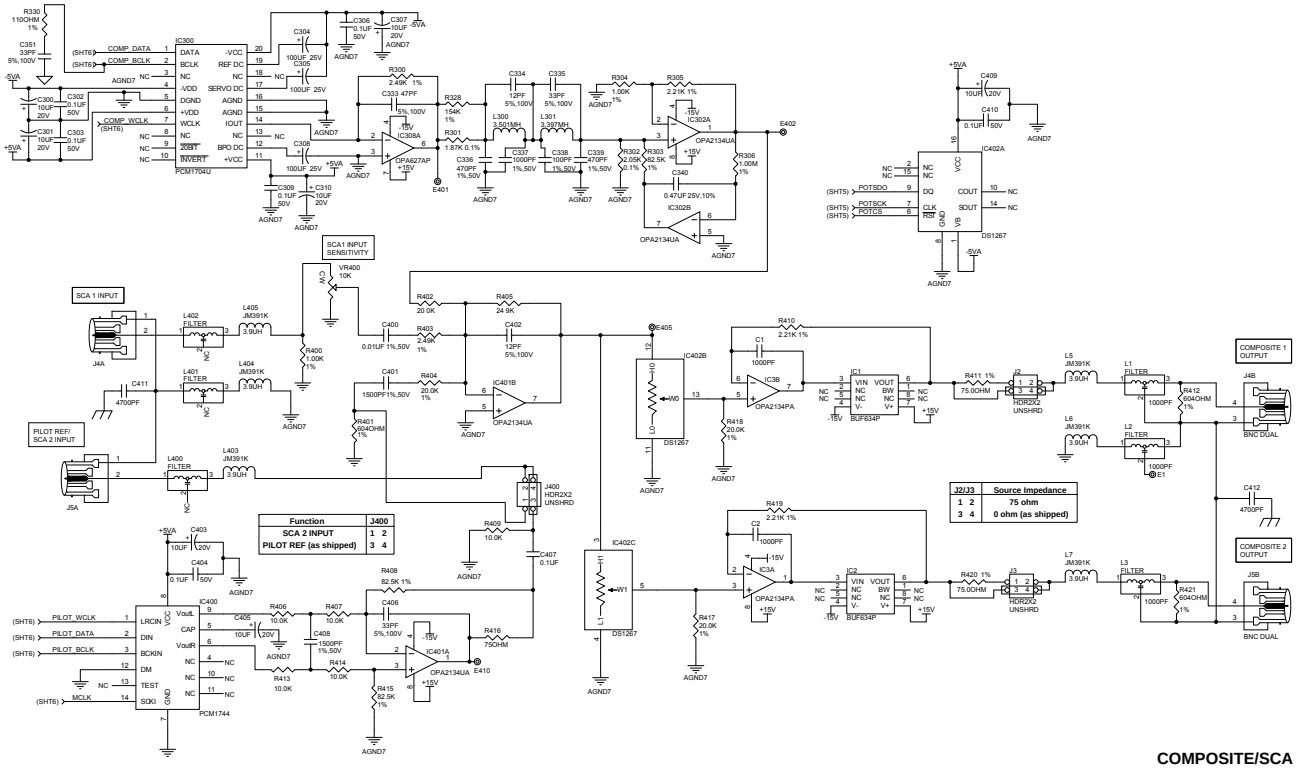



**8300 I/O BOARD PARTS LOCATOR**

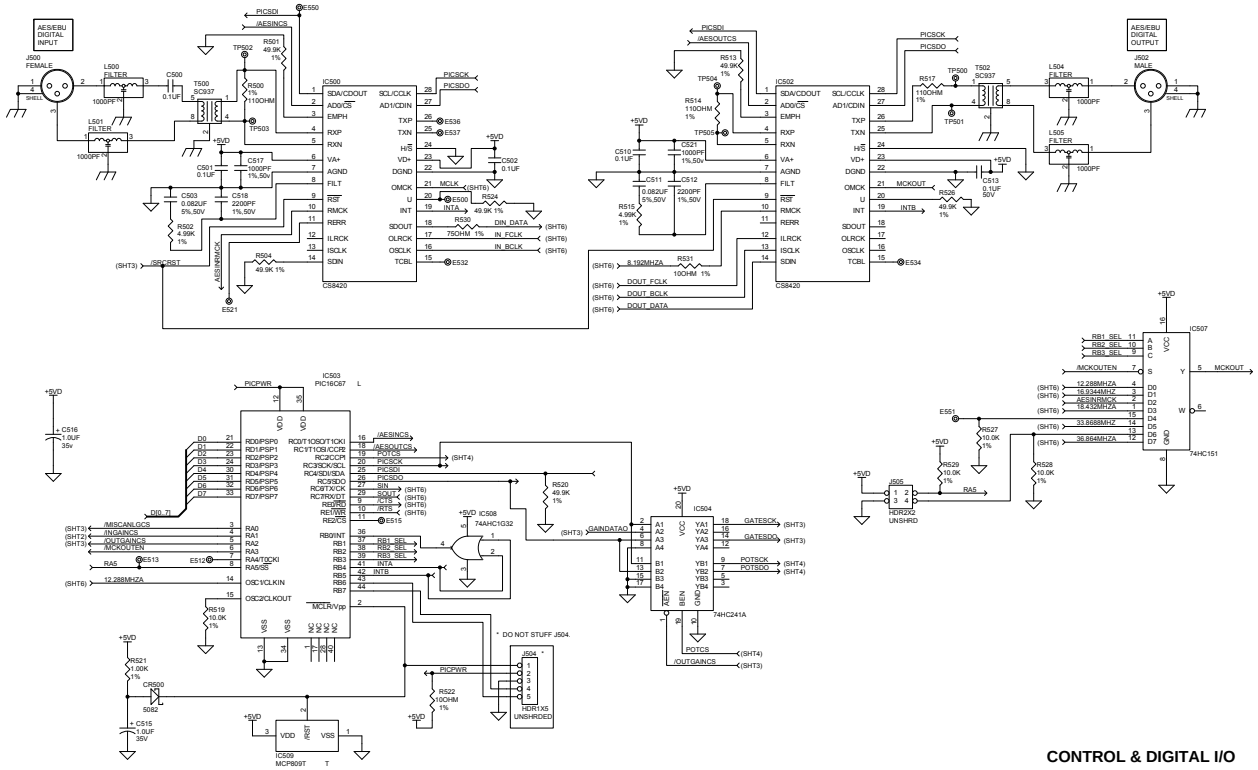



**LEFT & RIGHT ANALOG INPUTS**

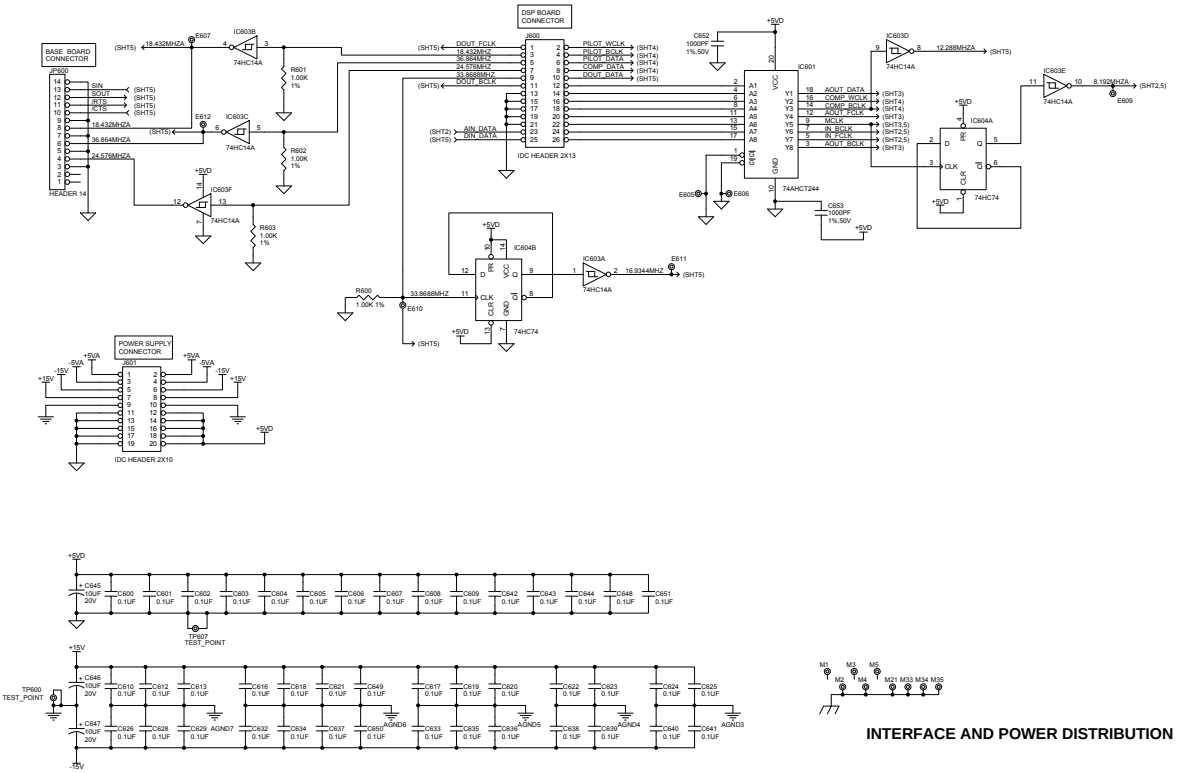

LEFT & RIGHT ANALOG OUTPUTS




**COMPOSITE/SCA**

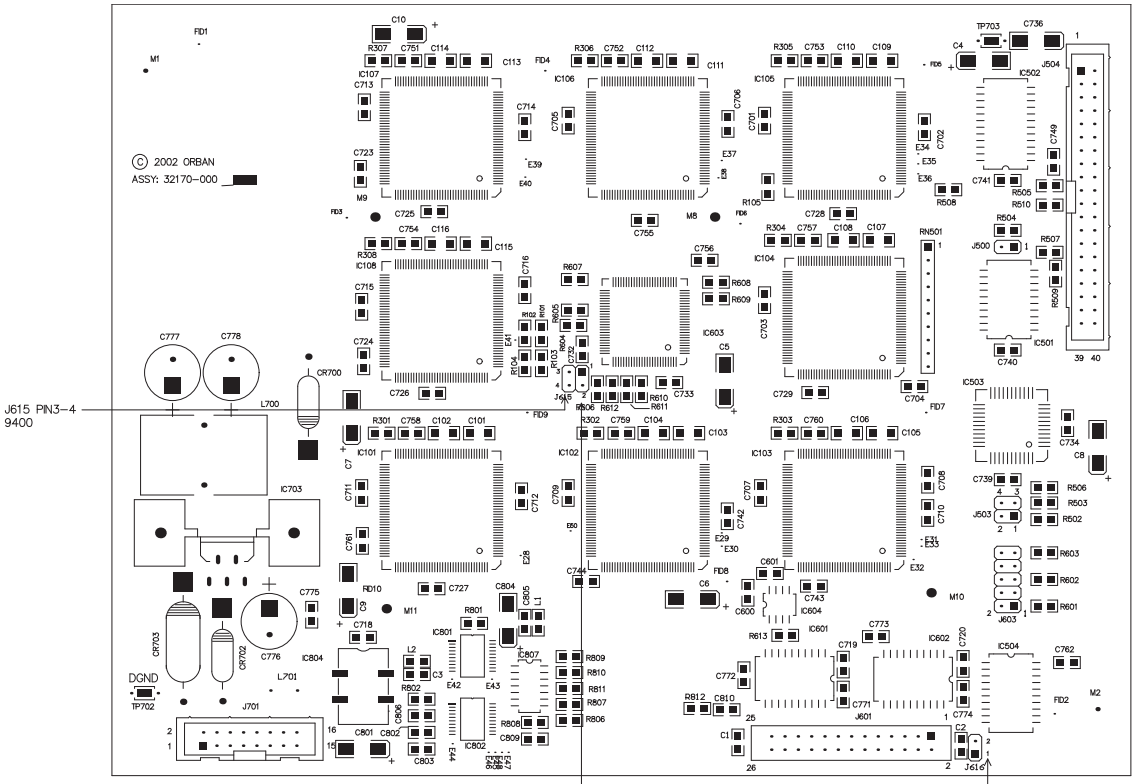



**CONTROL & DIGITAL I/O**



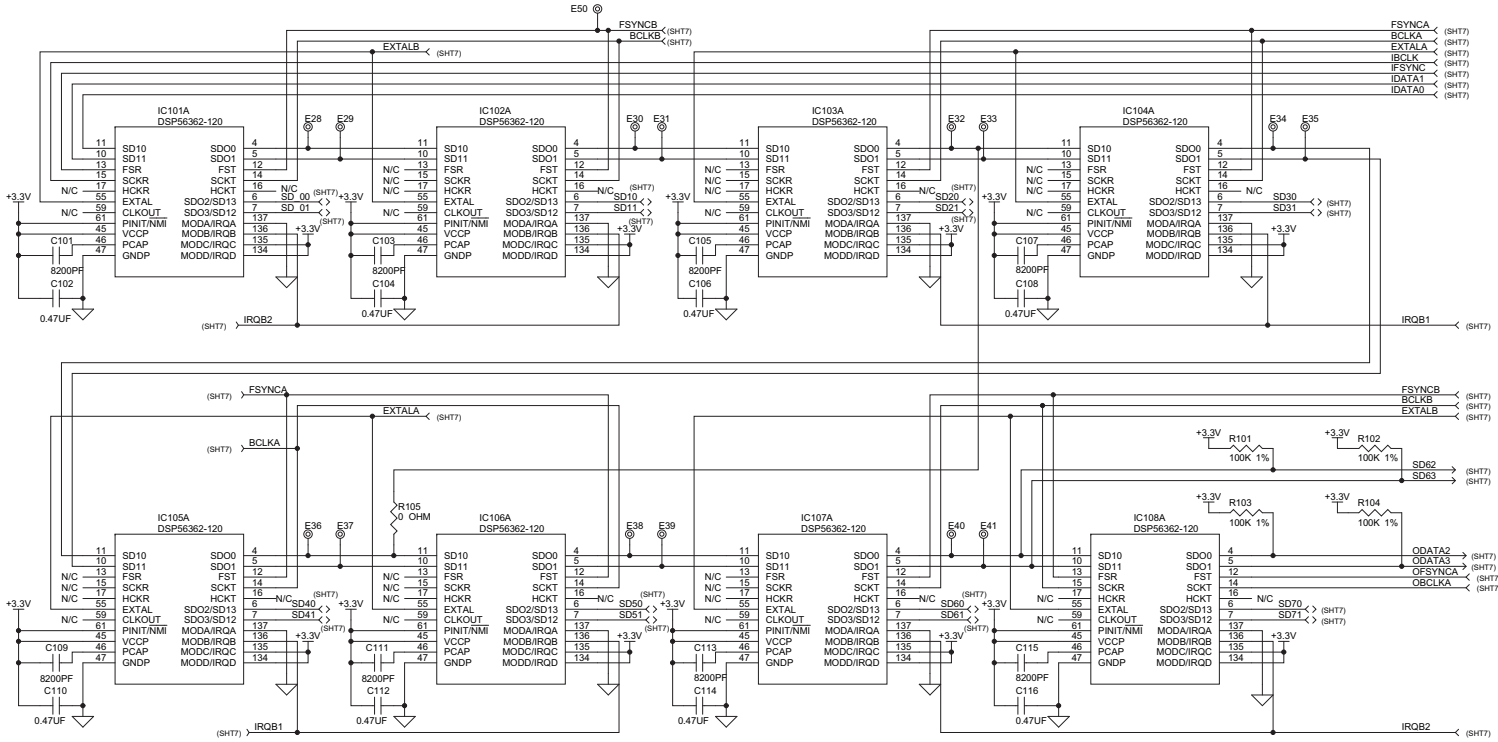



**INTERFACE AND POWER DISTRIBUTION**

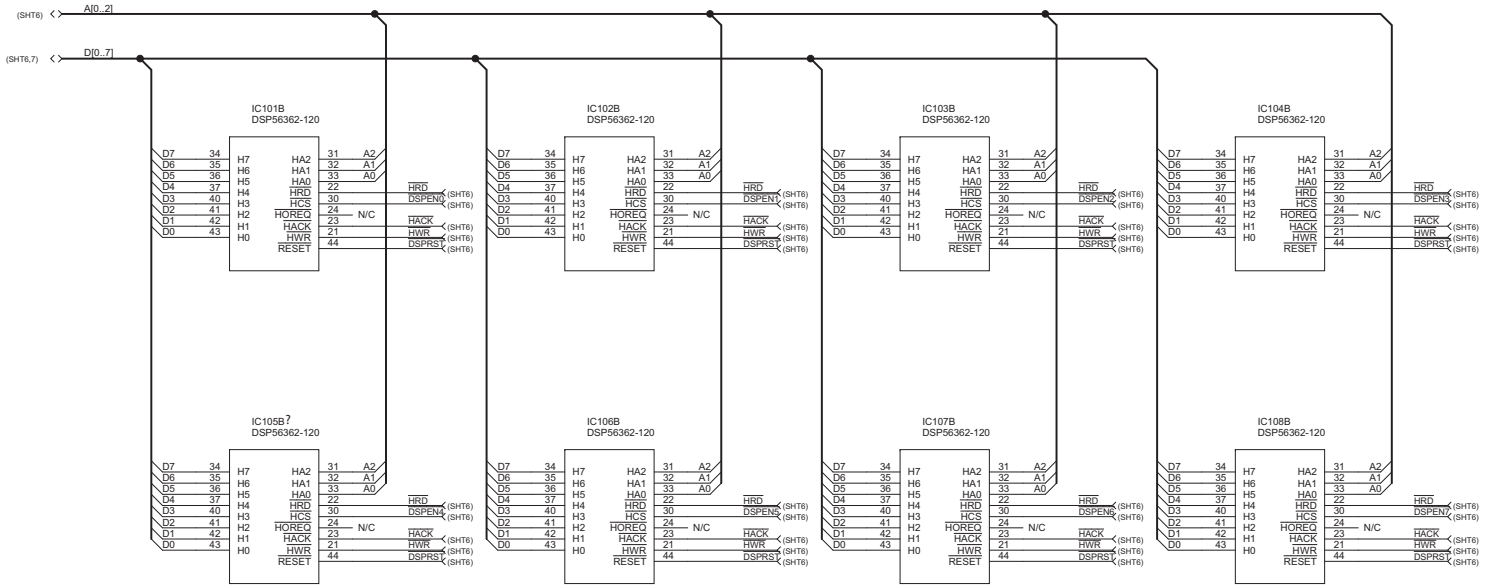



| JUMPERS INSTALL | 9400 | OTHER |
|---|---|---|
| J615 1-2 | NO | YES |
| J615 3-4 | YES | NO |
| J616 | YES | NO |

DSP BOARD PARTS LOCATOR DRAWING
32170.000.14

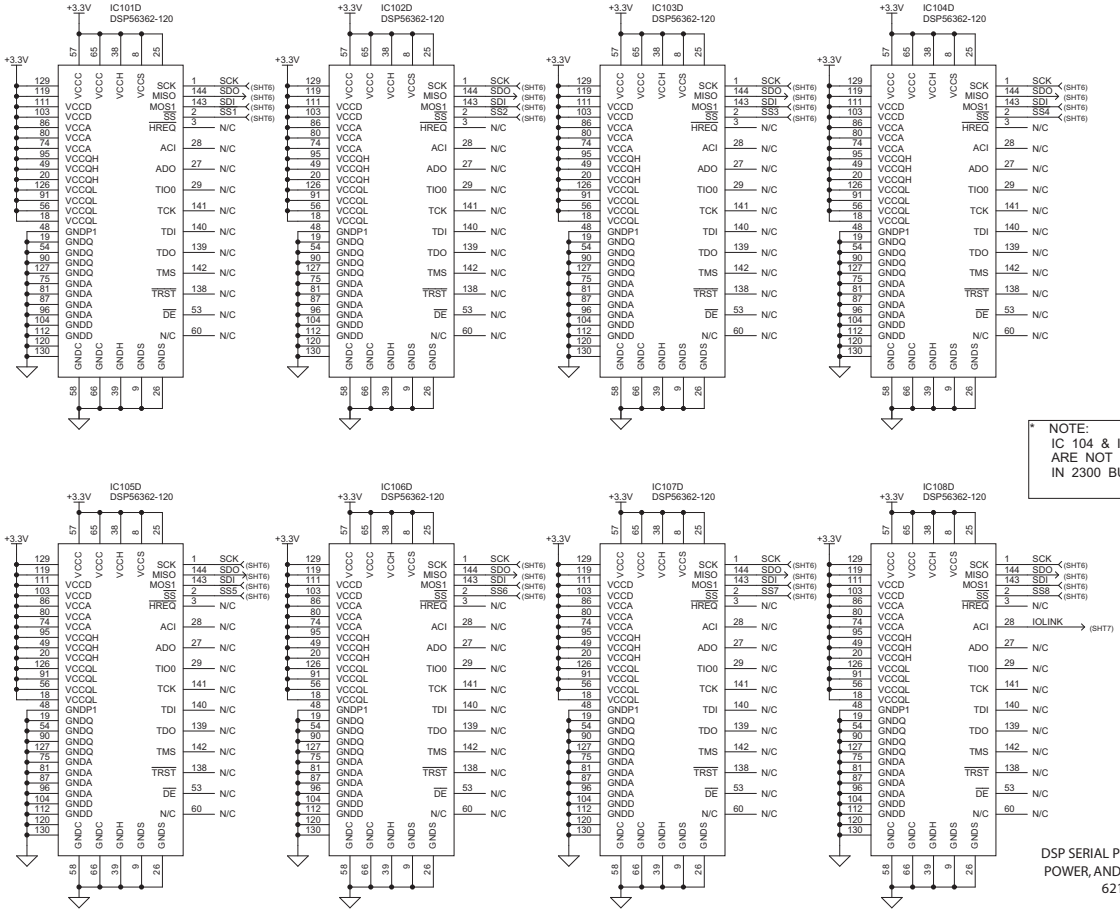



DSP ESAI SCHEMATIC
62170.000.12



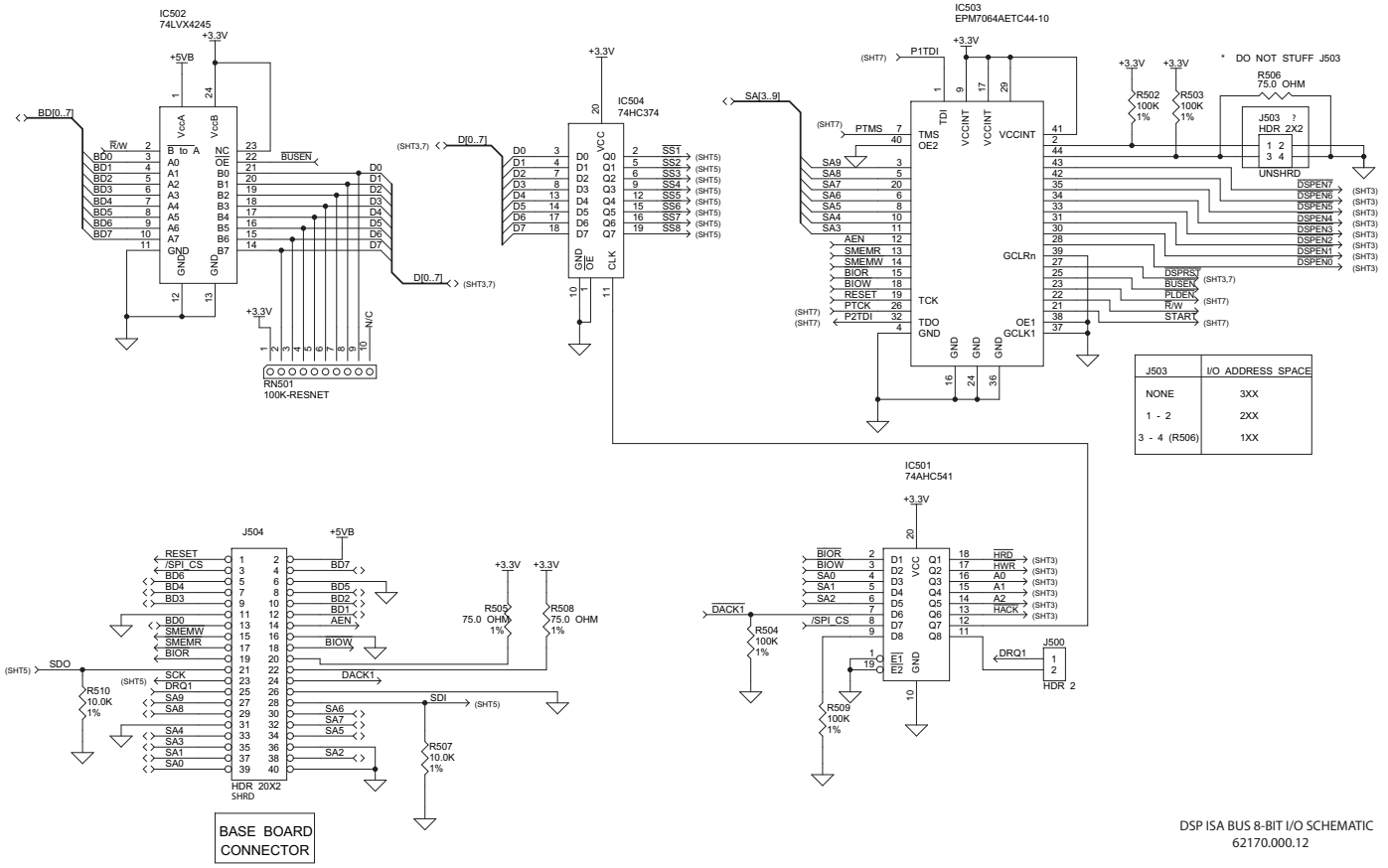

* NOTE:
IC 104 & IC 105
ARE NOT POPULATED
IN 2300 BUILD.

DSP HOST INTERFACE SCHEMATIC
62170.000.12

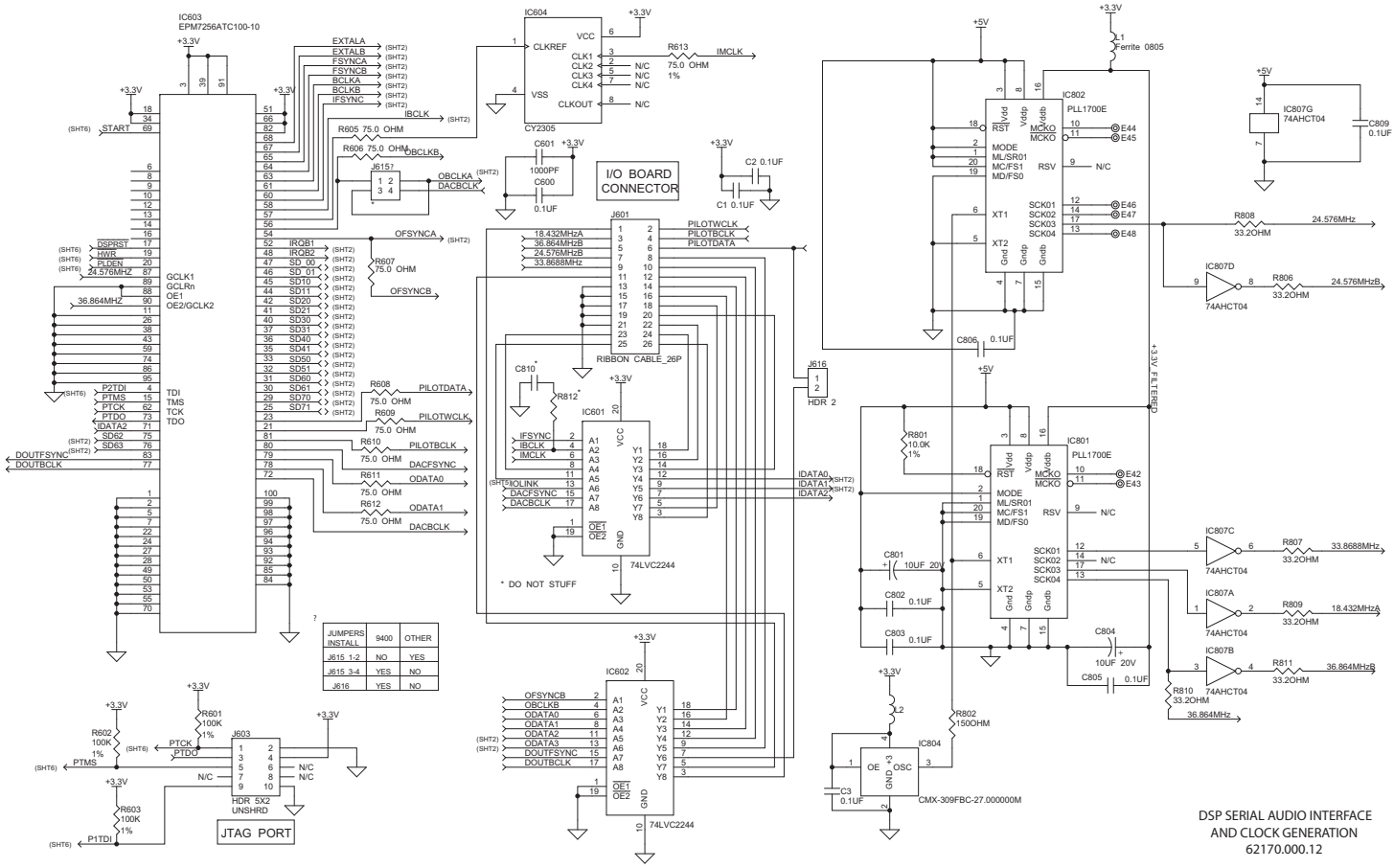



* NOTE:
IC 104 & IC 105
ARE NOT POPULATED
IN 2300 BUILD.

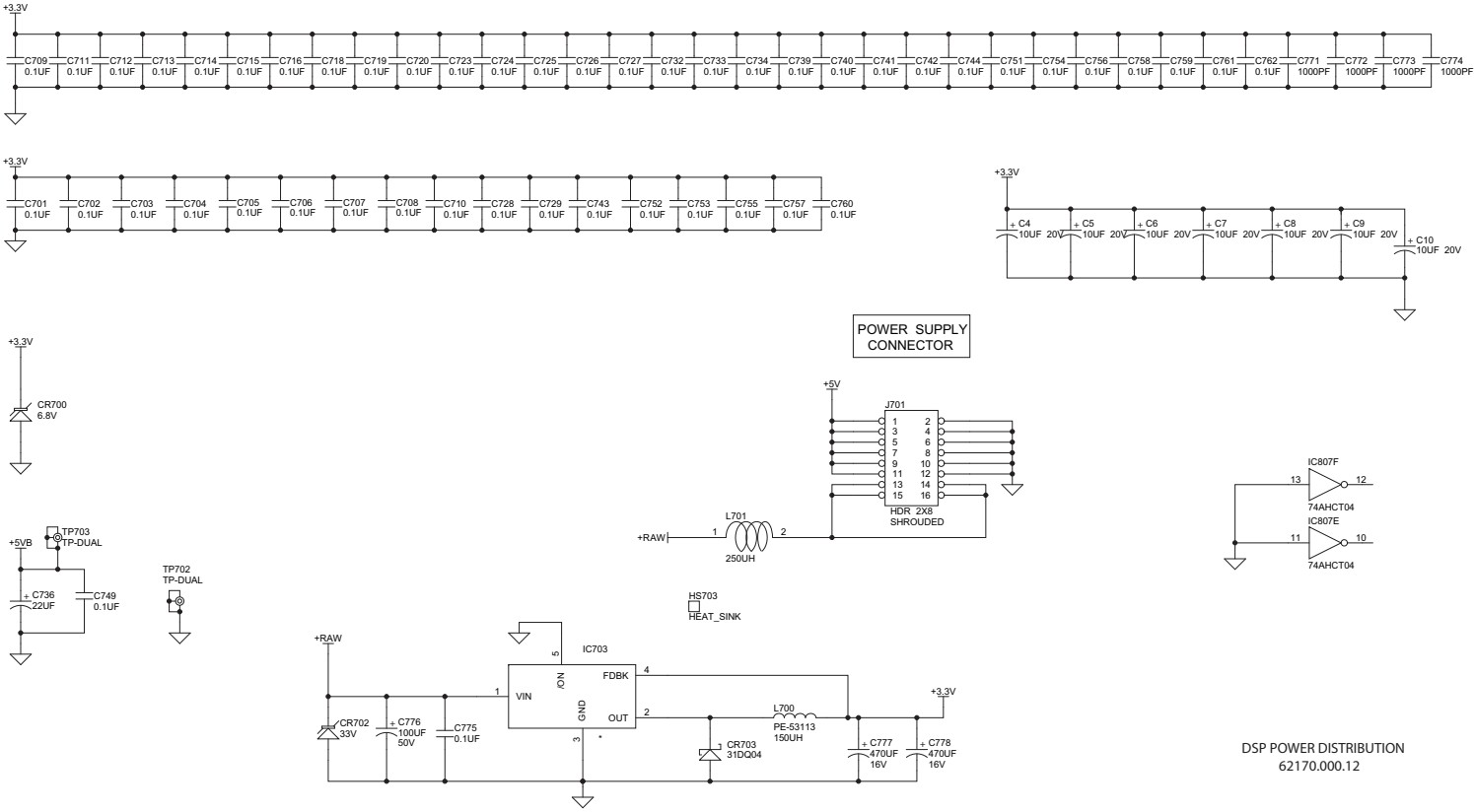
DSP SERIAL PERIPHERAL INTERFACE,
POWER, AND GROUND SCHEMATIC
62170.000.12



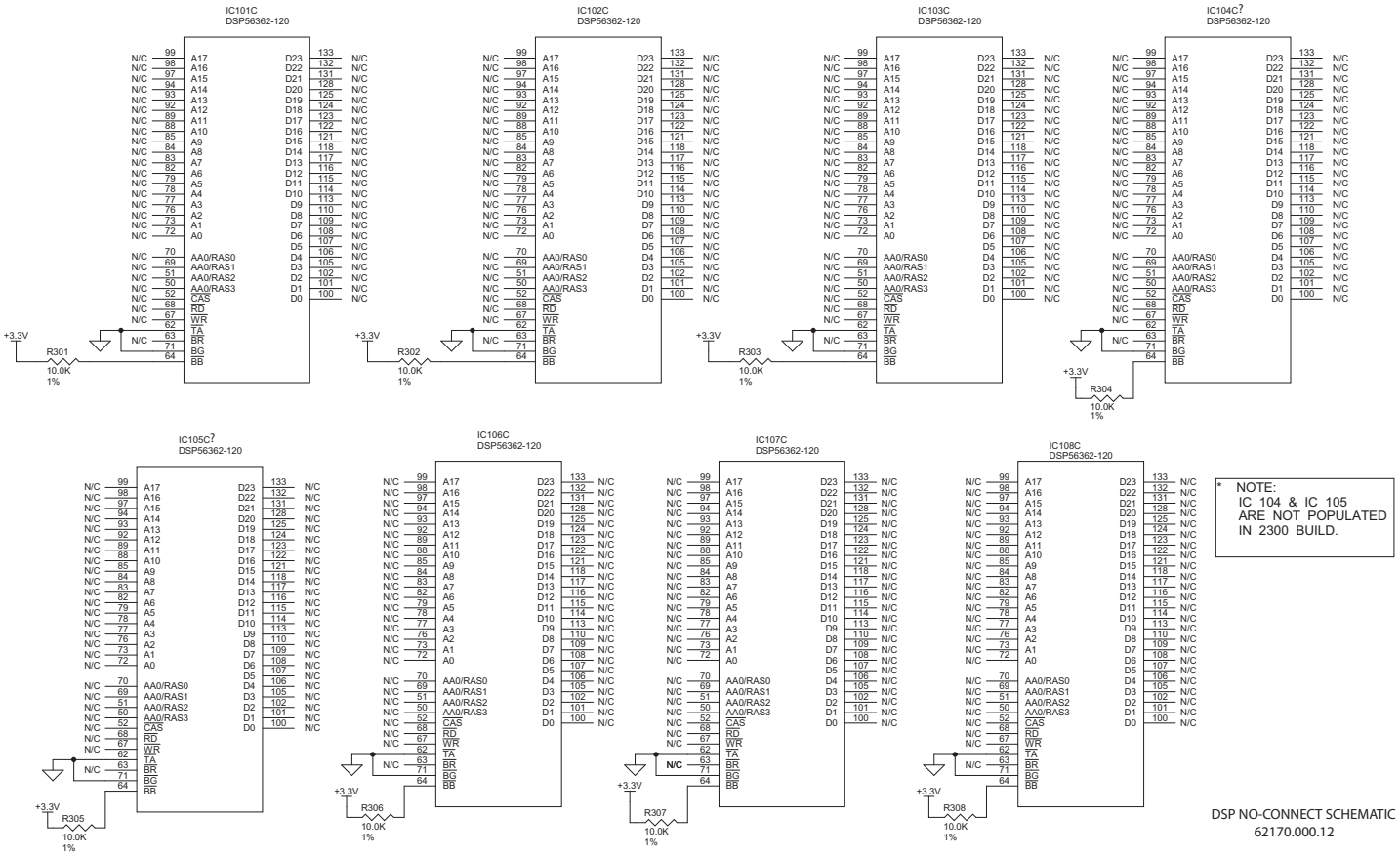

DSP ISA BUS 8-BIT I/O SCHEMATIC
62170.000.12




DSP SERIAL AUDIO INTERFACE
AND CLOCK GENERATION
62170.000.12

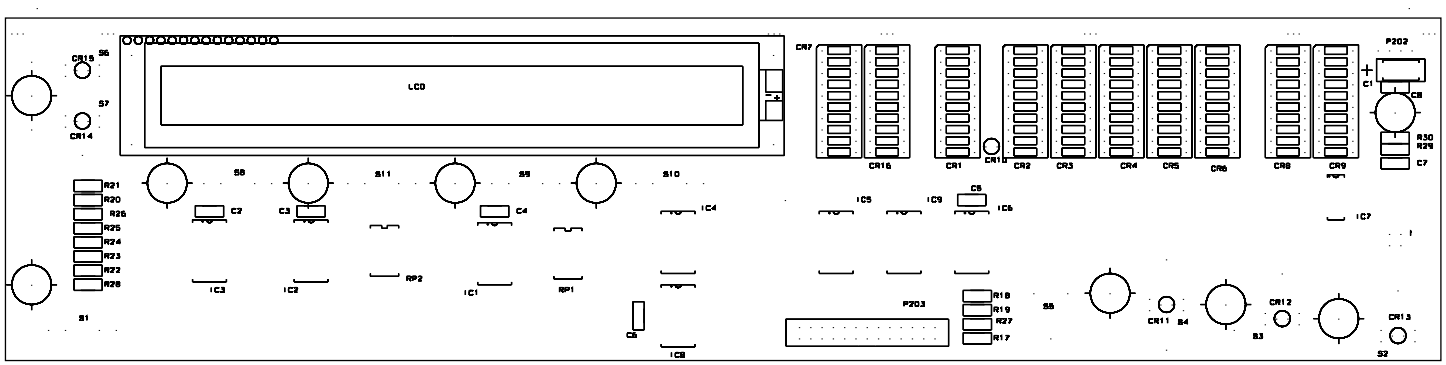



DSP POWER DISTRIBUTION
62170.000.12

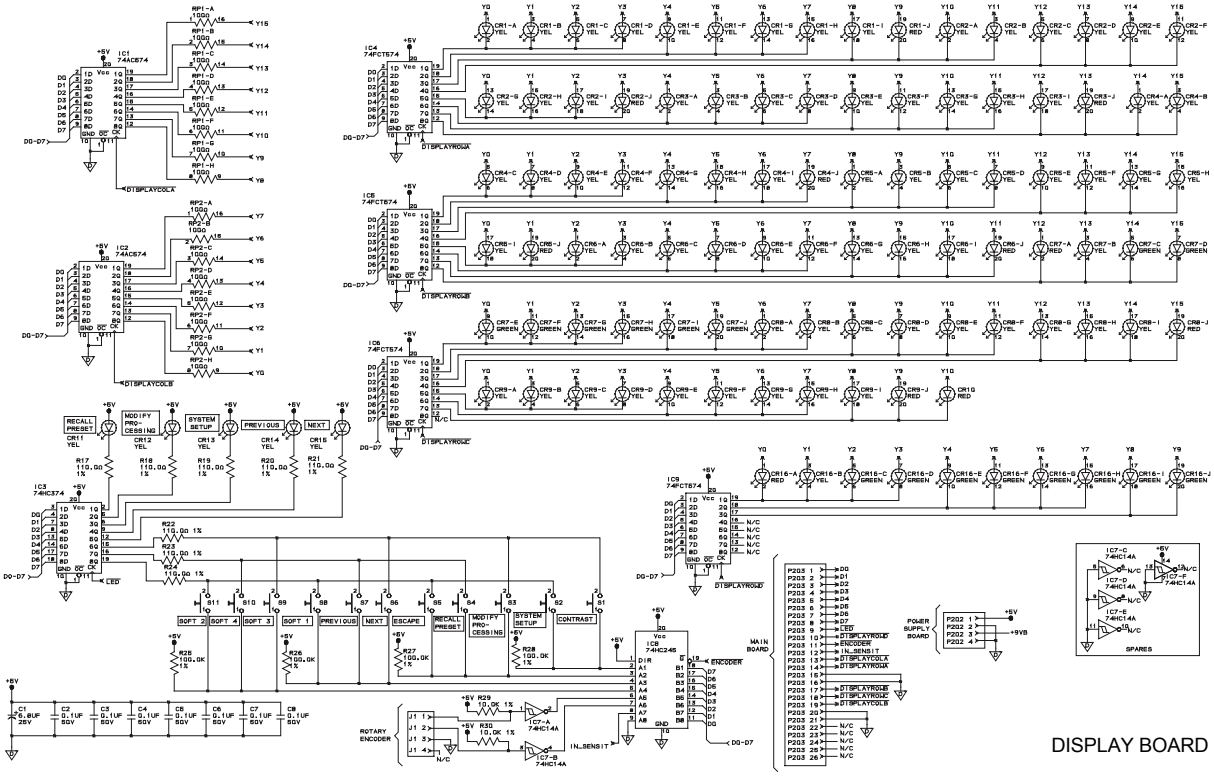


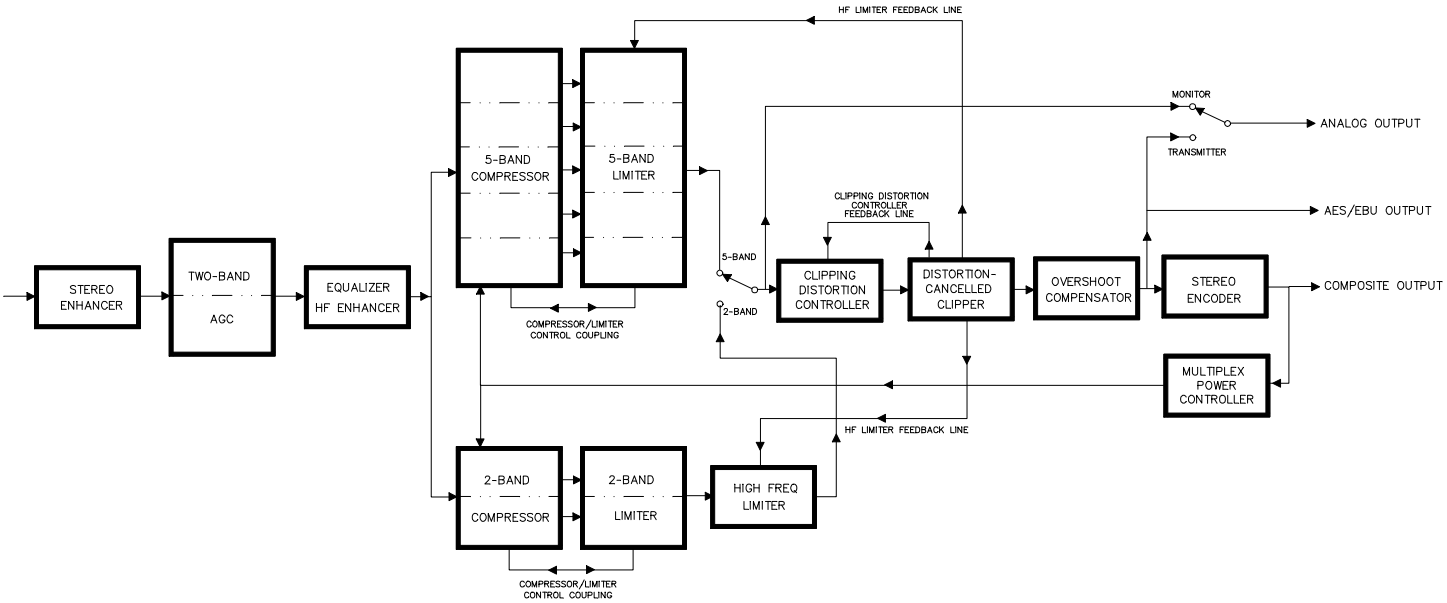

* NOTE:
IC 104 & IC 105
ARE NOT POPULATED
IN 2300 BUILD.

DSP NO-CONNECT SCHEMATIC
62170.000.12




**8300 DISPLAY BOARD PARTS LOCATOR**


DISPLAY BOARD
RECALL PRESET
MODIFY PRO-CESSING
SYSTEM SETUP
PREVIOUS
NEXT
SOFT 2
SOFT 4
SOFT 3
SOFT 1
ESCAPE
CONTRAST
ROTARY ENCODER
MAIN BOARD
POWER SUPPLY BOARD
SPARES


HF LIMITER FEEDBACK LINE
MONITOR
ANALOG OUTPUT
TRANSMITTER
AES/EBU OUTPUT
CLIPPING DISTORTION CONTROLLER FEEDBACK LINE
STEREO ENHANCER
TWO-BAND AGC
EQUALIZER HF ENHANCER
5-BAND COMPRESSOR
5-BAND LIMITER
COMPRESSOR/LIMITER CONTROL COUPLING
5-BAND
2-BAND
CLIPPING DISTORTION CONTROLLER
DISTORTION-CANCELLED CLIPPER
OVERSHOOT COMPENSATOR
STEREO ENCODER
COMPOSITE OUTPUT
MULTIPLEX POWER CONTROLLER
HF LIMITER FEEDBACK LINE
2-BAND COMPRESSOR
2-BAND LIMITER
HIGH FREQ LIMITER
COMPRESSOR/LIMITER CONTROL COUPLING