Operating Manual

OPTIMOD-FM

2300

Digital Audio Processor

Version 2.0 Software

orban

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

Model Number:	**Description:**
2300	OPTIMOD 2300, Stereo Encoder, Digital I/O, Protection/Two-Band Structure, 115V (for 90-130V operation) or 230V (for 200-250V operation), switchable to 50µs or 75µs.
2300J	As above, but for 90-117V operation.

MANUAL:

Part Number:	**Description:**
96122.202.01	2300 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.

www.orban.com

IMPORTANT SAFETY INSTRUCTIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Safety Instructions (European)

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

WARNING: THIS APPLIANCE MUST BE EARTHED.

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

GREEN and YELLOW - Earth BLUE - Neutral BROWN - Live

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

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

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

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

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

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

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

AC Power Cord Color Coding

Safety Instructions (German)

Gerät nur an der am Leistungsschild vermerkten Spannung und Stromart betreiben.
Sicherungen nur durch solche, gleicher Stromstärke und gleichen Abschaltverhaltens ersetzen. Sicherungen nie überbrücken.
Jedwede Beschädigung des Netzkabels vermeiden. Netzkabel nicht knicken oder quetschen. Beim Abziehen des Netzkabels den Stecker und nicht das Kabel 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.

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 4,208,548, 4,460,871, 6,337,999, 6,434,241, 6,618,486, and 6,937,912 protect OPTIMOD 2300.

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OPTIMOD-FM

2300

Digital Audio Processor

Version 2.0 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.

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

The OPTIMOD-FM 2300 Digital Audio Processor

Orban's all-digital OPTIMOD-FM 2300 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.

Starting with V2.0 software, the 2300 can be used as an extremely high-quality stand-alone stereo encoder operating at 64 kHz to 512 kHz sample rates and offering lowpass filtering, overshoot limiting, composite limiting, and an ITU412 multiplex power controller. When used in this mode, the 2300 must be driven (usually via an STL) by a full-featured FM audio processor (like Orban's 8500) that incorporates preemphasis-aware HF limiting and peak control.

OPTIMOD-FM 2300 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.

Absolute Control of Peak Modulation

- The 2300 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 2300 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.

- The 2300 achieves extremely tight **peak control** at all its outputs—analog Left/Right, AES3 Left/Right, and composite baseband.

- By integrating the **stereo encoder** with the audio processing, the 2300 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 2300 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 2300's audio outputs and stereo encoder.

Flexible Configuration

- The 2300 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 2300 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. This 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 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 2300 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 2300 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 2300 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 2300 has a defeatable, patented **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 2300-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) and works by adjusting the thresholds in the multiband compressor instead of adding another

wideband gain control stage. The limiter is thus entirely multiband, which minimizes spectral gain intermodulation. 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 2300 is designed and certified to **meet all applicable international safety and emissions standards**.

- The 2300 features a versatile Two-Band processing structure that can be set for loudness processing or for "purist" processing, depending on the user-configurable crossover type (either allpass or phase-linear).

- The 2300 **can increase the density and loudness** of the program material by two-band compression, limiting, and clipping. This improves the consistency of the station's sound and increasing loudness and definition without producing unpleasant side effects.

- The 2300 **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.

Controllable

- The 2300 **can be remote-controlled** by 5-12V pulses applied to eight programmable, optically isolated "general-purpose interface" (GPI) ports.

- **2300 PC Remote software** is a highly graphical application that runs under Windows 2000 and XP. It communicates with a given 2300 **via TCP/IP** over **modem, direct serial,** and **Ethernet** connections. You can configure PC Remote to switch between many 2300s via a convenient organizer that supports giving any 2300 an alias and grouping multiple 2300s into folders. Clicking a 2300's icon causes PC Remote to connect to that 2300 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 2300 features (including advanced controls not available from the 2300'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.

- A Bypass Test Mode can be invoked locally, by remote control (from either the 2300's GPI port or the 2300 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 2300's Ethernet port or serial port (connected to an external modem), or locally (by connecting a Windows® computer to the 2300's serial port through a null modem cable).

Stand-Alone Stereo Encoder Operation

- The **sample rate is 64 kHz and multiples thereof**, up to 512 kHz. The internal audio bandwidth is high enough to prevent overshoot caused by spectral truncation of the left/right input signals that are band-limited to 18 kHz or lower.

- 15, 16, and 17 kHz linear-phase **lowpass filtering** can be applied to the input signal. To minimize input/output delay, this filter can be bypassed, which is appropriate if the input signal is correctly band limited by the audio processor driving the 2300.

- A **Left/right domain overshoot limiter** is available. This uses the same technology as Orban's 8218 stand-alone stereo encoder, combining look-ahead and band-limited clipping techniques to control STL-induced overshoots while minimizing artifacts.

- A **dual-mode composite limiter** is available. It can operate in either **"Half-Cosine Interpolation"** mode or conventional **hard clipper** mode. The "Half-Cosine" mode provides better separation and preservation of stereo imaging, while the "Hard" mode provides brighter sound because it creates waveforms that are closer to square waves. Both modes provide excellent spectral protection of the pilot tone and subcarrier regions. To ensure accurate peak control, the limiter operates at 512 kHz sample rate.

- A high-accuracy **ITU412 multiplex power controller** is available, with user control over the multiplex power threshold. This allows you to compensate for overshoots in the signal path upstream from the 2300, preventing excessive reduction of the multiplex power

- The input signal can be **flat or pre-emphasized** to 50 μs or 75 μs.

- The 2300 can apply **J.17 de-emphasis** to the input signal.

- **Silence alarm** and **digital audio fault** tally outputs are available.

- Versatile **remote control** is available via RS232 serial, GPI, and Ethernet.

- All normal 2300 **inputs and outputs** are available, including **analog and digital inputs**, **two composite outputs** with independent level controls, and **two subcarrier inputs** (one of which can be repurposed to emit a **19 kHz pilot reference output** for RDS/RBDS generators).

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 using the LESS-MORE control to adjust OPTIMOD-FM for less or more processing. The factory presets are listed and described starting on page 3-14.

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.

To select "audio processor mode" or "stand-alone stereo encoder mode," recall a Factory or User Preset that uses this mode. The 2300 will automatically re-load DSP code to switch modes. This reload will cause all outputs to mute for less than one second. At the composite outputs, the stereo pilot tone will mute but any external subcarriers applied to the 2300's SCA inputs will not.

User Presets

User Presets permit you to change a Factory Preset to suit your requirements and then store those changes. You can make User Presets from any Factory Preset, including Factory Presets associated with the 2300's stand-alone stereo encoder mode.

You can store more than 100 User Presets, limited only by available memory in your 2300 (which will vary slightly depending on the version of your 2300's software). You can give your preset a name up to 18 characters long.

You cannot create User Presets from scratch. You must always start by recalling a Factory Preset. Make your 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 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 frequencies.

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 2-32) or through PC Remote.

Both analog and digital outputs are active continuously.

The 2300's output sample rate can be locked either to the 2300's internal crystal clock or to the sample rate present at its AES3 input.

The 2300 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 used mainly in older studio/transmitter links that employ NICAM technology. The 2300's provisions for J.17 make it fully compatible with systems using this standard.

When the 2300 is operated as a stand-alone stereo encoder, the analog and digital outputs emit the same signal that drives the 2300's stereo encoder DSP block. This signal may be lowpass filtered and/or protection-limited, depending on control settings in the active preset. The level, de-emphasis, and other parameters of these

outputs are set in SYSTEM SETUP and are the same regardless of whether the 2300 is operating in its audio processor or stand-alone stereo encoder modes.

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 2-30 and step 7 on page 2-33) or through 2300 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 impedance 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 1-13 and refer to Figure 2-3 on page 2-9.

Independent level control of each output is via software (see step 6 on page 2-32)

A ground lift switch is available on the rear panel. This is useful to prevent ground loops between the 2300 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 2300 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 2300'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 20 on page 2-23. See page 2-41 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 and two open-collector tally outputs on a DB-25 connector, which can be activated by 5-12V DC. The GPI inputs can control various functions of the 2300:

- 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 2300's stereo encoder can change stereo/mono mode and select the source when in mono mode.
- Switch the 2300 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 2-41) 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 2300's internal clock to the nearest hour or to midnight.

The tally outputs can be programmed to indicate the following:

- Input: Analog: Indicates that the 2300 is processing audio from its analog input.
- Input: Digital: Indicates that the 2300 is processing audio from its AES3 digital input.
- Analog Input Silent: Indicates that the level at either or both analog input channels is below the threshold set in step (A) on page 2-28.

- AES Input Silent: Indicates that the level at either or both digital input channels is below the threshold set in step in step (A) on page 2-28.
- AES Input Error: Indicates that the 2300's AES input receiver chip has detected a problem with the data being received such that the data is unusable. When the chip detects such an error, it automatically switches the input to Analog.
- No Function: Tally output is disabled.

You can reconfigure the functions of the inputs and outputs 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 2-41 for information on programming the remote control interface.

Computer Interface

On the rear panel of the 2300 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 2300 package ships with 2300 PC Remote software, an application for any IBM-compatible PC running Microsoft Windows 2000 (Service Pack 3 or higher) or XP. 2300 PC Remote permits you to adjust any 2300 preset by remote control or to do virtually anything else that you can do from the 2300's front panel controls. The program displays all of the 2300's LCD meters on the computer screen to aid remote adjustment.

RS-232 Serial Port

2300 PC Remote can communicate at up to 115 kbps via modem or direct connection between the computer and the 2300 through their RS-232 serial ports.

RJ45 Ethernet Connector

The 2300 can be connected to any 10 or 100 Mbps Ethernet network that supports the TCP/IP protocol.

See *Networking and Remote Control* on page 2-42 for more information.

Optimal Control of Peak Modulation Levels

In the 2300's audio processor mode, the audio processing circuitry 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 2300, 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 2300 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 composite waveform—a short length of coaxial cable. If this is impossible, the next best arrangement is to feed the 2300's AES3 digital output through an all-digital, uncompressed path to the transmitter's exciter, although this will preclude using the 2300's composite limiter.

Use the 2300'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 2300'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 left/right digital link is available to the transmitter, this is also an excellent means of transmission, although it will not pass the effects of the 2300'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 2300'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 requalified 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 using OPTIMOD-FM's 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 1-15). However, many analog composite baseband STLs do not control peaks perfectly because of bounce (see page 1-17), 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. The ideal link is an uncompressed digital composite STL because these have virtually flawless waveform fidelity and allow full use of the 2300's composite limiter.

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 2300's internal stereo encoder to feed the output of the encoder directly. You will achieve a louder sound on the air, with better control of peak modulation, than if you use most external stereo encoders. Exceptions are Orban's 8218 stereo encoder and the 2300 in stereo encoder mode. These encoders do not add overshoot, and, in fact, contains their own overshoot limiters. However, because it accepts audio in left/right form, the 8218 will not let you exploit the 2300's composite limiter. The 2300 (in stereo encoder mode) includes a composite limiter and does not have this limitation.

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 2300's left and right analog outputs. If possible, bypass the pre-emphasis network and the input low-pass filters in the encoder so that they cannot introduce spurious peaks. Because of their special design, OPTIMOD-FM's pre-emphasis network and low-pass filters perform the same functions while retaining tight peak control.

Connect the composite output of the 2300 to the baseband input of the exciter through less than 100 feet (30 meters) of coaxial cable. 100 feet of coaxial cable (assuming 30-pF / foot capacitance) will reduce measured separation at 15 kHz (worst case) to approximately 60dB. This separation is comfortably above the separation (approximately 20dB) that starts to cause perceptible changes in the stereo image.[1] See Figure 2-3 on page 2-9.

[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.]

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 2300's input, (2) they can pass the 2300's peak-controlled analog or digital left and right audio outputs, or (3) they can pass the 2300'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 2300 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 2300'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 2300 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 2300'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 2300's output is tightly band-limited to 15 kHz, it can be passed without significant 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 2300'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 2300'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 2300's stereo encoder to drive the composite STL transmitter.

Uncompressed digital composite baseband microwave STLs, if properly designed, have excellent performance and we recommend them highly. However, the fact that they are digital does not eliminate the requirement that they have low frequency response that is less than 3 dB down at 0.15 Hz. Any such STL should be qualified to ensure that it meets this specification.

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

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 2300 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 2300 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 8500.

If the 2300 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 2300.

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 2300 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 2300'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 2dB, 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 2300

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 2300 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 2300 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 a 2300, 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 2300's remote control feature offers the means to reduce the peak level of the 2300's audio output as necessary. This way, you can still use the 2300's line-up tone to adjust the steady-state deviation to ±75 kHz. Yet, the reduced peak level of the

audio emitted from the 2300 ensures that the carrier deviates no further than ±75 kHz after overshoot. (See step 20 on page 2-23.)

Using Lossy Data Reduction in the Studio

Many stations are now using lossy data reduction algorithms like MPEG-1 Layer 2 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, which is 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. Therefore, 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.

Transmission Levels

The transmission engineer is primarily concerned with the peak level of a program

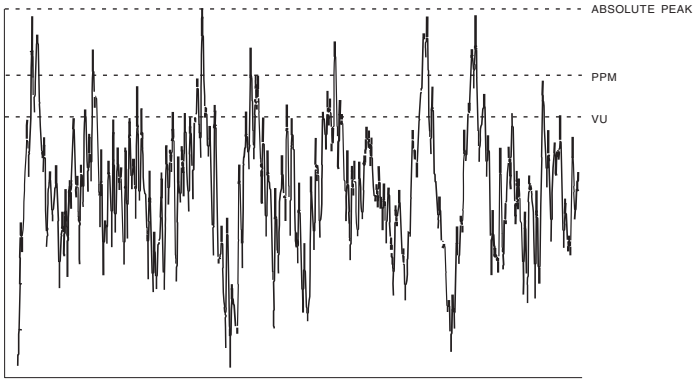


Fig. 1-1: Absolute Peak Level, VU and PPM Reading

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 2300 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 2300 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 2300's input meter.

Composite Output Level

The Orban 2300 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 or is being operated in stand-alone stereo encoder mode without overshoot limiting). 100% ordinarily corresponds to ±75 kHz-carrier deviation.

Note that if the 2300'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 2300 to the transmission system that it is driving, the 2300 contains an adjustable test tone oscillator that produces sine waves at 2300'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 2300's Left/Right analog output is switched to FLAT, a de-emphasis filter is inserted between output of the 2300's audio processing and its line output. Thus, as the frequency of the Test Tone is changed, the level at the 2300'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 2300's internal de-emphasis, so the 2300'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 2300'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 2300 is about 5 ms. A 5 ms delay is comfortable for most talent because they do not hear echoes of their own voices in their headphones. Because of the relatively low delay, customers can confidently replace an older, low-delay processor with the 2300 with no studio wiring changes. Moreover, off-air cueing of remote talent is routine.

If talent is particularly finicky, they may complain about comb-filtering-induced coloration even with the 2300's 5 ms delay. If this is the case, the best solution is to drive studio headphones from the output of an analog processor. Many stations have an older analog processor (like an Orban 8100) installed as a standby processor; this processor can be used to drive headphones.

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 2300.**

   Note that 2300 processing may not allow the full modulation level as required by EAS standards. It may therefore be necessary to temporarily defeat the 2300's processing during the broadcast of EAS tones and data. Placing the 2300 in its BYPASS Test Mode can defeat the processing. The BYPASS GAIN control allows a fixed gain trim through the 2300. See "Test Modes," on page 3-34 for more information.

2. **Place the 2300 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 2300 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 2300, 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 2-41.

   C) Place the 2300 in bypass mode by remote control.

a) Switch the 2300 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 2300 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 2300 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 2-38) 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: 2300

SERIAL NUMBER_____

Section 2 Installation

Installing the 2300

Allow about 2 hours for installation.

Installation consists of: (1) unpacking and inspecting the 2300, (2) checking the line voltage setting, fuse, and power cord, (3) setting the Ground Lift switch, (4) mounting the 2300 in a rack, (5) connecting inputs, outputs and power, (6) optional connecting of remote control leads, (7) optional connection of tally output leads, and (8) optional connecting of computer interface control leads.

When you have finished installing the 2300, proceed to "Quick Setup," on page 2-16.

DO NOT connect power to the unit yet!

1. Unpack and inspect.

If you note obvious physical damage, contact the carrier immediately to make a damage claim. Packed with the 2300 are:

- 1ea. Operating Manual
- 2ea. Line Cords (domestic, European)
- 2ea. Fuses (½-A-250V Slow-Blow for 115V; 500mA-250V for 230V)
- 2ea. Fuse holders (gray for 115V fuses and black for 230V fuses)
- 4ea. Rack-mounting screws, 10-32 x ½—with washers, #10
- 1ea. PC Remote Software CD

Save all packing materials! If you should ever have to ship the 2300 (e.g., for servicing), it is best to ship it in the original carton with its packing materials because both the carton and packing material have been carefully designed to protect the unit.

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

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

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

2. Check the line voltage, fuse and power cord.

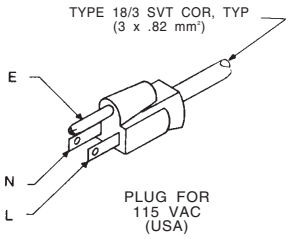
DO NOT connect power to the unit yet!

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

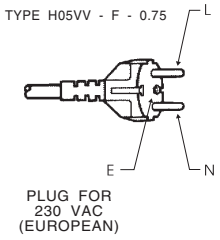
The 2300 is shipped from the factory with the VOLTAGE SELECT switch set to the 230V position. Check and set the VOLTAGE SELECT switch to your local voltage requirements. To change the operating voltage, set the VOLTAGE SELECT to 115V (for 90-130V) or 230V (for 200-250V) as appropriate.

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

The 2300 is shipped from the factory with the fuse and fuse holder both 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 500mA-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 2300's Model Number. The green / yellow wire is connected directly to the 2300 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 2300's circuit ground to its chassis ground). If you are using the 2300'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 2300 in a rack.

The 2300 requires one standard rack unit (1 O inches / 4.8 cm).

There should be a good ground connection between the rack and the 2300 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.

6. Connect remote control interface. (optional)

For a full listing of 2300's extensive remote control provisions, refer to *Remote Control Interface Programming* on page 2-41.

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 2 kΩ

±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	

REMOTE INTERFACE

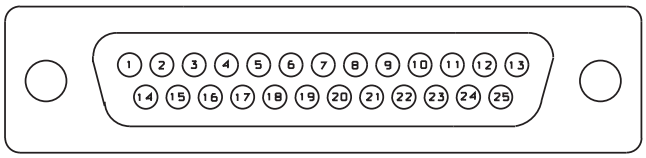


Figure 2-2: Wiring the 25-pin Remote Interface Connector

7. Connect tally outputs (optional)

See the schematic on page 6-35.

In stereo encoder mode, the 2300 supports two hardware tally outputs, which are NPN open-collector and operate with respect to pin 1 (common). Therefore, the voltage applied to the load (such as a relay or opto-isolator) must be positive. You can use the 12 VDC source on pin 25 to drive the high side of the load, taking into account the fact that the voltage on pin 25 is current limited by a 310 Ω resistor.

The tally outputs are protected against reverse polarity.

To avoid damaging the 2300, limit the current into a tally output to 30 mA. DO NOT connect a tally output directly to a low-impedance voltage source! The tally outputs are not protected against this abuse and the output transistors are likely to burn out.

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

See step 11 on page 2-28 for instructions on using the tally outputs.

8. Connect to a computer

You can connect to a computer via the 2300's serial connector or via an Ethernet network. (See *Networking* on page 2-42.)

> You must have the 2300 PC Remote application installed on your computer before you upgrade your 2300's firmware because 2300 PC Remote manages the upgrade.

See *Installing 2300 PC Remote Control Software* on page 2-48 for more detail.

2300 Rear Panel

The **Ground Lift Switch** can be set to connect the 2300'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 500mA-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 2300's Model Number.

An **RS-232 (PC Remote) Computer Interface,** labeled SERIAL PORT can be connected to 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 2300 to your existing transmitter remote control or other simple contact-closure control devices. The 2300 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 2-41.) The 2300 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 2300.

  (0 dBu = 0.775Vrms. For this application, the dBm @600Ω scale on voltmeters 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. It 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 2300 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 2300 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 2300'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.

> 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. 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.)

Very long cable runs are best handled by using the AES3id standard. 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 2300 input meters display 0 dB. The reference level is adjustable using the DI REF control.

The 2300 is a "multirate" system whose 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 2300'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 2300'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 2300 and the transmitter.

Connect the 2300'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 2300 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 better amplitude and phase response (and thus, higher 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 2300 composite output and the exciter's input, and presents the 2300 with a balanced, floating load.

Even when its composite limiter is being used heavily, the 2300 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).

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 2300's composite output in the analog domain, after D/A conversion of the 2300 stereo encoder's output but before the digitally controlled attenuators that set the composite output levels.

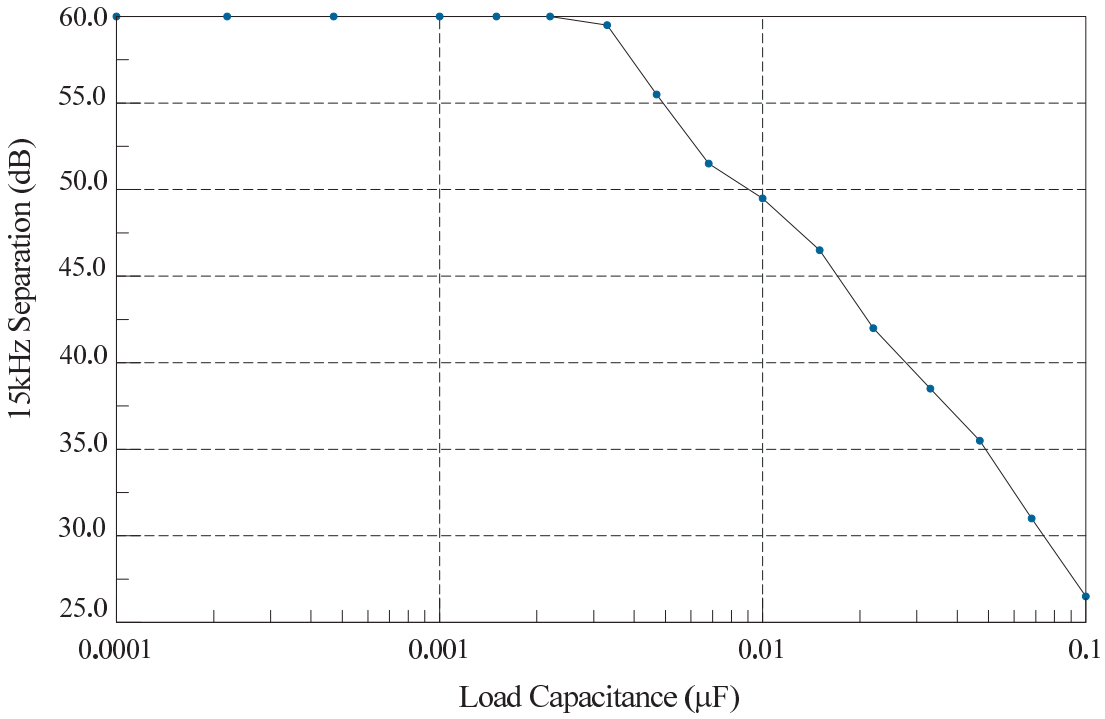


Figure 2-3: Separation vs. load capacitance

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 2300'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 2300'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.

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 2300 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 2300 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 2300's GROUND LIFT switch to its GROUND connect position, *except* when the 2300'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 2300'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 2-9.

- In high RF fields, the system is usually grounded through the equipment rack in which the 2300 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.

2300 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 2300 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 2300.

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 17 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 2300 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 2300'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 2300's analog to digital converter, which is a very common cause of audible distortion.

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

- **Multiplex Power** meter indicates the action of the ITU-R BS412 Multiplex Power controller. It shows how much the Multiplex 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. (See step 19 on page 2-22.)

- **Gain Reduction** meters show the gain reduction in the Master and Bass bands of the two-band compressor when the 2300 is in audio processor mode. Full-scale is 25 dB gain reduction.

  When the 2300 is in stand-alone stereo encoder mode, these meters show the gain reduction in the left/right overshoot limiter meters. Full scale is 5 dB gain reduction. If the overshoot limiter is turned off, these meters will not illuminate.

- **Left/Right Output** meters operate only when the 2300 is in stand-alone stereo encoder mode. These meters use the same LED arrays as the HF ENHANCE and HF LIMITER meters.

The following meters and indicators do not operate when the 2300 is in stand-alone stereo encoder mode:

- **Gate** LED indicates gate activity, lighting when the input audio falls below the threshold set by the multiband gate threshold control (with the Full Modify screen's 2B GATE control). When this happens, the multiband compressor's recovery time slows drastically to prevent noise rush-up during low-level passages.

- **AGC** meters show the gain reduction in the Master and Bass bands of the slow two-band AGC processing that precedes the two-band compressor. Full-scale is 25 dB gain reduction.

- **HF Enhance** meter indicates the amount of HF boost provided by the dynamic, program-adaptive high frequency enhancer located in the Equalization section. Calibration is in relative units because the amount of enhancement (in dB) depends on frequency.

  When the 2300 is in stand-alone stereo encoder mode, this LED array is repurposed to indicate the peak left channel drive level to the stereo encoder modulator, which follows all lowpass filtering and overshoot limiting. It uses the same scale as the COMPOSITE meter.

- **HF Limiter** meter indicates the amount of HF limiting. Because the left and right HF limiters are independent, we have programmed this meter so that it reads the higher of the left and right gain reductions.

  When the 2300 is in stand-alone stereo encoder mode, this LED array is repurposed to indicate the right channel level.

Studio Level Controller Installation (optional)

[This section does not apply to a 2300 being used as a stand-alone stereo encoder. In this mode, the 2300 must be driven by a full–featured FM audio processor (like Orban's 8500), usually via an STL].

[Skip this section if you are not using a studio level controller ahead of the 2300. Continue with "Quick Setup" on page 2-16.]

- If you are using an Orban 8100AST (or 8100A/ST) external AGC, refer to page 1-10.

- 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 2300.

- Discontinued Orban products usable as external AGCs include the 8200ST, 464A "Co-Operator," 8100AST, and 1100 OPTIMOD-PC. In this manual, we do not pro-

vide 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 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.

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

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

   Refer to Figure 2-4 on page 2-15.

   B) Place jumper JA in the CLIPPER ON position.

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

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

   E) 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.

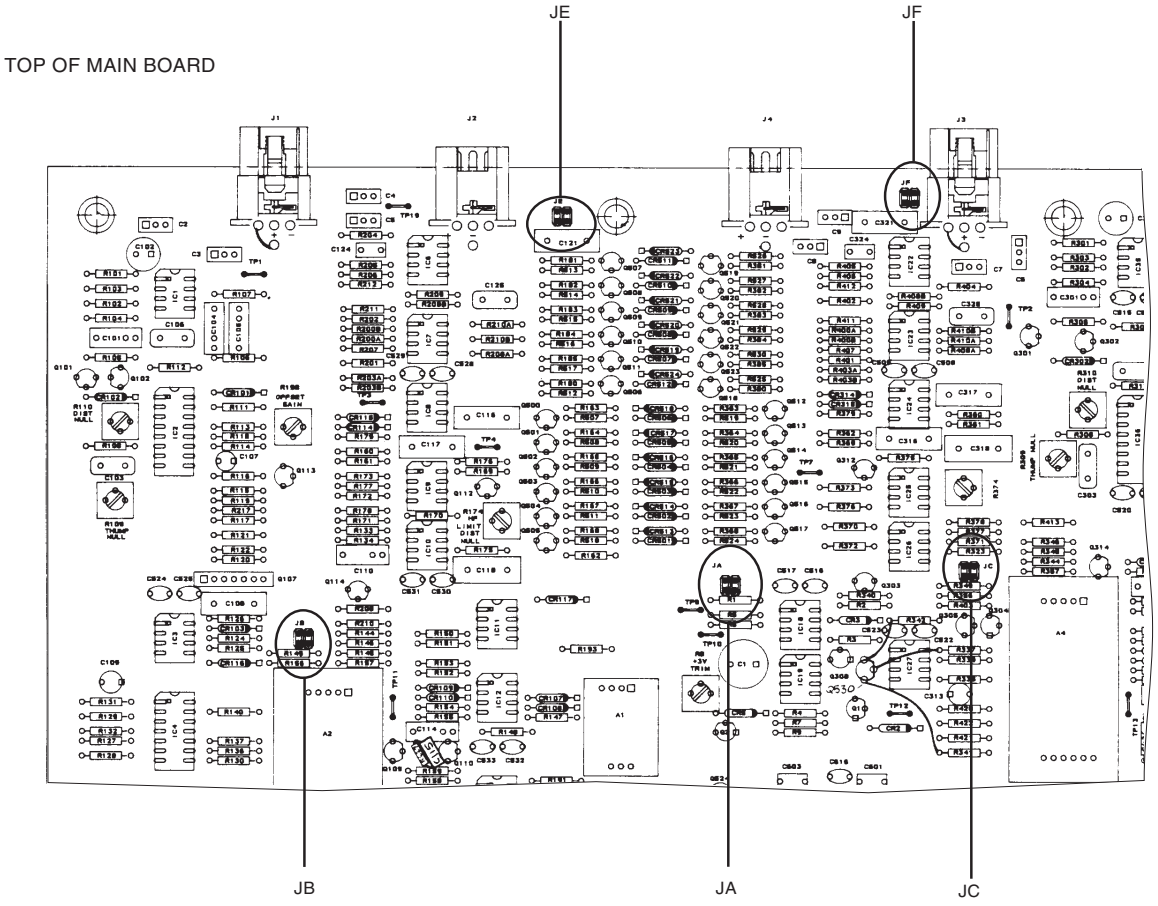
3. **Set 8200ST Output Level with tone.**

   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 2-15.)

   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.



Clipper Jumpers

*CLIPPER ON

CLIPPER OFF

Output Pre-Emphasis Jumpers

*FLAT

LEFT OUTPUT

RIGHT OUTPUT

PRE-EMPHASIZED

LEFT OUTPUT

RIGHT OUTPUT

Line-up Level Jumpers

*PEAK

LEFT OUTPUT

RIGHT OUTPUT

AVG

LEFT OUTPUT

RIGHT OUTPUT

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

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 filter 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, 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 (Audio Processor Mode)

Quick Setup guides you through 2300 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.

Regardless of whether you will be using the 2300 in audio processor or stereo encoder mode, you should complete this procedure. See *Setup for Stand-Alone Stereo*

Encoder Mode on page 2-24 for additional steps that apply to the stereo encoder mode.

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.

> Version 1.0 only supports Daylight Saving Time settings for the Northern Hemisphere. A more complete implementation will appear in a future software update.

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 2300's processing structures 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 2300 should be defeated. This is so that the two AGCs do not "fight" each other, and so they do not simultaneously increase gain, resulting in increased noise.

A) Press the NEXT button.

B) Set external AGC mode by turning the knob.

a) Set the field to YES if you have a external AGC (such as an Orban 6300, 1100, 1101, Orban 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 2300's AGC for all presets.

b) Set the field to NO If you do not have a external AGC installed; this setting enables the 2300 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 2300 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 2300.

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.

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

9. Set operating levels.

[If you are setting up the 2300 for use as a stand-alone stereo encoder, skip this step by pressing the NEXT *button twice.]*

You will set the operating levels of the 2300 to match the input levels it is receiving so the 2300'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 2300, 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 2300.

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.

The procedure does not apply to the 2300's stand-alone stereo encoder mode. In this mode, the level indicated on the screen during this step is the r.m.s. level (in dBu) of a 50 Hz input tone that produces 100% peak modulation at the 2300's composite output when the 2300's COMPOSITE LIMITER DRIVE control is set to 0 or OFF.

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.

The procedure does not apply to the 2300's stand-alone stereo encoder mode. In this mode, the level indicated on the screen during this step is the r.m.s. level (in dBfs) of a 50 Hz input tone that produces 100% peak modulation at the 2300's composite output when the 2300's COMPOSITE LIMITER DRIVE control is set to 0 or OFF.

10. 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 left/right outputs.]*

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 2300 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.

11. Set digital output to be flat or pre-emphasized.

(See the notes in step 10 above.)

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.

12. 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 2300'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 2300'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.

13. 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.

  You must use tone if you are setting up the 2300 as a stand-alone stereo encoder.

- To use program material, press the NO button.

14. 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 2300'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 2300's peak limiting system, thereby defining the maximum peak level that the 2300 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 obey the multiplex power limits specified by ITU-R BS412-9, you may seldom see peaks hitting ±75 kHz deviation. In this case, we advise you to set the output level using the 2300's reference 400Hz tone.

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

15. 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 monitor or analyzer connected to your transmitter.

16. Set the analog output level.

A) Press the NEXT button.

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

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

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

C) Press the NEXT button.

If you activated the modulation setup tone in step (13.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 BS412-9, you will also need to set up the 2300's Multiplex Power Controller by following the instructions in step 19 on page 2-22.

17. Choose a processing preset.

[If you are setting up the 2300 for use as a stand-alone stereo encoder, skip this step.]

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 2300 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 2300'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.

18. Complete Station ID (optional).

The Station ID is an optional setting that you can provide to associate the 2300 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 2300 to Orban's PC Remote application, and appears on the Main Screen when the 2300 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.

19. Activate the 2300's ITU-R BS412 multiplex power controller (optional).

[Skip this step if ITU-R BS412 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 BS412, set the ITU412-9 control to OFF.]

[If you are planning to use the 2300 in its stand-alone stereo encoder mode, make sure that the multiplex power controller is turned off until you have finished setting up the other stereo encoder parameters. Otherwise, it will interfere with setting output levels.]

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 2300 (including the transmitter), instead 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 2300's ITU-R BS412-9 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 2300'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 3-29.

20. 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 2300 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 2300 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 2300'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 2-35.

Setup for Stand-Alone Stereo Encoder Mode

[Skip this section if you are not going to use your 2300 in stand-alone stereo encoder mode.]

In the 2300's stand-alone stereo encoder mode, several controls that you might expect to find in I/O SETUP, such as input preemphasis status, are instead included in the Factory/User Presets. This allows you to save several setups as User presets and to recall them by remote control (GPI or PC Remote) or by the 2300's internal clock-based automation.

1. **Set up your 2300 using the Quick Setup instructions starting on page 2-17.**

   This will set the composite output level, preemphasis, and several other functions correctly.

2. **Turn the 2300's MPX power controller off.**

   When on, it causes gain reduction that makes it impossible to set the AI and DI reference level controls correctly with test tones. See step 19 on page 2-22.

3. **Recall the ST ENC NO LIM preset.**

   A) Press the RECALL button on the 2300's front panel.

   B) Turn the knob until ST ENC NO LIMIT is visible in the lower line of the display.

   C) Press the RECALL NEXT button.

   The 2300 is now in stand-alone stereo encoder mode. The L/R protection limiting and composite limiter are inactive. This makes it easier to adjust modulation using a test tone.

4. **Adjust the input to accept a flat or preemphasized signal.**

   Note for users of J.17 preemphasis: If you are using the digital input and set it to DIGITAL+J17 in step (7.B) on page 2-18, the 2300 will first apply J.17 deemphasis to the digital input signal. It will then leave it unchanged or preemphasize it at 50 or 75 µs, following the setting of the INPUT PRE-EMPH CONTROL, as adjusted in the steps immediately below.

   The J.17 option is rarely used; it applies mainly to NICAM links. You can set most Optimod-FMs to emit a J.17-preemphasized signal with or without additional 50 or 75 µs preemphasis. For example, see step (11.B) on page 2-19.

   A) Navigate to MODIFY / FULL CONTROL.

   B) If you do not see the INPUT PRE-EMPH soft button, press the NEXT button until it appears.

C) While holding down the INPUT PRE-EMPH soft button, rotate the knob to match the 2300 to the input signal's preemphasis.

All FM audio processing chains must include a preemphasis limiter to prevent high frequency overmodulation. Therefore, regardless of whether you choose FLAT or PRE-EMPH in this step, you must ensure that the signal driving the 2300 stereo encoder has already received 50 µs or 75 µs preemphasis limiting. (Any Optimod-FM will perform preemphasis limiting.) You must set the 50 or 75 µs preemphasis in the audio processor driving the 2300 to be the same as the 2300's preemphasis setting.

If the signal driving the 2300 has not already received preemphasis limiting, you must run the 2300 in its audio processing mode (not its standalone stereo encoder mode) so that the 2300 can perform the preemphasis limiting.

- Choose FLAT if the input signal has no 50 or 75 µs preemphasis.

FLAT causes the 2300 to apply 50 or 75 µs preemphasis to the input signal, following the preemphasis setting you specified in step 10 in Quick Setup (page 2-19).

- Choose PRE-EMPH if your input signal has already been pre-emphasized to 50 or 75 µs.

In step 10 in Quick Setup (page 2-19), make sure that you have set the 2300's preemphasis to match the preemphasis of the input signal. Even though the 2300 is not applying preemphasis, its L/R overshoot limiter needs to be aware of the input signal's preemphasis because the overshoot limiter uses different algorithms for 50 and 75 µs. This minimizes audible limited-induced artifacts.

Usually, the STL adds less peak overshoot to its input signal if its input and output signals are preemphasized. Doing this eliminates several stages of deemphasis and preemphasis. However, if the STL uses lossy digital compression (like MP2), you must run the STL flat and restore preemphasis in the 2300. *Studio-Transmitter Link* (starting on page 1-13) has a thorough discussion of these issues.

5. Adjust the input lowpass filter.

A) Navigate to MODIFY / FULL CONTROL.

B) If you do not see the LOWPASS FILTER soft button, press the NEXT button until it appears.

C) While holding down the LOWPASS FILTER soft button, rotate the knob to set the cutoff frequency of the phase-linear lowpass filter at the 2300's input.

It is usually unnecessary to use this filter; you may set it OFF unless you need to remove out of band noise from a noisy STL.

To minimize filter-induced overshoot, set the cutoff frequency as high as possible. While this filter introduces no phase distortion, it will add overshoot if it removes a significant amount of high frequency energy.

If you are using an Optimod-FM 8000, 8100, or 8500 audio processor to drive the STL, set the 2300's LOWPASS FILTER to OFF or 17 KHZ. If you are using any other Optimod-FM, set the filter to OFF, 16 KHZ or 17 KHZ.

6. Set the analog input reference level.

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

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

B) Set the INPUT to Analog.

> The 2300 will automatically switch to analog input if signal lock is unavailable at the AES3 input.

C) Apply a 50 Hz sine wave the 2300's analog input (usually through an STL) and set the peak level of the tone to equal the maximum peak output level produced by the FM audio processor driving the 2300.

> All digital Optimod-FM processors have a built-in tone oscillator that can generate this tone. Set the modulation in the Optimod's tone generator to 100%.
>
> Tone alignment does not account for any overshoots that the STL might generate with program material. Normally, you will use the 2300's left/right overshoot limiter and/or composite limiter to eliminate such overshoots. Do not substitute these limiters for the peak limiters in the audio processor driving the STL. The 2300's overshoot limiters should *only* be used to eliminate 3 dB or less STL-induced overshoot.

D) Navigate to SETUP / IO CALIB / ANLG IN CALIB / AI REF. Adjust the AI REF control to produce 100% composite modulation (usually ±75 kHz carrier deviation) as indicated on a modulation monitor or analyzer connected to your FM transmitter's output.

> If you set the composite output level correctly in step 14 (page 2-20) of Quick Setup, you should see the 2300's composite level meter indicate 100% modulation when the AI REF control is set correctly. It is very important to have set the composite output level correctly in this earlier step. This will correctly match the 2300's composite limiter threshold to the FM carrier deviation produced by the transmitter and will ensure that the 2300's headroom is used correctly. If you are not sure whether the 2300's composite output level was set correctly, refer to step 7 on page 2-33. Use "tone" method to set modulation. This uses the 2300's internal tone oscillator.

7. Set the digital input reference level.

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

Refer to the notes in step 6 above.

A) Navigate to SETUP / IO CALIB / DIG IN CALIB / INPUT and set the input to DIGITAL.

B) Apply a 50 Hz sine wave the 2300's digital input (usually through an STL) and set the level of the tone to correspond to 100% peak modulation of the composite stereo baseband signal. This level should be the same as the maximum peak output level produced by the FM audio processor driving the 2300.

C) Navigate to SETUP / IO CALIB / DIG IN CALIB / DI REF. Adjust the DI REF control to produce 100% composite modulation (usually ±75 kHz carrier deviation) as

indicated on a modulation monitor or analyzer connected to your FM transmitter's output.

8. Activate the L/R Peak Limiter (optional)

A) Navigate to MODIFY / FULL CONTROL.

B) If you do not see the L/R PEAK LIMITER soft button, press the NEXT button until it appears.

C) Set the control to IN.

This activates a peak limiter similar to the one in Orban's 8218 Stereo Encoder. The limiter controls peaks with a combination of look-ahead limiting and band-limited clipping. There are two limiters, operating independently on the left and right channels. They are intended only to remove overshoots caused by the STL. If used for more than 3 dB of peak reduction, they can cause audible side effects. To minimize audible distortion, it always better to minimize overshoots in the STL itself instead of relying on the L/R peak limiter to remove them.

9. Activate the Composite Limiter (optional)

A) Navigate to MODIFY / FULL CONTROL.

B) If you do not see the MPX LIMIT MODE soft button, press the NEXT button until it appears. Then select either HARD or HALFCOS modes.

When operating as a hard clipper, the composite limiter will produce maximum brightness in the frequency range from 5 to 15 kHz because, unlike left/right audio-domain clippers, it can produce square waves in this frequency range. The downside compared to Half-Cosine mode is that it can noticeably compromise stereo imaging.

When operating in Half-Cosine mode, the composite limiter produces somewhat less brightness but does not compromise stereo imaging. Orban's factory programmers prefer the sound of the Half-Cosine mode.

In either mode, the baseband output is overshoot compensated and bandlimited to 53 kHz, unlike conventional composite clippers.

The HARD mode is only available when the 2300 is operated as a standalone stereo encoder. In the 2300's audio processor mode, its composite limiter always operates in Half-Cosine mode.

C) If you do not see the MPX LIMIT DRIVE soft button, press the NEXT button until it appears.

D) Adjust the control as desired.

We recommend setting the control to "0." This sets the limiter threshold to be the same as the analog and digital reference levels, which correspond to 100% baseband tone modulation. This setting only removes overshoots.

Setting the control higher than "0" drives the limiter harder, causing progressively more limiting action but also more distortion, the texture of which depends on whether the MPX LIMIT MODE is set to HARD or

HALFCOS. The composite limiter is less forgiving than the L/R Peak Limiter because it operates more like a pure clipper. In general, it should be used with less than +1.0 dB of limiting. See *MPX LIMIT* on page 3-28.

10. Program Silence Sense (optional)

If you are using the 2300 in stereo encoder mode, you can program the 2300 to switch automatically from its digital input to its analog inputs if the INPUT SOURCE is set to DIGITAL and the signal at the digital input falls silent.

There are two silence detectors, one for the analog input and one for the digital input. The silence sense parameters apply to both simultaneously. Both detectors are available to drive the 2300's tally outputs but only the "digital input" silence detector is used for automatic input switching. (See step 11 below.)

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

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

When an active signal is restored to the digital input, the 2300 will automatically switch back to that input.

This feature is unavailable in the 2300's audio processing mode.

A) Navigate to MODIFY / FULL CONTROL / SILENCE THRESHOLD and set the Silence Threshold to the level below which the 2300 will interpret the input as being silent.

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

B) Press NEXT as necessary to see the SILENCE DELAY control. Set it to the amount of time that the input must be below the Silence Threshold before the 2300 automatically switches to the analog input.

C) Press NEXT as necessary to see the ANALOG FALLBACK control. Set it to YES if you wish the 2300 to switch automatically from the digital to analog input when silence is detected. Set the control to NO to defeat automatic switching.

11. Program Tally Outputs.

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

See step 7 on page 2-4 for wiring instructions.

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

A) Navigate to MODIFY / FULL CONTROL / TALLY OUT1.

B) Program tally output #1.

To program a given tally output, press and hold the soft button associated with the output you are programming. As you turn the control

knob, the functions listed below will appear in the highlighted field.

- **Input: Analog**: Indicates that the 2300 is processing audio from its analog input.
- **Input: Digital**: Indicates that the 2300 is processing audio from its AES3 digital input.
- **Analog Input Silent**: Indicates that the level at either or both analog input channels is below the threshold set in step 10 on page 2-28.
- **AES Input Silent**: Indicates that the level at either or both digital input channels is below the threshold set in step 10 on page 2-28.
- **AES Input Error**: Indicates that the 2300's AES input receiver chip has detected a problem with the data being received such that the data is unusable. When the chip detects such an error, it automatically switches the input to ANALOG.
- **No Function**: Tally output is disabled.

C) Program tally output #2 if you wish, following the procedure in step (B) above with the TALLY OUT2 button.

12. Save your work as a User Preset.

It is important to save your settings as a User Preset to preserve your work. You can create as many User Presets as you wish, each customized for a particular application, although most stand-alone stereo encoder applications will require only one preset. See *To Create or Save a User Preset* on page 3-13.

13. If required, activate the MPX Power Controller.

See step 19 on page 2-22.

The following material provides detailed instructions on how to set up the 2300 in its audio processor mode. 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 2300 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 2300 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 2300's gain reduction range to the level to which your studio operators peak their program material on the studio meters. This assures that the 2300'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 2300, 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 2300 to your standard studio level.]

a) Verify EXT AGC is set to NO.

Refer to step 1 on page 2-30.

b) Feed a tone at your reference level to the 2300

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 2300'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 2300 to your standard studio level—see step (D) above.]

a) Verify EXT AGC is set to NO.

Refer to step 1 on page 2-30.

b) Feed normal program material to the 2300

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 2300'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 2-30.

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 2300 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 2300 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 2-30), 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 2300 (including the transmitter), you may have to increase the setting of the PILOT LEVEL so that the pilot still produces 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 2300'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 BS412-9 in your country, activate the 2300's ITU-R BS412 controller. See step 19 on page 2-22.

F) You can specify the amount by which the 2300 automatically reduces main and stereo subchannel modulation to accommodate subcarriers within the modulation limits specified by the governing authority. See step 20 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 2300 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.

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 2-32 for instructions on how to turn on the calibration tone.

C) 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 are using program material, make sure that the program material is loud enough to produce peaks of frequent recurrence that hit the 2300's peak limiting system, thereby defining the maximum peak level that the 2300 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 BS412-9, you may seldom see peaks hitting ±75 kHz deviation. In this case, we advise you to set the output level by using the 2300'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 2300'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 2300'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 2300'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 2300's internal crystal-controlled clock) or EXTERNAL (the output sample rate is synchronized to the sample rate appearing at the 2300'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 2300 is 24 bits

The 2300 can also truncate its output word length to 20, 18, 16, or 14 bits. The 2300 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 2300 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 2300.

G) Set DIGITAL FORMAT to AES or SPDIF

H) Press the PREV button.

I) 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.C) on page 2-33.

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 2-30, set the EXT AGC to YES.

10. Select a processing preset.

See step 17 on page 2-21.

Automation Using the 2300'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 2-44.]

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. Then 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 2300 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 2-36.

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 2300 has several levels of security to prevent unauthorized people from changing its programming or operating state. Security determines the level of access for

anyone interacting with the 2300 through its front panel or connecting to the 2300 through a direct serial connection, dial-up networking (through modems), or the 2300's 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 2300.

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 2300 front panel, operate any button or the knob.

The PASSCODE screen appears.

B) Enter a passcode using the four soft buttons.

The 2300 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 2300's front panel. Once your PC is connected to the 2300, you will be able to access the 2300 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 2300.

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

The Restore Defaults screen appears.

C) To gain access to the 2300, press the ERASE ALL PASSCODES soft button.

D) Reprogram passcodes as necessary; see *To Create a Passcode* on page 2-38.

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 2300 "factory fresh" if it is being installed in a different facility.

Remote Control Interface Programming

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 2300'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 2300'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 2300'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 20 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 ex-

ample, 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 2300'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 2300'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 2300 remotely, either for downloading software upgrades or for PC Remote Control.]

The 2300 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 2300 through the 2300's RS-232 serial port, either by modem or directly through a null modem cable.

1. Prepare the 2300 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 2300 PC Remote software, then you must first be able to connect to the 2300. Therefore, you will usually perform this procedure from the 2300'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

The default port number is 6201.

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 2300.

- 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 2300 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 2300 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 2300. Orban Customer Service supports only the 3Com / U.S. Robotics® 56kbps fax modem EXT on the 2300 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 2300's serial port with a standard (not null) modem cable.

C) Set the modem to AUTO ANSWER and turn it on.

> For 3Com / U.S. Robotics® 56kbps fax modem EXT, set dipswitches 3, 5, and 8 in the down position to activate the AUTO ANSWER setting. All other dipswitches should be set to the up position.

4. Prepare the 2300 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 2300 through a null modem cable connected to your computer's serial port. Refer to *Installing 2300 PC Remote Control Software* on page 2-48.

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 UPD 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 (D) on page 2-43. 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 2-46).
- If the timeserver you selected in Windows is a named address not an IP address the 2300 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 2300 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 2-46]. 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 2300 PC Remote Control Software

This section briefly summarizes the procedure for installing 2300 PC Remote software on existing 2300s. If required, you will find more detailed instructions in the .pdf file automatically installed on your computer by Orban's installer program, `Setup2300_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 2300. You can also download it from `ftp.orban.com/2300`.

Instructions for using the PC Remote software are found in Section 3 of this manual.

Installing the Necessary Windows Services

The 2300 PC Remote application uses Windows' built-in communications and networking services to deal with the low-level details necessary to communicate with the 2300's serial port. (These services are also used to upgrade your 2300'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 2300 through a null modem cable. 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 2300 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 2300 PC Remote application*.

  > In all cases, regardless of whether your PC communicates to the 2300 through its serial port or Ethernet connector, it uses the ppp and the TCP/IP protocols to communicate with the 2300.

Check Hardware Requirements

To connect your PC to your 2300, regardless of the method you choose, you will need the following:

- Orban 2300 OPTIMOD-FM.

- *If connecting by serial cable:* a null modem cable (also called a "reverse" cable). This cable has DB9 female connectors at both ends for connecting the 2300 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 2300 side of the connection. Note that Orban Customer Service does not support any other type of modem for connecting to the 2300.

- *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.

  2300 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 2300, use shielded cable to protect the pins in the RS-232 connector from electrostatic discharge.

The following subsections provide steps for connecting to your 2300 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 2300

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 2300. *Appendix: Setting up Serial* Communications on page 2-51 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 2300. In most cases, all you need is your 2300's IP address, Subnet Mask, Port, and Gateway number, as set in step 1 on page 2-42. You will enter these when you create a "connection" to your 2300 from the 2300 PC Remote application—see step (E) on page 3-39. 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 2300 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 2300 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 2-43. If the gateway and firewall (if used) are configured correctly, it is possible to connect 2300 PC Remote to a 2300 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 2300. However, if you experience any problems with this process, or have any other 2300 questions, please contact Orban Customer Service:

phone: +1 510 351-3500

email: custserv@orban.com

For details on your new 2300 software, from new features to operational suggestions, refer to our FTP site (ftp.orban.com/2300).

Appendix: Setting up Serial Communications

This appendix provides instructions for setting up both direct serial and modem connections from your 2300 to your PC. You must do this when you define a new connection from the 2300 PC Remote application. The appendix provides procedures for both the Windows 2000 and Windows XP operating systems.

> Please note that the screen shots were originally prepared for the Optimod-FM 8300 manual and refer to that product. However, this does not affect the setup procedure.

Preparing for Communication through Null Modem Cable

1. **Configure your 2300.**

   A) On your 2300's front panel, navigate to SETUP / NETWORK & REMOTE.

   B) Hold down the PC CONNECT soft button and turn the knob until you see DIRECT on the display.

2. **Connect the cable.**

   A) Connect one end of a null modem cable to the DB9 serial connector on the 2300'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 2300 per available COM port on your computer. If you wish to control multiple local 2300s, it is better to use an Ethernet network connection. However, in principle you could control multiple 2300s serially from one COM port, using a hardware serial switch to select the 2300 you wish to control. In this case, you should set up a separate 2300 "connection" for each 2300 to be controlled, following the instructions below. All connections should reference the same COM port.

This connection is used both for upgrading your 2300 and for connecting the 2300 PC Remote application to your 2300.

Important: The Direct Serial Connection must have exclusive access to the PC COM port that connects to your 2300. 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 2-56.

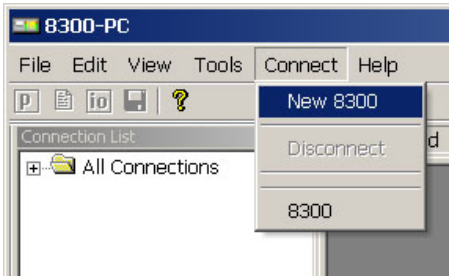
If you cannot access the Internet after making a Direct or Modem connection, you will have to reconfigure certain networking parameters in Windows. Please see *You Cannot Access the Internet After Making a Direct or Modem Connection to the 2300* on page 5-8.

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

A) Create a New Windows 2000 Direct Connection:

a) Launch 2300 PC Remote.

b) Choose "Connect / New 2300"

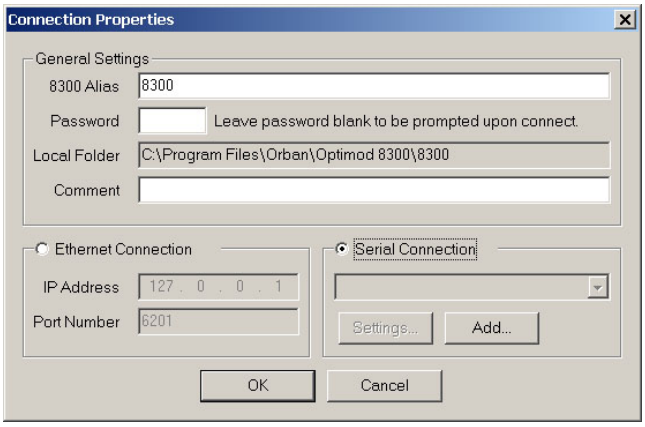


c) Give your 2300 a name (e.g., "KABC") by entering this name in the "2300 Alias" field.

d) If you wish to have 2300 PC Remote remember the password for this Optimod, enter the pass-word in the "Password" field.

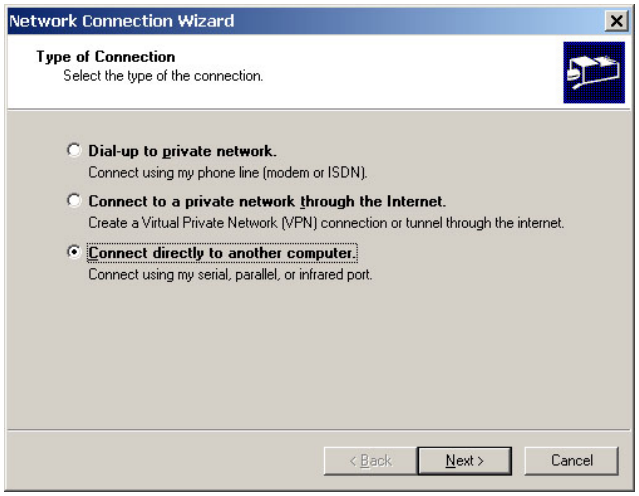
e) Select "Serial Connection."

f) Click "Add."



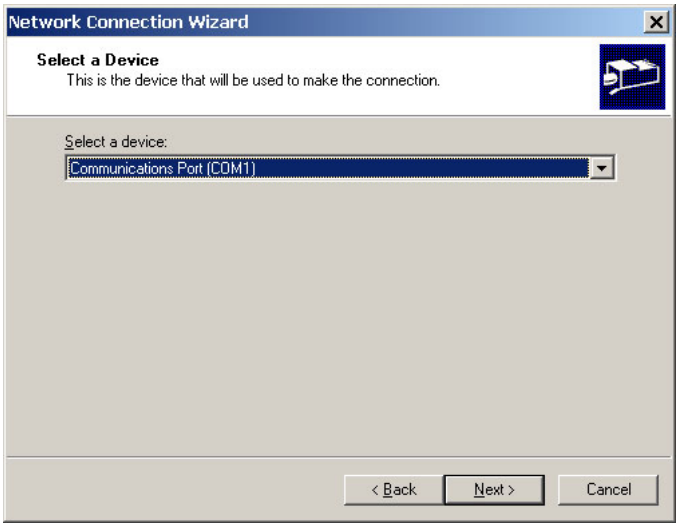
g) Select "Connect Directly to another computer."

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."

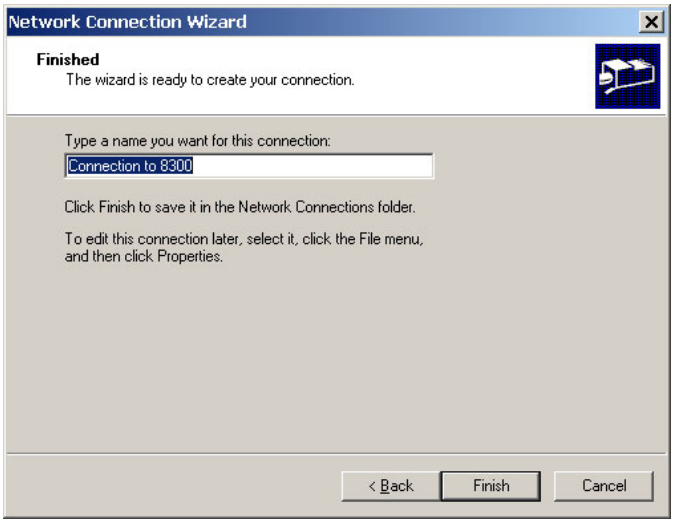
The correct setting depends on how your network and security are configured.

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

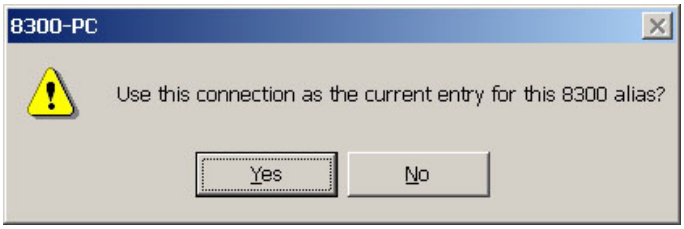
l) Click "Next."

m) Enter a name for your Connection such as: "Connection to 2300."

n) Click "Finish."

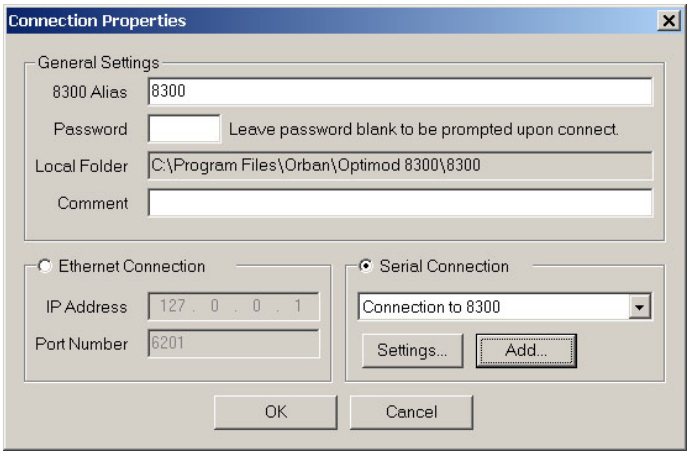


o) Click “Yes.”



B) Edit your new Direct Connection properties:

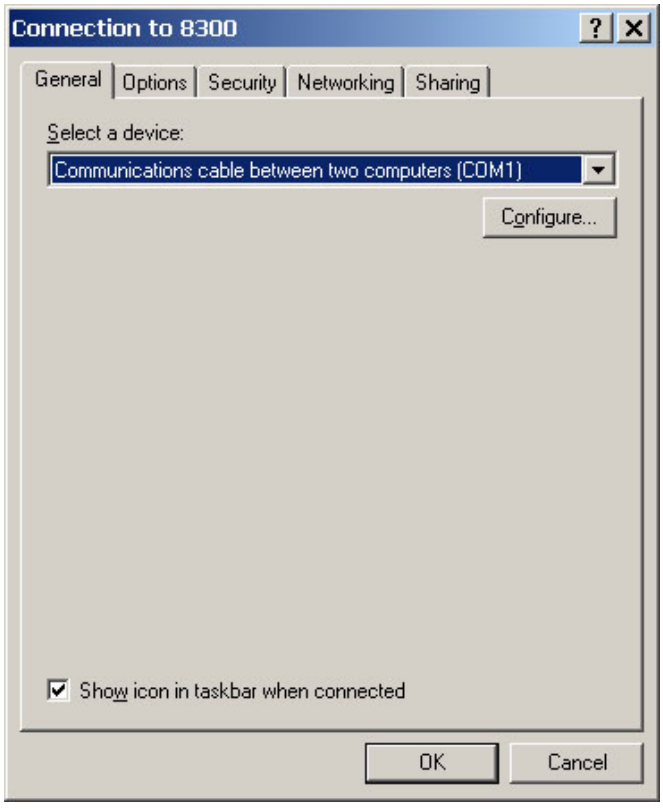
a) Click “Settings.”



b) Click the “General” tab.

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

d) Click “Configure.”

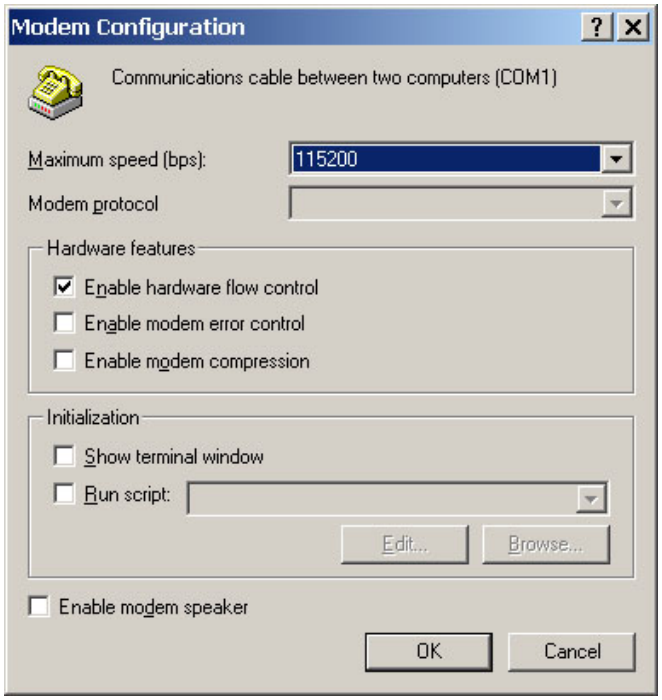


e) Set "Maximum speed (bps)" to "115200."

f) Check "Enable hardware flow control."

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

h) Click "OK."



i) Select the Networking tab.

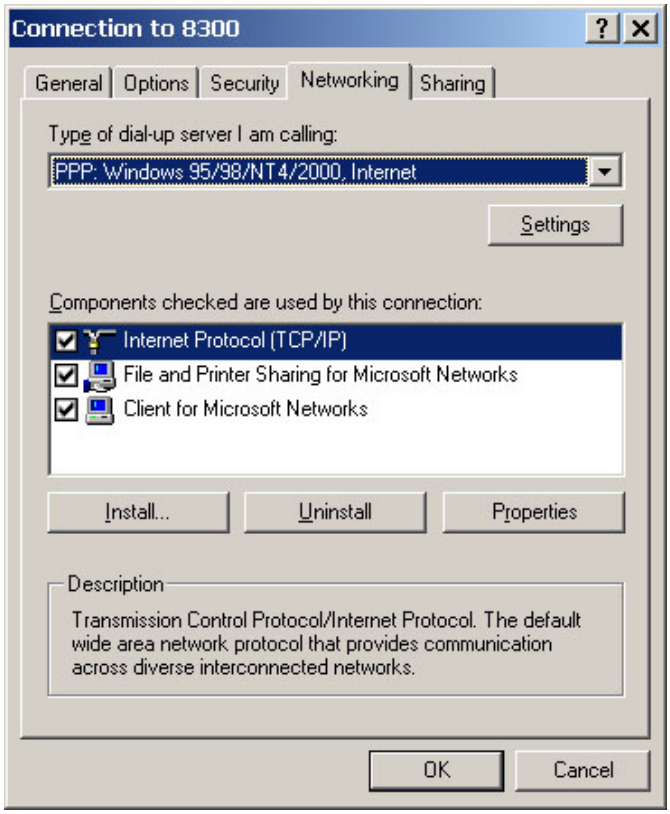
j) Make sure that "PPP: Windows 95 / 98 / NT 4 / 2000, Internet" appears in the "Type of dial-up server I am calling" field.

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."



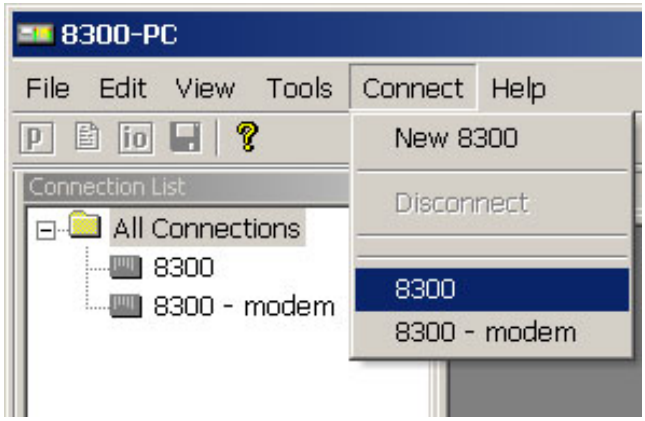
2. Launch an existing Windows 2000 Direct connection.

Once you have set up a "connection" specifying Direct Connect in the 2300 PC Remote application (see *To set up a new connection* on page 3-39), choosing this connection from 2300 PC Remote automatically opens a Windows Direct Connection to your 2300.

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 2-52).

Connecting Using Windows XP Direct Serial Connection

If you have already configured your direct serial cable connection, skip to step 2 on page 2-60.

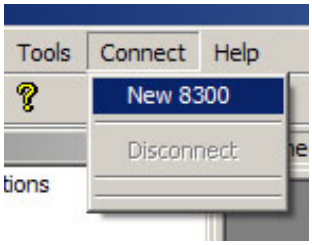
> If you cannot access the Internet after making a Direct or Modem connection, you will have to reconfigure certain networking parameters in Windows. Please see *You Cannot Access the Internet After Making a Direct or Modem Connection to the 2300* on page 5-8.

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

A) Create a New Windows XP Direct Connection:

a) Launch 2300 PC Remote.

b) Choose "Connect / New 2300"

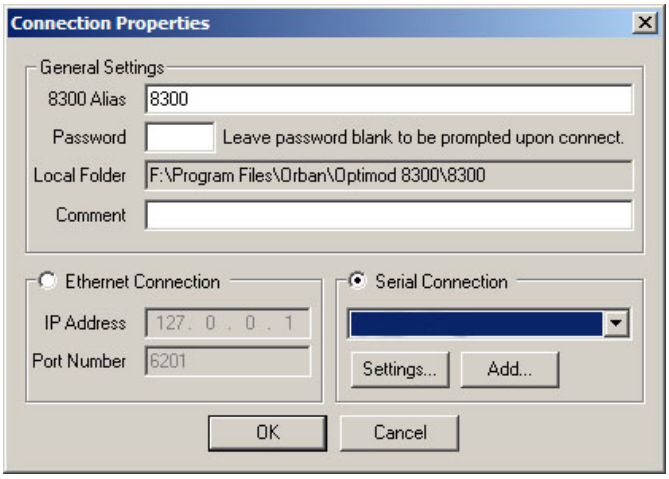


c) Give your 2300 a name (e.g., "KABC") by entering this name in the "2300 Alias" field.

d) If you wish to have 2300 PC Remote remember the password for this Optimod, enter the password in the "Password" field.

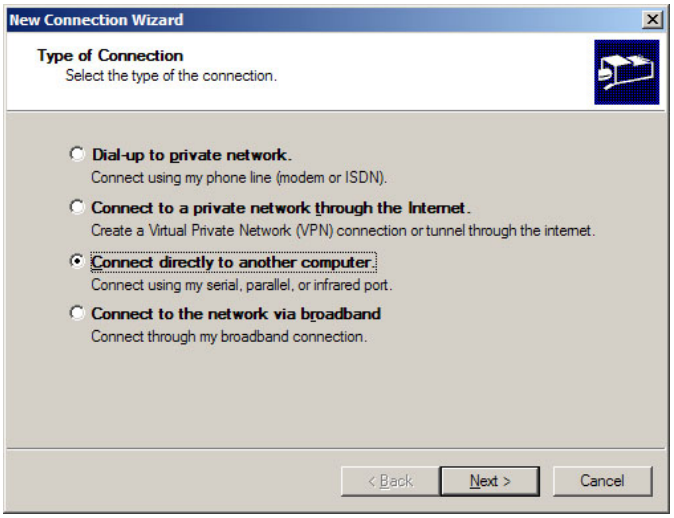
e) Select "Serial Connection."

f) Click the "Add" button.



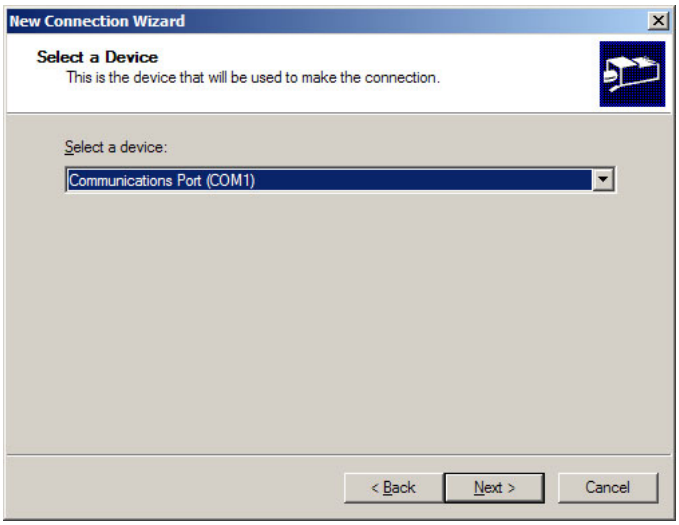
g) Choose "Connect directly to another computer."

h) Click "Next."



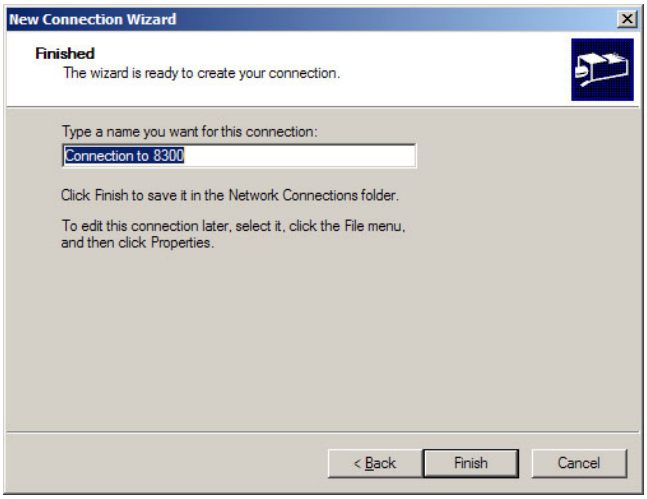
i) In the drop-down box, select the serial port you will be using to make the connection.

j) Click "Next."

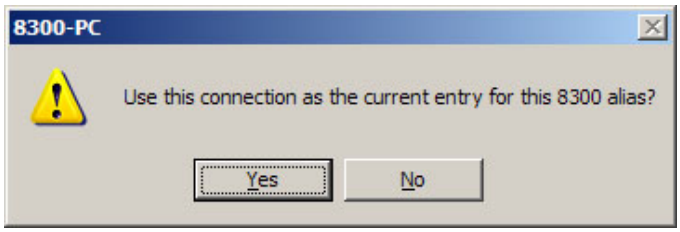


k) Type in a name for your Connection such as: "Connection to 2300."

l) Click "Finish."

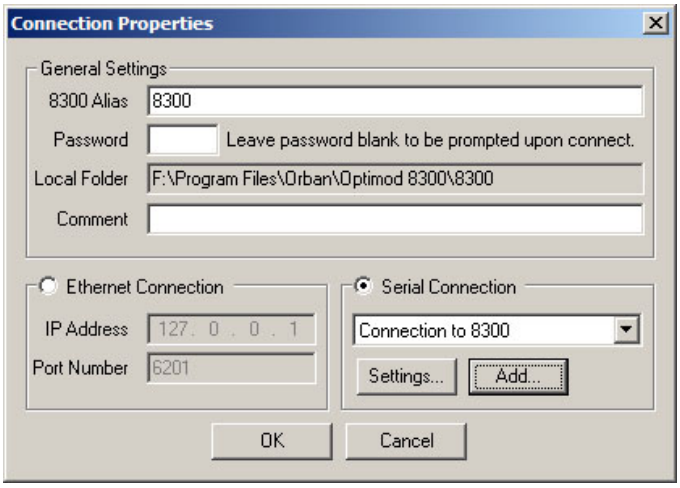


m)Click "Yes."



B) Edit your new Direct Connection properties:

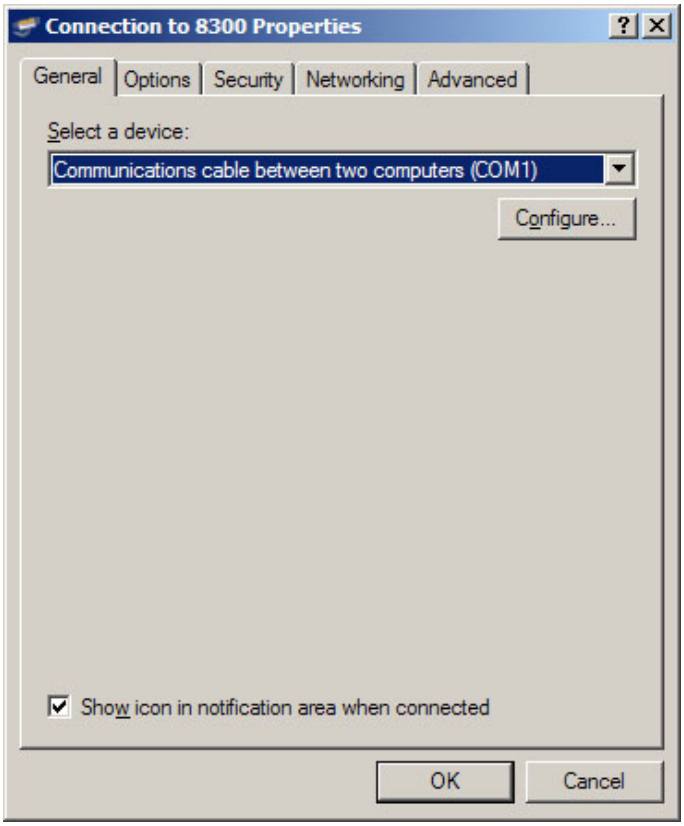
a) Click "Settings."



b) Click the "General" tab.

c) Select the device you set up in step (i) on page 2-57. This will usually be "Communications cable between two computers (COM1)."

d) Click "Configure."

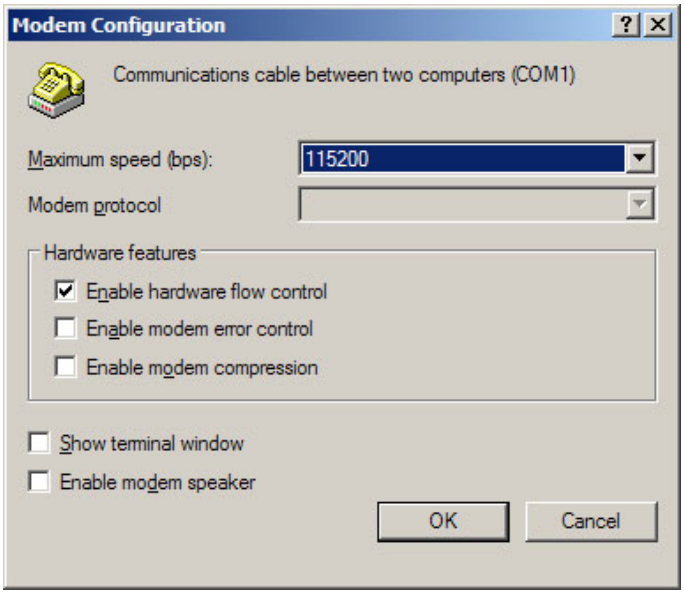


e) Set the "Maximum Speed (bps)" to 115200.

f) Check "Enable hardware flow control."

g) Make sure all other hardware features are unchecked.

h) Click "OK."



i) Select the Networking tab.

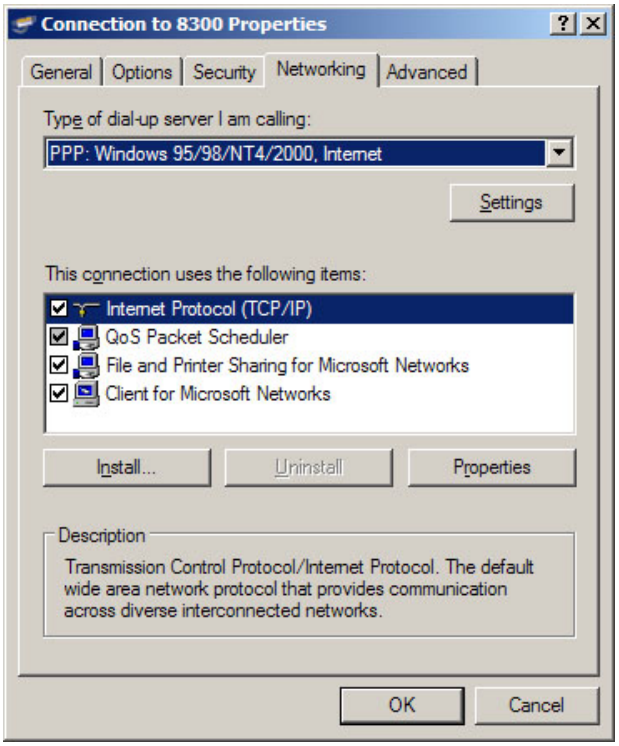
j) Make sure that "PPP: Windows 95 / 98 / NT 4 / 2000, Internet" appears in the "Type of dial-up server I am calling" field.

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."



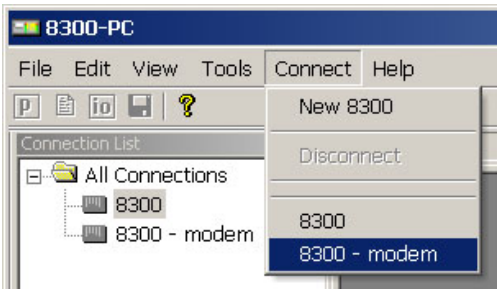
2. Launch an existing Windows XP Direct connection.

Once you have set up a "connection" specifying Direct Connect in the 2300 PC Remote application (see *To set up a new connection* on page 3-39), choosing this connection from 2300 PC Remote automatically opens a Windows Direct Connection to your 2300.

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 2-52).

Preparing for Communication through Modems

1. Prepare your 2300 for a modem connection through the serial port.

See step 2 on page 2-43.

2. If you have not already done so, create a 2300 passcode.

See *To Create a Passcode* on page 2-38.

3. Modem setup:

You will need two modems and two available phone lines, one of each for your PC and your 2300.

> Reminder: Orban supports only the 3Com / U.S. Robotics® 56kbps fax modem EXT on the 2300 side (although other 56kbps modems will often work OK).

Connect the modem to the 2300's serial port with a standard (not null) modem cable.

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 2300.

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 2300 and for connecting the 2300 PC Remote application to your 2300.

1. Add and configure modem for Windows 2000:

If your modem is already installed, skip to Launch a Windows 2000 Modem connection *on page 2-67.*

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:

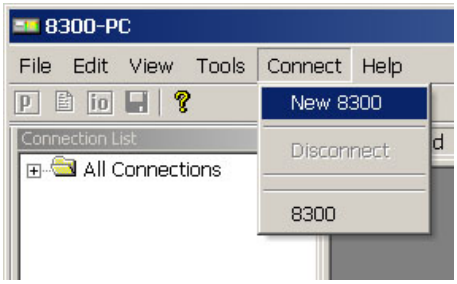
a) Click "Start / Settings / Network and Dial-up Connections / Make New Connection."

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

C) Create a New Windows 2000 Direct Connection:

a) Launch 2300 PC Remote.

b) Choose "Connect / New 2300"

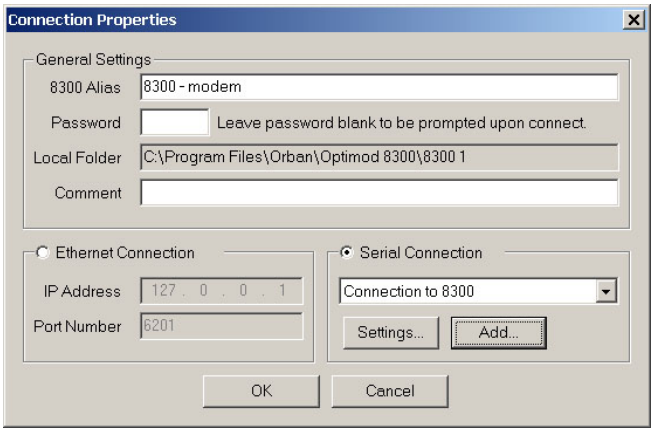


c) Give your 2300 a name (e.g., "KABC") by entering this name in the "2300 Alias" field.

d) If you wish to have 2300 PC Remote remember the password for this Optimod, enter the password in the "Password" field.

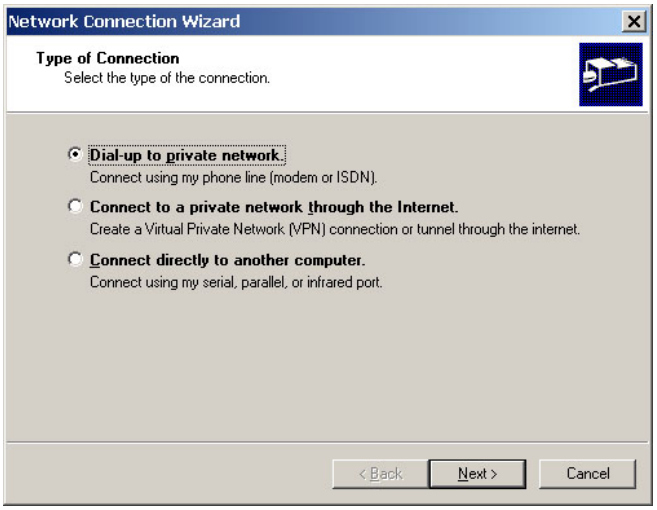
e) Select "Serial Connection."

f) Click the "Add" button.



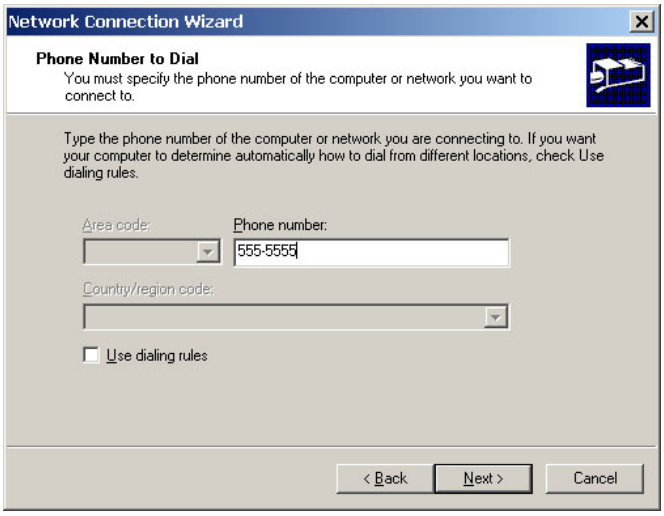
g) Select "Dial-up to private network."

h) Click "Next."



i) Enter the phone number of the modem connected to the 2300 that you are setting up.

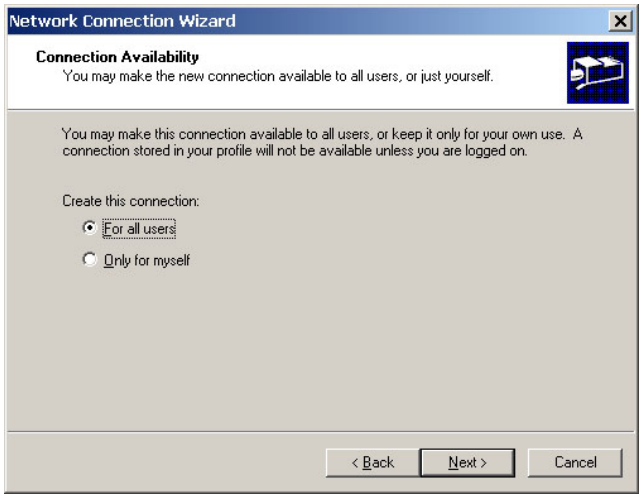
j) Click the "Next" button.



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

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

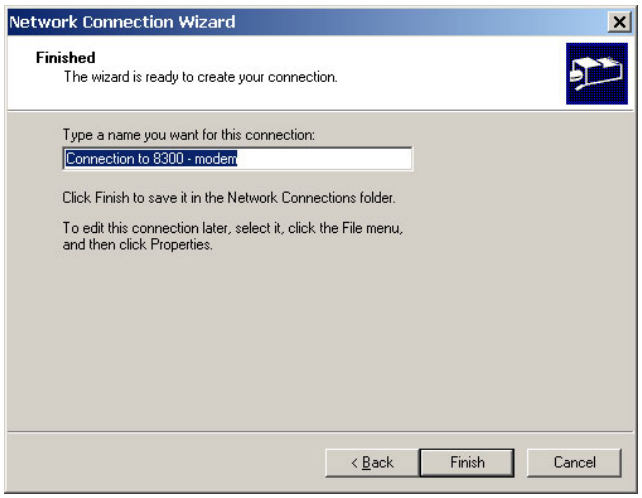
This screen may not appear in computers set up for single users.



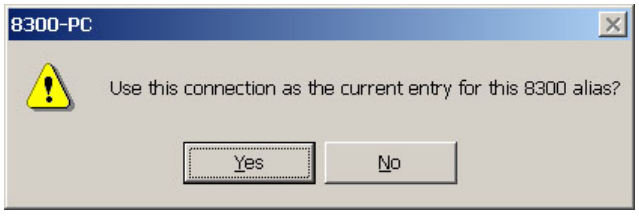
l) Click the "Next" button.

m) Type in a name for your Connection such as: "Connection to 2300–Modem."

n) Click the "Finish" button.

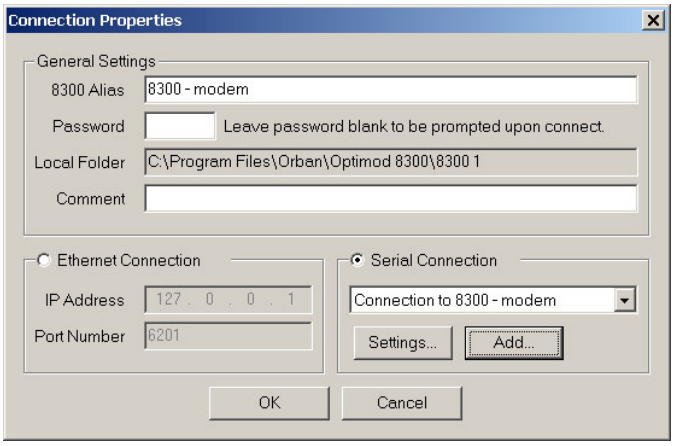


o) Click "Yes."



D) Edit your new Direct Connection properties:

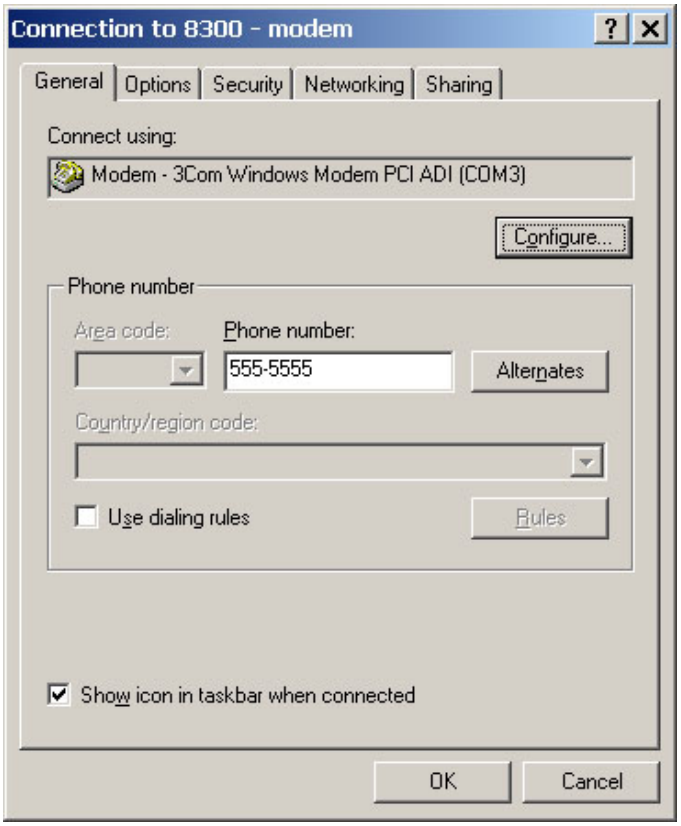
a) Click "Settings."



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."

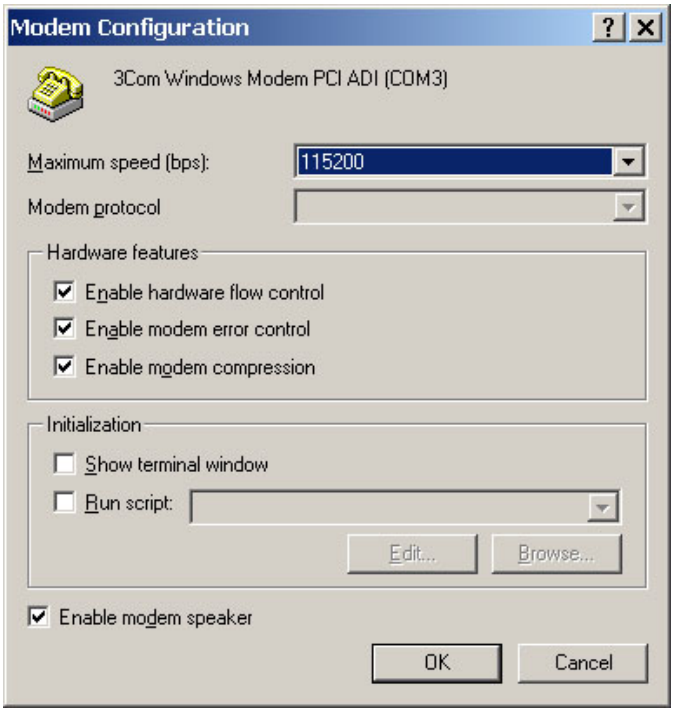
g) Check "Enable modem error control."

h) Check "Enable mcdem compression."

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

(Set "Enable Modem Speaker" according to your preference.)

j) Click "OK."



k) Select the Networking tab.

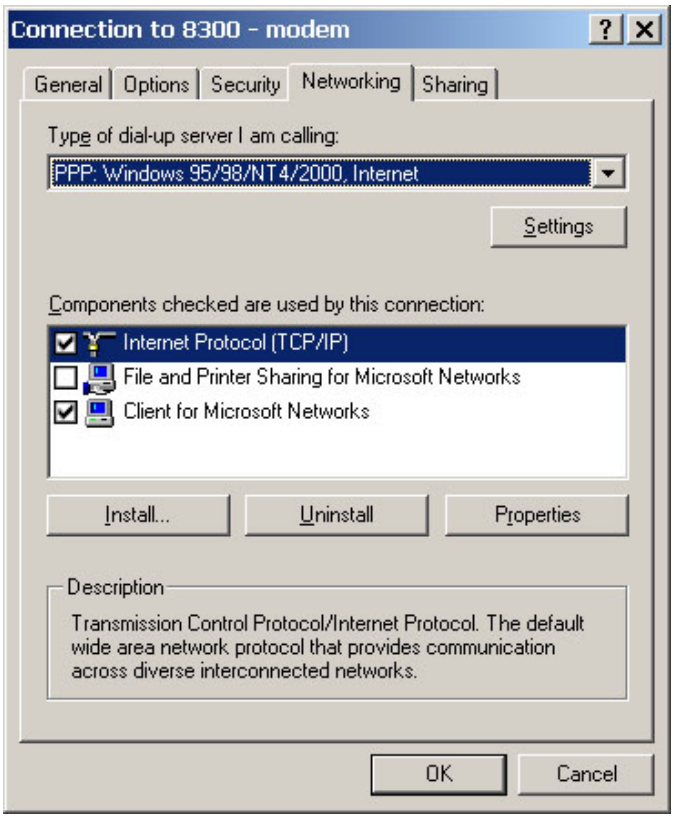
l) Make sure that "PPP: Windows 95 / 98 / NT 4 / 2000, Internet" appears in the "Type of dial-up server I am calling" field.

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."



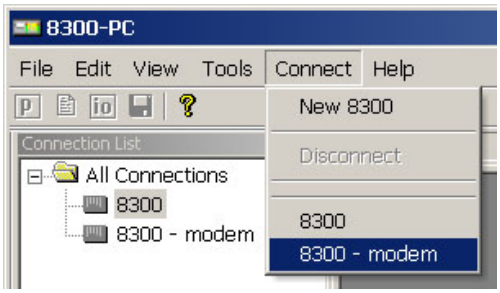
2. **Launch a Windows 2000 Modem connection.**

   Once you have set up a "connection" specifying a modem connection in the 2300 PC Remote application (see *To set up a new connection* on page 3-39), choosing this connection from 2300 PC Remote automatically opens a Windows modem connection to your 2300.

   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 2-63).

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 2-72.*

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.

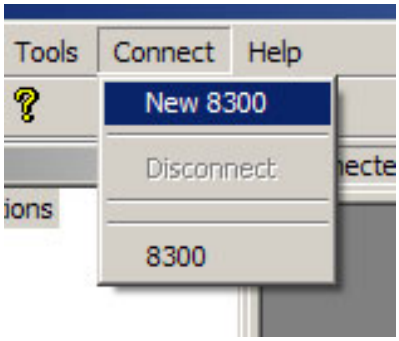
h) Click "OK."

C) Create a new Windows XP modem connection:

a) Launch 2300 PC Remote.

b) Choose "Connect / New 2300."

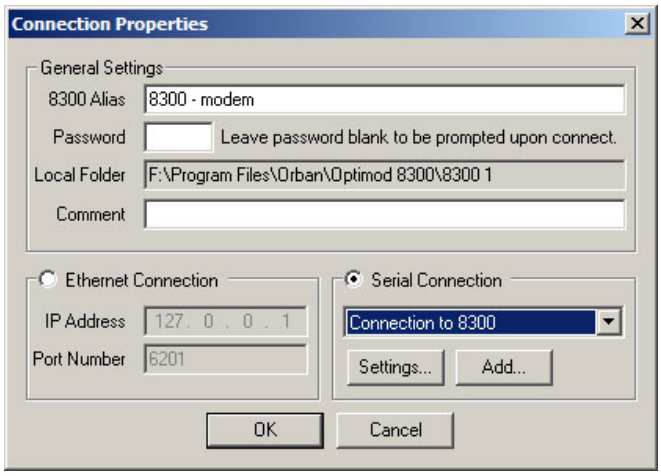
The Connection Properties window opens.



c) Give your 2300 a name (e.g., "KABC") by entering this name in the "2300 Alias" field.

d) If you wish to have 2300 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 2300 passcode must have been assigned via the 2300's front panel. (See *To Create a Passcode* on page 2-38.)



e) Click "Add."

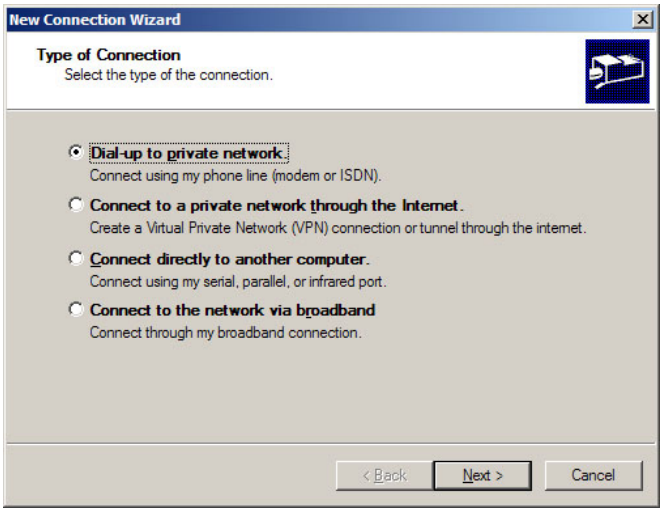
The Windows New Connection Wizard starts up.

f) Select "Serial Connection."

g) Click the "Add" button.

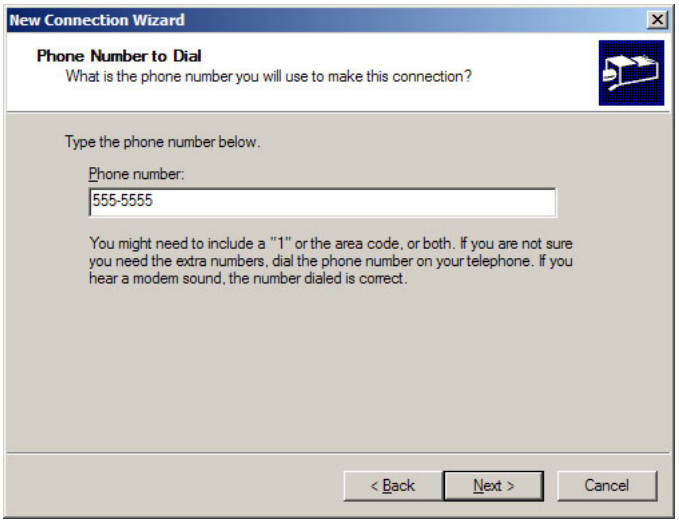
h) Select "Dial-up to private network."

i) Click "Next."



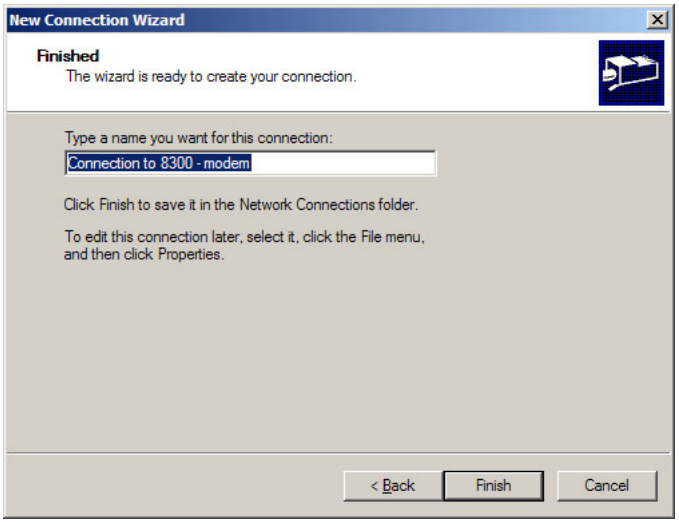
j) Enter the phone number of the modem connected to the 2300 you are setting up.

k) Click "Next."

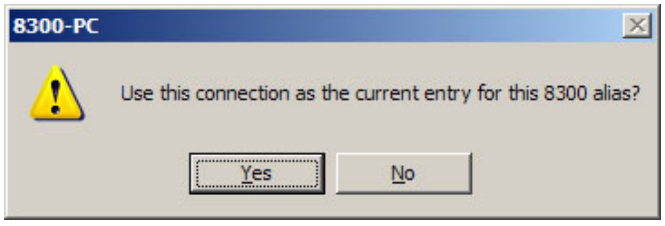


l) Type in a name for your Connection such as: "Connection to 2300 – Modem"

m) Click the "Finish" button.

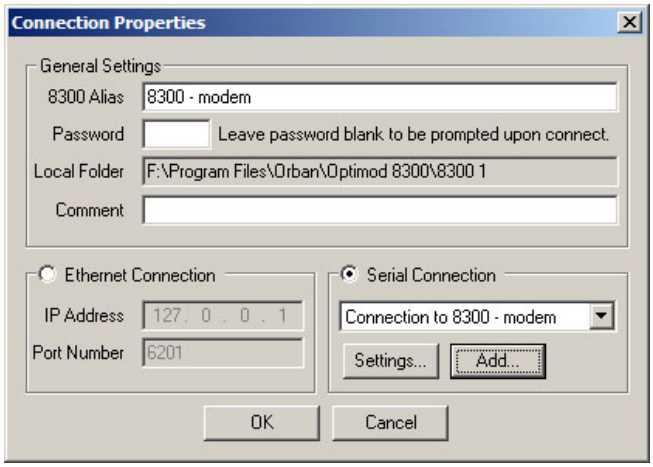


n) Click "Yes."



D) Edit your new Direct Connection properties:

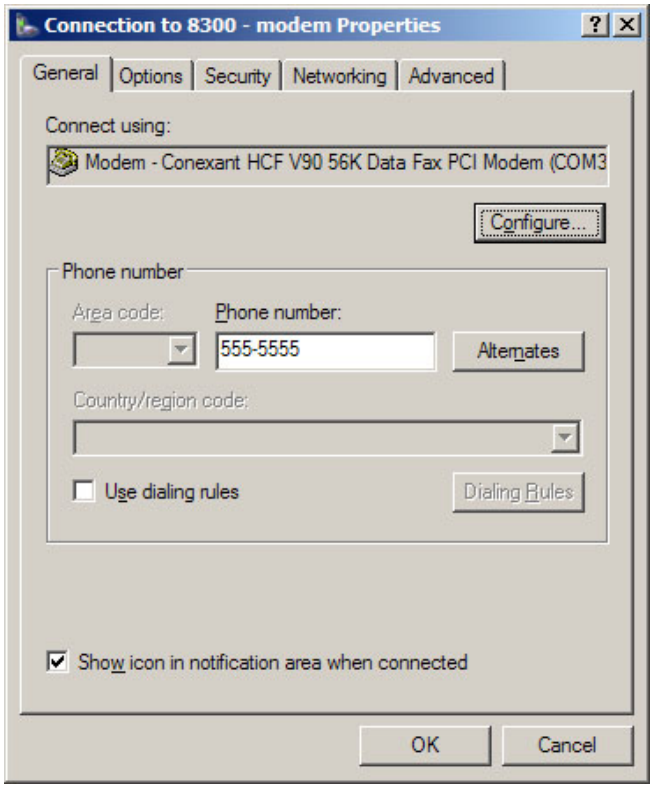
a) Click "Settings."



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."

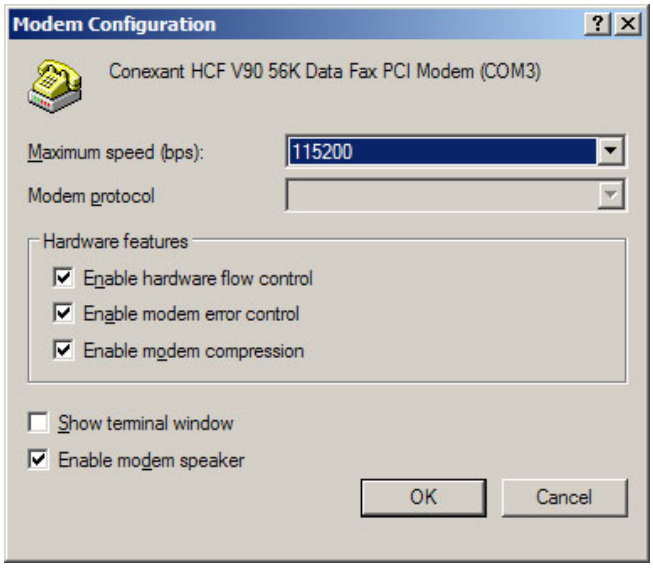
f) Check "Enable hardware flow control."

g) Check "Enable modem error control."

h) Check "Enable mcdem compression."

i) Make sure that no other box is checked. (Set "Enable Modem Speaker" according to your preference.)

j) Click "OK."



k) Select the Networking tab.

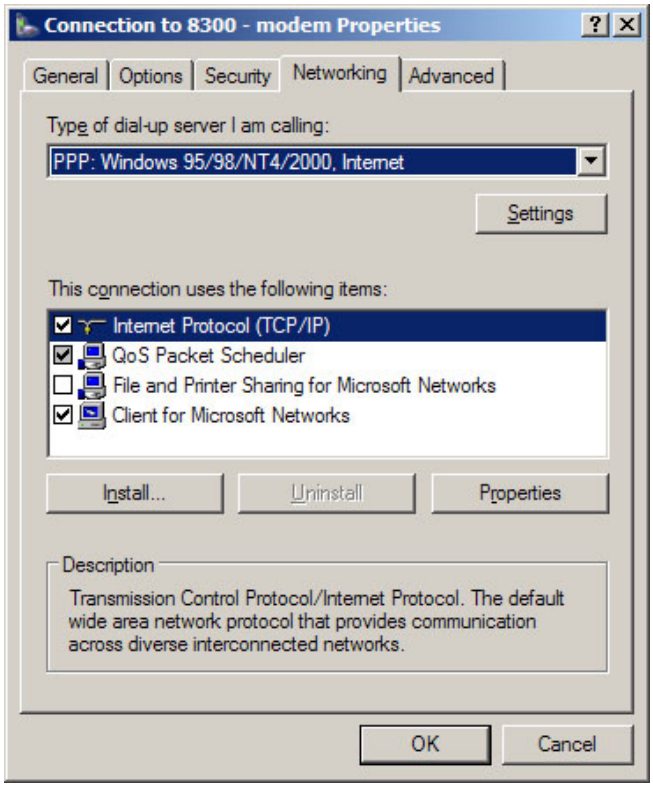
l) Make sure that "PPP: Windows 95 / 98 / NT4 / 2000, Internet" ap–pears in the "Type of dial-up server I am calling" field.

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

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

n) Click "OK."

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



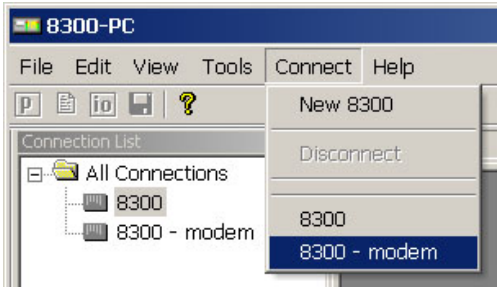
2. Launch an existing Windows XP modem connection.

Once you have set up a "connection" specifying a modem connection in the 2300 PC Remote application (see *To set up a new connection* on page 3-39), choosing this connection from 2300 PC Remote automatically opens a Windows modem connection to your 2300.

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 5-12. 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 2-63).

Updating your 2300's Software

The software version number of PC Remote must be the same as the version number of the software running within your 2300. If the software version of PC Remote is higher than the version running in your 2300, PC Remote will automatically detect this and will offer to update your 2300's software automatically.

1. **If you have not already done so, prepare your computer and the 2300 for a direct serial, modem, or Ethernet connection.**

   See *Networking and Remote Control* starting on page 2-42.

2. **Install the latest version of 2300 PC Remote software on your computer.**

   This is available from

   ftp://orban.com/2300

   See *Installing 2300 PC Remote Control Software* on page 2-48.

   See the readme2300_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 2300 PC Remote and set up a "connection" to the 2300 you will be updating.**

   See *To set up a new connection* on page 3-39.

4. Update your 2300.

A) Attempt to initiate communication to your 2300 via your connection.

See *To initiate communication* on page 3-39.

2300 PC Remote will automatically detect that the 2300 software version on your 2300 is not the same as the version of 2300 PC Remote. PC Remote will then offer to update your 2300 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 2300 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 2300 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 2300's rebooting.

Your 2300 will continue to pass audio normally while the update is occurring. *However, the audio will be interrupted for approximately 3 seconds when your 2300 reboots.*

Do not interrupt power to your 2300 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 2300 (because of extensive backup and error-checking provisions in your 2300), they will certainly cause the update to fail.

C) When the 2300 screen display returns after its automatic reboot, the 2300 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 2300 screen remains blank for more than one minute after the update has completed, manually reboot the 2300 by removing AC power from the 2300 for at least ten seconds and then powering the 2300 back up.

E) The 2300 software update is now complete. You should now be able to connect to your 2300 via PC Remote.

NOTE: If you cannot make a connection after a software upgrade, manually reboot the 2300 with a normal "power-off/power-on" sequence.

Section 3
Operation

2300 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 2300 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 2300.

  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 17 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 2300 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 2300'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 2300's analog to digital converter, which is a very common cause of audible distortion.

- **AGC** meters show the gain reduction of the Master and Bass bands of the slow, two-band AGC processing that precedes the multi-band compressor. Full-scale is 25 dB gain reduction.

- **Gain Reduction** meters show the gain reduction in the Master and Bass bands of the two-band compressor when the 2300 is in audio processor mode. Full-scale is 25 dB gain reduction.

  When the 2300 is in stand-alone stereo encoder mode, these meters show the gain reduction in the left/right overshoot limiter meters. Full scale is 5 dB gain reduction. If the overshoot limiter is turned off, these meters will not illuminate.

- **Left/Right Output** meters operate only when the 2300 is in stand-alone stereo encoder mode. These meters use the same LED arrays as the HF ENHANCE and HF LIMITER meters.

The following meters and indicators do not operate when the 2300 is in stand-alone stereo encoder mode:

- **Gate** LED indicates gate activity, lighting when the input audio falls below the threshold set by the multiband gate threshold control (with the Full Modify screen's 2B GATE control). When this happens, the multiband compressor's recovery time slows drastically to prevent noise rush-up during low-level passages.

- **AGC** meters show the gain reduction in the Master and Bass bands of the slow two-band AGC processing that precedes the two-band compressor. Full-scale is 25 dB gain reduction.

- **HF Enhance** meter indicates the amount of HF boost provided by the dynamic, program-adaptive high frequency enhancer located in the Equalization section. Calibration is in relative units because the amount of enhancement (in dB) depends on frequency.

  When the 2300 is in stand-alone stereo encoder mode, this LED array is repurposed to indicate the peak left channel drive level to the stereo encoder modulator, which follows all lowpass filtering and overshoot limiting. It uses the same scale as the COMPOSITE meter.

- **HF Limiter** meter indicates the amount of HF limiting. Because the left and right HF limiters are independent, we have programmed this meter so that it reads the higher of the left and right gain reductions.

  When the 2300 is in stand-alone stereo encoder mode, this LED array is repurposed to indicate the right channel level.

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 2300 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 (by setting the AGC and Two-Band Compressor crossovers to LINEAR and operating with a slow release time and large amounts of bass coupling)
- open but more uniform in frequency balance (and often more dramatic) than the input (by setting the AGC and Two-Band Compressor crossovers to LINEAR and operating with a medium release time and small amounts of bass coupling)
- dense, quite squashed, and loud (by setting the AGC and Two-Band Compressor crossovers to ALLPASS and operating with a fast release time and no bass coupling).

  Note that even this setting will not be as loud as an Orban five-band FM processor like the 8300 or 8400.

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 Manage-

ment 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 essential. 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 2300 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 2300 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 2300 has excellent 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 2300's Signal Processing Features

Signal Flow

When the 2300's is in audio processor mode, the signal flows through the 2300 through the following blocks (see page 6-64):

- **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
- **Two-Band Compression** with embedded HF clipping and additional HF limiter
- **Distortion-Cancelled Clipping**
- **Overshoot Compensation**
- **DSP-derived Stereo Encoder** (stereo generator)
- **Composite Level Control Processor**

Input Conditioning: The 2300 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, preferable to higher rates as a basic sample rate for these devices. 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 2300's output spectral control is immaculate, ensuring maximum stereo and RDS coverage. Moreover, the 2300'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 2300 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 2300 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 2300'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 and 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 2300 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 two-band compressor to produce sound that is bright and present without being excessively shrill.

Two-Band Compression: The two-band compressor uses Orban's "master / bass" band coupling.

Pre-Emphasis Control: In addition to using an effective high-frequency limiter, we control high frequencies with distortion-canceled clipping. The clipper in the 2300 operates at 256 kHz-sample rate and is full anti-aliased.

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).

DSP-derived Stereo Encoder: The 2300's stereo encoder is derived from algorithms first developed for the high-performance Orban 8218 stand-alone encoder. The 2300'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 2300 has two independent composite outputs, whose levels are both software-settable. The second output can be configured to provide a 19 kHz-reference output for subcarrier generators that need it. For convenience, two SCA inputs sum into the 2300's analog composite output amplifier.

The 2300 does not digitize SCAs.

Composite Limiter/Clipper: 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 2300 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.

For those who prefer the sound of conventional composite clipping, we also offer a defeatable composite clipper, which is available only when the 2300 is in stand-alone stereo encoder mode. This also provides excellent spectral protection for the pilot tone and subcarriers. The composite clipper drives the "Half-Cosine Interpolation" composite limiter, which serves as an overshoot compensator for the compos-

ite clipper when it is active. (Overshoot compensation necessary to remove overshoots introduced by the pilot- and SCA-protection filters following the composite clipper.)

Like conventional composite clipping, the "Half-Cosine Interpolation" composite limiter 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 2300'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 2300's main clipping system to do the vast majority of the work because of its sophisticated distortion-controlling mechanisms. This means that the 2300 does *not* rely on composite processing to get loud. Consequently, broadcasters using its left/right-domain AES3 digital output can enjoy the loudness benefits of the 2300's processing—the 2300 gets competitively loud without composite clipping. However, it is also possible to reduce the drive level to the 2300's left/right domain overshoot compensators and to increase the composite limiter drive by a corresponding amount. This arrangement uses the overall composite limiter (with or without the composite clipper's being active) to provide overshoot compensation. It has a different sound than using the left/right domain overshoot compensators—the sound is brighter but has more aliasing distortion (as discussed above). If the composite clipper is active, stereo separation will decrease.

Stand-Alone Stereo Encoder Mode

When the 2300's is in stereo encoder mode, the signal flows through the 2300 through the following blocks:

- **Input Conditioning**, including sample rate conversion to 64 kHz, defeatable 15, 16, or 17 kHz lowpass filtering, and the requisite preemphasis and deemphasis filters to allow the 2300 to accept, flat, preemphasized, or flat+J17 preemphasized audio.
- **Left/Right Overshoot Limiter.** This is intended to remove overshoots in studio/transmitter links caused by lossy digital audio compression (like MP2) or by unflat frequency response and group delay distortion. This is a very fast limiter using look-ahead and anti-aliased clipper technology. We recommend using no more than 3 dB of gain reduction.

- **DSP-derived Core Stereo Encoder** (stereo generator)
- **Composite Limiter/Clipper**.

ITU-R BS412 Compliance

ITU-R BS412 requires the integrated multiplex power over a sliding 60-second window to be limited to a standard value. The 2300 contains a patented, defeatable feedback multiplex power limiter that constantly monitors the multiplex power according to ITU-R BS412 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 two-band compression. This action retains the processing texture but reduces distortion while controlling multiplex power.

The 2300 gives you control over the multiplex power threshold. This allows you to compensate for overshoots in the signal path upstream from the 2300, 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.

Two-Band Purist Processing

In addition to two-band presets that are suitable for pop music and talk formats, the 2300 offers very high-quality two-band presets. These are phase-linear.

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 2300's two-band phase-linear structure keeps the musical spectrum coherent and natural.

Customizing the 2300's Sound

The subjective setup controls on the 2300 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 2300 controls to suit your format, taste, and competitive situation.

When you start with one of our Factory Presets, there are three levels of subjective adjustment available to you to let you customize the Factory Preset to your requirements: Basic Modify, Full Modify, and Advanced Modify.

See page 6-64 for a block diagram of the processing.

Basic Modify

BASIC MODIFY allows you to control three important elements of 2300 processing: the stereo enhancer, the equalizer, and the dynamics section (two-band 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 2300'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 2300 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 2300, LESS-MORE affects only the dynamics processing (compression, limiting, and clipping)—the 2300's equalization and stereo enhancement are decoupled from LESS-MORE. You can therefore change EQ or stereo enhancement and not lose the ability to use LESS-MORE. When you create a user preset, the 2300 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 allows you to adjust the dynamics section at approximately the level of "full control" available in Orban's 2200 processor. Like the 2200's Full Control, the 2300's Full Modify can get inexperienced on-air sound designers into trouble by allowing them to create presets that sound good on some material while producing objectionable distortion on other material.

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. 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 controllable. Even more so than the controls in Full Modify, these controls can be exceedingly dangerous in inexperienced hands, leading you to create presets that sound great on some program material, yet fall apart embarrassingly on other material because of excessive clipping that causes objectionable distortion. 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.

If you are tuning a user preset from the front panel, note that the Advanced Controls are hidden by default and only appear if you press the SHOW ADVANCED button, located on the last page of the Modify pages. When you press this button, its functionality toggles so that it is labeled HIDE ADVANCED.

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.

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.)

To Create or Save a User Preset

Once you have edited a preset, you can save it as a user preset. The 2300 can store an indefinite number of user presets, limited only by available memory.

The 2300 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 2300 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 2300 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 2300 will give you an opportunity to choose a new name for the preset you are saving.

You can save user presets from the 2300 PC Remote application. (See *Using the 2300 PC Remote Control Software* on page 3-38.) Please note that when you save presets from the PC Remote application, you save them in the 2300's memory (as if you had saved them from the 2300'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. Ar-

chived presets reside on a storage medium supported by your computer, while saved presets reside in the 2300'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 3-41.)

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.

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 2300'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 2300'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 that follows.

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 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.

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 two-band 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 2300 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.

Except for the CLASSICAL presets, all presets use phase rotation to minimize clipping distortion and maximize loudness.

CLASSICAL: As their names imply, the CLASSICA and CLASSICAL+AGC presets are optimized for classical music, gracefully handling recordings with very wide dynamic range and sudden shifts in dynamics. These presets are phase-linear and preserve the spectral balance of the original material as much as possible.

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 2300's signal processing 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

FACTORY PROGRAMMING PRESETS	
Preset Names	**Normal Less-More**
CLASSICAL	7.0
CLASSICAL+AGC	7.0
GENERAL PURPOSE	7.0
TALK	7.0
MUSIC-LIGHT	7.0
MUSIC-MEDIUM	7.0
MUSIC-HEAVY	7.0
MUSIC+BASS MEDIUM	7.0
MUSIC+BASS HEAVY	7.0

Table 3-1: Factory Programming Presets

dB, while the dynamics of crescendos are maintained.

The CLASSICAL 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 is also appropriate for "colorless" protection limiting.

CLASSICAL+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 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 preset) that performs less gain reduction. You can create such a preset by modifying the CLASSICAL preset with the LESS-MORE control—turn it down to taste.

2B GENERAL PURPOSE provides an average amount of processing and is useful (although not necessarily optimum) for almost any format except fine arts and classical. It is particularly useful for mixed-format stations that do not wish to change presets when they change program material.

TALK provides processing for Talk format stations that primarily feature news, call-in shows, interviews, and other voice material. TALK keeps the levels of announcers and guests consistent, and keeps a proper balance between voice and commercials.

MUSIC-LIGHT produces a very open, unprocessed sound for popular music formats. This sound is easily listenable for many hours without fatiguing listeners. It is appropriate for light rock, smooth jazz and similar formats.

MUSIC-MEDIUM provides processing that is between Music-Light and Music-Heavy. It is appropriate for formats like adult-oriented rock.

MUSIC-HEAVY provides aggressive processing for stations that want to maximize on-air loudness and that do not assume that a listener will listen to the station for hours at a time. It is appropriate for "contemporary hit radio" and similar formats.

MUSIC+BASS MEDIUM produces a very punchy, clean, open sound. It is appropriate for light urban and R&B formats.

MUSIC+BASS HEAVY provides aggressive processing with additional bass punch. It is appropriate for urban, rap, and contemporary hit radio formats.

The 2300's Audio Processing Controls Described

If you want to create your own User Presets, the following detailed discussion 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 2300.

Each 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. See *Customizing the 2300's Sound* on page 3-10 for a more detailed discussion of the various modification levels.

Equalizer Controls

The table summarizes the equalization controls. 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 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 HF Enhancer often increases the brightness of program material, some bass boost is usually desirable to keep the sound spectrally well balanced. Bass equalization settings 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 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 parametric equalizer whose bell-shaped boost and cut curves closely emulate those of a classic Orban analog parametric equalizer with conventional (within ±0.15 dB worst-case). This provides warm,

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
HF Enhancer	HF ENH	High Frequency Enhancer	0 … 15
HP Filter	30HZ HPF	30 Hz High Pass Filter	Off/On
Phase Rotate	PH-ROTATE	Phase Rotator	Out/In

Table 3-2: Equalizer Controls

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 2300'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 2300's curves are not distorted at high frequencies.

Midrange Parametric Equalizer is a parametric equalizer whose bell-shaped boost and cut curves closely emulate those of an analog parametric equalizer.

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.

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.

High Frequency Parametric Equalizer is a parametric equalizer whose bell-shaped boost and cut curves closely emulate those of an analog parametric equalizer.

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.

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") 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 2300's back end processing.

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.

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

- 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 page has the following controls:

ENH AMT ("Stereo Enhancer Amount") 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.

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 2300 conservatively and not attempting to achieve very high on-air loudness.

AGC Controls

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.

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 screens 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 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.

To do this, set EXTERNAL AGC to ON.)

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 2300 is the sum of the gain reduction in the AGC and the gain reduction in the two-band 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 TWO-BAND 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 two-band 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.

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	0-100 %
WIN. SIZE	AGC Window Size	–25 … 0 dB
WIN. REL	AGC Window Release	0.5 … 20 dB
AGC RATIO	AGC Ratio	∞:1, 4:1, 3:1, 2:1
AGC B-THR	AGC Bass Threshold	–12.0 … 2.5 dB
IDLE GAIN	AGC Idle Gain	–10 … +10 dB
AGC B-ATK	AGC Bass Attack	1 … 10
AGC M-ATK	AGC Master Attack	0.2 … 6
AGC B-REL	AGC Bass Release	1 … 10 dB / sec
AGC XOVER	AGC Crossover	Allpass, LinearNoDelay, Linear

Table 3-4: AGC Controls

- Moderate AGC + moderate compression gives a more dense sound, particularly as the release time of the two-band compressor is sped up.
- Moderate AGC + heavy compression (particularly with a FAST two-band 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 Two-Band 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 two-band compressor to gate, effectively freezing gain to prevent noise breathing.

There are two independent gating circuits in the 2300. The first affects the **AGC** and the second affects the **two-band compressor**. Each has its own threshold control.

The two-band compressor gate causes the gain reduction in bands 2 and 3 of the two-band 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 two-band 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 sets the balance provided in the AGC between bass and the rest of the frequency spectrum.

The AGC processes audio in a master band for all audio above approximately 200Hz, and a bass band for audio below approximately 200Hz. The AGC B 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 AGC B CPL control at 100% will sometimes cause bass loss, setting this control between 70% and 90% will often create the most accurate frequency balance. The optimal setting depends on the amount of gain reduction applied and on the AGC release time. Usually, you will adjust the AGC B CPL control until the Master AGC and Bass AGC Gain Reduction meters track as closely as possible unless you want the AGC to provide some gentle automatic re-equalization of the input material.

With the AGC MASTER RELEASE control set to 2 dB/second, setting the AGC B 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 AGC B CPL toward 100% (wideband) do not sound good. Instead, set the AGC B 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.

Advanced AGC Controls

WIN SIZE ("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.

WIN. REL ("AGC Window Release"; see AGC WINDOW SIZE above.)

AGC RATIO determines the compression ratio of the AGC. The compression ratio is the ratio between the change in input level and the resulting change in output level, both measured in units of dB.

Previous Orban AGCs had compression ratios very close to ∞:1, which produces the most consistent and uniform sound. However, the 2300 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 B-THR ("AGC Bass Threshold") determines the compression threshold of the bass band in the AGC. You can use it 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.

IDLE GAIN. ("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 B-ATK ("AGC Bass Attack") sets the attack time of the AGC bass compressor (below 200Hz).

AGC M-ATK ("AGC Master Attack") sets the attack time of the AGC master compressor (above 200Hz).

AGC B-REL ("AGC Bass Release") sets the release time of the AGC bass compressor.

AGC XOVER ("AGC Crossover") allows you to choose ALLPASS, LINEARNODELAY, or LINEAR modes.

- **ALLPASS** is a phase-rotating crossover like the one used in the Optimod-FM 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.

  ALLPASS has a smooth, shelving behavior and low delay. Its allpass characteristic complements the existing phase rotator that reduces voice distortion. If you set the 2B CROSSOVER control to ALLPASS, please note that there is little or nothing to be gained by using a phase-linear crossover in the 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.

  This crossover adds no extra delay to the signal path. LINEARNODELAY is thus 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.

  While LINEAR 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

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.

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 after the bass band in the two-band 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 2300 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.

SP B-CL THR ("Speech Bass Clip Threshold") set the threshold of the bass clipper when the 2300 detects the presence of pure speech (i.e., speech centered in the stereo soundstage and without any significant background sounds). The control is usually set to "0" to prevent the bass clipper from adding distortion on speech.

2B CLIP ("2B Clipping") 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.

SP 2B CL ("Speech 2B Clipping") has the same function as the 2B CLIP control, except that the 2300 uses the setting of this control instead of the 2B CLIP control whenever the 2300 detects the presence of speech. It is usually set substantially lower than the 2B CLIP control to reduce clipping distortion on speech.

B-CL 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."

2B HF 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. The setting of this control is quite critical to prevent objectionable distortion on program elements like bell trees and metallic percussion.

> The relationship and interaction between 2B CLIP, 2B HIGH FREQUENCY LIMITING, 2B 6-15 kHz FREQUENCY LIMITER, and 2B HIGH FREQUENCY CLIP THRESHOLD is complicated and is best appreciated by listening and experimenting:

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

Clipper Controls		
Full Modify Name	**Advanced Name**	**Range**
BASS CLIP	Bass Clip Threshold	–6.0 … 0.00
B-CLIP SHP	Bass Clip Shape	0 … 10
SP B-C THR	Speech Bass Clip Thresh	–6.0 … 0.00
2B CLIP	2B Clipping	–4 … +5
SP 2B CLIP	Speech 2B Clipping	–4 … +5
HF CLIP	High Frequency Clipping	–30 … –10 dB
FINAL CLIP	Final Clip Drive	–3.0 … +5.0
MPX LIMIT	Composite Limiter Drive	Off, 0 ... 3 dB
OSHOOT COMP	Overshoot Compensator Drive	–2.0 … +2.0

Table 3-5: Clipper Controls

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 TWO-BAND DRIVE control is advanced. The FINAL CLIP DRIVE and / or the 2B CLIP 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 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 2B MASTER COMPRESSION THRESHOLD, 2B BASS COMPRESSION THRESHOLD, 2B CLIP, BASS CLIP THRESHOLD, and FINAL CLIP 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.

MPX LIMIT ("Composite Limiter Drive") sets the drive level, in dB, into the 2300's composite limiter.

This control has no effect on the 2300's left and right analog or digital outputs.

> The MPX LIMIT 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. 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 MPX LIMIT control setting proportionately.

OSHOOT COMP ("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 is not distortion-canceled because distortion cancellation introduces overshoots, which would defeat the purpose of this processing. Therefore, 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.

MPX POWER OFFSET operates only when the ITU-412 multiplex power controller is activated (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.

Two-Band Controls

The tables below show a summary of the controls in the two-band compressor section.

2B DRIVE control adjusts signal level going into the two-band compressor. It 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 two-band-induced density gently increases between 0 and 10 dB of compression, 10 dB of compression 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

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 %
HF LIMIT	2B High Frequency Limiting	–4.0 … +2.0
6K+HF LIM	2B 6-15kHz HF Limiter	Off, –23.8 ... 0.0 dB
PARENT PRESET		[read-only]
LESS-MORE	Less-More Index	[read-only]; 1.0 … 10.0
2B M-THR	2B Master Compression Threshold	–15 … 0, Off
2B B-THR	2B Bass Compression Threshold	-10.0 … 5.0 dB, Off
2B M-ATK	2B Master Attack	4 … 50, Off
2B B-ATK	2B Bass Attack	4 … 50, Off
2B XOVER	2B Crossover	Allpass, LinearNoDelay, Linear

Table 3-6: Two-Band Controls

slower release times for more conservative, adult-oriented formats (particularly if women are an important part of your target audience).

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 it may unnaturally increase the level of quiet passages in input material with wide dynamic range. 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 2300 Two-Band structure. The first affects the *AGC* and the second affects the *two-band compressor*. Each has its own threshold control. However, only the action of the two-band gate can be seen on the 2300's front-panel GATE LED.

> The 2300 PC Remote application displays the actions of both the AGC gate and the two-band gate.

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 2300. 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.

HF LIMIT ("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).

PARENT PRESET and **LESS-MORE INDEX** are read-only fields.

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.

Advanced Two-Band Controls

2B M-THR ("2B Master Compression Threshold") sets the level where gain reduction starts to occur in the Master (above 200Hz) band of the Two-Band Compressor.

Because the 2B CLIP control also affects this threshold, it is usually unwise to adjust the 2B MASTER COMPRESSION THRESHOLD control away from the setting provided in the parent factory preset. Instead, use the 2B CLIP control to adjust the loudness / distortion tradeoff. The 2B CLIP control also affects the threshold of the bass compressor, so adjusting the 2B CLIP control allows you to affect the loudness / distortion tradeoff without changing the spectral balance between the master and bass bands.

The only situation where you might wish to adjust the 2B MASTER COMPRESSION THRESHOLD is if you have readjusted the 2B MASTER ATTACK control and this has caused the average master gain reduction to change. The 2B MASTER ATTACK control can then be adjusted to restore the original amount of average master gain reduction.

2B B-THR ("2B Bass Compression 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. Setting it to more positive numbers increases bass.

As the Two-Band Compressor BASS CPL control is moved towards "100%," the 2B BASS THRESHOLD control has progressively less effect on the sound.

2B M-ATK ("2B Master Attack") sets the attack time of the Two-Band Compressor master compressor (above 200Hz).

2B B-ATK ("2B Bass Attack") sets the attack time of the Two-Band Compressor bass compressor (below 200Hz).

6K+HF LIM ("2B 6-15 kHz HF 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.

2B CROSSOVER sets the structure of the two-band crossover to Linear, Linear with No Delay, or Allpass. See AGC CROSSOVER on page 3-25 for more information about these modes.

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 3-10 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 19 on page 2-22). Set it OFF if your country does not enforce the standard.

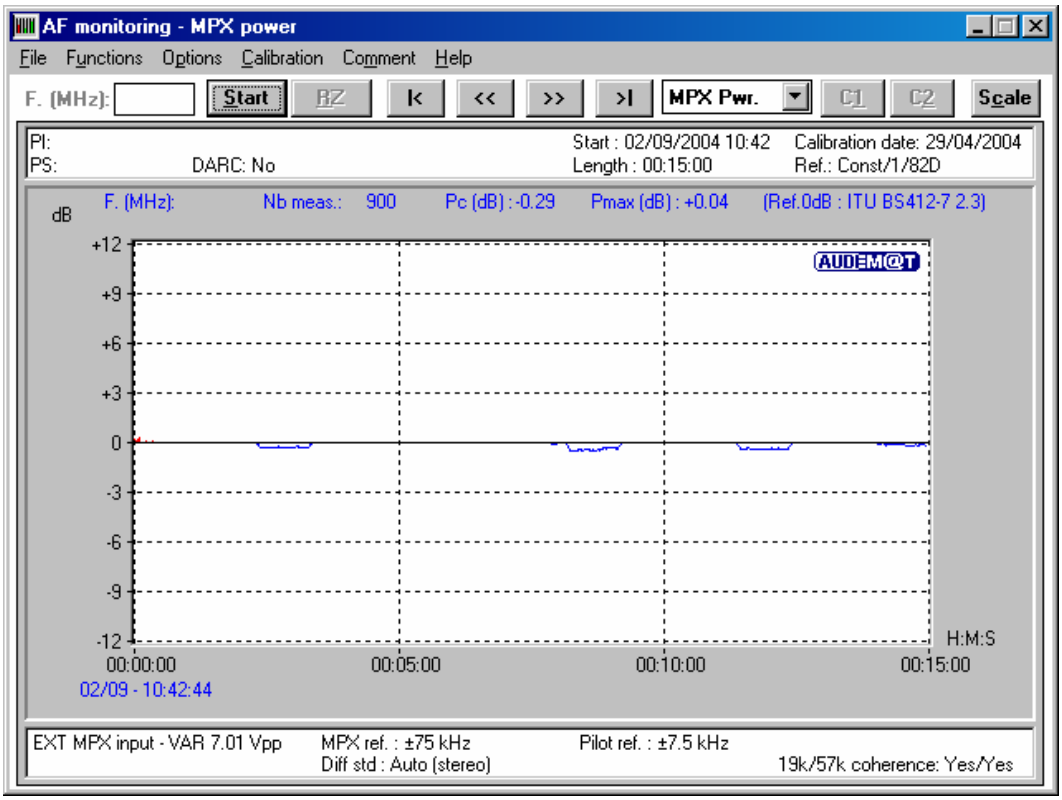


Figure 3-1: Multiplex Power over 15 Minute Observation Interval
with MPX Power Controller Active, measured at Optimod's Composite Output

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 2300. 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, and this forces you to reduce the average modulation to avoid overmodulating the transmitter. This would 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 2300. For example, if RF peak deviation exceeds the peak deviation produced by the 2300's sinewave oscillator (set for 100% modulation) 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 2300 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 3-29.

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 2300'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%.)

Multiplex Power Control in Stand-Alone Stereo Encoder Mode

When you use the 2300 in stand-alone stereo encoder mode, we recommend setting up your transmission system to produce approximately 3 dB of average MPX power control. This avoids unnatural loudness variations.

To achieve this goal when an Optimod-FM drives the 2300 stereo encoder, reduce the drive into the Optimod's peak limiters by turning down the MULTIBAND CLIPPING control in the on-air preset until the MPX Power gain reduction meter on the 2300 indicates an average of 3 dB of gain reduction. Save the result as a User Preset.

Do not reduce the drive level to the 2300 by turning down the driving Optimod's output level control because this does not decrease distortion in the Optimod's peak limiter, unlike turning down the MULTIBAND CLIPPING control.

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 3-7: Test Modes on page 3-36 shows the facilities available, which should be self-explanatory.

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 3-7: Test Modes

Getting the Bass Sound You Want

Probably the most frequently asked question we get regarding FM audio processor setup is "How do I get a (such-and-such) bass sound?" It seems that individual preference varies in this area more than it does anywhere else.

There are no magic formulas. The 2300 has 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 effusive bass, it is going to 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, the distortion occurring when the bass waveforms push the midrange and high frequency material into the 2300's final clipper.

There is one psychoacoustic trick you can exploit to create more apparent bass while efficiently using modulation headroom. 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 2300, you can use the bass clipper to make harmonic distortion for this purpose. (The B-CL SHAPE control determines the shape of the harmonic spectrum that is introduced by this gambit.)

Further, the bass clipper 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 flattop. (The fundamental of a square wave has a peak level 2.1 dB higher than the peak level of the square wave.) Bass fundamentals can thus exceed 100% modulation even if the composite stereo waveform does not exceed this level.

The attack time of the bass two-band compressor also affects bass punch by determining the amount of bass transient that is allowed to pass through the compressor before the attack clamps down on the rest of the waveform. Any transient that passes through the bass two-band 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). The 2B BASS ATTACK TIME settings in the factory presets have been adjusted with this tradeoff in mind, but you might like to make a different one. Further, the SPEECH BASS CLIPPER THRESHOLD control exploits the 2300's speech / music detector to allow the bass clipper threshold to be raised during speech, minimizing clipper-induced speech distortion.

The threshold of the bass two-band compressor also affects bass punch. We recommend that you carefully study the setting of this control (and the 2B BASS ATTACK TIME control) in the various 2300 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 CLIP 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.

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 fixed tone controls that apply coloration equally to all program material going into the main dynamics processing section of the 2300. (They do not affect the AGC section because they are located after it in the signal flow.) Accordingly, the two-band compressor in the 2300 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 2300, it is usually necessary to apply substantial bass boost to the input by using the equalizer con-

trols. (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 loudness because the master compressor will be forced to produce additional gain reduction.

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 mastering engineers, who make these trade-offs every day, have mastered these CDs.

The 2300 provides considerable 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 a 2300 bass expert.

Using the 2300 PC Remote Control Software

2300 PC Remote control software allows you to access any front-panel 2300 control. 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 2300.

The 2300 PC Remote software can connect to your 2300 via modem, direct serial cable connection, or Ethernet network. It communicates with your 2300 via the TCP/IP protocol, regardless of how it is connected to your 2300.

> PC Remote works best on displays of 1024x768 pel or higher. Scroll bars will appear when using lower resolutions.

Before running 2300 PC Remote, you must have installed the appropriate Windows communications services on your computer. By default, the installer installs a shortcut to `2300_PC.exe` on your desktop and in your Start Menu under Orban\Optimod 2300.

2300 PC Remote can control only one 2300 at a time, but it can readily switch between several 2300s. 2300 PC Remote has a built-in "address book" that allows it to select and connect to:

- any 2300 on the same network as the PC,
- an 2300 that can be accessed through a modem connected to the PC via dial-up networking, and,
- any 2300 that is connected directly to one of your PC's serial ports.

Before your PC can communicate with a given 2300, you must first set up a "connection," which is information that allows PC Remote to locate and communicate with the 2300.

To set up a new connection:

A) Launch `2300_PC.exe`.

B) Create a new 2300 connection by choosing NEW 2300 from the CONNECT file menu or by right-clicking on the ALL CONNECTIONS icon in the Connections List and selecting NEW 2300.

The Connection Properties dialog box opens.

C) Enter an Alias name for your 2300 (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 2-37.

Otherwise, enter a password to allow PC Remote to connect to your 2300 without requiring a password when the connection is initiated.

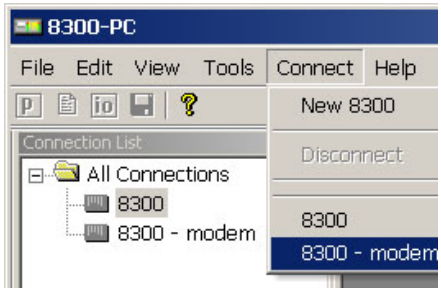
> To ensure a successful connection, a password must have already been entered into your 2300 unit.

E) If you are communicating with your 2300 through a network, select the Ethernet radio button and enter the appropriate IP address, subnet mask, port, and gateway data. These must agree with the values you set in step 1 on page 2-42. See also *Setting Up Ethernet, LAN, and VPN Connections* on page 2-50.

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 2-51.

F) Click OK after entering all required information.

To initiate communication:



Initiate communication by double-clicking on the desired 2300 alias in the Connections List, or by selecting the desired 2300 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 2300…" go to your 2300 unit and enter a passcode.
- If an Enter Passcode dialog box appears, enter a valid passcode and the 2300 PC Remote software will initiate a connection to the 2300 unit.

A window will appear saying, "Connecting to the 2300, 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 2300 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 2300. 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 (coded green) for Less-More, Stereo Enhancer, and EQ to access Basic Modify controls. All other menu tabs (coded red) 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.

Repeatedly 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 2300's memory each time 2300 PC Remote connects to that 2300. The 2300's memory is the "master." This means that if you delete a user preset from the 2300's memory (whether locally via its front panel or via 2300 PC Remote), 2300 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- 41.)

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 2300 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"). 2300 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, 2300 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 2300 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 assigned, 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 2300 user presets (*.orb23user), system files (*.orb23setup), and automation files (*.orb23autom).

If you want to restore files from a different directory (i.e., that might have been created on a different 2300), 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 (*.orb23user, *.orbu).

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 (*.orb23user, *.orbu)

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 (*.orb23setup).

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 (*.orb23autom)

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 2300s:

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 2300 to which 2300 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 2300s:

Right-click ALL CONNECTIONS in the Connections List and select NEW GROUP.

You can add multiple 2300 to a single group to help organize a network of 2300. However, only one 2300 from within a group can be connected to 2300 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 2300's front panel. If you then select that button, the ppp connection will close.

  This behavior ensures that a user can tell from the 2300's front panel if a remote connection is active. A user can disconnect the PC connection at the 2300 if he or she wishes. This minimizes the likelihood of someone's leaving a connection open while someone else tries to access that 2300.

About Aliases created by Optimod 2300 PC Remote Software

When you ADD A NEW 2300 using Optimod 2300 PC Remote, your 2300 is automatically given a 2300 Alias name to differentiate it from other 2300s. You can change the name anytime in the 2300 Properties window inside 2300 PC Remote.

When you add a new 2300 or change the name of an existing 2300 Alias, an Alias folder is created in the same location as the executable for Optimod 2300 PC Remote (usually \Program Files\Orban\Optimod 2300). The folder has the same name as the Alias name. Once you establish the initial connection to the 2300, all presets for that 2300 are automatically copied to the Alias folder; thus, the folder contains all the preset files for that 2300, both Factory and User. If you have backed up the 2300 using 2300 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 previ-

ous location and restore their contents by copying it from their associated 2300s when 2300 PC Remote connects to such a 2300.

Multiple Installations of Optimod 2300 PC Remote

Rarely, you may want to have more than one installation of 2300 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 2300 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 2300 PC Remote must match the version of the software in the 2300 controlled by it. Therefore, you will only need multiple installations of PC Remote (having separate version numbers) if:

- you are controlling multiple 2300s, and
- not all of your 2300s are running the same version of 2300 software, and
- you do not want to upgrade at least one controlled 2300 to the latest version of 2300 PC Remote software.

Each version of 2300 PC Remote has its own top-level folder, normally under \Program Files\Orban. (The default folder is \Program Files\Orban\Optimod 2300.) When you install a new version of 2300 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 2300v2).

Each version of 2300 PC Remote will display *all* 2300 Aliases, even those pointing to 2300s with incompatible version numbers. If you attempt to connect to an older version of 2300 from a newer version of 2300 PC Remote, 2300 PC Remote will offer to upgrade the software in the target 2300 so that the software corresponds to the version of 2300 PC Remote that is active. If you attempt to connect to newer version of 2300 from an older version of 2300 PC Remote, it will refuse to connect and will emit an error message regarding incompatible versions.

To Move Alias Folders:

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.

Even though each version of 2300 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 2300 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 re-created under the Optimod 2300 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 2300 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 2300 PC Remote executable.

- **Delete and Recreate the Alias:** Start the Optimod 2300 PC Remote executable you wish to use. Delete the old 2300 Aliases and create new ones to replace them. New Alias folders will be created in the same location as the Optimod 2300 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.

Section 4
Maintenance

Routine Maintenance

The 2300 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 2300's output.**

   A good ear will pick up many faults. Familiarize yourself with the “sound” of the 2300 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 2300 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 2300 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 2300 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 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 four cables that connect the display board assembly to the base board. Note the lead dress so you can reassemble the unit correctly.

B) Detach the front panel from the unit.

a) On each side of the chassis, remove the three screws close to the front panel.

b) Remove the front panel by sliding it out.

C) Set the front panel, face down, on a soft cloth to prevent scratches.

D) Using a 3/16-inch hex nut driver, remove the four hex nuts holding the two side brackets and central shield to the front panel. Remove the brackets and shield and set them aside.

E) Using a #1 Philips screwdriver, remove and reserve the eight screws and spacers that fasten the display board assembly to the front panel.

F) Lift the display board assembly off its supporting standoffs.

G) Separate the two boards in the display board assembly by carefully unplugging the top board from the bottom board. Note that there are four plugs and jacks.

3. Removing the 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 3.C), 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 (step 3 on page 4-2).

F) If you have not yet done so, remove the RS-232 interface assembly from the base board.

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) Disconnect the ribbon cable connecting the power supply to the base 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. 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 cables 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 front panel, face down, on a soft cloth to prevent scratches.

B) Lightly reattach the bottom and top circuit boards by mating the four plugs and jacks. Use care to align the pins with the jacks so that all pins are correctly aligned and no pins are bent. Do not push the pins all the way into the jacks yet; leave room between the upper and lower boards for spacers.

C) Reattach the board assembly to the front panel using the eight #1 Philips-head screws and spacers removed in step (2.E) on page 4-2:

a) Thread each screw through a spacer placed between the upper and lower circuit boards.

b) Push down the top board until it rests on the spacers.

c) Align the screws with the threaded standoffs on the front panel.

d) Evenly tighten all eight screws to reattach the board assembly to the panel.

D) Place the two side brackets over the captive screws located on each side of the front panel. Be sure that the large side of each bracket is oriented toward the rack-screw cutouts in the panel.

E) Place the metal shield over the captive screws on each side of the front panel. Align the shield so that its cutouts are aligned with the cables attached to the

circuit board assembly. Using a 3/16" nut driver, screw four hex nuts onto the captive screws.

F) Attach the front panel assembly to the unit:

a) Verify that all cables are dressed through cutouts in the shield.

b) Slide the front panel assembly into the front of the chassis so that the three threaded holes in the side brackets line up with the holes in the sides of the chassis.

c) Attack the front panel assembly by screwing the six screws removed in step 2.B)a) on page 4-2 into the holes in the sides of the chassis.

G) Reattach the four cables that connect the display board to the base board. Each cable has a different type or size of connector, so it is obvious which cable mates with which jack on the base board.

Carefully align the cables and connectors to avoid bending the pins.

14. Replacing the Top Cover:

Place the top on unit and reattach the 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 5M Hz 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 2300'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 2300 at most frequencies. However, in an emergency it is usually possible to detect many of the more severe faults that could develop in the 2300 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 2300'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 in the table below:

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

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

Number of Red Flashes	Problem With
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 2300 software controls are set to their default settings. [Refer to step (1.B) on page 4-7.]

B) Feed the 2300 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 2300 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 2300'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 2300 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 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 2300 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 2300.

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 2300.

6. Test Digital Sample Rate Converter (Receiver).

A) Verify 2300 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 2300.

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 2300 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 2300.

7. Test Digital Sample Rate Converter (Transmitter).

A) Connect an AES3 analyzer (like the Audio Precision System 2) to the 2300'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 2300's AES3 output follow the values in the chart below within given tolerances:

Sample Rate	Tolerance (PPM)	Tolerance (Hz)
32.0 kHz	100 PPM	±1.60 Hz
44.1 kHz	100 PPM	±4.41 Hz
48.0 kHz	100 PPM	±2.40 Hz
88.2 kHz	100 PPM	±8.82 Hz
96.0 kHz	100 PPM	±4.80 Hz

E) Disconnect the digital source generator from the 2300.

8. Test the 2300's stereo encoder.

A) Connect an accurate stereo monitor like the Belar FMMS-1 ("Wizard") stereo demodulator to the 2300's COMPOSITE OUTPUT 1.

This is labeled COMPOSITE OUT and appears on a BNC connector on the 2300's rear panel.

> **NOTE:** The recommended Belar monitor is the only instrument we have encountered that can accurately measure the performance of the 2300's stereo encoder. With most older-technology monitors, you will be measuring the performance of the monitor, not the 2300's encoder. (Of course, we have not evaluated every monitor on the market.)

B) On the 2300, 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 2300'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 –55 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 –55 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 2300'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 2300.

Q) With the COMP2 LVL still set to 0.0%, connect a frequency counter to either of the 2300'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 2-41.

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 2-42 (in particular, step 4 on page 2-44).

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 2300, 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 2300 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 2300 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 19 on page 2-22.

The 2300 may be in stand-alone stereo encoder mode. This is determined by the on-air preset.

Poor Peak Modulation Control

The 2300 ordinarily controls peak modulation to an accuracy of ±2%. This accuracy will be destroyed if the signal path following the 2300 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 cause falsely high modulation readings).

Verify that the source material at the 2300'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 2B 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 preset. Further, some of the louder 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.

Also, note that the 2300 is not capable of as favorable an on-air loudness/distortion tradeoff as Orban's five-band processors. If you attempt to increase loudness to compete with one of these five-band processors, you will get higher distortion than that produced by the five-band processing.

If you are using analog inputs, the peak input level must not exceed +27 dBu or the 2300'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 2300 has higher dynamic range than older designs. Therefore, without compromising the 2300's noise level, we could eliminate a control that was frequently misadjusted.

If you are using the 2300'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 2300's AGC. In this case, reduce the setting of the AGC's MAXDELTAGR controls.

If you are using an external processor ahead of the 2300, be sure it is not clipping or otherwise causing problems.

If the 2300 is in stand-alone stereo encoder mode, you may be overdriving its left/right protection limiter and/or composite limiter. It is unwise to do more than 3 dB of gain reduction in the protection limiter or to set the COMPOSITE LIMIT DRIVE control higher than 1.0 DB. See *Setup for Stand-Alone Stereo Encoder Mode* on page 2-24.

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 2300 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 2300. The first affects the AGC and the second affects the Two-band Compressor. Each has its own threshold control. (See 2B GATE on page 3-31.)

If you are using the 2300'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 2300 to digitize the input. (This ratio is better than 108 dB.) It is important to drive the 2300 with professional levels (more than 0 dBu reference level) to achieve adequately low noise. (Clipping occurs at +27 dBu.)

The 2300'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 2300'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 2300, the STL's noise level can severely limit the overall noise performance of the system because compression in the 2300 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 2300 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 2300 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 2300'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 2300's composite output and the transmitter has sufficient headroom.

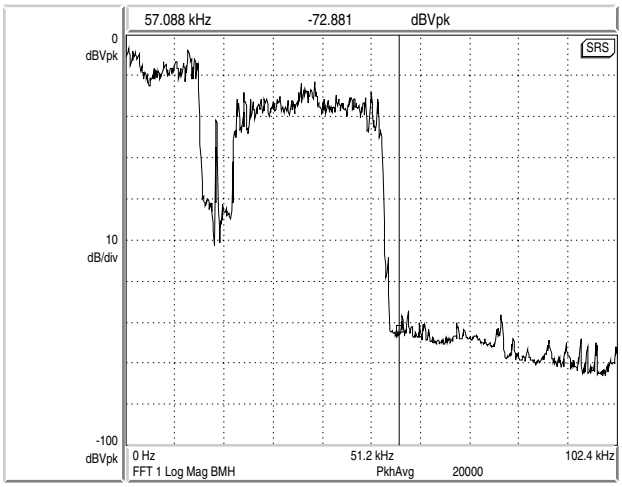


Fig. 5-1: Typical 2300 baseband spectrum with heavy processing, 0-100 kHz.

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.

If the 2300 is in stand-alone stereo generator mode, it is easy to accidentally drive its internal processing into clipping by applying too much level to the input while relying on the overshoot limiter and/or composite limiter to limit modulation to 100%. In addition, if the input signal has not been band-limited to 19 kHz or less, this can cause aliasing between the stereo main and subchannels. You can eliminate this aliasing (at the cost of overshoot, which the 2300's overshoot limiter can remove) by activating the input lowpass filter (step 5 on page 2-25).

See *Setup for Stand-Alone Stereo Encoder Mode* on page 2-24.

Shrill, Harsh Sound

Excess HF boost in the HF parametric equalizer or the HF Enhancer can cause this.

If you are driving an external stereo encoder with built-in pre-emphasis, you must set the 2300'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 2300 to perform these functions without overshoot. Section 1 of this manual contains a detailed explanation of these, and other, system design considerations.

Dull Sound

Because processing is two-band, it has less ability to automatically re-equalize such material than the five-band processing available in products like Optimod-FM 8400. However, when properly adjusted, the HF Enhancer will usually do a good job of re-equalizing such material.

If the 2300's output is set to Flat in System Setup / Output, there will be no pre-emphasis unless it is supplied elsewhere 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 2300 can generate test tones itself. The 2300 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 3-34.)

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 2300, or the 2300 should be temporarily switched to BYPASS to pass the tones.

System Receiving 2300's Digital Output Will Not Lock

Be sure that the 2300's output sample rate is set match the sample rate that the driven system expects. Be sure that the 2300'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 2300'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 2300 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.

Of course, the 2300 will not be as competitive as one of Orban's five-band processors like the 8400 or 8300. However, if your radio station does not seem to be competitive with others in your market using the 2300's class of processing, the cause is usually source material (including excess use of lossy digital compression), overshoot in the transmission link (including the FM exciter) following the 2300, 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 2-40.

Connection Issues between the 2300 and a PC, Modem, or Network

- **User Interface Slowdown**: The more user presets you make, the more slowly the 2300 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 2300 while the modem is connected or attempting to connect.

- **Security Passcode**: An ALL SCREENS (administrator) security passcode is required for upgrading, regardless of whether you are using a Direct, Modem, or Ethernet connection.

- **Passcode Format**: The passcode is case-sensitive. When entering it into Windows' Dial-up Connection dialog box, it must be typed exactly as it was originally entered into the Security screen.

- **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 2300. 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- 51.

- 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 2300'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 2300, 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 2300 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 2300:

If you are connected to the 2300 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 2300 unit's IP address. This means that all existing network connections point to the 2300 unit. To correct this:

A) In Start / Settings / Network and Dialup Connections, open the direct or modem connection you are using to connect to 2300.

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 2300 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 2300 - Direct" and choose "Properties."

C) The "Properties" window opens for "Optimod 2300 - 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 2300.)

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 2300 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 2300 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 2300 is correct:

a) On the 2300, 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 2300 - Modem" and choose "Properties."

C) The "Properties" window opens for "Optimod 2300 – 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 2300.

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 2300 - Direct" and choose "Properties."

C) The "Properties" window opens for "Optimod 2300 - 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 2300 – 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 2300.

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 2300 - Modem" and choose "Properties."

The "Properties" window opens for "Optimod 2300 - 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 2300.

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 2300'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. See http://www.orban.com/contact/ for contact information. Be prepared to describe the problem accurately. Know the serial number of your 2300 — this is printed on the rear panel of the unit.

Please check Orban's website, www.orban.com, for Frequently Asked Questions and other technical tips about 2300 that we may post from time to time. Manuals (in .pdf form) and 2300 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.

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 2300 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.

Input/Output Delay: Approximately 3 ms (audio processor mode or stereo generator mode with L/R overshoot limiter defeated; 7ms (stereo generator mode with L/R overshoot limiter active).

Installation

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 2300 then decimates to 32 kHz in DSP using an ultra-high-quality image-free synchronous sample rate converter.

Filtering: RFI filtered, with high-pass filter at 0.15 Hz (–3 dB).

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.

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.

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.

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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.

Digital Audio Output

Configuration: Stereo per AES3 standard. Output 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 2300 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 2300 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 1.875" x 14.25" / 48.3 cm x 4.8 cm x 36.2 cm. One rack unit high.

Humidity: 0–95% RH, non-condensing.

RFI / EMI: Tested according to Cenelec procedures. FCC Part 15 Class A device.

Shipping Weight: 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 2300. 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 2300 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 2300 system.

The Input Circuits include the connectors and RF filtering for the analog and digital audio inputs, the digital sync input, and the circuitry to interface these inputs to the digital processing.

The Output Circuits include the connectors and RF filtering for the analog and digital audio outputs, and the circuitry to interface the digital processing to these outputs.

The DSP Circuits implement the bypass, test tone, and audio processing using digital signal processing.

The Power Supply provides power for all 2300 circuit sections.

A block diagram of the DSP signal processing appears on page 6-64.

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 ISA 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 2300 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 2300's automation functions. The real-time clock is backed up by a DL2032 battery so that it keeps accurate time even when the 2300 is powered down. The battery is socketed and can be readily accessed by removing the 2300'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 2300'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 2300. 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 2300 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 2300 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 2300 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 ISA bus, which is buffered via IC3.

3. LED Meter Circuits

Located on display board

The meter LEDs are arranged in an 8x16 matrix, in rows and columns.

Each row of LEDs in the matrix has a 1 / 8 duty cycle ON time. The rows are multiplexed at a fast rate so that the meters appear continuously illuminated. Via the ISA 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 that has an adjustable (digitally controlled) gain. Analog switches set the gain. The outputs of a latch set the state of the switches. By writing data to the latch, the control circuits set the gain to correspond to what the user specifies via the front panel controls. The gain 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) con-

verter 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 2300'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 2300 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 balanced 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 2300 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 the entire composite signal, attenuating the SCA and stereo signals to the same extent.

The second SCA input can be jumpered to serve instead as a pilot reference source for RDS generators.

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. IC203B is a servo amplifier to remove DC offset at the output of IC302A. IC401a 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 2300, because this meter indicates only the composite signal generated by the DSP.

Digitally controlled attenuator IC402B receives the output of IC401A and sets the composite output level. IC3B, a 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 six 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 six DSP chips, each operating at approximately 100 million instructions per second (MIPS), for a total of 600 MIPS, 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 2300 and can occur abnormally if the 2300'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. U701 and U702 are local voltage regulators on the DSP board that derive the +3.3V supply for the DSP chips from the system digital 5V bus.

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 2300. 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 2300. See step (2.B) on page 4-9.

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 2300 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 2300 (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 2300	
44094.100.01	FIRMWARE 2300 U6 20LV8D	
62200.000.02	SCHEMATIC, CONTROL MODULE 2300	

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 1 / 4	
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, 1 / 4W, 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,	J3

PART #	DESCRIPTION	COMPONENT IDENTIFIER
	PCMOUNT	
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, 1 / 2 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 2300	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
20129.768.01	RESISTOR, 1 / 8W, 1%, 768 OHM, 0805	R111, R126

PART #	*DESCRIPTION*	*COMPONENT IDENTIFIER*
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
21145.000.01	CAPACITOR, NPO, 5%, 100V, 33pF-1206	C231, C335, C351, C406

PART #	*DESCRIPTION*	*COMPONENT IDENTIFIER*
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
27147.008.01	IC, SOCKET, DIP, 8-PINS, DUAL	IC100, IC102, IC207, IC208, IC1, IC2, IC3

PART #	DESCRIPTION	COMPONENT IDENTIFIER
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 2300	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
21137.282.01	CAPACITOR, 8200pF, ±15%, 1206, 50V	C101, C103, C105, C107, C109, C111, C113, C115

PART #	*DESCRIPTION*	*COMPONENT IDENTIFIER*
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
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

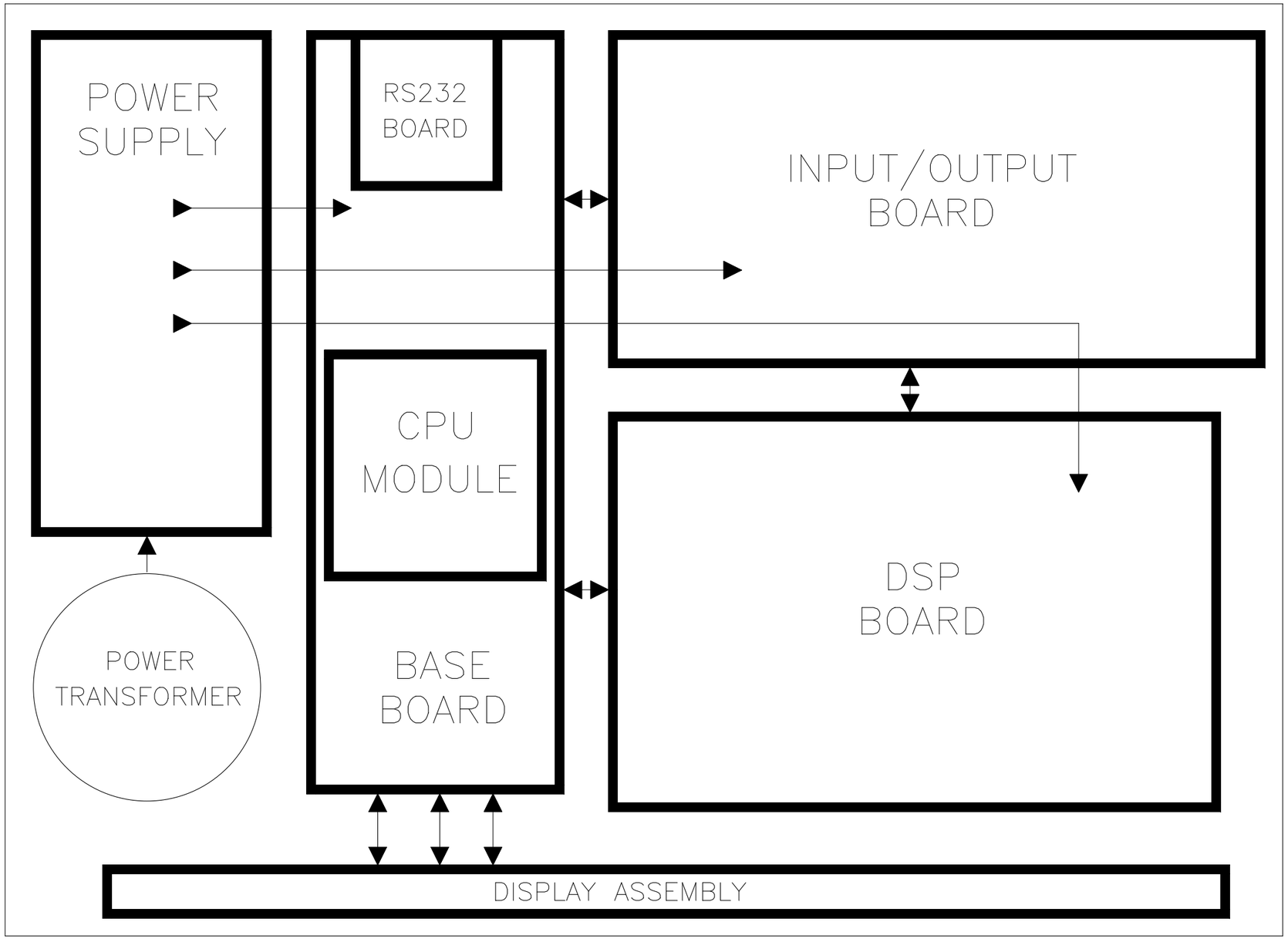
PART #	*DESCRIPTION*	*COMPONENT IDENTIFIER*
42007.080	SUBASSEMBLY, FLAT CABLE-26P- 8"	

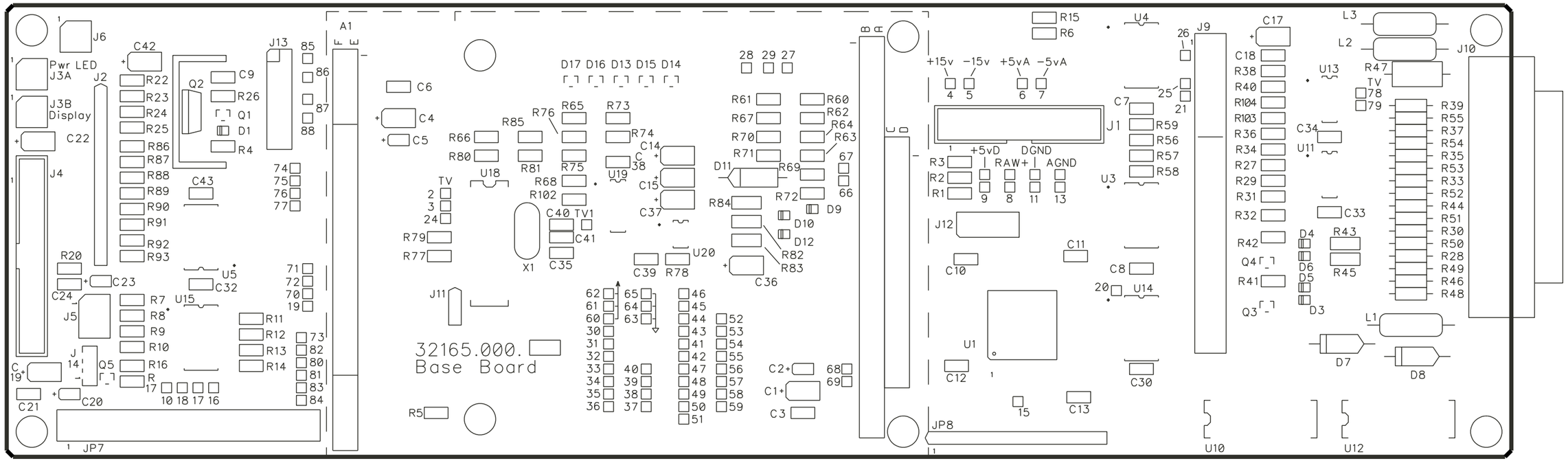
PART #	*DESCRIPTION*	*COMPONENT IDENTIFIER*
15062.390.01	LED SPACER, 390 HIGH	
20122.110.01	RESISTOR, TF, 1 / 8W, 1%, 110 OHM	R17-R24
20124.100.01	RESISTOR, TF, 1 / 8W, 1%, SURFACE-MOUNT 10K	R29, R30
20125.100.01	RESISTOR, TF, 1 / 8W, 1%, 100K	R25, R26, R27, R28
20226.000.01	RESISTOR, NETWORK, DIL, 2%, 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

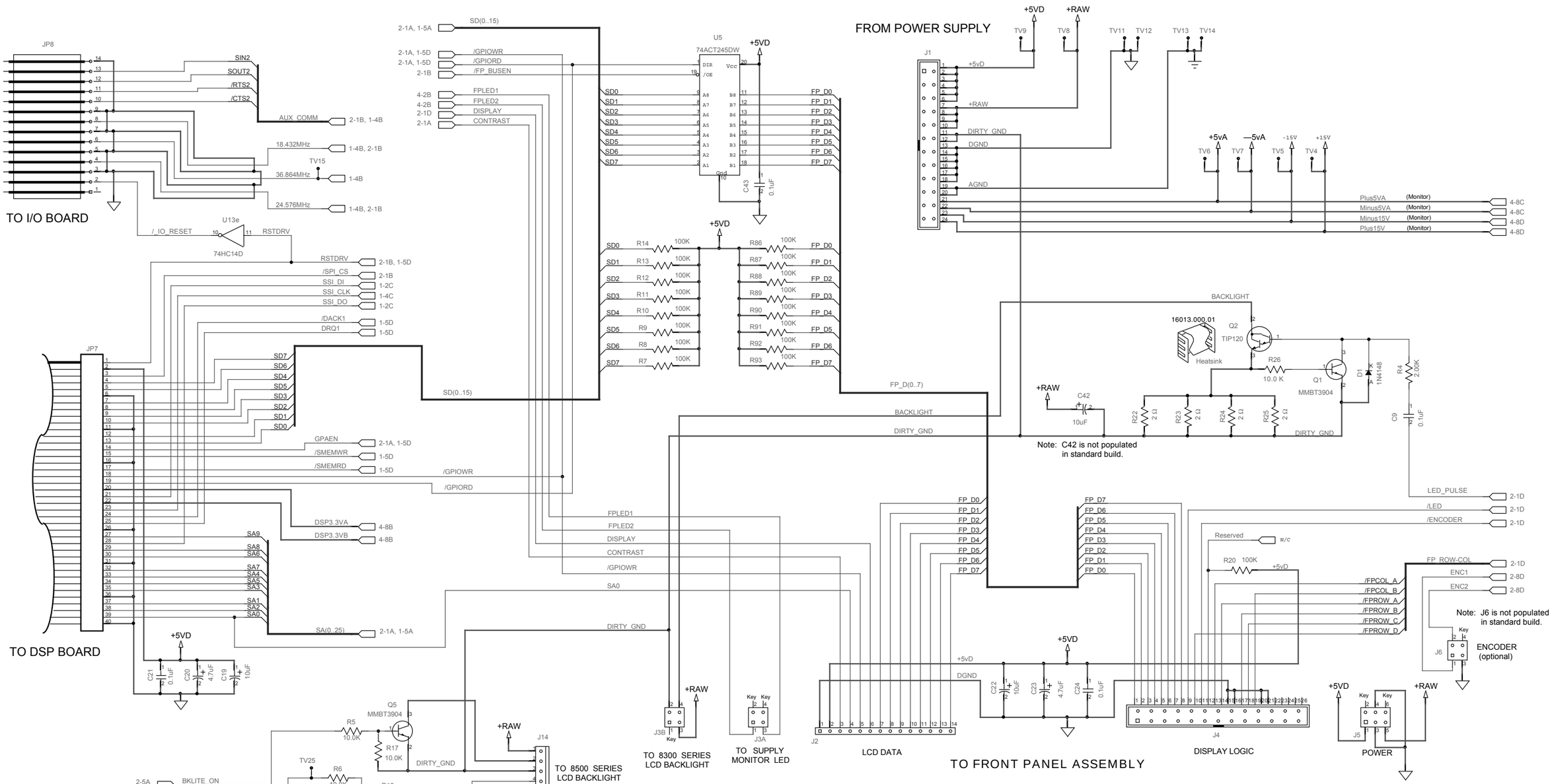
These drawings reflect the actual construction of your unit as accurately as possible. Any differences between the drawings and your unit are probably due to product improvements or production changes since the publication of this manual.

If you intend to replace parts, please read page 6-14. Please note that because surface-mount parts are used extensively in the 2300, 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.

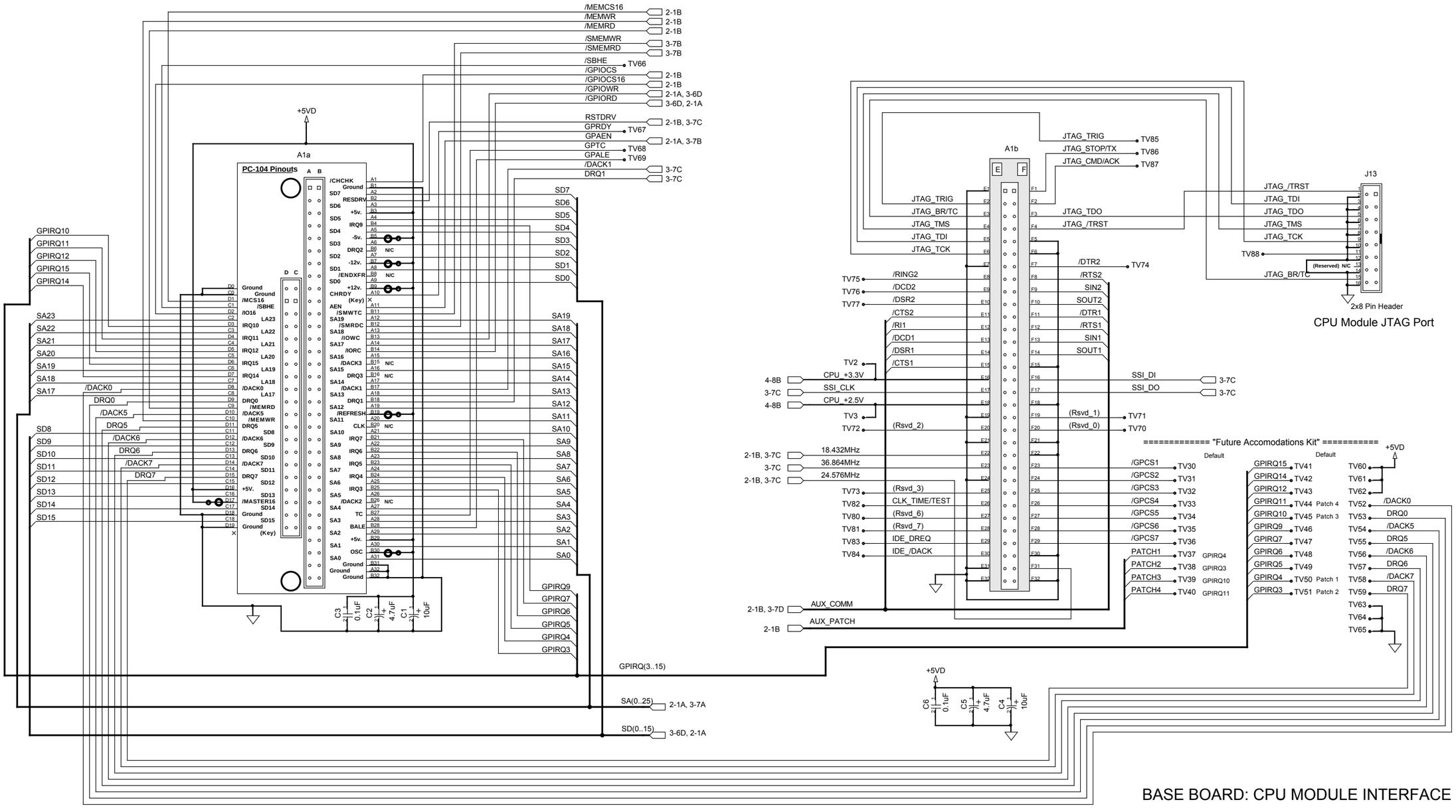

POWER
SUPPLY
RS232
BOARD
INPUT/OUTPUT
BOARD
CPU
MODULE
DSP
BOARD
POWER
TRANSFORMER
BASE
BOARD
DISPLAY ASSEMBLY



Base Board Parts Locator Drawing
(for schematic 62165.000.06)

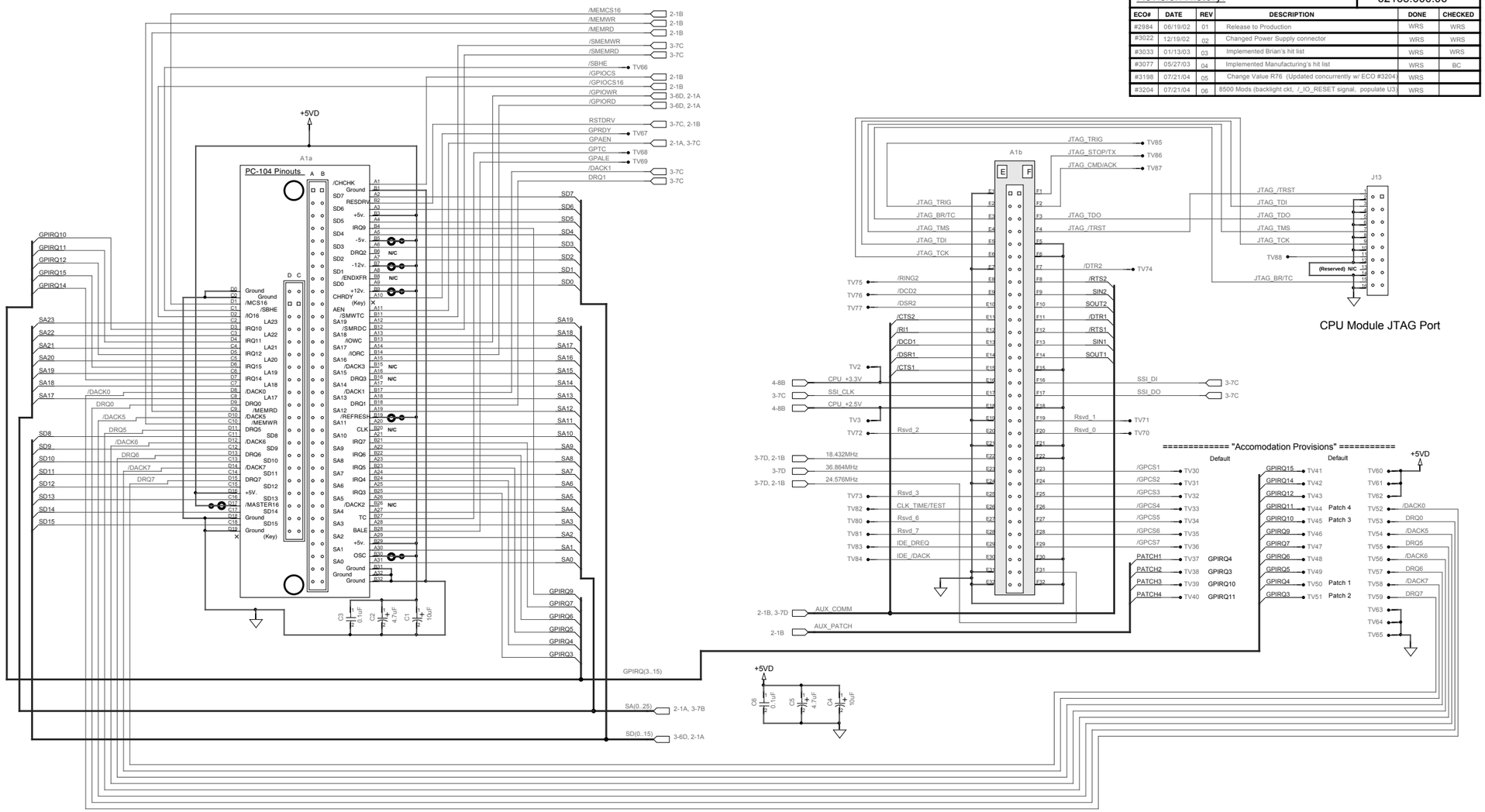


Base Board Schematic:
System Connections
(version 62165.000.06)
Sheet 1 of 4

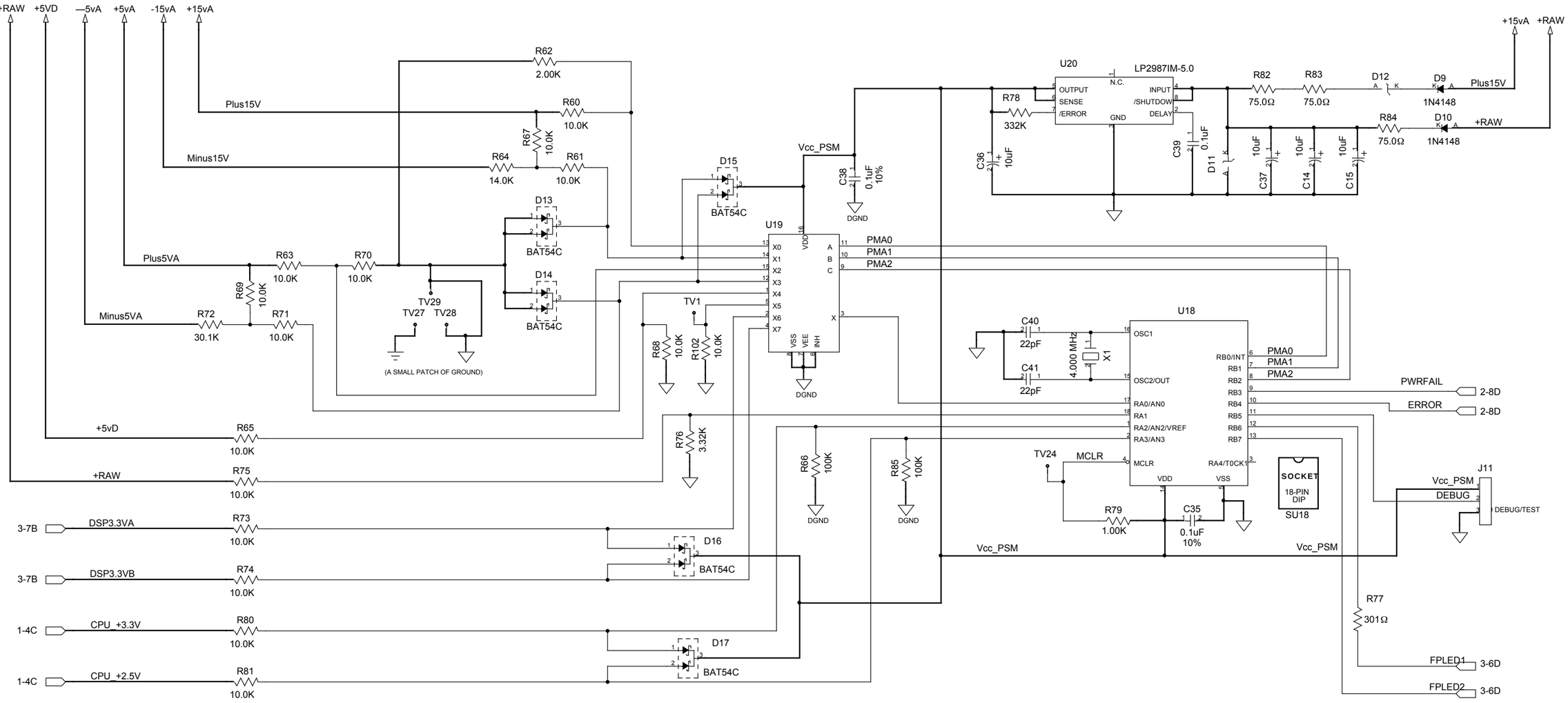


BASE BOARD: CPU MODULE INTERFACE

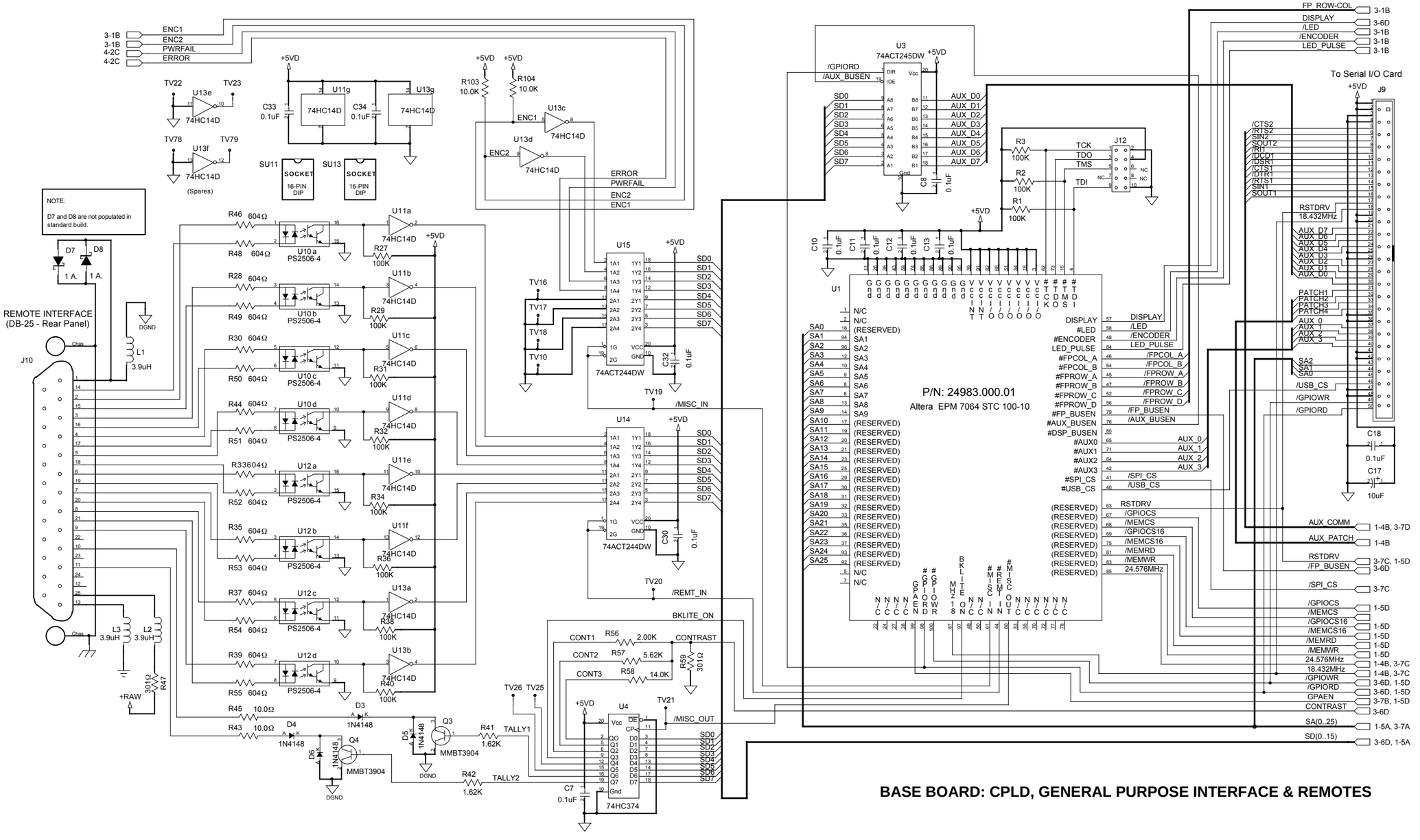
Revision History:				62165.000.06	
ECO#	**DATE**	**REV**	**DESCRIPTION**	**DONE**	**CHECKED**
#2984	06/19/02	01	Release to Production	WRS	WRS
#3022	12/19/02	02	Changed Power Supply connector	WRS	WRS
#3033	01/13/03	03	Implemented Brian's hit list	WRS	WRS
#3077	05/27/03	04	Implemented Manufacturing's hit list	WRS	BC
#3198	07/21/04	05	Change Value R76 (Updated concurrently w/ ECO #3204)	WRS	
#3204	07/21/04	06	8500 Mods (backlight ckt, /_IO_RESET signal, populate U3)	WRS	



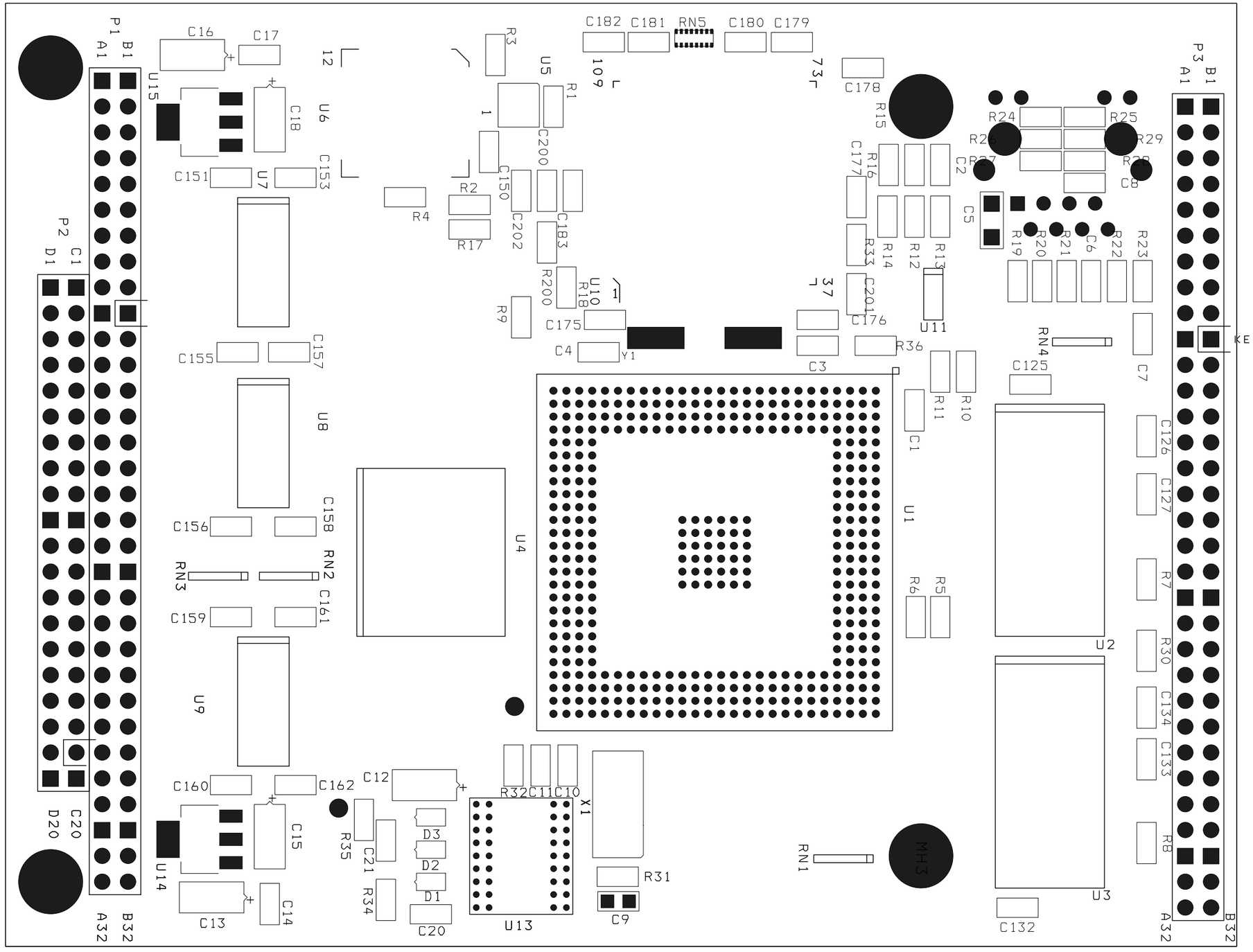
Base Board Schematic:
CPU Module Interface
(version 62165.000.06)
Sheet 2 of 4



BASE BOARD: POWER SUPPLY MONITOR



BASE BOARD: CPLD, GENERAL PURPOSE INTERFACE & REMOTES


P1
A1
B1
A32
B32
P2
C1
D1
C20
D20
P3
KEY
U15
U6
U7
U8
U9
U14
U5
U10
U4
U1
U2
U3
U11
U13
X1
Y1
MH3
RN1
RN2
RN3
RN4
RN5
C16
C17
C18
C151
C153
C155
C157
C156
C158
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C161
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C162
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R31
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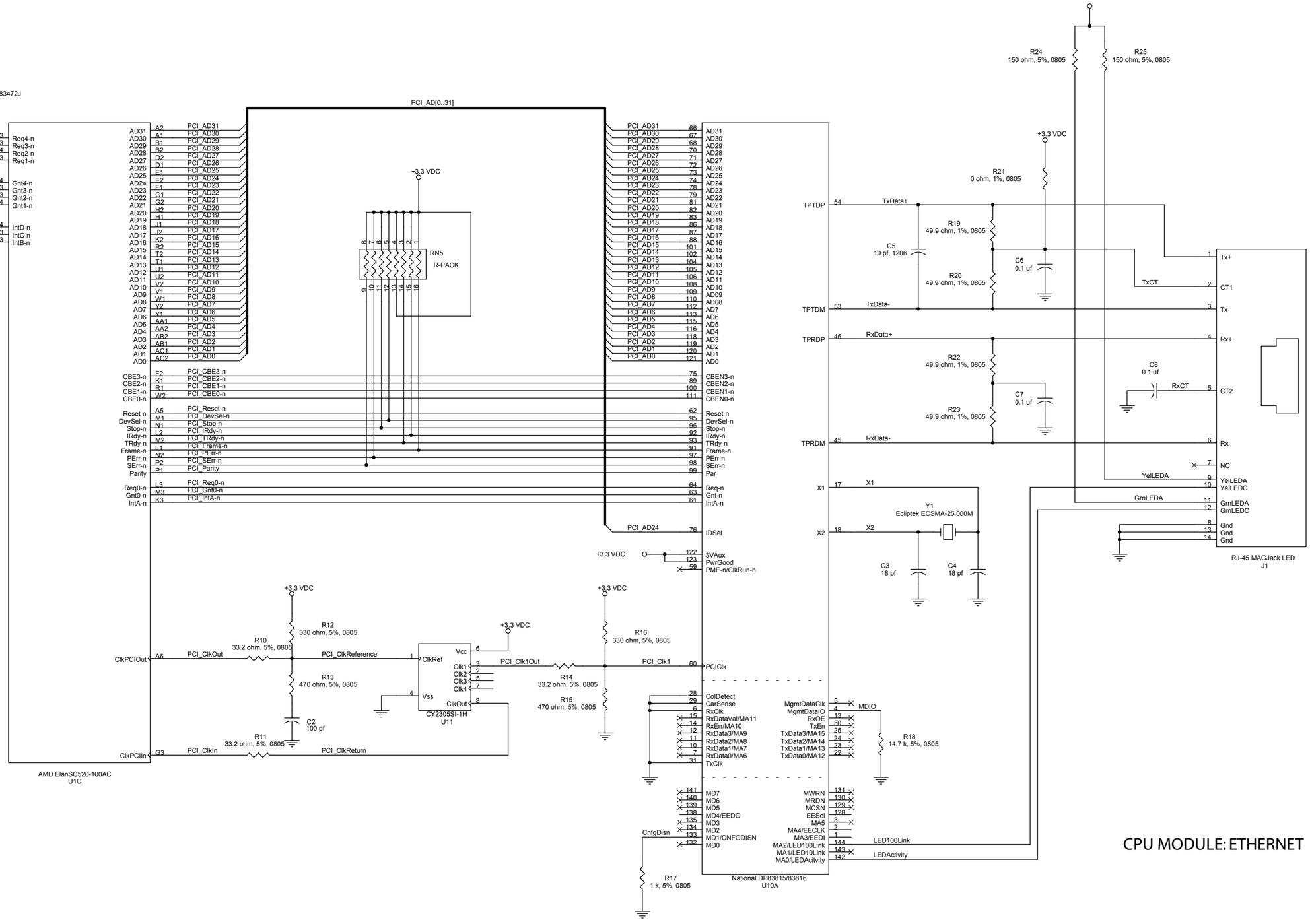
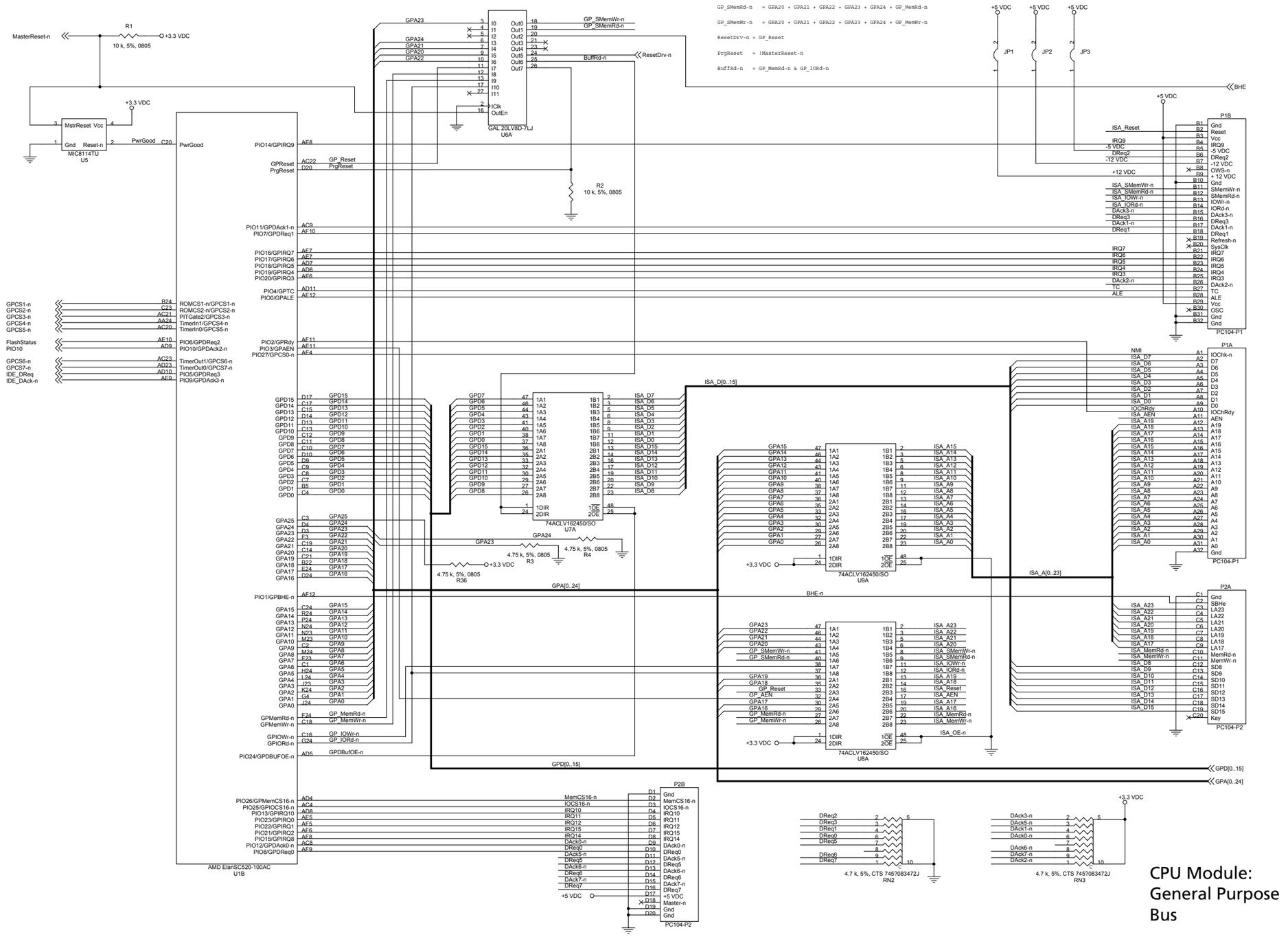
C10
C11
109
73
37
1
12

CPU Module

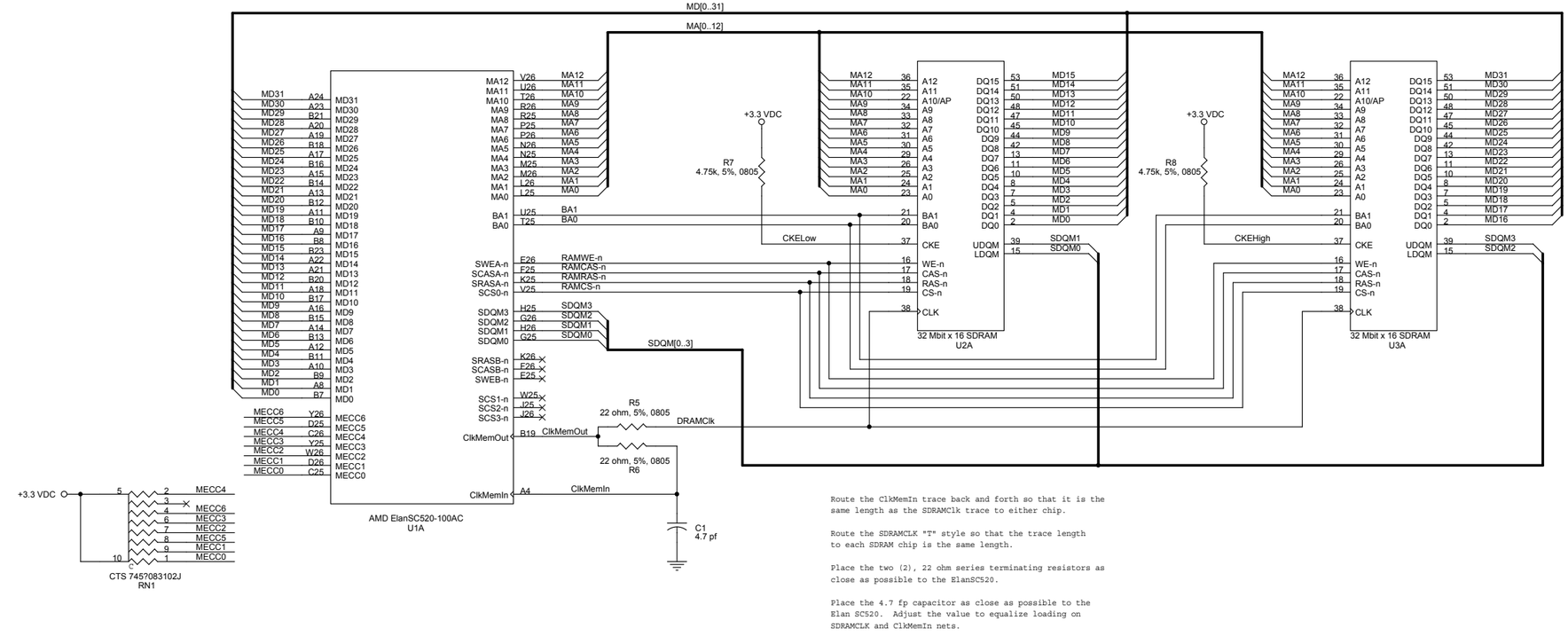


CPU MODULE: ETHERNET



CPU Module: General Purpose Bus

DRAM Circuitry



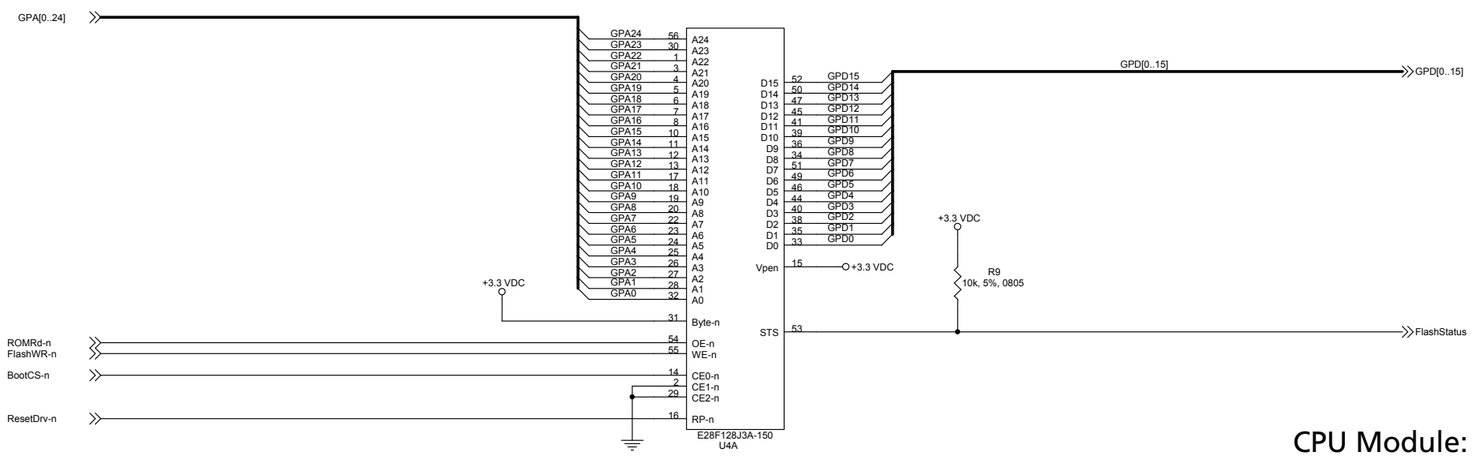
Route the ClkMemIn trace back and forth so that it is the same length as the SDRAMClk trace to either chip.

Route the SDRAMCLK "T" style so that the trace length to each SDRAM chip is the same length.

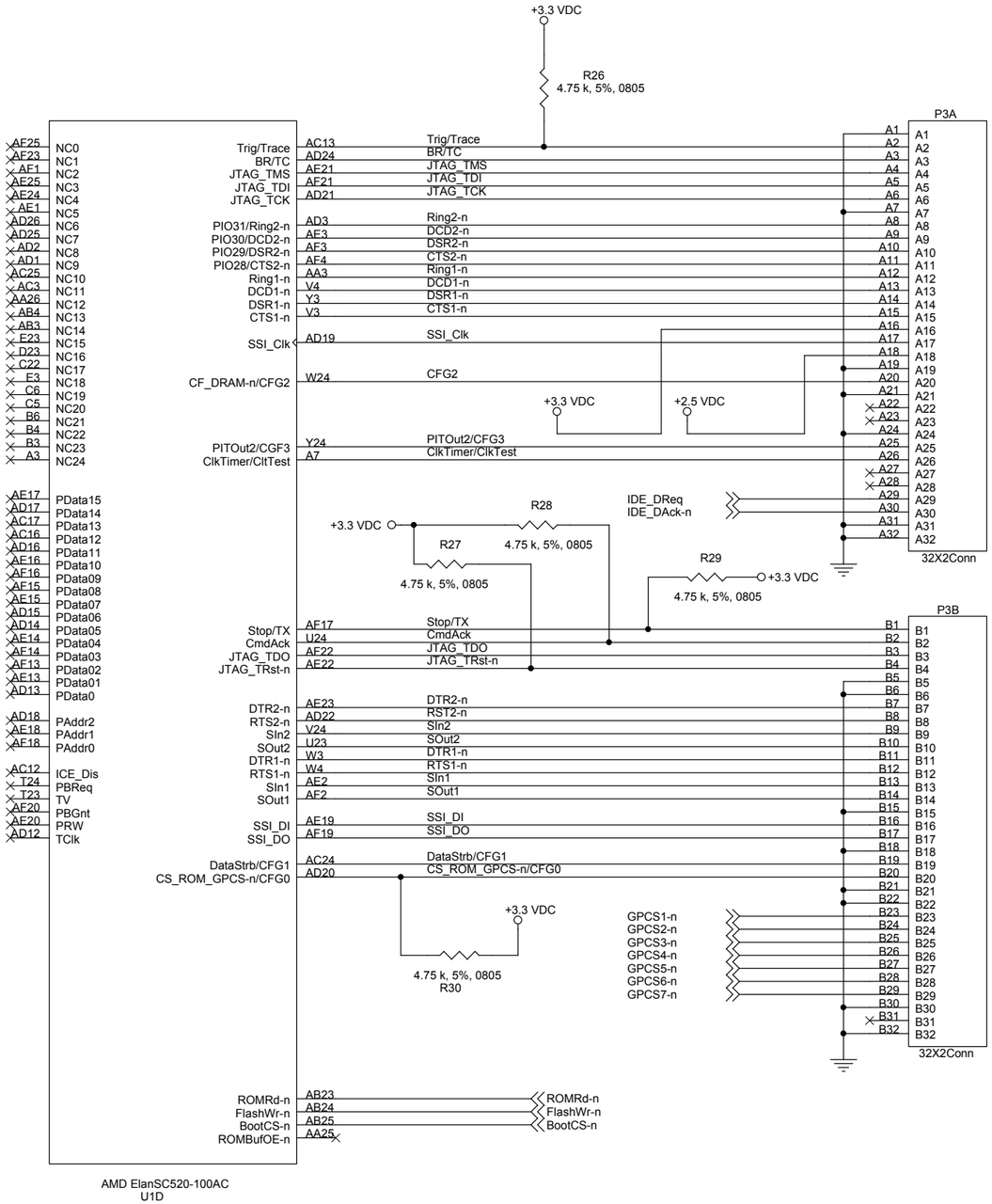
Place the two (2), 22 ohm series terminating resistors as close as possible to the ElanSC520.

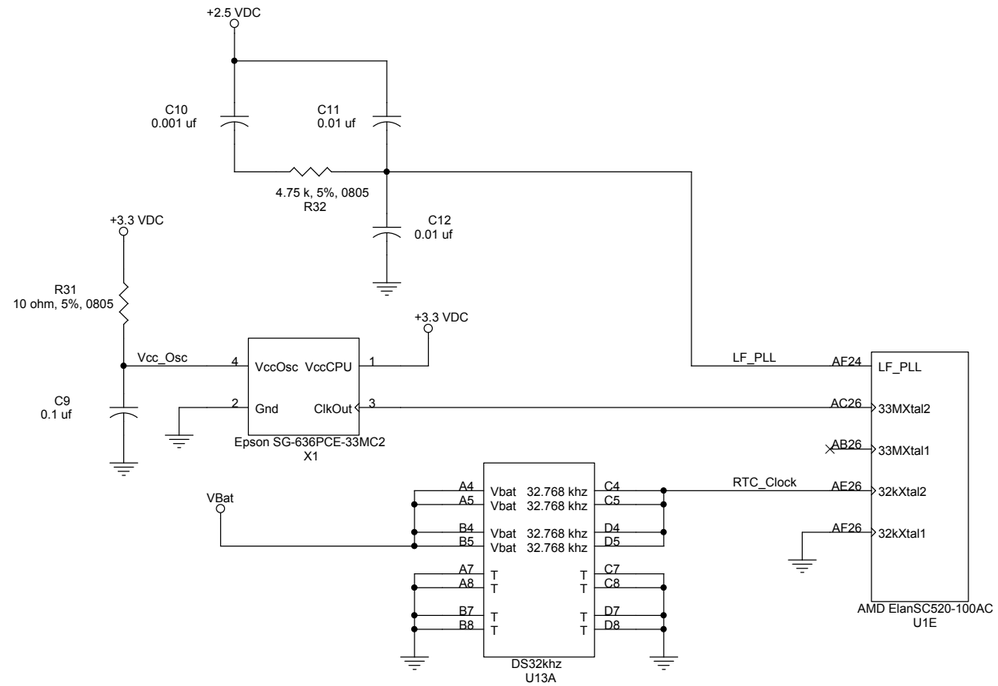
Place the 4.7 fp capacitor as close as possible to the Elan SC520. Adjust the value to equalize loading on SDRAMCLK and ClkMemIn nets.

Flash Circuitry

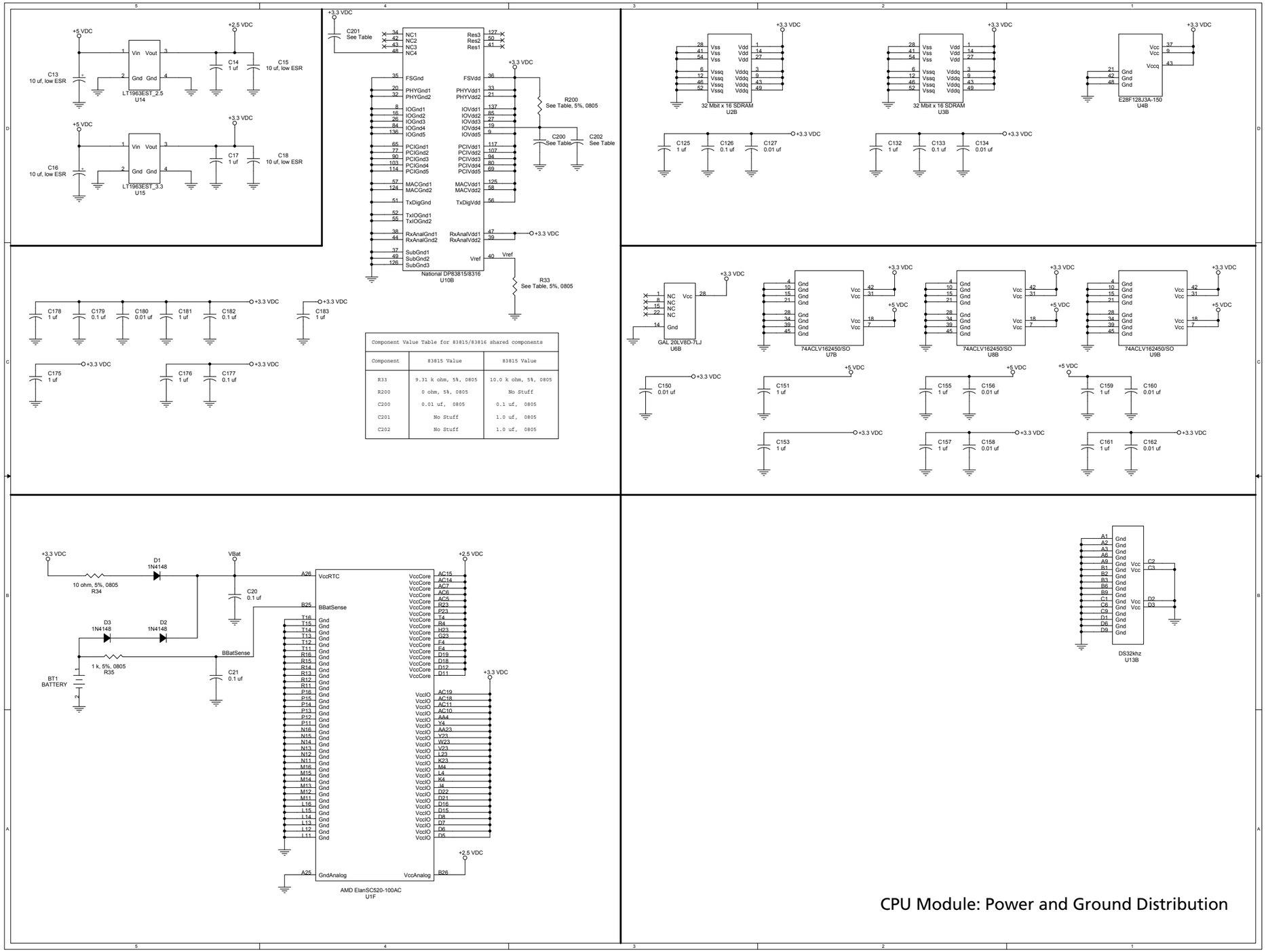


CPU Module: Memory

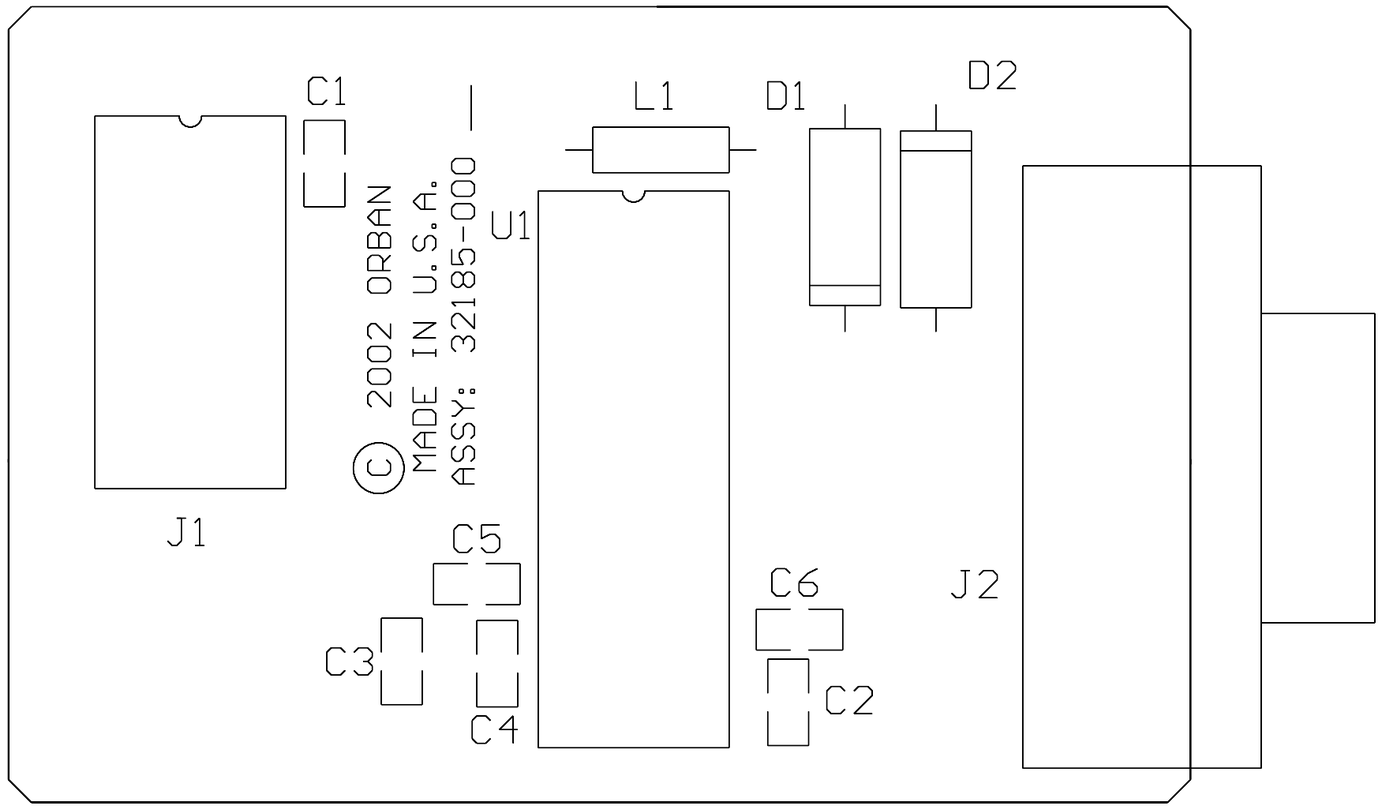




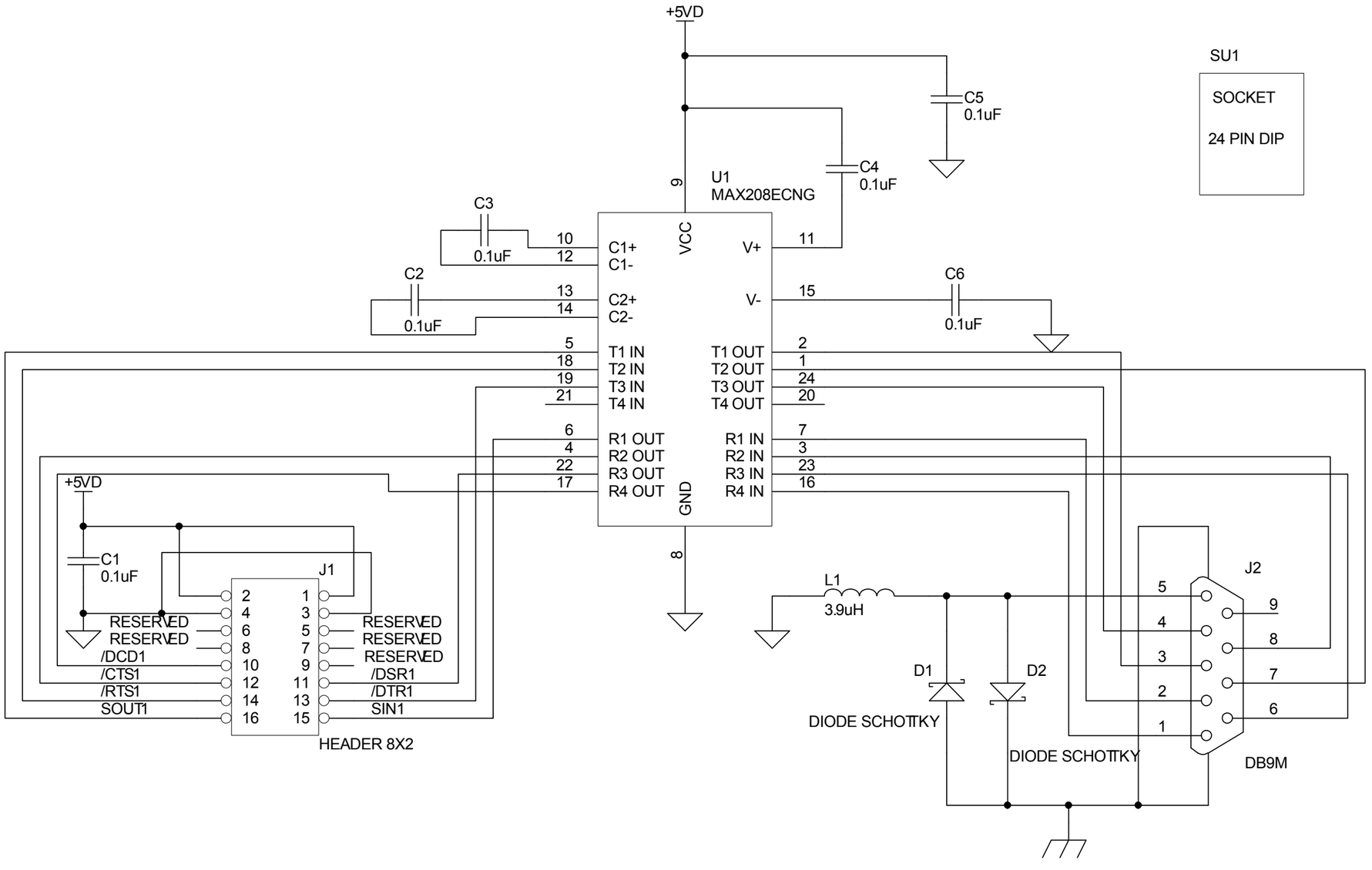
CPU Module: Miscellaneous Connections



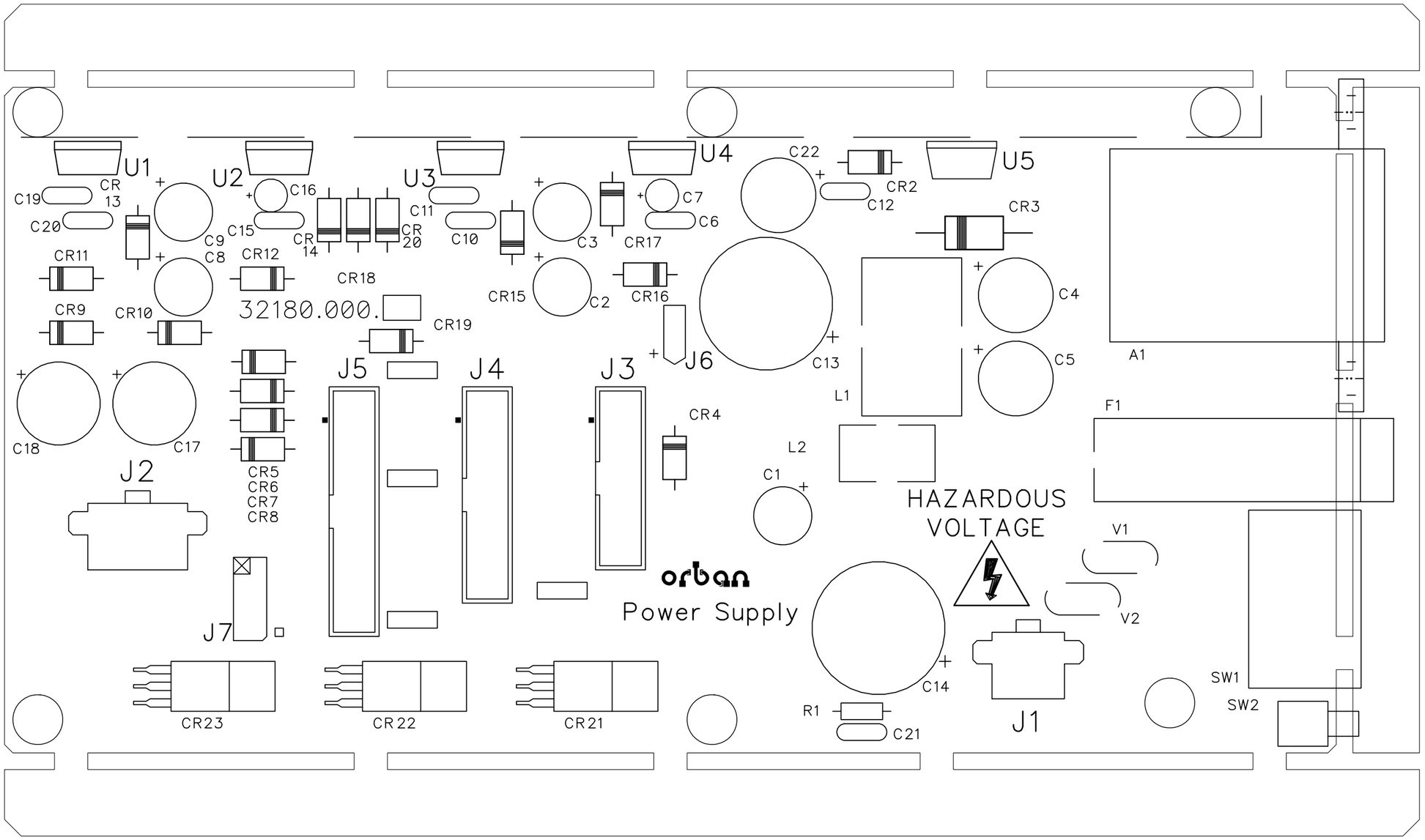
CPU Module: Power and Ground Distribution



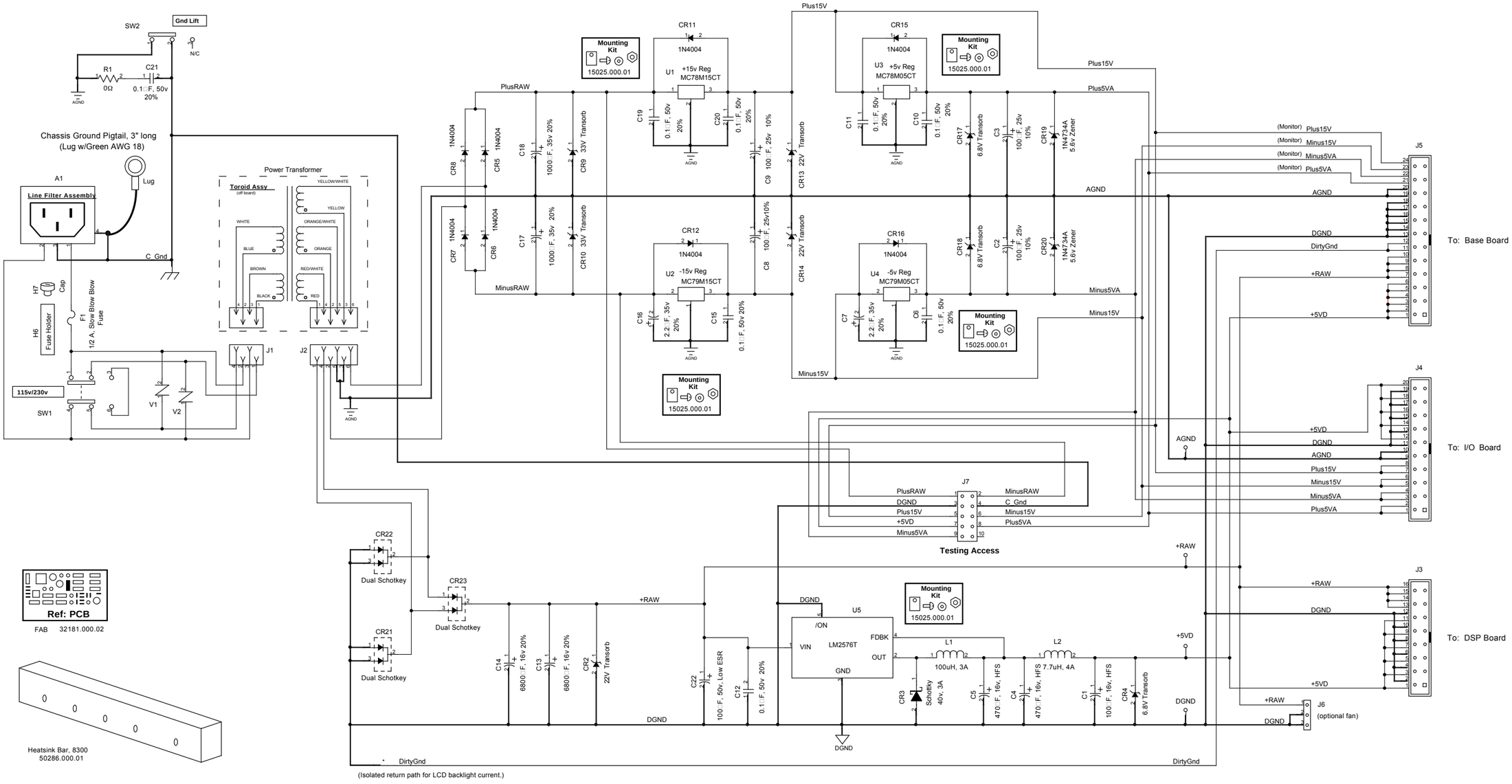
RS232 BOARD PARTS LOCATOR



RS232 DAUGHTER BOARD



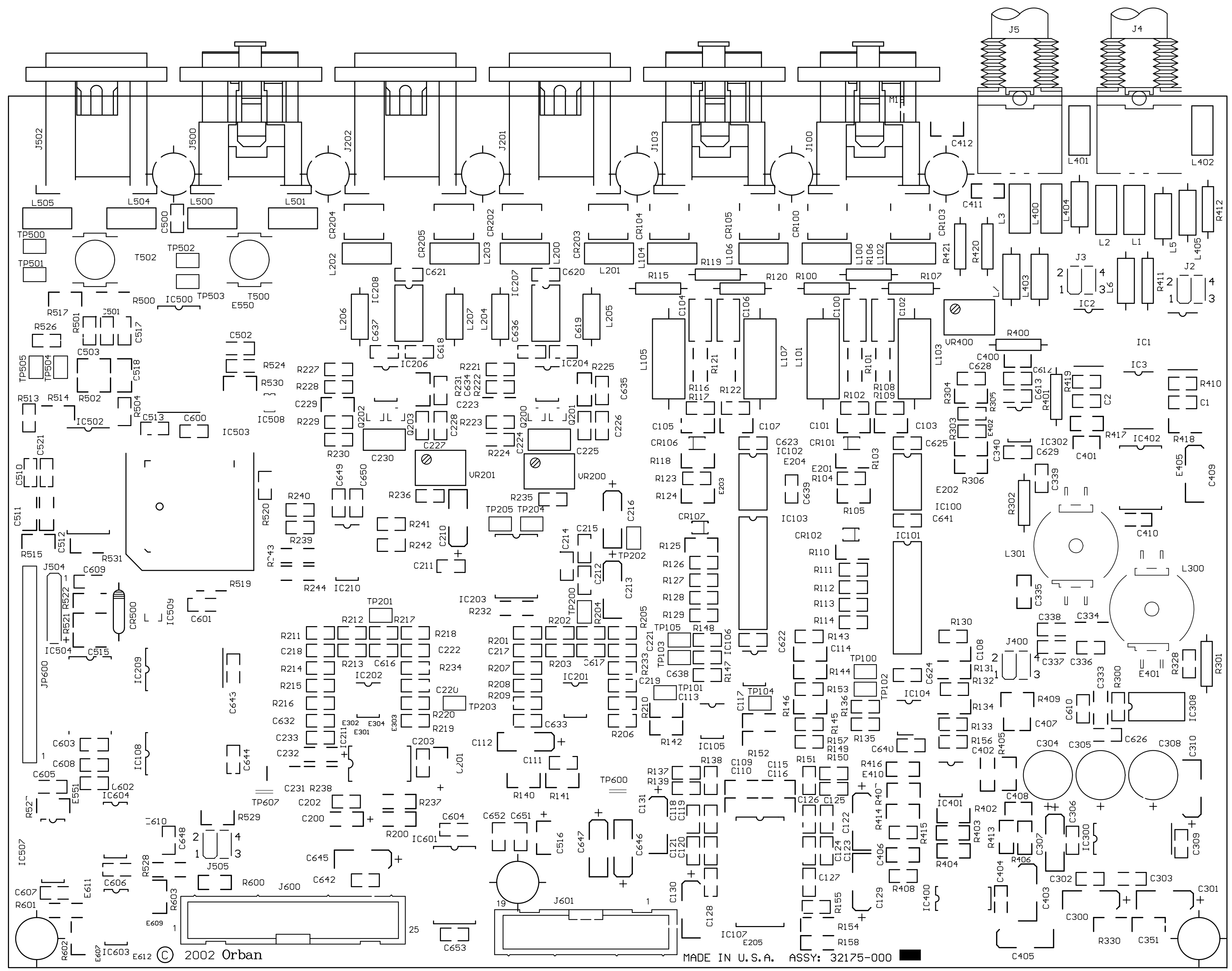
POWER SUPPLY PARTS LOCATOR



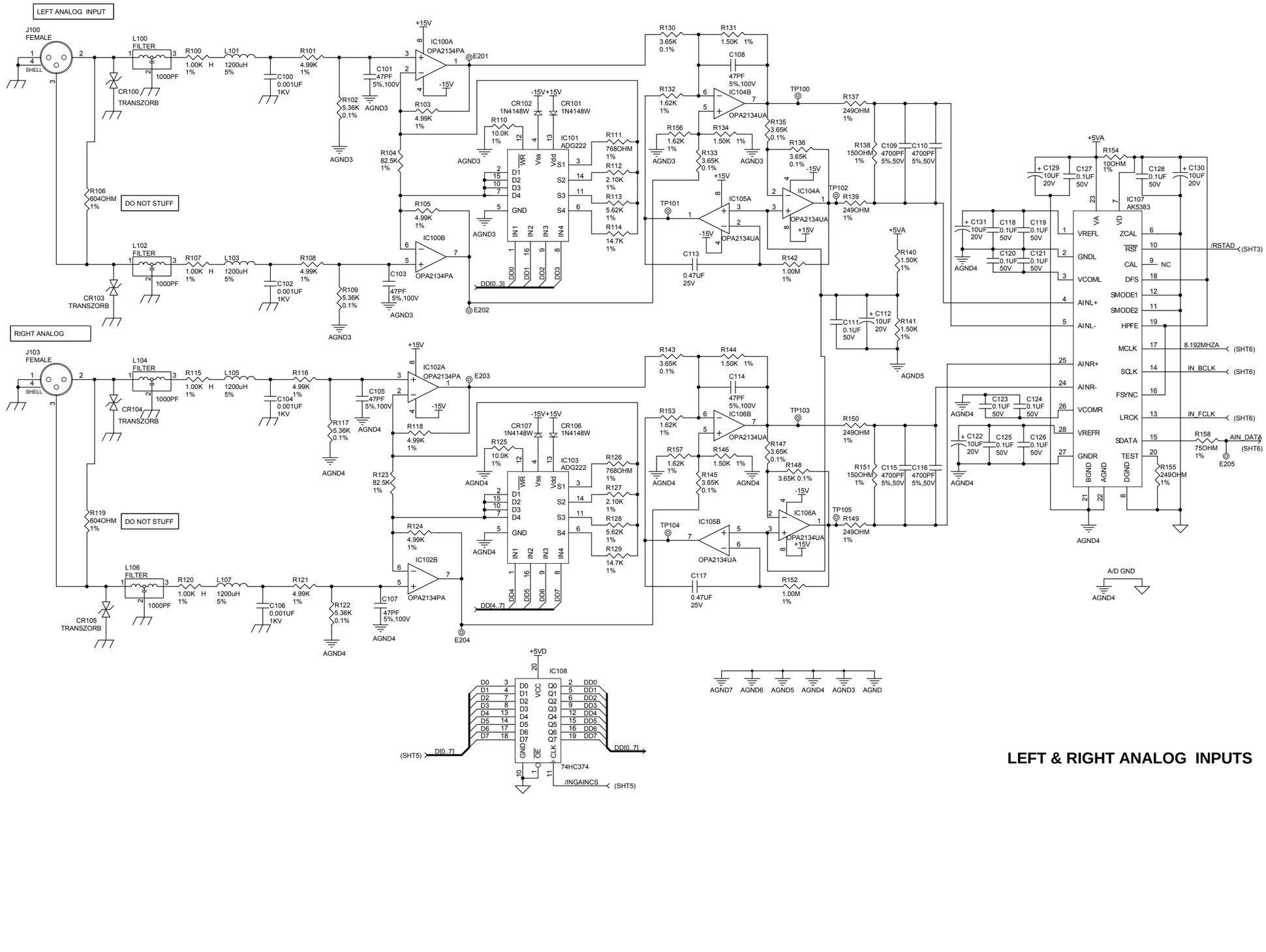
FAB 32181.000.02

Heatsink Bar, 8300
50286.000.01

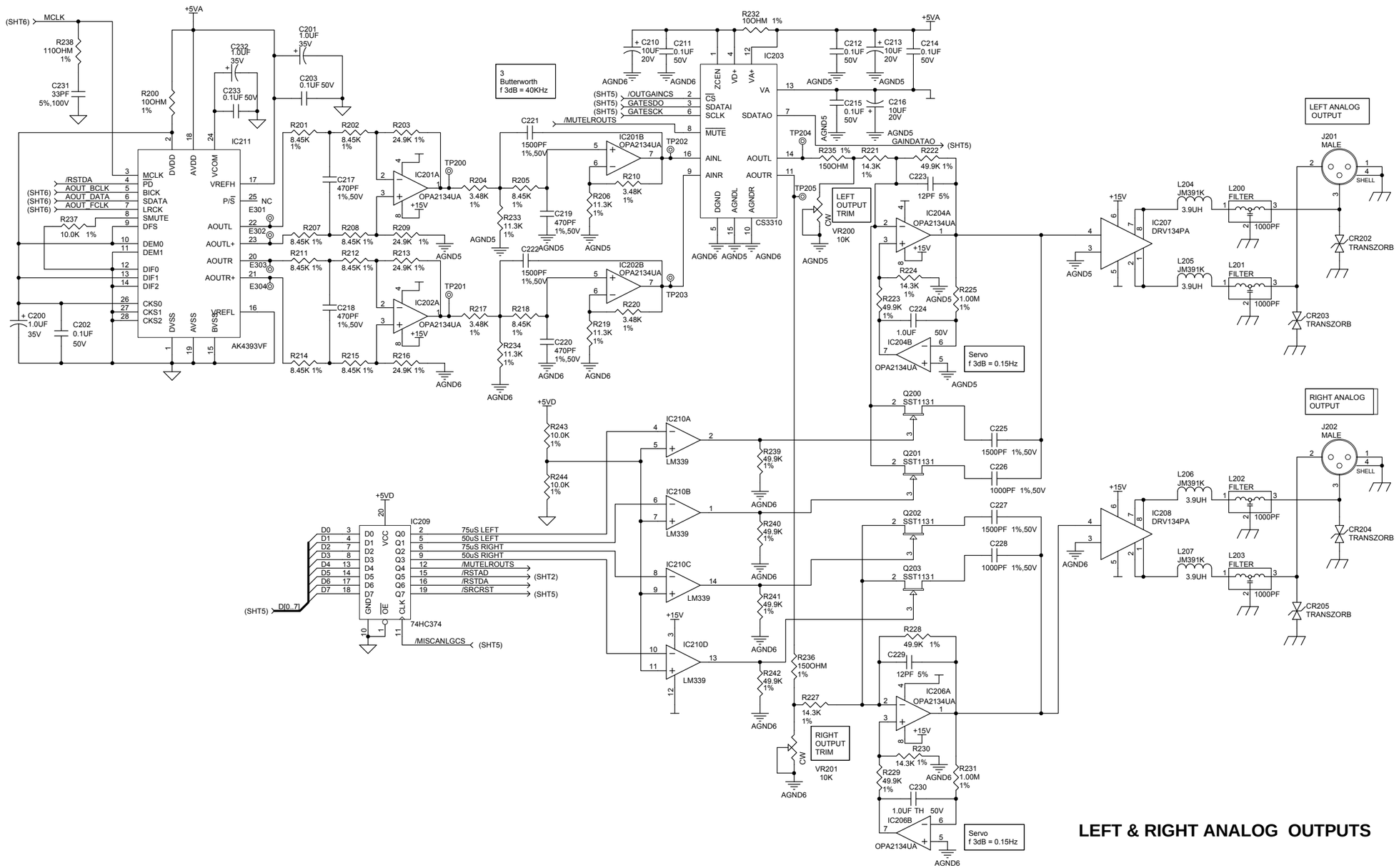
POWER SUPPLY



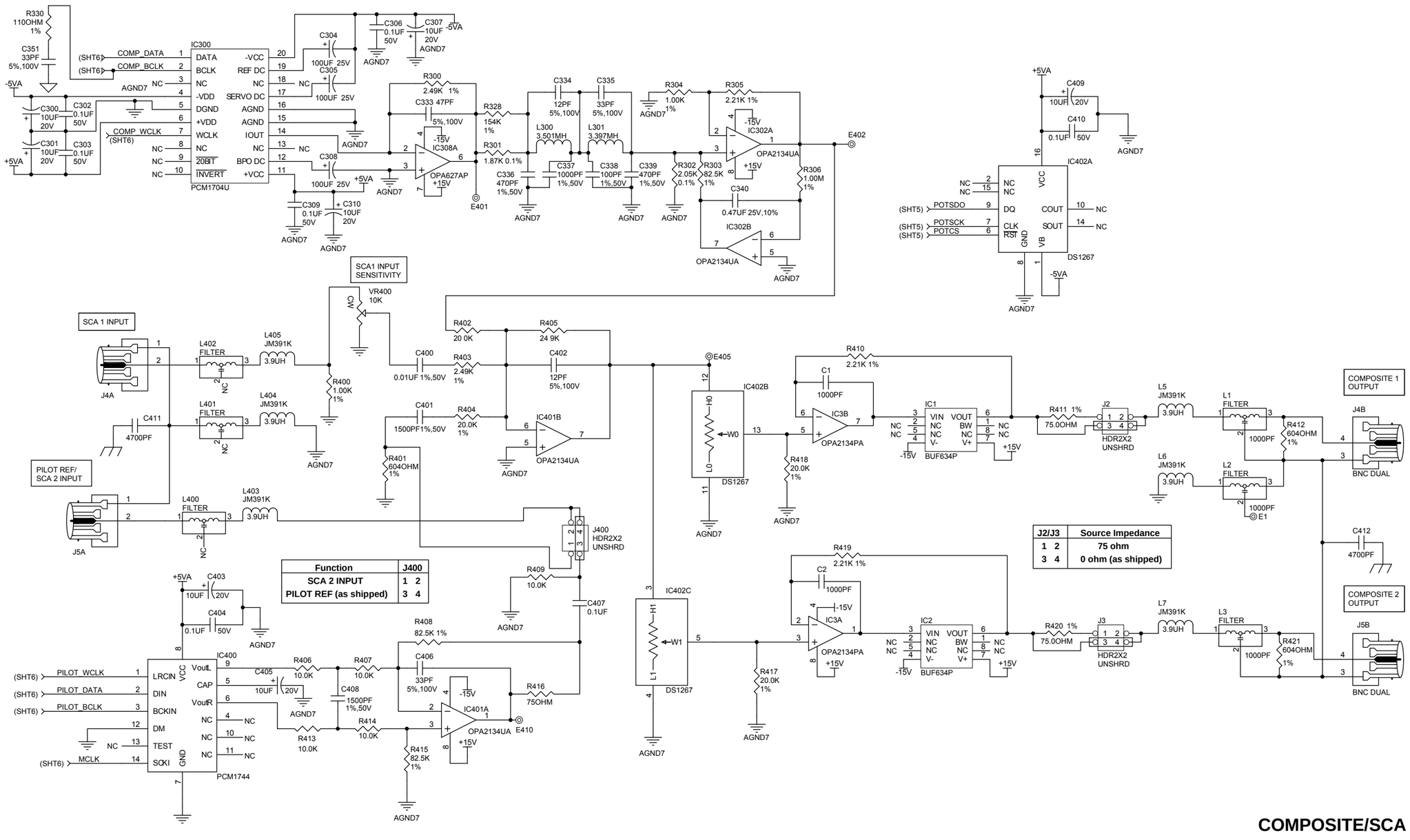
I/O BOARD PARTS LOCATOR



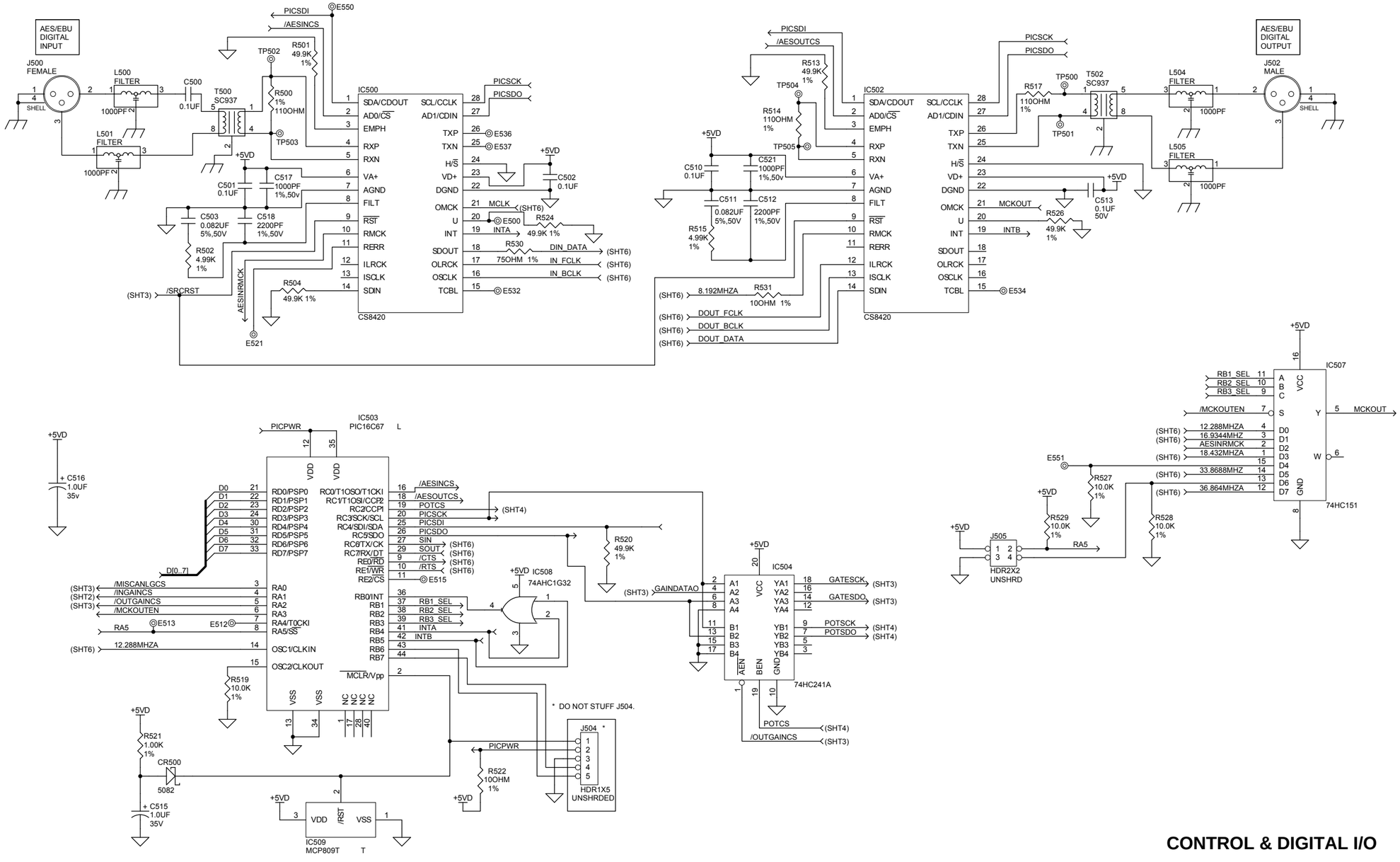
LEFT & RIGHT ANALOG INPUTS



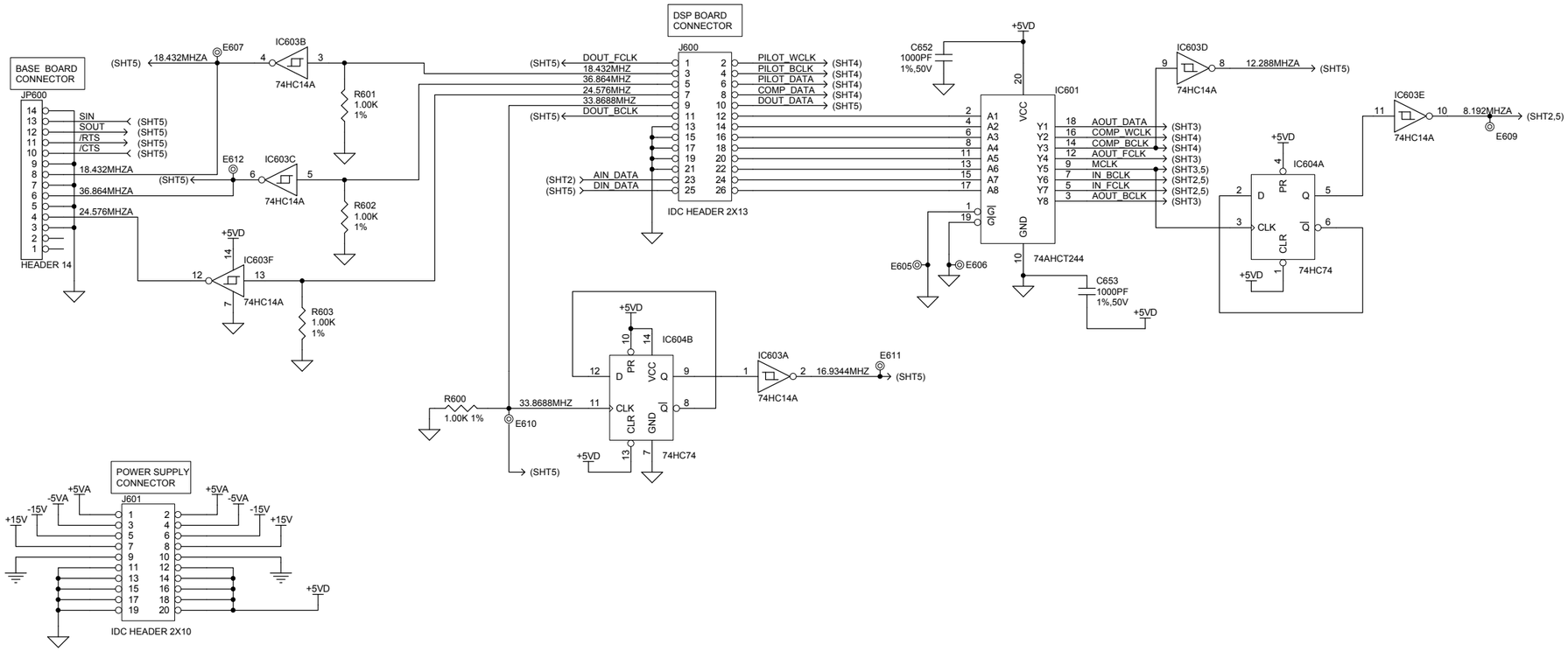
LEFT & RIGHT ANALOG OUTPUTS

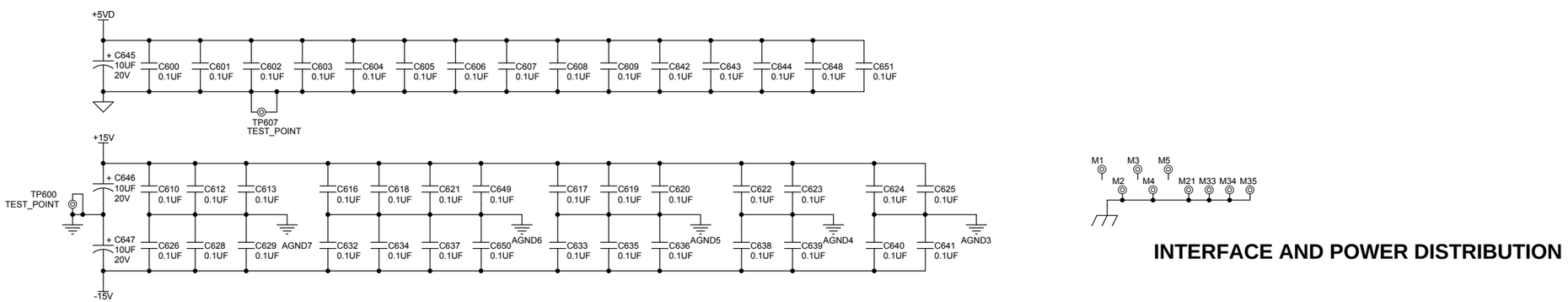


COMPOSITE/SCA



CONTROL & DIGITAL I/O

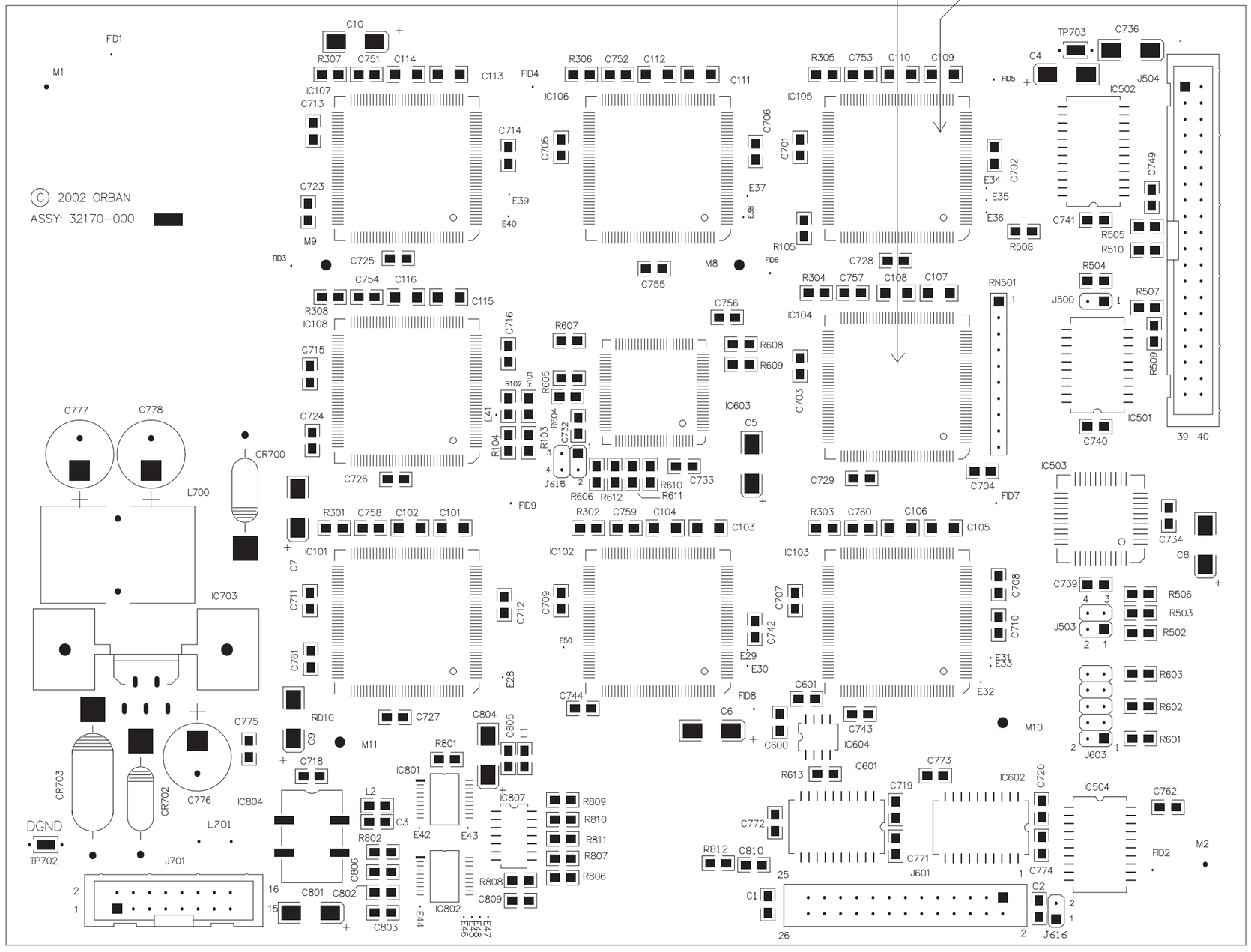




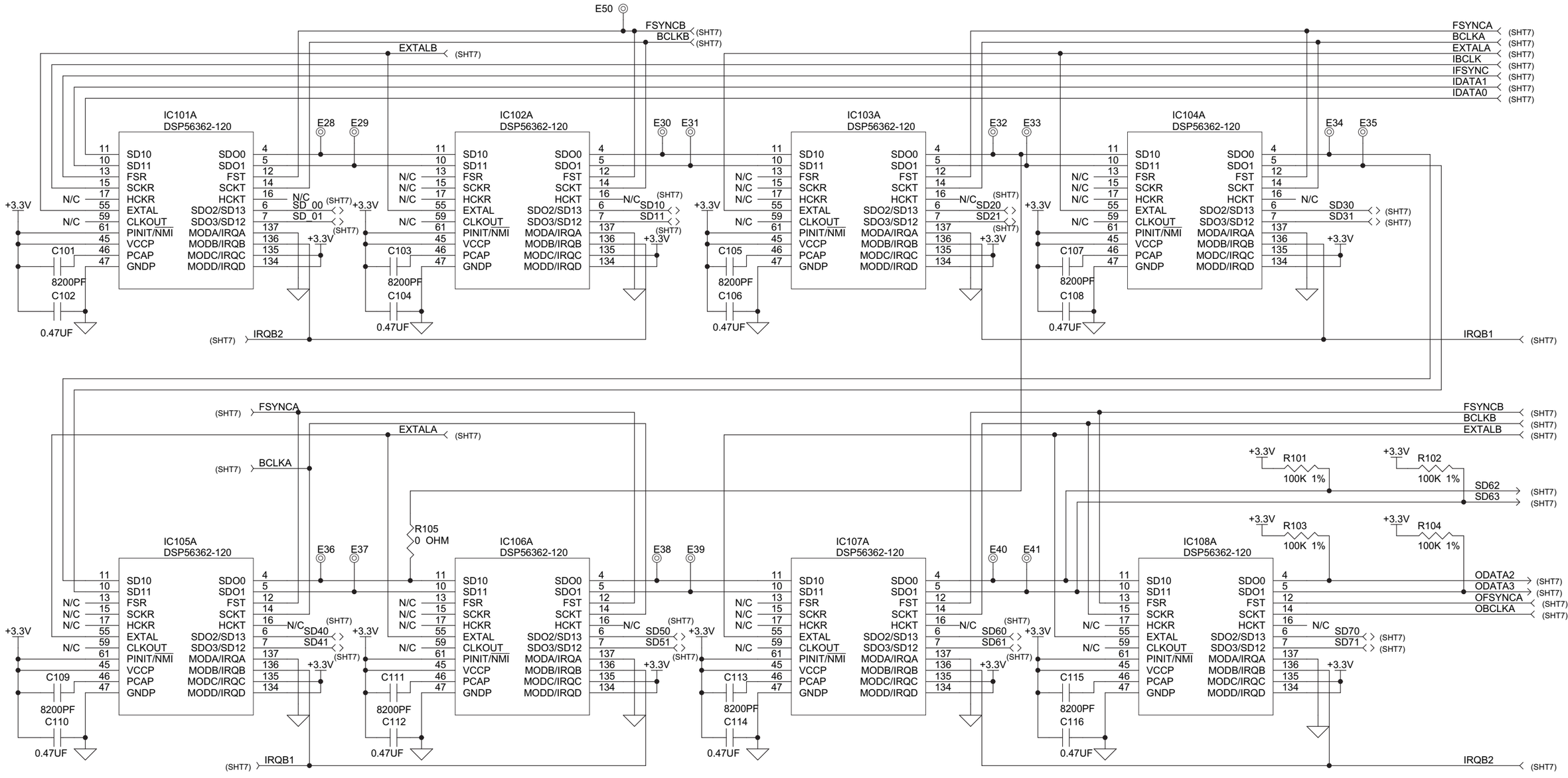
INTERFACE AND POWER DISTRIBUTION

NOTE 4

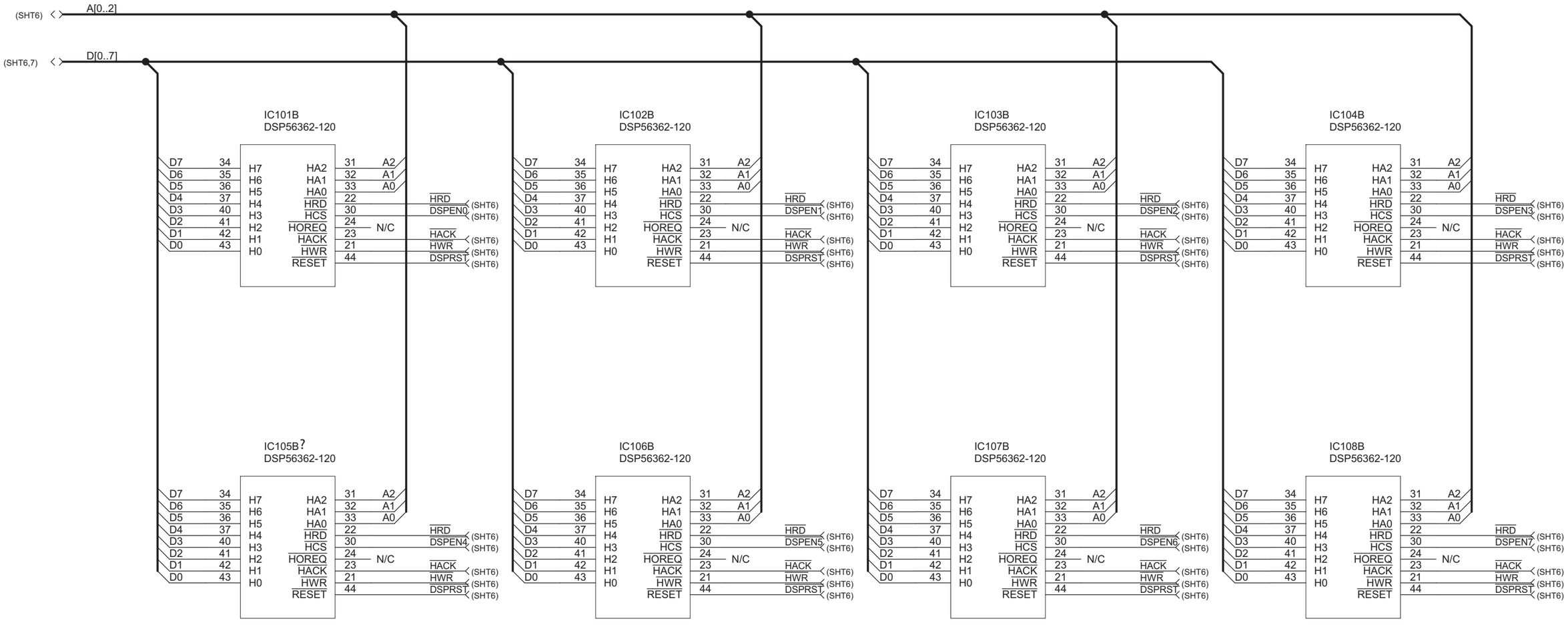
5. R615 & R616 ARE NOT STUFFED.
4. IC 104 & IC 105 ARE NOT STUFFED.
3. MARK ASSEMBLY REVISION LEVEL IN SPACE PROVIDED.
2. REFERENCE SCHEMATIC DRAWING NO. 62170-000
1. SQUARE PADS INDICATE PIN 1 OF CONNECTORS, CATHODE OF DIODES, POS. SIDE OF CAPS. PIN 1 OF IC'S.



DSP BOARD PARTS LOCATOR DRAWING
32170.300.11

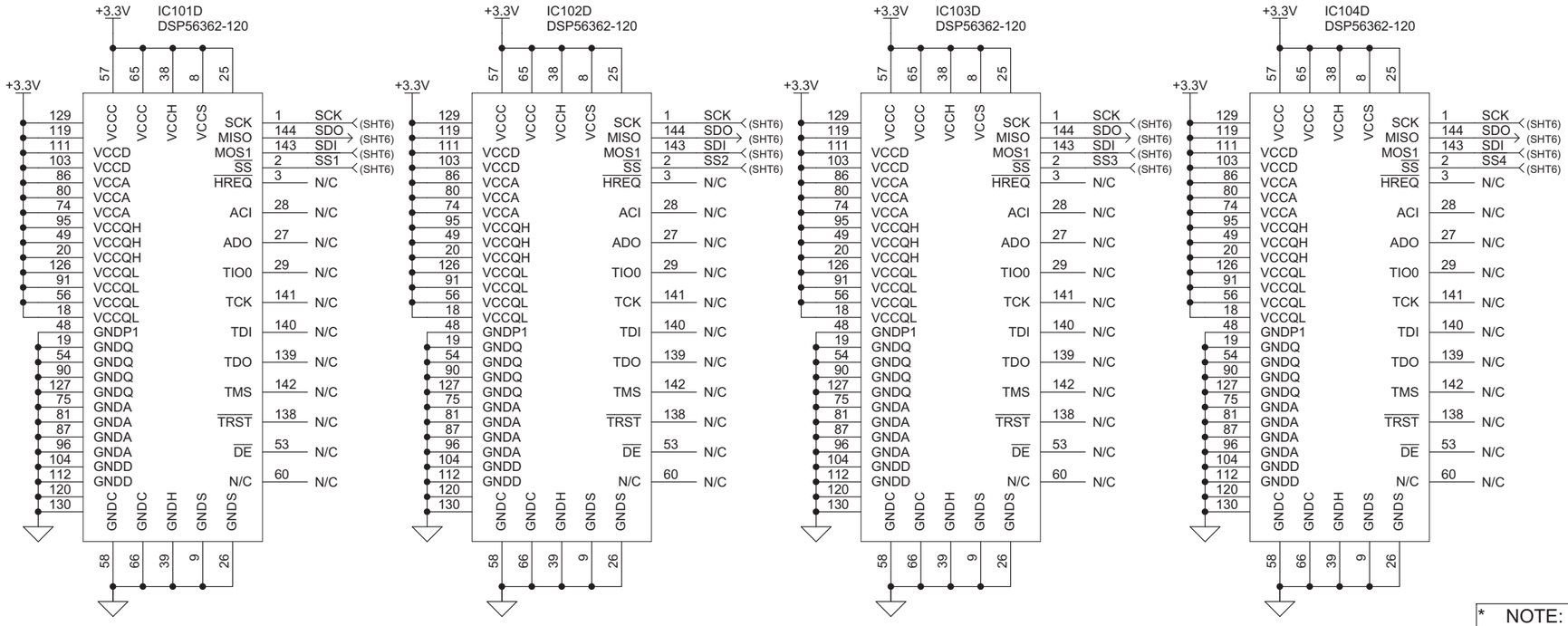


DSP ESAI SCHEMATIC
62170.000.12

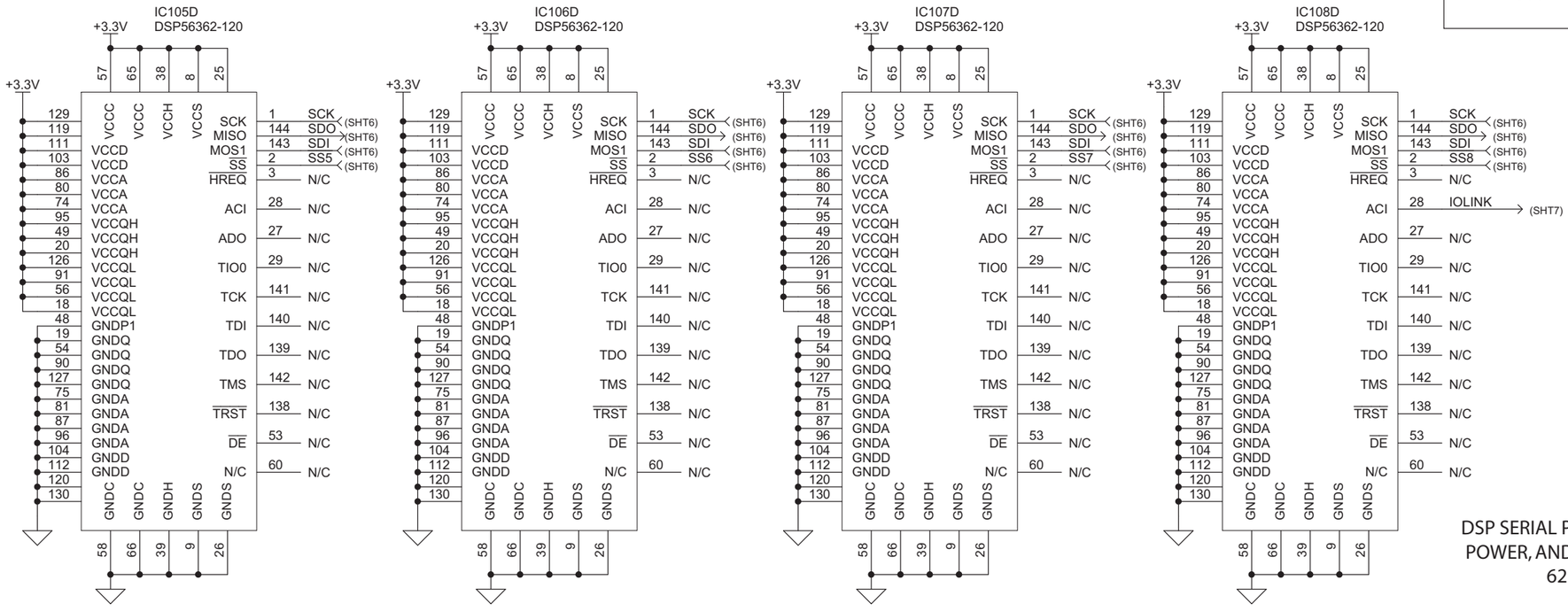


* NOTE:
IC 104 & IC 105
ARE NOT POPULATED
IN 2300 BUILD.

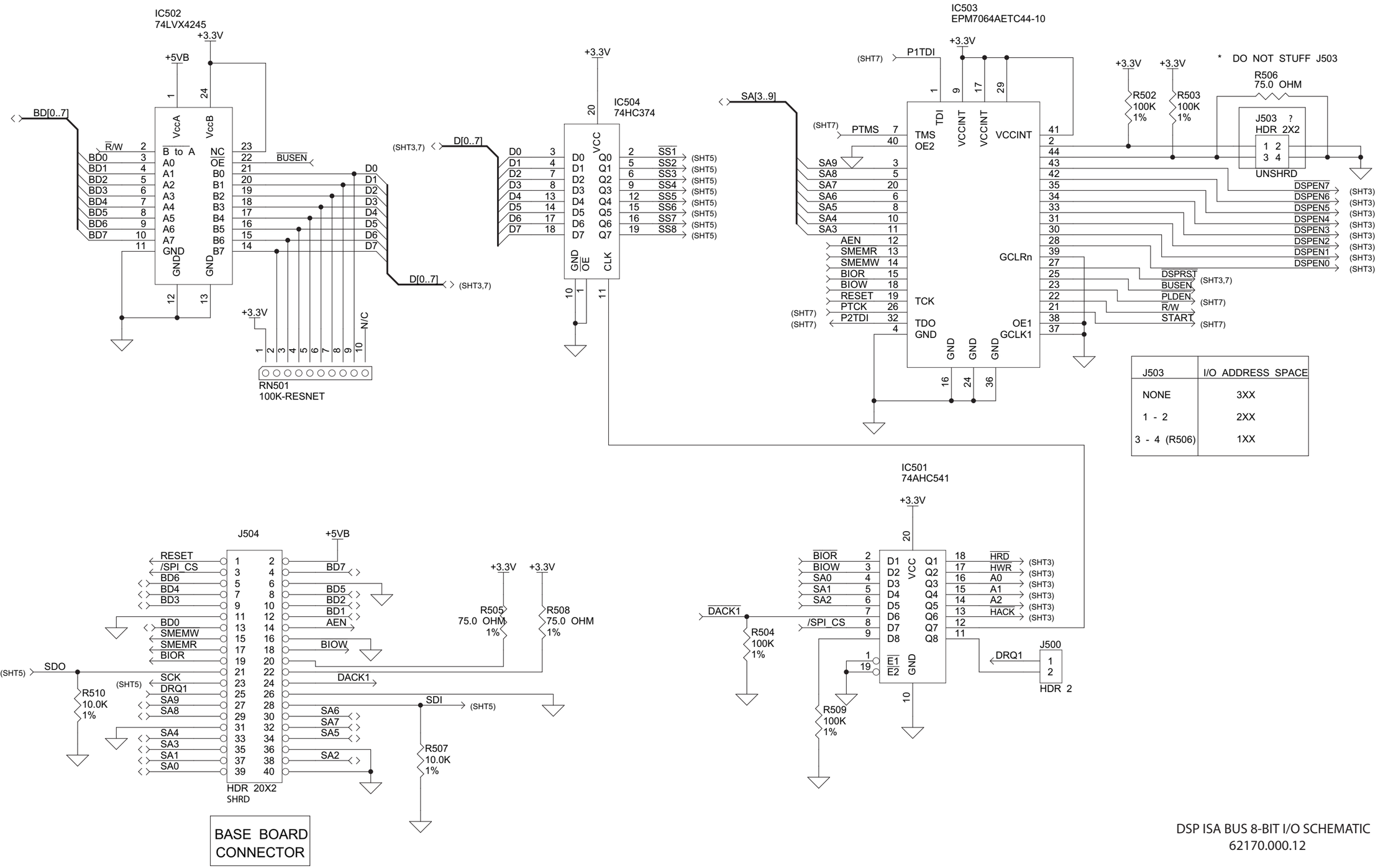
DSP HOST INTERFACE SCHEMATIC
62170.000.12



* NOTE:
IC 104 & IC 105
ARE NOT POPULATED
IN 2300 BUILD.

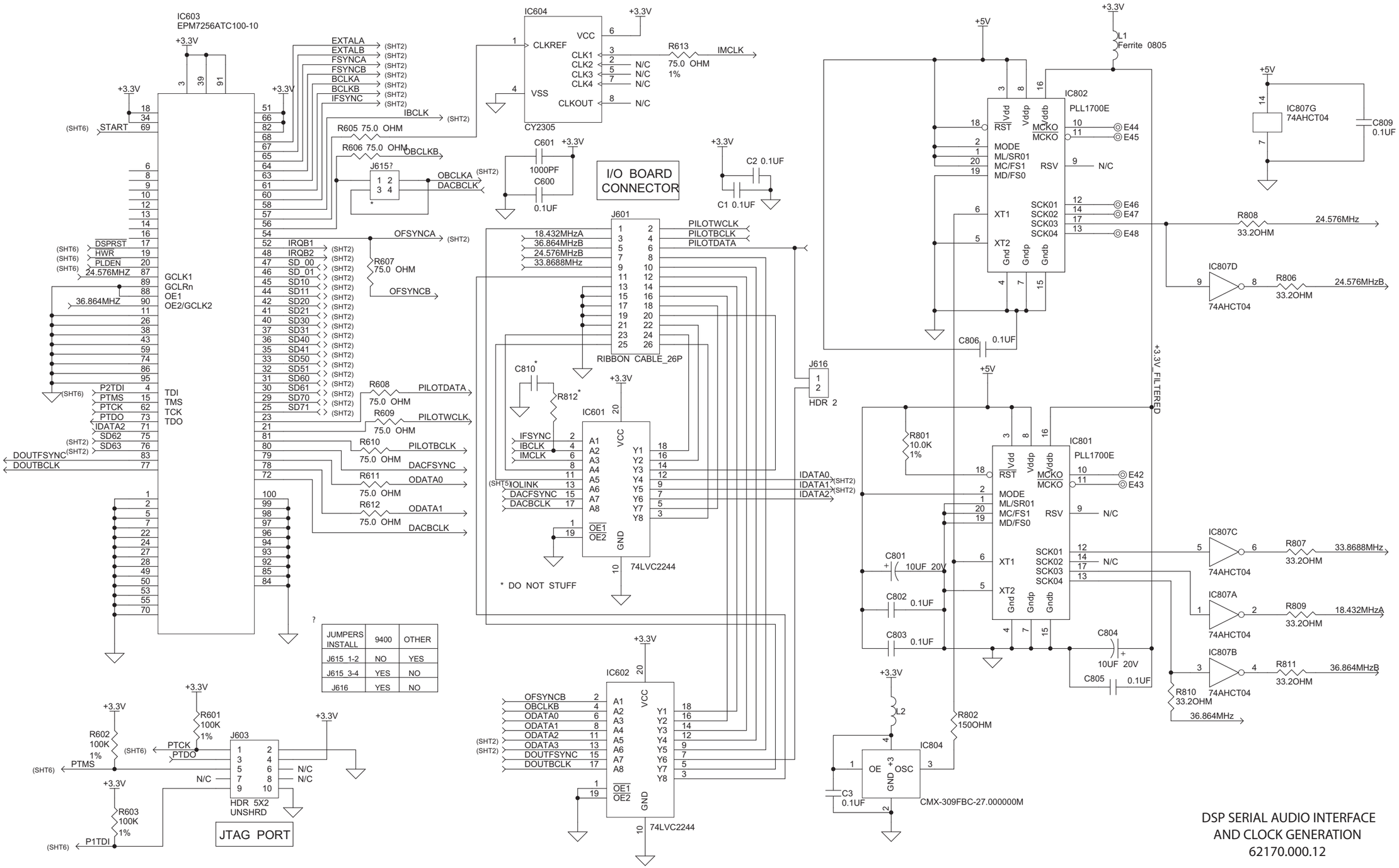


DSP SERIAL PERIPHERAL INTERFACE,
POWER, AND GROUND SCHEMATIC
62170.000.12

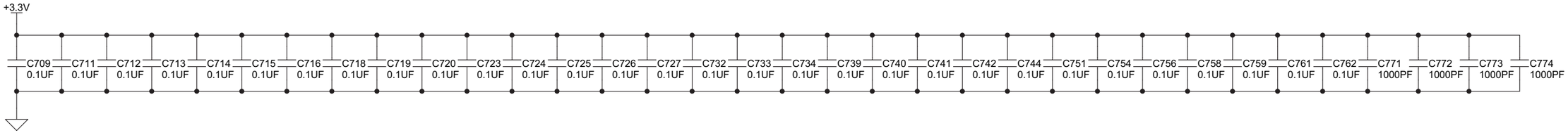


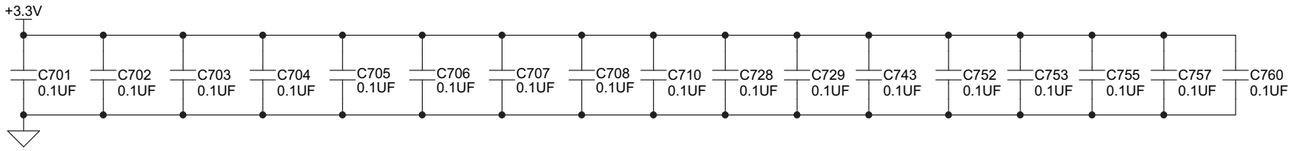
J503	I/O ADDRESS SPACE
NONE	3XX
1 - 2	2XX
3 - 4 (R506)	1XX

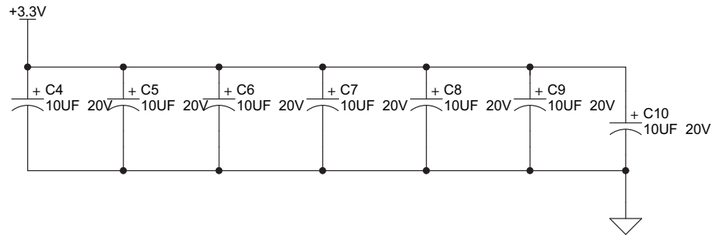
DSP ISA BUS 8-BIT I/O SCHEMATIC
62170.000.12



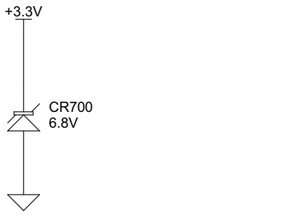
DSP SERIAL AUDIO INTERFACE
AND CLOCK GENERATION
62170.000.12

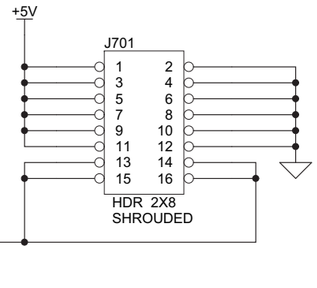


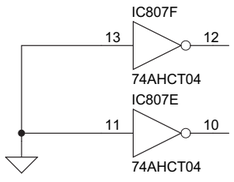


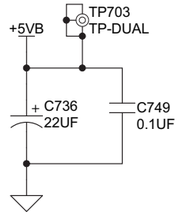


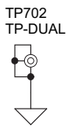
POWER SUPPLY CONNECTOR

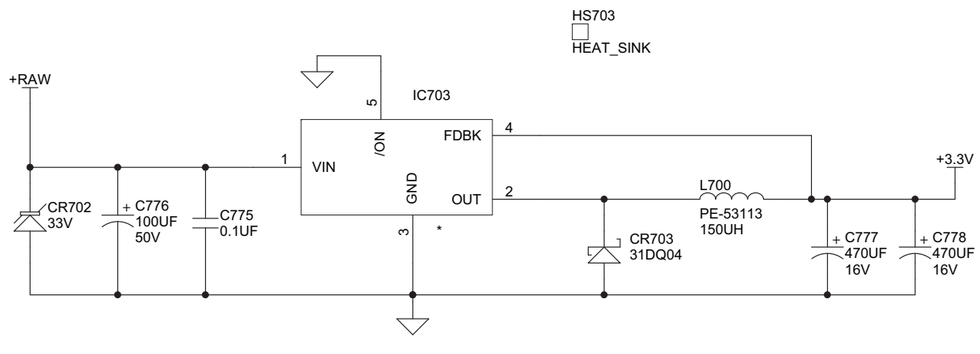




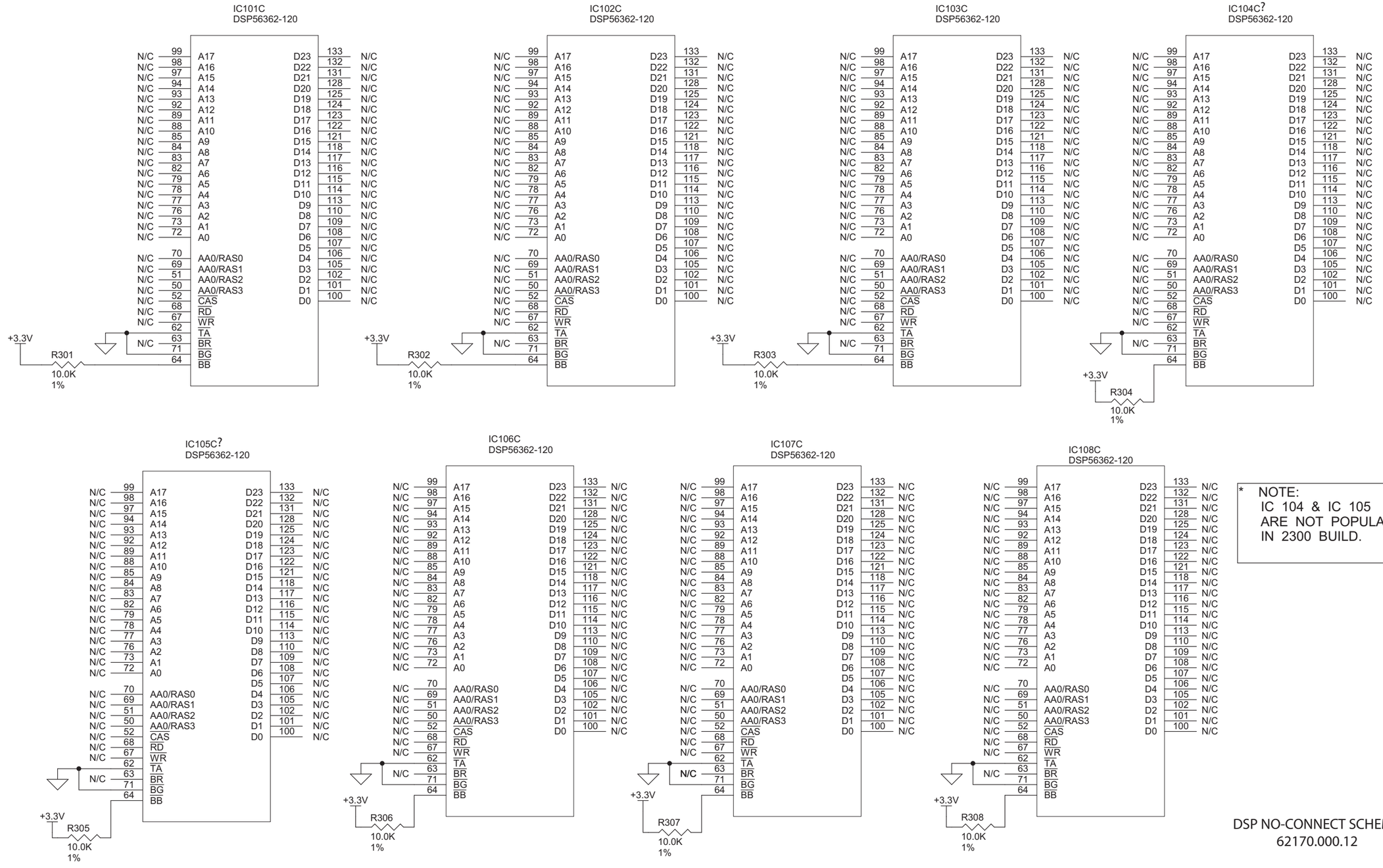








DSP POWER DISTRIBUTION
62170.000.12

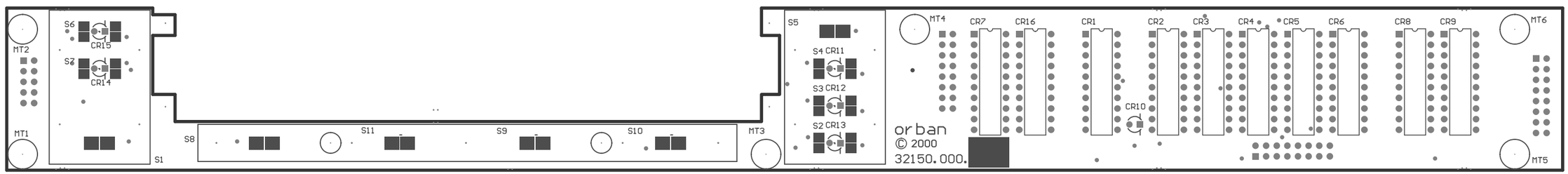


* NOTE:
IC 104 & IC 105
ARE NOT POPULATED
IN 2300 BUILD.

DSP NO-CONNECT SCHEMATIC
62170.000.12

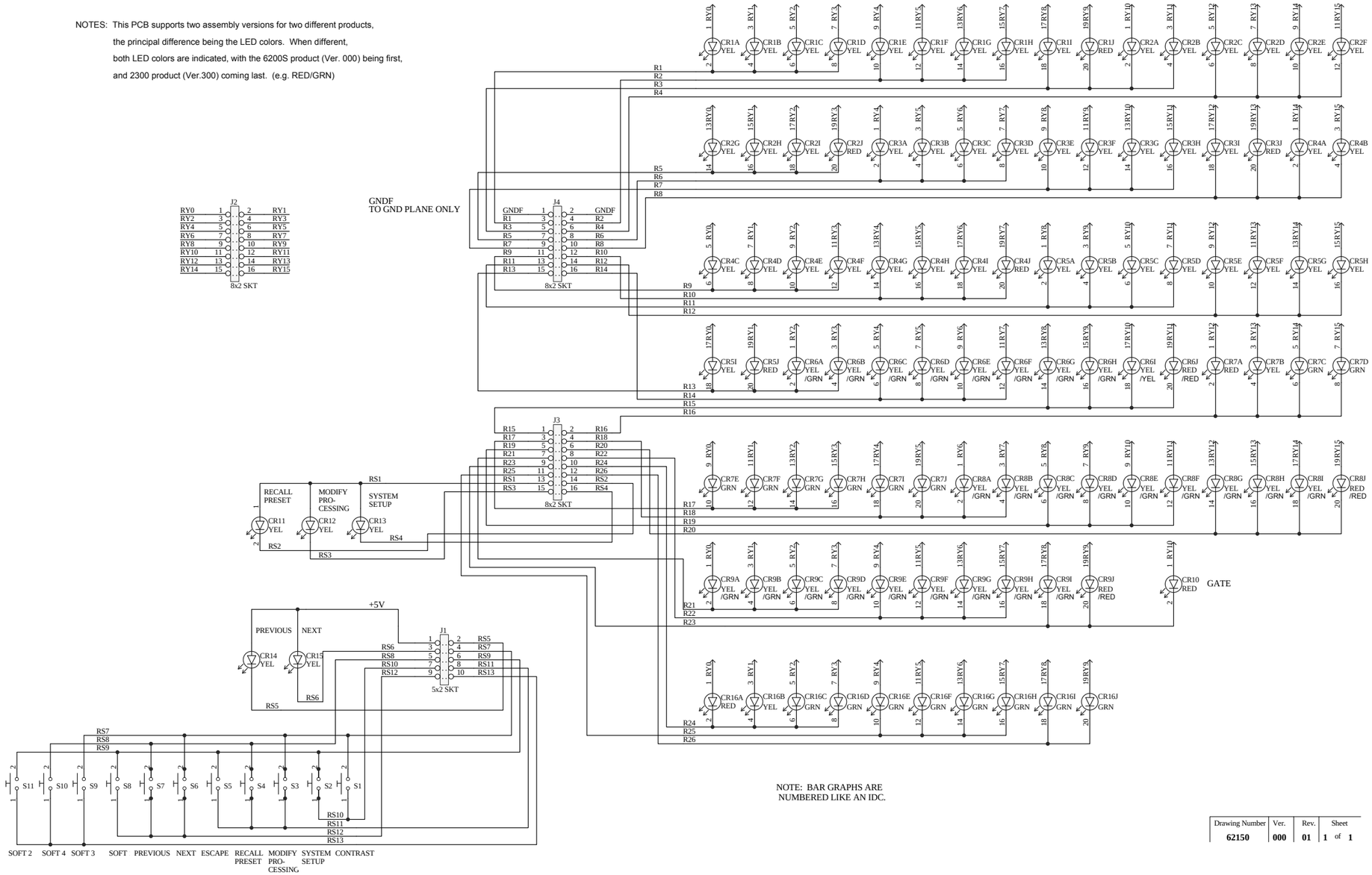
2. REFERENCE SCHEMATIC DRAWING NO. 62150-000-01
1. SQUARE PADS INDICATE PIN 1 OF CONNECTORS, CATHODE OF DIODES, POS. SIDE OF CAPS. PIN 1 OF IC'S.

DWG NO.	VER	REV	SHEET
32150	300	01	1 OF 1



2300 FRONT PANEL PART LOCATOR DIAGRAM -- FRONT CIRCUIT BOARD

NOTES: This PCB supports two assembly versions for two different products, the principal difference being the LED colors. When different, both LED colors are indicated, with the 6200S product (Ver. 000) being first, and 2300 product (Ver.300) coming last. (e.g. RED/GRN)



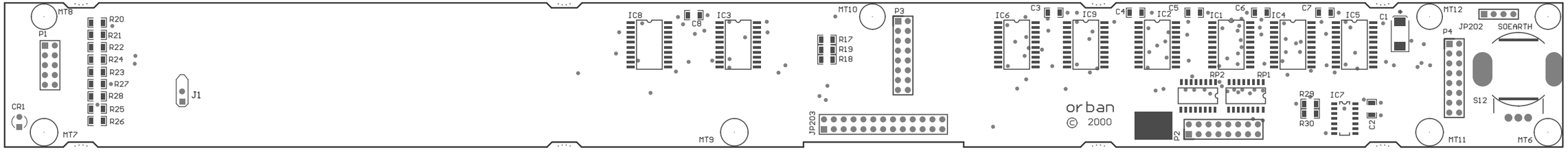
NOTE: BAR GRAPHS ARE NUMBERED LIKE AN IDC.

Drawing Number	Ver.	Rev.	Sheet
62150	**000**	**01**	**1** of **1**

2300 FRONT PANEL SCHEMATIC DIAGRAM -- FRONT CIRCUIT BOARD

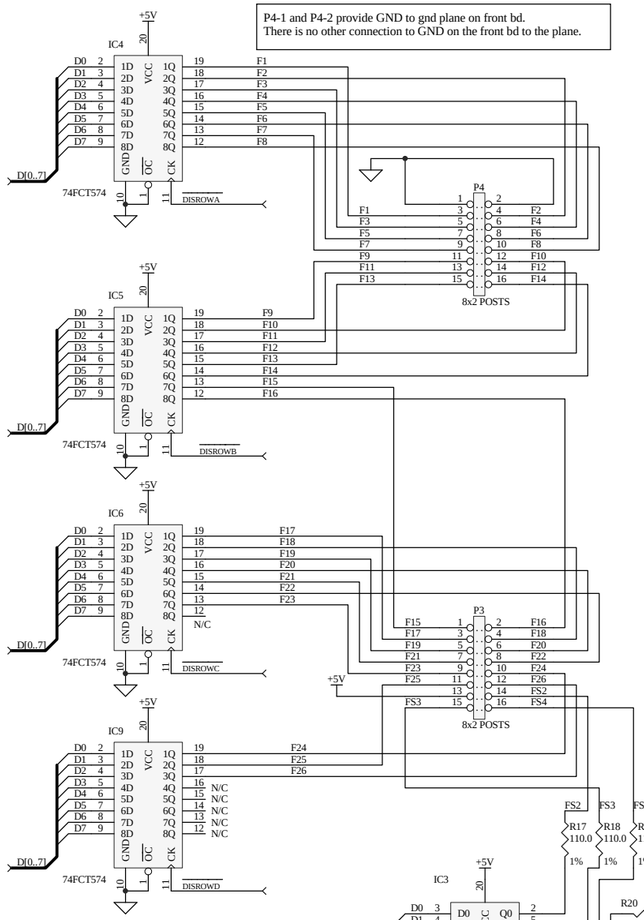
2. REFERENCE SCHEMATIC DRAWING NO. 62155-000-02
1. SQUARE PADS INDICATE PIN 1 OF CONNECTORS, CATHODE OF DIODES, POS. SIDE OF CAPS. PIN 1 OF IC'S.

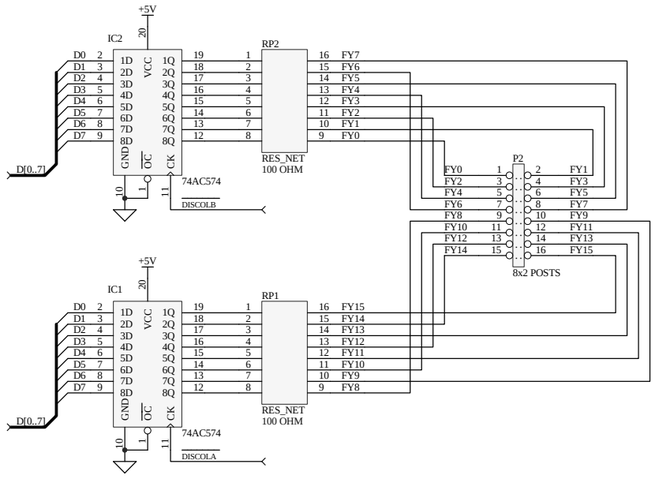
DWG NO.	VER	REV	SHEET
32155	300	01	1 OF 1

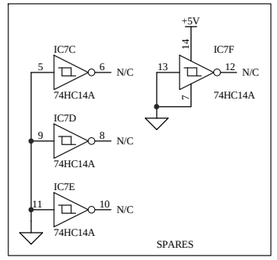


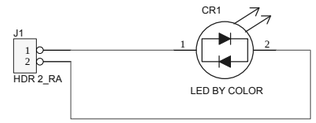
2300 FRONT PANEL PART LOCATOR DIAGRAM -- REAR CIRCUIT BOARD

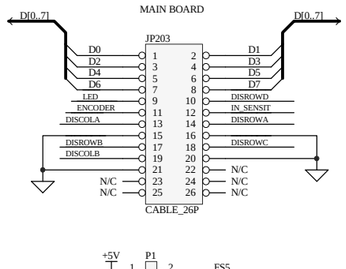
P4-1 and P4-2 provide GND to gnd plane on front bd.
There is no other connection to GND on the front bd to the plane.

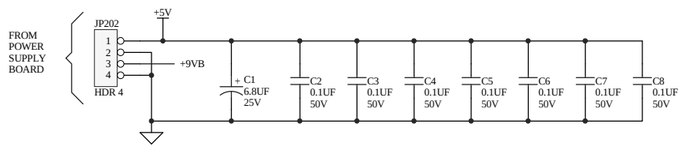


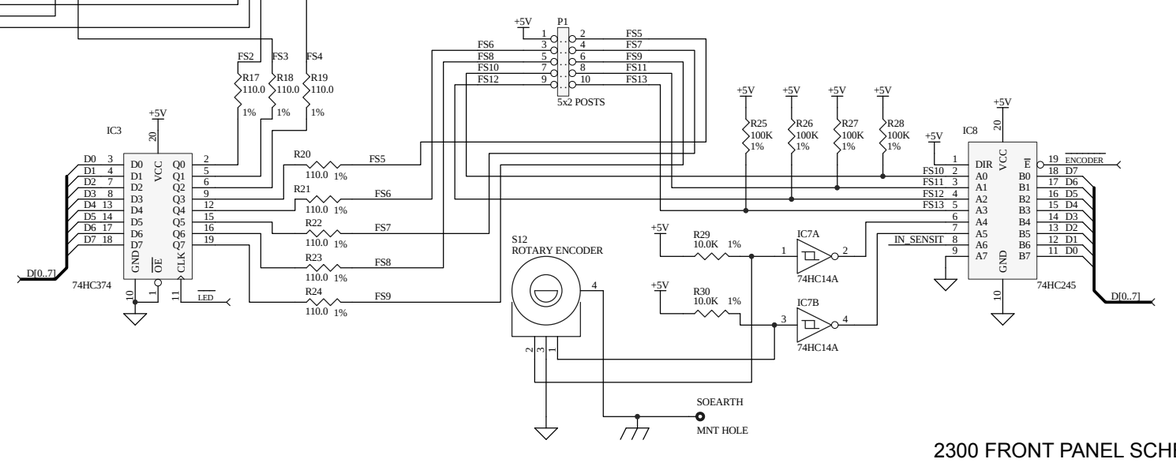






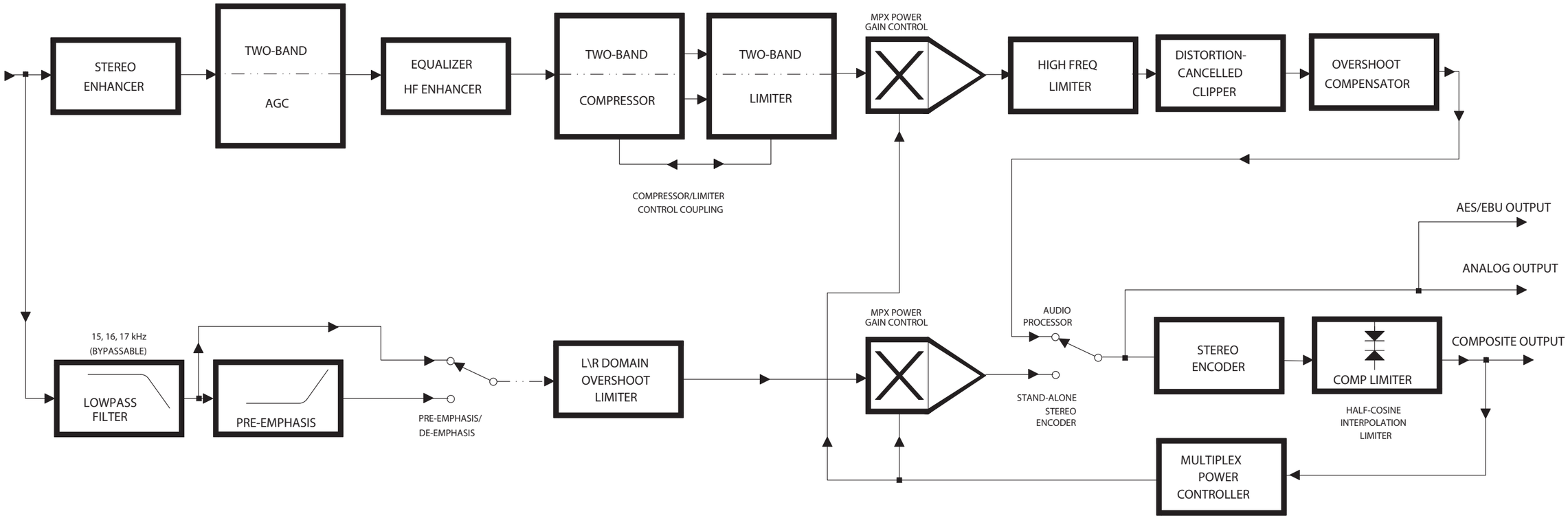






Drawing Number	Ver.	Rev.	Sheet
62155	000	02	1 of 1

2300 FRONT PANEL SCHEMATIC DIAGRAM -- REAR CIRCUIT BOARD



OPTIMOD-FM 2300 VERSION 2
SIMPLIFIED BLOCK DIAGRAM