Operating Manual

Programmable Mic Processor

Models 787A and 787ASL

orban

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

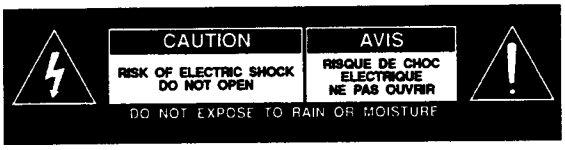
Model Number:	Description:
787A/U	Programmable Mic Processor 115V
787A/E	Programmable Mic Processor 230V
787A/UM	Programmable Mic Processor 115V Midi
787A/EM	Programmable Mic Processor 230V Midi
787A/U2	Programmable Mic Processor 115V RS232
787A/E2	Programmable Mic Processor 230V RS232
787A/U4	Programmable Mic Processor 115V RS422
787A/E4	Programmable Mic Processor 230V RS422
787A/UP	Programmable Mic Processor 115V Preamp
787A/EP	Programmable Mic Processor 230V Preamp
787A/UPM	Programmable Mic Processor 115V Preamp Midi
787A/EPM	Programmable Mic Processor 230V Preamp Midi
787A/UP2	Programmable Mic Processor 115V Preamp RS232
787A/EP2	Programmable Mic Processor 230V Preamp RS232
787A/UP4	Programmable Mic Processor 115V RS422
787A/EP4	Programmable Mic Processor 230V RS422
787ASL	Programmable Mic Processor Slave
787ASL/P	Programmable Mic Processor Slave Preamp
787ARC	Remote Control for 787A

OPTIONS AVAILABLE

Model Number:	Purpose:
RET045	MIDI Serial Port
RET046	Mic Preamp (Jensen Design)
RET050	RS-232 Serial Port
SC2	Clear Security Cover

MANUAL

Part Number:	Description:
95068-000-04C	787A 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.

IMPORTANT SAFETY INSTRUCTIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Safety Instructions (European)

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

WARNING: THIS APPLIANCE MUST BE EARTHED.

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

GREEN and YELLOW - Earth BLUE - Neutral BROWN - Live

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

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

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

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

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

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

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

AC Power Cord Color Coding

Safety Instructions (German)

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

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

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

Gerät und Netzkabel keinen übertriebenen mechanischen Beaspruchungen aussetzen.

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

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

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

Safety Instructions (French)

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

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

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

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

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

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

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

Safety Instructions (Spanish)

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

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

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

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

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

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

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

Safety Instructions (Italian)

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

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

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

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

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

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

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

Operating Manual

Programmable Mic Processor

Models 787A and 787ASL

orban

This manual is part number 95068-000-04C
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Operating Manual

Programmable Mic Processor

Models 787A and 787ASL

page contents

INDEX on next page

Index

Section 1 Introduction

page contents

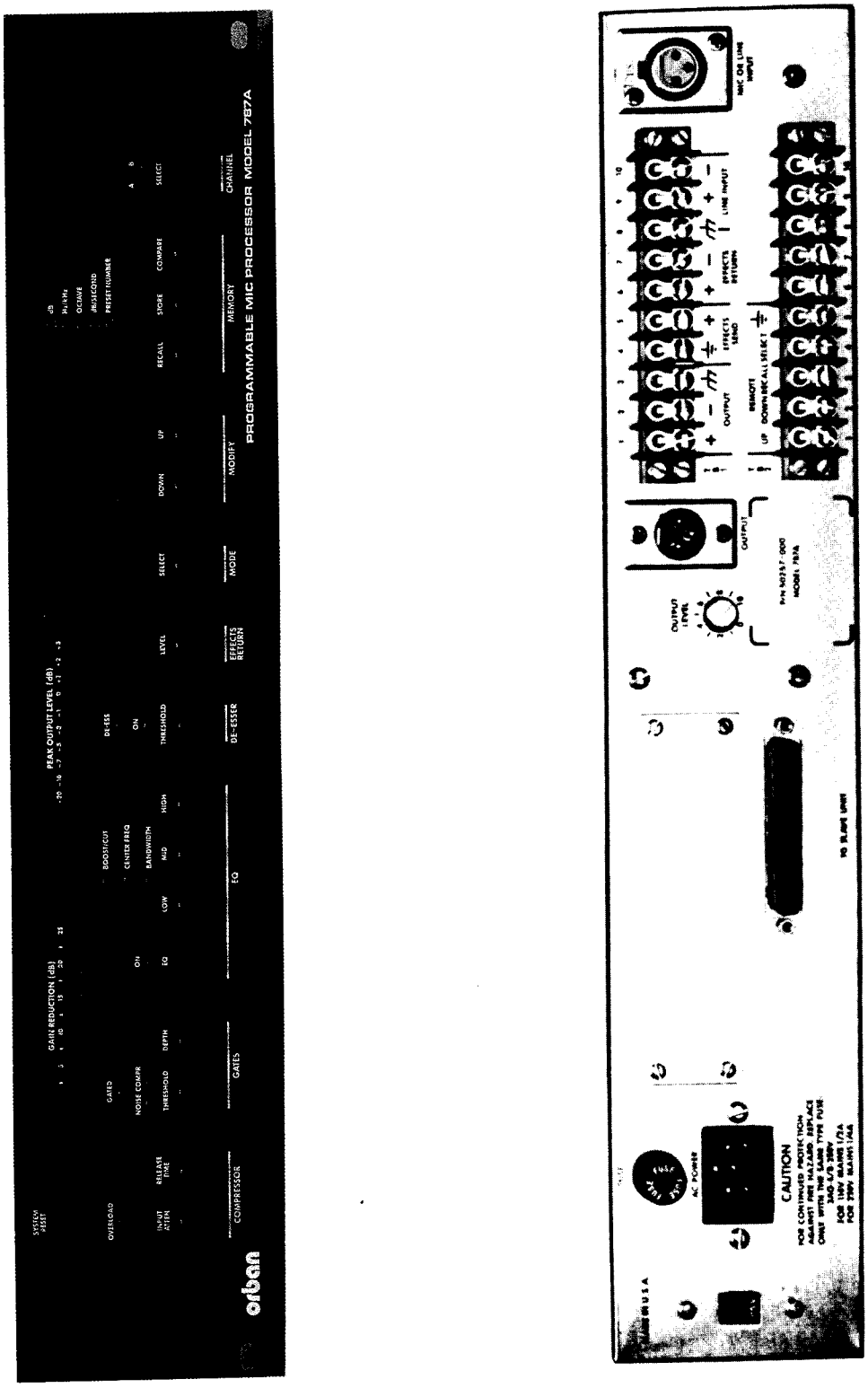

Fig. 1-1: Front and Rear Panels

The Orban 787A Programmable Mic Processor

The Orban 787A Programmable Mic Processor integrates a three-band parametric equalizer, compressor, de-esser, noise gate, and compressor gate into one compact, powerful system. The optional 787ASL Slave unit provides a second channel of programmable mic processing for dual-mono or stereo operation.

787A Programmable Mic Processor features include:

- Instantaneous access to 99 user-programmed control setups.
- 3-band parametric equalizer with variable frequency, bandwidth, and boost/cut for precision control.
- Smooth compressor with adjustable release time to deliver maximum presence and "punch" while maintaining consistent levels.
- Full-function de-esser to help control excessive sibilance.
- Compressor gate to prevent rush-ups during pauses.
- Noise gate to attenuate noise by up to 25dB.
- Effects send-and-return with programmable return level to simplify integration of external reverb or "psychoacoustic exciter."
- Digital display of current control settings.
- Easy-to-read bargraph displays of output and gain reduction levels.
- Memory protected by internal back-up battery.
- Security code to lock programming controls and prevent tampering.
- Optional MIDI or RS-232 interface.
- Optional basic remote control accessory with digital display.
- Line-level input standard; optional high quality transformer mic preamp with 48-volt phantom power.

Applications

Orban's Programmable Mic Processor integrates a unique combination of processing functions in a fully-programmable package. Its flexibility and efficiency provide all the processing tools you need to precisely define the sound of DJs, announcers, narrators, singers, or certain musical instruments — and, when you've got the sound you want, the Programmable Mic Processor remembers the control settings so you can get exactly the same sound later, with the push of a button.

Broadcast Mic Processing

Nearly any voice can be made more appealing by the judicious use of mic processing. Each voice at your station can be assigned a permanent set-up for each mic/studio combination for instant recall just before the voice airs. The Programmable Mic Processor gives you an important competitive edge by enabling you to get the sound you want quickly and consistently.

It can also dramatically improve the quality of phone line feeds for talk shows and remotes by making levels more consistent, improving frequency response, and reducing noise through gating.

Multi-Track Recording, Post-Production

The 787A can increase efficiency and result in significant savings of time in recording and production facilities. If you often work with the same voice talent, you can conveniently store their personal "sound" in memory and quickly achieve satisfying results each time you record. Set-ups for instruments can also be reproduced quickly and efficiently. Less time will be spent on tuning processors, so more time can be devoted to getting better creative results.

The producer who moves from studio to studio knows that the final product can vary tremendously. The Programmable Mic Processor eliminates some of the uncertainty and variation in getting that special "sound." The professional artist can note the settings and the particular mic used for an especially satisfying session, and then use these as a reasonable starting point for processing when working in other studios or at live venues.

Installed Sound Systems and Live PA

Why use daisy-chained signal processing when one unit will do? The Programmable Mic Processor takes up less rack space, guarantees that headroom will be used optimally to minimize noise and distortion, and ensures consistent quality. Performers can concern themselves with their performance, instead of worrying about the sound of the system. Pre-program the mic processing for each performer or set-up, then recall individualized processing for each performer with just the push of a button.

Security

Access to the 787A's audio processing controls can be restricted to authorized users with a programmable security code. When the unit is locked, only those controls which recall and compare preset control settings, unlock controls, and reset the system will function.

If you have an optional 787ASL second channel unit connected to your 787A, the controls for both units are locked or unlocked simultaneously.

If remote control or the optional MIDI or RS-232 interfaces are installed, the 787A (and 787ASL) can be controlled externally even when the front-panel controls are locked.

In situations where it is desirable to limit access to *all* front-panel controls, an optional acrylic security cover can be installed. This arrangement might be appropriate, for example, when the 787A is being controlled entirely by remote control or through the optional MIDI interface. See page 3-12 for more information.

Registration, Warranty, Feedback

Registration Card

There are two good reasons for returning the Registration Card:

1) It enables us to inform you of new applications, performance improvements, and service aids that are developed, and
2) It helps us respond promptly to claims under warranty without 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. If it is lost (or you have purchased this unit used), please photocopy the duplicate below, fill it in, and send it to Orban at the address on the inside of the front cover.

Registration Card

Model # _____ Serial # _____ Purchase Date _____

Your name _____ Title _____

Company _____ Telephone _____

Street _____

City, State, Mail Code (Zip), Country _____

Nature of your product application _____

How did you hear about this product? _____ Purchased from _____

Comments _____

_____

Which magazines do you find the most useful to your job?

___ Audio	___ Broadcast Engineering	___ Broadcast	___ dB Magazine
___ Electronic Musician	___ EQ	___ Millimeter	___ Mix
___ Post	___ Pro Sound News	___ Radio & Records	___ Radio World
___ RE/P	___ Sound & Communications	___ S & VC	___ TV Broadcast
___ TVTech	___ _____	___ _____	
	___ _____	___ _____	

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Warranty

The warranty, which can be enjoyed only by the first end-user of record, is stated on the separate Warranty Certificate packed with this manual. Save it for future reference. See page 5-7 for information about factory service.

User Feedback Form

We are very interested in your comments about this product. Your suggestions for improvements to the product or the manual will be carefully reviewed. Use the postpaid User Feedback Form in the back of this manual — or write us at the address on the inside of the front cover. Thank you.

Section 2 Installation

page contents

CAUTION

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Installation

Allow about 15 minutes for installation.

Installation consists of unpacking the 787A, mounting it in a rack (if desired), and connecting audio and power. In addition, input or output levels can be changed, low- and mid-band equalization can be relocated to follow the compressor, and external remote control or effects processing can be connected. If the optional 787ASL second channel slave unit will be used, a connector to accommodate the 787ASL must be installed on the 787A's rear panel.

Installation instructions for the optional 787ASL slave unit begin on page 2-14.

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 communications. This equipment complies with the limits for a Class A computing device, as specified by FCC Rules, Part 15, Subpart J, which are designed to provide reasonable protection against such interference when this type of equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference. If it does, the user will be required to eliminate the interference at the user's expense.

WARNING

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

1) Unpack and inspect.

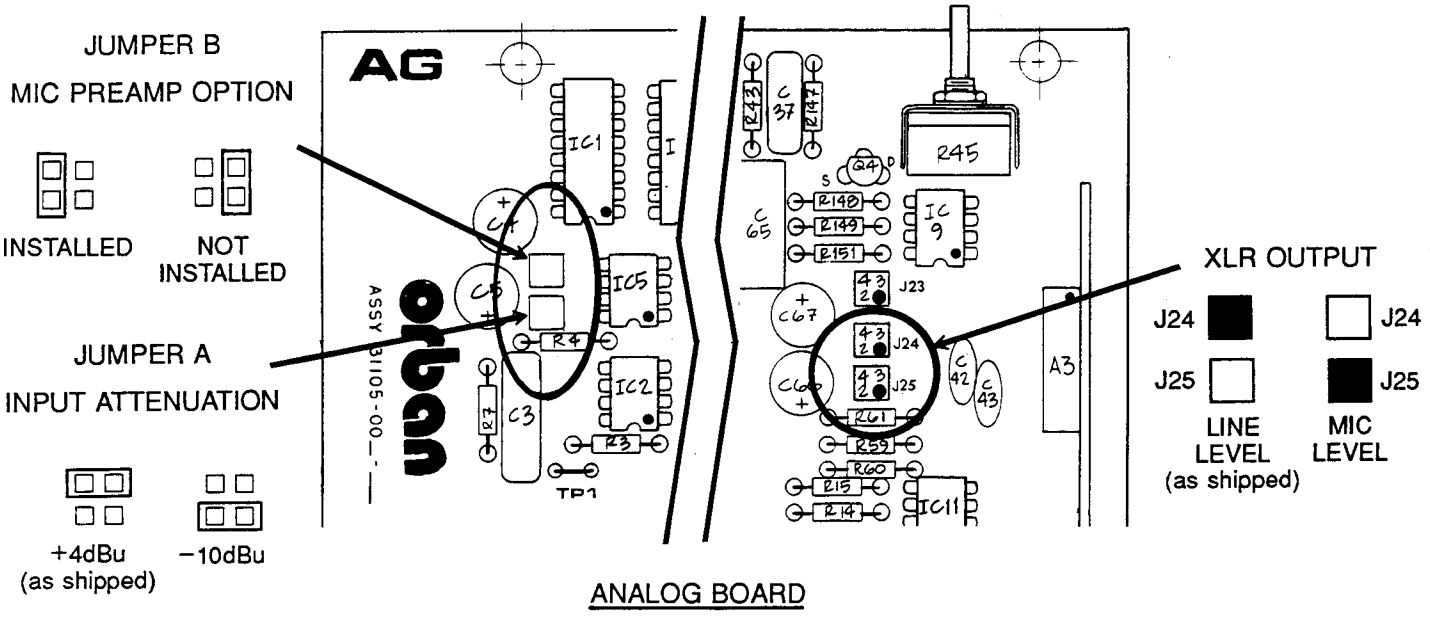
A☐ If obvious physical damage is noted, contact the carrier immediately to make a damage claim.

B☐ Make a mental note of how the unit is packed and *save all packing materials* for future use.

If you should ever have to ship the 787A (e.g., for servicing), it is best to ship it in the original packing materials since these have been carefully designed to protect the unit.

Packed with the 787A are:

1	Power cord
1	Warranty Certificate
1	Registration Card
1	Operating Manual



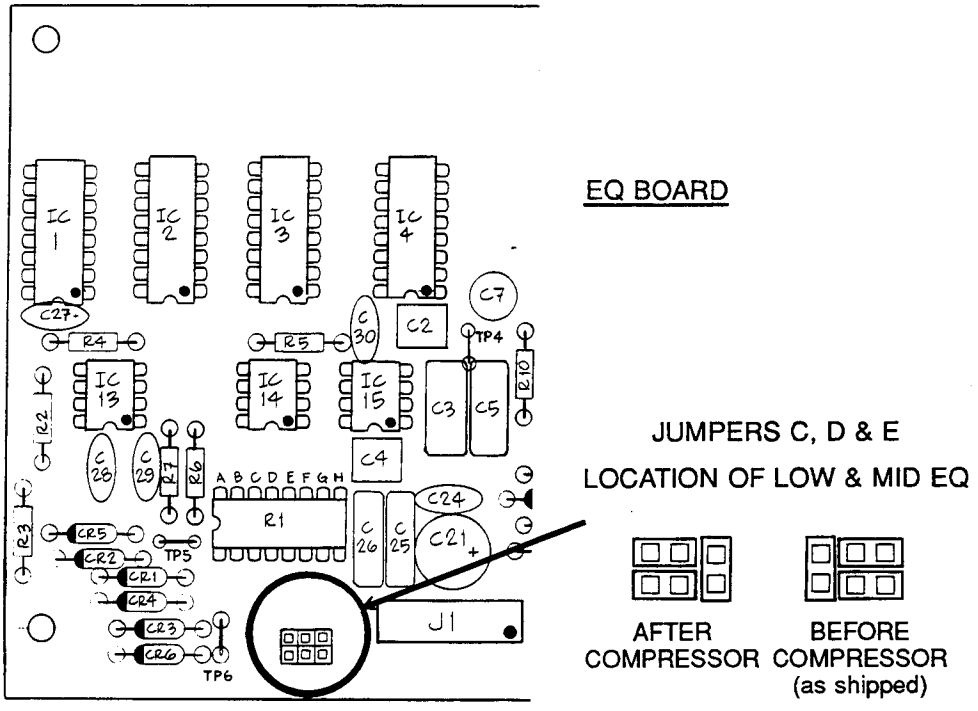


Fig. 2-1: Option Jumpers

2) Change input or output levels, reconfigure equalization. (optional)

DO NOT CONNECT POWER YET!

[Skip this step unless you will be feeding the 787A a −10dBu signal, want to relocate the low- and mid-band equalization to follow the compressor, or want mic level output.]

To move any of these jumpers, first remove the 787A's top cover. Remove the eight screws that hold the cover in place, then lift it off. If you are also installing the optional 787ASL second channel slave unit, leave the top cover off for step 3. When replacing the cover, replace all eight screws snugly (but be careful not to strip the threads by fastening the screws too tightly).

A☐ Change input attenuation level. (optional)

As shipped, the 787A is configured to accommodate an input signal level of +4dBu. If you are feeding the 787A a signal at −10dBu, move jumper A on the analog circuit board to the −10dBu position (see Fig. 2-1).

B☐ Change output level. (optional)

As shipped, the 787A's nominal output level is +4dBm into 600 ohms. This line output can be reduced to mic output level *at the XLR* OUTPUT *connector only* by moving the plug at connector J24 on the analog circuit board to connector J25 (see Fig. 2-1). The mic output level is approximately 60dB below the line output level. (This does not change the EFFECTS SEND output level.)

C☐ Move LOW and MID EQ, so they follow the compressor. (optional)

Most voice-only audio is best processed with the low- and mid-band equalization before the compressor, so that the compressor's output level is adjusted for level changes caused by equalization. However, this arrangement may result in "pumping" on music with a significant bass component. This happens because large amounts of bass energy will cause substantial gain reduction without contributing proportionately to average loudness, thus audibly modulating the loudness of the midrange energy (to which the ear is most sensitive). If the low and mid bands follow the compressor, bass boosts cannot affect the compressor's output level, and no pumping occurs. The trade-off here is that the output level of the 787A can vary with the amount of boost or cut if the compressor is located before equalization. Select the configuration that is most appropriate for your application.

As shipped, the low- and mid-band equalization is located before the compressor. If you want to relocate low- and mid-band equalization to *after* the compressor, move jumpers C, D, and E on the equalization circuit board to the AFTER COMPRESSOR position (see Fig. 2-1). (The high-band equalization is located after the compressor, and cannot be relocated.)

3) Install 787ASL connector. (optional)

[Skip this step unless you are also installing the optional 787ASL second channel slave unit at this time.]

A☐ If it is still in place, remove the 787A's top cover.

Remove the eight screws that hold the cover in place, then lift it off. Save the screws.

B☐ Remove the metal plate above the words TO SLAVE UNIT on the 787A's rear panel.

See Fig. 2-2. Discard the plate and matching screws.

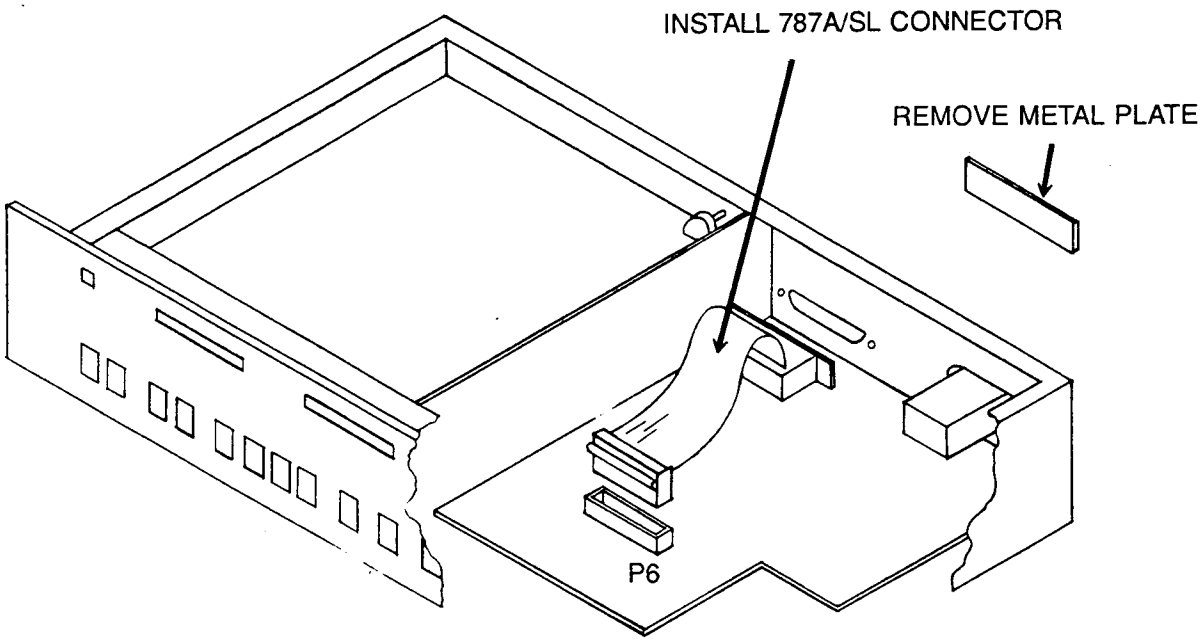


Fig. 2-2: Installation of 787ASL Connector in Host 787A

c❑ Attach the connector on the shorter cable provided with the 787ASL to the inside of the 787A's rear panel.

Use the two jackscrews and nuts provided with the 787ASL.

d❑ Plug the other end of the cable into connector P6 on the 787A's digital circuit board.

See Fig. 2-2.

e❑ Replace the top cover and the eight screws that hold it in place.

Tighten the screws snugly, but be careful not to strip the threads by fastening the screws too tightly.

4) Mount the 787A in a rack. (optional)

The 787A requires two standard rack units (3.5 inches, 8.9 cm).

For best EMI rejection, there should be a good ground connection between the rack and the 787A chassis.

Mounting the unit directly over large heat-producing devices (such as a vacuum-tube power amplifier) may shorten component life and is not recommended. The ambient temperature should not exceed 113°F (45°C) when equipment is powered.

5) Connect audio input and output.

See the connection and grounding information beginning on page 2-9.

Use the OUTPUT LEVEL control on the 787A's rear panel to match the output level to downstream equipment.

An optional mic preamp (RET046) can be installed to boost mic level inputs to line level.

6) Connect external effects generator. (optional)

Audio can be taken from a point following the compressor, equalization, and de-esser, processed externally, then returned to the 787A prior to the OUTPUT LEVEL pot. Reverb and "psychoacoustic excitation" for example, can be added in this way.

Connect external effects processing to the EFFECTS SEND and EFFECTS RETURN terminals on the rear panel. The connection and grounding information beginning on page 2-9 applies, *except* the EFFECTS SEND output is unbalanced, and the EFFECTS RETURN input level can be adjusted with the EFFECTS RETURN key on the front panel. The EFFECTS SEND level is nominally +4dBu, and cannot be adjusted.

7) Connect remote control. (optional)

The UP, DOWN, RECALL, and SELECT CHANNEL functions can be controlled by an external remote control system through the REMOTE terminals on the rear panel. Momentarily ground the appropriate terminal to activate a function.

Orban manufactures an optional basic remote control accessory (ACC024) which can be mounted at the console. The basic remote control accessory has UP, DOWN, RECALL, and SELECT CHANNEL controls and a digital preset number display.

The 787A can also be remotely controlled through the optional MIDI (RET045) or RS-232 (RET050) interface. See page 3-13 for more information.

8) Connect power.

A☐ DO NOT connect power to the unit yet!

B☐ Check the line voltage.

The 787A is shipped ready for 115 or 230V, 50/60Hz operation. Refer to the unit's rear panel for your Model # and the inside front cover of this manual for your Model #'s line voltage setting. To change the operating voltage, set the VOLTAGE SELECTOR to 115V or 230V as appropriate (voltages 15% of the nominal voltage are acceptable). Do not attempt this unless you are qualified to do so.

C☐ Check the value of the fuse and change the fuse if the value is incorrect.

For safety the fuse must be ½-amp 250V Slo-Blo fuse — 3AG or 250mA "T" type as appropriate (for 115-volt *(or) 230-volt operation.*

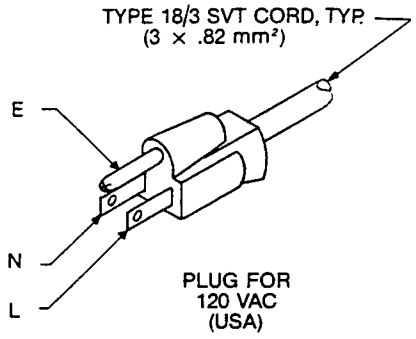
D☐ Connect the 787A's power cord to an appropriate AC power source.

The power cord is ordinarily terminated in a "U-ground" plug (USA standard), or CEE7/7 plug (Continental Europe), as appropriate to your 787A's Model #. The green (or green/yellow) wire from the safety-ground prong is connected directly to the 787A chassis.

If it becomes necessary to lift this ground to suppress ground loops, do so with a three-prong to two-prong adapter plug, rather than by damaging the power plug. But you should *not* defeat the ground unless absolutely necessary, because it eliminates the intrinsic safety feature of the three-wire system.

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	LINE	BROWN	BLACK
N	NEUTRAL	BLUE	WHITE
E	EARTH GND	GREEN-YELLOW	GREEN

Fig. 2-3: AC Power Cord Color Coding

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

The Registration Card enables us to inform you of new applications, performance improvements, and service aids which may be developed, and it helps us respond promptly to claims under warranty without 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. (If it is lost, use the duplicate on page 1-6.)

Audio Connections

Cable:

We recommend using **two-conductor shielded cable** (such as Belden 8451 or equivalent), because signal current flows through the two conductors only. The shield does not carry signal, is used *only* for shielding, and is ordinarily connected to ground at one end only.

Because use of single-conductor cables virtually eliminates any possibility of carefully controlling the system grounding scheme, it is NOT RECOMMENDED! Even so, it often does work adequately.

Sometimes, particularly if you are using the 787A with musical instruments or home-type equipment, single-conductor shielded cable may be the only practical alternative. In this case, connect the inner conductors of the shielded cables to the (+) sides of the 787A inputs and outputs. Connect the shield of the 787A *input* cable to the (−) input, and connect the shield of the 787A *output* cable to the 787A's (−) output terminal on the rear-panel barrier strip. Connect both IN (−) and OUT (−) terminals to the corresponding ⏚.

Connectors:

- **Input and output connectors** are XLR-type in parallel with barrier strip terminals (with #5 screws). If the optional mic preamp (RET046) is installed, connect mic level inputs to the XLR INPUT connector only — the barrier strip LINE INPUT terminals should only be used for line-level input signals. Effects send and return is through barrier strip connections only.

Levels:

- Nominal **input level** is +4dBu (−10dBu if the input level jumper has been moved — see step 2-A on page 2-4). The absolute overload point is +20dBu (or +6dBu if the input level jumper has been moved). If the optional mic preamp (RET046) is installed, levels and overload points will be approximately 65dB lower at the XLR INPUT connectors *only*.

Input Configuration:

See Fig. 2-4 for some examples.

- **The electronically-balanced input** of each channel is compatible with most professional and semi-professional sound equipment, balanced or unbalanced, with a source impedance of 600 ohms or less. If the source impedance is greater (as in some vacuum-tube audiophile preamps), remove capacitor C2, and connect the hot side of the driving equipment's outputs to the 787A's (+) inputs.

Audio Connections (continued)

Audio Input:

- Input connections are the same whether the driving source is balanced or unbalanced.
- Do not connect the cable shield — it should be connected at the source end only. Connect the red (or white) wire to the appropriate (+) input terminal, and the black wire to the corresponding (−) input terminal.
- If the output of another unit is unbalanced and does not have separate ⏚ and (−) (or LO) output terminals, connect both the shield and the black wire to the common (−) or ground terminal. It is rarely necessary to balance an unbalanced output with a transformer. As long as it is feeding a balanced input, the system will work correctly.

  (You must add an input transformer if the source equipment is powered from a separate mains transformer and power ground. Terminate the transformer's secondary with a 20k resistor.)

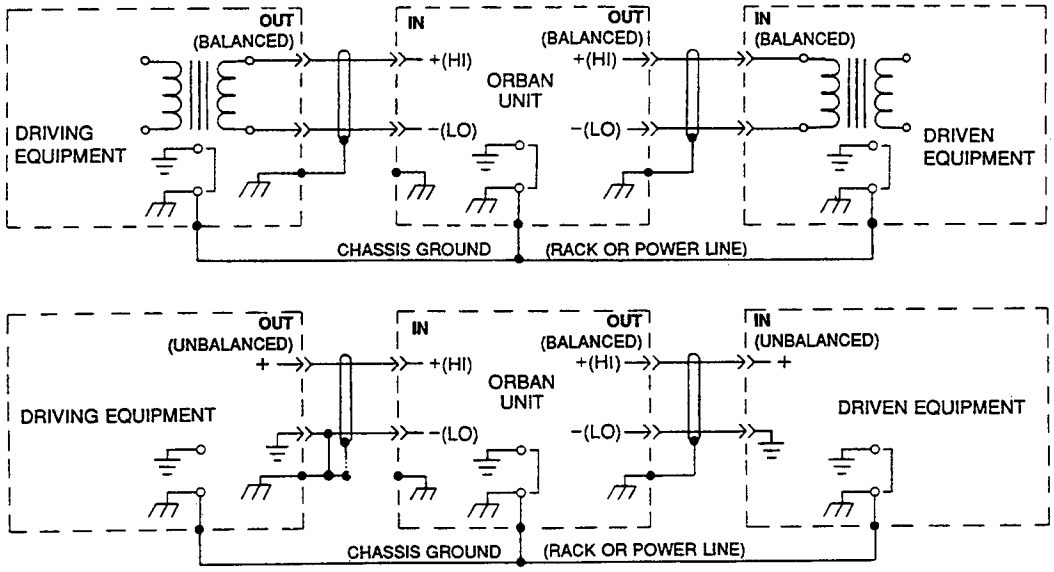


Fig. 2-4: Some Possible Grounding Schemes

Audio Connections (continued)

Output Configuration:

See Fig. 2-4 for some examples.

- The **electronically-balanced and floating output** simulates a true transformer output. The *source* impedance is 30 ohms. There is a 1000pF capacitor between each output (+) and (−) to the chassis for RFI suppression. The output is capable of driving loads of 600 ohms or higher. Maximum output level is +20dBm into 600 ohms.
- If an **unbalanced output** is required (to drive unbalanced inputs of other equipment), it should be taken between the (+) and (−) outputs. No special precautions are required even though one side of the output is grounded. Connect the (−) output terminal to ⏚.

Audio Output:

- Use two-conductor shielded cable (Belden 8451, or equivalent).
- At the 787A's output (and at the output of other equipment in the system), connect the cable's shield to the ⏚ terminal for that channel (pin 1 on XLR connectors). Connect the red (or white) wire to the channel's (+) terminal (pin 2 on XLR connectors), and the black wire to the channel's (−) terminal (pin 3 on XLR connectors).
- It may be necessary to isolate the 787A with output transformers when operating next to a transmitter, when driving more than 100 feet (30 meters) of cable, when the 787A's "ground" potential differs from that of driven equipment by more than 2 volts, or in other difficult situations.

Grounding

Very often, grounding is approached in a "hit or miss" manner. But with care it is possible to wire an audio studio so that it is free from ground loops (which induce hum and can cause oscillation) and provides maximum protection from power faults. 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 787A has balanced inputs.)
- All equipment *circuit grounds* should be connected to each other; all equipment *chassis grounds* should be connected together.
- *Cable shields* should be connected at one end only — preferably the source (output) end.

Power Ground:

- Ground the 787A 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 to 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:

- *In a small system,* the connection through power ground (via the power cord's third wire) will suffice. Connect the 787A's circuit ground (⏚) terminal to its chassis ground (⏚) terminal. Also connect the circuit and chassis grounds of other equipment.
- *In larger systems,* it is common to establish an isolated circuit ground system that is insulated from the power ground except at one point (usually the studio power distribution panel). In such a system, disconnect the 787A's circuit ground (⏚) terminal from its chassis ground (⏚) terminal, then connect the 787A's circuit ground (⏚) terminal to the isolated circuit ground system.

Grounding (continued)

Difficult Situations:

Because it is not always possible to determine if the equipment driving or being driven by the 787A has its circuit ground internally connected to its chassis ground (which is always connected to the ground prong of the AC power cord, if present), and because the use of the AC power ground often introduces noise or other imperfections such as RFI, hum, clicks, and buzzes, the wiring techniques in Fig. 2-4 are not universally applicable.

If you follow Fig. 2-4 and hum or noise appears, don't be afraid to experiment. If the noise sounds like a low-level crackling buzz, then probably there isn't *enough* grounding. Try connecting the (−) input of the 787A to a chassis ground terminal on the barrier strip and see if the buzz goes away. You can also try strapping the 787A's chassis and circuit grounds together, and see if this helps.

A ground loop usually causes a smooth, steady hum rather than a crackly buzz. If you have a ground loop, you can often break it by *disconnecting* the jumper between circuit and chassis grounds on the 787A's rear-panel barrier strip. In either case, think carefully about what is going on, and keep in mind the general principle: one and *only one* circuit ground path should exist between each piece of equipment! (Bear in mind that the circuit grounds of the 787A and the 787ASL slave unit are connected through the interconnect cable, and could conceivably introduce a ground loop if you do not take this connection into account in planning your wiring.)

When a single-conductor shielded cable is used for audio connections, the shield will ordinarily receive chassis ground from the external equipment which it is connecting to the output of the 787A. The chassis ground/circuit ground jumper on the rear barrier strip of the 787A should be left in whichever configuration gives minimum hum or buzz. To minimize hum or buzz, it may be necessary to jumper one or more shields to chassis ground, and/or to jumper the 787A's (−) output to chassis ground.

Installation of Optional 787ASL Slave Unit

Before installing the 787ASL, first install the host 787A — see page 2-2. The 787ASL can only be used if it is connected to a host 787A.

Allow about 30 minutes for installation.

Installation consists of unpacking the 787ASL, installing a connector in the host 787A, mounting the 787ASL in a rack (if desired), connecting audio inputs and outputs, and connecting the 787ASL to its host 787A. In addition, input or output levels can be changed, low- and mid-band equalization can be relocated to follow the compressor, and external effects processing can be connected.

1) Unpack and inspect.

A☐ If obvious physical damage is noted, contact the carrier immediately to make a damage claim.

B☐ Make a mental note of how the unit is packed and *save all packing materials* for future use.

If you should ever have to ship the 787ASL (e.g., for servicing), it is best to ship it in the original packing materials since these have been carefully designed to protect the unit.

Packed with the 787ASL:

1	Connector/cable assembly
1	Interconnect cable
1	Warranty Certificate
1	Registration Card

2) Install connector in host 787A.

WARNING

BE SURE THE POWER TO THE HOST 787 IS NOT CONNECTED.

A☐ Remove the host 787A's top cover.

If the 787A is in a rack, remove it and place it on a workbench. Remove the eight screws that hold the cover in place, then lift it off. Save the screws.

B☐ Remove the metal plate above the words TO SLAVE UNIT on the 787A's rear panel.

See Fig. 2-2 on page 2-5. Discard the plate and matching screws.

C☐ Attach the connector on the shorter cable provided with the 787ASL to the inside of the 787A's rear panel.

Use the two jackscrews and nuts provided with the 787ASL.

D❑ Plug the other end of the cable into connector P6 on the 787A's digital circuit board.

See Fig. 2-2.

E❑ Replace the top cover and the eight screws that hold it in place.

Tighten the screws snugly, but be careful not to strip the threads by fastening the screws too tightly.

3) Change input or output levels, reconfigure equalization. (optional)

[Skip this step unless you will be feeding the 787ASL a −10dBu signal, want to relocate the low- and mid-band equalization after the compressor, or want mic level output.]

To move any of these jumpers, first remove the 787ASL's top cover. Remove the six screws that hold the cover in place, then lift it off. When replacing the cover, replace all six screws snugly (but be careful not to strip the threads by fastening the screws too tightly).

A❑ Change input attenuation level. (optional)

As shipped, the 787ASL is configured to accommodate an input signal level of +4dBu. If you are feeding the 787ASL a signal at −10dBu, move jumper A on the analog circuit board to the −10dBu position (see Fig. 2-5).

B❑ Select mic-level output. (optional)

As shipped, the 787ASL's nominal output level is +4dBm into 600 ohms. This line output can be changed to a mic output level by moving the plug at connector J24 on the analog circuit board to connector J25 (see Fig. 2-5). The mic output level is approximately 60dB below the line output level. (This does not change the EFFECTS SEND output level.)

C❑ Move LOW and MID EQ, so they follow the compressor. (optional)

As shipped, the low- and mid-band equalization is located before the compressor. If you want to relocate low- and mid-band equalization to follow the compressor, move jumpers C, D, and E on the equalization circuit board to the AFTER COMPRESSOR position (see Fig. 2-5). (The high-band equalization is located after the compressor, and cannot be relocated.)

Both locations have advantages and disadvantages — see step 2-C on page 2-4.

4) Mount the 787ASL in a rack. (optional)

The 787ASL requires one standard rack unit (1¾ inches, 4.4 cm).

For best EMI rejection, there should be a good ground connection between the rack and the 787ASL chassis.

Mounting the unit directly over large heat-producing devices (such as a vacuum-tube power amplifier) may shorten component life and is not recommended. The ambient temperature should not exceed 113°F (45°C) when equipment is powered.

5) Connect audio input and output.

See the connection and grounding information beginning on page 2-9 (substitute "787ASL" for "787A)."

Use the OUTPUT LEVEL control on the 787ASL's rear panel to match the output level to equipment that follows the 787A.

An optional mic preamp (RET046) can be installed to boost mic level inputs to line level.

6) Connect external effects generator. (optional)

Audio can be taken from a point following the compressor, equalization, and de-esser, processed externally, then returned to the 787ASL prior to the OUTPUT LEVEL pot. Reverb and "psychoacoustic excitation" for example, can be added in this way.

Connect external effects processing to the EFFECTS SEND and EFFECTS RETURN terminals on the rear panel. The connection and grounding information beginning on page 2-9 applies, *except* the EFFECTS SEND output is unbalanced, and the EFFECTS RETURN input level can be adjusted with the EFFECTS RETURN key on the front panel. The EFFECTS SEND level is nominally +4dBu, and cannot be adjusted.

WARNING

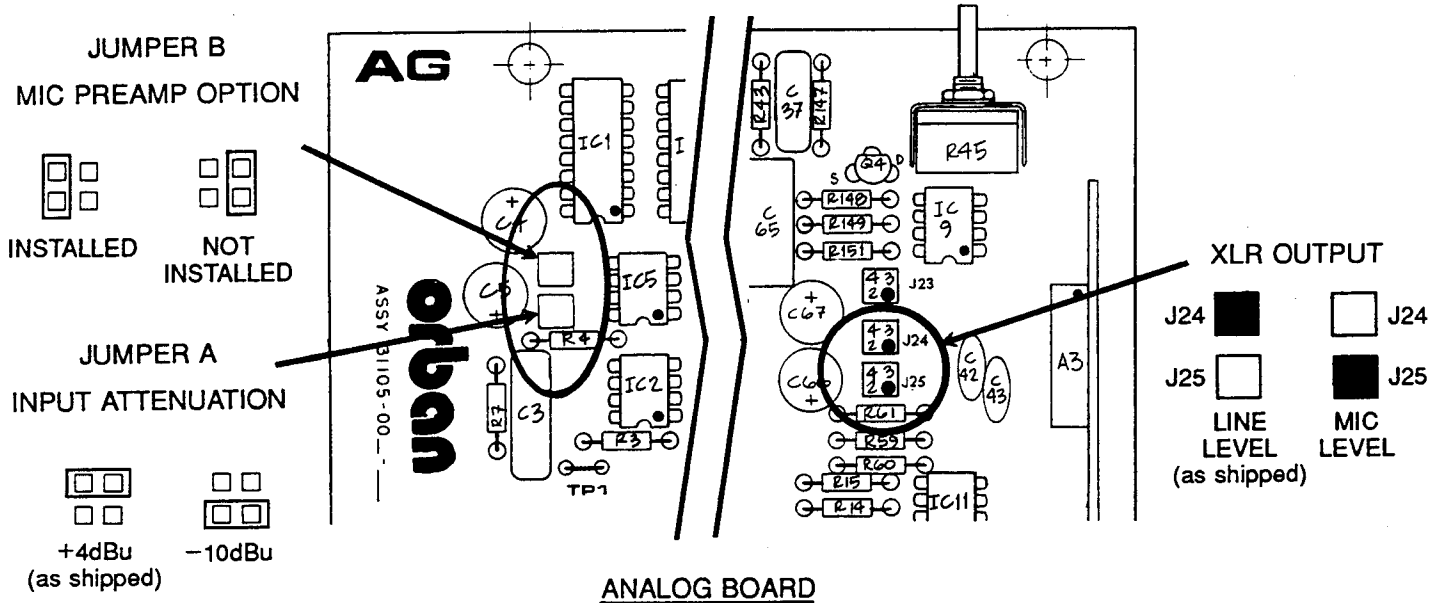
Unplug the 787A's power cord before connecting or disconnecting the 787ASL. Severe damage to the 787ASL may result if the units are connected while the host 787A is powered.

7) Connect the 787ASL to the host 787A with the interconnecting cable.

The 787A supplies the 787ASL with power through this cable. The cable also connects the circuit grounds of the two units.

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

The Registration Card enables us to inform you of new applications, performance improvements, and service aids which may be developed, and it helps us respond promptly to claims under warranty without 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. (If it is lost, use the duplicate on page 1-6.)



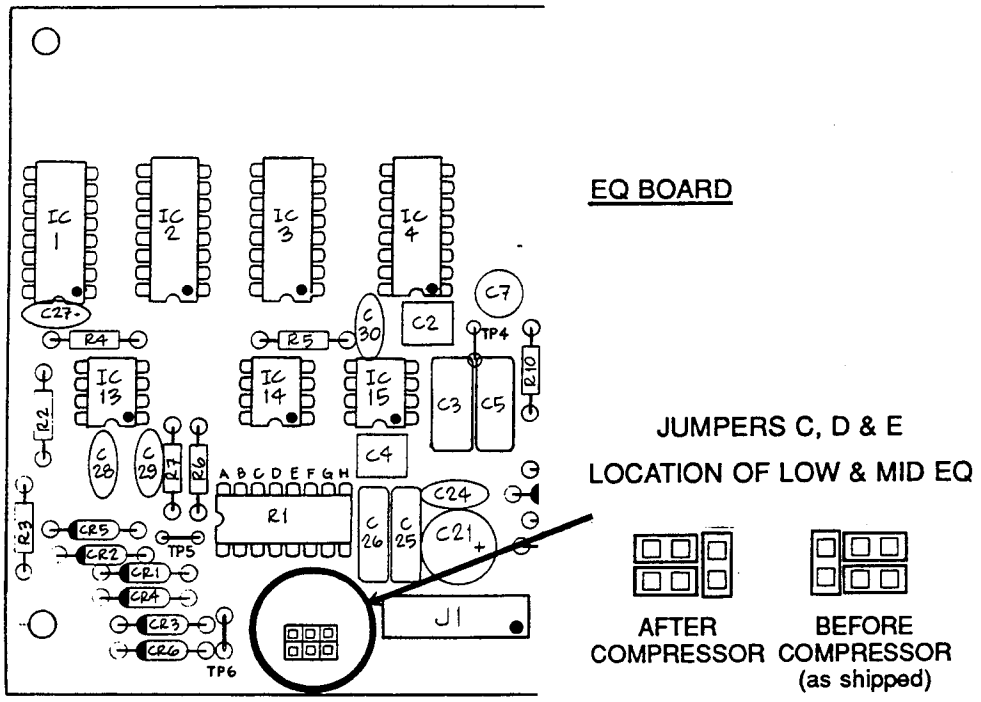
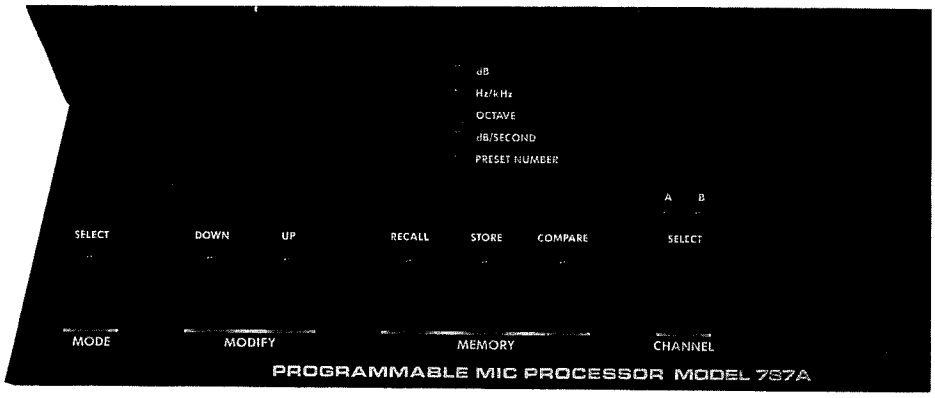


Fig. 2-5: Option Jumpers

Section 3
Operation

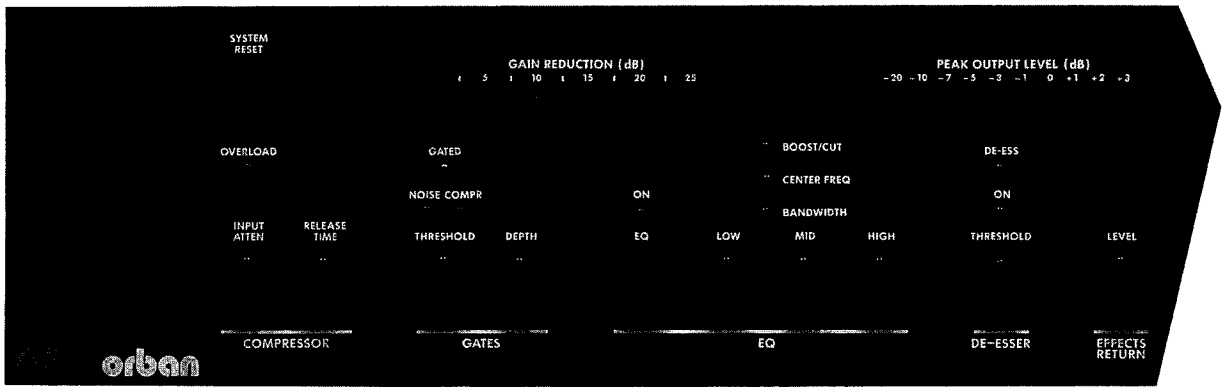
page contents

787A Controls and Displays



General notes:

- A flashing key light indicates that there is another step in programming that function.
- The UP and DOWN keys light when they can be used. The rate of change accelerates when UP or DOWN is held down.
- Display messages that begin with E are error messages — see page 5-2.
- A flashing decimal point on the numeric display indicates that the internal back-up battery level is low — see page 4-2.
- Panel display brightness can be adjusted with a BRIGHTNESS trimmer, accessible through a hole in the front left corner of the 787A's top cover.
- The SYSTEM RESET button resets the 787A's microprocessor should it "hang up" (it does not erase memory or cause audible glitches). The audio output is muted momentarily when RESET is pressed. See page 3-9 for a discussion of muting. The RESET button is also used to control certain functions and options.



Specific instructions on these pages:

Audio Processing

The 787A's audio processing functions include compression, noise gating, equalization, and de-essing. A send-return port with return level control is provided for external effects processing.

The arrangement of the 787A's audio processing circuitry is illustrated by the block diagram on page 3-5.

The values displayed when pressing the audio processing function keys are the *current control settings* (also known as *front panel settings*). The unit of measure for the displayed value is indicated by the lights to the right of the display.

If + L o c is displayed when an audio processing function key is pressed, the controls are locked — see 3-12.

If the optional 787ASL second channel slave unit is installed, the A or B channel must be selected — see 3-20.

Control Setting Ranges

Control:	Range:			
COMPRESSOR INPUT ATTENUATION	+5	to	−25dB	
COMPRESSOR RELEASE TIME	1	to	50dB/second	
GATE THRESHOLD	0	to	−30dB, OFF	
NOISE GATE DEPTH	0	to	−25dB	
BOOST/CUT	+16	to	−30dB, −∞ (- - -)	
CENTER FREQUENCY*	30	to	632Hz	low band
	210	to	7.65kHz	middle band
	420	to	15.3kHz	high band
BANDWIDTH	0.1	to	5 octaves	
DE-ESSER THRESHOLD	0	to	−48dB	
EFFECTS RETURN LEVEL	+16	to	−30dB, OFF	
OUTPUT LEVEL (on rear panel)	0	to	10 (arbitrary scale)	

* The coarse center frequency scale is logarithmic, with ten steps per octave. The fine center frequency scale is linear, with 2.5Hz steps for the low band, 30Hz steps for the middle band, and 60Hz steps for the high band. Note that the displayed frequency is rounded off as necessary.

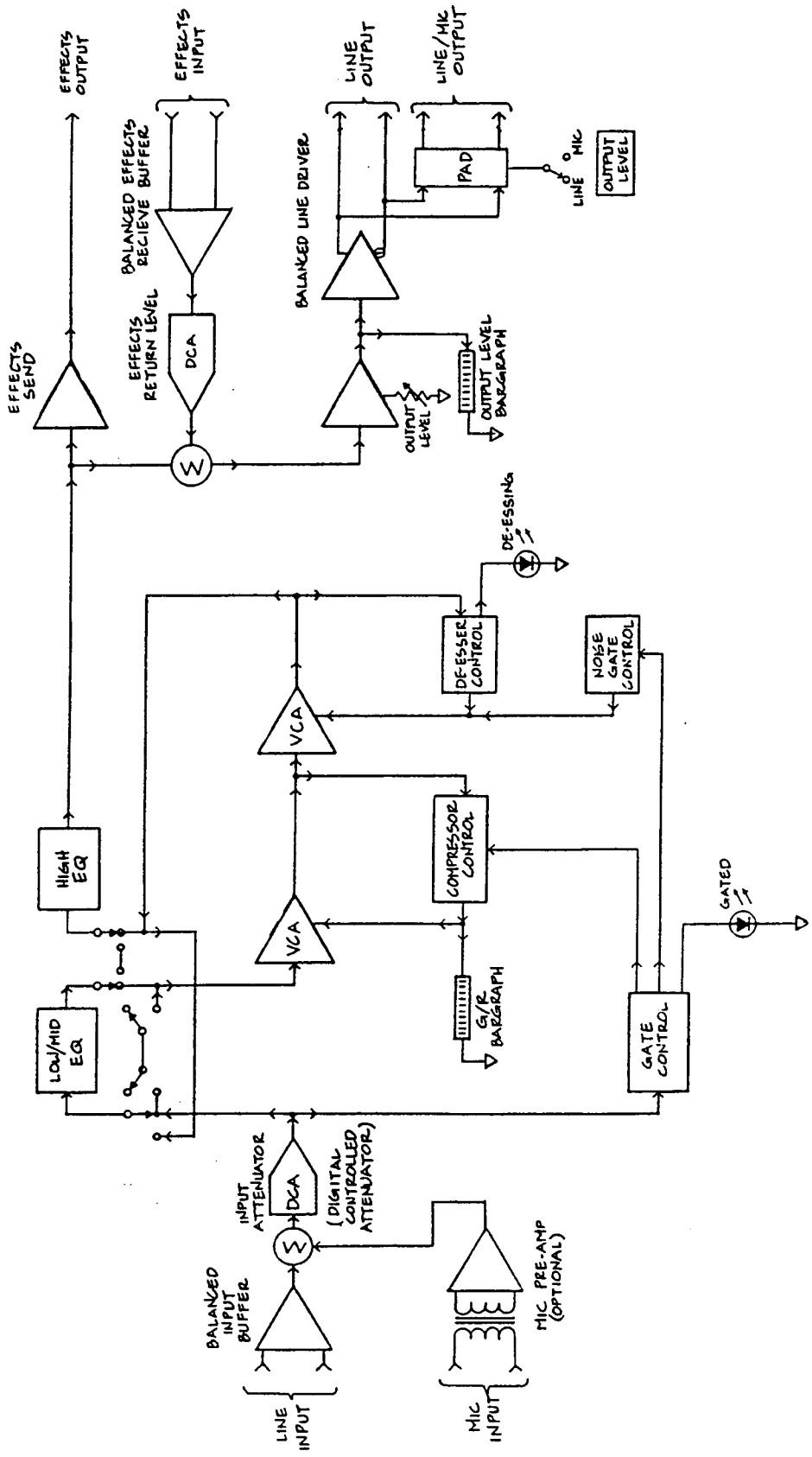


Fig. 3-1: Simplified Block Diagram

Compression

The 787A's compressor automatically controls the level of the audio signal by increasing gain when the input signal is quieter and decreasing the gain when the signal gets louder. The action of the compressor depends on the level of the audio signal and on the settings of three parameters:

The **input attenuator** controls the overall amount of gain reduction by setting the signal level going into the gain control circuitry.

To change the input attenuation level:

Press INPUT ATTEN; the current input attenuation level will be displayed, expressed in dB. Press UP or DOWN to change the level.

Be careful not to adjust the controls to produce so much gain reduction that the **red segment** of the GAIN REDUCTION display lights. Unlike the displays in some processors, the red segment of the 787A's GAIN REDUCTION display gives a warning that must be heeded. When the display is in the red, the compressor has run out of gain reduction range, the circuitry is being overloaded, and various nastinesses are likely to commence.

The **release rate** determines how fast the gain recovers when the audio level decreases suddenly: faster rates produce audio that is more consistent and dense, while slower rates give a more natural sound.

To change the release rate:

Press RELEASE TIME; the current release rate will be displayed, expressed in dB/second. Press UP or DOWN to change the release rate.

To prevent noise rush-up and pumping, the compressor will *slowly* move to 10dB gain reduction when the level of audio is below the **compressor gate threshold.**

To change the compressor gate threshold:

Press GATE THRESHOLD; the current compressor gate threshold level will be displayed, expressed in dB. Press UP or DOWN to change the threshold. Set the threshold to OFF to disable the compressor gate.

The GATED light will light when the compressor gate is active.

- The **GAIN REDUCTION display** shows the true peak gain reduction in dB. If the red LED at the far right of the bargraph lights, no further gain reduction is available.
- The **PEAK OUTPUT LEVEL display** indicates the peak output level of the 787A just before its final "active transformer" line amplifier. The display reads the true peak value (±0.5dB) of a 10-microsecond pulse.
- The **OVERLOAD light** will light when there is an overload anywhere in the 787A. To correct this, reduce the input level with the INPUT ATTEN key, reduce the level of the signal applied to the 787A, or reduce the amount of equalization boost.

Why use compression?

Compression is used to decrease the peak-to-average ratio, to enhance the intelligibility of audio, or to modify characteristics of the sound.

As a speaker or singer moves nearer to then back from the microphone, the level of the microphone's output will vary. If the level at the listener's ear is allowed to vary too much, it may become difficult to distinguish the performer's voice from background audio. Compression of the microphone signal can be used to make the audio level more consistent.

Decreasing the peak-to-average ratio also enables use of a higher *average* level in recording or broadcast media with limited bandwidth. Using compression in this way yields a denser, louder, more "processed" sound.

Increasing gain reduction and compressor release rate can dramatically change the waveform of the processed audio to give it more "punch." This technique can be used to strengthen a voice or alter the characteristic sound of a musical instrument. To achieve this effect, increase the INPUT ATTEN setting until the GAIN REDUCTION display indicates over 10dB of gain reduction, and increase the RELEASE TIME setting to at least 4dB/second.

Noise Gating

The 787A's noise gate prevents gain increase of low-level noise by attenuating signals that are below the noise gate threshold. The amount of attenuation applied is adjustable.

To turn the noise gate on:

Press GATE THRESHOLD; the NOISE light will light when the noise gate is on. Press GATE THRESHOLD again to turn the gate (and the light) off.

To change the noise gate threshold:

Turn the noise gate on by pressing GATE THRESHOLD; the current gate threshold level will be displayed, expressed in dB. (Both the compressor gate and the noise gate use the same threshold.) Press UP or DOWN to change the threshold.

To change the amount of attenuation applied by the noise gate:

Press DEPTH; the current amount of attenuation will be displayed, expressed in dB. The noise gate must be on (indicated by a lit NOISE light) for the DEPTH key to function. Press UP or DOWN to change the amount of attenuation.

The GATED light will light when the noise gate is active.

Equalization

The 787A's equalization circuitry enables you to individually boost or attenuate the low, middle, or high frequency components of the audio. The bandwidth (Q) and center frequency of each of these three bands is adjustable.

Equalization is useful for correcting deficiencies in the source medium or in room acoustics. It can also be used to create special effects and to acoustically imitate the ambiance of a particular room or environment.

To turn on the equalization circuitry:

Press EQ; the ON light above the key will light when equalization is on. Press EQ again to turn equalization (and the light) off.

To change the amount of boost or cut:

Select a band by pressing LOW, MID or HIGH. Repeatedly press the same key until the BOOST/CUT light is lit; the current boost (+) or cut (−) of the selected band will then be displayed, expressed in dB. Press UP or DOWN to change the amount of boost or cut.

Equalization must be on (indicated by a lit ON light) for the LOW, MID or HIGH keys to function.

To change the center frequency of a band:

Select the band by pressing LOW, MID or HIGH. Repeatedly press the same key until the CENTER FREQ light is lit; the current center frequency of the selected band will then be displayed, expressed in Hz or kHz. Press MODE to toggle between a coarse or fine scale. Press UP or DOWN to change the center frequency.

The center frequency is shown in kHz if it has a decimal point, and in Hz if it does not.

Both the MODE key and the LOW, MID or HIGH key will flash once to indicate a change to the coarse scale, or twice to indicate a change to the fine scale. The 787A returns to the coarse scale whenever a preset is recalled or stored.

Because MODE is used to toggle between fine and coarse center frequency scales, you must first exit center frequency selection by pressing another audio processing key before you can access other special modes with the MODE key.

To change the bandwidth of a band:

Select the band by pressing LOW, MID or HIGH. Repeatedly press the same key until the BANDWIDTH light is lit; the current bandwidth of the selected band will then be displayed, expressed in octaves. Press UP or DOWN to change the bandwidth.

- The LOW and MID equalization bands can be positioned before or after the compressor (see step 2-C on page 2-4). The 787A is shipped with these bands positioned before the compressor. If you experience pumping when using large boosts, placing the LOW and MID bands after the compressor will eliminate the pumping.
- The audio output is momentarily muted when EQ is pressed. Muting eliminates potential pops caused by large level changes when switching from one set of control settings to another. Because this muting may not be wanted in some applications, it is defeatable. Pressing RESET and INPUT ATTEN at the same time and then releasing RESET toggles muting on and off. The display will then indicate whether muting is on or OFF.

De-Essing

The 787A's de-esser attenuates vocal sibilance when the audio peaks with energy above 6kHz exceeds the de-esser threshold level.

To turn on the de-esser:

Press DE-ESSER THRESHOLD; the ON light above the key will light when the de-esser is on. Press DE-ESSER THRESHOLD again to turn the de-esser (and the light) off.

To change the de-esser threshold:

Turn the de-esser on by pressing DE-ESSER THRESHOLD; the current de-esser threshold level will be displayed, expressed in dB. Press UP or DOWN to change the threshold. Decreasing the threshold increases the amount of de-essing.

- The DE-ESS light will light when the de-esser is active.

Effects Port

Audio can be taken from a point following the compressor, equalization, and de-esser, processed by an external effects device, then returned to the 787A prior to the OUTPUT LEVEL pot. Reverb and "psychoacoustic excitation" for example, can be readily added in this way.

To adjust the effects return level:

Press EFFECTS RETURN LEVEL; the current effects return level will be displayed, expressed in dB. Press UP or DOWN to change the level. Set the effects return level to OFF to disable the effects return port.

The EFFECTS SEND level (approximately +4dBu) cannot be adjusted.

Memory

Up to 99 sets of control settings can be stored in memory for later retrieval. A set of control settings in memory is called a *preset.*

The current control settings can be quickly alternated with any preset to facilitate easy comparison.

If the optional 787ASL second channel slave unit is installed, the A or B channel must be selected — see page 3-20.

- The preset number is preceded by a c if the current control settings have been changed since the preset was recalled.
- To abort recall or store before finishing, press any key to the left of the DOWN key. To abort compare, press COMPARE again.
- Presets can also be recalled by remote control, or through the optional MIDI or RS-232 interfaces — see page 3-13.
- The audio output is muted momentarily when RECALL or COMPARE is pressed. Muting eliminates potential pops caused by large level changes when switching from one set of control settings to another. Because this muting may not be wanted in some applications, it is defeatable. Pressing RESET and INPUT ATTEN at the same time and then releasing RESET toggles muting on and off. The display will indicate whether muting is on or OFF.

To store the current settings:

Press STORE; the most recently stored or recalled preset number will be displayed. If you want to store to a different preset number, press UP or DOWN until the preset number you want is displayed. Press STORE again.

Control settings can be stored as presets 1 through 99.

Be sure to write down the preset number when you store a controls set-up. Include a note explaining how the preset is to be used. A sample log sheet is on page 3-22.

When you press STORE the second time, the control settings *previously* stored as that preset are temporarily saved in a special register called the LAST preset (located after preset 99). This gives you one last chance to change your mind and retrieve them.

To recall a preset:

Press RECALL; the most recently stored or recalled preset number will be displayed. If you want to recall a different preset, press UP or DOWN until the number of the preset you want is displayed. Press RECALL again.

Control settings can be recalled from presets 0 through 99. Preset 0, which can only be recalled, is an essentially "flat" set-up of the controls.

To compare a preset with the current control settings:

Press COMPARE. Press UP or DOWN until the number of the preset you want to compare with the front panel is displayed.

Repeatedly press COMPARE to alternate between current and preset settings. When the COMPARE key is lit, the preset settings are active; when the key light is off, the front panel settings are active.

To compare two presets, first recall one of the presets to the front panel.

Restricting Access to Controls

Access to the 787A's audio processing controls can be restricted to authorized users with a 4-digit programmable security code. When the controls are locked, only the keys which recall and compare preset control settings, unlock controls, and reset the system will function.

To lock controls:

Press MODE. Press UP or DOWN until - Loc is displayed. Hold down MODE while pressing INPUT ATTEN — then release both keys. Press UP or DOWN to display the first two digits of your security code, then press MODE to enter those digits. Press UP or DOWN to display the second two digits of your security code, then press MODE to enter those digits. + Loc will be displayed to indicate the controls are now locked.

The INPUT ATTEN key will flash when MODE is held down to remind you of which key to press. This two-key maneuver makes it more difficult to accidentally lock the controls.

You may use any four-digit number for your security code. The security code is set to 00, 00 at the factory, and resets to 00, 00 whenever the controls are unlocked.

Be sure to record the security code in a safe place.

To unlock controls:

Press MODE. Press UP or DOWN until + Loc is displayed. Press MODE again. Press UP or DOWN to display the first two digits of your security code, then press MODE to enter those digits. Press UP or DOWN to display the second two digits of your security code, then press MODE to enter those digits. - Loc will be displayed to indicate the controls are now unlocked.

- + Loc is displayed when a locked key is pressed.
- If you lose the security code, you can still unlock the controls. Remove the 787A's top cover and press LOCKOUT RESET button S1 to unlock the controls. S1 is located on the digital circuit board about 3 inches (8 cm) behind the RECALL key. This resets the security code to 00, 00.
- In situations where it is desirable to restrict access to *all* front-panel controls, an optional acrylic **security cover** can be installed. This arrangement might be appropriate, for example, when the 787A is being controlled entirely by remote control or through the optional MIDI interface. For the 787A, order SC2 CLEAR for a clear transparent security cover, SC2 BLUE for a blue transparent security cover, or SC2 WHITE for an opaque white security cover. For the 787ASL, order SC1 CLEAR, SC1 BLUE, or SC1 WHITE.

External Control

The 787A can be controlled through external remote control, or through a MIDI or RS-232 interface. Remote control is discussed below. See page 3-14 for MIDI interface information; see page 3-17 for RS-232 interface information.

The audio output is muted momentarily when front panel settings are received via MIDI or RS-232 interface. Muting eliminates potential pops caused by large level changes when switching from one set of control settings to another. Because this muting may not be wanted in some applications, it is defeatable. Pressing RESET and INPUT ATTEN at the same time and then releasing RESET toggles muting on and off. The display will indicate whether muting is ON or OFF.

Remote Control

The 787A can be remotely controlled through the optional MIDI or RS-232 interface, through the optional basic remote control accessory (ACC024), or through your remote control system connected to the REMOTE terminals on the 787A's rear panel.

The UP, DOWN, RECALL, and CHANNEL functions can be controlled by an external remote control system. RECALL must be invoked before UP or DOWN is. Momentarily ground the appropriate terminal to activate a function.

The basic remote control accessory, which is designed to be mounted at the console, has UP, DOWN, RECALL, and CHANNEL keys and a digital preset number display.

The front panel lights and displays will reflect remote control activity.

If the 787ASL second channel slave unit is installed, both it and the host 787A are controlled through the host 787A — the 787ASL has no REMOTE terminals.

MIDI Interface

Presets can be recalled with instructions sent through the MIDI interface. Preset memory or current front panel settings can be sent to or received from another device through the MIDI interface. The MIDI channel can be assigned, and the MIDI interface can be disabled from the front panel. To do any of this, the optional MIDI interface board must be installed.

If the optional 787ASL second channel slave unit is installed, the A or B channel must be selected — see page 3-20.

To assign MIDI channel:

Press MODE. Press UP or DOWN until chn is displayed. Hold down MODE and press INPUT ATTEN. Press UP or DOWN until the desired MIDI channel (1 through 16) is displayed, then press MODE.

The assignedd MIDI channel is used both for sending and receiving data. The assigned channel is effective immediately, even before you press MODE the last time.

Set the channel to OFF to disable the MIDI interface.

To send preset memory or front panel settings:

First connect the sending unit to the receiving unit and set the MIDI channel the same for both the sending and receiving units. If the receiving unit is a 787A or 787ASL, make sure receiving is not disabled (see below).

Press MODE. Press UP or DOWN until snd (send memory) or SFP (send front panel) is displayed. Press MODE again to execute your selection.

The display will blank out to show that the data is being sent. snt (sent) will be displayed when the transmission is completed. If the download is to a 787A or 787ASL, the display on the receiving unit (or its host) will read rcv (receiving) while the data is being received, and rcd (received) when transmission is completed.

One 787A's preset memory (containing all presets, from 1 through 99) can be sent to another 787A's memory. One 787A's current front panel settings can be sent to another 787A's "front panel."

Memory and front panel settings can also be sent to or received from an appropriate computer or memory device. Sending memory and front panels to or from a device other than a 787A (or 787ASL) is intended for archiving only — no provision has been made for controlling other devices, or for modifying settings from external devices.

To disable the 787A's ability to receive data:

Press MODE. Press UP or DOWN until + rcE (receive enabled) is displayed. Hold down MODE and press INPUT ATTEN; on will be displayed. Press UP or DOWN until OFF is displayed. Press MODE; -rcE (receive not enabled) will be displayed.

MIDI Implementation Data

Commands can be sent to the 787A through the MIDI interface to recall a preset or to send the preset memory or front panel settings to another device. The data needed to implement these commands follows.

"n " in the hex code column should be replaced by one of the alternatives listed in the corresponding explanation. Unless preceded by a "D ," all numbers in the explanations are also given in hexadecimal form.

PROGRAM CHANGE data sent from 787A:

Hex code:	Explanation:
C n	MIDI channel number: n = 0 through F (D 1 – D 16)
n n	preset number: n n = 00 through 64, 7F (00 = preset D 1, 64 = preset D 99, 7F = preset D 0)

PRESET DATA sent from 787A:

Hex code:	Explanation:
F 0	system exclusive command
0 0	
0 0	
2 1	Orban ID
0 n	MIDI channel number: n = 0 through F (D 1 – D 16)
0 1	787A product code
0 1	function: preset memory send
0 n	787A channel: n = 1 (channel A data) or 2 (channel B data) or 3 (channel A and B data)
n n	first byte of memory data
.	
.	
.	
n n	last byte of memory data
F 7	end of system exclusive

CURRENT SETTINGS DATA sent from 787A:

Hex code:	Explanation:
F 0	system exclusive command
0 0	
0 0	
2 1	Orban ID
0 n	MIDI channel number: n = 0 through F (D 1 – D 16)
0 1	787A product code
2 1	function: current settings send
0 n	787A channel: n = 1 (channel A data) or 2 (channel B data) or 3 (channel A and B data)
n n	first byte of memory data
.	
.	
.	
n n	last byte of memory data
F 7	end of system exclusive

PROGRAM CHANGE REQUEST sent to 787A:

Hex code:	Explanation:
C n	MIDI channel number: n = 0 through F (▷1 – ▷16) (00 = preset ▷1, 64 = preset ▷99, 7F = preset ▷0)
n n	preset number: n n = 00 through 64, 7F (00 = preset ▷1, 64 = preset ▷99, 7F = preset ▷0)

PRESET DATA SEND REQUEST sent to 787A:

Hex code:	Explanation:
F 0	system exclusive command
0 0	
0 0	
2 1	Orban ID
0 n	MIDI channel number: n = 0 through F (▷1 – ▷16)
0 1	787A product code
4 1	function: request preset memory send
0 n	787A channel: n = 1 (channel A data) or 2 (channel B data) or 3 (channel A and B data)
F 7	end of system exclusive (after receiving this byte, the 787A will send PRESET DATA)

CURRENT SETTINGS DATA SEND REQUEST sent to 787A:

Hex code:	Explanation:
F 0	system exclusive command
0 0	
0 0	
2 1	Orban ID
0 n	MIDI channel number: n = 0 through F (▷1 – ▷16)
0 1	787A product code
4 2	function: request current settings send
0 n	787A channel: n = 1 (channel A data) or 2 (channel B data) or 3 (channel A and B data)
F 7	end of system exclusive (after receiving this byte, the 787A will send CURRENT SETTINGS DATA)

RS-232 Interface

Presets can be recalled with instructions sent through the RS-232 interface. Memory or current front panel settings can be sent or received through the RS-232 interface. The RS-232 baud rate (data transmission rate in bits per second) can be selected, and the RS-232 interface can be disabled from the front panel. To do any of this, the optional RS-232 interface board must be installed.

The 787A's RS-232 interface has a DB-25 connector with DCE (digital communications equipment) wiring. RS-232 handshaking is used to prevent overflow of the input character buffer. The 787A uses the XON(^Q)/XOFF(^S) protocol. A separate RS-232 link must be used for each 787A unit. RS-232 data is transmitted in bytes of 8 bits, with no parity and 1 stop bit.

If the optional 787ASL second channel slave unit is installed, the A or B channel must be selected — see page 3-20.

To select RS-232 baud rate:

Press MODE. Press UP or DOWN until bPS (bits per second) is displayed. Hold down MODE and press INPUT ATTEN. Press UP or DOWN until the desired baud rate is displayed, then press MODE again.

The RS-232 baud rate can be set to 300, 600, 1200, 2400, 4800, 9600, or 19,200 bits per second. (Baud rates with decimal points are expressed in kbps, as: 1.20 = 1.20 kbps, or 1200 bps.) Set the baud rate to OFF to disable the RS-232 interface.

The selected baud rate is effective immediately, even before you press MODE the last time.

To send preset memory or front panel settings:

First connect the sending unit to the receiving unit and set the baud rate the same for both the sending and receiving units. If the receiving unit is a 787A or 787ASL, make sure receiving is not disabled (see below).

Press MODE, then press UP or DOWN until Snd (send memory) or SFP (send front panel) is displayed. Press MODE again to execute your selection.

The display will blank out to show that the data is being sent, then display Snt (sent) when the transmission is completed. If the download is to a 787A or 787ASL, the display on the receiving unit (or its host) will read rcv (receiving) while the data is being received, and rcd (received) when transmission is completed.

One 787A's preset memory (containing all presets, from 1 through 99) can be sent to another 787A's memory. One 787A's current front panel settings can be sent to another 787A's "front panel."

Memory and front panel settings can also be sent to or received from an appropriate computer or memory device. Sending memory and front panels to or from a device other than a 787A (or 787ASL) is intended for archiving only — no provision has been made for controlling other devices, or for modifying settings from external devices.

To disable the 787A's ability to receive data:

Press MODE. Press UP or DOWN until + rcE (receive enabled) is displayed. Hold down MODE and press INPUT ATTEN; on will be displayed. Press UP or DOWN until OFF is displayed. Press MODE; -rcE (receive not enabled) will be displayed.

RS-232 Implementation Data

Commands can be sent to the 787A through the RS-232 interface to recall a preset or to send the preset memory or front panel settings to another device. The data needed to implement these commands follows.

"n" in the ASCII code column should be replaced by one of the alternatives listed in the corresponding explanation. All data should be limited to ASCII characters in the range 32 through 127.

PROGRAM CHANGE data sent from 787A:

ASCII code:	Explanation:
55	787A product code
56	787A product code
55	787A product code
32	function: program change
n	787A channel: n = 65 (channel A data) or 66 (channel B data) or 67 (channel A and B data)
n	preset number
10	end of transmission

PRESET DATA sent from 787A:

ASCII code:	Explanation:
55	787A product code
56	787A product code
55	787A product code
33	function: preset memory send
n	787A channel: n = 65 (channel A data) or 66 (channel B data) or 67 (channel A and B data)
n	first byte of memory data
.	
.	
.	
n	last byte of memory data
10	end of transmission

CURRENT SETTINGS DATA sent from 787A:

ASCII code:	Explanation:
55	787A product code
56	787A product code
55	787A product code
34	function: current settings send
n	787A channel: n = 65 (channel A data) or 66 (channel B data) or 67 (channel A and B data)
n	first byte of memory data
.	
.	
.	
n	last byte of memory data
10	end of transmission

PROGRAM CHANGE REQUEST sent to 787A:

ASCII code:	Explanation:
55	787A product code
56	787A product code
55	787A product code
32	function: request program change
n	787A channel: n = 65 (channel A data) or 66 (channel B data) or 67 (channel A and B data)
n	preset number
10	end of transmission

PRESET DATA SEND REQUEST sent to 787A:

ASCII code:	Explanation:
55	787A product code
56	787A product code
55	787A product code
35	function: request preset memory send
n	787A channel: n = 65 (channel A data) or 66 (channel B data) or 67 (channel A and B data)
10	end of transmission (after receiving this byte, the 787A will send PRESET DATA)

CURRENT SETTINGS DATA SEND REQUEST sent to 787A:

ASCII code:	Explanation:
55	787A product code
56	787A product code
55	787A product code
36	function: request current settings send
n	787A channel: n = 65 (channel A data) or 66 (channel B data) or 67 (channel A and B data)
10	end of transmission (after receiving this byte, the 787A will send CURRENT SETTINGS DATA)

Second Channel Slave Unit

When the optional 787ASL second channel slave unit is installed, the control settings of both units are displayed on and controlled from the host 787A's front panel. The lights above the CHANNEL key on the host 787A indicates which unit is being controlled from the host's front panel. The 787A is channel A; the 787ASL is channel B.

The INPUT ATTEN of each channel can be adjusted separately to adjust channel balance. Although all controls may be set differently for each channel when they are STEREO COUPLED, both channels will receive the same gain reduction and gating as the channel that requires the *most* gain reduction. Stereo coupling better preserves stereo imaging. When operated independently, each channel's INPUT ATTEN can be adjusted to achieve the desired gain reduction for that channel.

The controls for both units are locked or unlocked simultaneously when the optional 787ASL second channel unit is installed.

When the optional 787ASL second channel unit is installed, the channel must be specified when performing certain memory and interface functions.

Memory:

- Select the CHANNEL the preset will be recalled *from* before pressing RECALL the first time; select the CHANNEL the preset will be recalled *to* before pressing RECALL the second time.
- Select the CHANNEL for store or compare before pressing STORE or COMPARE the first time. The selected channel's front panel settings are stored in or compared with the selected channel's memory. To store a preset from one channel as a preset for the other channel, first recall the preset to the other channel's front panel.
- If both channels are selected, the selected preset will be simultaneously recalled from the 787A's memory to 787A's front panel, and from the 787ASL's memory to its "front panel." Similarly, presets will be simultaneously stored in both memories from the corresponding front panels if both channel are selected before storing.
- If the 787ASL is set to STEREO COUPLE, the same preset will be recalled to both channels. A ≠ will appear before the preset number when RECALL is first pressed if the active settings for one channel are not the same as the stereo-coupled preset. When the 787ASL is set to STEREO COUPLE, presets are stored, recalled, and compared in pairs.

MIDI or RS-232 interface:

- Select the 787A CHANNEL that will be affected before selecting the MIDI channel, or sending the memory or front panel. Press MODE after selecting one or both 787A channel(s).
- Memory and front panels can be sent between a 787A and a 787ASL, between two 787ASLs, or between a 787ASL and an external storage device.
- The MIDI or RS-232 interface board is installed in the 787A only; the 787ASL is interfaced through its host 787A.

Quick Reference

To modify equalization parameters:

Press EQ to turn equalization on or off.
Toggle LOW, MID, or HIGH to select band and parameter.
When CENTER FREQ is lit, toggle MODE for coarse or fine scale.
Press UP or DOWN to modify displayed value.

To modify other audio processing parameters:

Press INPUT ATTEN, RELEASE TIME, GATE THRESHOLD, GATE DEPTH, DE-ESSER THRESHOLD, or EFFECTS RETURN LEVEL.
Press UP or DOWN to modify displayed value.

To recall preset:

Press RECALL.
Press UP or DOWN to display PRESET NUMBER.
Press RECALL.

To store preset:

Press STORE.
Press UP or DOWN to display PRESET NUMBER.
Press STORE.

To compare preset with panel:

Press COMPARE.
Press UP or DOWN to display PRESET NUMBER.
Toggle COMPARE.

To lock or unlock audio controls:

Press MODE.
Press UP or DOWN to display LOC.
To lock, hold down MODE while pressing INPUT ATTEN.
To unlock, press MODE.
Press UP or DOWN to display first two digits of security code.
Press MODE.
Press UP or DOWN to display second two digits of security code.
Press MODE.

To select interface channel, speed:

Press MODE.
Press UP or DOWN to display CHN or BPS.
Hold down MODE while pressing INPUT ATTEN.
Press UP or DOWN to display channel, bits per second, or OFF.
Press MODE.

To send memory or front panel:

Press MODE.
Press UP or DOWN to display SEnd (send memory), or SEnP (send front panel).
Press MODE.

To disable receive:

Press MODE.
Press UP or DOWN to display + rEu.
Press MODE.
Press UP or DOWN to display -rEu.
Press MODE.

Orban 787A Programmable Mic Processor

Log sheet:

Date:

Preset #	Channel (A, B, STEREO)	Set-up used for:	External effects:

Section 4 Maintenance

page contents

CAUTION

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Routine Maintenance

No routine maintenance of this product is required.

If the front panel becomes soiled, clean it with a mild household detergent and a damp cloth. Stronger solvents should not be used because they may damage plastic parts, paint, or the silk-screened lettering (99% isopropyl alcohol can be safely used).

An internal battery protects the 787A's memory during power failures and temporary disconnection. The battery will normally last up to 5 years. The decimal point on the display will flash when the battery needs to be replaced.

IMPORTANT

Before replacing the battery, download the contents of memory through the MIDI or RS-232 interface (see page 3-14 or 3-17) to save presets while the battery is being replaced.

To replace the battery:

First disconnect the 787A from AC power, and remove its top cover (see page 4-3). Replace the battery with a 3-volt lithium battery, such as Duracell® DL2032 (see Fig. 4-1 for location of battery), then replace the top cover. The memory will be unaffected for 15 to 30 seconds after the battery is removed — so work quickly!

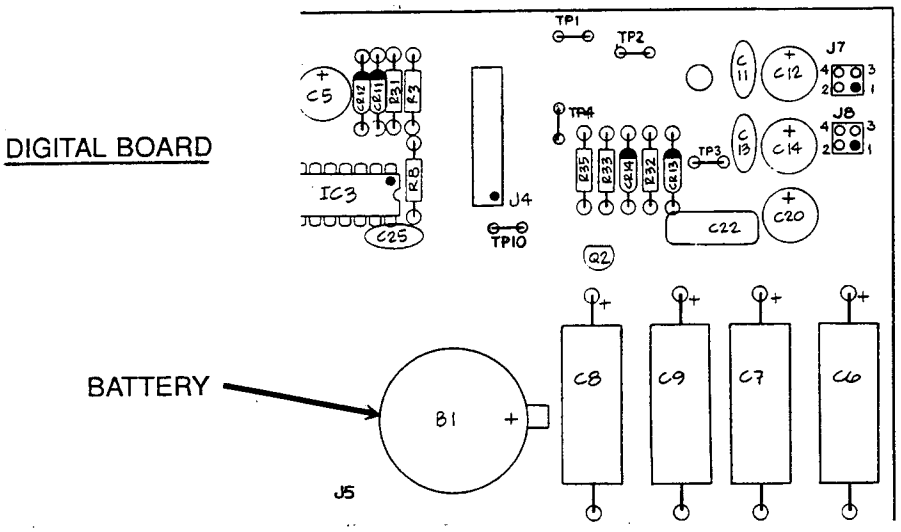


Fig. 4-1: Location of Memory Back-up Battery

Getting Inside the Chassis

To access the circuit boards, remove all ten screws holding the appropriate cover in place, then lift that cover off. (The 787ASL's covers are attached with six screws each.)

Remove the *top cover* for access to the jumpers on the component side of the analog circuit board. After removing the top cover, remove the three screws from each mounting flange (at the front of either side, behind the front panel) to access the rear of the front panel circuit board.

Remove the *bottom cover* for access to the equalization circuit board or the solder side of the digital circuit board.

When replacing the covers, replace all screws snugly (be careful not to strip the threads by fastening the screws too tightly).

Performance Evaluation, Alignment

Use these instructions to thoroughly check the performance of the 787A. To test a 787SL, use this procedure and the host 787A.

The evaluation includes checks of the power supplies, main audio paths, enhancement VCA circuitry, compressor and enhancer control, display calibration, gating control logic, and output stages.

IMPORTANT

Because the 787A circuitry is highly stable, routine performance evaluation and alignment are *not* required and *not* recommended. The following evaluation procedures are extremely thorough, and they are included primarily for reference. If you are familiar with the operation of your 787A, problems with its circuitry will be readily apparent to you in the audio or in abnormal behavior of the ENHANCEMENT display. **If you must perform these tests**, be sure you have the necessary equipment (see 4-4). If you do not have the proper instruments, please use Orban's excellent factory service facility (see page 5-7).

See assembly drawings in Section 6 for locations of components and test points. *All test points are located on the main circuit board.*

Perform procedures in order without skipping steps.

Equipment required:

Audio oscillator
With a residual distortion below 0.0015%

THD analyzer
With a residual distortion below 0.0015%

Audio voltmeter
Accurate to 2.0%

DVM
Accurate to 0.02%

Low frequency spectrum analyzer
Tektronix 5L4N in a 5111 BiStable mainframe, or equivalent. Alternatively, a sweep generator with 50-15,000Hz logarithmic sweep can be used with an oscilloscope in x/y mode.

Frequency meter
Accurate to 0.1%

Note: A Soundtech 1700 A/B will satisfy the first three requirements.

1) Remove the top and bottom cover:

A☐ Remove the eight screw which hold the top cover in place, then lift off the top cover.

B☐ Remove the eight screw which hold the bottom cover in place, then lift off the bottom cover.

2) Check power supply:

NOTE: All test points in this section are located on the digital (DG) board.

A☐ If present, remove the ground link on the rear panel terminal strip.

B☐ Verify the following resistances:

Between:	And:	Resistance:
Power cord ground pin	Chassis	0Ω
Each of the power cord blades	Chassis	∞Ω

C☐ Verify the following resistances:

Between:	And:	Resistance:
GROUND ⏚	GROUND ⏚	∞Ω
GROUND ⏚	Chassis	0Ω
GROUND ⏚	Test point TP11 (power supply common)	0Ω

D☐ Replace ground link, if used in your system.

E☐ Power up and measure the unregulated ±22V supplies at TP7 and TP1.

F☐ Verify that they are between ±18 and ±28 volts.

G☐ Measure the unregulated 8V supply at TP8 and verify that it is between +7 and +12.5 volts.

H☐ Measure the unregulated phantom supply at the collector of Q1 and verify that it is between +52V and +70V.

I☐ Measure the outputs of the ±15 volt regulators at TP2 and TP3

J☐ Verify that they are 15.0 volts, ±0.7V.

K☐ Measure the outputs of the Analog and the Digital +5 regulators at TP5 and TP6.

L☐ Verify that they are +5.0 volts, ±0.2V.

M☐ Measure the output of the +48 volt regulator at TP4 and verify that it is +48 volts, ±2V.

N☐ Verify the presence of +48V on pin 8 of J5 of the analog (AG) board.

O☐ Monitor the regulated power supply rails at TP2, TP3, TP4, TP5 and TP6 with the oscilloscope.

P☐ Press the RESET button to stop the processor and verify that the observed noise and ripple is below 4MV peak on all 5 supplies.

Q☐ Using the DVM, monitor the side of R72 on the AG board that is closest to IC16.

R☐ Verify a voltage of +9.2 (±0.1V).

S☐ Monitor pin 1 of IC18 and verify a voltage of −9.2V (±0.1V).

T☐ Power down, wait 5 seconds, and monitor the cathode of CR12 on the DG board.

U☐ Verify the presence of 3.0VDC (±0.2V).

V☐ Power up and monitor TP5 on the AG board with the DVM.

W☐ Adjust the REFERENCE TRIM pot (R139) for a reading of 3.0VDC (±0.1V).

3) Check display

A☐ With the oscilloscope, verify that the characteristic waveforms of the memory request and I/O request are present at pins 19 and 20 of IC4 (Z80) Refer to Figures 1 and 2. This indicates that the processor is running.

B☐ Power down and remove IC7 (DG board) from its socket and the Analog board power connector from J2.

C☐ Power up and verify that all processor controlled LEDs and display segments are lighted (the OVERLOAD, GATED and DE-ESSING should not be ON).

D☐ Rotate the DISPLAY BRIGHTNESS control (R2) through its range and verify proper operation.

E☐ Push the RESET button and verify that all LEDs and segments go out.

F☐ Verify that the GAIN REDUCTION and OUTPUT LEVEL bar graphs are fully illuminated.

G☐ Power down, replace IC7 and the AG power connector, Restore the power.

4) Check Digital Operation

A☐ Perform a RAM check by holding the RECALL key, momentarily pushing RESET, and releasing the RECALL key. Any display other than 00 indicates a RAM defect.

B☐ Push the RESET again to exit RAM check.

C☐ Push the RECALL key, MODIFY to program 0, push RECALL again.

D☐ Push the keys listed below and verify the indicated action. Each key will cancel the previously selected key.

Push INPUT ATTEN key, LED lights, push MODIFY, LED lights: display changes to a **NUMERIC** indication in dB. MODIFY changes the display within a range of −25dB to +5dB.

Push RELEASE TIME, LED lights, push MODIFY, LED lights: display changes to a numeric indication in dB/SECOND. MODIFY changes the display within a range of 1.0 to 50.0 dB/SECOND. Leave at 50dB/sec.

Push GATES-THRESHOLD, LED lights, push MODIFY, LED lights: display reads

- OFF, pushing again will toggle the NOISE GATE ON and OFF, MODIFY one step up and the green GATED LED will probably light if the gate circuit is functioning. MODIFY will adjust the GATE THRESHOLD within a range of -30dB to -0.0dB. Leave the GATE THRESHOLD at -30dB and leave the NOISE GATE ON.

Push GATES-DEPTH, LED lights, push MODIFY, LED lights: display has a numeric indication in dB, MODIFY changes the display within a range of -25.0dB to 0.0dB. Select COMPRESSOR GATE THRESHOLD and MODIFY to OFF.

Push EQ ON to toggle the EQ ON LED ON and OFF. No other LEDs change. Leave ON.

Push LOW EQ, LED lights, push MODIFY, LED lights one of the EQ FUNCTION LEDs lights, the corresponding units display LED (dB, Hz/kHz, OCTAVE) lights: subsequent pushes toggle the FUNCTION LEDs through the three functions with the corresponding units display LED lighting. The display will change accordingly. MODIFY will change the display as follows: BOOST/CUT -inF to +16dB, CENTER FREQ 30Hz to 632Hz, Q .10 TO 5. Leave at 0.0dB BOOST/CUT.

Push MID EQ, LED lights: same action as above except that **FREQ** range is 210Hz to 7.65kHz. Leave at 0.0dB BOOST/CUT.

Push HI EQ, LED lights: same action as above except that **FREQ** range is 420Hz to 15.3kHz. Leave at 0.0dB BOOST/CUT.

Push DE-ESS THRESHOLD, LED lights: display reads OFF, second push lights ON and MODIFY, display reads 0.0dB. Subsequent pushes toggle between ON and OFF, leave ON. MODIFY changes the display within the range of -48.0dB and 0.0dB. Leave at 0.0dB and OFF.

Push EFFECTS RETURN, LED lights, push MODIFY, LED, lights: display reads OFF. One push of MODIFY UP changes the display to -30.0dB. Subsequent MODIFY UP changes the display within a range of -30.0dB to +16.0dB.

Push MODE SELECT. First push starts flashing, lights MODIFY: display reads -Loc. Second push **hold down** flashes INPUT ATTEN. Push INPUT ATTEN key and display will read 00. Push twice more and MODIFY will go out, display will read + Loc and none of the audio processing keys will have any effect. Push the LOCKOUT RESET button on the Digital board and the display will change to -Loc.

Push RECALL. First push starts flashing, lights MODIFY: display reads PRESET NUMBER 0. MODIFY changes the display within the range of 0 to 99 and then LASt. Leave at 0. Second push and RECALL and MODIFY go out.

Push STORE: same as above except no LASt preset and it will not stop flashing until you change the preset to something other than 0.

Push COMPARE. First push starts key flashing and lights MODIFY. Change the program number with MODIFY. Second push changes the display back to the previous program number and the MODIFY and COMPARE go out. Subsequent pushes toggle between the previous two programs. Leave COMPARE OFF.

Push CHANNEL. No action. If a slave is connected the key will toggle between A, B, A+B and back to A.

Push REAR PANEL REMOTE. Momentarily ground the RECALL terminal and verify that the RECALL key starts flashing. Ground the UP and then the DOWN terminals and verify operation. Ground the RECALL terminal and verify that the RECALL key stops flashing. If a slave is connected, repeatedly ground the CHANNEL terminal and verify the same operation as the previous (CHANNEL) step.

5) Check memory functions

A☐ Select GATE THRESHOLD and MODIFY UP so the GATED LED lights.

B☐ Select the EQ ON key.

C☐ Select the DE-ESSER key and toggle to ON.

D☐ Select STORE and MODIFY UP to PRESET #1 (or any unused preset) then push STORE again. This will store GATE ENABLED, EQ ON and DE-ESSER ON in PRESET #1.

E☐ Select RECALL and MODIFY DOWN to PRESET #0.

F☐ Push RECALL again and verify that the functions above turn OFF.

G☐ Select COMPARE and MODIFY to PRESET #1.

H☐ Repeatedly push COMPARE and verify that the unit toggles between PRESETS 1 and 0.

I☐ Leave with COMPARE OFF and in PRESET #0.

6) Check audio input stage

NOTE: Unless otherwise specified: Distortion and noise measurements are taken in a 20-20000Hz bandwidth, tolerances are ±100Hz and ±0.5dB, the (−) INPUTS and OUTPUT are connected to ground and the OUTPUTS are loaded with 600 ohms. Test points referred to are on the analog (AG) board.

A☐ Connect the oscillator to the (+) INPUT of the 787A.

B☐ Adjust the oscillator for 1kHz and a level of +4.0dBm.

C☐ Monitor TP1 with the audio voltmeter, oscilloscope and THD analyzer.

D☐ Push INPUT ATTEN key and MODIFY to display a reading of −5dB and verify a level of −12.0dBm (±1.0dB).

E☐ Verify that the THD is below 0.05%.

F☐ Mute the signal and verify a residual noise below −75dBm.

G☐ Observe the oscilloscope for 'popcorn' noise or oscillation.

H☐ Restore the signal.

I☐ Connect the oscillator output to both the (+) and (−) INPUTs and verify a common mode cancellation of at least 50dB.

J☐ Disconnect the oscillator from the (−) INPUT and re-connect the ground.

K☐ Select INPUT ATTEN key and MODIFY to +5dB then DOWN to −25dB.

L☐ Verify that the signal is progressively reduced by the amount indicated on the display.

NOTE: In this and every other MODIFY function, every push of the key must have the indicated effect with no skips or jumps over its entire range of adjustment. MODIFY the INPUT ATTEN UP to −10dB.

M☐ Move jumper A to the −10 position and verify that the level observed increases by 14dB. Return the jumper to the +4 position.

7) Check compressor and control

A☐ Jumper the equalizer (EQ) board to POST compressor.

B☐ Select INPUT ATTEN key and MODIFY to −10dB.

C☐ Center the GAIN TRIM pot (R23).

D☐ Adjust the oscillator for +4dBm output.

E☐ Monitor TP2 with the audio voltmeter, THD analyzer and oscilloscope.

F☐ Verify a signal of −4dBm (±1dB).

G☐ Verify a G/R indication of about 10dB.

H☐ Push the INPUT ATTEN key and MODIFY UP until the red 25dB G/R LED barely lights.

I☐ Mute the signal and verify that the G/R indication starts to drop.

J☐ Push the RELEASE TIME key and MODIFY the release time toward 50dB/sec.

K☐ Verify that the release time progressively shortens.

L☐ Restore the signal.

M☐ Measure the release time at 50dB/sec, 12dB/sec and 5dB/sec.

N☐ Verify that the decay time to 0 (or 2.5dB) of G/R is about 0.5 seconds, 2.0 seconds and 5.0 seconds at the respective release time setting.

O☐ Restore the signal, push the INPUT ATTEN key and MODIFY to 20dB of G/R.

P☐ Monitor TP2 with the THD analyzer and adjust the DISTORTION NULL control (R37) for minimum THD.

Q☐ Verify that this level is below 0.1%.

R☐ Adjust the oscillator for +4dBm output and connect it, through a 10k resistor, to TP4.

S☐ Adjust the THUMP NULL control (R30) for minimum 1.0kHz feedthrough.

T☐ Disconnect the oscillator.

U☐ With the INPUT ATTEN set for +5dB, adjust the oscillator output level so the 5dB G/R LED just lights.

V☐ Note the audio level at TP2 and increase the oscillator output level by 15dB.

W☐ Verify that the G/R meter indicates 20dB of G/R (±1 segment) and that the level at TP2 increases by no more than 1dB.

X☐ Monitor TP3 with the DVM.

Y☐ Increase the oscillator level until the DC level is 10.0 volts. The G/R meter should indicate 25dB of G/R. Alternately monitor TP3 and TP4 and adjust the GAIN TRIM control for the same reading on both test points (±0.1V).

8) Check compressor and noise gate

A☐ Mute the oscillator and push the GATE THRESHOLD key.

B☐ Verify a display of OFF and that the green GATED LED is OFF.

C☐ MODIFY UP for a display of −30 (−29 is satisfactory) and verify that the GATED LED lights.

D☐ Restore the oscillator and set its output level (and the 787A INPUT ATTEN, if necessary) to produce about 20 dB of G/R.

E☐ Verify that the GATED LED goes out.

F☐ Mute the oscillator.

G☐ Verify that the GATED LED lights and the G/R indication holds and then slowly drifts to 10dB of G/R. MODIFY the GATE THRESHOLD DOWN to OFF and verify that the G/R indication decays to 0dB.

H☐ Restore the oscillator.

I☐ Adjust the oscillator level to 0dBm, push the INPUT ATTEN key, MODIFY to 0dB.

J☐ Push the GATE THRESHOLD key and MODIFY UP.

K☐ Verify that the GATED LED lights when the display reads −8dB (±2 steps).

L❑ Adjust the oscillator for −10dBm.

M❑ Turn the NOISE GATE ON and verify that the GATED LED is still ON.

N❑ Push the DEPTH key, note the level at TP2, and MODIFY the DEPTH down.

O❑ Verify that the level reduction corresponds to the display indication.

P❑ Turn the NOISE GATE OFF and verify that the signal returns to its original level.

Q❑ MODIFY the COMPRESSOR GATE to OFF.

R❑ Mute the oscillator and allow the indicated G/R to decay to 0.

S❑ MODIFY the COMPRESSOR GATE to −30.0dB.

T❑ Verify that the GATED LED lights and that the G/R indication drifts up to 10dB of G/R over a period of about 2 minutes. It is important that it reach its full GATED G/R.

U❑ Turn the NOISE GATE ON, MODIFY the DEPTH to −25dB and monitor TP2 with the DVM. Adjust the DE-ESS THUMP NULL (R41) until there is no difference in the DC level as the NOISE GATE is toggled between ON and OFF. This level will be very close to 0 volts.

NOTE: It is very important to do this as precisely as possible.

V❑ Turn the GATE THRESHOLD and the NOISE GATE to OFF.

W❑ Restore the oscillator.

9) Check parametric equalizer

A❑ Connect the spectrum analyzer input to TP10 on the EQ board and the tracking generator to the 787A INPUT.

B❑ Adjust the INPUT ATTEN and tracking generator output to a convenient level.

C❑ Set the analyzer for 10dB/division.

D❑ Turn the EQ ON, select LOW-BOOST/CUT and MODIFY UP to +16dB.

E❑ Select LOW-CENTER FREQuency and verify a 16dB boost (±1dB) at the indicated frequency. Return to 0.0dB BOOST/CUT.

F❑ Repeat step 2 for the MID and HIGH bands to verify basic EQ operation.

G❑ Return each band to 0dB BOOST/CUT.

H❑ Disconnect the spectrum analyzer, reconnect the oscillator and audio voltmeter.

I❑ Select MID-CENTER FREQuency, MODIFY to 7.65kHz, select MID-BANDWIDTH, MODIFY to .10 octave and set the oscillator for 7.65kHz.

NOTE: In this and the next step, use a frequency meter to verify the oscillators frequency. Monitor TP8 with the audio voltmeter and note the level observed. Monitor TP7 and adjust the MID GAIN TRIM control (C7) until the level is the same as observed at TP8 (±0.2dB).

J❑ Select HIGH-CENTER FREQuency, MODIFY to 15.3kHz, select HIGH-BANDWIDTH, MODIFY to .10 octave and set the oscillator for 15.3kHz. Monitor TP10 with the audio voltmeter and note the level observed. Monitor TP9 and adjust the HIGH GAIN TRIM control (C12) until the level is the same as observed at TP10 (±0.1dB).

K❑ Monitor TP10 with the audio voltmeter.

L❑ Select HIGH-BANDWIDTH and MODIFY to 5 octaves.

M❑ Select HIGH-BOOST/CUT.

N❑ While observing the voltmeter, MODIFY UP and verify that the boost conforms to the display indication.

O❑ Repeat MODIFYing DOWN.

P❑ Disconnect the oscillator and audio voltmeter.

Q❑ MODIFY UP to 0dB cut.

R❑ Connect the spectrum analyzer input to TP10 on the EQ board and the tracking generator to the 787A INPUT.

S❑ Adjust the INPUT ATTEN and tracking generator output to a convenient level.

T❑ Set the analyzer for 10dB/division.

U❑ Select LOW-BOOST/CUT and MODIFY UP to +16dB while observing the spectrum analyzer.

V❑ Verify that the boost increases to +16dB (±1dB).

W❑ Select LOW-BANDWIDTH and MODIFY in the range of 5 octaves to .10 octave.

X❑ Leave at .1 octave.

Y❑ Verify the proper adjustment of "Q".

Z❑ Select LOW-BOOST/CUT and MODIFY DOWN to −inF.

A1❑ Verify a cut of at least 40dB (you may need to use a manual sweep to see the true depth of the notch).

B1❑ Select LOW-CENTER FREQuency and MODIFY through its range.

C1❑ Verify that the cut frequency changes corresponding to the display indication. Return to 0.0dB BOOST/CUT.

D1❑ Repeat step 8 for the MID and HIGH bands.

E1☐ Refer to Figure 3 for a typical family of curves.

F1☐ Reset the EQ jumpers to PRE/POST configuration, turn EQ OFF and disconnect the spectrum analyzer.

10) Check EFFECTS RETURN

A☐ Connect the oscillator to the (+) EFFECTS RETURN INPUT and ground the (−) INPUT.

B☐ Push the EFFECTS RETURN key and MODIFY UP to +16.0dB.

C☐ Turn the OUTPUT LEVEL control fully CCW.

D☐ Adjust the oscillator to +4dBm at 1kHz.

E☐ Monitor pin 1 of IC5 with the audio voltmeter.

F☐ Verify a level of +17dBm (±1dB).

G☐ Verify a THD of less than 0.01%, mute the oscillator and verify that the residual noise is below −75dBm.

H☐ Restore the oscillator.

I☐ Increase the oscillator level to +8dBm and verify that the OVERLOAD LED starts flashing.

J☐ MODIFY the EFFECTS RETURN DOWN until the LED stops flashing.

K☐ Verify that the level observed is +19.0dBm (±1.0dB).

L☐ Return the oscillator level to +4dBm and MODIFY UP to +16.0.

M☐ Connect the oscillator to the (+) and (−) EFFECTS RETURN INPUTS.

N☐ Verify a common mode cancellation of at least 50dB.

O☐ Disconnect the oscillator from the (−) INPUT and reconnect the (−) INPUT to ground.

P☐ MODIFY DOWN and verify that the level observed is reduced corresponding to the display indication.

Q☐ Verify that the signal mutes when the display reads OFF.

R☐ MODIFY UP to +16.0.

S☐ Turn the OUTPUT LEVEL control fully CW.

T☐ Do not disconnect the oscillator.

11) Check output stage

A☐ Mute the EFFECTS RETURN signal and remove the ground from the (−) OUTPUT.

B☐ Monitor the (+) OUTPUT, then the (−) OUTPUT with the DVM.

C☐ Verify that the DC offset is below 15mV, typically 5mV.

D☐ Ground the (−) OUTPUT terminal, load the OUTPUT with a 600 ohm resistor and monitor the (+) OUTPUT terminal with the audio voltmeter, THD analyzer and oscilloscope.

E☐ Adjust the oscillator for an output level just below the threshold of clipping.

F☐ Verify that this level is greater than +20dBm.

G☐ Turn the OUTPUT LEVEL CCW until the OUTPUT level is +18dBm.

H☐ Verify that the THD is below 0.03%.

I☐ Observe the VU meter and verify that the 0dB segment is barely lit (±0.5dB in output level).

J☐ Ground the (+) terminal, monitor the (−) terminal and repeat steps 3 and 4.

K☐ Disconnect the oscillator from the EFFECTS RETURN.

L☐ MODIFY to OFF and remove the ground on the (+) OUTPUT terminal and place it on the (−) terminal.

12) Check DE-ESSER

A☐ Connect the spectrum analyzer to the INPUT and OUTPUT of the 787A. Select the DE-ESSER and turn it ON.

B☐ MODIFY the THRESHOLD to −48.0dB.

C☐ Select th INPUT ATTEN key and MODIFY to −10dB.

D☐ Set the analyzer to 2dB/division and increase the tracking generator output (and/or INPUT ATTEN and OUTPUT LEVEL) until the de-essing action is clearly visible.

E☐ Turn the DE-ESSER OFF and verify that the DE-ESSER action ceases.

F☐ Turn the DE-ESSER ON.

G☐ MODIFY UP step by step while verifying that the de-essing action diminishes. Refer to Figure 4 for typical curves.

H☐ Turn the DE-ESSER OFF and verify that the observed response is flat (±0.25dB).

13) Check EFFECTS SEND

A☐ Connect the oscillator to the INPUT of the 787A and adjust it to produce about 10dB of G/R. Turn the EQ OFF.

B☐ Monitor the EFFECTS SEND terminal with the audio voltmeter, THD analyzer and oscilloscope.

C☐ Verify a level of −1.0dBm (±1.0dB), and a THD below 0.10%.

D☐ Push the INPUT ATTEN key, MODIFY DOWN to −25.0dB, mute the signal and verify a residual noise below 70dBm.

E☐ Check for 'popcorn' or oscillation with the oscilloscope.

F☐ Monitor the (+) EFFECTS SEND terminal with the DVM.

G☐ Verify a DC offset of less than 25mV.

14) Check overall performance

A☐ Connect the oscillator to the INPUT of the 787A.

B☐ Monitor the OUTPUT with the audio voltmeter, THD analyzer and oscilloscope.

C☐ RECALL program 0 if another program has been selected.

D☐ Turn the OUTPUT LEVEL control fully CW.

E☐ Adjust the oscillator level to +4dBm and the INPUT ATTEN to produce 20dB of G/R.

F☐ Set the RELEASE TIME to 5dB/sec.

G☐ Measure the THD at 35Hz, 1kHz, 5kHz and 15kHz.

H☐ Verify that the THD is below 0.05%.

I☐ Mute the signal, set the GATE THRESHOLD to −30.0dB and wait for the G/R to drift up to 10dB.

J☐ Select the INPUT ATTEN key and MODIFY to −25dB.

K☐ Measure the residual noise and verify that it is below −65dBm.

L☐ Restore the signal and RECALL any other program.

M☐ Verify that the signal mutes momentarily as the program changes. If it does not, execute the MUTE function. Toggle and verify operation of the mute circuitry.

Section 5 Troubleshooting

page contents

CAUTION

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Problems and Possible Causes

Always verify that the problem is not in the source material being fed to the 787A, or in other parts of the system.

Keys do not respond:

The controls may be locked — see page 3-12. If the display and key lights are dark, check to see that the unit is plugged in.

Security code lost:

If the security code is lost, remove the 787A's top cover, and press LOCKOUT RESET button S1 to unlock the controls. S1 is located on the digital circuit board about 3 inches (8 cm) behind the RECALL key.

Error messages:

E - 1 : Time-out error or component failure on the optional MIDI or RS-232 interface board.

E - 2 : Memory or front panel send attempted with MIDI channel (or RS-232 baud rate) set to OFF (see page 3-14 or 3-17).

E - 3 : Attempted to send memory, front panel settings, or commands, but receiving unit is disabled (see page 3-14 or 3-17).

Flashing decimal point on the display:

The memory back-up battery is low and should be replaced. See page 4-2.

Memory loss after power failure:

The memory back-up battery is dead or missing. If the contents of memory were archived through the MIDI or RS-232 interface prior to the power failure, reload the memory (see page 3-14 or 3-17) *after* replacing the battery (see page 4-2).

PEAK OUTPUT LEVEL display flashes when key pushed:

This is normal, and does not indicate a problem.

Display shows bPS when MIDI interface installed, or chn when RS-232 interface installed:

When one of these optional interface boards is installed, the display is toggled to the appropriate mode label: chn for MIDI, or bPS for RS-232. It is remotely possible that the display could be accidentally toggled to the wrong mode label after installation. To correct this, press RESET while holding down MODE to toggle to the other mode label.

Optional basic remote control accessory doesn't work:

It is possible that the basic remote control accessory could be accidentally disabled after installation. To correct this, press RESET while holding down MODE, then release RESET. The display will toggle from OFF to rEC to indicate that the remote control accessory is enabled.

Program mutes when key pressed:

The audio output is normally muted when the RESET, EQ, RECALL, or COMPARE keys are pressed, or when front panel settings or RECALL are received via MIDI or RS-232 interface or remote control.

Press the RESET button while holding down the INPUT ATTEN key to toggle muting on and off. The display will indicate whether muting is On or OFF when these are pressed.

RFI, hum, clicks, or buzzes:

A grounding problem is likely. Review the information on grounding in Section 2.

The 787A's moderate RF suppression should be adequate for the vast majority of installations. However, installation next to a high-power transmitter may still cause problems. Additional RF suppression, careful examination of the grounding scheme, and other techniques familiar to the broadcast engineer may have to be employed.

Power supply problems:

The voltage regulators are operated conservatively, and can be expected to be extremely reliable. Before replacing the regulators, check to see whether other abnormalities in the circuitry (such as a shorted IC) have caused excessive current demand which is in turn causing the regulator ICs to either limit current or go into thermal shutdown (the two built-in protective modes). If it becomes necessary to replace a regulator, be sure to replace its heat dissipator securely.

Regulator ICs are frequency-compensated by capacitors at their outputs to prevent high-frequency oscillations. If one of these capacitors is ever replaced, be sure to use a low-inductance aluminum electrolytic. (A tantalum can fail because the current-delivering capacity of the power supply can cause a runaway condition if the dielectric is punctured momentarily; a high-inductance aluminum can fail to prevent a regulator from oscillating.) Check for oscillation on the power bus with an oscilloscope if C12, C13, C15, or C18 on the digital circuit board is replaced.

Output module failure:

The 5532 and 411 opamps used in the balanced output module may be freely replaced as necessary. However, the circuit is extremely sensitive to the characteristics of the resistors, so field repair of resistor failure (which is very unlikely) requires replacement of the entire output module in question if adequate headroom and common-mode rejection are to be maintained (see page 5-7 for information about factory service).

Diagnostic Routines

Checking the RAM

There are two diagnostics routines built into the 787A's software. One routine will check for errors in the RAM IC. The other routine will clear the entire contents of the RAM and intitialize all of the presets and operating parameters.

To verify RAM IC works correctly:

Press RECALL and RESET and release RESET. The display will show 0 0 . Press RECALL to envoke the RAM test. The display will momentaraly blank, and then 0 0 will be displayed if no errors occur. If any errors are detected, the number of blocks of memory affected will be displayed. In this case the RAM should be replaced. Pressing the RESET key will return the unit to its normal operating mode.

NOTE: The contents of memory will not be affected as a result of this test.

To clear the contents of the RAM IC :

Press RECALL and RESET and release RESET, then RECALL. The display will show 0 0 . Press UP to display 0 1 . Press RECALL and hold. The display will show c l r and the INPUT ATTEN LED will blink. Push INPUT ATTEN and then release both keys. The display will briefly show c l d and then return to 0 0 , the RAM diagnostics program. Pressing the RESET key will return the unit to its normal operating mode.

WARNING

All of the PRESETS stored in the unit will be erased forever. The RS-232, MIDI, or remote control and the EQ mute operating settings may need to be restored manually. Refer to the corresponding sections of this manual for instructions on how to configure the settings.

Components: Fault Diagnosis, Replacement

If you want to troubleshoot on the component level instead of returning the unit to the factory for service, read the circuit description in Section 6 before continuing. Servicing on the component level requires a deeper understanding of 787A circuitry.

Here are some suggestions for component-level troubleshooting:

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 ICs used without feedback (as comparators) and ICs with outputs that have been saturated due to excessive input voltage because of a defect in an earlier stage. However, if an IC'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 787A'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.

See the introduction to the parts list on page 6-23 for detailed information on **ordering parts**. Nearly all parts used in the 787A have been very carefully chosen to make best use of both major and subtle characteristics. For this reason, parts should always be replaced with *exact duplicates* if so indicated in the parts list. It is very risky to make "close-equivalent" substitutions because of the possibility of altering performance and/or compliance with regulatory requirements.

Certain parts are selected to tighter than normal specifications (most such parts are noted in the parts list — but it is almost always wiser to return the defective card to the factory for service). Certain parts require partial recalibration if replaced, and this may or may not be practical in the field (such parts are also noted in the parts list).

It is important to use correct technique when **replacing components** mounted on printed circuit cards. Failure to do so may result in circuit damage and/or intermittent problems. Because solder flows well into the through-holes of the double-sided plated-through circuit boards used in the 787A, a technique like the following is required.

To replace a component:

1) Remove the old component.

It is sometimes easier to cut the offending components from its leads, than removing the leads as described below.

A☐ Clear each lead to be removed by melting the solder *on the solder side* (underneath) of the printed circuit card. As soon as the solder is molten, vacuum it away with a spring-actuated de-soldering tool (like the Edsyn Soldapullt®).

Use a **30-watt soldering iron** — do *not* use a soldering gun or a high-wattage iron! DO NOT OVERHEAT THE CARD. Overheating will almost surely cause the conductive foil to separate from the card base. Even with care, it is easy to blister the enamel solder-mask coating (in most cases, this is no cause for concern: the coating is there mainly to prevent moisture from condensing between the traces and to simplify wave-soldering).

B☐ Release the component by gently wiggling each of the leads to break solder webs, then lift the component out.

2) Install the new component.

A☐ Bend the leads of the replacement component so they will fit easily into the appropriate circuit card holes.

B☐ Solder each lead to the bottom side of the card.

Use a 30-watt soldering iron and a good brand of *rosin-core* solder. Make sure that the joint is smooth and shiny.

If no damage was done to the plated-through hole when the old component was removed, soldering of the top (component side) pad is not necessary. But if removal did not progress smoothly, it would be prudent to solder each lead on the component side of the hole to avoid potential intermittent problems.

C☐ Cut each lead of the replacement component close to the solder (underneath) side of the circuit card with a pair of diagonal cutters.

D☐ Remove all residual flux with a cotton swab moistened with a solvent.

Suitable solvents include 1,1,1-trichloroethane (sold as Energine® Fireproof Cleaning Fluid), naphtha (sold as Energine® Regular Cleaning Fluid), and 99% isopropyl alcohol.

Make sure that the flux has actually been removed, and not just made less visible by smearing. While most rosin fluxes are not corrosive, they can slowly absorb moisture and become sufficiently conductive to degrade circuit performance.

Technical Support, Factory Service

If you require technical support, contact Orban customer service. Be prepared to accurately describe the problem. Know the serial number of your 8282 — this is printed on the rear panel of the unit.

Telephone: (1) 510/351-3500 or Write: Customer Service
Orban
or Fax: (1) 510/351-1001 1525 Alvarado Street
San Leandro, CA 94577 USA

Shipping Instructions

To ship the 787A, use the original packing material if it is available. If it is not, use a sturdy, double-wall carton no smaller than 22 × 15½ × 6.5 inches (56 × 37 × 16.5 mm) 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 wrap cushioning material around it. Do not pack the unit in crumbled newspaper — use bubble sheets, large foam beads, thick fiber blankets, or similar packing materials. Put at least 1.5 inches (4 cm) of cushioning on all sides of the unit, and tape the cushioning in place to prevent shifting during shipment. 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 (8cm) reinforced fiberglass or polyester sealing tape (narrow or paper tapes won't hold), top and bottom in an H pattern. Mark the package with the name of the shipper, and with these words in red:

DELICATE INSTRUMENT, FRAGILE!

Insure the package appropriately. 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.

The terms of our Warranty are detailed on a separate Warranty Certificate supplied with the unit. 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. Repaired units will be returned C.O.D. In all cases, transportation charges (which are usually quite nominal) are paid by the customer.

Section 6
Technical Data

page contents

Specifications

Performance

Frequency response: ±0.25Hz below compressor, de-esser, or gate threshold, 20–20,000Hz.

RMS noise: >85dB below output clipping level.

Installation

Audio Input – Line Level, Effects Receive Port

Impedance: >10kΩ load impedance, electronically balanced. Balanced source ≤600Ω recommended (not required).

Sensitivity: Can be used with nominal levels from −10dBu to +8dBu.

EMI suppressed: Yes.

Connector: XLR and Barrier strip (Barrier strip only for Effects Return) (#5 screws).

Audio Input – Mic Level (with optional mic preamp)

Impedance: 1500Ω load impedance, transformer balanced. Selectable −20dB pad.

Sensitivity: Can be used with nominal levels from −65dBu to −10dBu (with pad).

EMI suppressed: Yes.

Connector: XLR.

Audio Output — Line Level

Impedance: 30Ω source impedance, electronically balanced and floating to simulate transformer output. Output can be unbalanced by grounding one output terminal.

Output level: Adjustable for use with −10dBm to +8dBm (into 600Ω) systems. Output clipping level: >+20dBm into 600Ω.

EMI suppressed: Yes.

Connector: XLR and Barrier strip (#5 screws).

Audio Output — Mic Level

Impedance: 200Ω, balanced.

Level: −55dBm into 600Ω.

Audio Output — Effects Send Port

Impedance: 47Ω, single-ended.

Level: +4dBm into 600Ω.

Power

Power requirement: 115/230V AC (±10%), 50–60Hz, 16VA.

Connector: IEC mains connector with 3-wire "U-ground" or CEE7/7 power cord and plug.

EMI suppressed: Yes.

Fuse: 1/2-amp 3AG 250V Slow-Blo fuse for 115-volt operation; .250-amp "T" type 250V fuse for 230-volt operation.

Physical

Dimensions: 19 inches (48.3 cm) wide, 11 1/4 inches (28.5 cm) deep, 3 1/2 inches high. 787SL is 1 3/4 inches (4.5 cm) high.

Operating temperature range: 32–113°F (0–45°C)

Humidity: 0–95% relative humidity, non-condensing.

Options

MIDI interface: For sending data and commands between units — see page 3-14. Order RET045.

RS-232 interface: For sending data and commands between units — see page 3-17. Order RET050.

Mic preamp: Raises mic-level inputs to line level. Order RET046.

Basic remote control accessory: For remote control of UP, DOWN, RECALL, and SELECT CHANNEL. Displays preset number. Order ACC024.

Security cover (acrylic): To prevent unauthorized adjustment of controls — see page 3-12.

Circuitry

Compressor

Attack time: approximately 5 ms; program dependent.

Release time: adjustable between approximately 1dB/sec to 50dB/sec; linear release rate.

Compressor ratio: ∞ to 1

Range of gain reduction: 25dB.

Interchannel tracking with 787ASL: ±0.5dB, STEREO COUPLED.

Total harmonic distortion: <0.1% at 1kHz (release time = 2.5dB/sec, 15dB gain reduction). Typically <0.1% at 20Hz, <0.05% from 100–20,000Hz.

SMPTE intermodulation distortion: <0.05% (60/7,000Hz 4:1; 15dB gain reduction; release time = 2dB/sec).

Gain reduction element: Class-A proprietary VCA.

Equalizer

Type: 3-band parametric.

Equalization range: +16, −40dB.

Tuning range: 30–632Hz, 210–7,650Hz, 420–15,300Hz.

Bandwidth range: (at 8dB boost) 0.1–5 octaves (Q = 0.3–12.5).

Overload indicator: Lights for 200ms if the instantaneous peak output of any amplifier rises to within 1dB of its clipping point.

De-Esser

Attack time: Approximately 200ms.

Release time: Approximately 200ms.

Available attenuation: 25dB.

Noise Gate

Hold time: Approximately 250ms.

Attack time: Approximately 200ms.

Release time: <0.1ms.

Available attenuation: 25dB.

Memory

Capacity: 99 user-programmable registers for host unit; 99 user-programmable registers for slave unit.

Back-up: 5 year lithium battery.

Warranty

One year, parts and labor: Subject to limitations set forth in our Standard Warranty.

All specifications subject to change without notice.

Circuit Description

On the following pages, a detailed description of each circuit's function is accompanied by a component-by-component description of that circuit. **Keywords are highlighted** throughout the circuit descriptions to help you quickly locate the information you need.

This section begins with an overview of the 787A circuitry, and then provides a description of the digital and analog control circuitry.

Digital control circuitry is described in 9 major blocks: clock circuitry, power monitoring circuitry, basic microcomputing circuitry, display driver circuitry, switch decoding circuitry, digitally-controlled analog processing circuitry, MIDI option, RS-232 option, and remote control option.

Analog audio circuitry is described in 13 major blocks: input buffer, input attenuator, VCA (voltage-controlled amplifier), equalizer, compressor control, noise gate control, de-esser control, PEAK OUTPUT LEVEL metering, effects send and receive, overload indicator, power supply, and optional microphone pre-amp.

Overview

The Programmable Mic Processor is an analog signal processing device controlled by a microprocessor. The microprocessor and associated digital circuitry allow instant and repeatable modification of the analog signal processing. 99 user-definable processing settings are stored in battery backed-up RAM. These are called PRESETs and can be recalled at any time via front panel switches, rear panel contact closures, serial communications link (MIDI or RS-232), or with the REMOTE CONTROL unit. The presets are created using simple front panel keys and the LED displays. The microprocessor interprets and controls the activity of these input devices.

The parameters of the analog processing circuitry are set with Digital to Analog Converter (DAC) ICs. The DACs are controlled by the Z-80 microprocessor. The DACs are written to an 8-bit word and then clocked to latch the word in its internal register. This word adjusts the DACs internal resistor ladder network which is part of the analog circuit, thus altering a parameter of the analog circuit.

To set the operating parameter for a DAC, the Z-80 writes the data and address for the DAC to a pair of latches on the DIGITAL PCB. This isolates the analog cicuitry from the digital circuitry and the noise it generates.

The latches buffer the data and address lines and drive the ribbon cable connecting the two boards. The data line on the **analog board** directly connects to the DACs. Address decoders receive the address from the **digital board** and select the DAC to read the data. The DAC latches the data when clocked by the address decoder so the Z-80 can load the next DAC with data.

1. Digital Circuit Description

1. Overview

A Z-80 microprocessor is the central controller of the 787A. The basic functions of the Z-80 and its supporting digital circuitry decode the switches, drive the displays, set the analog processing circuitry, and store and retrieve the operating parameters and presets in memory.

2. Clock Circuitry

The clock circuit provides a 4MHz signal to the clock input of the Z-80 microprocessor and any serial board connected to the system. This provides the timing and synchronization necessary to make the digital circuitry work correctly.

Component-level description:

An 8MHz crystal Y1 is the feedback element in an inverter oscillator circuit consisting of inverter IC2a and loading and phase-shift compensation components R1, R2, C1, and C2. The 8MHz output at IC2b pin 4 is then buffered by IC2c, then divided by 2 with flip-flop IC3a. This 4MHz signal appears at the output of IC3a pin 5 and is then buffered by IC2d to provide the clock signal required by the Z-80 microprocessor. IC13b divides the buffered 8MHz clock signal at pin 6 IC2c to 4MHz and provides the inverted phase to drive the serial board.

3. Power Monitoring Circuitry

A voltage level sensing circuit monitors the regulated +5 volts. This circuit shuts down the Z-80 and protects the contents of the RAM when the voltage falls below 4.5 volts.

Component-level description:

The +5 volt supply is scaled with voltage divider R9 and R10 to 1.34 volts. This voltage is compared to a 1.2 volt precision reference diode CR1 with biasing resistor R12. When the +5 volt supply drops below 4.5 volts the output of IC13b pin 1 goes low and quickly discharges C3. Hysteresis is provided by R11 with CR2 to prevent current from flowing back to the input of IC13b. IC8a and IC8b double buffered this signal to obtain the correct polarity to enable the $\overline{\text{RESET}}$ pin 26 of the Z-80 microprocessor. The Z-80 will halt when the $\overline{\text{RESET}}$ pin of the Z-80 is set low. When +5 volts recovers to above 4.5 volts, IC13b pin 1 will go open collector allowing R13 to charge

C3. This triggers IC8a and IC8b to disable the $\overline{\text{RESET}}$ pin. The Z-80 will then re-initialize itself.

The $\overline{\text{RESET}}$ signal at IC8 pin 6 also disables the RAM chip IC7 at CE2 pin 26. CE2 low prevents any data from being written to the RAM. This prevents any data from becoming corrupt when +5 volts falls below the operating voltage of the circuit. The $\overline{\text{RESET}}$ signal also goes to J5 to reset appropriate ICs on any serial boards that are connected.

To prevent erratic display messages, the output of IC8a provides the DISPLAY BLANK signal to blank all of the front panel LEDS and displays except for the overload LEDS when the +5 volt supply is not in its correct operating range. Q3 is used as a low leakage diode to isolate IC8 from circuits on the display board which are not powered by the battery. R36 is a pull-up resistor.

The front panel RESET switch also activates the RESET condition described above. When the switch is pressed, C4 discharges through R15 which sets pin 2 of NAND gate IC8b low. This causes its output to go low, enabling the $\overline{\text{RESET}}$ signal.

4. Microcomputing Circuitry

The microcomputing circuitry consists of the Z-80 microprocessor, a random access memory (RAM) IC, a read only memory (ROM) IC, latched buffers, and other logic devices.

The Z-80 is the central computing device and controls the states of the other components. The software program in the ROM determines what operations the Z-80 will execute.

The digital board features two sections; **memory** and **input/output**. The memory section allows the Z-80 to access ROM and RAM. The input/output section allows access to the devices off the digital board: digital-controlled analog components, switches, displays, MIDI and RS-232.

Component-level description:

The $\overline{\text{MREQ}}$ (pin 19) of IC4 goes low when a **memory** function is executed. This signal enables the memory address decoder IC5 which selects the proper memory device to be accessed by the Z-80. If the address is in the range of 0000H to 4000H, pin 15 or pin 14 of IC5 will clock low. These outputs are ANDed together by AND gate IC9b and pin 6 will go low if either of its inputs are low. This will select ROM IC10. If the address is in the range of 4001H to 6000H IC5 pin 13 will clock low selecting RAM IC7. The $\overline{\text{WR}}$ (pin 22) of IC4 determines if the RAM is to be read from (high) or written to (low).

The $\overline{\text{I/O REQ}}$ (pin 20) IC4 goes low to access the **input/output** devices. This line allows IC6 to decode the address of the device being accessed. The address range of the input/output devices are from 0 to 100H. Address locations 0 to 1FH select the DAC buffered latches IC12 and IC14. 20H selects $\overline{\text{DACSELA}}$. 21H selects $\overline{\text{DACSELB}}$. 60H selects the serial port enable line $\overline{\text{MIDI}}$. 80H with $\overline{\text{WR}}$ selects $\overline{\text{SWWR}}$ to write to the **switch matrix**. 80H with $\overline{\text{RD}}$ selects $\overline{\text{SWRD}}$ to read the **switch matrix**. C0H selects the DISPLAY CHARACTER control line. E0H selects the DISPLAY SEGMENT control line.

5. Display Circuit

A constant current driver circuit multiplexed by the microprocessor drives the 4 numeric displays and most of the discrete LEDS on the front panel. There are 8 discrete constant current sources to drive up to 8 led segments or individual LEDs at each multiplexed time slot. There are eight sets of 8 segments or individual LEDs being multiplexed. Each of these sets is called a character.

Component-level description:

The constant current source consists of Q1–Q11, CR1–CR10, R1–R29, and C14. R1, CR1, and R2 set a constant current through Q1. The voltage at the emitter of Q1 and R4 determine this current. This current causes a voltage drop across R3 which is referenced to +8 volts (TP2). This voltage appears at TP1 buffered by Q2 and Q3 and filtered by C14. R5 biases Q2 and Q3 and CR2 prevents reverse biasing of the transistors.

There are eight constant current elements with outputs labeled A-H. These outputs are connected directly to the segments of the numeric displays and to the LEDs.

The voltage at the emitter of each segment driver transistor (Q4–Q11) determines the magnitude of the drive current. This voltage equals the voltage at TP1.

Each output transistor is turned on by drawing a base current through its corresponding 3.3kΩ base resistor. This current is sinked by transistor array IC4. The transistors in IC4 are driven by latch IC3. A high bit at the output of IC3 selects the character by turning on the corresponding transistor in IC4.

IC5 and IC6 select the character to be driven in a given time slot. The 787 multiplex rate is approximately 14.5 msec, or 1.8 msec per character. The data is set at input ports 1D to 8D of IC5. Pin 11 is then clocked to load the latch. IC5's latched outputs drive IC6 which is a package of 8 open collector NPN transistors. These transistors each drive a character consisting of up to 8 segments or discrete LEDs. A high bit at the output of IC5 selects the character by turning on the specific transistor in IC6. The outputs of IC6 go low to sink current through the desired segment from the 8 constant current sources.

6. Switch Decoding

The microprocessor decodes the front panel switches and the internal LOCKOUT RESET switch. The switches are arranged in a matrix so that a software algorithm can determine which if any of the switches are closed. The matrix is organized into 7 rows and 3 columns.

Component-level description:

The first step to decode the switches is to set all of the row drivers low with 8-bit latch IC16, and then to read the columns with buffer IC15. A closed switch causes the column the switch is connected to go low. If no switches in that column are closed, pull-up resistors R21a-R21g pull the column inputs

high. If the microprocessor finds that there are switches closed, it sets one row low at a time and reads the column inputs. By knowing which row and column is low the microprocessor can determine which switch is closed

IC15 and IC16 are also used to determine if any options are installed at the serial port J5, if the 787ASL slave chassis is connected, and if the slave is in the STEREO COUPLE position.

Options are detected much in the same way as the switch decoding scheme described above. Columns 1–3 are shared with the front panel switch circuitry, so the status of the options are only checked when none of the switches are closed. OPTION DETECT pin 12 of IC16 is a row driver. However, instead of switches being connected, diodes are installed on the option boards so that when the $\overline{\text{OPTION DETECT}}$ line goes low, the corresponding diode will pull its column low. Column 1 is used to detect the MIDI or RS-232 option. Column 2 detects the 787ASL. Column 3 checks if the slave is in the **STEREO COUPLE** mode.

The rear panel remote closure contacts are also read through IC15. These switches are not in a matrix. Each of the four switches has its own input port with IC15. Each connection to the terminal block has the same RF protection as the audio inputs, a .001uF capacitor chassis bypass and two ferrite beads. R17–R20 are in series with the inputs to current limit. To prevent excessive voltages from damaging internal circuitry CR5–10, CR15, CR16 clamp input voltages from exceeding +5.6 volts or −.6 volts.

The 3 volt RAM back-up battery is also monitored. IC13b compares the voltage of the battery to the voltage produced by divider R22 and R23. When the voltage of the battery falls below +2.5 volts, pin 14 of IC13 goes low. This output is read by the microprocessor at pin 8 of IC15. The decimal point of display 4 will blink when this condition is detected to warn the user that the battery needs to be replaced.

7. Digital-controlled Analog Processing Circuitry

These parameters of the analog processing circuitry are set with Digital to Analog Converters (DAC) ICs: INPUT GAIN, compressor RELEASE TIME, GATE THRESHOLD, NOISE GATE DEPTH, equalizer BOOST/CUT, CENTER FREQUENCY, and BANDWIDTH, DE-ESSER THRESHOLD, and EFFECTS RETURN LEVEL. The DACs are controlled by the Z-80 microprocessor. The DACs are written to an 8-bit word and then clocked to latch the word in its internal register. This word adjusts the DACs internal resistor ladder network which is part of the analog circuit, thus altering a parameter of the analog circuit.

Component-level description:

The Z-80 sends the address of the DAC to be accessed and the data to be written to it with latches IC12 and IC14. IC12 and IC14 are 8-bit latches that buffer the data and address busses from the digital board to the analog board. This prevent the high frequency noise present on the digital board busses from entering into the audio path on the analog board since the outputs of IC12 and IC14 only change state when new data is written to a DAC.

Pin 11 of IC12 and IC14 are clocked high simultaneously to set the address and data at the inputs of the IC's to their internal registers. The word stored

in the register of the latch is seen at its output because the OUTPUT ENABLE pin 1 is held low for both IC12 and IC14.

Control lines $\overline{\text{DACSELA}}$ and $\overline{\text{DACSELB}}$ are decoded with IC1 and connect directly to the analog board. $\overline{\text{DACSELA}}$ is used to enable the 787A DAC decoding circuitry on the analog board. $\overline{\text{DACSELB}}$ sets the 787ASL DAC decoding circuits. These control lines clock low after IC12 and IC14 have been loaded with the data and address.

This completes the discussion of the digital control lines from the **digital board**. The following discussion describes the **Digital Control Logic** on the **analog board**.

The data from IC12 is directly connected to all of the DACs and the address data from IC14 is sent to address decoders IC22, IC23, IC24, and IC25. The address data, plus the state of either DACSELA or DACSELB, enables the decoders to determine which DAC is selected to receive new data. One of the output pins of IC22, IC23, or IC24 clocks high to set the latch of the desired DAC. The DAC immediately changes the settings of its resistor ladder network to that directed by the new data.

8. MIDI Option:

The MIDI option is based on a serial **input/output** (SIO) IC and a counter timer chip (CTC) IC. The SIO IC provides serial to parallel and parallel to serial conversion. The CTC IC provides the transmit/receive clock for the SIO.

Component-level description:

The RESET signal from the DG board resets IC1 (pin 21) and IC6 (pin 17) whenever the Z-80 is reset.

CR2 is part of the **Option Detect** circuit described in the **Switch Decoding** section. CR2 allows the Z-80 to determine if the MIDI board is present.

The 4 megahertz clock from the DG board is buffered by IC2a and IC2d to drive IC1 pin 20 and IC6 pin 15. This clock allows synchronized communication between the Z-80 and the SIO and CTC IC's. IC2b, IC2c, and IC3f provide address decoding so the Z-80 can select either the CTC (IC6 pin 10 and 16) or the SIO (IC 1 pin 35 and 36).

IC7a divides the 4 megahertz clock to 2 megahertz, which appears at pin 5. The CTC generates the 31.5kHz transmit/receive clock for the SIO from the 2 megahertz signal. The 31.5kHz signal is seen at IC6 pin 7. This output drives IC1 pin 13 and 14.

The SIO receives data to be transmitted from the Z-80 on the 8-bit data bus labeled DB0–DB7. When the $\overline{\text{CE}}$ and $\overline{\text{IORQ}}$ (pins 35 and 36) are low in conjunction with $\overline{\text{RD}}$ the data is written to the SIO. This data is transmitted out serially at TxDa (pin 15). This output is buffered by IC3b which drives IC4b. IC4b is an open collector inverting buffer which provides the current driver for the MIDI current loop.

The MIDI current loop presents the diode of an opto-isolator between pins 4 and 5 of J3 with the anode connected to pin 4. Thus the transmitted signal

will not be seen at the MIDI OUT connector (J3) unless a MIDI device is connected to J3.

Serial data is received from the MIDI IN port (J1). R7 and IC5 are elements of a current loop. IC5 is a high gain opto-isolator with gain set by R12. Pin 6 of IC5 goes low when current passes through pins 2 and 3. R1 pulls pin 6 to +5 volts when there is no current in the loop. The signal at IC5 pin 6 is buffered by IC3d and IC3e. IC3e drives the receive data (RxDa pin 12) of IC1.

IC3e also drives the MIDI THRU port (J2). The MIDI THRU port operates the same as the MIDI OUT port described above.

9. RS-232 Option

The RS-232 option is based on a serial input/output (SIO) IC and a counter timer chip (CTC) IC. The SIO IC provides serial to parallel and parallel to serial conversion. The CTC IC provides the transmit/receive clock for the SIO.

Component-level description:

The RESET signal from the DG board resets IC7 (pin 21) and IC6 (pin 17) whenever the Z-80 is reset.

CR1 is part of the **Option Detect** circuit described in the **Switch Decoding** section. CR1 allows the Z-80 to determine if the RS-232 board is present.

The 4 megahertz clock from the DG board is buffered by IC1b and IC1c to drive IC7 pin 20 and IC6 pin 15. This clock allows synchronized communication between the Z-80 and the SIO and CTC IC's. IC5a, IC5d, and IC1e provide address decoding so the Z-80 can select either the CTC (IC6 pin 10 and 16) or the SIO (IC7 pin 35 and 36).

IC1a, Y1, C9, C10, R4, and R5 define a 6.144MHz oscillator circuit. The 6.144MHz clock signal appears at pin 2 IC1a. This signal is buffered by IC1f and then divided to 1.5285MHz by IC2a and IC2b. This signal drives pin 23 of IC6. The CTC generates the transmit/receive clock at the selected baud rate for the SIO from the 1.5285MHz signal. The clock signal at the selected baud rate is seen at IC6 pin 7. This output drives IC7 pin 13 and 14.

The SIO receives data to be transmitted from the Z-80 on the 8-bit data bus labeled DB0–DB7. When the $\overline{CE}$ and $\overline{IORQ}$ (pins 35 and 36) are low in conjunction with $\overline{RD}$ the data is written to the SIO. This data is transmitted out serially at TxDa (pin 15). This output drives the line interface IC IC4b. $\overline{RTS}$ (pin 17) and DTR (pin 16) are control lines which control the RS-232 communication protocols.

Serial data is received from the RS-232 connector (J1) at pin 2. IC3a is the receive buffer which drives the SIO RxDa input (pin 12). The serial data is converted to an 8-bit word and sent to the Z-80 on the data bus labeled DB0–DB7.

C1 and C4 are high frequency bypass capacitors to prevent oscillation on the ±22 volt supply. C2 and C9 are filter capacitors. C3 and C6 are output bypass capacitors. IC9 and IC8 are ±12 volt regulators which supply the

source voltages to drive the RS-232 outputs (J1 pins 3, 5, and 6) at the correct voltage levels.

10. Remote Control Option

The remote control circuitry allows for data from the Digital Board to be sent and received serially from the internal remote PCB to the external remote unit. This data will be interpreted at the remote external PCB to control the displays and LEDs and allow for the **digital board** to determine what keys have been pressed on the remote unit.

Component-level description:

Internal Remote Circuit

Data bit D0 is buffered by IC1d and present at the D inputs of flip-flops IC3a and IC3b. The data will appear inverted at the $\overline{Q}$ outputs of one of the flip-flops when IC1a and IC1b decode $\overline{MIDI}$ and A0 and clocks the flip-flop. This signal will then be level shifted by open collector inverters IC5a or IC5b. Pull-up resistors on the external remote PCB will allow the outputs of these inverters swing between 0 and +15 volts. R2 and R6 are for current limiting and work with C11 and C16 for signal shaping.

The signal at RD0 is level shifted by R7 and R8 and will appear at pin 9 of IC4b. CR2 assures that this signal will not exceed +5.6 volts. IC2b and IC2c buffer this signal. Data is read from pin 8 IC2c when IC1c decodes $\overline{MIDI}$ and $\overline{RD}$ to enable buffer IC4b.

Regulator IC6 provides the +15 volts for the external remote circuitry. C4, C5, and C6 provide frequency compensation for IC6. R3 provides a discharge path for C5 when the external unit is not connected. CR1 prevents IC6 from becoming reversed biased.

Capacitors C6–C16 with ferrite beads FB1–FB4 prevent high frequency noise from being radiated from the unit.

External Remote Circuit

C1, C2, C8, and C9 with FB1–FB4 provide RF filtering for the four wire connection to the Internal Remote PCB. R3 and R4 are pull-up resistors and R1 and R2 provide current limiting. CR1–CR4 prevent the voltage on RD0 and RD1 from going above +15 volts or below 0 volts.

Data received on RD0 and RD1 is buffered by IC6b, IC6c, IC7d and IC7d. Binary counter IC1 counts the pulses received on RD0 when RD1 is high. RD1 goes low to clock flip-flops IC3a, IC3b, and IC2b to latch the current count of IC1 at the flip-flops. RD1 low will also clear the current count of IC1. The outputs of the flip-flops are used to address either one of the switches, SW1–SW4; one of the displays, D1–D2; or the LEDs.

IC8 decodes the address from the flip-flops and selects binary counter IC5 to enable counting by IC6a. This count will be decoded by BCD to 7 segment drivers IC10 or IC4 and displayed on D1 or D2 when pin 5 is clocked setting the drivers latch. R21–R34 are current limiting resistors to set the displays segment current. BCD to 7 segment driver IC11 is selected by

IC8 to drive the discrete LEDs. Flip-flop IC2a pin 1 is set to +5 volts when the IC1 counts to 9 and triggers IC6d low. This signal is inverted by IC7b which sets flip-flop IC2a. Pin 1 of IC2a will drive R13 to turn on transistor Q1 to enable the LEDs contained in SW1–SW3.

2. Analog Circuit Description

1. Overview

The **block diagram** on 6-41 illustrates the following overview of 787A circuitry.

The line level input signal enters the 787A in balanced form receiving moderate **RFI suppression**. It is then applied to a very low-noise opamp configured as an "**active transformer**."

The microphone pre-amp input signal is applied to an input transformer. This signal is then fed to an opamp circuit with gain and summed with the line level input

The three bands of equalization are created by a state variable topology. This provides very stable operating characteristics. Constant "Q" is maintained when boost/cut, center frequency, or bandwidth is adjusted. Notching capabilities are provided.

The current-controlled gain block used in the 787A is a proprietary class-A **voltage-controlled amplifier** (VCA). It operates as a two-quadrant analog divider with gain *inversely* proportional to a current injected into a first gain-control port, and is cascaded with a two-quadrant analog multiplier with gain *directly* proportional to a current injected into a second gain-control port. Any "**thumps**" due to control current feedthrough are eliminated by applying DC to offset to the VCA's input.

The compressor is a feedback circuit: the output of the compressor is looped back to develop a gain-control signal that is applied to the VCA. This arrangement results in superior stability of characteristics with time and temperature, extremely LOW distortion, and optimized control-loop dynamic response.

The proprietary compressor **timing module** generates a control signal that enables the 787A to achieve natural-sounding control and very low modulation distortion. The RELEASE TIME control allows a 50:1 variation in the basic release dynamics. The release dynamics are determined by the **timing module** on the basis of the past history of the input.

Release time circuitry allows the recovery to proceed at a constant rate (in dB/second) regardless of the absolute gain reduction.

A **gating detector** monitors the level of the 787A's input signal, and activates the compressor gate or compressor and noise gate if this level drops below a threshold set with the GATE THRESHold control.

When the NOISE GATE is enabled the output of the 787A will be attenuated by the amount selected with the DEPTH control.

The DE-ESSER detects sibilance in the region of 6kHz and above and reduces the gain of the VCA until the average level of the sibilance is reduced below the threshold determined by the DE-ESSER THRESHOLD control.

EFFECTS SEND and RECEIVE ports allow the signal prior to the output attenuator to be sent to another processing device. The processed signal is then summed back in with the main signal at the desired level using the EFFECTS RETURN control.

The GAIN REDUCTION meter consists of ten comparators arranged to produce a meter with a 0–25dB linear scale.

The PEAK OUTPUT LEVEL meter is an LED bargraph that monitors the output level of the 787A just prior to the balanced output stage. The meter is driven by a **peak detector** capable of reading the peak level of a 10-microsecond pulse with an accuracy of 0.5dB (typical) when compared to its reading on a steady-state tone. It thus provides a true peak-reading capability, rather than a quasi-peak capability like an EBU-standard PPM (peak program meter).

Unregulated voltage is supplied by three pairs of **full wave diode rectifiers.** ±15v and +5v regulated voltages are supplied by a pair of overrated 500mA "three-terminal" IC regulators. A discrete circuit supplies the regulated +48 volts.

2. Input Buffer

The signal enters the 787A in balanced form receiving modest **RF suppression.** It is then applied to a very low-noise opamp configured as a differential amplifier with a 0.5 gain. When both non-inverting and inverting inputs are driven by a source impedance which is small with respect to 40k (600Ω or less), the amplifier is essentially insensitive to signal components that appear equally on the non-inverting and inverting inputs (such as hum), and responds with full gain to the difference between the non-inverting and inverting inputs. It therefore serves as an "**active transformer.**"

Since the INPUT ATTEN control is located after the opamp, the opamp will overload if its differential input exceeds approximately +26dBu (0dBu = 0.775V RMS; the dBm @ 600Ω scale on voltmeters can be read as if were calibrated in dBu).

Component-level description:

C1 and C2 shunt RF from the input leads to the chassis. Since these capacitors are not effective at VHF and higher frequencies, ferrite beads have been placed around the input and output leads to suppress such high-frequency RF. Although this **RF suppression** is modest, it should be adequate for the vast majority of installations.

The filtered signal is applied to opamp IC2a.

3. Input Attenuator

A Multiplying Digital to Analog Converter (MDAC) controls the input gain digitally. The transconductance of the MDAC and the resistors connected to the inverting terminal of the opamp determines the voltage gain of this stage. No gain is available with jumper A in the +4dB position. Approximately 14dB is available in the −10dB setting.

Component-level description:

The IC1's internal resistor ladder is set by the 8-bit word written to its internal data latch. The word present on the data bus labelled DB0–DB7 is loaded into the MDAC when pins 12 and 13 of IC1 are clocked low. The resistor ladder of IC1 is in the feedback path of inverting amplifier IC5b, controlling gain. R3 and R4 are summing resistors, in series when jumper A is in the +4dBu position. R4 is shorted in the −10dBu position. The gain can be adjusted from 0dB to −30dB in the +4dBu position and from +14dB to −16dB in the −10dBu position.

When jumper B is in the MIC OPTION position, the MIC PRE-AMP signal is summed into IC5b through the internal resistor between pin 16 and pin 1 of IC1. The gain applied to the mic signal can be adjusted from +30dB to 0dB.

The range of INPUT ATTEN**uation** is displayed on the front panel display as "+5dB" to "−25dB" for all jumper settings and input sources.

4. Voltage-controlled Amplifiers

The current-controlled gain block used in the 787A is a proprietary class-A **voltage-controlled amplifier** (VCA). It operates as a two-quadrant analog divider with gain *inversely* proportional to a current injected into a first gain-control port, and is cascaded with a two-quadrant analog multiplier with gain *directly* proportional to a current injected into a second gain-control port. For most gains, levels, and frequencies, total harmonic distortion (THD) is well under 0.1

A specially-graded Orban IC contains two matched, non-linear gain-control blocks with differential inputs and current outputs. Used alone, one such gain-control block would introduce considerable distortion. Therefore, the first of the two matched blocks is used as the feedback element for a separate opamp, and the second is driven by the pre-distorted output of that opamp. The gain of the VCA is therefore *inversely* proportional to the gain of the non-linear gain-control blocks. This enables the VCA to function as a two-quadrant analog divider.

If the VCA is not perfectly balanced, "**thumps**," due to control current feedthrough can appear at the output. These are eliminated by applying DC offset to the VCA's input.

The basic current-controlled gain in the compressor is *inversely* proportional to the control current generated by the compressor control circuitry. The gain is made proportional to a control voltage in dB by an exponential current converter.

Component-level description:

The first gain-control port is pin 6 of IC8; the second gain-control port is pin 3 of IC8. IC8 is the specially-graded Orban IC containing two matched non-linear gain-control blocks with differential inputs and current outputs. The separate opamp in the feedback loop is IC7.

The output of IC8 is first attenuated by R36, R35, C12, and then applied to the input of the feedback element IC8b at pin 9. The output of IC8 is pre-distorted as necessary to force the current output of IC8b to precisely and linearly cancel the audio input into the "virtual ground" summing junction of IC7. This same pre-distorted voltage is also connected to the input of IC8a at pin 16. Thus the output of IC8a at pin 13 is an undistorted current. This current is converted to a voltage in current-to-voltage converter IC6, R42, and C15. The output of IC6 at pin 1 is the output of the VCA.

The VCA behaves like a two-quadrant analog divider when the control current from Q2 is applied to the control port (pin 6) of IC8b. The gain-control current injected into this control port is developed by the compressor control circuitry.

The gain of IC8a is fixed by the current source which is set by R72 and IC18b. This current source is also the control current used by the DE-ESSER.

Second-harmonic distortion is introduced by differential offsets in either section of IC8. This distortion is canceled by applying a nulling voltage directly to the input of IC8a by means of resistor network R38, R39, and DIST NULL trimmer R37.

The "**thumps**" which can occur if the VCA is not perfectly balanced, are equivalent to multiplying the control current by DC. An adjustable DC offset is applied to the VCA input provided by R31 and THUMP NULL trimmer R30 for nulling this equivalent DC multiplication to zero.

C10, C11, R27, R28 provide frequency-compensation to prevent the VCA from oscillating supersonically.

The compressor control current is dB-linear. This voltage is transformed into a current *inversely* proportional to the desired compressor gain by exponential current converter IC20 and associated components.

IC19 and associated components form a log/antilog multiplier which multiplies the current flowing in R21 by the exponential of the voltage on the base of IC20 (pin 5). The current gain of the multiplier (and thus the output current of the exponential converter) increases as the voltage on the base of IC5 (pin 5) becomes more negative.

The current output of the log/antilog multiplier appears on the collector of IC20 (pin 3). Since it is the wrong polarity and level to correctly drive the control-current port of IC8b, it is applied to current inverter IC19b, Q2, R32, R33, C9. This circuit has a gain of 6.66x, and operates as follows:

A voltage proportional to the current output of IC20 (pin 3) is developed across R32 because of the feedback action of IC19b. C9 stabilizes IC19b against oscillations. Feedback forces IC19's (–) and (+) inputs to be at the same voltage. Thus, the same voltage that appears across R32 also appears across R33, and current flows in R33 in proportion to the ratio between the values of R32 and R33.

This current flows out of the (+) input line of IC19b into the emitter of Q2. Because Q2's base current is small compared to its emitter current, essentially the same current flows out of Q2's collector into the gain-control port of IC8b.

Since the base of Q2 is grounded, its emitter therefore sits at +0.6V. This forces both (+) and (−) inputs of IC19 to also sit at +0.6V, and ensures correct bias voltage for IC20's collector (pin 3).

CR2 protects Q2 from reverse base-emitter voltage which otherwise could cause junction breakdown and latch-up of the entire current-inverter circuit.

5. Equalizer

The three band equalizer consists of three stages of a state-variable topology. The switched resistor elements of multiplying Digital to Analog Converters (MDACs) allow microprocessor control of boost-cut, center frequency, and "Q" or bandwidth. The high and mid bands differ from the low band in that compensation capacitors C7 and C12 are used to correct phase characteristics to achieve maximum notching depth.

Component-level description:

The following component level description of the low band circuit can be readily extended to the other bands by analogy.

The LOW band consists of ICs 13–15 and ICs 1–4 with associated components. The state variable topology used provides a low-pass, high-pass, and band-pass output.

Pin 7, IC15 is the low-pass output. IC15b with MDAC IC3, C4, C25, and C26 is an integrator with gain adjustable with MDAC IC3.

The low-pass output is summed at IC13b by R3 with the input of the state variable to obtain the high-pass signal at pin 7 IC13b. The gain of the input signal set with MDAC IC1 determines the "Q", or bandwidth. MDAC IC4 with C2, C3, and C5 integrates the high-pass output to provide the band-pass output at pin 1 of IC 15.

The band-pass signal is summed at pin 6 IC14 with the input of the state variable and with an inversion of it's bandpass output. The gain of the inverted bandpass output is set with MDAC IC2 and IC13a determines the boost-cut characteristics at the output of the filter at Pin 7 IC14.

6. Compressor Control

The compressor is a feedback circuit: the gain-controlled output of the compressor is used to develop a gain-control signal that is applied to the compressor gain-control port of the VCA. This arrangement results in superior stability of characteristics with time and temperature, extremely low distortion, and optimized control-loop dynamic response.

The output of the opamp in the VCA is applied to a rectifier with threshold.

The rectifier feeds the compressor **timing module**, which contains proprietary circuitry that outputs a control voltage with dynamics appropriate to achieving natural-sounding control and very low modulation distortion. The output of the module can be wired in a logical "OR" circuit with other such modules to effect stereo tracking of an arbitrary number of channels.

The RELEASE TIME control allows a 50:1 variation in the basic release dynamics, which are determined by the **timing module** on the basis of the past history of the input. The release recovery proceeds at a constant rate (in dB/second) regardless of the absolute gain reduction.

A **gating detector** monitors the level of the 787A's input signal, and activates the gate if this level drops below a threshold set with the GATE THRESHold control.

The GAIN REDUCTION meter consists of ten comparators with current regulators at their outputs. The comparators are arranged to produce a meter with a linear scale. The ten LEDs in the bargraph are connected in series.

Component-level description:

The output of IC7 in the VCA is applied to a rectifier with threshold in IC21b, a conventional **full-wave rectifier. Attack times** are determined by R67, R65. Any DC offsets at IC7's output are blocked by C13.

IC15b is a comparator that prevents the release module from being overdriven by the input signal. When the gain control voltage at TP3 reaches 11.8v, pin 2 of IC15b will go to -15 volts and pinch off FET Q3. This will prevent any further gain reduction from taking place until the gain reduction control voltage drops below 11.8 volts.

The output of the timing module is a low-impedance unidirectional voltage source, negative-going with increasing gain reduction (scale factor of approximately 0.4V/dB). 0V corresponds to 0dB gain reduction. Approximately -10V corresponds to the maximum available gain reduction (25dB).

The gain reduction voltage, which is dB-linear, is attenuated and inverted by IC32a, R135, and R136 such that +3V = 25dB gain reduction. The attenuated voltage is mixed with a 50 or 60Hz "dither" signal through CR29, R30, and C23 (connected to the power transformer secondary), and then applied to the input of LM3914 bargraph driver IC2.

The LM3914 bargraph consists of ten comparators with current regulators at their outputs. The comparators are arranged to produce a meter with a linear scale. The LM3914 applies current (through any one of pins 1 through 10) to the appropriate node to light the desired LEDs.

Q13 is used as a zener diode to reduce the supply voltage to the LM3914 so that it is within the chip's 25V maximum rating. R31 sets the current through the LED bargraph.

The LM3914 has an internal string of series resistors that provide reference voltages for its ten comparators. The bottom of this string is grounded at pin 4; the top of the string is provided with +3.00VDC from pin 1 of IC29a.

C1 bypasses the LM3914 power supply to prevent the LM3914 from oscillating.

The compressor release time is set by the DC voltage produced by IC27 and IC28b. IC27 scales the +15 volt reference voltage at pin 15 and is buffered by IC28b. This voltage is fed into the compressor module A1 at pin 8.

Under gated conditions (when the gating FET Q1 is turned off by pulling its gate towards +15 volts), the gain control voltage is forced to move slowly towards the voltage produced by divider R19 and R18. This voltage is then routed to the **timing module** through R20.

The *gate is activated* when the output of IC38a at pin 1 is pulled HIGH by R16, and is *defeated* when it is negative.

The gating circuit determines the threshold and response time of the compressor gate and noise gate.

IC33A and IC33B full wave rectify the signal from the input attenuator. The charge time constant at hold capacitor C34 is set by R108, and the discharge time is set by R107. C33 provides a low frequency roll-off. R107 sets a gain of 20dB.

IC35 and IC36A form a digitally-controlled reference voltage. The output of IC36A is a fraction of the +15 volt reference at pin 15, inverted. The magnitude of this reference voltage will depend on the control word written to MDAC IC35.

The reference voltage is scaled by R109 and R110 and compared to the rectified input signal at IC36B. The output of IC36B will go low to −15V when the rectified signal is greater than the reference at pin 5 of IC36B and is high (+15) otherwise. R111 and R112 provide hysteresis to prevent noise from re-triggering this comparator circuit.

The **gate threshold** circuit is common to the noise and compressor gate, although each gate has its own timing circuity.

The compressor gate time constants are set by R93, R99, and C31. When the signal at pin 10 of comparator IC38 reaches the 7.5 volts set by divider R98 and R96, pin 13 of IC38 goes low. This forces comparator IC38 pin 1 low which turns off FET Q1. Q1 off causes the control voltage at TP4 to advance towards −4 volts, set by divider R18 and R19. R97 provides hysteresis.

When the signal at pin 10 IC38d goes above 7.5 volts, pin 13 IC38d is pulled to 2 volts by R100 and R101. This forces IC38a pin 1 high turning Q1 on. Normal release will then occur.

The gate LED on the front panel is driven by IC37a which is triggered by the compressor **gate detector** IC38d.

The control current input of the second stage of the VCA is also used for the DE-ESSER and the NOISE GATE.

The de-esser control current flows from the collector of IC17a. A current identical to the de-esser control current flows from the collector of IC17b, since IC17a and IC17b are matched transistors. The current output of IC17b is inverted in current mirror IC17c-e, and injected into the junction of R40 and R41, where it develops a voltage. The voltage is amplified in both inverting and non-inverting modes by IC6a. When the wiper of R41 is at 50% rotation, then IC6a's inverting and non-inverting gains are equal, and no effect is produced at IC6as' output due to cancellation. Moving the wiper of R41 to either side of the null point permits introduction of sufficient control voltage into IC6a's output to cancel any feedthrough in IC8A, regardless of the feedthrough's polarity.

7. Noise Gate:

The time constants for the noise gate is set by R113, R114, and C32. When the signal at pin 8 of comparator IC38c reaches the 7.5 volts set by divider R115 and R116 at pin 9 the output of the comparator goes low. This forces the output of IC15c (pin 13) low which swamps the voltage from IC13a applied through R81. CR11 prevents the depth control voltage at pin 5 IC16b from going below −.7 volts.

IC12, 13a, and 16b with associated components determine the noise gate depth, **attack time** and **release time**. IC12 scales the reference voltage set by CR22 R151a and R151b to determine the noise gate depth. R81 and R82 with C19 will determine the rate at which the gate will attenuate the audio signal.

8. DE-ESSER

The DE-ESSER circuit detects sibilance in the region of 6kHz and above and will attenuate the output of the VCA until the sibilance is below the amount selected by the DE-ESSER THRESHOLD control.

Component-level description:

The VCA output (which includes the effect of IC6B, the de-esser gain control element) is applied to the de-esser control module, A2. This contains circuitry which detects the presence of sibilance and which outputs a current when sibilance levels exceed a level set by IC14, IC13b, R79, and R80, the de-esser THRESHOLD control circuit.

The output current of the de-esser control module is applied to CR7 and CR9, which charge C17 and C18 to approximately equal positive voltages. The release time of the circuit is determined by R75 which discharges C18. When C18 has been discharged sufficiently to overcome the turn-on voltage of CR8, C17 will also discharge. Since the voltage on C17 determines the amount of de-esser gain reduction, this recovery delay function provided by CR8 substantially aids in smoothing the de-esser control voltage and reduces dynamic distortion.

IC18b is a non-inverting voltage-to-current converter. When the de-esser control voltage (buffered by IC16a) is at ground, 9.1 volts set by CR22 appears across R72 because feedback holds IC18b's (+) and (−) inputs at the same voltage. This causes current to flow in R72, which flows in the emitter IC17a. Essentially the same amount of current flows out of IC17a collector to the control-current port of IC8a, thus determining the quiescent gain of IC8a.

When the de-esser gain control voltage becomes more positive, The voltage across R72 is decreased, thus reducing the control current into IC8a and reducing the gain of the VCA.

The DE-ESSER control voltage is OR'ed with the NOISE GATE control voltage at IC18b. Therefore, both circuits can operate at the same time, with the voltage of greater magnitude determining the amount of attenuation.

9. Effects Send and Receive:

EFFECTS SEND and RECEIVE ports allow the signal prior to the output attenuator to be sent to another processing device. The processed signal is summed back in with the main signal at the desired level.

Component-level description:

Pin 16 of connector P3 is the output of the compressor and equalizer stages. This signal is buffered by IC11a and isolated with R10 before being sent to the EFFECTS SEND output of TB1.

The EFFECTS RECEIVE input stage consists of a balanced opamp circuit IC11b and R12–13. DC blocking capacitors C6 and C7 feed the EFFECTS RECEIVE gain stage IC4, IC5a, R143, and R144. R143 and R144 allow this stage to have up to 14dB of gain depending on the control word written to IC4. The output of the EFFECTS RECEIVE is at pin 1 IC5.

10. PEAK OUTPUT LEVEL Metering

The peak-detecting PEAK OUTPUT LEVEL meter is an LED bargraph that monitors the output level of the 787A just prior to the balanced output stage. The meter is driven by a **peak detector** capable of reading the peak level of a 10-microsecond pulse with an accuracy of 0.5dB (typical) when compared to its reading on a steady-state tone. It thus provides a true peak-reading capability, rather than a quasi-peak capability like an EBU-standard PPM.

Component-level description:

The output of IC9 (pin 6) is applied to amplifier IC32b. The output of IC32b is rectified by an inverting **half-wave precision rectifier** IC30a and associated components. The output of the rectifier is summed (through R127) with its input to create a full-wave rectified signal at the (+) input of IC30b (pin 5).

IC30b operates as a dual-time constant **peak detector.** A DC voltage equal to the peak value of the rectified signal at pin 5 of IC30b is developed at the top of C35, which is charged by IC30b pin 7 through diode-connected transistor Q5. IC29b buffers this voltage and provides feedback to IC30b's pin 6, "telling" IC30b how to charge C35, C36 so that the peak value of the waveform on IC30b's pin 5 is accurately followed.

To achieve the very fast response desired, the peak-holding capacitors C35 and C36 are relatively small. To achieve a sufficiently slow recovery time with a practical value resistor (R131 = 22meg), R131 is bootstrapped to the output of IC29b through R132. R133 introduces enough DC offset to produce approximately 0.5V across R130 and R131 at all times. This multiplies the effective value of R130 and R131 by about 30, and slows down the recovery time as desired.

The output of **peak detector** IC30a (pin 1) is applied to LM3916 bargraph driver IC1 (DP board). Other than the fact that this IC provides a VU (rather than a linear) scale, its operation is identical to the operation of the LM3914 used in the IC2 (DP board) socket (see above).

11. Overload Indicator

The output of each main-signal-path amplifier in the 787A is connected to an overload bus. This overload bus will light the front panel OVERLOAD LED when the signal at any point in the 787A is within 1dB of clipping.

Component-level description:

The output of each main-signal-path amplifier in the 787A is connected to a pair of diodes. One diode is connected to a +10 volt bus (created by R87, R88); and the other diode is connected to a −10 volt bus (created by R83, R84). If the instantaneous output of any amplifier exceeds ±10 volts, then the appropriate diode will conduct and couple a pulse onto one of the busses, which are of relatively high impedance. Positive-going overload pulses are fed into transistor inverter Q6 and appear at Q6's collector amplified and inverted so that they are negative going. Thus any overload appears at Q6's collector as a negative-going pulse. This pulse is coupled through C29 to IC34 and associated circuitry, connected as a one-shot multivibrator.

Ordinarily, IC34 is held off (pin 6 low) because R89 holds IC34's inverting input at a higher voltage than voltage divider R90, R92 holds its non-inverting input. A negative-going pulse transmitted through C29 pulls IC32's inverting input down, thus briefly switching IC32's output high. This in turn pulls IC32's non-inverting input high through R91, C30, and latches IC32's output high until C30 can discharge through R91, R90, R92, which normally takes 200 milliseconds. While IC34's output is high, the OVERLOAD lamp is illuminated through R102 and Q7, connected as a zener diode. Thus very fast overloads are "timestretched" and can be easily seen.

Under continuous overload conditions, it is normal for the overload LED to flash on and off.

12. Power Supply

Unregulated voltage for the analog circuitry is supplied by two pairs of **full-wave diode rectifiers**. The nominal unregulated voltage is ±22 volts DC at rated line voltage. This will vary widely with line voltage variations. Regulator dropout will occur if the unregulated voltage falls below about ±17.8 volts.

Unregulated voltage for the digital circuitry is supplied by two pairs of **full-wave diode rectifiers**. The nominal unregulated voltage is ±10 volts DC at rated line voltage. This will vary widely with line voltage variations. Regulator dropout will occur if the unregulated voltage falls below about ±7 volts.

This unregulated voltage is also used to power the front panel LEDs and displays.

Unregulated voltage for the phantom power is supplied by a **full-wave diode rectifier**. The nominal unregulated voltage is +70 volts DC at rated line voltage. This will vary widely with line voltage variations and load to the +48 volt source

Regulator dropout will occur if the unregulated voltage falls below about +55 volts.

Regulated voltages for the +15 volts and +5 volts are supplied by a pair of 500mA "three-terminal" IC regulators.

The +48 volt phantom power is supplied by a discreet voltage regulator.

Component-level description:

The two pairs of **full-wave diode rectifiers** that supply unregulated voltage are located in package BR1, BR2, and BR3. The rectifier pairs drive energy storage capacitors C9 C6, C7, and C8. The power transformer T1 can be strapped for either 115-volt or 230-volt operation (the two sections of the primary are paralleled for 115-volt operation and connected in series for 230-volt operation).

Four of the ICs which supply regulated voltages are "three-terminal" IC regulators IC1, IC2, IC3, IC17. These regulators are frequency-compensated by C12, C14, C15, C18 at their outputs to prevent high-frequency oscillations. Small 0.1mF/25V ceramic capacitors bypass the power busses to ground locally throughout the board to prevent signal-carrying ICs from oscillating due to excessive power-lead inductance.

(If replaced, C12, C14, C18, and C15 *must* be replaced by low-inductance aluminum electrolytic capacitors *only* — see "Power supply problems" on 5-3.)

The +48 volt phantom power is regulated by Darlington pass transistor Q1. The base of Q1 is referenced by a 51 volt zener diode CR13 which is biased by R32. The emitter of Q1 has a 1.2 volt forward drop across it when a load is applied. Current limiting protection is provided by Q2 and R33. When the output current sourced by Q1 causes a .6 volt drop across R33, Q2 will turn on and shut Q1 off by shunting its base to emitter voltage.

13. Microphone Pre-amp

The microphone pre-amp is a transformer/IC opamp hybrid. The transformer provides 20dB of gain and the opamp provides 16dB. A jumper selectable pad is provided to attenuate the input signal 20dB. +48 volt phantom power is also jumper selectable.

Component-level description:

The microphone pre-amp input signal is applied to input transformer T1.

T1's secondary winding is loaded by R6. R7 raises the DC impedance IC1 sees at its input to an appropriate level to avoid excessive open loop gain.

C2 and C3 provide RFI suppression. C14 compensates IC1's open loop gain for stability. R9, R10, and C4 set the gain and frequency response of IC1. R8 decouples IC1's output (pin 6) and C9, C10, and C11 are DC blocking capacitors. C11 bypasses C9, C10 to ensure highest audio quality.

The +48 volt phantom power is filtered by R1, C1, and C12. R2a and R2b are matched to increase the common mode rejection.

Parts List

Parts are listed by ASSEMBLY, then by TYPE, then by REFERENCE DESIGNATOR. Widely used common parts are not listed; such parts are described generally below (examine the part to determine exact value). See the following assembly drawings for locations of components.

SIGNAL DIODES, if not listed by reference designator in the following parts list, are:

Orban part number 22101-000, Fairchild (FSC) part number 1N4148, also available from many other vendors. This is a silicon, small-signal diode with ultra-fast recovery and high conductance. It may be replaced with 1N914 (BAY-61 in Europe).

(BV: 75V min. @ I_r = 5μA I_r: 25nA max. @ V_r = 20V V_f: 1.0V max. @ I_f = 100mA t_{rr}: 4ns max.) See Miscellaneous list for **ZENER DIODES** (reference designator VRxx).

RESISTORS should only be replaced with the same style and with the *exact* value marked on the resistor body. If the value marking is not legible, consult the schematic or the factory. Performance and stability will be compromised if you do not use exact replacements. Unless listed by reference designator in the following parts list, resistors are:

Metal film resistors which have conformally-coated bodies, and are identified by five color bands or a printed value. They are rated at 1/8 watt @ 70°C, ±1%, with a temperature coefficient of 100 PPM/°C. Orban part numbers 20038-xxx through 20045-xxx, USA Military Specification MIL-R-10509 Style RN55D. Manufactured by R-Ohm (CRB-1/4FX), TRW/IRC, Beyschlag, Dale, Corning, and Matsushita.

Carbon film resistors which have conformally-coated bodies, and are identified by four color bands. They are rated at 1/4 watt @ 70°C, ±5%. Orban part numbers 20001-xxx, Manufactured by R-Ohm (R-25), Piher, Beyschlag, Dale, Phillips, Spectrol, and Matsushita.

Carbon composition resistors which have molded phenolic bodies, and are identified by four color bands. The 0.090 × 0.250 inch (2.3 × 6.4 mm) size is rated at 1/4 watt, and the 0.140 × 0.375 inch (3.6 × 9.5 mm) size is rated at 1/2 watt, both ±5% @ 70° C. Orban part numbers 2001x-xxx, USA Military Specification MIL-R-11 Style RC-07 (1/4 watt) or RC-20 (1/2 watt). Manufactured by Allen-Bradley, TRW/IRC, and Matsushita.

Cermet trimmer resistors which have 3/8-inch (9 mm) square bodies, and are identified by printing on their sides. They are rated at 1/2 watt @ 70°C, ±10%, with a temperature coefficient of 100 PPM/°C. Orban part numbers 20510-xxx and 20511-xxx. Manufactured by Beckman (72P, 68W- series), Spectrol, and Matsushita.

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 local offices. Their USA headquarters addresses are given on page 6-39.

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
MAIN UNIT FINAL ASSEMBLY						
Miscellaneous						
B1	Coin Cell, Lithium; 3V	28041-000	DUR	DL2032	GE	
F1	Fuse, 3AG, Slo-Blo, 1/2A	28004-150	LFE	313.500	BUS	
NONE	Transformer, Power; 39VCT, 10VCT, 23VA	55012-000	ORB			
NONE	Filter, Line, 3 Amp	28015-000	COR	3EF1	MANY	
NONE	Line Cord, CEE	28102-002	BEL	17500	MANY	
NONE	Sub Assy, 10 Position Barrier Strip	40064-000	ORB			
NONE	Sub Assy, 10 Position Barrier Strip	40067-000	ORB			
NONE	Sub Assy, Heatsink Regulator	40068-001	ORB			
NONE	Sub Assy, XLR Connector, Input	40065-000	ORB			
NONE	Sub Assy, XLR Connector, Output	40066-000	ORB			
Switches						
NONE	Switch, Slide, Mains voltage selector	26140-000	SW	EPSI-SLI		
PCB ANALOG ASSEMBLY [AG]						
Capacitors						
C1,2	Mica, 500V, +1/2pF -1/2pF; 22pF	21017-022	CD	CD15-CD220D03	SAN	
C3	Met. Polyester, 100V, 10%; 1.0uF	21441-510	WIM	MKS-4100V5.1.0	WES,SIE	
C4-7	Alum., Radial, 50V, -20% +100%; 47uF	21208-647	SPR	502D 476G050CD1C	PAN	
C8	Mica, 500V, 5%; 100pF	21020-110	CD	CD15-FD101J03	SAN	
C9	Mica, 500V, +1/2pF -1/2pF; 10pF	21017-010	CD	CD15-CD100D03	SAN	
C10,11	Mica, 500V, 5%; 150pF	21020-115	CD	CD15-FD151J03	SAN	
C12	Mica, 500V, +1/2pF -1/2pF; 5pF	21017-005	CD	CD15-CD050D03	SAN	
C13	Alum., Radial, 63V, -20% +100%; 4.7uF	21209-547	SPR	502D 475G063BB1C	PAN	
C14	Tantalum, 35V, 10%; 0.22uF	21307-422	SPR	196D 224X9035HA1	MANY	
C15	Mica, 500V, +1/2pF -1/2pF; 47pF	21017-047	CD	CD15-CD470D03	SAN	
C16	Not used	---				
C17,18	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C19	Met. Polyester, 100V, 10%; 0.047uF	21441-347	WES	160C 473K250	SIE	
C20,21	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C22,23	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C24,25	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C26,27	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C28,29	Ceramic Disc, 50V, +80% -20%; 0.005uF	21108-250	CRL	CK-502		
C30	Ceramic Disc, 25V, 20%; 0.15uF	21106-415	CRL	UK25-154	MUR	
C31,32	Met. Polyester, 100V, 10%; 0.047uF	21441-347	WES	160C 473K250	SIE	
C33	Met. Polyester, 100V, 10%; 0.01uF	21441-310	WES	160C 103K630	SIE,WIM	

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
Main Unit Final Assy, PCB Analog Assy: Capacitors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS(1)	NOTES
C34	Met. Polyester, 100V, 10%; 0.047uF	21441-347	WES	160C 473K250	SIE	
C35,36	Met. Polyester, 100V, 10%; 0.01uF	21441-310	WES	160C 103K630	SIE,WIM	
C37	Mica, 500V, 5%; 1000pF	21024-210	CD	CD19-FD102J03	SAN	
C38	Met. Polyester, 100V, 10%; 0.047uF	21441-347	WES	160C 473K250	SIE	
C39-64	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C65	Met. Polyester, 100V, 10%; 1.0uF	21441-510	WIM	MKS-4100V5,1.0	WES,SIE	
C66,67	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
	Diodes					
CR5	Not used	---				
CR15	Not used	---				
CR22	Diode, Zener, 1W; 9.1V	22003-091	MOT	1N4739	MANY	
	Integrated Circuits					
IC1	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC2	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
IC3	Not used	---				
IC4	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC5	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC6	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC7	Linear, Single Opamp	24014-202	SIG	NE5534N	TI	
IC8	Linear, Dual Opamp	24208-302	RCA	CA3280A		
IC9	Linear, Single Opamp	24017-202	NAT	LF411CN		
IC10	Not used	---				
IC11	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
IC12	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC13	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC14	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC15	Quad Comparator	24710-302	NAT	LM339		
IC16	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC17	Multiple Discrete, TR. Array	24406-302	RCA	CA3096AE		
IC18	Linear, Dual Opamp	24206-202	TI	TL072CP	MOT	
IC19	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC20	Multiple Discrete, TR. Array	24406-302	RCA	CA3096AE		
IC21	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC22-25	Digital, 3 To 8 Line Decoder	24556-302	NAT	MM74HCT138N	TI	
IC26	Digital, Flip-Flop	24561-302	NAT	MM74HCT374N		
IC27	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC28-30	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC31	Quad Comparator	24710-302	NAT	LM339		
IC32,33	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC34	Linear, Single Opamp	24002-202	TI	UA741CN	RAY	
IC35	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC36	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC37	Linear, Dual Opamp	24203-202	MOT	MC1458CP1	TI,RCA	
IC38	Quad Comparator	24710-302	NAT	LM339		

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR

PCB Analog Assy: Capacitors, Diodes, ICs

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Modules						
A1	Module Assy, Compressor	31125-000-xx*	ORB			*Add suffix printed on part
A2	Module Assy, De-esser	31130-000-xx*	ORB			*Add suffix printed on part
A3	Module Assy, Output	31160-001-xx*	ORB			*Add suffix printed on part
Resistors						
R153a,b	Resistor Set, MF; 20.5K	28521-008	ORB			3
R45	Pot, Single, 10%; 50K (5020)	20721-000	ORB			20% CW Log
Transistors						
Q1	Transistor, JFET/P	23407-101	NAT	J174	SIL	
Q2	Transistor, Signal, PNP	23001-101	MOT	2N4125	FSC	
Q3,4	Transistor, JFET/N	23406-101	NAT	J113	SIL	
Q5-8	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
PCB DIGITAL & PWR SUPPLY ASSY [DG]						
Capacitors						
C1	Mica, 500V, +1/2pF -1/2pF; 30pF	21017-030	CD	CD15-CD300D03	SAN	
C2	Mica, 500V, 5%; 100pF	21020-110	CD	CD15-FD101J03	SAN	
C3-5	Alum., Radial, 63V, -20% +100%; 1uF	21209-510	SPR	502D 105G063BBIC	PAN	
C6-8	Alum., Axial, 40V, -10% +100%; 1000uF	21224-810	SIE	B41010-1000-40	PAN	
C9	Alum., Axial, 100V, -20% +20%; 100uF	21226-710	ME	3074HH101T100JPB	PAN	
C10	Not used	---				
C11	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C12	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C13	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C14,15	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C16,17	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C18	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C19	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C20	Alum., Radial, 63V, -20% +100%; 33uF	21209-633	SPR	502D 336G063CC1C	PAN	
C21	Met. Polyester, 100V, 10%; 0.01uF	21441-310	WES	160C 103K630	SIE,WIM	
C22	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5,0.1	WES,SIE	
C23	Met. Polyester, 100V, 10%; 0.01uF	21441-310	WES	160C 103K630	SIE,WIM	
C24-33	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Diodes						
BR1-3	Diode, Bridge, 200V, 1A	22301-000	VARO	VE-27	GI	
CR1	Diode, Voltage Reference	22081-112	NAT	LM385	MOT	
CR11,12	Diode, Signal, Hot Carrier	22102-001	HP	HP5082-2800	MANY	
CR13	Diode, Zener, 1W; 51V	22004-510	MOT	1N4757A	MANY	
CR14	Diode, Rectifier, 400V, 1A	22201-400	MOT	1N4004	MANY	

FOOTNOTES:
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(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB Analog Assy: Modules, Resistors, Transistors; PCB Digital & Pwr Supply Assy: Capacitors, Diodes

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Integrated Circuits						
IC1	Digital, NAND Gate	24557-302	RCA	CD54/74HCT32		
IC2	Digital, Hex Inverter	24551-302	NAT	74HCT04N	TI	
IC3	Digital, Dual Flip-Flop	24552-302	NAT	MM74HCT74N	TI	
IC4	Digital, CPU, Z80	24804-302	TOS	TMPZ84C00AP		
IC5,6	Digital, 3 To 8 Line Decoder	24556-302	NAT	MM74HCT138N	TI	
IC7	Digital, RAM	24806-302	TOS	TC5564PL-20		
IC8	Digital, Quad 2-Input NAND	24559-302	RCA	74HCT132E	TI	
IC9	Digital, AND Gate	24560-302	NAT	74HCT08		
IC10	Digital,PROM	44002-000	ORB			
IC11	Digital, Transceiver	24558-302	NAT	MM74HCT245N	RCA	
IC12	Digital, Flip-Flop	24561-302	NAT	MM74HCT374N		
IC13	Quad Comparator	24710-302	NAT	LM339		
IC14	Digital, Flip-Flop	24561-302	NAT	MM74HCT374N		
IC15	Digital, Buffer	24554-302	NAT	MM74HCT244N	TI	
IC16	Digital, Flip-Flop	24561-302	NAT	MM74HCT374N		
IC17	D.C. Regulator, 5V Positive	24307-901	NAT	LM78M05C	TI,MOT	
Miscellaneous						
NONE	Battery Holder, Coin Cell	28031-000	KEY	106		
P2	Cable Assy, Flat, 40 Pin, 5 inches	42008-050	ORB			
Y1	Crystal; 8 MHz	28051-001	MID	C2150		
Resistors						
R4-7	Resistor Network, SIP; 100K	20221-101	BEK	L10-1C104		
R21	Resistor Network, SIP; 100K	20221-101	BEK	L10-1C104		
R34	Resistor Network, SIP; 100K	20221-101	BEK	L10-1C104		
Switches						
S1	Switch, MOM., Gray; SPST	26301-005	SCH	D6-02-05		
Transistors						
Q1	Transistor, Power, NPN; TO-220	23604-201	TI	TIP122	RCA	
Q2,3	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	

FOOTNOTES:
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(2) No Alternate Vendors known at publication
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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR

PCB Digital & Pwr Supply Assy: ICs, Misc., Resistors, Switches, Transistors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS(1)	NOTES
PCB DISPLAY ASSEMBLY [DP]						
Capacitors						
C1	Alum., Radial, 63V, -20% +100%; 2.2uF	21209-522	SPR	502D 225G063BB1C	PAN	
C2-6	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C7-12	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C13	Alum., Radial, 63V, -20% +100%; 2.2uF	21209-522	SPR	502D 225G063BB1C	PAN	
C14	Alum., Radial, 63V, -20% +100%; 1uF	21209-510	SPR	502D 105G063BB1C	PAN	
C15	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Integrated Circuits						
IC1	Digital, Display Driver	24713-302	NAT	LM3916		
IC2	Digital, Display Driver	24712-302	NAT	LM3914		
IC3	Digital, Flip-Flop	24561-302	NAT	MM74HCT374N		
IC4	Digital, LED Driver	24410-302	MOT	ULN2803		
IC5	Digital, Flip-Flop	24561-302	NAT	MM74HCT374N		
IC6	Digital, LED Driver	24410-302	MOT	ULN2803		
LEDs						
D1-3	LED Display, 0-9, Red	25402-000	HP	5082-7613	GI	
D4	LED Display, +/- 1	25401-000	HP	5082-7616		
DS1	LED, Red	25106-003	HP	HLMP-1300	GI	
DS2	LED, Green	25106-002	HP	HLMP-1503	GI	
DS3-8	LED, Red	25106-003	HP	HLMP-1300	GI	
DS9	LED Array, 6-Green, 3-Yellow, 1-Red	25151-000	ORB			
DS10	Not used	---				
DS11,12	LED, Red	25106-003	HP	HLMP-1300	GI	
DS13	LED, Green	25106-002	HP	HLMP-1503	GI	
DS14-19	LED, Red	25106-003	HP	HLMP-1300	GI	
DS20	LED Array, 9-Yellow, 1-Red	25152-000	ORB			
Miscellaneous						
P1	Cable Assy, Flat, 40 Pin, 6 inches	42008-060	ORB			
Switches						
S1	Switch, MOM.; SPST	26302-001	SCH	D6-01-01		
S2-5	Switch, MOM., With Red LED; SPDT	26323-011	SCH	SEAUo.A.0102R		
S6	Switch, MOM.; SPDT	26322-010	SCH	SEAUo.A.0101		
S7-17	Switch, MOM., With Red LED; SPDT	26323-011	SCH	SEAUo.A.0102R		
S18	Switch, MOM.; SPDT	26322-010	SCH	SEAUo.A.0101		

FOOTNOTES:
(1) See last page for abbreviations
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(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB Display Assy: Capacitors, ICs
LEDs Misc., Switches

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Transistors						
Q1	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
Q2	Transistor, Signal, PNP	23002-101	MOT	2N4402	FSC	
Q3	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
Q4-11	Transistor, Signal, PNP	23002-101	MOT	2N4402	FSC	
Q12,13	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
PCB EQUALIZER ASSEMBLY [EQ]						
Capacitors						
C1	Met. Polyester, 100V, 10%; 1.0uF	21441-510	WIM	MKS-4100V5,1.0	WES,SIE	
C2	Polypropylene, 50V, 1%; 0.01uF	21701-310	NOB	CQ15P1H103FPP	WES	
C3	Mica, 500V, 1%; 1000pF	21022-210	CD	CD19-FD102F03	SAN	
C4	Polypropylene, 50V, 1%; 0.01uF	21701-310	NOB	CQ15P1H103FPP	WES	
C5	Mica, 500V, 1%; 1000pF	21022-210	CD	CD19-FD102F03	SAN	
C6	Alum., Radial, 50V, -20% +100%; 47uF	21208-647	SPR	502D 476G050CD1C	PAN	
C7	Polypropylene, Trimmer; 2-10pF	21802-000	ME	2807C00210MJ02F		
C8	Alum., Radial, 50V, -20% +100%; 47uF	21208-647	SPR	502D 476G050CD1C	PAN	
C9,10	Mica, 500V, 1%; 1000pF	21022-210	CD	CD19-FD102F03	SAN	
C11	Mica, 500V, +1/2pF -1/2pF; 22pF	21017-022	CD	CD15-CD220D03	SAN	
C12	Polypropylene, Trimmer; 2-10pF	21802-000	ME	2807C00210MJ02F		
C13	Mica, 500V, +1/2pF -1/2pF; 22pF	21017-022	CD	CD15-CD220D03	SAN	
C14-17	Mica, 500V, 1%; 1000pF	21022-210	CD	CD19-FD102F03	SAN	
C18	Mica, 500V, +1/2pF -1/2pF; 22pF	21017-022	CD	CD15-CD220D03	SAN	
C19-21	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C22-24	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C25,26	Mica, 500V, 1%; 1000pF	21022-210	CD	CD19-FD102F03	SAN	
C27-38	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Integrated Circuits						
IC1	See selected components	---				
IC2	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC3-5	See selected components	---				
IC6	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC7-9	See selected components	---				
IC10	Digital, Multiplying DAC	24714-302	AD	AD7524JN		
IC11,12	See selected components	---				
IC13,14	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
IC15	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC16,17	Linear, Dual Opamp	24207-202	SIG	NE5532N	TI,EXR	
IC18,19	Linear, Dual Opamp	24211-202	MOT	MC34082P		
IC20	Linear, Dual Opamp	24209-202	NAT	LF412CN		
IC21	Linear, Dual Opamp	24211-202	MOT	MC34082P		

FOOTNOTES:
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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB Display Assy: Transistors; PCB Equalizer Assy: Capacitors, ICs

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
PCB REMOTE INTERFACE ASSEMBLY [RI]						
Capacitors						
C1,2	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C3	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C4	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C5	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C6	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C7,8	Ceramic Disc, 25V, 20%; 0.01uF	21106-310	CRL	UK25-103	MUR, SPR	
C9,10	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
C11-13	Ceramic Disc, 25V, 20%; 0.01uF	21106-310	CRL	UK25-103	MUR, SPR	
C14,15	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
C16	Ceramic Disc, 25V, 20%; 0.01uF	21106-310	CRL	UK25-103	MUR, SPR	
Diodes						
CR1	Diode, Rectifier, 400V, 1A	22201-400	MOT	1N4004	MANY	
Integrated Circuits						
IC1	Digital, NAND Gate	24557-302	RCA	CD54/74HCT32		
IC2	Digital, Quad 2-Input NAND	24559-302	RCA	74HCT132E	TI	
IC3	Digital, Dual Flip-Flop	24552-302	NAT	MM74HCT74N	TI	
IC4	Digital, Buffer	24554-302	NAT	MM74HCT244N	TI	
IC5	Digital, Hex Inverter	24601-302	TI	SN7406		
IC6	D.C. Regulator, 15V Positive	24304-901	NAT	LM78M15UC	TI,MOT	
Miscellaneous						
NONE	Cable Assy, Flat, 26 Pin, 8 inches	42007-080	ORB			
PCB RS-232 ASSEMBLY [RS]						
Capacitors						
C1	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C2	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C3,4	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C5	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C6	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C7	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C8	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C9	Mica, 500V, 5%; 100pF	21020-110	CD	CD15-FD101J03	SAN	
C10	Mica, 500V, +1/2pF -1/2pF; 33pF	21017-033	CD	CD15-CD330D03	SAN	
C11-14	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	

FOOTNOTES:
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(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB Remote Interface Assy; PCB RS-232 Assy: Capacitors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
Miscellaneous						
P2	Cable Assy, Flat, 26 Pin, 6 inches	42007-060	ORB			Main unit only
P2	Cable Assy, Flat, 26 Pin, 3 inches	42007-030	ORB			Slave unit only
Resistors						
R1	Resistor Network, 8 POS.; 20K	20201-501	BEK	698-3-R20KD		
R2	See selected components	---				
R5,6	See selected components	---				
R8	Resistor Network, 8 POS.; 20K	20201-501	BEK	698-3-R20KD		
R9	See selected components	---				
R12,13	See selected components	---				
R15	Resistor Network, 8 POS.; 20K	20201-501	BEK	698-3-R20KD		
R16	See selected components	---				
R19,20	See selected components	---				
Selected Components						
IC1/R2	Matched Set, IC/Resistor	40075-000	ORB			3
IC3/R6	Matched Set, IC/Resistor	40075-000	ORB			3
IC4/R5	Matched Set, IC/Resistor	40075-000	ORB			3
IC5/R9	Matched Set, IC/Resistor	40075-000	ORB			3
IC7/R13	Matched Set, IC/Resistor	40075-000	ORB			3
IC8/R12	Matched Set, IC/Resistor	40075-000	ORB			3
IC9/R16	Matched Set, IC/Resistor	40075-000	ORB			3
IC11/R20	Matched Set, IC/Resistor	40075-000	ORB			3
IC12/R19	Matched Set, IC/Resistor	40075-000	ORB			3
PCB MIC OPTION ASSEMBLY [MC]						
Capacitors						
C1	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C2,3	Mica, 500V, +1/2pF -1/2pF; 33pF	21017-033	CD	CD15-CD330D03	SAN	
C4	Mica, 500V, 1%; 160pF	21018-116	CD	CD15-FD161F03	SAN	
C5	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C6	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C7	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C8	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C9,10	Alum., Radial, 50V, -20% +100%; 47uF	21208-647	SPR	502D 476G050CD1C	PAN	
C11	Met. Polyester, 100V, 10%; 1.0uF	21441-510	WIM	MKS-4100V5.1.0	WES,SIE	
C12	Alum., Radial, 63V, -20% +100%; 22uF	21209-622	SPR	502D 226G063CC1C	PAN	
C13	Not used	---				
C14	Mica, 500V, +1/2pF -1/2pF; 22pF	21017-022	CD	CD15-CD220D03	SAN	

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR

PCB RS-232 Assy: Misc., Resistors, Selected Components; PCB Mic Option Assy: Capacitors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
	Integrated Circuits					
IC1	Linear, Single Opamp	24014-202	SIG	NE5534N	TI	
	Miscellaneous					
T1	Transformer	29108-000	JEN	JE-115K-E		
	Resistors					
R2a,b	Resistor Set, MF; 6.81K	28521-023	ORB			3
PCB MIDI OPTION ASSEMBLY [MD]						
	Capacitors					
C1	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C2,3	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
	Diodes					
CR1	Diode, Rectifier, 400V, 1A	22201-400	MOT	1N4004	MANY	
	Integrated Circuits					
IC1	Digital, Microprocessor, Z80, SIO/0	24803-302	TOS	TMPZ84C40P		
IC2	Digital, NAND Gate	24557-302	RCA	CD54/74HCT32		
IC3	Digital, Hex Inverter	24551-302	NAT	74HCT04N	TI	
IC4	Digital, Hex Inverter	24601-302	TI	SN7406		
IC5	Optocoupler	25005-302	HP	6N138	GI	
IC6	Digital, Microprocessor, Z80	24807-302	TOS	TMPZ84C30P		
IC7	Digital, Dual Flip-Flop	24552-302	NAT	MM74HCT74N	TI	
	Miscellaneous					
P1	Cable Assy, Flat, 26 Pin, 8 inches	42007-080	ORB			
PCB R/C DISPLAY ASSEMBLY [DB]						
	LEDs					
D1,2	LED Display, 0-9, Red	25402-000	HP	5082-7613	GI	

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB Mic Option Assy: ICs, Misc., Resistors; PCB MIDI Option Assy; PCB R/C Display Assy

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
PCB R/C MAIN ASSEMBLY [MB]						
Capacitors						
C1,2	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
C3-7	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C8,9	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
C10	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C11	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
Diodes						
CR1-6	Diode, Rectifier, 400V, 1A	22201-400	MOT	1N4004	MANY	
Integrated Circuits						
IC1	Digital, Up-Counter	24508-302	RCA	CD4520BE		
IC2,3	Digital, Dual Flip-Flop	24502-302	RCA	CD4013BE		
IC4	Digital, Driver	24563-302	NAT	CD4511BC	RCA	
IC5	Digital, Up-Counter	24508-302	RCA	CD4520BE		
IC6	Digital, Quad 2-Input NAND	24509-302	RCA	CD4093BE		
IC7	Digital, Hex Inverter	24505-302	RCA	CD4069UBE	SIG	
IC8	Digital, 1-in-4 Decoder	24506-302	RCA	CD4555BE	SIG	
IC9	Digital, 8 Channel Analog Multiplexer	24530-302	NAT	CD4051BC	RCA	
IC10,11	Digital, Driver	24563-302	NAT	CD4511BC	RCA	
IC12	Digital, Dual Flip-Flop	24502-302	RCA	CD4013BE		
IC13	Digital, Encoder	24529-302	NAT	CD4532BCN	RCA	
IC14	Digital, Quad 2-Input NAND	24509-302	RCA	CD4093BE		
IC15	Digital, Dual Flip-Flop	24502-302	RCA	CD4013BE		
Transistors						
Q1	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	
PCB R/C SWITCH ASSEMBLY [SB]						
Capacitors						
C1-4	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
Switches						
S1-3	Switch, MOM., With Red LED; SPDT	26323-011	SCH	SEAUo.A.0102R		
S4	Switch, MOM.; SPDT	26322-010	SCH	SEAUo.A.0101		

FOOTNOTES:
(1) See last page for abbreviations
(2) No Alternate Vendors known at publication
(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB R/C Main Assy; PCB R/C Switch Assy

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
PCB REMOTE INTERFACE ASSEMBLY [R1]						
Capacitors						
C1,2	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C3	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C4	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C5	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C6	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C7,8	Ceramic Disc, 25V, 20%; 0.01uF	21106-310	CRL	UK25-103	MUR, SPR	
C9,10	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
C11-13	Ceramic Disc, 25V, 20%; 0.01uF	21106-310	CRL	UK25-103	MUR, SPR	
C14,15	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	
C16	Ceramic Disc, 25V, 20%; 0.01uF	21106-310	CRL	UK25-103	MUR, SPR	
Diodes						
CR1	Diode, Rectifier, 400V, 1A	22201-400	MOT	1N4004	MANY	
Integrated Circuits						
IC1	Digital, NAND Gate	24557-302	RCA	CD54/74HCT32		
IC2	Digital, Quad 2-Input NAND	24559-302	RCA	74HCT132E	TI	
IC3	Digital, Dual Flip-Flop	24552-302	NAT	MM74HCT74N	TI	
IC4	Digital, Buffer	24554-302	NAT	MM74HCT244N	TI	
IC5	Digital, Hex Inverter	24601-302	TI	SN7406		
IC6	D.C. Regulator, 15V Positive	24304-901	NAT	LM78M15UC	TI,MOT	
Miscellaneous						
NONE	Cable Assy, Flat, 26 Pin, 8 inches	42007-080	ORB			
PCB RS-232 ASSEMBLY [R5]						
Capacitors						
C1	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C2	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C3,4	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C5	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C6	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C7	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C8	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C9	Mica, 500V, 5%; 100pF	21020-110	CD	CD15-FD101J03	SAN	
C10	Mica, 500V, +1/2pF -1/2pF; 33pF	21017-033	CD	CD15-CD330D03	SAN	
C11-14	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	

FOOTNOTES:
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(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB Remote Interface Assy;
PCB RS-232 Assy: Capacitors

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
	Integrated Circuits					
IC1	Digital, Hex Inverter	24551-302	NAT	74HCT04N	TI	
IC2	Digital, Dual Flip-Flop	24552-302	NAT	MM74HCT74N	TI	
IC3	Digital, Quad Line Receiver	24662-302	NAT	DS14C89A		
IC4	Digital, Quad Line Driver	24661-302	NAT	DS14C88N		
IC5	Digital, NAND Gate	24557-302	RCA	CD54/74HCT32		
IC6	Digital, Microprocessor, Z80	24807-302	TOS	TMPZ84C30P		
IC7	Digital, Microprocessor, Z80, SIO/0	24803-302	TOS	TMPZ84C40P		
IC8	D.C. Regulator, 12V Negative	24310-901	NAT	LM79M12C	TI,MOT	
IC9	D.C. Regulator, 12V Positive	24309-901	NAT	LM78M12C	TI,MOT	
	Miscellaneous					
NONE	Cable Assy, Flat, 26 Pin, 8 inches	42007-080	ORB			
Y1	Crystal; 6.144MHz	28051-002	MID	C1950		
	PCB SLAVE DISPLAY ASSEMBLY [SD]					
	Capacitors					
C1,2	Alum., Radial, 63V, -20% +100%; 2.2uF	21209-522	SPR	502D 225G063BB1C	PAN	
	Integrated Circuits					
IC1	Digital, Display Driver	24713-302	NAT	LM3916		
IC2	Digital, Display Driver	24712-302	NAT	LM3914		
	LEDs					
DS1	LED, Red	25106-003	HP	HLMP-1300	GI	
DS2,3	LED, Green	25106-002	HP	HLMP-1503	GI	
DS4	LED Array, 9-Yellow, 1-Red	25152-000	ORB			
DS5	LED Array, 6-Green, 3-Yellow, 1-Red	25151-000	ORB			
	Transistors					
Q1,2	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	

FOOTNOTES:
(1) See last page for abbreviations
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(3) Actual part is specially selected from part listed, consult Factory
(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB RS-232 Assy: ICs, Misc.; PCB Slave Display Assy

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
PCB SLAVE INTERCONNECT ASSY [SI]						
Capacitors						
C1	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C2	Alum., Axial, 40V, -10% +100%; 1000uF	21224-810	SIE	B41010-1000-40	PAN	
C3	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C4	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C5	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C6	Alum., Axial, 40V, -10% +100%; 1000uF	21224-810	SIE	B41010-1000-40	PAN	
C7	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C8	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C9	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C10	Alum., Axial, 40V, -10% +100%; 1000uF	21224-810	SIE	B41010-1000-40	PAN	
C11	Monolythic Ceramic, 50V, 20%; 0.1uF	21123-410	SPR	1C25 Z5U104M050B	KEM	
C12	Alum., Radial, 25V, -20% +100%; 100uF	21206-710	PAN	ECE-A1EV101S		
C13	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C14	Alum., Axial, 100V, -20% +20%; 100uF	21226-710	ME	3074HH101T100JPB	PAN	
C15	Met. Polyester, 100V, 10%; 0.1uF	21441-410	WIM	MKS-4100V5.0.1	WES,SIE	
C16	Alum., Radial, 63V, -20% +100%; 33uF	21209-633	SPR	502D 336G063CC1C	PAN	
C17,18	Met. Polyester, 100V, 10%; 0.01uF	21441-310	WES	160C 103K630	SIE,WIM	
Diodes						
CR1	Diode, Rectifier, 400V, 1A	22201-400	MOT	1N4004	MANY	
CR2	Diode, Zener, 1W; 51V	22004-510	MOT	1N4757A	MANY	
Integrated Circuits						
IC3	D.C. Regulator, 5V Positive	24307-901	NAT	LM78M05C	TI,MOT	
Miscellaneous						
P2	Cable Assy, Flat, 40 Pin, 2 inches	42008-020	ORB			
P4	Cable Assy, Flat, 16 Pin, 6.5 inches	40056-065	ORB			
Switches						
SW1	Switch, Single, Push-Push; 4PDT	26116-000	SCH	F014UEEB01BAG		
Transistors						
Q1	Transistor, Power, NPN; TO-220	23604-201	TI	TIP122	RCA	
Q2	Transistor, Signal, NPN	23202-101	MOT	2N4400	FSC	

FOOTNOTES:
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SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
PCB Slave Interconnect Assy

REF DES	DESCRIPTION	ORBAN P/N	VEN (1)	VENDOR P/N	ALTERNATE VENDORS (1)	NOTES
REMOTE CONTROL FINAL ASSEMBLY						
LEDs						
DS1,2	LED, Red	25103-000	GI	MV-5053		
Miscellaneous						
NONE	Cable Assy, Flat, 14 Pin, 2.5 inches	42006-025	ORB			
NONE	Cable Assy, Flat, 16 Pin, 2.5 inches	42009-025	ORB			
SLAVE UNIT FINAL ASSEMBLY						
Miscellaneous						
NONE	Cable Assy, Flat, 37 Pin, "D" Conn.	42011-000	ORB			Main unit to slave unit
NONE	Cable Assy, Flat, 37 Pin, 8 inches	42010-080	ORB			Internal main unit
NONE	Cable Assy, Flat, 37 Pin, 3.5 inches	42010-035	ORB			
NONE	Sub Assy, 10 Position Barrier Strip	40064-000	ORB			
NONE	Sub Assy, XLR Connector, Output	40066-000	ORB			
NONE	Sub Assy, Heatsink Regulator	40068-002	ORB			
NONE	Sub Assy, XLR Connector, Input	40065-000	ORB			
SUB ASSY, 10 POSITION BARRIER STRIP						
Capacitors						
C1-7	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	TB1
NONE	Ceramic Disc, 1KV, 10%; 0.001uF	21112-210	CRL	DD-102	MUR	TB2
SUB ASSY, HEATSINK REGULATOR						
Integrated Circuits						
IC1	D.C. Regulator, 15V Positive	24304-901	NAT	LM78M15UC	TI,MOT	
IC2	D.C. Regulator, 15V Negative	24303-901	NAT	LM79M15AUC	TI,MOT	
IC3	D.C. Regulator, 5V Positive	24307-901	NAT	LM78M05C	TI,MOT	Main unit only

FOOTNOTES:
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(4) Realignment may be required if replaced, see Circuit Description and/or Alignment Instructions

SPECIFICATIONS AND SOURCES FOR REPLACEMENT PARTS

787A MIC PROCESSOR
Remote Ctrl Final Assy; Slave Final Assy; Sub Assy, 10 Position Barrier Strip; Sub Assy, Heatsink Regulator

AB Allen-Bradley Co., Inc.
1201-T South Second Street
Milwaukee, WI 53204

AD Analog Devices, Inc.
One Technology Way
PO Box 9106
Norwood, MA 02062-9106

AKG AKG Acoustics, Inc.
1525 Alvarado Street
San Leandro, CA 94577

AM Amphenol Corporation
358 Hall Avenue
Wallingford, CT 06492

BEK Beckman Industrial Corporation
4141 Palm Street
Fullerton, CA 92635-1025

BEL Belden Electronic Wire & Cable
PO Box 1980
Richmond, IN 47374

BRN Bourns, Inc
Resistive Components Group
1200 Columbia Avenue
Riverside, CA 92507

BUS Bussmann Division
Cooper Industries
PO Box 14460
St. Louis, MO 63178

CD Cornell-Dubilier Elec.
1700 Rte. 23 North
Wayne, NJ 07470

CLIF Cliff Electronics Company, Inc.
4876 East Second Street
Benicia, CA 94510

CRL Mepcopal/Centralab
See Mepcopal

CSC Crystal Semiconductor Corporation
4210-T. South Industrial Dr.
Austin, TX 78744

CTS CTS Corporation
907 North West Blvd.
Elkhart, IN 46514

CW CW Industries
130 James Way
Southampton, PA 18966

DBX dbx
A division of AKG Acoustics, Inc.
1525 Alvarado Street
San Leandro, CA 94577

DEL Delta Products Corp
361 Fairview Way
Milpitas, CA 95035

DUR Duracell, Inc.
Berkshire Industrial Park
Bethel, CT 06801

ELSW Electro Switch
77 King Avenue
Weymouth, MA 02188

EMI Emico Inc.
123 Main Street
Dublin, PA 18917

EXR Exar Corporation
2222 Qume Dr.
PO Box 49007
San Jose, CA 95161-9007

FR Fair-Rite Products Corp.
PO Box J
Wallkill, NY 12589

FSC Fairchild Camera & Instr. Corp.
See National Semiconductor

GI General Instruments
Optoelectronics Division
See Quality Technologies

HA Harris Semiconductor
2460 N 1st Street
Suite 200
San Jose, CA 95131-0124

HO Hoyt Elect. Inst. Works
19 Linden St.
Penacook, NH 03303

HP Hewlett-Packard Co.
Components Group
640 Page Mill Road
Palo Alto, CA 94304

INS Intersil, Inc.
See Harris Semiconductor

ITW ITW Switches
An Illinois Tool Works Co.
6615 W. Irving Park Rd.
Dept. T
Chicago, IL 60634

KB Kingbright USA Corporation
225 Brea Canyon Road
City of Industry, CA 91789

KEM KEMET Electronics Corporation
Post Office Box 5928
Greenville, South Carolina 29606

KEY Keystone Electronics Corp.
31-07 20th Rd.
Astoria, NY 11105

LFE Littlefuse
A Subsidiary of Tracor, Inc.
800 E. Northwest Hwy
Des Plaines, IL 60016

LT Linear Technology Corp.
1630 McCarthy Blvd.
Milpitas, CA 95035

LUMX Lumex Opto/Components Inc.
292 E. Hellen Road
Palatine, IL 60067

MAL Mallory Capacitor Co.
Emhart Electrical/Electronic Gr.
4760 Kentucky Ave
Indianapolis, IN 46241

MAR Marquardt Switches, Inc.
2711-TR Route 20 East
Cazenovia, NY 13035

MAT Matsushita Electric Corp of America
One Panasonic Way
Secaucus, NJ 07094

ME Mepcopal/Centralab
A North American Phillips Corp.
11468 Sorrento Valley Road
San Diego, CA 92121

MID Hollingsworth/Wearnes
Hollingsworth Solderless Terminal Div.
357 Beloit Street
Burlington, WI 53105

MIL J.W. Miller Division
Bell Industries
306 E. Alondra
Gardena, CA 90247

MOT Motorola Semiconductor
PO Box 20912
Phoenix, AZ 85036

MUR Murata Erie North America
2200 Lake Park Drive
Smyrna, GA 30080

NAT National Semiconductor Corp.
2900 Semiconductor Drive
PO Box 58090
Santa Clara, CA 95051

NEC NEC Technologies
159 Swanson
Bax Braugh, MA 01719

NEL NEL Frequency Controls, Inc.
357 Beloit Street
Burlington, WI 53105

NOB Noble U.S.A., Incorporated
5450 Meadowbrook Industrial Ct.
Rolling Meadows, IL 60008

OKI OKI Semiconductor
785 N. Mary Ave.
Sunnyvale, CA 94086-2909

OHM Ohmite Manufacturing Company
3601 Howard Street
Skokie, IL 60076

ORB Orban
A division of AKG Acoustics, Inc.
1525 Alvarado Street
San Leandro, CA 94577

PAN Panasonic Industrial Company
Two Panasonic Way
7E-2T
Secaucus, NJ 07094

QT Quality Technologies, Inc.
610 North Mary Ave.
Sunnyvale, CA 94086

RAL Raltron Electronics Corp.
9550 Warner Ave.
Fountain Valley, CA 92708

RAY Raytheon Company
Semiconductor Division
350 Ellis Street
Mountain View, CA 94039

RCA RCA Solid State
See Harris Semiconductor

ROHM Rohm Corporation
8 Whatney
Irvine, CA 92718

SAE Stanford Applied Engineering, Inc
340 Martin Avenue
Santa Clara, CA 95050

SAN Sangamo Weston Inc.
Capacitor Division
See Cornell-Dubilier

SCH ITT Schadow, Inc.
8081 Wallace Road
Eden Prairie, MN 55344

SIE Siemens Components Inc.
Heimann Systems Div.
186 Wood Avenue South
Iselin, NJ 08830

SIG Philips Components - Signetics
North American Phillips Corp.
811 E. Arques
Sunnyvale, CA 94088

SPR Sprague Electric Co.
41 Hampden Road
PO Box 9102
Mansfield, MA 02048-9102

SW Switchcraft
A Raytheon Company
5555 N. Elston Avenue
Chicago, IL 60630

TAI Taiyo America, Inc.
700 Frontier Way
Bensenville, IL 60106

TDK TDK Electronics Corporation
12 Harbor Park
Port Washington, NY 11050

TI Texas Instruments, Inc.
PO Box 225012
Dallas, TX 75265

TOS Toshiba America, Inc.
9740 Irvine Blvd.
Irvine, CA 92718

TRW TRW Electronics Components
Connector Division
1501 Morse Avenue
Elk Grove Village, IL 60007

VARO Varo Semiconductor, Inc.
PO Box 469013
Garland, TX 75046-9013

WES Westlake
See Mallory Capacitor Co.

WIM The Inter-Technical Group Inc.
Wima Division
PO Box 23
Irvington, NY 10533

ZI ZILOG Inc.
210 Hacienda Ave.
Campbell, CA 95008

Vendor Codes

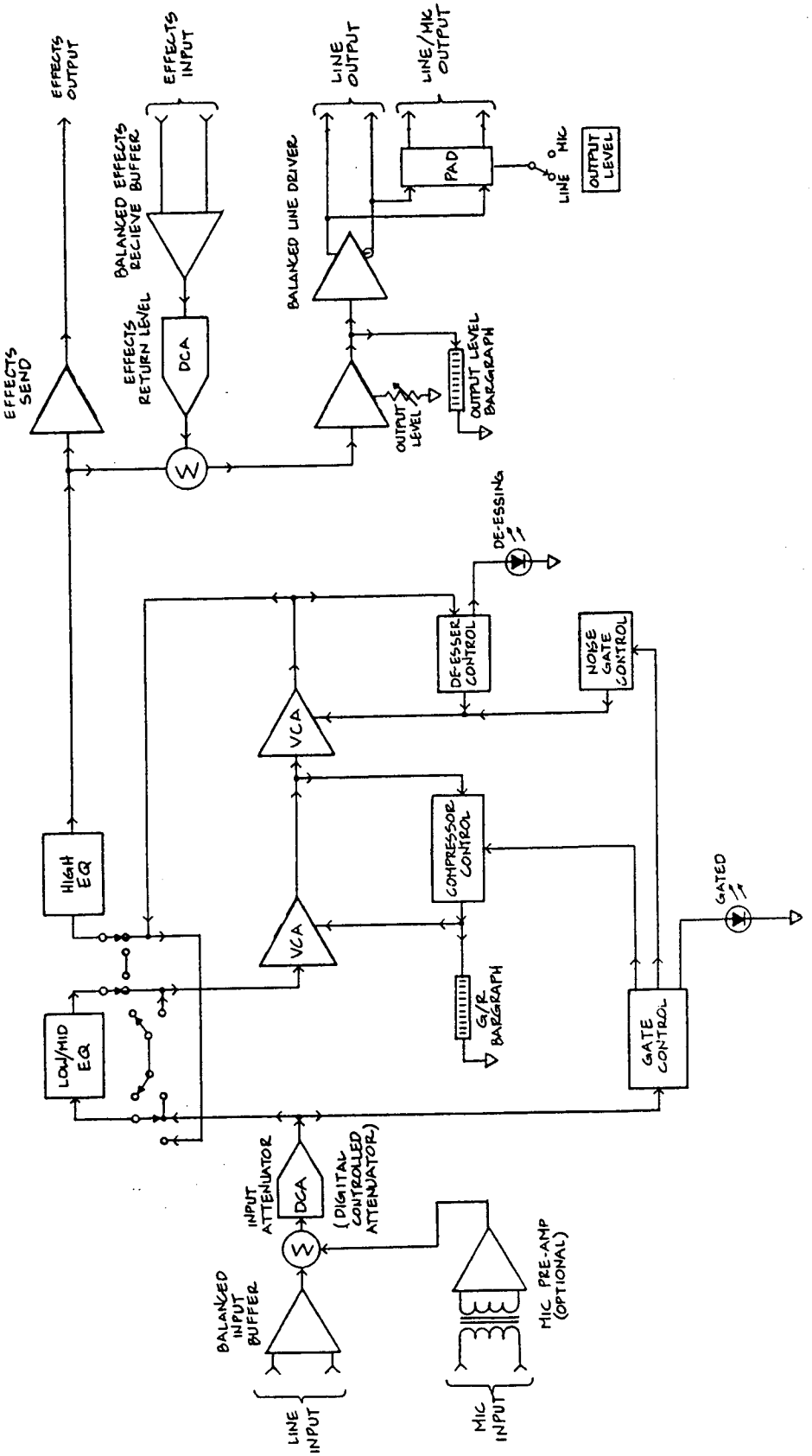
Schematics, Assembly Drawings

The following drawings are included in this manual:

Page	Board ID	Function	Drawing
6-41		Block Diagram	
6-42	AG	Analog	PC Assembly
6-43	AG	Analog	Schematic
6-44			Schematic
6-46	EQ	Equalizer	PC Assembly
6-47	EQ	Equalizer	Schematic
6-48	DG	Digital & Power Supply	PC Assembly
6-49	DG	Digital & Power Supply	Schematic
6-50			Schematic
6-52	DP	Display	PC Assembly
6-53	DP	Display	Schematic
6-54	SI	Slave Interconnect	PC Assembly
6-55	SI	Slave Interconnect	Schematic
6-56	SD	Slave Display	PC Assembly
6-57	SD	Slave Display	Schematic
6-58	MC	Mic Option	PC Assembly
6-59	MC	Mic Option	Schematic
6-60	DB	Remote Control Display	PC Assembly
6-61	MB	Remote Control	PC Assembly
6-62	MB	Remote Control	Schematic
6-63	SB	Remote Control Switch	PC Assembly
6-64	RI	Remote Interface	PC Assembly
6-65	RI	Remote Interface	Schematic
6-66	MD	Midi Option	PC Assembly
6-67	MD	Midi Option	Schematic
6-68	RS	RS-232	PC Assembly
6-69	RS	RS-232	Schematic

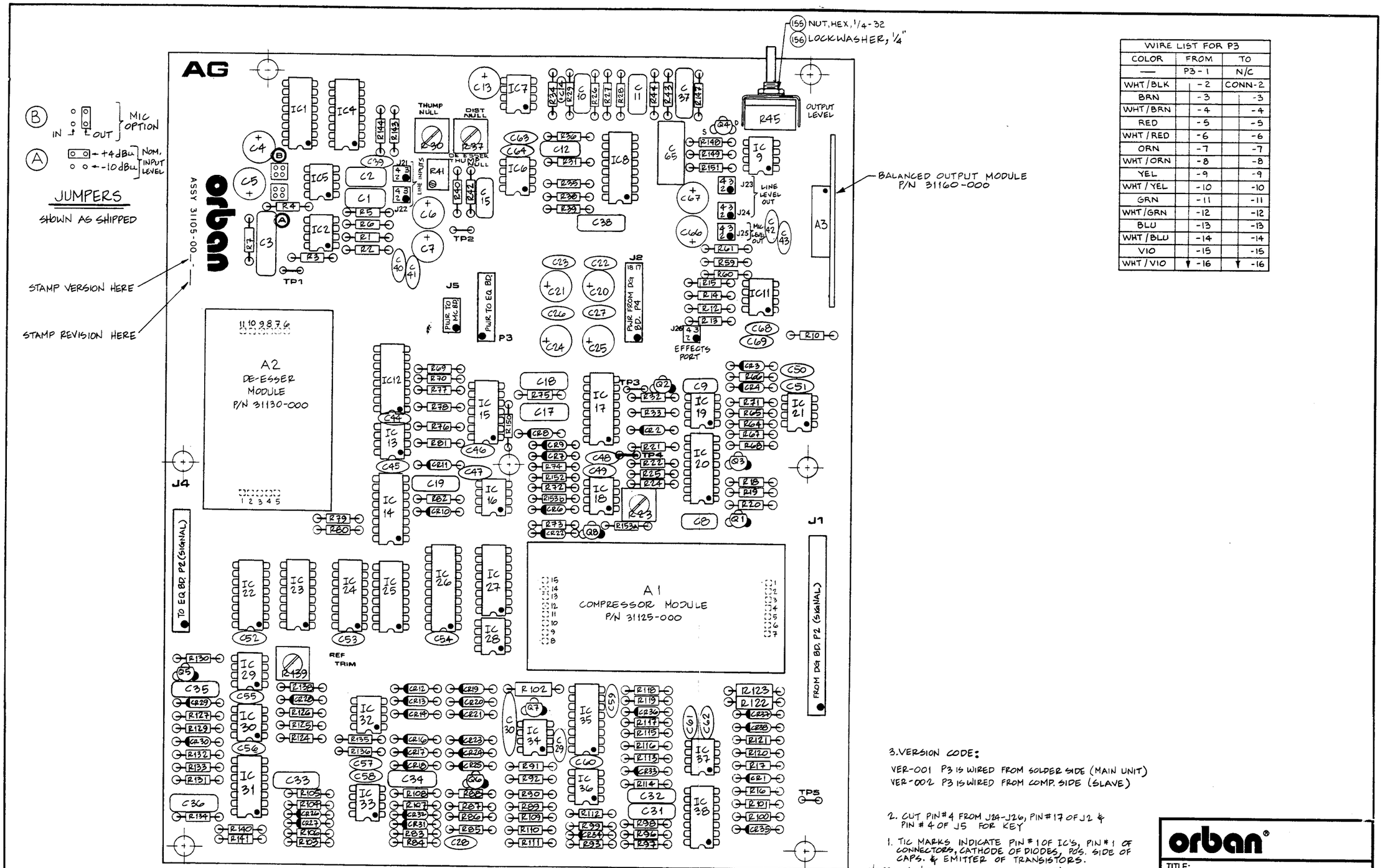
These drawings reflect the actual construction of your unit as accurately as possible. Any differences between the drawings and your unit are almost undoubtedly due to product improvements or production changes since the publication of this manual. Major changes are described in addenda to this manual.

If you intend to replace parts, please read page 6-23.



orban®

TITLE: BLOCK DIAGRAM
787A & 787ASL
60181-000-01



COMPONENT SIDE

WIRE LIST FOR P3		
COLOR	FROM	TO
—	P3-1	N/C
WHT/BLK	-2	CONN-2
BRN	-3	-3
WHT/BRN	-4	-4
RED	-5	-5
WHT/RED	-6	-6
ORN	-7	-7
WHT/ORN	-8	-8
YEL	-9	-9
WHT/YEL	-10	-10
GRN	-11	-11
WHT/GRN	-12	-12
BLU	-13	-13
WHT/BLU	-14	-14
VIO	-15	-15
WHT/VIO	-16	-16

3. VERSION CODE:
VER-001 P3 IS WIRED FROM SOLDER SIDE (MAIN UNIT)
VER-002 P3 IS WIRED FROM COMP. SIDE (SLAVE)

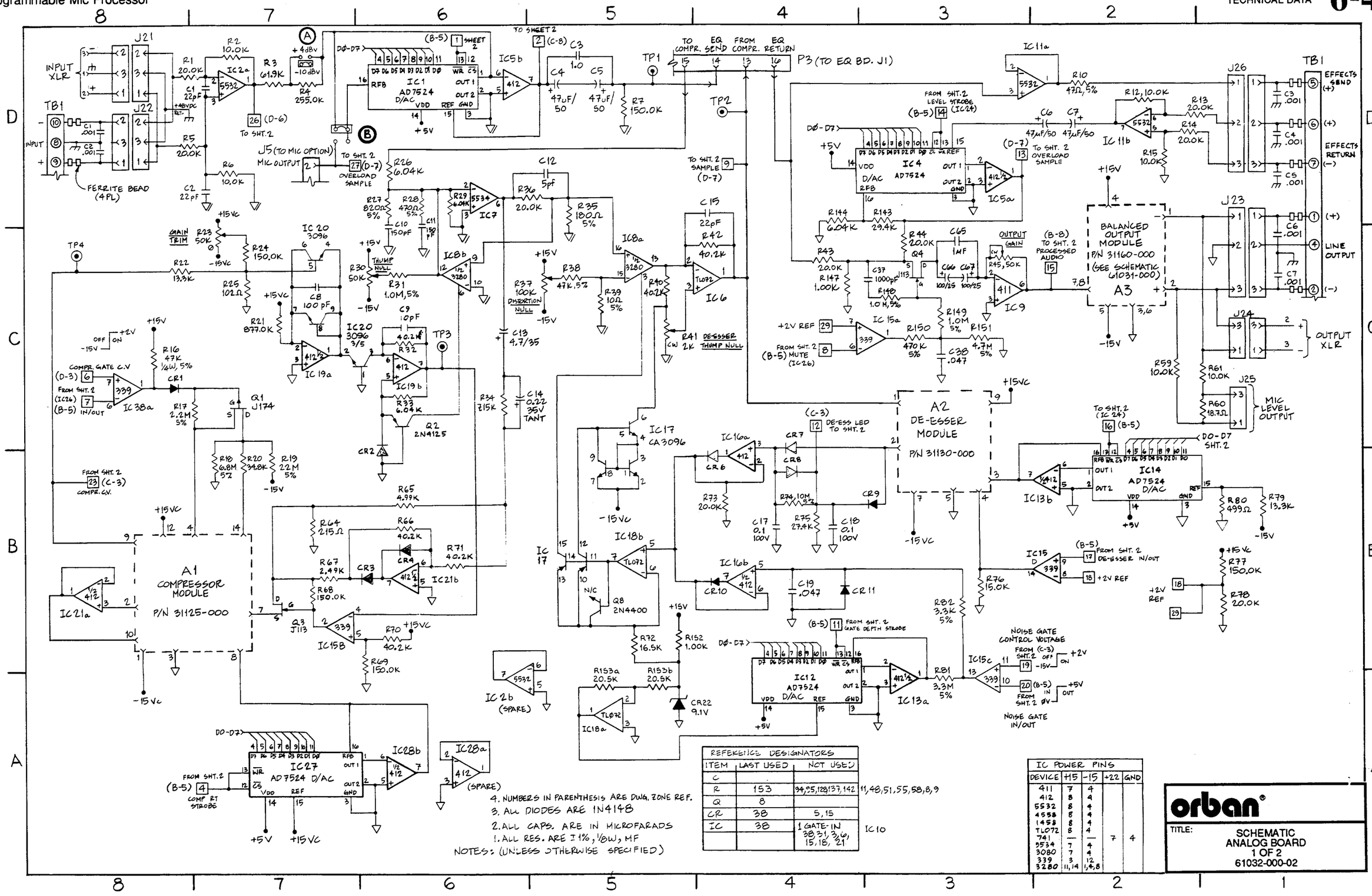
2. CUT PIN #4 FROM J24-J26, PIN #17 OF J2 & PIN #4 OF J5 FOR KEY

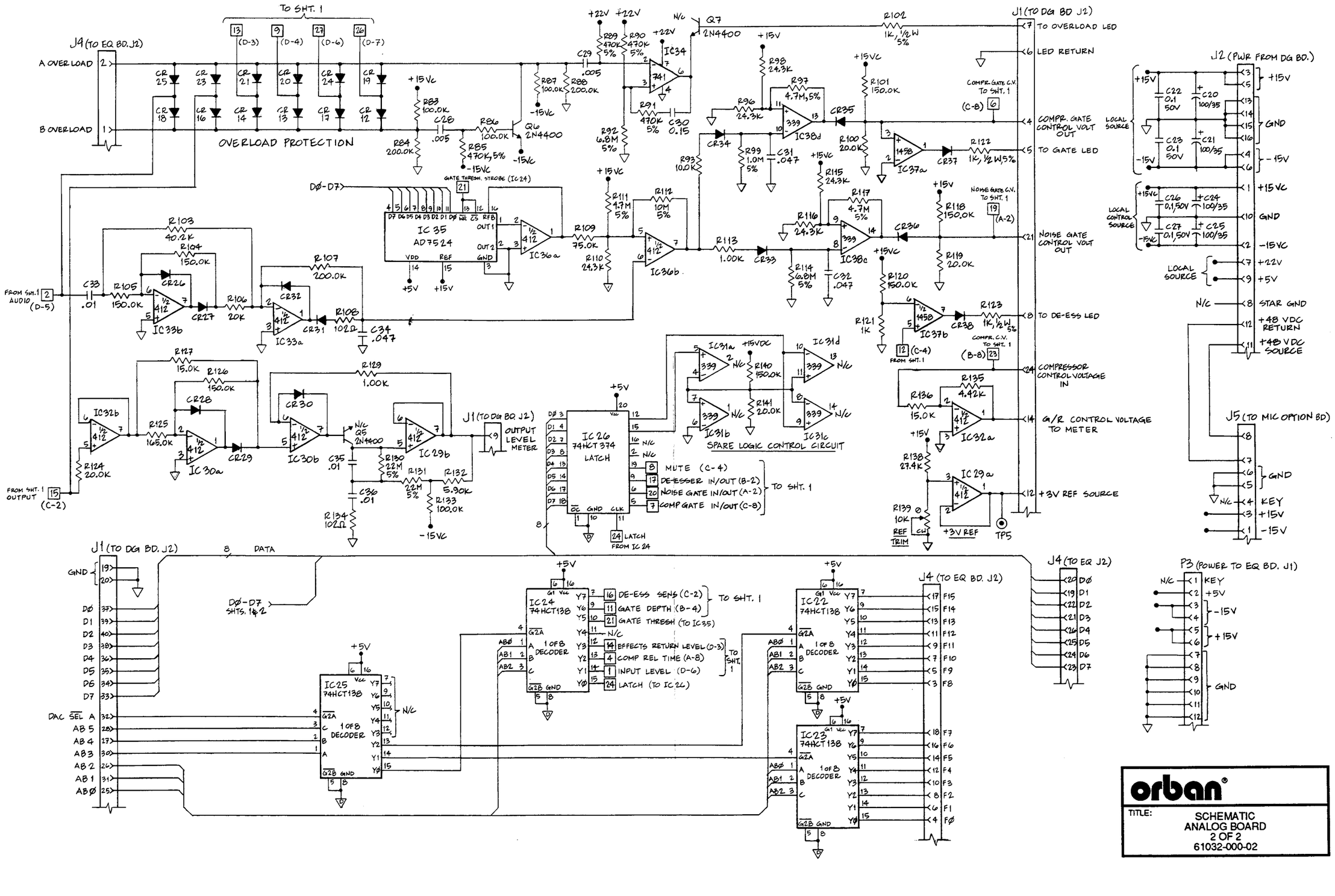
1. TIC MARKS INDICATE PIN #1 OF IC'S, PIN #1 OF CONNECTORS, CATHODE OF DIODES, POS. SIDE OF CAPS. & EMITTER OF TRANSISTORS.

NOTES: (UNLESS OTHERWISE SPECIFIED)

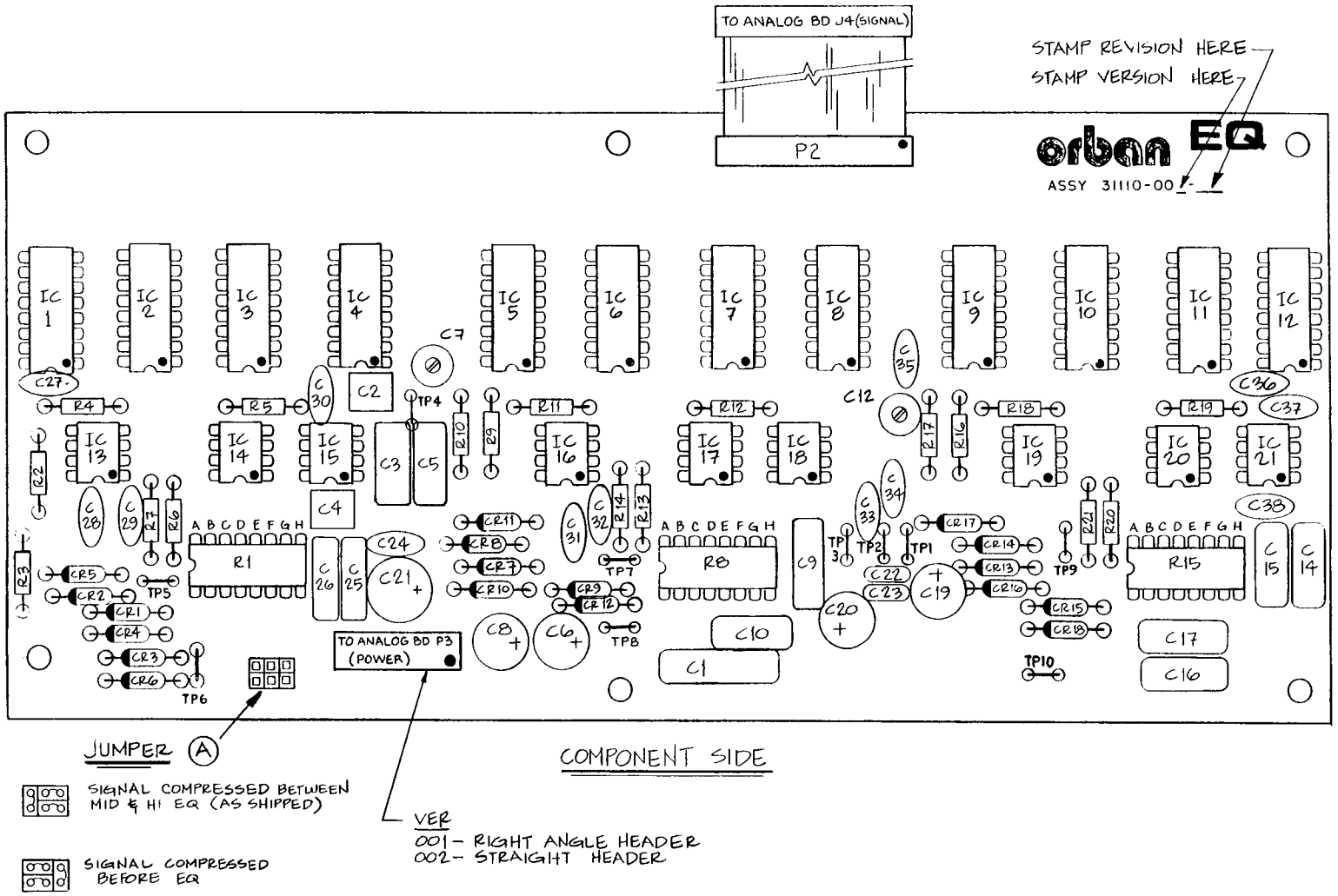
orban®

TITLE:
ASSEMBLY DRAWING
ANALOG BOARD
31105-000-02


J21
INPUT XLR
J22
TB1
INPUT
FERRITE BEAD (4PL)
C1 .001
C2 .001
R1 20.0K
R2 10.0K
C1 22pF
IC2a 5532
R3 61.9K
R4 255.0K
+4dBv
-10dBv
+48VDC EXT.
R5 20.0K
R6 10.0K
C2 22pF
26 (D-6) TO SHT.2
+15VC
GAIN TRIM R23 50K
R24 150.0K
R22 13.3K
R25 102Ω
TP4
IC 20 3096
C8 100 pF
R21 877.0K
-15VC
OFF ON +2V -15V
R16 47K 1/4W, 5%
COMPR. GATE C.V (D-3)
FROM SHT. 2 (IC26) (B-5) IN/OUT
IC 38a 339
CR1
R17 2.2M 5%
Q1 J174
R18 6.8M 5%
R20 34.8K
R19 22M 5%
FROM SHT. 2 23 (C-3) COMPR. C.V.
A1 COMPRESSOR MODULE P/N 31125-000
IC21a 1/2 412
IC 21b
R64 215Ω
R65 4.99K
R66 40.2K
R67 2.49K
CR3
CR4
R68 150.0K
R71 40.2K
Q3 J113
IC15B 339
R70 40.2K
R69 150.0K
IC 20 3096 3/5
IC 19a
C9 10pF
R32 40.2K
IC19 b
R33 6.04K
Q2 2N4125
CR2
TP3
R34 715R
C14 0.22 35V TANT
C13 4.7/35
R30 50K THUMP NULL
R31 1.0M,5%
IC8b 1/2 3280
R37 100K DISTORTION NULL
R38 47K,5%
R39 10Ω 5%
IC8a 1/2 3280
R40 40.2K
R41 DE-ESSER THUMP NULL 2K
IC 2b (SPARE)
IC 28a 412 (SPARE)
IC27 AD7524 D/AC
FROM SHT.2 (B-5) 4 COMP RT STROBE
DO-D7
+5V
+15VC
J5 (TO MIC OPTION) MIC OUTPUT
TO SHT. 2 27 (D-7) OVERLOAD SAMPLE
R26 6.04K
R27 820Ω 5%
R28 470Ω 5%
C10 150pF
C11 150 pF
R29 6.04K
IC7 5534
C12 5pF
R36 20.0K
R35 180Ω 5%
TO SHT. 2 SAMPLE (D-7) 9
C15 22pF
R42 40.2K
IC6 TL072
R41 DE-ESSER THUMP NULL 2K
IC 17 CA3096
IC18b TL072
Q8 2N4400
N/C
-15VC
R72 16.5K
R152 1.00K
R153a 20.5K
R153b 20.5K
IC18a TL072
CR22 9.1V
IC 17
IC 16a
CR6
CR7
CR8
CR9
R73 20.0K
R74 10M 5%
R75 27.4K
C17 0.1 100V
C18 0.1 100V
IC 16b
CR10
CR11
C19 .047
(C-3) 12 DE-ESS LED TO SHT. 2
A2 DE-ESSER MODULE P/N 31130-000
IC12 AD7524 D/AC
IC 13a 412
R81 3.3M 5%
IC15c 339
NOISE GATE CONTROL VOLTAGE FROM (C-3) SHT.2 OFF -15V +2V ON
(B-5) 20 FROM SHT. 2 +5V OUT
NOISE GATE IN/OUT
(B-5) 11 FROM SHT. 2 GATE DEPTH STROBE
TO COMPR. EQ SEND FROM EQ COMPR. RETURN
P3 (TO EQ BD. J1)
TP1
TP2
R7 150.0K
IC11a 5532
R10 47Ω, 5%
FROM SHT.2 LEVEL STROBE (B-5) 14 (IC24)
IC4 AD7524 D/AC
IC5a 412
C6 47µF/50
C7 47µF/50
(D-7) 13 TO SHT. 2 OVERLOAD SAMPLE
R144 6.04K
R143 29.4K
R44 20.0K
Q4
C65 1MF
C66 100/25
C67 100/25
OUTPUT GAIN
R45, 50K
IC9 411
(B-8) TO SHT. 2 PROCESSED AUDIO 15
R43 20.0K
R147 1.00K
C37 1000pF
R148 1.0 M,5%
R149 1.0M 5%
R150 470K 5%
R151 4.7M 5%
C38 .047
+2V REF 29
FROM SHT. 2 (B-5) MUTE (IC26) 8
IC 15a 339
IC11b 5532
R12, 10.0K
R13 20.0K
R14 20.0K
R15 10.0K
C3 .001
C4 .001
C5 .001
C6 .001
C7 .001
TB1
EFFECTS SEND (+) 5
(+) 6
EFFECTS RETURN (-) 7
LINE OUTPUT (+) 1
(-) 2
OUTPUT XLR
J26
J23
J24
J25
BALANCED OUTPUT MODULE P/N 31160-000 (SEE SCHEMATIC 61031-000) A3
R59 10.0K
R61 10.0K
R60 18.7Ω
MIC LEVEL OUTPUT
TO SHT.2 (IC 24) 16 (B-5)
DO-D7 SHT. 2
IC14 AD7524 D/AC
IC13b 1/2 412
R80 499Ω
R79 13.3K
R76 15.0K
R82 3.3K 5%
IC15 339
(B-5) 17 FROM SHT. 2 DE-ESSER IN/OUT
18 +2V REF
R77 150.0K
R78 20.0K
+2V REF 18 29
REFERENCE DESIGNATORS
ITEM | LAST USED | NOT USED
C | - | -
R | 153 | 94,95,128,137,142
Q | 8 | -
CR | 38 | 5, 15
IC | 38 | 1 GATE-IN 38, 31, 3, 6, 15, 18, 21
IC10 11,48,51,55,58,8,9
IC POWER PINS
DEVICE | +15 | -15 | +22 | GND
411 | 7 | 4
412 | 8 | 4
5532 | 8 | 4
4558 | 8 | 4
1458 | 8 | 4
TL072 | 8 | 4
741 | — | — | 7 | 4
5534 | 7 | 4
3080 | 7 | 4
339 | 3 | 12
3280 | 11, 14 | 1, 4, 8
4. NUMBERS IN PARENTHESIS ARE DWG. ZONE REF.
3. ALL DIODES ARE 1N4148
2. ALL CAPS. ARE IN MICROFARADS
1. ALL RES. ARE 1%, 1/8W, MF
NOTES: (UNLESS OTHERWISE SPECIFIED)
orban®
TITLE: SCHEMATIC ANALOG BOARD 1 OF 2
61032-000-02



orban®	
TITLE:	SCHEMATIC ANALOG BOARD 2 OF 2 61032-000-02

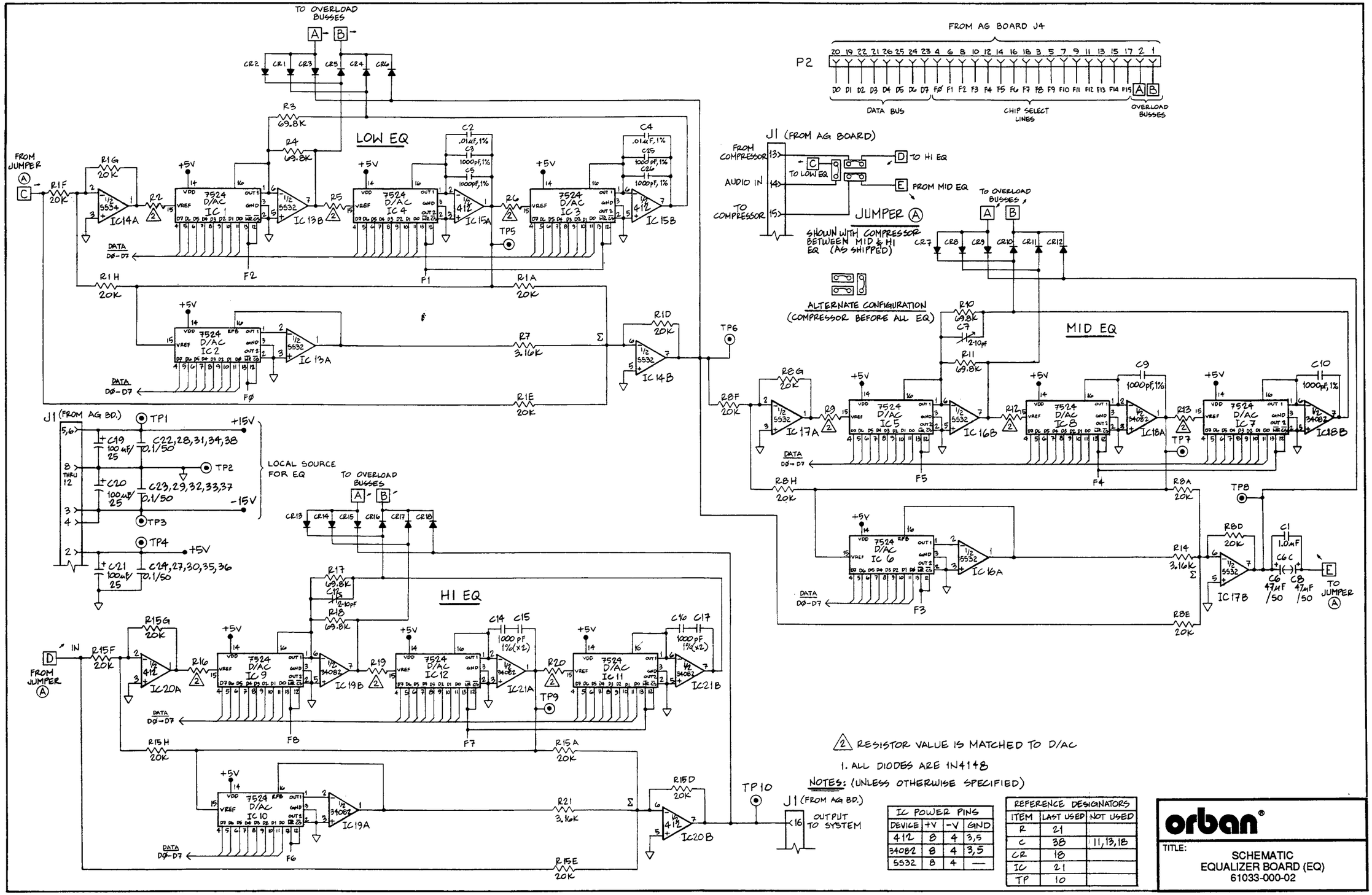


NOTES: (UNLESS OTHERWISE SPECIFIED)

1. TIC MARKS INDICATE PIN 1 OF ICs, CATHODE OF DIODES, PLUS OF CAPS & PIN 1 OF CONNECTORS.

orban®

TITLE:
ASSEMBLY DRAWING
EQUALIZER BOARD
31110-000-03



2 RESISTOR VALUE IS MATCHED TO D/AC

1. ALL DIODES ARE 1N4148

NOTES: (UNLESS OTHERWISE SPECIFIED)

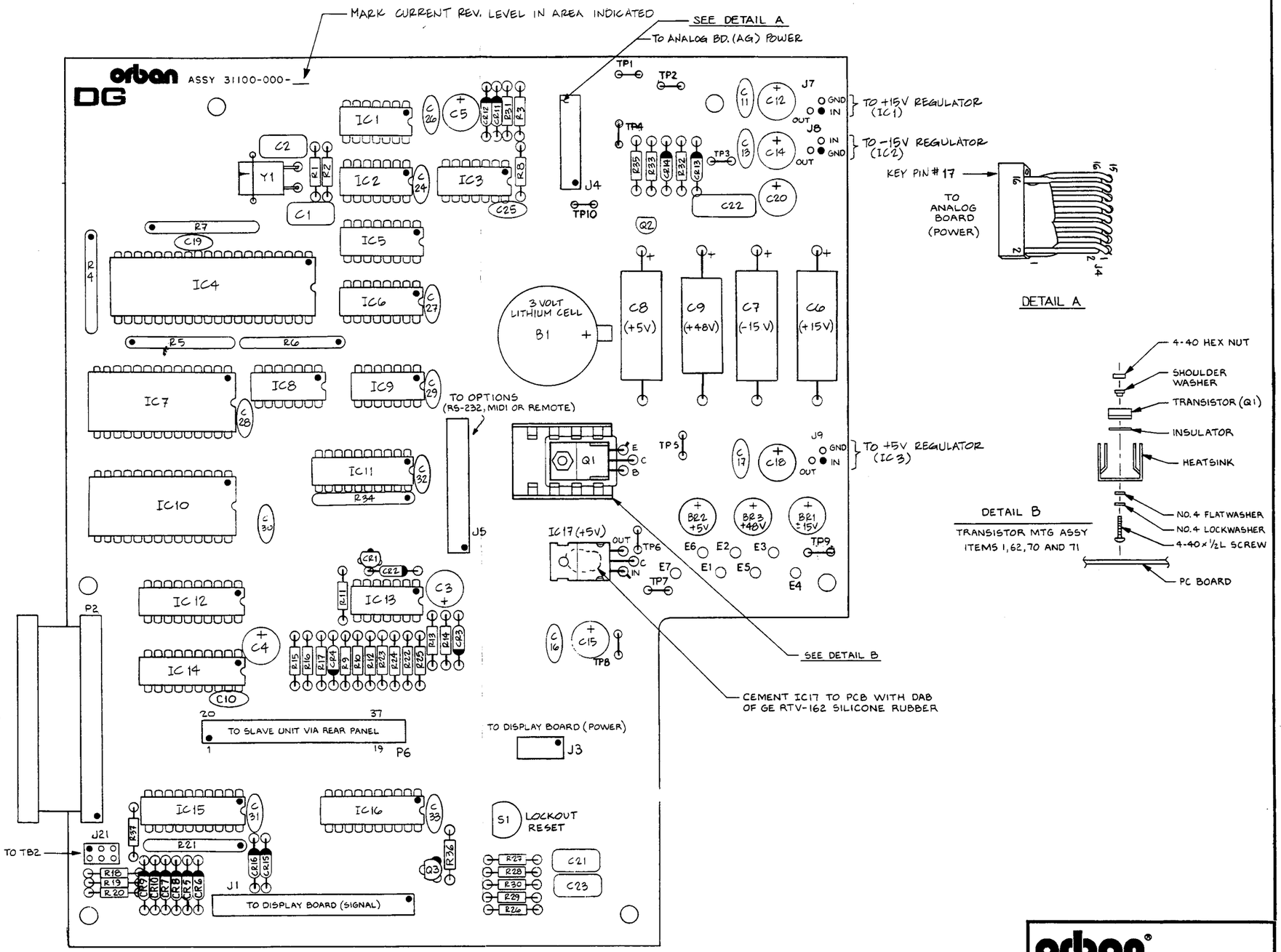
IC POWER PINS			
DEVICE	+V	-V	GND
4112	8	4	3,5
34082	8	4	3,5
5532	8	4	—

REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
R	21	
C	38	11,13,18
CR	18	
IC	21	
TP	10	

orban®

TITLE:
SCHEMATIC
EQUALIZER BOARD (EQ)
61033-000-02

WIRE LIST FOR P4		
COLOR	FROM	TO
BLK	P4-1	CONN-1
WHT/BLK	-2	-2
BRN	-3	-3
WHT/BRN	-4	-4
RED	-5	-5
WHT/RED	-6	-6
ORN	-7	-7
WHT/ORN	-8	-8
YEL	-9	-9
WHT/YEL	-10	-10
GRN	-11	-11
WHT/GRN	-12	-12
BLU	-13	-13
WHT/BLU	-14	-14
V10	-15	-15
WHT/V10	-16	-16
—	N/C	-17
—	N/C	-18



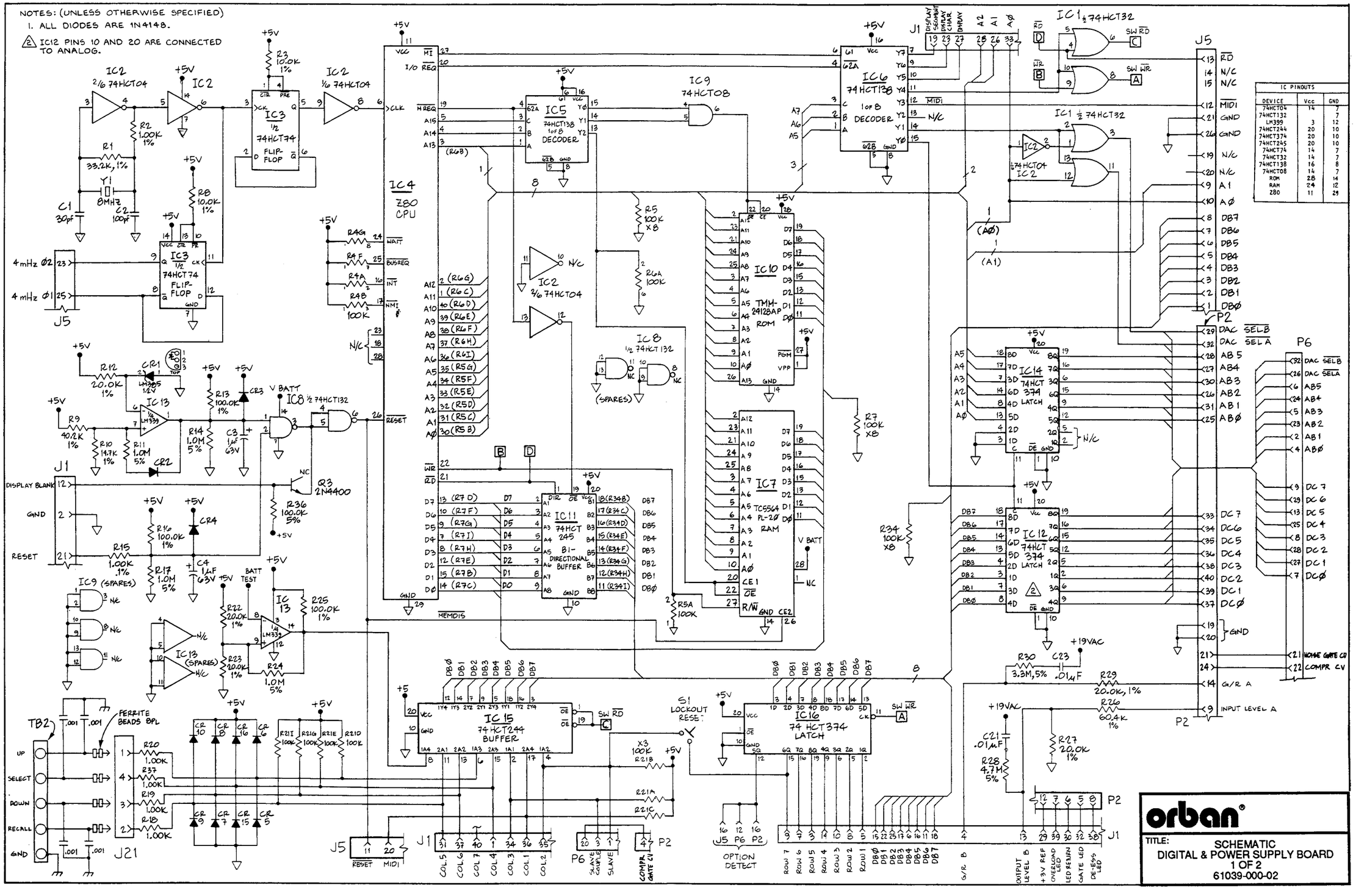
1. TIC MARKS INDICATE PIN#1 OF IC'S, PIN #1 OF CONNECTORS, CATHODE OF DIODE, POS. SIDE OF CAPS, EMITTER OF TRANSISTORS, POS. SIDE OF BATTERY, PIN#1 OF SIP'S.

NOTES: (UNLESS OTHERWISE SPECIFIED)

COMPONENT SIDE

orban®

TITLE:
ASSEMBLY DRAWING
DIGITAL & POWER SUPPLY BOARD
31100-000-03


NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL DIODES ARE 1N4148.
2. IC12 PINS 10 AND 20 ARE CONNECTED TO ANALOG.
IC1 1/4 74HCT32
IC2 2/6 74HCT04
IC2 1/6 74HCT04
IC3 1/2 74HCT74 FLIP-FLOP
IC4 Z80 CPU
IC5 74HCT138 1 OF 8 DECODER
IC6 74HCT138 1 OF 8 DECODER
IC7 TC5564 PL-20 RAM
IC8 1/2 74HCT132
IC9 74HCT08
IC10 TMM-2912BAP ROM
IC11 74HCT 245 BI-DIRECTIONAL BUFFER
IC12 74HCT 374 LATCH
IC13 1/4 LM339
IC14 74HCT 374 LATCH
IC15 74HCT244 BUFFER
IC16 74HCT374 LATCH
IC PINOUTS
DEVICE | Vcc | GND
74HCT04 | 14 | 7
74HCT132 | 14 | 7
LM399 | 3 | 12
74HCT244 | 20 | 10
74HCT374 | 20 | 10
74HCT245 | 20 | 10
74HCT74 | 14 | 7
74HCT32 | 14 | 7
74HCT138 | 16 | 8
74HCT08 | 14 | 7
ROM | 28 | 14
RAM | 24 | 12
Z80 | 11 | 29
4 mHz Ø2
4 mHz Ø1
J5
J1
J21
TB2
P2
P6
R1 33.2K, 1%
R2 1.00K 1%
R3 10.0K 1%
R4A 100
R4B 100
R4F 100
R4G 100
R5 100K X8
R5A 100K
R6A 100K
R7 100K X8
R8 10.0K 1%
R9 40.2K 1%
R10 14.7K 1%
R11 1.0M 5%
R12 20.0K 1%
R13 100.0K 1%
R14 1.0M 5%
R15 1.00K 1%
R16 100.0K 1%
R17 1.0M 5%
R18 1.00K
R19 1.00K
R20 1.00K
R21A 100K
R21B 100K
R21C 100K
R21D 100K
R21E 100K
R21F 100K
R21G 100K
R21I 100K
R22 20.0K 1%
R23 20.0K 1%
R24 1.0M 5%
R25 100.0K 1%
R26 60.4K 1%
R27 20.0K 1%
R28 4.7M 5%
R29 20.0K, 1%
R30 3.3M, 5%
R34 100K X8
R36 100.0K 5%
R37 1.00K
C1 30pf
C2 100pf
C3 1µF 63V
C4 1µF 63V
C21 .01µF
C23 .01µF
Y1 8MHz
CR1 LM385 1.2V
CR2
CR3
CR4
Q3 2N4400
S1 LOCKOUT RESET
V BATT
+5V
+19VAC
(SPARES)
FERRITE BEADS 8PL
UP
SELECT
DOWN
RECALL
GND
RESET
MIDI
OPTION DETECT
SW RD
SW WR
DISPLAY BLANK
MEMDIS
WAIT
BUSREQ
INT
NMI
RESET
DAC SELB
DAC SELA
AB5
AB4
AB3
AB2
AB1
ABØ
DC7
DC6
DC5
DC4
DC3
DC2
DC1
DCØ
GND
NOISE GATE CV
COMPR CV
G/R A
INPUT LEVEL A
G/R B
INPUT LEVEL B
+3V REF
OVERLOAD LED
LED RETURN
GATE LED
DE-ESS LED
orban
TITLE: SCHEMATIC DIGITAL & POWER SUPPLY BOARD 1 OF 2
61039-000-02

REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
C	33	10
IC	17	
R	36	
CR	14	
BR	3	
TP	10	

P6 (TO SLAVE UNIT VIA 37-PIN D-CONN)

P4 (TO ANALOG BD. J2)

J5 (TO MIDI, RS-232 OR REMOTE P1)

J3 (TO DISPLAY BD. P2)

L1 LINE FILTER ASSY.

VOLTAGE SELECTOR

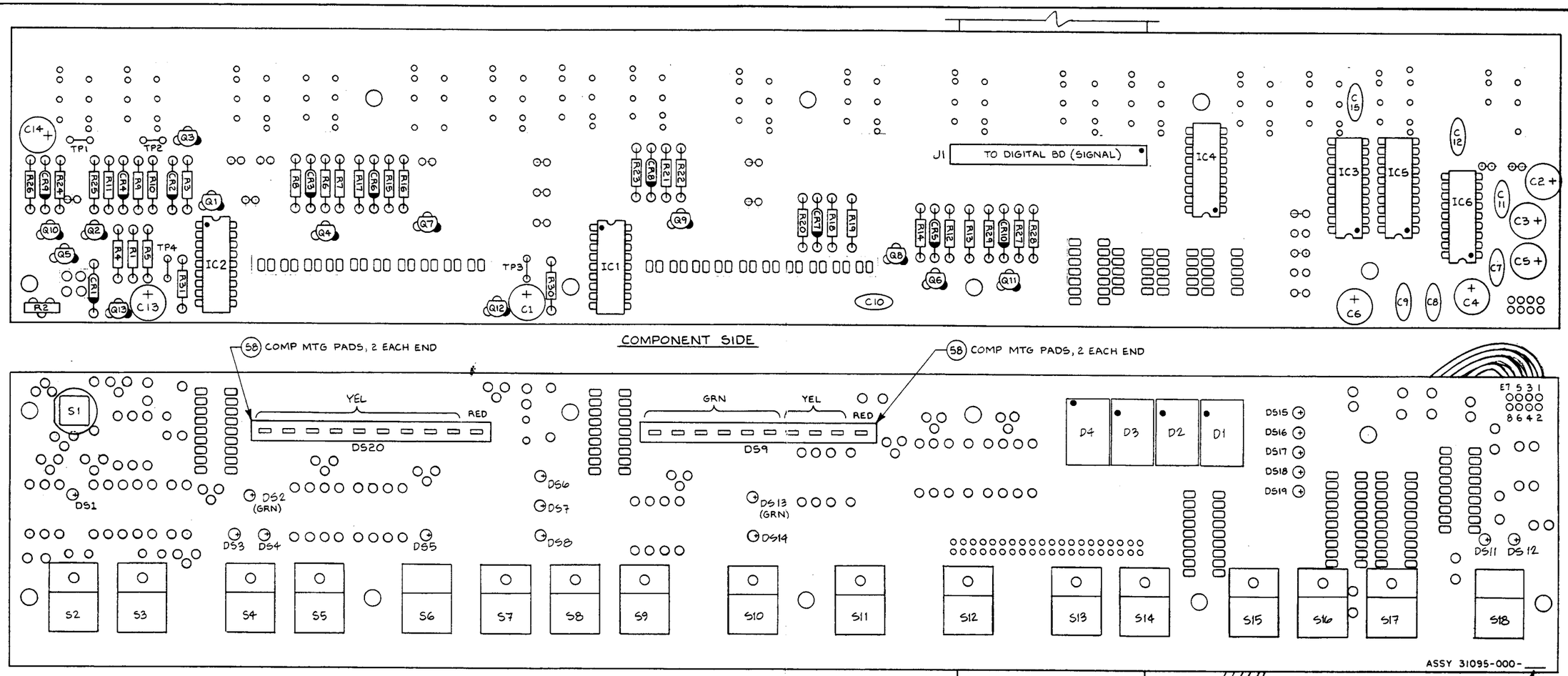
BACKUP POWER SUPPLY

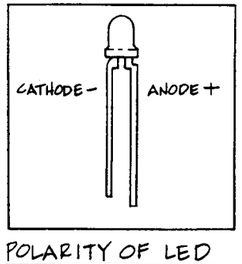
POWER SUPPLY SECTION

SEE SHEET 1 FOR NOTES

orban®

TITLE: SCHEMATIC
DIGITAL & POWER SUPPLY BOARD
2 OF 2
61039-000-02





POLARITY OF LED

5. DO NOT ALLOW SWITCH TO COME IN CONTACT WITH SOLVENTS OR FLUX.
4. COMPONENTS MOUNTED ON SOLDERSIDE MUST LIE FLUSH, FLAT & SQUARE.
3. MAX COMPONENT HEIGHT IS .450. MOUNT C1-6, 13 & 14 PARALLEL TO BOARD SHOULD THEY EXCEED .450.
2. WIRES TO E#'S CONNECTED ON FAR SIDE, PUT POLARIZING PLUG IN POSITION 1 OF CONNECTOR.

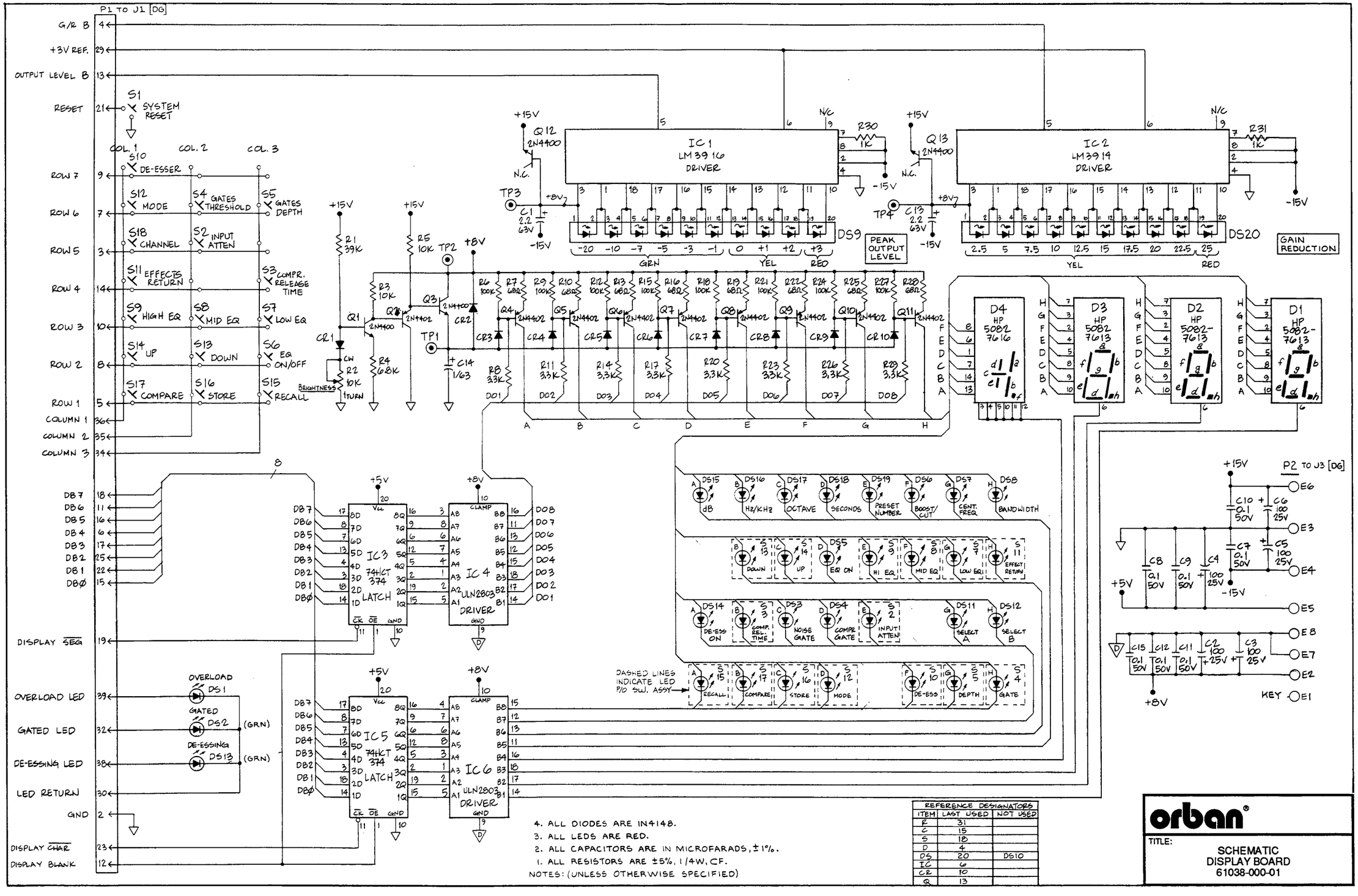
1. TIC MARKS INDICATE PIN 1 OF IC'S, CATHODE OF DIODE, PIN #1 OF DISPLAY, EMITTER OF TRANSISTOR, PLUS OF CAP, PIN#1 OF HEADER

NOTES: (UNLESS OTHERWISE SPECIFIED)

WIRE LIST FOR P2		
COLOR	FROM	TO
BLK	P2-1	CONN-1
WHT/BLK	P2-2	CONN-2
BRN	P2-3	CONN-3
WHT/BRN	P2-4	CONN-4
RED	P2-5	CONN-5
WHT/RED	P2-6	CONN-6
—	P2-7	N/C
WHT/ORN	P2-8	CONN-8

orban®

TITLE:
PCA
DISPLAY BOARD (DP)
31095-000-03



4. ALL DIODES ARE IN4148.
3. ALL LEDS ARE RED.
2. ALL CAPACITORS ARE IN MICROFARADS, ±1%.
1. ALL RESISTORS ARE ±5%, 1/4W, CF.

NOTES: (UNLESS OTHERWISE SPECIFIED)

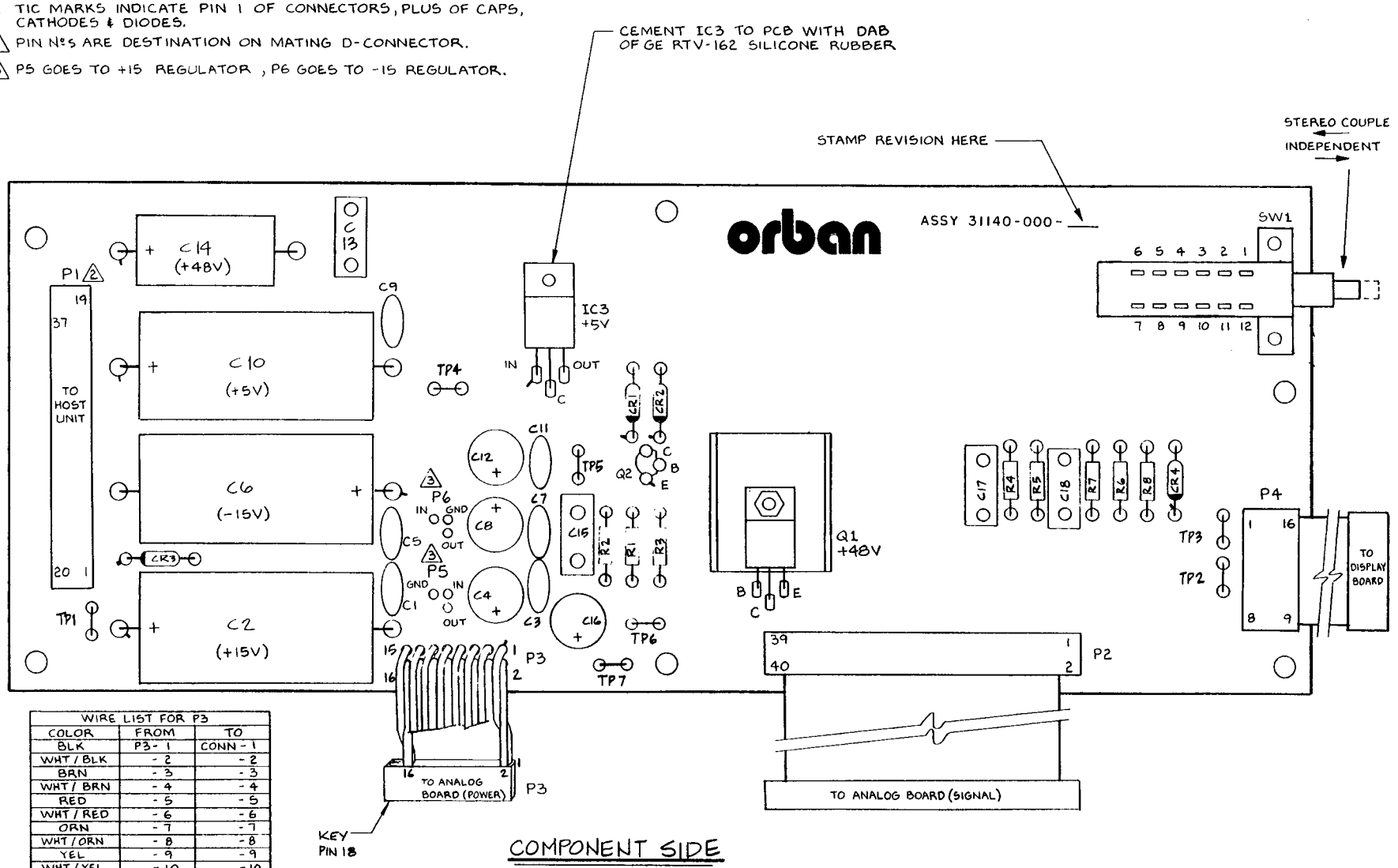
REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
R	31	
C	15	
S	18	
D	4	
DS	20	DS10
IC	6	
CR	10	
Q	13	

orban®

TITLE:
SCHEMATIC
DISPLAY BOARD
61038-000-01

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. TIC MARKS INDICATE PIN 1 OF CONNECTORS, PLUS OF CAPS, CATHODES & DIODES.
2. PIN Nos ARE DESTINATION ON MATING D-CONNECTOR.
3. P5 GOES TO +15 REGULATOR, P6 GOES TO -15 REGULATOR.

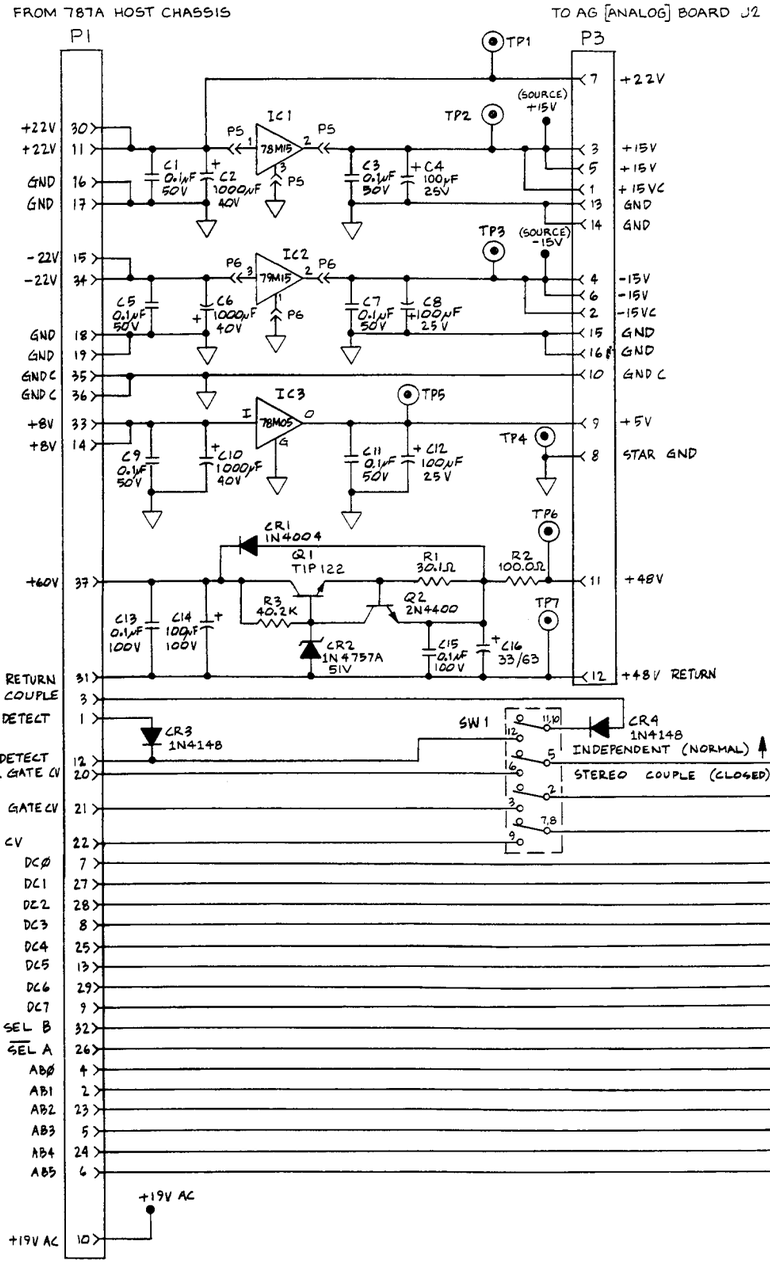


COMPONENT SIDE

WIRE LIST FOR P3		
COLOR	FROM	TO
BLK	P3- 1	CONN - 1
WHT / BLK	- 2	- 2
BRN	- 3	- 3
WHT / BRN	- 4	- 4
RED	- 5	- 5
WHT / RED	- 6	- 6
ORN	- 7	- 7
WHT / ORN	- 8	- 8
YEL	- 9	- 9
WHT / YEL	- 10	- 10
GRN	- 11	- 11
WHT / GRN	- 12	- 12
BLU	- 13	- 13
WHT / BLU	- 14	- 14
VIO	- 15	- 15
WHT / VIO	- 16	- 16
—	N/C	- 17
—	N/C	- 18

orban®

TITLE:
ASSEMBLY DRAWING
SLAVE INTERCONNECT
31140-000-02



NOTES: (UNLESS OTHERWISE SPECIFIED)

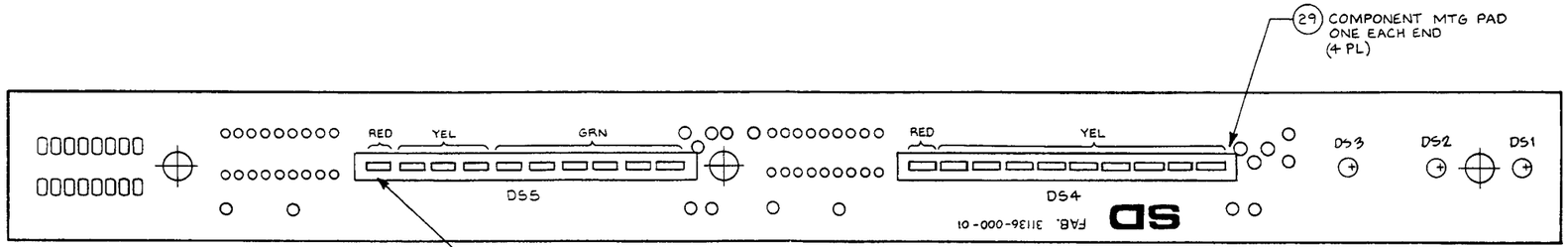
1. ALL RESISTORS ARE 1/8W, ±1% MF

REFERENCE DESIGNATORS

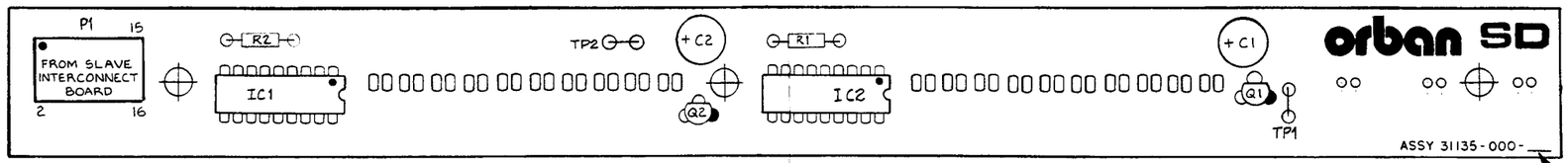
ITEM	LAST USED	NOT USED
C	18	
CR	4	
Q	2	
P	6	
R	8	
SW	1	
TP	6	

orban®

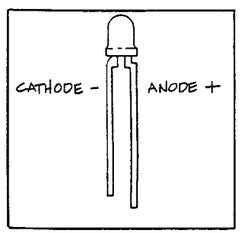
TITLE:
SCHEMATIC
SLAVE INTERCONNECT
61040-000-02



SOLDER SIDE
SHOWN UPSIDE DOWN (SECOND ASSEMBLY)



COMPONENT SIDE



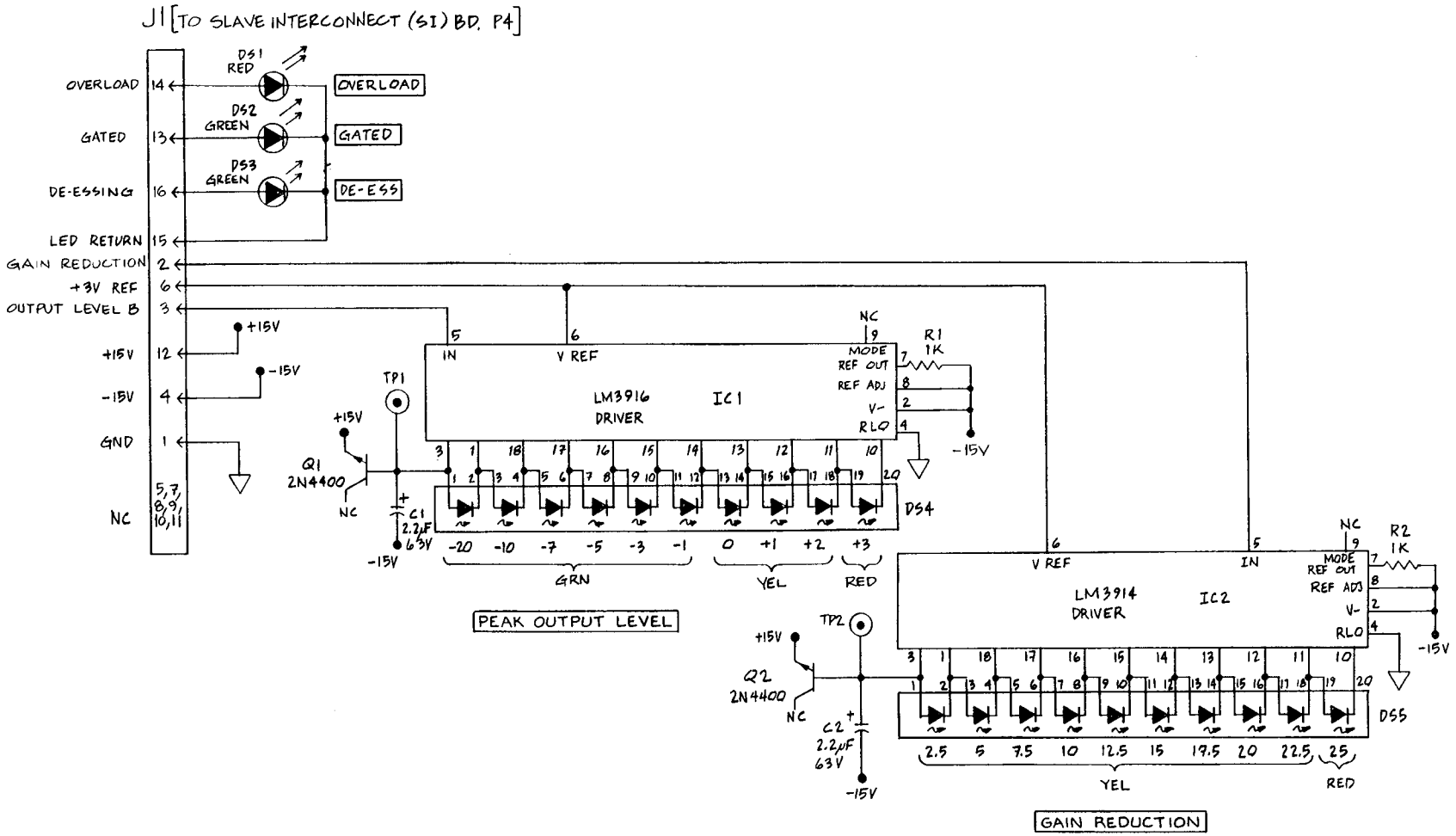
POLARITY OF LED

1. TIC MARKS INDICATE PIN 1 OF IC'S, EMITTER OF TRANSISTORS POSITIVE SIDE OF CAPACITORS AND PIN 1 OF CONNECTORS.

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban®

TITLE:
ASSEMBLY DRAWING
SLAVE DISPLAY
31135-000-02



1. ALL RESISTORS ARE 1/8W, ±1%, MF.

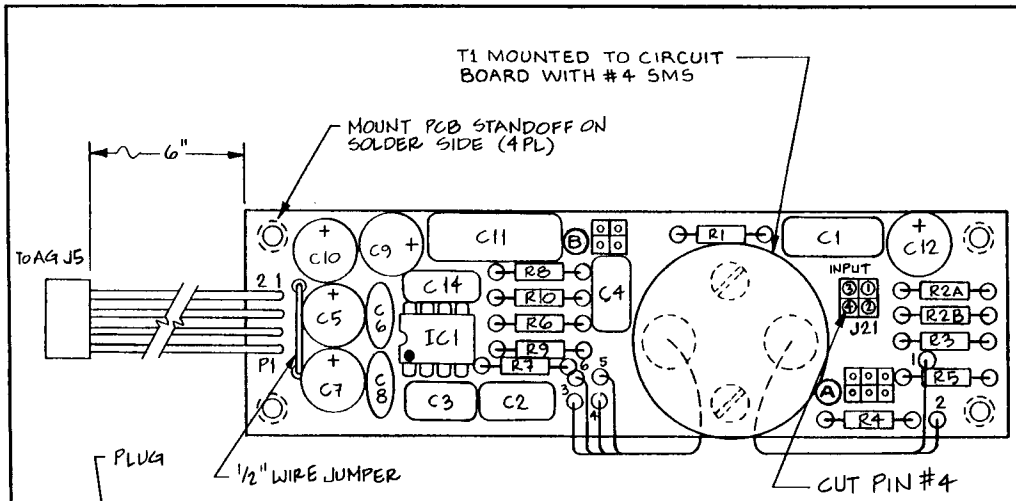
NOTES: (UNLESS OTHERWISE SPECIFIED)

REFERENCE DESIGNATORS

ITEM	LAST USED	NOT USED
C	2	
DS	5	
IC	2	
Q	2	
R	2	
TP	2	
P	1	

orban®

TITLE:
SCHEMATIC
SLAVE DISPLAY
61041-000-01



WIRE LIST FOR P1		
COLOR	FROM	TO
BLK	P1-1	CONN-1
WHT/BLK	-2	-2
BRN	-3	-3
——	-4	-4
RED	-5	-5
WHT/RED	-6	-6
ORN	-7	-7
WHT/ORN	-8	-8

TRANSFORMER CONN'S	
COLOR	TO
T1- RED	1
- BRN	2
- WHT	3
- BLK	4
- ORN	5
- YEL	6

COMPONENT SIDE

BERG CONN. END VIEW

+48V PHANTOM POWER { OUT, IN

JUMPER (B) (SHOWN AS SHIPPED)

OUT IN 20dB PAD

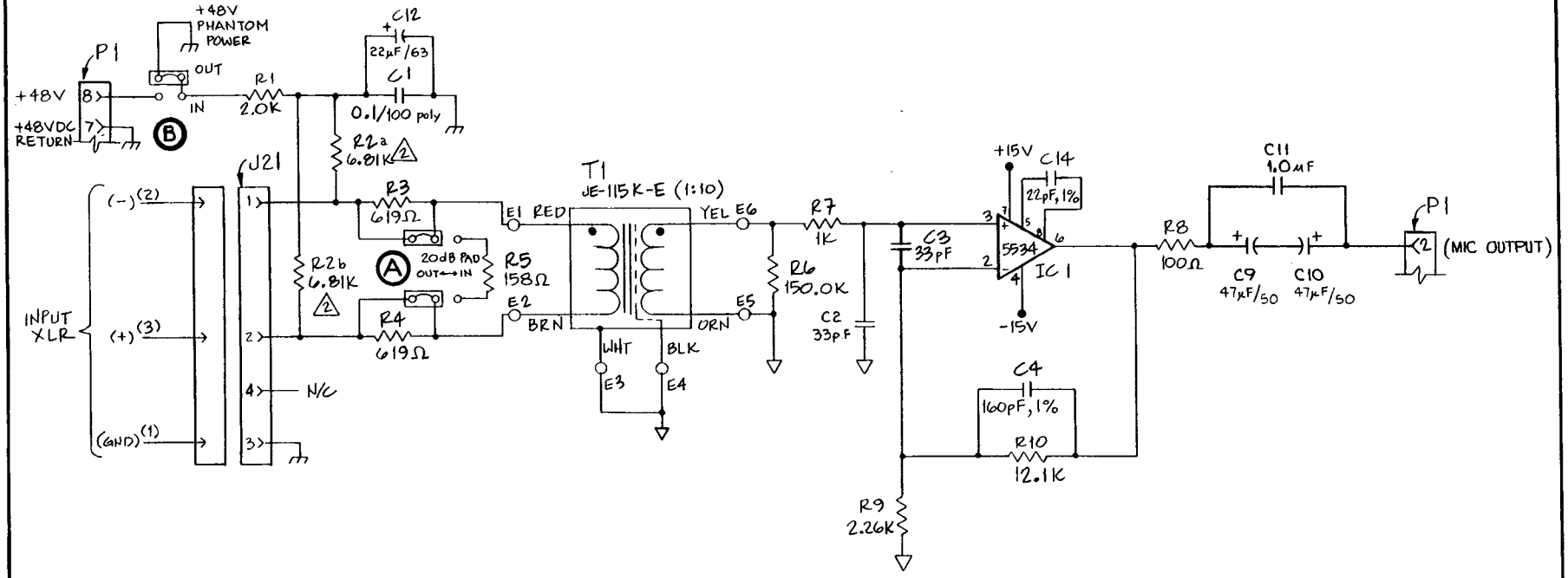
JUMPER (A) (SHOWN AS SHIPPED)

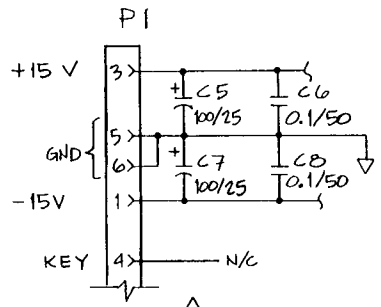
1. TIC MARKS INDICATE PIN # 1 OF IC'S, POS. SIDE OF CAPS & PIN # 1 OF CONNECTORS

NOTES: (UNLESS OTHERWISE SPECIFIED)

orban®

TITLE: ASSEMBLY DRAWING MIC OPTION 31115-000-02





2 SELECTED

1. JUMPERS SHOWN AS SHIPPED

NOTES: (UNLESS OTHERWISE SPECIFIED)

REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
R	10	
C	14	13
IC	1	
E	6	
T	1	

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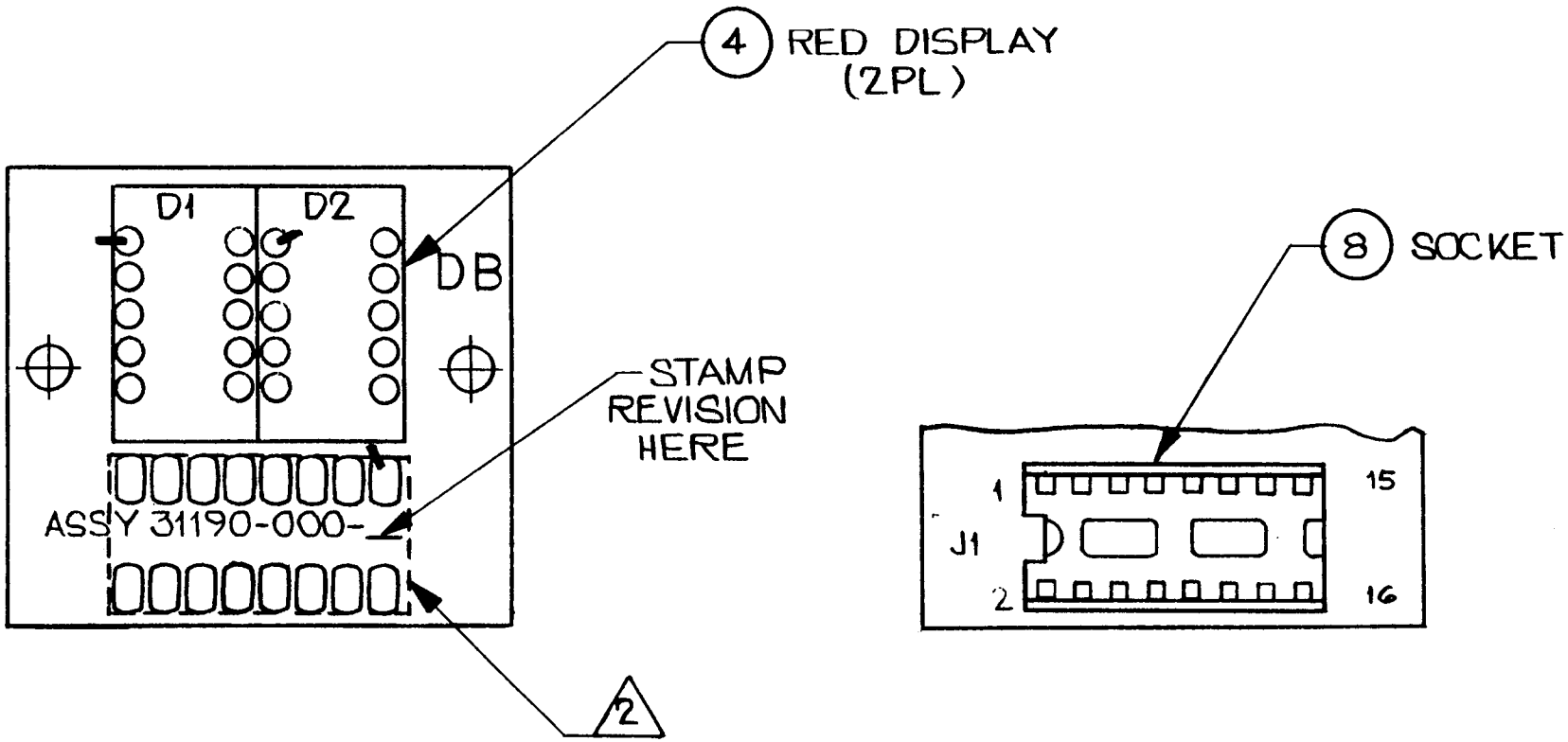
TITLE:
SCHEMATIC
MIC OPTION BOARD
61035-000-01



COMPONENT SIDE

SOLDER SIDE

2. DOTTED COMPONENT TO BE INSTALLED ON SOLDER SIDE AS SHOWN
1. TIC MARKS INDICATE PIN #1 OF LED'S, PIN #1 OF CONNECTOR.
NOTES: (UNLESS OTHERWISE SPECIFIED)

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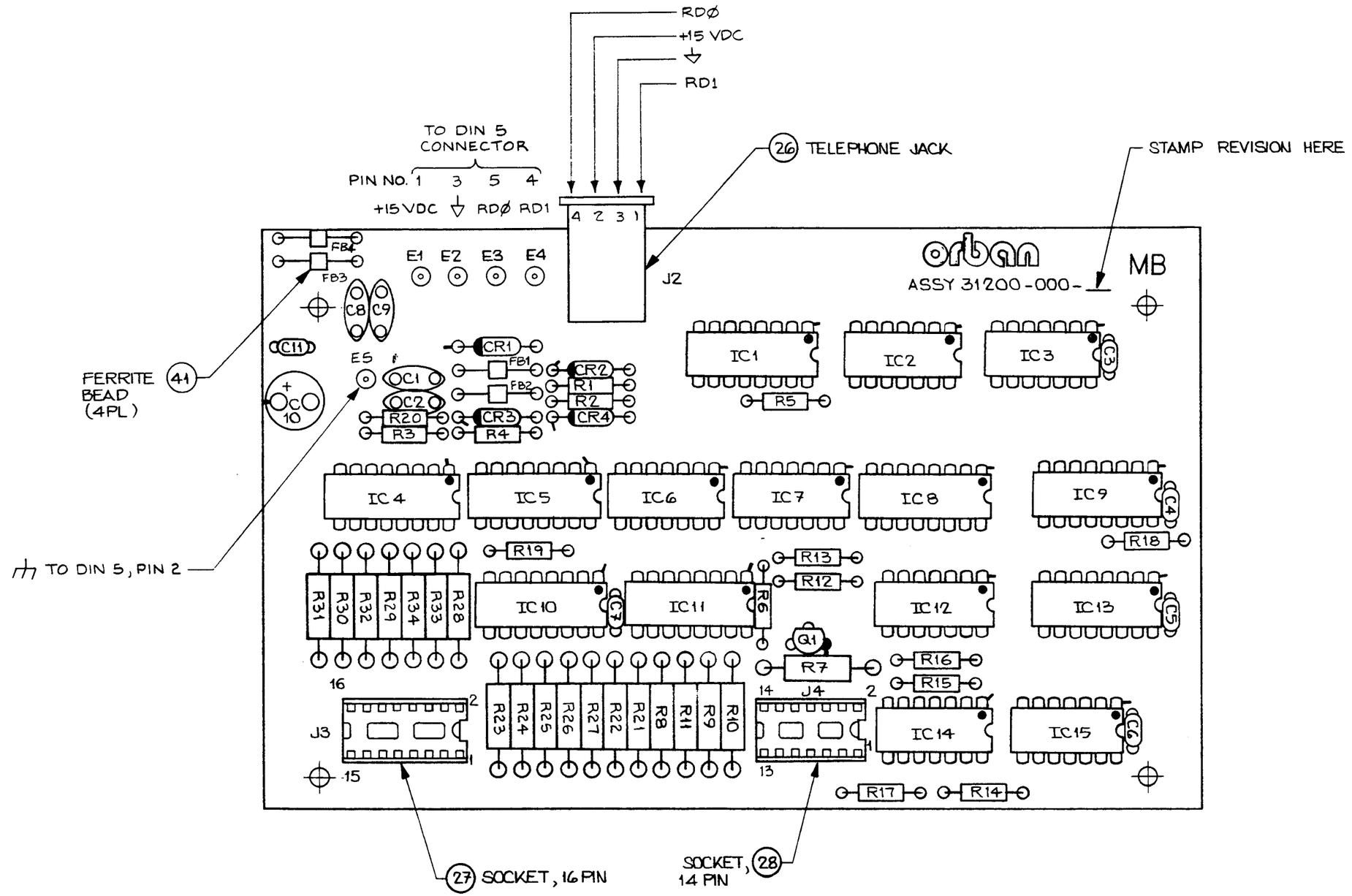
TITLE: PCB ASSEMBLY
REMOTE CONTROL
DISPLAY BOARD (DB)
31190-000-01



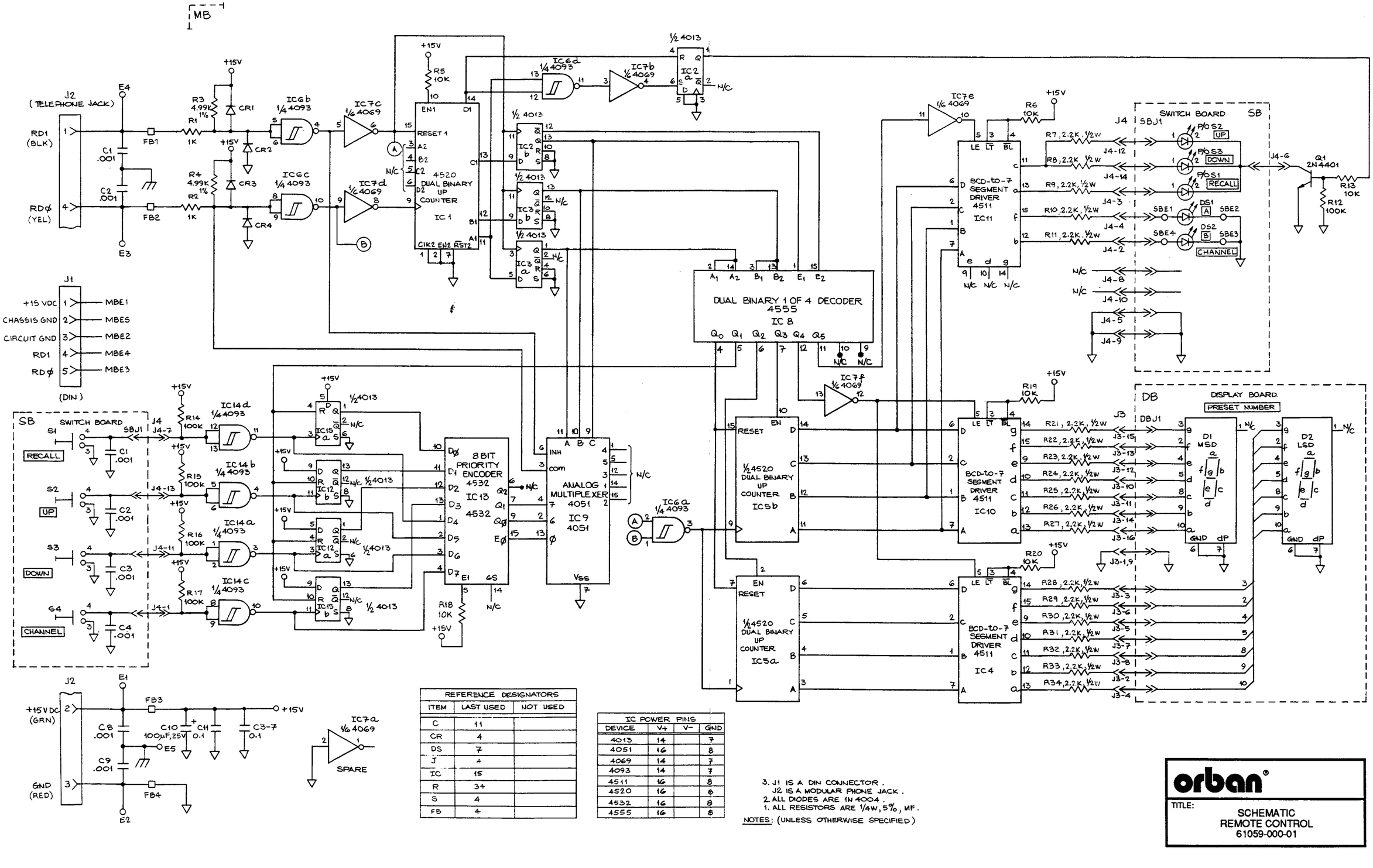
2. TIC MARKS INDICATE PIN #1 OF IC, PIN #1 OF CONNECTORS, CATHODE OF DIODES, POS. SIDE OF CAPACITORS, EMITTER OF TRANSISTOR.
1. REFERENCE SCHEMATIC DWG. NO. 61059-000

NOTES: (UNLESS OTHERWISE SPECIFIED)

COMPONENT SIDE

orban®

TITLE:
PCB ASSEMBLY
REMOTE CONTROL (MB)
31200-000-02



REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
C	11	
CR	4	
DS	7	
J	4	
IC	15	
R	34	
S	4	
FB	4	

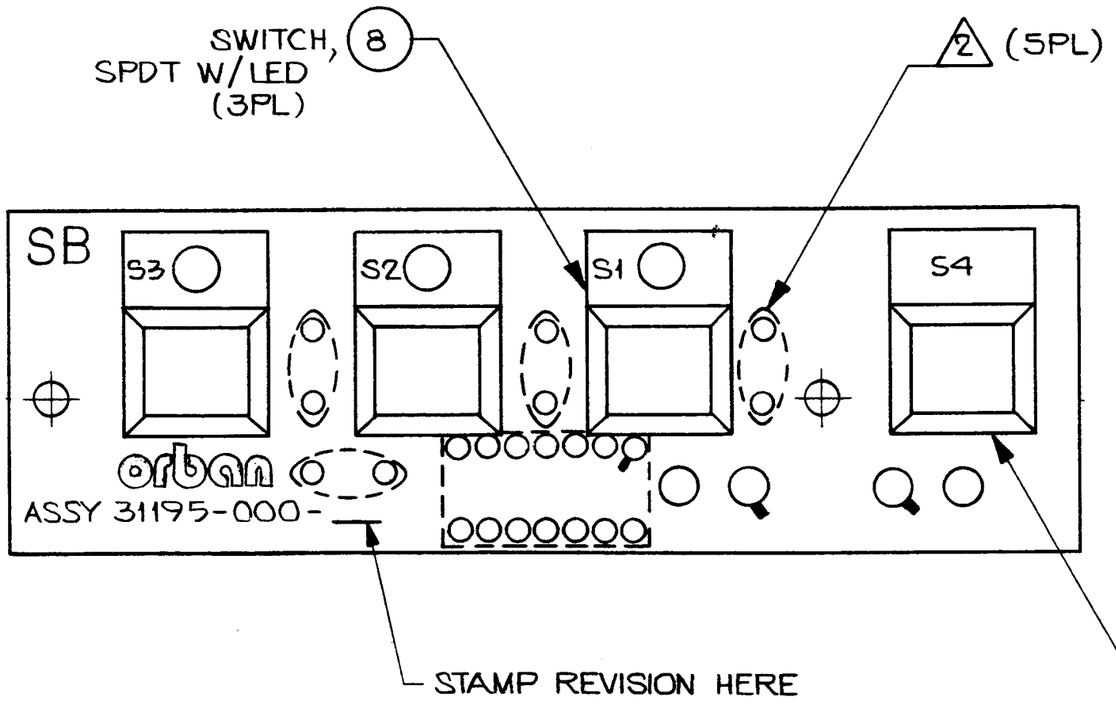
IC POWER PINS			
DEVICE	V+	V-	GND
4013	14		7
4051	16		8
4069	14		7
4093	14		7
4511	16		8
4520	16		8
4532	16		8
4555	16		8

3. J1 IS A DIN CONNECTOR. J2 IS A MODULAR PHONE JACK.
2. ALL DIODES ARE 1N4004.
1. ALL RESISTORS ARE 1/4W, 5%, MF.

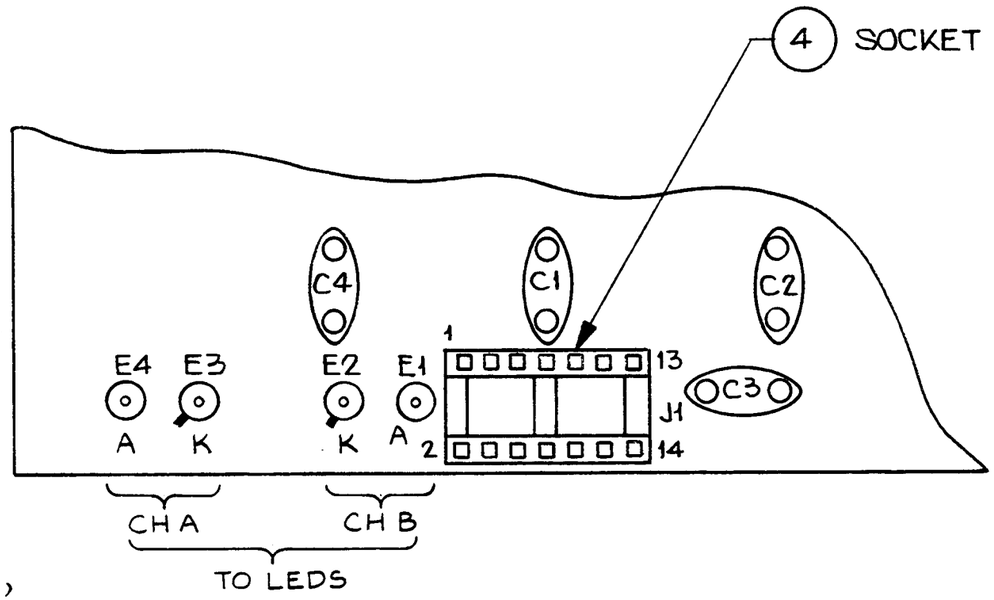
NOTES: (UNLESS OTHERWISE SPECIFIED)

orban®

TITLE: SCHEMATIC REMOTE CONTROL 61059-000-01



COMPONENT SIDE



SOLDER SIDE

2. DOTTED COMPONENTS TO BE INSTALLED ON SOLDER SIDE AS SHOWN.
1. TIC MARKS INDICATE PIN #1 OF CONNECTOR, CATHODE OF LED'S.
NOTES: (UNLESS OTHERWISE SPECIFIED)

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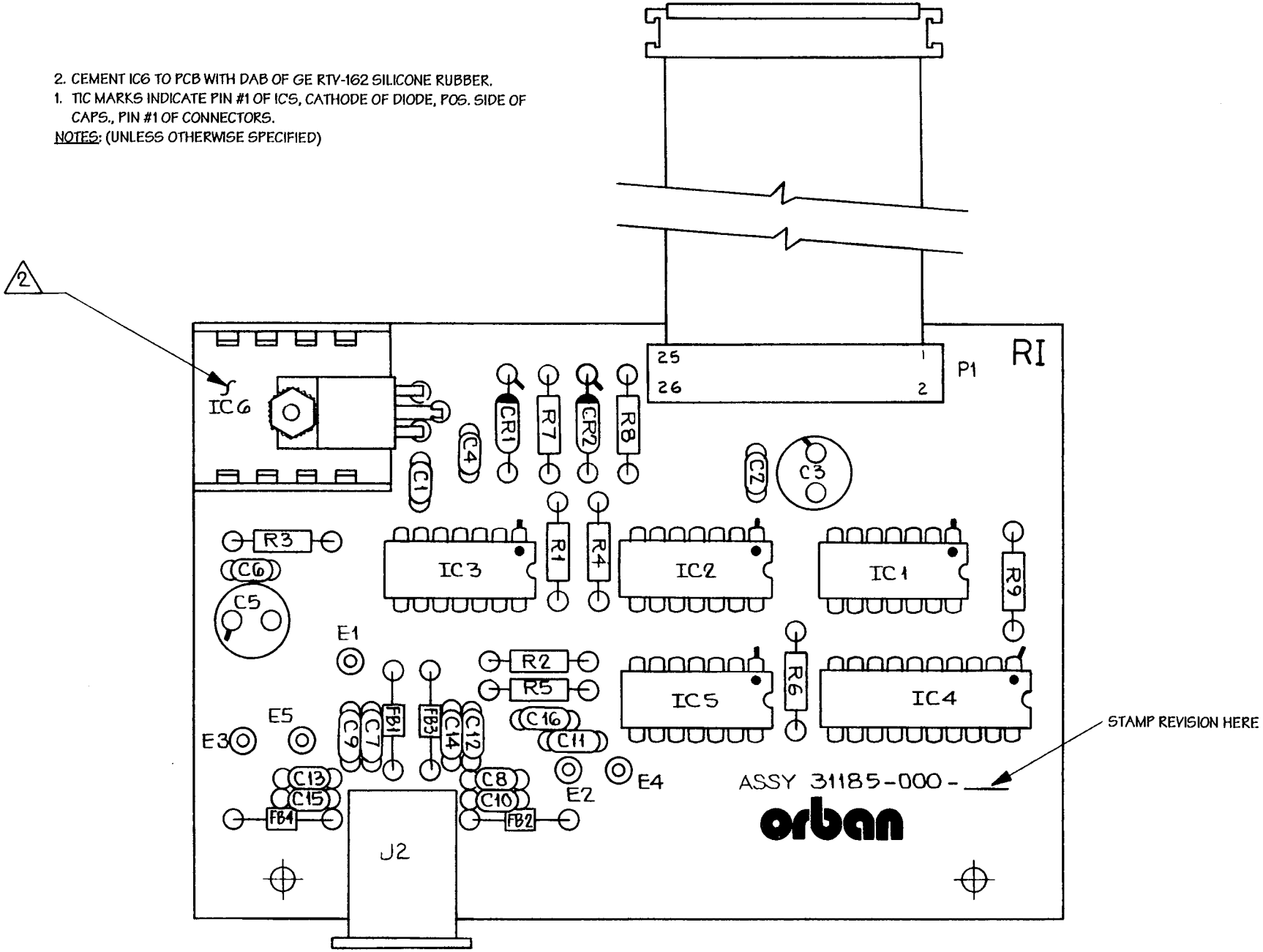
TITLE: PCB ASSEMBLY
REMOTE CONTROL
SWITCH BOARD (SB)
31195-000-01

2. CEMENT IC6 TO PCB WITH DAB OF GE RTV-162 SILICONE RUBBER.
1. TIC MARKS INDICATE PIN #1 OF ICS, CATHODE OF DIODE, POS. SIDE OF CAPS., PIN #1 OF CONNECTORS.

NOTES: (UNLESS OTHERWISE SPECIFIED)



COMPONENT SIDE

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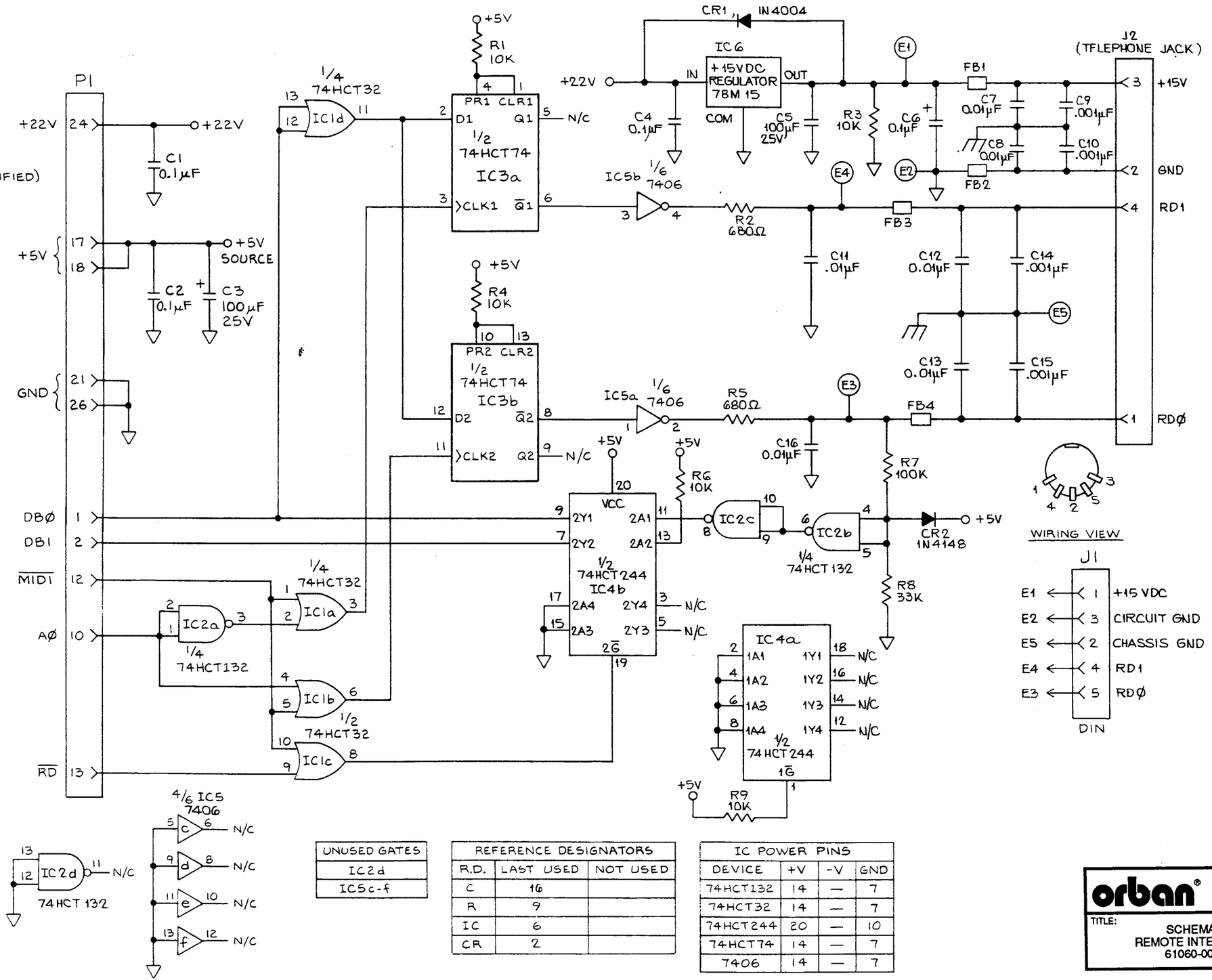
TITLE:
PCB ASSEMBLY
REMOTE INTERFACE (RI)
31185-000-02

NOTES:(UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTORS ARE 1/4W, 5%



UNUSED GATES
IC2d
IC5c-f

REFERENCE DESIGNATORS		
R.D.	LAST USED	NOT USED
C	16	
R	9	
IC	6	
CR	2	

IC POWER PINS			
DEVICE	+V	-V	GND
74HCT132	14	—	7
74HCT32	14	—	7
74HCT244	20	—	10
74HCT74	14	—	7
7406	14	—	7

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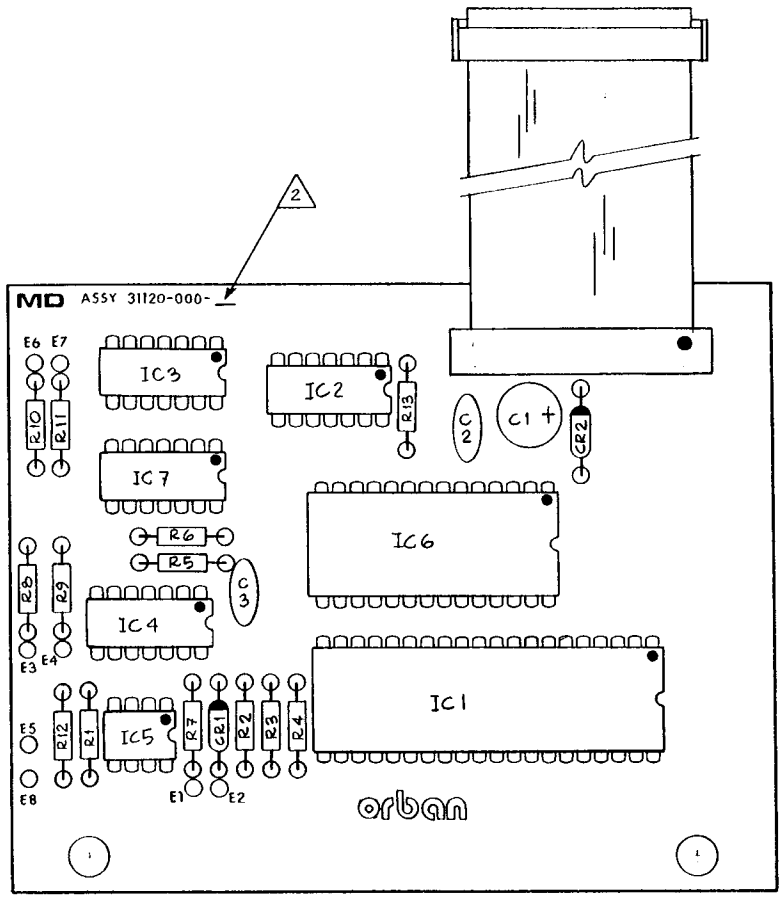
TITLE: SCHEMATIC
REMOTE INTERNAL (RI)
61060-000-01



COMPONENT SIDE

REFERENCE WIRELIST

FROM	TO	FUNCTION
E1	J1-4	IN
E2	J1-5	IN
E3	J2-4	THRU
E4	J2-5	THRU
E5	J2-2	GND
E6	J3-4	OUT
E7	J3-5	OUT
E8	J3-2	GND

2 MARK ASSEMBLY REV. LEVEL IN SPACE PROVIDED

1. TIC MARKS INDICATE PIN # 1 OF IC'S, CATHODE OF DIODE, POS. SIDE OF CAPS & PIN # 1 OF CONNECTOR

NOTES: (UNLESS OTHERWISE SPECIFIED)

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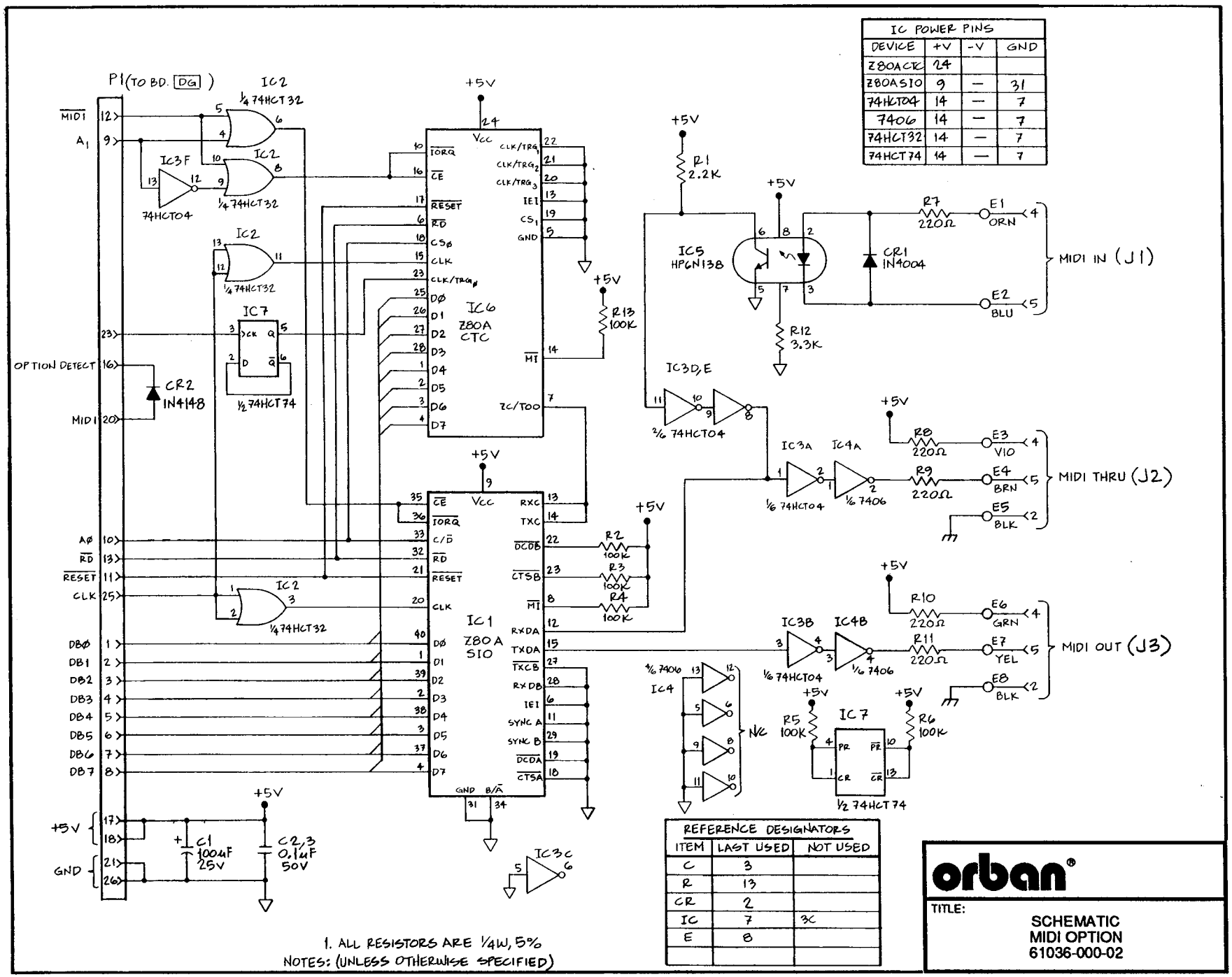
TITLE:
ASSEMBLY DRAWING
MIDI OPTION
31120-000-02



IC POWER PINS			
DEVICE	+V	-V	GND
Z80ACTC	24		
Z80ASIO	9	—	31
74HCT04	14	—	7
7406	14	—	7
74HCT32	14	—	7
74HCT74	14	—	7

REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
C	3	
R	13	
CR	2	
IC	7	3C
E	8	

1. ALL RESISTORS ARE 1/4W, 5%

NOTES: (UNLESS OTHERWISE SPECIFIED)

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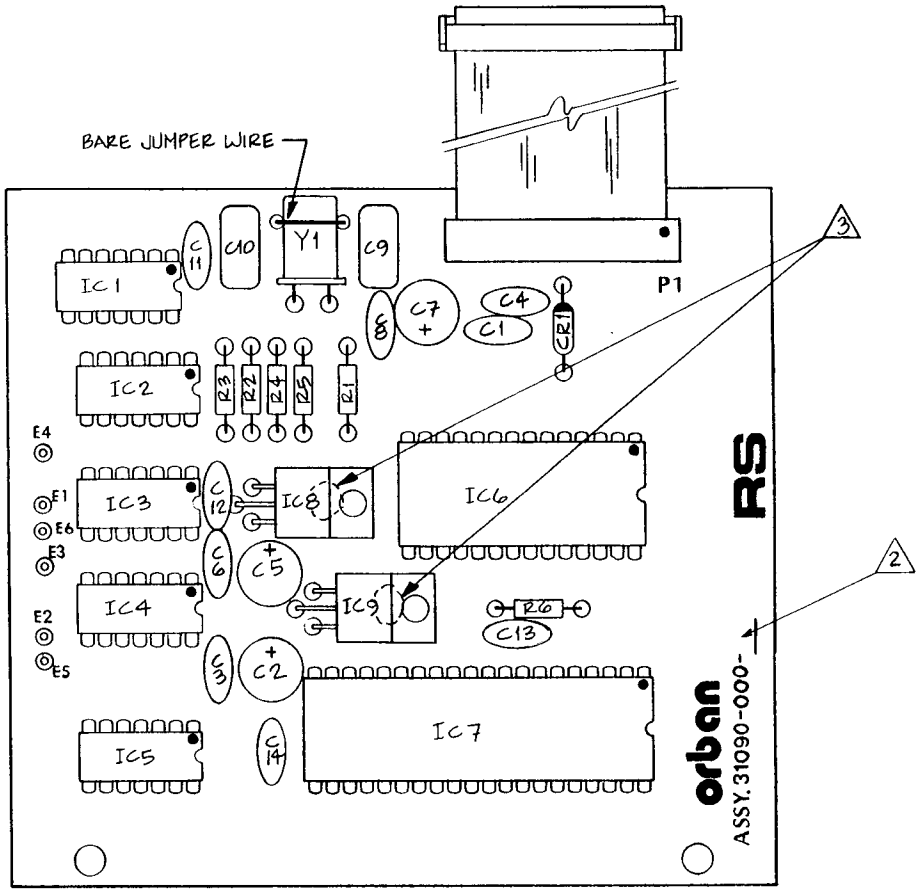
TITLE:
SCHEMATIC
MIDI OPTION
61036-000-02



REFERENCE WIRELIST

FROM	TO	FUNCTION
E1	J1-2	TxD
E2	J1-3	RxD
E3	J1-5	CTS
E4	J1-4	RTS
E5	J1-6	DSR
E6	J1-20	DTR
E7	J1-7	SIG. GND
E8	J1-1	CHAS. GND

COMPONENT SIDE

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. TIC MARKS INDICATE PIN Nº 1 OF IC'S, CATHODE OF DIODE, POS. SIDE OF CAPS., PIN Nº 1 OF CONNECTOR

△2 MARK ASSEMBLY REVISION LEVEL, WITH RED MARKER IN SPACE PROVIDED.

△3 CEMENT IC8 & IC9 TO PCB WITH DAB OF GE RTV-162 SILICONE RUBBER

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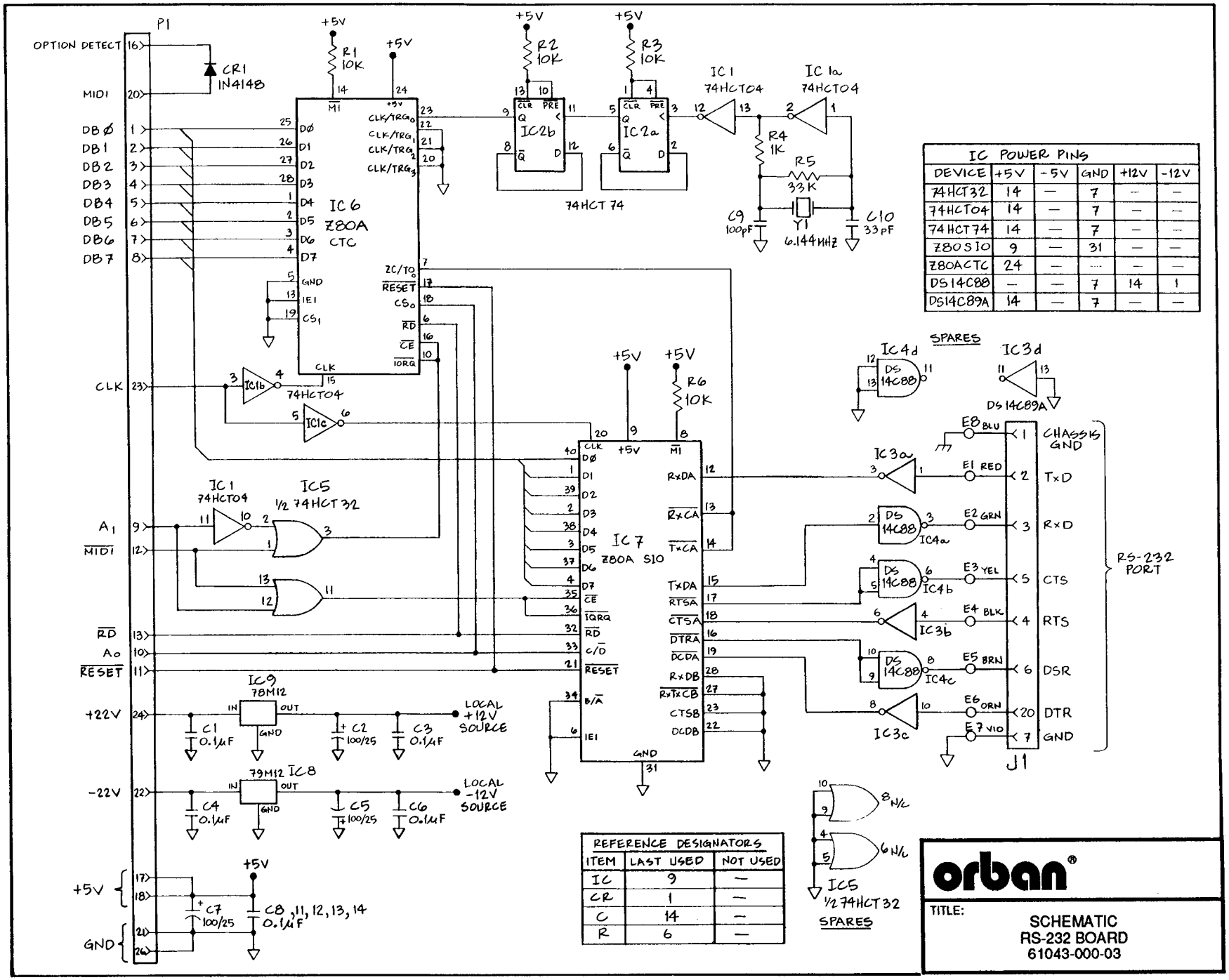
TITLE:
PC ASSEMBLY
RS-232 BOARD
31090-000-02



IC POWER PINS					
DEVICE	+5V	-5V	GND	+12V	-12V
74HCT32	14	—	7	—	—
74HCT04	14	—	7	—	—
74HCT74	14	—	7	—	—
Z80SIO	9	—	31	—	—
Z80ACTC	24	—	—	—	—
DS14C88	—	—	7	14	1
DS14C89A	14	—	7	—	—

REFERENCE DESIGNATORS		
ITEM	LAST USED	NOT USED
IC	9	—
CR	1	—
C	14	—
R	6	—

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TITLE:
SCHEMATIC
RS-232 BOARD
61043-000-03

Abbreviations

Some of the abbreviations used in this manual may not be familiar to all readers:

AGC	automatic gain control
dBu	0dBu = 0.775V RMS. For this application, the dBm-into-600Ω scale on voltmeters can be read as if it were calibrated in dBu.
DJ	disk jockey, an announcer who plays records in a club or on the air
EMI	electromagnetic interference
FCC	Federal Communications Commission (USA regulatory agency)
FET	field effect transistor
G/R	gain reduction
IC	integrated circuit
IM	intermodulation (or "intermodulation distortion")
JFET	junction field effect transistor
LED	light-emitting diode
N&D	noise and distortion
RF	radio frequency
RFI	radio-frequency interference
RMS	root-mean-square
THD	total harmonic distortion
VCA	voltage-controlled amplifier
XLR	a common style of 3-conductor audio connector