Operating Manual

Automatic Stereo Synthesizer

Model 275A

orban®

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

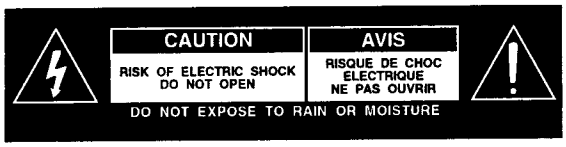
Model Number:	**Description:**
275A/U	Stereo Synthesizer, 115V
275A/E	Stereo Synthesizer, 230V

OPTIONS:

Model Number:	**Description:**
275ARC	Remote Control
275ASPK	Spare Parts Kit
SC1	Clear Security Cover

MANUAL:

Part Number:	**Description**
95053-000-02	275A 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 sòlo con la tensiòn y clase de corriente señaladas en la placa indicadora de caracteristicas.

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

Proteger el cable de alimentaciòn 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 sometar el aparato y el cable de alimentaciòn a esfuerzo mecànico excesivo.

Para evitar el contacto con tensiones eléctricas peligrosas, el aparato no debe abrirse. En caso de producirse fallos de funcionamiento, debe ser reparado sòlo 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 protégerse contra la humedad, impidiendo que penetren ésta o liquidos en el mismo.

En caso de producirse fallos de funcionamiento como consecuencia de la penetraciòn de liquidos 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

Automatic Stereo Synthesizer

Model 275A

orban®

This manual is part number 95053-000-02.
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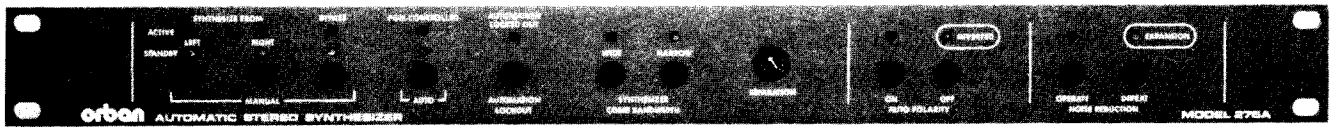
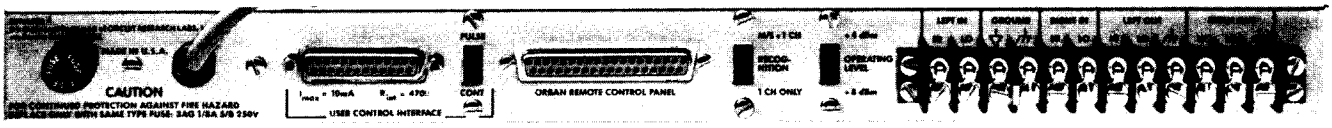


Front Panel



Rear Panel

ORBAN MODEL 275A AUTOMATIC STEREO SYNTHESIZER

SECTION 1:
System Description And Application

1. PERFORMANCE HIGHLIGHTS

-- Stereo inputs and outputs
Designed to be placed permanently in series with the program line.

-- Fully compatible with mono receivers
They reproduce the synthesizer's original mono input.

-- Audio-controlled switching between true and synthesized stereo
Synthesizer is activated when audio is absent on one channel and, optionally, when both channels are nearly equal. In addition, local and remote manual override control is available.

-- Smooth "cross-fade" switching between modes
Program-adaptive crossfade rate avoids clicks and pops.

-- Automatically detects and corrects polarity-reversals
Automatically corrects "out-of-phase" stereo inputs.

-- Phase-shift-derived comb filter stereo synthesis
Orban's patented phase-shift-derived comb filter stereo synthesis technique. Two remote-selectable stereo synthesis modes allow matching the spatial perspective to the program material. "Narrow" mode centers dialogue. "Wide" is more dramatic on music and effects.

-- Single-ended dynamic noise reduction
A combination of program-controlled lowpass filtering and downward expansion is available for noise reduction on synthesized material. 10dB reduction of hiss and hum is typically achieved.

-- Optically-isolated automation control of all functions

-- Optional 19" rack-mount Remote Control Panel
Duplicates main unit control panel.

-- Fully-balanced, transformerless inputs and outputs
+26dBm clipping level permits use with +4 or +8dBm lines.

-- Space-saving chassis
Mounts in 1 3/4" of rack space.

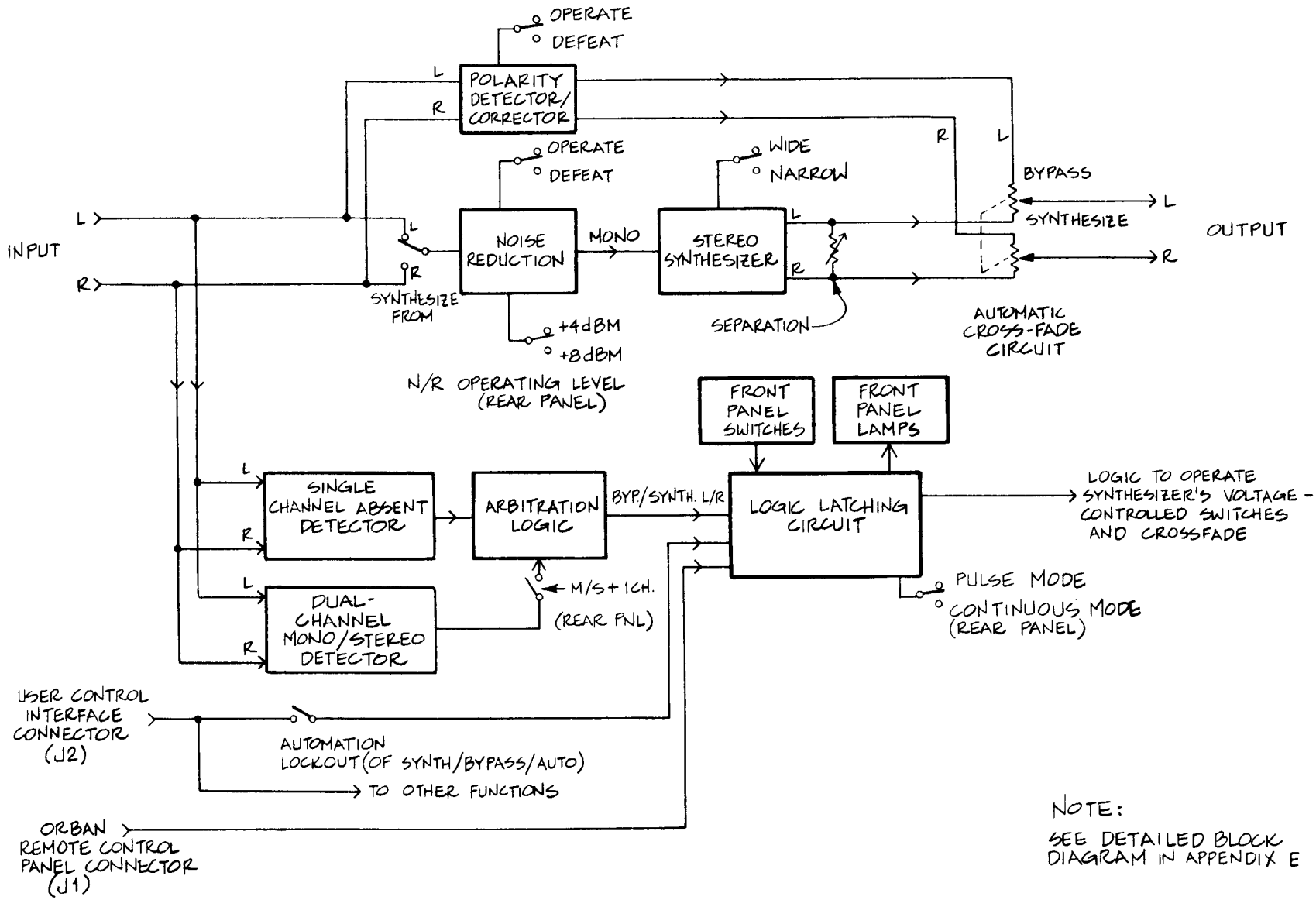


Fig. 1-1: Conceptual Block Diagram, Model 275A Automatic Stereo Synthesizer

2. PRODUCT OVERVIEW

Because of the continuing use of program material with mono soundtracks in the age of stereo TV, most TV stereo broadcasters need an automatic device that monitors the program audio and that effectively reprocesses mono material into pseudo-stereo, augmenting the entertainment value of mono material without operator intervention.

The Orban 275A performs this function and also includes other useful features and functions.

The four primary functions are:

1) Mono/Stereo Detection and/or Single-Channel Recognition
2) Stereo Synthesis of Mono Material
3) Automatic Reverse-Polarity Detection And Correction (for true stereo material)
4) Dynamic Noise Reduction (in Synthesize mode only)

Fig. 1-1 shows a conceptual block diagram which may be helpful in understanding the unit. A more complete explanation of the functions is found in **Section 3 (Operating Instructions).**

1) Mono/Stereo Detection

Mono source material is automatically distinguished from stereo by two techniques: if a) audio is absent from one channel, or b) both channels have nearly identical material, the source is considered mono and the stereo synthesizer is activated. Otherwise, the source is considered stereo and the signal bypasses most of the rest of the system.

Some slack is provided in the recognition circuitry to compensate for the interchannel phase shifts and level imbalances inevitable in real-world operations. The amount of slack is internally adjustable by the user.

The recognition technique based on nearly identical channels can be defeated by a rear-panel switch. Then, operation of the stereo synthesizer can be controlled unambiguously in production by muting one channel when stereo synthesis is desired and by providing both channels when Bypass mode is desired, thus improving the reliability of automatic detection.

NOTE:

While the transition between true stereo and synthesized stereo is graceful, certain types of "stereo" program material may cause overly frequent transitions. An example is a talk show where center-channel (i.e., mono) dialogue is frequently alternated with music or crowd noises. In such cases, it may be desirable to make the unit treat <u>all</u> material as stereo by forcing the unit into Bypass mode manually (or with overriding automation).

Error-free recognition of most stereo programs is technically impossible because equal material in both channels will always be recognized as mono (by definition). The Orban 275A is superior because it makes fewer errors than other units.

In addition, special signal and control nodes have been brought out on a rear-panel connector to readily interface future circuitry that might be developed to further reduce the incidence of errors.

Appendix D provides instructions for building a circuit that introduces a differential phase shift of 20^{o} to 30^{o} between the left and right channels over a frequency range of 100-1000Hz. This phase shift has negligible effect upon the stereo imaging and mono sum, but will unambiguously force all stereo program material passed through it to be recognized as stereo. True stereo material can thus be encoded through this circuit prior to broadcast to assure that the recognition circuit cannot switch to Synthesize mode. It is hoped that the networks will use a similar means to automatically encode true stereo material to avoid recognition errors.

2) Stereo Synthesis

The Stereo Synthesizer operates on mono material only. It creates a pseudo-stereo effect from the mono by dividing the audio spectrum into several frequency bands and by directing these bands alternately to the left and right channels. The ear perceives this as a stereo-like effect with substantial depth and a relatively wide spatial perspective, but with little specific directionality. The mono listener receives the stereo sum signal, which is identical to the mono input (or the mono input as processed by the Noise Reduction circuit, if activated), and which is free from phase cancellations and other errors.

When the synthesizer is automatically activated by recognition of nearly identical channels, stereo is synthesized from the left channel. If the synthesizer is automatically activated by recognition of "one-channel-only", it will synthesize from the active input channel. Either left or right channel inputs can be selected for synthesis -- manually, or remotely by external automation.

(Due to the potential for small phase discrepancies between the left and right channels in most plants, we do not provide a method of synthesizing from the sum of the channels, which is likely to be slightly degraded by phase cancellations.)

The stereo synthesizer has two modes: Wide and Narrow. The Wide mode creates a few wide frequency bands and results in a dramatic sense of stereo space on music and effects. The Narrow mode creates many narrow frequency bands and is better suited for programs heavy in dialogue where it is important that voices appear from the center of the stereo space. In Narrow mode, the stereo impression on music is less vivid. A SEPARATION control allows adjustment of the relative width of the stereo soundstage.

The Wide or Narrow mode is selected manually or by an external automation system.

3) Automatic Polarity Detector/Corrector

This circuit operates on stereo material (in Bypass mode) only. The channels are monitored for a polarity reversal (which could seriously affect the quality of the mono sum). When a polarity reversal is detected, it is automatically corrected. Such polarity reversals can occur due to errors in production, transmission, or patching.

This feature may be turned on and off manually or by automation. It may be desirable to turn it off when broadcasting Dolby^{R} stereo soundtracks, since out-of-phase "surround" information has been purposely mixed into many such tracks to activate the rear-channel "surround" speakers in a theater. Such material, if it dominates the mix, may falsely trigger the Automatic Polarity Corrector.

4) Noise Reduction

Noise reduction operates on synthesized mono material only. Stereo material is not generally contaminated by excess noise and would not greatly benefit from this type of noise reduction. This single-ended dynamic noise reduction system can be used with any mono program material to achieve lower noise while minimizing perceived high frequency loss due to the noise reduction function. It is particularly useful for films with optical sound.

The noise reduction function combines program-controlled lowpass filtering (to reduce hiss) with wideband downward expansion (to reduce low-level hum, rumble, sprocket noise, and other such noise).

The noise reduction is activated or defeated manually or by external automation.

5) Other Features

All functions can be selected at the front panel or at the optional Orban Remote Control Panel 275A/RC, which may be located up to about 5000 feet away from the main 275A chassis (see **Appendix C**). The 275A can be also controlled by an external automation system. (In case of automation problems, the manual controls can override those automation signals which select stereo synthesis modes.)

The automation signals controlling stereo synthesis may be either continuous voltages or pulses, depending on the setting of the rear-panel PULSE/CONTINUOUS switch. In PULSE mode, the automation duplicates the function of the buttons: A pulse will latch the logic. In CONTINUOUS mode, a continuous automation voltage will immediately override the manual controls; the logic will revert to its former state ("standby" state) when the voltage is removed.

The standby state may even be changed by means of the buttons <u>while</u> an overriding voltage is present; the synthesizer will not change state until the continuous voltage is removed. The standby state will usually be AUTO (i.e., control by the 275A's internal recognition circuit), although any other state may be chosen if appropriate.

These various alternatives provide considerable flexibility in integrating the 275A with various automation schemes.

Stereo inputs and outputs are active-balanced. Inputs are bridging and can be selected for +4dBm or +8dBm nominal levels by means of a rear-panel switch. Outputs can provide +26dBm into 600 ohms. Normally, 150:600-ohm transformers must be used in 150-ohm systems.

SECTION 2:
Installation

1. OVERVIEW OF INSTALLATION PROCEDURE

1. Read **Section 1 (System Description and Application).**
2. Install optional remote control and set internal plug, if desired.
3. Reposition internal powerup jumpers, if desired.
4. Check AC power strapping; restrap, if desired.
5. Mount unit in rack.
6. Connect audio inputs and outputs; set rear-panel OPERATING LEVEL switch.
7. Set rear-panel center-channel RECOGNITION switch.
8. Perform initial program tests.
9. Connect automation through User Control Interface, if desired.
10. Return Registration Card to Orban.

IMPORTANT

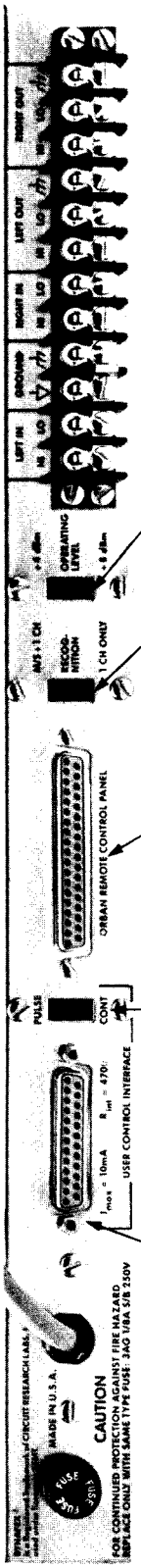
READ THE INSTRUCTIONS IN THIS SECTION. This unit may not function properly unless these instructions are followed carefully.

DO NOT MOUNT THE UNIT DIRECTLY ABOVE LARGE, HEAT-PRODUCING DEVICES, such as vacuum-tube power amplifiers, as this may shorten component life. Ambient temperature should not exceed 113°F (45°C) with equipment on.

If you are installing the optional Orban Remote Control Panel 275A/RC, and/or if you are going to use the synthesizer audio loop-through connection (on the User Control Interface connector) to add external processing to the synthesized signal, **DO NOT MOUNT THE MAIN CHASSIS in the rack until you have read Sections 2.2 (Remote Control) and 2.9 (External Automation).**

WARNING

DO NOT DEFEAT AC POWER GROUND. 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. Such voltage can cause electrical shock resulting in severe injury or death.



OPERATING LEVEL set-up switch:
Selects +4dBm or +8dBm nominal operating level (labels valid for 600-ohm systems only). Affects only the Noise Reduction circuit, changing its threshold as appropriate.

RECOGNITION set-up switch:
Determines the recognition method of the AUTO recognition circuit: one-channel-absent is always recognized; when the switch is set to M/S+1CH, nearly identical material on both channels is also recognized.

Orban REMOTE CONTROL PANEL 275A/RC connector:
(Mates with DC-37M connector, supplied with 275A/RC.) Carries lines for the duplication of all controls and indicators appearing on the front panel, except for the SEPARATION control. To use this connector, an internal plug must be moved (see following page). If this plug is in the wrong position, no front-panel lamps will light and the unit will not operate normally.

Automation Mode set-up switch:
The PULSE setting causes the logic to latch on incoming automation pulses (through the 25-pin USER CONTROL INTERFACE connector). The CONTINUOUS setting causes the logic state to follow continuous voltages and to revert to the standby default state when no voltage is present. (See **Other Features** in **Section 1.**)

USER CONTROL INTERFACE connector:
(Mates with DB-25M connector, not supplied.) Offers optically-isolated inputs to interface with external automation. Allows control of all front-panel functions except SEPARATION control. Also includes audio and control nodes to interface with auxiliary equipment that may be developed in the future. (See **Appendix C** for wiring instructions.)

Fig. 2-1: Rear-panel Connectors and Switches

2. REMOTE CONTROL PANEL 275A/RC (Optional)

[See **Appendix C** for wiring instructions.]

The Remote Control Panel replicates the main chassis' front panel, except that the SEPARATION control is omitted. The Panel is powered from the main chassis, and is connected to it by means of a 19-pair cable terminated at both ends with a 37-pin DC-37 connector. Both connectors are supplied. The customer must provide the cable. Strictly speaking, shielding of the cable is unnecessary (although it may be wise in a high-RF environment). The only requirement is that the total end-to-end resistance of any wire within the cable be less than 100 ohms. Check before you buy to make sure that the cable is compatible with your plant wiring practices and local building codes. Some cable suggestions are shown in **Appendix C.**

To configure the main chassis: Remove the top cover of the main chassis. The unit is shipped from the factory with one ribbon cable from the front panel plugged into a 16-pin DIP socket, J5, located towards the rear panel. This is correct for non-remote operation. For remote operation, this cable must be unplugged from J5 and plugged into J4, which is immediately to the right of J5 when observed with the front panel facing you (see Fig. 2-2).

IMPORTANT!

Since all lamps are wired in series (including those which activate the 275A's optically-coupled crossfade function), the 275A will not work (although it will not be damaged) if the cable is plugged into J4 when the 275A/RC Remote Control Panel is not correctly connected. In particular, no lamps will light. If the Remote Control Panel is to be disconnected for any reason, the 275A's internal cable **must either be repositioned to J5, or an appropriate external user-supplied jumper plug must be inserted in the Remote Control Panel connector** to achieve normal operation. See **Appendix C** for a wiring diagram.

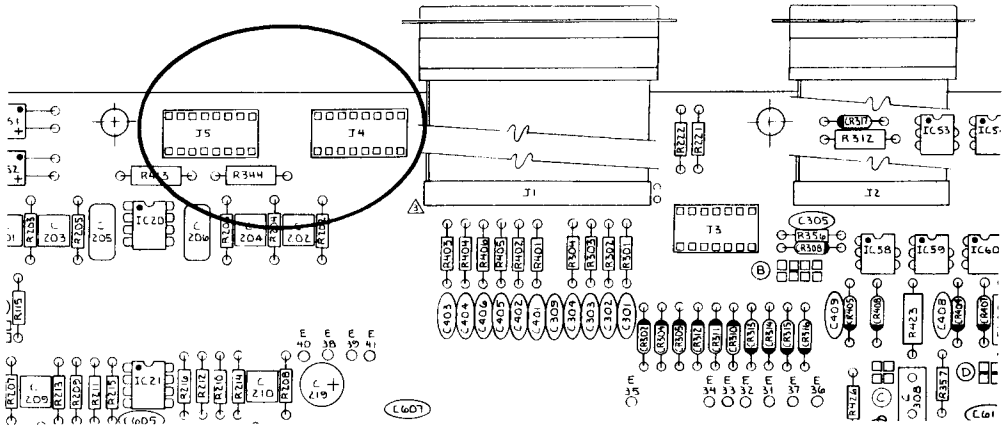


Fig. 2-2: Chassis Configuration For Remote Control Operation

3. POWER-UP JUMPERS

As shipped, the 275A will power up as indicated in following table. To select an alternative power-up configuration, reposition the appropriate jumpers according to Fig. 2-3.

	As Shipped	Alternatives	Jumper
Mode	AUTO	SYNTH FROM L SYNTH FROM R BYPASS	B
Auto Polarity	ON	OFF	C
Comb Bandwidth	NARROW	WIDE	E
Noise Reduction	OPERATE	DEFEAT	D

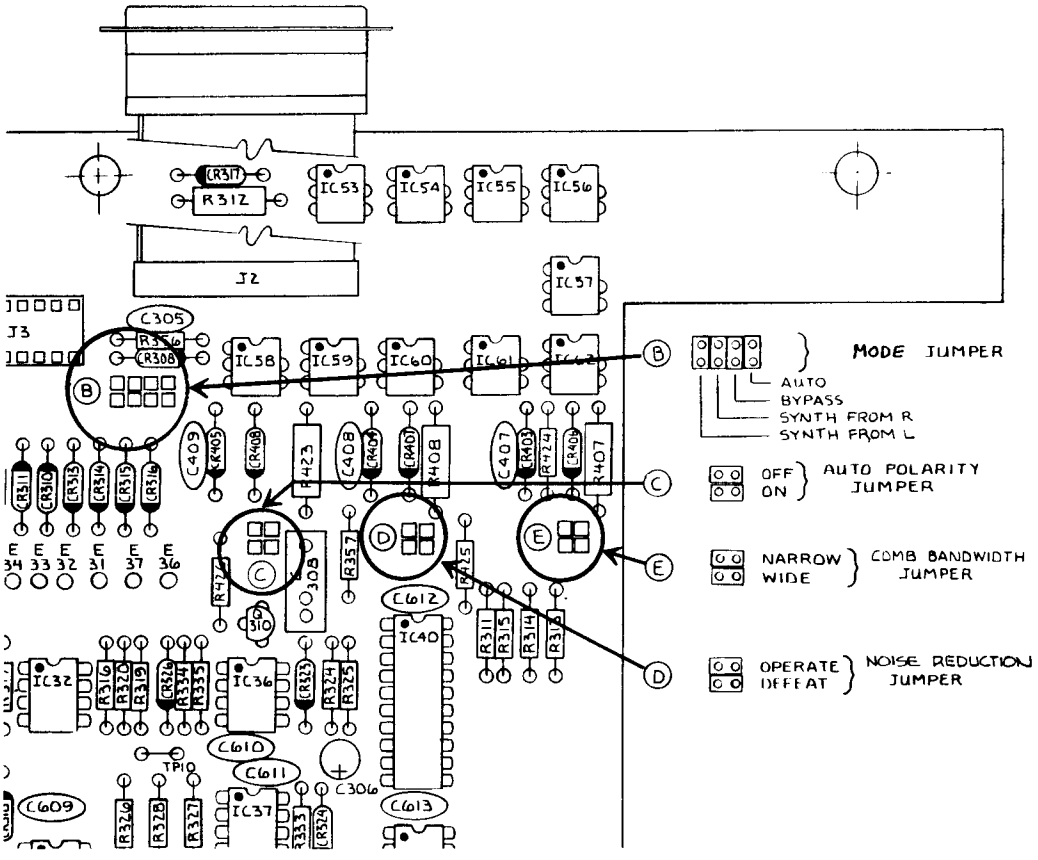


Fig. 2-3: Powerup Jumpers

4. AC POWER

The power transformer can be connected for 115-volt or 230-volt, 50 or 60Hz AC operation. If a 230-volt option was specified when the unit was ordered, a tag on the power cord warns of the modification.

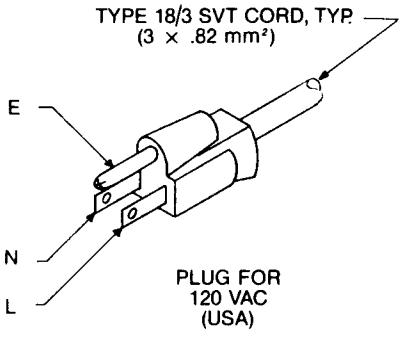
The two primary windings of the power transformer are connected in parallel for 115-volt operation and in series for 230-volt operation. (See the **Schematic Diagram** in **Appendix E.**)

To strap the power transformer for a different voltage, remove the top cover. Strapping instructions are found on the insulating fishpaper around the power transformer. It is not necessary to rearrange the heavy insulated wiring; all strapping can be performed with bare jumper wire. Take care not to burn the insulation.

The power cord is ordinarily terminated in a "U-Ground" plug to USA standards. The green/yellow wire (which is connected to the long prong) is connected directly to the 275A chassis. Circuit ground is connected to the chassis ground by means of a single green wire adjacent to the power transformer. If it becomes necessary to isolate the audio ground from the chassis to eliminate hum due to ground loops, this wire may be disconnected.

WARNING!

If the chassis ground itself is defeated, certain ground fault conditions in the unit or in the system to which it is connected can result in appearance of full line voltage between chassis and earth ground. Such voltage is capable of causing electrical shock, possibly resulting in severe injury or death.



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

Fig. 2-4: AC Line Cord Color Coding

5. MOUNTING RACK REQUIREMENTS

Vertical space of one standard rack unit (1 3/4"/4.5cm) is required for the 275A or the 275A/RC Remote Control Panel.

It is expected that either the main chassis or the optional Remote Control Panel would be located at Master Control.

6. AUDIO CONNECTIONS AND OPERATING LEVEL

Inputs and outputs are presented on a Cinch 140-Y barrier strip (#5 screw), which will accommodate either spade lugs or a fanning strip (for quick connect/disconnect).

1) Input:

The inputs are active single-amplifier quasi-balanced bridging, and will clip if levels in excess of +26dB (ref .775V) are applied to them. (High common-mode rejection will be maintained if the impedance driving the inputs is 600 ohms or less.)

A rear-panel switch sets the threshold of the Noise Reduction circuit for various operating levels. Set the switch as follows:

Source Level	Switch
+4dBm/600ohms	+4
+8dBm/600ohms	+8
+8dBm/150ohms (no transformer)	+4
+8dBm/150ohms (150:600-ohm transformer)	+8

2) Output:

The outputs are active balanced-to-ground with a balanced source impedance of 94 ohms. DO NOT GROUND EITHER SIDE OF AN OUTPUT, as this will short one output amplifier to ground through a 47-ohm resistor (although the output amplifiers are protected against short circuits, shorts to ground will thermally stress them, and will also introduce highly distorted currents into the audio ground system which might crosstalk into other signal paths). If you want to drive an unbalanced load, connect it between a (+) output and ground.

The outputs will interface correctly with +4 and +8dBm 600-ohm systems. However, they will tend to clip if an attempt is made to drive a +8dBm 150-ohm system. In such a system, it is necessary to reduce input levels such that the peak current delivered to the line is 30mA.

[To maintain 16dB headroom, it is necessary to limit the nominal "0" level of a 150-ohm system to +2.3dBm (-3.73dBu; 504mV rms) or less if the output of the 275A is connected directly to the line. Unity gain and satisfactory headroom performance can only be achieved in a +8dBm 150-ohm system if 150:600-ohm transformers are placed at the 275A's input and output.]

As shipped, the 275A is calibrated for unity gain into a 600-ohm load in Bypass mode. (The gain in Synthesize mode is frequency-dependent.)

It is important to maintain consistent polarity at left and right inputs, and at the left and right outputs. If the inputs are wired in reverse polarity ("out-of-phase"), this will be indicated by virtually constant illumination of the 275A's polarity INVERTED lamp (provided that the AUTO POLARITY function is ON). No indication will be provided if the outputs are wired in reverse polarity, but virtually no sound will be heard from mono receivers when mono program material is broadcast and the 275A is in Bypass mode.

7. RECOGNITION SWITCH

Select the desired mode for the Recognition Switch. See **Mono/Stereo Detection** in **Section 1** for a discussion of its function.

8. INITIAL PROGRAM TESTS

Listen to samples of typical program material from the outputs of the 275A to confirm that the audio is being passed through the unit cleanly, and that the various control functions are operating as described.

9. EXTERNAL AUTOMATION

There are ten optically-isolated User Control Interface inputs available for use with a user-supplied automation system (see Fig. 2-5). They differ from the Remote Control nodes in that the system's response to the four basic mode inputs depends upon the setting of the rear-panel PULSE/CONTINUOUS switch.

To avoid ground loops or other problems in the plant grounding system, the User Control Interface inputs are all optically isolated from the 275A ground. The 275A's +22V unregulated DC supply and its ground are available on the connector and may be used to operate the control inputs through contact closures. External power may also be used.

Maximum recommended momentary current is 50mA. However, if the optoisolators are driven continuously, we recommend limiting the current to 10mA to assure long LED life. Since internal 470-ohm current-limiting resistors are included in the 275A, the maximum continuous voltage which can be accommodated without external current-limiting resistors is 5V (logic level). If the +22V is used with continuous contact closures, current should be limited by means of a 1.8K 1/2W ±10% carbon composition resistor in series with each contact.

See **Other Features** in **Section 1** for a discussion of how to set the Automation Mode switch.

To accommodate possible future developments, we have made the bandpass-filtered outputs of the left and right channels available on the connector. In addition, a loop-through connection facilitates application of external processing to the audio signal prior to stereo synthesis. If such external processing is to be used, you must open the top cover of the 275A and move Jumper "A" to the "IN" position (see Fig. 2-6).

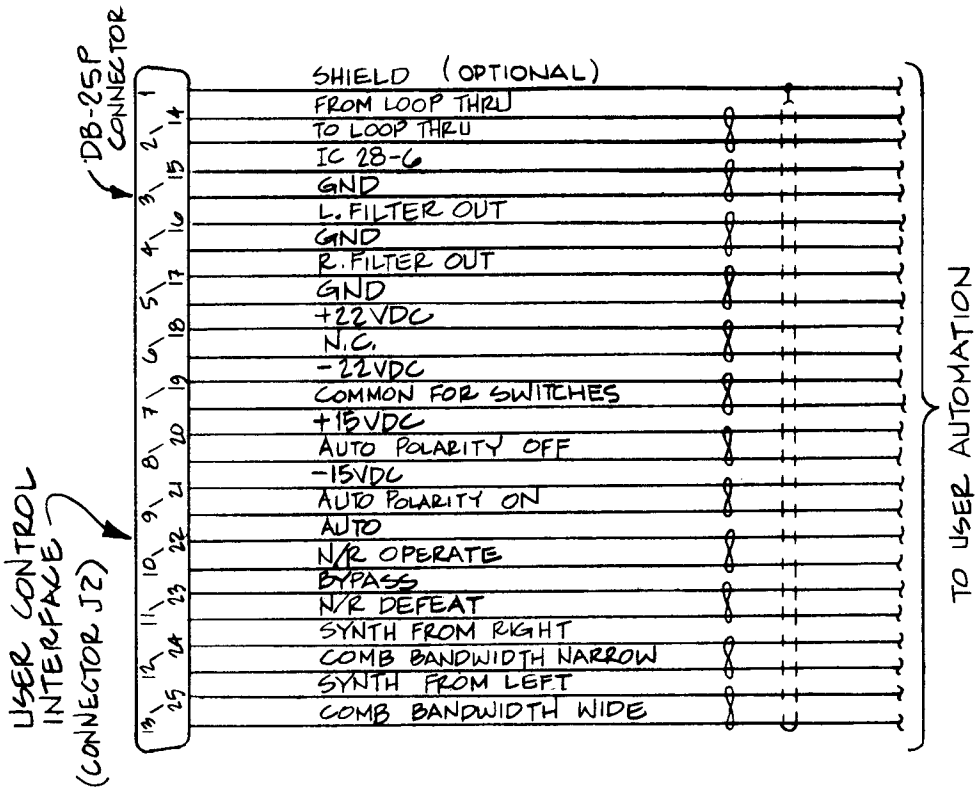


Fig. 2-5: User Interface Control Inputs

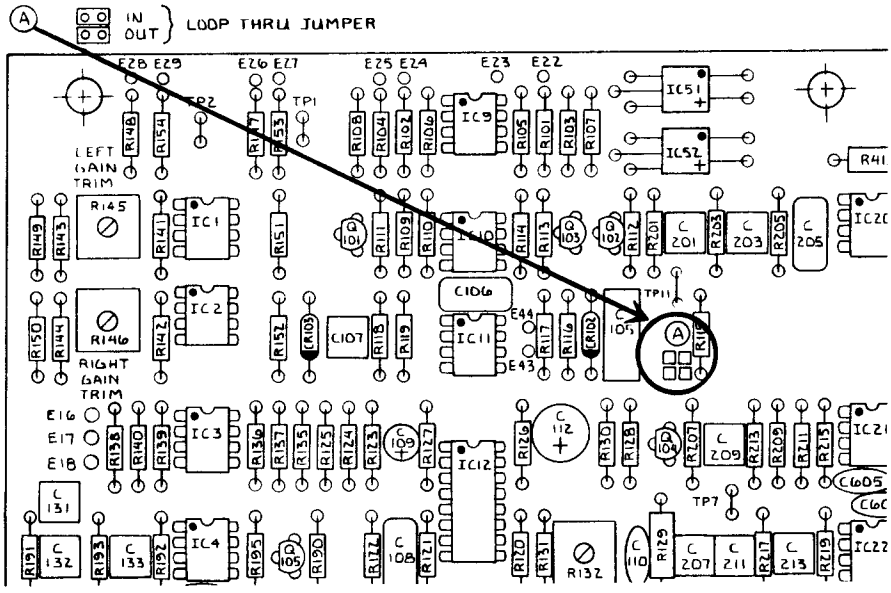


Fig. 2-6: Loopthrough Jumper Diagram

10. REGISTRATION CARD

Returning the Registration Card will make it possible for us to inform you of new applications, performance improvements, service aids, and so forth which may be developed over the life of the product. Having your Registration Card on file will also help us respond promptly to claims under Warranty without having to request a copy of your bill of sale or other proof of purchase.

If the Registration Card is lost, photocopy the duplicate in the front of this manual and send the filled-in copy to Orban at the address on the title page.

NOTE: MASTER CONTROL OPERATOR'S GUIDE

Appendix A is a concise summary of the operating instructions. It can be copied and delivered intact (or with local editing) to the Master Control Operator to provide a quick, operator-oriented guide to operation of the 275A.

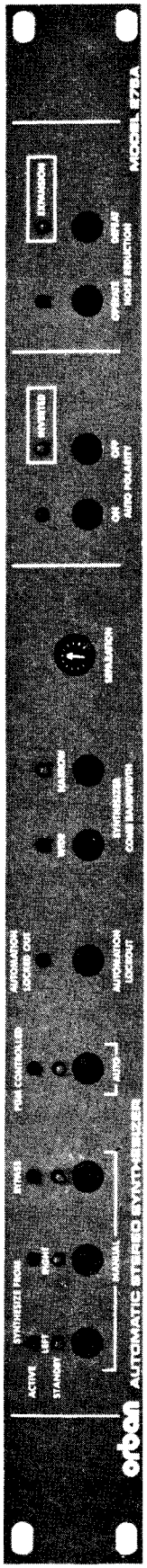


Fig. 3-1
FRONT PANEL CONTROLS

SECTION 3:
Operating Instructions

1. SUMMARY [See **Appendix A** for a 2-page **Guide For The Master Control Operator**].

Red ACTIVE lamps (upper row) indicate an active function.

Yellow STANDBY lamps (lower row) indicate the current standby function. STANDBY lamps light only when a User Interface Control input is activated. The current standby function will become active when the current active function is released (which is when all User Control Interface inputs become inactive, or when the AUTOMATION LOCKOUT button is pressed to regain manual control). The standby function is selected off-line by pressing the corresponding button.

MANUAL buttons select the source channel (**LEFT** or **RIGHT**) for stereo synthesis, or **BYPASS** the stereo synthesizer. All these MANUAL controls cancel the AUTO function.

AUTO button initiates automatic, program-controlled mono/stereo detection. If source is recognized as mono, stereo is synthesized from an automatically selected channel.

(A rear-panel RECOGNITION switch enables or disables the recognition of center-channel mono. An internal RECOGNITION THRESHOLD trimmer adjusts the sensitivity of this function. See **Section 1.**)

AUTOMATION LOCKOUT enables panel controls (including those on the optional 275A/RC Remote Control Panel) to override User Control Interface inputs. When this button is pressed, the current standby function becomes active.

SYNTHESIZER COMB BANDWIDTH buttons select **WIDE** (best for music and effects) or **NARROW** (best for dialog) bandwidths.

SEPARATION determines the amount of artificial channel separation in Synthesize mode only (it has no effect on true stereo material). This setting can affect perceived relative loudness between true and synthesized stereo material.

AUTO POLARITY ON initiates automatic monitoring and correction of phase for true stereo material. The **INVERTED** lamp indicates that an incorrect input polarity has been corrected. **OFF** ends this function.

NOISE REDUCTION OPERATE applies single-ended dynamic noise reduction to the synthesized stereo signal only. The **EXPANSION** lamp indicates broadband downward expansion. **DEFEAT** turns off the noise reduction circuit.

(To avoid accidental shut-off, no power switch is provided.)

2. GENERAL OPERATING INSTRUCTIONS

[See **Section 1** for a conceptual overview of the 275A.]

1) Basic Mode Switching

The Orban 275A Stereo Synthesizer monitors the audio feed, comparing the two channels. In Auto mode, when the 275A determines that the audio is mono, it automatically synthesizes a convincing stereo effect from its left or right input. When the 275A determines that the audio is stereo, it passes the audio through without processing (Bypass mode). Transitions between the modes are smooth cross-fades. The red lamps on the front panel (or on the optional 275A/RC Remote Control Panel) indicate the current mode:

SYNTH FROM L,
SYNTH FROM R,
BYPASS, or
AUTO.

When the 275A is in Auto mode, its determination won't always be correct. But the errors will be "polite". To avoid the possibility of such errors, it is best if the unit is manually controlled when possible, particularly during stereo programs. A program known to be in stereo should be run in Bypass mode (without synthesis).

A mono program will be synthesized to stereo from either the left or right input channel. If a stereo program is known to contain mono spots, switching to AUTO shortly before a spot will assure that the 275A's mode is changed to Synthesize at the proper time without further attention.

To cause the 275A to choose between Bypass (true stereo) and Synthesize modes according to its analysis of the program material, activate its Auto mode by pressing its front-panel AUTO button.

In Auto mode, the 275A will <u>always</u> synthesize from the active channel if the other channel is mute. If neither channel is mute, the position of the rear-panel RECOGNITION switch determines the 275A's response. If the RECOGNITION switch is in the M/S+1CH position and center-channel mono is detected, the unit will synthesize from the <u>left</u> channel. If the RECOGNITION switch is in the 1CH ONLY position, center-channel mono will <u>not</u> be recognized -- it will always be considered stereo.

An internal MONO/STEREO RECOGNITION THRESHOLD trim can be adjusted if the circuit consistently fails to recognize center-channel mono in your plant. See **Appendix B** for adjustment instructions.

To manually choose BYPASS or SYNTHESIZE, press one of the three MANUAL buttons. This will automatically cancel the AUTO function.

It is also possible for external automation to choose Bypass or Synthesize modes through the User Control Interface. If the rear-panel switch is set to PULSE, a pulse at the connector has the same effect as pushing a front-panel button. If the switch is set to CONTINUOUS, an external control signal overrides the current mode of the 275A only as long as that signal is present. When the signal is removed, the 275A immediately reverts to the mode indicated by the illuminated

STANDBY lamp (this is the mode the 275A was in before receiving the external control signal, unless the standby mode had been changed manually).

2) Automation Lockout

To prevent the 275A from responding to control inputs present at its User Control Interface (in the case of automation error, for example), press the AUTOMATION LOCKOUT button. The 275A will immediately enter the default mode indicated by a yellow STANDBY lamp (if none are lit, the mode will not change). As soon as AUTOMATION LOCKOUT is activated, another mode (including Auto) may be selected with the buttons. (Auto mode will operate normally -- it has nothing to do with AUTOMATION LOCKOUT, which refers only to external User Control Interface signals.)

To cancel AUTOMATION LOCKOUT, press that button again.

3) Synthesizer Comb Bandwidth

To choose between wide (5-band comb filter) and narrow (15-band comb filter) stereo synthesizer comb bandwidths, press the appropriate front-panel WIDE or NARROW buttons. WIDE produces the most dramatic stereo effect on music or sound effects. However, it does not center dialog as well as NARROW, which is recommended as the "safe" general-purpose choice for most TV applications.

4) Separation

To establish the amount of separation produced in Synthesize mode, adjust the front-panel SEPARATION control. As discussed in more detail below, the setting of this control can affect the perceived loudness balance between true and synthesized stereo. (That balance can be adjusted by means of an internal trimmer: see **Appendix B.**) The SEPARATION control is set according to taste, usually between "50" and "100".

5) Auto Polarity

The channels of a true stereo feed must remain in-phase with each other at all times to avoid cancellations which would otherwise seriously damage the quality of mono reception. It is not uncommon to experience occasional polarity reversals in program sources or from patching errors.

The Auto Polarity circuit monitors the polarity and corrects it (by reversing the polarity of the right channel) if necessary. The INVERTED lamp indicates when incorrect input polarity is being corrected.

To activate or defeat the automatic polarity-reversal sensor/corrector, press the AUTO-POLARITY ON or OFF buttons.

AUTO-POLARITY is typically left ON. However, some program material (particularly material with "surround" information, like Dolby^{R} stereo movies) can be purposely produced with short sections containing out-of-phase information. It may be wise to manually defeat the circuit when such material is broadcast or if errors in the Auto Polarity function are observed.

6) Noise Reduction

The Noise Reduction feature applies single-ended dynamic noise reduction to the synthesized signal only. It is particularly useful for films with optical soundtracks and other noisy mono feeds.

To activate or defeat the Noise Reduction circuit, press the NOISE REDUCTION OPERATE or DEFEAT button.

Noise Reduction is normally left in OPERATE. Sometimes, when the unit is operating in Auto mode, transitions between true and synthesized stereo can be made less noticeable by DEFEATing the Noise Reduction.

Broadband downward expansion is indicated by illumination of the EXPANSION lamp.

3. FURTHER DISCUSSION OF FUNCTIONS

1) MANUAL Buttons and Indicators

These are the SYNTHESIZE FROM LEFT, SYNTHESIZE FROM RIGHT, and BYPASS controls. Pushing any of these buttons immediately cancels Auto mode (if it was ON) and immediately forces the 275A into the selected mode. However, if the rear-panel PULSE/CONTINUOUS switch is set to CONTINUOUS, the SYNTH FROM L, SYNTH FROM R, or BYPASS User Control Interface input can override the manual mode-select buttons. As soon as the User Control Interface inputs cease to be active, the 275A will revert to the mode it was in before the input became active. If no User Control Interface inputs are active when a button is pushed, the mode selected by the button will be immediately activated.

The actual mode of the 275A is always indicated by the red ACTIVE lamp associated with a given button. If, and only if, a User Control Interface input is active, one of four yellow STANDBY lamps will light, indicating the default mode (the mode to which the 275A will revert when no User Control Interface inputs are active). The STANDBY indicators thus also serve to indicate to the operator when a User Control Interface input is active.

Even while a User Control Interface input is active, a new default mode can be chosen by means of the buttons on the 275A panel; the result will be immediately indicated by illumination of the appropriate yellow STANDBY lamp indicator, but the actual mode of the 275A will not change until no User Control Interface line is active.

If the operator wishes to manually override all User Control Interface inputs (except COMB BANDWIDTH, AUTO-POLARITY, and NOISE REDUCTION), this can be done by pushing the AUTOMATION LOCKOUT button which will inactivate the SYNTH LEFT/RIGHT, BYPASS and AUTO inputs. Operating the AUTOMATION LOCKOUT button will cause the 275A to revert to a preset "default" mode as indicated by one of the four yellow STANDBY lamps. Full manual control by means of the buttons (including selection of Auto mode) is then available.

Manual mode selection always causes a relatively fast (approximately 100ms) crossfade between modes. Crossfade speed is indicated by the speed at which the red BYPASS lamp changes intensity.

2) AUTO Button and Indicators

Auto mode is a "supervisory" mode. When Auto mode is activated, the internal mono/stereo recognition circuits within the 275A can cause switching between the two fundamental operating modes: Synthesize and Bypass. The action of the recognition circuitry depends upon the nature of the input program material and upon the setting of the rear-panel RECOGNITION switch.

If audio is present at only one input, the 275A chooses Synthesize mode, regardless of the setting of the rear-panel RECOGNITION switch. Cross-fading is fast -- approximately 100ms.

If audio is present at both inputs and the RECOGNITION switch is set to 1CH ONLY ("single-channel recognition only"), Bypass mode is chosen. Cross-fading is fast.

However, if the RECOGNITION switch is set to M/S+1CH ("mono/stereo and single-channel recognition"), center-channel audio ($\pm$3dB, $\pm10^{o}$ nominal) is recognized as mono and forces Synthesize From Left mode, while more-uncorrelated or out-of-balance audio is recognized as stereo, forcing Bypass mode. In these latter cases, cross-fading is slow (approximately 2 seconds).

If no signal is present, the unit "freezes" in its current mode. (The control circuitry considers any signal more than 40dB below operating level to be "noise", and ignores it. Further rejection is provided at the 60Hz hum/vertical field frequency.)

NOTE:

Auto mode, unlike the other three basic operating modes, cannot be invoked through the User Control Interface when the PULSE/CONTINUOUS switch is set to CONTINUOUS. (It may automatically default to that mode if it has been preset to do so.) However, it can be invoked by activating its User Control Interface line with the automation set to PULSE.

(It was assumed that continuous signal automation would be programmed with the operating mode appropriate for a given piece of program material. If Auto mode is chosen as the standby mode, then absence of a specifically-programmed continuous automation signal will automatically release control to the 275A's internal Recognition circuit.)

Auto mode is cancelled by pushing the SYNTH FROM L, SYNTH FROM R, or BYPASS buttons. It is also cancelled by activating any of these three User Control Interface lines when using pulsed automation.

If two or more User Control Interface lines are active simultaneously, the logic assumes this to be an external automation error and immediately switches the 275A to Auto mode, engaging its internal Recognition circuitry.

3) AUTOMATION LOCKOUT Button and Indicator

The AUTOMATION LOCKOUT button forces the 275A to ignore User Control Interface commands on the following lines: SYNTH FROM L, SYNTH FROM R, BYPASS, and AUTO. The other lines are unaffected.

The lockout works with both PULSE and CONTINUOUS automation. If the button is pushed while a continuous-signal User Control Interface line is active, the 275A will immediately revert to the current standby mode.

AUTOMATION LOCKOUT does not affect commands from the 275A/RC Remote Control Panel.

The AUTOMATION LOCKOUT button is toggling: to cancel the Automation Lockout function, press the button again.

4) WIDE and NARROW COMB BANDWIDTH Buttons and Indicators

These determine whether the bandwidth between adjacent notches in the comb filters used in stereo synthesis is narrow or wide. WIDE results in five bands; NARROW creates fifteen. WIDE may produce a more dramatic sense of stereo space. However, NARROW is more subtle and centers dialogue better, and is therefore the safest choice for all-around use.

Wide or narrow bandwidths can be selected by activating the appropriate lines on the User Control Interface. It is therefore possible to change comb bandwidths by remote control or automation according to the requirements of the program material. Musical programming, for example, might sound better with wide bandwidths, while material containing substantial amounts of speech would sound better with narrow bandwidths.

5) SEPARATION Control

The SEPARATION control determines the amount of stereo difference signal (L-R) in the synthesized stereo. It does not affect the stereo sum (L+R) signal. The control has no effect when the 275A is in Bypass mode.

The control is continuously variable from "0" (no separation: the original mono appears on both output channels) to "100" (L-R level = L+R level: the left and right output channels exhibit complementary comb filter responses with the maximum-depth notches).

When the SEPARATION control is advanced from "0" to "100", the peak level of the L and R channels increases 6dB because L-R information equal in level to the L+R information is added. However, the perceived loudness in stereo increases only 3dB because, in a reverberant (real room) environment, the left and right channel loudnesses add according to power, not voltage. Meanwhile, the level of the mono sum (L+R) is unaffected.

This can affect the loudness balance between true stereo and synthesized stereo. Most true stereo has considerably less L-R energy than L+R energy. If the ratio between L+R and L-R is substantially different in the synthesized stereo than in the true stereo, the audio processing prior to the transmitter will tend to increase on-air loudness when the 275A switches from synthesized to true stereo because the gain reduction produced by such processing is largely determined by the peak

level at its left and right inputs, which in turn is affected by the ratio of L+R to L-R.

It may therefore be desirable to set the SEPARATION control less than "100" if switching from true to pseudo-stereo typically causes a substantial loudness decrease. This effect will be most noticeable on mono receivers, because there is no loudness increase due to the presence of L-R when the signal is auditioned in mono, yet L-R is forcing the audio processor to produce increased gain reduction, reducing mono loudness simultaneously.

Because the SEPARATION control is the only front-panel control unavailable on the optional 275A/RC Remote Control Panel, separation must be adjusted locally at the main 275A chassis.

6) AUTO POLARITY ON/OFF Button and Indicators

The 275A contains a circuit which monitors the stereo signal for reverse polarity (an "out-of-phase" condition) and corrects such problems by inverting the polarity of the right channel if necessary. There is some program material (particularly Dolby^{R} stereo mixes for feature films) that contains substantial out-of-phase "surround" information. If such material dominates for more than a few hundred milliseconds, it can activate the polarity correction circuit. This has so far proven to be very rare because the circuit within the 275A has been designed to be highly resistant to "falsing" due to such effects. Nevertheless, it sometimes occurs.

If the program material is so extreme that the Auto Polarity circuit momentarily flips the polarity on pure "surround" information, such momentary "correction" may actually improve the sound at mono sets. However, the polarity inversion will be quite audible and disturbing to stereo listeners. For this reason, it may be wise to defeat the Auto Polarity circuit when material containing "surround" information is broadcast. The AUTO POLARITY ON/OFF buttons and their corresponding control lines on the User Control Interface provide a way to do this locally, by remote control, or by automation.

If the Auto Polarity circuit detects and corrects a reverse-polarity condition, the INVERTED lamp on the front panel will light. The lamp above the AUTO POLARITY ON button lights when the Auto Polarity circuit is activated, permitting correction to occur if reverse-polarity material is detected.

7) NOISE REDUCTION OPERATE/DEFEAT Button and Indicators

The 275A can apply single-ended noise reduction to the synthesized signal only. The noise reduction combines broadband downward expansion with program-controlled high-frequency filtering.

The lamp above the NOISE REDUCTION ON button lights when the noise reduction circuit is activated. Broadband downward expansion is indicated by illumination of the EXPANSION lamp.

The noise reduction system will ordinarily cause a small amount of audible dulling or high frequency loss. The brighter the original mono program material, the less the HF loss that will be produced. Because some program material will be dulled, it may be desirable to defeat the noise reduction circuit if the original mono program material is so noise-free that further noise reduction is not needed.

In addition, if the Auto mode is used with M/S+1CH recognition, stereo program material containing substantial amounts of mono center-channel material may force the 275A to alternate between Synthesize and Bypass modes depending on the instantaneous stereo content of the program material. Since noise reduction is applied only to synthesized material, this will result in the Noise Reduction circuit being turned on and off as the 275A switches between Synthesize and Bypass. This may aggravate the audibility of any such undesired switching, some of which is inevitable when the recognition circuitry is set to M/S+1CH. (See **Section 1** for a more complete discussion.)

NOISE REDUCTION OPERATE/DEFEAT is also available at the User Control Interface for connection to automation.

SECTION 4:
Maintenance

1. INTRODUCTION

This section of the manual provides instructions on how to maintain the 275A, how to make sure that it is working according to specifications, and how to repair it if something goes wrong.

Factory service is available throughout the life of the 275A. Please refer to **Factory Service** in this section for further information.

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.

(per UL 813)

2. PREVENTIVE MAINTENANCE

The front panel may be cleaned with a mild household detergent. Strong solvents should be avoided, as they may damage the paint, the silk-screened lettering, or the plastic buttons and LED's.

3. CORRECTIVE MAINTENANCE

All Orban products are designed to be completely free of failures throughout eternity. However, Orban research has recently discovered that there is no justice in the world and, in fact, there is not supposed to be any.

For this reason, this Corrective Maintenance section is included.

1) Service Access

Access to the 275A for service and adjustment is straightforward.

The 275A contains two circuit cards -- a main card which contains all the active circuitry, and a vertical card which supports the front-panel buttons and LED's. Full access to the main card is obtained by removing the top and bottom covers. It should never be necessary to remove the main card from the chassis.

All wiring between the vertical card and the main card is carried in two ribbon cables (which go to the rear of the main card) and several flexible wiring strips which are soldered to the bottom of the vertical card and to the main card.

To replace pushbutton switches or LED's, the vertical card must be detached from the front panel by removing the five screws holding it to standoffs mounted on the front panel. After the screws have been removed, it is possible to slowly and

carefully pull the card back from the front panel so that all buttons and LED's are clear of their holes. The card may then be tilted back as necessary, imagining a "hinge" where the vertical card meets the main card.

To reassemble the unit, follow the above directions in reverse. Before tightening the screws holding the vertical card to the standoffs, test all buttons to make sure that they do not bind against the front panel when operated. If they do, realign the vertical card as necessary.

2) Component Replacement

All IC's in the unit are socketed and can be readily replaced from the top surface of the main board. If IC12 (the N/R chip) is replaced, realignment of R132 (Thump Null) and R134 (Gain Trim) is required. If IC51 or IC52 (the LED photocouplers) are replaced, realignment of the corresponding gain trim (R145 and R146) is required. See **Section 5** for alignment instructions.

WARNING

Disconnect the 275A from the AC power line before replacing components to avoid the danger of electric shock.

If any of the CMOS logic chips are replaced, use reasonable care to avoid damage due to static electricity. If relative humidity is below 50%, use a grounded workbench and make sure that the 275A chassis is grounded to it. To prevent static damage to a chip, do not touch the its leads unless you are also touching the workbench, or are connected to it through a standard high-resistance grounded wrist strap. (Such wrist straps are connected to ground through 1 megohm or more, eliminating the danger of electric shock.)

If the large filter capacitors are to be replaced, fasten them securely to the board, using the original factory installation as a model. This will prevent their breaking loose from vibration in the future.

3) Replacement Parts

If you have difficulty finding parts for this or any other Orban product, Orban Customer Service stands ready to supply you with the required parts at a fair price. Please contact us at the address on the title page of this Manual.

4) Replacement of Components on Printed Circuit Boards

It is important to use the correct technique for replacing components mounted on PC boards. Failure to do so will result in possible circuit damage and/or intermittent problems.

The circuit boards used in the 275A are of the double-sided plated-through variety. This means that there are traces on both sides of the board, and that the through-holes contain a metallic plating in order to conduct current through the board. Because of the plated-through holes, solder often creeps 1/16" up into the hole, requiring a sophisticated technique of component removal to prevent serious damage to the board.

a) Removal:

If the technician has no practical experience with the elegant and demanding technique of removing components from double-sided PC boards without board damage, it is wiser to cut each of the leads of an offending component from its body while the leads are still soldered into the board. The component is then discarded, and each lead is heated independently and pulled out of the board with long-nose pliers. Each hole may then be cleared of solder by carefully heating with a low-wattage soldering iron and sucking out the remaining solder with a spring-activated desoldering tool like the Edsyn Soldapullt^{R}. THIS METHOD IS THE BEST METHOD OF CLEARING A PLATED-THROUGH HOLE OF SOLDER!

Another technique is:

1. Use a 30-watt soldering iron to melt the solder on the solder (underneath) side of the PC board. Do not use a soldering gun or a high-wattage iron! As soon as the solder is molten, vacuum it away with a spring-actuated suction desoldering tool. DO NOT OVERHEAT THE BOARD. Overheating will almost surely damage the board by causing the conductive foil to separate from the board. Use a pair of fine needle-nose pliers to wiggle the lead horizontally until it can be observed to move freely in the hole.

2. Repeat step 1 until each lead to be removed has been cleared of solder and freed.

3. Now lift the component out.

b) Installation:

1. Bend the leads of the replacement component until it will fit easily into the appropriate PC board holes. Using a good brand of rosin-core solder, solder each lead to the bottom side of the board with a 30-watt soldering iron. Make sure that the joint is smooth and shiny. If no damage has been done to the plated-through hole, soldering of the topside pad is not necessary. However, if the removal procedure did not progress smoothly, it would be prudent to solder each lead at the top side as well in order to avoid potential intermittent problems.

2. Cut each lead of the replacement component close to the solder (underneath) side of the PC board with a pair of diagonal cutters.

3. Remove all residual flux with a cotton swab moistened with a solvent like 1,1,1-trichloroethane, naptha, or 99% isopropyl alcohol. The first two solvents are usually available in supermarkets under the brand name Energine^{R} Fire-proof Spot Remover and Regular Spot Remover, respectively. The alcohol, which is less effective, is usually available in drug stores. Rubbing alcohol is highly diluted with water and is ineffective.

   It is good policy to make sure that this defluxing operation has actually removed the flux and has not just smeared it so that it is less visible. While most rosin fluxes are not corrosive, they can slowly absorb moisture and become sufficiently conductive to cause progressive deterioration of performance.

5) Troubleshooting IC Opamps

IC opamps are usually operated so 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 the technician measures more than a few millivolts between these two terminals, the IC is probably bad.

Exceptions are IC's used without feedback (as comparators) and IC's whose outputs have been saturated due to excessive input voltage because of a defect in an earlier stage. Also, be sure that the voltmeter is not interacting with these sensitive points and affecting the measured voltage. However, if an IC's "+" input is more positive than its "-" input, yet the output of the IC is sitting at -14 volts, this almost certainly indicates that it is bad. The same holds true if the above polarities are reversed.

Because the characteristics of the 275A are essentially independent of opamp AC characteristics, an opamp can usually be replaced without need for recalibration. However, some of the control circuitry is sensitive to opamp DC characteristics, like bias current and offset voltage. Because of this, high-performance LF412 dual opamps are used in several sockets. These devices must be replaced by exact replacements: TL072's or LF353's are not satisfactory.

NOTE

IC12 contains most of the Noise Reduction circuitry. If it is replaced, recalibration of R132 and R134 according to instructions in **4) Component Replacement** (above) is necessary.

A defective opamp may appear to work, yet it may 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 sparingly, because it can cause resistive short circuits due to moisture condensation on cold surfaces.

4. FACTORY SERVICE

Please refer to the terms of your Orban Associates Limited One-Year Standard Warranty, which extends to the first end-user. This warranty was packed with the 275A, but is not bound with this manual. 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) shall be borne by the customer.

You must get a Return Authorization number from Orban Customer Service before returning this unit for service. After a formal Return Authorization number is obtained, ship the unit to CUSTOMER SERVICE at the address on the title page of this manual.

YOUR RETURN AUTHORIZATION NUMBER MUST BE SHOWN ON THE LABEL, OR THE PACKAGE WILL NOT BE ACCEPTED!

5. SHIPPING INSTRUCTIONS

If the original packing material is available, it should be used. Otherwise, use a carton of at least 200 pounds bursting test and no smaller than 22"w x 5"h x 12"d.

The 275A should be packed so that there is at least 1-1/2" of packing material protecting every point. A plastic wrap around the chassis will protect the finish. Cushioning material such as Air-Cap, Bubble-Pak, foam "popcorn", or fiber blankets are acceptable. Folded newspaper is not suitable. Blanket-type materials should be tightly wrapped around the 275A and taped in place to prevent the unit from shifting out of its packing and contacting the walls of the carton.

The carton should be packed evenly and fully with the packing material filling all voids such that the unit cannot shift in the carton. Test for this by closing but not sealing the carton and shaking vigorously. If the unit can be felt or heard to move, use more packing.

The carton should be well-sealed with 3" reinforced sealing tape applied across the top and bottom of the carton in an "H" pattern. Narrower or parcel-post type tapes will not stand the stresses applied to commercial shipments.

The package should be marked with the name of the shipper, and with these words in red: DELICATE INSTRUMENT, FRAGILE! Even so, the freight people may throw the box around as if it were filled with junk. The survival of the unit depends almost solely on the care taken in packing!

SECTION 5:
Alignment And Performance Evaluation

1. GENERAL

This section provides a series of thorough bench tests which will usually verify whether or not the 275A is operating normally.

The 275A is aligned as these tests are performed. The 275A has five trimmers (which standardize the gains of the left and right channels in Bypass mode, standardize the gain of the synthesizer relative to "Bypass", determine the threshold of mono detection in the automatic recognition circuit, and null DC offset). Alignment is ordinarily required only when IC12, IC51, or IC52 is replaced.

Refer to the drawings in **Appendix E** for the location of test points and trimpots.

2. POWER SUPPLY

Equipment Required:
1) VTVM or DVM
2) Oscilloscope

The following tests will verify correct operation of the Power Supply:

1) Unregulated Power Supplies
Using the DC voltmeter, measure the voltage from circuit ground to both positive and negative unregulated supplies. This can be readily measured across the two large filter capacitors. This voltage may be expected to vary widely depending on line voltage; it should measure between ±18 and ±26 volts DC.

2) Voltage Regulators
Measure the voltage at TP4 (+15V) and TP6 (-15V). If the absolute value of either voltage exceeds 15.75 VDC, it implies that its associated IC regulator is defective. If the absolute value of either voltage is less than 14.25 VDC, refer to **Power Supply** in **Section 6** for troubleshooting hints.

3) Ripple and Noise
Using the oscilloscope, measure the ripple and noise on the regulated positive and negative power buses. Ripple and noise should be less than 4mV peak on each bus.

3. SIGNAL PROCESSING CIRCUITRY

Equipment Required:
1) Oscilloscope with DC-coupled display
2) 20-20,000Hz bandpass filter, 18dB/octave slopes
3) VTVM or DVM
4) Harmonic distortion analyzer with built-in 400Hz and 80kHz filters and residual THD below 0.0015%
5) Low-distortion oscillator with residual THD below 0.0015%
6) A pair of 604-ohm ±1% resistors

7) Low Frequency Spectrum Analyzer with Tracking Generator (e.g. Tektronix 5L4N in 5111 Bistable Storage Mainframe; an FFT-based spectrum analyzer with signal source [HP3561A], or a sweep generator and X/Y oscilloscope could also be used)
8) An audio preamplifier with BALANCE control (or other means for pan-potting a signal continuously from right to left)

[A Sound Technology 1700A or H-P 339 will satisfy (4) and (5).]

NOTE:

The term "dBu" is used in the following procedure. In a 600-ohm circuit, "dBu" and "dBm" are identical. However, "dBu", unlike "dBm", is not dependent on circuit impedance: it is simply a voltage. Read "dBu" on the "dBm/600ohms" scale of your audio voltmeter.

Further, the levels specified are read differentially across the input or output terminals as appropriate. The 275A's outputs are balanced-to-ground. If your AC Voltmeter/Distortion Analyzer is not equipped with a balanced input, measure 275A output levels between the 275A's "HI" output terminal and its chassis ground, subtracting 6dBu from all 275A output levels specified in the procedure below.

1) Audio Path Alignment And Verification

a) Bypass Mode Gain Trim And Performance Evaluation

Press the AUTO POLARITY ON and BYPASS buttons. Verify that the green AUTO POLARITY and red BYPASS lamps light. Connect the oscillator to the 275A left input. Load the 275A left output with a 604-ohm ±1% resistor. Set the oscillator frequency to 1kHz and its output level to +4dBu as measured across the 275A input. Adjust R145 (LEFT GAIN trim) for +4dBu as measured across the left output of the 275A.

Increase the oscillator level to produce +20dBu at the 275A output. Measure the harmonic distortion at 20Hz, 1kHz, and 15kHz. Verify that THD does not exceed 0.02% at any frequency.

Suppress the oscillator, and measure RMS noise at the 275A output. Verify that noise does not exceed -80dBu in a 20-20kHz bandwidth.

Repeat all of step a) for the right channel.

b) Auto Polarity Test

Leave the oscillator connected to the right input of the 275A. Connect the oscillator to the left input of the 275A in reverse polarity, and verify that the INVERTED lamp lights. Then reverse the polarity of the connection to the left input, and verify that the INVERTED lamp turns off.

(If the circuit does not appear to be working, suppress the oscillator output for 5 seconds to reset the circuit. Then repeat the test.)

c) Synthesize Mode Alignment, Noise, And Distortion

Connect the oscillator to the 275A left input only. Turn the SEPARATION control fully counterclockwise. Press the SYNTH FROM LEFT button and make sure that the corresponding red lamp lights. Press the NOISE REDUCTION DEFEAT button and make sure that the corresponding green lamp is off.

Suppress the oscillator output. Connect the DVM to TP3 and adjust R132 (Thump Null Trimmer) for 0.000VDC.

Set the oscillator for 1kHz and +20dBu (as observed differentially at the 275A input terminals). Adjust R134 (GAIN Trim) for +18dBu (measured differentially) at the 275A left output.

Measure THD at 20Hz, 1kHz, 15kHz with +18dBu at the 275A output. Verify that the THD does not exceed 0.3%.

Suppress the oscillator output and measure the noise at the 275A output. Verify that it does not exceed -67dBu in a 20-20kHz bandwidth.

(**NOTE:** In a properly operating the 275A, the amount of noise and distortion produced in either Synthesize mode is a function of IC12's performance, since it is in the signal path regardless of whether the Noise Reduction is ON or OFF. If distortion or noise is excessive, the most probable cause is a defective IC12.)

d) Noise Reduction Test

Press the SYNTHESIZE FROM LEFT, NOISE REDUCTION OPERATE, and NARROW buttons on the 275A. Verify LED responses. The SEPARATION control should still be at "0". Connect the 5L4N Tracking Generator output to the 275A left input. Adjust the output level of the tracking generator until the EXPANSION lamp just barely comes on. Observe the swept response at the 275A left output. Fig. 5-1 shows the response as the input is stepped downward in 5dB steps, starting at the level which just lights the EXPANSION lamp. Note the downward broadband expansion and the high frequency rolloff.

Fig. 5-2 shows the frequency response in an expanded (2dB/div) scale at an input level 10dB below the expansion threshold.

Fig. 5-3 shows the normal frequency response of the circuit when the NOISE REDUCTION is DEFEATed. Note that it is down approximately -2dB at 20kHz.

e) Synthesize Mode Frequency Response

Turn the SEPARATION control to "100" (fully clockwise). Press the NOISE REDUCTION DEFEAT button. Observe the 275A left output with the spectrum analyzer set for 20-20kHz log span, 10dB/div. Set the tracking generator output level to permit the swept response to be seen easily. Then observe the right output. Fig. 5-4 shows the expected frequency responses of the two channels overlaid. Note the complementary comb filter characteristic.

Press WIDE button on the 275A. Observe the left and right outputs, and verify that they are similar to Fig. 5-5, which shows both channels overlaid.

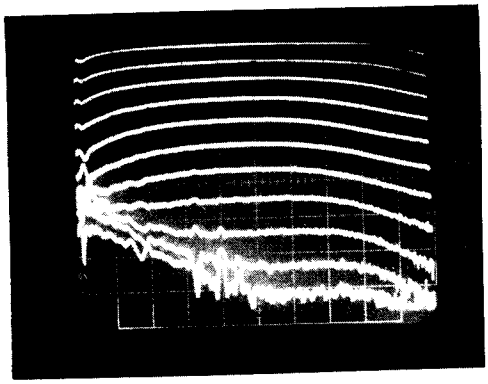


Fig. 5-1: Noise Reduction Swept Response (20-20kHz log span, 10dB/div)

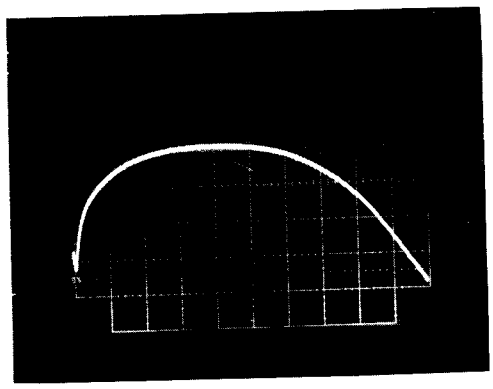


Fig. 5-2: Noise Reduction Swept Response, 10dB Below Expansion Threshold (20-20kHz log span, 2dB/div)

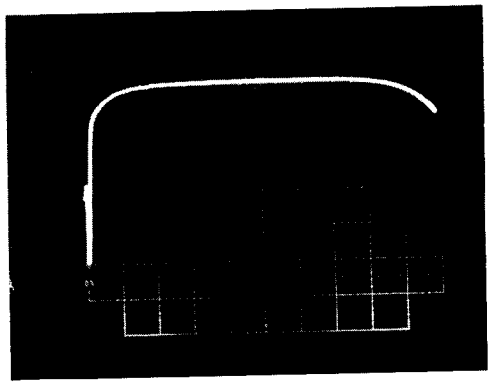


Fig. 5-3: Frequency Response in Synthesize Mode; SEPARATION=0; NOISE REDUCTION DEFEATed (20-20kHz log span, 2dB/div)

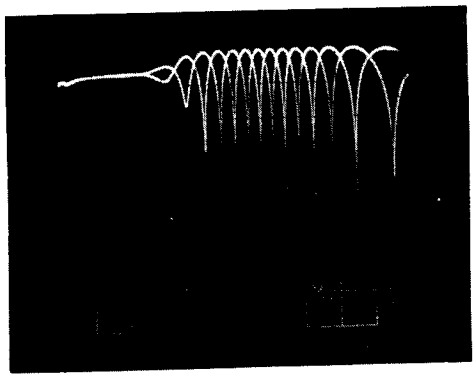


Fig. 5-4: Synthesizer Response, Narrow Mode (20-20kHz log span, 10dB/div)

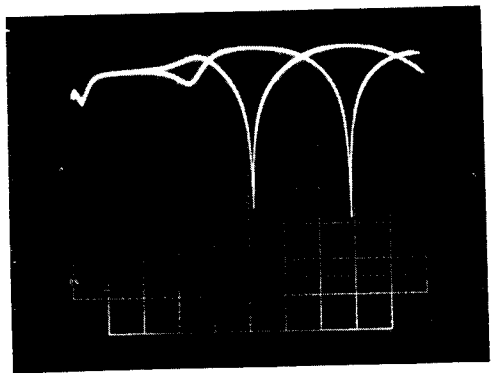


Fig. 5-5: Synthesizer Response, Wide Mode (20-20kHz log span, 10dB/div)

Connect the tracking generator to the 275A right input. Press the SYNTHESIZE FROM RIGHT button. Verify that the corresponding red lamp lights. Verify that the response shown in Fig. 5-5 can again be observed at the 275A outputs.

2) Control Circuit Bandpass Filter Performance Verification

Leave the tracking generator connected to the 275A right input. Observe TP7 with the spectrum analyzer, and verify that the swept response is very close to Fig. 5-6.

Repeat for the right channel, connecting the tracking generator to the 275A right input and observing TP8.

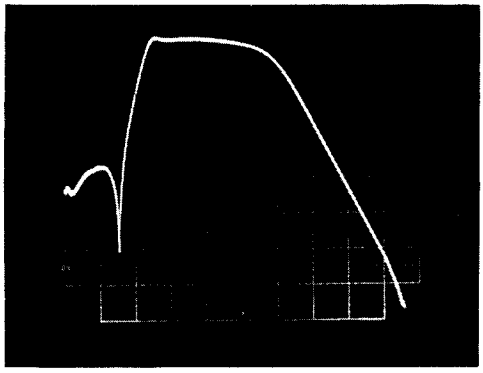


Fig. 5-6: Control Circuit Bandpass Filter Response
(20-20kHz log span, 10dB/div)

3) Automatic Recognition Circuit Tests

a. Connect the oscillator to a panpot (such as a preamp with a balance control). Connect the left and right outputs of the panpot to the left and right inputs of the 275A respectively.

Set the oscillator to 1kHz and +4dBu.

Set the rear-panel RECOGNITION switch on the 275A to M/S+1CH.

b. Temporarily suppress the oscillator's output. First press the 275A's SYNTH FROM LEFT button. Then press the AUTO button. Verify that that the red lamp above the BYPASS switch fades in over a 2 second interval (approximately).

c. Turn the panpot full left. Restore the oscillator, and observe that the red lamp above SYNTH FROM LEFT comes on immediately.

Temporarily suppress the oscillator by quickly fading its output off, and verify that the lights do not change state.

NOTE

If the oscillator is switched off instead of faded off, a state change may occur. In the instructions below, always "suppress" the oscillator by fading it quickly off instead of switching it off. This simulates the envelopes found in normal program material.

Restore the oscillator.

d. Now start turning the panpot very slowly towards center. Observe that as you do so, the BYPASS lamp will slowly fade in. When this happens, stop. Suppress the oscillator; verify no change of state; restore oscillator.

Continue to pan towards center until the SYNTH FROM LEFT lamp comes on and the BYPASS lamp slowly fades out. Stop; suppress oscillator; verify no change of state; restore oscillator.

Continue to pan away from center towards right. Verify that the BYPASS lamp fades in slowly, and that the SYNTH FROM LEFT lamp stays on until the BYPASS lamp has reached full brightness. Stop; suppress oscillator; verify no change of state; restore oscillator.

Continue to pan right. Verify that at almost full right, the SYNTH FROM RIGHT lamp comes on and the BYPASS lamp turns off quickly. Stop; suppress oscillator; verify no change of state; restore oscillator.

e. Set the rear-panel RECOGNITION switch to 1CH ONLY. Pan full left; verify that the SYNTH FROM LEFT lamp comes on quickly. Suppress oscillator; verify no change of state; restore oscillator.

Pan towards center. Verify that the BYPASS lamp comes on quickly when you pan slightly off full left. Stop; suppress oscillator; verify no change of state; restore oscillator.

Pan through center to full right. Verify that very slightly before full right the SYNTHESIZE FROM RIGHT lamp comes on and the BYPASS lamp turns off quickly. Stop; suppress oscillator; verify no change of state.

4) Optional 275A/RC Remote Control Interface Tests

If you have not installed the optional Orban Remote Control Panel 275A/RC, then these tests are not relevant to you. However, they are included for completeness.

Reposition the 16-pin DIP plug from J5 to J4 (on the rear of the main circuit board) and plug the 275A/RC Remote Control Panel into its rear-panel connector.

Press all buttons on the Remote Control, and verify that the lamps respond as they would if the unit were being controlled from the front panel.

If you do the tests below to verify operation of the User Control Interface, leave the Remote Control connected. When the User Control Interface tests cause the

yellow STANDBY lamps to light, verify that they also light on the Remote Control panel.

When you are through with the tests, place the 16-pin DIP plug into J5 (non-remote operation) or J4 (remote operation) as appropriate for your installation.

5) **Optional User Control Interface Logic Tests**

These tests are not relevant to you if you are not using the User Control Interface connector. Nevertheless, complete verification of 275A logic operation requires that these tests be performed.

Performance of these tests requires that voltages be applied to the User Control Interface connector to verify its operation and that of the internal logic. If your facility has not already installed the interface, please refer to **Section 2.**

a. Apply voltage sequentially to the following inputs on the User Control Interface connector:

WIDE
NARROW
AUTO-POLARITY ON
AUTO-POLARITY OFF
NOISE REDUCTION OPERATE
NOISE REDUCTION DEFEAT

Verify that the lamps respond the same way as they do to the front-panel buttons.

b. Switch the rear-panel PULSE/CONTINUOUS switch to PULSE. Sequentially apply a pulse to:

SYNTH FROM LEFT
SYNTH FROM RIGHT
BYPASS
AUTO

Verify that the red lamps respond as if the identically-named buttons were pushed. Verify that the yellow lamp associated with each function lights as long as the corresponding User Control Interface input is active.

c. Press the front-panel SYNTH FROM LEFT button. Then press the AUTOMATION LOCKOUT button. Verify that the corresponding red lamp lights. Repeat step **b,** immediately above. Verify that the yellow SYNTH FROM LEFT lamp lights whenever an input is active, but the state of the 275A (as indicated by the red lamps) cannot be changed from SYNTH FROM LEFT by means of the User Control Interface inputs.

Press the AUTOMATION LOCKOUT button again to restore normal automation operation.

d. Switch the PULSE/CONTINUOUS switch to CONTINUOUS. Press SYNTH FROM LEFT on the 275A front panel. Sequentially excite the SYNTH FROM LEFT, SYNTH FROM RIGHT, and BYPASS User Control Interface inputs. Verify that when an input is active, the yellow SYNTH FROM LEFT lamp lights, and the red lamp lights corresponding to the active input also goes on. When the input becomes inactive, the red SYNTH FROM LEFT lamp lights.

Test all other combinations by performing the same test, but first preset SYNTH FROM RIGHT, then BYPASS, then AUTO. Verify that the red lamps follow the User Control Interface inputs as long as they are active, but revert to the preset mode when the inputs become inactive.

e. Activate any two User Control Interface inputs simultaneously. Verify that the red AUTO lamp lights, indicating that an automation fault is detected by the 275A, which then passes control to its internal Recognition circuitry.

f. Activate the front-panel AUTOMATION LOCKOUT function. Verify that SYNTH FROM L, SYNTH FROM R, and BYPASS User Control Interface inputs can no longer change the state of the 275A, as indicated by the red lamps.

SECTION 6:
Circuit Description

Please refer to the block diagram and schematic in **Appendix E.**

The circuitry is divisible into several major blocks:

1) main audio path
2) noise reduction circuit
3) stereo synthesizer
4) auto-polarity circuit
5) mono/stereo recognition circuit
6) control logic
7) remote control
8) power supply

These will be described in order.

1. MAIN AUDIO PATH

1) Input Buffer

[The left channel will be discussed; the right channel is identical.]

The signal enters the 275A in balanced form. C101, C102 shunt RF from the input leads to the chassis. These capacitors are not effective at VHF and higher frequencies; therefore, ferrite beads have been placed around the input and output leads to suppress such high frequency RF. It should be noted that this degree of RF-proofing is moderate but adequate for a 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 considerations familiar to the broadcast engineer may have to be used in conjunction with the 275A's built-in RF suppression.

The filtered signal is applied to IC9b, a very low-noise opamp configured as a differential amplifier with a gain of 0.5. When both non-inverting and inverting inputs are driven by a source impedance which is small with respect to 100K (such as 600 ohms 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. Thus it serves as an "active transformer". Ordinarily, best results are obtained for unbalanced signals if the non-inverting (+) input is grounded and the inverting (-) input is driven.

IC9b will overload if its differential input exceeds approximately +26dBu.

2) Crossfade Circuit

The output of the left input buffer is applied directly to IC51, which consists of a photoconductive cell and an LED. The output of the right input buffer is passed through a voltage-controlled polarity-flipping circuit (IC10a) whose gain is +1 if Q101 is OFF (gate at -15V) and -1 if Q101 is ON (gate at ground). The output of IC10a is passed to IC52, another photoconductive cell/LED.

The left and right outputs of the stereo synthesizer are passed through R141, R142, and are connected to the outputs of the cells. In Bypass mode, the cells are conductive due to current's flowing through their associated LED's. Their resistances are approximately 200 ohms, and they almost completely swamp out any signal from R141, R142 by shunting it into the low output impedance of IC9b and IC10a. Thus the input signal is applied to the line amplifiers.

Conversely, in Synthesize mode the cells are off (at a high resistance; no current flowing through their associated LED's), essentially no loss occurs across R141, R142, and the synthesized signal is applied to the line amplifiers.

A smooth crossfade between the input and synthesized signals is achieved by ramping the current through the LED's within the photocouplers. When the ramp is done and the photoconductive cells are fully on, signal is removed from the input of the stereo synthesizer by turning off Q102, Q103, thus achieving perfect suppression of the synthesized signal.

The ramp generator will be described below in **6. Control Logic.**

The line amplifiers are conventional. They consist of a non-inverting amplifier IC1a, IC2a with a gain of slightly greater than +1 (to compensate for loss in IC51, IC52) driving an inverting amplifier IC1b, IC2b with a gain of -1. A balanced-to-ground output is thus created with the ability to drive up to +26dBm into 600 ohms.

2. NOISE REDUCTION CIRCUIT

Most of the noise reduction circuit is contained within IC12. (See Fig. 6-1 for a block diagram and pinout of the chip.) The noise reduction combines broadband downward expansion with a program-controlled high-frequency rolloff.

Dynamic filtering works by rolling off the highs starting at approximately 1kHz unless enough highs are detected in the signal to cover the noise floor in the mid- and high-frequency range. When this happens, the filter slides open to pass more and more of the full audio band as more highs are detected.

Audio is applied to the input of the sliding-cutoff filter (pin 6 of IC12) through R122. IC11a and associated components form a highpass filter whose output is applied to pin 2 of IC12 to control the bandwidth of IC12's sliding-cutoff filter.

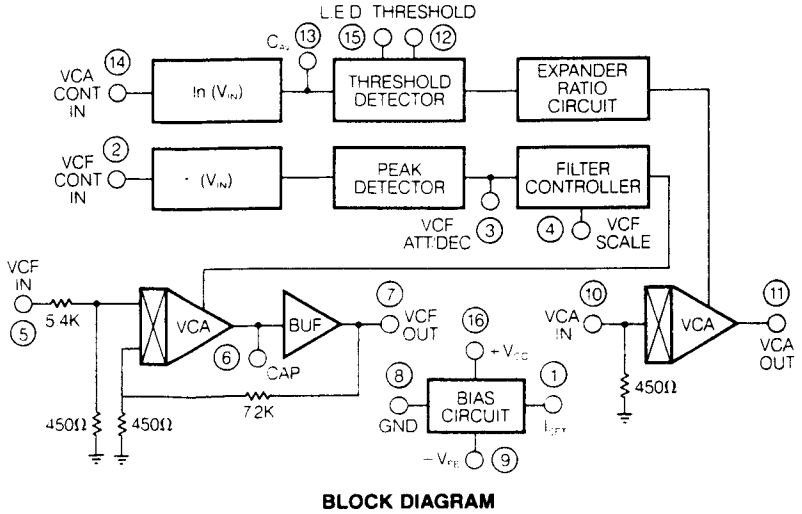
Downward expansion uses a voltage-controlled amplifier (VCA) controlled by a level detector. These maintain dynamic range integrity for all levels above a preset threshold. As the input level decreases below threshold, the EXPANSION lamp comes on and gain reduction occurs at an increasing rate with decreasing input level (see Fig. 6-1).

Signal is applied to the VCA input through R120, R121. A DC offset voltage from the Thump Null trimmer R132 is mixed in to allow minimization of DC output level changes with changes in VCA gain reduction.

Audio to the VCA controller section is applied through C105, R126. This audio, as well as the audio feeding the voltage-controlled filter (VCF) controller, is supplied from the output of IC11b, which can be switched to have either +4dB gain (for +4dBm nominal levels) or 0dB gain (for +8dBm nominal levels).

The release time for the downward expander is determined by C112, R130.

IC13a is a current-to-voltage converter which converts the output current of the VCA into a voltage suitable for driving the stereo synthesizer circuitry.



BLOCK DIAGRAM

Fig. 6-1: IC12 (SSM2200) Pinout And Block Diagram

3. STEREO SYNTHESIZER

The stereo synthesizer works by creating an artificial L-R signal which is then added to the mono to obtain the synthesized left channel and subtracted from the mono to obtain the synthesized right channel. This creates a "complementary comb filter": the sum of the two channels is equal to the original mono, thus mono compatibility is assured.

The artificial L-R signal is created by passing the signal through a chain of phase shifters IC5a, IC6, IC7, and IC8, and through 200Hz highpass filter IC4a. Q105, when OFF (gate at -15V), bypasses all phase shifters except IC8b, producing a WIDE comb filter bandwidth with few "teeth" (see Fig. 5-5). When Q105 is ON, all the phase shifters are in the circuit, and the comb filter bandwidth is narrow with many "teeth" (see Fig. 5-4).

The "separation" of the synthesized stereo is determined by adjusting the amount of artificial L-R by means of R194 (SEPARATION). IC3a and IC3b matrix the artificial L-R with the mono to create the two synthesized stereo channels, which are then applied to the crossfade circuit through R141, R142.

4. AUTO POLARITY CIRCUIT

Before being applied to the various recognition circuits in the 275A, the left channel signal is passed through a 0.1-1kHz bandpass filter IC20a, IC21a, IC22a. The right channel signal is passed through an identical filter IC20b, IC21b, IC22b. (See Fig. 5-6.)

By performing polarity and mono/stereo recognition using signals within this frequency band, these recognition circuits ignore low-frequency disturbances (like hum), and also ignore high frequencies (which tend to have interchannel phase errors due to time delays between the left and right channels of practical audio recorders).

The Auto Polarity circuit compares the peak level of the bandpassed L+R with the peak level of the bandpassed L-R. If the L-R exceeds the L+R by 2:1 for a significant period, the circuit assumes that the input is "out-of-phase", and automatically reverses the polarity of the right channel on the next zero-crossing.

1) L+R Peak Detector

IC16a, IC17 form a positive peak detector for L+R. This circuit is capable of following signal envelopes very quickly, yet has relatively low ripple.

The left and right signals are summed in R223, R227. R225 adds a DC offset to make sure that the peak detector output is clamped to approximately +25mV in absence of signal to avoid false operation of the polarity detector on noise.

The basic peak detector is CR201, C216. R228 closes a feedback loop around the peak detector to improve accuracy.

Every time that IC16a supplies a charging pulse to C216 through CR201, it also charges C215 through CR202. C215 discharges through R232. As long as pulses occur more than every 8ms or so, C215 will remain sufficiently charged to keep the output of IC17a close to -15V, which will keep Q201 off. When Q201 is off, C216 can only discharge slowly through R235.

However, if a charging pulse has not occurred for 8ms, the output of IC17a goes high, and Q201 turns on, connecting R234 in parallel with R235, thus speeding recovery. This switching between fast and slow time constants allows the peak detector to follow falling envelopes quickly, yet limits the amount of ripple modulation on its output.

2) L+R/L-R Comparator And Time Constant

The peak-detected L+R is applied to the "+" input of IC18, while -(L-R)/2, derived in IC16b, is applied to IC18's "-" input. Unless the peak level of -(L-R)/2 exceeds the peak level of the L+R at some time, the output of IC18 will always be high (close to +15V). However, if the peak level is exceeded, IC18's output will go low (towards -15V) on every peak which exceeds the level, charging C217 towards -15V through CR204 and R237.

A few peaks will not be sufficient to trip the circuit. However, consistently dense peaks will discharge C217 below -7.5V, forcing the output of IC19 HIGH. This upward-going pulse clocks D flip-flop IC14a. IC14a is connected (through IC14b, which delays transitions until a right-channel audio zero-crossing) to the polarity switch Q101 in the right channel audio path. Q101 forces IC10a to be non-inverting when IC14a's output is LOW (ground), and to be inverting when IC14a's output is HIGH (+15V). IC14a is configured to change state on every clock pulse. IC14a therefore corrects the polarity by changing state when a clock pulse is received.

To minimize audible clicks when the polarity is changed, it is desirable to switch on a zero-crossing of the right channel signal. IC15 is a zero-crossing detector: It

clocks D-flip-flop IC14b on zero-crossings, permitting the output of IC14b to follow the output of IC14a only on the next zero-crossing after IC14a has changed state.

5. MONO/STEREO RECOGNITION CIRCUIT

NOTE: To better understand the explanation below, please note that the SYNTH FROM L, SYNTH FROM R, and BYPASS logic operates between -15V (LOW) and 0V (HIGH). These lines are activated by a -15V (LOW) signal. The three outputs from the AUTO Recognition circuit activate their associated mode when they go LOW, and do nothing when they are HIGH (at ground).

1) Single Channel Recognition

The left channel is amplified 30dB by IC23a, and is then AC-coupled (through C221) to comparator IC31. R276, R278 apply +50mV of DC offset to IC31's "-" input. The DC output from the L+R peak detector is applied to IC31's "+" input. When sufficient left channel signal is present, the output of IC31 goes negative with sufficient duty cycle to hold C223 close to -15VDC through CR217. This forces the output of comparator IC28c to ground (HIGH), indicating "signal present on left channel".

If signal is absent on the left channel, but right channel signal produces a DC output from the L+R peak detector, the "+" input of IC31 will always be more positive than its "-" input and output of IC31 will be held towards +15V, permitting C223 to discharge towards ground through R286. When C223 has discharged to approximately -7.5VDC, the output of IC28c goes to -15V (LOW), indicating "left channel absent, right channel present". This single-channel condition forces the synthesizer into Synth From R mode, provided that Auto mode has been chosen. If Auto mode is <u>not</u> chosen, the output of IC31 is forced towards -15V by CR216 at all times and the output of IC28c can never go LOW.

When the synthesizer goes into Synth From R, the output of IC34c (Right Auto Offset line) goes to -15V (it is otherwise at ground). This changes the offset on the "-" input of IC31 from +50mV to -432mV and is a "gating" function: even in absence of signal, the output of IC31 will now go towards +15V, and the circuit will continue to call for Synth From R mode. To break out of this gated mode, there must be enough signal present in the left channel to overcome the -432mV offset and once again charge C223 towards -15V.

Automatic detection of a "signal present on left, absent on right" condition is performed in an entirely symmetrical way by means of IC23b, IC30, IC34d. This automatically calls for Synth From L.

When signal is present on <u>both</u> left and right channels, the outputs of both IC28c and IC28d are HIGH (ground). This forces the output of IC29d LOW (-15V), calling for Bypass mode (unless this state is overridden by the Center-Channel Mono Detector's calling for Synth From L, or unless the output of IC29d is overridden by CR210's pulling the junction of R291 and CR218 HIGH; the latter override occurs when Auto mode is defeated).

2) Center-Channel Recognition

The outputs of the left and right bandpass filters are applied to the "+" inputs of comparators IC24a, IC24b, whose "-" inputs are connected through voltage divider R250, R251 to the peak-detected L+R. This offsets the comparator thresholds in proportion to the peak level of the L+R.

The outputs of the comparators are processed by Exclusive-OR gate IC25a. This produces a LOW (-15V) signal when its inputs are identical, and a HIGH (ground) signal otherwise. The duty cycle of the output of IC25a thus depends on the amount of time that the left and right channel comparator outputs are identical.

If both channels were absolutely identical, the output of IC25a would always be LOW. As the channels become less and less identical (more and more "stereo"), the amount of time in which the output of IC25a is HIGH becomes ever greater. R255 and C219 time-average the output of IC25a. The voltage on C219 thus corresponds to the stereophonic content of the left and right signals: the more stereo, the closer the voltage approaches ground.

This voltage is detected by comparator IC28a, whose trip point is adjusted by means of R263 (Mono Threshold). Hysteresis is supplied by positive feedback through R260 (IC25d serves as a buffer), so that the mono-to-stereo and stereo-to-mono trip points are not identical: once the circuit has decided that program material is "stereo" or "mono", the hysteresis makes it more difficult for the circuit to "change its mind". This avoids "chattering" between mono and stereo on marginal program material.

IC28b is a silence-gating detector. When the peak L+R level falls below approximately 68mV, the output of IC23b goes LOW (-15V) and turns on tri-state buffer IC41a. Ordinarily, the Disable pin (#19) is HIGH (ground) and the output of IC41a has a high impedance. When IC41a is turned ON, it completes a positive feedback path through R257, R258, CR212 to make sure that the state of IC28a does not change during silence. (IC25c is an inverter; feedback is taken to the "-" input of IC28a; thus, overall positive feedback occurs.)

The voltage on C219 is forced to be close to -15V if IC28a was indicating "mono" before silence occurred (IC28a output at ground), or -7.5V if IC28a was indicating "stereo" (IC28a output at -15V).

The output of IC25c is HIGH if stereo is detected; LOW for center-channel mono. When the RECOGNITION switch S14 is set to 1CH ONLY, IC25c is completely disconnected from the main 275A logic. If S14 is set to M/S+1CH, IC28d operates the same as IC28c (described above in **Single Channel Recognition**) when IC25c indicates stereo. When IC25c indicates center-channel mono, it pulls R281 to -15V. This puts approximately -15V on pin 11 of IC28d. IC30b cannot pull pin 10 of IC28d down this far. Therefore, the output of IC28d is forced LOW, which invokes Synth From L mode.

If Auto mode is not active, the Center-Channel Mono Recognition circuit is suppressed by pulling C219 HIGH through CR211. This corresponds to the "stereo" (do-nothing) detection condition. Detection of center-channel mono can also be suppressed by pulling C219 to ground through User Control Interface connector J2-13.

6. CONTROL LOGIC

1) General

The control logic is a mixture of various logic types and voltages. This was done to reduce parts count, cost, and complexity.

Most logic is realized in CMOS, operating from 15V supplies. The logic for NOISE REDUCTION OPERATE/DEFEAT and AUTO-POLARITY ON/OFF operates between ground (LOW) and +15V (HIGH) to allow the most simple interfacing between the logic and the circuits being controlled. All other CMOS operates between -15 (LOW) and ground (HIGH).

Discrete diode logic is mixed with the CMOS wherever use of such discrete logic would simplify the circuitry.

2) Comb Bandwidth

[Logic operates between -15V (LOW) and ground (HIGH)].

IC27a, IC27b are crosscoupled to form an RS flip-flop circuit which "remembers" its state until switched to a new one by a momentary pulse or continuous signal (it doesn't care which). Its inputs are provided by front-panel switches S6, S7, as well as by optoisolators IC57, IC62 which isolate the User Control Interface from the logic.

When Q401 turns on (collector at -15V), Q105 turns off. This permits the output of phase shifter IC8b to feed signal through R195 into buffer amplifier IC4b. All other phase shifters are bypassed, and a WIDE comb bandwidth is generated.

When Q401 turns off (collector floating), Q105 turns ON through R190. This connects the output of phase shifter IC5a to the input of IC4b and swamps out any significant signal leakage through R195, switching all phase shifters into the circuit and providing a NARROW comb bandwidth.

When Q402 is off, current flows through DS11 (NARROW LED), CR401, CR402, and R413. R413 provides current limiting. When Q402 is on, its voltage drop is lower than that of CR401, CR402 in series. Therefore, current is shunted away from DS11 and flows instead in DS10 (WIDE LED). (This "tree" principle of logic decoding for the lamps is used, in a more complex way, for the yellow STANDBY lamps as well.)

3) NOISE REDUCTION OPERATE/DEFEAT

[Logic operates between ground (LOW) and +15 (HIGH)].

IC26a, IC26b form an RS flip-flop. Q404 turns on to disable the operation of IC12 through CR102, CR103. However, signal still flows through IC12 even when the Noise Reduction function is OFF.

4) AUTO POLARITY ON/OFF

[Logic operates between ground (LOW) and +15V (HIGH)].

IC26d and IC26c form an RS flip-flop. When the output of IC26c is HIGH, it prevents IC14a and IC14b (through CR409) from changing state, thus suppressing the Auto Polarity function.

C218, CR207 is a power-up circuit for IC14a, IC14b that assures these D flip-flops will always power-up such that the polarity is non-inverted.

5) Basic Mode Switching, General

[This logic operates between -15V (LOW) and ground (HIGH)].

Because this logic can operate in either Pulse or Continuous modes, and because it is interconnected with the Recognition circuitry, it is substantially more complex than the simple logic discussed above. The **Block Diagram in Appendix E** shows the logic (in a somewhat conceptual form), and should be used in conjunction with this description.

Briefly, the logic uses RS flip-flops to "remember" the Standby state, and tri-state gates to electronically switch between the output of the RS flip-flop "memory" and the User Control Interface inputs as required. Auxiliary circuits determine when a User Control Interface input is active (a normal condition), or when more than one such input is active (a fault condition which automatically invokes Auto mode). An Automation Lockout circuit enables the User Control Interface to be entirely isolated from the logic.

6) Input Decode And Latches

IC39a, IC39b is the SYNTH LEFT/RIGHT latch which remembers whether LEFT or RIGHT was the last Synth mode invoked. The state of the latch can be changed by the Recognition circuit (through CR301, CR303), by the pushbuttons (through CR302, CR304), or by the User Control Interface (through CR313, CR314; and through IC40a, which is enabled in Pulse mode only).

IC39c, IC39d is the SYNTH/BYPASS latch which determines if the operating mode is Bypass or either Synth mode. Its state can be changed by the same sources as the SYNTH LEFT/RIGHT latch. In addition, CR306, CR307 conduct whenever a SYNTH L or SYNTH R input is received from any source, and switch the latch into Synth mode.

IC27c, IC27d is the AUTO latch. Its state can be changed to AUTO by means of the buttons, the User Control Interface (Pulse mode only), and the Fault output line through CR309 from the User Control Interface Status Sensor (see below). Its state will be changed to non-Auto (through CR310, CR311, CR312) if SYNTH FROM L, SYNTH FROM R, or BYPASS commands are received from the buttons or User Control Interface. Commands from the Recognition circuit are specifically isolated to prevent them from turning AUTO mode off.

When the yellow STANDBY lamps are enabled by the User Control Interface Active sensor (IC32b) turning Q311 on, these lamps always indicate the status of the input latches. The outputs of the latches are decoded by a "tree" arrangement similar to that used to decode the WIDE/NARROW lamps.

7) Pulse/Continuous Logic

Subsequent logic can be driven either by the input latches or by the User Control Interface inputs. Switching between these two sources is effected by tri-state gates IC40b, IC41b.

Each set of four gates can be thought of as a 4PST switch. When the Disable node for a switch is HIGH, the switch is OFF; when it is LOW, the switch is ON. The outputs of the switches IC40b and IC41b are connected in parallel, pairwise, switching the AUTO, BYPASS, SYNTH FROM L, and SYNTH FROM R lines between the input latches and the User.Control Interface inputs. IC33b is a logical inverter which assures that only one switch is ON at a time.

In Pulse mode, IC41b is always ON. In this mode, IC40a ordinarily connects the User Control Interface inputs to the input latches, unless IC40a is turned OFF by a command from the Automation Lockout circuit or by the User Control Interface Status Sensor detecting that two or more User Control Interface inputs are active simultaneously.

In Continuous mode, IC40a is always OFF, so that the User Control Interface inputs can never affect the state of the input latches. Meanwhile, IC41b is ON until IC32b detects activity on a User Control Interface input line. As soon as this occurs, IC40b is switched ON and IC41b is switched OFF, connecting the User Control Interface inputs directly to subsequent logic and permitting these inputs to control machine status as long as User Control Interface input activity is detected.

8) User Interface Status Sensor

This consists of IC32 and associated circuitry. When no User Control Interface inputs are active, pins 3 and 5 of IC32 are pulled to ground by R316. The outputs of IC32a and IC32b are both HIGH (towards +15V).

When one User Control Interface input is activated, pins 3 and 5 of IC32 are pulled to -2.7V. Since pin 6 of IC32 is at -1.5V, while pin 2 of IC32 is at -4.0V, this turns the output of IC32b LOW (towards -15V) but leaves the output of IC32a HIGH, indicating normal "User Line Active" status. When more than one User Control Interface input is activated, pins 3 and 5 of IC32 go below -4.0V and both IC32a and IC32b go LOW, indicating a fault condition.

When IC32b goes LOW, it turns on the appropriate yellow STANDBY lamp (by turning on Q311 to supply current to the "tree" which decodes the lamps), and also, in Continuous mode, turns IC40b ON and IC41b OFF.

When IC32a goes LOW, it turns off IC40a and IC40b and turns on IC41b, disconnecting the User Control Interface inputs from all logic.

When activated, the Automation Lockout circuit forces pin 1 of IC35a to -15V, thus forcing pin 2 of IC32a to -15V and preventing detection of a fault condition. (Such detection would otherwise cause a state change to AUTO, contrary to the intent of the Automation Lockout function.)

9) Crossfade Ramp Generator

IC37 is a level shifter which senses the logic level on the BYPASS line.

When the logic is in Bypass mode, C308 is ordinarily at -1V. When the logic changes to non-Bypass (i.e., Synth) mode, IC37 clamps the output of IC38 HIGH (towards +15V) through CR324. This reverses-biases CR325, essentially removing IC38 from the circuit. This permits C308 to produce an exponentially-falling ramp by discharging towards ground through R333, R331 (if Q308 is ON), R329, and R330.

Q308 switches the crossfade between Slow (Q308 Off; its gate connected to its source through R332) and Fast (Q308 On; its gate clamped to -15V through R265 and diode-connected transistor Q309.) IC29b and IC29c are logic to determine the crossfade time; crossfading is Slow if the Center-Channel Recognition circuit has caused a state change, and Fast if the state change was caused by any other means.

When the logic switches to BYPASS, IC38 becomes active. From the point of view of its "+" input, IC38 is a non-inverting amplifier with a gain of +2. The amplifier output appears at the anode of CR325. Feedback holds the "-" and "+" inputs of IC36a within 2mV of each other. Therefore, the voltage on the "+" input of IC38 is essentially identical to the voltage on C308 except for a slight offset introduced by R335 which places the anode of CR325 slightly more negative than C308. This offset permits C308 to start to charge slowly towards -1V (through R333 and, if Q308 is ON, R331). The more negative the voltage on C308 becomes, the more voltage differential there is between C308 and the anode of CR325, and therefore the faster the change in the voltage on C308. A ramp which starts slowly and then speeds up is thus produced on C308. This "reverse exponential" is the mirror image of the process which occurs when IC38 is clamped OFF by IC37.

If it were not stopped, this process would continue to increase in speed indefinitely. Instead, it is stopped at -1V by IC36b. IC36b's "+" input is held to -1V by R324, R325. As long at its "+" input is more negative than its "-" input, IC36b's output sits close to -15, reverse-biasing CR323, which prevents C308 from being affected by IC36b. When IC36b's "-" input equals -1V, CR323 turns on, closing the feedback loop around IC36b and actively clamping C308 to -1V. When this occurs, the output of IC33d goes LOW (-15V), indicating "Ramp Done" to the Latch And Left/Right Decode logic (discussed below).

IC36a, Q310, and associated components form a voltage-to-current converter. Feedback from IC36a causes the voltage across R334 to equal the voltage across C308. The resultant current through R334 flows through Q310 and emerges from its collector. Its collector is connected to three LED's in series: the two in optically-coupled resistors IC51 and IC52, and DS5, the front-panel BYPASS indicator. The illumination of the BYPASS indicator therefore serves to indicate whether the ramp generator is operating correctly. In particular, it shows a clear fade-in and fade-out when the ramp speed is Slow.

10) Latch And Left/Right Decode Logic

Switching of left and right audio into the Synthesizer circuitry is effected by FET's Q102 (left) and Q103 (right). When Bypass mode is chosen, the FET that was ON remains ON until the crossfade ramp is finished. As soon as the ramp is finished, the FET turns OFF to entirely isolate the Synthesizer from the main 275A audio outputs.

When a Synth mode is chosen, the correct FET (Q102 or Q103) immediately turns on to permit a smooth crossfade.

This scheme means that Q102 and Q103 do not turn off as soon as the main logic chooses Bypass mode. Instead, they remain on as appropriate until the crossfade is finished. Achieving this requires special logic, which is realized in IC42.

IC42c, IC42d form an RS flip-flop. If IC41b is on, this flip-flop simply follows the SYNTH LEFT/RIGHT latch IC39a, IC39b. However, if IC41b is off and IC40b is on, the User Control Interface inputs, not the input latches, control the logic lines. Flip-flop IC42c, IC42d has one output active at all times. This assures that at least one FET (Q102 or Q103) will be on to assure a smooth crossfade to BYPASS, even when BYPASS has been invoked by the User Control Interface input.

"Ramp Done" is indicated by pin 11 of IC33d's going LOW (-15V). This forces both pin 3 and pin 4 of IC42 HIGH (ground). These pin 3 and pin 4 signals are inverted by IC34a and IC34b, which both go LOW when the ramp is done, assuring that both Q102 and Q103 are OFF.

11) Active Status Lamps

Lamps are driven from logic outputs to indicate that the 275A's actual status is SYNTH FROM L, SYNTH FROM R, or BYPASS, and to indicate AUTO Mode. An examination of the schematic, combined with an understanding of the logic (as explained above), should be sufficient to allow understanding of the operation of these lamps.

12) Automation Lockout Circuit

IC35b is configured as a buffer with strong hysteresis, achieved by means of positive feedback through R340. This circuit de-bounces S5 (AUTOMATION LOCKOUT).

Feedback between IC35a's inverted output and its D input causes the circuit to change state every time it receives a positive-going edge from IC35b, thus toggling the Automation Lockout function between ON and OFF every time S5 is operated.

When Automation Lockout is enabled, it turns IC40a and IC40b OFF by pulling pins 1 and 19 to ground, entirely disconnecting the SYNTH L, SYNTH R, BYPASS, and AUTO User Control Interface inputs from the 275A logic system.

7. REMOTE CONTROL

The optional Orban Remote Control Panel 275A/RC is a small, passive chassis which is driven entirely from the 275A's power supply. To avoid wasting power supply current, all remote lamps are placed in series with the lamps in the main chassis. This requires that an internal plug be moved when the 275A/RC is installed to enable the remote lamps. When this plug is in the Remote position, disconnection of the Remote Control Panel will interrupt current through the main chassis lamps, causing the main chassis to be dark and forcing the unit into Synthesize mode (because no current can flow through the lamps in optically-coupled resistors IC51 and IC52).

If Bypass mode is logically chosen under this condition, no audio will appear at the 275A outputs.

All pushbuttons' outputs are applied to RC lowpass filters (to eliminate RFI) and are then paralleled with the equivalent buttons in the main chassis.

8. POWER SUPPLY

Unregulated voltage is supplied by two pairs of full wave diode rectifiers (in package CR101) operating into a pair of energy storage capacitors C501, C502. The power transformer T1 is strappable 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.

The nominal unregulated voltage is roughly $\pm$24 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 $\pm$17.8 volts.

Regulated voltages are supplied by a pair of overrated 500mA "three terminal" IC regulators IC71, IC72. Because they are operated so conservatively, they can be expected to be extremely reliable. Therefore, 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 causing the regulator IC's to go either into current limiting or into thermal shutdown, their two built-in protective modes. If it becomes necessary to replace a regulator, be sure to replace its heat dissipator securely.

The regulators IC71 and IC72 are frequency-compensated by C503, C504 at their outputs to prevent high frequency oscillations. If C503 or C504 are ever replaced, be sure to use low-inductance aluminum electrolytics. Tantalums can fail because the current-delivering capacity of the power supply can cause a runaway condition if the dielectric is punctured momentarily; high-inductance aluminums can fail to prevent the regulators from oscillating. It is therefore necessary to check for oscillation on the power bus with an oscilloscope if C503 or C504 is replaced. In addition, small 0.1uF/25V ceramic capacitors bypass the power busses to ground locally throughout the board to prevent signal-carrying IC's from oscillating due to excessive power-lead inductance.

LED Brightness

In some installations, the LED's may be too bright. The brightness of most of the LED's can be changed by increasing the values of series resistors R343, R344, R350, R352, R354, R413, R416, and R421. Since the red BYPASS LED is in series with internal optoisolators which must be run at 20 mA, it can only be dimmed by shunting current around it; a 100-ohm, 1/4-watt shunt should result in an approximately 50% reduction in brightness. All other LED's are operated at about 10 mA; replacing the 1.5k resistors with 6.8k resistors should halve the brightness (1.5 mA). However, due to the nature of the LED's, resistor values must be chosen by experiment.