MODEL ASE-1

AM STEREO EXCITER

AND

C-QUAM® STEREO SYSTEM

INSTALLATION MANUAL

MODEL ASE-1 AM STEREO EXCITER

FCC I. D. DK76/C1300

DELTA ELECTRONICS, INC.
5730 GENERAL WASHINGTON DRIVE
ALEXANDRIA, VIRGINIA 22312

D93-346

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CERTIFICATE OF WARRANTY

Delta warrants to Purchaser that the product it delivers will be free of defects in materials and be of good quality and workmanship.

This warranty applies to the period of one year from the date of delivery except for component parts purchased from other sources and assembled in Delta's production. Such component parts bear only the warranty of the manufacturer thereof in effect at the time of shipment to Purchaser.

Delta will, at its own expense and, after written notice has been received and acknowledged by Delta, repair or replace any product which proves to be defective (according to the usage of the trade) during the above designated warranty period when such product is received by Delta at its Alexandria address with shipment costs prepaid by Purchaser.

Delta will not be liable for consequential damages.

No other warranty is expressed or implied.

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SAFETY PRECAUTIONS

This Manual is intended for use by trained and qualified operating or service personnel who are familiar with handling potentially hazardous electrical/electronic circuits. It is not intended to contain a complete statement of safety precautions which should be observed.

Avoid risking electrical shock in handling all circuits where substantial currents or voltages may be present.

LIABILITY

The information in this Manual is based on data available at the time of publication. However, the manufacturer cannot assume liability with respect to technical application of the contents and shall, under no circumstances, be responsible for damage or injury (whether to person or property) resulting from use of the subject equipment.

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To obtain service replacement or warranty items, write or call Delta at the address shown on the cover. Please supply product Model Number and Serial Number and replacement part identification (including Order Number and description). Shipping of replacements may be unduly delayed if the necessary information is not supplied. A complete List of Materials is provided in this Manual.

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Delta will file all claims for loss and damage on this equipment so long as the inspection report is obtained. Disposition of the damaged items will be determined by Delta.

FIELD ENGINEERING SERVICE

Requests for installation, field engineering or service assistance should be directed to Delta.

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SECTION 1

INTRODUCTION

1.1 SCOPE

This manual describes the installation, adjustment and maintenance of the Model ASE-1/ASM-1 C-QUAM Stereo System manufactured by Delta Electronics, Inc. and primarily describes the Model ASE-1 AM Stereo Exciter as shown in Figure 1-1. A detailed description of the Model ASM-1 AM Stereo Modulation Monitor is contained in its own technical manual, D93-345. Section 2 contains a description and specifications for the AM Stereo Exciter. Section 3 of this manual deals with the checkout of newly delivered C-QUAM stereo equipment including closed loop Exciter - Monitor performance checks. Section 4 describes the installation of the Exciter with the broadcast transmitter, adjustments of the transmitter and Exciter for optimum stereo performance, and necessary performance measurements. Section 5 is the theory of operation and Section 6 describes care, maintenance and repair procedures for the Exciter. Section 7 contains lists of material for all replaceable components and component location photographs. An Interconnect Diagram, functional block diagram and schematic diagrams are in Section 8.

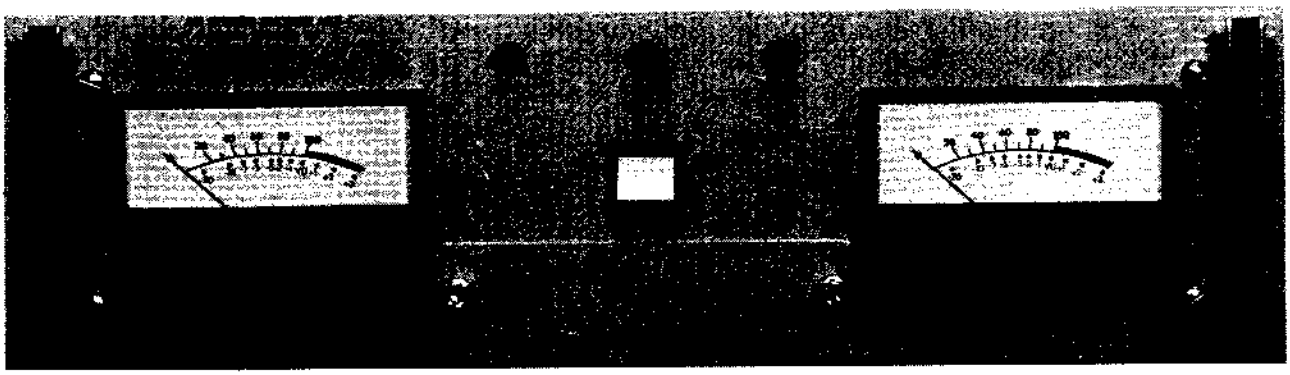
As noted in the accompanying Customer Information, Delta warrants its C-QUAM Stereo products as to material integrity, quality and workmanship, excluding component parts purchased from other sources. Also, this manual is intended for use only by personnel familiar with potentially hazardous electrical/electronic circuitry. It does not contain a complete statement of safety precautions. The information presented is accurate up to issue date, but Delta cannot assume reliability for technical application of that information, nor for damage or injury resulting from use of the subject C-QUAM Stereo equipment.

1.2 WHAT IS C-QUAM?

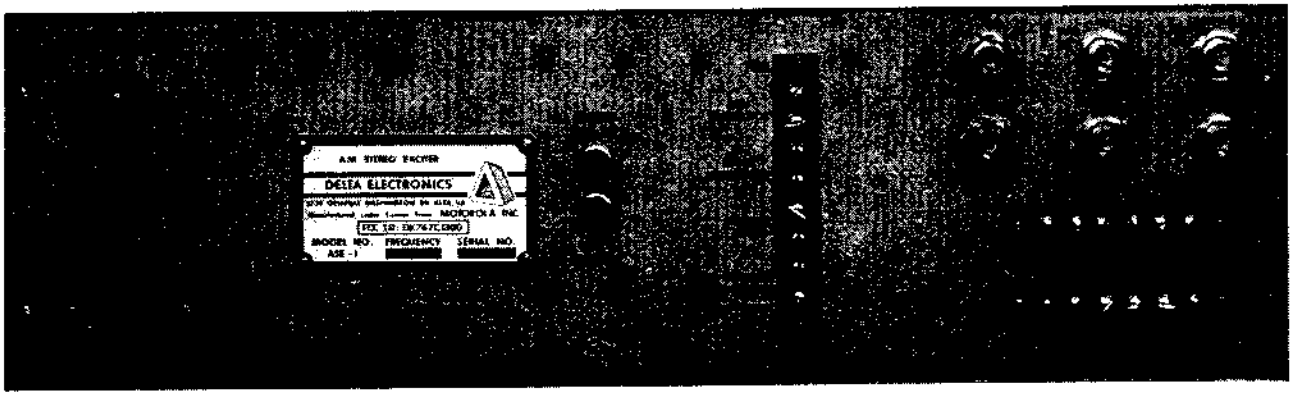
C-QUAM is the Compatible Quadrature Amplitude Modulation method of stereo transmission by which a main (L+R) and a subchannel (L-R) signal are transmitted on a single carrier. This is accomplished by using two modulation modes to transmit the main and stereo information channels. Stereo receivers separate the signals to ultimately produce left and right channel audio while typical monophonic receivers detect only the L+R (mono) content of the C-QUAM signal. The most important feature of C-QUAM is that no compromises are made in monophic performance in order to transmit stereo. It is truly a compatible stereo transmission system.

1.2.1 AM and PM Modulation

To ensure a full understanding of C-QUAM, a quick presentation of modulation characteristics is in order.



FRONT VIEW



REAR VIEW

FIGURE 1-1
ILLUSTRATION OF COMPLETE EQUIPMENT

Amplitude modulation is the process in which one signal's amplitude is varied by another signal. An oscilloscope display depicts the amplitude variation versus time of the AM signal. This is the familiar RF envelope display illustrated in Figure 1-2A. The AM signal can also be described in the frequency domain with an amplitude versus frequency plot. Figure 1-2B illustrates a typical spectrum analyzer display of an AM signal. The display reveals a carrier and two sidebands separated from the carrier by the modulating frequency. In AM, as the modulation is increased, the sideband amplitudes increase but the average carrier level remains constant.

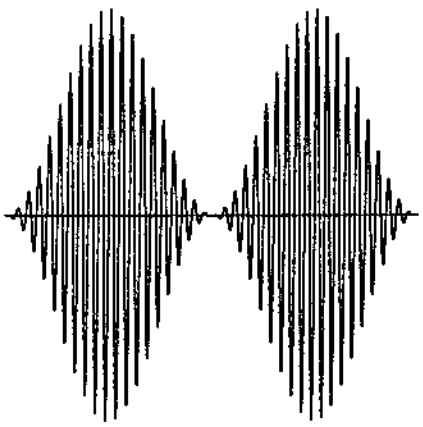


Figure 1-2A

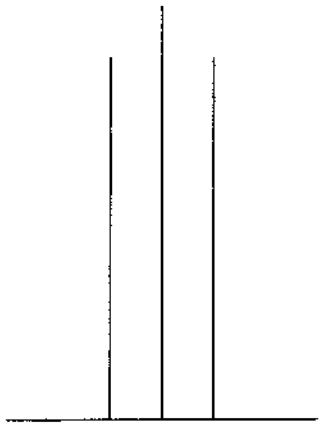


Figure 1-2B

Phase modulation results in very different time and frequency domain plots. PM is generated by varying the phase of the carrier signal, and thus, its frequency, while the amplitude remains constant. Figure 1-3A illustrates a PM signal RF envelope. The spectrum analyzer plot of a PM signal reveals sidebands spaced at multiples of the modulation frequency from the carrier. Since the amplitude of the PM signal is constant, the phasing of the sidebands is such that they add and subtract to produce a constant amplitude. Figure 1-3B illustrates the PM signal spectrum plot.

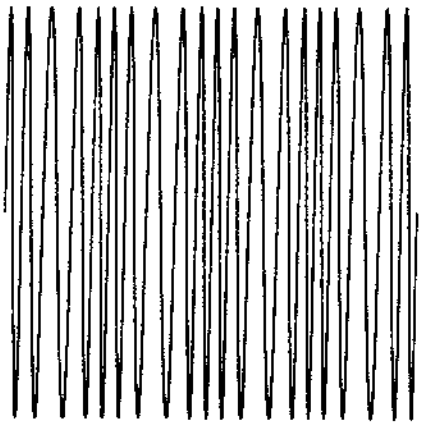


Figure 1-3A

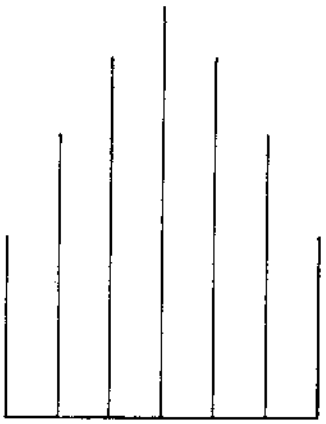


Figure 1-3B

Since the phase of the carrier is not affected by amplitude variations, a phase detector output is zero when an AM signal is input. Similarly, an envelope detector does not detect phase variations of the PM signal. All the sidebands add and subtract according to their phasing to produce a constant amplitude RF signal. Thus, a phase modulated carrier can also be amplitude modulated producing a signal that carries two channels of information easily separated at the receiver. Most important is the fact that neither modulation mode affects the output of the other mode detector. This effect allows C-QUAM to be perfectly compatible with all AM receivers. C-QUAM transmits the L+R (mono) information with AM while the L-R (stereo) information is contained on the PM signal. The millions of existing envelope detector type radios now in use detect only the L+R AM signal, thus producing a clear undistorted mono audio signal that is completely unaffected by the L-R stereo subchannel information sent on the same carrier. Stereo decoders detect the L+R and L-R separately and dematrix them to produce left and right stereo audio.

1.2.2 Generating C-QUAM

The AM/PM method of stereo transmission discussed can be achieved by several methodologies. C-QUAM uses the L+R information to produce an in phase, I, AM signal while the L-R information is used to generate a quadrature (90° phase shifted), Q, suppressed carrier signal. Summing the I and Q signal results in a signal that is both amplitude modulated and phase modulated. This quadrature amplitude modulated (QUAM) signal is not compatible with envelope detector receivers because the Q channel amplitude affects the amplitude of the sum of the I and Q channels. The QUAM signal is thus passed through a limiter to strip off the amplitude variations leaving only a phase modulated carrier. This phase modulated carrier generated from quadrature amplitude modulation replaces the carrier normally generated by the crystal oscillator in the broadcast transmitter. The I information (L+R) can then be used to amplitude modulate the phase modulated carrier in the broadcast transmitter as is done in conventional AM. The output of the transmitter is thus the C-QUAM signal. Figure 1-4 illustrates the C-QUAM transmission methodology.

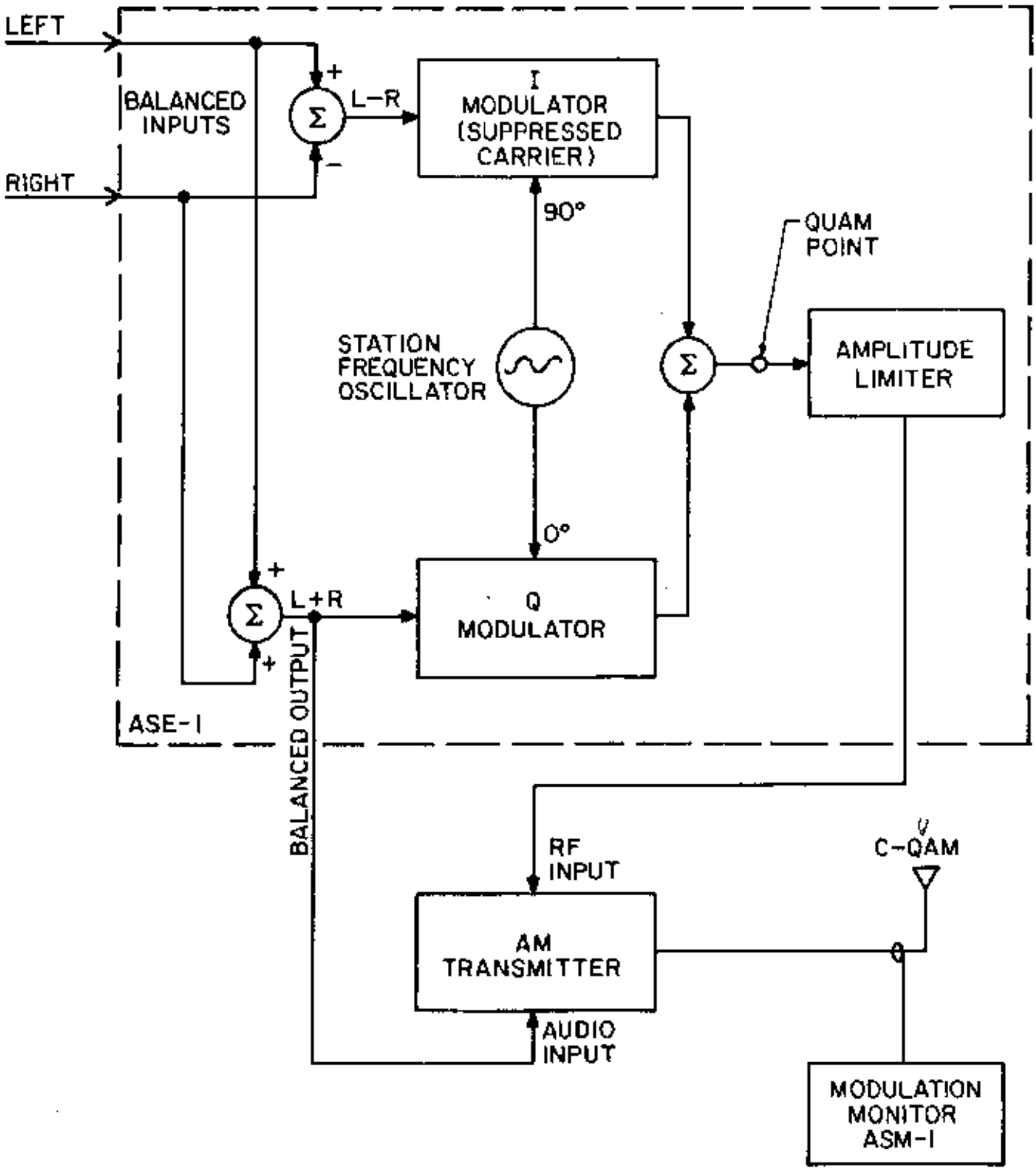


FIGURE 1-4

AM STEREO EXCITER SIMPLIFIED BLOCK DIAGRAM

SECTION 2

EQUIPMENT DESCRIPTION AND SPECIFICATIONS

2.1 MODEL ASE-1 AM STEREO EXCITER EQUIPMENT DESCRIPTION

The Model ASE-1 AM Stereo Exciter manufactured by Delta Electronics, Inc. is designed to convert a monophonic station to C-QUAM AM stereo. This Exciter receives left and right channel audio signals and produces RF and audio signals for one or two transmitters. The RF signal from the Exciter replaces the RF signal from the crystal controlled oscillator in the transmitter. The audio signal is fed to the transmitter modulator input.

The Exciter contains switchable delay circuits and adjustable high and low frequency equalization filters to compensate for the modulator characteristics of a wide variety of transmitters. Two sets of these circuits are included for compensation of two transmitters. Adjustment of these circuits and connections of the Exciter to the transmitter is described in Section 4 of this manual.

2.2 SYSTEM SPECIFICATIONS

2.2.1 System Closed Loop Performance

The following is typical closed loop performance of the Exciter operating into the Monitor.

Stereo Separation at 50% single channel:

40 dB minimum 50 Hz to 5 KHz
30 dB minimum 5 KHz+ to 10 KHz
25 dB minimum 10 KHz+ to 15 KHz

Stereo Separation at 70% single channel:

35 dB minimum 100 Hz to 5 KHz

Frequency Response:

50 Hz to 10 KHz +0.5 dB any modulation
10 KHz + to 15 KHz ±1 dB any modulation

Harmonic Distortion:

L=R monaural 0.5% maximum at 95% modulation
L=-R pure stereo 0.5% typical at 100% modulation
L, R single channel 1.0% typical at 70% modulation

2.2.2 Model ASE-1 AM Stereo Exciter Specifications

Audio Input:

Right 0 dBm to 10 dBm balanced 600 ohms
Left 0 dBm to 10 dBm balanced 600 ohms
Both inputs adjustable with factory installed pad per customer requirements.

Meter Functions:

$(L+R)_Q$ and $(L-R)_Q$ or L and R meter functions switched at the front panel between meters. $(L+R)_I$ can be monitored on (L+R) meter by using (L+R) Env switch under the cover on the front panel.

Meter Range:

-20 to +3 dB
0 dB = 100% modulation

RF Outputs:

Dual square wave to 38 Vp-p into 50 ohms.
Dual TTL level outputs.

(L+R) Outputs:

Dual output, adjustable under cover on front panel via 10-turn potentiometer up to 16 dBm, 600 ohms balanced.

Stereo-Monophonic:

Switched under cover on front panel. Switched L=R for monaural. Stereo or monophonic mode is indicated by LED on front panel. May also be remotely switched via rear panel terminals.

Phase Equalization:

Internally adjustable phase equalization is provided to compensate for phase variations in the transmitter chain. Two paths are available for Day/Night or Main/Aux modes.

Sample Transmitter Output:

A sample transmitter output is provided on the rear panel for diagnostic, comparison of station's transmitter characteristics. Exciter may be set for C-QUAM signal from this output. Sample transmitter output 2 Vp-p into 50 ohms.

2.3 MODEL ASE-1 AM STEREO EXCITER CONTROLS AND CONNECTORS

2.3.1 Exciter Front Panel

REF	DESCRIPTION	FUNCTION
M801 M802	Left Meter Right Meter	Audio level meters for test/set up. Note: the meters are not to be used as an indication of modulation.
DS801	Pilot Indicator LED	On/Off indicator of pilot output
DS802	Stereo Indicator LED	On/Off indication of stereo operating mode
DS803	Night Indicator LED	On/Off indication of night operating mode
S801	Meter Function Switch	In the top position, the meters indicate the relative level of the left and right channel audio drive. In the bottom position, the meters indicate L+R and L-R audio drive levels.

2.3.2 Exciter Front Subpanel

REF	DESCRIPTION	FUNCTION
R782	+ Limit	Audio drive level limiting adjustment
R781	- Limit	Audio drive level limiting adjustment
R784	Day L+R	Sets output levels of L+R signal fed to modulation input of station day transmitter
R785	Night L+R	Sets output levels of L+R signal fed to modulation input of station night transmitter
R783	Balance	Allows slight amplitude adjust-ment between left and right inputs
S803	Mono/Stereo Switch	Selects between mono and stereo mode. Works in parallel with remote terminals of TB3.
S802	Stereo Pilot Switch	On/Off pilot switch

REF	DESCRIPTION	FUNCTION
S805	L+R Envelope Switch	Momentary action pushbutton switch to test if drive to the transmitter is present
S804	Night/Day Switch	Changes equalization for use with another transmitter or antenna. Works in parallel with remote terminals of TB3.

2.3.3 Exciter Rear Panel

REF	DESCRIPTION	FUNCTION
J4	Sync	Sync from Encoder Assembly. Unmodulated RF for frequency counter or testing.
J2	Day Var. RF	Adjustable square wave output to AM transmitter for high power drive (to 37 Vp-p into 50 ohms). This signal is the phase modulated substitute for the day transmitter's oscillator.
J3	Night Var. RF	Adjustable square wave output to AM transmitter for high power drive (to 37 Vp-p into 50 ohms). This signal is the phase modulated substitute for the night transmitter's oscillator.
J1	Sample Transmitter Output	C-QUAM output for test of Exciter to Monitor. 2 Vp-p into 50 ohms.
TB3-7, TB3-8	Remote Night/Day Switch	Works in parallel with front switch for changing equalization when using another transmitter or antenna. In night mode when contacts are closed.
TB2	Audio Input	Left and right 600 ohm balanced audio input 0 dBm to 10 dBm (determined at time of installation)
TB1 1-3	Day L+R Output	Balanced output from L+R amplifier to station transmitter (normal AM modulation input). Adjusted by Day L+R front subpanel control, +16 dBm maximum.

REF	DESCRIPTION	FUNCTION
TB1 4-6	Night L+R Output	Balanced output from L+R amplifier to station transmitter (normal AM modulation input). Adjusted by Night L+R front subpanel control, +16 dBm maximum.
J5 J6	Day TTL RF Night TTL RF	Phase modulated signal which is acceptable for TTL compatible transmitters. Substitutes for normal oscillator of station transmitter. Will drive terminated 50 ohm coaxial cables.
TB3-5 TB3-6	Remote Mono	Works in parallel with front subpanel STEREO switch. When contacts are closed, unit is in monophonic operation.
TB3-1 TB3-2 TB3-3 TB3-4	Day Interlock Night Interlock	Protects unused transmitter from loss of RF drive when using the switched variable RF outputs of J2 and J3
	Right and Left Delay	Day binary delay switches accessed from rear panel
F1	Line Fuse	1 ampere slo-blo
FL1	Line Input	120 VAC 50/60 Hz. May be internally strapped for 230 VAC.
	Identification Label	This label contains the FCC ID number which must remain on unit for legal operation

SECTION 3

ASE-1/ASM-1 CHECKOUT AND CLOSED LOOP TESTS

3.1 GENERAL

Section 3 describes the steps and procedures required to verify that the Model ASE-1 AM Stereo Exciter and the Model ASM-1 AM Stereo Modulation Monitor have arrived in good mechanical condition and are in good working order. This includes operating the two units in a closed loop configuration.

The Exciter has a sample transmitter output which transmits a C-QUAM signal. In closed loop tests, this signal is fed directly into the Monitor input. The closed loop readings of the Monitor reflect the performance of both units along with the audio source used in closed loop testing.

The procedures in paragraph 3.5 detail the complete closed loop adjustments and tests should it ever be necessary to remove the Exciter from service to verify its operation. Closed loop testing of new units to verify operation is described in paragraph 3.5.3.

Section 4 details the marriage of the Exciter, the Monitor and the station's transmitter(s).

3.2 INITIAL CHECKOUT

3.2.1 Incoming and Chassis Inspection

The shipping cartons for the Exciter and Monitor are designed to protect the equipment with normal handling during shipment. Thoroughly inspect the equipment for any evidence of mishandling. Report damage to the carrier immediately.

Check the contents of the two boxes against packing lists. Report missing items to Delta Electronics, Inc. immediately.

3.2.2 Mechanical Checkout

CAUTION

Complete this procedure before applying power to units.

Remove all screws from the top panels of the Exciter and the Monitor. Check that each socketed printed circuit assembly is properly seated in its socket. If not, open the card socket by operating the cam lever and reseat the board by firmly pressing down on the board while closing the socket using the cam lever.

After confirming that all printed circuit assemblies are properly seated in their sockets, secure the top covers to the Monitor and Exciter.

3.2.3 Incoming Closed Loop Tests

The check the electrical condition of the Exciter and the Monitor, connect the Exciter and the Monitor in the closed loop configuration and perform the tests described below.

3.3 TEST EQUIPMENT

3.3.1 Required Equipment

1. Low Distortion Oscillator, 600 ohm balanced output, +16 dBm
2. Distortion Analyzer capable of measuring average or true rms level

3.3.2 Suggested Equipment

1. A device for switching the oscillator output to the left and right inputs of the Exciter. While this switching can be done by changing the connections to the Exciter, a switchbox such as that shown schematically in Figure 3-1 greatly eases the system installation.
2. A device for selecting the Monitor outputs to feed the distortion analyzer, such as the one shown schematically in Figure 3-2. Again, this switching can be done by hand if necessary.

3.4 USE OF EQUIPMENT

3.4.1 Audio Source

Provision must be made to apply a test tone to the Exciter's audio inputs, TB2, in four modes: left only, right only, left and right in phase (L=R), and left and right out of phase (L=-R). The switchbox of Figure 3-1 switches the left and right channels on or off, and for L=-R, reverses the polarity of the right channel. Connect the balanced audio oscillator to the switchbox input and the two outputs of the switchbox to the inputs of the Exciter.

If a balanced output oscillator is not available, an unbalanced oscillator can be used in its place. Connect the "+" terminal of the oscillator to the "+" input of the switchbox, and connect the neutral or ground lead to both the "-" and the "c" (common) inputs. In any case, it should be verified that under high modulation conditions, the source introduces negligible distortion into the audio signal.

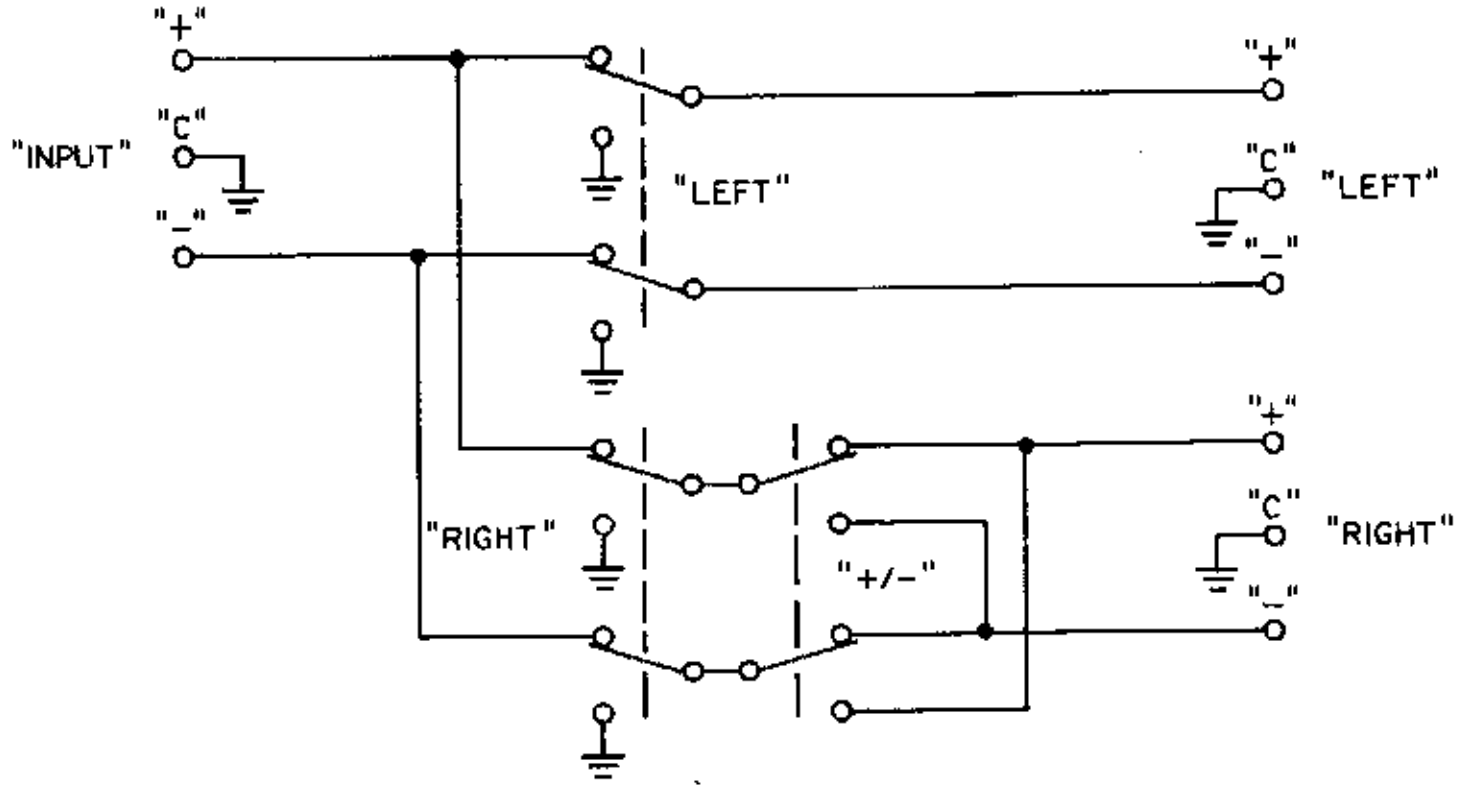


FIGURE 3-1
OSCILLATOR SWITCHING UNIT

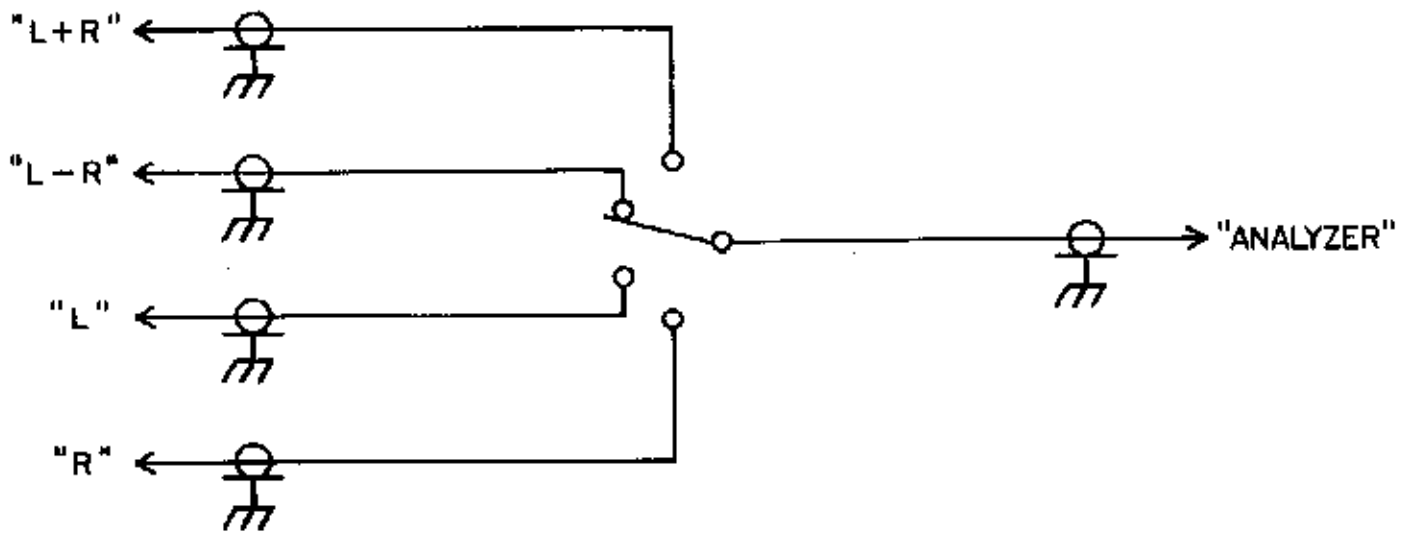


FIGURE 3-2
MONITOR OUTPUT SELECT SWITCH

3.4.2 Audio Level Measurements

Although separation measurements may be made using the Monitor front panel meters, these meter circuits are quasi-peak detector circuits for modulation display and are not preferred for separation measurements. For more accurate separation measurements, a true RMS or averaging meter should be connected to the left and right BNC connectors on the Monitor's rear panel. RMS measurements are preferred because these measurements indicate the residual energy of the undriven channel regardless of wave shape.

3.5 CLOSED LOOP TESTS

3.5.1 Closed Loop Setup

Provide for audio input to the Exciter a detailed in paragraph 3.4.1.

Provide for Monitor output switching of J9-J12 either by use of a switchbox or by making sure the rear of the Monitor is accessible.

Connect the sample transmitter output of the Exciter, J1, to the input of the Monitor, J13, with a 50 ohm coaxial cable. Turn the RF ATTENUATOR control on the rear of the Monitor fully clockwise for maximum sensitivity.

Power up both units but apply no audio to the Exciter. Check the meter lamps on each unit to see that all are lit.

Switch the PILOT/CARRIER toggle switch on the Monitor front panel to the CARRIER position. Adjust the front panel CARRIER SET control of the Monitor slowly until the PILOT/CARRIER meter settles on the SET position. At this point, the Monitor should be phased locked to the Exciter and the L-R meter should show a stable reading.

3.5.2 Residual System Noise

Remove all audio to the input of the Exciter, select the PILOT switch out, and the STEREO switch in. Read the Monitor meters for L+R and L-R as detailed in the Modulation Monitor technical manual, D93-345. The L+R noise floor should be lower than -60 dB and the L-R noise floor should be lower than -50 dB as read on the front panel meters. Once the station transmitter replaces the Exciter's sample transmitter, the noise level on both the main (L+R) and the sub (L-R) channels will be higher than this noise floor.

3.5.3 Preparation of Exciter

The Model ASE-1 AM Stereo Exciter is shipped from the factory set for closed loop performance measurements. In this case, proceed to paragraphs 3.5.7 through 3.5.9 for closed loop measurements. If, however, separation performance is not attained, adjustments of the closure potentiometer and, perhaps, the high frequency equalization circuits will be necessary.

If this system has been removed from service for testing or troubleshooting, be sure to note and record the positions of all affected switches and potentiometers before proceeding with these closed loop tests and adjustments. This will speed the reinstallation process.

Switch the Exciter into Day mode, Stereo on, Pilot off.

Remove the top cover from the ASE-1 and gain access to the Audio Equalization Matrix Assembly, the Audio Night Processor Assembly and the Sample Transmitter Assembly.

Switch all Day equalization filters out of the circuits; switch S301, S302, S303, S304, S305 and S306 down.

3.5.4 Main to Subchannel Crosstalk

Monitor the L-R BNC output of the Monitor and modulate L+R at 50% at 1 KHz. Adjust the Balance control, R783, on the Exciter front subpanel for minimum L-R meter reading.

3.5.5 Closure Adjust

Locate the closure adjust potentiometer, R902, on the Sample Transmitter Assembly.

Modulate L 50% at 1 KHz. Monitor the left and right BNC outputs for left and right channel levels. Adjust the Closure potentiometer for best separation, i.e. lowest right channel level. Note this level of left separation.

Modulate R 50% at 1 KHz. Note this level of right separation and the difference between left and right separations. Because the Closure was adjusted for best left separation, the right separation will be worse (less). Adjust the Closure to improve the right separation by half of the difference.

Again modulate L50% at 1 KHz and adjust the Closure to halve the difference between the left and right separations.

Repeat these last two steps until the left and the right separations are equal.

3.5.6 High Frequency Equalization Adjust

Switch the High Frequency Equalization circuit into the I path: S303, S305 up.

Modulate L50% at 5 KHz. Monitor the Monitor right channel BNC output and adjust R3100 on the Audio Equalization Matrix Assembly to null the right channel.

Modulate R 50% at 5 KHz. Monitor the Monitor left channel BNC output and adjust R3102 on the Audio Equalization Matrix Assembly to null the left channel.

Repeat the last two steps until each channel has achieved the best separation possible.

Reduce the modulating frequency to 1 KHz. Adjust the Sample Transmitter Closure control, R902, to equalize the left versus right and the right versus left separations. This will improve one and degrade the other, giving the best overall performance.

3.5.7 Frequency Response Test

Modulate L+R at 1 KHz. Monitor the level of the L+R output of the Monitor with the analyzer. Set this level as the reference level. Without affecting the audio input level to the Exciter, change the frequency to 50 Hz. Note this level. Compare this with the closed loop specifications in paragraph 2.2.1.

Repeat this step over several frequencies to verify that the system meets the closed loop specifications. A master closed loop performance check sheet appears in Appendix B.

3.5.8 Harmonic Distortion Test

Modulate L+R 95% at 50 Hz. Monitor the distortion in the L+R output of the Monitor with the analyzer. Compare this with the closed loop specifications in paragraph 2.2.1.

Repeat this step over several frequencies to verify that the system meets the closed loop specifications.

3.5.9 Stereo Separation Test

Module L 50% at 50 Hz. Monitor the level of the unbalanced left output of the Monitor with the analyzer. Set this level as the reference level. Monitor the complimentary channel (unbalanced right, in this case) and note the separation. Compare this with the closed loop specifications in paragraph 2.2.1.

Repeat this step over several frequencies to verify that the system meets the closed loop specifications.

SECTION 4

INSTALLATION

4.1 INTRODUCTION

C-QUAM AM stereo represents a major technological advance over traditional AM broadcasting. Because of this new technology, Delta engineers or Delta-approved contract installers must oversee the installation of the system. Each installation team member is a seasoned broadcast engineering professional with many years of training and practical experience to offer. In addition, Delta is formulating plans for customer engineering seminars to provide user support.

Installation and training generally requires two to three days. Certain tests normally will be completed during the FCC experimental period after midnight.

The installation personnel sent to your station to install the AM stereo system should be expected to:

connect, adjust and align the Delta equipment;

verify AM transmission system performance from the Exciter input to the sampled output of the transmitter; and

familiarize the station engineer with the proper operation of the equipment as it applies to your station.

Installation personnel should not be expected to make other station equipment repairs or corrections. Your station engineer is in charge of the station's broadcasting plant. Installation team personnel, in their efforts to obtain the greatest possible frequency response, best stereo separation and the lowest distortion, plus the best possible envelope modulation will, from time to time, make adjustments to the station's transmitter and associated equipment - but always with your station engineer's blessing.

The demands of AM stereo broadcasting points out weaknesses in transmitters and antenna systems that are not apparent in conventional AM mono broadcasting. However, as with conventional AM mono, a good clean signal is dependent upon all the links in the audio, transmitter and antenna chain.

Audio console output should be clean and free of distortion. Audio input to the console should be checked for proper phasing. This requirement applies to all links in the audio chain: processing amplifiers, phone lines or STL links, patch panels, etc. Phase inverters in audio processors should be disabled.

After having received your new C-QUAM System by Delta and completing the system closed loop checkout outlined in Section 3, you are now ready to begin the installation process. The procedures for installing the C-QUAM System is a sequential one which must be adhered to for optimum results.

4.2 AM STEREO MODULATION MONITOR INSTALLATION

The installation of the Model ASM-1 AM Stereo Modulation Monitor is a very straight-forward operation. It mounts in a standard 19 inch rack and is secured by four mounting screws. Teflon washers are recommended here to keep the Monitor's cosmetic appearance intact. Avoid mounting the Modulation Monitor in areas of high heat generation as the performance of the decoding circuit will degrade.

CAUTION

Before connecting the transmitter's RF sample to the Monitor, ensure the sample level is between 1 and 10 Vrms into a 50 ohm load. Serious damage will result if this level is exceeded.

4.2.1 Day RF Sample Level

Before connecting the RF sample to the unit, turn the RF attenuator on the rear panel to maximum attenuation (fully counterclockwise when facing the rear panel). Turn the CARRIER SET pot on the front panel fully counterclockwise (maximum attenuation). Set the PILOT/CARRIER switch on the front panel to the CARRIER position. Remove the 50 ohm load from the transmitter's carrier sample and connect the carrier sample to the RF input (J13) on the rear panel. Adjust the CARRIER SET pot on the front panel fully clockwise. Decrease the step attenuator on the rear panel one step (10 dB) at a time until a carrier indication is seen on the carrier meter. Adjust the CARRIER SET pot to fine tune the carrier level so that the meter's display rests in the center at the SET position. The Monitor is now ready for operation.

4.2.2 Night RF Sample Level

If transmitter power levels and/or patterns change, ensure RF sample levels remain constant for each power or pattern change.

4.2.3 Operational Checkout

Modulation the transmitter with either tones or program material and watch the modulation meters on the Monitor. Ensure the Monitor's modulation indications are correct beyond a reasonable doubt. To verify correct indications, view the RF sample going to the Monitor on an oscilloscope. In the envelope pattern, modulation percentage can be estimated.

4.3 TRANSMITTER

4.3.1 General

It would be difficult, at best, to develop a specific procedure for installing C-QUAM and have it apply to every make and model transmitter currently on the air. The following text is designed to give the installer a general procedure as to what work is required to be done to the transmitter for the best possible stereo performance.

To achieve the best possible stereo performance, the transmitter must operate with optimum monophonic performance. If your transmitter uses tubes in the modulator and final amp stages, it is recommended that the tubes have minimum operating hours on them. If operation hours on these tubes is extensive, replacements are in order.

4.3.2 Transmitter Tuning and Modifications

The transmitter should be adjusted to the lowest noise and distortion figures obtainable. Most AM transmitters exhibit some incidental phase and incidental amplitude modulation. For good AM stereo, these must be minimized by tuning adjustments, retubing the transmitter, adjustment of neutralization controls, additional filtering in the power supply and other appropriate techniques. Each installation is unique. Installation team personnel will determine what corrective techniques are required, but the station engineer should make every effort to provide a good starting point before the installation of the stereo system begins.

4.4 AM STEREO EXCITER INSTALLATION

4.4.1 Stereo RF Interfacing

The Model ASE-1 AM Stereo Exciter signal replaces the signal developed by the transmitter's oscillator section, therefore many station engineers build in redundancy - a means to revert to the transmitter's oscillator. A simple switching arrangement will be installed. Normally, this switch will be physically located in the transmitter's exciter. It allows the switching of the transmitter's RF drive from the transmitter's exciter to your new C-QUAM Exciter. Again, each transmitter is different and the determination of the RF drive interface switching scheme should be determined by the qualified installer.

After the interface switching scheme is installed and the RF drive is established from the C-QUAM Exciter, its level must be set. To do this, a scope is required. While probing the center pole of the switch, alternately switch back and forth from the transmitter's exciter to the Stereo Exciter. The same RF waveform having the same amplitude should be viewed in either position of the switch. It may be necessary to terminate the coax from the Stereo Exciter with a 50 ohm load to ground. Do not place this 50 ohm load on the center pole of the switch. It should be physically soldered on the switch terminal where the coax from the Stereo Exciter is connected. At this point a minor problem can occur. It is possible that there can be a frequency beat-note between the transmitter's oscillator and the Stereo Exciter's oscillator. To solve this, remove the transmitter's crystal #2 and switch the transmitter's exciter to operate in the #2 crystal position when the installed stereo interfacing switch is in the stereo position.

4.4.2 Stereo Audio Interfacing

In addition to supplying RF drive to the transmitter, the Model ASE-1 AM Stereo Exciter also supplies the L+R audio drive. The L+R audio output of the Exciter is a 600 ohm balanced output capable of varying from -6 dB to +16 dB. This audio output is located on the rear panel on terminal

block TB1 and is controlled by a panel mount multi-turn potentiometer on the front panel. This L+R audio feed is present in both the day and night modes of the Exciter. There is also a separate L+R level control for the night mode. It is recommended that a shielded pair audio cable from the Exciter to the transmitter is used.

The C-QUAM AM Stereo Exciter simply takes the left and right audio channels and sums them into L+R for the broadcast transmitter audio input. Two basic objectives must be met in connections to the transmitter. One is the phasing of the transmitter audio input, and the input level must be precisely adjusted so that the C-QUAM modulation will be transmitted properly. The audio frequency response and distortion of the circuitry is sufficiently low that it will not affect the monaural performance of the transmitter.

4.4.3 Initial L+R Level Set

With no audio applied to the Exciter, adjust the front panel multi-turn potentiometers labeled "DAY L+R" and "NIGHT L+R" fully counterclockwise. Power sup the transmitter and operate into the antenna or dummy load. Apply audio to the Exciter such that the Exciter indicates 50% L+R modulation. Slowly adjust the "DAY L+R" level control clockwise until a 50% L+R modulation condition exists on the Model ASM-1 AM Stereo Modulation Monitor. Final adjustment of this level will be discussed in paragraph 4.4.6.

4.4.4 Transmitter Adjustments for Stereo

There is a major concern in this category, Incidental Phase Modulation (IPM). Incidental Phase Modulation sources in AM broadcast transmitters vary considerably. However, two common sources are (1) final amplifier tuning and (2) the final amplifier neutralization, with the latter being most critical. IPM is directly related to the level of crosstalk between the main channel (L+R) and subchannel (L-R) when the transmitter is operating in monophonic mode. Effectively, it is the limiting factory for stereo performance. This main to subchannel crosstalk directly determines the limit of stereo separation obtainable. To accurately measure this, modulate the transmitter at 50%, 1 KHz, L+R with the stereo and pilot switched out and, using the Model ASM-1 Modulation Monitor, read the amount of L-R present; this is IPM. To minimize this IPM, adjust the transmitter's neutralization and watch the L-R modulation indication on the Monitor. After adjusting out as much IPM as possible with the neutralization, try the final tuning. If your transmitter employs tubes in the modulator and final PA, adjustment of the grid tuning control will also reduce the IPM level. In effect, the transmitter is being retuned for best IPM. A good indication or a good target level for IPM is about 40 dB below the L+R amplitude modulation.

Keep in mind that many transmitter manufacturers have experience in AM stereo and can lend assistance in the installation process. In addition, assistance can also be obtained from Delta Electronics.

4.4.5 Delay Set

The C-QUAM AM Stereo System is connected to the AM broadcast transmitter via two inputs; audio and RF. In most transmitters, the amount of time it takes for the RF and the audio to propagate through the transmitter is different (usually the audio takes longer). If the difference in propagation time is not corrected, the L-R (phase) information will arrive at the receiver earlier than the L+R information with the resultant loss of separation due to improper dematrixing. Thus, the Exciter contains circuitry which can be switched in and adjusted to delay the audio fed to the Exciter internal modulators to match the characteristics of the transmitter.

To accurately set the delays, the use of an oscilloscope with XY capability is required. Using two 50 ohm coaxial cables, connect the left output (J9) on the rear panel of the Monitor to the scope's X input. Also connect the right output (J11) to the scope's Y input. Place the scope controls to display the XY pattern. On the front panel of the Exciter, select the STEREO switch and place all others in the out position. Now, modulate the transmitter with 50% left only stereo at 1 KHz. Observe the scope and adjust channel one and two's vertical sensitivity such that its entire display is in view. Most likely, the scope's display will look like an oval along the horizontal axis. This oval or loop must be closed up. To do this, remove the hole plug on the rear panel labeled "LEFT DELAY" and using an insulated alignment tool, select left binary delay (S608 on D33-334). If the loop does not completely close up, additional delay (bulk) is required in the left channel. The Day Bulk Delay board, internal to the Exciter, is physically mounted on the solder side of the Audio Night Processor Assembly, D33-334. The Day Bulk Delay is located closest to the rear panel. It uses a four-position DIP switch. Each switch, when closed (switch toggle away from center of board), adds 8 uS of additional delay. Figure 4-1 shows the physical location of the Bulk Delay Assemblies and the function of their switches.

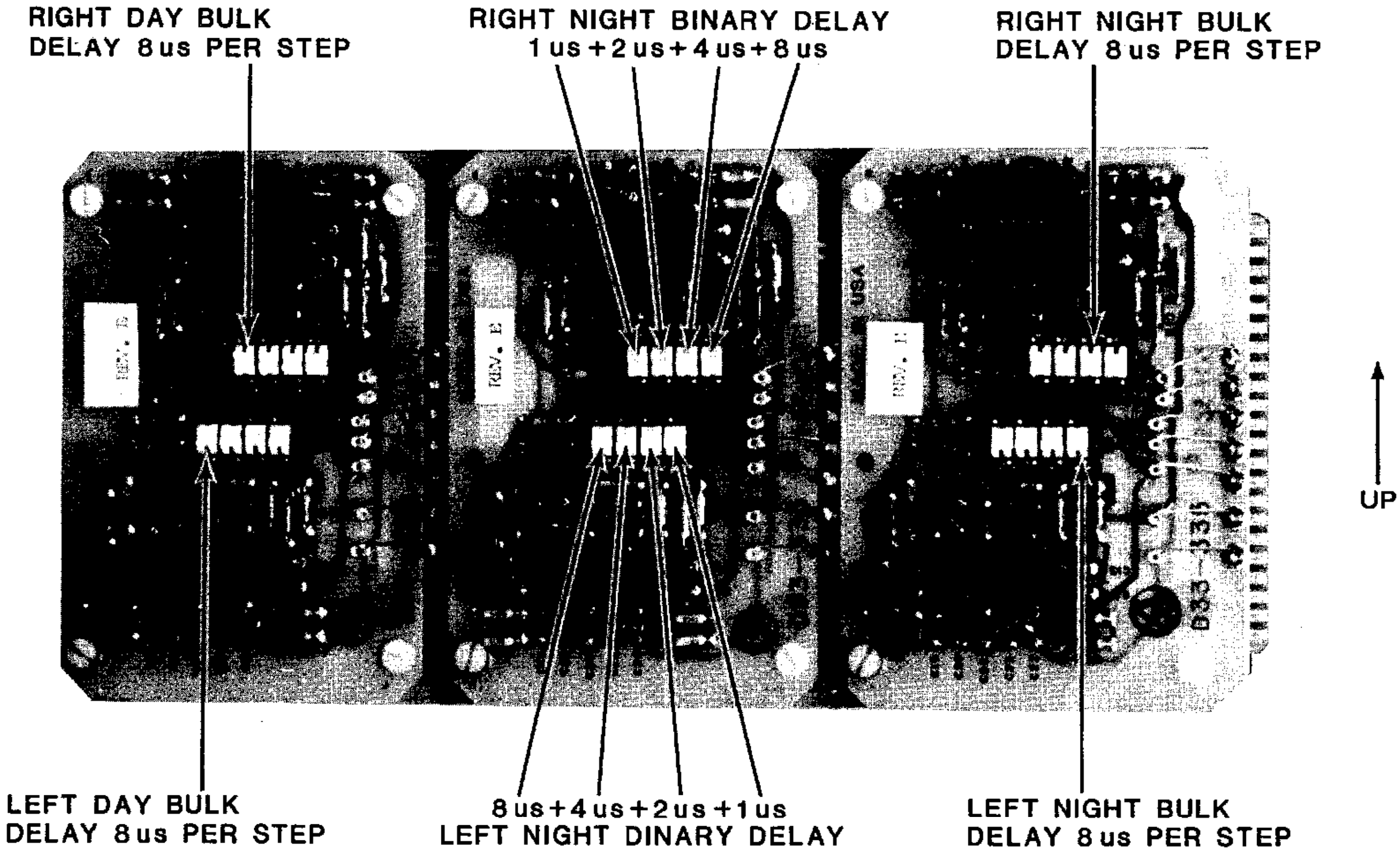
After left delays are set and the loop closed, modulate the transmitter with 50% right only stereo at 1 KHz and repeat the Bulk Delay settings for the right channel. After this is accomplished, leave the scope connected for use in the next step.

4.4.6 L+R Drive Intermediate Tuning

The next step is to again adjust the L+R drive level to the transmitter. While viewing the scope and modulating left only 50% stereo at 1 KHz, adjust the front panel multi-turn potentiometer labeled "L+R DAY". Careful adjustment of this control will result in a scope display showing a horizontal straight line with no vertical deviation. Switching to right channel under the same modulation conditions, the resultant scope display should be a vertical straight line with no horizontal deviations. Refer to Figure 4-3 for appropriate scope displays.

After this step has been completed, do not disconnect the scope as it is set up for the next step.

REAR PANEL



NOTE: DELAY IS IN WHEN SWITCH TOGGLE TOWARD EDGE OF BOARD. ALL DELAYS SHOWN OUT (TOGGLES TOWARD CENTER OF BOARD).

FIGURE 4-1

DELAY CIRCUITS

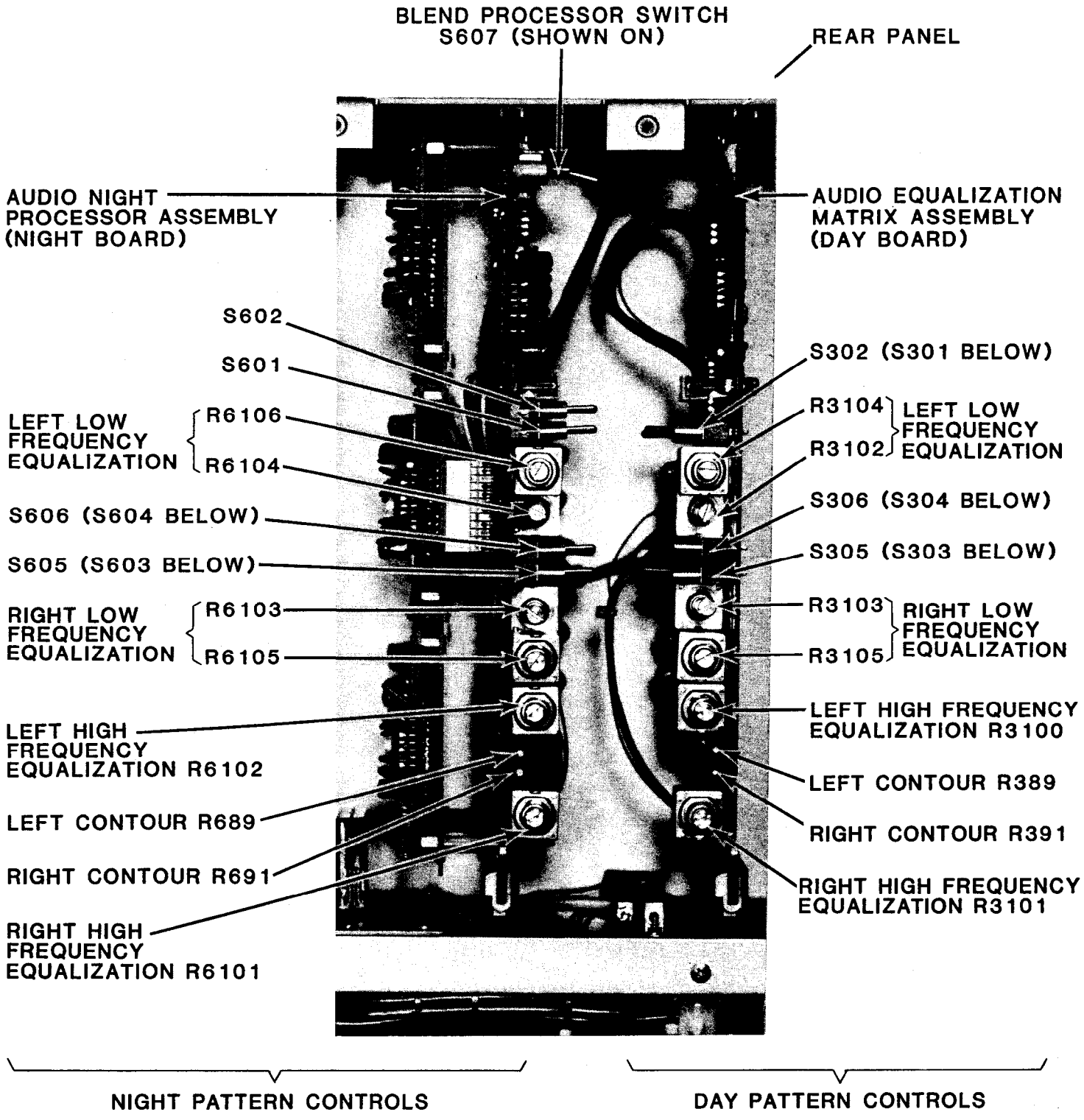
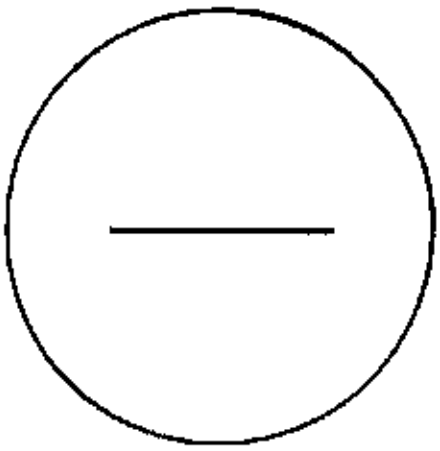
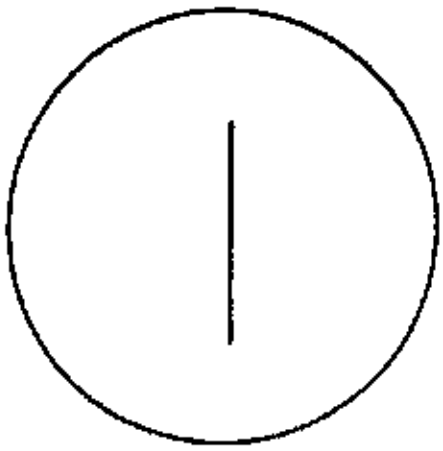


FIGURE 4-2

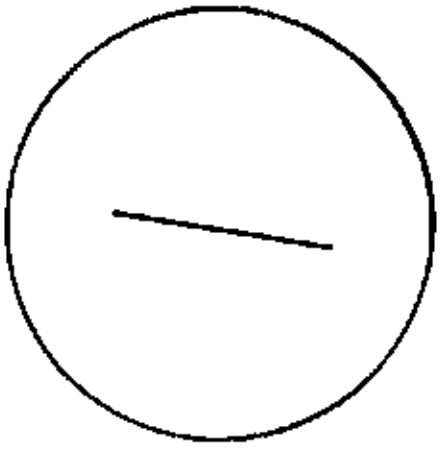
TOP VIEW
EQUALIZATION CONTROLS



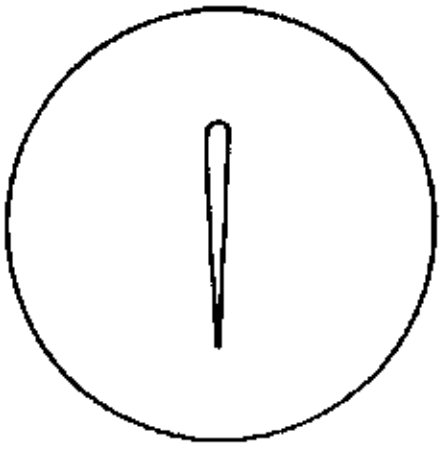
IDEAL LEFT ONLY



IDEAL RIGHT ONLY



POOR L+R GAIN ADJUST



POOR RIGHT EQUALIZATION

FIGURE 4-3

4.4.7 High Frequency Equalization Alignment

After completing the intermediate adjustment of the L+R drive, the high frequency equalization is next. Modulate the transmitter with 50% left only stereo at 5 KHz. While increasing the modulating frequency, the scope display will deviate from the straight line obtained previously to an oval or something resembling a circle. Referring to Figure 4-2, switch in the day high frequency S305 and S303 on the D33-320 board. While viewing the scope, adjust R3100, left high frequency equalization potentiometer, and again close the loop to a flat horizontal line. While modulating 50% right only stereo at 5 KHz, repeat the above step for a flat vertical line while adjusting R3101 right high frequency equalization control. Leave the scope connections in place as it is set up for the next step. Note that the high frequency equalization introduces a slight delay so that the delay setting of paragraph 4.4.5 may have to be readjusted.

4.4.8 Low Frequency Equalization Alignment

Modulate the transmitter with left only stereo at 50% on 100 Hz. Select in S301 and S302 low frequency equalization. While viewing the scope display, adjust R3102 for maximum loop closure. Change the modulating frequency to 50 Hz and adjust R3104 for maximum loop closure. Repeat the adjustment of R3102 at 100 Hz and R3104 at 50 Hz until maximum loop closure is achieved at both frequencies. Switch the modulation from Left Only to Right Only at the same frequency and level. Again viewing the scope, adjust R3103 and R3105 as described above for maximum loop closure.

4.4.9 Optimizing Stereo Performance

The steps outlined in this section must be performed to ensure that a proper C-QUAM signal is bring produced and to make the system operate the best it can.

Using the scope on the initial line-up made it possible to rough-in final Exciter/transmitter settings. Now a more accurate means of alignment is necessary to optimize and complete the installation. Actual level/separation measurements must be made. The steps of paragraphs 4.4.5, 4.4.6, 4.4.7 and 4.4.8 must be repeated. When repeating these steps, replace the scope as an indicating device with a sensitive level detector or an AC voltmeter capable of detecting AC voltages in the audio spectrum without rolling off. Also, when repeating these steps, all adjustments are made to achieve maximum stereo channel separation. When measuring separation, one channel is driven with audio and the undriven channel is measured with respect to the driven channel (i.e. the left channel is 40 dB down from the right).

4.5 FINAL SYSTEM PERFORMANCE

To determine overall system performance, a final on-the-air performance evaluation is required. This evaluation shall include a monaural distortion (THD+N) category, a stereo distortion category, a stereo separation category and a frequency response category. This evaluation is an excellent tool that can be used to evaluate overall system performance, find areas of concern and overall give the installer knowledge on the

outcome of his efforts. Master performance evaluation forms and worksheets are supplied in Appendix B to this technical manual to aid the installer and inform the installer as to what system parameters have to be measured.

4.6 OCCUPIED SPECTRUM

This section outlines the necessity for measuring the occupied bandwidth of the station using a spectrum analyzer. This measurement is required to complete the C-QUAM installation. It is very important to measure the occupied spectrum of the station after the C-QUAM installation to ensure conformity to the FCC regulations (73.44 AM Transmission System Emission Limitations and 73.128 AM Stereophonic Broadcasting).

First, place the station on the air under normal programming conditions. Connect the input of the spectrum analyzer to the carrier sample. Align the spectrum analyzer such that it displays the carrier on the center graticule with 10 KHz per vertical division and 10 dB per horizontal division. Under programming conditions, ensure that the displayed spectrum is within the FCC requirements of occupied bandwidth.

SECTION 5

THEORY OF OPERATION

5.1 GENERAL

A description of the function and operation of each printed circuit board assembly in the Model ASE-1 is contained below. Refer to the appropriate schematic diagram, the interconnect diagram, and the functional block diagram when reading these sections.

5.2 AUDIO INPUT ASSEMBLY, D33-351

The Audio Input Assembly receives balanced, 600 ohm, left and right channel, audio inputs from the rear panel audio input terminals of TB2-1 through TB2-6 and delivers unbalanced left and right channel audio signals to the input of the blend processor circuit on the Audio Night Processor Assembly (J10-17, U and J10-19, W). This circuit assembly is located on the left side panel adjacent to terminal block TB2. It replaces the Audio Interface Assembly, D33-336, for Exciter Serial Numbers 071 and above. Since the circuit is composed of two identical amplifier sections, only the left channel circuit will be described.

A balanced, left channel audio signal from TB2-1 through TB2-3 is fed through a Pi section RF filter to remove induced RF energy from the transmitter. This filter, composed of C1 through C4, L1 and L2, is a lumped element 600 Ohm transmission line for audio frequencies. Its output is connected to the input of a Pi section 600 ohm attenuator of R1 through R4, R9 and R10. R1 through R4 are socketed to accept 1/4 watt, 5% resistors per the selection table of the schematic diagram for various audio input levels. Note that these levels are the levels of both left and right audio necessary to produce 100% amplitude modulation (L=R). Unless otherwise specified, resistors are installed for +10 dBm. If field replacement of these resistors become necessary, the balance and common mode rejection potentiometers, R29 and R25 respectively, should be readjusted.

Any DC component in the signal at the output of the attentuator is removed by the circuitry of C11 through C13, R13 and R14. C11 through C13 are low leakage electrolytics biased by R13 and R14 for low distortion. The remaining AC audio signal is amplified and converted to an unbalanced signal by operational amplifier U1. Any DC offset appearing at the output of U1 due to operational amplifier offset voltages and bias currents is removed by the balance control, R29. Common mode signals are removed from U1 output by adjustment of the common mode rejection potentiometer, R25, labelled CMR. This is done by connecting the positive and negative signal inputs together (TB2-1 to TB2-3) and applying an unbalanced audio signal between the positive input and the common input, TB2-1 and TB2-2 respectively. R25 is then adjusted for minimum signal at the output of U1.

5.3 AUDIO INTERFACE ASSEMBLY, D33-336

For Exciters with Serial Numbers 070 and below, the Audio Interface Assembly is used for transformer isolation and attenuation of input audio and transformer isolation of output audio to the transmitter. These

Exciters also include an L&R Amplifier on the L&R Amplifier/Sample Transmitter Assembly. For Exciters with Serial Numbers 071 and above, these circuits are replaced by the Audio Input Assembly, D33-351, and the Audio Output Assembly, D33-357. The Audio Interface Assembly is mounted on the left side panel.

Since the left and right channel audio input circuits are identical, only the left channel circuit will be described. A balanced, 600 ohm, left channel audio source is connected to the rear panel terminals TB2-1 through TB2-3. This signal is fed through an attenuator circuit composed of R551, R552 and R555. The resistor values for this attenuator are given in the table on the schematic diagram for various nominal input levels. Note that these levels are the levels of both left and right channel inputs (L=R) that will produce 100% amplitude modulation. The output of this attenuator is fed to the primary of isolation transformer T701. This transformer output is connected to the left input of the blend processor circuit (J10-17, U) on the Audio Night Processor Assembly.

The balanced, (L+R)I audio signal from the L&R Amplifier is fed to the primary of T703, the audio output isolation transformer. The secondary of this transformer is connected to rear panel terminals TB1-3 through TB1-6.

5.4 AUDIO EQUALIZATION MATRIX ASSEMBLY, D33-320

The Audio Equalization Matrix Assembly contains left and right channel high frequency and low frequency audio equalization filters for the day mode of operation; matrix and clipper circuits to generate main channel audio (L+R) and subchannel audio (L-R) signals for the Encoder Assembly, the Sample Transmitter Assembly and the Audio Output Assembly; and meter detector circuits.

Left and right audio signals from the blend processor circuit of the Audio Night Processor Assembly are buffered by U308A and U308B respectively. These signals are routed via J301-1&2 through J602-1&2 and the day/night select relay K601 on the Audio Night Processor Assembly. When the day mode is selected, the signals return through J602-3&6 and J301-3&6 to the inputs of the high frequency equalization circuits of U307.

These circuits are low pass filters with variable cutoff frequencies controlled by double ganged, equalization potentiometers, R3100 and R3101. The highest cutoff frequency occurs when R3100 and R3101 are fully counterclockwise producing the least equalization. The shape of the response curve near the cut off frequency (the Q of the filter) is controlled by contour potentiometers R389 and R391. With these potentiometers fully clockwise, the filters are at minimum Q resulting in a smooth butterworth response. When the high frequency equalization circuits are not required (their selection switches S303 through S306 are in the down position), the equalization potentiometers should be fully counterclockwise and the contour potentiometers should be fully clockwise.

The output of the high frequency equalization filters may be switched into either the audio path to the Encoder Assembly (the Q path) or the audio path to the Sample Transmitter and the transmitter modulator (the I path). If S303 and S305 are switched up, the high frequency equalization

is in the envelope modulation or I path to the Sample Transmitter and transmitter modulator. This is the normal condition when using the Sample Transmitter for closed loop measurements. For the I path, the audio signals from S303 and S305 run through R329 and R338, and J302-9&10 to J601-9&10 on the Audio Night Processor Assembly. The signals are selected by relay K602 for either day or night audio and returned through J601-3&4 to J302-3&4 on the Audio Equalization Matrix Assembly. This is the input of the (L+R)I matrix, U303D.

Usually, however, S303 and S305 are down and S304 and S306 are up placing high frequency equalization in the Q path to the Encoder Assembly. The high frequency equalization and contour controls are adjusted to match the frequency response of the Encoder Assembly's phase modulation with the frequency response of the transmitter modulator for best high frequency separation. The high frequency equalization filters may be switched out of both the I and Q paths by setting S303 through S306 in the down position.

The audio signals in the Q path proceed from S304 and S306 to the inputs of the low frequency equalization circuits of U306 and to switches S301 and S302. If S301 and S302 are in the up position, the low frequency equalization circuits are inserted in the Q audio path. Since the left channel and right channel low frequency equalization circuits are identical, only the left channel circuit will be described. The left channel low frequency equalization circuit consists of two two-pole, high pass, active filter sections in series to form a four pole high pass filter. The corner frequencies of both two pole sections are independently controlled by R3102 and R3104 so that this circuit can be adjusted to give either a two or four pole response. The corner frequencies are lowest (least equalization) when R3102 and R3104 are fully clockwise. These filters are adjusted to match the low frequency response of the phase modulated signal from the Encoder Assembly with the low frequency response of the transmitter modulator. This is usually done by alternately adjusting R3102 at 100 Hz and R3104 at 50 Hz left channel only modulation for best separation at both frequencies. These circuits are switched out of the Q path when S301 and S302 are in the down position and, for this case, R3102 through R3106 should be set fully clockwise for minimum low frequency loading of the previous stages.

The Q path signals from S301 and S302 are fed through J302-7&8, J601-7&8 on the Audio Night Processor Assembly, through the day binary delay circuits of U602 and U603, through P603-7&4 and the day bulk delay circuit on the Delay Mounting Assembly, back through P603-6&5 and day/night select relays K603 and K604, through J601-2&1 to J302-2&1 to the inputs of the (L+R)Q and (L-R)Q matrix circuits of U301. U301A is the (L+R)Q matrix. Any difference signal (L-R) of the left and right channel audio from J301-2&1 cancel at the summing junction, U301-2. Only sum signals (L=R) appear at the output at U301-1. This is the (L+R)Q signal buffered through U302B to the Encoder Assembly and to the front panel LEFT, RIGHT/L+R, L-R rocker switch. Two clipper circuits limit the excursions of the (L+R)Q signals. The circuit of U302A is a negative clipper controlled by R3109 in Exciters with Serial Numbers 071 and above and controlled by the -LIM potentiometer on the front subpanel of Exciters with Serial Numbers to 070. This clipper is necessary to prevent total cutoff of RF drive to the transmitter under -100% amplitude modulation conditions, when the QUAM modulator formed by U102 through U104 on the Encoder Assembly would otherwise produce no RF output. Thus, for Exciters with Serial Numbers to 070, the -LIM control is

a critical adjustment and should not be changed after initial setup. The circuit of U302C is the (L+R)Q positive clipper controlled by the +LIM potentiometer on the front subpanel.

The left channel audio signal from J301-2 is buffered by U301B and the right channel audio from J301-1 is inverted by U301C. These signals are summed by U301D, the (L-R)Q matrix. Only difference signals appear at the output of U301D pin 14. This is the subchannel information buffered through U304C to the Encoder Assembly and to the LEFT, RIGHT/L+R, L-R meter switch on the front panel. The (L-R)Q signal level is limited in its excursions by the clipper circuits of U302D and U304B. U302D is the (L-R)Q negative clipper controlled by the -LIM potentiometer on the front subpanel. U304B is the (L-R)Q positive clipper controlled by the +LIM potentiometer on the front subpanel.

The I audio path signals from S303 and S306 through K602 on the Audio Night Processor appear at J602-3&4. These signals are summed by U303D, the (L+R)I matrix. This (L+R)I signal is buffered by U303B to provide an audio signal for the Sample Transmitter Assembly. The (L+R)I signal is also buffered and amplified by U304D and U303A providing an audio signal through the DAY L+R and NIGHT L+R controls on the front subpanel to the Audio Output Assembly. The output of U303A also feeds audio to the L+R ENV switch on the front subpanel. The excursions of the (L+R)I signal are limited by the clipper circuits of U304A and U303C. U304A is the (L+R)I negative clipper controlled by the -LIM potentiometer on the front subpanel. U303C is the positive (L+R)I clipper controlled by the +LIM potentiometer on the front subpanel.

Exciters with Serial Numbers to 070 are normally supplied with all clipper circuits disabled except the mandatory (L+R)Q negative clipper. This is accomplished by disconnecting one side of diodes CR302, and CR307 through CR310, folding back the unused leads and covering the diodes with clear sleeving. The inactive +LIM control is set fully clockwise to minimize harmonic distortion. Envelope limiting is then controlled by external audio processing. If internal modulation limiting is desired, the above diodes may be reinstalled and the +LIM control set for positive modulation clipping. The -LIM control should remain untouched since it is set to prevent cutoff of RF drive to the transmitter. Note, however, that the clipper circuits will produce a slight amount of second harmonic audio distortion just before clipping occurs so that the preferred method of modulation control is by external processing.

For Exciters with Serial Numbers 071 and above, the +LIM and -LIM control range has been extended so that when these potentiometers are set fully clockwise, the above mentioned second harmonic distortion does not occur. Thus, it is not necessary to disable any of the clipper circuits by lifting diodes. All clippers are active. Note also that since the (L+R)Q negative clipper has its own control, the -LIM control is no longer a critical adjustment. The -LIM along with the +LIM control may be freely used for modulation limiting or set fully clockwise for modulation limiting by external processing.

The circuits of U305 form two meter detector circuits for converting audio signals on their inputs to DC currents for the front panel meters. The left and right channel audio signals from the input of the

(L+R)Q matrix at J310-2&1 are attenuated by R367, R368, R383 and R348 and fed to the LEFT, RIGHT/L+R, L-R switch on the front panel. When this switch is in the up position, left and right channel audio signals are fed to the meter detector circuits. The left hand meter displays the left channel audio level and the right hand meter displays the right channel audio level. When the LEFT, RIGHT/L+R, L-R switch is in the down position, (L+R)Q and (L-R)Q audio signals are fed to the meter detector circuits so that the left hand meter displays the main channel (L+R) audio level and the right hand meter displays the subchannel (L-R) audio level. The (L+R)I audio level may be monitored by depressing the L+R ENV switch on the front subpanel. This substitutes (L+R)I audio for (L+R)Q audio to the left meter detector circuit.

Since the left and right meter detector circuits are identical, only the left circuit will be described. As the audio signals at pin 12 of U305D goes positive, CR304 conducts and the circuit of U305D is an amplifier with gain controlled by R351. The operational amplifier acts to bring the voltage at the cathode of CR304 to a level such that the voltage on pin 13 of U305D equals the voltage on pin 12. The amplified signal at the cathode of CR304 charges C339 through R353. When the audio input at pin 12 of U305D goes negative, CR304 cuts off and CR303 conducts. The operational amplifier adjusts its output voltage on pin 14 so that the voltage on pin 13 equals the voltage on pin 12. Without CR303, the output of the operational amplifier would quickly move to the negative supply rail whenever its input went negative, thus limiting the frequency range of the detector due to error caused by the time necessary for the operational amplifier to slew from the negative rail. The circuit operates as a half wave rectifier with a filtered output on C339. This voltage is buffered by follower U305C which generates meter current through R357.

Slight circuit modifications to the Audio Equalization Matrix Assembly are incorporated in Exciters with Serial Numbers 071 and above. The 47 ohm resistors R301 and R311 are deleted and R3106 and R3107 have been added. R303 and R312 have been changed from 47 ohms to 100 ohms and C306 and C319 have been changed from 0.022 uF to 0.01 uF. Control for the (L+R)Q negative clipper has been changed from the -LIM potentiometer on the front subpanel to added resistors R3108 through R3110. C355, C356 R3111 and R3112 have been added to AC couple the meter detector circuits. R348 and R368 have been changed from 93.1K ohms to 200K ohms.

5.5 AUDIO NIGHT PROCESSOR ASSEMBLY, D33-334

The Audio Night Processor Assembly contains high and low frequency equalization circuits used when the front subpanel NIGHT switch is depressed or when the night contacts of rear panel terminal block TB3 are closed. The NIGHT switch and the night contacts of TB3 control relays on the Audio Night Processor Assembly that route audio signals through either the day equalization filters on the Audio Equalization Matrix Assembly or through the night equalization filters on the Audio Night Processor Assembly. Day and night bulk (8 uS steps) and binary (1 uS step) delay circuits are also selected by these relays. The day binary delay circuit is part of the Audio Night Processor Assembly. The remaining delay circuits are mounted to the Delay Mounting Assembly which is connected to, and mounted on, the Audio

Night Processor Assembly. Audio signals are fed between the Audio Night Processor Assembly and the Audio Equalization Matrix Assembly by two detatchable cables.

The Audio Night Processor Assembly also contains a blend processor circuit useful in preventing very high angles of phase modulation beyond the detection range of stereo decoders. Such modulation might occur if, for instance, one channel of an audio telephone link is lost causing an external audio processor to "pump up" the remaining channel to maintain envelope modulation. The blend processor circuit also activates to prevent high phase angles whenever significant amounts of subchannel information (L-R) is present during negative envelope peaks (i.e. L+R near -1). This condition might occur with audio that is heavily processed, stereo enhanced, and not single channel limited. Note that this circuit also prevents spectrum spreading associated with high angles of phase modulation thus limiting occupied bandwidth.

The left and right channel audio signals from the Audio Input Assembly are connected to J10-U and J10-W respectively. The signal currents flow through R664 and R665 to an optically controlled variable resistor, U604. Under normal modulation conditions, U604 is turned off presenting a high resistance between the left and right channel audio signals. If, however, a high phase angle condition occurs, U604 is turned on and the left and right channel audio signals are blended together by the low resistance path of U604. The left and right audio signals are partially summed so that their difference components are reduced with a corresponding reduction in phase modulation. The left and right channel audio outputs of the blend processor circuit at J10-V and J10-X are connected to the balance potentiometer on the front subpanel and the audio input buffer circuits of U308 on the Audio Equalization Matrix Assembly.

The blend processor circuit monitors the (L+R)Q and (L-R)Q audio signals from the Audio Equalization Matrix Assembly to determine when a High phase angle condition occurs. These are the signals used by the Encoder Assembly to generate the phase modulated carrier signal.

The (L-R)Q audio signal is half wave peak detected by the circuit of U601C. An inverted version of the positive portion of the (L-R)Q signal appears at the anode side of CR609 while the negative portion produces no output (i.e. zero volts). This signal is summed with the (L-R)Q signal at the input of U601D, pin 13. Notice, however, that R654 is exactly half of R653 so that the signal currents from U601C are twice the currents from the (L-R)Q source. Thus during the positive portion of the (L-R)Q signal, the signal current drawn from the summing junction by U601C is twice the signal current supplied to the summing junction by the (L-R)Q source. The summing junction, therefore, sees a negative input equivalent to the inverse of the (L-R)Q signal. During the negative portion of the (L-R)Q signal, U601C draws no current and the summing junction sees the negative input of the (L-R)Q signal. The summing currents appear as if from a negative rectified source. A DC offset current is supplied to the summing junction by R655 and R656. Since U601D sums and inverts these signals, its output at pin 14 is a positive rectified version (absolute value) of the (L-R)Q signal, offset by a negative DC voltage.

The signal from U601D is the positive reference signal for U601B, an inverting amplifier with (L+R)Q input. Whenever the negative portion of the (L+R)Q signal falls below this reference signal, the output of U6-1B will swing positive indicating a high phase angle condition. The phase angle at which this occurs is determined by the DC offset introduced by R655. This is usually set for a phase angle equivalent to 75% single channel modulation. A positive output on U601B pin 7 charges C627 through CR601. The follower circuit of U601A then turns on Q601 and U604 blending left and right channel audio. For accurate testing of system performance at 75% single channel, the blend processor circuit may be disabled by opening the process defeat switch, S607 located at the rear of the Audio Night Processor Assembly. When this switch is set toward the front panel, the blend processor circuit is active.

The high and low frequency equalization circuit of the Audio Night Processor Assembly are identical to those of the Audio Equalization Matrix Assembly described above. The Audio Night Processor Assembly, however, contains the relay switching circuits to select between these filters. The schematic diagram of the Audio Night Processor Assembly shows these relays in the deactivated position selecting the filters of the Audio Equalization Matrix Assembly for the day pattern of operation. K601 routes the left and right channel audio signals from the buffers of U308 (Audio Equalization Matrix Assembly) to the inputs of the day or night high frequency equalization filters. The inputs of the (L+R) I matrix are selected by K602 from either S303 and S305 or S603 and S605. Potentiometers R611 and R626 allow exact matching of I path signals from these two sources. The input signals to the Q path matrix circuits are selected by K603 and K604 between the outputs of the day or night delay circuits. The signals from these two sources may be exactly matched using Potentiometers R619 and R622.

Usually the audio signals take longer to travel through the transmitter modulator circuit than the RF signal takes to travel through the RF chain. In order to produce proper C-QUAM at the transmitter output, the RF signal must be delayed to match the delay of the transmitter modulator. This is done by delaying the audio signals to the Encoder Assembly (Q path) and thereby delaying the phase information in the RF signal to the transmitter. Switchable delay circuits are incorporated between the outputs of the low frequency equalization filters and the inputs to the matrix circuits.

The Audio Night Processor Assembly contains two types of audio delay circuits. Binary delay circuits may be set to delay the audio signal from 0 to 15 microseconds in one microsecond steps. Bulk delay circuits add 0 to 32 microseconds delay in 8 microsecond steps. One each of the binary and bulk delay circuits are contained in the left and right channels of both day and night Q paths. The binary delay circuit for the day pattern is contained on the Audio Nigh Processor Assembly circuit board. All other delay circuits are on the Delay Mounting Assembly held to the back of the Audio Night Processor Assembly by standoffs.

Since the day binary delay sections for the left and right channels are identical circuits, only the left channel circuit will be described. The four delay circuits of U602A through U602D are all pass filters designed for a constant signal delay of 8 microseconds, 4 microseconds, 2 microseconds and 1 microsecond, respectively. These delays are switched

into the circuit as needed by rotary switch S608 accessed from the rear panel. Similarly, the day binary delay for the right channel is switched by S609, also accessed from the rear panel.

The binary delay circuits for the night pattern are on the center circuit assembly of the Delay Mounting Assembly. These circuits are identical to the day binary delay circuits except that they are inserted into the Q path by four pole, double throw, dip switches. The top dip switch controls right channel binary delays and the bottom dip switch controls left channel binary delays. Each switch toggle is labeled with a number from 1 to 4. The toggle labeled 1 controls the 1 microsecond delay circuit. The toggle labeled 2 controls the 2 microsecond delay circuit. The toggles labeled 3 and 4 control the 4 microsecond and 8 microsecond delay circuits respectively. When the toggle is toward the center of the board, the delay is out of the circuit. When the toggle is toward the edge of the board, the delay is in the circuit.

The day and night bulk delay circuits are also on the Delay Mounting Assembly. These are identical circuits composed of four each 8 microsecond all pass filters for both left and right channel delays. These four 8 microsecond delays are controlled by four pole, double throw, dip switches. The top switch controls the right channel bulk delay and the bottom switch controls the left channel bulk delay. Each toggle controls an 8 microsecond delay. The delay is switched out when the toggle is toward the center of the board. When the toggle faces the edge of the board, 8 microseconds delay is inserted into the circuit.

5.6 AUDIO OUTPUT ASSEMBLY, D33-357

The Audio Output Assembly provides balanced, 600 ohm audio signals for two transmitters. For Exciters with Serial Numbers 071 and above, the Audio Output Assembly replaces the L&R Amplifier on the L&R Amplifier/Sample Transmitter Assembly and replaces the audio output transformer, T703, of the Audio Interface Assembly. The Audio Output Assembly is mounted by standoffs to the Audio Input Assembly on the left side panel.

An audio signal labelled (L+R)I from U303A on the Audio Equalization Matrix Assembly is connected to the L+R DAY and L+R NIGHT controls of the front subpanel. The outputs of these potentiometers are fed to the inputs of the Audio Output Assembly, pins 1 and 2. Since this assembly consists of two identical circuits for the day and night audio, only the day audio circuits of U1, U2 and U3 will be described. The unbalanced audio passes through DC blocking capacitor C1 to the operational amplifier, follower stage of U1. The low impedance output of U1 provides the signal for non-inverting amplifier U2 and inverting amplifier U3. These two stages have the same gain so that their outputs form a balanced signal. These outputs are fed through R27 and R28 for a 600 ohm source impedance to rear panel terminals TB1-1 through TB1-3. Any DC offsets present at the outputs of U2 and U3 are removed by adjustment of balance potentiometers R4 and R12 respectively. The amplifiers of U4, U5 and U6 provide a balanced, 600 ohm, night audio signal to rear terminals TB1-4 through TB1-6.

5.7 ENCODER ASSEMBLY, D33-319

The Encoder Assembly produces a phase modulated carrier frequency signal for the RF Amplifier Assembly and the Sample Transmitter Assembly. The instantaneous phase angle of this signal is determined by the (L+R)Q and (L-R)Q audio signals from the Audio Equalization/Matrix Assembly and the 25 Hz pilot signal. This assembly contains a crystal controlled 25 Hz sine wave circuit for the pilot signal.

The circuitry of Q101 is a colpitts, crystal controlled oscillator operating at four times the carrier frequency (4X Fc). The signal from this oscillator is fed to U101, an ECL dual D flip flop which generates two sets of balanced square waves at the carrier frequency. The balanced square waves of U101 pins 14 and 15 lag 90 degrees behind the balanced square waves on pins 2 and 3. These sets of signal lines are labelled -90 degrees and 0 degrees respectively. A sample of the -90 degrees signal drives buffer transistor Q112 which provides an unmodulated carrier frequency square wave to the SYNC BNC connector on the rear panel. This is a convenient place to connect a frequency counter.

The 0 degree signal from U101 is fed to two balanced modulators of U102 and U103. U103 is a supressed carrier modulator generating sidebands from the (L+R)Q audio feed. U102 serves to insert a carrier signal so that the sum of the signals from U102 and U103 is a carrier frequency signal amplitude modulated by L+R audio.

The -90 degree or quadrature signal from U101 provides an RF signal to U104, a supressed carrier modulator generating sidebands from (L-R)Q audio and the 25 Hz pilot signal from the front subpanel PILOT switch. These quadrature sidebands are summed with the amplitude modulated signal from U102 and U103 to form a quadrature amplitude modulated signal (QUAM). The signal currents from modulators U102, U103 and U104 are summed in the primary of T101, the input of a carrier frequency bandpass filter.

The double tuned bandpass filter formed by the circuits of T101 and T102 supress the harmonics of the carrier frequency inherent in the square wave signals from U101 and pass the desired carrier frequency signals. This circuit is carefully adjusted at the factory using sweep measurement techniques for maximum bandpass flatness and phase linearity. Field adjustment of this circuit should normally not be attempted.

The carrier frequency signals from the bandpass circuit are amplified by the circuits of Q102 through Q105, Q114 and Q115. This provides a QUAM signal to an RF limiter composed of transistor array U105, Q106, Q107 and associated parts. The output of the limiter appears at pins 7 and 8 of U105, feeding signals to Q108 through Q111. Buffer transistors Q108 and Q111 provide a balanced signal to the RF Amplifier Assembly, D33-322. Buffer transistors Q109 and Q110 provide a balanced signal to the Sample Transmitter Assembly, D33-321.

The watch crystal oscillator of Q113 generates a 32.768 KHz signal for divider U106. The output of U106 feeds a 25 Hz square wave to the low pass filters of U107A and U107B. These filters eliminate the harmonics of

the square wave producing a clean 25 Hz sine wave which is routed through the front subpanel PILOT switch and relay K1 to the quadrature modulator, U104.

5.8 L & R AMPLIFIER/SAMPLE TRANSMITTER, D33-321

The L&R Amplifier/Sample Transmitter Assembly generates a C-QUAM signal for the rear panel Sample Transmitter BNC connector. The Exciter can be set up and adjusted so that the Sample Transmitter output may be connected directly to the Model ASM-1 Stereo Modulation Monitor for closed loop performance checks. For System Serial Numbers to 070 and below, this assembly also contains the L&R Amplifier which delivers audio for the transmitter modulator. For system Serial Numbers 071 and above, the L&R Amplifier has been deleted and the audio for the transmitter modulator is furnished by the Audio Output Assembly, D33-357.

The Sample Transmitter consists of a modulator, U901; a bandpass filter of T901 and T902; and a buffer amplifier of Q901 and Q902. A balanced, square wave, RF signal from Q109 and Q110 of the Encoder Assembly is fed to pins 8 and 10 of modulator U901. This signal is amplitude modulated by an audio (L+R)I signal from U303B on the Audio Equalization Matrix Assembly. The degree of modulation is controlled by the carrier adjust potentiometer, R902. This control is adjusted under single channel modulation (usually 50%) for maximum separation.

The modulated signal from pins 6 and 12 of U901 is connected to the primary of T901, the input to the bandpass filter. This filter eliminates the harmonics inherent in the square wave RF signal at the modulator input leaving the carrier signal and its modulation sidebands. This filter has been carefully adjusted using sweep alignment techniques for maximum bandpass flatness and phase linearity. Field adjustments of T901 and T902 should normally not be attempted.

The desired signal from the secondary T902 appears across R938, the output level control. This control is adjusted to produce an output signal sufficient to drive a Model ASM-1 Modulation Monitor. The signal from R938 is amplified by Q901 and Q902 which provides a signal to the rear panel Sample Transmitter BNC port.

Exciters with Serial Numbers 070 and below contain the L&R Amplifier of U902. An (L+R)I audio signal from U303A on the Audio Equalization Matrix Assembly is controlled by the L+R potentiometer on the front subpanel and is fed to the input of U902 at J7-7. The four operational amplifiers of U902 are arranged as two inverting and two non-inverting amplifiers. The outputs of the two non-inverting amplifiers are summed by R930 and R932 for the +OUT at J7-5,E. The inverting amplifier outputs are summed by R931 and R933 for the -OUT at J7-3,C. The +OUT and -OUT form a balanced signal feeding the primary of T703, the audio output transformer located on the left rear side panel. The secondary of T703 is connected to audio output terminals, TB1-3 through TB1-6.

Exciters with system Serial Numbers 071 and above do not have the L&R Amplifier. The (L+R)I audio from U303A on the Audio Equalization Matrix Assembly is fed to the DAY L+R and NIGHT L+R controls on the front subpanel. The output of these controls deliver (L+R)I audio signals to the two

amplifiers of the Audio Output Assembly. These amplifiers produce balanced audio signals connected directly to TB1-3 through TB1-6. The output transformer, T703, and the L&R Amplifier have been removed.

5.9 RF AMPLIFIER ASSEMBLY, D33-332

The RF amplifier Assembly converts low level balanced RF signals from the Encoder Assembly to TTL level and high level square wave RF signals to replace the transmitter crystal oscillator drive. For Exciters with Serial Numbers 070 and below, the RF Amplifier Assembly (revision levels A through D) delivers a single TTL level RF signal and a single variable level square wave RF signal to two rear panel BNC connectors. These signals are connected as required to one or two transmitters. If, however, two transmitters require the same type signal (TTL or square wave), some external method of switching or splitting the signal will be required.

For Exciters with Serial Numbers 071 and above, the RF Amplifier Assembly (revision levels E and F) delivers two TTL level outputs to rear panel BNC connectors and a variable level square wave output switched between two rear panel BNC connectors. These four output sources are connected as needed for transmitter RF drive. The level of each variable output is independently controllable so that two transmitters may be set up for day/night or main/alternate operation without the use of an external power splitter, hybrid or relay.

The RF Amplifier Assembly is mounted on the left side panel. An Amplifier Extension Assembly, D33-342, is mounted on standoffs to the RF Amplifier Assembly as part of the same assembly. For Exciters with Serial Numbers 070 and below, the Amplifier Extension Assembly contains an adjustable voltage regulator to control the level of the square wave output and a TTL line driver to provide TTL level signals through terminated coaxial cables. For Exciters with Serial Numbers 071 and above, the Amplifier Extension Assembly contains additional circuits for another TTL output, provisions for switching the square wave output between two BNC ports, independent square wave levels for day and night operation and interlock circuits to protect an undriven transmitter.

A balanced RF signal from Q108 and Q111 on the Encoder Assembly is fed to the RF Amplifier Assembly input connectors, J501 and J502. This signal passes through isolation transformer T504 to a balanced driver amplifier of Q501 and Q502. The output of this amplifier drives the gates of Q503 and Q504, a class B push-pull amplifier that generates the square wave output at the secondary of T502. Bias to Q503 and Q604 is adjusted by R518 and R512 respectively so that with no RF signal, each transistor draws 5 ma current as measured at W1 on the Amplifier Extension Assembly. The GAIN potentiometer, R502, adjusts the drive level to Q503 ad Q504 to produce a clean square wave into 50 ohms with no ringing. The symmetry potentiometer, R508, sets the duty cycle of the output and ensures a clean TTL signal. A sample of the drive signal from Q501 is fed to the amplifier circuit of Q505 and Q506 to generate a TTL level signal for the input(s) of the TTL line driver(s) on the Amplifier Extension Assembly.

For Exciters with Serial Numbers 070 and below, the square wave output from the secondary of T502 is routed directly though J503 to the EXCITER OUT BNC connector on the rear panel. The output level is adjusted

by R531 to control the supply voltage to the primary center tap of T502. A TTL level signal from the collector of Q506 feeds the input of line driver U501. The output of U501 is fed through J504 to the rear panel TTL BNC connector.

For Exciters with Serial Numbers 071 and above, a day/night select relay, K501, is included in the circuit. The square wave output from the secondary of T502 is routed through one set of this relay's contacts and through J503 and J505 to the DAY VAR RF and NIGHT VAR RF BNC connectors on the rear panel. Note that only one output is active at any given time depending upon the state of K501. If two transmitters are both run from the square wave outputs, the interlock contacts from K501 appearing on TB3-1 through TB3-4 should be used to protect the undriven transmitter. Another set of contacts of K501 are used to select either R531 or R532, the day and night adjustment potentiometers for VR501. These potentiometers control the day and night square wave levels by varying the supply voltage at the primary center tap of the T502. A TTL level signal from the collector of Q506 feeds the inputs of TTL line drivers U501 and U502. The outputs of these circuits are fed through J504 and J506 to the DAY TTL RF and NGHT TTL RF BNC ports on the rear panel.

5.10 POWER SUPPLY ASSEMBLY

Line power flows through line filter FL1 and fuse F1 to the primary of transformer T1. The primary windings of T1 may be wired for a nominal primary voltage of 120 VAC or 240 VAC as shown on the Interconnect Diagram. The center tapped secondary of T1 provides AC power for the Power Supply Assembly.

The secondary voltage from J12-C, J12-Z and J12-1A feeds a bridge rectifier circuit composed of CR401 through CR404. The positive output of this bridge charges filter capacitor C403 and the negative output charges C412. An unregulated -24V supply from C412 appears at J12-F to supply current for all day/night selection relays. Resistor R402 reduces the voltage of C412 to regulator VR403 thereby reducing the power dissipation of VR403. VR402 provides regulated -15V supply through J12-R,V,18.

C403 provides positive supply current through dropping resistor R401 to regulator VR401. VR401 provides regulated +15V supply through J12-T,X,20. VR401 also supplies current through R403 for regulator VR402. VR402 supplies +5V through J12-U.

SECTION 6

MAINTENANCE

6.1 GENERAL

This section describes on-site maintenance procedures. The Model ASE-1 AM Stereo Exciter is a self-contained unit requiring litter periodic maintenance. The Exciter has been designed using established technology and should, therefore, give years of reliable operation.

6.2 CLEANING

When cleaning the front panel, avoid abrasive cleaning agents or strong chemical cleaners which may cause fine scratches or fog the plastic meter faces. A mild liquid glass cleaner on a soft, clean cloth is recommended. The interior of the unit must be free of foreign objects. Although the top and bottom covers of the unit largely prevent dust build-up within the unit, some foreign matter may accumulate through the adjustment holes in the top cover. If this should occur, power down the unit, remove all socketed printed circuit assemblies and clean the interior of the unit with a damp cloth or an air gun.

When operating in dusty environments, the top cover adjustment holes should be covered with paper tape and the cover for the front subpanel should be installed.

6.3 POWER SUPPLY CHECK

The DC output of the power supply can be checked at the following locations on the power supply's card edge connector, J12:

Regulated Voltage	Tolerance	Location	Maximum Ripple
+5V	±0.25V	J12-U	25 mVp-p
+15V	±0.5V	J12-20,T,X	25 mVp-p
-15V	±0.5V	J12-18,R,V	25 mVp-p

Unregulated Voltage	Tolerance	Location	Maximum Ripple
-24V	±4.0V	J12-F	N/A

6.4 CARRIER OSCILLATOR ADJUSTMENT

The carrier frequency should be monitored or periodically checked by connecting an accurate frequency counter to the SYNC BNC connector, J4, on the rear panel. The carrier frequency should be well within ±20 Hz of the assigned frequency. If, however, the carrier frequency drifts out of tolerance and the frequency counter proves to be accurate against WWV or some other known accurate frequency standard, adjust C151 on the Encoder Assembly to bring the carrier frequency into tolerance.

6.5 PILOT LEVEL CHECK

The pilot level should be periodically checked using the pilot meter of the Model ASM-1 AM Stereo Modulation Monitor. The meter should indicate in the black band verifying proper pilot level. If this is not so, check the pilot level on the Monitor's L-R meter under no modulation conditions. The pilot level should read just below -26 dB. the pilot level may be adjusted by R217 at the bottom of the Encoder Assembly. This requires that the Encoder Assembly be placed on an extender card and the pilot level should be rechecked after the Encoder Assembly is installed in its card edge connector.

6.6 OPERATIONAL CHECK

A stereo proof of performance check should be performed at least once a year to verify that the total C-QUAM transmission system has not drifted from its installed values.

6.7 LAMP REPLACEMENT

The meter lamps are run below rated current for extended life. If, however, a lamp burns out, power down the unit and remove it from the rack. Remove the four #10 screws on the front panel and fold the front panel forward. Remove the bad bulb from the meter housing and desolder its leads from the terminal strip. Solder the leads of a new bulb to the terminal strip and seat the lamp in the meter housing. Carefully reinstall the front panel using the four #10 screws and ensure that no wires are pinched. Install the unit in the rack and power up.

6.8 REPAIRS

Many of the circuits may be repaired in the field. This applies to all audio circuits, the Power Supply Assembly and the RF Amplifier Assembly. The bandpass circuits of the Sample Transmitter Assembly should not be touched since they are carefully adjusted using sweep measurement techniques. The rest of the Sample Transmitter Assembly may be repaired.

Other than the pilot circuit, the circuits and adjustments of the Encoder Assembly should not be touched. These circuits require an involved adjustment procedure beyond the scope of this manual. The bandpass circuit on the Encoder Assembly is particularly important and should not be adjusted.

If repairs or adjustments become necessary, consult the appropriate theory of operation section before attempting the repair. After the repair or adjustments are complete, a C-QUAM system performance check should be completed against a properly operating Modulation Monitor to ensure correct operation.

SECTION 7

LIST OF MATERIAL

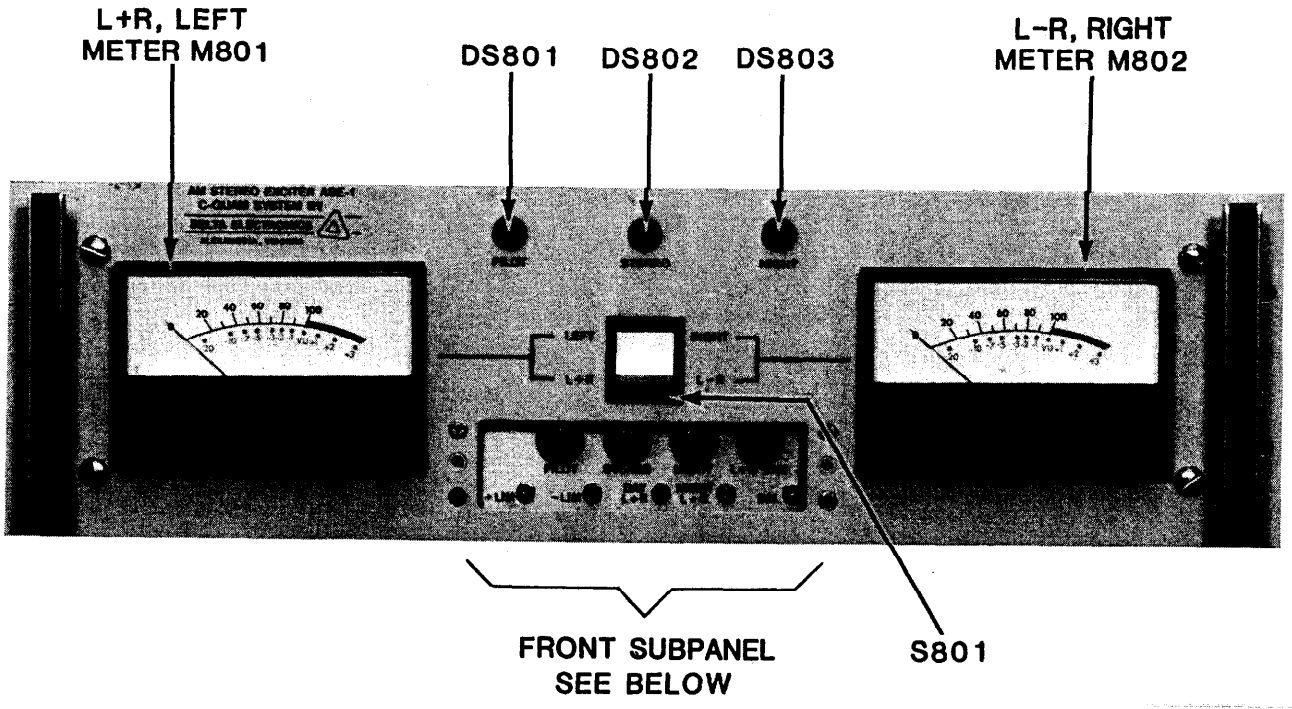
7.1 INTRODUCTION

Maintenance parts in the ASE-1 are identified by reference designations. These designations are used on the photographs, schematic diagrams, and Lists of Material to identify the components. The component reference designation is also marked adjacent to the component on the printed circuit assemblies. The letter(s) in the reference designation identifies the class of item such as a resistor, relay or transistor or identifies a subassembly such as a printed circuit assembly. The number differentiates between parts or subassemblies of the same class.

The Lists of Material for the Model ASE-1 AM Stereo Exciter and for the maintenance significant assemblies are presented as follows:

7.2 LIST OF MATERIAL, MODEL ASE-1 SYSTEM COMPONENTS

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
Unit 1	Model ASE-1 AM Stereo Exciter	Delta	DI5-10	015-0010
------	Power Cord	Belden	17280	678-0001
------	Extender Card	Delta	D33-337	033-0337
------	Technical Manual	Delta	D93-346	093-0346



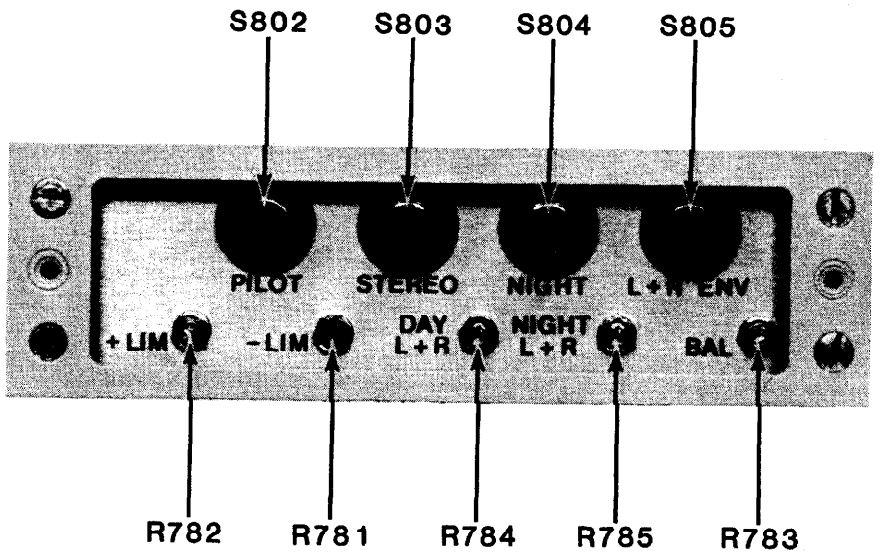


FIGURE 7-1

COMPONENT LOCATIONS,
FRONT PANEL

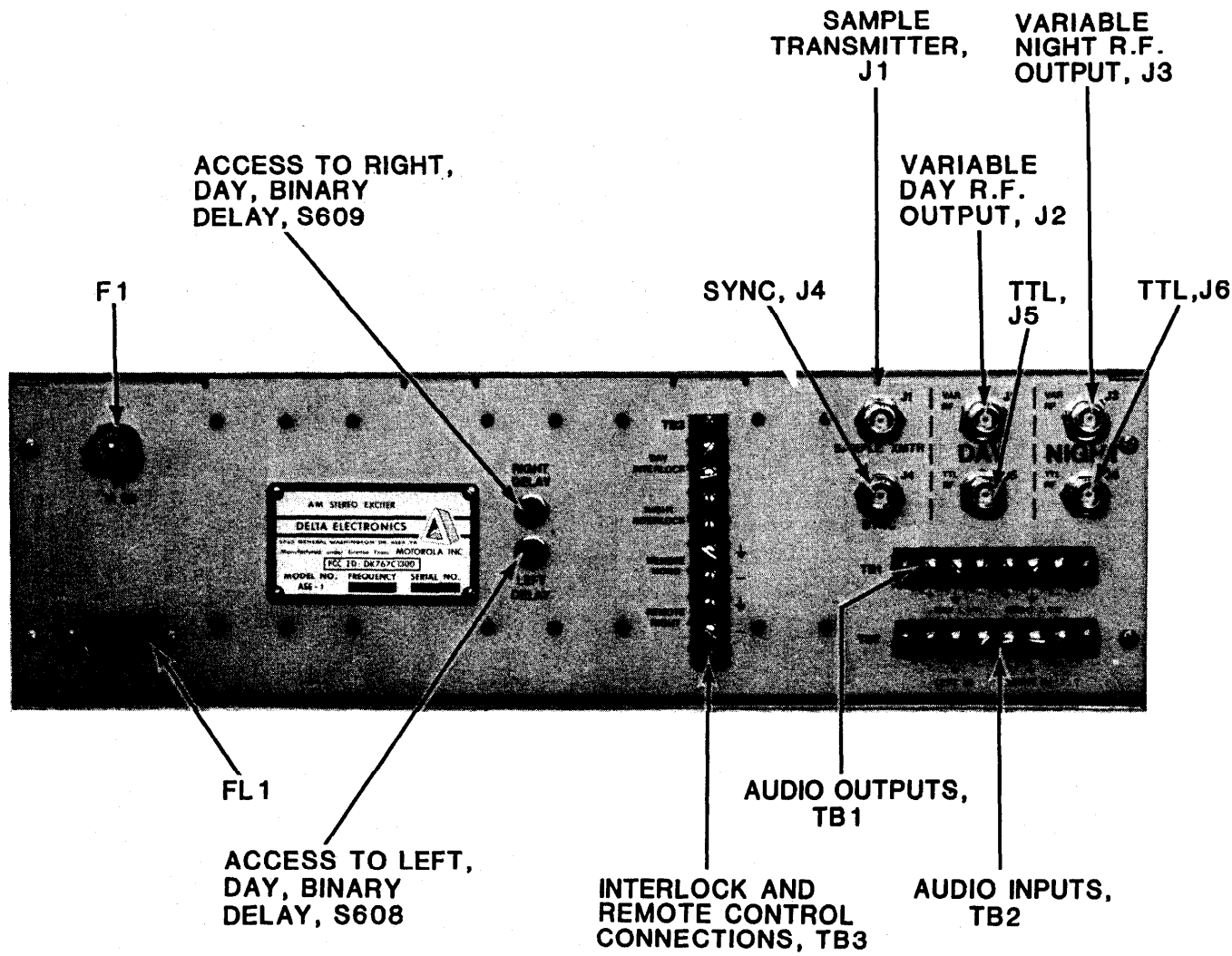


FIGURE 7-2

COMPONENT LOCATIONS, REAR VIEW

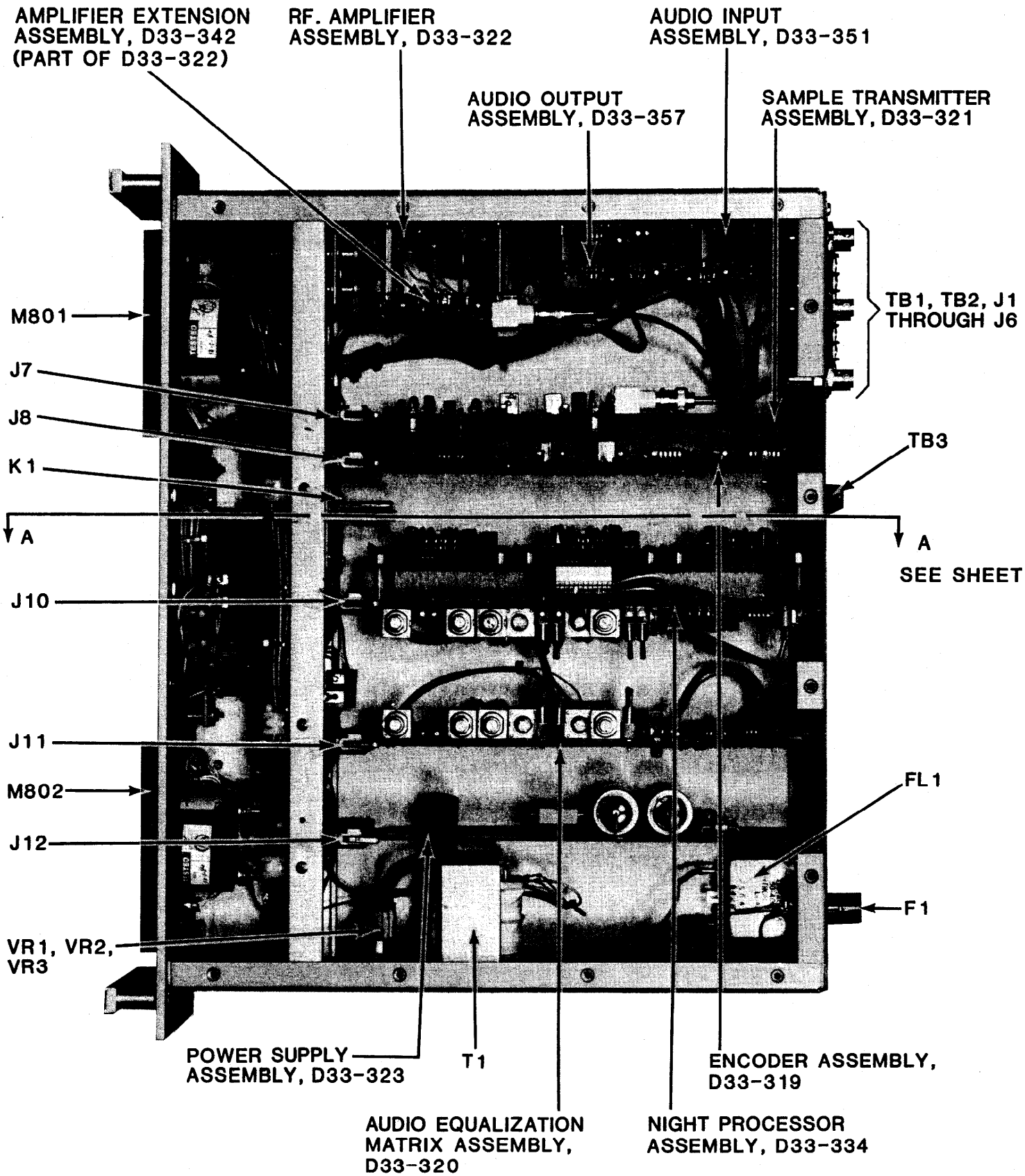


FIGURE 7-3

COMPONENT LOCATIONS, TOP VIEW

7.3 LIST OF MATERIAL, FINAL ASSEMBLY, MODEL ASE-1 AM STEREO EXCITER, D15-10, REV. N

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
A1	Bulk Delay TB, 1 uS Steps	Delta	D33-335-1	033-0335-001
A1	Bulk Delay TB, 8 uS Steps	Delta	D33-335-2	033-0335-002
A100	Encoder Assembly	Delta	D33-319-2	033-0319-002
A200	Audio Output Assembly	Delta	D33-357	033-0357
A300	Audio Equalization Matrix Assembly	Delta	D33-320-2	033-0320-002
A400	Power Supply Assembly	Delta	D33-323	033-0323
A500	RF Amplifier Assembly	Delta	D33-322	033-0322
A600	Audio Night Processor Assembly	Delta	D33-334	033-0334
A700	Audio Input Assembly (Serial Numbers 071 and above)	Delta	D33-351	033-0351
A700	Audio Interface Assembly (Serial Numbers 070 and below)	Delta	D33-336	033-0336
A900	Sample Transmitter Assembly	Delta	D33-321-3	033-0321-003
CR1	Diode, Silicon		1N4148	410-4148
F1	Fuse, Type 3AG, 1A, Slo-Blo	Littelfuse	313001	632-1020
FL1	Filter, Line	Corcom RTron	2K4 RNF-2P6	630-0002
J5	Hole Plug, 1/2 Inch Hole	H. H. Smith	653	
J6	Same as J5			
J7	Connector, Card Edge, Zero Insertion Force, Side Entry	Amp	531025-3 531025-9	618-0077

7.3 LIST OF MATERIAL, FINAL ASSEMBLY, MODEL ASE-1 AM STEREO EXCITER, D15-10, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
J8, J10 thru J12	Same as J7			
K1	Relay, 4 Form C, 24V	P & B	R40-E1-X4-V800	654-0051
T1	Transformer, Power, Dual Primary, 36 VAC CT Secondary	Signal	DP241-8-36	362-0030
TB1	Terminal Block, 6 Position	Kulka	599-2004-6	670-0010-006
TB2	Same as TB1			
TB3	Terminal Block, 8 Position	Kulka	599-2004-8	670-0010-006
TB4	Terminal Strip	H. H. Smith Cinch Jones	864 52A	
TB5	Same as TB4			
XF1	Fuseholder	Littelfuse	342014AL	634-0010
XK1	Socket, Type R40, Straight, Relay, Chassis Mount	P & B	27E135	736-0005

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C101	Capacitor, Fixed, Mica, 180 pF, 10%, 500V	Arco	CM05FD181J03	302-0181
C102	Capacitor, Electrolytic, 100 uF, 20%, 25V	Nichicon	ULB1E101M	320-0067
C103	Capacitor, Fixed, Polyester Film, .047 uF, 10%, 100V	Nichicon	QYA2A473K	330-0020
C105	Capacitor, Fixed, Mica, 24 pF, 10%, 500V		CM05ED240J03	302-0240
C106	Capacitor, Fixed, Monolithic, Ceramic, .1 uF, 20%, 50V	Sprague	1C20Z5U104050B	310-0051
C107 thru C111	Same as C106			
C112	Capacitor, Fixed, Mica, 33 pF, 10%, 500V	Arco	CM05ED330J03	302-0330
C113 thru C117	Same as C112			
C120A	Capacitor, Fixed, Silver Mica, 10%, per station frequency			
C120B	Same as C120A			
C121	Capacitor, Fixed, Mica, 10%, per station frequency			
C125	Capacitor, Fixed, Monolithic Ceramic, .47 uF, 20%, 50V	Sprague	1C20Z5U474M050B	310-0052
C126	Same as C125			

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C130	Capacitor, Fixed, Mica, 30 pF, 10%, 500V	Arco	CM05ED300J03	302-0300
C131	Same as C105			
C132	Capacitor, Fixed, Polyester Film, .22 uF, 10%, 250V	Nichicon	QXM2E224K	330-0024
C135	Capacitor, Fixed, Polyester Film, .0022 uF, 10%, 100V	Nichicon	QYA2A222K	330-0013
C136	Capacitor, Fixed, Polyester Film, .1 uF, 10%, 100V	Nichicon	QYA2A104K	330-0021
C137 thru C139	Same as C136			
C140	Same as C106			
C141	Same as C106			
C142	Capacitor, Fixed, Electrolytic, 4.7 uF, 20%, 50V	Nichicon	ULB1H4R7M	320-0063
C143 thru C145	Same as C132			
C146	Jumper, #22 AWG Bus Wire with Teflon Sleeving			
C147	Capacitor, Variable, Side Mount, 5.5-18 pF	Eric Tusonix	DV11PR18A 538-006A5.5-18	346-0003
C150	Same as C103			
C151	Same as C147			

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C152	Same as C112			
C155	Capacitor, Fixed, Mica, 100 pF, 10%, 500V	Arco	CM05ED101J03	302-0101
C156	Same as C155			
C157	Same as C125			
C158	Capacitor, Fixed, Ceramic, 0.01 uF, +80-20%, 25V	Sprague	HY-520	310-0009
C159	Same as C106			
C162	Same as C125			
C163	Capacitor, Fixed, Electrolytic, 22 uF, 20%, 16V	Nichicon	ULB1C220M	320-0066
C201	Same as C101			
CR101	Diode, Silicon		1N4148	410-4148
CR102 thru CR108	Same as CR101			
Q101	Transistor, FET	Motorola	U310	436-0002
Q102	Transistor, NPN	Motorola	MPS6513	426-0008
Q103	Transistor, PNP	Motorola	MPS6517	426-0009
Q104	Same as Q103			
Q105 thru Q107	Same as Q102			

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
Q108	Same as Q103			
Q109	Same as Q102			
Q110	Same as Q102			
Q111	Same as Q103			
Q112	Same as Q103			
Q113	Same as Q101			
Q114	Same as Q102			
Q115	Same as Q102			
R101	Resistor, Fixed, Film, 100K Ohm, 5%, 1/4W		RL07S104J	202-0104
R102	Resistor, Fixed, Film, 100 Ohm, 5%, 1/4W		RL07S101J	202-0101
R103	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R104	Resistor, Fixed, Film, 10K Ohm, 5%, 1/4W		RL07S103J	202-0103
R105	Resistor, Fixed, Film, 39K Ohm, 5%, 1/4W		RL07S393J	202-0393
R106	Resistor, Fixed, Film, 56 Ohm, 5%, 1/4W		RL07S560J	202-0560
R107	Same as R106			

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R108	Resistor, Fixed, Film, 22 Ohm, 5%, 1/4W		RL07S220J	202-0220
R109	Same as R108			
R110	Resistor, Fixed, Film, 330 Ohm, 5%, 1/4W		RL07S331J	202-0331
R111	Same as R106			
R112	Same as R106			
R113	Same as R108			
R114	Same as R108			
R115	Same as R110			
R116	Resistor, Fixed, Film, 750 Ohm, 5%, 1/4W		RL07S751J	202-0751
R117	Resistor, Variable, 100 Ohm, 15T	Bourns	3006P-1-101	244-0070
R118	Resistor, Fixed, Film, 470 Ohm, 5%, 1/4W		RL07S471J	202-0471
R119	Same as R103			
R120	Resistor, Fixed, Film, 1.2K Ohm, 5%, 1/4W		RL07S122J	202-0122
R121	Resistor, Fixed, Film, 2.7K Ohm, 5%, 1/4W		RL07S272J	202-0272
R122	Resistor, Fixed, Film, 560 Ohm, 5%, 1/4W		RL07S561J	202-0561

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R123	Resistor, Variable, 1K Ohm, 15T	Bourns	3006P-1-102	244-0064
R124	Resistor, Fixed, Film, 8.2K Ohm, 5%, 1/4W		RL07S822J	202-0822
R125	Same as R122			
R126	Same as R102			
R127	Same as R102			
R128	Same as R116			
R129	Same as R117			
R130	Same as R120			
R131	Same as R118			
R132	Same as R103			
R133	Resistor, Fixed, Film, 22K Ohm, 5%, 1/4W		RL07S223J	202-0223
R134	Resistor, Fixed, Film, 220 Ohm, 5%, 1/4W		RL07S221J	202-0221
R135	Same as R117			
R136	Same as R118			
R137	Same as R133			
R138	Same as R134			
R139	Same as R102			

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R140	Same as R102			
R141	Resistor, Fixed, Film, 3.9K Ohm, 5%, 1/4W		RL07S392J	202-0392
R142	Same as R141			
R143	Resistor, Fixed, per station frequency			
R145	Same as R143			
R146	Resistor, Fixed, Film, 4.7K Ohm, 5%, 1/4W		RL07S472J	202-0472
R147	Same as R110			
R148	Same as R121			
R149	Same as R110			
R151	Resistor, Fixed, Film, 820 Ohm, 5%, 1/4W		RL07S821J	202-0821
R152	Same as R121			
R153	Resistor, Fixed, Film, 2.2K Ohm, 5%, 1/4W		RL07S222J	202-0222
R154	Same as R102			
R155	Same as R123			
R156	Same as R121			
R157	Same as R153			
R158	Resistor, Variable, 5K Ohm, ±15 Turn	Bourns	3006P-1-502	244-0019

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R159	Same as R110			
R161	Same as R151			
R162	Same as R110			
R163	Same as R121			
R164	Same as R146			
R165	Same as R118			
R166	Same as R118			
R167	Same as R108			
R168	Same as R141			
R169	Same as R153			
R170	Same as R103			
R171	Same as R108			
R172	Same as R141			
R173	Resistor, Fixed, Film, 270 Ohm, 5%, 1/4W		RL07S271J	202-0271
R174	Same as R173			
R175	Same as R104			
R176	Same as R124			
R177	Same as R124			

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R178	Resistor, Fixed, Film, 3.3K Ohm, 5%, 1/4W		RL07S332J	202-0332
R179	Same as R153			
R180	Same as R153			
R181	Same as R104			
R182	Same as R173			
R183	Resistor, Fixed, Film, 2.74K Ohm, 1%	Dale	RN55D2741F	212-2741
R184	Resistor, Fixed, Film, 68 Ohm, 5%, 1/4W		RL07S680J	202-0680
R185	Same as R146			
R186	Same as R108			
R187	Same as R108			
R188	Same as R184			
R189	Same as R146			
R190	Same as R173			
R191	Same as R183			
R192	Resistor, Fixed, Film, 2.2M Ohm, 5%, 1/4W		RL07S225J	202-0225
R193	Resistor, Fixed, Film, 220K Ohm, 5%, 1/4W		RL07S224J	202-0224

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R194	Same as R146			
R195	Same as R103			
R196	Same as R104			
R197	Same as R146			
R198	Resistor, Fixed, Film, 390K Ohm, 5%, 1/4W		RL07S394J	202-0394
R199	Same as R116			
R200	Same as R117			
R201	Same as R118			
R202	Same as R103			
R203	Same as R133			
R204	Same as R134			
R205	Same as R117			
R206	Same as R118			
R207	Same as R133			
R208	Same as R134			
R209	Resistor, Fixed, Film, 5.1K Ohm, 5%, 1/4W		RL07S512J	202-0512
R210	Resistor, Fixed, Film, 820K Ohm, 5%, 1/4W		RL07S824J	202-0824

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R251	Same as R146			
R252	Resistor, Fixed, Film, 51.5 Ohm, 1%, 1/4W	Dale	RN55D51R1F	212-0511
R253	Same as R252			
R254	Resistor, Fixed, Film, 511 Ohm, 1%	Dale	CCF555110F RN55D5110F	212-5110
R255	Same as R254			
T101	Transformer, Variable	Delta	D05-119-1	005-0119-001
T102	Same as T101			
TP101	Test Point	Vector	T44	672-0053
TP102 thru TP110	Same as TP101			
U101	IC, Dual D Flip-Flop	Motorola	MC10131L	516-0006
U102	IC, Modulator, Demodulator	Motorola	MC1496L	548-0010
U103	Same as U102			
U104	Same as R102			
U105	IC, Transistor Array	RCA	CA3054	542-0012
U106	IC, 12-Bit Counter	Motorola	MC14040B	522-0040
U107	IC, Dual Op Amp, JFET	T. I.	TL082CP	540-0028
W1	Jumper, #22 AWG Bus Wire with Teflon Sleeving			

7.4 LIST OF MATERIAL, ENCODER ASSEMBLY, REFERENCE DESIGNATION A100, D33-319-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
W2 thru W5	Same as W1			
XC120A	Socket, Spring, 0.018-0.040 Dia	Amp	380598-3	736-0042
XC120B	Same as XC120A			
XC121	Same as XC120A			
XR143	Same as XC120A			
XR145	Same as XC120A			
XU101	Socket, IC, 16 Pin DIP	Samtech	ICO-316-SGT	736-0026
XU102	Socket, IC, 14 Pin DIP	Samtech	ICO-314-SGT	736-0025
XU103 thru XU105	Same as XU102			
XU106	Same as XU101			
XU107	Socket, IC, 8 Pin DIP	Samtech	ICO-308-SGT	736-0036
XY101	Socket, Spring, 0.036-0.051 Dia	Amp	1-380758-0	736-0043
Y101	Selected Crystal, 4 X Carrier Frequency	Delta	D05-110-XXX	005-0110-XXX
Y102	Crystal, Clock, 32.768 KHz	Q-Matics	32.768KHZ	624-0017

7.5 LIST OF MATERIAL, AUDIO OUTPUT ASSEMBLY, REFERENCE DESIGNATION A200, D33-357, REV. C

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C1	Capacitor, Fixed, Mylar, 1 uF, 63V		MRT18225-10065	330-0005
C4	Same as C1			
C7	Capacitor, Fixed, Ceramic, 0.47 uF, 50V	Sprague	1C20Z5U474M050B	310-0052
C8 thru C18	Same as C7			
L1	Jumper, #22 AWG Bus Wire with Teflon Sleeving			
L3	Same as L1			
L5	Same as L1			
L7	Same as L1			
R1	Resistor, Fixed, Film, 51K Ohm, 5%, 1/4W		RL07S513J	202-0153
R2	Same as L1			
R3	Resistor, Fixed, Film, 2.2K Ohm, 5%, 1/4W		RL07S222J	202-0222
R4	Resistor, Variable, 100K Ohm	Bourns	3006P-1-104	244-0048
R5	Resistor, Fixed, Film, 22K Ohm, 5%, 1/4W		RL07S223J	202-0223
R6	Resistor, Fixed, Film, 3K Ohm, 5%, 1/4W		RL07S302J	202-0302

7.5 LIST OF MATERIAL, AUDIO OUTPUT ASSEMBLY, REFERENCE DESIGNATION A200, D33-357, REV. C CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R7	Resistor, Fixed, Film, 18K Ohm, 5%, 1/4W		RL07S183J	202-0183
R8	Resistor, Fixed, Film, 43K Ohm, 5%, 1/4W		RL07S433J	202-0433
R9	Same as R3			
R10	Resistor, Fixed, Film, 39K Ohm, 5%, 1/4W		RL07S393J	202-0393
R11	Resistor, Fixed, Film, 1.8K Ohm, 5%, 1/4W		RL07S182J	202-0182
R12	Same as R4			
R13	Same as R5			
R14	Same as R1			
R15	Same as L1			
R16	Same as R3			
R17	Same as R4			
R18	Same as R5			
R19	Same as R6			
R20	Same as R7			
R21	Same as R8			
R22	Same as R3			

7.5 LIST OF MATERIAL, AUDIO OUTPUT ASSEMBLY, REFERENCE DESIGNATION A200, D33-357, REV. C CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R23	Same as R10			
R24	Same as R11			
R25	Same as R4			
R26	Same as R5			
R27	Resistor, Fixed, Film, 300 Ohm, 5%, 1/2W		RL20S301J	204-0301
R28 thru R30	Same as R27			
U1	IC, Op Amp, 8 Pin DIP	T. I.	TL081CP	540-0027
U2	IC, Op Amp, 8 Pin DIP	Signetics	NE5534N	540-0019
U3	Same as U2			
U4	Same as U1			
U5	Same as U2			
U6	Same as U2			
XU1	Socket, IC, 8 Pin DIP	Samtech	ICO-308-SGT	736-0036
XU2 thru XU6	Same as XU1			

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C305	Capacitor, Fixed, Metalized Poly Film, .01 uF, 10%, 100V	Nichicon	QYA2A103K	330-0015
C306	Capacitor, Fixed, Metalized Poly Film, .022 uF, 100V	Nichicon	QYA2A223K	330-0018
C307	Same as C305			
C309	Capacitor, Fixed, Metalized Poly Film, .33 uF, 100V	Nichicon	QXM2E334K	330-0025
C310	Same as C309			
C311	Capacitor, Fixed, Monolithic Ceramic, .1 uF, 50V	Sprague	1C10Z5U104M050B	310-0050
C312	Capacitor, Fixed, Metalized Poly Film, 2.2 uf, 250V	Nichicon	QXM2E225J	330-0026
C313	Same as C312			
C318	Same as C305			
C319	Same as C306			
C320	Same as C305			
C321	Same as C311			
C322	Same as C309			
C323	Same as C309			
C324	Same as C312			

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C325	Same as C312			
C326	Same as C311			
C327	Same as C311			
C328	Capacitor, Fixed, Mica, 220 pF, 500V	Arco	CM05FD221J03	302-0221
C329	Same as C328			
C330	Same as C311			
C331	Same as C311			
C333	Same as C311			
C334	Same as C328			
C335	Same as C328			
C337	Same as C311			
C338	Capacitor, Fixed, Mica, 560 pF, 5%, 300V	Arco	DM15-561J	302-0561
C339	Capacitor, Fixed, Tantalum, 4.7 uF, 50V	Sprague	196D475X9050K	326-0004
C340	Same as C311			
C341	Same as C338			
C342	Same as C339			

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C344	Same as C311			
C345	Same as C328			
C346	Same as C328			
C348 thru C351	Same as C311			
C353	Same as C311			
C354	Same as C311			
C355	Capacitor, Fixed, Monolithic Ceramic, 0.47 uF, 20%, 50V	Sprague	1C20Z54474M050B	310-0052
C356	Same as C355			
CR301	Diode, Silicon		1N4148	410-4148
CR302 thru CR310	Same as CR301			
P301	Connector, Header, 6 Pin	Amp	640456-6	616-0042-006
P302	Connector, Header, 10 Pin	Amp	1-640456-0	616-0042-010
R301	Wire, Bus, #22 AWG, Tinned Copper with Teflon Sleeving			
R303	Resistor, Fixed, Film, 100 Ohm, 5%, 1/4W		RL07S101J	202-0101
R305	Resistor, Fixed, Film, 20K Ohm, 5%, 1/4W		RL07S203J	202-0203

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R306	Same as R305			
R308	Resistor, Fixed, Film, 10K Ohm, 5%, 1/4W		RL07S103J	202-0103
R309	Resistor, Fixed, Film, 1.1K Ohm, 5%, 1/4W		RL07S112J	202-0112
R310	Resistor, Fixed, Film, 24K Ohm, 5%, 1/4W		RL07S243J	202-0243
R311	Same as R301			
R312	Same as R303			
R313	Same as R305			
R314	Same as R305			
R315	Same as R308			
R316	Same as R309			
R317	Same as R310			
R318	Resistor, Fixed, Film, 10.2K Ohm, 1%	Dale	RN55D1022F CCF-551022F	212-1022
R319	Same as R318			
R320	Resistor, Variable, 1K Ohm, 10%	Bourns	3006P-1-102	244-0064
R321	Resistor, Fixed, Film, 19.6K Ohm, 1%	Dale	RN55D1962F CCF-551962F	212-1962

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R322	Resistor, Variable, 5K Ohm, 10%	Bourns	3006P-1-502	244-0019
R323	Resistor, Fixed, Film, 120 Ohm, 5%, 1/4W		RL07S121J	202-0121
R324	Same as R308			
R325	Resistor, Fixed, Film, 560 Ohm, 5%, 1/4W		RL07S561J	202-0561
R326	Resistor, Fixed, Film, 205 Ohm, 1%	Dale	RN55D2050F CCF-552050F	212-2050
R327	Resistor, Fixed, Film, 100K Ohm, 5%, 1/4W		RL07S104J	202-0104
R328	Wire, Bus, #22 AWG with Sleeving	Alpha	298	674-0001
R329	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R330 thru	Same as R318			

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R322	Resistor, Variable, 5K Ohm, 10%	Bourns	3006P-1-502	244-0019
R323	Resistor, Fixed, Film, 120 Ohm, 5%, 1/4W		RL07S121J	202-0121
R324	Same as R308			
R325	Resistor, Fixed, Film, 560 Ohm, 5%, 1/4W		RL07S561J	202-0561
R326	Resistor, Fixed, Film, 205 Ohm, 1%	Dale	RN55D2050F CCF-552050F	212-2050
R327	Resistor, Fixed, Film, 100K Ohm, 5%, 1/4W		RL07S104J	202-0104
R328	Wire, Bus, #22 AWG with Sleeving	Alpha	298	674-0001
R329	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R330 thru R333	Same as R318			
R334	Same as R320			
R335	Same as R318			
R336	Same as R321			
R337	Same as R322			
R338	Same as R329			

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R339	Resistor, Fixed, Film, 51.1 Ohm, 1%	Dale	RN55D51R1F	212-0511
R340	Same as R318			
R341	Same as R318			
R342	Same as R320			
R343	Same as R321			
R344	Same as R322			
R345	Same as R323			
R346	Same as R308			
R347	Same as R339			
R348	Resistor, Fixed, Film, 200K Ohm, 1%	Dale	RN55D2003F CCF-552003F	212-2003
R349	Same as R327			
R350	Resistor, Fixed, Film, 47.5K Ohm, 1%	Dale	RN55D4752F CCF-554752F	212-4752
R351	Same as R320			
R352	Resistor, Fixed, Film, 2.2K Ohm, 5%, 1/4W		RL07S222J	202-0222
R353	Resistor, Fixed, Film, 3.9K Ohm, 5%, 1/4W		RL07S392J	202-0392

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R357	Resistor, Fixed, Film, 4.7K Ohm, 5%, 1/4W		RL07S472J	202-0472
R358	Same as R350			
R359	Same as R320			
R360	Same as R352			
R361	Same as R353			
R365	Same as R357			
R366	Same as R339			
R367	Resistor, Fixed, Film, 21.5K Ohm, 1%	Dale	RN55D2152F CCF-552152F	212-2152
R368	Same as R348			
R369	Same as R323			
R370	Same as R308			
R371	Same as R327			
R372	Same as R328			
R373	Same as R308			
R374	Same as R327			
R377	Resistor, Fixed, Film, 464 Ohm, 1%	Dale	RN55C4640F	212-4640-001

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R378	Same as R322			
R379	Same as R329			
R380	Same as R308			
R381	Same as R327			
R382	Same as R301			
R383	Same as R367			
R384	Same as R308			
R385	Same as R327			
R386	Same as R301			
R387	Same as R326			
R388	Same as R328			
R389	Same as R320			
R390	Same as R353			
R391	Same as R320			
R392	Same as R353			
R393	Same as R326			
R394	Same as R339			
R395	Same as R326			

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R396	Same as R339			
R399	Same as R323			
R3100	Resistor, Variable, Dual Section, 1K Ohm	Bourns A. B.	81A2AB20A10A10 70R1N040S102W	240-0036
R3101	Same as R3100			
R3102	Resistor, Variable, Dual Section, 100K Ohm	Bourns A. B.	81A2AB52A20A20 70R1N140S104W	240-0038
R3103	Same as R3102			
R3104	Resistor, Variable, Dual Section, 5K Ohm/50K Ohm	Bourns A. B.	81A2AB20A13A18 24M641	240-0037
R3105	Same as R3104			
R3106	Same as R303			
R3107	Same as R303			
R3108	Resistor, Fixed, Film, 3.0K Ohm, 5%, 1/4W		RL07S302J	202-0302
R3109	Resistor, Variable, 1K Ohm, 10%	Bourns	3006P-1-102	244-0064
R3110	Resistor, Fixed, Film, 33K Ohm, 5%, 1/4W		RL07S333J	202-0333
R3111	Resistor, Fixed, Film, 301K Ohm, 1%		RN55D3013F	212-3013

7.6 LIST OF MATERIAL, AUDIO EQUALIZATION MATRIX ASSEMBLY, REFERENCE DESIGNATION A300, D33-320-2, REV. P CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R3112	Same as R3111			
S301	Switch, Toggle, SPDT, PC Mount	JBT	MPC-123	660-0051
S302 thru S306	Same as S301			
TP1	Terminal, Test Point	Vector	T44	672-0053
TP2 thru TP9	Same as TP1			
U301	IC, Op Amp, 14 Pin DIP	T. I. National	TL084ACN LF347BN	540-0026-001
U302 thru U307	Same as U301			
U308	IC, Op Amp, 8 Pin DIP	T. I.	TL082CP	540-0028
W1	Wire, #24 AWG, Solid, Tinned, PVC Insulation	Alpha	1561/24	
XU301	Socket, IC, 14 Pin DIP	Samtech	ICO-314-SGT	736-0025
XU302 thru XU307	Same as XU301			
XU308	Socket, IC, 8 Pin DIP	Samtech	ICO-308-SGT	736-0036

7.7 LIST OF MATERIAL, POWER SUPPLY ASSEMBLY, REFERENCE DESIGNATION A400, D33-323, REV. J

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C401	Capacitor, Fixed, Ceramic Disc, .001 uF, 20%, 1KV	Sprague	5GA-D10	310-0013
C402	Same as C401			
C403	Capacitor, Fixed, Electrolytic, 2000 uF, 50V	Mallory	TC50200B	320-0069
C404	Same as C401			
C405	Same as C401			
C406	Capacitor, Fixed, Poly Film, .1 uF, 10%, 100V	Nichicon	QYA2A104K	330-0021
C407	Capacitor, Fixed, Poly Film, .22 uF, 10%, 100V	Nichicon	QYA2A224K	330-0022
C408	Same as C406			
C409 thru C411	Same as C407			
C412	Same as C403			
CR401	Diode, Silicon, Rectifier	Motorola	1N4720	410-4720
CR402 thru CR404	Same as CR401			
CR405	Diode, Silicon	Motorola	1N4002	410-4002
CR406	Same as CR405			

7.7 LIST OF MATERIAL, POWER SUPPLY ASSEMBLY, REFERENCE DESIGNATION A400, D33-323, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
CR407	Same as CR405			
R401	Resistor, Fixed, WW, 5 Ohm, 10%, 5W	TRW	PW5-5	224-0002
R402	Same as R401			
R403	Resistor, Fixed, Film, 47 Ohm, 5%, 2W		RL42S470J	208-0470
VR401	Voltage Regulator, +15V, 1.5A, TO-220 Case	Motorola Only	MC7815CT	544-0003-015
VR402	Voltage Regulator, +5V, 1.5A, TO-220 Case	Motorola Only	MC7805CT	544-0003-005
VR403	Voltage Regulator, -15V, 1.5A, TO-220 Case	Motorola Only	MC7915CT	544-0004-015
XVR401	Socket, Transistor, Crimp Type	Molex	10-01-2031	736-0045
XVR401E1	Terminal, Crimp	Molex	08-50-0108	622-0078
XVR402	Same as XVR401			
XVR402E1	Same as XVR401E1			
XVR403	Same as XVR401			
XVR403E1	Same as XVR401E1			

7.8 LIST OF MATERIAL, RF AMPLIFIER ASSEMBLY, REFERENCE DESIGNATION A500, D33-322, REV G

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C503	Capacitor, Fixed, Ceramic Disc, .005 uF	Sprague	TG-D50	310-0029
C509	Capacitor, Fixed, Monolithic Ceramic, .47 uF, 50V	Sprague	1C20Z5U474M050B	310-0052
C510 thru C514	Same as C509			
C520	Same as C503			
C530	Capacitor, Fixed, Monolithic Ceramic, .1 uF, 50V	Sprague	1C20Z5U104M050B	310-0051
C531	Capacitor, Fixed, Poly Film, .01 uF, 100V	Nichicon	QYA2A103K	330-0015
C532	Capacitor, Fixed, Mica, 15 pF, 5%, 500V		CM05CD150J03	302-0150
C533	Same as C509			
CR501	Diode, Zener, 62V, 1W	Motorola	1N4759A	410-4759-001
CR502	Same as CR501			
J501	Connector, BNC		UG-657/U	612-0050
J502 thru J504	Same as J501			
J505	Connector, Transistor Socket	Molex	10-18-2031	736-0044
J506	Same as J505			

7.8 LIST OF MATERIAL, RF AMPLIFIER ASSEMBLY, REFERENCE DESIGNATION A500, D33-322, REV. G CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
L503	Inductor, Fixed, RF Choke, 30 uHi	Miller	74F335A1	350-0028
L504	Same as L503			
L505	Same as L503			
Q501	Transistor, PNP	Motorola	MPS6517	426-0009
Q502	Same as Q501			
Q503	Transistor, Power FET	Siliconix	VN89AD	436-0003
Q504	Same as Q503			
Q505	Transistor, NPN	Motorola	MPS6513	426-0008
Q506	Same as Q505			
R501	Resistor, Fixed, Film, 820 Ohm, 5%, 1/4W		RL07S821J	202-0821
R502	Resistor, Variable, 5K Ohm, 15 Turn	Bourns	3262W-1-502	244-0075
R503	Resistor, Fixed, Film, 470 Ohm, 5%, 1/4W		RL07S471J	202-0471
R504	Resistor, Fixed, Film, 22 Ohm, 5%, 1/4W		RL07S220J	202-0220
R505	Same as R501			
R506	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102

7.8 LIST OF MATERIAL, RF AMPLIFIER ASSEMBLY, REFERENCE DESIGNATION A500, D33-322, REV. G CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R508	Resistor, Variable, 2K Ohm	Piher	PT10LV-2K OHM	244-0068
R517	Resistor, Fixed, Film, 680K Ohm, 5%, 1/4W		RL07S684J	202-0684
R518	Resistor, Variable, 500K Ohm, 15 Turn	Bourns	3006P-1-504	244-0079
R519	Same as R517			
R520	Same as R518			
R521	Resistor, Fixed, Film, 39K Ohm, 5%, 1/4W		RL07S393J	202-0393
R522	Same as R504			
R523	Resistor, Fixed, Film, 18K Ohm, 5%, 1/4W		RL07S183J	202-0183
R524	Same as R506			
R525	Resistor, Fixed, Film, 27 Ohm, 5%, 1/4W		RL07S270J	202-0270
R526	Resistor, Fixed, Film, 22K Ohm, 5%, 1/4W		RL07S223J	202-0223
R527	Resistor, Fixed, Film, 47K Ohm, 5%, 1/4W		RL07S473J	202-0473
R528	Resistor, Fixed, Film, 2.2K Ohm, 5%, 1/4W		RL07S222J	202-0222
T501	Transformer, PCB Mount	Mini-Circuits	MCLT2.5-6T	364-0007

7.8 LIST OF MATERIAL, RF AMPLIFIER ASSEMBLY, REFERENCE DESIGNATION A500, D33-322, REV. G CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
T502	Transformer	Coil-Craft	D2275	364-0005
TB501	Connector, 3/8" Feed-Thru, Block	Kulka	411-1904-4	670-0008-004

7.9 LIST OF MATERIAL, RF AMPLIFIER EXTENSION ASSEMBLY, D33-342, REV. F

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C516	Capacitor, Fixed, Ceramic, 0.47 uF	Sprague	1C20Z5U474M050B	310-0052
C517 thru C519	Same as C516			
C521	Same as C516			
C522	Same as C516			
CR503	Diode, Silicon, Rectifier		1N4002	410-4002
CR504	Same as CR503			
J503	Connector, BNC to PWB, Right Angle	Amp	226990-1	612-0048
J504 thru J506	Same as J503			
K501	Relay, 4 Form C, 24V	P & B	R40-E1-X4-V800	654-0051
L506	Inductor, 30 uH	Miller	74F335A1	350-0028
L507	Same as L506			
R529	Resistor, Fixed, Film, 270 Ohm, 5%, 1/4W		RL07S271J	202-0271
R530	Resistor, Fixed, Film, 470 Ohm, 5%, 1/4W		RL07S471J	202-0471
R531	Resistor, Variable, 10K Ohm	Bourns	3006P-1-103	244-0030
R532	Same as R531			

7.9 LIST OF MATERIAL, RF AMPLIFIER EXTENSION ASSEMBLY, D33-342, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R533	Same as R529			
TB502	Terminal Block, 6 Position	Kulka	411-1904-006	670-0008-006
U501	Line Driver, Dual, TTL	T. I. Signetics	SN75123N 8T23	532-0006
U502	Same as U501			
VR501	Voltage Regulator	Motorola	LM317T	544-0028
W1	Wire, Bus, #22 AWG, Solid, Copper Tinned			
XK501	Socket, Relay, R40 Type, Right Angle, PC Mount	P & B	27E323	736-0008
XU501	Socket, IC, 16 Pin DIP	Samtech	ICO-316-SGT	736-0026
XU502	Same as XU501			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C605	Capacitor, Fixed, Film, .01 uF, 10%, 100V	Nichicon	QYA2A103K	330-0015
C606	Capacitor, Fixed, Film, .022 uF, 10%, 100V	Nichicon	QYA2A223K	330-0018
C607	Same as C605			
C608	Capacitor, Fixed, Monolithic Ceramic, .1 uF, 50V	Sprague	1C20Z5U104M050B	310-0051
C609	Capacitor, Fixed, Metalized Poly Film, .33 uF, 10%, 250V	Nichicon	QXM2E334K	330-0025
C610	Same as C609			
C611	Same as C608			
C612	Capacitor, Fixed, Metalized Poly Film, 2.2 uF, 10%, 250V	Nichicon	QXM2E225K	330-0026-001
C613	Same as C612			
C619	Same as C605			
C620	Same as C606			
C622	Same as C609			
C623	Same as C609			
C624	Same as C612			
C625	Same as C612			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C626	Same as C608			
C627	Capacitor, Fixed, Electrolytic, 1 uF, 63V	Nichicon Sprague	ULB1H1R0M 502D105G063BB1C	320-0061 320-0068
C628	Same as C627			
C629	Capacitor, Fixed, 6800 pF, 5%	Sprague Nichicon	5CC0G682X5100C5 QYA2A682J	330-0030
C630	Capacitor, Fixed, .018 uF, 5%	Sprague Nichicon	7CC0G183X5100E5 QYA2A183J	330-0017
C631	Capacitor, Fixed, .001 uF, 5%, 100V	Sprague Nichicon	7CC0G102X5100D1 QYA2A102K	330-0012
C632	Same as C629			
C633	Same as C631			
C634	Same as C630			
C635	Same as C629			
C636	Same as C630			
C637	Same as C631			
C638	Same as C630			
C639	Same as C631			
C640	Same as C629			
C641	Same as C629			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C642	Same as C630			
C643	Same as C631			
C644	Same as C629			
C645	Same as C630			
C646	Same as C631			
C647	Same as C631			
C648	Same as C629			
C649	Same as C630			
C650	Same as C630			
C651	Same as C629			
C652	Same as C631			
C654 thru C659	Same as C608			
C660	Same as C605			
C661	Same as C608			
CR601	Diode, Silicon		1N4148	410-4148
CR602 thru CR604	Same as CR601			
J601	Connector, Header, 10 Pin	Amp	1-640456-0	616-0042-010

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
J602	Connector, Header, 6 Pin	Amp	640456-6	616-0042-006
K601	Relay, DPDT, DIP, w/Diode	Sigma EI&S	195TE2C2E-24G D2C24D	654-0073
K602 thru K604	Same as K601			
P603	Connector, Electrical, 12 Contact	Amp	1-640440-2	616-0041-012
Q601	Transistor, NPN	Motorola	MPS6513	426-0008
R603	Resistor, Fixed, Film, 100 Ohm, 5%, 1/4W		RL07S101J	202-0101
R605	Resistor, Fixed, Film, 20K Ohm, 5%, 1/4W		RL07S203J	202-0203
R606	Same as R605			
R608	Resistor, Fixed, Film, 10K Ohm, 5%, 1/4W		RL07S103J	202-0103
R609	Resistor, Fixed, Film, 1.1K Ohm, 5%, 1/4W		RL07S112J	202-0112
R610	Resistor, Fixed, Film, 24K Ohm, 5%, 1/4W		RL07S243J	202-0243
R611	Resistor, Variable, 1K Ohm, 15 Turn	Bourns	3006P-1-102	244-0064
R612	Same as R603			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R613	Same as R605			
R614	Same as R605			
R615	Same as R608			
R616	Same as R609			
R617	Same as R610			
R618	Resistor, Fixed, Film, 301 Ohm, 1%		RN55D3010F	212-3010
R619	Same as R611			
R621	Same as R618			
R622	Same as R611			
R623	Resistor, Fixed, Film, 806 Ohm, 1%		RN55D8060F	212-8060
R624	Same as R623			
R625	Same as R618			
R626	Same as R611			
R627	Same as R618			
R651 thru R653	Same as R605			
R654	Same as R608			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R655	Resistor, Variable, 100K Ohm, 15 Turn	Bourns	3006P-1-104	244-0048
R656	Resistor, Fixed, Film, 100K Ohm, 5%, 1/4W		RL07S104J	202-0104
R657	Resistor, Fixed, Film, 36K Ohm, 5%, 1/4W		RL07S363J	202-0363
R658	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R659	Resistor, Fixed, Film, 560K Ohm, 5%, 1/4W		RL07S564J	202-0564
R660	Resistor, Fixed, Film, 820K Ohm, 5%, 1/4W		RL07S824J	202-0824
R661	Same as R658			
R662	Resistor, Variable, 5K Ohm, 15 Turn	Bourns	3006P-1-502	244-0019
R663	Resistor, Fixed, Film, 3.3K Ohm, 5%, 1/4W		RL07S332J	202-0332
R664	Resistor, Fixed, Film, 750 Ohm, 5%, 1/4W		RL07S751J	202-0751
R665	Same as R664			
R666 thru R668	Same as R623			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R669	Resistor, Fixed, Film, 402 Ohm, 1%		RN55D4020F	212-4020
R670	Same as R669			
R671	Same as R669			
R672	Resistor, Fixed, Film, 200 Ohm, 1%		RN55D2000F	212-2000
R673	Same as R672			
R674	Same as R672			
R675	Resistor, Fixed, Film, 100 Ohm, 5%, 1/4W		RL07S101J	202-0101
R676	Same as R675			
R677	Same as R675			
R678 thru R680	Same as R623			
R681 thru R683	Same as R669			
R684 thru R686	Same as R672			
R687	Same as R675			
R688	Same as R675			
R689	Same as R611			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R690	Resistor, Fixed, Film, 3.9K Ohm, 5%, 1/4W		RL07S392J	202-0392
R691	Same as R611			
R692	Same as R690			
R693	Same as R675			
R6101A	Resistor, Variable, Dual Section, 1K Ohm, 5/8" FMS Shaft	Bourns A. B.	81A2AB20A10A10 70R1N040S102W	240-0036
R6101B	Same as R6101A			
R6102A	Same as R6101A			
R6102B	Same as R6101A			
R6103A	Resistor, Variable, Dual Section, 100K Ohm, 1-5/8" FMS Shaft	Bourns A. B.	81A2AB52A20A20 70R1N140S104W	240-0038
R6103B	Same as R6103A			
R6104A	Same as R6103A			
R6104B	Same as R6103A			
R6105A	Resistor, Variable, Dual Section, 5K Ohm/50K Ohm, 5/8" FMS Shaft	Bourns A. B.	81A2AB20A13A18 24M641	240-0037
R6105B	Same as R6105A			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, 533-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R6106A	Same as R6105A			
R6106B	Same as R6105A			
R6107	Same as R603			
R6108	Same as R603			
S601	Switch, Toggle, SPDT, PC Mount	JBT	MPC-123	660-0051
S602 thru S607	Same as S601			
S608	Switch, DIP, Binary Select, Positions	Amp	53137-5	662-0022
S609	Same as S608			
TP1	Terminal Test Point	Vector	T44	672-0053
TP2	Same as TP1			
U601	IC, Quad Op Amp JFET	T. I.	TL084CN	540-0026
U602	Same as U601			
U603	Same as U601			
U604	IC, Opto-Isolated, Variable Resistor	Vactec	VTL5C1	446-0003
U606	Same as U601			
U607	Same as U601			

7.10 LIST OF MATERIAL, AUDIO NIGHT PROCESSOR ASSEMBLY, REFERENCE DESIGNATION A600, D33-334, REV. Q CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
W1	Wire, Hookup, #22 AWG Stranded, PVC/No Nylon Jacket	Alpha	7055	
W2 thru W6	Same as W1			
W15 thru W50	Same as W1			
XP603	Cover, Strain Relief	Amp	1-643075-2	622-0085-012
XS608	Socket, IC, 16 Pin	Samtech	ICO-316-SGT	736-0026
XS609	Same as XS608			
XU601	Socket, IC, 14 Pin	Samtech	ICO-314-SGT	736-0025
XU602	Same as XU601			
XU603	Same as XU601			
XU606	Same as XU601			
XU607	Same as XU601			

7.11 LIST OF MATERIAL, DELAY MOUNTING BOARD, D33-348, REV. C

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
J603	Header, Electrical, 12 Contact	Amp	1-640456-2	616-0042-012
XP603	Cover, Connector	Amp	1-640550-2	616-0041-112

7.12 LIST OF MATERIAL, AUDIO INPUT ASSEMBLY, REFERENCE DESIGNATION A700, D33-351, REV. D

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C1	Capacitor, Fixed, Polyester, 0.0033 uF, 10%, 100V	Nichicon	QYA2A332K	330-0014
C2 thru C8	Same as C1			
C9	Capacitor, Fixed, Silver Mica, Selected			
C10	Same as C9			
C11	Capacitor, Fixed, Electrolytic, 10 uF, 20%, 50V	Nichicon	UTM1H100MPA	320-0071
C12 thru C18	Same as C11			
C19	Capacitor, Fixed, Silver Mica, 43 pF, 5%		CM05ED430J03	302-0430
C20	Same as C19			
C21	Capacitor, Fixed, Ceramic, 0.47 uF, 50V	Sprague	1C20Z50474M050B	310-0052
C22 thru C24	Same as C21			
L1	Inductor, Fixed, 560 uH, 5%	Miller	70F564A1	350-0030
L2 thru L4	Same as L1			
MP1	Standoff, Swage	CTC	350-1246-13-07	738-0006

7.12 LIST OF MATERIAL, AUDIO INPUT ASSEMBLY, REFERENCE DESIGNATION A700, D33-351, REV. D CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
MP2 thru MP4	Same as MP1			
MP5	Standoff, Male-Female	E. F. Johnson	312-7483-024	738-0059
MP6 thru MP8	Same as MP5			
R1	Resistor, Attenuator, per customer requirement			
R2 thru R8	Same as R1			
R9	Resistor, Fixed, Film, 300 Ohm, 5%, 1/4W		RL07S301J	202-0301
R10 thru R12	Same as R9			
R13	Resistor, Fixed, Film, 100K Ohm, 5%, 1/4W		RL07S104J	202-0104
R14 thru R16	Same as R13			
R17	Resistor, Fixed, Film, 2.7K Ohm, 5%, 1/4W		RL07S272J	202-0272
R18	Same as R17			
R19	Resistor, Fixed, Film, 4.7K Ohm, 5%, 1/4W		RL07S472J	202-0472
R20	Same as R19			

7.12 LIST OF MATERIAL, AUDIO INPUT ASSEMBLY, REFERENCE DESIGNATION A700, D33-351, REV. D CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R21	Resistor, Fixed, Film, 12K Ohm, 5%, 1/4W		RL07S123J	202-0123
R22	Same as R21			
R23	Resistor, Fixed, Film, 18K Ohm, 5%, 1/4W		RL07S183J	202-0183
R24	Same as R23			
R25	Resistor, Variable, 2K Ohm, 10 Turn	Bourns	3006P-1-202	244-0012
R26	Same as R25			
R27	Resistor, Fixed, Film, 620 Ohm, 5%, 1/4W		RL07S621J	202-0621
R28	Same as R27			
R29	Resistor, Variable, 100K Ohm, 10 Turn	Bourns	3006P-1-104	244-0048
R30	Same as R29			
R31	Resistor, Fixed, Film, 22K Ohm, 5%, 1/4W		RL07S223J	202-0223
R32	Same as R31			
U1	IC, Operational Amplifier	Signetics	NE5534N	540-0019
U2	Same as U1			
W1	Wire, Bus, #22 AWG	Alpha	298	674-0001

7.12 LIST OF MATERIAL, AUDIO INPUT ASSEMBLY, REFERENCE DESIGNATION A700, D33-351, REV. D CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
XC9	Insertion Spring Socket	Amp	380598-3	736-0042
XC10	Same as XC9			
XR1 thru XR8	Same as XC9			
XU1	Socket, IC, 8 Pin	Samtech	ICO-308-SGT	736-0036
XU2	Same as XU1			
XW1	Teflon Insulation Tubing	Alpha	TFT200-22	684-0007-002

7.13 LIST OF MATERIAL, AUDIO INTERFACE ASSEMBLY, REFERENCE DESIGNATION A700, D33-336, REV. E
(APPLICABLE TO MODEL ASE-1 EXCITER SERIAL NUMBERS 001 THROUGH 070)

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R551	Resistor, Fixed, Film, per customer requirement			
R552 thru R556	Same as R551			
T701	Transformer, Audio	Marvel Electric	M47A238C	360-0004
T702	Same as T701			
XR551	Insertion Spring Socket	Amp	50462-7	736-0032
XR552 thru XR556	Same as XR551			
XT701	Spacer, .025 Inch	H. H. Smith	2100	738-0014
XT702	Same as XT701			

7.14 LIST OF MATERIAL, SAMPLE TRANSMITTER ASSEMBLY, REFERENCE DESIGNATION A900, D33-321-3, REV. J

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C901	Capacitor, Fixed, Ceramic, Disc, 100 pF, 1000V	Sprague	5GA-T10	310-0049
C902	Same as C901			
C903	Capacitor, Fixed, Polyester Film, .01 uF, 100V	Nichicon	QYA2A103K	330-0015
C904	Same as C901			
C905	Capacitor, Silver Mica, per station frequency			
C906	Capacitor, Fixed, Ceramic, Disc, 0.1 uF, 100V	Sprague	TG-S10	310-0031
C907	Same as C903			
C908	Capacitor, Fixed, Electrolytic, 100 uF, 25V	Nichicon	ULB1E101M	320-0067
C909	Capacitor, Fixed, Ceramic, .1 uF, 50V	Sprague	1C20Z5U104M050B	310-0051
C910	Same as C903			
C911	Capacitor, Fixed, Metalized Poly Film, .22 uF, 250V	Nichicon	QXM2E224K	330-0024
C912	Same as C911			
C913A	Same as C905			
C913B	Same as C905			

7.14 LIST OF MATERIAL, SAMPLE TRANSMITTER ASSEMBLY, REFERENCE DESIGNATION A900, D33-321-3, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
J901	Connector, BNC to PCB, Right Angle Mount	Amp	226990-1	612-0048
L901	Inductor, Fixed, 30 uH, 450 mA	Miller	74F335A1	350-0028
L902	Same as L901			
Q901	Transistor, NPN	Motorola	MPS6513	426-0008
Q902	Transistor, PNP	Motorola	MPSU52	426-0010
R901	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R902	Resistor, Variable, 1K Ohm	Bourns	3006P-1-102	244-0064
R903	Resistor, Fixed, Film, 15K Ohm, 5%, 1/4W		RL07S153J	202-0153
R904	Resistor, Fixed, Film, 820 Ohm, 5%, 1/4W		RL07S821J	202-0821
R905	Resistor, Fixed, Film, 3.9K Ohm, 5%, 1/4W		RL07S392J	202-0392
R906	Resistor, Fixed, Film, 1.2K Ohm, 5%, 1/4W		RL07S122J	202-0122
R907	Same as R905			
R908	Resistor, V4W, 5%, per station frequency			
R909	Same as R908			

7.14 LIST OF MATERIAL, SAMPLE TRANSMITTER ASSEMBLY, REFERENCE DESIGNATION A900, D33-321-3, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R910	Resistor, Fixed, Film, 180K Ohm, 5%, 1/4W		RL07S184J	202-0184
R911	Resistor, Fixed, Film, 47K Ohm, 5%, 1/4W		RL07S473J	202-0473
R912	Resistor, Fixed, Film, 470 Ohm, 5%, 1/4W		RL07S471J	202-0471
R913	Resistor, Fixed, Film, 33 Ohm, 5%, 1/4W		RL07S330J	202-0330
R914	Resistor, Fixed, Film, 100 Ohm, 5%, 1/4W		RL07S101J	202-0101
R915	Resistor, Fixed, Film, 10 Ohm, 5%, 1/4W		RL07S100J	202-0100
R916	Resistor, Fixed, Film, 120 Ohm, 5%, 1/2W		RL20S121J	204-0121
R917	Same as R915			
R918	Resistor, Fixed, Film, 47 Ohm, 5%, 1/4W		RL07S470J	202-0470
R936	Same as R912			
R938	Resistor, Variable, 500K Ohm	Bourns	3006P-1-504	244-0079
R939	Same as R912			
T901	Transformer, Variable	Delta	D05-119	005-0119
T902	Same as T901			

7.14 LIST OF MATERIAL, SAMPLE TRANSMITTER ASSEMBLY, REFERENCE DESIGNATION A900, D33-321-3, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
TP901	Test Point	Vector	T44	672-0053
TP902	Same as TP901			
TP903	Same as TP901			
U901	IC, Modulator	Motorola	MC1496L	548-0010
XC905	Socket, Spring, 0.018-0.040 Dia	Amp	380598-3	736-0042
XC913A	Same as XC905			
XC913B	Same as XC905			
XR908	Same as XC905			
XR909	Same as XC905			
XU901	Socket, IC, 14 Pin DIP	Samtech	ICO-314-SGT	736-0025

7.15 LIST OF MATERIAL, BULK DELAY TB ASSEMBLY, REFERENCE DESIGNATION A1, D33-335, REV. H

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C1	Capacitor, Fixed, Polyester, 6800 pF, 5%	Nichicon Ill. Cap.	QYA2A682J 582UMR100K	330-0030
C2	Capacitor, Fixed, Polyester, .001 uF, 10%	Nichicon Ill. Cap.	QYA2A102K 102UMR1010K	330-0012
C3	Capacitor, Fixed, Polyester, .018 uF, 5%	Nichicon	QYA2A183J	330-0017
C4	Same as C1			
C5	Same as C2			
C6	Same as C3			
C7	Same as C1			
C8	Same as C2			
C9	Same as C3			
C10	Same as C1			
C11	Same as C2			
C12	Same as C3			
C13	Same as C1			
C14	Same as C2			
C15	Same as C3			
C16	Same as C1			

7.15 LIST OF MATERIAL, BULK DELAY TB ASSEMBLY, REFERENCE DESIGNATION A1, D33-335, REV. H CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C17	Same as C2			
C18	Same as C3			
C19	Same as C1			
C20	Same as C2			
C21	Same as C3			
C22	Same as C1			
C23	Same as C2			
C24	Same as C3			
C25	Capacitor, Fixed, .1 uF, 50V	Sprague Nichicon	1C20Z5U104M050B QYA2A104K	310-0051 330-0021
C26 thru C28	Same as C25			
R1 thru R24	Resistor, Fixed, Film, 806 Ohm, 1% (8 uS Steps)	Dale	RN55D8060F	212-8060
R1 thru R3	Resistor, Fixed, Film, 806 Ohm, 1% (1 uS Step)	Dale	RN55D8060F	212-8060
R4 thru R6	Resistor, Fixed, Film, 100 Ohm, 1% (1 uS Step)	Dale	RN55D1000F	212-1000

7.15 LIST OF MATERIAL, BULK DELAY TB ASSEMBLY, REFERENCE DESIGNATION A1, D33-335, REV. H CONTINUED

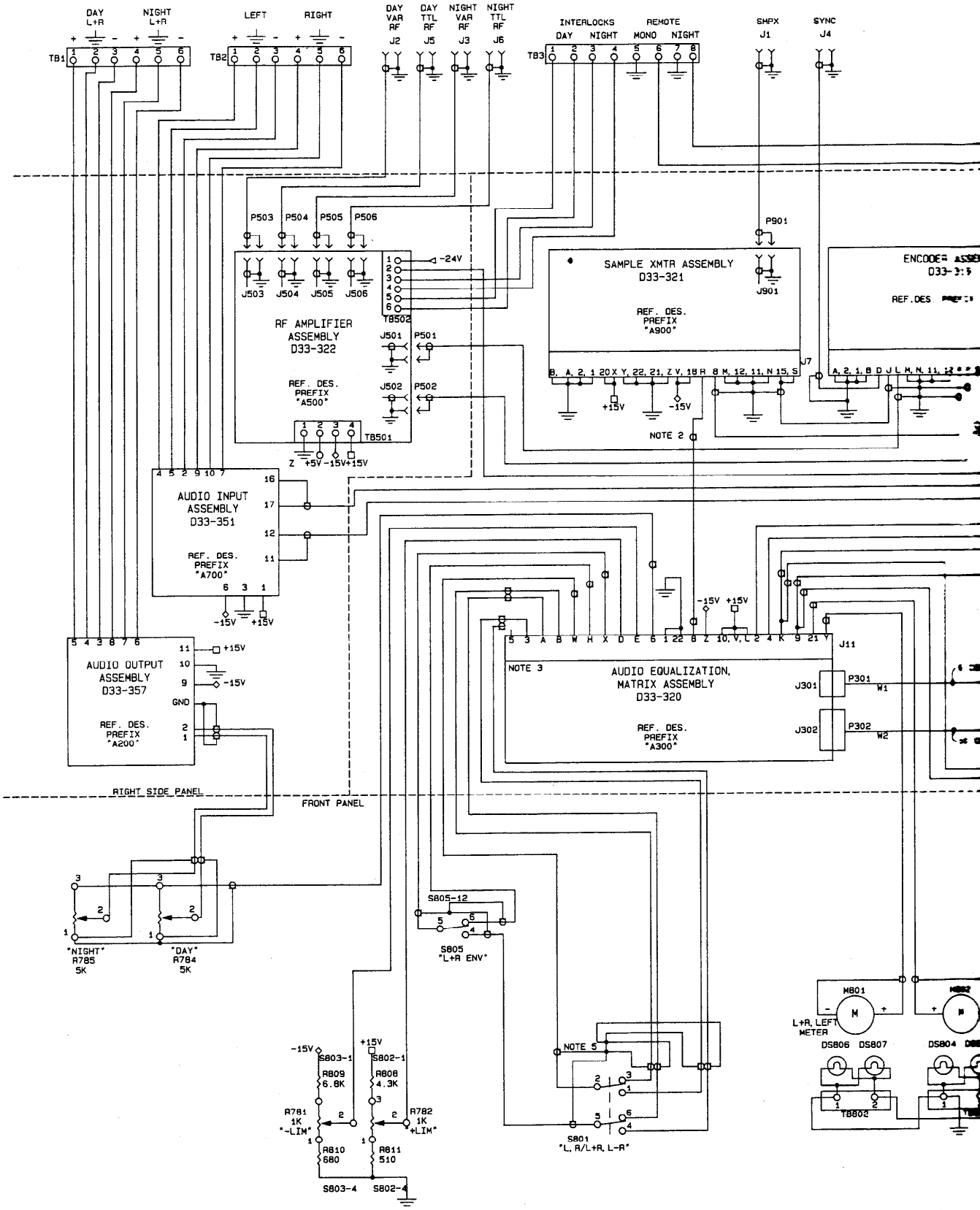
Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R7 thru R9	Resistor, Fixed, Film, 200 Ohm, 1% (1 uS Step)	Dale	RN55D2000F	212-2000
R10 thru R12	Resistor, Fixed, Film, 402 Ohm, 1% (1 uS Step)	Dale	RN55D4020F	212-4020
R13 thru R15	Same as R7 (1 uS Step)			
R16 thru R18	Same as R10 (1 uS Step)			
R19 thru R21	Same as R1 (1 uS Step)			
R22 thru R24	Same as R4 (1 uS Step)			
S1	Switch, Dip, Quad, SPDT, Lever		2-435470-4	660-0048
S2	Same as S1			
U1	IC, Quad JFET Op-Amp	T. I. National	TL084ACN LF347BN	540-0026-001
U2	Same as U1			
XU1	Socket, IC, 14 Pin	Samtech	ICO-314-SGT	736-0025
XU2	Same as XU1			

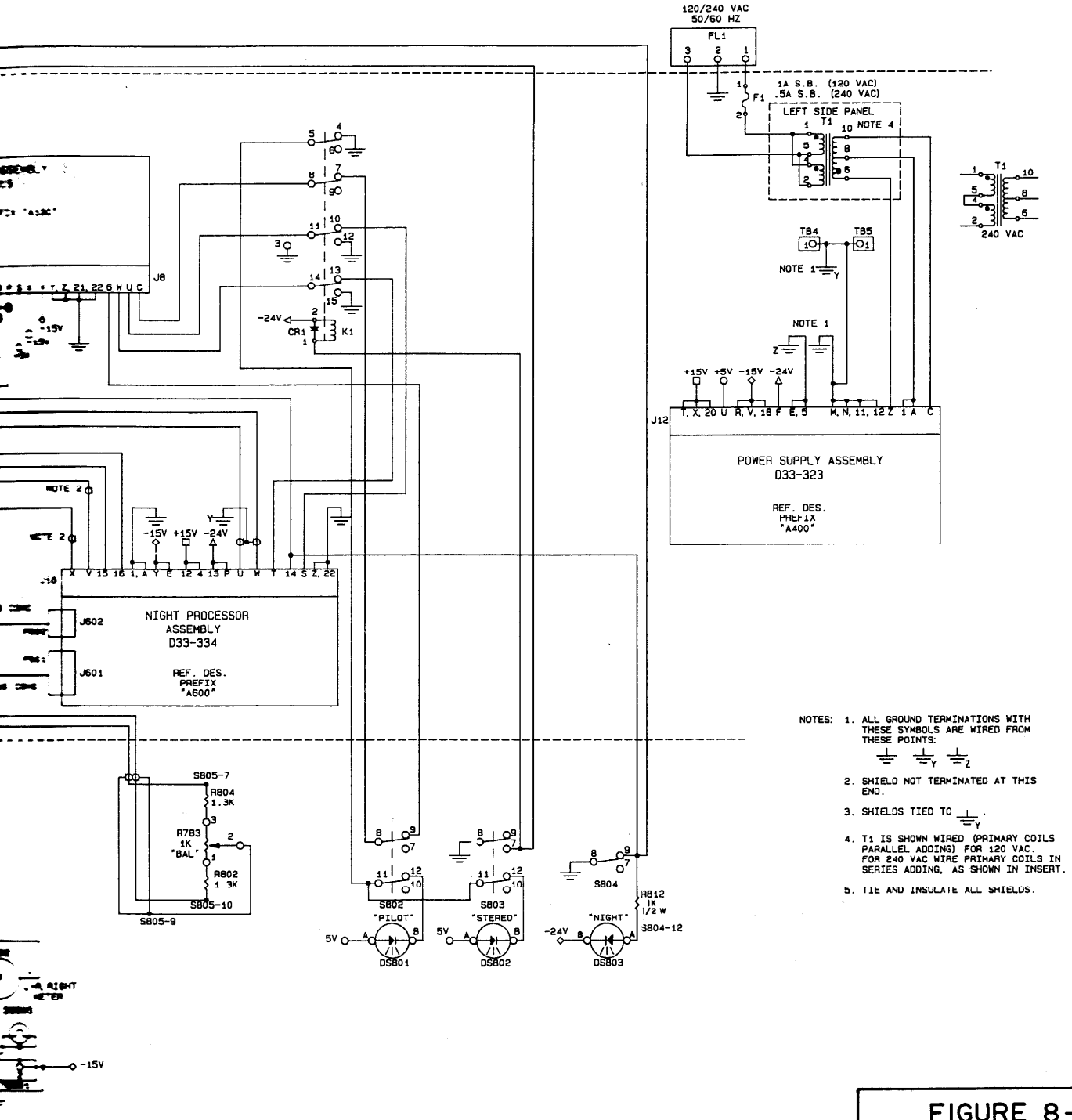
SECTION 8

SCHEMATIC DIAGRAMS

This section contains a Functional Block Diagram, an Interconnect Diagram and schematic diagrams for each printed circuit assembly. These diagrams appear in the following order:

The following schematic diagrams apply to Model ASE-1 AM Stereo Exciters with serials number 001 through 070.

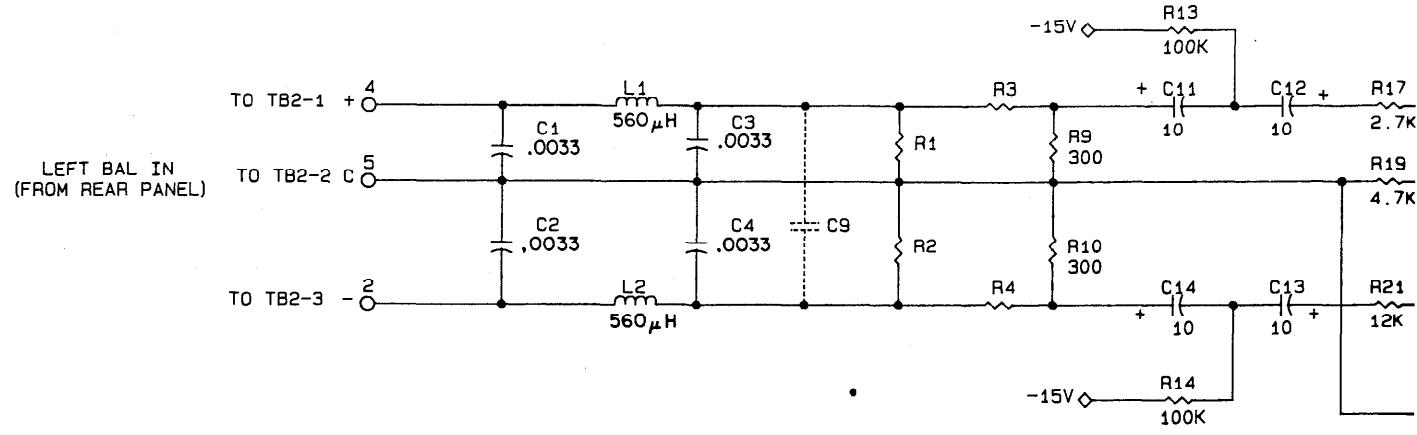

DAY L+R
NIGHT L+R
LEFT
RIGHT
TB1
TB2
DAY VAR RF J2
DAY TTL RF J5
NIGHT VAR RF J3
NIGHT TTL RF J6
INTERLOCKS DAY NIGHT
REMOTE MONO NIGHT
TB3
SMPX J1
SYNC J4
P503 P504 P505 P506
J503 J504 J505 J506
-24V
T8502
RF AMPLIFIER ASSEMBLY D33-322
REF. DES. PREFIX "A500"
J501 P501
J502 P502
TB501
Z +5V -15V +15V
SAMPLE XMTR ASSEMBLY D33-321
REF. DES. PREFIX "A900"
P901
J901
J7
+15V
-15V
NOTE 2
AUDIO INPUT ASSEMBLY D33-351
REF. DES. PREFIX "A700"
-15V +15V
AUDIO OUTPUT ASSEMBLY D33-357
+15V
-15V
GND
REF. DES. PREFIX "A200"
RIGHT SIDE PANEL
FRONT PANEL
NOTE 3
AUDIO EQUALIZATION, MATRIX ASSEMBLY D33-320
REF. DES. PREFIX "A300"
J11
J301 P301 W1
J302 P302 W2
"NIGHT" R785 5K
"DAY" R784 5K
S805-12
S805 "L+R ENV"
-15V
+15V
S803-1
S802-1
R809 6.8K
R808 4.3K
R781 1K "-LIM"
R782 1K "+LIM"
R810 680
R811 510
S803-4
S802-4
NOTE 5
S801 "L, R/L+R, L-R"
M801
L+R, LEFT METER
DS806 DS807
DS804
T8802

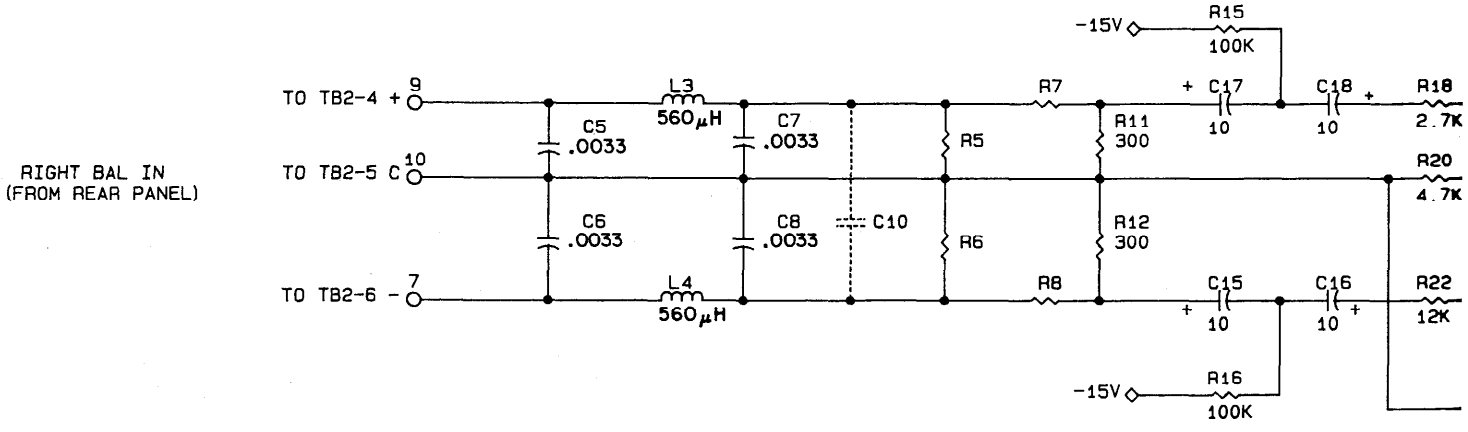


NOTES:
1. ALL GROUND TERMINATIONS WITH THESE SYMBOLS ARE WIRED FROM THESE POINTS: ⏚ ⏚Y ⏚Z
2. SHIELD NOT TERMINATED AT THIS END.
3. SHIELDS TIED TO ⏚Y.
4. T1 IS SHOWN WIRED (PRIMARY COILS PARALLEL ADDING) FOR 120 VAC. FOR 240 VAC WIRE PRIMARY COILS IN SERIES ADDING, AS SHOWN IN INSERT.
5. TIE AND INSULATE ALL SHIELDS.

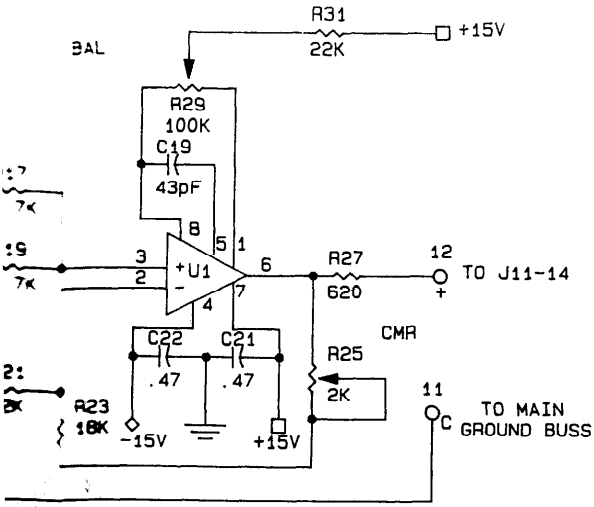
FIGURE 8-2

INTERCONNECT DIAGRAM



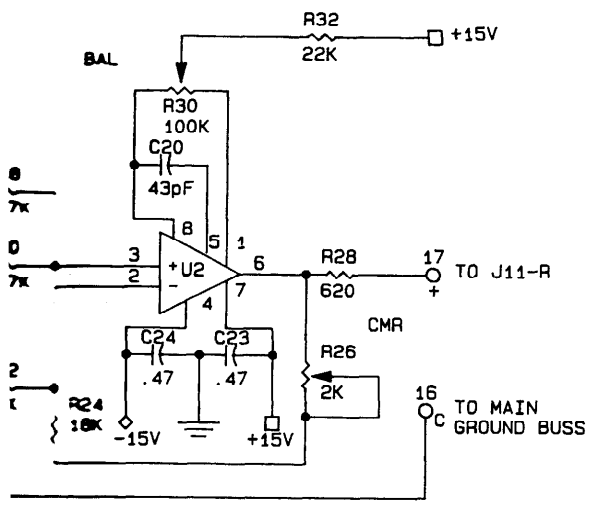


100% MODULATION AUDIO INPUT LEVEL, (dBm INTO 600 OHMS)	R3, R4 R7, R8 (OHMS)	R1, R2 R5, R6 (OHMS)
+16	3,600	330
+14	2,700	330
+12	2,000	330
+10	1,600	360
+8	1,200	360
+6	910	430
+4	620	430
+2	470	510
+0	300	620
-2	180	820
-4	75	1500
-6	0	INF.

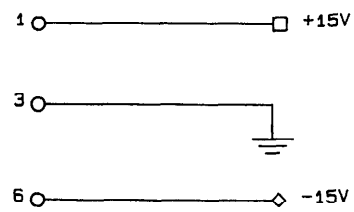


LEFT OUT
(TO DAY BOARD)

NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/5%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS,
3. TEST ANS INSPECTION PROCEDURE: 7D33-351.
4. U1 AND U2 ARE NE5534N.
5. R1 THRU R8 MOUNTED IN SOCKETS. C9 AND C10 NOT NORMALLY USED.



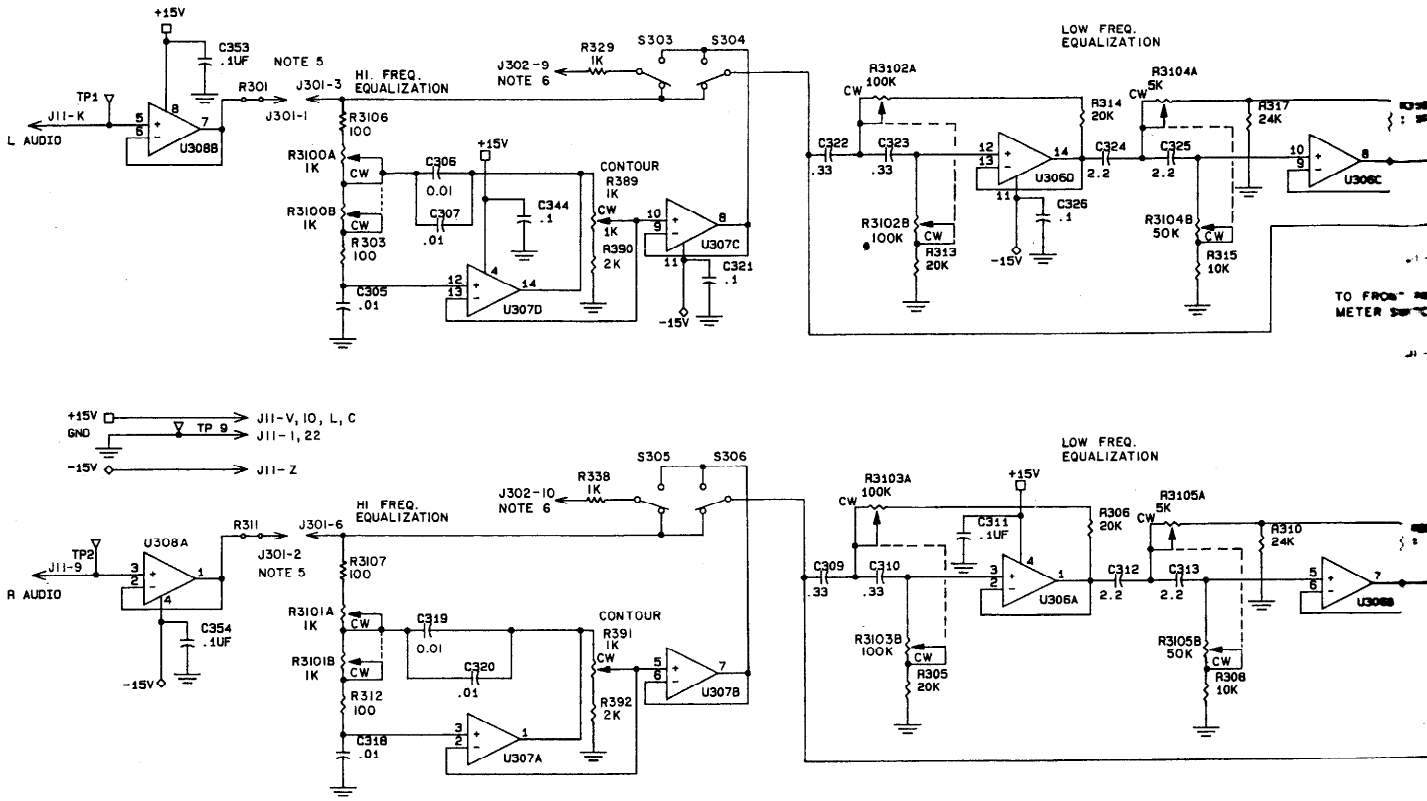
RIGHT OUT
(TO DAY BOARD)

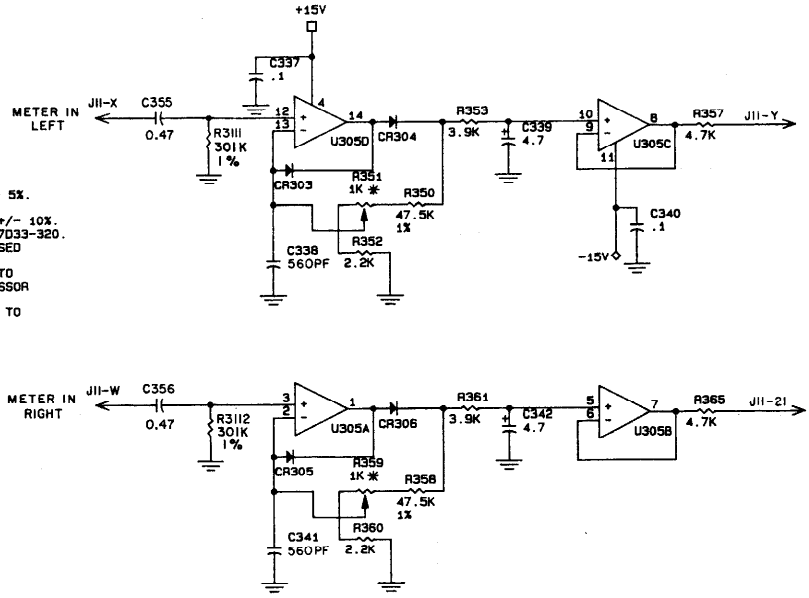


REF. DES. PREFIX "A700"

FIGURE 8-3

SCHEMATIC DIAGRAM
AUDIO INPUT
ASSEMBLY





NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE IN OHMS, 1/4W, +/- 5%.
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7D33-320.
4. ASTERISK * THESE POTS ARE ACCESSED FROM REAR OF PCB.
5. J301-1 THROUGH 6 ARE CONNECTED TO J602-6 ON THE AUDIO NIGHT PROCESSOR ASSEMBLY.
6. J302-1 THROUGH 10 ARE CONNECTED TO J601-1 THROUGH 10 ON THE AUDIO NIGHT PROCESSOR ASSEMBLY.

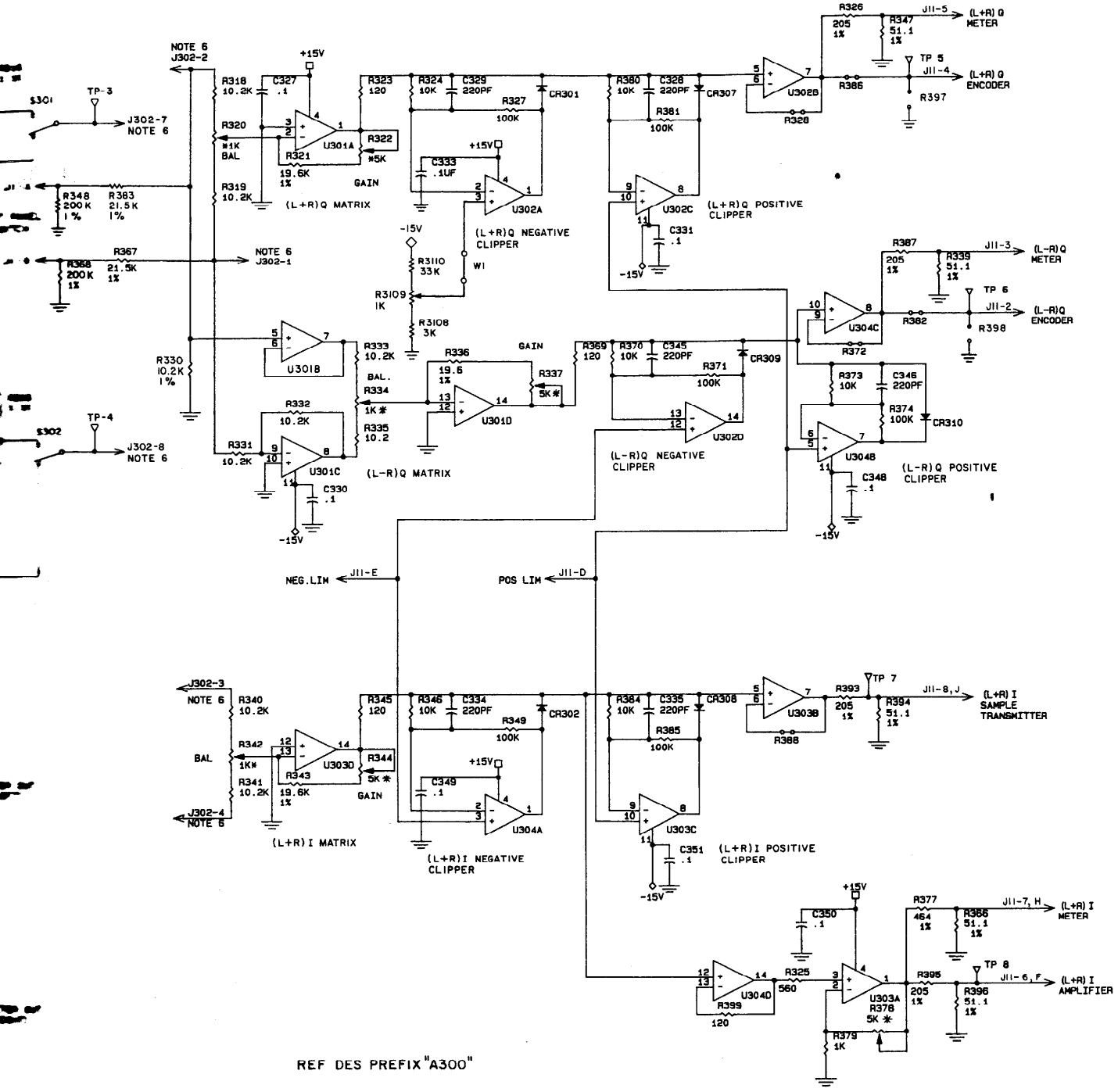
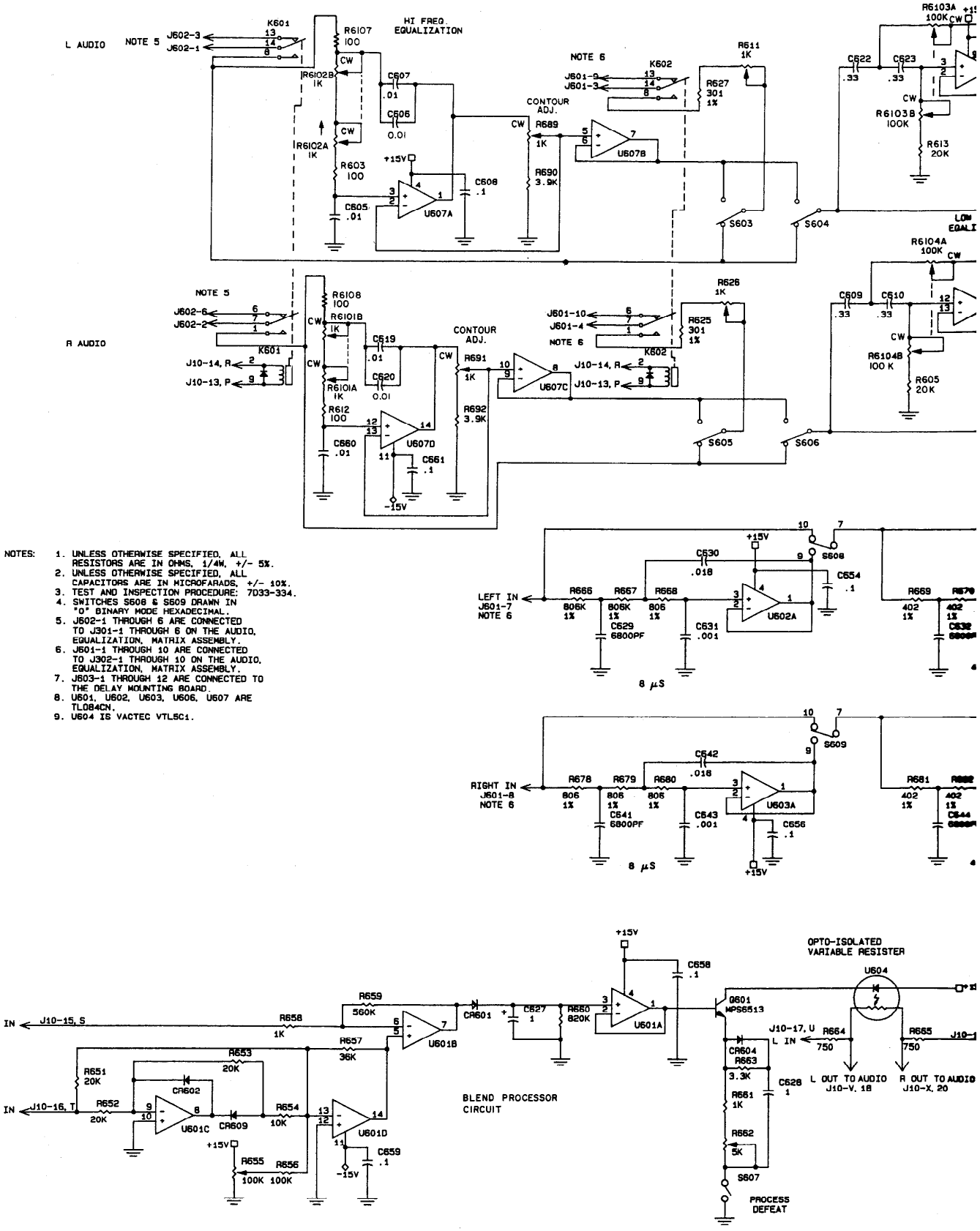
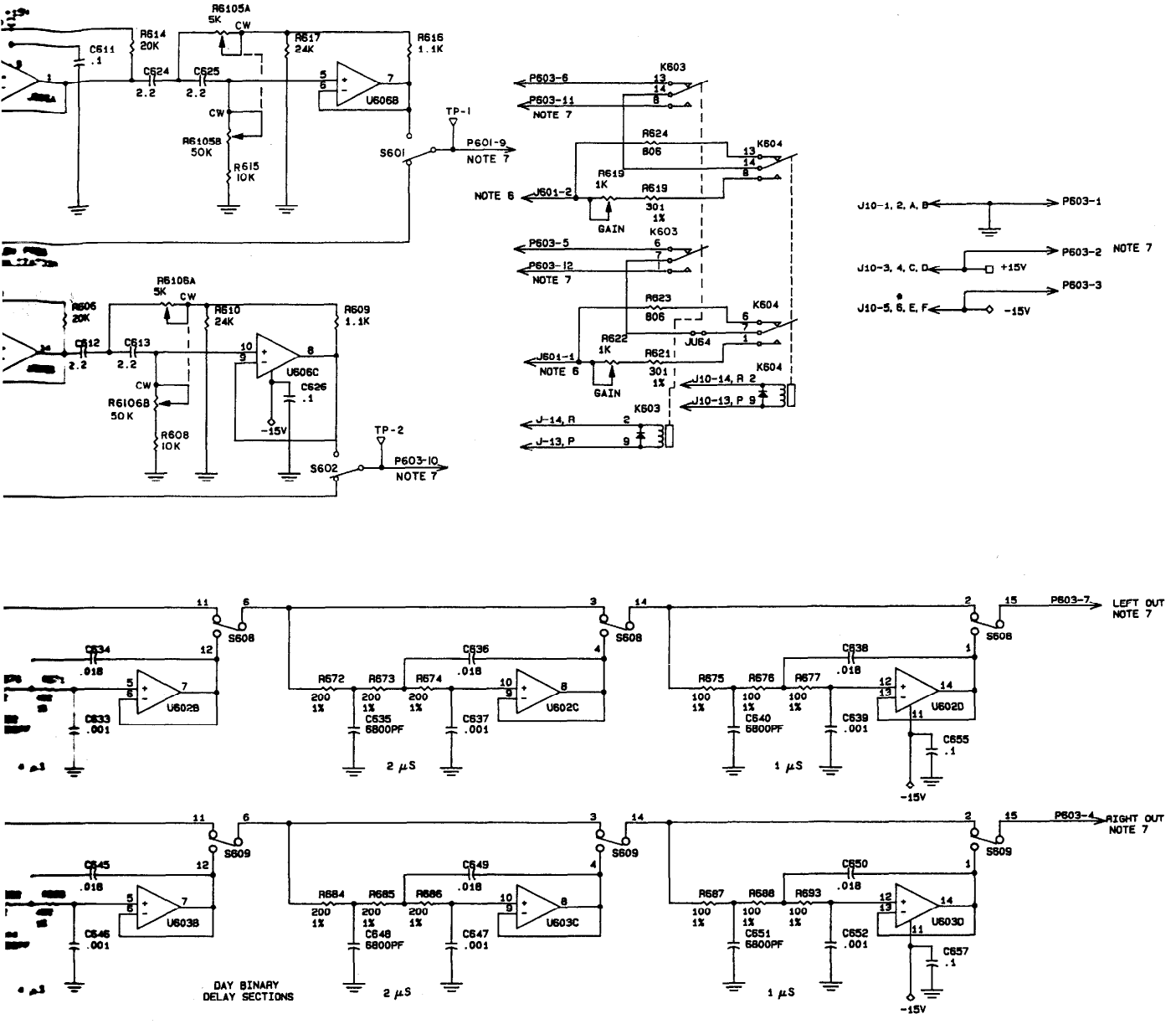


FIGURE 8-4

SCHEMATIC DIAGRAM
AUDIO EQUALIZATION,
MATRIX ASSEMBLY

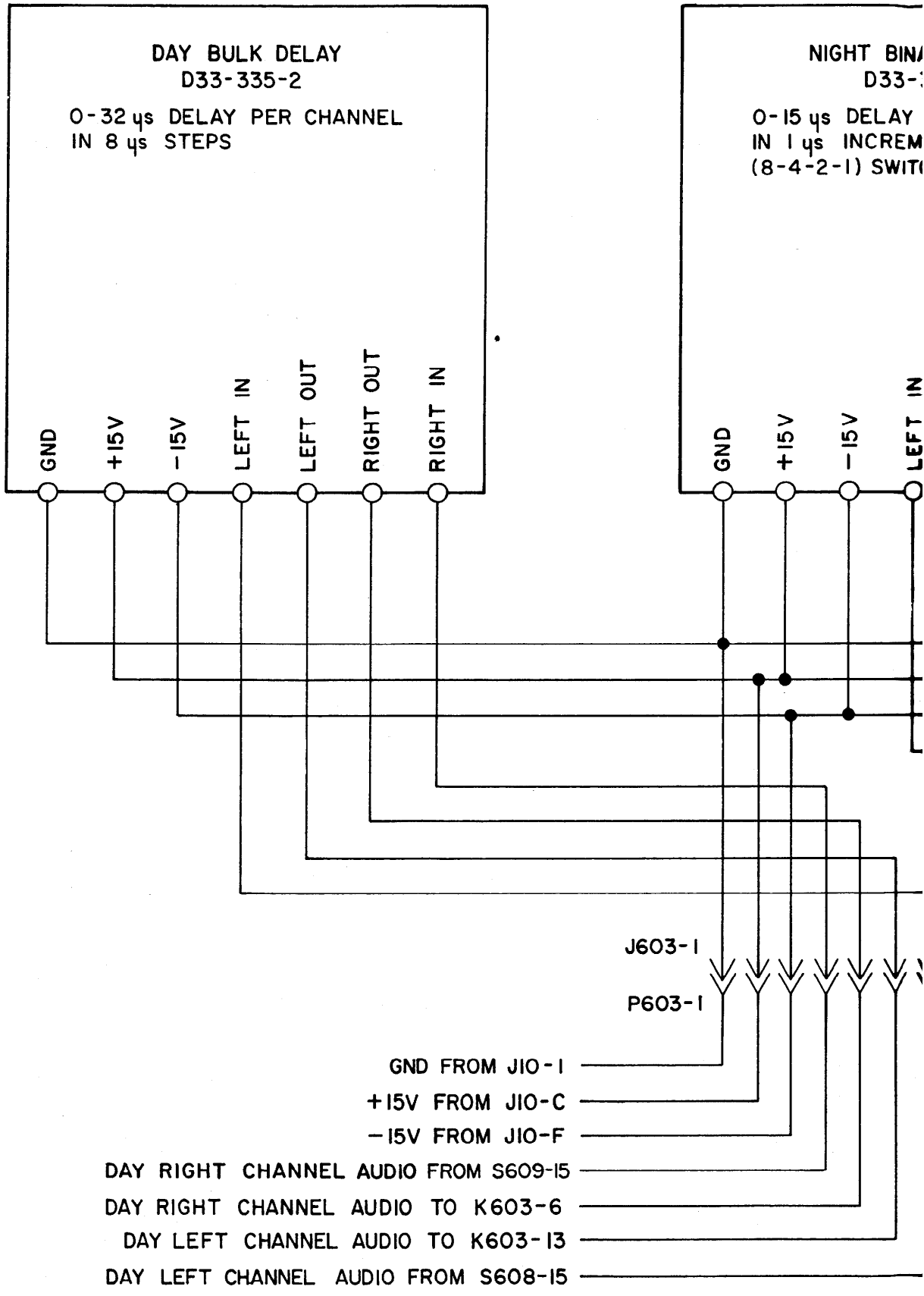

L AUDIO
NOTE 5
J602-3
J602-1
K601
R6107 100
HI FREQ. EQUALIZATION
R6102B 1K
R6102A 1K
C607 .01
C606 0.01
R603 100
C605 .01
+15V
U607A
C608 .1
CONTOUR ADJ.
R689 1K
R690 3.9K
U607B
NOTE 6
J601-9
J601-3
K602
R627 301 1%
R611 1K
S603
S604
R6103A 100K
R6103B 100K
R613 20K
C622 .33
C623 .33
LOW EQUALI
R AUDIO
NOTE 5
J602-6
J602-2
K601
J10-14, R
J10-13, P
R6108 100
R6101B 1K
R6101A 1K
C619 .01
C620 0.01
R612 100
C660 .01
U607D
C661 .1
-15V
CONTOUR ADJ.
R691 1K
R692 3.9K
U607C
J601-10
J601-4
NOTE 6
K602
R626 1K
R625 301 1%
S605
S606
R6104A 100K
R6104B 100 K
R605 20K
C609 .33
C610 .33
NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/- 5%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7D33-334.
4. SWITCHES S608 & S609 DRAWN IN "0" BINARY MODE HEXADECIMAL.
5. J602-1 THROUGH 6 ARE CONNECTED TO J301-1 THROUGH 6 ON THE AUDIO, EQUALIZATION, MATRIX ASSEMBLY.
6. J601-1 THROUGH 10 ARE CONNECTED TO J302-1 THROUGH 10 ON THE AUDIO, EQUALIZATION, MATRIX ASSEMBLY.
7. J603-1 THROUGH 12 ARE CONNECTED TO THE DELAY MOUNTING BOARD.
8. U601, U602, U603, U606, U607 ARE TL084CN.
9. U604 IS VACTEC VTL5C1.
+15V
S608
LEFT IN J601-7 NOTE 6
R665 806K 1%
R667 806K 1%
R668 806 1%
C629 6800PF
C631 .001
C630 .018
C654 .1
U602A
8 μS
R669 402 1%
S609
RIGHT IN J601-8 NOTE 6
R678 806 1%
R679 806 1%
R680 806 1%
C641 6800PF
C643 .001
C642 .018
C656 .1
U603A
R681 402 1%
(L+R) G IN
J10-15, S
(L-R) G IN
J10-16, T
R658 1K
R659 560K
R657 36K
R653 20K
R651 20K
R652 20K
R654 10K
R655 100K
R656 100K
CR602
CR609
U601C
U601D
C659 .1
CR601
C627 1
R650 820K
U601A
C658 .1
BLEND PROCESSOR CIRCUIT
OPTO-ISOLATED VARIABLE RESISTER
U604
Q601 MPS6513
J10-17, U
L IN
R664 750
R665 750
CR604
R663 3.3K
C628 1
R661 1K
R662 5K
S607
PROCESS DEFEAT
L OUT TO AUDIO J10-V, 18
R OUT TO AUDIO J10-X, 20



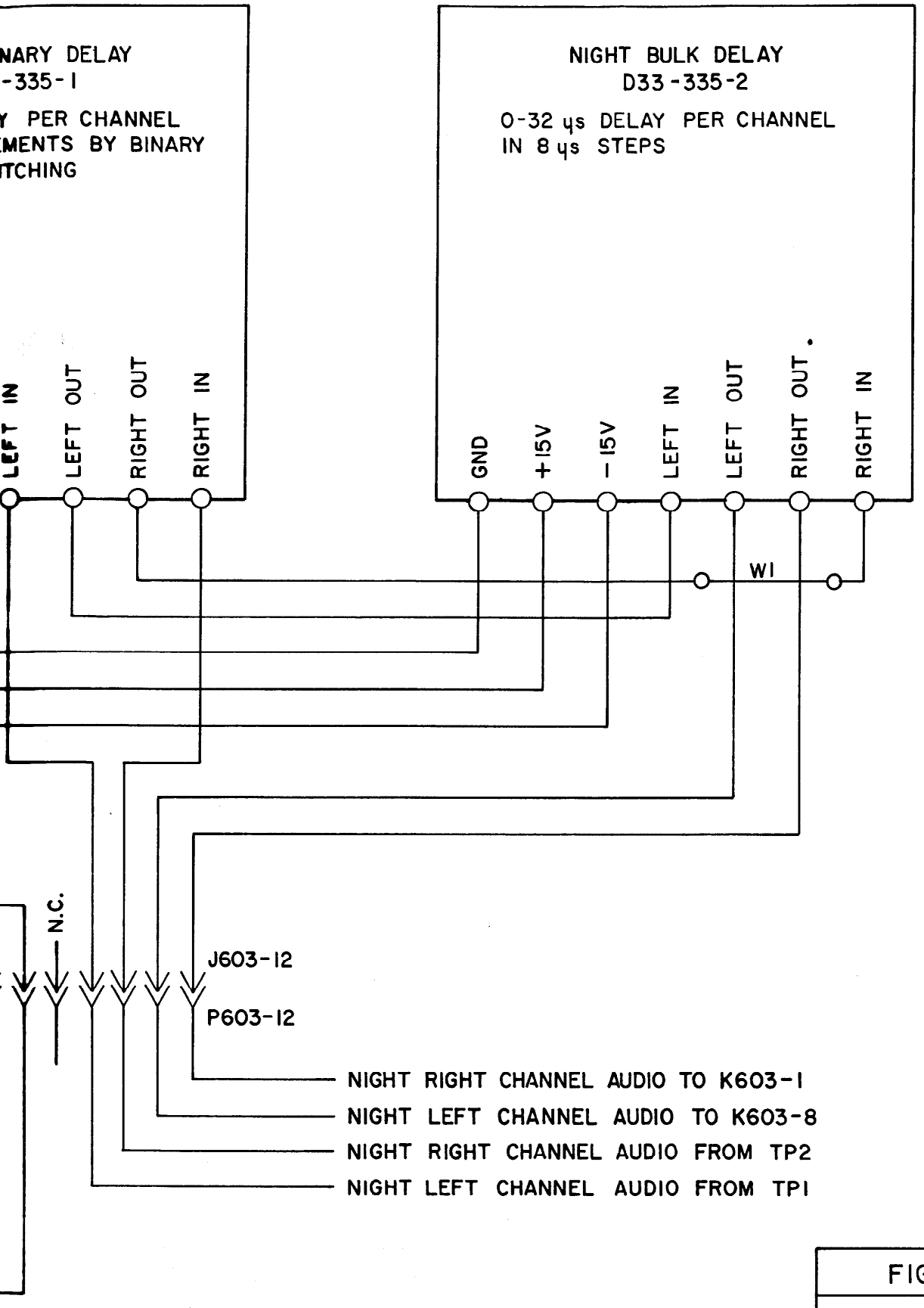
REF DES PREFIX "A600"

FIGURE 8-5

SCHEMATIC DIAGRAM
AUDIO NIGHT PROCESSOR
ASSEMBLY



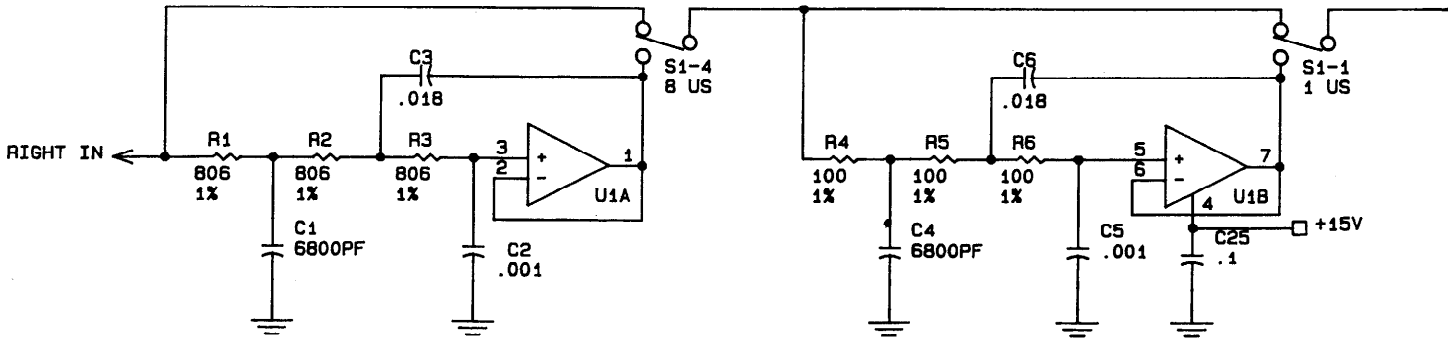
NOTE: DELAYS ARE SWITCH
WHEN SWITCH PADDL
OF ASSEMBLY.

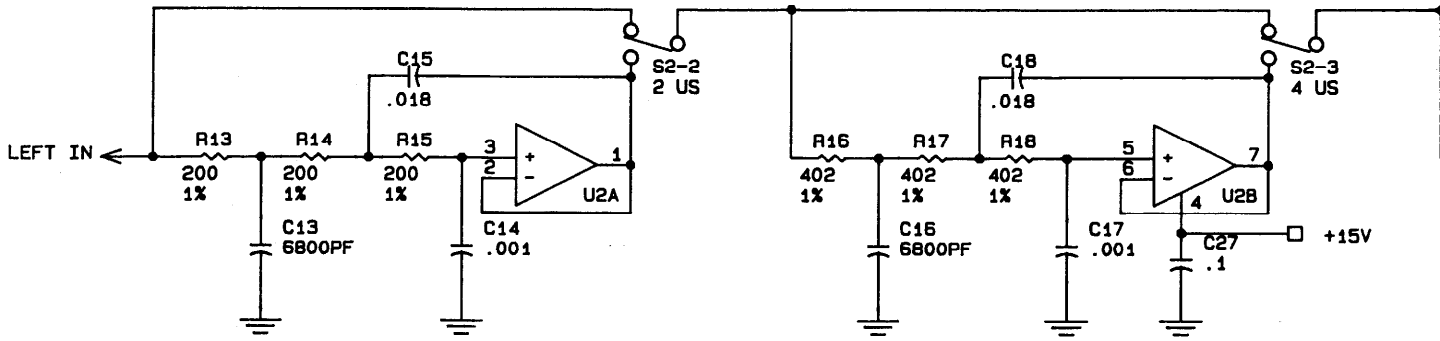


HED OUT OF THE CIRCUIT
OLES ARE TOWARD CENTER

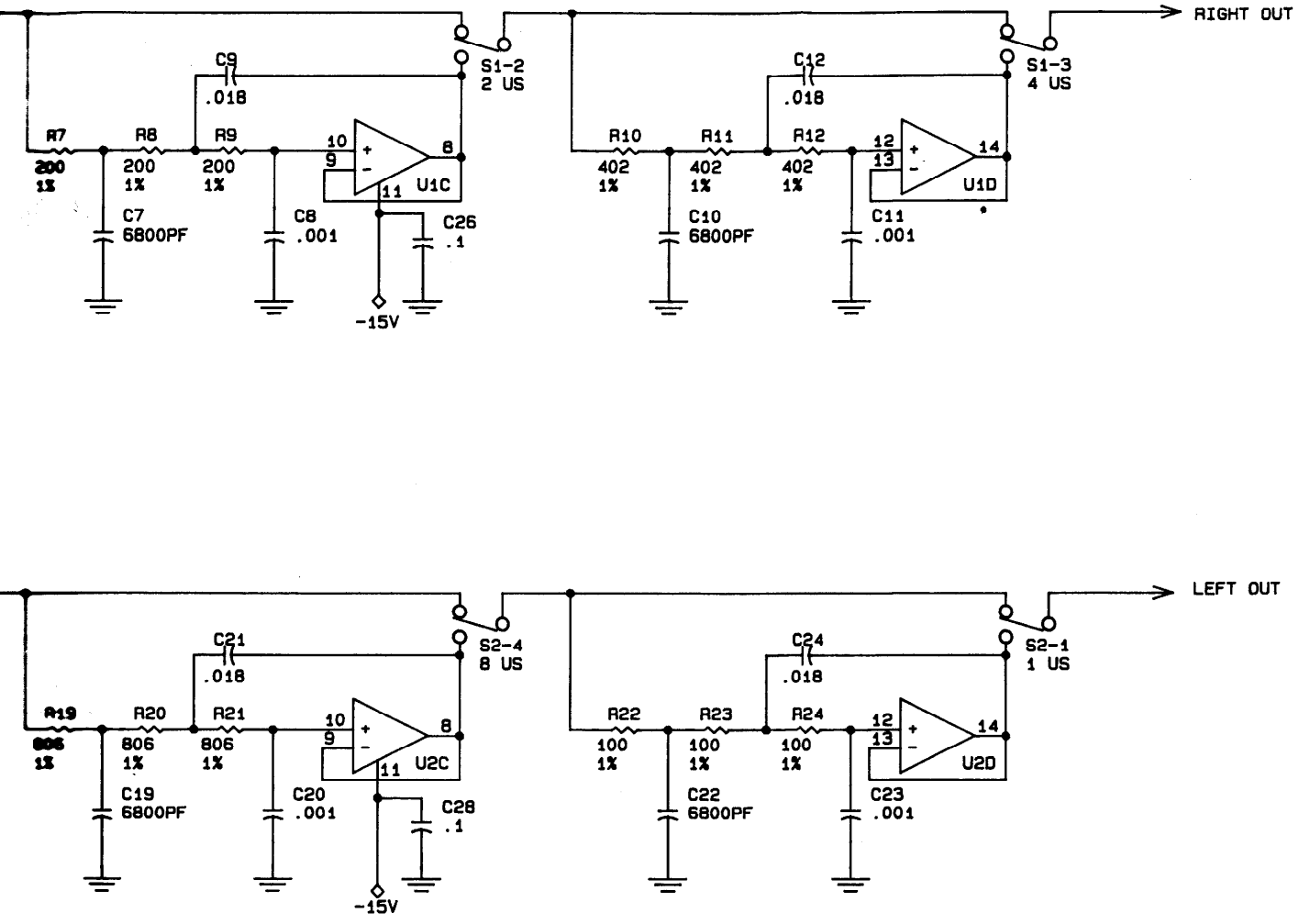
FIGURE 8-6

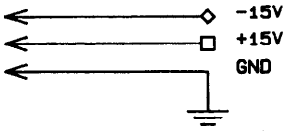
SCHEMATIC DIAGRAM
DELAY MOUNTING
ASSEMBLY





NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/- 5%.
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7D33-335.
4. U1, U2 ARE LF347BN OR TL084CN
5. D33-335-1: EACH STEP=1 MICROSECOND.
   D33-335-2: EACH STEP=8 MICROSECONDS.
6. SWITCH DELAYS AND RESISTOR VALUES SHOWN FOR -1 ASSEMBLY.
   FOR -2 ASSEMBLY R1-R24 ARE 806 OHMS.

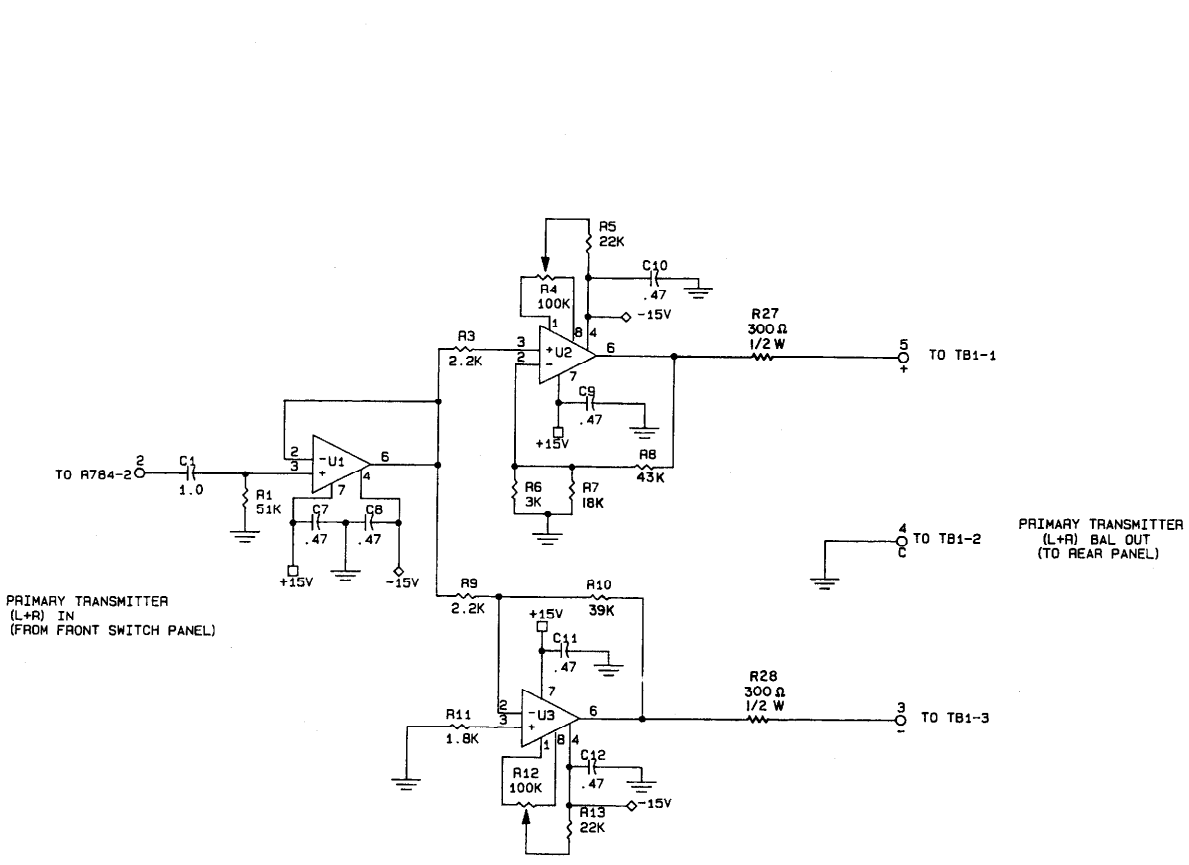


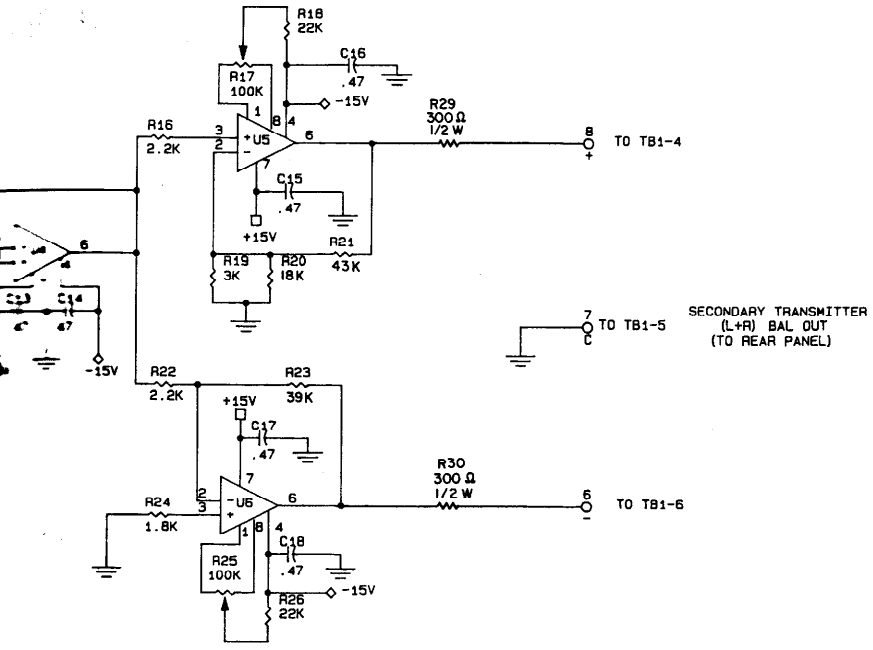


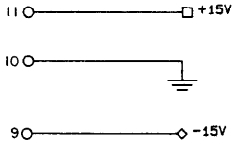
REF DES PREFIX "A1"

FIGURE 8-7

SCHEMATIC DIAGRAM
BULK DELAY TB
ASSEMBLY


SECONDARY TRANSMITTER
(L+R) IN
(FROM FRONT SWITCH PANEL)
TO R785-2
C4
1.0
R14
51K
R5
22K
C10
.47
R4
100K
-15V
R27
300Ω
1/2W
R3
2.2K
+U2
TO TB1-1
C9
.47
+15V
R8
43K
R6
3K
R7
18K
TO R784-2
C1
1.0
-U1
R1
51K
C7
.47
C8
.47
+15V
-15V
TO TB1-2
PRIMARY TRANSMITTER
(L+R) BAL OUT
(TO REAR PANEL)
PRIMARY TRANSMITTER
(L+R) IN
(FROM FRONT SWITCH PANEL)
R9
2.2K
R10
39K
+15V
C11
.47
R28
300Ω
1/2W
R11
1.8K
-U3
TO TB1-3
C12
.47
R12
100K
-15V
R13
22K



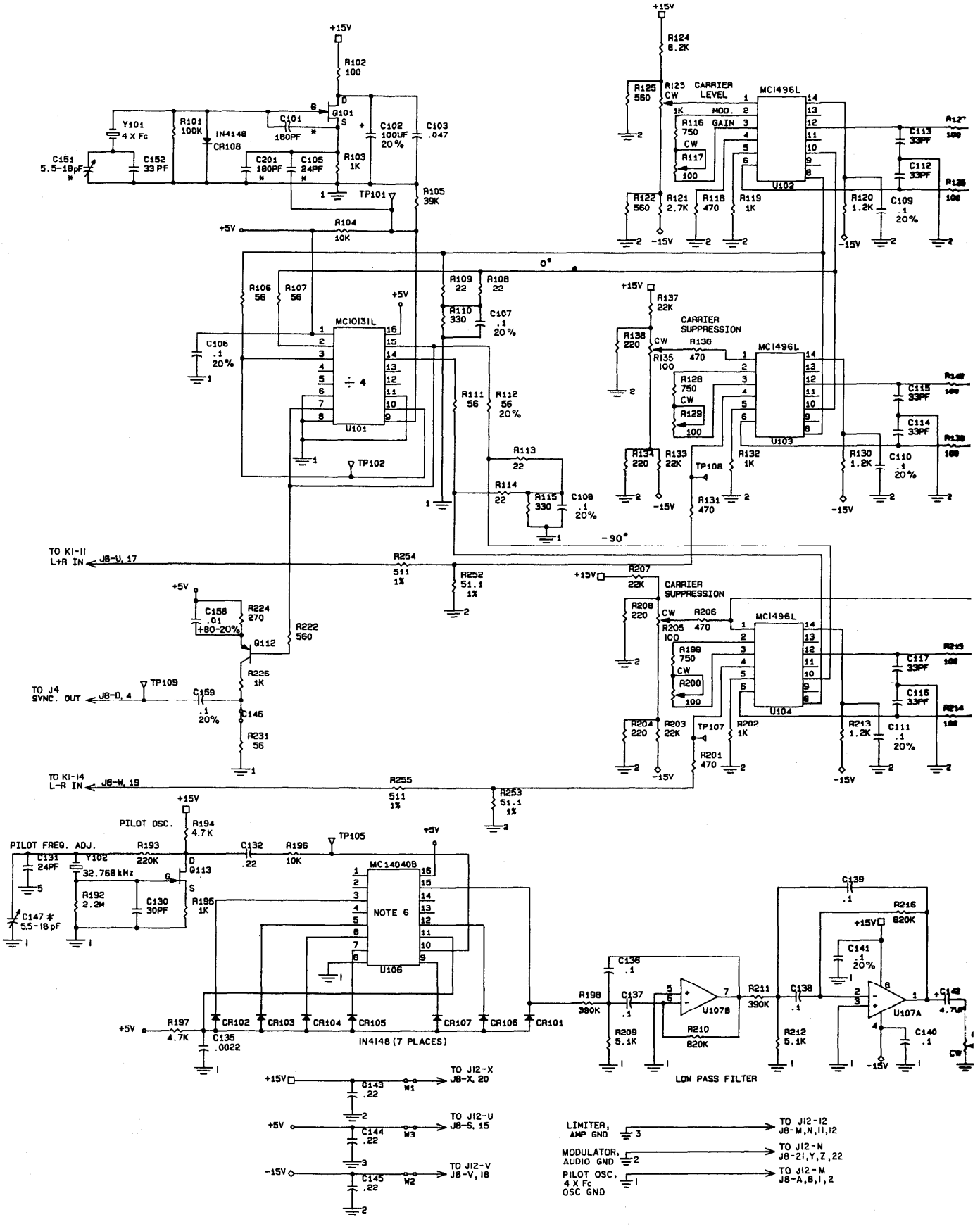


REF. DES. PREFIX "A200"

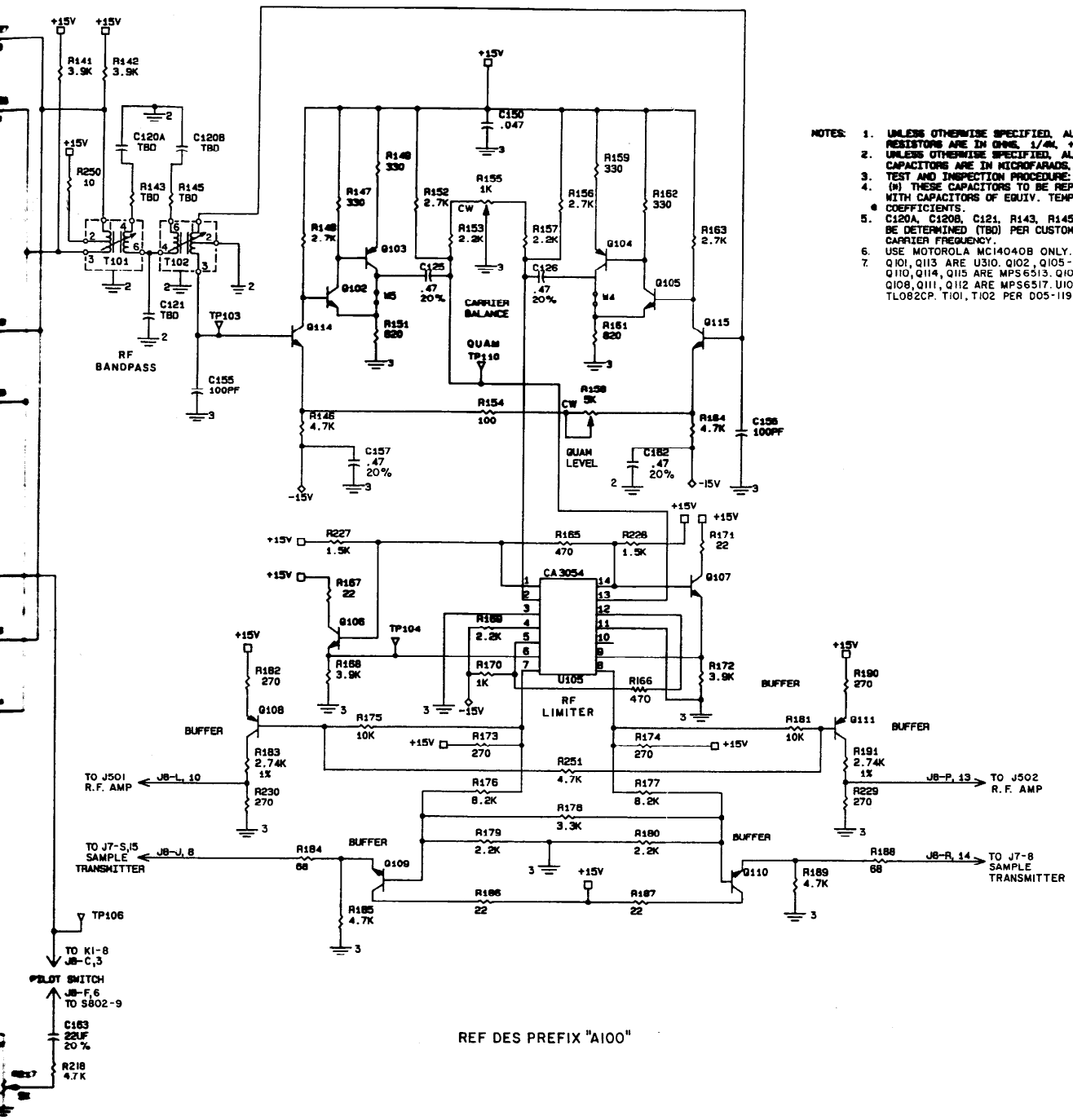
NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/-5%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7D33-357.
4. U1 AND U4 ARE TL081CP.
   U2, U3, U5, AND U6 ARE NE5534N.

FIGURE 8-8

SCHEMATIC DIAGRAM
AUDIO OUTPUT
ASSEMBLY


+15V
R102 100
G
D
Q101
S
Y101 4 X Fc
R101 100K
IN4148 CR108
C101 180PF *
C102 100UF 20%
C103 .047
C151 5.5-18pF *
C152 33 PF
C201 180PF *
C106 24PF *
R103 1K
TP101
R105 39K
+5V
R104 10K
R106 56
R107 56
MC1013IL
÷ 4
U101
TP102
C106 .1 20%
R109 22
R108 22
R110 330
C107 .1 20%
R111 56
R112 56 20%
R113 22
R114 22
R115 330
C108 .1 20%
0°
-90°
R124 8.2K
R125 560
R123 CW CARRIER LEVEL
MC1496L
U102
R116 750 MOD. GAIN
R117 100
R122 560
R121 2.7K
R118 470
R119 1K
R120 1.2K
C109 .1 20%
C113 33PF
C112 33PF
-15V
R137 22K
CARRIER SUPPRESSION
R138 220
R136 470
R135 100
R128 750
R129 100
U103
R134 220
R133 22K
TP108
R132 1K
R131 470
R130 1.2K
C110 .1 20%
C115 33PF
C114 33PF
TO KI-II L+R IN
J8-U, 17
R254 511 1%
R252 51.1 1%
R207 22K
R208 220
R206 470
R205 100
R199 750
R200 100
U104
R204 220
R203 22K
TP107
R202 1K
R201 470
R213 1.2K
C111 .1 20%
C117 33PF
C116 33PF
C158 .01 +80-20%
R224 270
R222 560
Q112
R226 1K
TO J4 SYNC. OUT
J8-D, 4
TP109
C159 .1 20%
C146
R231 56
TO KI-I4 L-R IN
J8-W, 19
R255 511 1%
R253 51.1 1%
PILOT OSC.
R194 4.7K
PILOT FREQ. ADJ.
C131 24PF
Y102 32.768 kHz
R193 220K
C132 .22
R196 10K
TP105
R192 2.2M
C130 30PF
R195 1K
C147 * 5.5-18 pF
MC140408
NOTE 6
U106
R197 4.7K
C135 .0022
CR102
CR103
CR104
CR105
CR107
CR106
CR101
IN4148 (7 PLACES)
C136 .1
R198 390K
C137 .1
R209 5.1K
U107B
R210 820K
R211 390K
C138 .1
R212 5.1K
U107A
C139 .1
R216 820K
C141 .1 20%
C140 .1
C142 4.7uF
LOW PASS FILTER
+15V
C143 .22
W1
TO J12-X
J8-X, 20
C144 .22
W3
TO J12-U
J8-S, 15
C145 .22
W2
TO J12-V
J8-V, 18
LIMITER, AMP GND
TO J12-12
J8-M,N,11,12
MODULATOR, AUDIO GND
TO J12-N
J8-21,Y,Z,22
PILOT OSC, 4 X Fc OSC GND
TO J12-M
J8-A,B,1,2

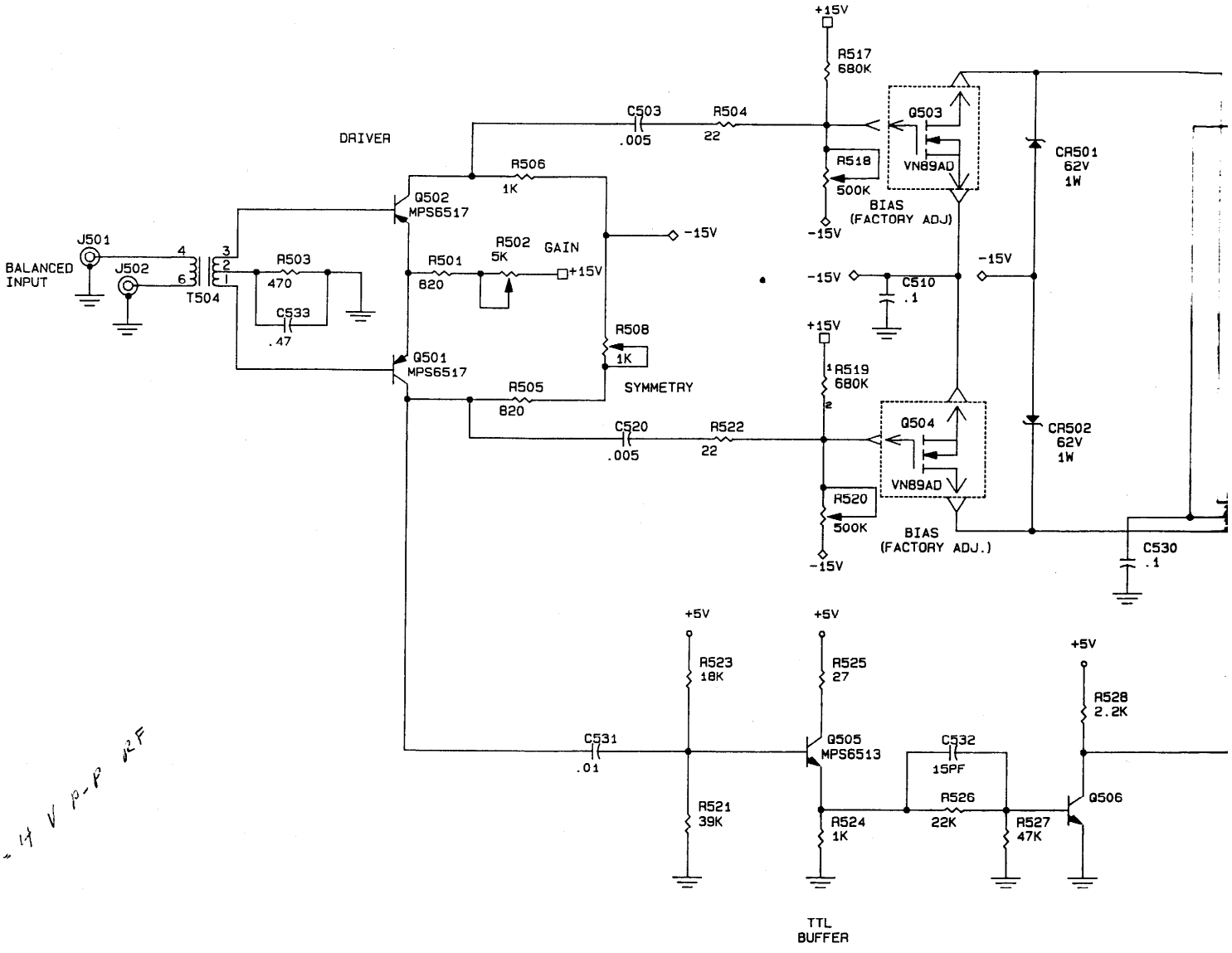
D93-346



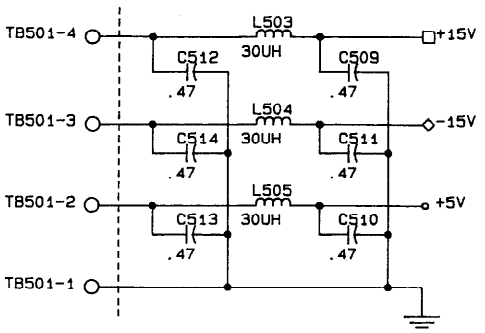
REF DES PREFIX "A100"

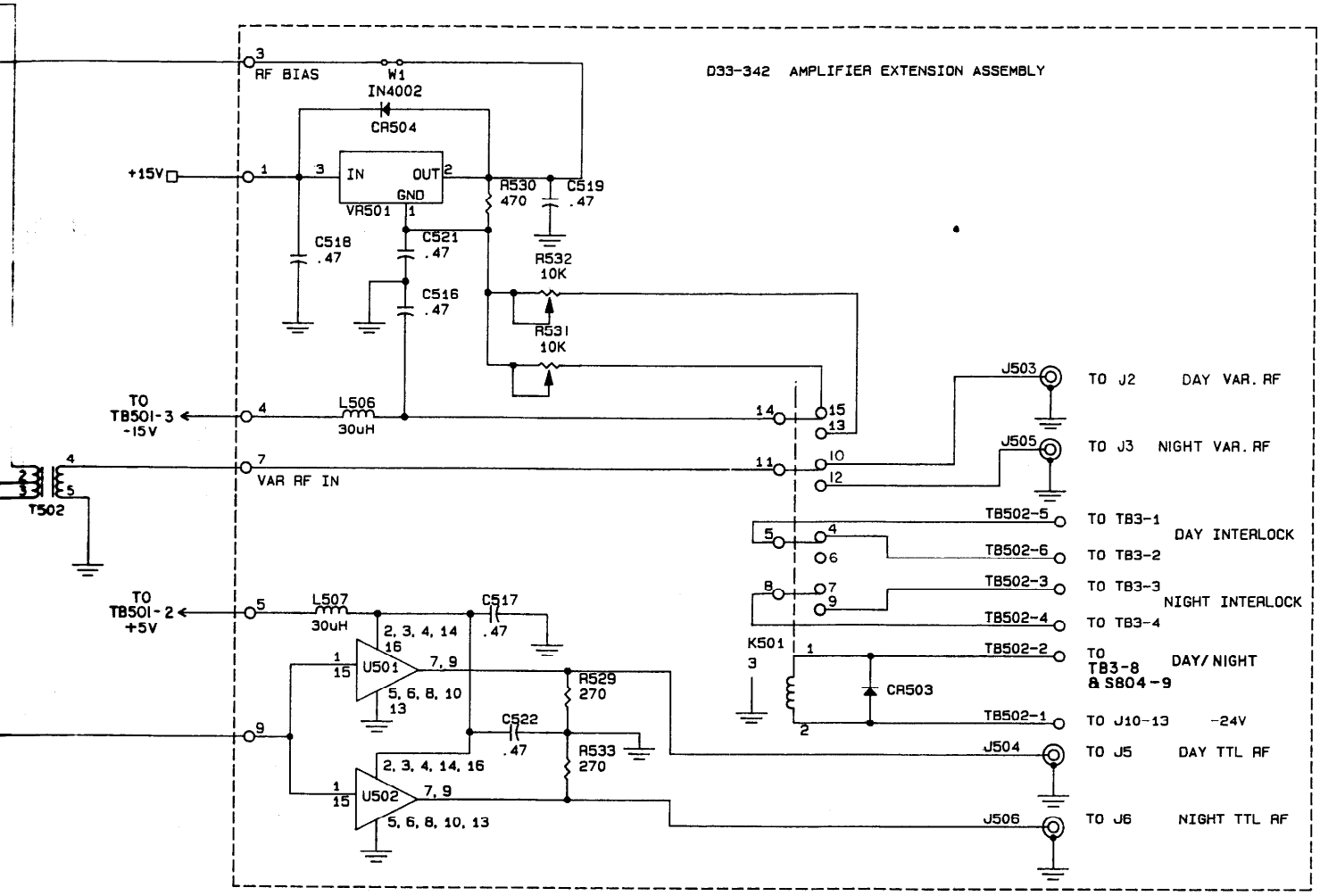
FIGURE 8-9

SCHEMATIC DIAGRAM
ENCODER ASSEMBLY


+15V
R517
680K
C503
.005
R504
22
Q503
VN89AD
R518
500K
BIAS
(FACTORY ADJ)
-15V
CR501
62V
1W
DRIVER
R506
1K
Q502
MPS6517
J501
BALANCED
INPUT
J502
T504
R503
470
C533
.47
R501
820
R502
5K
GAIN
+15V
-15V
C510
.1
R508
1K
SYMMETRY
Q501
MPS6517
R505
820
R519
680K
C520
.005
R522
22
Q504
VN89AD
R520
500K
BIAS
(FACTORY ADJ.)
CR502
62V
1W
C530
.1
+5V
R523
18K
R525
27
R528
2.2K
C531
.01
Q505
MPS6513
C532
15PF
R521
39K
R524
1K
R526
22K
R527
47K
Q506
TTL
BUFFER

3/16F = 4 V P-P @ F


TB501-4
TB501-3
TB501-2
TB501-1
L503
30UH
L504
30UH
L505
30UH
C512
.47
C509
.47
C514
.47
C511
.47
C513
.47
C510
.47
+15V
-15V
+5V

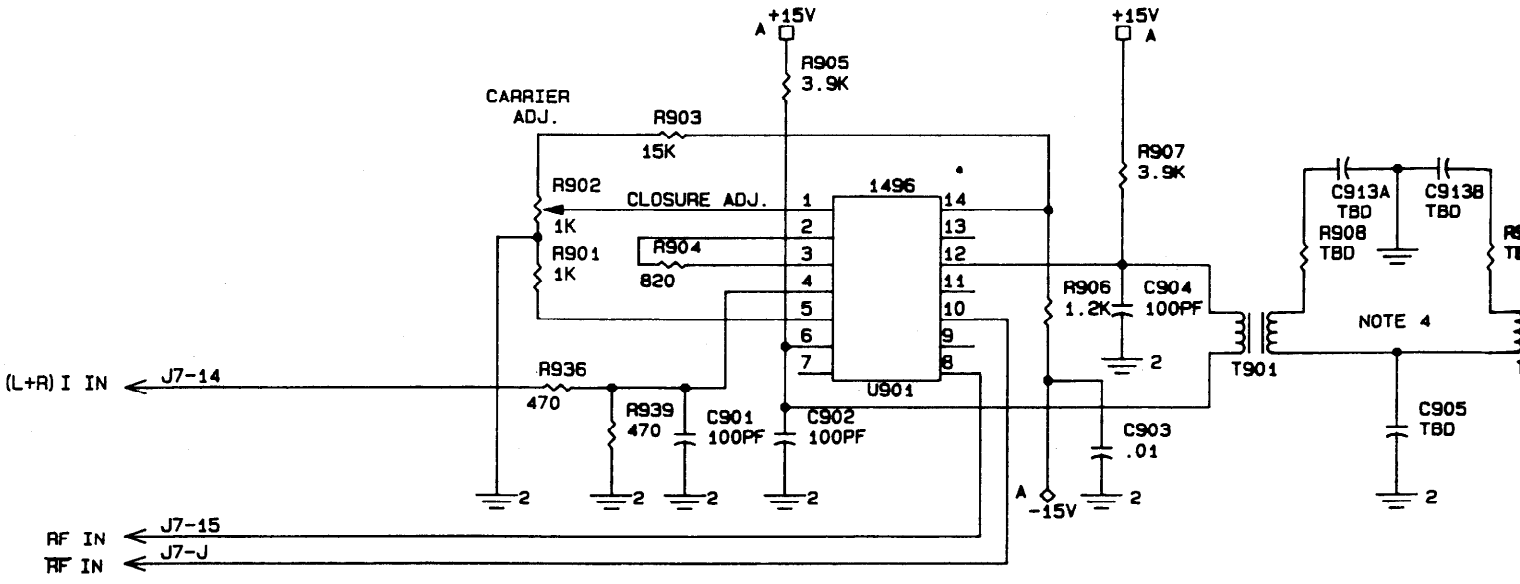


NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/- 5%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURES: 7D33-322
   7D33-342
4. Q503 AND Q504 ARE MOUNTED ON LEFT SIDE PANEL.
5. D33-342 IS A SUB-ASSEMBLY OF D33-322 AND HAS NO REF. DES. PREFIX.
6. U501 AND U502 ARE SN75123N.
   VR501 IS LM317T.
   K501 IS R40-EI-X4-V800.

REF. DES. PREFIX "A500"

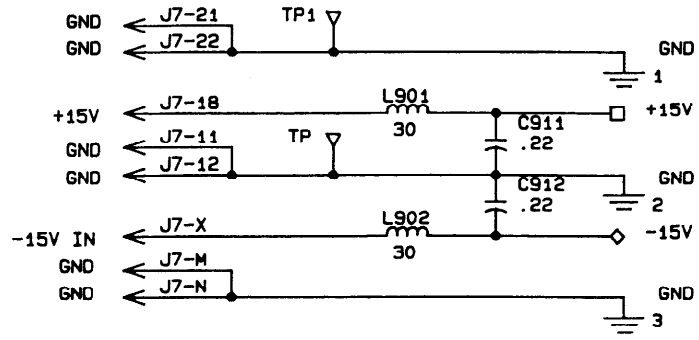
FIGURE 8-10

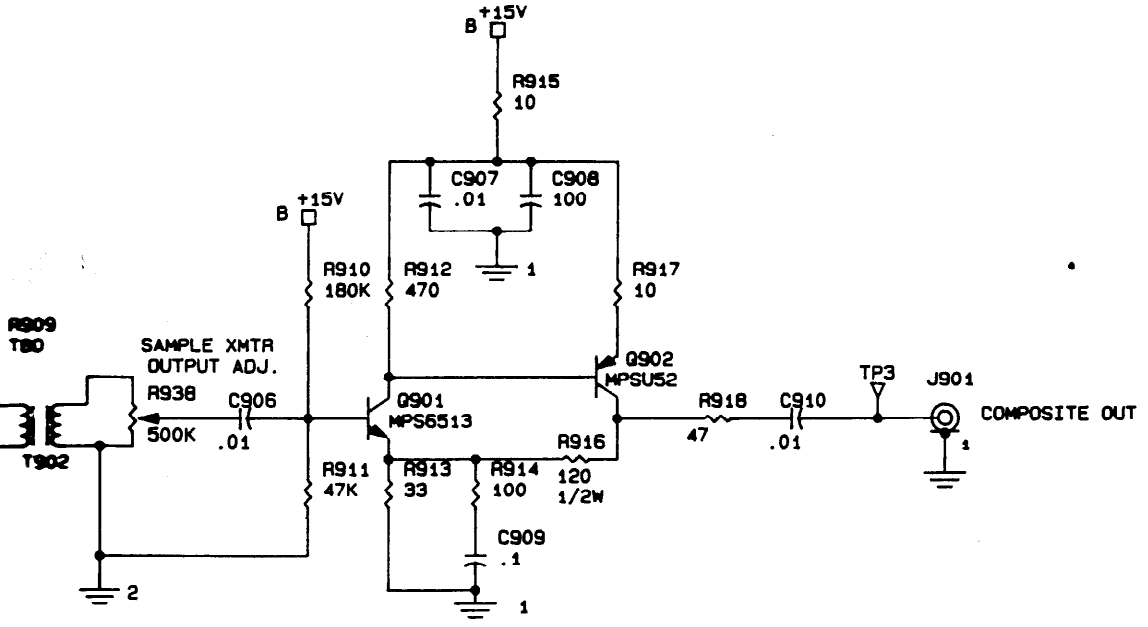
SCHEMATIC DIAGRAM
RF AMPLIFIER
ASSEMBLY



MODULATOR

BANDPASS



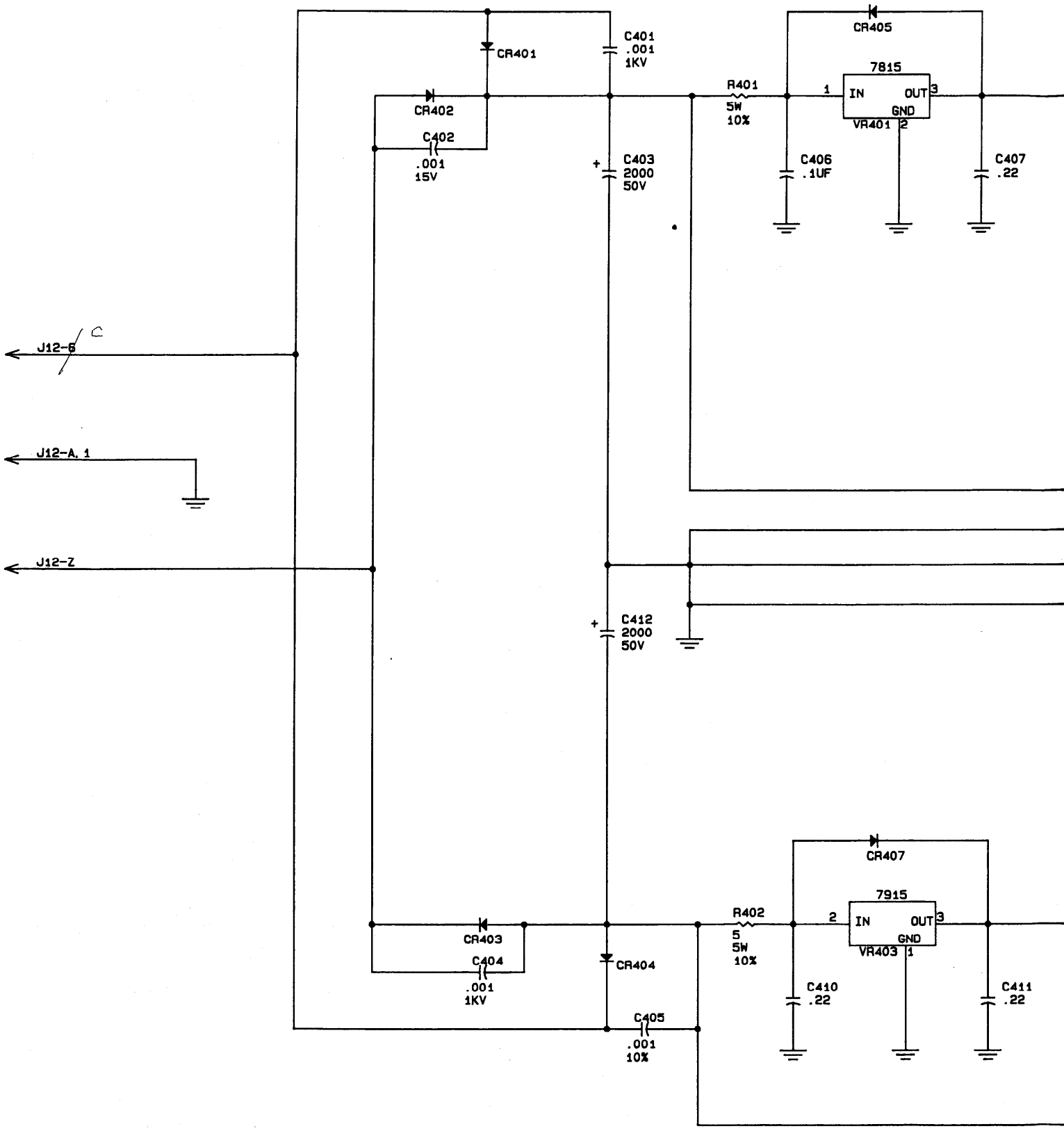


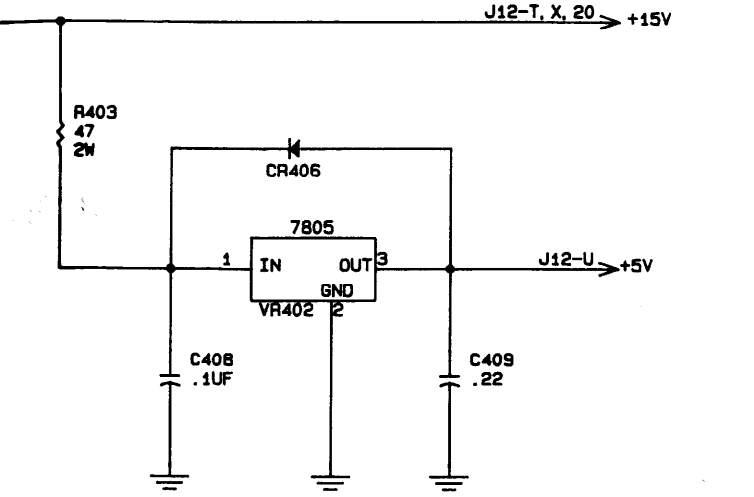
NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/- 5%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7033-321.
4. C905, C913A, C913B, R908, R909: VALUES TO BE DETERMINED (TBD) PER CUSTOMER'S CARRIER FREQ.
5. U901 IS MC1495
6. T901 AND T902 ARE 82-0498.

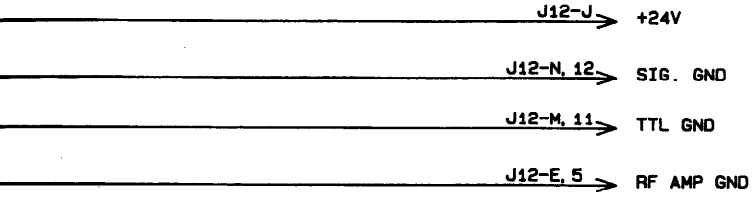
REF DES PREFIX "A900"

FIGURE 8-11

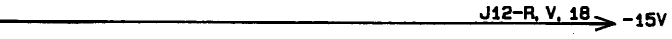
SCHEMATIC DIAGRAM
SAMPLE TRANSMITTER


CR401
C401
.001
1KV
CR405
7815
R401
5W
10%
1
IN
OUT
3
GND
VR401
2
CR402
C402
.001
15V
C403
2000
50V
C406
.1UF
C407
.22
J12-B
J12-A. 1
J12-Z
C412
2000
50V
CR407
7915
R402
5
5W
10%
2
IN
OUT
3
GND
VR403
1
CR403
C404
.001
1KV
CR404
C405
.001
10%
C410
.22
C411
.22





NOTES:
1. UNLESS OTHERWISE SPECIFEID ALL RESISTORS ARE IN OHMS, 1/4W, +/- 5%.
2. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7D33-323.
4. CR401, CR402, CR403, CR404 ARE 1N4720. CR405, CR406, CR407 ARE 1N4002.
5. VOLTAGE REGULATORS ARE MOUNTED ON RIGHT SIDE PANEL HEATSINK.



REF DES PREFIX "A400"

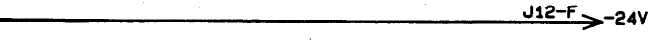
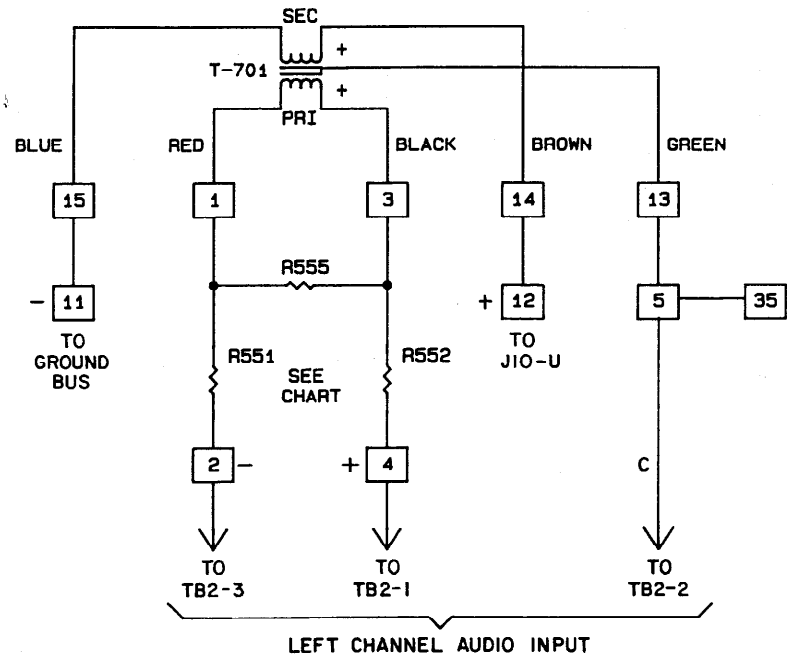
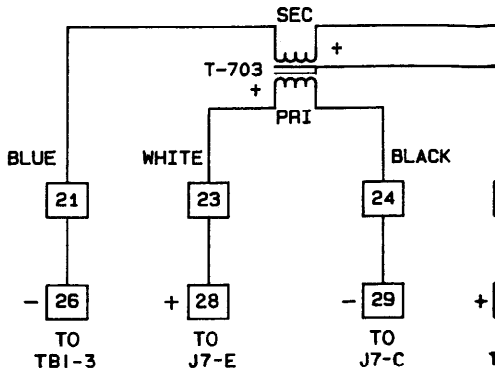


FIGURE 8-12

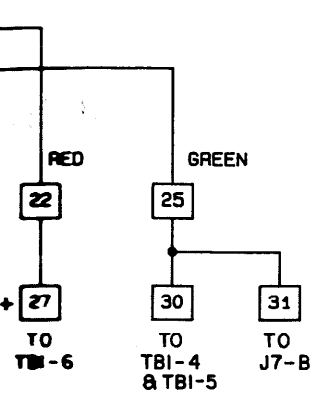
SCHEMATIC DIAGRAM
POWER SUPPLY
ASSEMBLY

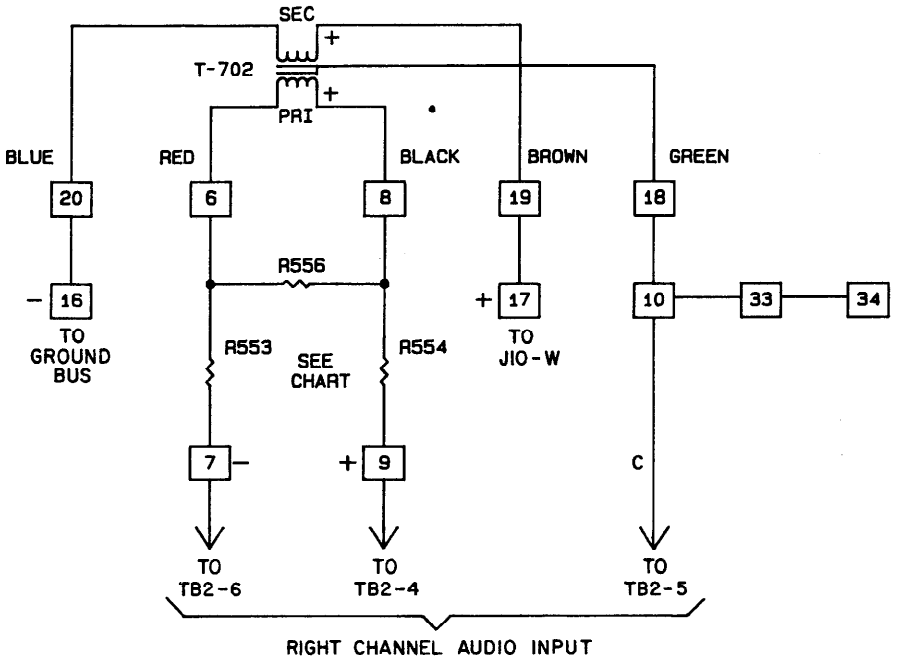




NOTES: 1. MODULATION CHART INDICATES RESISTORS AS REQUIRED PER CUSTOMER SPECIFICATION.

100% MODULATION		
STATION LEFT & RIGHT AUDIO INPUT INTO 600 OHMS DBM	R555 & R556 1% OHMS	R551- 1 OH
+10	113	24
+8	147	24
+6	205	22
+4	280	20
+2	402	18
0	604	15
-2	1020	11
-4	2260	61
-6	INF.	0





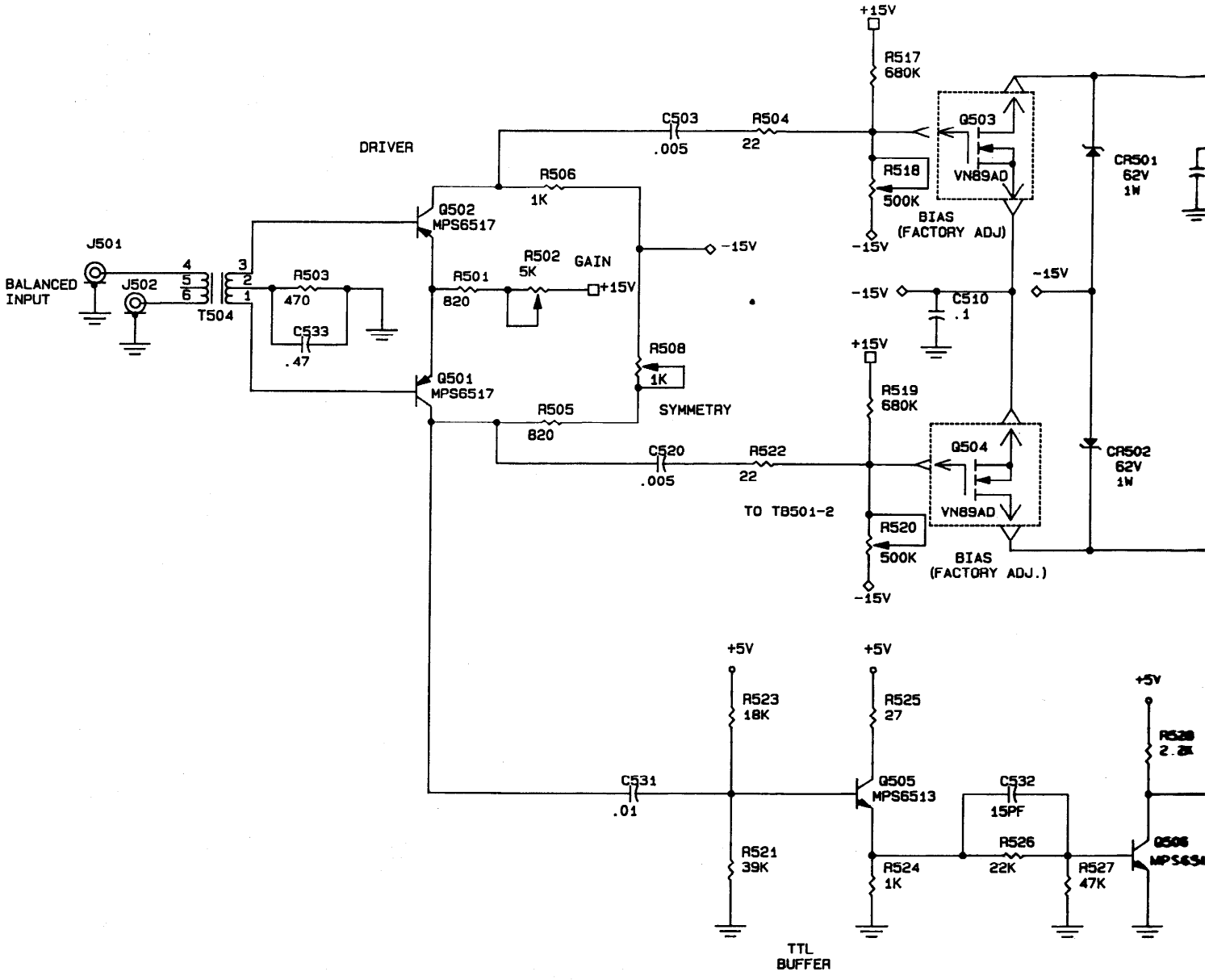
1-R554 1% 0MS
48
43
28
85
82
30
10
1.9
0

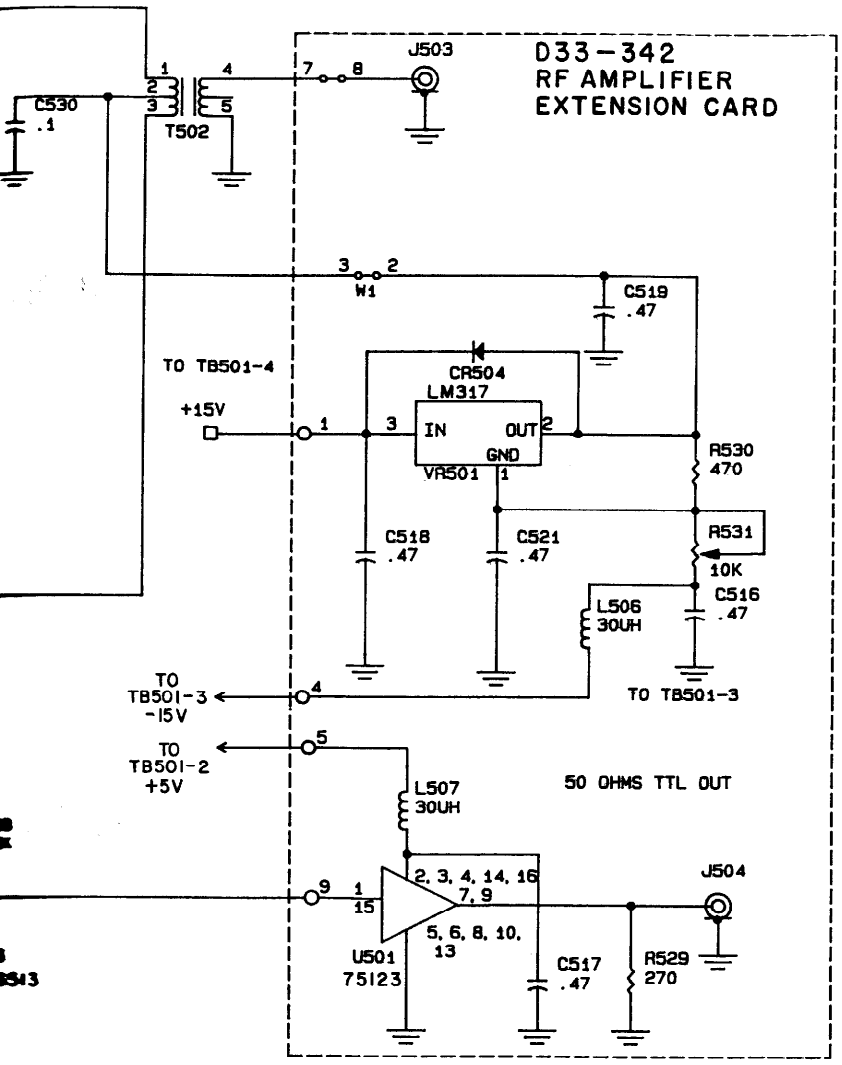
REF DES PREFIX "A700"

SCHEMATIC DIAGRAM APPLICABLE TO ASE-1 UNITS WITH SERIAL NUMBERS 070 AND LOWER.

FIGURE 8-13

SCHEMATIC DIAGRAM
AUDIO INTERFACE
ASSEMBLY


+15V
R517
680K
C503
.005
R504
22
Q503
VN89AD
R518
500K
BIAS
(FACTORY ADJ)
CR501
62V
1W
DRIVER
R506
1K
Q502
MPS6517
J501
BALANCED
INPUT
J502
T504
R503
470
C533
.47
R501
820
R502
5K
GAIN
+15V
-15V
R508
1K
SYMMETRY
Q501
MPS6517
R505
820
C510
.1
R519
680K
C520
.005
R522
22
Q504
VN89AD
R520
500K
BIAS
(FACTORY ADJ.)
CR502
62V
1W
TO TB501-2
+5V
R523
18K
R525
27
C531
.01
Q505
MPS6513
C532
15PF
R526
22K
R527
47K
R524
1K
R521
39K
TTL
BUFFER
TB501-4
TB501-3
TB501-2
TB501-1
L503
30UH
L504
30UH
L505
30UH
C512
C509
C514
C511
C513
C510
.47



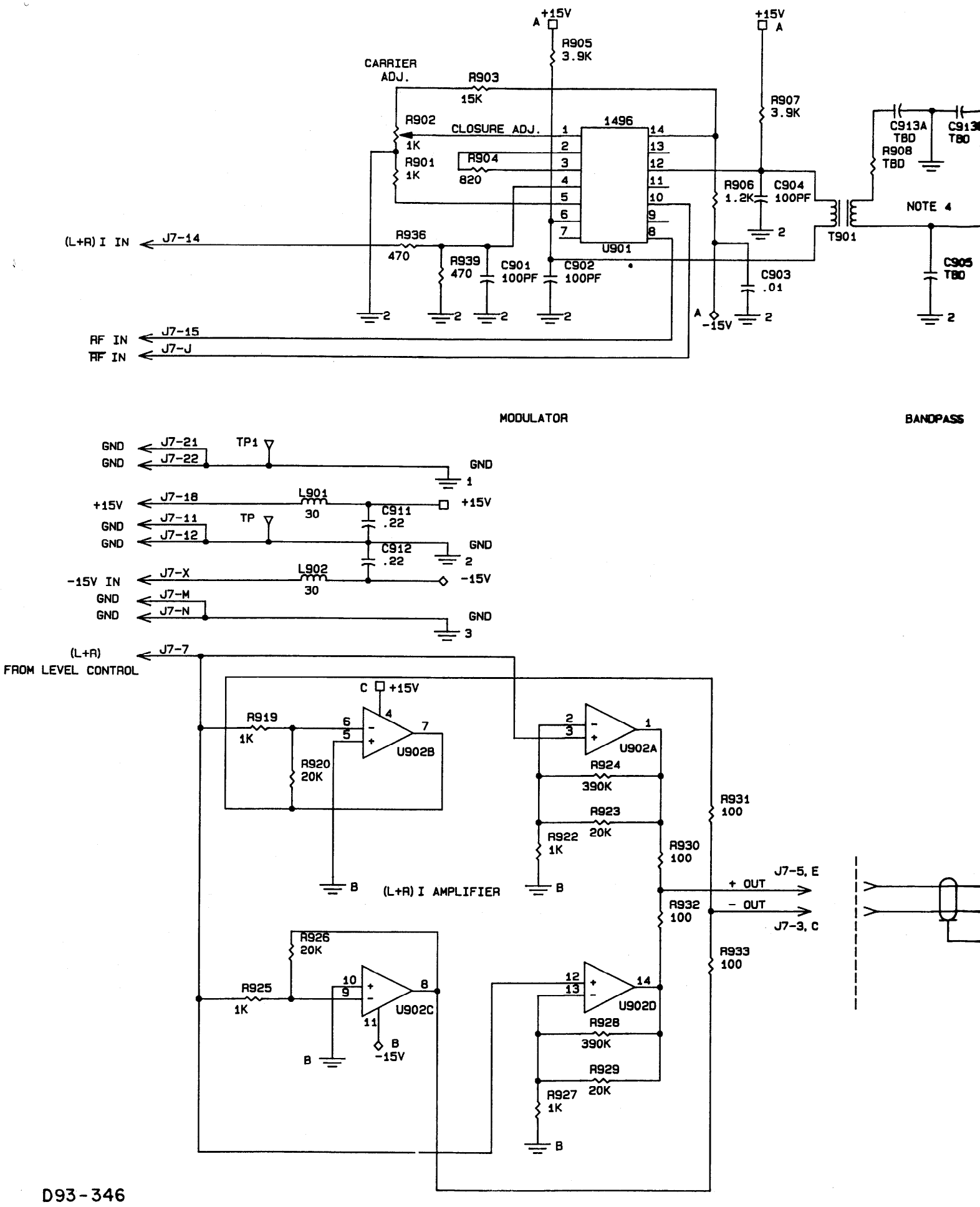
NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/- 5%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7D33-322.
4. ALL INDUCTORS IN MICROHENRYS UNLESS OTHERWISE INDICATED.
5. Q503 NAD Q504 ARE MOUNTED ON LEFT SIDE PANEL.
6. SUB-ASSEMBLY D33-342, SHOWN ENCLOSED IN LARGE DASHED LINE, IS MOUNTED ON D33-322.

REF DES PREFIX "A500"

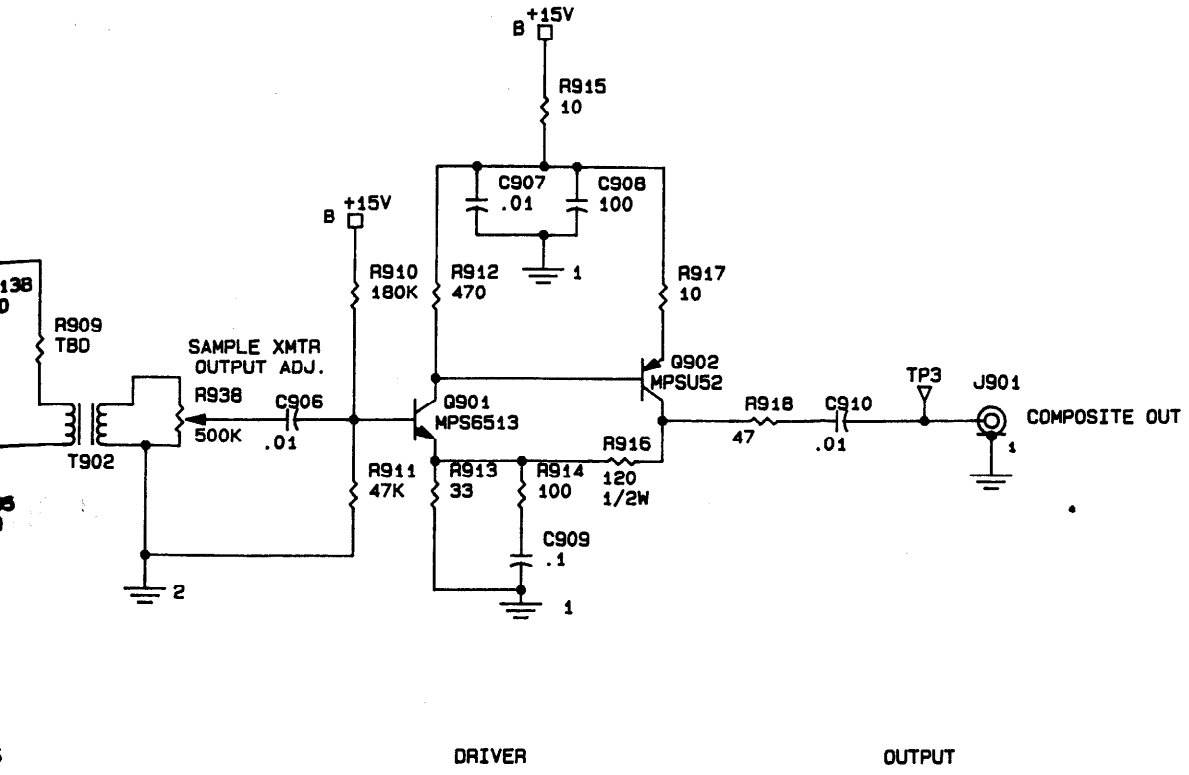
SCHEMATIC DIAGRAM APPLICABLE TO ASE-1 UNITS WITH SERIAL NUMBERS 070 AND LOWER.

FIGURE 8-14

SCHEMATIC DIAGRAM
RF AMPLIFIER
ASSEMBLY


+15V
A
R905
3.9K
CARRIER
ADJ.
R903
15K
R902
1K
CLOSURE ADJ.
R901
1K
R904
820
1496
U901
R907
3.9K
R906
1.2K
C904
100PF
C913A
TBD
C913
TBD
R908
TBD
NOTE 4
T901
C905
TBD
(L+R) I IN
J7-14
R936
470
R939
470
C901
100PF
C902
100PF
C903
.01
-15V
RF IN
J7-15
RF IN
J7-J
MODULATOR
BANDPASS
GND
J7-21
J7-22
TP1
GND
1
+15V
J7-18
L901
30
C911
.22
+15V
GND
J7-11
J7-12
TP
C912
.22
GND
2
-15V IN
J7-X
L902
30
-15V
GND
J7-M
GND
J7-N
GND
3
(L+R)
FROM LEVEL CONTROL
J7-7
C
+15V
R919
1K
R920
20K
U902B
B
(L+R) I AMPLIFIER
U902A
R924
390K
R923
20K
R922
1K
R931
100
R930
100
R932
100
R933
100
J7-5, E
+ OUT
- OUT
J7-3, C
R926
20K
R925
1K
U902C
-15V
U902D
R928
390K
R929
20K
R927
1K

D93-346



NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/- 5%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7033-321.
4. C905, C913A, C913B, R908, R909: VALUES TO BE DETERMINED (TBD) PER CUSTOMER'S CARRIER FREQ.
5. U901 IS MC1495
   U902 IS TL084CN
6. T901 AND T902 ARE 82-0498.

REF DES PREFIX "A900"

SCHEMATIC DIAGRAM APPLICABLE TO ASE-1 UNITS WITH SERIAL NUMBERS 070 AND LOWER.

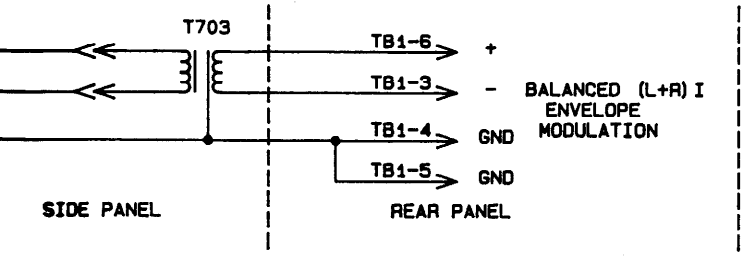


FIGURE 8-15

SCHEMATIC DIAGRAM
L & R AMPLIFIER / SAMPLE
TRANSMITTER ASSEMBLY

APPENDIX A

A VECTOR APPROACH TO C-QUAM

A VECTOR APPROACH TO C-QUAM®

Introduction:

In order for C-QUAM (compatible quadrature amplitude modulation) to be successful, members of the broadcast community need a clear, intuitive understanding of C-QUAM fundamentals. To this end, a graphical approach to C-QUAM is presented in this article with the hope of clearing up any uncertainty, confusion or mystery about C-QUAM. Additionally, this approach is useful in understanding some of the factors that limit C-QUAM stereo performance in the real world and the steps necessary to reduce these limiting factors.

A Vector Model of Modulation:

The following is a brief description of the vector model of modulation for readers who are unfamiliar with the concept.

It can be shown mathematically that an RF carrier may be plotted on the complex plane as a vector rotating counter-clockwise at the carrier frequency, W_c radians per second, as shown in Figure 1. The magnitude of the carrier has been normallized. That is, the magnitude of all vectors discussed in the remainder of this article are divided by the magnitude of the carrier vector. The angle that the vector makes with the real axis, P, is W_{ct} radians assuming that the carrier vector passed the real axis at t=0.

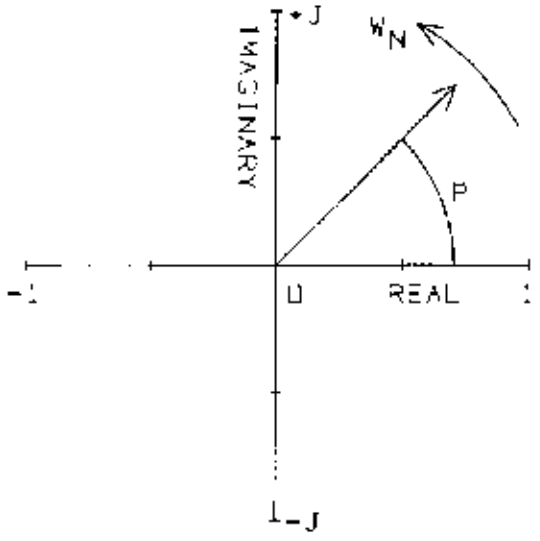


Figure 1

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Now we rotate the complex plane counter-clockwise about the origin (0) so that the real axis is vertical. As the vector rotates and aligns with the real axis, we lock onto the vector by rotating the complex plane counter-clockwise at the carrier rate. Thus, if we climb aboard the complex plane, we will see the carrier vector stationary and aligned with the real axis as shown in Figure 2.

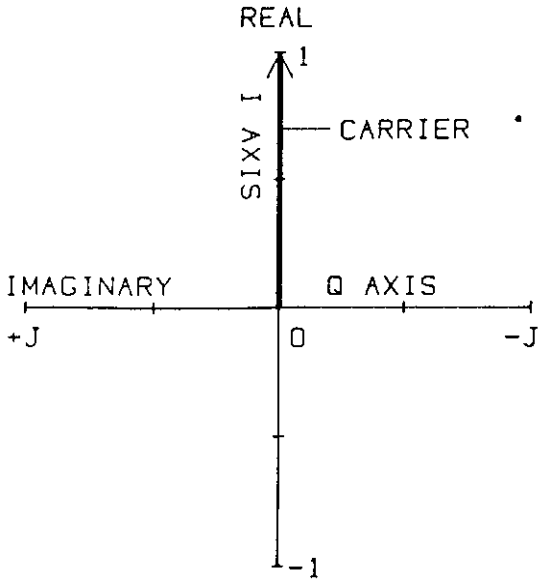
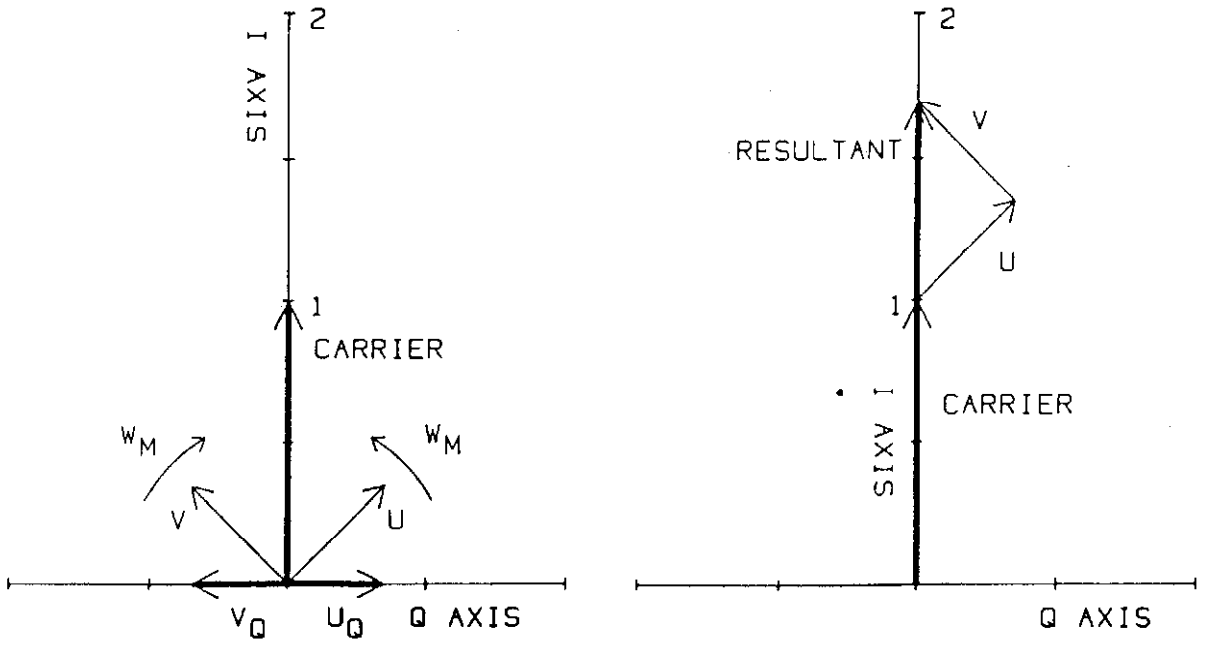


Figure 2

The carrier vector now has an angle of zero degrees with the real axis establishing a phase reference. Vectors that lie along the real axis are in-phase with the carrier and are sometimes called I vectors. The real axis may therefore be re-labelled the I axis as shown in Figure 2. A vector pointing to the right along the imaginary axis (not shown) would lag behind the carrier vector by ninety degrees while a vector pointing to the left along the imaginary axis would lead the carrier by ninety degrees. Vectors along this axis are said to be "in quadrature" with the carrier and are sometimes called Q vectors. The imaginary axis is re-labelled the Q axis as shown in Figure 2.

Now add two vectors U and V of equal magnitude at frequencies $W_c + W_m$ and $W_c - W_m$ respectively as shown in Figure 3a. Since our reference axis is already rotating at W_c, the U vector will rotate counter-clockwise at a frequency $W_c + W_m - W_c = W_m$. Similarly, vector V will rotate at a frequency of $W_c - W_m - W_c = -W_m$ or clockwise at W_m. Notice that vector U and V are arranged so that as they rotate, the angle of U to the reference is equal and opposite to the angle of V. The quadrature components of vectors U and V, U_Q and V_Q respectively in Figure 3a, are equal in magnitude and in opposite directions. If we add vectors U and V to the carrier vector as shown in Figure 3b, U_Q will always cancel V_Q and the resultant will be a stretched or compressed version of the carrier vector. This is called amplitude modulation (AM) and U and V are called the upper and lower sidebands respectively.



Figures 3A and 3B

When broadcasting stereo source material in monophonic AM, the left and right audio channels are summed (L+R) and fed to the transmitter modulator so that the resultant vector of Figure 3b has a magnitude equal to 1+L+R. Figure 3b shows the ideal case for single tone amplitude modulation. If, however, U_Q does not exactly cancel V_Q, the resulatant vector of Figure 3b will be slightly tilted away from the in-phase axis. This effect is called incidental phase modulation (IPM).

Now re-orient the U and V vectors so that they maintain equal and opposite angles with the quadrature axis as shown in Figure 4. For clarity the carrier vector has been omitted. The components of U and V along the in-phase axis, labelled U_I and V_I, are equal in magnitude and in opposite direction. If vectors U and V are added, U_I will exactly cancel V_I so that the magnitude of the carrier vector (not shown) is unaffected. The resultant of U and V extends only along the quadrature axis always maintaining a plus or minus ninety degree phase angle with the carrier vector.

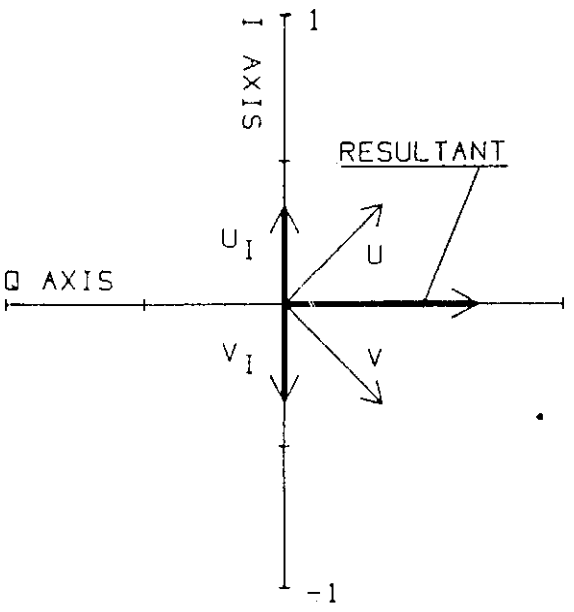


Figure 4

This vector can be generated by a balanced modulator driven by a carrier frequency signal at minus ninety degrees phase angle to the carrier signal and by an audio signal at frequency W_m. The modulator output is a double sideband suppressed carrier signal where U is the upper sideband and V is the lower sideband. In generating C-QUAM, the audio signal to the balanced modulator is left channel minus right channel audio (L-R). During monophonic modulation L-R=0 and the resultant vector of Figure 4 disappears.

For the remainder of this article the contra-rotating vectors U and V will not be shown. Instead, only the resultant vectors of Figure 3b and Figure 4 along the in-phase and quadrature axes will be shown.

Quadrature Amplitude Modulation:

If the resultant vectors of Figure 3b and Figure 4 are combined as shown in Figure 5, the in-phase vector which is 1+L+R long adds with the quadrature vector which is L-R long to form quadrature amplitude modulation or QUAM. This is stereo modulation since it contains both L+R and L-R information.

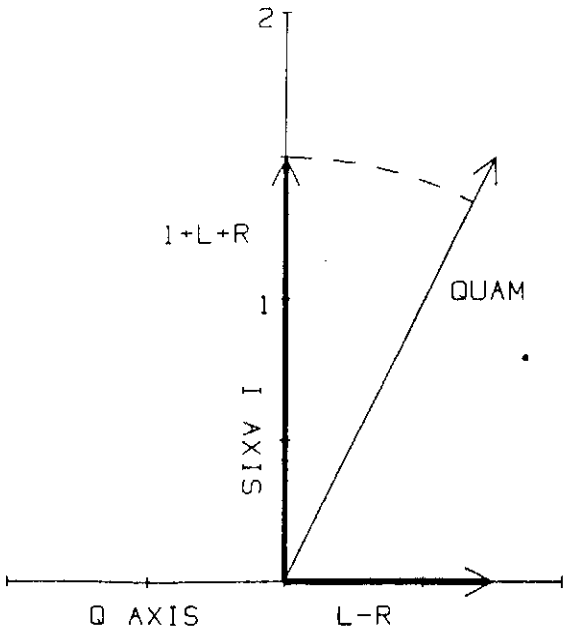


Figure 5

Compatible Quadrature Amplitude Modulation:

Unfortunately, QUAM has one drawback for stereo transmission; it is not compatible with the envelope detectors in existing monophonic receivers. The QUAM vector is longer than the I vector (1+L+R) so an envelope detector will have too large an output. The solution to the compatibility problem is fairly obvious - shorten the QUAM vector until it is the same length as the I vector as shown in Figure 6. This shorter vector is called compatible quadrature amplitude modulation or C-QUAM.

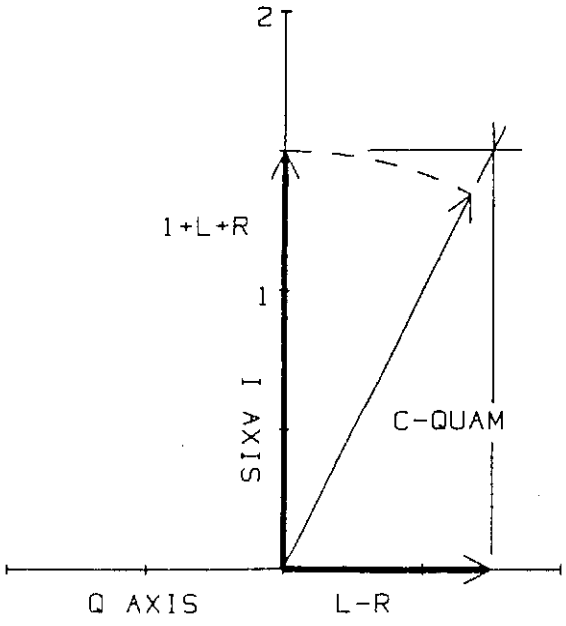


Figure 6

Inspection of Figure 6, reveals that the C-QUAM vector is just a phase modulated I vector. C-QUAM is generated by feeding a QUAM signal to an RF limiter to produce a phase modulated carrier. This carrier replaces the crystal oscillator in the broadcast transmitter. An L+R audio signal is fed (input) to the transmitter modulator exactly as in monophonic transmission. The transmitter output is C-QUAM.

Clearly, however, the transmitter output may not be perfect C-QUAM since the C-QUAM vector's direction may be shifted from its ideal phase angle by IPM and its length may be affected by the transmitter's audio response, hum, noise, distortion and incidental AM. The total transmission system response to these errors must be evaluated at the output of the stereo decoder, a modulation monitor or radio receiver.

In the decoding process, the C-QUAM signal is stretched back to a QUAM signal and 1+L+R and L-R audio signals are recovered using synchronous detectors. A block diagram of this decoding scheme is shown in Figure 7. The C-QUAM vector is stretched by a variable gain RF amplifier in a feedback loop. The C-QUAM signal is envelope detected to produce a reference signal for comparison to the I synchronous detector output. The envelope detector output is proportional to the length of the C-QUAM vector and the I synchronous detector output is proportional to the I component of the amplifier output. The amplifier gain is adjusted by the feedback loop so that the I synchronous detector output equals the C-QUAM envelope detector output. This can only occur when the amplifier output is the desired QUAM signal.

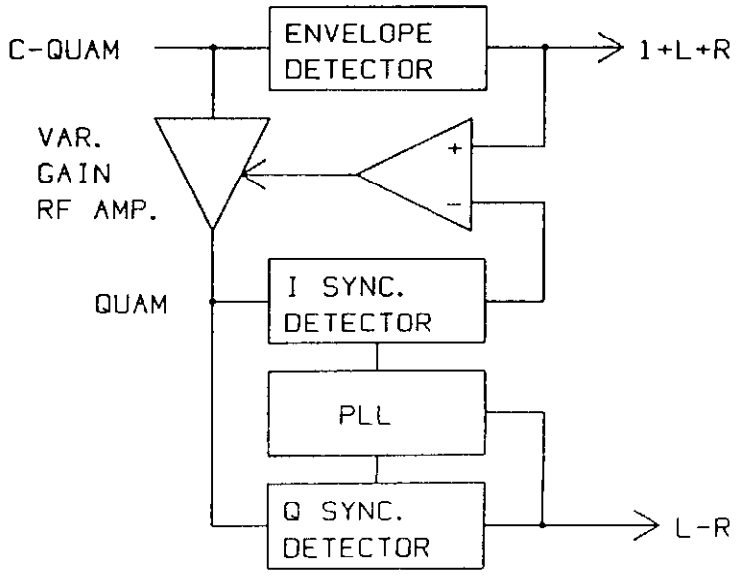


Figure 7

The effects of the above mentioned transmission errors can now be examined in light of the decoding model.

Effects of IPM:

Experience has shown that the greatest limiting factor to the channel separation performance of C-QUAM is incidental phase modulation in the transmitter. This causes the C-QUAM vector to tilt from its proper phase angle as shown in Figure 8. The recovered 1+L+R (monophonic) audio is still correct since the length of the C-QUAM vector is unaffected by IPM. However, the IPM has caused decoding of quadrature vector Q' instead of the correct length vector, Q. The resulting error in the recovered L-R audio degrades stereo channel separation.

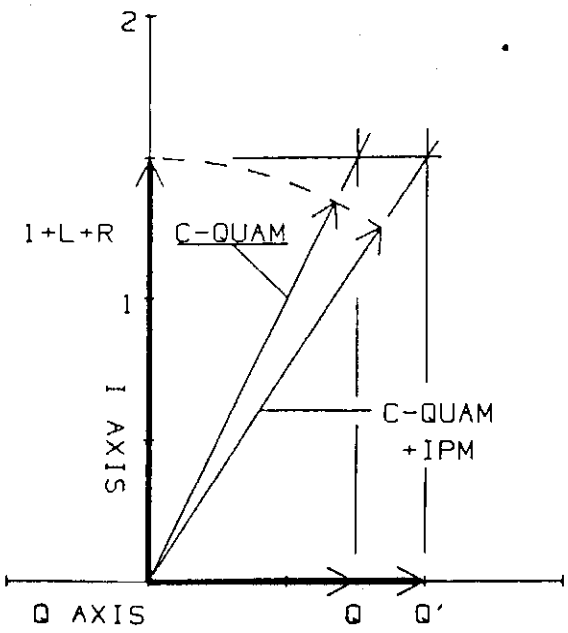


Figure 8

As a rule of thumb, the maximum channel separation is equal to the main channel (L+R) to subchannel (L-R) crosstalk. That is, if the transmitter is modulated at 50% 1 KHz AM (L=R=0.25) and the recovered L-R audio is X dB below the level of the recovered L+R audio, the best channel separation attainable is X dB at 1 KHz L or R=0.5.

Main channel to subchannel crosstalk is a convenient method of evaluating transmitter performance since the L-R reading of the modulation monitor is an indication of the level of IPM. Typical subchannel readings for broadcast transmitters in monophonic service are from 15 to 25 dB below the main channel. To improve separation, the transmitter IPM must be reduced to a tolerable level. The L-R readings can usually be improved to less than -30 dB and sometimes less than -40 dB by neutralization, and additional power supply filtering.

Amplitude Error:

The next most important factor in separation performance is the accuracy of the length of the C-QUAM vector. The major factor effecting this length is the frequency response of the transmitter modulator. Figure 9 shows a shortened C-QUAM vector which would typically occur as a result of high frequency roll off in the transmitter modulator. The decoders synchronous

detectors see the I' and Q' vectors instead of the I and Q vectors. The I' and Q' vectors are proportionally shortened versions of the I and Q vectors so that the decoded 1+L+R and L-R audio signals are also proportionally reduced. However, when the 1 is subtracted from the shortened 1+L+R signal, the remaining L+R audio is reduced by more than the proportion that the L-R audio is reduced. Thus separation is degraded.

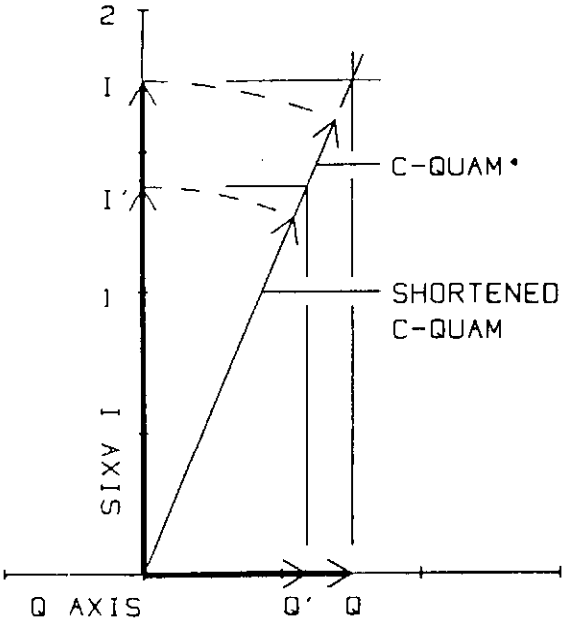


Figure 9

Figure 10 illustrates a method for correcting separation loss due to transmitter audio response roll-off. The line at 45 degrees to the in-phase axis is the path traced by the tip of the QUAM vector for left channel only modulation (R=0). Thus for perfect separation under left only conditions, any C-QUAM vector must be stretched to this line by the variable gain amplifier in the decoding circuit. Figure 10 shows the desired C-QUAM vector and its shortened version reduced by 6 dB. Without changing phase angle, this vector would be stretched to point X well off the line. If, however, the phase angle is reduced as shown so that Q' is further reduced to Q*, perfect separation is restored.

The reduction in phase modulation is accomplished by equalizing filters ahead of the phase determining circuits in the exciter. To the extent that these equalizing filters can track the transmitter audio response roll-off, high separation is maintained.

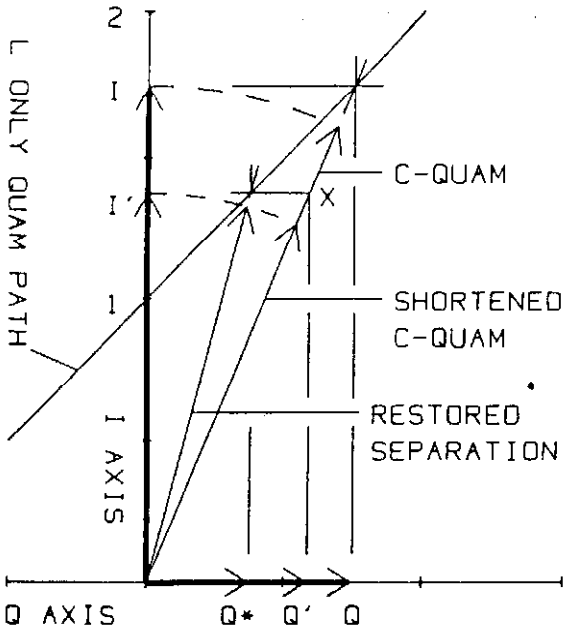


Figure 10

Incidental amplitude modulation (IAM) is another source of error in the length of the C-QUAM vector. The degree of IAM is checked by modulating at L=-R=0.5 (100% L-R). The transmitter output should be pure phase modulation with no amplitude variation. Any recovered L+R signal is due to IAM. If the level of IAM is not well below the level of IPM, a mis-tuned high Q circuit in a low level RF stage is the likely source of the IAM.

Distortion, hum and noise place a limit on the system separation performance. If the transmitter meets the FCC hum and noise rules, distortion will be the predominant limiting factor unless it is exceptionally low. The distortion products of the transmitter modulator appear added to or subtracted from the C-QUAM vector. The distortion component in the decoded L+R signal is different than the distortion component decoded in the L-R signal for reasons given above. Therefore, the distortion components will not cancel in the de-matrixing to left and right audio and distortion products will appear in both channels.

When making single channel separation measurements, distortion products will appear in the decoded output of the undriven channel. Since neither the stereo modulation monitor nor conventional test equipment use frequency selective detectors to measure separation, these distortion products will appear as an equivalent separation loss.

Conclusion:

Use of the vector modulation model leads to understanding of C-QUAM stereo encoding and decoding, the factors that affect stereo system performance, and the steps necessary to control these factors. With proper installation by experienced personnel, these factors are well controlled yielding excellent stereo performance.

APPENDIX B

ASE-1/ASM-1 EQUIPMENT

PERFORMANCE MEASUREMENT

SAMPLE FORMS

FINAL CLOSED LOOP DATA

STATION CALL _____

FREQ. _____

DATE _____

ENGINEER/TECHNICIAN _____

SYSTEM SERIAL NUMBER _____

DELAYS INSTALLED _____

_____

_____

REMARKS _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

DATE SHIPPED _____

FINAL CHECK _____

APPROVED _____

DAY MODE

AM STEREO CLOSED LOOP DATA

DIST/SEP	50 Hz	100 Hz	400 Hz	1 KHz	5 KHz	7.5 KHz	10 KHz	12.5 KHz	15 KHz
L+R 95%									
L-R 95%									
L 75%									
R 75%									
L+R 50%									
L 50%									
R 50%									
L+R 25%									
L 25%									
R 25%									

RESPONSE	50 Hz	100 Hz	400 Hz	REF.	5 KHz	7.5 KHz	10 KHz	12.5 KHz	15 KHz
L+R 95%									
L-R 95%									
L 75%									
R 75%									
L+R 50%									
L 50%									
R 50%									
L+R 25%									
L 25%									
R 25%									

IPM L+R, 50%, 1 KHz

Carrier only: Residual L+R= Meter=

NIGHT MODE

AM STEREO CLOSED LOOP DATA

DIST/SEP	50 Hz	100 Hz	400 Hz	1 KHz	5 KHz	7.5 KHz	10 KHz	12.5 KHz	15 KHz
L+R 95%									
L-R 95%									
L 75%									
R 75%									
L+R 50%									
L 50%									
R 50%									
L+R 25%									
L 25%									
R 25%									

RESPONSE	50 Hz	100 Hz	400 Hz	REF.	5 KHz	7.5 KHz	10 KHz	12.5 KHz	15 KHz
L+R 95%									
L-R 95%									
L 75%									
R 75%									
L+R 50%									
L 50%									
R 50%									
L+R 25%									
L 25%									
R 25%									

IPM L+R, 50%, 1 KHz

Carrier only: Residual L+R= Meter=

L-R= Meter=

STATION CALL _____

FREQUENCY _____

DATE _____

WRITER _____

LOAD: DUMMY _____ ANT _____

TRANSMITTER MAKE & MODEL _____

_____

REMARKS _____

_____

_____

_____

_____

_____

INSTALLATION PROOFS

DISTORTION / SEPARATION		AUDIO FREQUENCY 50	100	200	400	1K	2K	3K	5K	7.5K	10K	12.5K	15K
L+R (MONO)	95%												
L–R (STEREO)	95%												
L+R	75%												
L	75%	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸
R	75%	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸
L+R	50%												
L	50%	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸
R	50%	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸
L+R	25%												
L	25%	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸
R	25%	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸	⧸
RESPONSE													
L+R	95%					0							
L–R	95%					0							
L+R	75%					0							
L	75%					0							
R	75%					0							
L+R	50%					0							
L	50%					0							
R	50%					0							
L+R	25%					0							
L	25%					0							
R	25%					0							
CROSSTALK L+R→L–R													
CROSSTALK L–R→L+R													
IPM													
CARRIER SHIFT													
PILOT FREQ., INS.													
OPERATING FREQUENCY													

☐ OPTIONAL DIST. DIST. / SEP.