TECHNICAL MANUAL

FOR

MODEL ASM-1

C-QUAM® AM STEREO

MODULATION MONITOR

DELTA ELECTRONICS

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

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ADDENDUM I

TO

TECHNICAL MANUAL

FOR

MODEL ASM-1 C-QUAM®

AM STEREO MODULATION MONITOR

AI.1 SCOPE

This addendum corrects the ASM-1 technical manual issued 24 February 1986 to accurately reflect the equipment configuration. Any manuals issued after 24 October 1986 will have the corrected pages already inserted into the manual text. For retrofitting of previous manuals, the corrected pages will be provided with this addendum to be inserted by the customer into the manual. Corrected pages are identified by an (AI) to the right of the document number in the lower left hand corner of the page.

AI.2 CORRECTIONS

The technical manual has been corrected as summarized below:

Section 3 - Paragraphs 3.2.9 through 3.2.9.4: Revised electrical characteristics specifications.

Section 6 - Paragraph 6.4: Revised reference oscillator adjustment procedures.

Section 7 - Section 7.1: Replaced Section 7.7 with Sections 7.7.1 and 7.7.2 on the list.

Section 7.3: Added F1 for 240 VAC operation and changed existing F1 to Slo-Blo with note for 120 VAC operation.

Revised Section 7.4 "List of Material, AVC Assembly, Reference Designation A100, D33-328, Rev. G" to "List of Material, AVC Assembly, Reference Designation A100, D33-328, Rev. J".

Replaced Section 7.7 "List of Material, Frequency Converter Assembly, Reference Designation A700, D33-324, Rev. M" with Sections 7.7.1, "List of Material, Frequency Converter Assembly, Synthesized, Reference Designation A700, D33-324-1 and D33-324-2, Rev. N" and 7.7.2, "List of Material, Frequency Converter Assembly, Non-Synthesized, Reference Designation A700, D33-324-3 and D33-324-4, Rev. N".

Section 7.10: Changed heading from "Rev. F" to "Rev. G".

Section 7.11: Changed heading from "Rev. E" to "Rev. F".

Section 8 - Added list of schematic diagrams.

Deleted Monitor Block Diagram and added Model ASM-1 C-QUAM AM Stereo Monitor Functional Block Diagram.

Revised AVC Assembly Schematic Diagram.

Revised Schematic Diagram, Pushbutton Switch Assembly, Left.

Revised Schematic Diagram, Pushbutton Switch Assembly, Right.

Revised Schematic Diagram, Frequency Converter Assembly (Sheet 1 of 2) and renamed "Schematic Diagram, Frequency Converter Assembly, Synthesized".

Revised Schematic Diagram, Frequency Converter Assembly (Sheet 2 of 2) and renamed "Schematic Diagram, Frequency Converter Assembly, Non-Synthesized".

Revised Decoder II Assembly Schematic Diagram (Sheets 1 and 2) and renamed "Decoder II Assembly Schematic Diagram, (Delta)" and "Decoder II Assembly Schematic Diagram, (Motorola)".

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.

CUSTOMER INFORMATION

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 content and shall, under no circumstances, be responsible for damage or injury (whether to person or property) resulting from use of the subject equipment.

REPLACEMENT PARTS

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.

EQUIPMENT DAMAGED IN TRANSIT

The equipment should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. Report all shortages and damage to Delta at the address shown on the cover.

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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 Technical Manual describes the Model ASM-1, AM Stereo Modulation Monitor, manufactured by Delta Electronics, Inc. The ASM-1 monitors modulation using the C-QUAM method of AM stereo transmission.

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 the monophonic performance in order to transmit stereo. It is truly a compatible stereo transmission system.

1.3 AM AND PM MODULATION

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

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 1-1A. The AM signal can also be described in the frequency domain with an amplitude versus frequency plot. Figure 1-1B 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 sidebands amplitudes increase but the average carrier level remains constant.

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 instantaneous frequency, while the amplitude remains constant. Figure 1-2A 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 1-2B illustrates the PM signal spectrum plot.

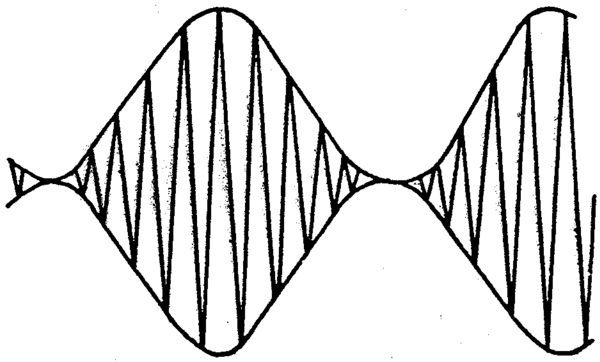


FIGURE 1-1A

ENVELOPE

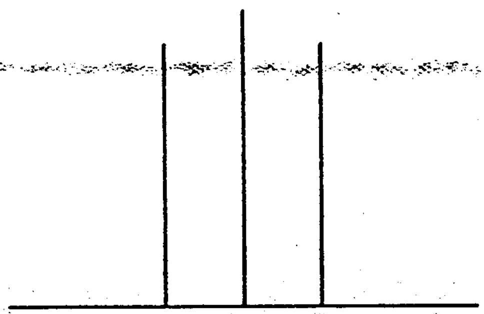


FIGURE 1-1B

SPECTRUM

FIGURE 1-1

AMPLITUDE MODULATION

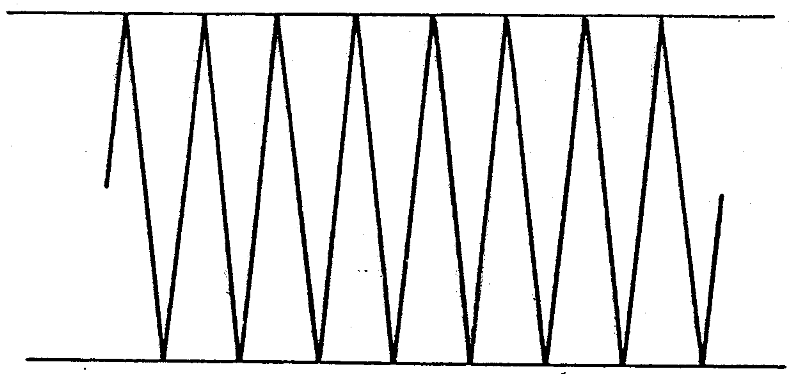


FIGURE 1-2A

ENVELOPE

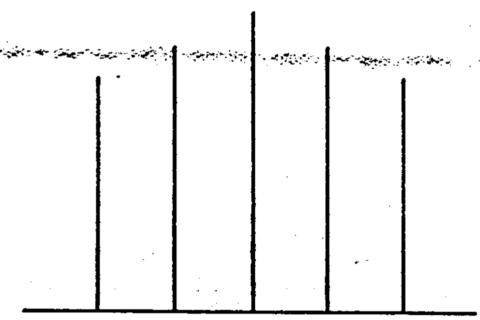


FIGURE 1-2B

SPECTRUM

FIGURE 1-2

PHASE MODULATION

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, 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.

1.4 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, double sideband suppressed carrier (DSSC) signal. Summing the I and Q signals 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 1-3 illustrates the C-QUAM transmission methodology. The block diagram of Figure 1-3A shows how the I and Q signals are derived and summed to produce the QUAM signal. The vector diagram of Figure 1-3B shows the QUAM signal as the vector sum of the I and Q signals with a corresponding phase shift. After bandpass filtering and limiting, a constant amplitude phase modulated carrier remains as shown in Figure 1-3C. Finally, this carrier is fed to the transmitter where it is modulated by main channel audio to produce C-QUAM as shown in Figure 1-3D. Note that the amplitude of the C-QUAM signal is exactly the same as an AM signal for complete compatability.

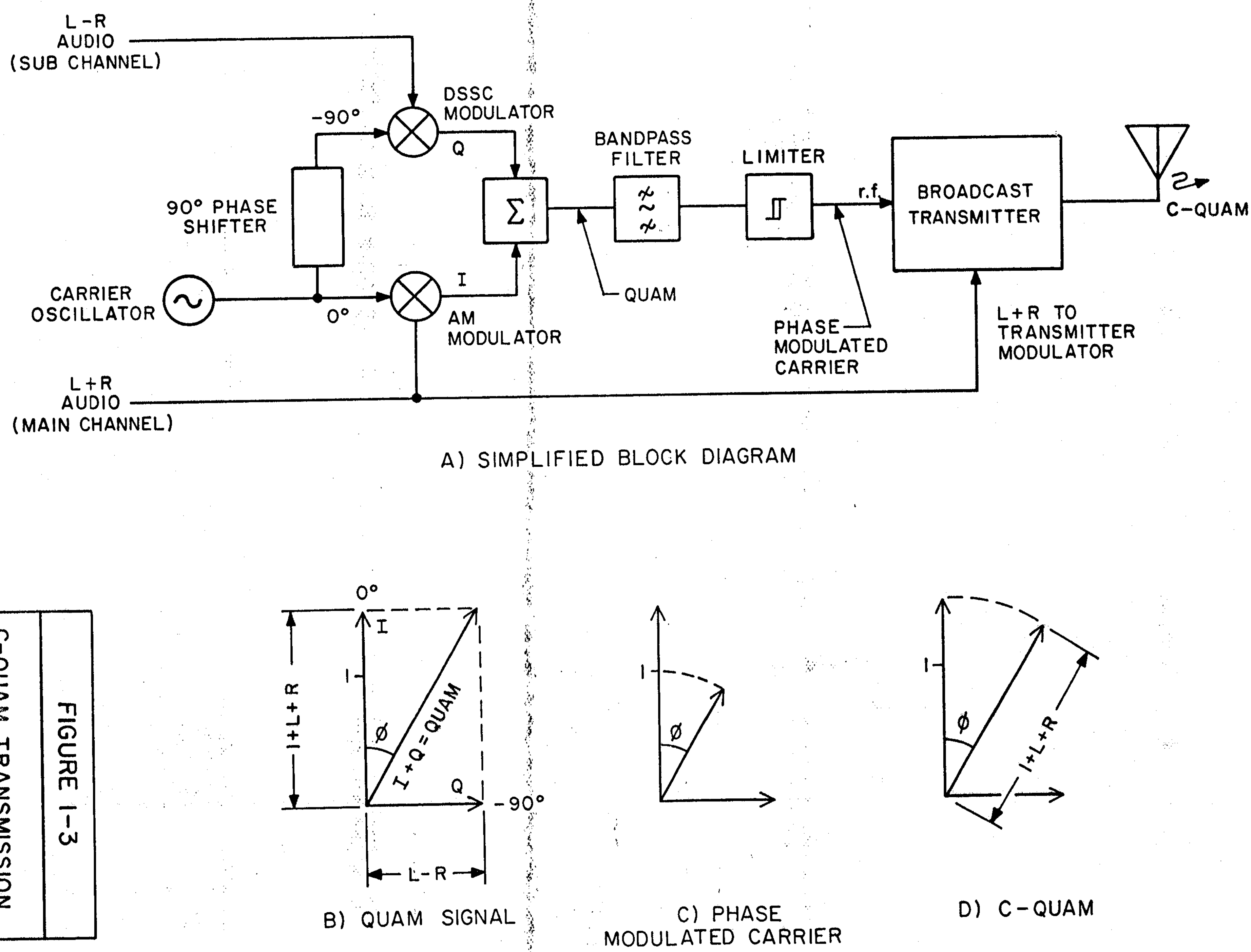


FIGURE 1-3

C-QUAM TRANSMISSION METHOD

1.5 DECODING C-QUAM

Decoding C-QUAM signals is substantially the reverse of the encoding process. Referring to Figure 1-4A, note that the C-QUAM signal passes through a variable gain amplifier and is fed to a Q (quadrature) detector. The long term average output of the Q detector (DC component) is zero. Any variation from zero of the DC component will appear at the output of the loop filter and cause the VCO to correct phase to eliminate the variation. Thus the VCO is phase locked to the average carrier phase, zero degrees. The VCO signal is used to drive an in phase synchronous (I) detector which decodes the zero degree vector component of the amplified C-QUAM signal. Similarly, a ninety degree phase shifted VCO signal drives a quadrature phase synchronous (Q) detector which decodes the quadrature (-90°) vector component of the amplified C-QUAM signal.

The length of the C-QUAM vector of Figure 1-4B appears at the output of the envelope detector. It is apparent from Figure 1-4B that by appropriately amplifying the C-QUAM vector, the in phase (I detector) component can be made equal in magnitude to the magnitude of the C-QUAM vector. This is the function of the comparator which adjusts the variable gain amplifier to restore a QUAM signal for the I and Q detectors. Note that Figure 1-4B now becomes the same diagram as Figure 1-3B and that the outputs of the I and Q detectors are the desired 1+L+R and L-R signals.

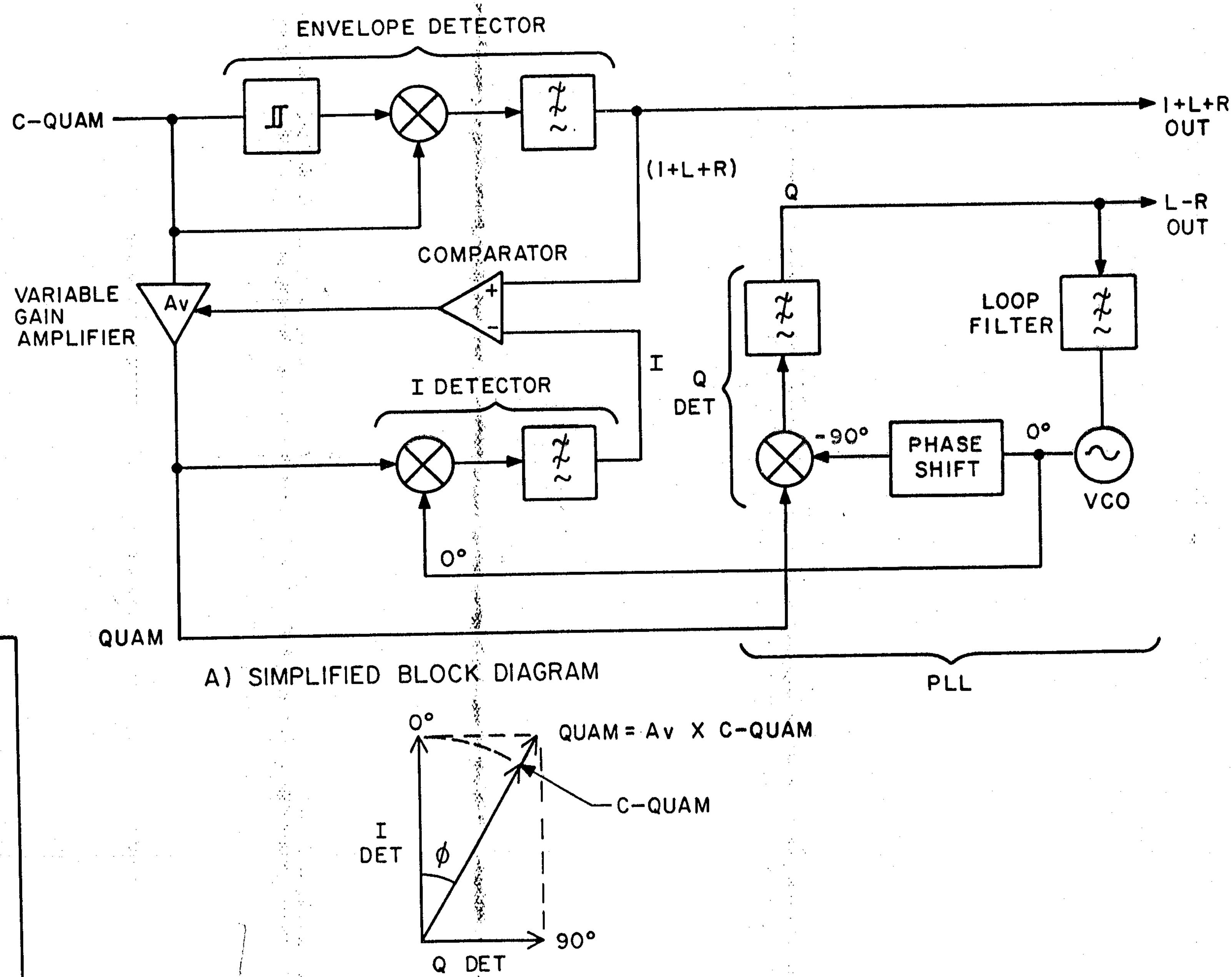


FIGURE 1-4

DECODING C-QUAM

SECTION 2

EQUIPMENT CHECKOUT AND INSTALLATION

2.1 DELIVERY INSPECTION

The shipping cartons for the Monitor are designed to protect the equipment for normal handling during shipment. Unpack and thoroughly inspect the equipment for any evidence of mishandling. Report damage to the carrier immediately. Identify all deliverable items including card extender and Technical Manual. Check for mechanical integrity of the unit and overall outer appearance.

2.2 EQUIPMENT DAMAGED IN TRANSIT

The equipment should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. Report all shortages and damages to Delta.

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 furnished by Delta.

2.3 MECHANICAL CHECKOUT

CAUTION

Complete the below procedure before applying power to the unit.

Remove top panel screws from the Monitor and check that all circuit cards are properly seated in their sockets. Cards may be reseated by operating the cam levers to open each card socket and firmly pressing down on the card edge while closing the socket using the cam lever. Normal card complement and placement are shown in Figure 2-1. Secure the top cover.

2.4 REPLACEMENT PARTS

To obtain service replacement or warranty items, write or call Delta. Please supply product identification (Model Number and Serial Number) and replacement part identification (including Stock 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 Technical Manual.

2.5 FUNCTIONAL CHECKOUT

Plug the unit line cord into a suitable AC outlet. Verify meter functions and indicator light functions.

Unplug unit before proceeding.

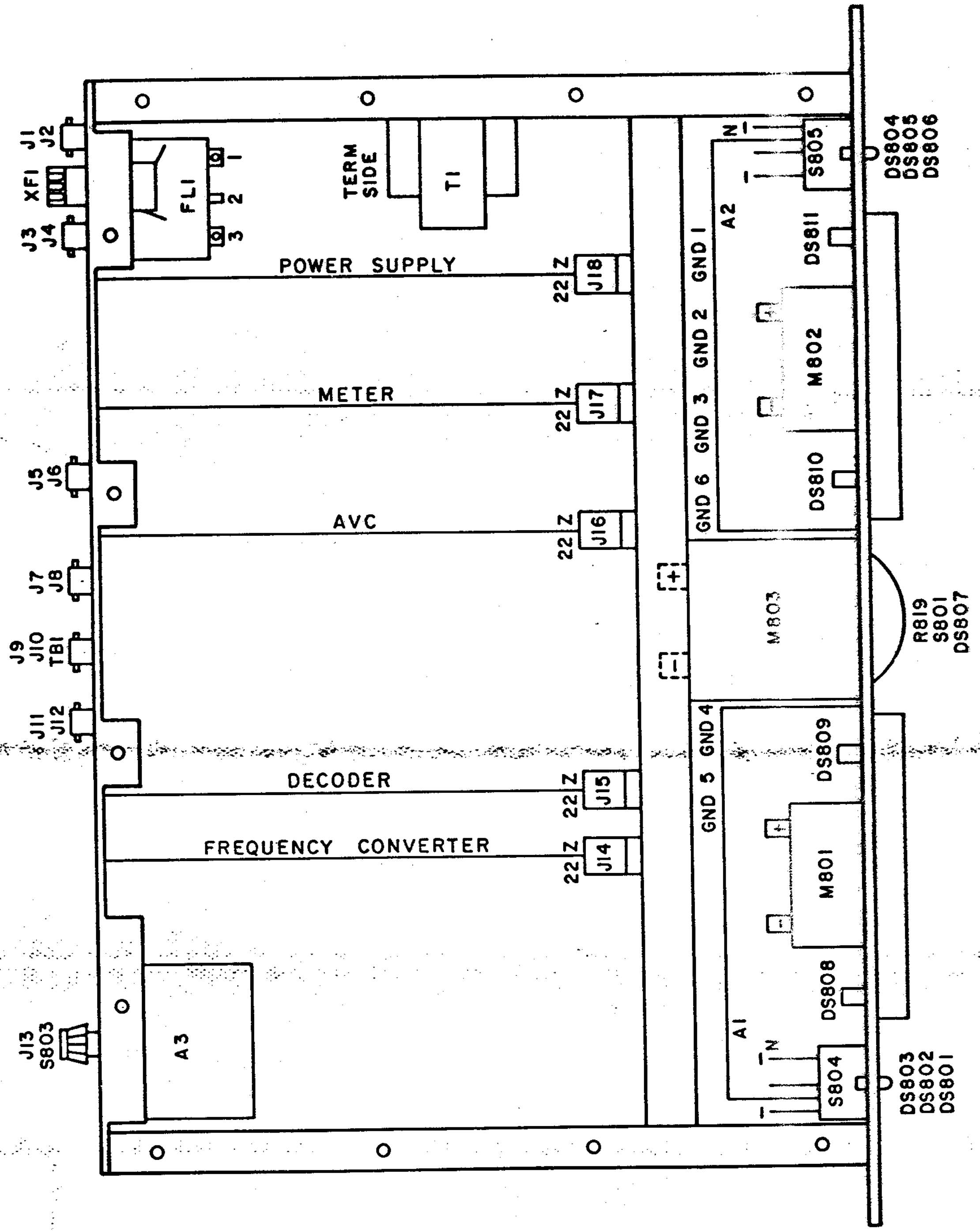


FIGURE 2-1

COMPONENT LOCATIONS
TOP VIEW

NOTE

There is no power switch for the Monitor. Therefore, unplug the line cords to turn the unit off.

2.6 FIELD ENGINEERING SERVICE

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

2.7 INSTALLATION

The installation of the AM Stereo Modulation Monitor, Model ASM-1, is a very straight-forward operation.

After completing the equipment checkout as outlined in Section 2.3, install and secure the unit in a standard 19" rack avoiding areas of excessive heat. Apply power.

CAUTION

Before connecting the transmitter's RF sample to the Monitor, ensure the sample level is between 1 to 10 Vrms (28 Vp-p maximum) into a 50 ohm load at 100% AM. Serious damage will result if this level is exceeded.

2.8 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 while 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 to approximately the center of its range. 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. Again 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.

2.9 NIGHT RF SAMPLE LEVEL

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

2.10 OPERATIONAL CHECKOUT

Modulate 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 a scope; in the envelope pattern, modulation levels can be confirmed.

SECTION 3

SPECIFICATIONS AND EQUIPMENT DESCRIPTION

3.1 SCOPE

This section describes the Model ASM-1 AM Stereo Modulation Monitor specifications and details front and rear panel descriptions and functions.

3.2 SPECIFICATIONS

3.2.1 RF Input

RF Sensitivity	1-10 Vrms
Input Impedence	50 Ohms
Input Attenuation	0-50 dB in 10 dB steps
Connector	BNC

3.2.2 Rear Panel Detector Outputs

Envelope Detector (J5)	2V p-p at 100% AM
L-R Detector (J7)	2V p-p at 100% PM
I Detector (J8)	2V p-p at single channel, 50%
Pilot (J6)	25 Hz at 2.5 Vrms
Connectors	BNC

3.2.3 Rear Panel Audio Outputs

Balanced (TB1):	
Left	0 dBM into 600 @ L+R = 100%
Right	0 dBM into 600 @ L+R = 100%
Connector	Terminal Block
Unbalanced:	
L+R	1.5 Vrms at 100% L+R
L-R	1.5 Vrms at 100% L-R
Left	1V RMS at 50% Left Only
Right	1V RMS at 50% Right Only
Connectors	BNC

3.2.4 Remote Flasher and Meter Outputs

L+R Flasher (J1)	+13 VDC Triggered
L-R Flasher (J3)	+13 VDC Triggered
L+R Meter (J2)	+0.45 VDC at 100% L+R 60 Ohm Source
L-R Meter (J4)	+0.45 VDC at 100% L-R 60 Ohm Source
Connectors	BNC

3.2.5 Front Panel Meters

3.2.5.1 Modulation Meters

Positive Range	0 to 140%
Negative Range	0 to 100%
Attenuation Range	0 to -50 dB
Measuring Functions	+L+R, -L+R, +L, -L, +L-R, -L-R, +R, -R
Meter Scales	% of Modulation and dB Levels
dB Scale Range	+3 to -20 dB
Meter Size	3" H X 4.5" W

3.2.5.2 Carrier/Pilot Meter

Carrier Scale Range	-20% to +20%
Carrier Shift Indication	Direct Reading
Pilot Level	Direct Reading
Meter Functions	Switchable
Meter Size	0.7" H X 2.6" L

3.2.6 Peak Flashers

+/- L or +/- L+R	1% to 199% Programmable Thumbwheel Controlled
+/- R or +/- L-R	1% to 199% Programmable Thumbwheel Controlled

3.2.7 Flashers

-100% L+R	LED Indicator Fixed Calibration
+125% L+R	LED Indicator Fixed Calibration
L-R 100% (L-R Limit)	LED Indication Fixed Calibration
High Angle (L-R Neg Limit)	LED Indication Fixed Calibration
Pilot Tone Indicator	LED Indicator Fixed Calibration

3.2.8 Physical Characteristics

Front Panel	19" Rack Mount
Unit Dimensions	19" W X 5.25 H X 14.7" D
Unit Weight	24 lbs.
Operating Temperature	0oC to 50oC

3.2.9 Electrical Characteristics

Intermediate Frequency (IF)	450 KHz
Residual Noise L+R	-65 dB (referenced to 100% L+R)
Residual Noise L-R	-55 dB (referenced to 100% L-R)

3.2.9.1 Distortion vs. Frequency

L+R

95%, 50 Hz to 15 KHz	≤ 0.5%

L-R

100%, 50 Hz to 15 KHz	≤ 1%

3.2.9.2 Response vs. Frequency

95%; L+R, 50 Hz to 15 KHz	< ±0.1 dB
100%; L-R, 50 Hz to 7.5 KHz	< ±0.1 dB
100%; L-R, 7.5K to 15 KHz	< ±0.5 dB
75%; L or R, 50 Hz to 7.5 KHz	< ±0.1 dB
75%; L or R, 7.5 KHz to 15 KHz	< ±0.5 dB

3.2.9.3 Separation vs. Frequency

50%, L or R only, 50 Hz to 1 KHz	45 dB
50%, L or R only, 1 KHz to 5 KHz	40 dB
50%, L or R only, 5 KHz to 15 KHz	35 dB
75%, L or R only, 50 Hz to 5 KHz	35 dB
75%, L or R only, 5 KHz to 15 KHz	30 dB

3.2.9.4 Crosstalk vs. Frequency

95%, L+R, 50 Hz to 5 KHz	45 dB
95%, L+R, 5 KHz to 15 KHz	40 dB
100%, L-R, 50 Hz to 1 KHz	50 dB
100%, L-R, 1 KHz to 5 KHz	45 dB
100%, L-R, 5 KHz to 15 KHz	35 dB

3.2.10 Power Requirements

Line Voltage	115 or 240 Vac
Line Frequency	50/60 Hz
Power	61 Watts

3.3 FRONT AND REAR PANEL DESCRIPTION

In the following tables, the front panel controls and rear panel outputs are described.

TABLE 3-1

MODEL ASM-1 AM STEREO MODULATION MONITOR

FRONT PANEL CONTROLS

REF	DESCRIPTION	FUNCTION
M801, M802	Large Front Panel Meters	These meters indicate modulation levels as selected by S801 and S802.
S801	Left Meter Attenuation Range Setting Switches	These switches select appropriate attenuation levels in 10 dB steps for the left-hand modulation meter
S802	Right Meter Attenuation Range Setting Switches	These switches located directly below the right-hand modulation meter and selects appropriate attenuation levels in 10 dB steps for the meter
S801A	Left Meter Modulation Function Switches	These four switches select what the left meter displays: +L+R, -L+R, +L or -L. They also control the left peak flasher's operation (DS803) as to what they will trigger on.
S802A	Right Meter Modulation Function Switches	These four switches select what the right meter displays: +L-R, -L-R, +R or -R. They also control the right peak flasher's operation (DS804) as to what they will trigger on.
DS803	Left Programmable Peak Flasher	The Left peak flasher modulation range is set via the left-hand thumbwheel switch. Its function depends upon the modulation switch setting of S801A.
S804	Left Thumbwheel Switch	This switch controls the level of modulation for which the Left flasher, DS803, fires.

TABLE 3-1

MODEL ASM-1 AM STEREO MODULATION MONITOR

FRONT PANEL CONTROLS

(CONTINUED)

REF	DESCRIPTION	FUNCTION
DS802	L+R +125% Flasher	This peak flasher indicates the presence of +125% envelope modulation. It is not programmable and does not depend upon S801A's setting. It is a fixed factory calibration.
DS801	L+R -100% Flasher	This is a peak reading flasher which indicates negative 100% envelope modulation. This flasher is not programmable and does not depend on S801As setting It is a fixed factory calibration.
DS804	Right Peak Flasher	The Right peak flasher modulation range is set via the right-hand thumbwheel switch. Its function depends upon the modulation switch settings of S802A.
S805	Right Thumbwheel Switch	This switch controls the level of modulation for which the right flasher, DS804, fires.
DS805	L-R Limit Flasher (100% L-R)	The flasher gives indication of a 100% sub channel modulated signal. It has no external settings and is a fixed factory adjustment.
DS806	L-R Negative Limit Flasher (high angle)	The L-R negative limit flasher gives indication that the L-R signal is overmodulating the combined modulation envelope. It indicates peaks of 90% or greater single channel modulation. This flasher has no external settings and is a fixed factory adjustment.
DS807	Pilot Tone Indicator	Indicates presence of 25 Hz pilot tone.

TABLE 3-1

MODEL ASM-1 AM STEREO MODULATION MONITOR

FRONT PANEL CONTROLS

(CONTINUED)

M803	Carrier Level Meter	Establishes a carrier reference level necessary to insure that the circuits driving the modulation meters are affected only by modulation changes. The carrier level meter indicates the average RF signal level input to the monitor decoder circuits. The RF signal input is set to a level (indicated on the meter and determined by the manufacturer) by means of the carrier set control R819. As long as the carrier level indication is within the range of the meter (+/-20% change of RF level), the modulation circuits will be within their design accuracy.
S803	Switch	Two position calibration meter function switch. In the pilot tone position, the carrier meter must indicate in the black square (pilot) position. This is a fixed factory adjustment which does not have an external setting. In the carrier set position, the meter must indicate in the center on (set). The set position can be adjusted with the carrier set and rear panel (RF attenuator) controls.
R819	Carrier Set Control	Vernier control which operates in conjunction with the 50 dB RF step attenuator on the back panel.

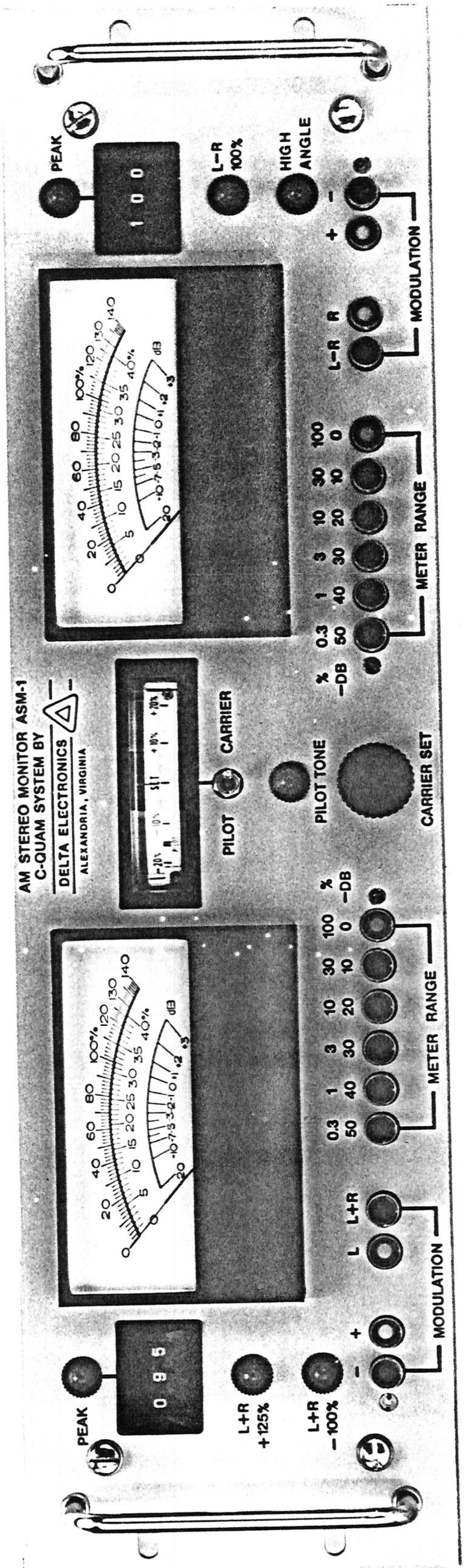


FIGURE 3-1

MODEL ASM-1
FRONT PANEL

TABLE 3-2

MODEL ASM-1 AM STEREO MODULATION MONITOR

REAR PANEL OUTPUTS

REF	DESCRIPTION	FUNCTION
J1	Remote Peak Flasher L+R	Drive signal for remote operation of flasher
J2	Remote Modulation Meter L+R	DC drive current for remote panel meter operation
J3	Remote Peak Flasher L-R	Drive signal for remote operation of flasher
J4	Remote Modulation Meter L-R	DC drive current for remote panel meter operation
J5	Envelope Detector	Test output to evaluate monitor decoder
J6	Pilot Tone Output	Connection for measurement of pilot frequency and level
J7	L-R Detector	L-R (quad) detector test output to evaluate monitor decoder
J8	In Phase Detector (I Det)	Test output to evaluate monitor decoder operation
J9	Unbalanced Output Left	For distortion measurements of left audio channel
J10	L+R	L+R (mono) output for transmitter testing of monaural signal
J11	Unbalanced Output Right	For distortion measurements of right audio channel
J12	L-R	L-R Output for transmitter testing of stereo signal
J13	RF Input	RF input from transmitter (10V RMS Max)
S803 (Assembly A800)	RF Atten	A 50 dB step attenuator in 10 dB steps used with the front panel carrier set control to calibrate the monitor
TB1	600 Balanced	Balanced 600 Ohm Stereo audio output

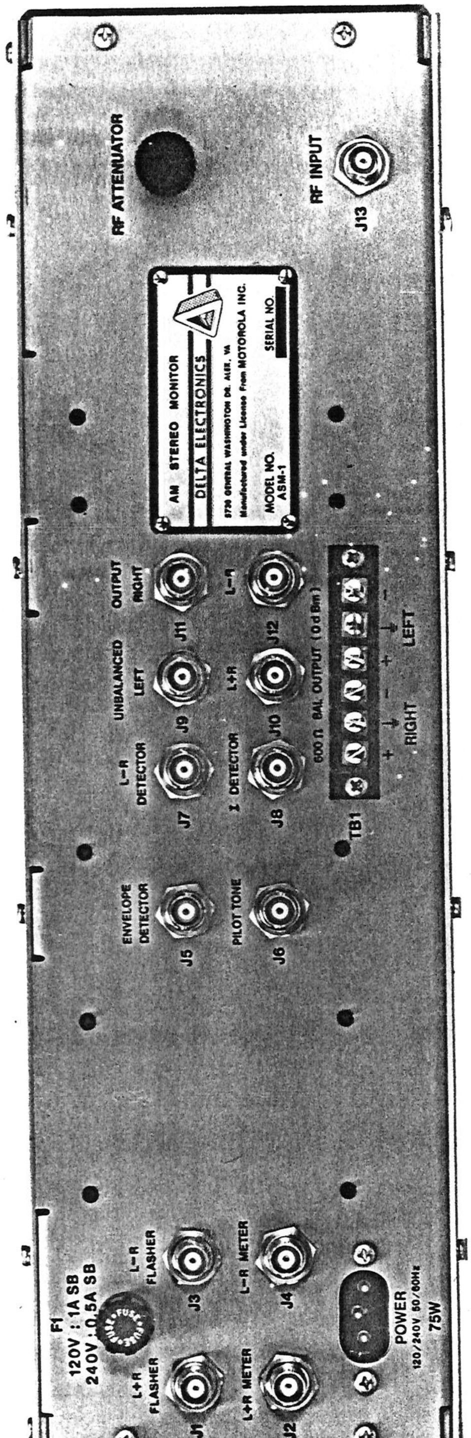


FIGURE 3-2
MODEL ASM-1 REAR PANEL

SECTION 4

OPERATION AND PROOF OF PERFORMANCE

4.1 GENERAL

Although the FCC has deregulated the AM monaural proof of performance requirements, the AM stereo proof of performance is still required. For AM stereo proofs, certain FCC rules apply. The characteristics to be measured are described in Section 73.1590 and the minimum performance specifications are described in Sections 74.40 and 73.128.

The following text outlines procedures on how to perform a full stereo as well as mono proof using the Delta AM Stereo Modulation Monitor.

4.2 MONITOR FEATURES

The Modulation Monitor is capable of accurately demodulating and indicating amplitude modulation, left minus right modulation, left channel modulation, right channel modulation, carrier shift, right or left channel noise levels, separation, and level of pilot tone. In addition, the level of incidental phase modulation can be readily calculated from the left minus right modulation indication when modulating with pure AM. The frequency of pilot tone modulation can be measured with instruments connected to rear panel ports on the Modulation Monitor. The distortion and noise levels of the Modulation Monitor are sufficiently low that the measurements made of the various performance characteristics will be reflective of the limits of the broadcast transmitter/stereo encoder performance.

4.3 L+R INDICATIONS

The main L+R modulation percentage indicator can be read directly on the Monitor by selecting L+R on the left modulation selector switch, S801A, and viewed on the left-hand meter. By using the +/- function of S801A, either positive or negative L+R modulation will be indicated on the meter.

4.3.1 L+R Distortion Measurements

The L+R distortion can be measured by connecting a coaxial cable from the rear panel port (J10) labeled L+R to a distortion analyzer.

4.4 L-R INDICATIONS

The subchannel L-R modulation percentage indication can be read directly on the Monitor by selecting L-R on the right modulation selector switch, S802A, and viewed on the right-hand meter. By using the +/- function of S802A, either positive or negative L-R modulation will be indicated on the meter.

4.4.1 L-R Distortion Measurements

The L-R distortion can be measured by connecting a coaxial cable from the rear panel port (J12) labeled L-R to a distortion analyzer.

4.5 LEFT ONLY INDICATIONS

The left (L) only modulation percentage indication can be read directly on the Monitor by selecting L on S801A and viewed on the left-hand meter. By using the +/- function of S801A, either positive or negative left modulation will be indicated on the meter.

4.5.1 Left Only Distortion Measurement

The left channel distortion can be measured by connecting a coaxial cable from the rear panel port (J9) labeled LEFT to a distortion analyzer.

4.6 RIGHT ONLY INDICATIONS

The right (R) only modulation percentage indication can be read directly on the Monitor by selecting R on S802A and viewed on the right-hand meter. By using the +/- function of S802A, either positive or negative right modulation will be indicated on the meter.

4.6.1 Right Only Distortion Measurement

The right channel distortion can be measured by connecting a coaxial cable from the rear panel port (J11) labeled RIGHT to a distortion analyzer.

4.7 CARRIER SHIFT MEASUREMENT

The carrier shift can be read by observing the carrier level indicator on the C-QUAM AM Stereo Modulation Monitor. With no modulation applied, the carrier level indicator should be carefully set to the SET position. The next step is to modulate the transmitter with L+R at 25%, 50%, 85% and, if possible, 100% at 400 Hz. While viewing the carrier level indicator on the Monitor, the amount of carrier shift can be directly determined.

4.8 NOISE LEVEL MEASUREMENTS

The main (L+R), sub (L-R), left (L) and right (R) channel noise levels can be directly read on the Monitor by selecting the appropriate mode for the left or right meters, and depressing the meter range buttons until an on scale reading is obtained. The noise level is obtained by adding the meter range value with the indication of the red dB scale on the meter. It is already calibrated against 100 percent modulation. Noise level measurements can also be made from the respective rear panel ports. The recommended method of measurement is using the respective rear panel ports.

4.9 INCIDENTAL PHASE MODULATION MEASUREMENT

Under main channel modulation only (AM modulation or L-R), any incidental phase modulation (IPM) will result in L-R meter readings related to the degree of incidental phase modulation. The peak angle of incidental phase modulation in radians is approximately equal to the voltage ratio of the L-R meter reading to 100% for low levels of IPM typically encountered in AM transmitters. Thus, an L-R reading of -40 dB indicates an IPM phase angle of about 0.01 radians (0.57 degrees).

For best stereo transmission, IPM should be reduced by proper neutralization and power supply regulation in the transmitter. A good rule of thumb is that stereo separation is no better than subchannel (L-R) to main channel (L+R) crosstalk.

4.10 SINGLE CHANNEL SEPARATION MEASUREMENTS

For measurement of separation, modulate the transmitter with left only audio at 50%, 1 KHz. The left channel is modulated with a tone and a distortion meter or audio voltmeter is used to measure the audio output voltage from the left channel output of the Modulation Monitor. The audio voltage from the right channel output of the Modulation Monitor is then measured. The difference in dB is the separation. The reverse process is used to measure the separation of a modulated right channel into the left.

The front panel meters can be used directly when set to "L" and "R". The separation can be read directly on the panel meters by subtracting the readings in dB of the two meters added to the respective pushbutton settings. Note that of the two methods for measuring separation, the method utilizing the rear panel ports will be the most accurate and is the preferred method.

4.11 PILOT TONE LEVEL AND FREQUENCY

The relative pilot tone level may be measured directly on the Modulation Monitor by setting the PILOT/CARRIER switch under the carrier meter to the PILOT position and reading the level of pilot tone on the carrier level panel meter. When the correct level of pilot tone is present, the meter's indication will rest in the black block on the meter's face. To accurately measure the pilot level, remove all other modulation and set the L-R attenuator pushbutton to -20. The meter should indicate just below -26 dB.

Pilot tone frequency may be measured from the PILOT TONE port (J6) on the back of the Modulation Monitor. Pilot tone should be 25 Hz $\pm$ 0.1 Hz.

SECTION 5

THEORY OF OPERATION

5.1 GENERAL

A brief description of the function of each printed circuit board assembly in the Model ASM-1 is contained in Section 5.2 below. Sections 5.3 through 5.3 describe the operation of each assembly in greater detail.

5.2 CIRCUIT CARD FUNCTIONS

5.2.1 AVC Assembly (D33-328, Reference Designation A100)

The AVC Assembly controls the level of the L+R and L-R audio signals from the Decoder Assembly allowing these audio signals to be used as an instantaneous indication of the modulation level. This assembly also contains the carrier level detector and carrier meter drive circuitry, along with the pilot detector and meter drive circuits. With the exception of the two peak flashers, the five remaining flasher drivers on the AVC panel are:

1. +125% envelope limit
2. -100% envelope
3. L-R limit (100% L-R)
4. Neg. limit (high angle of phase modulation)
5. Pilot tone indicator

5.2.2 Meter Control Assembly (D33-329, Reference Designation A300)

The Meter Assembly contains the audio amplifiers and peak detectors which drive the front panel left and right meters. Additionally, it provides the circuitry to drive both left and right peak flashers operating in conjunction with the front panel mounted thumbwheels. This assembly provides the audio matrix circuitry for the balanced and unbalanced outputs to the rear panel ports. Pilot reject filters are included on this circuit card which eliminate the 25 Hz pilot tone from the meters when making measurements of the left or right channel.

5.2.3 Decoder Assembly (D33-332, Reference Designation A500)

The Decoder Assembly receives 450 KHz IF from the Frequency Converter Assembly, then detects and separates the envelope -(1+L+R) and quadrature -(L-R) audio signals which are sent to the AVC card. For test purposes, it provides three detected outputs to rear cabinet ports:

1. Envelope detector output, J5
2. In-phase detector, J8
3. L-R quadrature detector, J7

5.2.4 Frequency Converter Assembly (D33-324, Reference Designation A700)

The station RF signal from the input attenuator is converted to 450 KHz intermediate frequency (IF) on this board. Local oscillator frequency is derived by two optional methods. Units for which the operating frequency is unknown prior to use (i.e. frequency agile) have a phase locked loop frequency synthesized local oscillator with frequency controlled by DIP switches. Units operating on a fixed frequency use a crystal oscillator local oscillator for higher performance by eliminating PLL phase noise.

5.2.5 Power Supply Assembly (D33-330, Reference Designation A900)

The power supply operates from either a 110V or 230V AC source. A line filter is used to filter the AC line of unwanted signals or line interference. The Power Supply Assembly is protected by a 2 ampere fuse and provides +5, +15, -15, and ±24 volt DC outputs.

5.3 POWER ATTENUATOR ASSEMBLY

An RF sample of the transmitter's signal is fed into J13 on the rear panel. The Power Attenuator Assembly's ladder attenuator is adjusted via the attenuator switch, S803, to reduce the level of the RF sample bringing it within the control range of the carrier set potentiometer, R819. Care should be exercised when installing the unit to ensure that high level samples are not fed into the attenuator when switched to low attenuation settings.

5.4 FREQUENCY CONVERTER ASSEMBLY

This assembly converts the carrier frequency C-QUAM signal from the carrier set potentiometer to a C-QUAM signal at an intermediate frequency, usually 450 KHz. Four optional versions of this board exist. Part Numbers D33-324-1 and D33-324-2 are frequency agile versions for 10 KHz and 9 KHz frequency spacing respectively. With these optional assemblies, the operating frequency of the unit is determined by an internal DIP switch setting that sets the frequency of a phase locked loop synthesized local oscillator. Part Numbers D33-324-3 and D33-324-4 use a fixed frequency, crystal controlled local oscillator for 10 KHz and 9 KHz frequency spacing respectively. The fixed frequency, local oscillator contributes less phase noise than the synthesized version, realizing higher Monitor performance.

The crystal oscillator of Q701 and its buffer transistor, Q702, provide either a high frequency reference oscillator for the synthesized local oscillator or a four times multiple of the local oscillator. In the non-synthesized version, the four times local oscillator signal is fed from the collector of Q702, through DC blocking capacitor C717, to the line receiver chip, U707. The ECL level square waves from U707 are divided by four in U704 to produce complimentary, ECL level local oscillator signals for the balanced mixer, U701.

For the synthesized version of this circuit, the output of Q702 drives a CMOS divider, U706, producing a reference frequency for the phase locked loop at four times the spacing frequency. Resistors R714, R718 and R720 convert the CMOS level reference signal to ECL level for use by the phase-frequency detector, U705. Differential phase error pulses from U705 are fed to the active loop filter of operational amplifier U750. Residual reference frequency signals at the test point are balanced out by R723. The DC output of the loop filter controls the capacitance of varactor diode CR750 which controls the frequency of the oscillator circuit of Q751, the VCO. The output of the VCO is four times the local oscillator frequency.

The VCO output is fed, through DC blocking capacitor C717, to line receiver U707. One output of U707 drives divider U704 producing a balanced local oscillator signal to the mixer, U701, as described above. The other output of the line receiver U707 drives the programmable divider of U702 and U703. The division number is controlled by DIP switch S701. The output of the programmable divider is compared to the reference frequency by U705, the phase-frequency comparator. The loop functions to bring the programmable divider output to exactly the same frequency as the reference frequency. Thus, the VCO frequency will be the divider multiple of the reference frequency, four times local oscillator frequency.

The DIP switch setting is determined by the local oscillator frequency desired. If, for instance, the Monitor will operate at 1230 KHz with 10 KHz spacing and 450 KHz intermediate frequency, the local oscillator frequency will be 1680 KHz (1230 KHz + 450 KHz). The VCO frequency will be four times the local oscillator frequency or 6720 KHz. Therefore, the division number of the programmable divider will be 6720 KHz/40 KHz or 168. The required DIP switch setting is the binary version of 168-1 or 10100111 where the ones represent closed switches and zeros are open switches.

The C-QUAM signals from the carrier set control is fed, through transformer L702, to balanced mixer U701. The output of U701, containing the difference frequency component of the C-QUAM signal and the local oscillator signal, is fed through transformer L701 to the buffer circuit of Q704. The tuned circuit of C727 and L703 tunes the difference frequency (intermediate frequency) helping eliminate unwanted mixing components. The output of the buffer stage, Q704, provides an intermediate frequency, C-QUAM signal for the Decoder Assembly.

5.5 DECODER ASSEMBLY

The Decoder Assembly functions to reduce the intermediate frequency (IF) C-QUAM signal from the Frequency Converter Assembly to audio frequency (baseband) main channel -(1+L+R) and subchannel -(L-R) components. The basic operation of the circuit is described in Section 1.4 which should be reviewed before proceeding. The original Decoder Assembly, D33-332, and an improved Decoder Assembly, D33-363, are described below.

5.5.1 Decoder Assembly, D33-332

The IF C-QUAM signal is fed through the tuned circuit of C586 and L502 and the tuned circuit of C590 and L501 further reducing unwanted mixing products. The IF C-QUAM signal then splits into three balanced signal paths. The first path takes the signal into an RF limiter composed of the components associated with Q505 through Q508 and U510. The output of U510 is a constant amplitude signal at the intermediate frequency containing the

C-QUAM phase information. This signal feeds one port of balanced mixer U505. The second IF C-QUAM path takes the signal directly to the second port of mixer U505 forming a product (envelope) detector. The output circuit of the mixer contains a trap, L503, to reduce sum frequency components, twice intermediate frequency. The mixer output is buffered through U511 and filtered by U503A producing the envelope detector (main channel audio -(1+L+R)) output described in Section 1.4.

The third IF C-QUAM signal path is to a variable gain RF amplifier comprising the circuits of Q501 through Q504, Q509, U501 and U502. The balanced outputs of Q503 and Q504 drive one port of each mixer U508 and U509. U508 is the in-phase (I) synchronous detector, detecting the zero degree component of the amplified IF C-QUAM signal. Its output is buffered by U511 and filtered by U503B to produce the I detector output. U509 is the quadrature (Q) synchronous detector, detecting the minus ninety degree component of the amplified IF C-QUAM signal. Its output is filtered by U504C producing the subchannel -(L-R) audio signal.

The buffered outputs from the envelope detector, U505, and the I detector, U508, are compared by the circuits of U506, U507 and Q510 through Q512. Comparator output (error) signals are fed to the variable gain RF amplifier control line, U501 pins 2 and 4, automatically adjusting the gain of the amplifier so that the output of the I detector is equal to the envelope detector output. At very high gain, corresponding to large phase angle swings, the variable gain RF amplifier gain versus control voltage curve reverses slope which can cause Decoder "lockup". The voltage limiter circuit of U503D, CR504 and R501 keeps the control line voltage out of the "lockup" region.

The output of the L-R detector is fed to an inverting 25 Hz (pilot tone) tuned circuit of U504A. The maximum response of this circuit is adjusted to 25 Hz by R502 and its output is summed with the non-inverted L-R signal at the junction of R572 and R573. The magnitude of the inverted 25 Hz summing current is adjusted by R571 so that no 25 Hz pilot signal component appears on the input of U504D. The remaining L-R (Q detector) signals are filtered by the PLL loop filter of U504D. Its output controls the capacitance of varactor diode CR503 thereby controlling the frequency of the crystal oscillator of the loop VCO, Q513. The VCO frequency is eight times the intermediate frequency and is buffered by Q514 and fed to dividers U512 and U513. U512 provides balanced ECL level in-phase and quadrature signals to the high level ports of the I and Q synchronous detectors. The PLL acts to keep the quadrature detector DC output to zero.

The PLL has a narrow capture range which may not be sufficient during start-up to acquire lock on the IF C-QUAM signal. Under this condition the I detector output will swing wildly beyond the levels encountered in normal operation. This output from U503B is fed to a level detector circuit, U503C. Whenever the I detector output swings wildly, U503C peak detects through CR505 and C566 activating relay K501 through follower U504B. K501 places R651 in the circuit increasing the gain of the loop filter to widen the capture range.

5.5.2 Decoder II Assembly, D33-363

The intermediate frequency C-QUAM signal passes through the tuned circuits of L502 and L501 and is fed to three balanced signal paths. The first path takes the signal through transistor buffer stages of U516 (in pins 13 and 16 and out pins 2 and 8) to a limiter circuit of U510 (in pins 9 and 10). The output of U510 (pins 2 and 3) is a constant amplitude, intermediate frequency signal containing C-QUAM phase information. This signal feeds the high level input port of balanced mixer U505, pins 8 and 10. The second IF C-QUAM path takes the signal directly to the low level input port of mixer U505 (pins 1 and 4) forming an envelope detector. The output circuit of this mixer, at pins 6 and 12 of U505, contains a second harmonic trap circuit of L503 to eliminate the 900 KHz sum signal leaving the desired baseband signal (1+L+R) predominant. This balanced output is buffered through the follower circuits of U511 (in pins 3 and 6, out pins 4 and 8) and is filtered and converted to an unbalanced main audio channel signal, -(1+L+R), by the operational amplifiers U514A and U514B. This signal is the Envelope Detector output appearing at TP515 and the rear panel BNC port, J5.

The third IF C-QUAM signal path is to a variable gain RF amplifier with an input at pins 6 and 9 of U501. This circuit is composed of U501, U502, Q501 through Q504 and associated components. The output of this variable gain amplifier appears on the emitters of Q503 and Q504 feeding the low level inputs of balanced mixers U508 and U509 at pins 1 and 4 of each chip.

Mixer U508 is an in-phase synchronous (I) detector demodulating the zero degree component of the amplified IF C-QUAM signal. Its output circuit, pins 6 and 12, contains a second harmonic trap to remove the 900 KHz mixing product leaving a predominant baseband output. This signal is fed through the follower circuits of U511 (in pins 10 and 13 and out pins 11 and 12) to operational amplifier circuits of U503A and U503B which filter and convert the signal to unbalanced form. This is the I Detector output appearing at TP505 and the rear panel BNC port, J8.

U509 is a quadrature (Q) detector demodulating the minus ninety degree component of the amplified IF C-QUAM signal. Its output, pins 6 and 12, contain a second harmonic trap to remove the 900 KHz mixing product leaving a predominant baseband signal. This signal is filtered and converted to unbalanced form by operational amplifiers U514C and U514D and appears at TP510 and the rear panel L-R Detector BNC port, J7.

The quadrature detector output signal from TP510 is fed to a 25 Hz inverting bandpass filter of U504A. A 25 Hz pilot signal at TP513 will be 180 degrees out of phase with the same signal at TP510. These two signals are summed at TP514 so that any 25 Hz pilot signal component cancel. The remaining quadrature detector signal is fed to a phase lock loop filter of U504B. The output of this filter controls the frequency of the voltage controlled crystal oscillator of Q513. The output of this oscillator is buffered by Q514 and divided (in frequency) by two in U513. The signal is further divided by four in the dual D flip flop, U512. The signals from U512 are a pair of balanced square waves in quadrature. The 0 degree balanced signal from U512, pins 2 and 3, feeds the high level port of the I detector, U508 pins 8 and 10. The -90 degree balanced signal from U512 pins 15 and 14 feeds the high level port of the Q detector, U509 pin 8 and 10.

The phase lock loop (PLL) described above acts to keep the average (DC) voltage of the quadrature detector output at zero. This can only occur when the signals from U512 are in proper phase relationship with the IF C-QUAM signal. If the signal at the high level port of the Q detector is not in quadrature (-90 degrees) with the in phase (carrier) component of the IF C-QUAM signal (a phase error), the output of the quadrature detector would contain a DC component. This DC signal would integrate in the loop filter causing a correction voltage to appear at the VCO to reduce the phase error.

The PLL has a narrow capture range which may not be sufficient during start-up to acquire lock on the IF C-QUAM signal. Under this condition, the I detector output at TP505 will swing wildly beyond the levels encountered in normal operation. Whenever this occurs, operational amplifier U503C will charge C566 through CR505 which will cause operational amplifier U503D to cut on K501. R651 is then placed in the loop filter circuit widening the PLL capture range.

As described in Section 1.4, the RF variable gain amplifier is controlled by an error signal derived from comparing the envelope detector signal with the I detector signal. The buffered output signals from these detectors are taken from U511 and converted to unbalanced signals by U506 and U507. These unbalanced signals from TP516 and TP517 are compared by the differential amplifier circuit of Q511 and Q512 producing the error or correction signal. This signal is buffered through Q510 feeding the correction line and controlling the variable RF amplifier gain.

The gain of the variable gain RF amplifier increases with negative voltage until, at a very high gain corresponding to large phase angles, the gain versus control voltage curve reverses slope. Under this condition, the decoder may "lockup". A voltage limiter circuit of U515 and Q509 on the correction line prevents "lockup". As the correction line approaches a protective voltage limit set by R501, U515A output (pin 7) comes off the negative rail and brings the positive input of U515B above the negative input. The output of U515B swings from the negative rail to the positive rail cutting on Q509 through CR507. Q509 shunts some of the differential signal to Q511 and Q512 reducing the loop gain. As the correction line voltage continues to fall, the output of U515A will rise until CR504 conducts for hard limiting on the correction lines.

5.6 AVC ASSEMBLY

The AVC Assembly regulates the level of the main channel -(1+L+R) and subchannel -(L-R) audio from the Decoder Assembly for proper metering. This is done by feeding the envelope detector -(1+L+R) and Q detector -(L-R) signals through two carefully adjusted four quadrant multipliers acting as matched variable amplifiers controlled by a common feedback signal. The feedback signal is derived from comparing the DC output of the envelope four quadrant multiplier (regulated envelope) with a DC standard voltage. Any difference between the two DC voltages will generate a feedback (error) signal adjusting the gain of both multipliers to re-establish a correct regulated envelope signal.

U102 and U104C together are the envelope multiplier. Its output is fed to U104A which compares this regulated envelope signal to the DC reference voltage from U104B. U104D filters the error signal and provides the gain control feedback voltage to maintain regulated signals from both multiplier circuits. If, for instance, the transmitter's power drops 5%, then the DC component of the envelope detector output and the AC components of the envelope and Q detectors would drop by 5%. If no correction were taken, our modulation meters would read 5% low. However, since the regulator circuit will increase the gain of both multipliers by 5% to restore the DC component level, the AC components are also increased by 5%, restoring correct meter reading.

Since the DC level from the regulated envelope signal is now fixed, it is easily removed by the circuit of U105C yielding main channel audio (L+R) for positive peak meter readings. This signal is inverted by U105B for -(L+R) peak meter readings. The output of the regulated quadrature multiplier, U103 and U106A, is inverted by U106C for +(L-R) peak meter readings and inverted again by U106D for -(L-R) meter readings. The +(L+R), -(L+R), +(L-R) and -(L-R) signals are dematrixed by U111 producing +L, -L, +R and -R signals for peak meter readings. These eight peak meter reading signals are routed to the front panel switch decks, S801 and S802, where they are selected and attenuated before traveling to the appropriate meter circuit and peak flasher (thumbwheel controlled) circuit.

The reference voltage (equal to regulated envelope DC component) from U104B is buffered by U105D and fed to the +(L+R) 125% comparator, U117C, and the (L-R) 100% comparator, U117A. The regulated envelope signal, (1+L+R), is buffered by U105A and fed to the +(L+R) 125% comparator circuit. R161, R162 and R255 divide the regulated envelope signal such that the regulated envelope signal must reach +125% in order for the voltage on U117C pin 8 to exceed the reference voltage on pin 9. When this occurs, the output of U117C will go low, triggering one-shot U108 which flashes the front panel +125% modulation indicator, DS802.

The regulated quadrature signal from U106C drives an absolute value circuit, U106B, which converts both positive and negative voltages to positive voltages. Whenever this absolute value signal exceeds the magnitude of the reference voltage, (L-R) is greater than 100% and the output of comparator U117A goes low. This triggers one-shot U107 flashing the front panel L-R LIMIT (L - R 100%) indicator, DS805.

Whenever the regulated envelope signal from U105A drops below zero volts, the negative envelope modulation is more than 100% (overmodulation) and the output of comparator U117D goes low. This triggers one-shot U109 firing the front panel L+R -100% indicator, DS801.

Comparator U117B functions to detect high phase angles of the C-QUAM signal by analyzing the absolute value of the regulated quadrature signal from U106B and a divided version of the regulated envelope signal. For high angles to occur, the regulated envelope signal must be small (negative envelope modulation) while the quadrature signal is large. This can be confirmed by observing Figure 1-3. R258 is adjusted so that the output of U117B goes low whenever the phase angle reaches 83 degrees, equivalent to 90% single channel modulation. A low output from U117B triggers one-shot U110 flashing the front panel NEGATIVE LIMIT (High Angle) indicator, DS806. If this flasher fires, corrective action should be taken since integrated circuit decoders in receivers cannot decode such high angle modulation.

The regulated quadrature signal from U106C is filtered by four 25 Hz bandpass sections of U113 to isolate the pilot signal. The output of this filter is fed to the rear panel pilot tone connector, J6, for pilot frequency checks. The PLL tone decoder, U114, will lock on the presence of a pilot signal illuminating the front panel PILOT indicator, DS807. CR108 and C136 peak detect the pilot signal for meter amplifier U115A and U115D which drives the carrier (pilot) meter, M803, through the meter function switch, S803.

The envelope detector output (unregulated) is filtered by U112D to remove modulation components. The output of U112D (positive DC) is compared to a -1.2 volt DC reference from U101A by summing amplifier U112C. Its output will be zero volts for a nominal signal level from the envelope detector (-1.000 VDC) which results in a SET reading (0 ma) on the carrier level meter, M803. U115C buffers and amplifies the output of the summing amplifier providing carrier level meter current through R264 and the meter function switch, S803. The circuits of U112A and U112B are protection circuits for the carrier level meter preventing excessive current flow in the meter circuit.

5.7 METER CONTROL ASSEMBLY

The +(L+R), -(L+R), +(L-R), -(L-R), +L, -L, +R and -R signals from the AVC Assembly are selected by the front panel switch deck assemblies and are fed to the variable peak flasher circuits on the Meter Control Assembly. For clarity, the left peak flasher circuit will be described since the right circuit is identical.

The selected signal is buffered by U305A and is compared to a variable threshold voltage by U306. The variable threshold voltage is generated by the constant current source of U303A and the variable resistor of the left thumbwheel switch on the front panel. This determines the threshold of modulation (the selected signal) that will trip comparator U306. Whenever the selected signal exceeds the threshold, the output of U306 will go low triggering one-shot U307. The output of the one-shot fires the front panel peak flasher indicator, DS803, and is fed to the rear panel remote flasher connector, J1.

After attenuation, the same selected signals from the AVC Assembly are fed to the meter quasi-peak detector circuits on the Meter Control Assembly. Again, for clarity, only the left meter circuit will be described since the right meter circuit is identical. The attenuated signal is fed through the amplifier circuit of U301B to a precision positive peak detector circuit of U301A and U301B. Its output is buffered by U302A driving the left front panel meter, M801. The detector output also goes through isolation resistors R442 and R443 to the rear panel remote modulation meter connector, J2.

For the single channel audio signals (+L, -L, +R and -R), proper peak flasher and metering performance requires the absence of pilot signal components. Whenever these single channel audio signals are selected, they are routed from the switch deck assemblies through pilot frequency rejection circuits on the Meter Control Assembly and back to the switch deck assemblies. Only the left pilot reject filter will be described since the right pilot reject filter is identical. The circuits of U304A, U304B and U305B form a bi-quad (state variable) filter configured as a notch filter. R325 adjusts the notch frequency to eliminate the 25 Hz pilot signal from the single channel audio signals.

The envelope detector and quadrature detector outputs from the Decoder Assembly are AC coupled to dematrixing circuits of U308 and U309. The outputs of U309B and U309D are sent to the left and right unbalanced output connectors, J9 and J11 respectively, on the rear panel. The outputs of U308A and U309C are isolated through T301 and T302 and are fed to the balanced output barrier strip, TB1, on the rear panel. Pilot signal components exist in all of these outputs.

5.8 POWER SUPPLY ASSEMBLY

The Power Supply Assembly converts the dual secondary AC voltages of the power transformer to regulated +5 VDC, +15 VDC and -15 VDC. The low voltage AC secondary from the power transformer is fed to a bridge rectifier circuit composed of CR904, CR905, CR907 and CR908. For units Serial Numbers 51 and below, the power transformer secondary is center tapped and diodes CR907 and CR908 are omitted. The rectified voltage charges filter capacitor C906 which supplies current to voltage regulator VR901 generating +5 VDC. VR901 is mounted on the side panel for heat sinking.

A higher voltage, center tapped, power transformer secondary feeds a second bridge rectifier composed of diodes CR900 through CR903. The positive side of this bridge rectifier charges filter capacitor C900 supplying current to the +15 VDC regulator, VR900, mounted on the side panel for heat sinking. The negative side of the bridge rectifier charges filter capacitor C901 which supplies current for the -15 VDC regulator, VR902, mounted on the side panel for heat sinking. The unregulated voltages from C900 and C901, appearing on J18 pin J and pin R respectively, are unused.

SECTION 6

MAINTENANCE

6.1 GENERAL

This section describes on-site maintenance procedures. The ASM-1 AM Stereo Modulation Monitor is a self-contained unit requiring little maintenance. The following paragraphs outline maintenance procedures that can be performed on-site.

CAUTION

When servicing the Monitor, absolutely no internal adjustments should be made (unless discussed in the following paragraphs). The ASM-1 Monitor is a precision instrument and factory calibrated using specialized test equipment under a precisely controlled and sequential procedure. Internal tampering of any adjustment will hinder many operating parameters and seriously effect its measuring/operating capability. If a problem exists that cannot be corrected and does not apply to the procedures outlined in this section, factory attention is necessary.

6.2 GENERAL CLEANING

It is obvious that when cleaning the front panel, any abrasive cleaning agent can do damage to the painted surface as well as to the meter faces. It is recommended that a liquid glass cleaner on a soft, clean cloth be used. The interior of the unit must be free of foreign objects. To clean it, power down the unit and remove carefully all printed circuit assemblies. With the unit upside down, wipe out all foreign objects. Forced, low pressure air can also be used. After the cleaning is complete, reseat all printed circuit assemblies in their proper card edge connectors as shown in Figure 2-1.

6.3 POWER SUPPLY CHECK

The DC outputs of the Power Supply Assembly can be checked and verified at the following locations on the Power Supply's card edge connector, J18:

Regulated Voltage	Tolerance	Location	Ripple
+5V	± 0.25V	J18-B,2,16	< 25 mV
+15V	± 0.50V	J18-F,6	< 25 mV
-15V	± 0.50V	J18-P,13	< 25 mV

Unregulated Voltage	Tolerance	Location	Ripple
+24V	± 4.0V	J18-J	N/A
-24V	± 4.0V	J18-R	N/A

6.4 REFERENCE OSCILLATOR ADJUSTMENT

The capture range of the PLL on the Decoder Assembly is ±20 Hz. This is a very small window in which the Decoder Assembly operates. It may be necessary to adjust the output of the reference oscillator on the Frequency Converter Assembly (D[illegible]24) to keep the PLL on the Decoder at or near the center of the capture range. To accomplish this, probe the banded side of CR506 on the Decoder Assembly with an accurate DC voltmeter, referenced to ground. Adjust C[illegible] on the Frequency Converter Assembly for 5 to 6 volts DC. Extreme caution must be given not to touch any other adjustments on the Decoder and Frequency Converter Assemblies.

6.5 FRONT PANEL METER LAMP REPLACEMENT

The internal drive circuitry for the front panel meter lamps was designed as to afford long life for the meter lamps. However, if it becomes necessary to change out a meter lamp, power down the unit and remove it from its rack mounting. Disconnect the front panel assembly by the four #10 machine screws on the front panel. Remove the bad meter lamp from its meter housing and desolder its leads from the terminal strip. Solder the leads of the new lamp to the terminal strip and reseat the new lamp into its meter housing. Carefully reinstall the front panel, insuring that no harness wires are being pinched or cut. Reinsert the four #10 machine screws on the front panel.

SECTION 7

LIST OF MATERIAL

7.1 INTRODUCTION

Maintenance parts in the ASM-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.

Reference designations for the parts of a subassembly are grouped in a hundreds series with some subassemblies having two hundreds series. For instance, the AVC assembly has both the 100s and 200s series of parts. R104 and R264 are both resistors on the AVC assembly.

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

7.2 LIST OF MATERIAL, MODEL ASM-1 SYSTEM COMPONENTS

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
Unit 1	Model ASM-1 AM Stereo Modulation Monitor	Delta	D15-12	015-0012
------	Power Cord	Belden	17280	678-0001
-------	Extender Card	Delta	D33-337	033-0337
-------	Technical Manual	Delta	D93-345	093-0345

7.3 LIST OF MATERIAL, FINAL ASSEMBLY, MODEL ASM-1 AM STEREO MONITOR, D15-12, REV. K

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
A1	Switch Panel, Left	Delta	D33-327	033-0327
A2	Switch Panel, Right	Delta	D33-326	033-0326
A100	AVC Assembly	Delta	D33-328	033-0328
A300	Meter Control Assembly	Delta	D33-329	033-0329
A500	Decoder Assembly	Delta	D33-332	033-0332
A500	Decoder II Assembly	Delta	D33-363	033-0363
A700	Frequency Converter Assembly (10 KHz Frequency Spacing)	Delta	D33-324-3	033-0324-003
A700	Frequency Converter Assembly (9 KHz Frequency Spacing)	Delta	D33-324-4	033-0324-004
A800	Power Attenuator Assembly	Delta	D33-333	033-0333
A900	Power Supply Assembly	Delta	D33-330-2	033-0330-002
DS801	LED, Red, 5V	Dialight	507-4757-3731-500	646-0001
DS802 thru DS807	Same as DS801			
DS808	Bulb, 28 VDC, 40MA, T1-3/4, 6 Inch Wire Leads	Micro Lamp	M2187	644-0018
DS809 thru DS811	Same as DS808			

7.3 LIST OF MATERIAL, FINAL ASSEMBLY, MODEL ASM-1 AM STEREO MONITOR, D15-12, REV. K CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
F1	Fuse, Type 3AG, Slo-Blo, 1A (Use For 120 VAC Operation)	Littelfuse	313001	632-1020
F1	Fuse, Type 3AG, Slo-Blo, 0.5A (Use For 240 VAC Operation)	Littelfuse	313.500	632-1015
FL1	Filter, Line	Corcom RTron	2K4 RNF-2P6	630-0002
J14	Connector, Card Edge, Zero Insertion Force, Side Entry	Amp	531025-3	618-0077
J15 thru J18	Same as J14			
M801	Meter, Modulation Level	Meter-Master	591C42-20A	002-0051
M802	Same as M801			
M803	Meter, Carrier/Pilot Level	Meter-Master	591B42-19	002-0050
M819	Resistor, Variable, 200 Ohm	Allen-Bradley	RV4NAYSD201A	240-0035
S801	Switch, SPDT, Panel Mount	American Switch	ST1-1KMZQ	660-0049
S804	Thumbwheel Assembly, Left and Right	Delta	D34-69	034-0069
S805	Same as 804			
T1	Transformer, Power, Dual Primary, Dual Secondary	Signal	DMT8-15	362-0031
TB1	Terminal Block, 6 Position	Kulka	599-2004-6	670-0010-006
W1	Cord, Line, 3 Cond, 13 AWG	Belden	17280	678-0001

7.3 LIST OF MATERIAL, FINAL ASSEMBLY, MODEL ASM-1 AM STEREO MONITOR, D15-12, REV. K CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
XDS801	Socket, LED, Panel Mount	Dialight	250-8738-14-504	648-0004
XDS802 thru XDS807	Same as XDS801			
XF1	Fuseholder	Littelfuse	342014AL	364-0010
XR819	Knob, Black, Matte Finish	Raytheon	90-1-2G	730-0028

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C106	Capacitor, Fixed, Electrolytic, 100 uF, 25V	Nichicon	ULB1E101M	320-0067
C107	Capacitor, Fixed, Film, .047 uF, 100V	Nichicon	QYA2A473K	330-0020
C108	Same as C106			
C109	Capacitor, Fixed, Monolithic, Ceramic, .47 uF, 50V	Sprague	1C20Z5U474M050B	310-0052
C110	Capacitor, Fixed, Film, .01 uF, 100V	Nichicon	QYA2A103K	330-0015
C111	Same as C109			
C112	Same as C110			
C113	Same as C109			
C114	Same as C110			
C115	Same as C109			
C116	Same as C110			
C117	Capacitor, Fixed, Tantalum, 4.7 uF, 50V	Sprague	CSR13G475KM	326-0009-001
C118	Capacitor, Fixed, Electrolytic, 2.2 uF, 50V	Nichicon	ULB1H2R2M	320-0062
C119	Capacitor, Fixed, Film, 0.1 uF, 100V	Nichicon	QYA2A104K	330-0021

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C120	Same as C119			
C121	Same as C119			
C122	Capacitor, Fixed, Polycarb, NPO, 0.1 uF, 1%, 100V	S & EI	22RB104F	330-0033
C123	Capacitor, Fixed, Mica, 82 PF, 500V		CM05ED820J03	302-0820
C124	Same as C107			
C125	Capacitor, Fixed, Polyester Film, .001 uF	Nichicon	QYA2A102K	330-0012
C126	Same as C119			
C127	Same as C110			
C128	Same as C122			
C129	Same as C123			
C131	Same as C106			
C133	Same as C117			
C134	Same as C117			
C135	Capacitor, Fixed, Electrolytic, 10 uF, 25V	Nichicon	ULB1E100M	320-0064
C136	Same as C117			
C137	Same as C117			

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C138	Same as C119			
C139	Same as C119			
C141	Same as C119			
C142	Same as C135			
C143 thru C147	Same as C109			
C148	Same as C106			
CR101	IC, Diode, Zener, 1.2V		LM385H-1.2	548-0025
CR102	Same as CR101			
CR103	Diode, Silicon		1N4148	410-4148
CR104	Same as CR103			
CR106 thru CR109	Same as CR103			
CR113	Same as CR103			
CR114	Same as CR103			
R104	Resistor, Fixed, Film, 3.3K Ohm, 5% 1/4W		RL07S332J	202-0332
R109	Resistor, Fixed, Film, 8.2K Ohm, 5%, 1/4W		RL07S822J	202-0822

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R110	Resistor, Fixed, Film, 10K Ohm, 5%, 1/4W		RL07S103J	202-0103
R111	Same as R104			
R112	Resistor, Fixed, Film, 4.75K Ohm, 1%		RN55D4751F CCF554751F	212-4751
R113	Same as R112			
R114	Resistor, Fixed, Film, 27K Ohm, 5%, 1/4W		RL07S273J	202-0273
R115	Resistor, Fixed, Film, 330K Ohm, 5%, 1/4W		RL07S334J	202-0334
R116	Same as R115			
R117	Same as R114			
R118	Resistor, Fixed, Film, 15K Ohm, 5%, 1/4W		RL07S153J	202-0153
R119	Resistor, Fixed, Film, 22K Ohm, 5%, 1/4W		RL07S223J	202-0223
R120	Same as R109			
R121	Same as R110			
R122	Same as R104			
R123	Same as R112			
R124	Same as R112			

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R125	Same as R114			
R126	Same as R115			
R127	Same as R115			
R128	Same as R114			
R129	Same as R118			
R130	Same as R119			
R131	Resistor, Fixed, Film, 75K Ohm, 5%, 1/4W		RL07S753J	202-0753
R132	Resistor, Variable, 5K Ohm	Bourns	3299Y-1-502	244-0076
R133 thru R135	Same as R132			
R136	Same as R131			
R137	Same as R109			
R138	Same as R110			
R139	Resistor, Fixed, Film, 12K Ohm, 5%, 1/4W		RL07S123J	202-0123
R140	Same as R109			
R141	Same as R104			
R142 thru R146	Same as R109			

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R147	Same as R115			
R148	Same as R110			
R149	Resistor, Fixed, Film, 82K Ohm, 5%, 1/4W		RL07S823J	202-0823
R150	Resistor, Fixed, Film, 24.9K Ohm, 1%		RN55D2492F CCF552492F	212-2492
R151	Same as R150			
R152	Resistor, Fixed, Film, 10.0K Ohm, 1%		RN55D1002F CCF551002F	212-1002
R153	Same as R152			
R154	Same as R119			
R155	Resistor, Fixed, Film, 33K Ohm, 5%, 1/4W		RL07S333J	202-0333
R156	Resistor, Fixed, Film, 33.2K Ohm, 1%		RN55D3322F CCF553322F	212-3322
R157	Same as R156			
R158	Same as R156			
R159	Same as R118			
R160	Resistor, Fixed, Film, 820 Ohm, 5%, 1/4W		RL07S821J	202-0821
R161	Same as R110			

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R162	Resistor, Fixed, Film, 6.8K Ohm, 5%, 1/4W		RL07S682J	202-0682
R163	Same as R118			
R164	Same as R160			
R165	Same as R160			
R166	Same as R118			
R167	Same as R160			
R170	Same as R160			
R171	Same as R118			
R172	Same as R160			
R173	Same as R160			
R174	Resistor, Fixed, Film, 100 Ohm, 5%, 1/4W		RL07S101J	202-0101
R175	Same as R118			
R176	Resistor, Fixed, Film, 180 Ohm, 5%, 1/4W		RL07S181J	202-0181
R177	Resistor, Fixed, Film, 180K Ohm, 5%, 1/4W		RL07S184J	202-0184
R178	Resistor, Fixed, Film, 330 Ohm, 5%, 1/2W		RL20S331J	204-0331

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R179	Same as R177			
R180	Same as R178			
R181	Same as R177			
R182	Same as R178			
R183	Same as R177			
R184	Same as R178			
R185	Same as R162			
R186	Same as R162			
R187	Same as R132			
R188	Resistor, Fixed, Film, 3.9K Ohm, 5%, 1/4W		RL07S392J	202-0392
R189	Same as R152			
R190	Same as R152			
R191	Same as R162			
R192	Same as R162			
R193	Same as R132			
R194	Same as R188			
R195	Same as R152			

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R196	Same as R152			
R197	Resistor, Fixed, Film, 150K Ohm, 5%, 1/4W		RL07S154J	202-0154
R198	Same as R149			
R199	Same as R177			
R201	Resistor, Fixed, Film, 5.6K Ohm, 5%, 1/4W		RL07S562J	202-0562
R202	Resistor, Fixed, Film, 120K Ohm, 5%, 1/4W		RL07S124J	202-0124
R203	Same as R201			
R204	Resistor, Fixed, Film, 39K Ohm, 5%, 1/4W		RL07S393J	202-0393
R205	Resistor, Fixed, Film, 13K Ohm, 5%, 1/4W		RL07S133J	202-0133
R206	Resistor, Fixed, Film, 1.2K Ohm, 5%, 1/4W		RL07S122J	202-0122
R207	Same as R139			
R208	Same as R204			
R209	Same as R205			
R210	Same as R206			
R211	Same as R139			

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R212	Resistor, Fixed, Film, 1.21M Ohm, 1%		RN55D1214F CCF551214F	212-1214
R213	Resistor, Fixed, Film, 1M Ohm, 1%		RN55D1004F CCF551004F	212-1004
R214	Resistor, Fixed, Film, 4.75M Ohm, 1%		RN55D4754F CCF554754F	212-4754
R215	Same as R212			
R216	Resistor, Fixed, Film, 562K Ohm, 1%		RN55D5623F CCF555623F	212-5623
R217	Resistor, Fixed, Film, 2.21M Ohm, 1%		RN55D2214F CCF552214F	212-2214
R219	Resistor, Fixed, Film, 390K Ohm, 5%, 1/4W		RL07S394J	202-0394
R220	Resistor, Fixed, Film, 270K Ohm, 5%, 1/4W		RL07S274J	202-0274
R221	Resistor, Fixed, Film, 1.2M Ohm, 5%, 1/4W		RL07S125J	202-0125
R222	Same as R212			
R223	Same as R213			
R224	Resistor, Fixed, Film, 560 Ohm, 5%, 1/4W		RL07S561J	202-0561
R225	Same as R132			

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R226	Resistor, Fixed, Film, 470 Ohm, 5%, 1/4W		RL07S471J	202-0471
R227	Same as R104			
R228	Same as R201			
R229	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R230	Same as R132			
R231	Same as R178			
R232	Same as R109			
R233	Same as R109			
R234	Same as R202			
R235	Same as R202			
R236	Same as R162			
R237	Same as R204			
R238	Same as R139			
R239	Same as R206			
R240	Same as R139			
R241	Same as R110			
R242	Same as R132			

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R243	Same as R132			
R244	Resistor, Fixed, Film, 3K Ohm, 5%, 1/4W		RL07S302J	202-0302
R245 thru R247	Same as R132			
R250	Same as R201			
R251	Same as R104			
R252	Same as R132			
R254	Same as R214			
R255	Same as R132			
R256	Same as R132			
R257	Same as R174			
R258 thru R260	Same as R132			
R261	Same as R156			
R262	Resistor, Fixed, Film, 330 Ohm, 5%, 1/4W		RL07S331J	202-0331
R263 thru R268	Same as R110			
U101	Integrated Circuit, Dual Op-Amp, 8 Pin	T. I.	TL082CP	540-0028

7.4 LIST OF MATERIAL, AVC ASSEMBLY, REFERENCE DESIGNATION A100, D33-328, REV. J CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
U102	Integrated Circuit, Modulator	Motorola	MC1495L	548-0024
U103	Same as U102			
U104	Integrated Circuit, Quad Op-Amp	T. I.	TL084CN	540-0026
U105	Same as U104			
U106	Same as U104			
U107	Integrated Circuit, Timer, 8 Pin	Motorola	MC1455P1	548-0001
U108 thru U110	Same as U107			
U111 thru U113	Same as U104			
U114	Integrated Circuit, PLL, 8 Pin	National Semiconductor	NE567N	548-0027
U115	Same as U104			
U116	Integrated Circuit, Op-Amp, 8 Pin	Motorola	MC1741CP	540-0002
U117	Integrated Circuit, Comparator, 14 Pin	Motorola	MC3302P	540-0014
W1	Header, Test/Operate Jumper, 3 Position	Berg	65507-103	
XW1	Jumper, Test/Operate	Berg	65474-001	642-0013

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C304	Capacitor, Fixed, Polycarbonate, .047 uF, 1%	S & EI	22RB473F	330-0032
C305	Same as C304			
C312	Same as C304			
C313	Same as C304			
C317	Capacitor, Fixed, Tantalum, 4.7 uF, 35 VDC	Sprague	196D475X9035JA1	326-0001
C318	Same as C317			
C319	Capacitor, Fixed, Tantalum, 10 uF, 35V	Sprague	196D106X9035PE4	326-0015
C320 thru C322	Same as C319			
C323	Capacitor, Fixed, Electrolytic, 100 uF, 25V	Nichicon	ULB1E101M	320-0067
C324	Capacitor, Fixed, Monolithic Ceramic, .47 uF, 50V	Sprague	1C20Z5U474M050B	310-0052
C325	Capcitor, Fixed, Ceramic, .01 uF, 1KV	Sprague	5GA-S10	310-0017
C326	Same as C323			
C327	Same as C324			
C328	Same as C325			

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C329	Same as C323			
C330	Capacitor, Fixed, Polyester Film, 0.0033 uF, 100V	Nichicon	QYA2A332K	330-0014
C331	Same as C330			
C332	Capacitor, Fixed, Ceramic Disc, .001 uF, 1KV	Sprague	5GA-D10	310-0013
C333	Same as C332			
C334	Same as C323			
C335	Capacitor, Fixed, Monolithic Ceramic, 0.1 uF, 50V	Sprague	1C20Z5U104M050B	310-0051
C336	Same as C335			
C337	Capacitor, Fixed, Electrolytic, 10 uF, 25V	Nichicon	ULB1E100M	320-0064
C338	Same as C337			
C339	Same as C323			
C340	Capacitor, Fixed, Polyester Film, .047 uF, 100V	Nichicon	QYA2A473K	330-0020
C341	Same as C340			
C342	Same as C323			
C343	Same as C323			

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C344	Capacitor, Fixed, Ceramic Disc, .0047 uF, 1KV	Sprague	5GA-D47	310-0048
C345 thru C348	Same as C324			
C349	Same as C344			
C350	Same as C324			
C351	Same as C324			
CR301	Diode, Silicon, Hot Carrier	H. P.	5082-2800	416-0020
CR302	Same as CR301			
CR304	Same as CR301			
CR305	Same as CR301			
Q301	Transistor, NPN		MPS6513	426-0008
R318	Resistor, Fixed, Film, 681K Ohm, 1%		RN55D6813F	212-6813
R319	Same as R318			
R320	Resistor, Fixed, Film, 56.2K Ohm, 1%		RN55D5622F	212-5622
R321 thru R324	Same as R320			
R325	Resistor, Variable, 100K Ohm	Bourns	3299Y-1-104	244-0078

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R326	Resistor, Fixed, Film, 270K Ohm, 5%, 1/4W		RL07S274J	202-0274
R327	Resistor, Fixed, Film, 1.5K Ohm, 5%, 1/4W		RL07S152J	202-0152
R343	Resistor, Fixed, Film, 100 Ohm, 5%, 1/4W		RL07S101J	202-0101
R356	Same as R318			
R357	Same as R318			
R358 thru R362	Same as R320			
R363	Same as R325			
R364	Same as R326			
R365	Same as R327			
R377	Resistor, Fixed, Film, 22K Ohm, 5%, 1/4W		RL07S223J	202-0223
R378	Resistor, Fixed, Film, 10K Ohm, 5%, 1/4W		RL07S103J	202-0103
R379	Resistor, Fixed, Film, 8.2K Ohm, 5%, 1/4W		RL07S822J	202-0822
R380	Resistor, Variable, 5K Ohm	Bourns	3299Y-1-502	244-0076
R381	Same as R379			

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R382	Same as R379			
R383	Same as R380			
R384	Same as R379			
R385	Same as R380			
R386	Resistor, Fixed, Film, 3.3K Ohm, 5%, 1/4W		RL07S332J	202-0332
R387	Same as R380			
R389	Same as R343			
R390 thru R392	Same as R343			
R394	Same as R343			
R395	Resistor, Fixed, Film, 820 Ohm, 5%, 1/4W		RL07S821J	202-0821
R396	Same as R395			
R397	Same as R327			
R398	Resistor, Fixed, Film, 121K Ohm, 1%		RN55D1213F	212-1213
R399	Resistor, Fixed, Film, 33.2K Ohm, 1%		RN55D3322F	212-3322
R401	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R402	Resistor, Variable, 500 Ohm	Bourns	3299Y-1-501	244-0072
R403	Same as R399			
R404	Same as R398			
R405	Resistor, Fixed, Film, 180K Ohm, 5%, 1/4W		RL07S184J	202-0184
R406	Resistor, Fixed, Film, 330 Ohm, 5%, 1/2W		RL20S331J	204-0331
R407	Same as R406			
R408	Same as R395			
R409	Same as R395			
R410	Same as R398			
R411	Same as R399			
R412	Same as R401			
R413	Same as R402			
R414	Same as R399			
R415	Same as R398			
R416	Same as R405			
R417	Same as R406			
R418	Same as R406			

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R419	Same as R378			
R421	Same as R327			
R422	Resistor, Fixed, Film, 150 Ohm, 5%, 1/2W		RL07S151J	202-0151
R425	Resistor, Fixed, Film, 5.6K Ohm, 5%, 1/4W		RL07S562J	202-0562
R426	Resistor, Fixed, Film, 2.2K Ohm, 5%, 1/4W		RL07S222J	202-0222
R427	Same as R426			
R428	Same as R327			
R429	Same as R327			
R430	Resistor, Fixed, Film, 100K Ohm, 5%, 1/4W		RL07S104J	202-0104
R431	Same as R430			
R432	Same as R386			
R433	Same as R343			
R434	Resistor, Fixed, Film, 10 Ohm, 5%, 1/4W		RL07S100J	202-0100
R435	Same as R434			
R436	Same as R432			
R437	Same as R343			

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R438	Same as R386			
R439	Resistor, Fixed, Film, 4.7K Ohm, 5%, 1/4W		RL07S472J	202-0472
R440	Resistor, Fixed, Film, 12K Ohm, 5%, 1/4W		RL07S123J	202-0123
R441	Resistor, Fixed, Film, 22M Ohm, 5%, 1/4W		RL07S226J	202-0226
R442	Resistor, Fixed, Film, 470 Ohm, 5%, 1/4W		RL07S471J	202-0471
R443	Resistor, Fixed, Film, 68 Ohm, 5%, 1/4W		RL07S680J	202-0680
R444	Same as R442			
R445	Resistor, Fixed, Film, 130 Ohm, 5%, 1/4W		RL07S131J	202-0131
R446	Same as R439			
R447	Same as R440			
R448	Same as R441			
R449	Same as R442			
R450	Same as R443			
R451	Same as R442			
R452	Same as R445			

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R453	Same as R426			
R454	Same as R426			
R455	Resistor, Fixed, Film, 10K Ohm, 1%		RN55D1002F	212-1002
R456 thru R458	Same as R455			
R461	Same as R378			
R462	Same as R378			
R463	Same as R440			
R464	Same as R378			
R465	Same as R377			
R466	Same as R378			
R467	Same as R401			
R468	Resistor, Fixed, Film, 330 Ohm, 5%, 1/4W		RL07S331J	202-0331
T301	Transformer, Audio, 1500 Ohm P, 600 Ohm S	Marvel Electric	M47A254	360-0005
T302	Same as T301			
U301	Integrated Circuit, Quad Op-Amp	T. I.	TL084CN	540-0026
U302	Same as U301			

7.5 LIST OF MATERIAL, METER CONTROL ASSEMBLY, REFERENCE DESIGNATION A300, D33-329, REV. F CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
U303	Integrated Circuit, Op-Amp 8 Pin DIP	T. I.	TL082CP	540-0028
U304	Same as U301			
U305	Same as U301			
U306	Integrated Circuit, Comparator, 14 Pin DIP	Motorola	MC3302P	540-0014
U307	Integrated Circuit, Timer, 8 Pin DIP	Motorola	MC1455P1	548-0001
U308	Same as U301			
U309	Same as U301			
U310	Same as U307			
W1	Jumper, #22 AWG Bus Wire, Teflon Sleeving			
XU303	Socket, IC, 8 Pin DIP	Samtec	ICO-308-SGT	736-0036
XU307	Same as XU303			
XU310	Same as XU303			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C501	Capacitor, Fixed, Ceramic, Disc, 6.8 PF, 500V, NPO	Sprague	10TCC-V68	312-0015
C502	Same as C501			
C503	Capacitor, Fixed, Polyester Film, .047 uF, 100V	Nichicon	QYA2A473K	330-0020
C504	Same as C503			
C506	Capacitor, Fixed, Polyester Film, .01 uF, 100V	Nichicon	QYA2A103K	330-0015
C508	Capacitor, Fixed, Monolithic, Ceramic, .47 uF, 50V	Sprague	1C20Z5U474M050B	310-0052
C509	Capacitor, Ceramic, 10 PF, NPO	Sprague	10TCC-Q10	312-0016
C510	Same as C503			
C512	Capacitor, Fixed, Ceramic, Disc, 56 PF, 1KV, NPO	Sprague	10TCC-Q56	312-0019
C513	Same as C512			
C514	Capacitor, Fixed, Polyester Film, .001 uF, 100V	Nichicon	QYA2A102K	330-0012
C515	Same as C514			
C516	Capacitor, Fixed, Polyester Film, .1 uF, 100V	Nichicon	QYA2A104K	330-0021
C517	Same as C516			
C518	Same as C514			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C519	Same as C514			
C520 thru C523	Same as C512			
C524	Capacitor, Fixed, Polyester, Tubular, 1.0 uF, 50V	Cornell-Dubilier	MMW05W1-20	330-0036
C525	Capacitor, Fixed, Metalized, Polycarbon, 6.8 uF, 100V	Roederstein	MKC1860-568/01	330-0035
C527	Capacitor, Fixed, Ceramic, Disc, .001 uF, 1KV	Sprague	5GA-D10	310-0013
C530	Capacitor, Fixed, Tantalum, 4.7 uF, 35V	Sprague	196D475X9035JA1	326-0001
C533	Same as C530			
C534	Same as C527			
C539	Capacitor, Fixed, Ceramic, Disc, 33 PF, 1KV, N075	Sprague	10TCC-Q33	312-0017
C540	Same as C530			
C541	Same as C539			
C542	Same as C530			
C543	Same as C503			
C544	Same as C530			
C545	Same as C506			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C546	Same as C506			
C547	Same as C530			
C548	Capacitor, Fixed, Ceramic Disc, 100 PF, 1KV, N750	Sprague	10TCC-T10	312-0021
C549	Same as C548			
C553	Capacitor, Fixed, .0047 uF, 100V, 1%	S & EI	22RB472F	330-0031
C554 thru C556	Same as C553			
C557	Same as C503			
C558	Capacitor, Fixed, Monolithic, Ceramic, .1 uF, 50V	Sprague	1C20Z5U104M050B	310-0051
C559	Same as C506			
C560	Same as C503			
C561	Capacitor, Fixed, Mica, 180 PF, 5%, 500V		CM05FD181J03	302-0181
C564	Same as C553			
C565	Same as C553			
C566	Same as C508			
C568	Same as C503			
C569	Same as C558			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C570 thru C573	Same as C503			
C581	Same as C503			
C582	Same as C503			
C583	Same as C530			
C584	Same as C539			
C585	Same as C539			
C586	Capacitor, Fixed, Polyester Film, 1800 PF, 100V	Nichicon	QYA2A182K	330-0028
C587	Same as C539			
C588	Same as C558			
C589	Capacitor, Fixed, Mica, 5%			
C590	Capacitor, Fixed, Silver Mica, 330 PF, 5%, 500V		CM05CD331J03	302-0331
C591	Same as C508			
C592	Capacitor, Variable, Ceramic, 7 - 40 PF	Tusonix	513-011G7-40	346-0002
CR501	Diode, Silicon		1N4148	410-4148
CR503	Diode, Varactor	Motorola	MV1404	416-0017
CR504 thru CR506	Same as CR501			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
K501	Relay	Gordos	741A7	654-0072
L501	Inductor, Variable	Beltronics	BT82-0523	352-0030
L502	Inductor, Variable	Beltronics	BT82-0522	352-0029
L503	Inductor, Variable	Beltronics	BT83-0638	352-0031
L504	Same as L503			
L505	Same as L503			
Q501	Transistor, PNP	Motorola	MPS6517	426-0009
Q502	Same as Q501			
Q503	Transistor, NPN	Motorola	MPS6513	426-0008
Q504	Same as Q503			
Q505	Same as Q503			
Q506	Same as Q501			
Q507	Same as Q503			
Q508	Same as Q501			
Q509	Same as Q501			
Q510	Same as Q503			
Q511	Same as Q501			
Q512	Same as Q501			
Q513	Transistor, FET	Motorola	U310	436-0002

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
Q514	Same as Q503			
R501	Resistor, Variable, 10K Ohm	Bourns	3006P-1-103	244-0030
R502	Resistor, Variable, 500K Ohm	Bourns	3006P-1-504	244-0079
R503	Resistor, Variable, 100 Ohm	Bourns	3006P-1-101	244-0070
R504	Same as R503			
R505	Same as R503			
R509	Resistor, Fixed, Film, 270 Ohm, 5%, 1/4W		RL07S271J	202-0271
R510	Same as R509			
R511	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R512	Resistor, Fixed, Film, 332 Ohm, 1%, 1/4W		RN55D3320F	212-3320
R513	Same as R511			
R514	Same as R512			
R515	Resistor, Fixed, Film, 1.3K Ohm, 5%, 1/4W		RL07S132J	202-0132
R516	Same as R515			
R517	Resistor, Fixed, Film, 100 Ohm, 5%, 1/4W		RL07S101J	202-0101
R518	Same as R511			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R519	Same as R511			
R520	Same as R517			
R521	Same as R517			
R522	Resistor, Fixed, Film, 330 Ohm, 5%, 1/4W		RL07S331J	202-0331
R523	Resistor, Fixed, Film, 68 Ohm, 5%, 1/4W		RL07S680J	202-0680
R524	Same as R523			
R525	Same as R522			
R526	Resistor, Fixed, Film, 22 Ohm, 5%, 1/4W		RL07S220J	202-0220
R527	Same as R526			
R528	Resistor, Fixed, Film, 2.74K Ohm, 1%, 1/4W		RN55D2741F CCF552741F	212-2741
R529	Same as R528			
R530	Same as R523			
R531	Resistor, Fixed, Film, 680 Ohm, 5%, 1/4W		RL07S681J	202-0681
R532	Same as R523			
R533	Resistor, Fixed, Film, 1.8K Ohm, 5%, 1/4W		RL07S182J	202-0182

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R534	Same as R531			
R535	Same as R523			
R536	Same as R523			
R537	Resistor, Fixed, Film, 820 Ohm, 5%, 1/4W		RL07S821J	202-0821
R538	Resistor, Fixed, Film, 750 Ohm, 5%, 1/4W		RL07S751J	202-0751
R539	Same as R537			
R540	Resistor, Fixed, Film, 5.1K Ohm, 5%, 1/4W		RL07S512J	202-0512
R541	Resistor, Fixed, Film, 1.6K Ohm, 5%, 1/4W		RL07S162J	202-0162
R542	Resistor, Fixed, Film, 2.4K Ohm, 5%, 1.4W		RL07S242J	202-0242
R543	Same as R542			
R544	Resistor, Fixed, Film, 470 Ohm, 5%, 1/4W		RL07S471J	202-0471
R545	Same as R544			
R546	Resistor, Fixed, Film, 3.6K Ohm, 5%, 1/4W		RL07S362J	202-0362
R547	Resistor, Fixed, Film, 2.7K Ohm, 5%, 1/4W		RL07S272J	202-0272
R548	Same as R547			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R549	Resistor, Fixed, Film, 4.7K Ohm, 5%, 1/4W		RL07S472J	202-0472
R550	Same as R547			
R551	Resistor, Fixed, Film, 12K Ohm, 5%, 1/4W		RL07S123J	202-0123
R552	Same as R547			
R553	Same as R541			
R554	Same as R551			
R555	Same as R547			
R556	Same as R547			
R557	Resistor, Fixed, Film, 27K Ohm, 5%, 1/4W		RL07S273J	202-0273
R558	Same as R557			
R559	Resistor, Fixed, Film, 56K Ohm, 5%, 1/4W		RL07S563J	202-0563
R560	Same as R559			
R561	Same as R531			
R562	Resistor, Fixed, Film, 82K Ohm, 5%, 1/4W		RL07S823J	202-0823
R563	Resistor, Fixed, Film, 2.2M Ohm, 5%, 1/4W		RL07S225J	202-0225

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R564	Same as R511			
R565	Resistor, Fixed, Film, 1.2K Ohm, 5%, 1/4W		RL07S122J	202-0122
R566	Same as R523			
R567	Same as R523			
R568	Resistor, Fixed, Film, 3.3K Ohm, 5%, 1/4W		RL07S332J	202-0332
R569	Resistor, Fixed, Film, 910K Ohm, 5%, 1/4W		RL07S914J	202-0914
R570	Resistor, Fixed, Film, 62K Ohm, 5%, 1/4W		RL07S623J	202-0623
R571	Resistor, Variable, 5K Ohm,	Bourns	3006P-1-502	244-0019
R572	Same as R568			
[illegible]	[illegible]			
R574	Resistor, Fixed, Film, 270K Ohm, 5%, 1/4W		RL07S274J	202-0274
R575	Resistor, Fixed, Film, 43K Ohm, 5%, 1/4W		RL07S433J	202-0433
R576	Same as R559			
R577	Same as R557			
R578	Same as R557			
R579	Same as R559			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R580	Same as R547			
R581	Same as R547			
R582	Same as R559			
R583	Same as R557			
R584	Same as R557			
R585	Same as R559			
R586	Same as R523			
R587	Same as R523			
R588	Same as R528			
R589	Resistor, Fixed, Film, 51 Ohm, 5%, 1/4W		RL07S510J	202-0510
R590	Same as R531			
R591	Same as R528			
R592	Same as R589			
R593	Same as R541			
R594	Resistor, Fixed, Film, 470K Ohm, 5%, 1/4W		RL07S474J	202-0474
R595	Same as R523			
R596	Same as R523			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R597	Same as R528			
R598	Same as R541			
R599	Same as R531			
R601	Same as R526			
R602	Same as R526			
R603	Same as R522			
R604	Same as R526			
R605	Same as R526			
R606	Same as R522			
R607	Resistor, Fixed, Film, 2.2M Ohm, 5%, 1/4W		RL07S222J	202-0222
R608	Same as R607			
R609	Same as R533			
R610	Same as R533			
R611	Same as R528			
R612	Resistor, Fixed, Film, 51.1 Ohm, 1%		RN55D51R1F CCF5551R1F	212-0511
R613	Same as R612			
R614	Same as R607			
R615	Same as R549			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R616	Resistor, Fixed, Film, 6.8K Ohm, 5%, 1/4W		RL07S682J	202-0682
R617	Resistor, Fixed, Film, 390 Ohm, 5%, 1/4W		RL07S391J	202-0391
R618	Same as R617			
R619	Same as R528			
R620	Same as R528			
R621	Same as R612			
R622	Same as R612			
R623	Same as R528			
R624	Same as R528			
R625	Same as R612			
R626	Same as R612			
R627 thru R630	Same as R549			
R636	Same as R544			
R637	Same as R544			
R638	Same as R528			
R639	Same as R528			
R640	Same as R517			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R643	Same as R511			
R644 thru R648	Same as R523			
R649	Resistor, Fixed, Film, 10K Ohm, 5%, 1/4W		RL07S103J	202-0103
R650	Same as R616			
R651	Same as R607			
R661	Same as R522			
R663	Same as R616			
R664	Same as R523			
R665	Resistor, Fixed, Film, 120K Ohm, 5%, 1/4W		RL07S124J	202-0124
R666	Resistor, Fixed, Film, 7.5K Ohm, 5%, 1/4W		RL07S752J	202-0752
R667	Same as R594			
R668	Same as R511			
R671	Same as R607			
U501	Integrated Circuit, Transistor Array, 14 Pin	RCA	CA3045	542-0011
U502	Same as U501			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
U503	Integrated Circuit, Quad Op-Amp, 14 Pin	T. I.	TL084CN	540-0026
U504	Same as U503			
U505	Integrated Circuit, Modulator, 14 Pin	Motorola	MC1496L	548-0010
U506	Same as U501			
U507	Same as U501			
U508	Same as U505			
U509	Same as U505			
U510	Integrated Circuit, Triple Line Receiver, 16 Pin	Motorola	MC10116L	516-0005
U511	Integrated Circuit, Transistor Array, 16 Pin	RCA	CA3183E	542-0013
U512	Integrated Circuit, Dual D Flip-Flop, 16 Pin	Motorola	MC10131L	516-0006
U513	Same as U512			
W1	Jumper, Coaxial	Delta	D51-45-1	051-0045-001
W2	Jumper, Coaxial	Delta	D51-45-2	051-0045-002
W3	Jumper, Coaxial	Delta	D51-45-3	051-0045-003
W4	Jumper, #22 AWG, Bus Wire, Teflon Tubing			

7.6 LIST OF MATERIAL, DECODER ASSEMBLY, REFERENCE DESIGNATION A500, D33-332, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
XC589	Socket, Spring, 0.036-0.051 Diameter	Amp	380598-3	736-0042
Y501	Crystal, 3.6 MHz, HC-6/U	Delta	D05-110-37	005-0110-037

7.7.1 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-1 AND D33-324-2, REV. N

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C701	Capacitor, Fixed, Mica, 180 pF, ±5%		CM05FD181J03	302-0181
C703	Capacitor, Fixed, Ceramic, Disc, .001 uF, 1000V	Sprague	5GA-D10	310-0013
C704	Same as C703			
C705	Capacitor, Fixed, Monolithic, Ceramic, .1 uF, 50V	Sprague	1C20Z5U104M050B	310-0051
C706	Same as C705			
C707	Same as C701			
C708	Same as C705			
C709	Capacitor, Silver Mica, 33 PF		CM05ED330J03	302-0330
C710	Capacitor, Variable, 5.5-18 PF, Trimmer	Erie	DV11PR18A	346-0003
C712 thru C715	Same as C705			
C716	Capacitor, Fixed, Polyester Film, .047 uF, 100V	Nichicon	QYA2A473K	330-0020
C717	Capacitor, Fixed, Polyester Film, .01 uF, 100V	Nichicon	QYA2A103K	330-0015
C718	Same as C717			

7.7.1 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-1 AND D33-324-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C720	Capacitor, Fixed, Ceramic, Disc, 330 PF, NPO	Sprague	10TCC-T33 10TS-T33	312-0024 312-0023
C721	Same as C720			
C727	Capacitor, Fixed, Ceramic, Disc, 220 PF	Sprague	10TS-T22	312-0022
C728	Same as C705			
C729	Same as C705			
C730	Same as C716			
CR701	Diode, Silicon	Motorola	1N4148	410-4148
L701	Inductor, Variable, Tuning	Delta	D05-130	005-0130
L702	Transformer, P. C. Mount	Mini-Circuits Labs	T2.5-6T	364-0007
L703	Inductor, Variable, Tuning	Delta	D05-128	005-0128
L704	Inductor, 300 uH	Miller	70F304A1	350-0031
Q701	Transistor, FET	Siliconix	U310	436-0002
Q702	Transistor, NPN	Motorola	MPS6513	426-0008
Q704	Same as Q702			
R701	Resistor, Fixed, Film, 390 Ohm, 5%, 1/4W		RL07S391J	202-0391

7.7.1 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-1 AND D33-324-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R702	Resistor, Fixed, Film, 560 Ohm, 5%, 1/4W		RL07S561J	202-0561
R703	Resistor, Fixed, Film, 820 Ohm, 5%, 1/4W		RL07S821J	202-0821
R704	Resistor, Fixed, Film, 22 Ohm, 5%, 1/4W		RL07S220J	202-0220
R706	Resistor, Fixed, Film, 330 Ohm, 5%, 1/4W		RL07S331J	202-0331
R707	Resistor, Fixed, Film, 68 Ohm, 5%, 1/4W		RL07S680J	202-0680
R708	Same as R707			
R709	Resistor, Fixed, Film, 1.8K Ohm, 5%, 1/4W		RL07S182J	202-0182
R710	Same as R709			
R711	Resistor, Fixed, Film, 150K Ohm, 5%, 1/4W		RL07S154J	202-0154
R712	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R714	Resistor, Fixed, Film, 4.7K Ohm, 5%, 1/4W		RL07S472J	202-0472
R716	Same as R703			
R717	Same as R712			

7.7.1 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-1 AND D33-324-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R718	Resistor, Fixed, Film, 10K Ohm, 5%, 1/4W		RL07S103J	202-0103
R719	Resistor, Fixed, Film, 1.2K Ohm, 5%, 1/4W		RL07S122J	202-0122
R720	Resistor, Fixed, Film, 3.9K Ohm, 5%, 1/4W		RL07S392J	202-0392
R721	Same as R712			
R722	Same as R712			
R723	Resistor, Variable, 10K Ohm	Trimpot	3006P-1-103	244-0030
R724	Resistor, Fixed, Film, 10 Ohm, 5%, 1/4W		RL07S100J	202-0100
R725	Resistor, Fixed, Film, 47K Ohm, 5%, 1/4W		RL07S473J	202-0473
R726	Same as R709			
R727	Same as R709			
R728	Same as R712			
R731	Resistor, Fixed, Film, 47 Ohm, 5%, 1/4W		RL07S470J	202-0470
R732	Resistor, Fixed, Film, 180 Ohm, 5%, 1/4W		RL07S181J	202-0181

7.7.1 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-1 AND D33-324-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R733	Resistor, Fixed, Film, 680 Ohm, 5%, 1/4W		RL07S681J	202-0681
R734	Resistor, Fixed, Film, 9.1K Ohm, 5%, 1/4W		RL07S912J	202-0912
R735	Same as R719			
R736	Same as R704			
S701	Switch, 8 In Line	Grayhill	76SB08S	666-0032
U701	Integrated Circuit, Modulator, 14 Pin DIP	Motorola	MC1496L	548-0010
U702	Integrated Circuit, Hex Counter, 16 Pin	Motorola	MC10136L	516-0007
U703	Same as U702			
U704	Integrated Circuit, Type D, Master Slave Flip-Flop	Motorola	MC10131L	516-0006
U705	Integrated Circuit, Phase Detector	Motorola	MC12040P	548-0026
U706	Integrated Circuit, Ripple Counter	Motorola	MC14024B	522-0024
U707	Integrated Circuit, Triple Line Receiver	Motorola	MC10116	516-0005
XL702	Socket, 6 Pin DIP	Samtech	SS-120-T-2	736-0039

7.7.1 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-1 AND D33-324-2, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
XU701	Socket, IC, 14 Pin DIP	Samtech	ICO-314-SGT	736-0025
XU702	Socket, IC, 16 Pin DIP	Samtech	ICO-316-SGT	736-0026
XU703	Same as XU702			
XU704	Same as XU702			
XU705	Same as XU701			
XU706	Same as XU701			
XU707	Same as XU702			
Y701	Crystal, 2.304 MHz, HC-33/U, 0.001% Tolerence, 0.0005% TC 0-50C, Series R Less Than or Equal to 130 Ohms, Load Capacitance 32 PF Parallel, Fundamental Mode (9 KHz Spacing Only: For ASM-1 P/N D33-324-2)	Cinox		624-0038
Y701	Crystal, 2.560 MHz, HC-33/U, 0.001% Tolerence, 0.0005% TC 0-50C, Series R Less Than or Equal to 130 Ohms, Load Capacitance 32 PF Parallel, Fundamental Mode (10 KHz Spacing Only: For ASM-1 P/N D33-324-1)	Cinox		624-0032

7.7.2 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, NON-SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-3 AND D33-324-4, REV. N

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C701	Capacitor, Fixed, Mica, 180 pF, ±5%		CM05FD181J03	302-0181
C703	Capacitor, Fixed, Ceramic, Disc, .001 uF, 1000V	Sprague	5GA-D10	310-0013
C704	Same as C703			
C705	Capacitor, Fixed, Monolithic, Ceramic, .1 uF, 50V	Sprague	1C20Z5U104M050B	310-0051
C707	Same as C701			
C708	Same as C705			
C709	Capacitor, Silver Mica, 33 PF		CM05ED330J03	302-0330
C710	Capacitor, Variable, 5.5-18 PF, Trimmer	Erie	DV11PR18A	346-0003
C713	Same as C705			
C714	Same as C705			
C716	Capacitor, Fixed, Polyester Film, .047 uF, 100V	Nichicon	QYA2A473K	330-0020
C717	Capacitor, Fixed, Polyester Film, .01 uF, 100V	Nichicon	QYA2A103K	330-0015
C718	Same as C717			
C720	Capacitor, Fixed, Ceramic, Disc, 330 PF, NPO	Sprague	10TCC-T33 10TS-T33	312-0024 312-0023
C721	Same as C720			

7.7.2 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, NON-SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-3 AND D33-324-4, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C727	Capacitor, Fixed, Ceramic, Disc, 220 PF	Sprague	10TS-T22	312-0022
C728	Same as C705			
C729	Same as C705			
CR701	Diode, Silicon	Motorola	1N4148	410-4148
L701	Inductor, Variable, Tuning	Delta	D05-130	005-0130
L702	Transformer, P. C. Mount	Mini-Circuits Labs	T2.5-6T	364-0007
L703	Inductor, Variable, Tuning	Delta	D05-128	005-0128
L704	Inductor, 300 uH	Miller	70F304A1	350-0031
Q701	Transistor, FET	Siliconix	U310	436-0002
Q702	Transistor, NPN	Motorola	MPS6513	426-0008
Q704	Same as Q702			
R701	Resistor, Fixed, Film, 390 Ohm, 5%, 1/4W		RL07S391J	202-0391
R702	Resistor, Fixed, Film, 560 Ohm, 5%, 1/4W		RL07S561J	202-0561
R703	Resistor, Fixed, Film, 820 Ohm, 5%, 1/4W		RL07S821J	202-0821
R704	Resistor, Fixed, Film, 22 Ohm, 5%, 1/4W		RL07S220J	202-0220

7.7.2 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, NON-SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-3 AND D33-324-4, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R706	Resistor, Fixed, Film, 330 Ohm, 5%, 1/4W		RL07S331J	202-0331
R707	Resistor, Fixed, Film, 68 Ohm, 5%, 1/4W		RL07S680J	202-0680
R708	Same as R707			
R711	Resistor, Fixed, Film, 150K Ohm, 5%, 1/4W		RL07S154J	202-0154
R712	Resistor, Fixed, Film, 1K Ohm, 5%, 1/4W		RL07S102J	202-0102
R714	Resistor, Fixed, Film, 4.7K Ohm, 5%, 1/4W		RL07S472J	202-0472
R716	Same as R703			
R717	Same as R712			
R719	Resistor, Fixed, Film, 1.2K Ohm, 5%, 1/4W		RL07S122J	202-0122
R725	Resistor, Fixed, Film, 47K Ohm, 5%, 1/4W		RL07S473J	202-0473
R726	Same as R709			
R727	Same as R709			
R728	Same as R712			
R731	Resistor, Fixed, Film, 47 Ohm, 5%, 1/4W		RL07S470J	202-0470

7.7.2 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, NON-SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-3 AND D33-324-4, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R732	Resistor, Fixed, Film, 180 Ohm, 5%, 1/4W		RL07S181J	202-0181
R733	Resistor, Fixed, Film, 680 Ohm, 5%, 1/4W		RL07S681J	202-0681
R734	Resistor, Fixed, Film, 9.1K Ohm, 5%, 1/4W		RL07S912J	202-0912
R735	Same as R719			
R736	Same as R704			
U701	Integrated Circuit, Modulator, 14 Pin DIP	Motorola	MC1496L	548-0010
U704	Integrated Circuit, Type D, Master Slave Flip-Flop	Motorola	MC10131L	516-0006
U707	Integrated Circuit, Triple Line Receiver	Motorola	MC10116	516-0005
W1	Wire, Bus, #22 AWG Teflon Sleeving			
XL702	Socket, 6 Pin DIP	Samtech	SS-120-T-2	736-0039
XU701	Socket, IC, 14 Pin DIP	Samtech	ICO-314-SGT	736-0025
XU704	Same as XU702			
XU707	Same as XU702			
XY701	Socket, 0.036-0.051 Dia.	Amp	1-380758-0	736-0043

7.7.2 LIST OF MATERIAL, FREQUENCY CONVERTER ASSEMBLY, NON-SYNTHESIZED, REFERENCE DESIGNATION A700, D33-324-3 AND D33-324-4, REV. N CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
Y701	Selected Crystal, 4 X Carrier Frequency[1]	Delta	D05-110-XXX[2]	005-0110-XXX[2]
	HOLDER: HC-6/U			
	FUNDAMENTAL FREQUENCY "AT" CUT			
	LOAD CAPACITANCE: 32 PF PARALLEL			
	FREQUENCY TOLERANCE: $\pm$0.0005% @ 25°C			
	TEMPERATURE COEFFICIENT: $\pm$0.0005% @ 0°C TO 50°C			
Y701	Selected Crystal, 4 X Carrier Frequency[3]	Delta	D05-116-YYY[4]	005-0116-YYY[4]
	HOLDER: HC-6/U			
	FUNDAMENTAL FREQUENCY "AT" CUT			
	LOAD CAPACITANCE: 32 PF PARALLEL			
	FREQUENCY TOLERANCE: $\pm$0.0005% @ 25°C			
	TEMPERATURE COEFFICIENT: $\pm$0.0005% @ 0° to 50°C			

1 Carrier frequency can be any frequency from 540 to 1600 kHz in 10 kHz steps

2 XXX = 0.1F-53 where F is the carrier frequency in kHz as described in note 1

3 Carrier freq. can be any freq. from 531 to 1602 kHz in 9 kHz steps except frequencies divisible by 10 kHz

4 $YYY = \frac{F-522}{9} - INT\left(\frac{F-450}{90}\right)$ where F is the carrier frequency in kHz as described in note 3

7.8 LIST OF MATERIAL, POWER ATTENUATOR ASSEMBLY, REFERENCE DESIGNATION A800, D33-333, REV. D

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R839	Resistor, Fixed, Film, 82 Ohm, 5%, 2W		RL42S820J	208-0820
R840	Resistor, Fixed, Film, 82 Ohm, 5%, 1/4W		RL07S820J	202-0820
R841	Same as R840			
R842	Same as R840			
R844	Resistor, Fixed, Film, 100 Ohm, 5%, 2W		RL42S101J	208-0101
R845	Resistor, Fixed, Film, 51 Ohm, 5%, 1/2W		RL20S510J	204-0510
R846	Same as R845			
R847	Same as R845			
R848	Resistor, Fixed, Film, 33 Ohm, 5%, 1/4W		RL07S330J	202-0330
R857	Same as R848			
S803	Switch, Rotary	Centralab	PA7007	662-0024

7.9 LIST OF MATERIAL, POWER SUPPLY ASSEMBLY, REFERENCE DESIGNATION A900, D33-330, REV. H

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
C900	Capacitor, Fixed, Electrolytic, 2000 uF, 50 VDC	Mallory	TC50200	320-0069
C901	Same as C900			
C902	Capacitor, Fixed, Film, .1 uF, 10%, 100V	Nichicon	QYA2A104K	330-0021
C904	Same as C902			
C906	Same as C900			
C908	Same as C902			
C909	Capacitor, Fixed, Electrolytic, 5 uF, 25V	Sprague	TE-1202	320-0013
CR900	Diode, Silicon, Rectifier	Motorola	1N4720	410-4720
CR901 thru CR905	Same as CR900			
CR907	Same as CR900			
CR908	Same as CR900			
VR900	Voltage Regulator, +15V, 1.5A, TO-220 Case	Motorola Only	MC7815CT	544-0003-015
VR901	Voltage Regulator, +5V, 1.5A, TO-220 Case	Motorola Only	MC7805CT	544-0003-005

7.9 LIST OF MATERIAL, POWER SUPPLY ASSEMBLY, REFERENCE DESIGNATION A900, D33-330, REV. H CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
VR902	Voltage Regulator, -15V, 1.5A, TO-220 Case	Motorola Only	MC7915CT	544-0004-015
XVR900	Socket, Transistor, Crimp Type	Molex	10-01-2031	736-0045
XVR901	Same as XVR900			
XVR902	Same as XVR900			
XVR900E1	Terminal, Crimp	Molex	08-50-0108	622-0078
XVR900E2	Same as XVR900E1			
XVR900E3	Same as XVR900E1			
XW1	Sleeving, Teflon	Alpha	TFT-200-22	684-0007-022
XW2	Same as XW1			
XW3	Same as XW1			
W1	Wire, Bus, Solid Copper, Tinned, #22 AWG	Alpha	298	674-0001
W2	Same as W1			
W3	Same as W1			

7.10 LIST OF MATERIAL, SWITCH PANEL ASSEMBLY, LEFT, REFERENCE DESIGNATION A1, D33-327, REV. G

Reference Designation	Description	Manufacuturer	Manufacturer Part No.	Delta Order No.
R803	Resistor, Fixed, Film, 2.21K Ohm, 1%, 1/4W		RN55D2211F CCF552211F	212-2211
R805	Resistor, Fixed, Film, 681 Ohm, 1%, 1/4W		RN55D6810F CCF556810F	212-6810
R807	Resistor, Fixed, Film, 221 Ohm, 1%, 1/4W		RN55D2210F CCF552210F	212-2210
R809	Resistor, Fixed, Film, 68.1 Ohm, 1%, 1/4W		RN55D68R1F CCF5568R1F	212-0681
R811	Resistor, Fixed, Film, 22.1 Ohm, 1%, 1/4W		RN55D22R1F CCF5522R1F	212-0221
R813	Resistor, Fixed, Film, 10.0 Ohm, 1%, 1/4W		RN55D10R0F CCF5510R0F	212-0100
R817	Resistor, Variable, 5K Ohm	Piher Murata	PT15ZB-5K RVA-1214H-102-10-502-M	
SW1	Switch Assembly, 12 Position, DPDT	Delta	D05-113-2	005-0113-002
SW2 thru SW12	Same as SW1			

7.11 LIST OF MATERIAL, SWITCH PANEL ASSEMBLY, RIGHT, REFERENCE DESIGNATION A2, D33-326, REV. F

Reference Designation	Description	Manufacuturer	Manufacturer Part No.	Delta Order No.
R804	Resistor, Fixed, Film, 2.21K Ohm, 1%, 1/4W		RN55D2211F CCF552211F	212-2211
R806	Resistor, Fixed, Film, 681 Ohm, 1%, 1/4W		RN55D6810F CCF556810F	212-6810
R808	Resistor, Fixed, Film, 221 Ohm, 1%, 1/4W		RN55D2210F CCF552210F	212-2210
R810	Resistor, Fixed, Film, 68.1 Ohm, 1%, 1/4W		RN55D68R1F CCF5568R1F	212-0681
R812	Resistor, Fixed, Film, 22.1 Ohm, 1%, 1/4W		RN55D22R1F CCF5522R1F	212-0221
R814	Resistor, Fixed, Film, 10.0 Ohm, 1%, 1/4W		RN55D10R0F CCF5510R0F	212-0100
R818	Resistor, Variable, 5K Ohm	Piher Murata	PT15ZB-5K RVA-1214H-102-10-502-M	
R819	Resistor, Fixed, Film, 56 Ohm, 5%, 1/4W		RL07S560J	202-0560
R820	Resistor, Fixed, Film, 24 Ohm, 5%, 1/4W		RL07S240J	202-0240
SW1	Switch Assembly, 12 Position, All DPDT	Delta	D05-113-1	005-0113-001
SW2 thru SW12	Same as SW1			
W1	Jumper, #22 AWG Bus Wire, Teflon Sleeving			

7.12 LIST OF MATERIAL, LEFT AND RIGHT THUMBWHEEL ASSEMBLY, REFERENCE DESIGNATION S804, S805, D34-69, REV. A

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Order No.
R801	Resistor, Fixed, Film, 1K Ohm, 1%, 1/4W		RN55D1001F	212-1001
R802	Resistor, Fixed, Film, 301 Ohm, 1%, 1/4W		RN55D3010F	212-3010
R803	Resistor, Fixed, Film, 402 Ohm, 1%, 1/4W		RN55D4020F	212-4020
R804	Resistor, Fixed, Film, 100 Ohm, 1%, 1/4W		RN55D1000F	212-1000
R805	Same as R804			
R806	Resistor, Fixed, Film, 30.1 Ohm, 1%, 1/4W		RN55D30R1F	212-0301
R807	Resistor, Fixed, Film, 40.2 Ohm, 1%, 1/4W		RN55D40R2F	212-0402
R808	Resistor, Fixed, Film, 10.0 Ohm, 1%, 1/4W		RN55D10R0F	212-0100
R809	Same as R808			
S801	Thumbwheel Switch Assembly	Interswitch	IS02135	005-0111
W801	Wire, Buss, #22 AWG	Alpha	298	674-0001
W802	Same as W801			
XW801	Tubing, Teflon, #22 AWG	Alpha	TFT200-22	684-0007-022
XW802	Same as XW802			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
C501	Capacitor, Fixed, Chip, 100 PF, 10%, NPO, 50V, Pretinned	RMC Murata-Erie	0805C101BKDZU00 GRM40NPO101K50VPB	318-0001
C502	Same as C501			
C503	Capacitor, Fixed, Polyester, 0.047 uF, 10%, 100V	Nichicon	QYA2A473K	330-0020
C504	Same as C503			
C508	Same as C501			
C510	Same as C503			
C512	Capacitor, Fixed, Polycarbonate, 0.022 uF, 2%, 50V	Elpac Components	C5A223G	330-0042
C513	Capacitor, Fixed, Chip, 0.001 uF, 10%, NPO, 50V, Pretinned	RMC Murata-Erie	1812C102BKDZU00 GRM422NPO102K50VPB	318-0002
C514	Capacitor, Fxed, Polycarbonate, 0.0022 uF, 1%, 50V	Elpac Components	C5A222F	330-0040
C515	Same as C514			
C516	Capacitor, Fixed, Polyester, 0.1 uF, 5%, 100V	Nichicon	QYA2A104J	330-0021-001
C517	Same as C516			
C518	Same as C514			
C519	Same as C514			
C524	Capacitor, Fixed, Mylar, 1.0 uF, 10%, 63V	REI	MKT-1822-510-6-5	330-0005

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
C525	Capacitor, Fixed, Polyester, 6.8 uF, 5%, 63V	REI	MKG1862-568-6-5	330-0038
C527	Same as C514			
C530	Same as C503			
C533	Same as C503			
C534	Same as C514			
C539	Capacitor, Fixed, Chip, 30 pF, 10%, NPO, 50V, Pretinned	RMC Murata-Erie	0805C300BKDZU00 GRM40NPO200K50VPB	318-0003
C540	Same as C503			
C541	Same as C539			
C542	Same as C503			
C548	Capacitor, Fixed, Ceramic Disk, 100 pF, 5%, NPO, 500V	Sprague	10TCC-T10	312-0021
C549	Same as C548			
C553	Capacitor, Fixed, Polypropylene, 0.0047 uF, 1%, 50V	Elpac Components	P5B472F	330-0039
C554 thru C556	Same as C553			
C557	Same as C503			
C559	Capacitor, Fixed, Polyester, 0.01 uF, 10%, 100V	Nichicon	QYA2A103K	330-0015

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
C560	Same as C503			
C561	Capacitor, Fixed, Mica, 180 pF, 5%, 500V		CM05FD181J03	302-0181
C562	Same as C561			
C564	Same as C553			
C565	Same as C553			
C566	Same as C503			
C568	Same as C503			
C570 thru C573	Same as C503			
C581 thru C583	Same as C503			
C584	Same as C539			
C585	Same as C539			
C586	Capacitor, Fixed, Polyester, 0.0018 uF, 10%, 100V	Nichicon	QYA2A182K	330-0028
C587	Capacitor, Fixed, Polystyrene, 330 pF, 2.5%, 33V	Mallory	SXK333	330-0041
C588	Capacitor, Fixed, Polyester, 0.001 uF, 10%, 100V	Nichicon	QYA2A102K	330-0012
C590	Capacitor, Fixed, Ceramic, 0.47 uF, 20%, 50V	Sprague	1C20Z5U474M0508	310-0052

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
C591	Capacitor, Fixed, Ceramic Disk, 33 pF, 1KV, N075	Sprague	10TCC-Q33	312-0017
C592	Same as C503			
C593	Same as C501			
C594	Same as C501			
C601	Same as C514			
C602	Same as C514			
C603	Same as C503			
C604	Same as C514			
C605	Same as C514			
C606	Same as C503			
C607	Same as C514			
C608	Same as C514			
C609	Capacitor, Fixed, Polyester, 0.022 uF, 10%, 100V	Nichicon	QYA2A223K	330-0018
C610 thru C612	Same as C503			
C613	Same as C512			
C614	Same as C512			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
C615	Capacitor, Fixed, Electrolytic, 3.3 uF, 20%, 50V	Nichicon	ULB1HR3M	320-0072
C616	Same as C615			
C617	Capacitor, Fixed, Ceramic, 10 pF, 5%, NPO, 63V	Sprague	10TCC-Q10	312-0016
C618	Same as C617			
C619	Same as C512			
C620 thru C624	Same as C501			
C625	Same as C539			
C626	Same as C539			
C627 thru C631	Same as C501			
C632	Same as C503			
C633 thru C637	Same as C501			
C638 thru C640	Same as C503			
C641	Capacitor, Fixed, Chip, 68 pF, 10%, NPO, 50V, Pretinned	RMC Murata-Erie	0805C680BKDZU00 GRM40NPO680K50VPB	318-0004
C642	Capacitor, Fixed, Mica, 5%, 500V, Value TBD Per 7D33-363		CM05	302-XXXX

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
C643	Capacitor, Variable, Ceramic, 7-40 pF	Tusonix	513-011G7-40	346-0002
CR501	Diode, Silicon, Signal		1N4148	410-4148
CR503	Diode, Varactor	Motorola	MV1404	416-0017
CR504 thru CR508	Same as CR501			
F1	Inductor, Ferrite Bead	Stackpole	57-0181	388-0002
F2 thru F18	Same as F1			
K501	Relay, SPST, 24V, SIP	Gordos	741A7	654-0072
L501	Inductor, Variable	Bel-Tronics	BT82-0523	352-0030
L502	Inductor, Variable	Bel-Tronics	BT82-0522	352-0029
L503	Inductor, Variable	Bel-Tronics	BT83-0638	352-0031
L504	Same as L503			
L505	Same as L503			
L506	Inductor, Variable	Bel-Tronics	BT84-0726	352-0034
Q501	Transistor, PNP	Motorola	MPS6517	426-0009
Q502	Same as Q501			
Q503	Transistor, NPN	Motorola	MPS6513	426-0008
Q504	Same as Q503			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
Q509	Transistor, FET	Motorola	U310 J310	436-0002
Q510	Same as Q503			
Q511	Same as Q501			
Q512	Same as Q501			
Q513	Same as Q509			
Q514	Same as Q503			
R501	Resistor, Variable, 10K Ohm, 25 Turn, Cermet	Bourns	3299Y-001-103	244-0082
R502	Resistor, Variable, 500K Ohm, 25 Turn, Cermet	Bourns	3299Y-001-504	244-0083
R503	Resistor, Variable, 100 Ohm, 25 Turn, Cermet	Bourns	3299Y-001-101	244-0084
R504	Same as R503			
R505	Resistor, Variable, 500 Ohm, 25 Turn, Cermet	Bourns	3299Y-001-501	244-0072
R509	Resistor, Fixed, Film, 267 Ohm, 1%, 1/4W		RN55D2670F	212-2670
R510	Same as R509			
R511	Resistor, Fixed, Film, 475 Ohm, 1%, 1/4W		RN55D4750F	212-4750

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R512	Resistor, Fixed, Film, 2.74K Ohm, 1%, 1/4W		RN55D2741F	212-2741
R513	Same as R511			
R514	Same as R512			
R515	Resistor, Fixed, Film, 2.43K Ohm, 1%, 1/4W		RN55D2431F	212-2431
R516	Same as R515			
R517	Resistor, Fixed, Film, 3.92K Ohm, 1%, 1/4W		RN55D3921F	212-3921
R518	Resistor, Fixed, Film, 3.01K Ohm, 1%, 1/4W		RN55D3011F	212-3011
R519	Resistor, Fixed, Film, 1K Ohm, 1%, 1/4W		RN55D1001F	212-1001
R520	Same as R519			
R521	Same as R518			
R522	Resistor, Fixed, Film, 1.5K Ohm, 1%, 1/4W		RN55D1501F	212-1501
R523	Same as R522			
R524	Resistor, Fixed, Film, 3.48K Ohm, 1%, 1/4W		RN55D3481F	212-3481
R525	Same as R522			
R526	Same as R519			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R527	Resistor, Fixed, Film, 1.21K Ohm, 1%, 1/4W		RN55D1211F	212-1211
R528	Same as R512			
R529	Same as R512			
R530	Resistor, Fixed, Film, 100 Ohm, 1%, 1/4W		RN55D1000F	212-1000
R531	Resistor, Fixed, Film, 750 Ohm, 1%, 1/4W		RN55D7500F	212-7500
R532	Resistor, Fixed, Film, 1M Ohm, 1%, 1/4W		RN55D1004F	212-1004
R533	Resistor, Fixed, Film, 1.82K Ohm, 1%, 1/4W		RN55D1821F	212-1821
R534	Resistor, Fixed, Film, 681 Ohm, 1%, 1/4W		RN55D6810F	212-6810
R535	Same as R524			
R536	Same as R522			
R537	Same as R527			
R538	Resistor, Fixed, Film, 3.32K Ohm, 1%, 1/4W		RN55D3321F	212-3321
R539	Same as R519			
R540	Resistor, Fixed, Film, 5.11K Ohm, 1%, 1/4W		RN55D5111F	212-5111

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R541	Same as R527			
R542	Same as R515			
R543	Same as R515			
R544	Same as R511			
R545	Same as R511			
R546	Resistor, Fixed, Film, 6.19K Ohm, 1%, 1/4W		RN55D6191F	212-6191
R547	Same as R512			
R548	Same as R512			
R549	Resistor, Fixed, Film, 4.75K Ohm, 1%, 1/4W		RN55D4751F	212-4751
R550	Resistor, Fixed, Film, 2.67K Ohm, 1%, 1/4W		RN55D2671F	212-2671
R552	Same as R550			
R553	Resistor, Fixed, Film, 1.62K Ohm, 1%, 1/4W		RN55D1621F	212-1621
R555	Same as R512			
R556	Same as R512			
R557	Resistor, Fixed, Film, 8.26K Ohm, 1%, 1/4W		RN55D8661F	212-8661

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R558	Resistor, Fixed, Film, 40.2K Ohm, 1%, 1/4W		RN55D4022F	212-4022
R559	Resistor, Fixed, Film, 43.2K Ohm, 1%, 1/4W		RN55D4322F	212-4322
R560	Resistor, Fixed, Film, 1.15K Ohm, 1%, 1/4W		RN55D1152F	212-1152
R561	Same as R534			
R562	Resistor, Fixed, Film, 82.5K Ohm, 1%, 1/4W		RN55D8252F	212-8252
R563	Resistor, Fixed, Film, 2.2M Ohm, 5%, 1/4W		RL07S225J	202-0225
R564	Same as R512			
R565	Same as R527			
R566	Resistor, Fixed, Film, 39.2 Ohm, 1%, 1/4W		RN55D39R2F	212-0392
R567	Same as R566			
R568	Same as R538			
R569	Resistor, Fixed, Film, 1.21M Ohm, 1%, 1/4W		RN55D1214F	212-1214
R570	Resistor, Fixed, Film, 61.9K Ohm, 1%, 1/4W		RN55D6192F	212-6192
R571	Resistor, Variable, 5K Ohm, 25 Turn, Cermet	Bourns	3299Y-001-503	244-0076

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R572	Same as R538			
R573	Same as R511			
R574	Resistor, Fixed, Film, 100K Ohm, 1%, 1/4W		RN55D1003F	212-1003
R575	Same as R559			
R576	Same as R560			
R577	Same as R557			
R578	Same as R558			
R579	Same as R559			
R580	Same as R512			
R581	Same as R512			
R582	Same as R559			
R583	Same as R558			
R584	Same as R557			
R585	Same as R560			
R586	Same as R511			
R587	Same as R511			
R588	Same as R512			
R589	Same as R503			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R590	Same as R534			
R591	Same as R512			
R593	Same as R553			
R594	Resistor, Fixed, Film, 475K Ohm, 1%, 1/4W		RN55D4753F	212-4753
R595	Resistor, Fixed, Film, 150K Ohm, 1%, 1/4W		RN55D1503F	212-1503
R596	Same as R595			
R597	Same as R512			
R598	Same as R553			
R599	Same as R534			
R601	Resistor, Fixed, Film, 22.1 Ohm, 1%, 1/4W		RN55D22R1F	212-0221
R602	Same as R601			
R603	Resistor, Fixed, Film, 332 Ohm, 1%, 1/4W		RN55D3320F	212-3320
R604	Same as R601			
R605	Same as R601			
R606	Same as R603			
R607	Same as R527			
R608	Same as R527			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R609	Same as R533			
R610	Same as R533			
R611	Same as R512			
R612	Resistor, Fixed, Film, 51.1 Ohm, 1%, 1/4W		RN55D51R1F	212-0511
R613	Same as R612			
R614	Resistor, Fixed, Film, 2.21K Ohm, 1%, 1/4W		RN55D2211F	212-2211
R615	Same as R549			
R616	Resistor, Fixed, Film, 6.81K Ohm, 1%, 1/4W		RN55D6811F	212-6811
R617	Same as R603			
R618	Same as R603			
R619	Same as R512			
R620	Same as R512			
R621	Same as R612			
R622	Same as R512			
R623	Same as R512			
R624	Same as R512			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R625	Same as R612			
R626	Same as R612			
R627 thru R630	Same as R549			
R636	Same as R511			
R637	Same as R511			
R638	Same as R512			
R639	Same as R512			
R640	Same as R530			
R643	Same as R519			
R644	Resistor, Fixed, Film, 68.1 Ohm, 1%, 1/4W		RN55D68R1F	212-0681
R645 thru R648	Same as R644			
R649	Same as R512			
R650	Same as R616			
R651	Same as R614			
R661	Same as R511			
R663	Same as R616			
R664	Same as R644			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R665	Resistor, Fixed, Film, 121K Ohm, 1%, 1/4W		RN55D1213F	212-1213
R666	Resistor, Fixed, Film, 22.1K Ohm, 1%, 1/4W		RN55D2212F	212-2212
R667	Same as R594			
R668	Same as R519			
R671	Same as R501			
R672	Same as R574			
R673	Same as R574			
R674	Same as R530			
R675	Resistor, Fixed, Film, 121 Ohm, 1%, 1/4W		RN55D1210F	212-1210
R676	Same as R530			
R677	Same as R530			
R678	Same as R519			
R679	Same as R519			
R680	Same as R644			
R681	Same as R509			
R682	Same as R601			
R683	Same as R601			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R684	Same as R644			
R685	Same as R530			
R686	Same as R530			
R687	Resistor, Fixed, Film, 825 Ohm, 1%, 1/4W		RN55D8250F	212-8250
R688	Same as R687			
R689	Same as R519			
R690	Same as R522			
R691	Same as R524			
R692	Same as R527			
R693	Resistor, Fixed, Film, 10K Ohm, 1%, 1/4W		RN55D1002F	212-1002
R694	Resistor, Fixed, Film, 39.2K Ohm, 1%, 1/4W		RN55D3922F	212-3922
R695	Resistor, Fixed, Film, 332K Ohm, 1%, 1/4W		RN55D3323F	212-3323
R696	Same as R665			
R697	Same as R693			
R698	Resistor, Fixed, Film, 221K Ohm, 1%, 1/4W		RN55D2213F	212-2213

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
R699	Resistor, Fixed, Film, 5.62K Ohm, 1%, 1/4W		RN55D5621F	212-5621
TP501	Test Point	Vector	K24C	672-0060
TP502 thru TP519	Same as TP501			
U501	IC, Transistor Array	RCA	CA3045	542-0011
U502	Same as U501			
U503	IC, Quad WB JFET OP AMP	National	LF347N	540-0031
U504	IC, Dual JFET OP AMP	TI	TL082C	540-0028
U505	IC, Balanced Modulator	Motorola	MC1596L	548-0010-001
U506	Same as U501			
U507	Same as U501			
U508	Same as U505			
U509	Same as U505			
U510	IC, Line Receiver, ECL	Motorola	MC10116L	516-0005
U511	IC, Transistor Array	RCA	CA3183	542-0013
U512	IC, Dual D Flip-Flop, ECL	Motorola	MC10131L	516-0006
U513	Same as U512			
U514	Same as U503			

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
U515	Same as U504			
U516	Same as U511			
W501	Jumper, Wire, Bus, 22 AWG	Alpha	298	674-0001
W502 thru W511	Same as W1			
W512	Jumper, Coaxial	Delta	D51-49-1	051-0049-001
W513	Jumper, Coaxial	Delta	D51-49-2	051-0049-002
XC642	Socket, Spring, 0.018-0.040 DIA	Amp	380598-3	736-0042
XU501	Socket, IC, 14 Pin Dip	Samtech	ICO-314-SGT	736-0025
XU502	Same as XU501			
XU503	Same as XU501			
XU504	Socket, IC, 8 Pin Dip	Samtech	ICO-308-SGT	736-0036
XU505 thru XU509	Same as XU501			
XU510	Socket, IC, 16 Pin Dip	Samtech	ICO-316-SGT	736-0026

7.13 LIST OF MATERIAL, DECODER II ASSEMBLY, D33-363, REV. A CONTINUED

Reference Designation	Description	Manufacturer	Manufacturer Part No.	Delta Part No.
XU511 thru XU513	Same as XU510			
XU514	Same as XU501			
XU515	Same as XU504			
XU516	Same as XU510			
Y501	Crystal, 3.6 MHz, HC-6/U	Delta	D05-110-37	005-0110-037

SECTION 8

SCHEMATIC DIAGRAMS

8.1 LIST OF SCHEMATIC DIAGRAMS

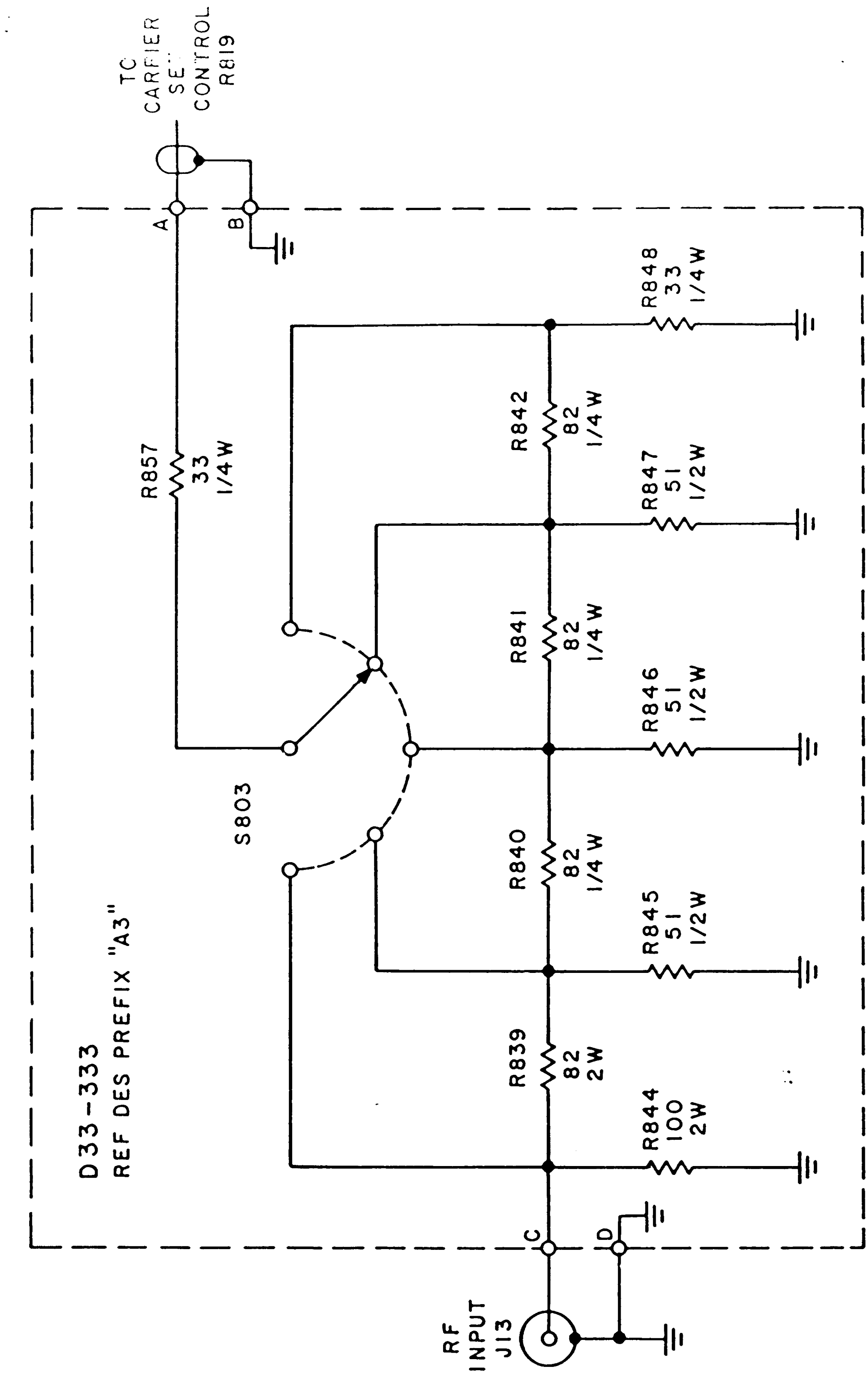
This section contains an overall functional block diagram of the Monitor and schematic diagrams of the major assemblies. The diagrams are presented in the following order.

DIAGRAM-APPLICABLE TO ASM-1 UNITS SERIAL NO. 153 AND HIGHER.

FIGURE 8-1

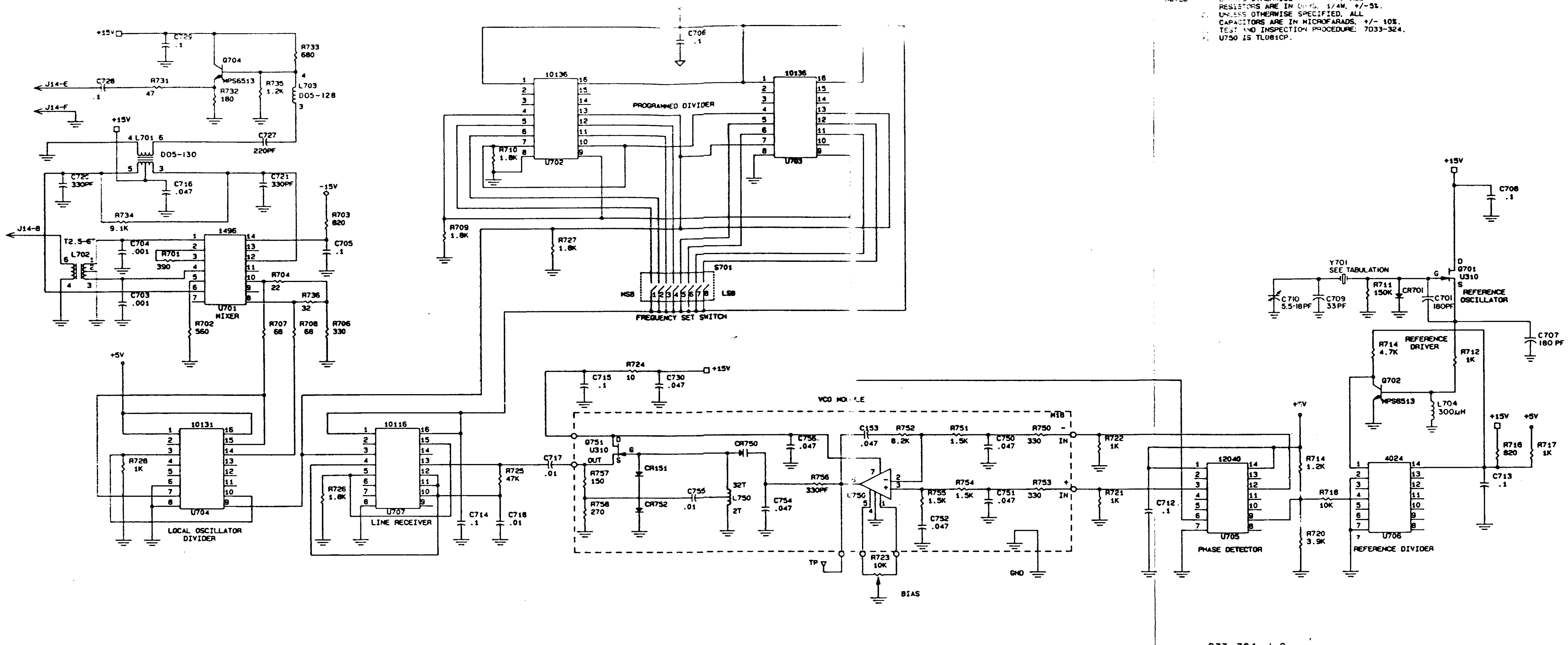
MONITOR FUNCTIONAL BLOCK DIAGRAM

D93 - 345(AI)

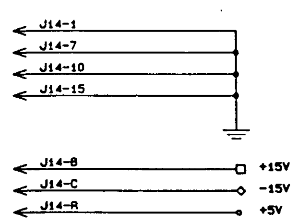


SCHEMATIC DIAGRAM
POWER ATTENUATOR
ASSEMBLY

NOTES: 1. UNLESS OTHERWISE [illegible], ALL RESISTORS ARE IN OHMS, 1/4W, +/-5%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/- 10%.
3. TEST AND INSPECTION PROCEDURE: 7033-324.
4. U750 IS TL081CP.



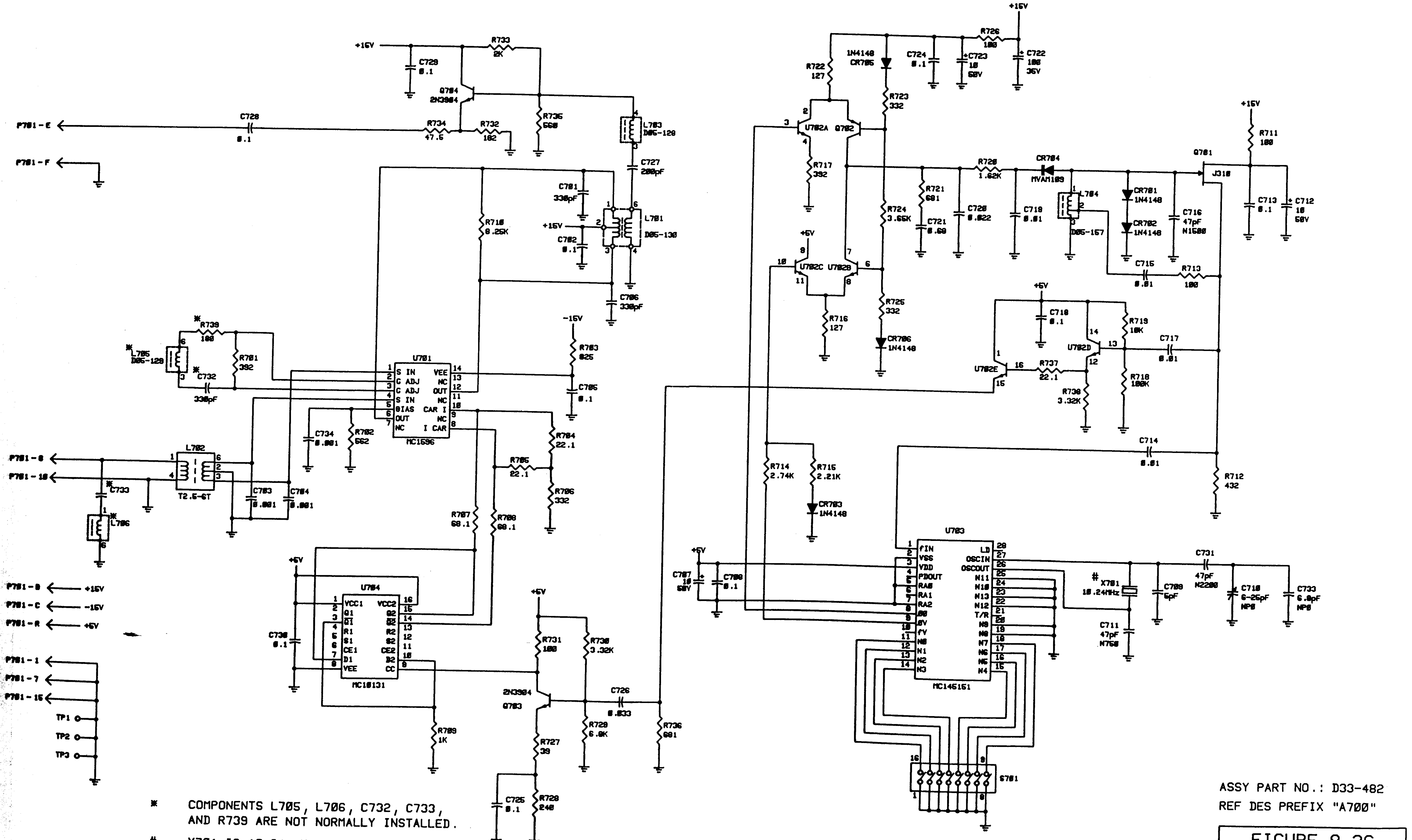
ASSY PART NO.	CRYSTAL Y701
D33-324-1	2.56 MHz CRYSTAL FOR 10 KHz CHANNEL SPACING
D33-324-2	2.30 MHz CRYSTAL FOR 9 KHz CHANNEL SPACING



D33-324-1, 2
REF DES PREFIX "A700"

FIGURE 8-3A

SCHEMATIC DIAGRAM
FREQUENCY CONVERTER
ASSEMBLY
SYNTHESIZED



* COMPONENTS L705, L706, C732, C733, AND R739 ARE NOT NORMALLY INSTALLED.

\# X701 IS 10.24 MHz FOR 10 kHz SPACING AND 9.216 MHz FOR 9kHz SPACING.

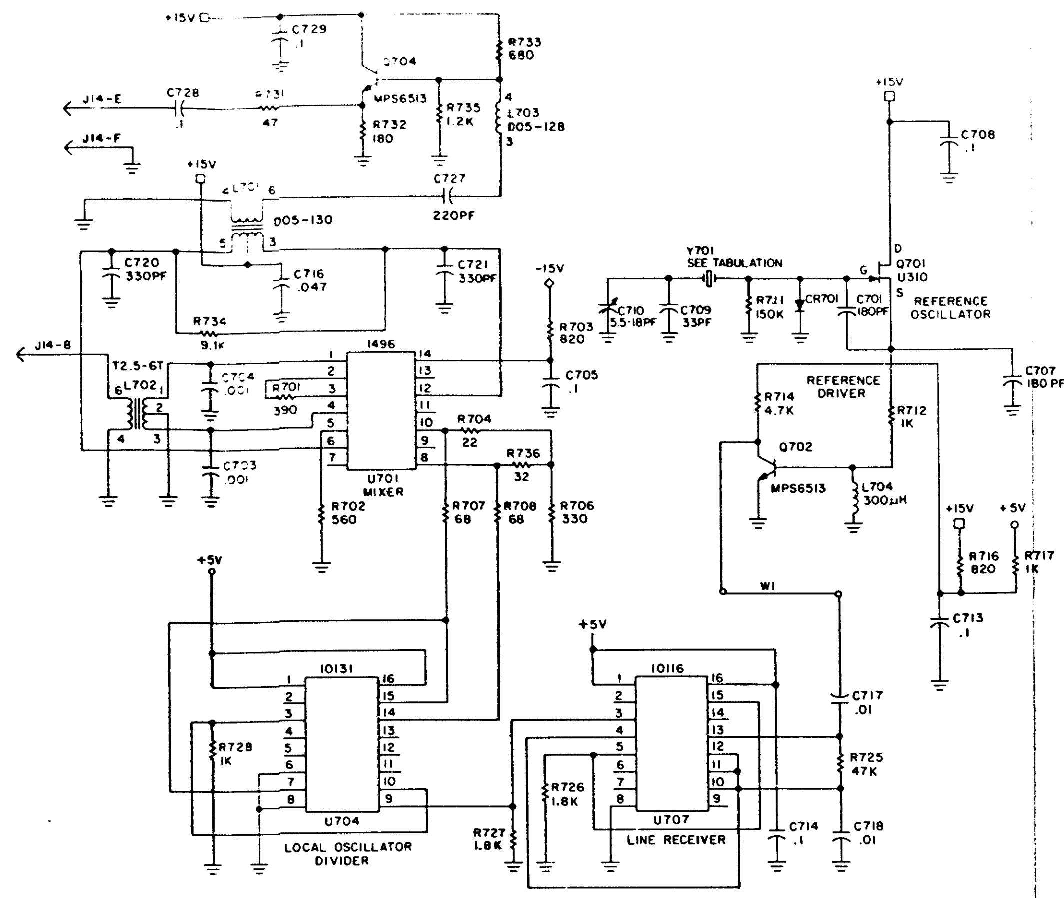
ASSY PART NO.: D33-482

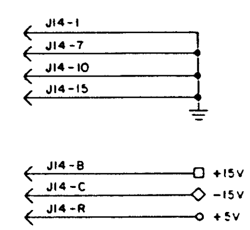
REF DES PREFIX "A700"

FIGURE 8-3C

SYNTHESIZED FREQUENCY CONVERTER ASSEMBLY SCHEMATIC DIAGRAM

93-345





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: 7D33-324.

ASSY PART NO.	CRYSTAL Y701
D33-324-3	D05-110-XXX TYPE CRYSTAL USED FOR 10KHz CHANNEL SPACING
D33-324-4	D05-116-XXX TYPE CRYSTAL USED FOR 9KHz CHANNEL SPACING

REF DES PREFIX "A700"

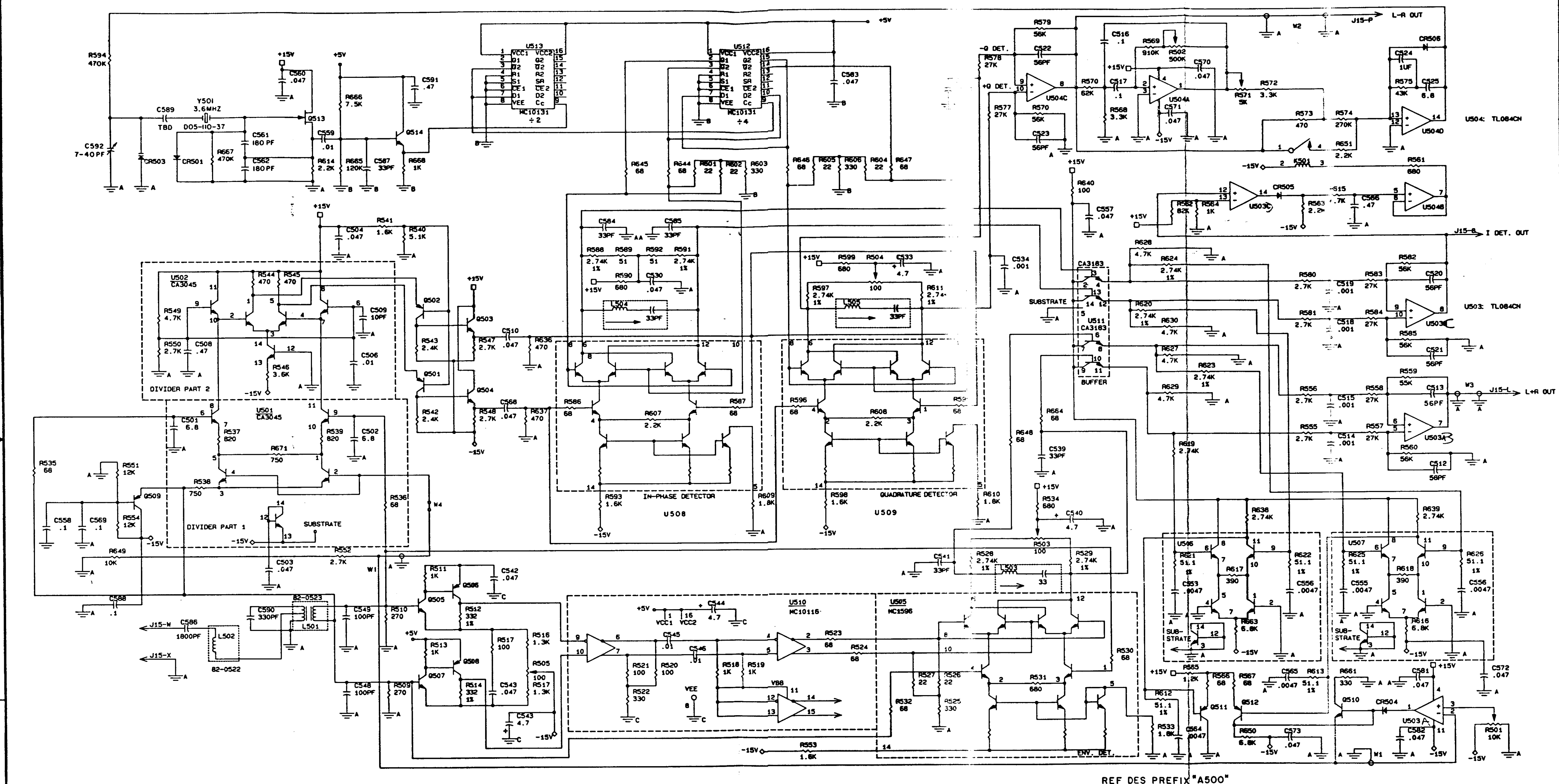
FREQUENCY CONVERTER ASSEMBLY

FIGURE 8-3B

SCHEMATIC DIAGRAM
FREQUENCY CONVERTER
ASSEMBLY
NON-SYNTHESIZED

SEE SHEET OF 8033-332 FOR REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED



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: 7033-332.

J15-C +15V, J15-3, J15-E -15V, J15-5, J15-R +5V, J15-7
J15-1 B, J15-22 C
J15-16, J15-8, J15-6, J15-18 A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: FRACTIONS DECIMALS ANGLES

MATERIAL: L/M:8

FINISH:

ASM-1 — USED ON — APPLICATION

DRAWN: Henry M. Payne DATE 4/2/85
CHECKED
ENGINEER
APPROVED
CONTRACT NO. REL. DATE
DESIGN ACTIVITY APPROVAL
APPROVED

DELTA ELECTRONICS, INC.
ALEXANDRIA, VIRGINIA

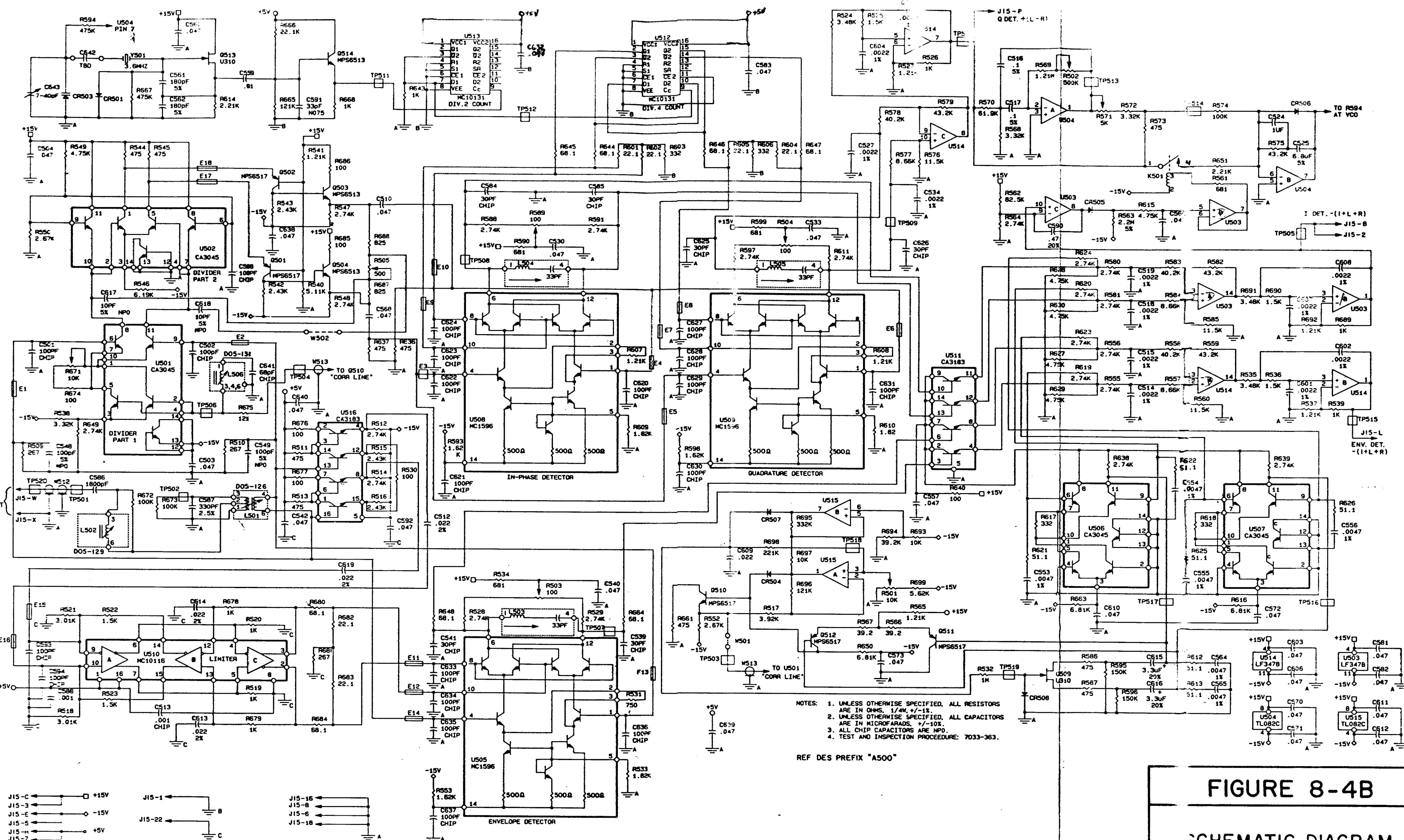
DECODER ASSEMBLY

IDENT NO	SIZE	DRAWING NO.	REV.
482	D	4D33-332	N

SCALE NONE — SHEET 1 OF 1

4D33-332

D95-768



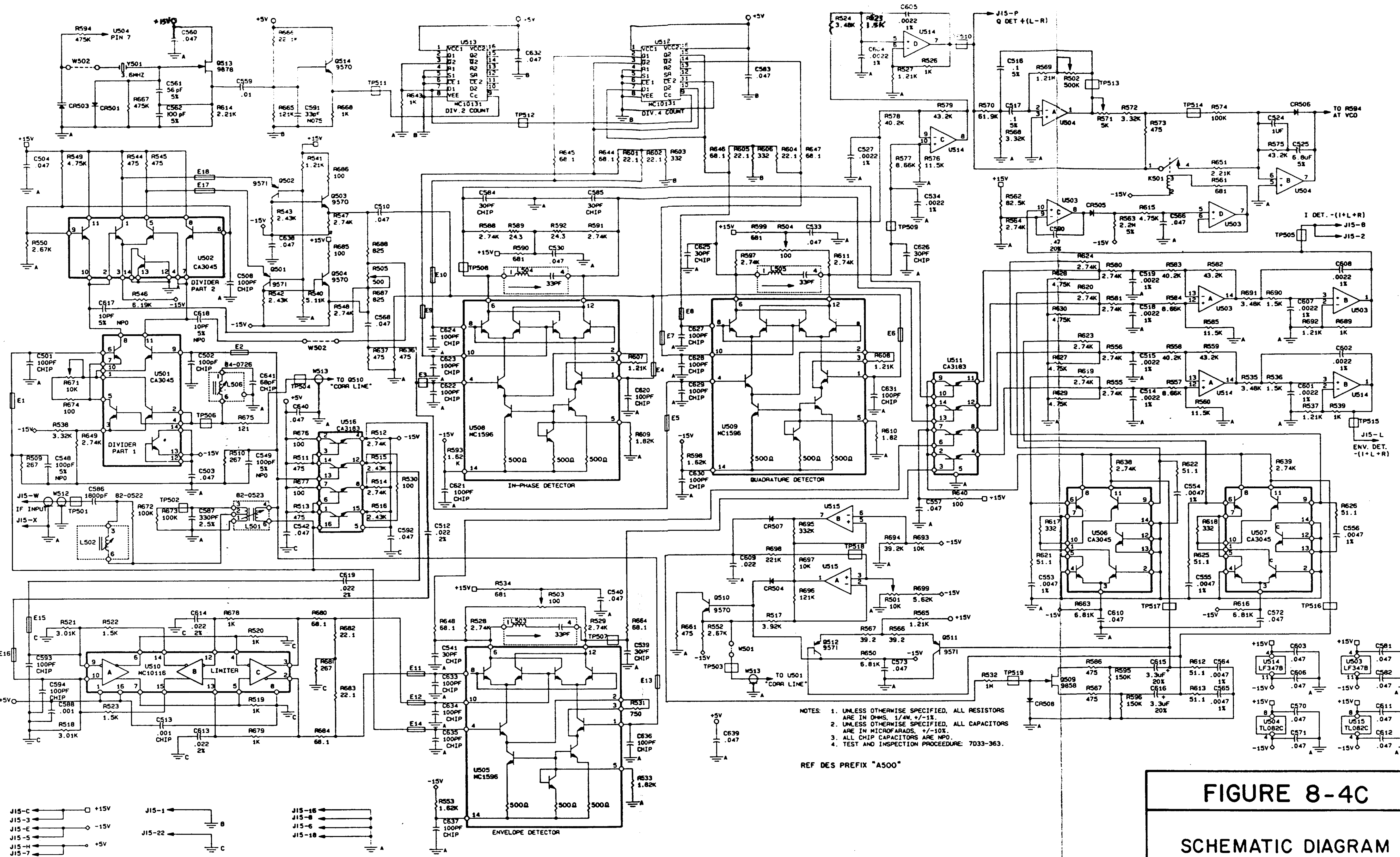
NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/-1%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/-10%.
3. ALL CHIP CAPACITORS ARE NPO.
4. TEST AND INSPECTION PROCEEDURE: 7033-363.

REF DES PREFIX "A500"

FIGURE 8-4B

SCHEMATIC DIAGRAM DECODER II ASSEMBLY (DELTA)

D93-345(AI)

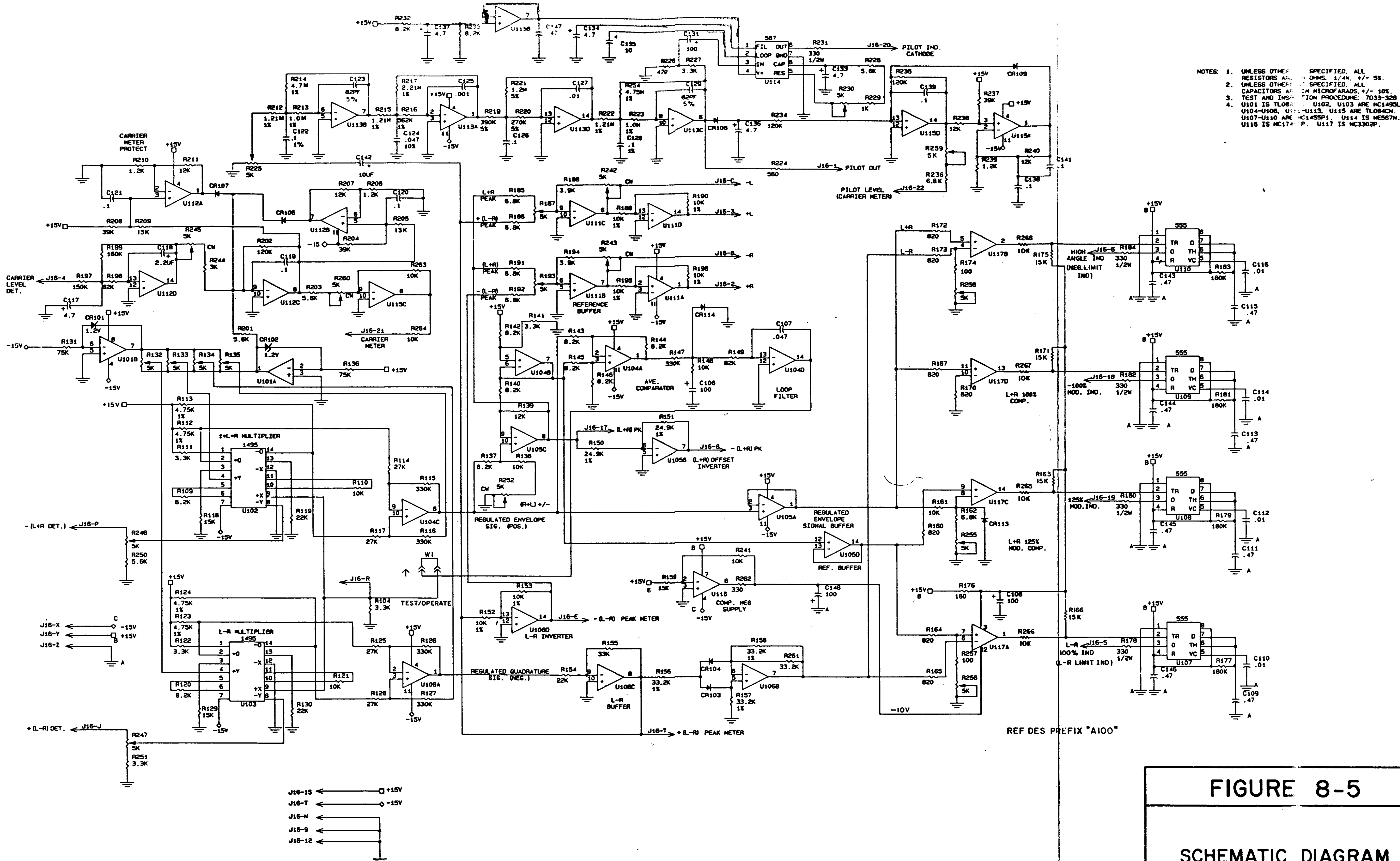


NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, +/-1%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN MICROFARADS, +/-10%.
3. ALL CHIP CAPACITORS ARE NPO.
4. TEST AND INSPECTION PROCEEDURE: 7D33-363.

REF DES PREFIX "A500"

FIGURE 8-4C

SCHEMATIC DIAGRAM
DECODER II ASSEMBLY
(MOTOROLA)



NOTES:
1. UNLESS OTHER[illegible] SPECIFIED, ALL RESISTORS AR[illegible] OHMS, 1/4W, +/- 5%.
2. UNLESS OTHER[illegible] SPECIFIED, ALL CAPACITORS A[illegible] IN MICROFARADS, +/- 10%.
3. TEST AND INS[illegible]TION PROCEDURE: 7033-328
4. U101 IS TL08[illegible]. U102, U103 ARE MC1495L. U104-U106, U[illegible]-U113, U115 ARE TL084CN. U107-U110 ARE [illegible]C1455P1. U114 IS NE567N. U116 IS MC174[illegible]P. U117 IS MC3302P.

FIGURE 8-5

SCHEMATIC DIAGRAM
AVC ASSEMBLY

D93-345(AI)

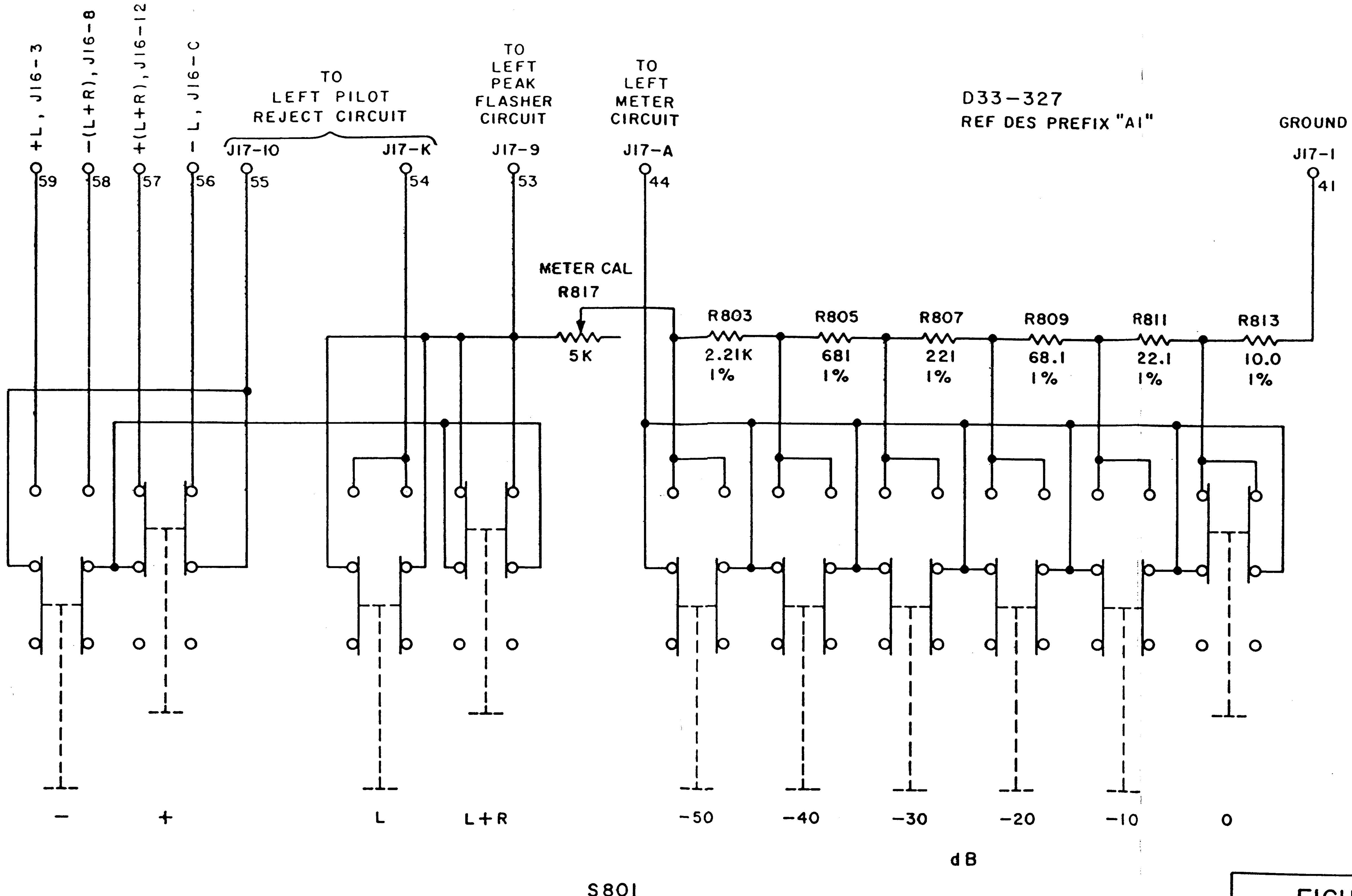


FIGURE 8-6A

SCHEMATIC DIAGRAM
PUSHBUTTON SWITCH
ASSEMBLY, LEFT

D93-345(A1)

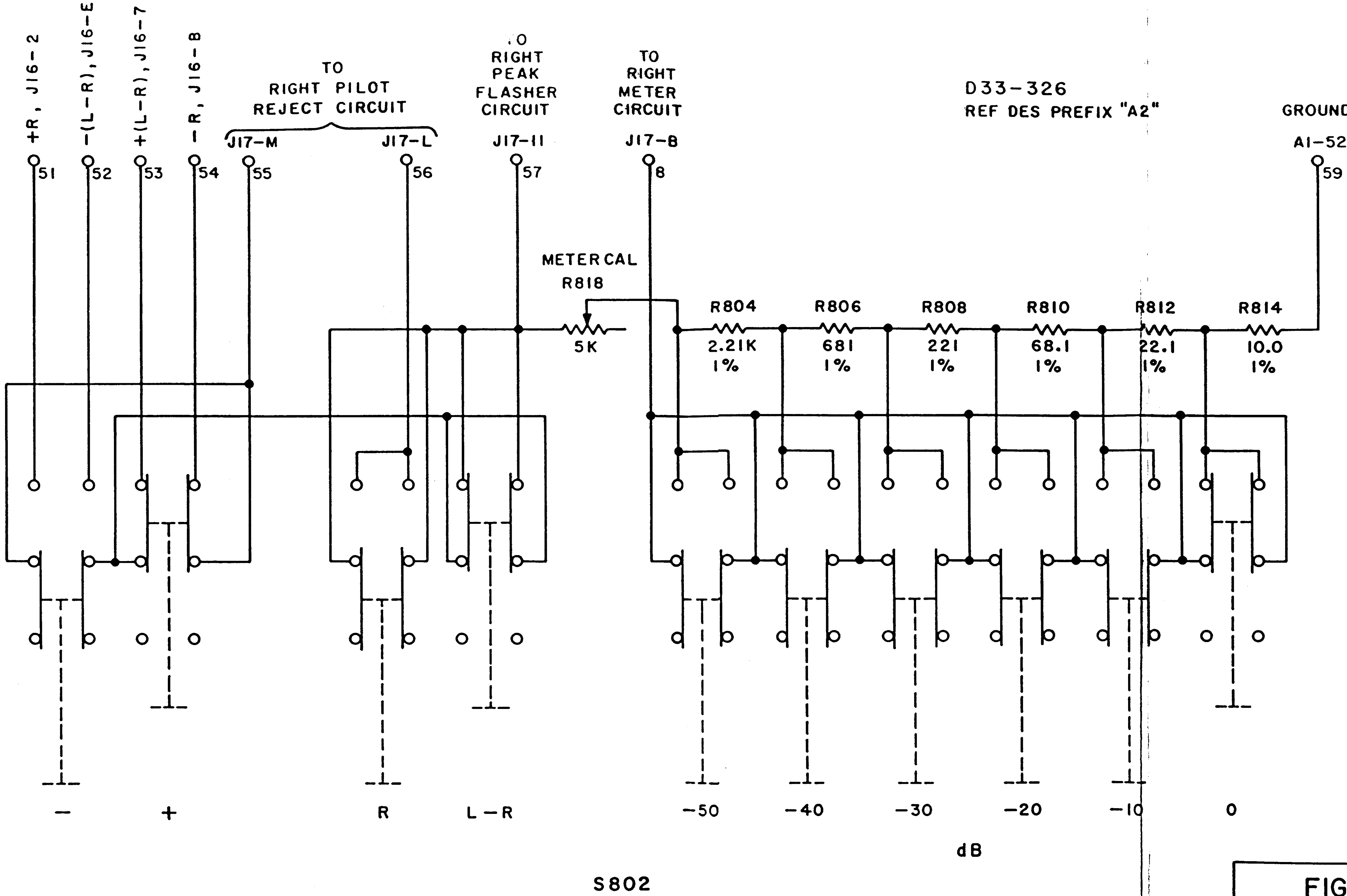
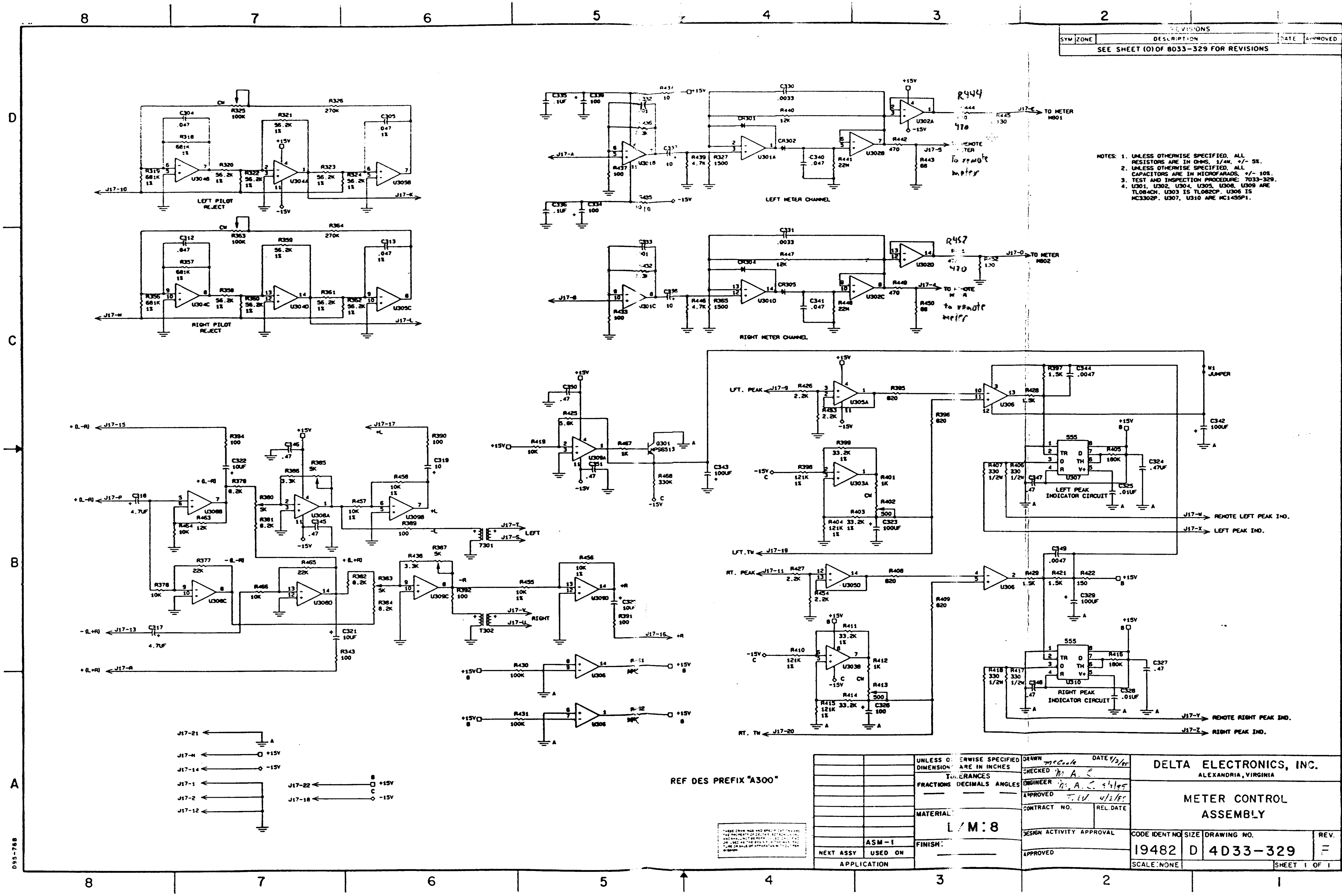


FIGURE 8-6B

SCHEMATIC DIAGRAM
PUSHBUTTON SWITCH
ASSEMBLY, RIGHT

D93-345(A1)


REVISIONS
SYM ZONE DESCRIPTION DATE APPROVED
SEE SHEET (0) OF 8D33-329 FOR REVISIONS
LEFT PILOT REJECT
RIGHT PILOT REJECT
LEFT METER CHANNEL
RIGHT METER CHANNEL
TO METER M801
TO METER M802
LEFT PEAK INDICATOR CIRCUIT
RIGHT PEAK INDICATOR CIRCUIT
REMOTE LEFT PEAK IND.
LEFT PEAK IND.
REMOTE RIGHT PEAK IND.
RIGHT PEAK IND.
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: 7033-329.
4. U301, U302, U304, U305, U308, U309 ARE TL084CN. U303 IS TL082CP. U306 IS MC3302P. U307, U310 ARE MC1455P1.
REF DES PREFIX "A300"
DELTA ELECTRONICS, INC.
ALEXANDRIA, VIRGINIA
METER CONTROL ASSEMBLY
CODE IDENT NO 19482
SIZE D
DRAWING NO. 4D33-329
REV. F
SCALE: NONE
SHEET 1 OF 1
4D33-329F

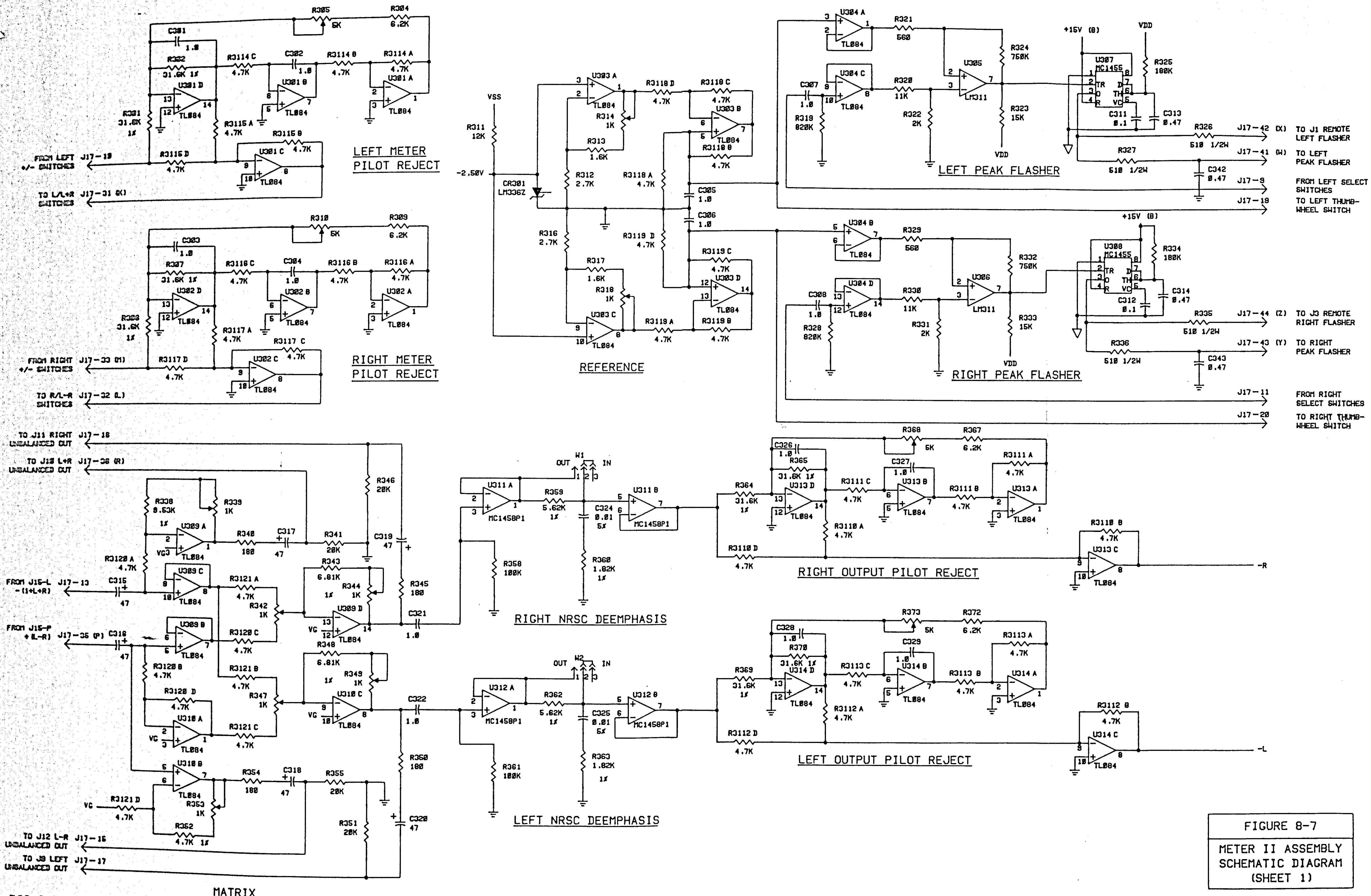
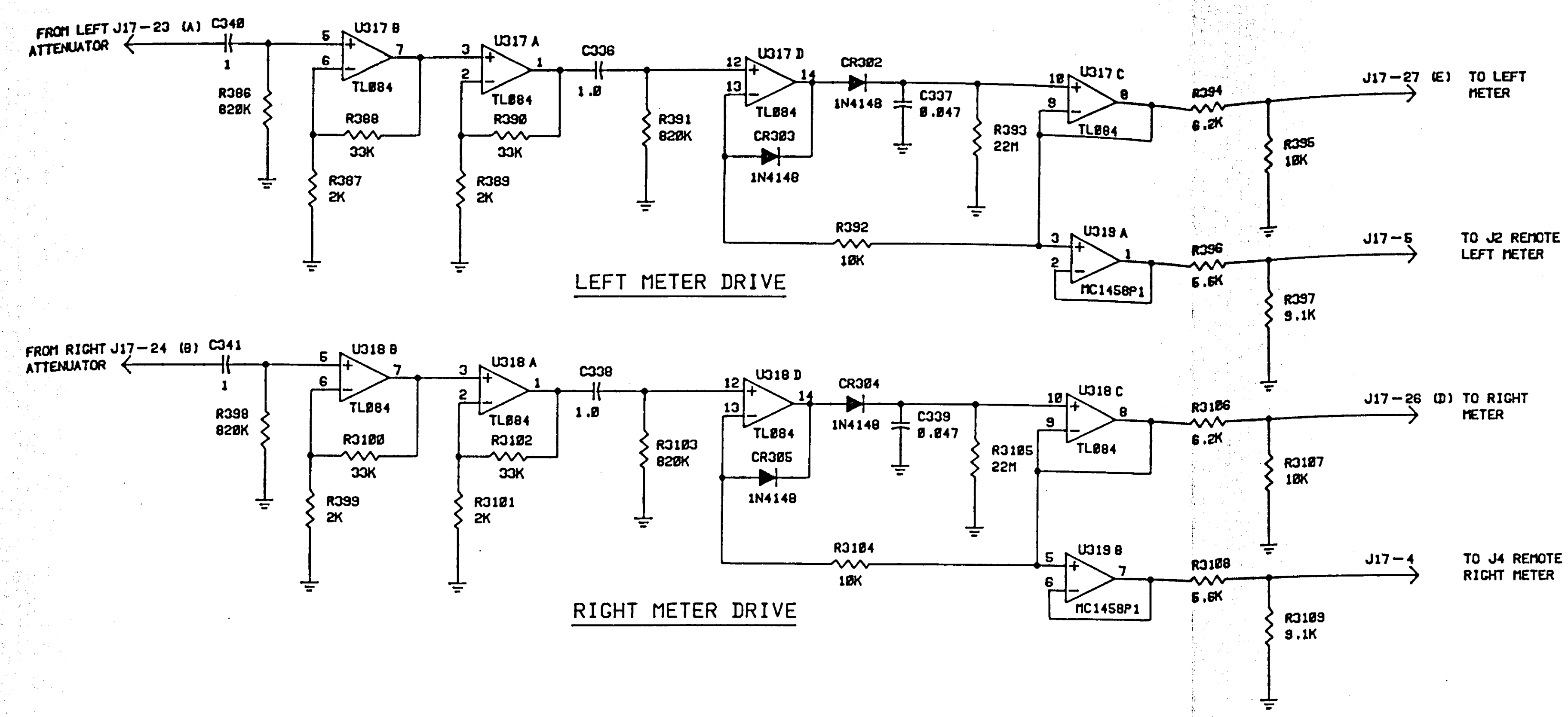
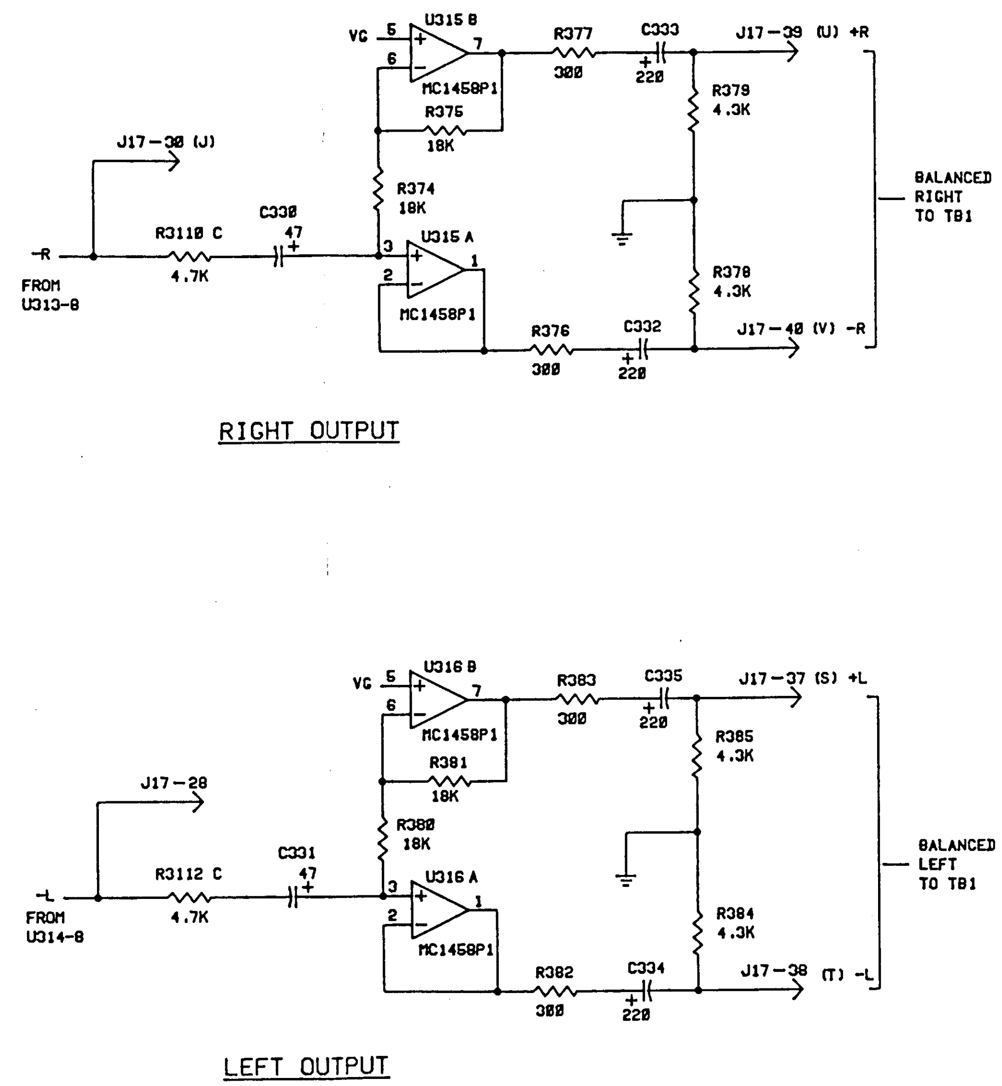
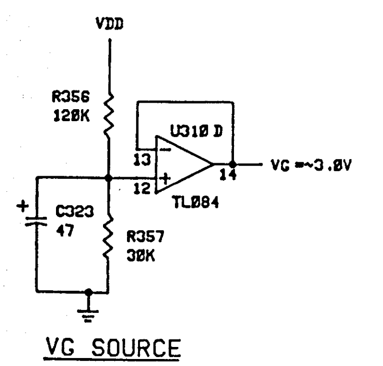


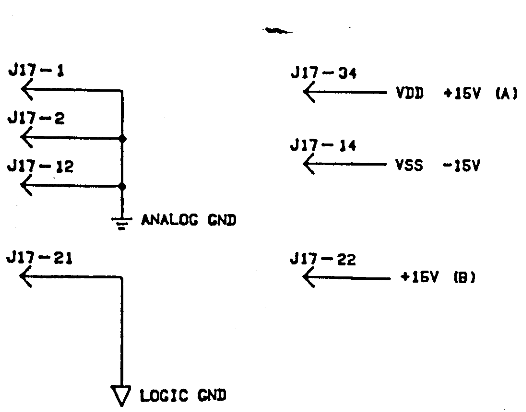
FIGURE 8-7

METER II ASSEMBLY SCHEMATIC DIAGRAM (SHEET 1)

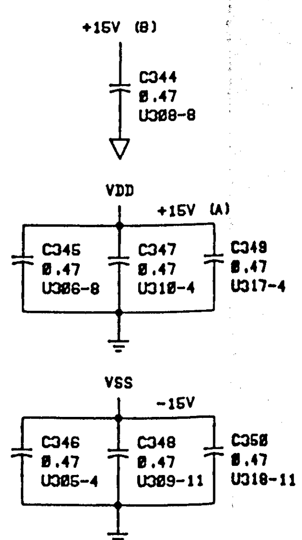








INTEGRATED CIRCUIT CONNECTIONS NOT SHOWN			
I.C.	+15V (A) (VDD)	-15V (VSS)	GND
U301	4	11	
U302	4	11	
U303	4	11	
U304	4	11	
U305	8	4	1
U306	8	4	1
U309	4	11	
U310	4	11	
U311	8	4	
U312	8	4	
U313	4	11	
U314	4	11	
U315	8	4	
U316	8	4	
U317	4	11	
U318	4	11	
U319	8	4	



NOTES: 1. UNLESS OTHERSISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W.

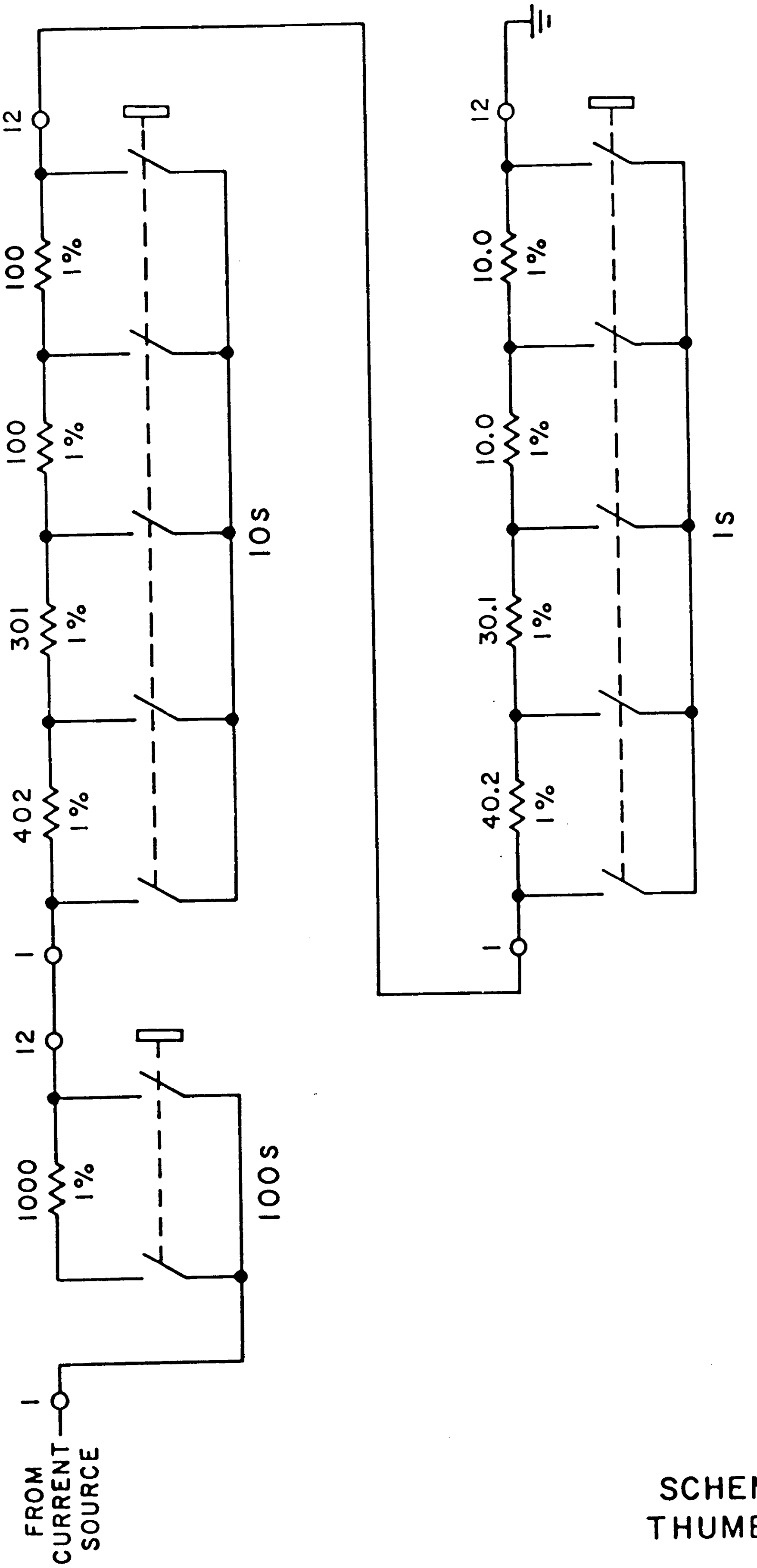
2. ALL SIP RESISTORS ARE +/-2%. UNLESS OTHERWISE SPECIFIED, ALL OTHER RESISTORS ARE +/-5%.

3. ALL CAPACITORS ARE IN MICROFARADS.

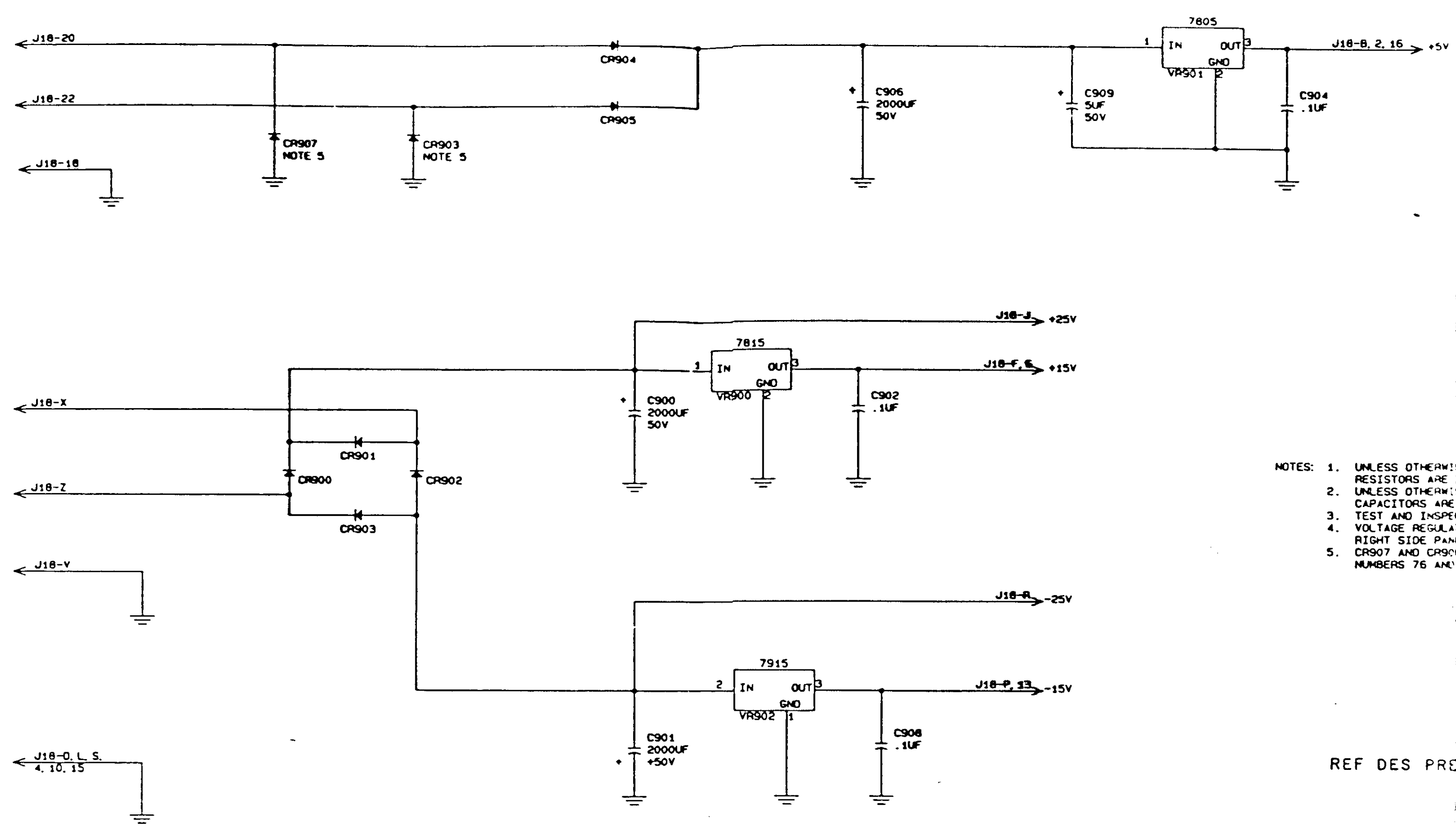
4. ALL ELECTROLYTIC CAPACITORS +/-20%. UNLESS OTHERWISE SPECIFIED, ALL OTHER CACITORS ARE +/-10%.

FIGURE 8-7

METER II ASSEMBLY SCHEMATIC DIAGRAM (SHEET 2)



SCHEMATIC DIAGRAM
THUMBWHEEL SWITCH
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: 7033-330.
4. VOLTAGE REGULATORS ARE MOUNTED ON RIGHT SIDE PANEL HEATSINK.
5. CR907 AND CR908 INSTALLED FOR SERIAL NUMBERS 76 AND ABOVE.

REF DES PREFIX "A900"

SEE SHEET (0) OF 8... -330 FOR R...

	ASM-1
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
FRACTIONS DECIMALS ANGLES
MATERIAL: L/M:8
FINISH:

DRAWN McCoole DATE 4/3/85
CHECKED
ENGINEER
APPROVED
CONTRACT NO. REL DATE
DESIGN ACTIVITY APPROVAL
APPROVED

DELTA ELEC...ICS, INC.
ALEXAND...IA

POWER ...LY
ASSE...

CODE IDENT NO 19482 | SIZE D | DRAWING 4D...330 | REV. -
SCALE: NONE | SHEET 1 OF 1

4D33-330

D95-76R