Nuoptix inc.

STEREO OPTICAL RECORDING SYSTEM

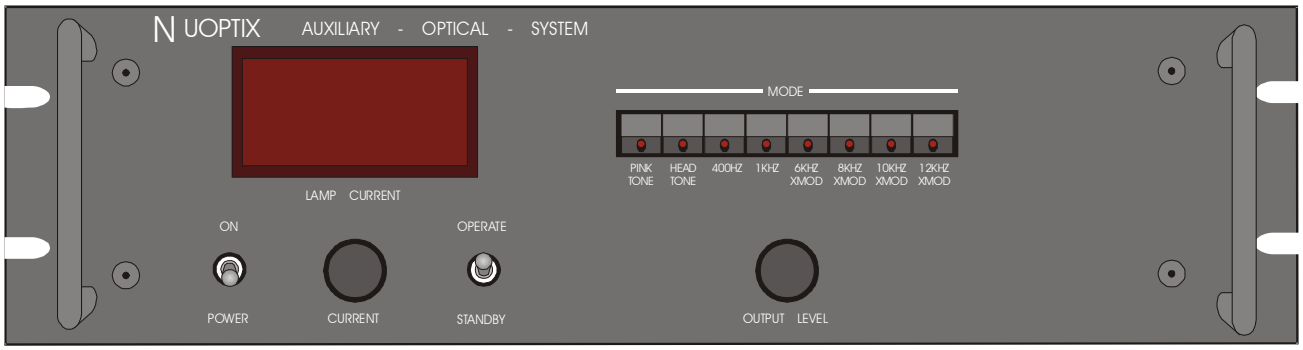

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TABLE OF CONTENTS

SPECIFICATIONS

STEREO OPTICAL RECORDING SYSTEM (SORS)

Electrical Characteristics:

Input Type:	Balanced differential amplifier
Input Level:	-10dbm to +10dbm (for 100% track)
Input Impedance:	10K ohms (may be driven from any souce 0 to 5K ohms)
Preamp Input:	SORS provides ±15VDC to and accepts monitor signals from photocell preamplifier
Output:	Drives modified 5 contact Westrex type light valves
Frequency Response:	20Hz to 14kHz
S/N Ratio:	>65 db
Power Requirements:	Powered by Auxillary Optical System

Physical Characteristics:

Dimensions:	19 inches (482.6 mm) wide 5.25 inches (133.3mm) tall 14.4 inches (368.3mm) deep
Weight:	12 lbs. 10 oz. (3.95 Kg.)

SPECIFICATIONS

AUXILLARY OPTICAL SYSTEM (AOS)

Electrical Characteristics

Lamp Output:	12VDC at 4.25 to 8.50 amps
Digital Meter:	Displays lamp current in amps
Signal Output:	Minus infinity to +13dbm Auto-controlled from SORS
Frequency Tolerence:	±0.005%
Output Frequencies:	400Hz Tone, 800 Hz Head Tone, 1kHz Tone 6kHz, 8kHz, 10kHz, 12kHz X-MODS
Pink Tone:	30 components 1/3 octave spacing Equal amplitude
Pink Tone Freqs:	24,32,40,48,64,80,96,128,160,192,256,320, 384,512,640,768,1024,1280,1536,2048, 2560,3072,4096,5120,6144,8192,10240, 12288,16384,20480 Hertz
Power Output:	±15VDC at 1.5 amps +5VDC at 0.5 amps
Power Requirements:	115 VAC or 230 VAC at 60Hz or 50 Hz
Power Consumption:	Approximately 225 watts

Physical Characteristics:

Dimensions:	19 inches (482.6mm) wide 5.25 inches (133.3mm) tall 14.5 inches (368.3mm) deep
Weight:	26 lbs. 8 oz. (13.2 Kg)

GENERAL DESCRIPTION

The Stereo Optical Recording System (SORS) and Auxillary Optical System (AOS) together comprise a complete photographic sound track recording package for making both monaural and Stereo Optical sound track negatives on a Westrex type recorder. The system uses a specially modified five contact light valve and electro-optical monitoring system. The SORS provides direct independent electronic control of each of the four "ribbons" in the five contact light valve. This allows electronic track placement and spacing so that a single valve can be used for both mono and stereo recording. The SORS monitors the light passing through the light valve to the film and uses this information to display on digital meters a direct readout of optical track size which means extremely accurate dimensions can be maintained. The SORS uses CCD technology to delay the audio signal while the noise reduction signal is being configured. This results in the lowest possible noise and eliminates the transient distortion and muted sound quality of older generation optical sound tracks. The direct electronic control of the light valve modulator provides for frequency response from 20Hz to 14kHz. The system provides for selected print loss equalization and exact level setup by use of digital peak signal monitoring. The SORS will accept input signal bus levels from -10dbm to +10dbm. It has a separate monaural input which is automatically selected when the system is switched to

the mono mode. The system provides line level monitor outputs capable of driving 600 ohm loads.

The AOS auxillary system provides a unique set of digitally generated test signals which can be instantly selected and injected into a recorded track. By digitally generating the test signals their frequency and level are extremely accurately defined. This assures that crossmodulation test tracks made on the machine are absolutely standard and readable on the new static crossmodulation reading system. A unique new Pink Tone signal is also selectable. This signal is also digitally generated and provides a flat spectrum on 1/3 octave spectrum analyzers and has the unique property that a three frame burst is all that is required to measure the frequency response of the recording system.

INSTALLATION INSTRUCTIONS

The SORS may be rack mounted in a standard 19 inch rack directly above the AOS unit. The AOS must have at least one inch clearance below to allow adequate air flow into the slots in its bottom panel. The case of the AOS is connected to the power cord third wire common. The case of AOS is connected to the case of the SORS through the G terminal XLR interconnect to the AOS. Signal ground is isolated from the case in both units. It is recommended that all audio signals be carried on shielded cables and that the recorder and the SORS and the AOS be tied to a common chassis ground.

Stray light falling directly onto the optical recorder visual observation window should be avoided as it can result in erroneous SETUP readings.

The pin outs of all connections on both units is given on page 23 as well as being indicated on the system schematics.

OPERATION

Before turning the system on or off the front panel mode switch should be set to the SETUP position. This electrically disconnects the light valve from the electronics and thereby protects it from electrical transients. The system is turned on by the power switch on the front of the AOS. To record an optical track, first set the record lamp current and select MONO or STEREO mode with the SORS front panel toggle switch. (Note that the lamp current may be reduced when not recording by toggling the lamp standby switch to the standby position. The reduced lamp current prolongs lamp life.) With the mode switch in the SETUP position adjust the SETUP pot controls on the front panel to read the slack light valve ribbon spacing (in mils) for the particular light valve in use. Rotate the mode switch to the BIAS position and adjust the two 10 turn controls labeled BIAS to provide the desired size bias lines as indicated on the digital meters. A 1.5 mil bias line for stereo recording and a 2.0 mil. bias line for monoaural recording is recommended. Note that different BIAS settings will be required for stereo and mono recording. Rotate the mode switch to the RECORD position and adjust the input bus level signal to read 50% using the INPUT level controls. The SORS will accept input bus levels from -10 dbm to +10 dbm. Prior to or following recording any of the test signals from the AUXILLARY

ELECTRONICS may be recorded by switching the input select switch from INPUT to AUX. The XMOD test signals may be used to verify crossmodulation distortion cancellation on the print or for recording standard crossmodulation distortion tests. The PINK TONE test signal is a digitally generated signal which appears as a spectrally flat signal on a 1/3 octave spectrum analyzer but can be read from a recording as short as 3 frames to verify *system and print frequency response. Following the recording, the mode switch may be switched to the REVERSE position for density check or to the E TEST position which alternates reverse bias and bias line. Following the recording the mode switch should be returned to the SETUP position to protect the light valve.

CAUTION: OPERATION OF THE RECORDING SYSTEM WITH CONSTANT FREQUENCY ABOVE 8kHz AND 80% MAY CAUSE PERMANENT DAMAGE TO THE LIGHT VALVE.

MONITORING

The monitor controls on the front panel of the SORS adjust the output monitor level but have no effect on the recording itself. The P.E.C./DIRECT toggle switch selects the monitor signal from the input or from the photocell monitor. The SORS is designed so that the adjustment of the SETUP controls assures that the P.E.C. and DIRECT monitor levels match. The internal PEC trimpot (R85) is set to match P.E.C. and direct monitor level (see P.E.C. amplifier adjustments).

EXPLANATION OF CONTROL

The INPUT controls adjust the input signal levels. The SETUP controls adjust the gains of the photocell monitor amplifiers which are DC coupled. The gain is set so that when the SORS unit is in the SETUP mode the front panel digital meters read the standby or "slack" ribbon spacing in mils. This standby track spacing may be verified by developing a strip of film exposed with the SORS in the SETUP position and measuring the track dimensions with a microscope. The BIAS control adjusts the gain of the output drive amplifier of the SORS whose output is the composite of the audio and noise reduction signals. In the BIAS mode only the noise reduction signal is present, and the ten turn BIAS controls may be adjusted to provide the desired size bias lines.

The Mono/Stereo toggle switch does two things. It selects the audio input to the SORS from either the two stereo inputs or the monaural input and it selects the proper track placement and spacing required for the two different recording modes.

CALIBRATION AND NECESSARY EQUIPMENT

The SORS is factory calibrated and use of the following procedures is not required in daily operation. The following equipment is required to calibrate the Stereo Optical Recorder: An audio signal source whose distortion is less than 0.05%; a digital voltmeter; a distortion analyzer; oscilloscope and frequency counter. The distortion analyzer should be band limited to 20kHz at its input to eliminate high frequency clock signal feed through. (Note: All measurements made during the calibration of the unit are made between the stated test point and the system ground. A convenient ground is provided as a loop of bare wire labeled GND on the PC board.)

INPUT SIGNAL LEVEL CALIBRATION

Rotate both BIAS controls on the front panel fully counter-clockwise to zero. Remove the film loss EQ by setting dip switches DS1 and DS2 to the OPEN position. Apply a 100% signal (i.e. 6db over buss level) at 400Hz to the MONAURAL input connector on the SORS back panel. Toggle the Mono/Stereo switch to the MONO position and set the input controls on the front panel to midrange. Rotate the mode switch to the RECORD position. Turn power on. Adjust IN LEV (R49) for +10 dbm at test point TP1. Adjust MTR CAL (R113) so that the panel meter reads 100. Do the same for both channels. This sets the operating level of the unit.

DELAY CALIBRATION

Delay calibration is factory set and should never need adjustment but if it should the following procedure should be used. Rotate inside clip ICLP (R11) and outside clip OCLP (R40) fully clockwise. This removes the clipper operation for the next part of the procedure. Adjust DEL IN (R9) for 0 dbm at TP5. This adjusts the signal level to the input of the delay circuit. With a frequency counter at TP6 adjust CLK (R52) for 150 kHz. The clock frequency determines the audio delay. Adjusting to 150 kHz provides for 25mS of audio delay. With the scope probe attached to TP7 adjust BAL (R55) so that the two sampled 400Hz waveforms lay directly on top of one another and appear as a single waveform. Increase the input level to 130% on the panel meter. Adjust BIAS (R31) to yield minimum distortion at TP8.

NOISE REDUCTION CALIBRATION

Once again the noise reduction should not require adjustment once factory set but the following procedure can be used if alignment is necessary. Check to be sure the clipper trimpots R11 and R40 are turned fully clockwise. Rotate the mode switch to the BIAS position. Adjust comparator CMP (R141) so that the voltage at TP10 just switches from +15 to -15 volts. This allows the NR circuit to follow signals that are at extremely low levels. Return the mode switch to RECORD and set the input level to 100%. Adjust DEL NR (R136) so that the voltage at TP9 just begins to increase. For best results R136 should be set just before the increase occurs. This adjusts the level of the delayed signal fed back to the NR peak follow circuit. This holds the NR circuit open until the end of the delayed signal. Adjust NR GAIN (R171) for -0.1VDC at TP11. This adjusts the NR gain or margin. Adjust AUD (R144) for a 7.60V peak to peak signal (2.68 VRMS) at TP12. Note there will be approximately +0.2VDC at this point. This sets the required amount of audio signal to be summed to the DC noise reduction signal. (Note: The adjustment of R144 should be verified by photographic development tests of tracks as described in the TRACK PLACEMENT AND SIZE ADJUSTMENT section. The final setup requires that the modulated amplitudes on the track be that given on page 16 for a given meter reading in the RECORD position. R144 should be adjusted finally for that result.)

CLIPPER CALIBRATION

This adjustment reduces the amount of clash on excessive overloads. Adjust ICLP (R11) for +4.0 VDC at TP4 and adjust OCLP (R40) for –4.0 VDC at TP 3. This setting clips signals just over 130% on the inside and outside part of the track.

TRACK PLACEMENT

This section will require a series of darkroom development tests. On the PC board layout diagram you will notice four trimpots labeled S1, S2, M1 and M2. Trimpots S1 and S2 displace the ribbons while the unit is in the stereo mode. Trimpots M1 and M2 displace the ribbons while in the mono mode. Trimpots S1 and M1 move the ribbons that are closest to the picture area of the film while S2 and M2 move the ribbons that are closest to the sprocket holes. Ribbon positions can be quickly and accurately set by using the front panel meters. With the BIAS controls reduced to zero and the rotary mode switch set to BIAS the meters will accurately read the ribbon spacing if the SETUP pots on the front panel have been properly adjusted to slack spacing reading (See Operating Instructions). Now the meter will accurately reflect any movements of the individual ribbons made by the ribbon placement trimpots. One must first determine how much and in which direction each ribbon needs to be moved using a film development test. The appropriate internal placement trimpots can be adjusted while observing the front panel meters to gauge the resultant displacements. This will provide rapid and accurate positioning of the track edges. Track placement should be verified by a final photographic development test.

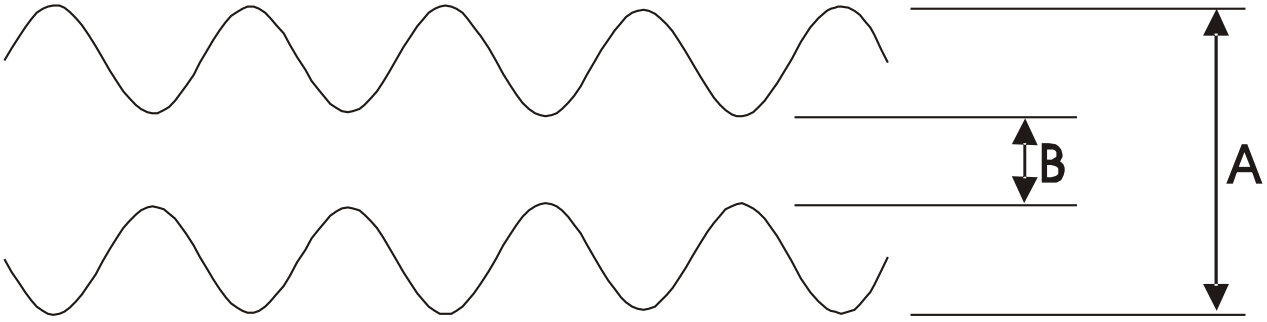
SIZE ADJUSTMENT

Record an 80% signal at 400Hz and develop the negative. Measure the total recorded modulation as determined using the formula on the page titled “How to Measure % Modulation” on the next page. If the measured modulation does not equal 80%, do the following:

- Connect a dB meter connected to the monitor output then adjust R144
- Rotate the mode switch to the RECORD position.
- Toggle the PEC/DIRECT switch to PEC.
- Rotate the monitor level potentiometer to midrange (12 o'clock position)
- Reading the db meter, adjust R144 to achieve the appropriate gain/loss required.

db = 20 x log(80 ÷ %modulation measured)

HOW TO MEASURE % MODULATION ON 35mm DUAL BILATERAL OPTICAL TRACKS



$$\%MOD = \frac{A-B}{38} \times 100 \qquad \text{MONO TRACK}$$

$$\%MOD = \frac{A-B}{33} \times 100 \qquad \text{STEREO TRACK}$$

EXAMPLE: % MODULATION OF ONE TRACK OF A STEREO TRACK

A = 31.5 MILS

B = 5.8 MILS

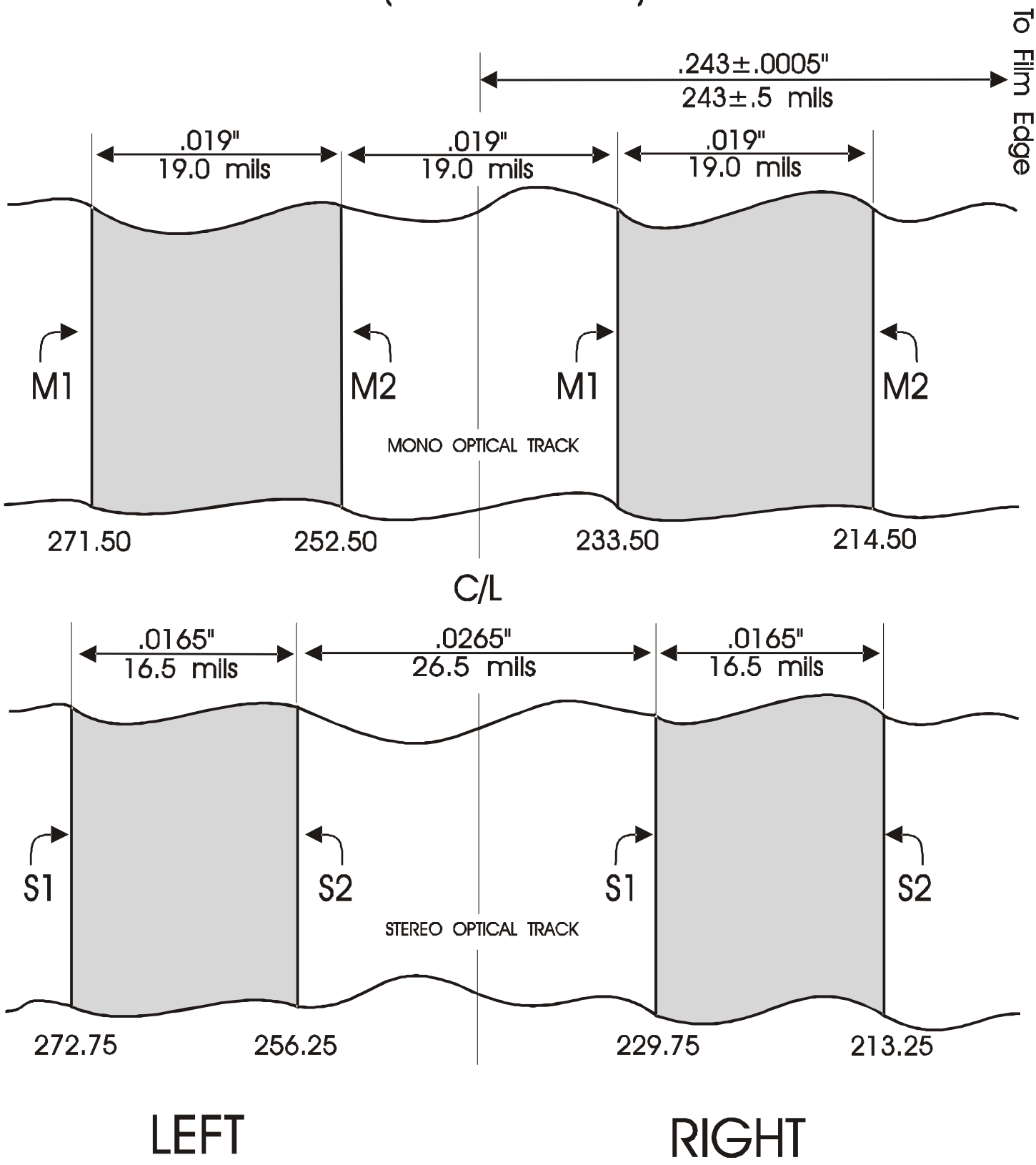
(A-B) = 25.7 MILS

$\frac{(A-B)}{33} \times 100 = 77.8\%$ MODULATION

MUST MEASURE BOTH TRACKS OF DUAL BILATERAL TRACK AND AVERAGE

OPTICAL TRACK DIMENSIONS AND PLACEMENT

(WITH ZERO BIAS)



LIGHT VALVE EQUALIZATION

Check to see that film loss EQ dip switches DS1 and DS2 are set to OPEN (i.e. flat or no equalization). Toggle the recording lamp to OPERATE and set to nominal current. Rotate the mode switch to the SETUP position and adjust the SETUP controls for slack spacing meter reading. Advance the mode switch to the BIAS position and increase the BIAS controls on the front panel for an 8 mil bias line as indicated on the front panel meter. Advance the mode switch to the RECORD position and apply a 50% signal at 400Hz. With the DIRECT/P.E.C. toggle switch in the P.E.C. position increase the MONITOR control for a 0 dbm level on the monitor output. Carefully sweep the input frequency making sure that the input level remains constant and adjust the light valve equalization internal trimpots to achieve a flat response as monitored on the P.E.C. monitor output. The reduced signal and bias level are used to assure that the light valve does not clash during the equalization procedure. The 2KHZ, 4KHZ and 6KHZ are boost and cut filters with midrange being flat. The 8KHZ (R71) is a cut only filter with CW being flat. The 8KHZ filter has a frequency trim control F8 (R93) with midrange being around 8.5 KHZ. The Q of this filter is similar to that of the light valve. Setting the notch frequency of the 8KHZ filter to just above the light valve resonance frequency, say 9KHZ, results in the most accurate equalization. The 10KHZ (R74) is a boost only filter with a frequency trim control F10 (R94). Rotating F10 CW increases the frequency. Increasing the frequency of the 10KHZ filter to near its upper limit yields equalization out to higher frequencies.

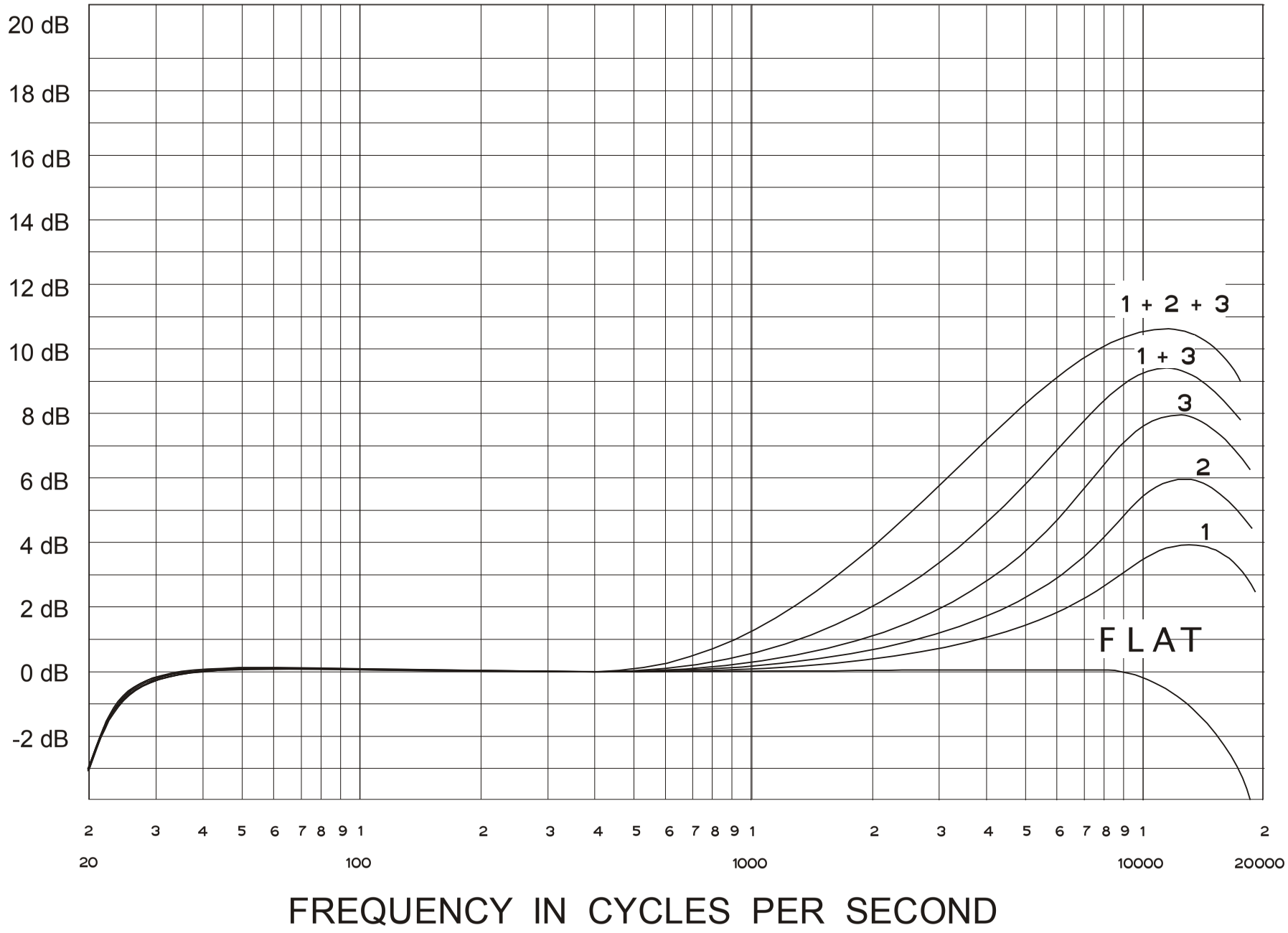
LAMP BALANCE

Optical sound track negatives must be properly exposed to assure crossmodulation distortion cancellation. This is accomplished by preparing crossmodulation tests for each laboratory at which sound track negatives are to be made. In addition the two tracks of a Stereo Optical or dual bilateral optical sound track must be of equal density. Hand development test at the recording studio may be used to assure this balance of density. The photoelectric monitoring system on the SORS is very helpful in achieving lamp balance which is changed by moving the record lamp horizontally. You will note that with the SORS in the SETUP position the meters read the amount of light exposing the two tracks. As the lamp is moved horizontally the displayed numbers will change. You will note that there is a simple relationship between the meter readings and the densities measured on the exposed negative and that this may be used to balance the lamps by monitoring the meters while moving the lamp.

FILM LOSS EQUALIZATION

After all the calibration procedures are complete, film loss EQ dip switches DS1 and DS2 should be set. DS1 is for recording preemphasis and DS2 is for monitor deemphasis. Both are complimentary to each other and should therefore always be set in the same condition. Refer the SORS PRINT LOSS EQUALIZATION curves to select the appropriate position. Position 1 with the 680pf capacitor is recommended for 35mm recording.

SORS PRINT LOSS EQUALIZATION



P.E.C. AMPLIFIER ADJUSTMENTS

Unplug the recording lamp from the back panel of the SROS. Rotate the mode switch to the SETUP position and rotate the SETUP pot on the front panel fully clockwise. Adjust PEC OFFSET pot (R182) so that the front panel meters read zero. (Caution: The PEC offset can be effected if bright light is allowed to fall on the visual track window. The window size has been reduced to minimize the problem but still care should be exercised.) Reconnect the recording lamp and set to the nominal recording lamp current. Adjust the the SETUP controls for the proper slack ribbon spacing readings. Rotate the mode switch to BIAS and adjust for a 1.5 mil bias line. Change to RECORD mode and adjust the input to 80% at 400 Hz. With the DIRECT/P.E.C. in the DIRECT position adjust the MONITOR level control on the front panel for +10 dbm at TP15. Now toggle the switch to the P.E.C. position and adjust PEC trimpots (R85) for +10 dbm. This adjustment matches the direct and P.E.C. levels. Connect the input to the LEFT channel only. Adjust XTK (R81) for minimum signal appearing at TP15 of the right channel board. Connect the input to the RIGHT channel only and adjust XTK (R81) for minimum signal appearing at TP15 of the left channel board. This adjustment cancels any crosstalk that may have accumulated in the optical system.

PIN OUT CONNECTS FOR THE SORS AND THE AOS

1. Left, Right & Mono Signal Inputs - 3 pin female XLR
   - Pin 1 - Ground
   - Pin 2 - Low
   - Pin 3 - High

2. Left & Right Channel Monitor Outputs - 3 pin male XLR
   - Pin 1 - No Connect
   - Pin 2 - Ground
   - Pin 3 - High

3. Optical Preamplifier - 5 pin male XLR

   C502 PREAMP

   - Pin 1 - Right Input - RT
   - Pin 2 - +15 V Supply - V+
   - Pin 3 - COM - COM
   - Pin 4 - -15 V Supply - V-
   - Pin 5 - Left Input - LT

4. Light Valve Output - 5 pin female XLR

   LV TERMINALS

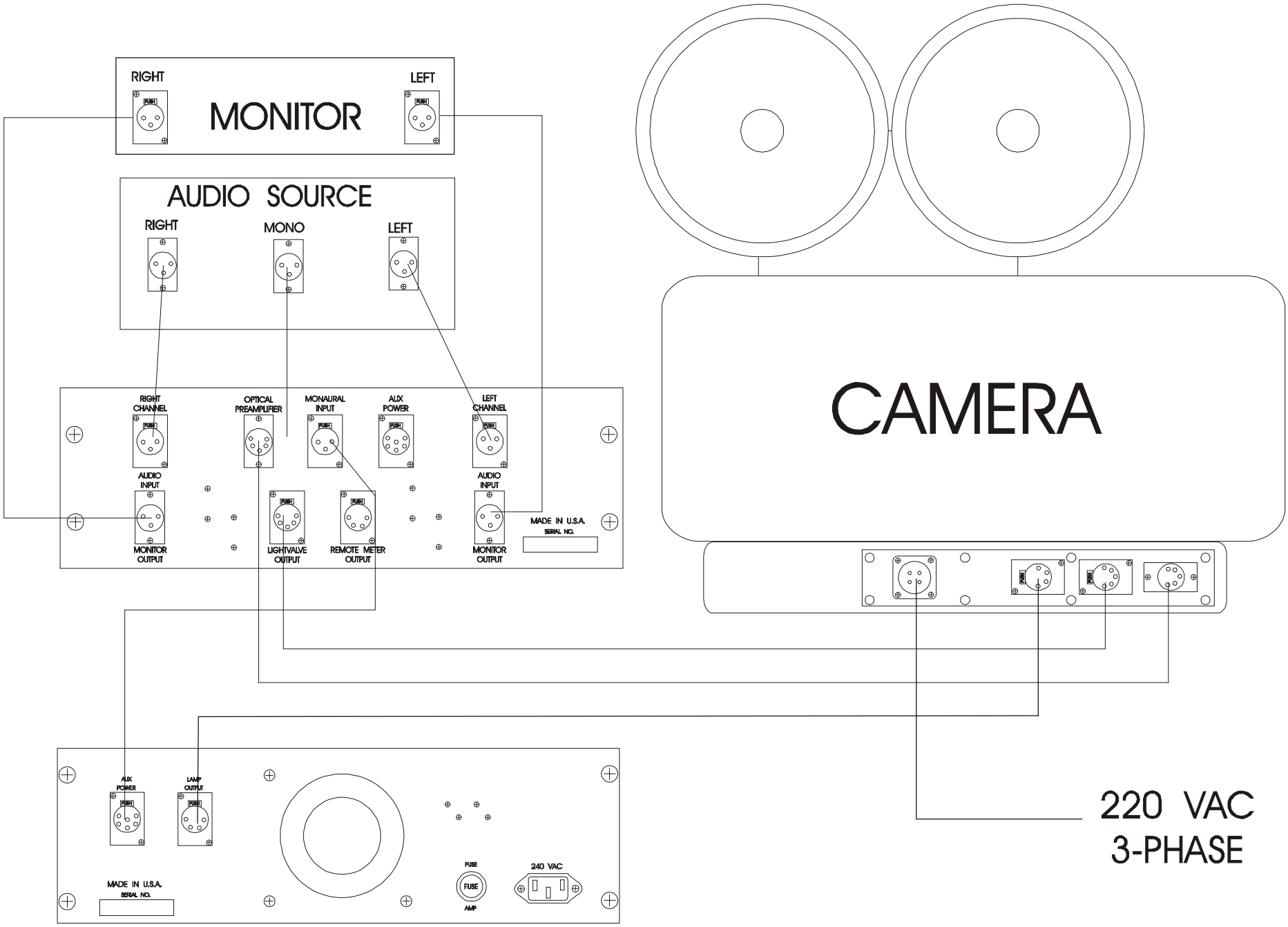
   - Pin 1 - Left - (Sprocket Side) - 1
   - Pin 2 - Left + (Picture Side) - 2
   - Pin 3 - COM - 3
   - Pin 4 - Right - (Sprocket Side) - 4
   - Pin 5 - Right + (Picture Side) - 5

5. Remote Meter Output - 4 pin female XLR
   - Pin 1 - Left + Output
   - Pin 2 - Ground
   - Pin 3 - Ground
   - Pin 4 - Right + Output

6. Auxillary System - 6 pin female XLR

(SORS Input)	(AOS Output)
Pin 1	Pin 1 - + 15V Supply
Pin 2	Pin 2 - - 15V Supply
Pin 3	Pin 3 - Aux Generator Signal
Pin 4	Pin 4 - Generator On/Off Control
Pin 5	Pin 5 - +5 Volts
Pin 6	Pin 6 - Ground

7. Lamp Output - 4 pin female XLR
   - Pin 1 - Low Side
   - Pin 2 - Low Side
   - Pin 3 - High Side
   - Pin 4 - High Side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RIGHT
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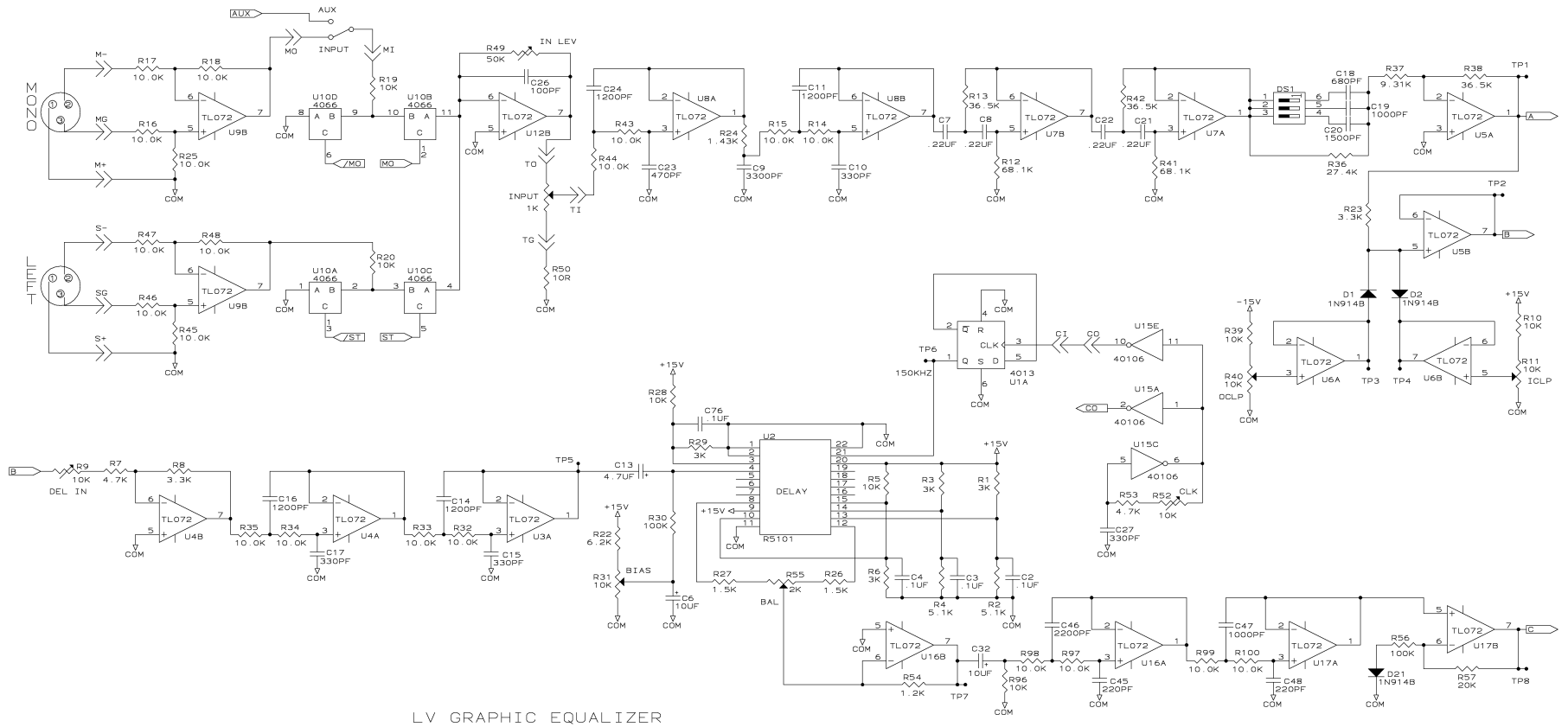

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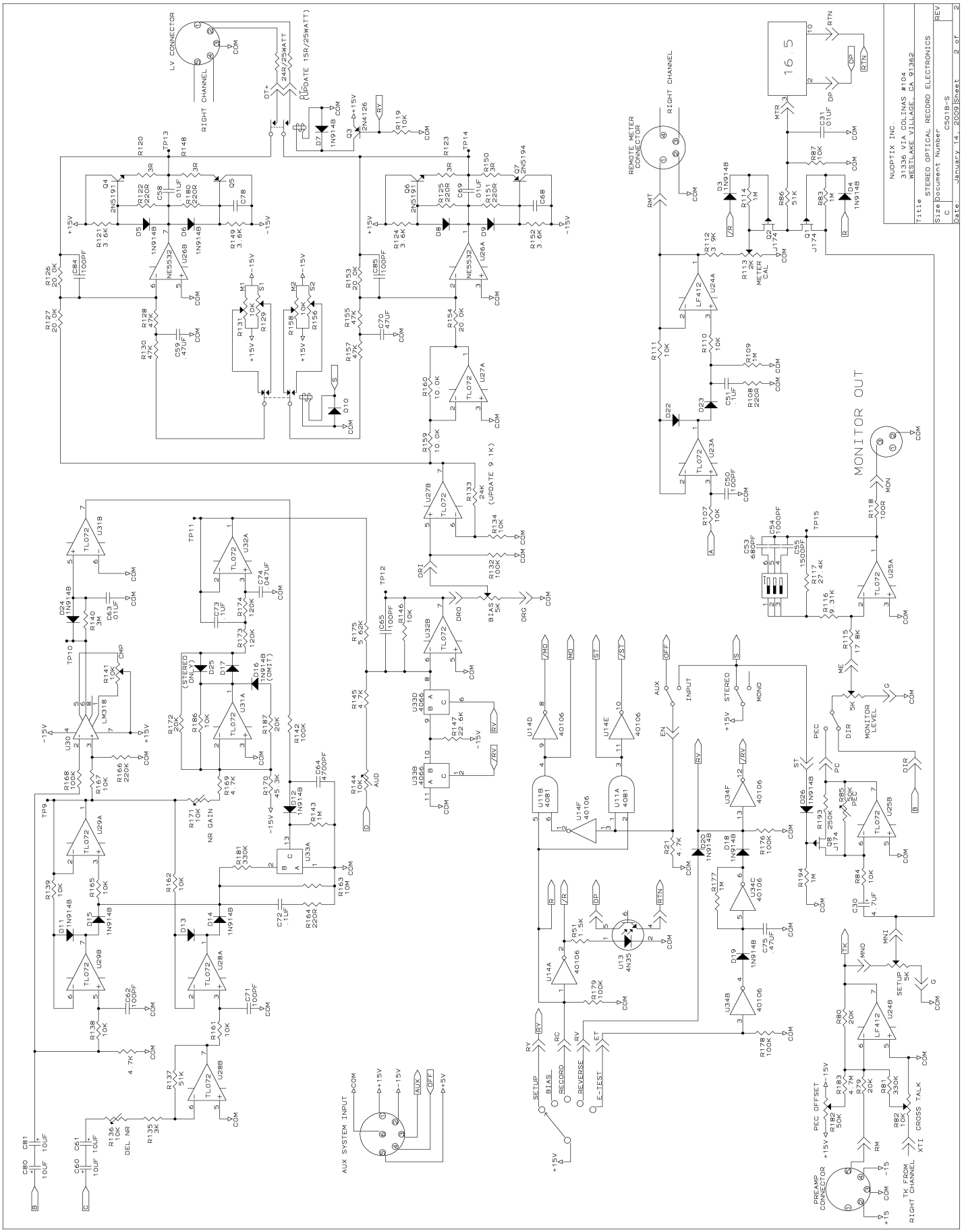
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PREAMP CONNECTOR
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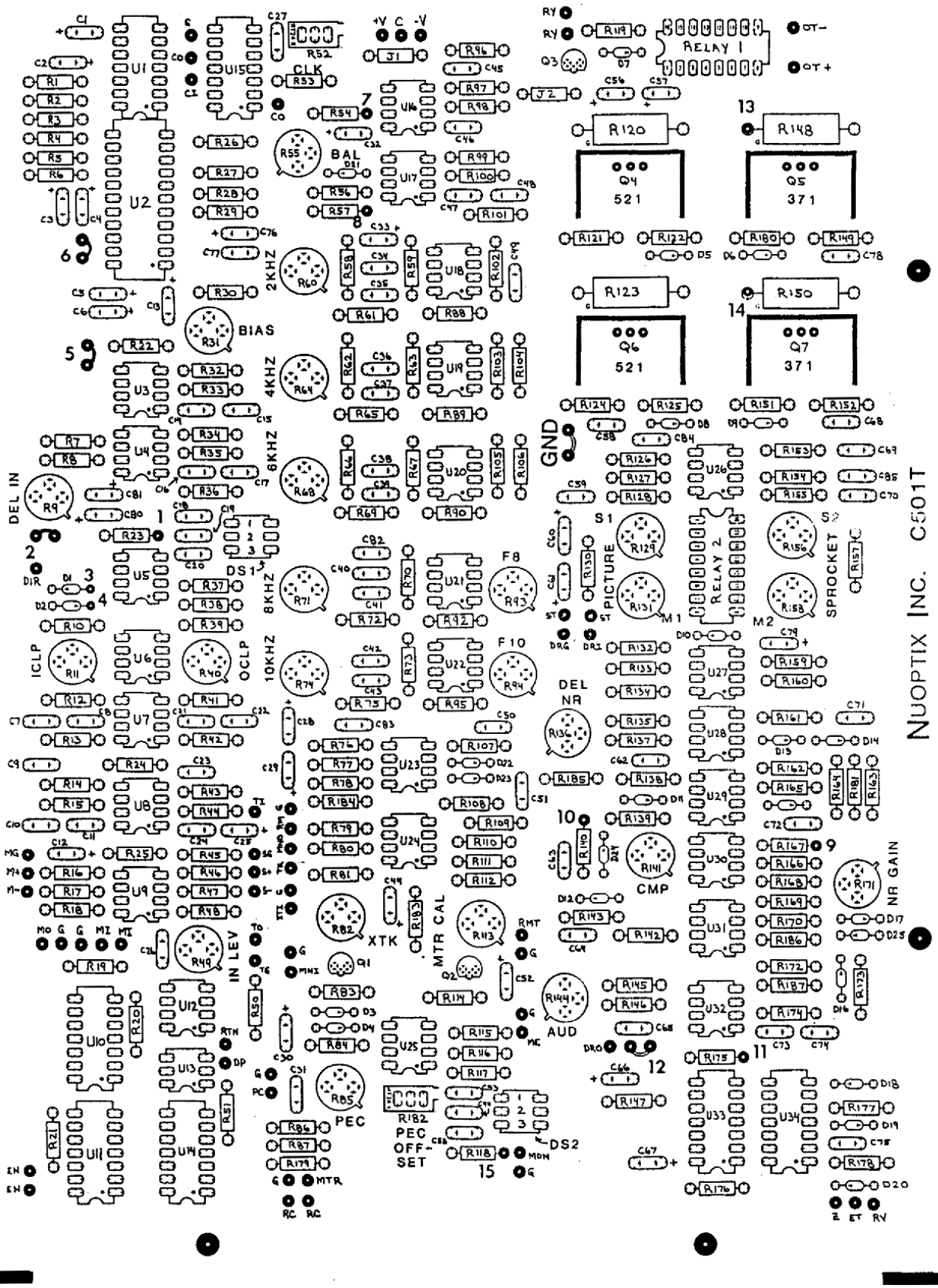
E-TEST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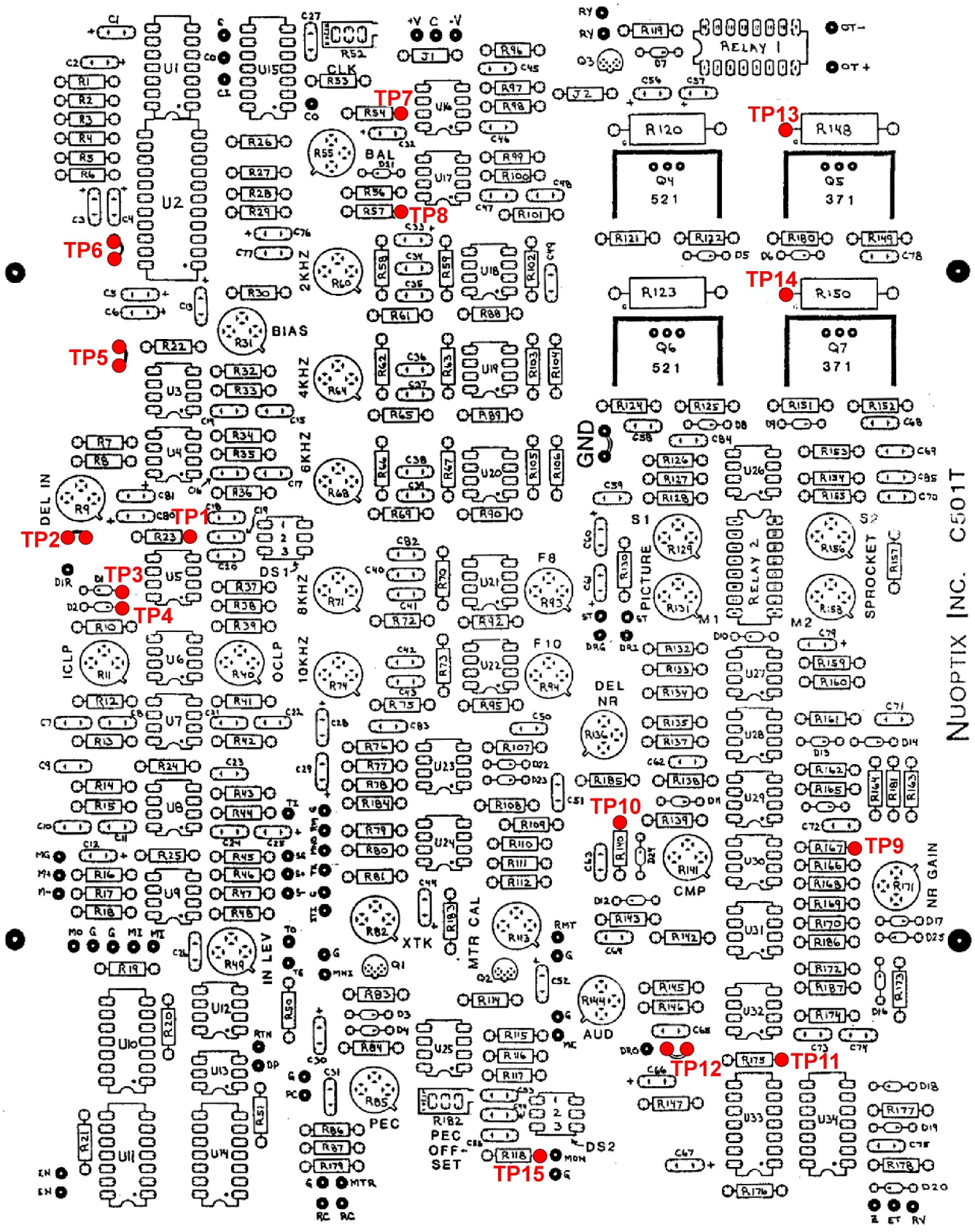
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Q5 371
Q6 521
Q7 371
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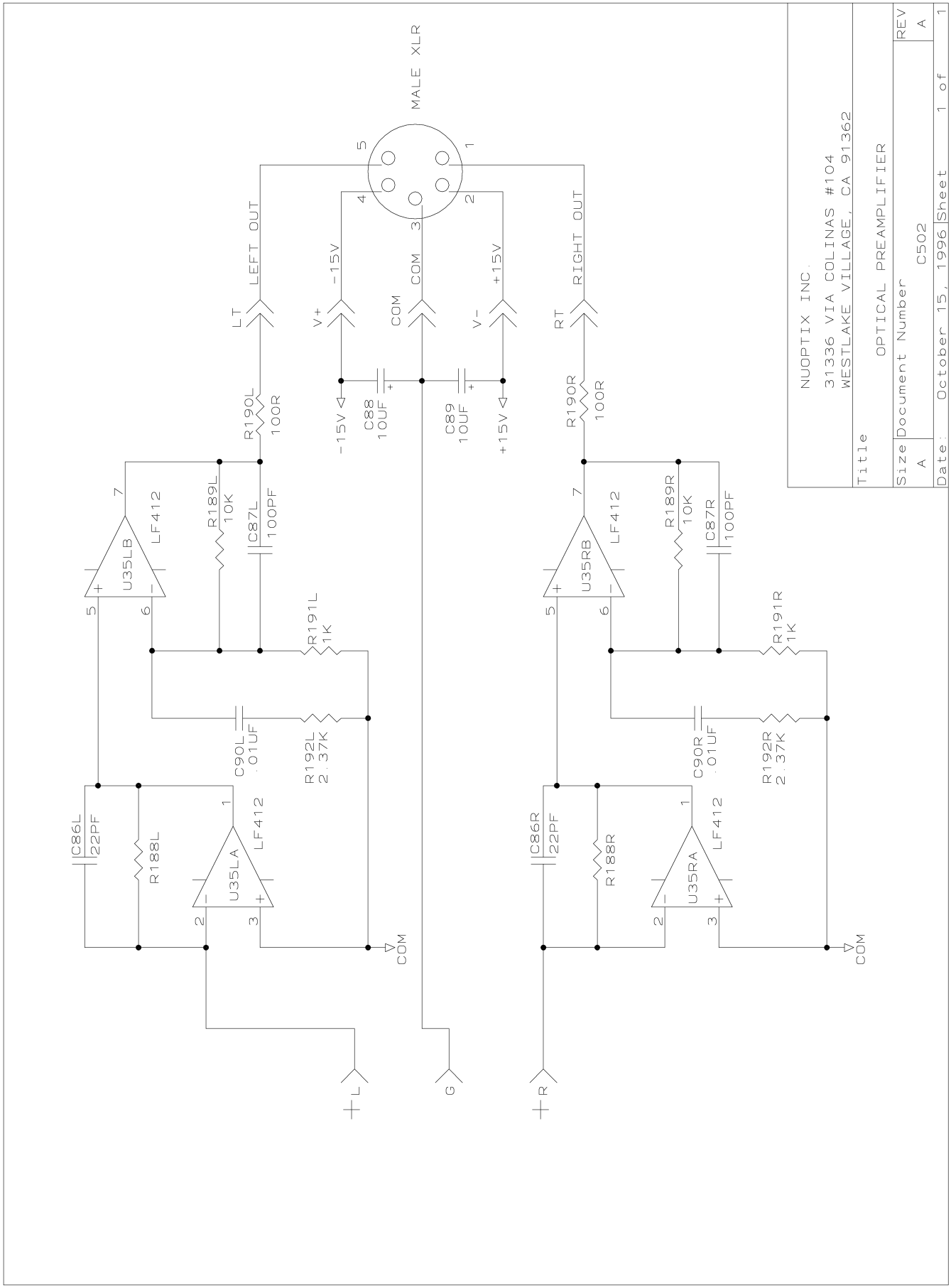
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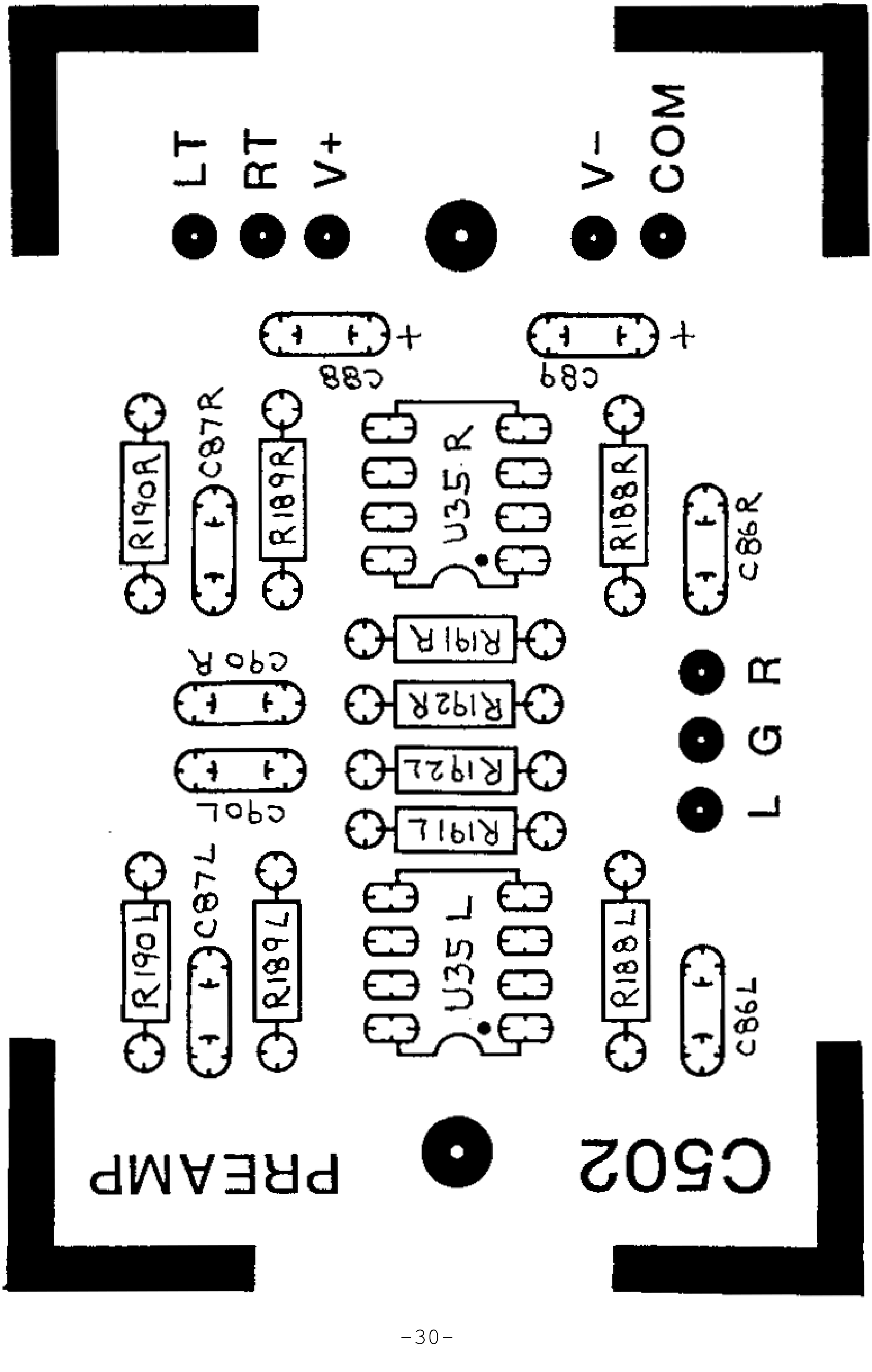
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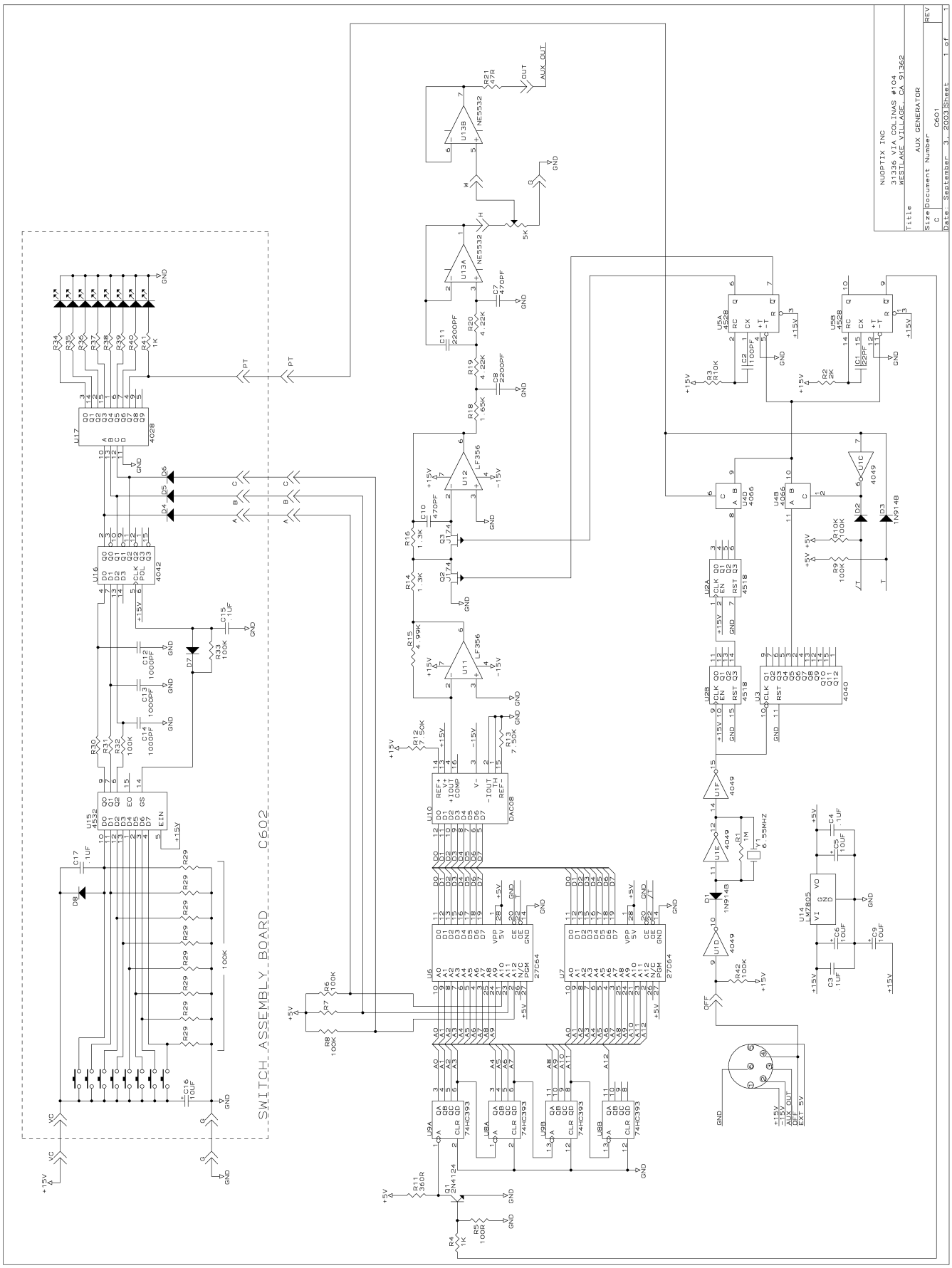
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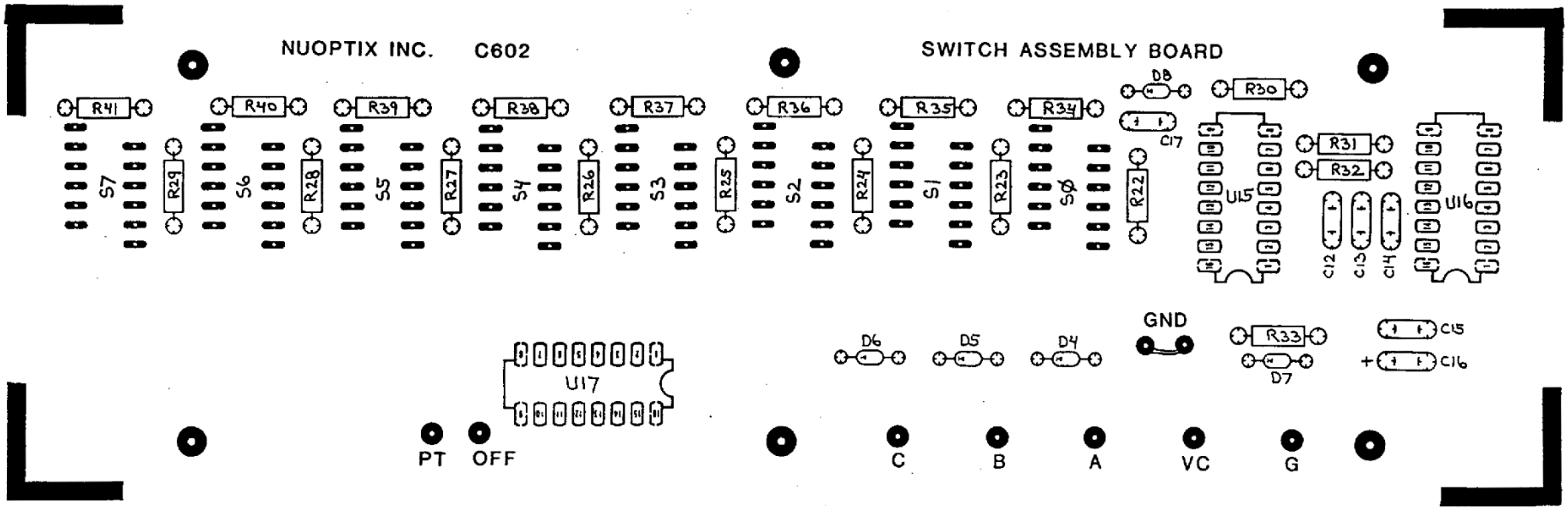
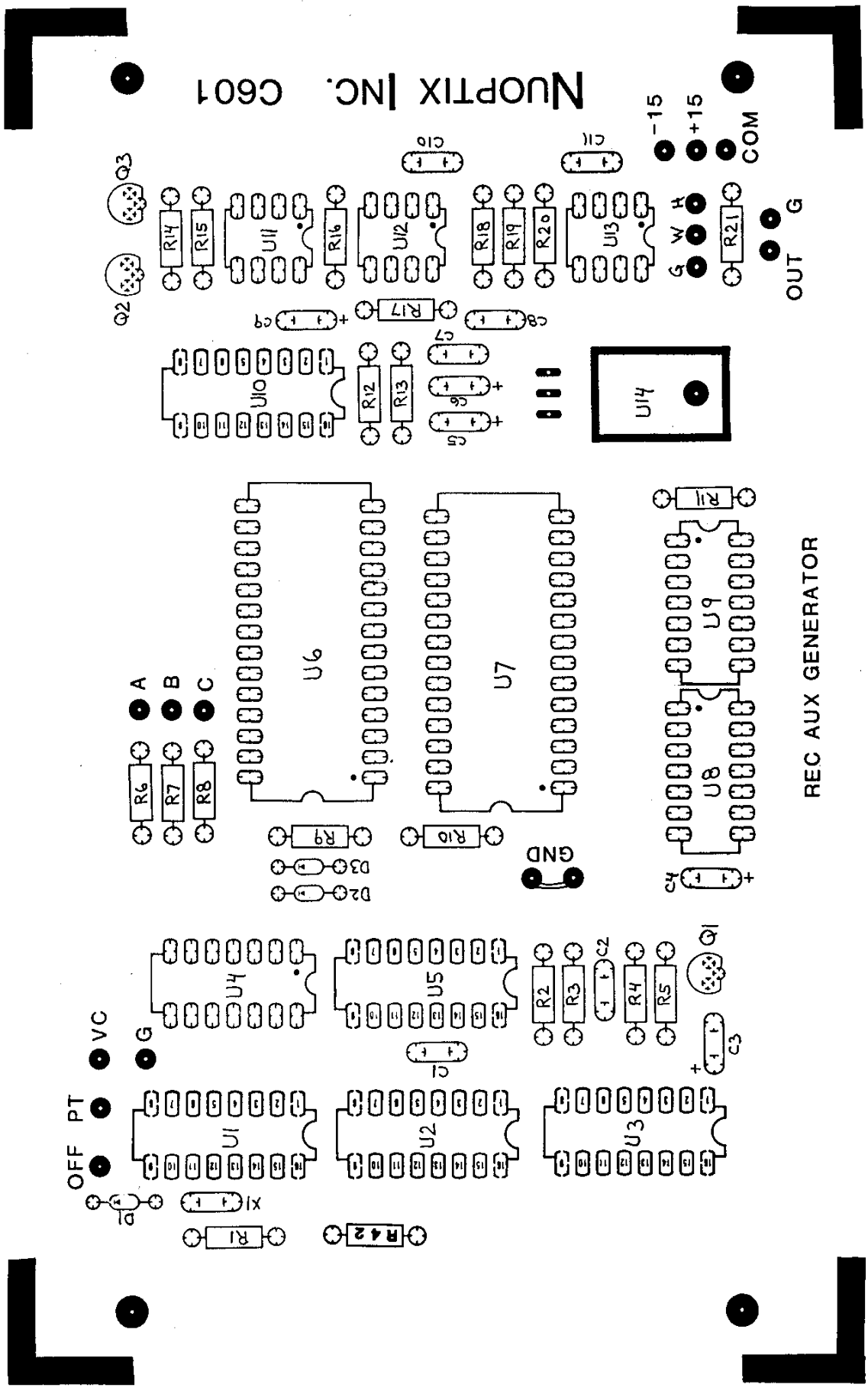
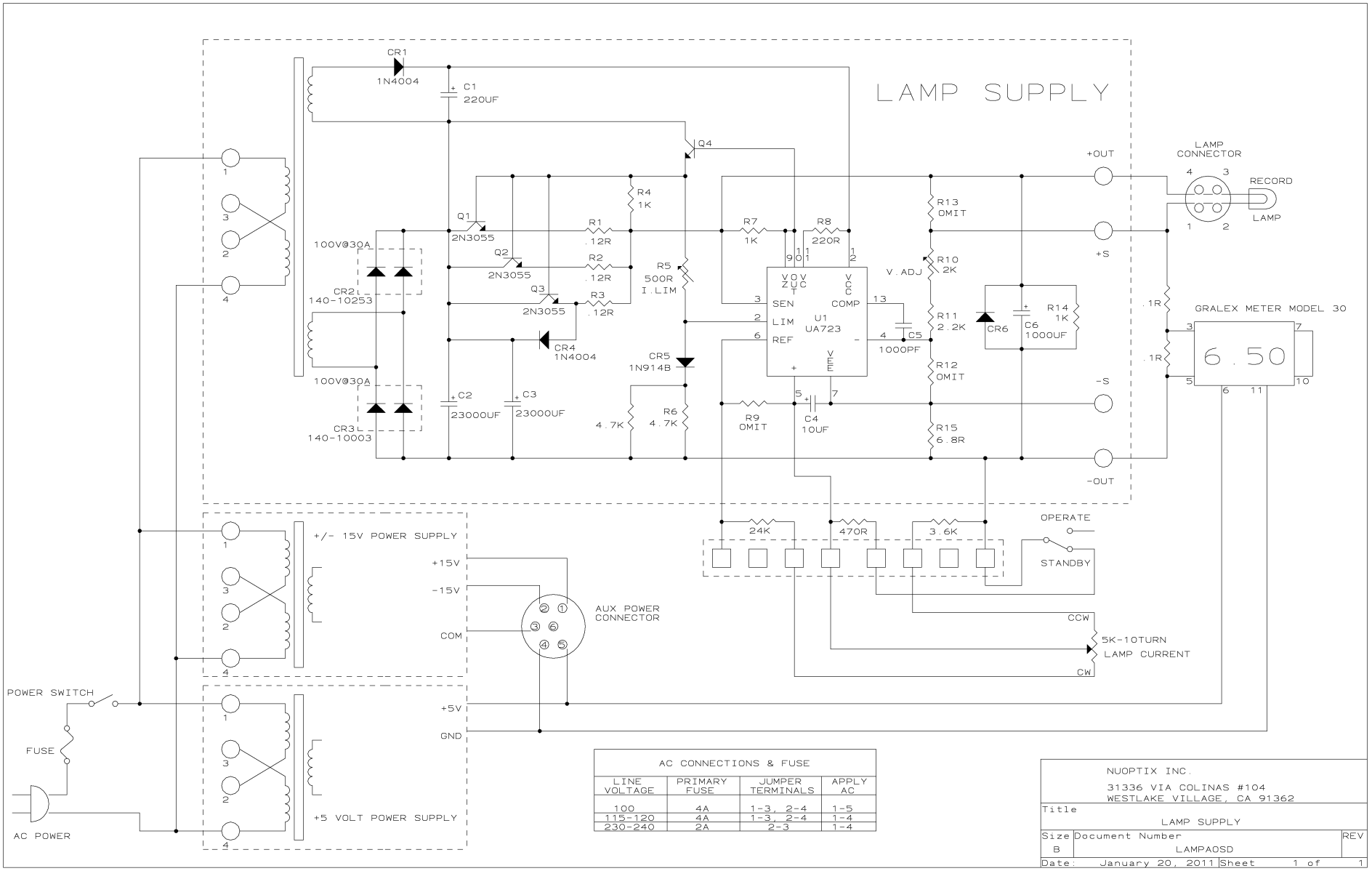
1N914B
1N9148
+15V
-15V
+5V
GND


NUOPTIX INC. C602
SWITCH ASSEMBLY BOARD
R41
R40
R39
R38
R37
R36
R35
R34
R30
R31
R32
R33
R29
R28
R27
R26
R25
R24
R23
R22
S7
S6
S5
S4
S3
S2
S1
S0
D8
C17
U15
U16
C12
C13
C14
C15
C16
D6
D5
D4
D7
GND
U17
PT
OFF
C
B
A
VC
G


NUOPTIX INC. C601
REC AUX GENERATOR
OFF
PT
VC
G
A
B
C
GND
-15
+15
COM
OUT
G
W
H
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R42
C1
C2
C3
C4
C5
C7
C8
C9
C10
C11
Q1
Q2
Q3
D1
D2
D3
X1



AC CONNECTIONS & FUSE			
LINE VOLTAGE	PRIMARY FUSE	JUMPER TERMINALS	APPLY AC
100	4A	1-3, 2-4	1-5
115-120	4A	1-3, 2-4	1-4
230-240	2A	2-3	1-4

NUOPTIX INC.
31336 VIA COLINAS #104
WESTLAKE VILLAGE, CA 91362

Title: LAMP SUPPLY

Size: B | Document Number: LAMPAOSD | REV:

Date: January 20, 2011 | Sheet 1 of 1