



Nuoptix Cross-Modulation
Distortion Analyzer
RA1718

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General Description

The Nuoptix cross-modulation distortion analyzer is designed to measure the amount of residual cross-modulation distortion in optical sound track recordings for the purpose of determining the correct exposure of the sound track negative. The instrument has an automatic mode of operation in which it recognizes the type of signal being monitored and switches to the proper mode and measures the relevant quantity. The analyzer also determines the phase of residual distortion thereby indicating whether the negative is over or under exposed. This feature greatly facilitates cross-modulation testing.

Circuit Description

The signal is received by a high input impedance differential amplifier U8 followed by a level set potentiometer R11 which is the front panel LEVEL control. Overload detector U3 detects if the first stage amplifier or following buffer amplifier is overloaded. If overload occurs the front panel overload LED D15 is illuminated. Following the LEVEL pot the signal follows two paths. The first path beginning with op-amp U7 is a 4 pole 2 KHz high pass filter. The output of this high frequency filter provides the output measured by the analyzer in the HIGH FREQUENCY mode. The output of this filter also pass through a full wave rectifier U6 and a 5 pole 800 Hz low pass filter U5. This circuit outputs a 400 Hz signal demodulated from a received cross-modulation signal. Op-amps U16 comprise a 5 pole 800Hz low pass filter identical to that comprising op-amp U6 described above. It outputs all low frequencies in the input signal, particularly any 400Hz signal present. U12 and U9 comprise a synchronous detector used to detect the amount of 400 Hz present. It is synchronously driven by either the demodulated cross-modulation signal or the 400Hz signal itself. By using synchronous detection the phase of any residual 400 Hz distortion can be measured. Threshold

detectors U1, U2 and U17 and gates U18, U19 and U21 are used to determine the type of signal being received by detecting the presence or absence of high frequency, low frequency and high frequency modulation and thereby switching to the proper mode when in the AUTO operation. The front panel MODE switch allows the operator to force the analyzer to any selected mode of operation or it allows the machine to automatically set itself to the proper mode of operation in the AUTO mode. Front panel LED's indicate the current measurement mode in all circumstances.

Operation

It is recommended that 80% peak modulation of all signals be used in making optical sound track cross-modulation distortion tests. The recommended series of test signals is as follows for 35mm film:

- 1) 10 seconds of 400Hz @ 80% at nominal lamp current exposure
- 2) 10 seconds at each of 5 lamp current exposures in steps of .2 amps about the nominal expected lamp exposure. For example, if the expected required lamp current was 6.00 amps then following lamp current exposures would be used: 5.60, 5.80, 6.00, 6.20 and 6.40 amps. These tests should all be made using an 80% peak cross-modulation test signal at 8Khz.

When reading the above cross-modulation series connect the audio output of the optical sound track playback or projector being used to the 3 pin XLR in put connector on the back of the analyzer. Set the analyzer to AUTO and the RESPONSE toggle switch to FAST. (This provides a .1 second response time: SLOW provides a 3 second response time to average out noise if the track is found to so noisy as to cause erratic readings on the FAST response time settings). With the 400Hz signal present use the LEVEL control on the analyzer to set the meter to read 100. If the overload lamp is lit it is an indication that the input signal is overloading the first or second stage of the analyzer and in input signal level will have to be attenuated. It is important that at no time during the measurements the overload indicator be lit as this can result in erroneous readings. When the cross-modulation signals following the 400Hz signal arrive the analyzer will automatically switch to the XMOD mode as indicated by the indicator LED's and measure the percent cross-modulation present to the nearest 0.1% as indicated on the meter. The cross-modulation distortion will also be either plus or minus depending on whether the negative is over or under exposed for that setting. The distortion percentages, including their sign, should be recorded and plotted as a function of lamp current and lamp current o the horizontal axis. When the cross-modulation distortion measurements are plotted they will be seen to fall on a straight line. The intersection of

that line with the 0% distortion axis indicates the desired lamp current and negative density.

You will find that with the above procedure it is possible to determine proper exposure and density of the negative even if the rest do not pass through cancellation. A straight line drawn through the plotted points will intersect the 0% distortion at the proper lamp current and negative density even if all the plotted points lay above or below the 0% distortion axis.

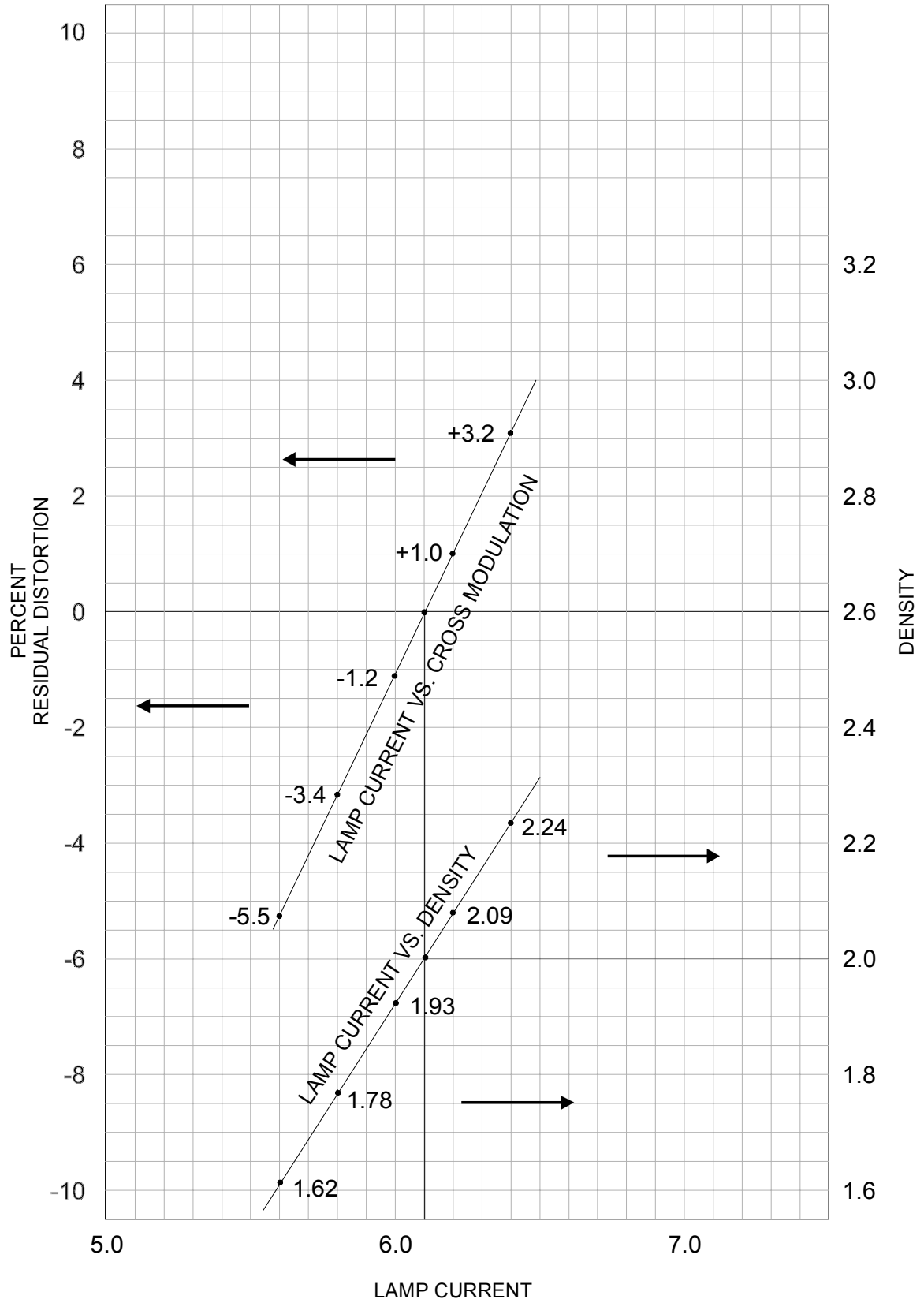
On the cross-modulation worksheet shown below, the following measurements were plotted as an example:

<u>LAMP CURRENT</u>	<u>XMOD</u>	<u>DENSITY</u>
5.60 amps	-5.5%	1.62
5.80	-3.4%	1.78
6.00	-1.2%	1.93
6.20	+1.0%	2.09
6.40	+3.4	2.24

The required lamp current is found at the intersection of the lamp current vs XMOD plot at 6.05 amps. The lamp current vs. density plot indicates a required density for cancellation of 2.0 amps.

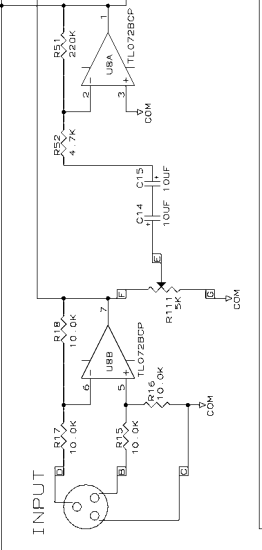
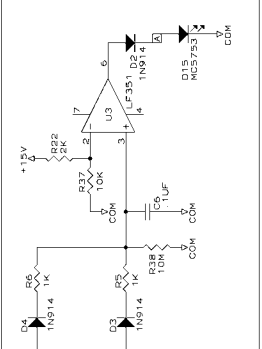
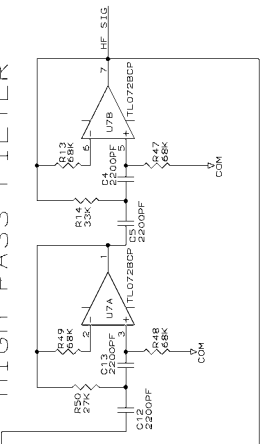
The analyzer may be switched to H.F. mode during a cross-modulation tone to determine the amount of high frequency loss in the print. The analyzer used a peak follow circuit to determine the high frequency level and if the XMOD signal was recorded at the same peak level as the 400Hz reference setup tone, the percent reading will accurately give a measure of high frequency loss. For example, if the reading was 50 when switched to H.F., this would indicate a 6 dB loss at the frequency of the XMOD. The Nuoptix Optical sound recording equipment provides a XMOD signal at 8Khz for the purpose of checking XMOD and high frequency response.

XMOD WORKSHEET

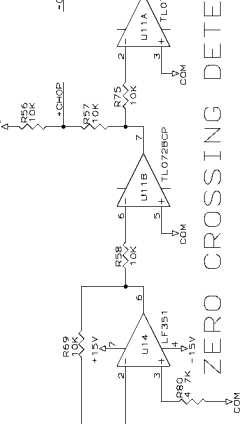


AA -15V
BB -15V
COM

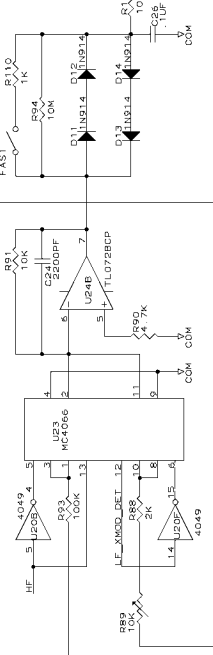
HIGH PASS FILTER



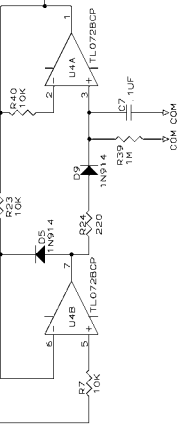
ZERO CROSSING DETECTOR



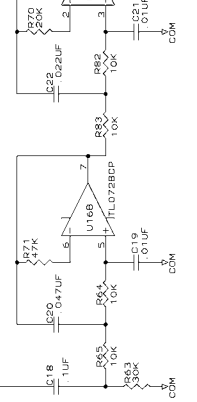
METERING CIRCUIT



HF PEAK DETECTOR

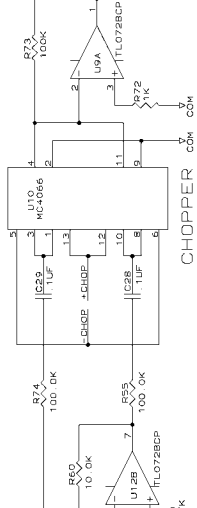
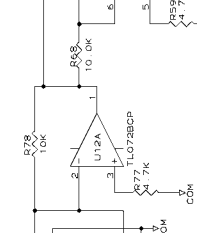


LOW PASS FILTER

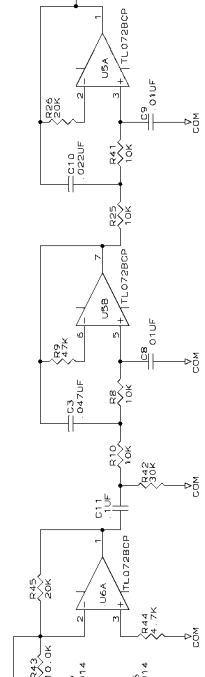


GAIN SEL

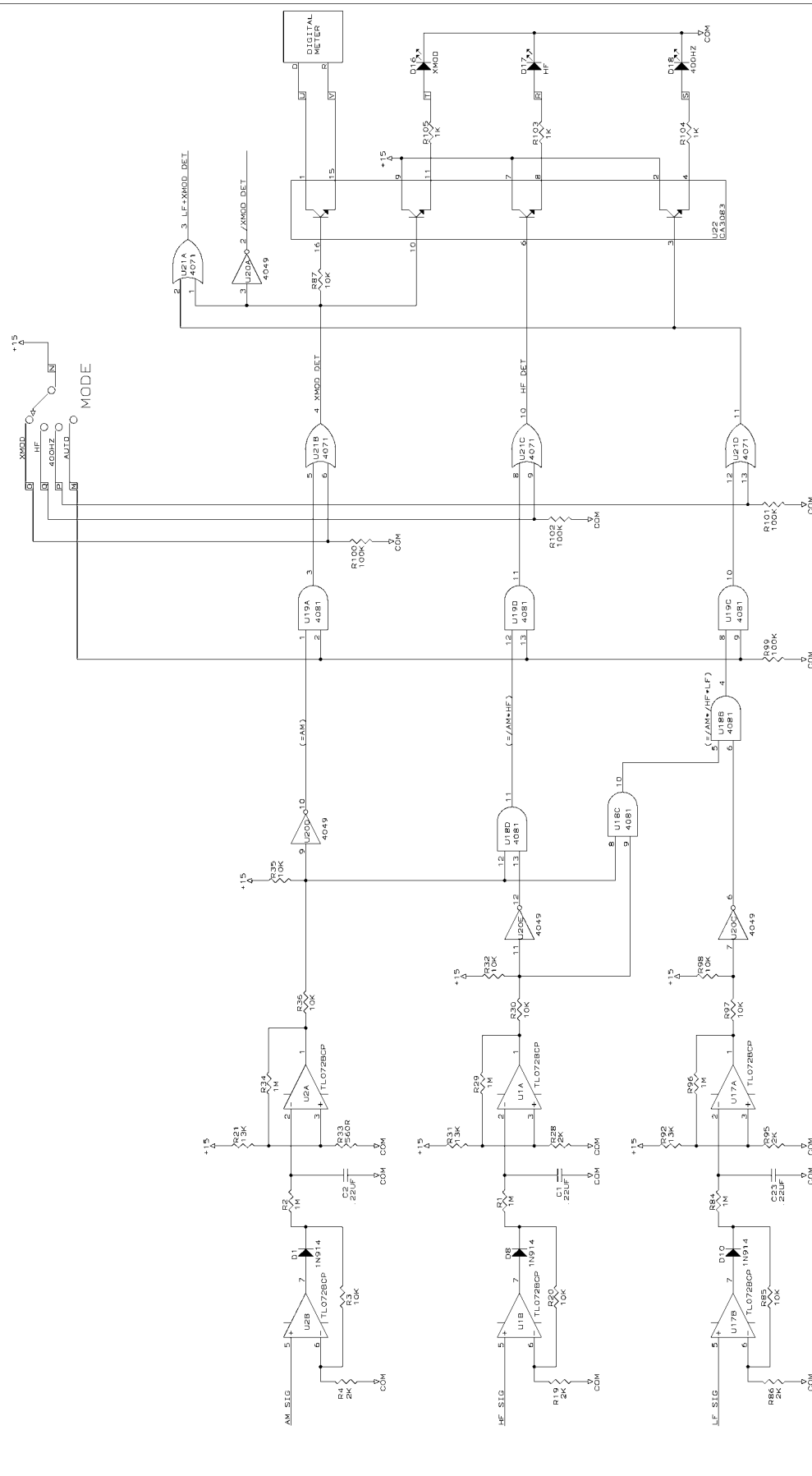
(X10 FOR XMOD)



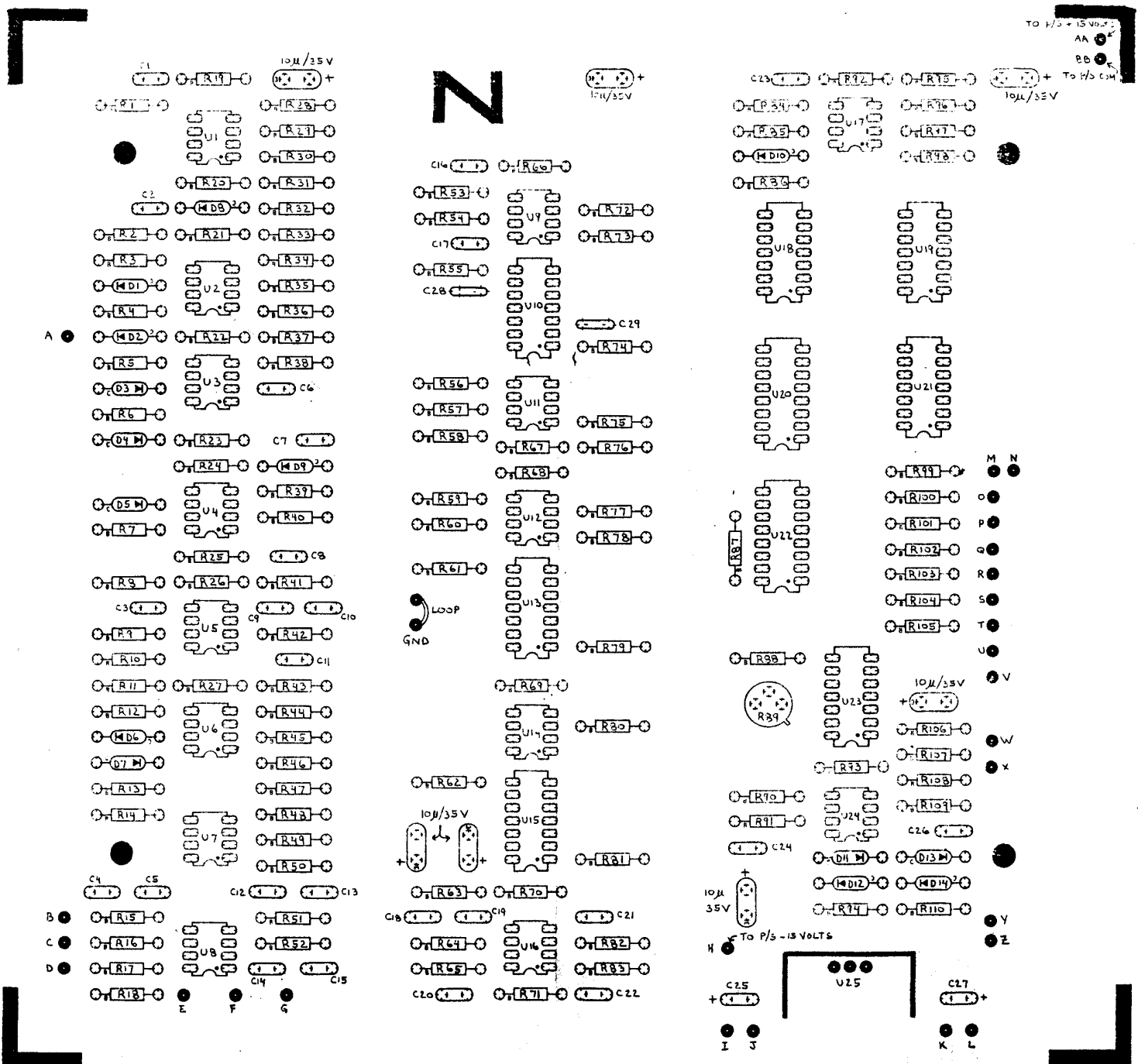
AM DEMODULATOR



NUOPTIX	31326	A	COLUMNS #101
FILENAME	111010101	CA	31382
TITLE	DYNAMIC CROSS MODULATION READER		
Size Document Number	719A	-	B109
DATE	MARCH 19	-	1997 Sheet 1 of 2



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Title DYNAMIC CROSS MODULATION READER	
Sheet	Document Number
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DATE	MAR 20, 1977 Sheet 2 of 2



TO P/5 - 15 VOLT
 AA
 BB
 TO P/5 GND
 10µ/35V

DRAWING: 8107