J R Sky, Inc.

Cross-Modulation Distortion Analyzer

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revised: November 29, 2007

GENERAL DESCRIPTION

The Cross-Modulation (XMOD) 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 analyzer 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.

RECORDING A XMOD SERIES

A XMOD series consists of one 400 Hz signal tone recording at the nominal lamp current setting and five or more XMOD tone recordings at various lamp current settings. The XMOD signal recording should bracket the nominal lamp current setting by 0.2 amp increments.

For example, if your current nominal lamp current setting is 6.00 amps for XMOD cancellation, then you should record your XMOD series using the following lamp currents: 5.60, 5.80, 6.00, 6.20 and 6.40 amps. Note that the nominal lamp current setting of 6.00 amps is in the middle with two other lamp current settings on each side of the 6.00 amps. Additional lamp current settings can be recorded if desired.

At the end of every XMOD signal recording, an END TEST signal must be recorded so that density measurements can be read at the laboratory.

Here is a step-by-step procedure for recording a XMOD series assuming that your current lamp current setting was 6.00 amps for XMOD cancellation:

Recording the 400Hz test signal:

1) With the camera motor off, rotate the MODE switch on the SORS electronics to the PREVIEW mode. Select the 400Hz test signal on the AOS unit and adjust the level for 50% on the SORS digital meters.

2) Rotate the MODE switch to RECORD.

3) Adjust the lamp current for 6.00 amps on the AOS unit.

4) Open the 1231 camera film compartment door (right door).

5) Start the camera motor with the door open and wait for 15 <u>feet</u> of film to roll through.

6) Now with the motor still running, gently close the film compartment door.

7) Record 10 <u>seconds</u> of film.

8) With the camera motor still running, open the film compartment door.

9) Stop the camera motor.

Recording the XMOD test signal:

10) With the camera motor off and the MODE still in the RECORD position, select the XMOD test signal. Depending on what the "Film Loss Equalization" setting for your Nuoptix Electronics is set to, you should read a modulation level between 70 and 90% on the SORS digital meters. If the "Film Loss Equalization" is set to position 2, then the modulation level should read around 80%. The absolute reading is not critical so long as it is between 70-90%.

11) Adjust the lamp current for 5.60 amps on the AOS unit.

12) Open the 1231 camera film compartment door.

13) Start the camera motor with the door open and wait for 15 feet of film to roll through.

14) Now with the motor still running, gently close the film compartment door.

15) Record 10 seconds of film.

16) Now rotate the MODE switch to the TEST position.

17) Record an additional 5 feet of film.

18) With the camera motor running, open the film compartment door.

19) Stop the camera motor.

20) Rotate the MODE switch back to the RECORD position.

To complete the XMOD series, repeat steps 11-20 and record four additional series using the 5.80, 6.00, 6.20 and 6.40 amps for the lamp current settings.

In the procedure given above, the film compartment door is closed only while the film motion is "up to speed". This is very important as it prevents possible errors in measurement reading. It is also useful to separate the series and allows an easy means to identify the individual test series.

Have the laboratory develop the negative at normal speed and have them read the density for each of the XMOD series. Have the laboratory develop the "sound only print" at normal density.

USING THE XMOD ANALYZER

Connect the output of your optical playback to the three-pin XLR input connector on the rear of the XMOD analyzer. The input uses a differential amplifier to accommodate either balanced or unbalanced inputs. Set the analyzer mode to AUTO and the RESPONSE toggle switch to FAST, which provides a one second response time. The SLOW position provides a three second response time to average out noise if the track is found to be noisy.

Play back the previously recorded 400 Hz test signal "sound only print" film. With the 400 Hz signal present, use the level control on the analyzer to set the meter to read 100. The unit should automatically detect the presence of the 400 Hz signal and illuminate the 400 Hz LED. It is important that at no time during the measurements the overload indicator be lit as this will result in erroneous readings.

Now play back each of the previously recorded XMOD test signal "sound only print" series. Again, the unit should automatically detect the presence of the XMOD signal and illuminate the XMOD LED. Record the distortion reading (including the sign) to the nearest 0.1% for each of the XMOD test signals in the series. The XMOD distortion analyzer will read either plus or minus depending on whether the negative is over or under exposed.

Download and save the following Microsoft® Excel spreadsheet from the link given below:
http://www.jrsky.com/manuals/Xmod.xls

Enter the distortion reading, including their sign, on the "DATA" tab of the downloaded spreadsheet corresponding to the lamp current. Now select the "Distortion vs. Current" tab of the spreadsheet. The intersection of that line with the 0% distortion axis indicates the desired lamp current and negative density.

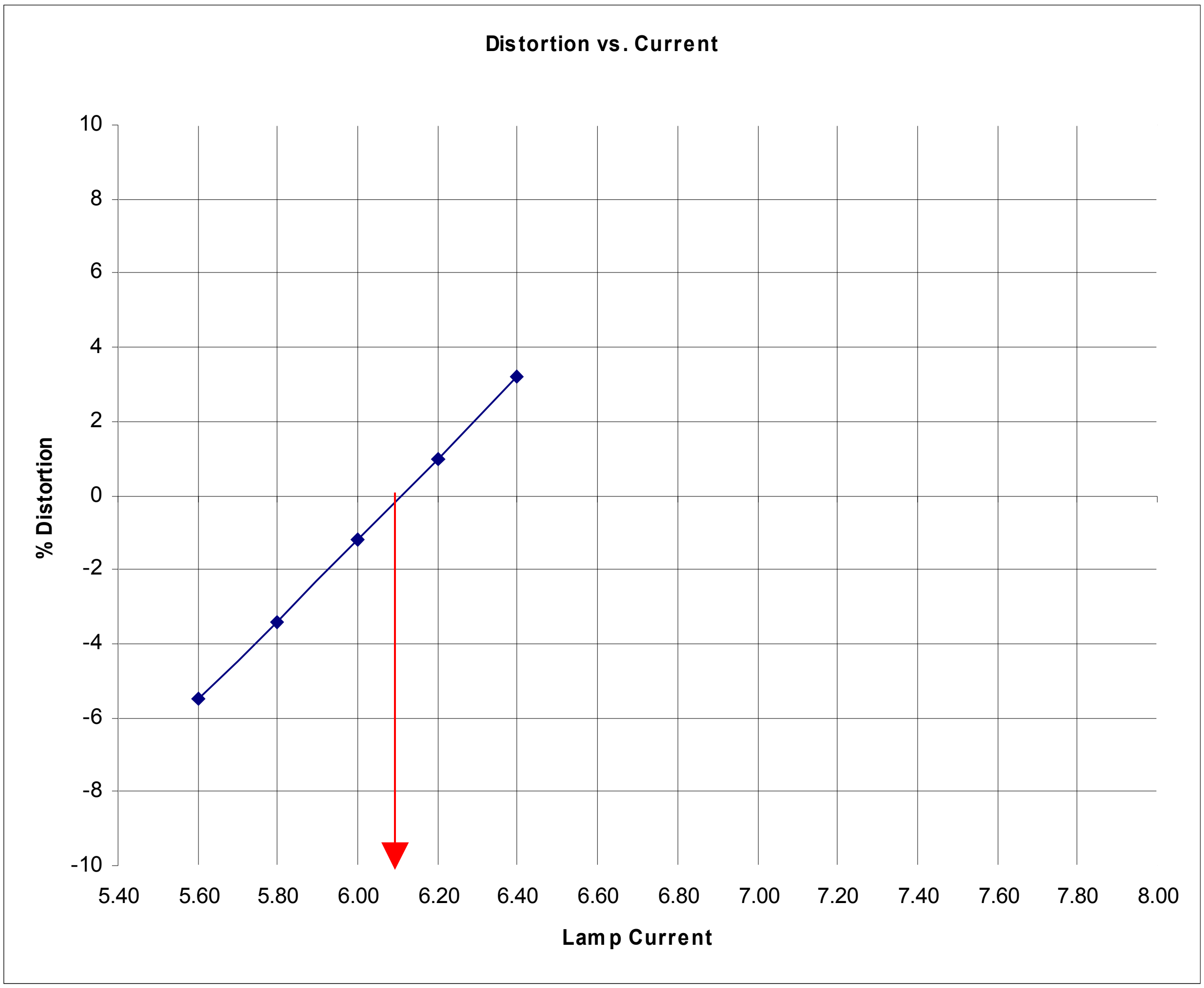
You will find that with the above procedure it is possible to determine proper exposure and density of the negative even if the tests do not pass through cancellation. A straight line drawn through the plotted points will intersect the 0% distortion at the proper lamp current and negative density even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

EXAMPLE

On the cross modulation worksheet example the data was entered on the "DATA" tab of the spreadsheet as shown below:

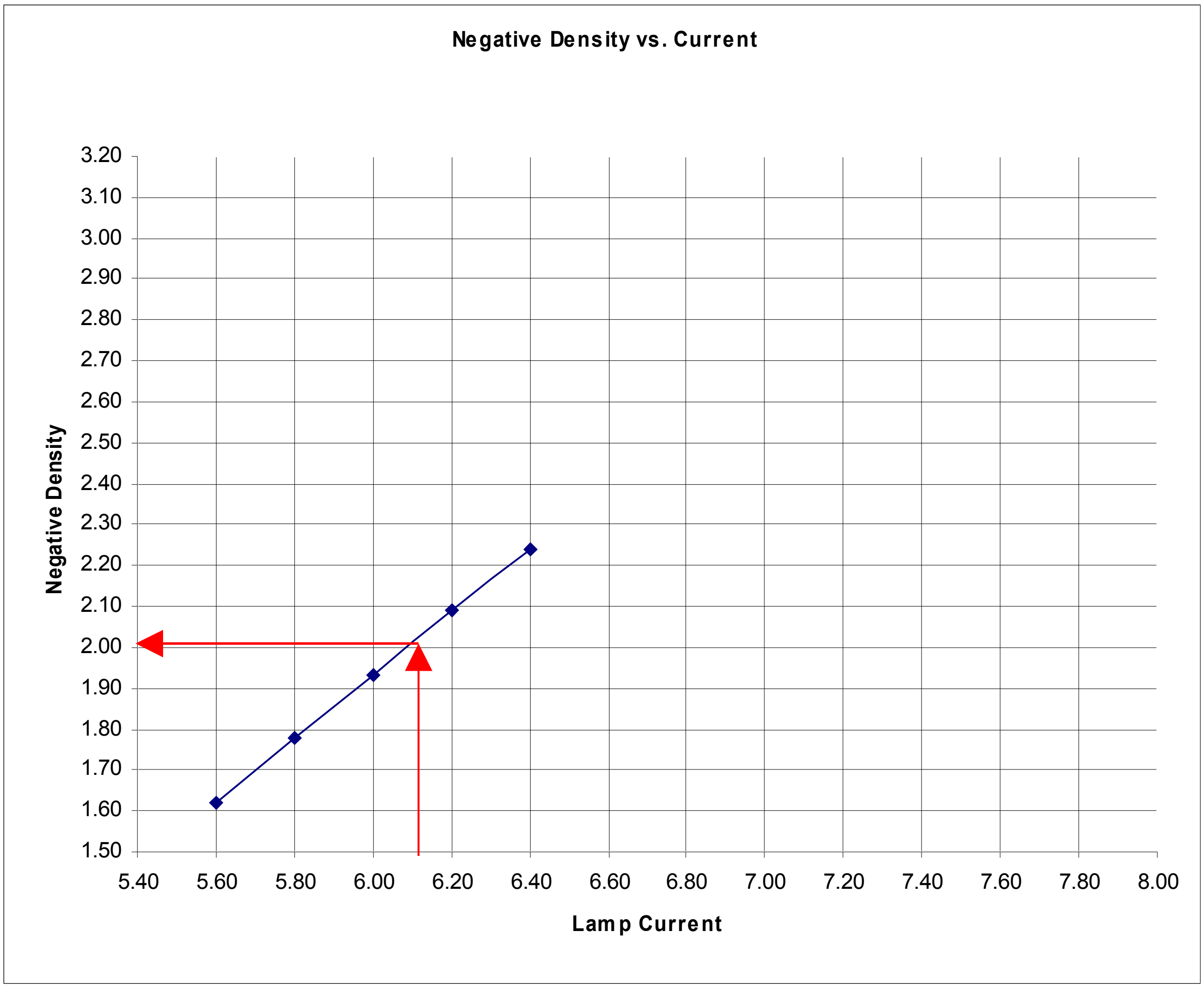
Lamp Current	Distortion (+/-10%)	Negative Density (1.50-3.20)
5.20		
5.40		
5.60	-5.5	1.62
5.80	-3.4	1.78
6.00	-1.2	1.93
6.20	1.0	2.09
6.40	3.2	2.24
6.60		
6.80		
7.00		
7.20		
7.40		
7.60		
7.80		
8.00		

Now select the “Distortion vs. Current” tab of the spreadsheet and note where line crosses the 0% axis, in this case 6.10 amps as shown below in red below. This is now your desired lamp current setting.



Blank work sheets are provided at the end of this manual in the event you do not have Microsoft® Excel loaded on your computer.

Now select the Negative vs. Current tab. Find where 6.10 amps on the x-axis crosses the graph (see red arrow pointing up) and note where that point crosses the y-axis (red arrow pointing left), in this example, around 2.00 ND. This is now becomes your target negative film density.   The laboratory should be instructed to develop all future negatives at this target density. You must provide a density test for the laboratory at the end of every film reel you record.

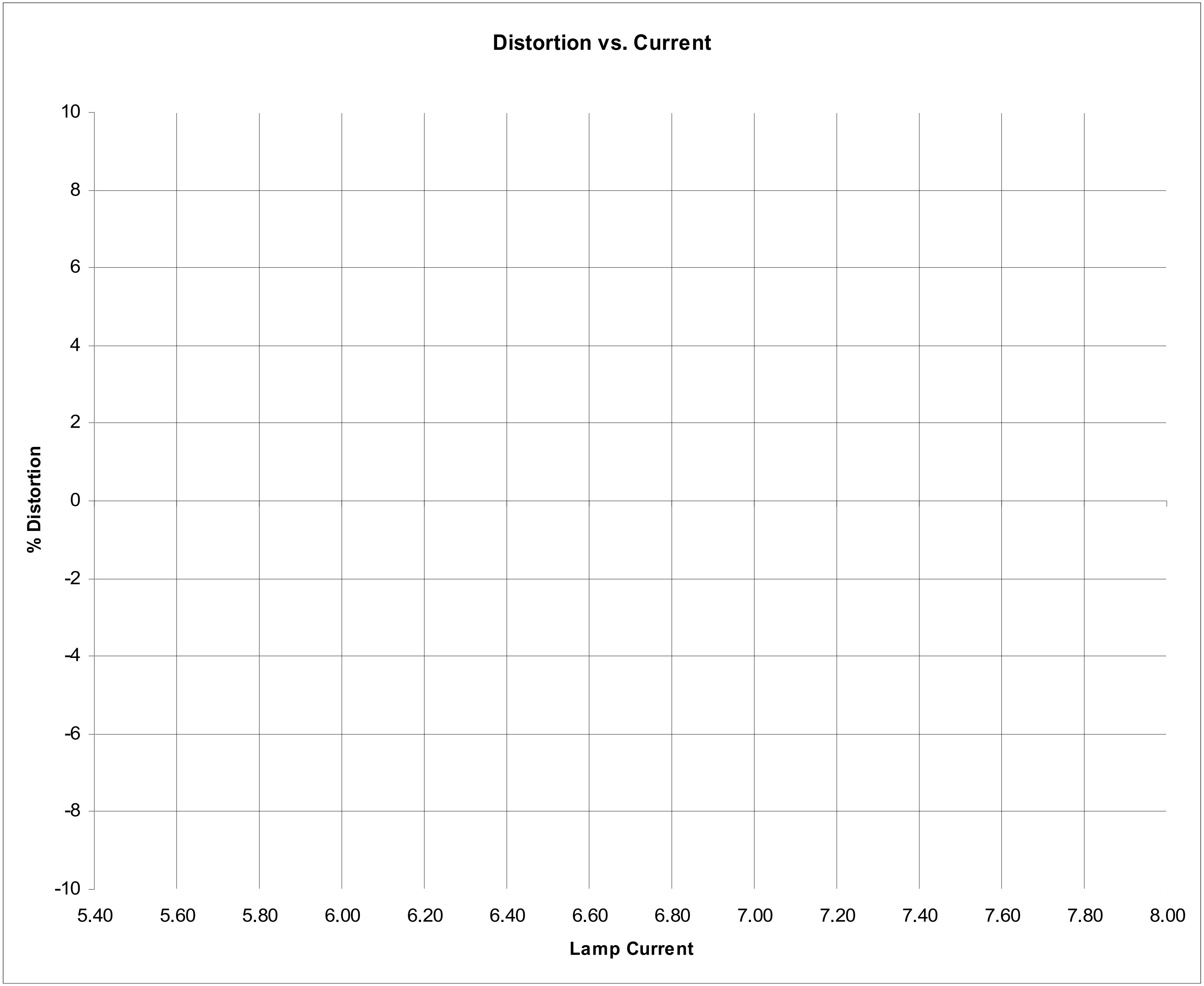


It should be noted that for high quality stereo optical recording, there should be a 0.05 ND or less difference in the negative film density between the left and right tracks (0.1 ND for dual bilateral mono tracks). The camera lamp balance should be checked regularly.

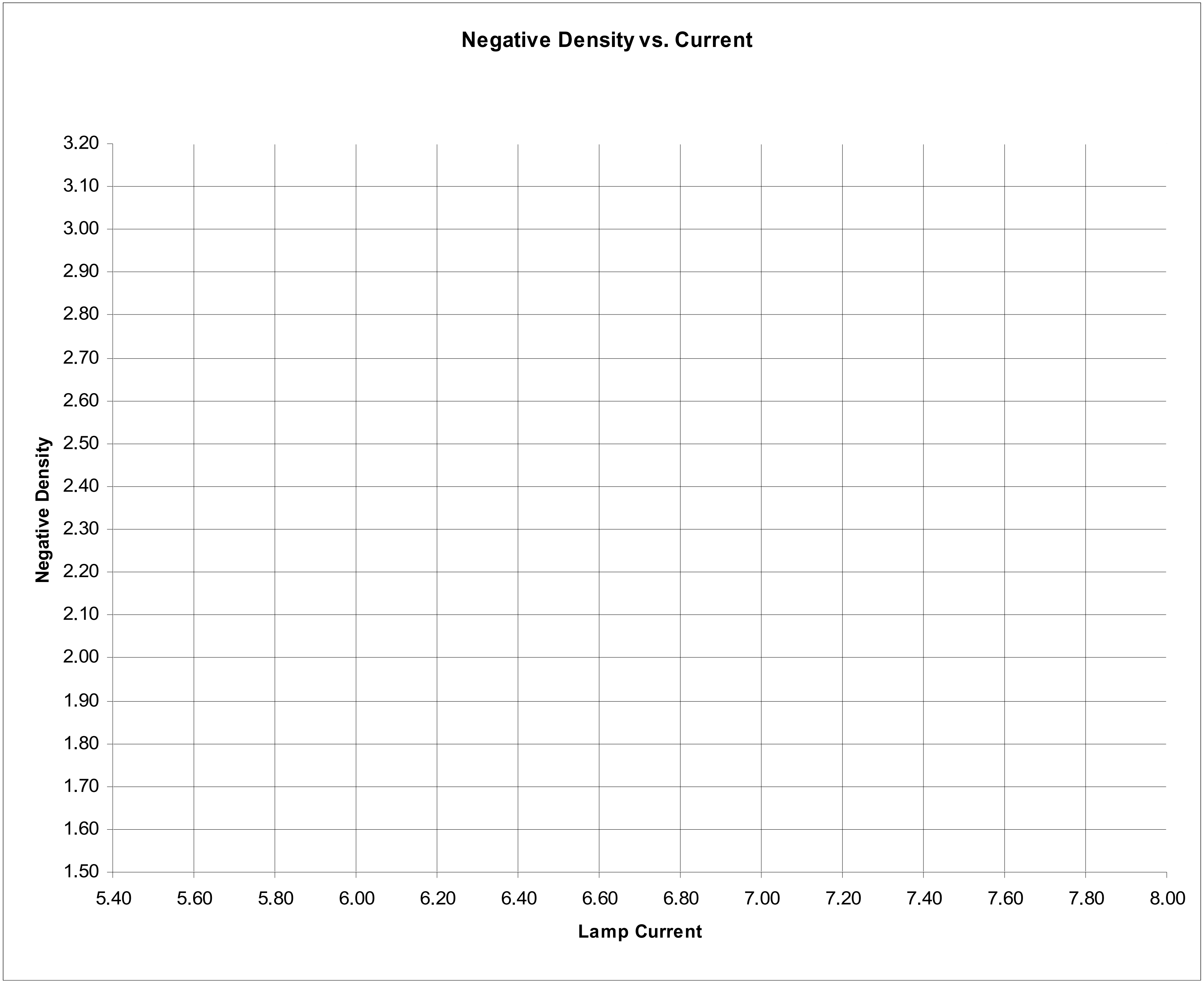
For additional information regarding XMOD, click on the link below:
www.jrsky.com/manuals/XmodKodak.pdf

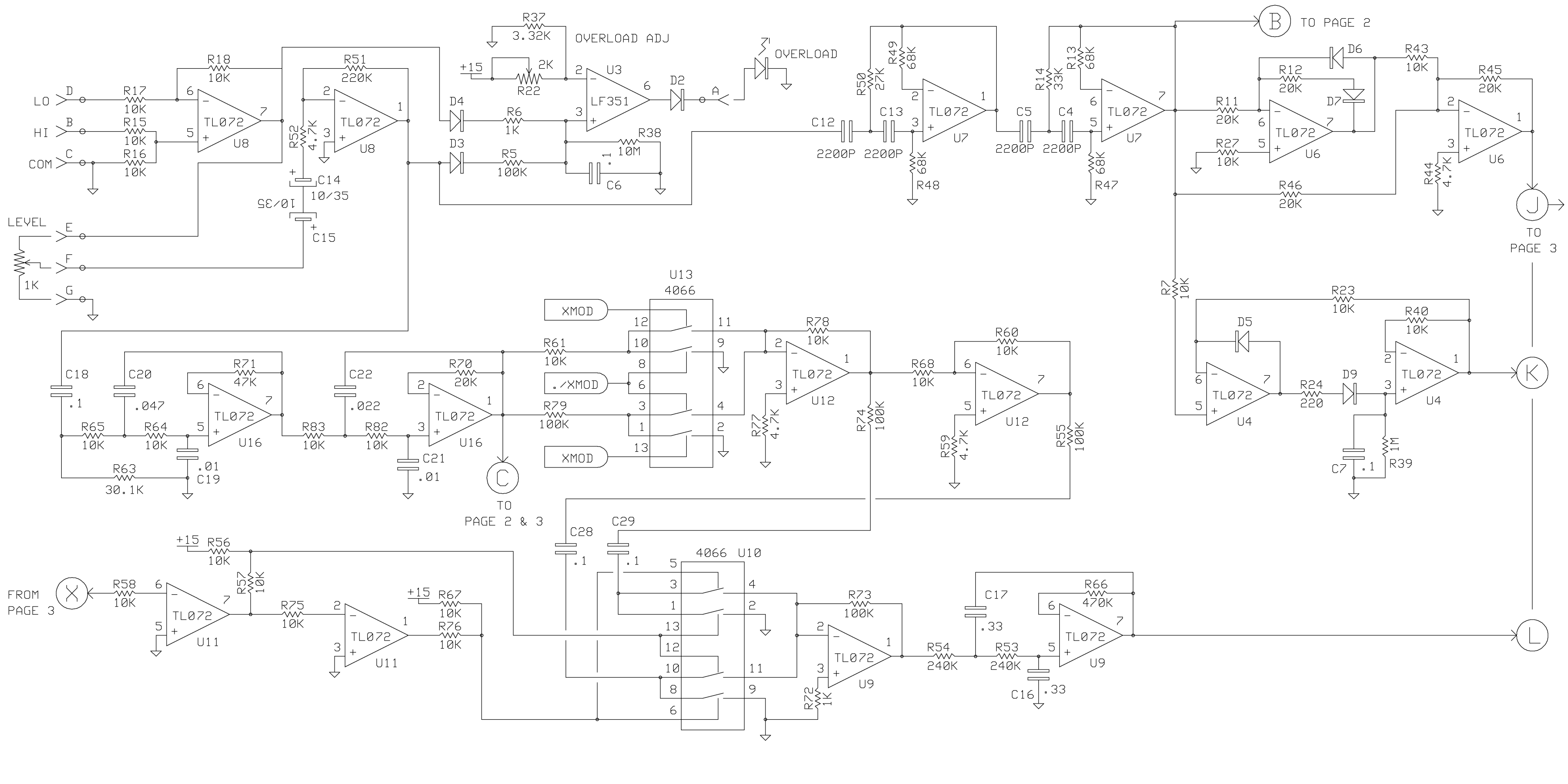
CIRCUIT DESCRIPTION

The signal is received by a high input impedance differential amplifier U8 followed by a level set potentiometer R11which 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—lights. 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 passes 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 800 Hz low pass filter identical to that comprising Op amp—U6—described above. It outputs all low frequencies in the input signal, particularly any 400 Hz 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 400 Hz 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 mode. The front panel MODE switch allows the operator to force the analyzer to any selected mode of operation, or it allows the analyzer to automatically set itself to the proper mode of operation in the AUTO mode. Front panel LEDs indicate the current measurement mode in all circumstances.



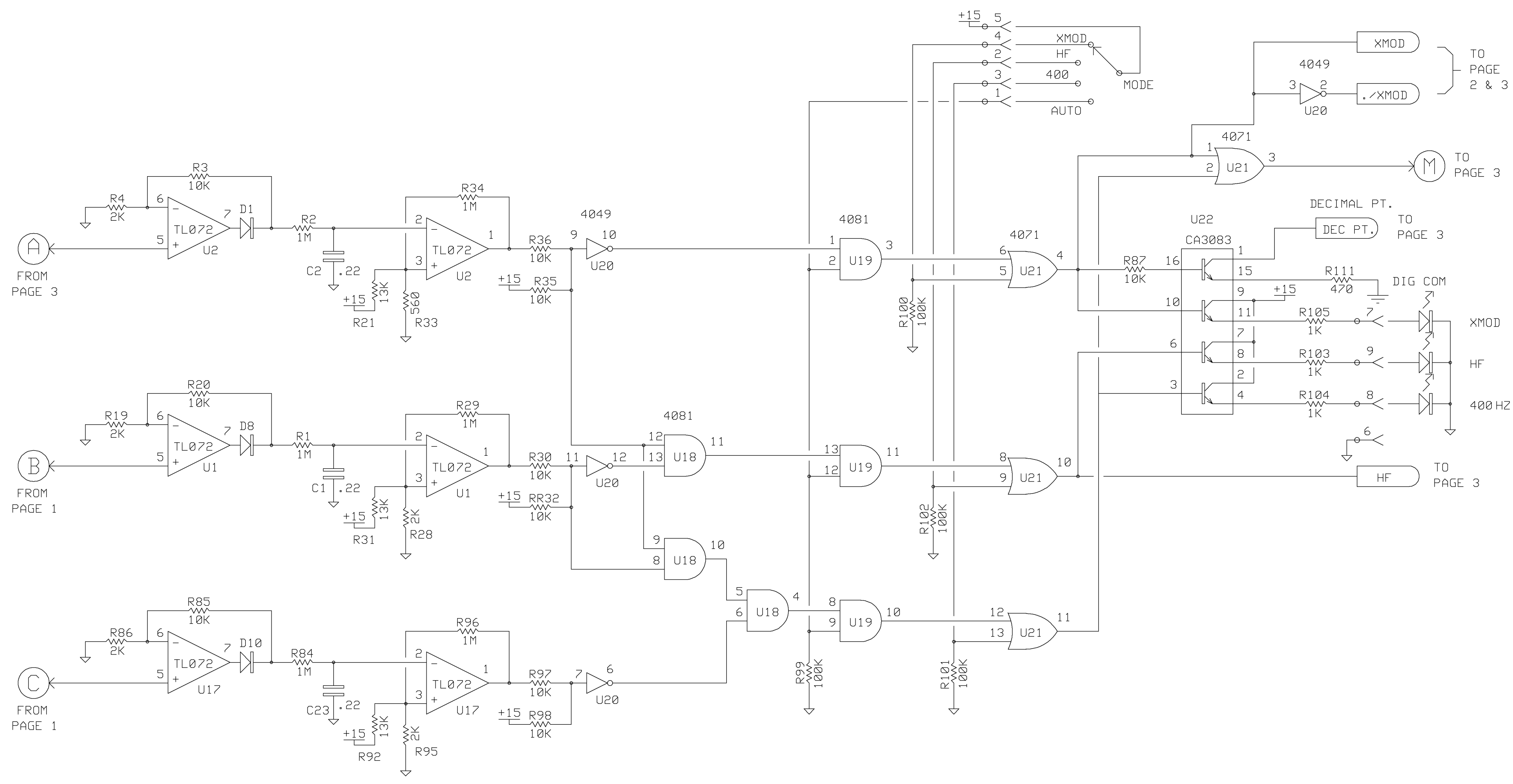
Distortion vs. Current
10
8
6
4
2
0
-2
-4
-6
-8
-10
% Distortion
5.40
5.60
5.80
6.00
6.20
6.40
6.60
6.80
7.00
7.20
7.40
7.60
7.80
8.00
Lamp Current


Negative Density vs. Current
Negative Density
3.20
3.10
3.00
2.90
2.80
2.70
2.60
2.50
2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
5.40
5.60
5.80
6.00
6.20
6.40
6.60
6.80
7.00
7.20
7.40
7.60
7.80
8.00
Lamp Current



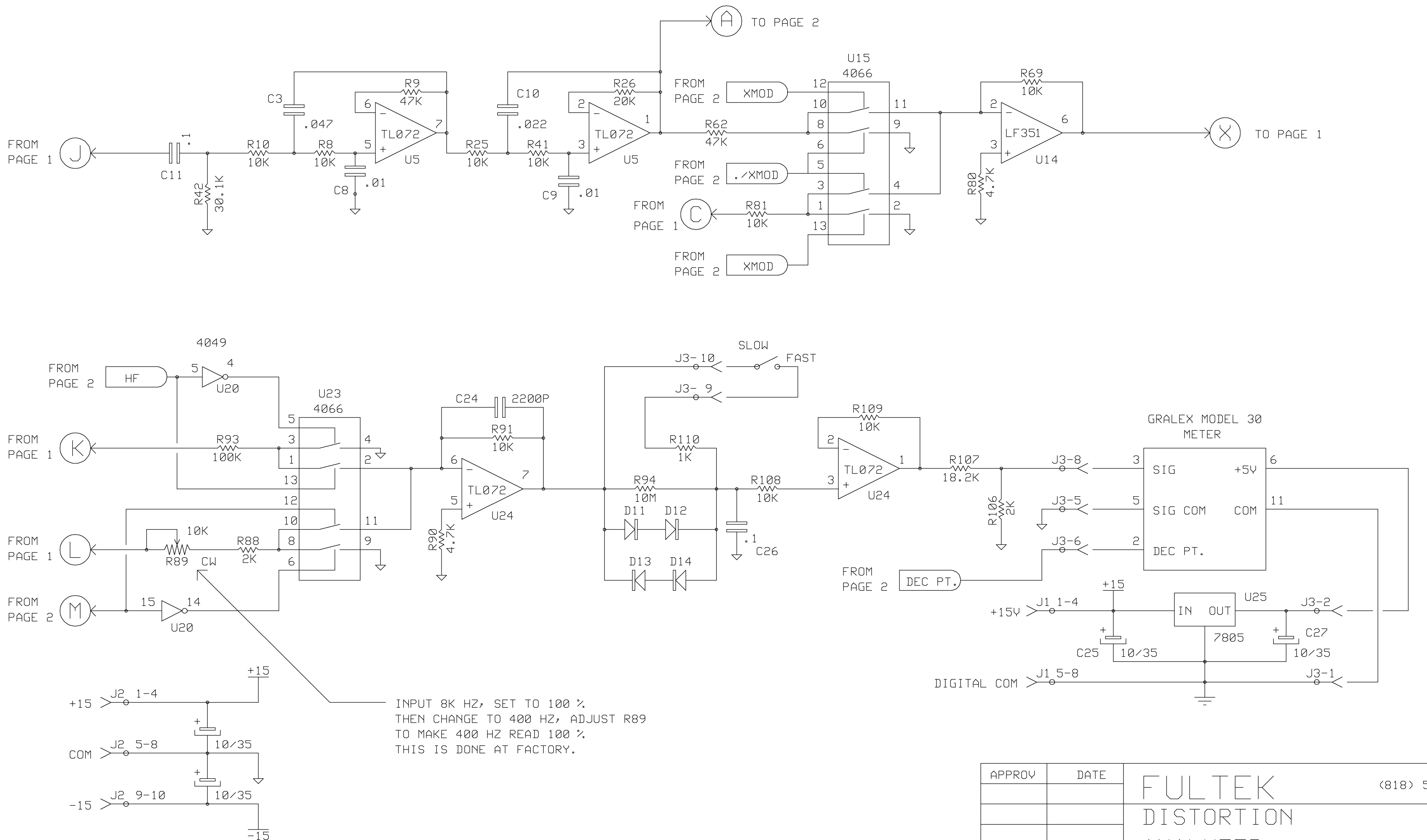
NOTE: ALL DIODES ARE 1N4148
UNLESS OTHERWISE MARKED

APPROV	DATE	FULTEK (818) 505-8836	
JMF	3-22-96	DISTORTION	
JMF	2-19-97	ANALYZER	
SHEET 1	OF 3	DRAWING NO. B52001	SIZE B



NOTE: DIODES ARE ALL 1N4148
UNLESS OTHERWISE MARKED

APPROV	DATE	
		FULTEK (818) 505-8836
		DISTORTION
		ANALYZER
SHEET 2 OF 3		DRAWING NO. B52022 SIZE B



INPUT 8K HZ, SET TO 100 %.
THEN CHANGE TO 400 HZ, ADJUST R89
TO MAKE 400 HZ READ 100 %.
THIS IS DONE AT FACTORY.

NOTE: ALL DIODES ARE 1N4148
UNLESS OTHERWISE MARKED

APPROV	DATE	FULTEK (818) 505-8836
		DISTORTION ANALYZER
SHEET 3 OF 3		DRAWING NO. B52003 — SIZE B

FULTEK
B5200 B REV B
SILK SCREEN

BOARD DIMENSIONS:
X = 8.50"
Y = 8.0"