WESTREX RA-1717 ANALYZER

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WESTREX RA-1717 ANALYZER

Operation:

The RA-1717 is primarily intended for motion picture laboratory use. In this role, it can guarantee, with minimal testing time, that a printer is printing optical sound tracks satisfactorily. This preventive maintenance role requires that a strip of standard cross-modulation test be printed and tested on the RA-1717 on a regular basis.

The short cross-modulation negative strip may be spliced into leader of work being printed, at standard printer light. This negative is just that, a standard, track position is correct, modulation level is correct, and it is designed for cross-modulation cancellation at standard print density.

The RA-1717 can make its test on a very short segment of film; however, we recommend printing at least one foot and preferably two feet of the standard negative strip, to assure that any mechanical perturbations caused by the splice are eliminated by the end of the test strip. It also makes finding the test strip easier.

To test printer alignment, the printed strip is inserted into the RA-1717 film slot and slid a few frames. If the printer is properly aligned, the O.K. light will light and the test is completed. (Note: The segment tested should be away from the negative splice. As indicated above, the splice can introduce short mechanical perturbations in the printer.)

To print the standard negative, standard printer light and print density are required for cancellation. This means the work negative being printed would be exposed and developed for the same cancellation criteria.

Film studios are introducing the practice of printing a few frames of cross-modulation test signal directly following sync-pop during negative recording. This cross-modulation burst has usually been spliced into the magnetic recording used to make the negatives, just like sync-pop. At the request of the studio, the print of this segment can also be tested and the result reported to the recording studio.

The result of the above testing procedure is that a laboratory first can be assured all their printers are working correctly, and secondly, can inform recording studios if their negative recordings are exposed properly for standard printing; and if they are not, by how much they are off. This kind of feedback will be of great help to the studios, requires very little effort by the laboratories, and assures a high quality end product.

The digital readout displays either the modulation index or the track distortion, depending on the setting of the front panel MODE toggle switch. Before using the RA-1717, it should be zeroed in both the X.M. and M.I. modes by switching to those modes and adjusting the front panel zero pots, with no film in the film slot, so the digital meter reads zero. To test a sound track, the film is slid sound track away from you into the film slot so that the film rests firmly against the back of the film slot. When this is done, the RA-1717 switches from the calibration mode to the read mode. If the film is slid very slightly in the slot, the sample light will flash and a reading will appear on the

digital meter. The limit light or lights will light or the O.K. light will light. Sliding the film further will result in readings being made every 0.045 inches along the track. Regardless of which position the mode switch is in, the RA-1717 monitors both X.M. and M.I. to determine if the limit level criteria are met.

Cycling the mode switch through the intermediate "Reset" position resets all internal logic to the state as though you had just inserted the film, so the limit lights if lit will reset and be ready to monitor for limit criteria again. When the film is slid along in the film slot, be sure it is pressed firmly against the back of the slot. This is important because the M.I. reading takes into account track position, so if the film is not against the back stop, it will appear to the RA-1717 that the track is misplaced and it will give an erroneous M.I. reading.

Several inches of a track may be slid through the film slot to monitor the X.M. and M.I. all along the track to verify the track meets the limit criteria. If the M.I. and X.M. readings are consistently within the limits set in the machine, yet the RA-1717 still rejects the print, there may be a large flaw at one point on the track. By resetting the RA-1717, the location of the flaw can be found by noting at exactly what point along the track the limit light is lit.

When testing a strip of film, it is advisable to slide the film smoothly in one direction, since jiggling the film in the slot can result in erroneous readings.

The X.M. limit light lights if the distortion exceeds the internally set level. The M.I. limit light lights if the Modulation Index is less than the limit level internally set.

It is normal for X.M. readings to vary plus or minus 1 or even 2 percent on good sound tracks. A new clean track printed from one of the new fine grain negative stocks often will vary less than plus or minus 0.5 percent. Variation larger than 2 percent consistently along the track indicates track problems.

Head Installation and Alignment:

To test an optical sound track of a given format requires the use of the appropriate RA-1717 optical head. Optical heads for various formats are interchangeable on the RA-1717. The head may be changed by removing the two 6-32 Allen head screws from the bottom of the replacement head. With these screws removed, the head may be slipped out forward from the 15 pin gold finger printed circuit connector. A new head may be slid onto the connector, making sure the contacts in the connector on the back of the new head are properly aligned with the gold fingers on the RA-1717 main board. When using a head never before used on your RA-1717, its small top plate should be removed by unscrewing the four flathead 2-56 Phillips head screws from it; this will expose 4 trimpots. With the new head installed and with this plate removed, the two 6-32 Allen screws should be screwed in to secure the new head in position. Turn on the RA-1717 and allow it to warm up for 10 minutes. Then measure the voltage at TP1 with a digital meter and adjust the small trimpot on the extreme left in the head (when looking from the front of the RA-1717) to obtain the voltage specified for TP1 for that head. (Note that the top of the RA-1717 must be removed to have access to the trimpots when the head is installed.) The above procedure should be repeated for TP2, 4 and 5 and the remaining trimpots in the head. The voltages should be set to within plus or minus 5 millivolts of the specified voltage. Once this procedure is completed, the head is aligned for your machine. Remove the head from the RA-1717 and replace the cover plate with the four 2-56 flat-head screws. If it is not possible to zero the meter reading for a given head, the above procedure should correct the situation.

Limit Set:

This sets the limits of Distortion and the Modulation Index which the RA-1717 requires as acceptable. The distortion limit is set by toggling the appropriate rocker switches on the minidip switch S1 at the upper left corner of the main printed circuit board as viewed from the front of the machine with the top removed. Rocker switch 1 sets the limit at 1%, 2 at 2%, and so on to 6%. The modulation limit is set by toggling the appropriate rocker switch on the minidip switch S2 on the upper middle of the main printed circuit board. Rocker switch 1 selects an M.I. limit of 10%, rocker switch 2, 20%; and soon to 70% for rocker switch 7. I n all cases only one rocker switch should be on.

System Description:

Refer to the System Block Diagram in Figure 1. Light from an incandescent lamp passes through the optical track being tested, then through an optical mask, and then to a four-element photocell. The center two elements of the photocell array are used in measuring the distortion, and the outer two elements are used in measuring the modulation index. The photocurrents from the cell elements pass through optical preamplifiers and then to two differencing circuits, whose outputs are proportional to the difference in the amount of light falling on their two respective photocell elements.

The output of the M.I. difference amplifier goes to the sampling circuit, which examines the signal and sends control signals to the signal acquisition circuit, telling it when to acquire its signal. The sample circuit also sends signals to the control logic which it uses in its initialization routine.

As film is moved along the film slot, the output of the difference amplifiers move up and down. In the case of the X.M. difference amplifier, the amplitude of this variation is a

measure of the distortion on the track. In the case of the M.I. difference amplifier, the variation is a measure of the modulation index. The sample circuit tells the signal acquisition circuit when to capture and hold these inputs. Since the sample circuit derives its signal from the M.I. difference circuit, all samples are made relative to the phase of the modulation of the high frequency on the tracks so that in the X.M. mode, the phase of the distortion component is detected directly, since the phase relationship of the distortion and modulation is indicated by the phase of its distortion difference amplifier output at the sample time.

The control logic monitors the total light falling on the M.I. elements via the light level circuit. It also has inputs from the sample circuit. The control logic sets the internal state of the RA-1717. With no film in the film slot, it sets the RA-1717 into the zeroing mode. This is the state in which the digital meter may be zeroed in the S.M. and M.I. modes using the front panel zero controls.

With film inserted, the control logic switches internal states and at the appropriate point sends acquisition signals to the acquisition circuit and sample and meter hold signals to the switching and drive circuitry. S.M. and M.I. limit circuits are level comparators which toggle flip flops if the S.M. or M.I. exceed set levels. The output of these circuits also goes to the switching and drive circuitry. The system operation will be made clearer by the following Circuit Description.

Circuit Description:

Refer to the RA-1717 Circuit Diagram. Operational amplifiers U6 and U7 are the X.M. optical preamplifiers. U14and U15 are the M.I. optical preamplifiers. U4 and U5 are the X.M. difference amplifier with U5 inverting the signal from preamplifier U6 and U4, then summing the two signals to derive the difference in the outputs of U6 and U7. U12 and U13 comprise the M.I. difference circuit and function in the same way as U4 and U5. Dual amplifier U11 is a resettable peak follow and hold which acquires the peak positive excursions of the output of the M.I. difference amplifier. U11 is reset by U9 when the signal goes more negative than -450 millivolts. U8 detects when its current input is greater than the value stored in the resettable peak follow and hold and turns on the sample and hold circuit U16. Dual amplifier U20 detects when the current signal value from the M.I difference amplifier U12 has dropped more than 300 millivolts below its peak value stored in U11. When this happens, the output of U20 goes to +15 volts and triggers the 0.1 millisecond one-shot multivibrator U18 which turns on the sample and hold circuit U17 that acquires the signal held by sample and hold U16. The output of U20 also triggers the other one-shot multivibrator in U18 which is a 10 millisecond one-shot actuating the sample light. One-shot U19 is also triggered by U20. Its output controls the hold input of the digital meter, so that if no new sample is made then within one-half second, the last reading is held by the digital meter.

U2 and U3 detect the total light level falling on the two M.I. photocell elements. When the light level goes down upon inserting film in the film slot, the output of U3 at TP7 goes to +15 volts and the output of U2 goes to -15 volts.

Flip flop U22 with output on pin 13 toggles on when the light level has gone down due to film insertion and the output of the M.I. difference amplifier has gone negative. This is the "ready" flip-flop. When a sample is made after the ready flip-flop is set, the "initialization" flip-flop toggles on. Its output is on pin 1 of U22.

Signal switch U29 selects the output of sample and hold U17 when the output of U2 goes low, when film is inserted in the film slot. With film inserted, U29 connects the meter amplifier U30 to the signal selected by the front panel MODE toggle switch directly before it goes to the acquisition sample and hold U16. In this mode, the difference amplifier can be zeroed using the front panel pots R111 and R113.

U28 is the M.I. limit comparator. If the M.I. difference amplifier exceeds the level set by the minidip rocker switch S2, the output of U20 goes high. If this occurs after the initialization flip flop U22 has been set, U24 is toggled on and the M.I. limit light is extinguished, indicating that the M.I. is of an adequate level.

Dual comparator U1 is the X.M. limit comparator. If the output of the X.M. difference amplifier exceeds the limit set by minidip switch S1 in either the positive or the negative direction, flip-flop U24 with output on pin 1 is toggled on, and the X.M. limit light is turned on if the initialization flip-flop is also on.

If the X.M. limit flip-flop is off, the M.I. flip flop is on, and the initialization flip-flop is on, then all criteria have been met and the O.K. light is turned on.

The sample light is flashed each time a new sample is acquired. The incandescent lamp used to illuminate the optical track is powered by a 10.0 volt regulated supply. If, with a given head, the voltages measured at test points 1, 2, 4 and 5 cannot be set to the desired voltage, the lamp voltage may be changed to bring them within range.

Optical Mask:

The optical mask/photocell arrangement is the heart of the RA-1717. The center two elements of the photocell are used to measure the cross-modulation distortion. The optical mask samples the transmittance of the optical track through rectangular apertures across the full width of the rack. There are two sets of four apertures, one set over each of the two X.M. photocell elements. The rectangular apertures within each set are one wavelength of the 400 Hz cross-modulation modulation frequency apart. For example, the distance is 0.045 inches for 35mm film. The space between the two sets of apertures is 1.5 wavelengths of the 400 Hz cross-modulation modulation frequency apart, or 0.0675 inches on 35mm sound tracks. If there is any residual 400 Hz signal on the track, the light transmitted by one set of the apertures will move up while the other moves down, and vice versa, as the optical track is moved over the apertures. The RA-1717 detects the magnitude of the difference in transmittance detected by the apertures. The optical mask/photocell RA-1717 combination functions as a stationary 400 Hz bandpass filter for the detection of residual 400 Hz distortion on an optical sound track. The number and size of the apertures determines the characteristics of the filter. The frequency response of the RA-1717 virtual filter is shown in Figure 2. The M.I. aperture and cells function in a manner similar to that described above, except that the apertures are designed to "detect" in the sense of half-wave rectifying the high frequency signal on the film optical track and simultaneously bandpassing the 400 Hz component of the "optically" rectified signal.

Lamp Replacement:

To replace the head illumination lamp, first turn the RA-1717 off and remove the four 6-32 round head Phillips screws holding the light box to the front panel. Having done this, the light box, with the head attached, may be removed exposing the lamp. Unsolder the two leads from the lamp, marking which connects to the center terminal of the lamp. The lamp can be removed by loosening the Allen head set screw in the bottom of the lamp block inside the RA-1717 and slipping the lamp out the front of the panel. The replacement lamp should be installed with the filament horizontal, and the above steps should be retraced to complete the installation. The lamp voltage is set to 10.0 volts by the pot on the power supply mounted on the back panel of the RA-1717.

WESTREX RA-1717 FACTORY ELECTRONIC ALIGNMENT

Remove the track reading head from the RA-1717 and install the alignment head. Turn the POWER switch on. Turn all front panel controls so that they are midrange with the arrows pointing up. Set the MODE switch to the M.I. position. Connect the positive lead of a digital voltmeter (DVM) to TP3 and the negative lead to the GND loop located on the P.C. board near U10. Adjust R32 to obtain a 0 mVDC reading. This should be adjusted to within a millivolt. Connect the positive lead of the DVM to TP6 and adjust R54 to obtain a 0 mVDC reading. Next apply a 2.0 volt sine wave signal to 40 Hz to both BNC connectors on the alignment head simultaneously. Connect the positive lead of the DVM to TP3 and adjust R17 to achieve a minimum AC voltage reading. Connect the positive lead of the DVM to TP6 and adjust R43 to achieve a minimum AC voltage reading.

Disconnect the signal to the right BNC connector leaving the 2.00 VAC signal applied to only the left connector. With the DVM still connected to TP6, adjust R42 to get a 7.07 VAC reading on the DVM. Connect the positive lead of the DVM to TP3 and adjust R16 to obtain a 7.07 VAC reading.

Move the positive lead of the DVM to TP9 and adjust R79 for a 7.07 VAC reading. Turn R49 clockwise. Connect the positive lead of an oscilloscope to TP8 and the negative lead to the GND loop. Set it for 5 VDC/Ch and 5 mS/Ch with the trace in the center. Turn R49 counterclockwise slowly until you get a square wave with sharp edges. Now remove the oscilloscope leads from the unit.

Next adjust R92 so that the front panel meter reads -100.0. Connect the positive lead of your DVM to TP11 and adjust R1 to obtain a 0.600 VDC reading. Move the positive lead to TP10 and adjust R61 to obtain a 7.00 VDC reading. Finally, hold the positive lead of your DVM to pin 2 of U3 and adjust R31 to obtain a 5.8 VDC reading. This completes the alignment procedure for the RA-1717 Analyzer.

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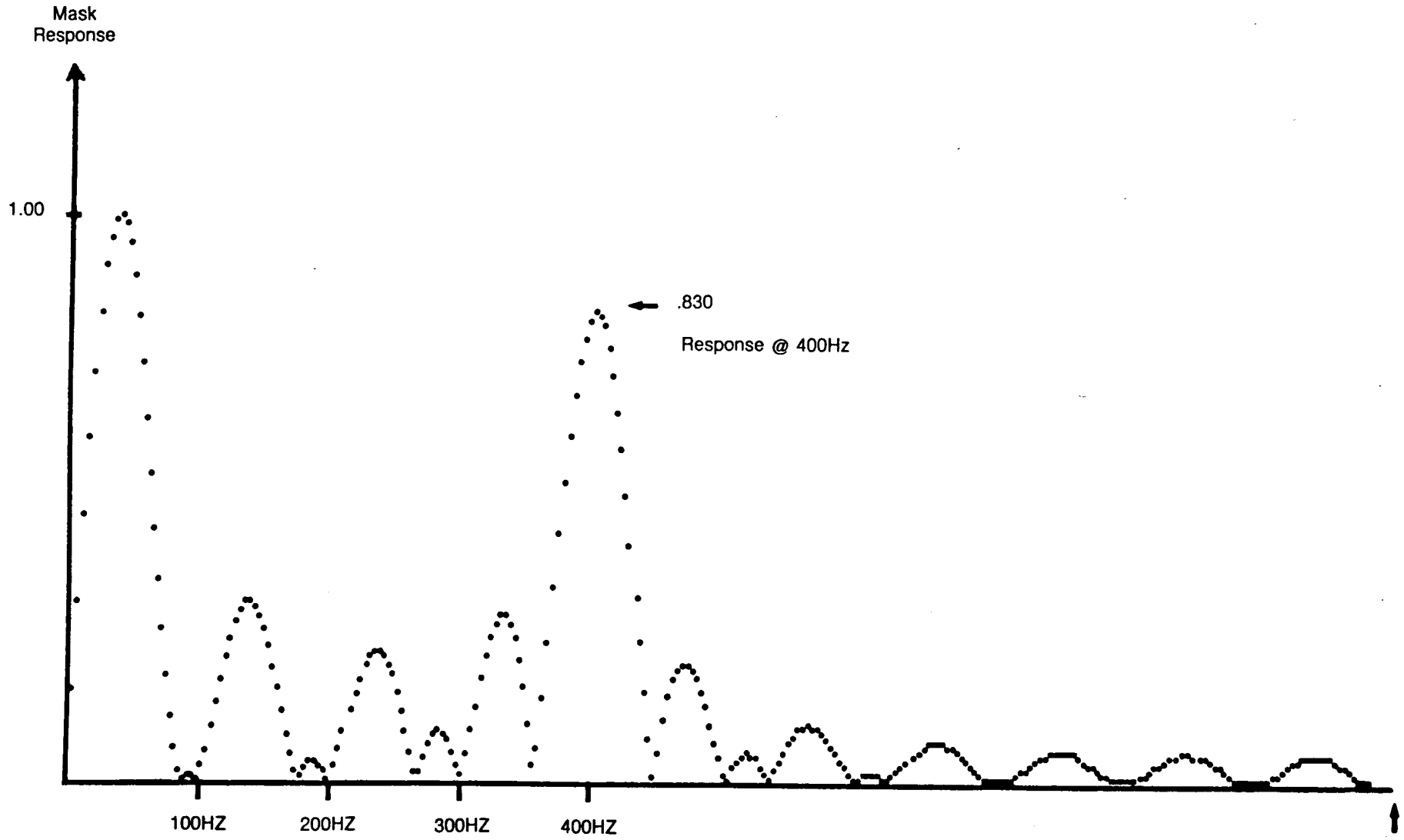
X.M. and M.I. limit circuits are level comparators which toggle flip-flops if the X.M. or M.I. exceed set levels. The output of these circuits also goes to the switching and drive circuitry. The system operation will be made clearer by the following Circuit Description.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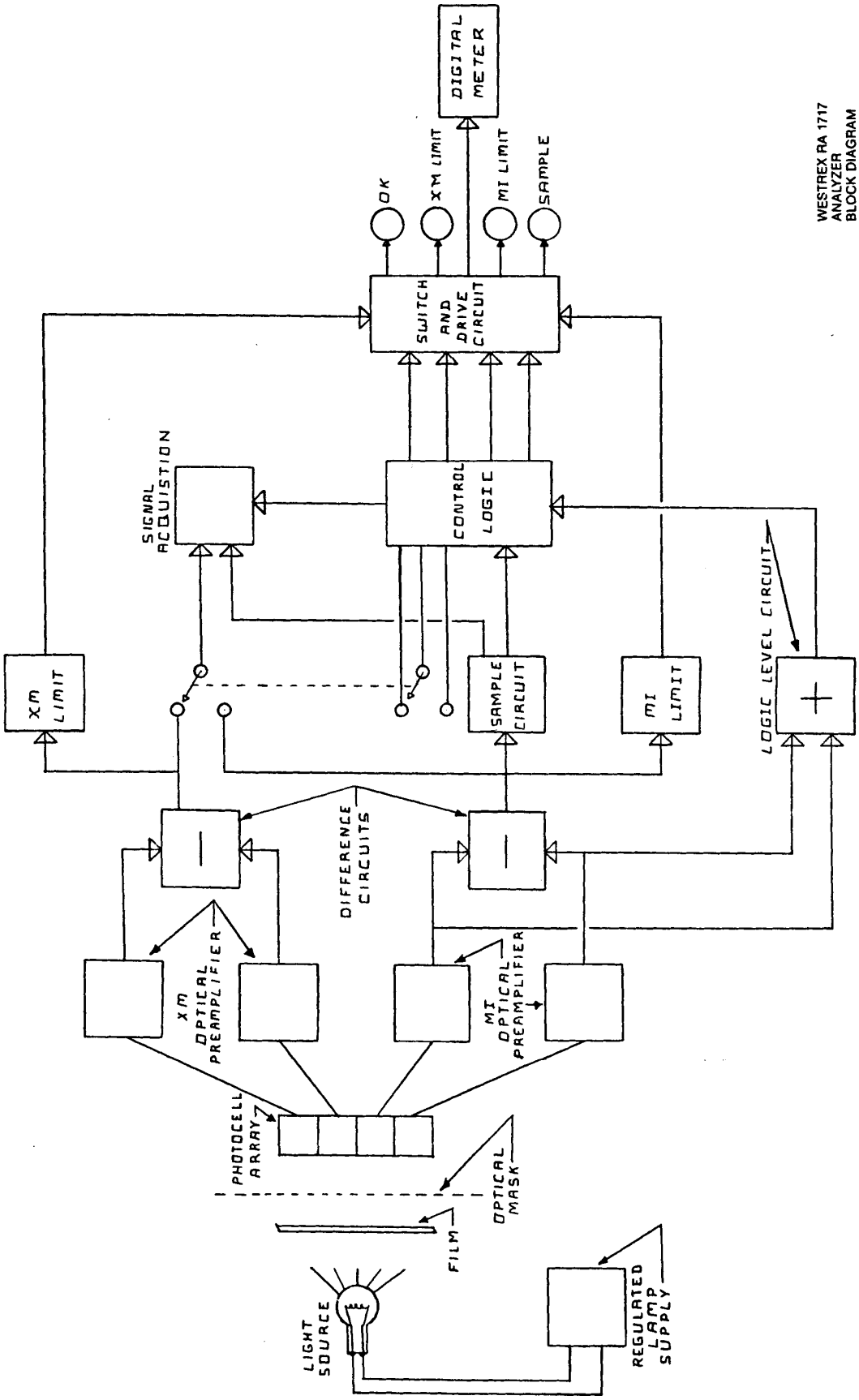
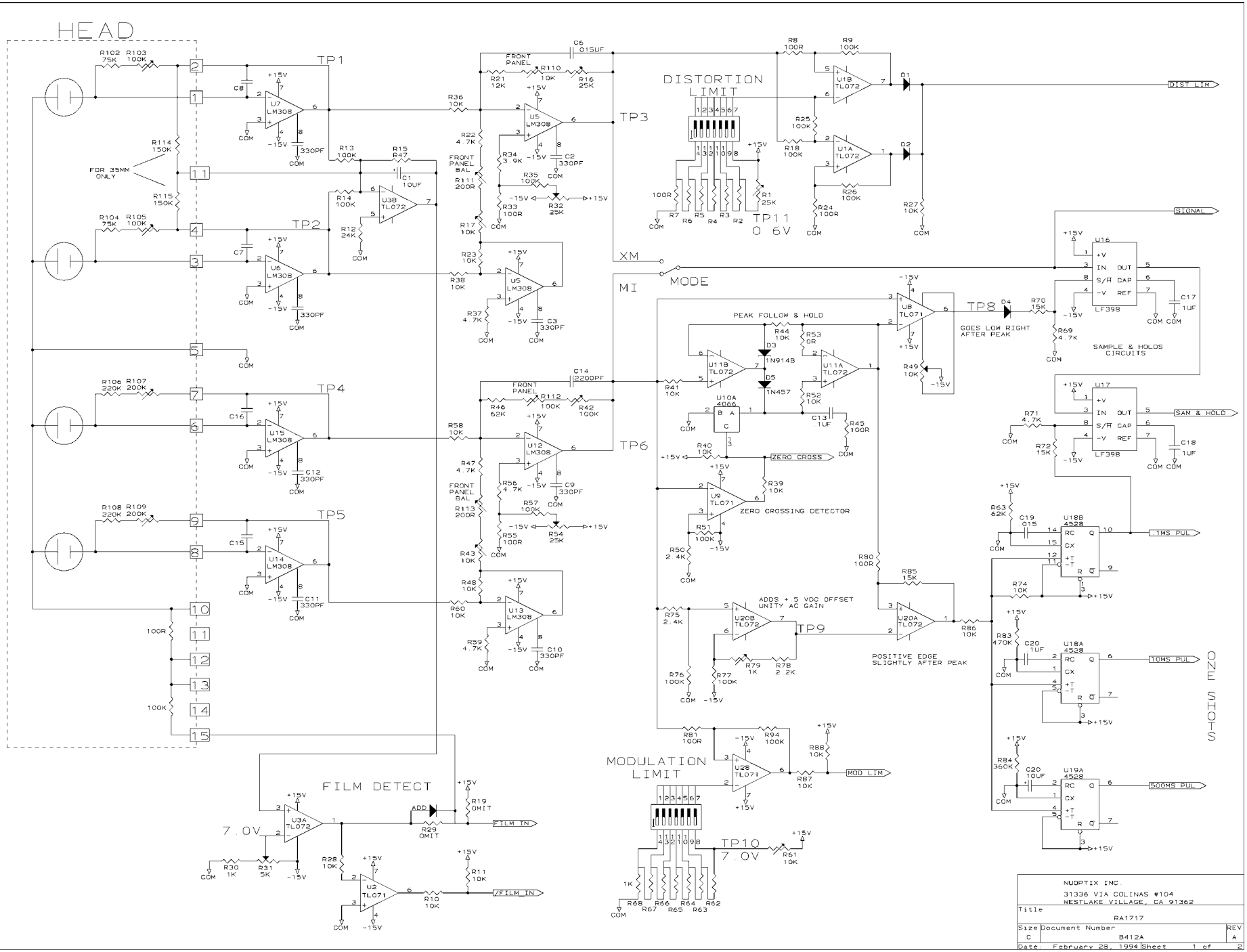
Response @ 400Hz
100HZ
200HZ
300HZ
400HZ
FREQUENCY

Figure II



WESTREX RA 1717
ANALYZER
BLOCK DIAGRAM


HEAD
TP1
TP2
TP3
TP4
TP5
TP6
TP8
TP9
TP10
TP11
0 6V
7.0V
DISTORTION LIMIT
MODE
XM
MI
PEAK FOLLOW & HOLD
GOES LOW RIGHT AFTER PEAK
SAMPLE & HOLDS CIRCUITS
ZERO CROSSING DETECTOR
ADDS +.5 VDC OFFSET UNITY AC GAIN
POSITIVE EDGE SLIGHTLY AFTER PEAK
FILM DETECT
MODULATION LIMIT
FOR 35MM ONLY
FRONT PANEL
FRONT PANEL BAL
DIST LIM
SIGNAL
SAM & HOLD
ZERO CROSS
MOD LIM
FILM_IN
/FILM_IN
1MS PUL
10MS PUL
500MS PUL
OZE SIGNALS
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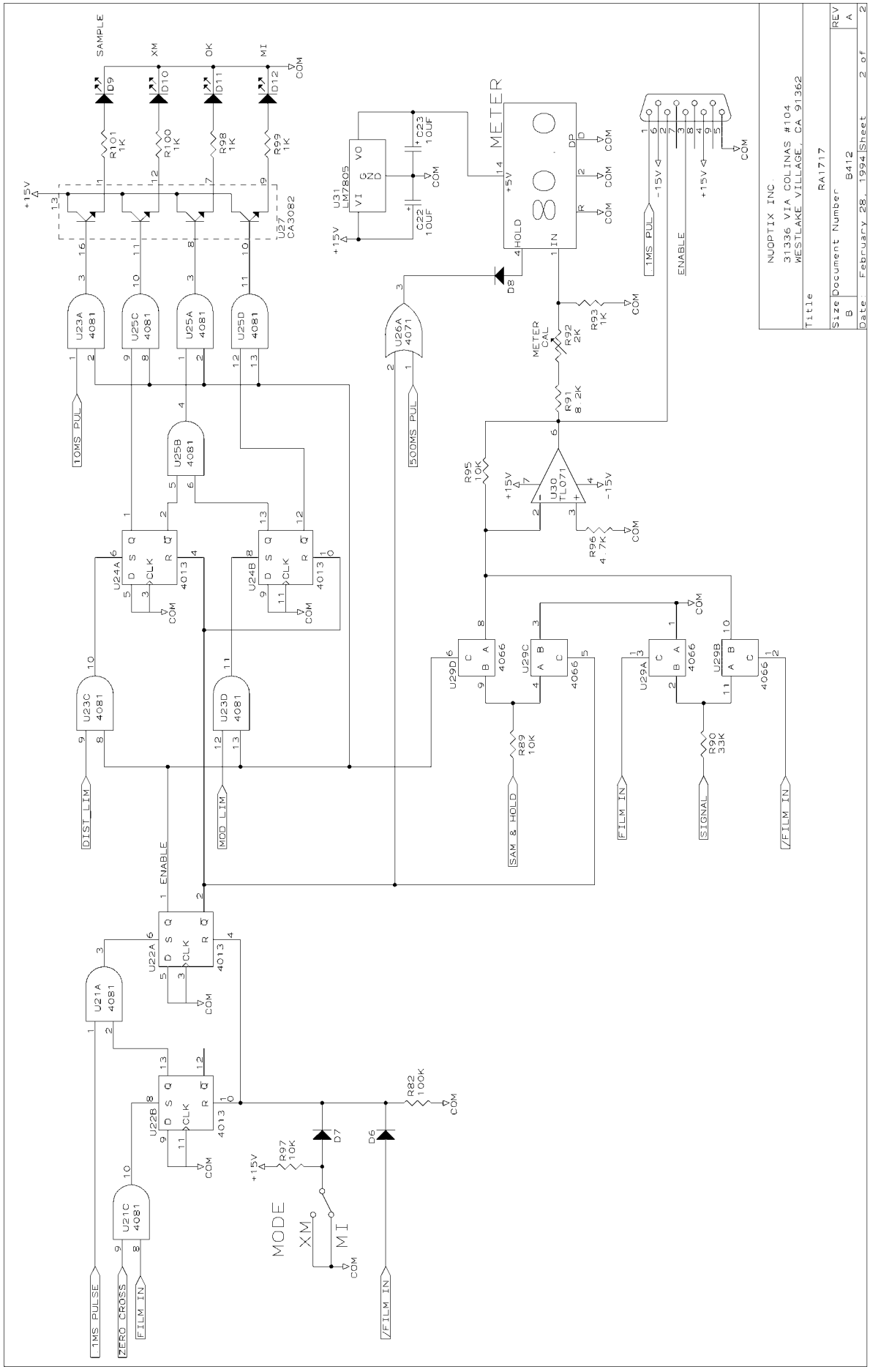
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OK
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D10
D11
D12
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METER CAL
R92 2K
R91 8.2K
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U25A 4081
U25D 4081
U26A 4071
500MS PUL
10MS PUL
U25B 4081
U24A 4013
U24B 4013
R95 10K
U30 TLC071
R96 4.7K
U23C 4081
U23D 4081
U29D 4066
U29C 4066
U29A 4066
U29B 4066
R89 10K
R90 33K
DIST LIM
MOD LIM
SAM & HOLD
FILM IN
SIGNAL
/FILM IN
ENABLE
U22A 4013
U21A 4081
U22B 4013
R82 100K
R97 10K
D7
D6
MODE
XM
MI
U21C 4081
1MS PULSE
ZERO CROSS
FILM IN
/FILM IN

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PARTS LAYOUT DIAGRAM