

LA SERIES

COMPRESSOR/LIMITERS

SPECIFICATIONS

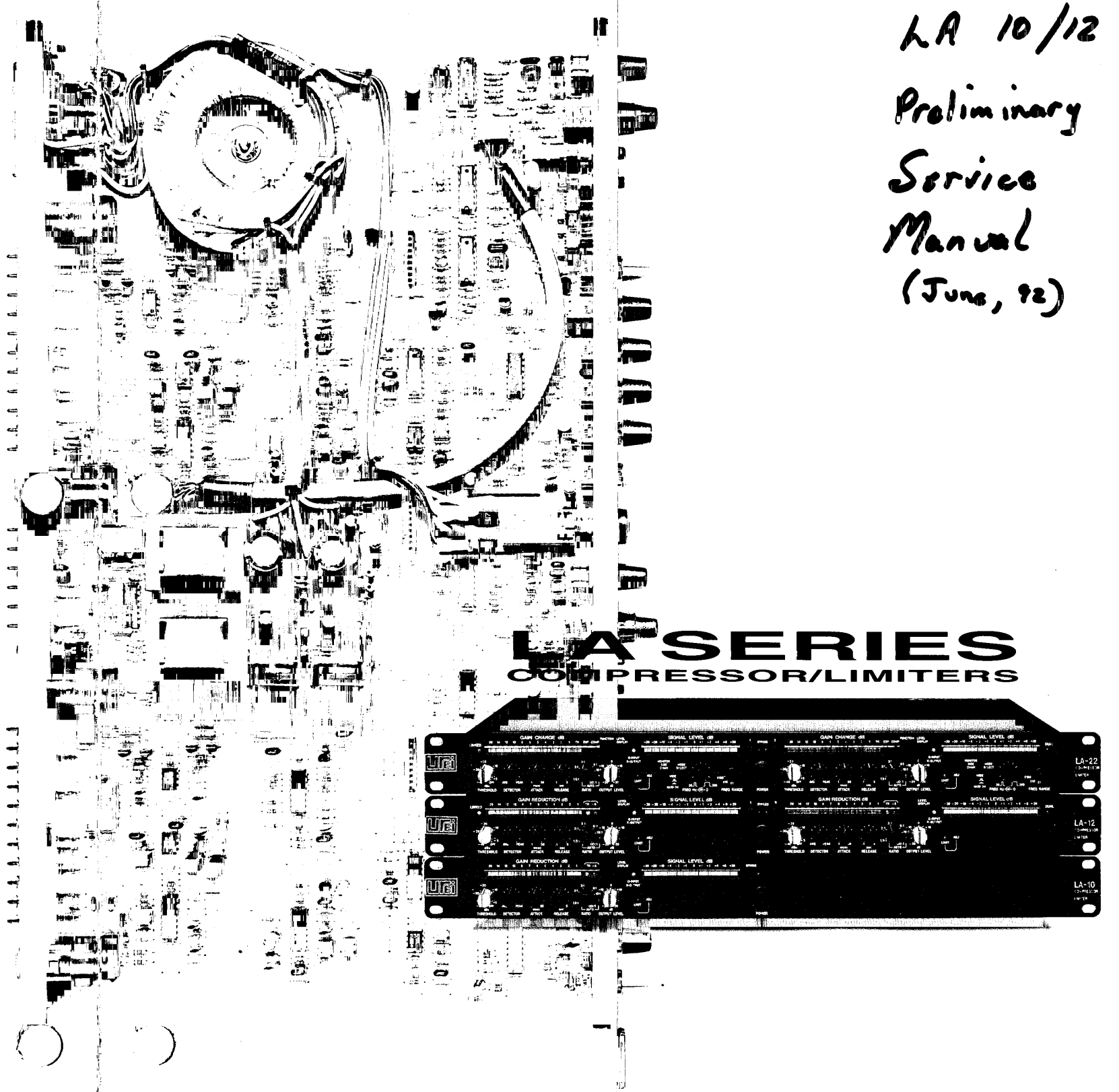
	LA-10	LA-12	LA-22
Inputs:	Active balanced bridging.	Active balanced bridging.	Active balanced bridging.
Input Impedance:	40k Ω balanced input, 20k Ω unbalanced (with detector normalised to input).	40k Ω balanced input, 20k Ω unbalanced (with detector normalised to input).	40k Ω balanced input, 20k Ω unbalanced (with detector normalised to input).
Detector Input Impedance:	100k Ω balanced input, 50k Ω unbalanced.	100k Ω balanced input, 50k Ω unbalanced.	100k Ω balanced input, 50k Ω unbalanced.
Maximum Input Level:	+24 dBu (12.3 V rms).	+24 dBu (12.3 V rms).	+24 dBu (12.3 V rms).
Gain:	± 20 dB, adjustable with front panel output level controls.	± 20 dB, adjustable with front panel output level controls.	± 20 dB, adjustable with front panel output level controls.
Frequency Response:	20 Hz - 20 kHz ± 0.2 dB	20 Hz - 20 kHz ± 0.2 dB	20 Hz - 20 kHz ± 0.2 dB
Dynamic Range:	< 115 dB	< 115 dB	< 115 dB
Signal To Noise Ratio:	110 dBA, 22 kHz A weighted noise bandwidth.	110 dBA, 22 kHz A weighted noise bandwidth.	110 dBA, 22 kHz A weighted noise bandwidth.
THD:	< 0.006% typical @ 1 kHz, 0.02% maximum @ +14 dBu input.	< 0.006% typical @ 1 kHz, 0.02% maximum @ +14 dBu input.	< 0.006% typical @ 1 kHz, 0.02% maximum @ +14 dBu input.
Attack Times			
Average Detectors:	1 - 50 ms	1 - 50 ms	1 - 50 ms
Peak Detectors:	$\leq 100 \mu\text{s}$	$\leq 100 \mu\text{s}$	$\leq 100 \mu\text{s}$
Output Peak Limiters:	50 μs	50 μs	50 μs
Release Times			
Average Detectors:	100 ms - 5 s for 10 dB of release.	100 ms - 5 s for 10 dB of release.	100 ms - 5 s for 10 dB of release.
Peak Detectors:	10 ms	10 ms	10 ms
Output Peak Limiters:	40 ms	40 ms	40 ms
Compression/Expansion Ratios:	Adjustable from 1.5:1 to ∞ :1.	Adjustable from 1.5:1 to ∞ :1.	Adjustable from 1.5:1 to ∞ :1.
Threshold of Limiting/Expansion:	Adjustable from -40 dBu to Off.	Adjustable from -40 dBu to Off.	Adjustable from -40 dBu to Off.
Outputs:	Transformer isolated, symmetrical floating.	Transformer isolated, symmetrical floating.	Transformer isolated, symmetrical floating.
Maximum Output Level:	+24 dBm into 600 Ω	+24 dBm into 600 Ω	+24 dBm into 600 Ω
Connectors			
Inputs and Outputs:	XLR type 3 pin (pin 2 high), 6.3 mm (1/4 in) TRS phone jack.	XLR type 3 pin (pin 2 high), 6.3 mm (1/4 in) TRS phone jack.	XLR type 3 pin (pin 2 high), and barrier strip.
Limiting Detectors:	6.3 mm (1/4 in) TRS phone jack normalised to input.	6.3 mm (1/4 in) TRS phone jack normalised to input.	Barrier strip.
Link:	Barrier strip.	Barrier strip.	Barrier strip.
AC Power Requirements:	100-120/220-240 V AC, 50-60 Hz, 25 W maximum.	100-120/220-240 V AC, 50-60 Hz, 25 W maximum.	100-120/220-240 V AC, 50-60 Hz, 30 W maximum.
AC Line Cord:	Detachable, IEC type.	Detachable, IEC type.	Detachable, IEC type.
Front Panel Dimensions:	1U (44 mm x 483 mm; 1 3/4 in x 19 in).	1U (44 mm x 483 mm; 1 3/4 in x 19 in).	1U (44 mm x 483 mm; 1 3/4 in x 19 in).
Depth Behind Panel:	260 mm (10 1/4 in).	260 mm (10 1/4 in).	273 mm (10 3/4 in).
Finish:	Powdercoated black	Powdercoated black	Powdercoated black
Net Weight:	6.4 kg (14 lbs).	6.4 kg (14 lbs).	6.4 kg (14 lbs).

Standard Accessory (common to all models): Security cover, Part No. SC8

UREI

SIGNAL PROCESSING

LA 10/12
Preliminary
Service
Manual
(June, 92)



UREI

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LA SERIES COMPRESSOR/LIMITERS

A HISTORY OF HITS.

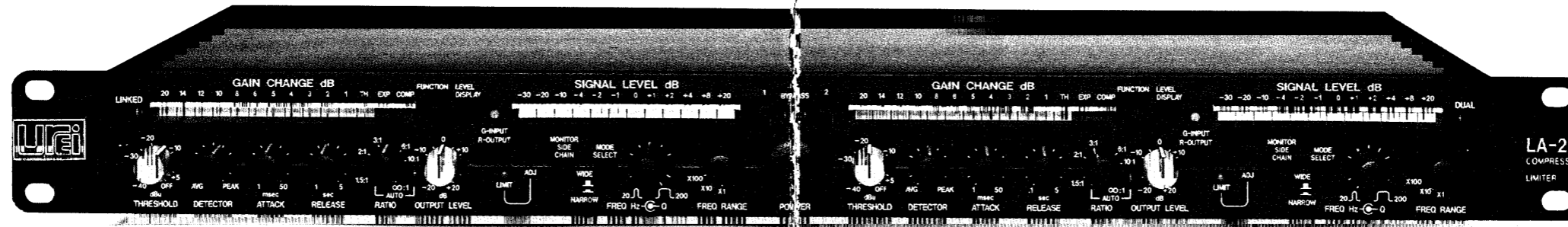
It is virtually impossible to determine how many major recordings have been impacted by UREI products. For well over two decades, recording engineers have considered UREI Compressor/Limiters to be essential tools of the studio.

Likewise, these same devices have been staples of the Live Sound and Broadcast industries, aiding engineers in achieving the desired levels of sonic performance for their respective audio needs.

Experience is the ultimate teacher and UREI engineers have been to class. Combining proven performance with modern technology, the LA Series family of Compressor/Limiters was developed to meet the needs of today's audio professional.

LA Series Compressor/Limiters deliver transparent control over audio levels, employing Smart-Slope™ compression ratios from 1.5:1 through infinity:1. Ultra low noise circuitry and intelligent feature selection make LA Series ideal for the most demanding applications, including all levels of recording, broadcast, installed sound and sound reinforcement.

The three LA Series models, LA-10, LA-12 and LA-22, all share virtually identical performance



LA-22

The "flagship" of the LA Series, the two channel LA-22 is truly the most flexible device of its type. This unit was designed with two key features which significantly increase its corrective and creative utility.

First, a front panel pushbutton switch converts the LA-22 from a gain "reduction" system to a dynamic gain "expander".

Secondly, the LA-22 is equipped with an onboard fully parametric filter system which can be used to "focus" the gain reduction or

Dual Channel Frequency Selective Compressor/Limiter/Expander

expansion action at a specific center frequency as narrow as 1/6 octave or as wide as 2-1/2 octaves.

In the gain reduction mode, the "spectral agility" provided by the parametric filter (continuously variable center frequency selection from 20 Hz to 20 kHz) makes the LA-22 a particularly effective "De-esser". It can also be utilized as a very precise feedback suppressor. Its creative application is limitless.

In the expansion mode, one example of its utility would be to use the parametric filter to enhance vocal intelligibility of

recordings, sound reinforcement systems or paging systems. This would be achieved by setting the parametric filter center frequency and 'Q' to expand only the range of the human voice. Once again, its creative capabilities are limited only by your imagination.

The parametric filters are fully accessible via the rear panel barrier strips and can be used as single channel independent equalizers or can be fed to the Side Chain to achieve frequency dependent control of the full bandwidth signal.

The onboard parametric filter circuit adds a degree of flexibility to the LA-22 previously unavailable in products of this type.

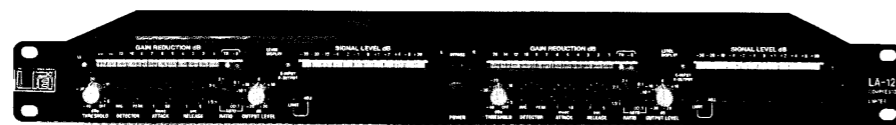
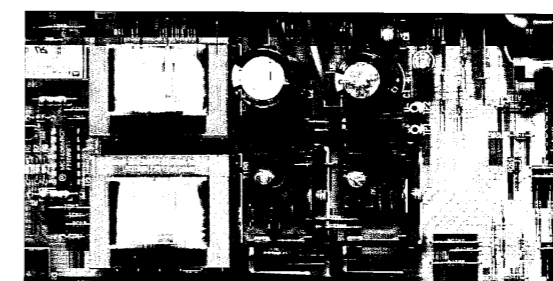
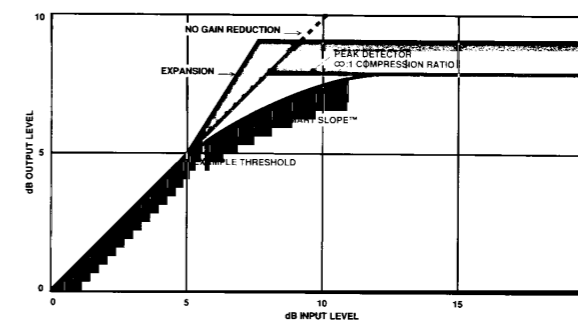
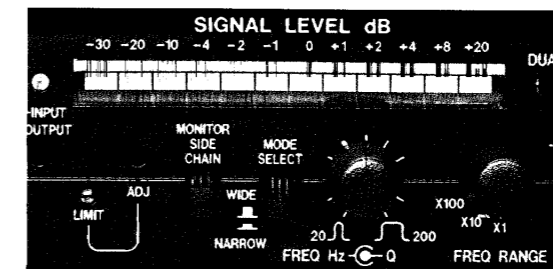
Center frequency selection is continuously variable from 20 Hz to 20 kHz with the 'Q' adjustable from 1/6 to 2 1/2 octaves. This enables you to gain reduce or expand within a limited range of frequencies, without effecting the remainder of the audio signal. The parametric filter can also be routed to the side chain so that full band gain reduction or expansion can occur as a result of a specific frequency(ies).

Transparent Gain Reduction or Expansion from Smart-Slope™ Compression Ratios.

Typical input vs. output level curves for LA Series Compressor/Limiters.

To achieve ideal isolation, the output stage incorporates real transformers integrated with our patented active circuit.

This combination of technologies virtually eliminates the distortion and saturation often associated with transformer output stages.



LA-12

A dual channel version of the LA-10, the LA-12 packs more performance in the same size chassis. The two channels can be operated independently, linked for stereo, or linked to other units

Dual Channel Compressor/Limiter

for multi-channel applications. The LA-12 offers solid gain reduction capability in a package that is ideal for the recording studio, broadcast studio or live sound reinforcement system.



LA-10

The LA-10 is a single channel device, ideal for use in sound contracting and broadcast. Its simple design makes it cost effective for use in basic systems

Single Channel Compressor/Limiter

without sacrificing performance or features. The LA-10 can be linked via a rear panel barrier strip to work in conjunction with other units for stereo or multi-channel applications.

characteristics and differ only in terms of number of channels and features.

Housed in a compact 1U rack space chassis, LA Series Compressor/Limiters feature three separate gain reduction circuits: Peak, Average and Peak Output Ceiling limiting. Front panel controls allow total command over Threshold, Detector mode, Attack, Release, Ratio and Output Level. When rotated completely counter-clockwise, the Ratio control activates an "Auto" function which sets the Compression Ratio and Peak/Average to factory preset values for quick set up. Two high visibility LED displays provide visual indication of Input/Output levels and Gain Reduction.

Active Balanced Bridging circuitry on the inputs permits these units to be driven by signals in excess of +24 dBu. The output stage incorporates a real transformer to attain ideal isolation, optimized by a patented active circuit which virtually eliminates the distortion and saturation sometimes associated with transformer output stages.

These hot new tools from UREI can help you produce great hits. LA Series, a new standard from the people who have set the standards for compressor/limiters for over 20 years.

LA-10 LA-12
7110A/7112 COMPRESSOR/LIMITER THEORY OF OPERATION

11/18/91

Robert Girard

LA-10 LA-12
The 7110A and 7112 series Compressor/Limiters are professional performance units providing multi-configurable function parameters. The 7110A is a single channel unit, and the 7112 is a dual channel model with the same circuitry as the 7110A, as well as an internal link switch, allowing the VCA control ports to operate from the same source (more detail on this later). The general concept and usefulness of these devices centers around the need to control audio signal levels automatically, in real-time, in order to prevent overloading of limited dynamic range equipment such as tape recorders (especially digital tape recorders), or to "compress" the wild changes in level of some vocal performances. There are of course, many other uses for the compressor/limiter, too many to give attention to here.

The 71XX (referring to both the 7110A and 7112) system are comprised of 7 main sections (see Fig. 1. (*)):

1. Input buffer
2. VCA (voltage controlled amplifier) section
3. Side chain (rms and peak subsections, Auto mode)
4. Output limiter (fast peak limiter)
5. Balanced transformer isolated output amplifier
6. Signal level, gain reduction display section
7. Power supply

Each of these sections will be addressed in detail throughout this document, with the overall intent of providing the production test and repair technician, as well as the outside service technician valuable technical and functional information.

Regarding overall system function and specification definitions, please refer to the attached product specification documents for both the 7110A and 7112 products. It is important to supplement this document with the specification documents in order to fully understand the products.

(*) Note: FIG. 1 depicts the 7112 block diagram. The 7110A block is identical except for being single channel only

I. INPUT BUFFER/DETECTOR BUFFER SECTION:

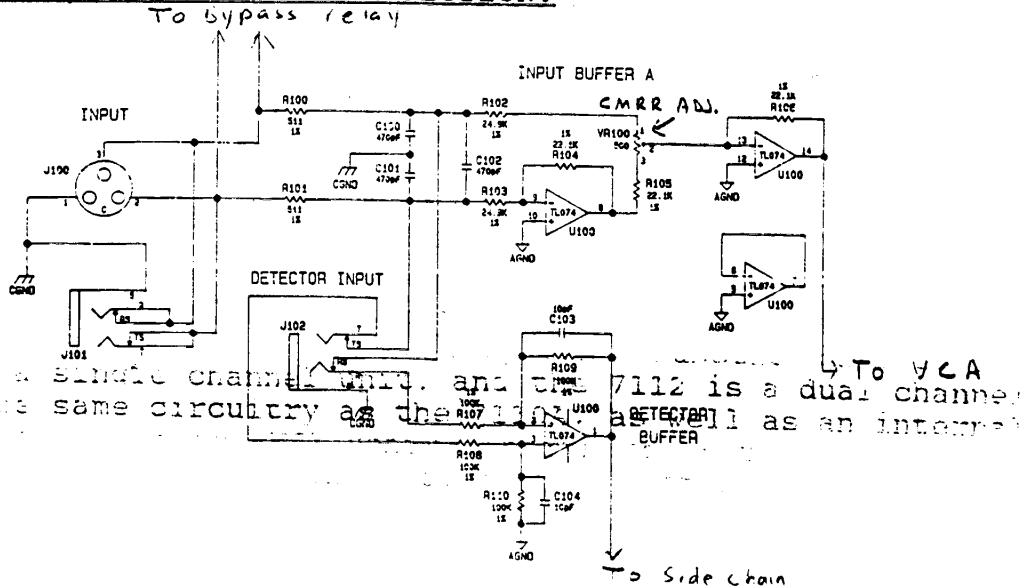


Fig. 2

This section consists of two types of balanced-to-single ended (or differential amplifier) circuits. The first type, used as the audio chain input buffer, has a trimpot adjustment for maximum common mode rejection. A typical cmrr curve for this circuit is shown in Fig.3. The gain of this stage is fixed at -1.3dBr, and THD+N at 1kHz is typically below 0.004% THD. Both XLR and balanced 1/4" input jacks are available for input connection, located on the rear panel.

The second section is used as an input buffer for the control section (side chain), and is a typical differential amplifier, with a gain of unity. In normal operation, the input for the detector buffer is supplied by the main audio signal, causing the control section to react to the program material, and perform typical

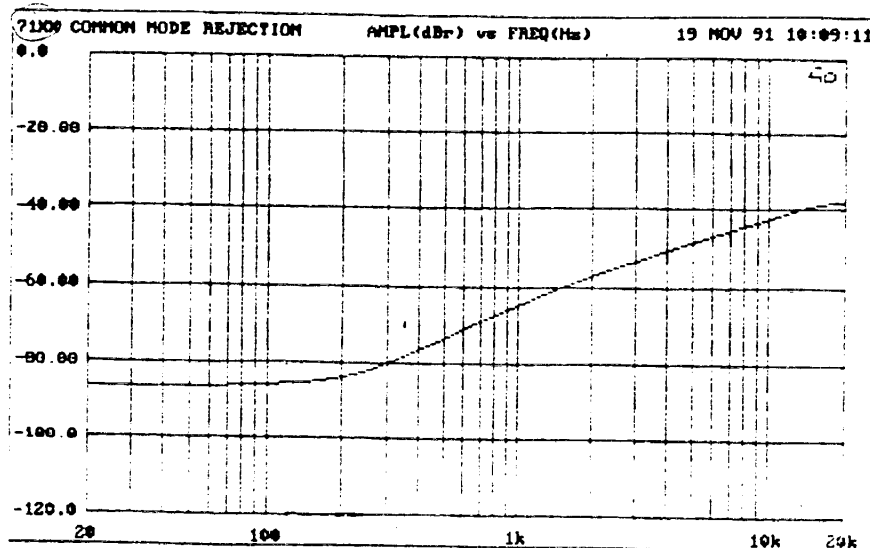


Fig. 3

compress/limit functions. However, when an external source is connected to the side chain via the switched jack, the main source is disconnected from the side chain, and is driven by an audio source independent of the program material.

II. VCA (VOLTAGE CONTROLLED AMPLIFIER) SECTION:

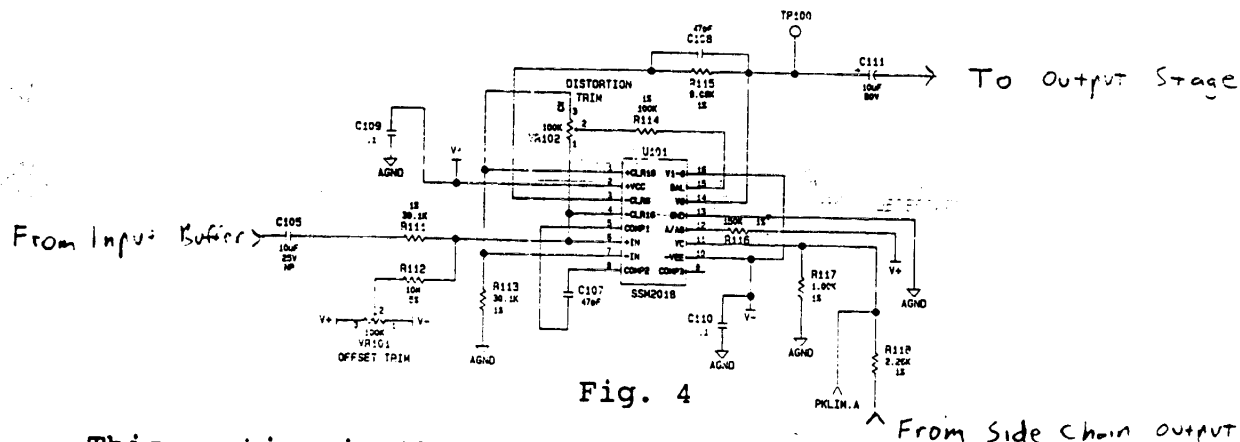


Fig. 4

This section is the heart of the 71XX Compressor/Limiter product. The SSM2018 VCA operates as a D.C. voltage controlled gain amplifier. The control law at the control port (pin 11), is -30mV/dB . From a starting point of 0 VDC, for every increase in D.C. voltage of approx. 30mV D.C., a gain change of -1 dB results, causing a 1 dB loss through this section.

The control circuitry discussed in the following sections accesses the control port of the VCA in order to perform the various compress/limit functions characterized by the (71XX). When no limiting is occurring, and the front panel output level control is set for 0 dB, there will be approx. 0 VDC at the control port. The nominal throughput gain (with 0 VDC at the control port) is -10.4dBr . Combined with the input buffer gain of -1.3 dBr , the total output-to-input gain at the VCA section output is approx -11.7 dBr .

There are two trim pots in this section. The first is the distortion trim, when set for minimum distortion with 0 dBu at the input to the unit, should be about .008% At 1kHz, with a 30kHz test bandwidth filter applied. The second trim minimizes D.C. offset at the VCA output. The method for doing the offset trim should be as follows:

1. Connect a DVM to test point TP100 (TP300 as well for (7112)). Apply no audio test signal
 2. Rotate front panel level control to full clockwise position
 3. Adjust trimpot for minimum DC offset.
 4. Rotate level control to 0 dB setting
 5. Verify offset to be less than 10mV D.C.
- AWKWARD READING
SHOULD BE REWOUND
IT SOUNDS LIKE ADJUST
SHOULD BE MADE TO BOT
VCA'S SIMULTANEOUSLY*

If a VCA cannot be trimmed, it should be replaced.

71XX SIDE CHAIN

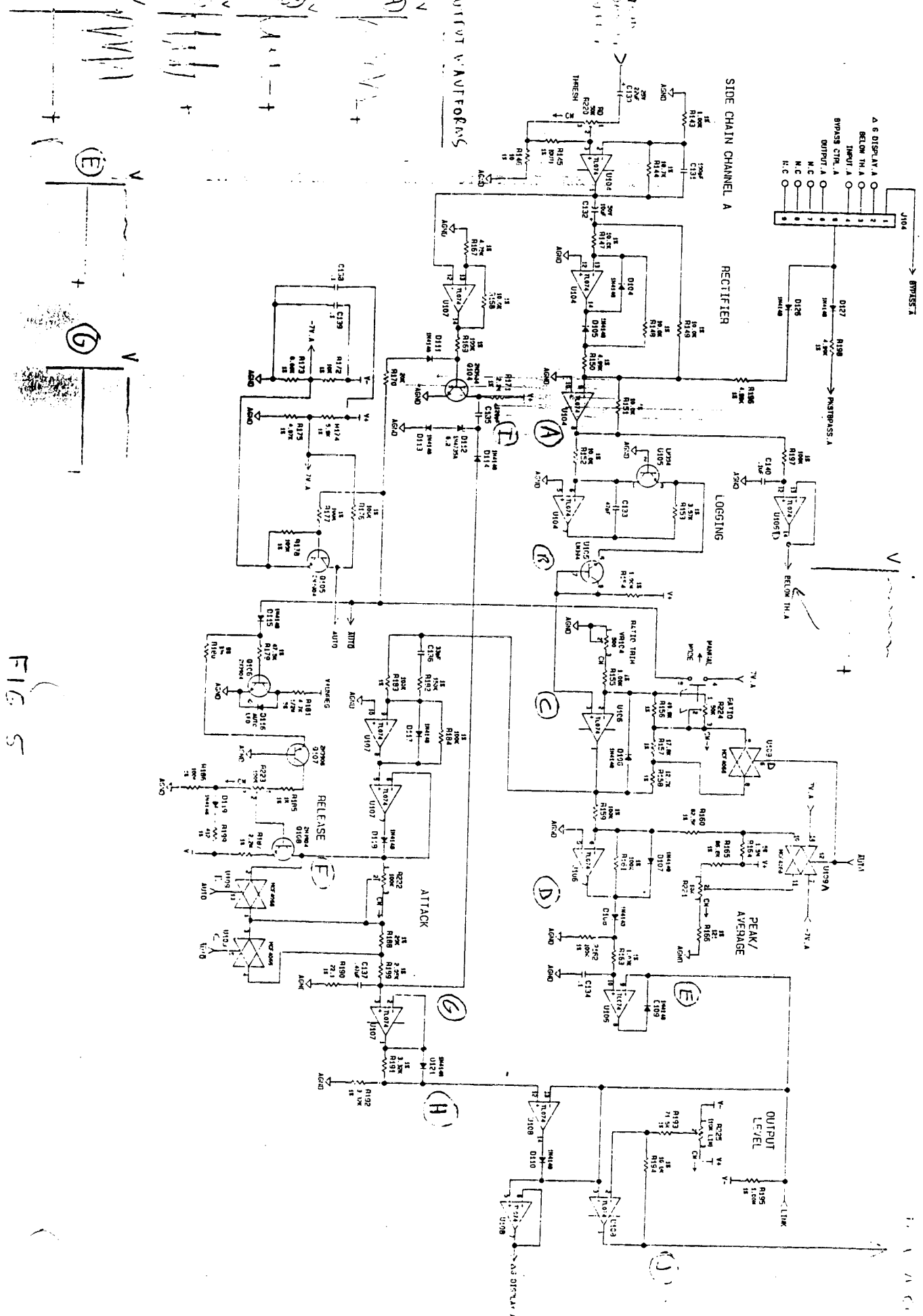


FIG 5

III. SIDE CHAIN (RMS AND PEAK SUBSECTIONS):

The main function of the side chain is the conversion of an audio signal into a D.C. control signal applied to the VCA control port to change the gain of the circuit. This basic concept is the key to compressor/limiter operation.

The 71XX side chain consists of two main sections, with their associated subsections (see Fig. 5 For complete side chain). The first main section, the peak limiter section, is comprised of subsections D and E. The rms or " average " limiter section is comprised of subsections F, G, H, and I.

The basic difference between the peak and rms sections is twofold; the peak limiter has fixed attack and release times, whereas the rms limiter has fully adjustable attack and release times, and the peak limiter has a faster attack and release time than the rms section can achieve. There are a couple of other differences as well, and these will be explained later. For an overview of the user-adjustable controls, read the section named " controls " in the product specification sheet.

A. SIDE CHAIN INPUT AMPLIFIER, FULL-WAVE RECTIFIER:

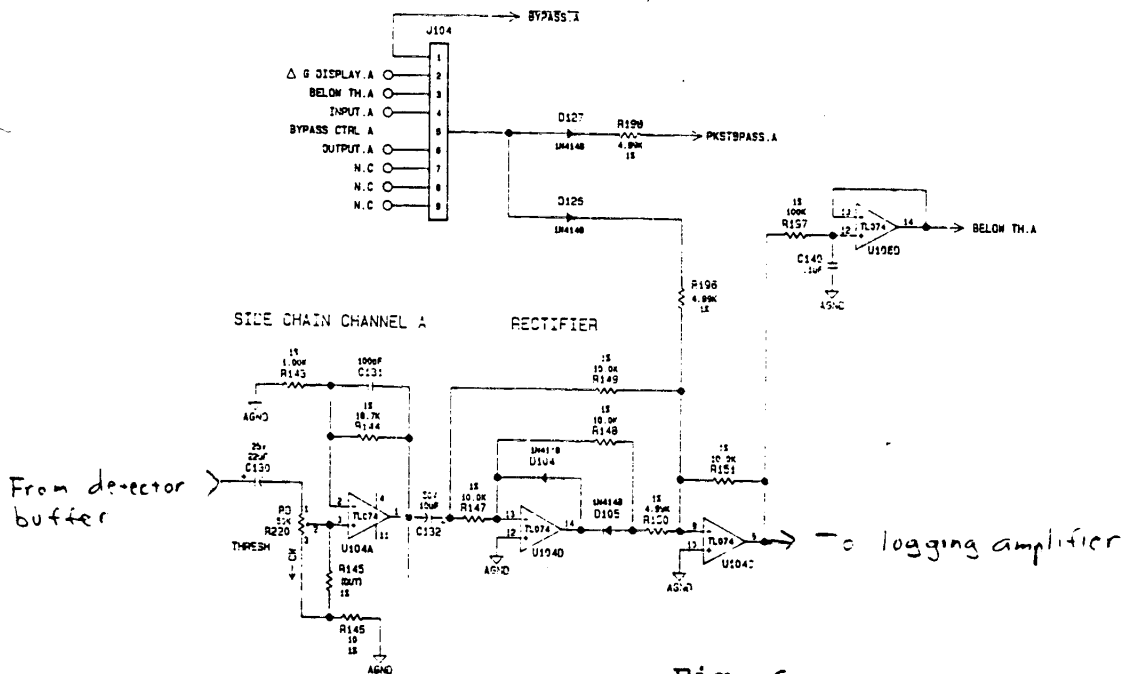


Fig. 6

This section performs two functions; provides an adjustable gain amplifier (threshold) for limiter function sensitivity, and full-wave rectifies the audio signal as a first step in the AC to DC conversion process. See Fig. 6 For a diagram of waveform outputs of this stage. Also included is a ripple filter for use as a signal driver for the " below threshold " level LED indicators (see display board section for details).

B. LOGGING AMPLIFIER:

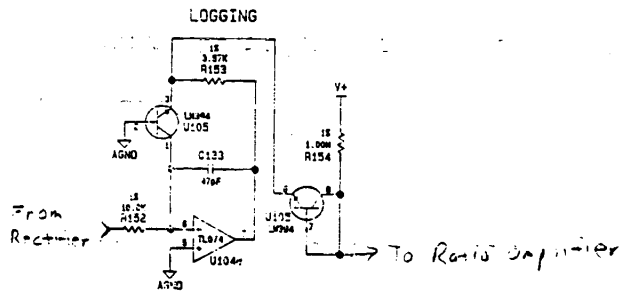


Fig. 7

whereas the peak limiter has fully adjustable attack and release times whereas the rms limiter has fully adjustable attack and release times.

In order to accommodate the VCA control function (30 mVDC/dB), it is necessary to perform a log conversion of the rectified audio signal. This circuit uses a matched transistor pair to accurately achieve the transfer function of 3.3mV/dB. In other words, for every 1 dB change in peak signal level delivered by the full-wave rectifier stage, the resultant change in peak signal output of the logging stage will be approx. 33mV.

C. RATIO CONTROL AMPLIFIER:

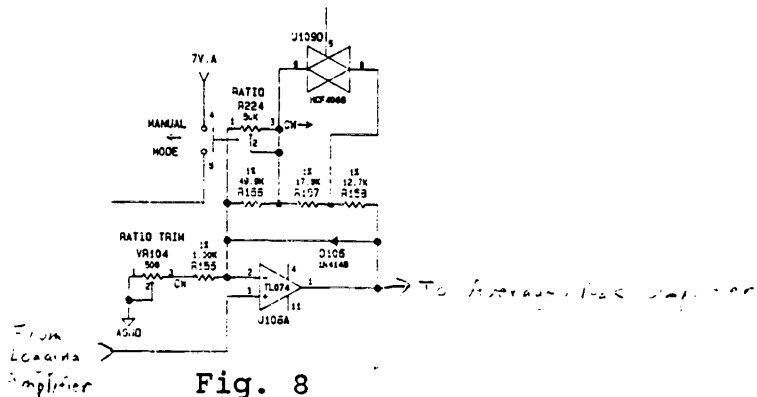


Fig. 8

This stage serves two purposes. The first is to amplify the very low level of the log converter to more useable levels. The second is to provide the user with an adjustable compression ratio (*) from 1.5:1 to ∞ :1, by way of adjusting the gain of this stage. The gain is approx. 21dB at 1.5:1, and about 30dB at ∞ :1. This stage is a non-inverting voltage amplifier. Included in this circuit is a trimpot which is used to trim the

(*) Note:

Compression ratio is defined as the ratio of change in input level to change in output (input change : output change).

Ex. If the compression ratio is 10:1, then for every 10 dB change in input signal level, the output will change 1dB.

infinite compression ratio ($\infty:1$ setting). Shown in Fig. 9 is the output vs. input of a 71XX when set to $\infty:1$. Note that there are 3 distinct sections of the curve. Section 1 represents the response before threshold (threshold occurs at -10dBu input level), and therefore has a 1:1 ratio, or no limiting. Section 2 is the "Smartslope" TM intermediate slope (more detail on this later), and section 3 is the fully active compressor/limiter region. This section is what is used to trim the ratio amplifier for accurate $\infty:1$ compression. Note that from 10dBu input level, to 20dBu, the output level has essentially no change (up or down). This is the correct response, and the trimpot should be adjusted to achieve this response.

ESSENTIALLY

Fig. 7

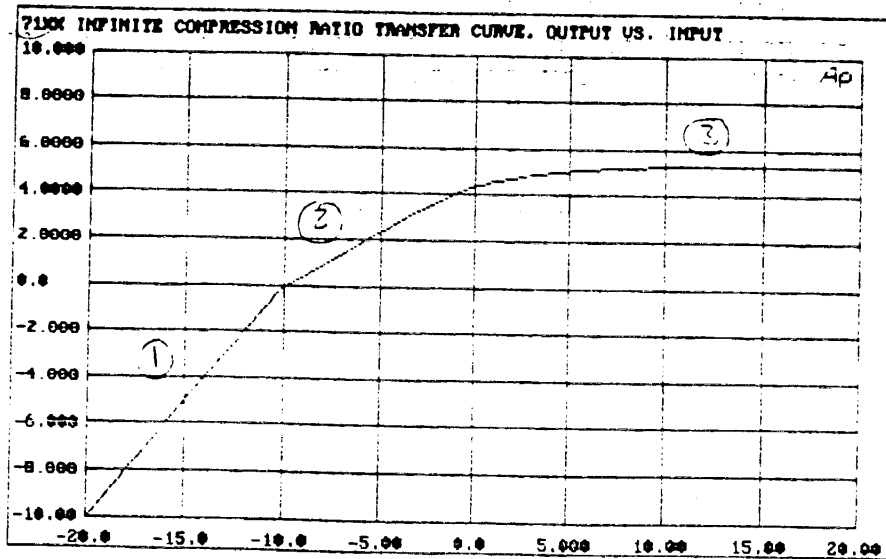


Fig. 9

D & E. AVERAGE/PEAK RESPONSE AMPLIFIER & PEAK LIMITER:

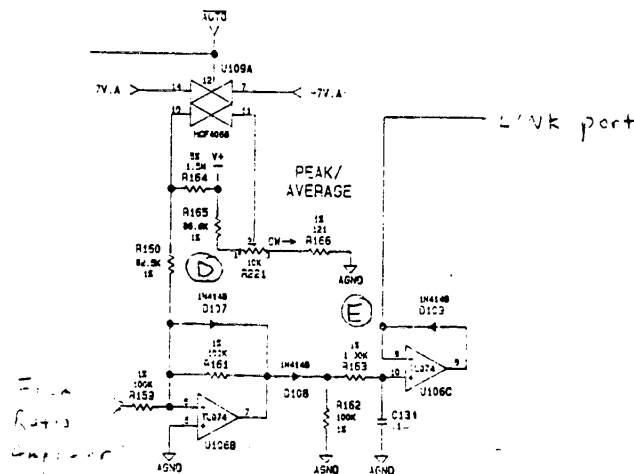


Fig 10.

The average/peak control amplifier section (Fig. 10) is a user-adjustable amplifier/driver stage which feeds the peak limiter attack/release response circuit (section E). The purpose of this circuit is to allow the user to set a ratio between peak and average limiting response, by controlling how much signal is applied to the peak limiter circuit. Note that there is always a fixed drive level (from the ratio amplifier stage output) to the rms section, as the average/peak control circuit affects only the peak section.

The average/peak amplifier stage is an inverting summing voltage amplifier with a signal gain of -1 (inverting, unity), and a variable offset voltage input which is controlled by the user via the average/peak control. At full counterclockwise position (average), the offset into the amplifier is about 2 VDC, resulting in a -2V output offset. At full clockwise position (peak), the offset generated is almost 0 VDC. The offset sums with the input signal resulting in a composite output voltage contributed to by both the signal and the offset voltage. By decreasing the offset voltage (clockwise rotation), the greater is the overall D.C. positive magnitude into the peak limiter section.

The peak limiter section E (Fig. 10) is a simple buffered R-C charge-discharge circuit, where the attack and release times are generated by the following components:

Attack time: R163, C134 (100us)

Release time: R162, R163, and C134 (10ms)

The diode D109 and opamp section U106C combine to create an active diode, which acts as a negative voltage isolator, i.e., any voltage less than approx. 0VDC generated by the peak limiter section reverse-biases the diode circuit, preventing negative voltage feedthrough to the VCA control port.

F, G, & H. RMS (AVERAGE) LIMITER:

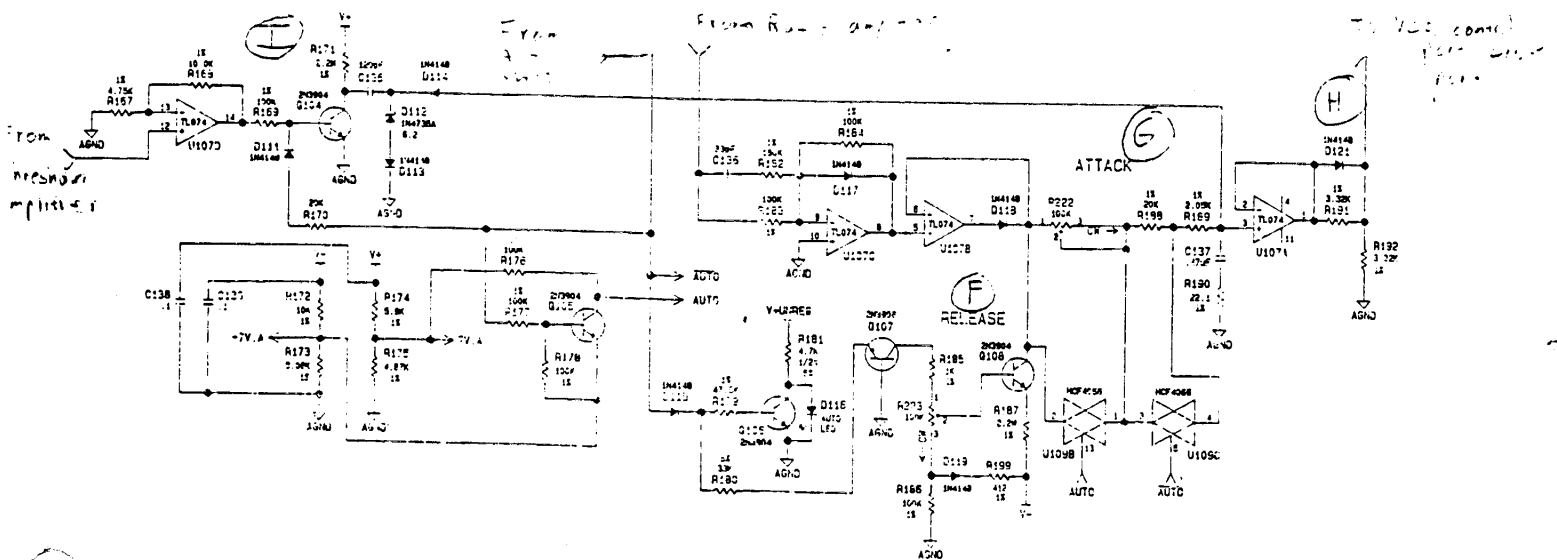


Fig. 11
-9-

The rms or average limiter control circuitry is a more user-controllable version of the peak limiter. Both attack and release times are variable by way of front panel controls. In section F, the potentiometer R222 changes the effective total resistance in combination with the capacitor C137. This allows the attack time to vary between 1ms min. to 50ms max.

Section F controls the release time through an adjustable current sink Q108, where the base voltage is adjusted by the potentiometer R223. The lower the base-to-emitter voltage of the transistor Q108, as adjusted by R223, the lower the collector current. The lower the collector or sink current, the less discharge from C137, which has the effect of lengthening the release time of the circuit. An adjustment range from 100ms to 5sec is obtained. The benefit of the use of the current sink is that a large control range is easily accomplished, and due to the constant collector current provided by the circuit to discharge the C137, a linear discharge ramp results, providing a more linear response, especially important for long release times.

Section H is known as the " Smartslope " TM circuit. As was briefly mentioned in section C, this circuit provides an intermediate transitional stage between no limiting action, and the full response limiting provided by the rms sections. When limiting begins, there is a positive voltage developed at the output of U107, pin 1. As this voltage begins to increase (from 0V), the diode D121 is initially not forward biased, therefore only the resistor divider composed of R191 and R192 affect the output. This divider network causes the D.C. output of the rms limiter section to be attenuated by 1/2. When a large enough drive voltage is developed, the diode D121 will eventually begin to conduct and short out the divider network, allowing a 1 to 1 transfer to the VCA for all drive voltages above this point.

Referring back to Fig. 9, the net effect of this circuit creates a less abrupt transition at the threshold of limiting, or " soft knee ", which allows for a smoother audio response.

I. AUTO MODE, FREQUENCY CONTROLLED RELEASE:

Until now, a few components shown in the previous circuit sections have not been discussed. These are the CMOS 4066 analog switch sections attached to the ratio amp, average/peak amp, and the rms attack and release circuits. These are referenced as U109A, U109B, U109C, and U109D. Also included here are transistors Q105 and Q106 and Q107. These components act as switches, which are controlled by the mechanical rotary switch attached to the ratio control R224. When this switch is open (fully counterclockwise position of R224 after " click ") the Auto mode is enabled. This mode fixes preset values for compression ratio, average/peak ratio, and rms section attack and release times, essentially locking out the front panel controls, except for threshold and output level.

The utility of this function is that the Auto mode provides the user access to a quick and easy setup which can be used fairly successfully with many different applications. This can save time and headaches when careful adjustment of the controls is not necessary.

When the Auto mode is activated, the following conditions exist:

1. The control logic line AUTO goes to 8VDC, AUTO goes to -7.9VDC.
2. U109D goes open, allowing R157 to be active in the feedback of the ratio amp.
3. U109A goes open, disconnecting the average/peak control release R221 wiper from affecting the offset voltage.
4. U109B becomes active, shorting the attack control R222
5. U109C goes open, allowing R188 to become part of the attack/release time circuitry
6. Q107 goes open, causing the collector to float open, disconnecting the current path in the base bias path of the release control R223. This has the effect of fixing the base voltage of Q108 to approx. -17VDC
7. Section I becomes active (see Fig. 11)

FREQUENCY CONTROLLED RELEASE CIRCUIT:

When the auto mode is enabled, the circuit designated section I (Fig. 11) becomes active. This circuit is called a " nibbler " circuit. The nibbler is basically a pulse generator which is driven by the audio signal output of the Threshold amplifier (see Fig. 6), so the pulse frequency is the same as the side chain input signal. The pulse train output of Q104 is capacitor coupled (and rectified by D114) to the attack/release charge/discharge node of the rms limiter. The pulse output of Q104 has the effect of pulling a small amount of charge out of C137 through C135 during the transitional portion of the pulse train (edge triggered). The more of these transitions that occur during any given time-frame, the more current will be pulled or " nibbled " out of C137. This causes the release time to become shorter. So then there becomes a inverse relationship between signal frequency and release time: the higher the signal frequency, the shorter the release time of the rms limiter section.

The purpose behind this function is that the release time and audio signal THD are related. The shorter the release time is, the more low frequency THD is generated by the limiting response. By having the release time controlled in part by the signal itself, the THD can be somewhat normalized for all signal frequencies, while at the same time providing a " best fit " release time for any range of signal.

Fig. 12 shows the sweep response of the limiter in Auto mode, set for 10 dB of limiting at 1kHz.

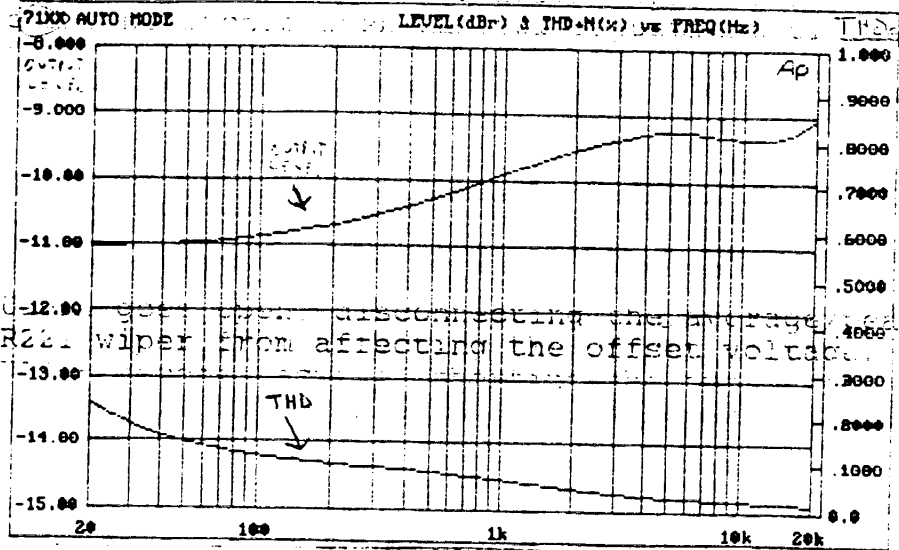


Fig. 12

J. OUTPUT LEVEL CONTROL, LINK PORT:

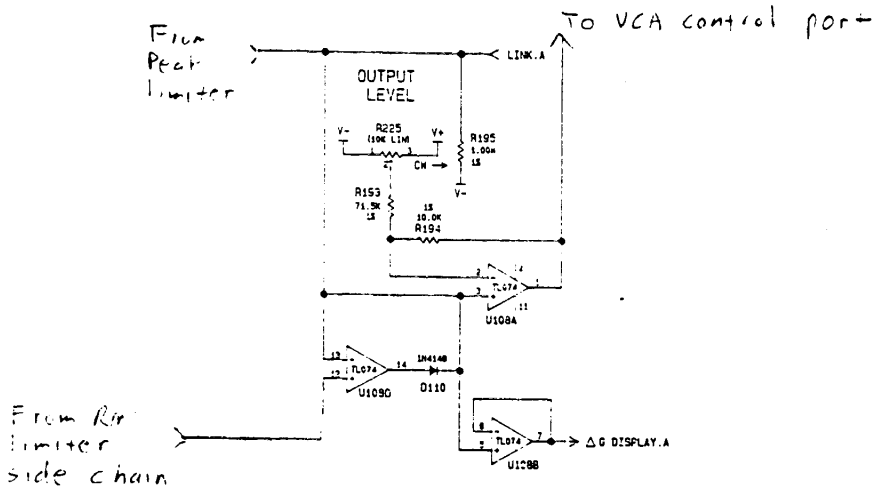


Fig. 13

This section is used as a node at which the peak and rms limiter outputs join and form the composite drive signal used to modulate the VCA gain. This node is also used as a point at which other 71XX VCA control signals can be linked via the "LINK" port on the rear panel barrier strip. This allows any number of units hooked up in this manner to control the gain reduction of the other units. Also, for the 7112 only,

by depressing the rear panel Link switch, the left and right channels become internally linked at both of the side chain outputs for the purpose of creating a stereo limiter.

The output level of the 71XX is controlled by R225, which controls the DC offset voltage of the side chain drive output. This circuit is similar to the average/peak control circuit discussed in section D. The amount of control is typically -24 dB to +24 dB from full counterclockwise to full clockwise.

IV. OUTPUT LIMITER (FAST PEAK LIMITER):

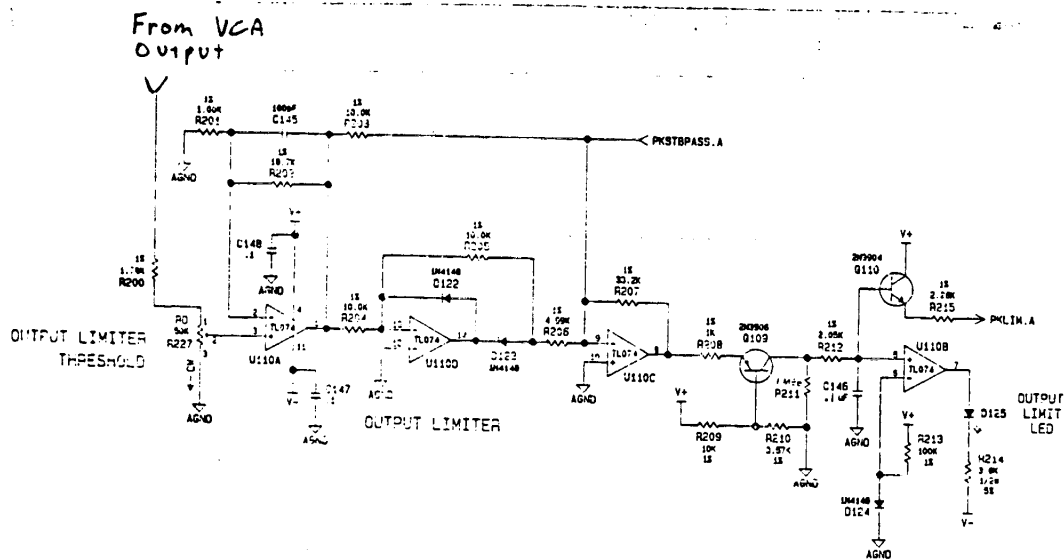


Fig. 14

The output limiter circuit serves one basic purpose. It is used to quickly suppress any signal level above its threshold to prevent potential damage to susceptible equipment such as horn drivers, which can be destroyed by severe signal peaks. Unlike the side chain previously discussed, which takes the signal from the input of the 71XX, the output limiter takes its signal from the output of the VCA itself, creating a feedback loop system useful for this purpose. The effect is that when the output limiter threshold is exceeded, it forces a reduction in the gain of the VCA until the signal output is reduced to a level just below threshold. The net result is that once the threshold point has been reached, no increase in output level is possible, effectively clamping the output signal level. This is accomplished due to the fact that when the output limiter is triggered, it responds with a large voltage step (18VDC) output to the VCA control port. This occurs when Q110 is activated (see Fig. 14). The attack and release times are controlled by R212, R211, and C146. As with the rms and peak side chain circuitry, the DC control signal is generated by way of

a full wave rectifier circuit identical to that in the sidechain. The threshold is user adjusted by a front panel screwdriver adjustable potentiometer, R227. The minimum threshold level is -10 dBu (-R227 full counterclockwise position). The attack time is 50us, and release time is 40ms. An easy way to verify the functionality of this stage is to observe the steady-state response of output level and THD using a sine wave input:

1. Apply unit input level of 0 dBu, 1kHz
2. Make sure rms/peak limiter is inactive (R220 full clockwise position).
3. Turn R227 to fully counterclockwise position

The resulting output should be approx. -10 dBu, with THD at about 1%. The front panel " Limit " LED should be on.

V. TRANSFORMER ISOLATED OUTPUT STAGE:

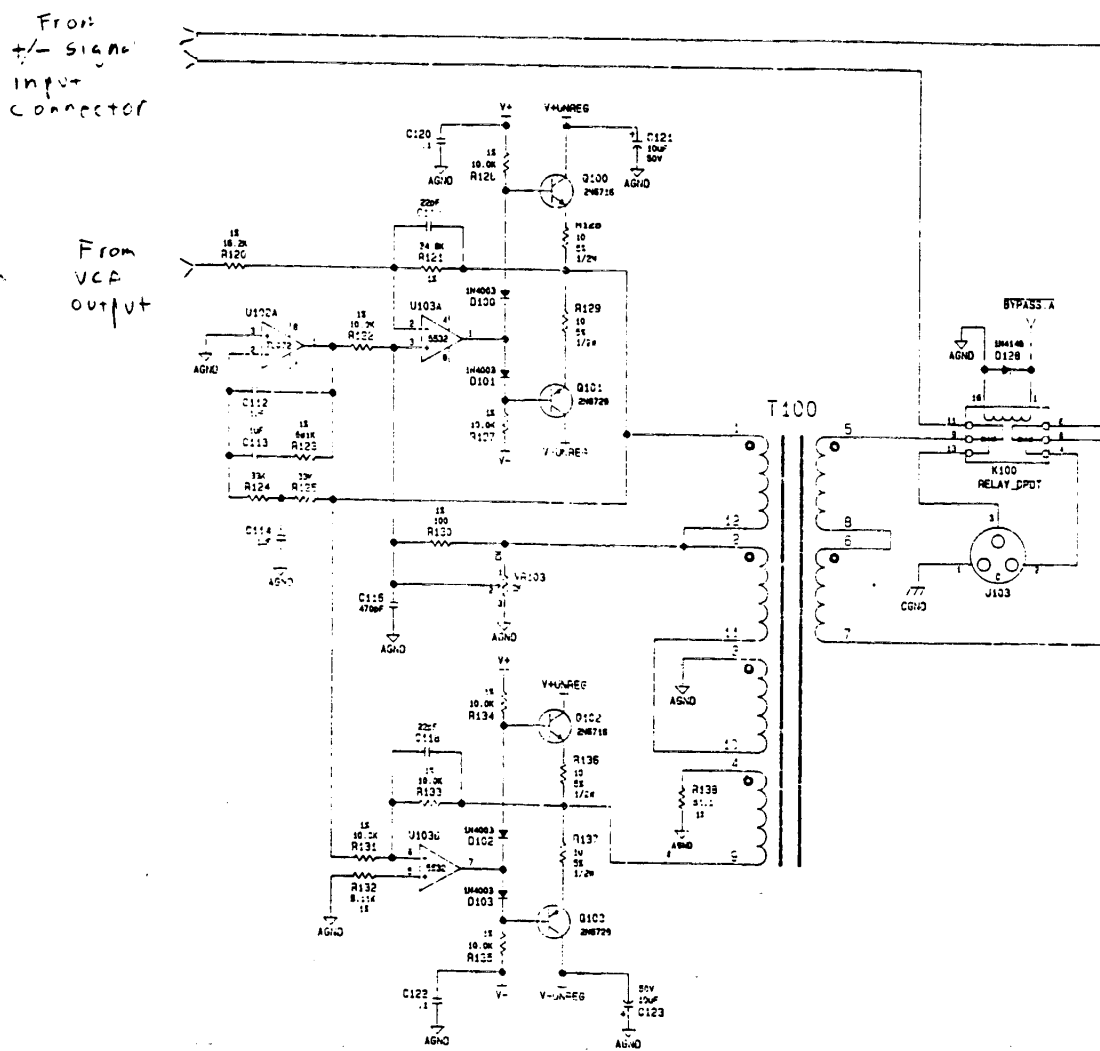


Fig. 15

The output stage is an advanced ultra-low distortion, transformer coupled audio line drive circuit. It is capable of driving -24 dBm (600 ohm load) with less than .001% THD, even at 20Hz. One note of clarification is necessary here. Even though the output stage has this low THD characteristic, the rated THD spec is higher (see spec sheet for details). The reason is that the SSM2018 VCA THD is not as low as the capability of the output stage, due to existing VCA design limitations. This fact is mentioned only in that if the output stage performance for a particular unit is in question, an excellent method of analysis or troubleshooting is to isolate the VCA output from the output stage (remove C111 or C311) and drive the output stage directly from a high quality test signal (attach signal source to jumper JW19 for channel 1 and JW52 for channel 2 access). The result should appear as in the sweep plot in Fig. 16.

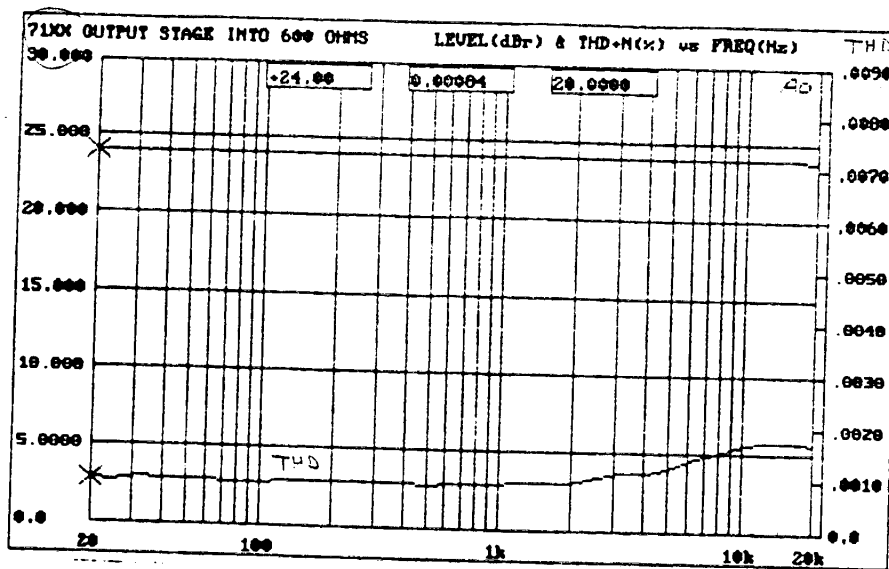


Fig. 16

Assuming the output stage performs correctly, the normal 71XX system output sweep should appear as in Fig. 17 and Fig. 18 (These are with the VCA in, with no limiting occurring).

Integrated into the output circuit is a trimpot (VR103, VR303) used to minimize the low frequency THD. It is recommended to perform this adjustment at 0 dBu in/out at 20 Hz. Fig. 17 shows typical output performance with the low frequency trim completed. (*)

The section comprised of U102A and its associated passive components is a DC integrator circuit, which nulls the DC offset at the transformer primary inputs (T100 pins 1 and 9). In normal operation, the typical offsets will be less than +/-10mV at these pins. If not check the integrator, as well as the drive transistors and their associated temperature compensation diodes (D100-D103) for shorts or opens.

The output impedance of the circuit is approx 62 ohms.

(*)Note: Test filter bandwidth for THD measurement is 22Hz - 30kHz

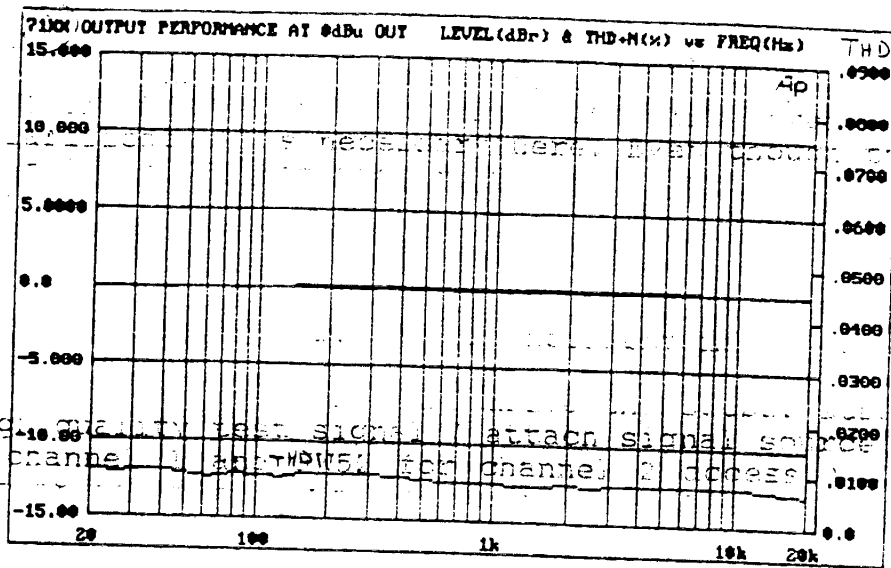


Fig. 17

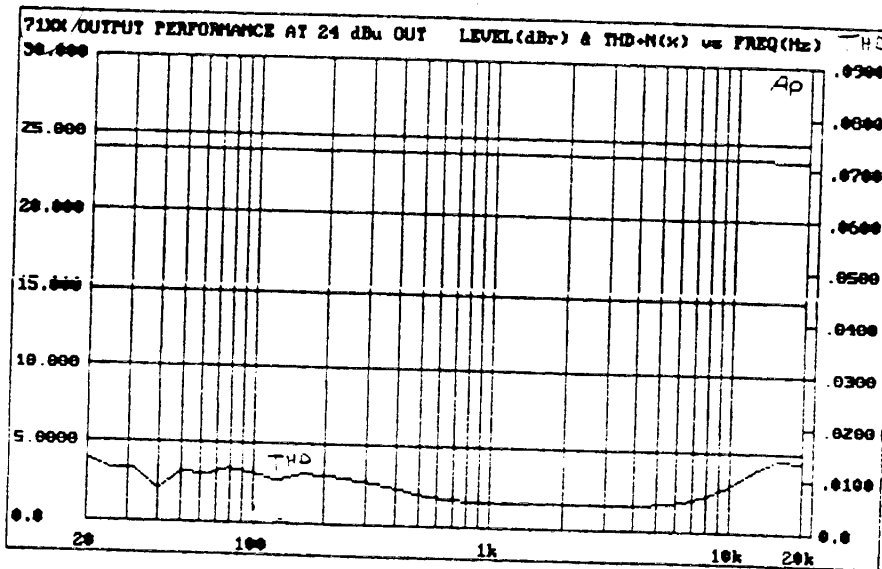


Fig. 18

The relay K100 (K300 as well for the 7112) is used to bypass the electronics either when the power is off to the unit, or if the front panel channel bypass switch is depressed when power is on. This allows for a hardwire path from the input connector to the output connector (more on bypass functions later).

VI. SIGNAL LEVEL, GAIN REDUCTION DISPLAYS:

This main section can be broken down into the following sub-sections:

- A. Signal level display AC-to-DC converter/driver
- B. Signal level bargraph display, display drivers
- C. Gain reduction level bargraph display, display drivers
- D. Below threshold display
- E. Bypass control functions

A. SIGNAL LEVEL DISPLAY AC-TO-DC CONVERTER/DRIVER:

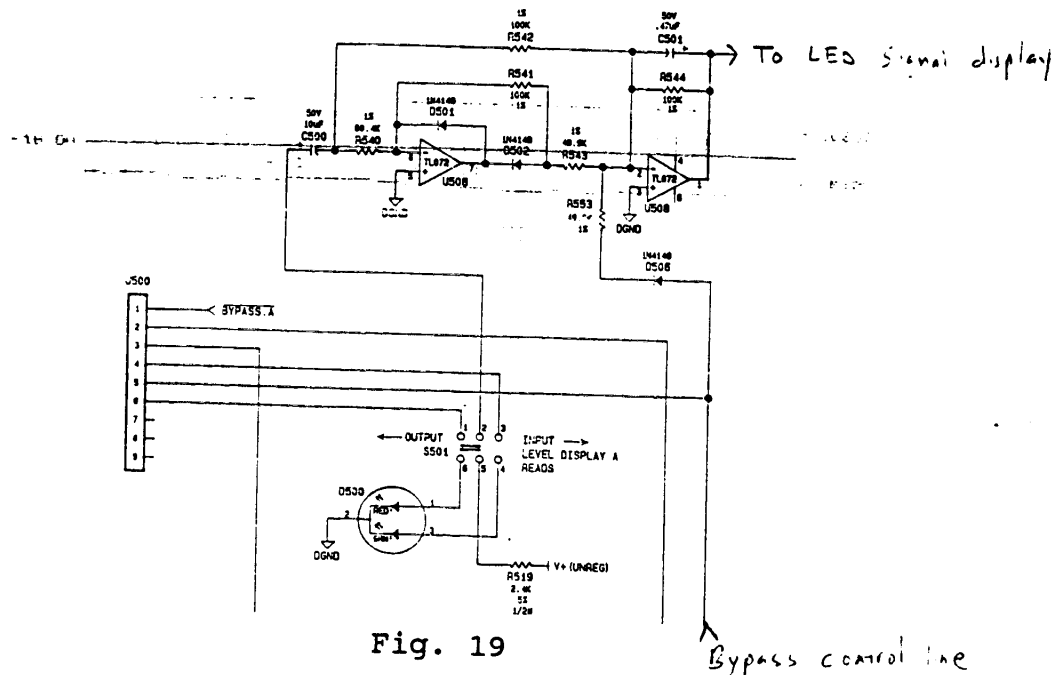


Fig. 19

Bypass control line

This circuit is essentially the same as the rectifier circuits discussed earlier. The only important difference is that there is an additional capacitor (C501) added to filter the signal ripple, and to create set release time to simulate VU meter decay characteristics. The input to this circuit is a switch (S501) which routes either the 71XX input level, or output level signal to the signal display.

B. SIGNAL LEVEL BARGRAPH DISPLAY, DISPLAY DRIVERS:

This circuit is comprised of a 12-segment LED bargraph, and its associated drivers (see Fig 20). The drivers are LM339 comparator sections, arranged in a ladder network, along with the resistor ladder used to set the individual threshold voltages. The transistors Q502 and Q503 form a constant current source to drive the LED's without changing brightness levels as more or less LED's are turned on and off. The current is determined by the value of R526 and the voltage across it. The equation for the current is $i = V/R$, where V is the voltage across R526, (about .68VDC) and R is the value of R526, which is 75 ohms. This results in a constant current of about 9mA to the LED's.

From signal display
rectifier/driver

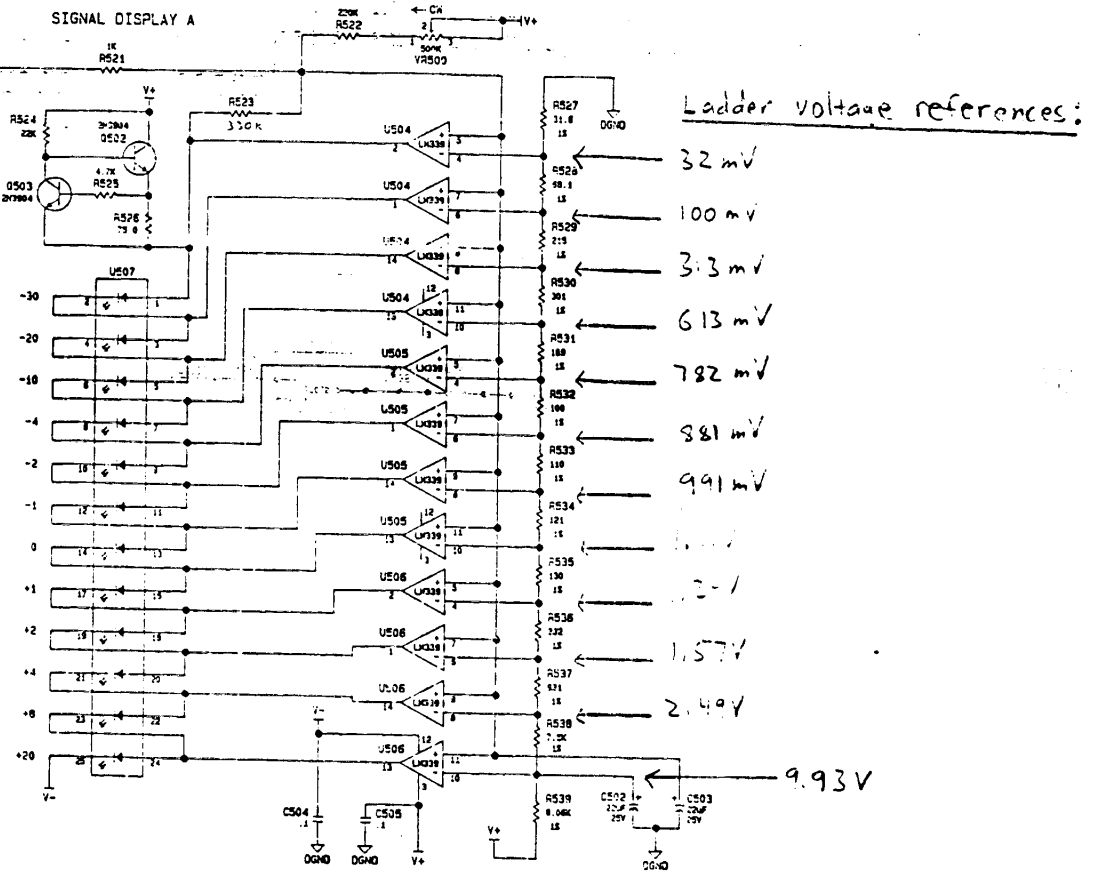


Fig. 20

The method of operation is as follows. Starting from 0 signal (all LED's off), there is initially 0VDC at the comparator control line (U504 pin 5, 7, 9 etc..). At this time all of the comparator outputs are low (-18VDC), thereby prohibiting any voltage drop across any of the LED's. When a positive going voltage is driven by the output of the rectifier circuit, rising above the threshold point of the first comparator section (U504 pin 4), the output at pin 2 goes open collector (high state) allowing the current source to create a voltage across the " -30 " LED segment. This series of events continues in the same manner as a higher and higher voltage is driven by the rectifier circuit, eventually turning on all the LED's.

Integrated into this circuit block is a trimpot VR500 (VR600 as well for the 7112) which is used to trim the accuracy of the " -30 " or -30dB LED turn-on point. By adjusting this trimpot, the -30dB LED can be calibrated (*) to a turn-on level of

(*)Note: When performing this adjustment, it is best to have the signal display input select switch set to the " input " mode, as the " output " mode is user adjustable via R226.

-29.5dBu, resulting in a turn-off point of about -31.5dBu. This difference between turn-on and turn-off levels is called " hysteresis ", basically referring to the fact that there is gap, or window between the on and off threshold, even though there is only one reference voltage generated by the resistor ladder per each comparator segment. The hysteresis is generated by the feedback resistor R523 injecting an offset to the control line every time a comparator is triggered. The result of this is that the hysteresis prevents any of the comparators from oscillating, thereby causing an LED to transition from off to a " half on , half off " or half brightness state when its associated comparator is exactly at threshold. It should be noted that the hysteresis is not a constant for all the segments in terms of a dB window. It is constant however, in terms of a comparator voltage differential. Its effect at the user level will be most detectable for the -30 LED, and almost undetectable at the +20 LED.

C. GAIN REDUCTION LEVEL BARGRAPH DISPLAY, DISPLAY DRIVERS:

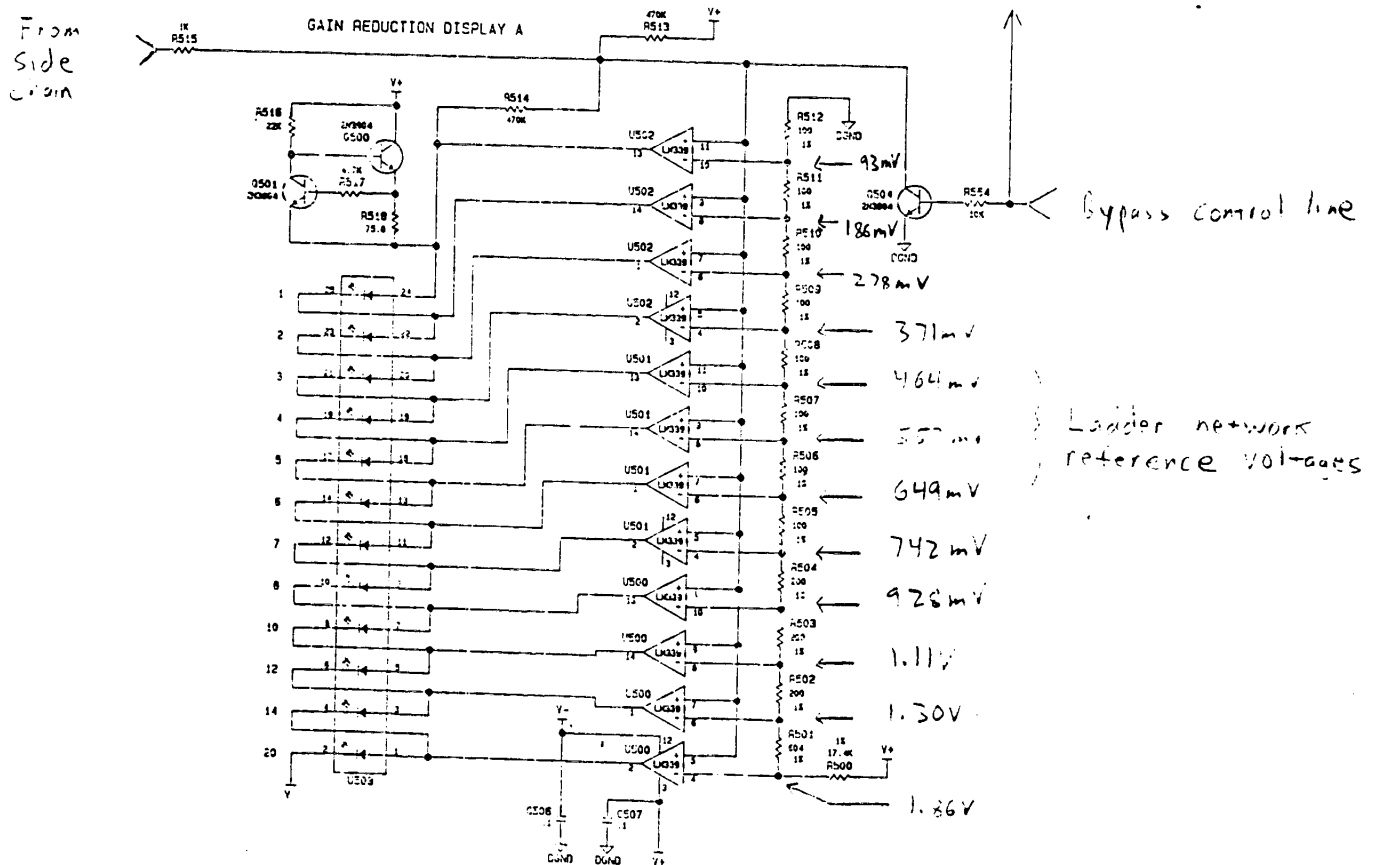


Fig. 21

This section is identical to the that discussed in the

previous section, except for having different voltage references as set by the resistor ladder, and opposite orientation of start location. Also, there is no need for an accuracy trim for this section. The function of this section is to indicate the amount of gain reduction occurring at any given moment as controlled by the side chain. This display does not indicate gain reduction caused by the output limiter (section IV).

D. BELOW THRESHOLD DISPLAY:

that the hysteresis is not constant for all the segments in terms of a dB window. It is constant however, in terms of

Below
Threshold
Signal line

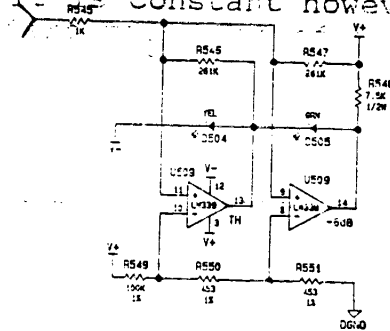


Fig. 22

This section is a mini-version of the signal/gain reduction displays already discussed. The function of this display is to indicate the level of the signal feeding the side chain below the threshold, starting with -6 dB below for the first LED, and the threshold point for the second LED. It should be noted that this display is an approximation of these points, with slight errors induced depending on the settings of the side chain controls. The input drive for this display is supplied by a buffer in the side chain designated by U106D (U306D as well for 7112, see Fig. 5). The input to the buffer is the output of the side chain full wave rectified signal, with a low pass filter applied to reject ripple.

E. BYPASS CONTROL FUNCTIONS:

When the (71XX) unit is powered-on, if it is desired to bypass the audio chain electronics by way of the relay circuit discussed in section V, there is a front panel pushbutton switch (one per channel) which engages a number of functions which comprise the Bypass mode. The main function, controlling the audio chain relay, has already been discussed. However, in order to truly "bypass" the channel, several other conditions should exist in order to avoid confusion for the user and provide functional consistency. These conditions are defined as follows:

When the Bypass mode is engaged, the following conditions will exist:

- A. In the case of the (7112), only the channel whose bypass switch has been depressed will be affected
- B. The audio chain relay will be switched to hardwire the signal input of the unit to its output connector with no active or passive components in the signal path except for the relay itself
- C. The side chain becomes inactive to prevent it from affecting another channel via the Link port
- D. The output limiter becomes inactive, preventing its associated LED from being turned on
- E. The signal level, gain reduction, and below threshold LED displays become inactive

In order to discuss the implementation of the functions defined in sections C, D, and E, we will refer to the sections and associated figures previously discussed.

SECTION C (refer to Fig. 6):

When the bypass switch is engaged (S502 or S602), a 27VDC signal is routed from the display board down to the side chain via the " Bypass ctrl.A " (or B for channel 2 of the (7112) pin of connector J104 or J304. This voltage is applied to the side chain rectifier and causes its output to go to the negative rail (-18VDC). This has the effect of disabling the side chain.

SECTION D (refer to Fig. 14):

The " Bypass ctrl.A " (or B) signal applies 27VDC to the output limiter rectifier, disabling it in the same manner as in section C.

SECTION E (refer to Fig. 6, 19 and 21):

When the side chain becomes inactive, this prevents any signal from driving the " Below threshold " display.

When the bypass switch is engaged, the same 27VDC signal used to disable sections C and D, also disables the signal display rectifier in the same way, also disabling the signal display LED array. This same signal also biases the base of the transistor Q504 (Fig. 21), saturating it and causing it to short to ground the control signal driving the gain reduction LED array. This prevents any signal generated by the Link port from activating this display during Bypass mode.

VII. POWER SUPPLY:

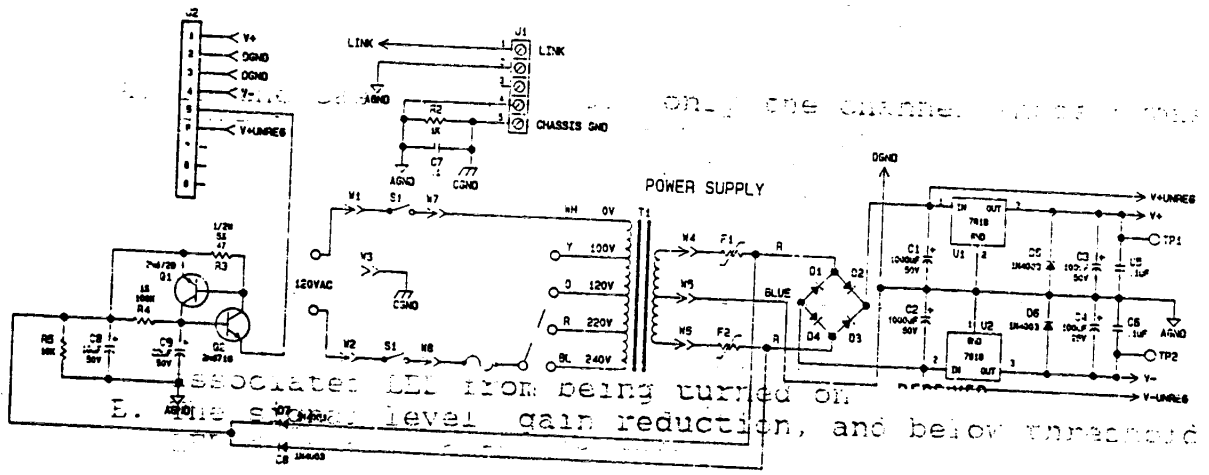


Fig. 23

The AC to DC power supply used here is capable of being driven by all the standard international voltages (100V, 120V, 220V, and 240V). By using a multi-tap torroidal power transformer and a user-configurable power connector/fuseholder, accomodating any of these voltages is a simple task. The DC voltage generated by the full wave bridge is nominally approx. +/- 27VDC. These voltages are referred to as the " V+ (unreg) " and " V- (unreg) " lines. These voltage lines are then used as inputs for the +18V and -18V regulators, which supply most of the electronics. AC ripple on the unregulated lines is typically around 500mV rms. The nominal AC operating line current is approx. 200mA rms (primary current, at 120VAC input).

The circuit comprised of Q1, Q2 and their associated components is the delayed turn-on/relay driver circuit, which powers the audio relay coils. When power-on occurs, the R-C charge-time determined by R4 (100k) and C9 (22uF) creates a delay of about 2 seconds (*), preventing turn-on transients from affecting the signal output.

(*)Note: For the 7112 only, the turn on time is 2 seconds when neither of the Bypass switches is enabled during turn-on, and about 3-4 seconds if either of the Bypass switches is enabled.

JBL

GAIN REDUCTION dB
20 14 12 10 8 7 6 5 4 3 2 1 TH -6

SIGNAL LEVEL dB
-20 -10 -4 -2 -1 0 +1 +2 +4 +8 +20

LEVEL DISPLAY

BYPASS

THRESHOLD **DETECTOR** **ATTACK** **RELEASE** **RATIO** **OUTPUT LEVEL**

0-OUTPUT
R-OUTPUT

LIMIT
ADJ

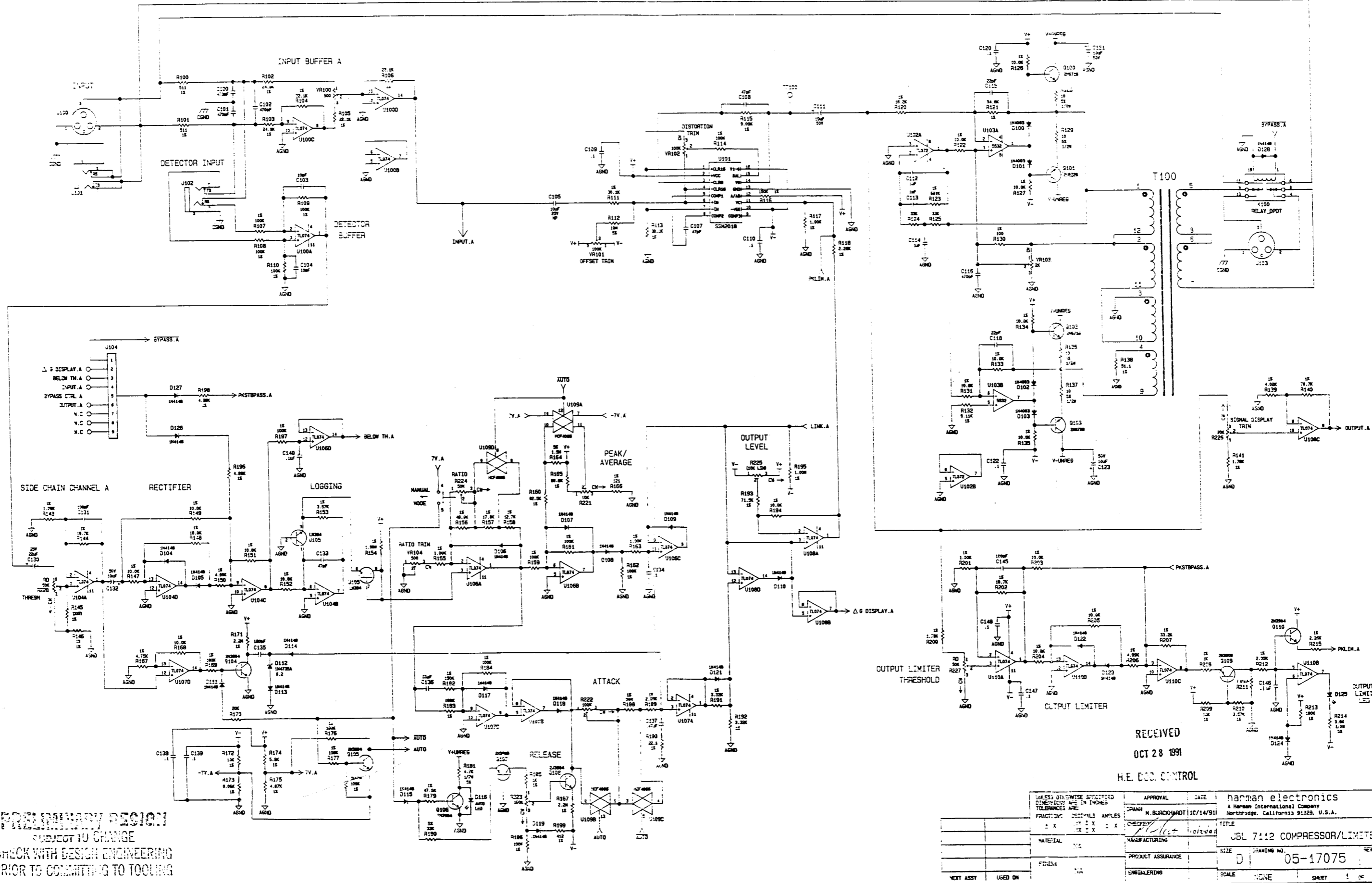
POWER

+

MODEL
7110A
COMPRESSOR
LIMITER

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EDD	REV.	DESCRIPTION	DATE	APPROVED	



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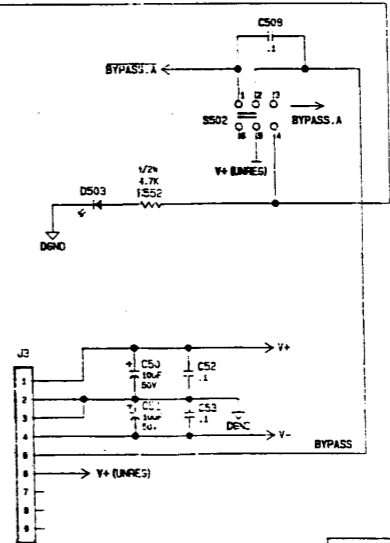
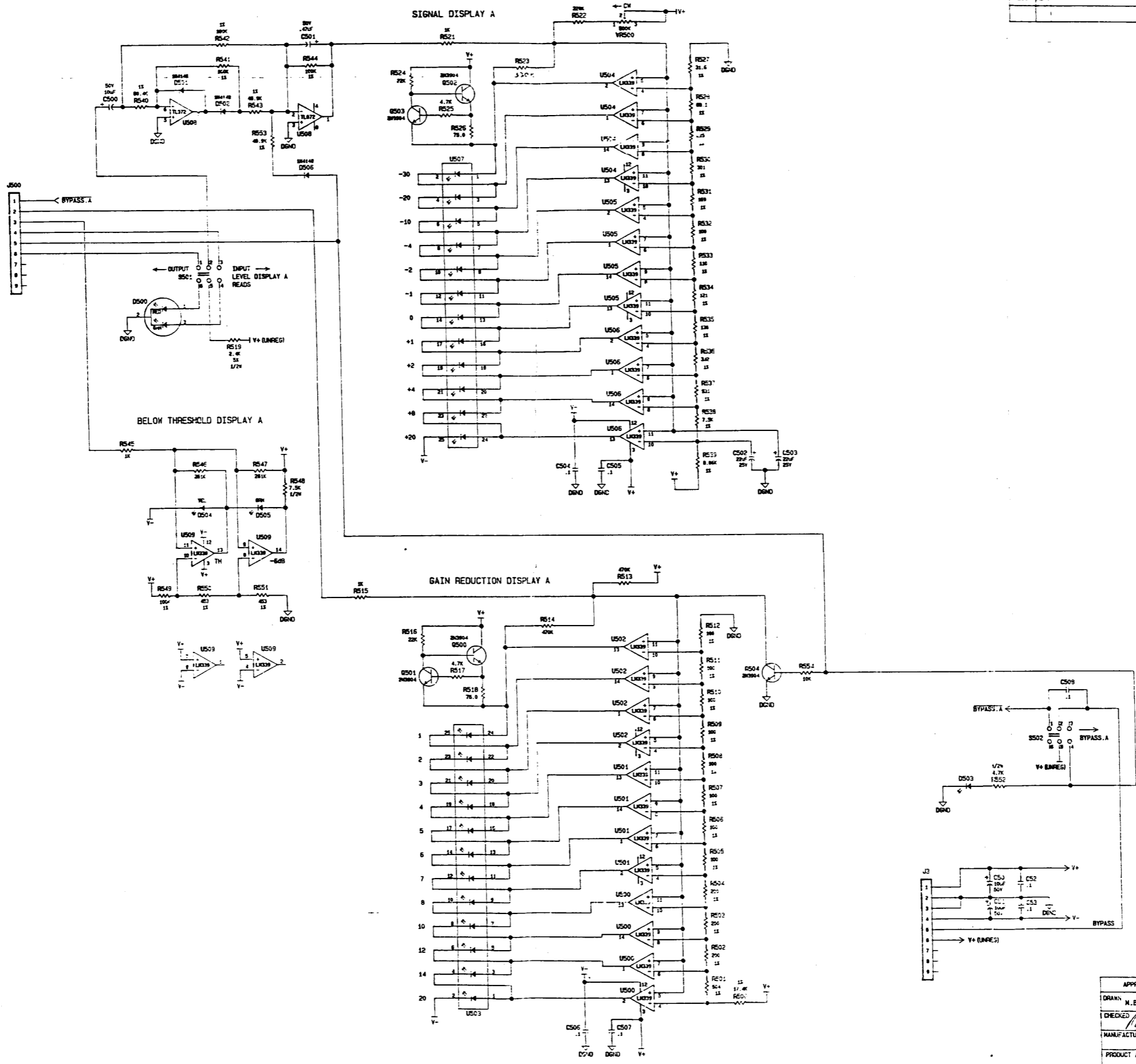
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FRACTIONS: DECIMALS: ANGLES:	M. BURKHARDT	10/14/91	
TITLE	CHECKED		JBL 7112 COMPRESSOR/LIMITER
MATERIAL	MANUFACTURING		SIZE: DRAWING NO. 05-17075 REV 17
FINISH	PRODUCT ASSURANCE		SCALE: NONE SHEET 1 OF 2
NEXT ASSY USED ON	ENGINEERING		FILE: 17075-1.DWG PLOTTED: 10/14/91

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DATE	APPROVED



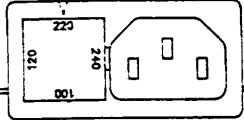
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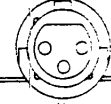
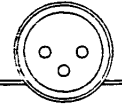
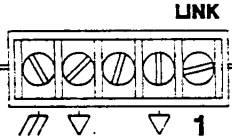
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MANUFACTURING		TITLE: JBL 7110A DISPLAY BOARD
PRODUCT ASSURANCE		SCALE: DRAWING NO. 260293
ENGINEERING		SHEET 1 OF 1

RISK OF FIRE - REPLACE FUSE AS MARKED

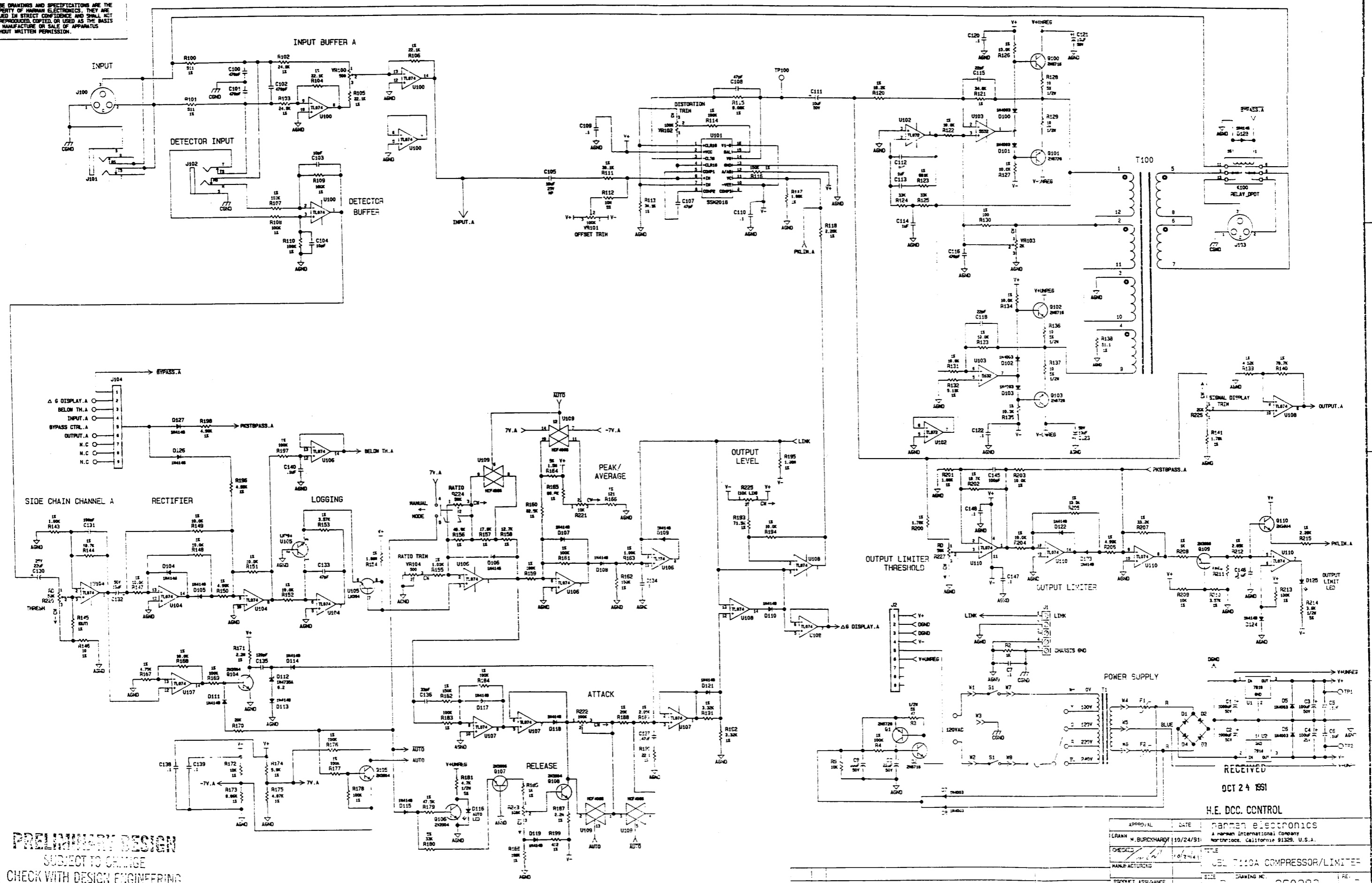
100/250 V ~ 1/8 A 250 V
250/500 V ~ 1/4 A 250 V



100/220/230/240 V ~
50/60 Hz 65 WATTS MAX
PROFESSIONAL AUDIO PRODUCT
MADE IN THE U.S.A. BY MARSHALL ELECTRONICS



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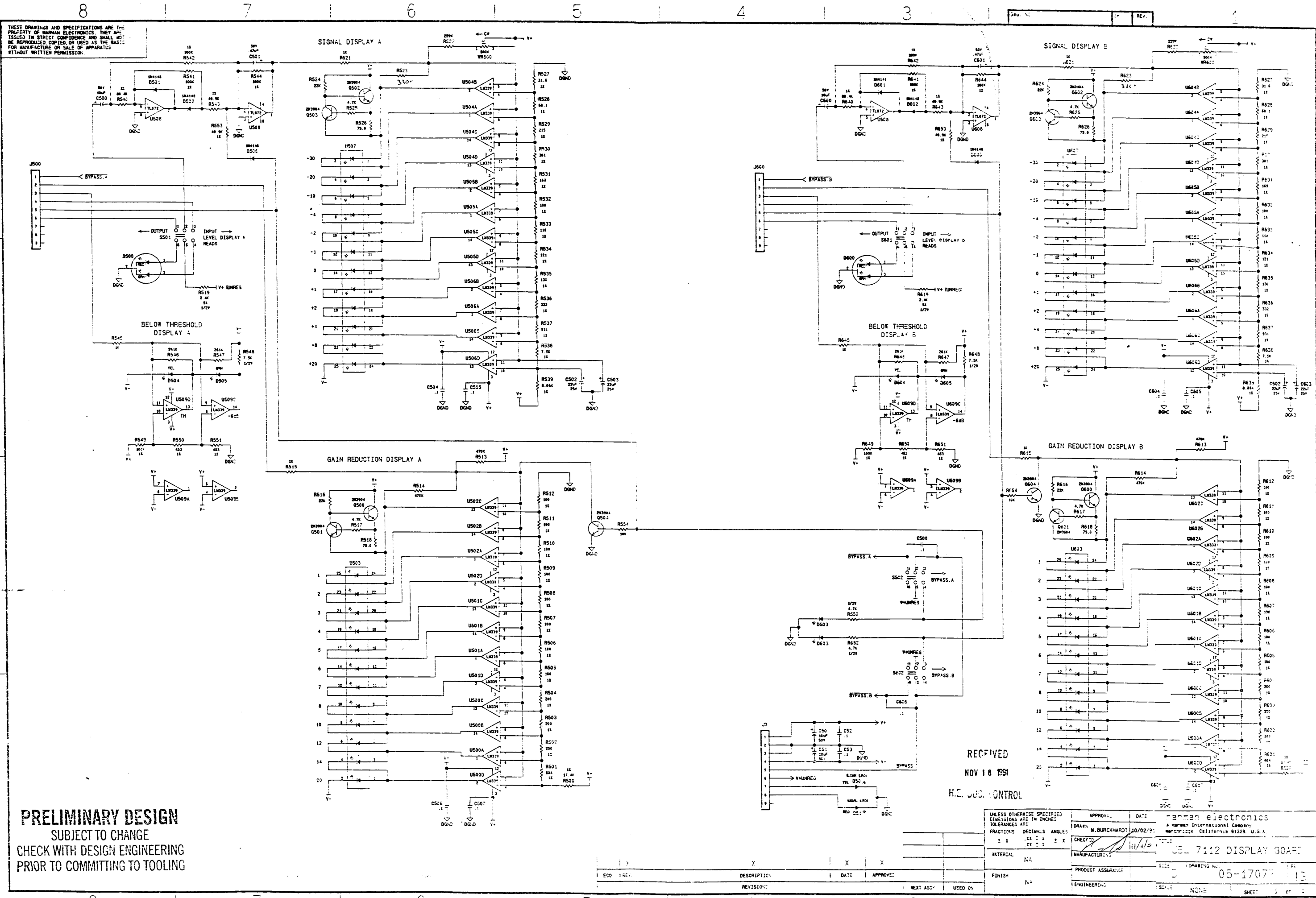
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MANUFACTURING	SIZE	DRAWING NO. 260282
PRODUCT ASSURANCE	SCALE	SHEET 1 OF 3
ENGINEERING	REVISIONS	

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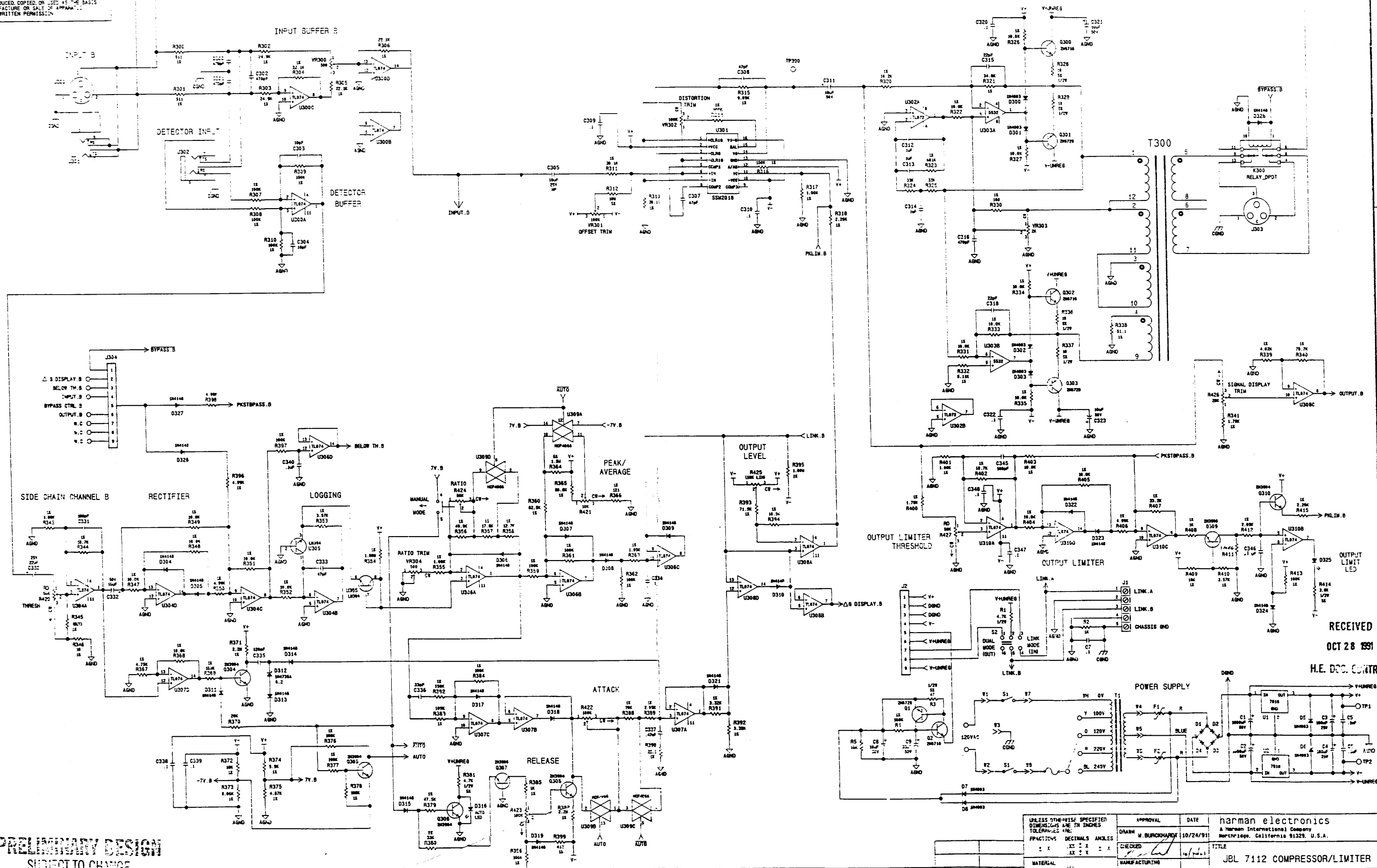
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FINISH				SIZE D DRAWING NO. 05-17075 REV 17
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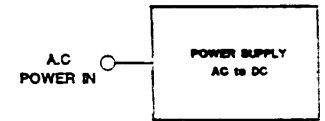
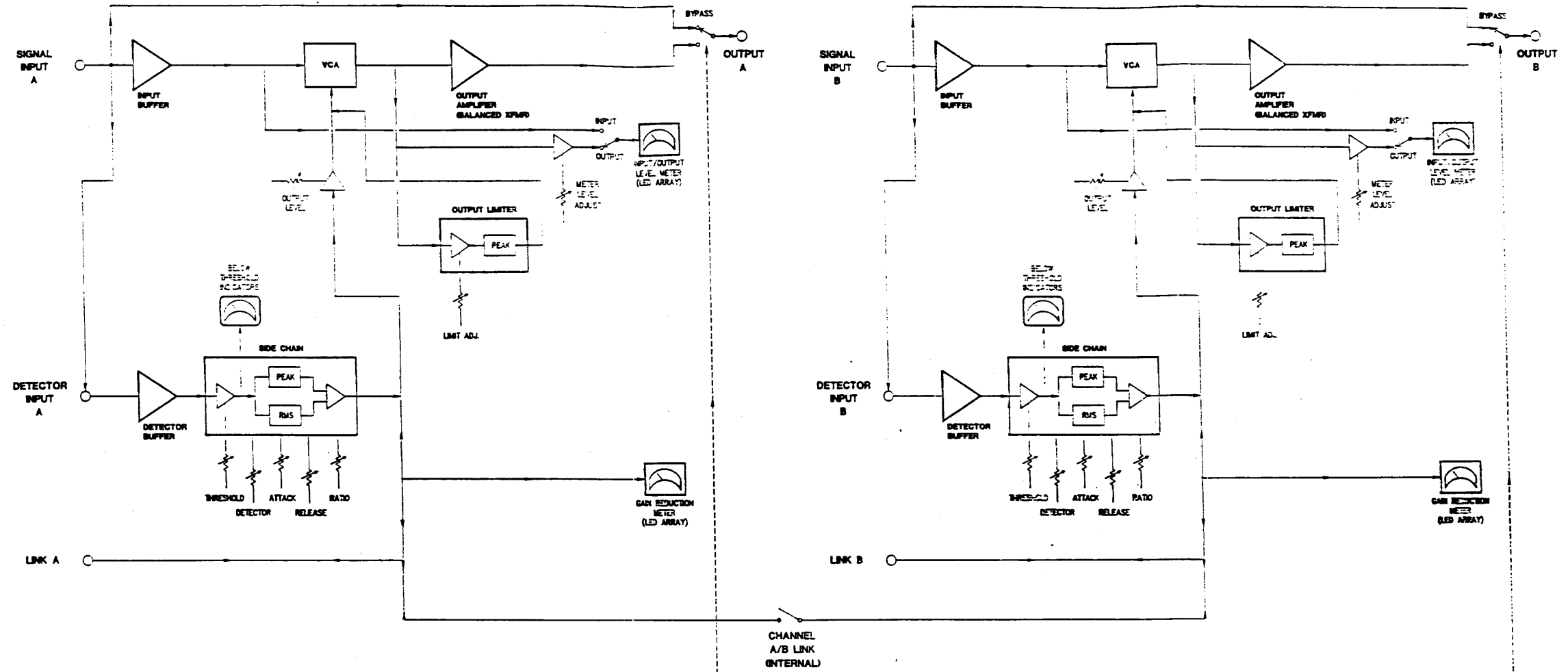
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CHANNEL A

CHANNEL B



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MATERIAL	NA	MANUFACTURING							
FINISH	NA	PRODUCT ASSURANCE							
ENGINEERING		SCALE	NONE	SHEET	1	OF	1		

harmon electronics
A Harmon International Company
Northbrook, California 94061, U.S.A.
BLOCK DIAGRAM
7112 COMPRESSOR/LIMITER
D 256385
REV 02
SCALE NONE SHEET 1 OF 1

Technical Manual



UREI LA-10

SPECIFICATIONS

- Inputs: Active balanced bridging
 - Input Impedance: 40k Ω balanced input, 20k Ω unbalanced (with detector normalised to input)
 - Detector Input Impedance: 100k Ω balanced input, 50k Ω unbalanced
 - Maximum Input Level: +24 dBu (12.3 V rms)
 - Gain: ± 20 dB, adjustable with front panel output level controls
 - Frequency Response: 20 Hz - 20 kHz ± 0.2 dB
 - Dynamic Range: <115 dB
 - Signal To Noise Ratio: 110 dBA, 22 kHz A weighted noise bandwidth
 - THD: <0.006% typical @ 1 kHz, 0.02% maximum @ +14 dBu input
- Attack Times**
- Average Detectors: 1 - 50 ms
 - Peak Detectors: $\leq 100 \mu s$
 - Output Peak Limiters: 50 μs
- Release Times**
- Average Detectors: 100 ms - 5 s for 10 dB of release
 - Peak Detectors: 10 ms

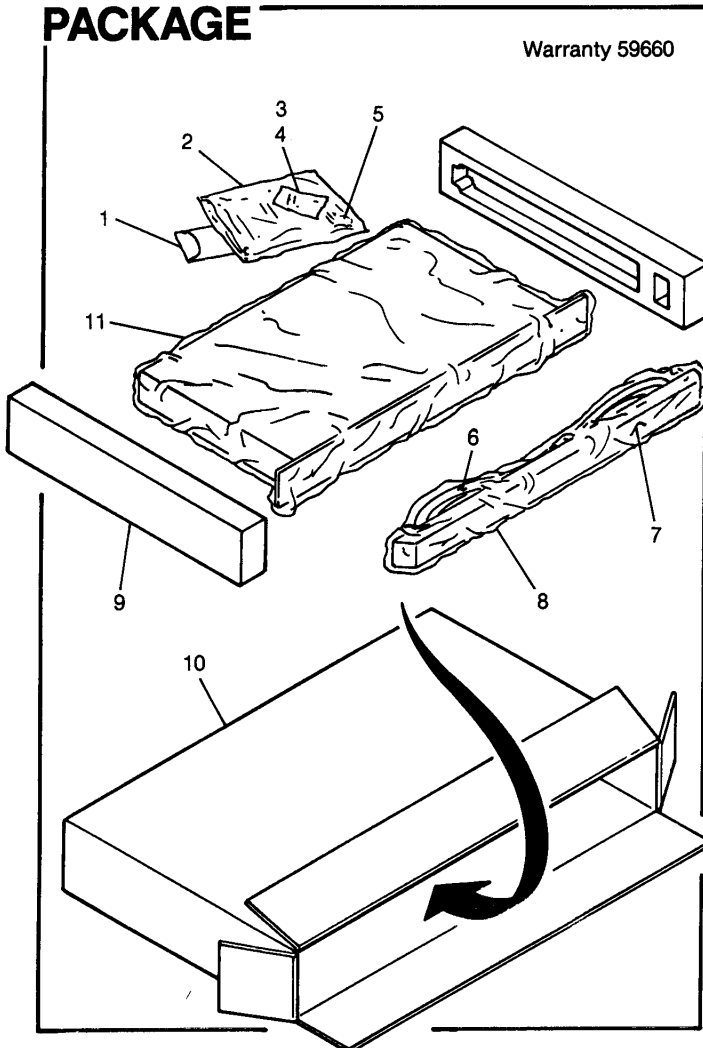
- Output Peak Limiters: 40 ms
 - Compression/Expansion Ratios: Adjustable from 1.5:1 to ∞ :1
 - Threshold of Limiting/Expansion: Adjustable from -40 dBu to Off
 - Outputs: Transformer isolated, symmetrical floating
 - Maximum Output Level: +24 dBm into 600 Ω
- Connectors**
- Inputs and Outputs: XLR type 3 pin (pin 2 high), 6.3 mm (1/4 in) TRS phone jack
 - Limiting Detectors: 6.3 mm (1/4 in) TRS phone jack normalised to input
 - Link: Barrier strip
 - AC Power Requirements: 100-120/220-240 V AC, 50-60 Hz, 25 W maximum
 - AC Line Cord: Detachable, IEC type
 - Finish: Powdercoated black
 - Enclosure Dimensions: See Below
 - Net Weight: 14 lbs. (6.4 kg.)

WARRANTY INFORMATION:

- Refer to the Warranty Statement packed with each product.

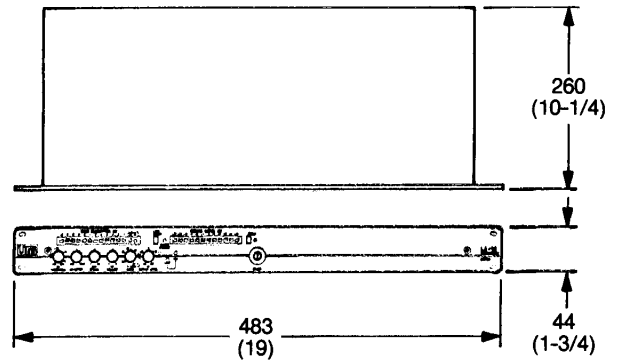
PACKAGE

Warranty 59660



COMPONENT VIEW

OVERALL DIMENSIONS
DIMENSIONS ARE mm AND (in.)



COMPONENT PARTS LIST

ITEM	PART NO.	QTY	DESCRIPTION
1	10-13788	1	KIT, RACK, SCR, BLK
2	260302	1	MNL, USER, LA-10
3	276193-001	2	FUSE, SB, 1/2A, 250V, 5 x 20, UL
4	255236	1	FUSE, SB, 1/4A, 250V, 5 x 20
5	33-0147	1	BAG, POLY, 12" x 16"
6	36-0543	1	CORD, PWR, DETCH, 3COND, 18GA
7	267151-001	1	COVR, SCRPTY, LA-XX
8	33-0074	1	BAG, POLY, 5" x 22"

UREI LA-10 REV B

UREI LA-10

COMPONENT PARTS LIST

ITEM	PART NO.	QTY	DESCRIPTION
9	33-16828	2	END, PAD, FOAM
10	33-16827	1	CRTN, LA-XX/79XX
11	33-0071	1	BAG, POLY, 18" x 24"
12	25-16774	2	COVR, PNL, FAB
13	25-14284	1	LBL, WARN, ELEC-SHOCK
14	260313	1	PNL, REAR, FAB, LA-10
15	264036	1	TAPE, DBL-SIDED, ADH, 3/16 x 2
16	263437	1	CONN, PWR, W/FUHLR, LA-12
17	261108	1	SCR, 6-32 x 3/4, TRXPNH, BZ
18	274608-001	1	LBL, SER#, LA-XX
19	28-0057	2	WSHR, #6, EXT, TTH
20	H100-15199	3	NUT, 6-32, KEP
21	255104	1	WSHR, 8, 1-7/16 x 032, ALUM
22	30-0216	1	SCR, 8-32 x 1-1/4, PPH, SEMS
23			
24	25-16772	2	PNL, SIDE, FAB
25	267074-001	1	PNL, FRNT, LA-10
26	30-0057	12	SCR, 6-32 x 3/8, PPH
27	25-16781-001	6	SPCR, BSHG
28	25-12993	1	NAMEPL
29	24-16780	1	KNOB, PWR, SW
30	29-17000	6	NUT, SPANNER, 7MM
31	24-16999-001	4	KNOB, INR
32	24-16999-002	2	KNOB, INR
33			
34			
35			
36			

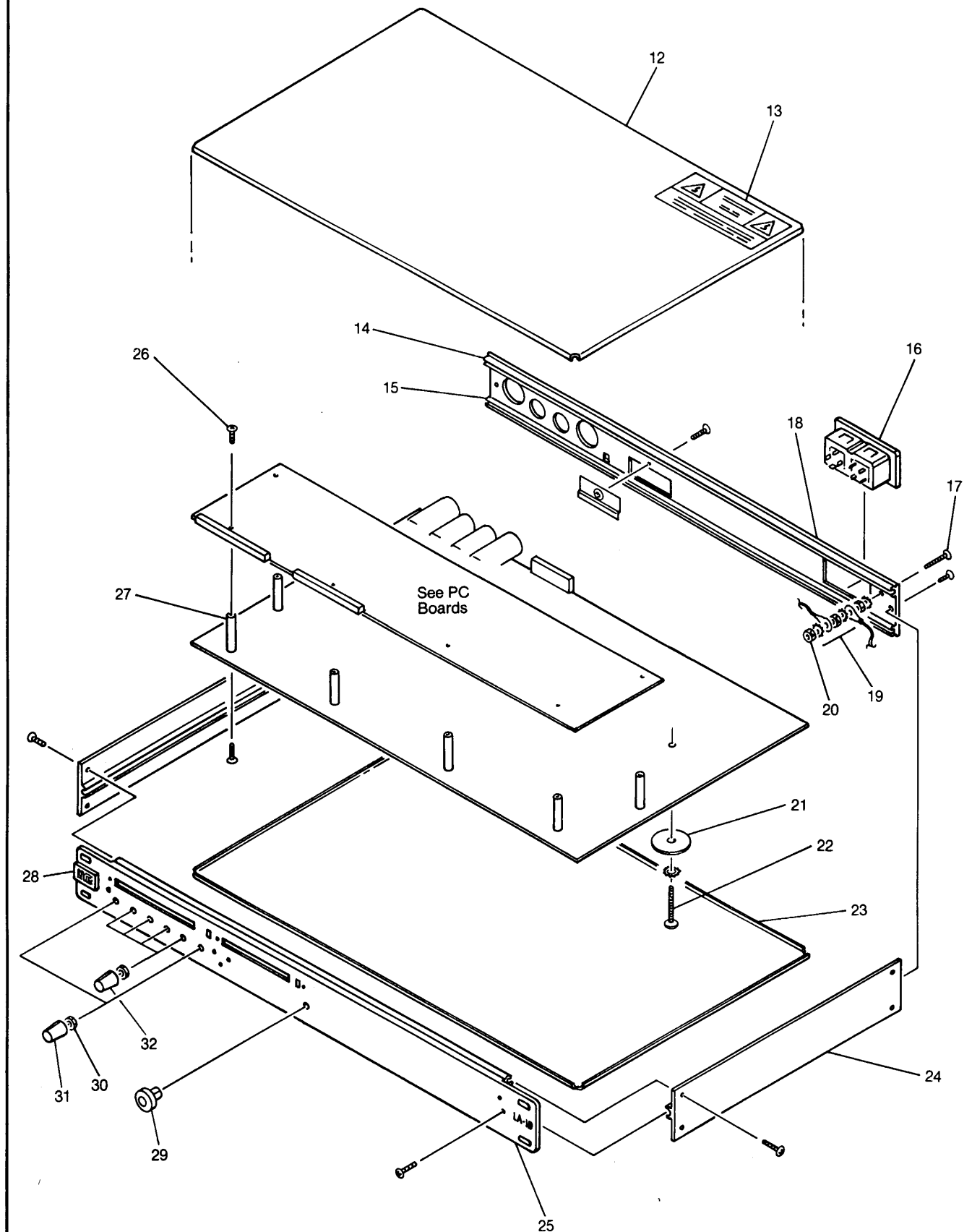
CIRCUIT BOARDS

1	13-0711	1	LED, BAR-GRAPHIC, RED, 12P
2	13-0746	1	LED, T1, YEL
3	13-0745	1	LED, T1, GRN
4	25-16826	1	MASK, LED
5	13-0712	1	LED, GRN/RED, DICHRO
6	13-0710	1	LED, BAR-GRAPHIC, 12P
7	24-16779	2	KNOB, PBTN
8	13-0744	1	LED, T1, RED
9	15-0494	2	SW, DPDT, ALT-ACT, PCMT
10	14-0505	3	CAP-EL, 10UF, 50V, RD
11	HM14-0582	7	CAP-SF, .1UF, 5%, 50V
12	27-0634	2	HDR, STR, 9POS, .1" CTR
13	HM14-0576	2	CAP-EL, 22, 25V, 85C
14	HM14-0752	1	CAP-SF, .47UF, 5%, 50V
15	13-0304	1	IC, TL072CP, OP-AMP, DUAL
16			
17	15-0517	1	POT, TRIM, CF, 500K, LIN
18	HM13-0413	5	XSTR, TO-92, NPN, 2N3904
19	275009-001	7	IC, LM339AN, E-CMPRTR

ITEM	PART NO.	QTY	DESCRIPTION
20			(See Item 3 or 4 on 1st page)
21			
22	29-0081	1	NUT, 8, KEPS
23	255126	1	WSHR, 8, 1/2 X .03, STL
24	52921-001	1	XFMR, PWR, LA-12/22
25	13-0148	3	XSTR, 2N6716, NPN, 60V
26	13-0424	3	XSTR, 2N6728, PNP, 60V
27	14-0505	5	CAP-EL, 10UF, 50V, RD
28	14-0601	1	CAP-EL, 22UF, 20%, 50V, RD
29	13-0005	12	DIOD, IN4003, 200V, 1A, SI
30	27-0218	3	TERM, SPADE, .250, PCMNT
31	13-0206	1	IC, 7818CT, RGLTR, 1A
32	31-0067	2	RVT, POP, .125 x .345 RADS 41
33	264663-001	1	ASY, CABL, PWR, LA-XX, WHT
34	27-0641	5	TER, TAB, MALE, .187"
35	264663-003	2	ASY, CABL, PWR, LA-XX, BRN
36	15-0500	1	SW, PWR, DPST, 6A, 250V
37	14-0633	1	CAP-CD, 33PF, 10%, 500V
38	HM14-0752	1	CAP-SF, .47UF, 5%, 50V
39	15-16767	1	POT, TRIM, 50K, M, REVD, LOG
40	14-0756	1	CAP-CD, 120PF, 10%, 100V
41	13-0744	2	LED, T1, RED
42	15-16769	1	POT, TRIM, 20K, M, LIN
43	13-0190	1	DIOD, ZR, 1N4735A, 6.2V, 5%, 1
44	15-16763	1	POT, 9MM, W/SW, 50K, 10%, LIN
45	HM13-0414	2	XSTR, T092, PNP, 2N3906
46	15-16761	2	POT, 9MM, 100K, 10%, LIN
47	HM13-0413	5	XSTR, T0-92, PNP, 2N3904
48	15-16760	2	POT, 9MM, 10K, 10%, LIN
49	52920-001	1	POT, 9MM, 50K, 10%, REV'D, "D"
50	HM14-0576	1	CAP-EL, 22, 25V, 85C
51	HM14-0582	14	CAP-SF, .1UF, 5%, 50V
52			
53			
54	13-0514	1	XSTR, LM394CN, DUAL
55	13-0217	6	IC, TL074, QUAD, OP-AMP
56	15-0491	2	POT, TRIM, 100K, M, HZL, MT
57	14-0863	1	CAP-EL, 10UF, 20%, 25V, RD, NP
58	50901-004	3	CAP-PF, 470PF, 5%, 50V, R
59	14-0635	2	CAP-CD, 100PF, 10%, 500V
60	13-0737	1	IC, VCA, SSM-2018
61	HM14-0585	3	CAP-CD, 47PF, 5%, 500V, NPO
62	15-0481	1	POT, TRIM, 2K, M, .5W, HZ
63	14-0636	1	CAP-CD, 470PF, 10%, 500V
64	15-0496	2	POT, TRIM, 500, M, HZMT, CRMT
65	13-0304	1	IC, TL072CP, OP-AMP, DUAL
66	14-0753	3	CAP-MP, 1UF, 10%, 63V
67	27-0419	1	CONN, PCMT, 3P, FEM

UREI LA-10

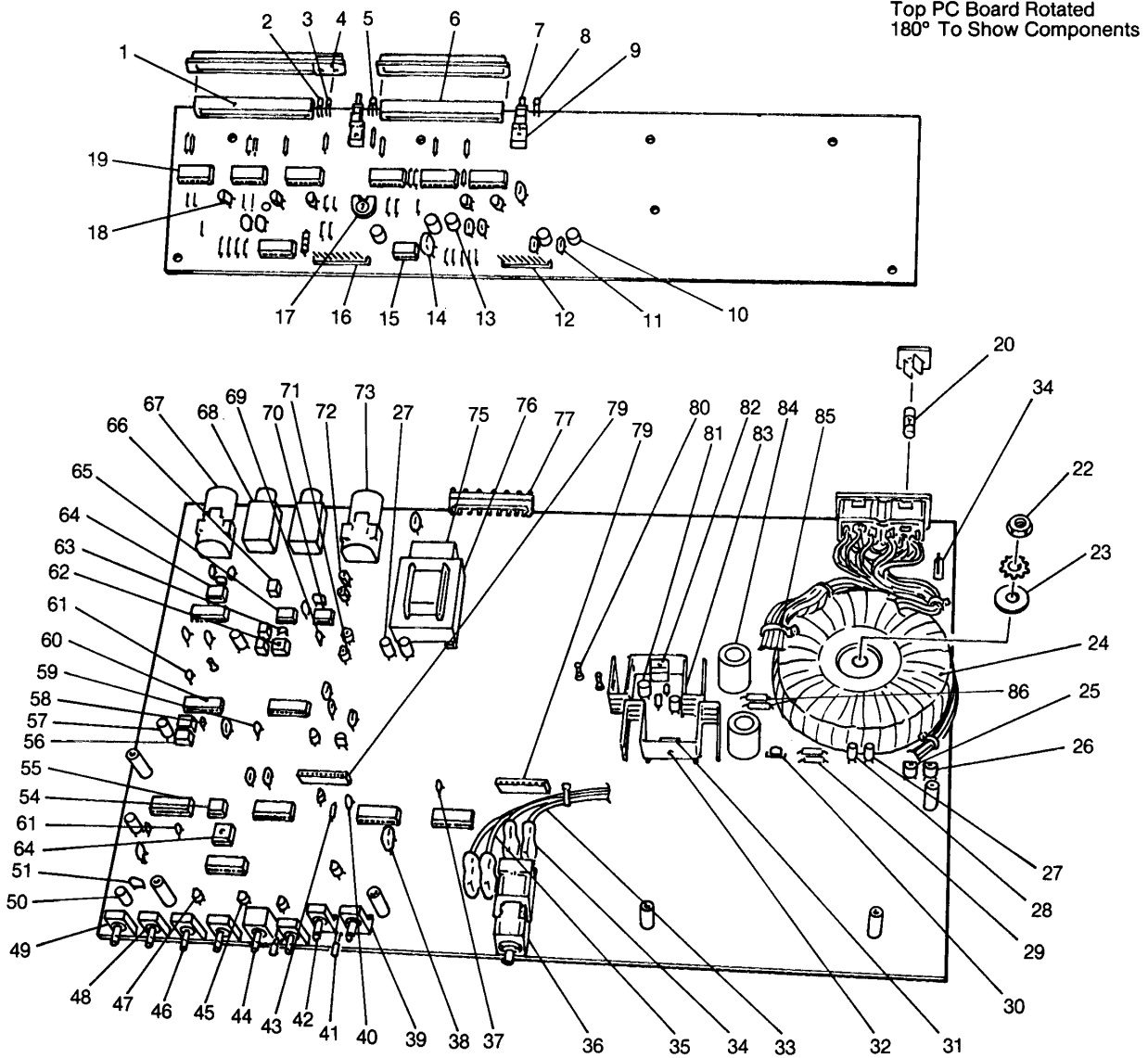
COMPONENT EXPLODED VIEW



UREI LA-10

UREI LA-10

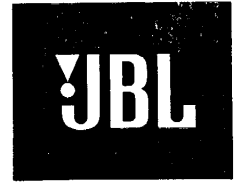
CIRCUIT BOARDS



ITEM	PART NO.	QTY	DESCRIPTION
68	27-0367	2	JACK, PHONE, .250, DIA, 90DEG
69	14-0767	2	CAP-CD, 22PF, 5%, 1KV
70	S500-1513	1	IC, LM833N
71			
72			
73	27-0420	1	CONN, PCMT, 3P, MALE
74			
75	15-0400	1	RLY, 24V, DPDT
76	16-16825	1	XFMR, OUT
77	27-0625	1	BAR-STP, 5POS, .325" CTR
78			
79	27-0632	2	SKT, STR, 9 POS, .1" CTR
80	52924-001	3	TEST-POINT, PCMT
81	14-0603	2	CAP-EL, 100UF, 20%, 25V, RD
82	13-0207	1	IC, 7918CT, RGTLR, 1A

ITEM	PART NO.	QTY	DESCRIPTION
83	36-0552	2	HTSK, TO220, W/MNTG, TAB
84	14-0523	2	CAP-EL, 1000UF, 50V, RD
85	256207	9	TIE-WRAP, 4", BLK
86	278344-001	2	FUSE
87			
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97			

Technical Manual



UREI LA-12

SPECIFICATIONS

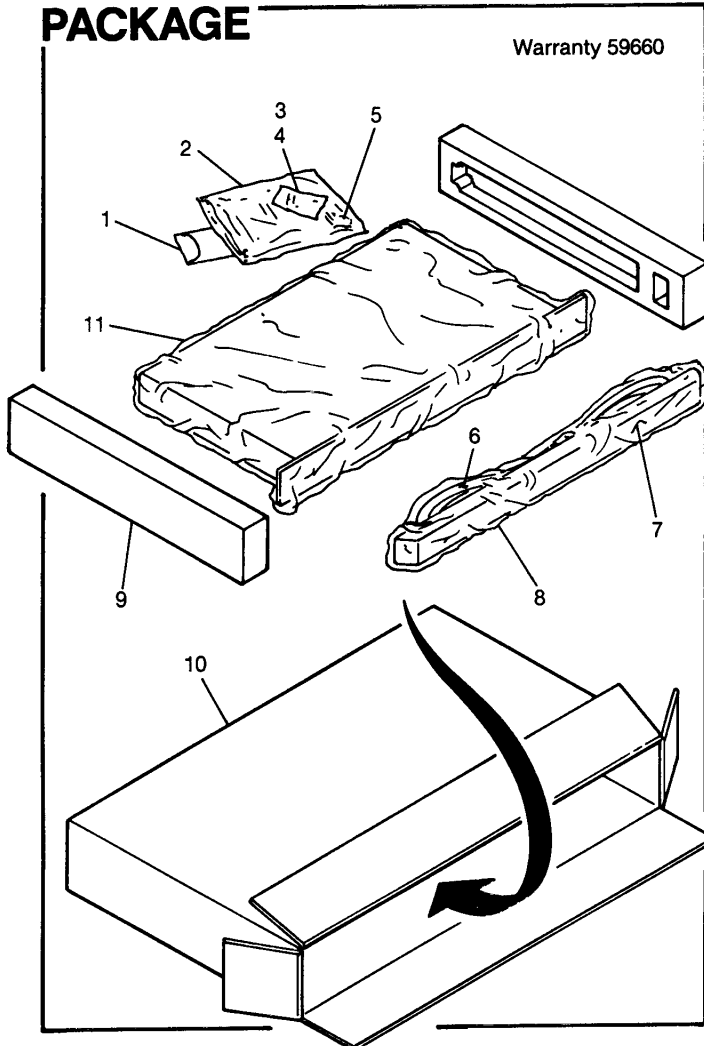
- Inputs: Active balanced bridging
 - Input Impedance: 40k Ω balanced input, 20k Ω unbalanced (with detector normalised to input)
 - Detector Input Impedance: 100k Ω balanced input, 50k Ω unbalanced
 - Maximum Input Level: +24 dBu (12.3 V rms)
 - Gain: ± 20 dB, adjustable with front panel output level controls
 - Frequency Response: 20 Hz - 20 kHz ± 0.2 dB
 - Dynamic Range: <115 dB
 - Signal To Noise Ratio: 110 dBA, 22 kHz A weighted noise bandwidth
 - THD: <0.006% typical @ 1 kHz, 0.02% maximum @ +14 dBu input
- Attack Times**
- Average Detectors: 1 - 50 ms
 - Peak Detectors: $\leq 100 \mu\text{s}$
 - Output Peak Limiters: 50 μs
- Release Times**
- Average Detectors: 100 ms - 5 s for 10 dB of release
 - Peak Detectors: 10 ms

- Output Peak Limiters: 40 ms
 - Compression/Expansion Ratios: Adjustable from 1.5:1 to ∞ :1
 - Threshold of Limiting/Expansion: Adjustable from -40 dBu to Off
 - Outputs: Transformer isolated, symmetrical floating
 - Maximum Output Level: +24 dBm into 600 Ω
- Connectors**
- Inputs and Outputs: XLR type 3 pin (pin 2 high), 6.3 mm (1/4 in) TRS phone jack
 - Limiting Detectors: 6.3 mm (1/4 in) TRS phone jack normalised to input
 - Link: Barrier strip
 - AC Power Requirements: 100-120/220-240 V AC, 50-60 Hz, 25 W maximum
 - AC Line Cord: Detachable, IEC type
 - Finish: Powdercoated black
 - Enclosure Dimensions: See Below
 - Net Weight: 14 lbs. (6.4 kg.)

WARRANTY INFORMATION:

- Refer to the Warranty Statement packed with each product.

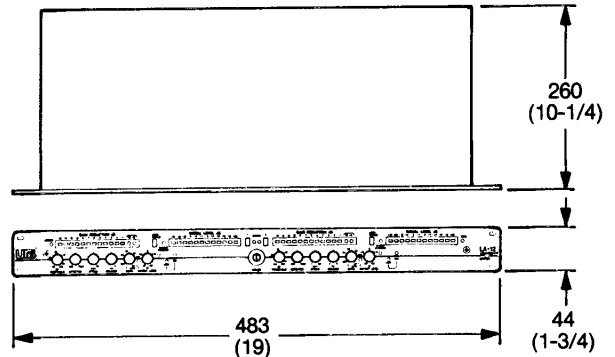
PACKAGE



Warranty 59660

COMPONENT VIEW

OVERALL DIMENSIONS
DIMENSIONS ARE mm AND (in.)



COMPONENT PARTS LIST

ITEM	PART NO.	QTY	DESCRIPTION
1	10-13788	1	KIT, RACK, SCR, BLK
2	260302	1	MNL, USER, LA-12
3	276193-001	2	FUSE, SB, 1/2A, 250V, 5 x 20, UL
4	255236	1	FUSE, SB, 1/4A, 250V, 5 x 20
5	33-0147	1	BAG, POLY, 12" x 16"
6	36-0543	1	CORD, PWR, DETCH, 3COND, 18GA
7	267151-001	1	COVR, SCRTRY, LA-XX
8	33-0074	1	BAG, POLY, 5" x 22"

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COMPONENT PARTS LIST

ITEM	PART NO.	QTY	DESCRIPTION
9	33-16828	2	END, PAD, FOAM
10	33-16827	1	CRTN, LA-XX/79XX
11	33-0071	1	BAG, POLY, 18" x 24"
12	25-16774	2	COVR, PNL, FAB
13	25-14284	1	LBL, WARN, ELEC-SHOCK
14	25-16773	1	PNL, REAR, FAB, LA-12
15	264036	1	TAPE, DBL-SIDED, ADH, 3/16 x 2
16	263437	1	CONN, PWR, W/FUHLR, LA-12
17	261108	1	SCR, 6-32 x 3/4, TRXPNH, BZ
18	274608-001	1	LBL, SER#, LA-XX
19	28-0057	2	WSHR, #6, EXT, TTH
20	H100-15199	3	NUT, 6-32, KEP
21	255104	1	WSHR, 8, 1-7/16 x .032, ALUM
22	30-0216	1	SCR, 8-32 x 1-1/4, PPH, SEMS
23			
24	25-16772	2	PNL, SIDE, FAB
25	267096-001	1	PNL, FRNT, LA-12
26	30-0057	12	SCR, 6-32 x 3/8, PPH
27	25-16781-001	6	SPCR, BSHG
28	25-12993	1	NAMEPL
29	24-16780	1	KNOB, PWR, SW
30	29-17000	6	NUT, SPANNER, 7MM
31	24-16999-001	10	KNOB, INR
32	24-16999-002	4	KNOB, INR
33			
34			
35			
36			

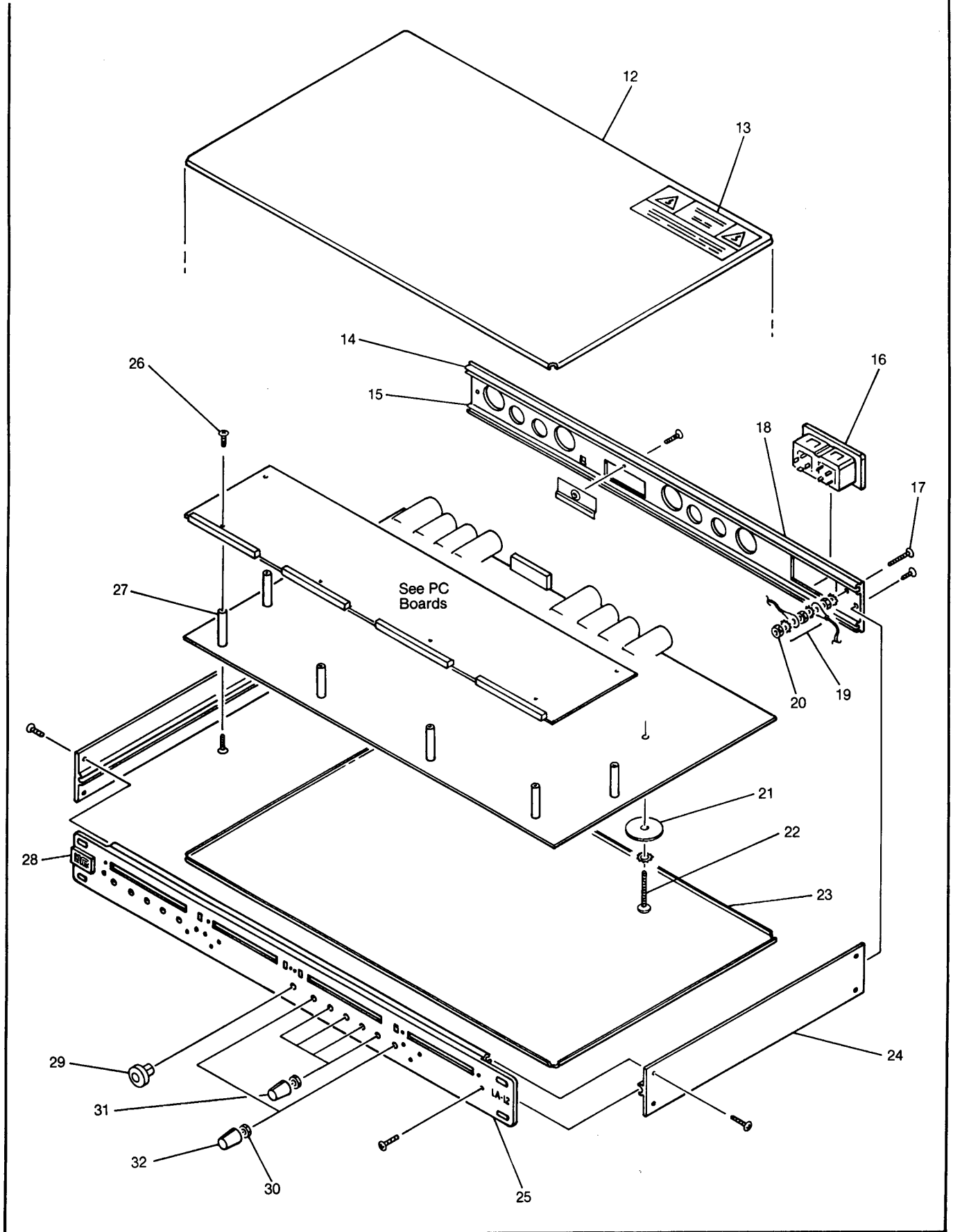
CIRCUIT BOARDS

1	13-0711	2	LED, BAR-GRAPHIC, RED, 12P
2	13-0746	2	LED, T1, YEL
3	13-0745	2	LED, T1, GRN
4	25-16826	2	MASK, LED
5	13-0712	2	LED, GRN/RED, DICHRO
6	13-0710	2	LED, BAR-GRAPHIC, 12P
7	24-16779	4	KNOB, PBTN
8	13-0744	2	LED, T1, RED
9	15-0494	4	SW, DPDT, ALT-ACT, PCMT
10	14-0505	6	CAP-EL, 10UF, 50V, RD
11	HM14-0582	14	CAP-SF, .1UF, 5%, 50V
12	27-0634	3	HDR, STR, 9POS, .1" CTR
13	HM14-0576	4	CAP-EL, 22, 25V, 85C
14	HM14-0752	2	CAP-SF, .47UF, 5%, 50V
15	13-0304	2	IC, TL072CP, OP-AMP, DUAL
16			
17	15-0517	2	POT, TRIM, CF, 500K, LIN
18	HM13-0413	10	XSTR, TO-92, NPN, 2N3904
19	275009-001	12	IC, LM339AN, E-CMPRTR

ITEM	PART NO.	QTY	DESCRIPTION
20			(See Item 3 or 4 on 1st page)
21			
22	29-0081	1	NUT, 8, KEPS
23	255126	1	WSHR, 8, 1/2 X .03, STL
24	52921-001	1	XFMR, PWR, LA-12/22
25	13-0148	3	XSTR, 2N6716, NPN, 60V
26	13-0424	3	XSTR, 2N6728, PNP, 60V
27	14-0505	5	CAP-EL, 10UF, 50V, RD
28	14-0601	1	CAP-EL, 22UF, 20%, 50V, RD
29	13-0005	12	DIOD, IN4003, 200V, 1A, SI
30	27-0218	3	TERM, SPADE, .250, PCMNT
31	13-0206	1	IC, 7818CT, RGLTR, 1A
32	31-0067	2	RVT, POP, .125 x .345 RADS 41
33	264663-001	1	ASY, CABL, PWR, LA-XX, WHT
34	27-0641	5	TER, TAB, MALE, .187"
35	264663-003	2	ASY, CABL, PWR, LA-XX, BRN
36	15-0500	1	SW, PWR, DPST, 6A, 250V
37	14-0633	1	CAP-CD, 33PF, 10%, 500V
38	HM14-0752	2	CAP-SF, .47UF, 5%, 50V
39	15-16767	2	POT, TRIM, 50K, M, REVD, LOG
40	14-0756	2	CAP-CD, 120PF, 10%, 100V
41	13-0744	4	LED, T1, RED
42	15-16769	2	POT, TRIM, 20K, M, LIN
43	13-0190	2	DIOD, ZR, 1N4735A, 6.2V, 5%, 1
44	15-16763	2	POT, 9MM, W/SW, 50K, 10%, LIN
45	HM13-0414	4	XSTR, T092, PNP, 2N3906
46	15-16761	4	POT, 9MM, 100K, 10%, LIN
47	HM13-0413	4	XSTR, TO-92, PNP, 2N3904
48	15-16760	10	POT, 9MM, 10K, 10%, LIN
49	52920-001	4	POT, 9MM, 50K, 10%, REV'D, "D"
50	HM14-0576	2	CAP-EL, 22, 25V, 85C
51	HM14-0582	28	CAP-SF, .1UF, 5%, 50V
52			
53			
54	13-0514	2	XSTR, LM394CN, DUAL
55	13-0217	12	IC, TL074, QUAD, OP-AMP
56	15-0491	4	POT, TRIM, 100K, M, HZL, MT
57	14-0863	2	CAP-EL, 10UF, 20%, 25V, RD, NP
58	50901-004	6	CAP-PF, 470PF, 5%, 50V, R
59	14-0635	4	CAP-CD, 100PF, 10%, 500V
60	13-0737	2	IC, VCA, SSM-2018
61	HM14-0585	6	CAP-CD, 47PF, 5%, 500V, NPO
62	15-0481	2	POT, TRIM, 2K, M, .5W, HZ
63	14-0636	2	CAP-CD, 470PF, 10%, 500V
64	15-0496	4	POT, TRIM, 500, M, HZMT, CRMT
65	13-0304	2	IC, TL072CP, OP-AMP, DUAL
66	14-0753	6	CAP-MP, 1UF, 10%, 63V
67	27-0419	2	CONN, PCMT, 3P, FEM

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COMPONENT EXPLODED VIEW

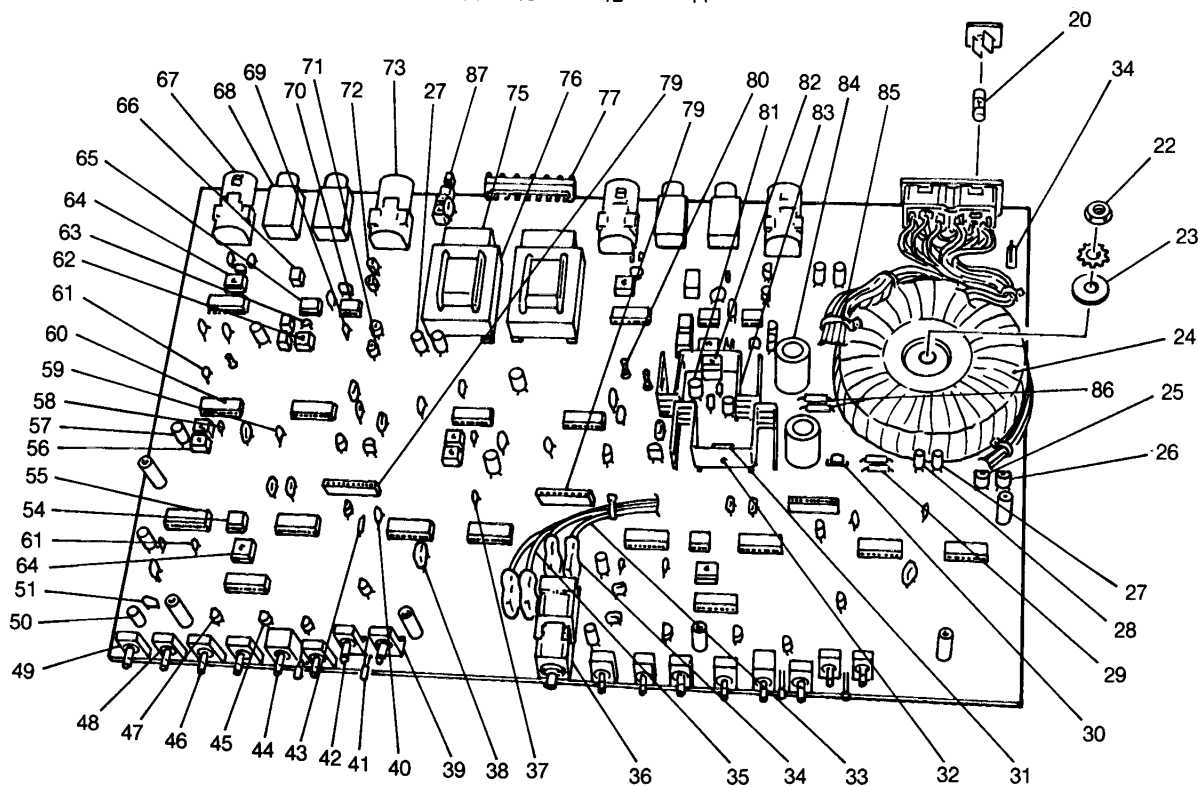
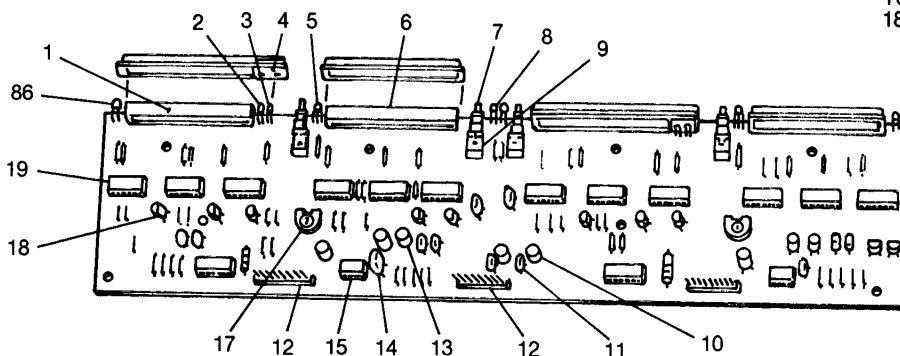


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UREI LA-12

CIRCUIT BOARDS

Top PC Board Rotated
180° To Show Components



ITEM	PART NO.	QTY	DESCRIPTION
68	27-0367	4	JACK, PHONE, .250, DIA, 90DEG
69	14-0767	4	CAP-CD, 22PF, 5%, 1KV
70	S500-1513	2	IC, LM833N
71			
72			
73	27-0420	2	CONN, PCMT, 3P, MALE
74			
75	15-0400	2	RLY, 24V, DPDT
76	16-16825	2	XFMR, OUT
77	27-0625	2	BAR-STP, 5POS, .325" CTR
78			
79	27-0632	4	SKT, STR, 9 POS, .1" CTR
80	52924-001	6	TEST-POINT, PCMT
81	14-0603	4	CAP-EL, 100UF, 20%, 25V, RD
82	13-0207	2	IC, 7918CT, RGTLR, 1A

ITEM	PART NO.	QTY	DESCRIPTION
83	36-0552	4	HTSK, T0220, W/MNTG, TAB
84	14-0523	4	CAP-EL, 1000UF, 50V, RD
85	256207	9	TIE-WRAP, 4", BLK
86	278344-001	2	FUSE
87	15-0494	1	SW, DPDT, ALT-ACT, PCMT
88			
89			
90			
91			
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