



ES52000 Digital Controller

Professional Series

Owners Manual

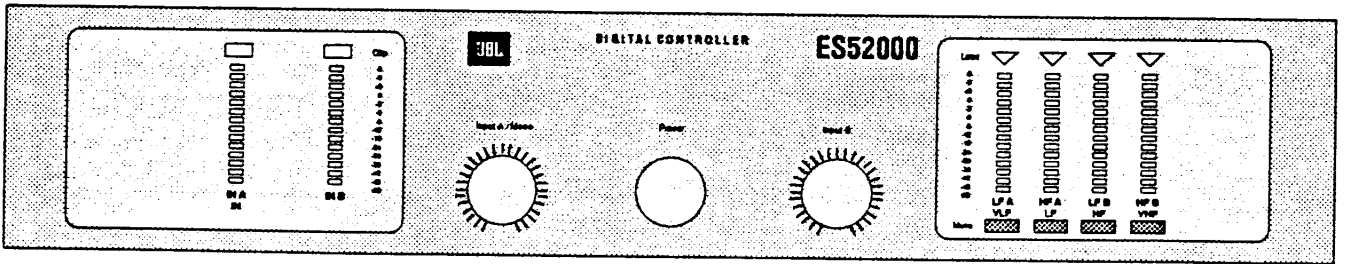


Table of Contents

Introduction	3
Unit Description	4
Installation	5
Grounding	8
Input Connections	9
Using Floating or Balanced Cables for Longer Runs	9
Setup	9
Operation	14
In Case of Difficulty	15
Specifications	17

Illustrations

Figure 1: ES52000 Block Diagram	3
Figure 2: Fuse holder	6
Figure 3: Fuse holder oriented for 240 V operation	6
Figure 4: Dual-channel two-way interconnection	7
Figure 5: Single-channel two way interconnection	7
Figure 6: Three-way high interconnection	7
Figure 7: Three-way low interconnection	7
Figure 8: Four-way interconnection	8
Figure 9: Front panel	13
Figure 10: Rear panel	13
Figure 11: Stereo two-way output indicator configuration	18
Figure 12: Mono two-way output indicator configuration	18
Figure 13: Mono three-way VLF output indicator configuration	18
Figure 14: Mono three-way VHF output indicator configuration	18
Figure 15: Mono four-way output indicator configuration	18

Tables

Table 1: Fuse values	6
Table 2: Minimum line voltages	6
Table 3: Input and output connector wiring	9
Table 4: System switch positions for pre-programmed JBL systems	10
Table 5: Output level control settings for use with JBL ES Series amplifiers	12
Table 6: Setup frequencies for adjusting ES52000 output level controls	12
Table 7: Power amplifier output voltages	12

Introduction

Thank you for purchasing the JBL ES52000 Digital Controller, one of the most advanced signal processing devices available to the audio professional. Before attempting to use the ES52000, please take the time to familiarize yourself with its features, setup and operation to ensure that you obtain its maximum performance.

Please return the Registration Form included with this manual to JBL. Registering your ES52000 will make certain that you are notified when updated ROM's are released and available from your JBL supplier. These new ROM's may include programs for new systems and/or revised programs for existing systems.

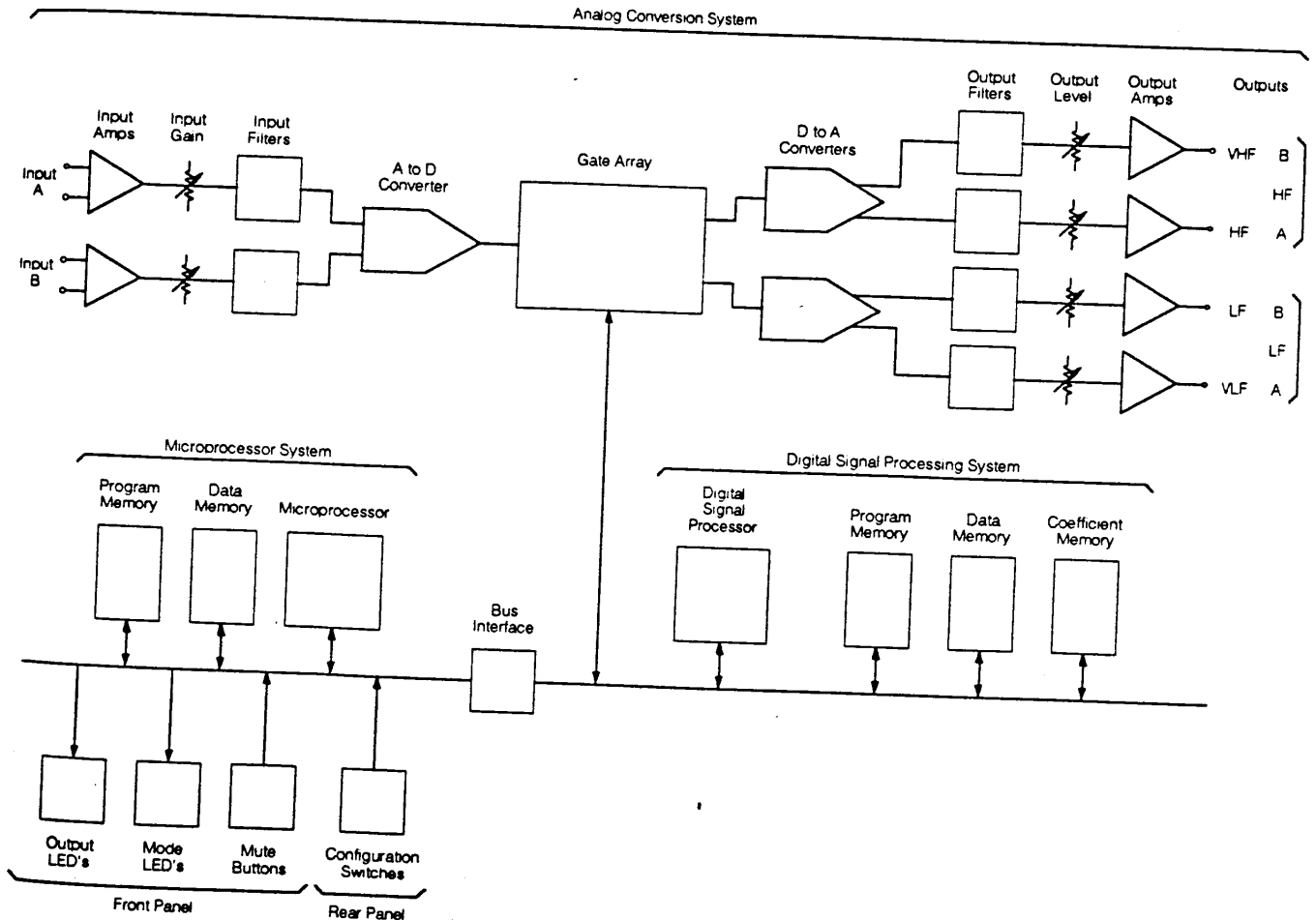


Figure 1: ES52000 Block Diagram

Unit Description

The ES52000 is factory-programmed for use in conjunction with the JBL loudspeaker systems listed in Table 4 on page 10. It combines the functions of two-way dual-channel or two-, three- or four-way single-channel active frequency division, system equalization, time delay, and (in single-channel configurations) transducer protection limiters, all providing unique advantages achievable only in the digital domain.

All crossover and system equalization filters in the ES52000 are FIR (finite impulse response) digital designs whose amplitude responses are independent of their phase responses and which have constant group delay and no phase shift; conventional analog and other digitally implemented filters have IIR (infinite impulse response) characteristics which inherently change the signal's phase relationships in direct relation to their filtering action.

The crossover filters, in addition to being zero phase shift FIR types, feature extremely steep slopes: between 50 and 100 dB per octave, depending on the particular system settings, and have precision signal alignment correction to compensate for the different acoustical centers of the various cone transducers and compression drivers as mounted in the JBL systems for which it is factory programmed.

Because of the large number of variables which cannot be anticipated, the ES52000 does not replace any equalization required to compensate for acoustical conditions caused by the space in which the loudspeakers are mounted or the location of the loudspeakers in that space.

The ES52000 utilizes audiophile grade analog circuitry, 64 times oversampled 18 bit A to D (analog to digital) converters, and 8 times oversampled 18 bit D to A (digital to analog) converters, with full 20 kHz bandwidth, 44.1 kHz sampling rate, and 24 bit signal processing in the digital domain for maximum dynamic range and minimum signal distortion at low levels. Both inputs are electronically balanced. The four outputs are unbalanced low impedance; optional transformers may be added by a qualified technician if symmetrical, floating output isolation is desired.

Thirty-two points of FIR digital equalization are provided in both low frequency and high frequency bands, in single- and dual-channel modes, to smooth the loudspeaker frequency response down to approximately 150 Hz. The system equalization filter coefficients have been adaptively derived by computer analysis in anechoic conditions and confirmed in extensive listening tests. An active analog two pole high pass filter optionally adds 2.5 db of boost at 30 Hz and provides infrasonic rolloff for cone transducer protection below 30 Hz; this filter may be enabled by a qualified technician. Between 30 Hz and 150 Hz, loudspeaker frequency response is boundary dependent and will be affected primarily by the room and system mounting in the room; thus, no equalization is provided in this band.

Peak program limiting is provided in each band when the ES52000 is operated in single-channel configurations. Output level controls for each band allow user setup of the ES52000 with the system's power amplifiers for flat response, while limiters prevent amplifier clipping and transducer damage.

Unlike those in other loudspeaker system processors, the ES52000 limiters do not modify the crossover frequencies, slopes, or system equalization, so that the systems' tonal characteristics below maximum output are not level-dependent. The limiters are not available in dual-channel two-way mode.

Front panel controls are provided for adjustment of input gain and muting of each output channel; LED (light emitting diode) bar graph level indicators provide precise information on operating mode, input and output levels and clipping, output limiting and channel muting. Rear panel controls located under a removable security cover provide for mode selection, system selection and output level.

Unit Description

The ES52000 does not use amplifier sense cables since its output signal is based on correct adjustment of its output level attenuators. Thus, one ES52000 can control any number of loudspeaker systems of the same type and can be located some distance away from the amplifiers (installation of the optional output transformers may be desirable in such cases). If the ES52000 is located at the mixing position, for example, the mixer can view its level indicator LED's and monitor system headroom during a performance.

Caution: If any of the ES52000's output channels is driving more than one power amplifier, each amplifier connected to that output must have the same output power and gain in order to maintain system balance and proper limiting thresholds.

All loudspeaker system settings are contained in a factory programmed ROM (read only memory) integrated circuit mounted in an internal socket. This allows a qualified technician to install a revised ROM containing additional system programs, so that future loudspeaker system enhancements and changes may be accommodated by today's ES52000.

Installation

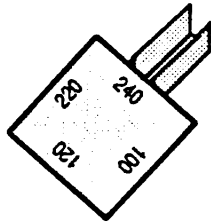


Figure 2: Fuse holder.

Line Voltage	Fuse Value (Amperes)
100–120 V	1/2
220–240 V	1/4

Table 1: Fuse values.

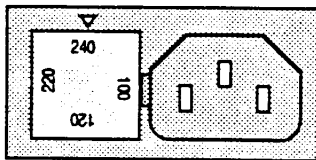


Figure 3: Fuse holder oriented for 240 V operation.

Line Voltage Setting	Minimum Line Voltage
100 V	83 V
120 V	100 V
220 V	183 V
240 V	200 V

Table 2: Minimum line voltages.

Unpack the ES52000 and carefully inspect it for transportation damage. If any physical damage is discovered, save all of the packaging and immediately contact the dealer or distributor from whom it was purchased. The ES52000 is supplied with a removable IEC-type mains power cord, a separate fuse block (illustrated in Figure 2), 1/4-ampere and 1/2 ampere fuses, a security cover fastened on the rear panel which covers the system selection and amplifier gain adjustments, and this manual. If any parts are missing, contact your supplier.

The ES52000 can be used with nominal power line voltages of 100–120 V and 220–240 V, 50 to 60 Hz. Voltage selection is accomplished by inserting the proper fuse shown in the chart (Table 1) into the block and installing the fuse block into the IEC power connector on the back panel. Notice that the end cap on the block can be installed in four different orientations. The operating voltage is set by rotating the cap so that the mains voltage is at the top, with the inverted triangle above the top edge of the fuse holder mounting position pointing to it. In the illustration, Figure 3, the cap is oriented for a setting of 240 V. Note the small slot between the right side of the end cap and the line cord socket. The fuse holder is unfastened from the connector by inserting a small flat-bladed screwdriver under the fuse end cap through this slot and gently prying the cap outward.

Warning:

ORIENTATION OF FUSE HOLDER DETERMINES OPERATING VOLTAGE.

Before connecting the ES52000 to the power mains, recheck to be sure that the voltage selector is properly set for the voltage in your area, and that the installed fuse is of the correct value. Damage to the ES52000 caused by incorrect mains voltage setting is not covered by warranty.

Caution: If the mains voltage applied to the ES52000 is below the minimum shown in Table 2 on this page, the unit either may fail to operate or may operate intermittently.

If the power amplifiers being driven by the ES52000 are located at some distance, installation of the optional output transformers may be desirable to minimize the possibility of environmental electrical interference coupling into the audio cabling. The four transformers (two each JBL Part No. 16-14550 and two each JBL Part No. 16-13036) may be obtained from the ES52000's supplier and must be installed by a qualified technician.

The ES52000 is designed for installation in a standard electronic rack and fits in a 2U (89 mm or 3.5 in high) space. Since some power amplifiers radiate significant amounts of electromagnetic energy which might couple into the ES52000's analog circuitry and create noise in the audio signal, it is suggested that the ES52000 be mounted at least one space (44 mm or 1.75 in) away from any amplifiers in the same rack. The external RF (radio frequency) radiation level from the digital circuitry in the ES52000 complies with stringent governmental requirements and should not interfere with the operation of well-designed audio equipment. As with any equipment containing a microprocessor or other digital circuitry, however, care should be taken to ensure that the ES52000 and other nearby units are properly grounded and that the ES52000 is operated with its top and bottom chassis covers installed and all screws in place.

Depending on the loudspeaker systems to be used with the ES52000, it can be configured as a dual-channel two-way controller or a single-channel two-, three- or four-way controller. See the block diagrams, Figures 4, 5, 6, 7 and 8 on pages 7 and 8, for recommended system interconnections. Any additional external room and/or program equalization must precede the ES52000 in the audio chain to maintain the effectiveness of its digital limiting parameters.

Installation

Figure 4: Dual-channel two-way interconnection.

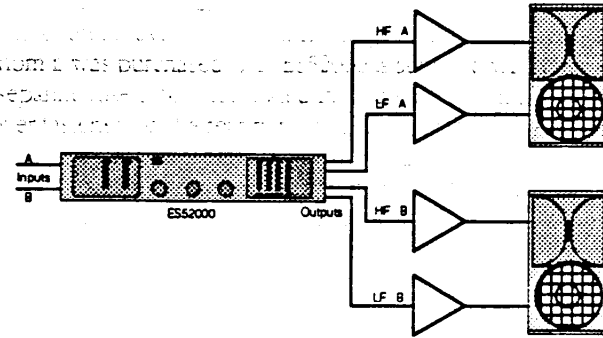


Figure 5: Single-channel two-way interconnection.

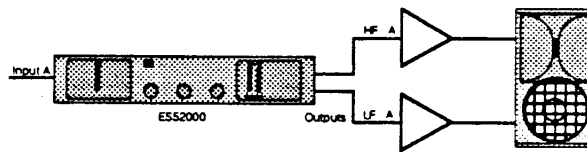


Figure 6: Three-way high interconnection.

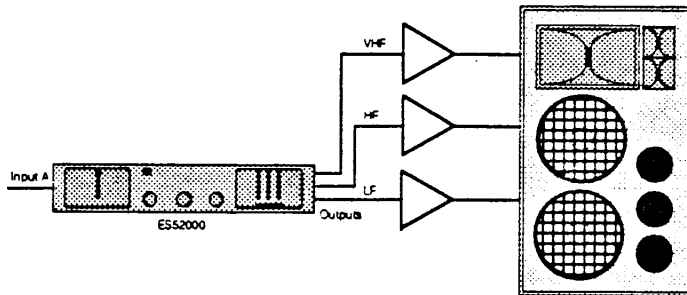


Figure 7: Three-way low interconnection.

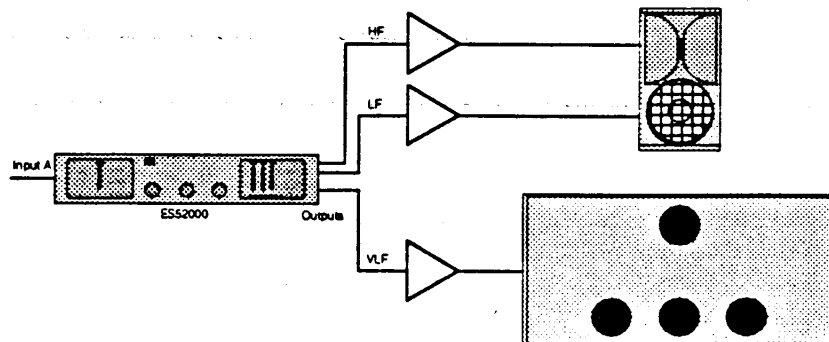
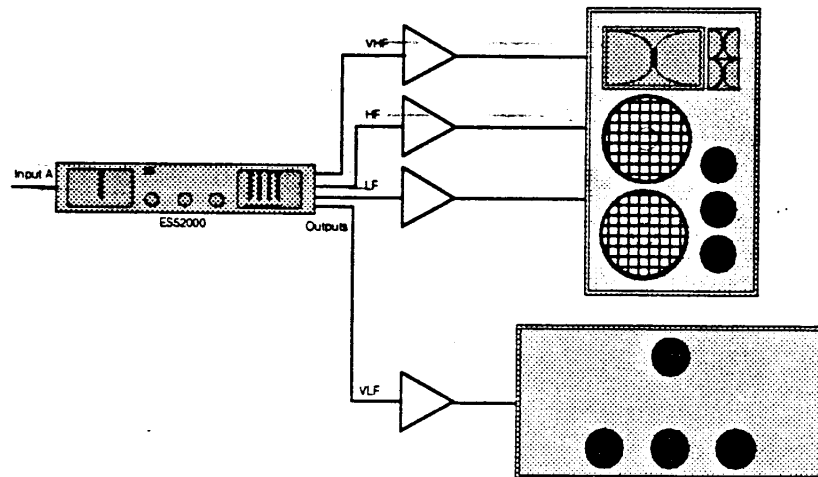


Figure 8: Four-way interconnection.



Grounding

For safe operation, the ES52000 must be connected to a good mechanical ground. This provides a current path for any voltage which might appear on the chassis due to a severe electrical fault in one of the power amplifiers. Without this path, the unit might be a shock hazard. In addition, a good quality ground on the chassis provides shielding from external fields. To comply with safety regulations in many localities, and to protect our customers, we provide this product with a ground connection through a three-wire power cord. Local ordinances and regulations apply—check with the applicable government agencies for further information.

In many situations, the power cord ground connection will present no problem. But there are instances where a hum or buzz will be introduced due to a phenomenon known as a ground loop. This can result when there is a significant potential between the chassis of the ES52000 and the mechanical ground to which the amplifier(s) are connected.

If this is the case, check the power amplifier(s) to see if there is a simple means of disconnecting the audio ground from the chassis. If so, the first attempt at a solution should be to remove this connection. This may have a significant effect on reducing the hum. Audio ground will then be referenced from the signal source, and the amplifier chassis ground will be separate but still connected to mechanical ground for shock protection.

In some instances, the voltage difference between the grounds will be so great that a direct connection to mechanical ground is not possible without hum in the output. Installation of output transformers in the ES52000 may allow the signal to be connected while maintaining ground isolation. Check for this using a 3 prong to 2 prong AC adaptor between the power cord and the power outlet, temporarily ungrounding the unit. Try the amplifier both with and without the ground to chassis connection. Determine which connection works best. **Remember, for safety you must still have a connection to chassis ground.** This is normally made through a properly grounded third pin AC connection. However, in some installations, some different method of grounding may be acceptable and satisfactory for both safety and noise. Any alternate method of grounding of the amplifier should assume that full line current will flow in the ground wire under fault conditions, and the wire should be sized accordingly.

Installation

Input Connections

Signal	XL Pin #
High	2
Low	3
Ground	1

Table 3: Input and output connector wiring.

The ES52000 provides balanced, differential inputs and will not unbalance floating or balanced output sources. Balanced wiring is the preferred style, especially when running long lines, due to the ability of a balanced input to reject signals (such as hum fields) which are induced equally into both of the signal carrying conductors. Even if the previous piece of equipment has an unbalanced output, it may be advantageous to wire it to the input of the ES52000 as though it were balanced. This takes advantage of the ability of the input to reject common-mode noise. Wire the connectors according to Table 3 on this page.

To use an unbalanced source, wire the signal carrying conductor of the cable from that source to XL connector pin 2, and wire the shield to XL connector pin 3. XL pin 1 may also be connected to shield ground if that is compatible with your system grounding. (See the **Grounding** section, page 8.)

We recommend that two-conductor shielded cable be used, even in an installation using unbalanced wiring. Do not depend on the shield wire itself to complete the signal connection. Stranded shield wires are more subject to breakage, especially in portable installations, than the more protected internal insulated wires. Using this wiring system, the worst that would happen with a broken shield would be a rise in noise or hum due to the lack of shielding. If the ground connection were completely lost, this would result either in loss of audio or a very loud hum.

Using Floating or Balanced Cables for Longer Runs

Shielded cables are recommended for all input and output signals. Longer cables should be balanced or floating to reduce susceptibility to RFI (radio frequency interference) and hum. If the output of the device feeding the ES52000 is balanced or floating, no transformer is required; simply use a dual-conductor shielded cable. If the output feeding the ES52000 is unbalanced, an isolation transformer *may* be necessary at the source device's output.

The input impedance of the ES52000 is very high. Therefore, if the controller is to be used in a true 600 ohm system, attach a 620 ohm resistor across the input terminals to terminate the source.

Long cable runs between the ES52000 and the power amplifiers may necessitate installation of the optional output transformers into the controller by a qualified technician. With shorter cables, particularly where interconnected equipment is mounted in a single rack or is powered by the same AC receptacle, there is less need for balanced or floating input and output cables.

Setup

Three settings are required when the ES52000 is installed: mode selection, system selection and amplifier gain. These settings are made with controls located under a removable security cover on the rear panel, shown in Figure 10, page 13.

Caution: *The switch positions defining Mode and System selection are read and interpreted by the ES52000's internal microprocessor during its self-test sequence when power is applied to the unit. Switch position changes made while power is on will not become active until the unit is turned off for a few seconds and turned on again.*

Installation

Switch Setting	Model Numbers
1	4850A
	4851A
	4750A
	4751A
	4755A
2	4756A
	4852A
3	4853A
	4870A
	4871A
	4770A
4	4771A
	4872A
	4873A
5	4825A
	4726A*
6	SR4732N
7	K-2

Table 4: System switch positions for pre-programmed JBL systems. The 4800A systems are from the JBL Concert Series. The 4700A systems are from the European JBL Sound Power Series. The K-2 is an audiophile-oriented consumer system.

* Early production of the 4726A contained passive power equalization which must be removed when the system is used with the ES52000. Consult your dealer for further information.

Mode selection is made by setting the Mode rotary switch (1) to the system configuration: Two-Way Dual-Channel, Two-Way Single-Channel, Three-Way High (used for three-way systems with actively crossed over ultra-high frequency transducers), Three-Way Low (used for two-way systems in conjunction with subwoofers), or Four-Way.

System selection is made by setting the System rotary switch (2) according to Table 4 on this page. Because the ES52000 is factory programmed and computer optimized for JBL systems, its use with components and/or systems from other manufacturers will give unpredictable results. JBL cannot provide information about the ES52000's compatibility with other manufacturers' loudspeakers.

Caution: *The system parameters for the ES52000 are contained in an internal factory programmed ROM which may be changed by a qualified technician to accommodate future systems. If an updated ROM has been installed, the system settings on the ES52000 may not correspond exactly to those listed in this manual. It is important, therefore, to attach the sticker which will be provided with each updated ROM onto the ES52000's rear panel when the ROM is installed, to place the new system listing page provided with the ROM into this manual for reference, and to check the system settings chart on the rear panel of the ES52000 to confirm the correct settings.*

Note: Since the ES52000's equalization parameters have been determined in anechoic conditions, they do not take into account the acoustical conditions of the environment in which the loudspeaker system is to be used or the way in which the system is mounted in that environment. Thus, additional external equalization may be needed to optimize the system's response in the room. Time spectrum analysis equipment users should be aware that the propagation delay through the ES52000 is up to 30 milliseconds, depending on the loudspeaker system and mode settings.

Amplifier gain is programmed into the ES52000 with the four output level controls [(3), (4), (5), (6)].

Caution: *The accuracy of the system frequency response and protection limiter thresholds depends on correct user setting of these controls. Be certain that the controls are properly set. Do not use these controls to balance the subjective frequency response of the loudspeakers.*

Output level settings for JBL ES and SR Series power amplifiers are given in Table 5 on page 12. The power amplifier gain controls should be turned to maximum (fully clockwise). Replace the security cover after completing the settings and tighten its screws.

If the amplifiers are not JBL ES or SR Series units, the ES52000 output level controls may be set, using an audio sine wave signal generator and an RMS voltmeter, as follows:

1. Set the System Selection switch to position 0 (zero), which bypasses all system-specific equalization. Set the Mode Selection switch to the position appropriate for the speaker system used. Connect the selected power amplifiers to the ES52000's outputs. **Important: The loudspeakers must be disconnected from the amplifiers to avoid possible transducer damage.**

2. Connect the audio signal generator to the Channel A input of the ES52000. Turn on the generator, the ES52000 and the power amplifiers, and turn the amplifier gain controls (if any) to their maximum settings (fully clockwise). Set the Channel A input level control on the ES52000 front panel (shown in Figure 9, Page 13, (1)) to maximum (clockwise).

Installation

3. Table 6 on page 12 shows the setup frequencies for each output band of the ES52000. Set the signal generator to the lowest frequency specified in the table for the system mode chosen, and connect the voltmeter to the output terminals of the signal generator.
4. Adjust the generator output level control for -10 dBu (0.254 V). Then connect the voltmeter to the output terminals of the amplifier handling the selected band. Adjust the appropriate output level control on the rear panel of the ES52000 to obtain the amplifier output voltage specified in Table 7 on page 12. **Important: VLF settings must be made with the infrasonic filter disabled.**
5. Repeat Steps 3 and 4 for each of the frequency bands for the selected mode.
6. If Dual Channel Two-Way mode has been selected, repeat Steps 2—5 above for Channel B.
7. Set the System Selection switch to the position required for proper operation of the loudspeaker system used with the ES52000.
8. Replace the security cover and tighten the screws.

Warning: The ES52000 will not protect against transducer damage resulting from amplifier clipping or instability. The selected amplifiers must have sufficient headroom to keep them from severe clipping during normal system operation. Amplifier clipping at levels below rated output can result if the power line voltage feeding the amplifiers falls below nominal levels. Some amplifiers may also clip or otherwise perform in unexpected ways, possibly causing transducer damage, if the impedance of the load is below recommended minimum values and/or is highly reactive. The use of properly sized, high quality amplifiers fed from stable power lines will minimize the likelihood of such problems occurring.

Installation

Output Band	Setup Frequency
VLF	20 Hz
LF	200 Hz
HF	2 kHz
VHF	10 kHz

Table 6: Setup frequencies for adjusting the ES52000 output level controls. The generator feeding these signals to the ES52000 should be set to -10 dBu (0.245 V), and the input gain of the ES52000 should be set to maximum.

Mode	Mode Switch Setting	VHF/HF-B Setting	HF/HF-A Setting	LF/LF-B Setting	VLF/LF-A Setting
Stereo Two-way	A				
Mono Two-way	B				
Mono Three-way VLF	C				
Mono Three-way VHF	D				
Mono Four-way	E				

Table 5: ES52000 output level control settings for use with JBL ES and SR Series power amplifiers. When using VLF loudspeakers (Modes C or E), the VLF output level may be reduced if there is excessive deep bass in the environment.

Mode	Mode Switch Setting	VHF/HF-B Setting	HF/HF-A Setting	LF/LF-B Setting	VLF/LF-A Setting
Stereo Two-way	A	5.6 V	5.6 V	18.4 V	18.4 V
Mono Two-way	B		5.6 V		18.4 V
Mono Three-way VLF	C		5.6 V	18.4 V	17.5 V*
Mono Three-way VHF	D	8.8 V	8.0 V	18.4 V	
Mono Four-way	E	8.8 V	8.0 V	18.4 V	17.5 V*

Table 7: Power amplifier output voltages for proper operation of the ES52000 output limiters. When the ES52000 input gain is set at maximum and is being fed by the signals shown in Table 6, set the amplifier output level controls at maximum and the ES52000 output level controls to obtain the voltages in this table.

*When using VLF loudspeakers (Modes C or E), the VLF output level may be reduced if there is excessive deep bass in the environment.

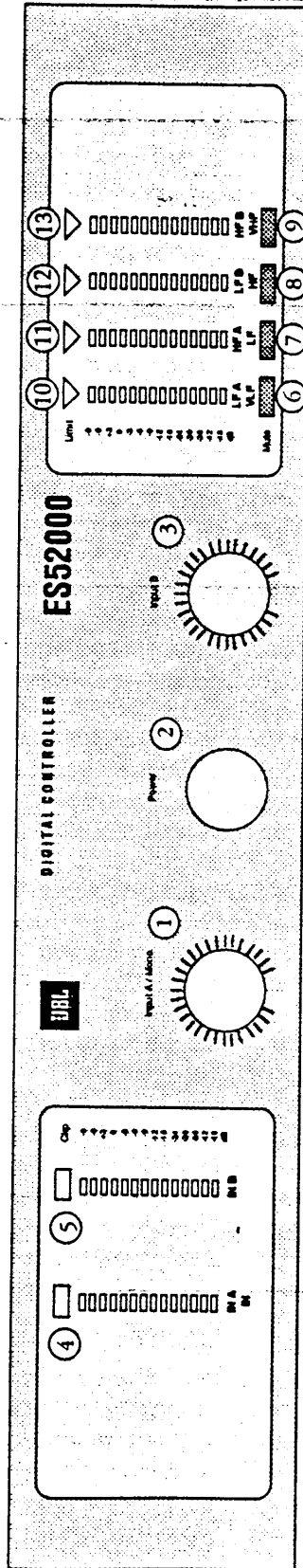


Figure 9: Front panel.

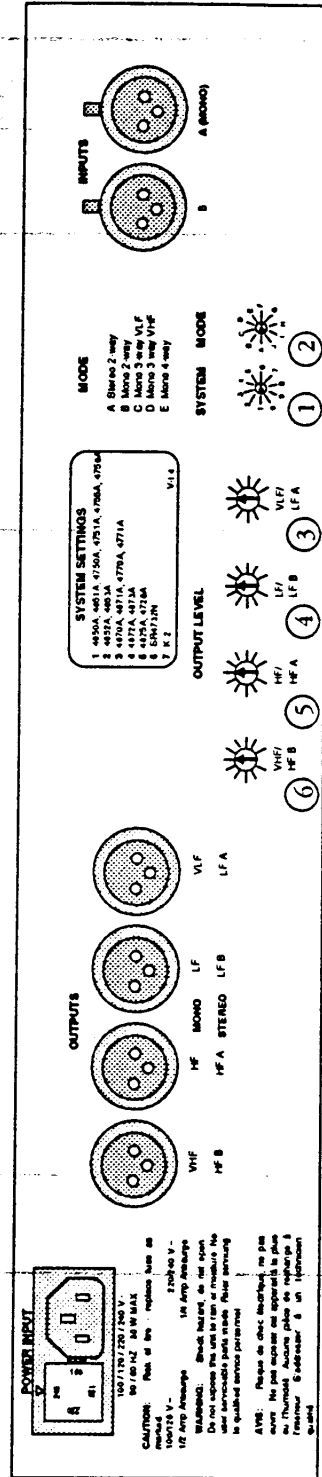


Figure 10: Rear panel.

Operation

The ES52000 has two input gain controls [(1), (3)] located on the front panel, shown in Figure 9, page 13. Input B, the right-hand control (3), is used only when the controller is set to dual-channel two-way mode. Make certain that the gain controls are set at minimum (fully counter-clockwise) prior to applying power. The unit is turned on by depressing the power switch button between the two gain controls (2). All front panel LED's will briefly illuminate during the self-test procedure following the application of power.

Prior to feeding audio through the Controller, check the front panel illumination to confirm that the proper mode has been set on the rear panel switch, using Figures 11, 12, 13, 14, and 15 on page 18 as a guide. If the mode switch is incorrectly set, it is possible that high frequency transducer damage may result from the wrong frequency band being fed to it. The mode switch may be operated while the power is on, but it will have no effect until the ES52000's power is turned off and on again.

The four pushbuttons on the front panel [(6), (7), (8), (9)], one under each output bar graph indicator, alternately engage and disengage muting for their associated output channels. An indicator will light when the channel is muted. This capability is useful when equalizing and troubleshooting an audio installation.

While feeding audio signals to the input(s), insure that all output channels are not muted, then rotate the gain control(s) clockwise until the input and output LED bar graph indicator(s) show activity. When illuminated, the top segments of the input level indicators [(4), (5)] indicate that the maximum input level capability of the ES52000 has been exceeded and the analog input cir-cuits are clipping—the input level should be reduced until clipping ceases.

The digital limiters in all single-channel operating modes and the internal gain structure of the controller prevent clipping in the digital stages and analog output circuitry. However, it is possible to clip the digital stages when operating in the dual-channel mode if the input analog stages are in severe overload.

Because of the internal equalization in the digital domain, it is possible, depending on the spectral content of the program material, for the digital limiters to activate when the input level is set below the channel's clipping point. If this happens, the top segment of the affected band's output display will illuminate [(10), (11), (12), (13)]. The limiters are peak responding, so the processor's input stage may clip before limiting effects become audible. Each limiter affects only the level of its output band and does not affect the crossover frequencies and slopes of that band or the levels of any other output band.

The gain structure and limiting thresholds of the ES52000 have been designed for maximum loudspeaker output before transducer damage. In conservatively designed systems, experience may show that the loudspeakers are always operated several dB below their rated maximum power and the ES52000's maximum input and output levels, as shown on the bar graphs, are also always several dB below clipping and limiting levels. In these cases, it may be desirable to trade some of the headroom for an improvement in signal to noise ratio by lowering each of the output level controls by the desired number of decibels and raising the input gain control(s) by the same amount.

Caution: *This procedure reduces the maximum level available from the loudspeakers prior to the onset of the ES52000's limiting and/or input clipping, and should be done only if the operator is certain that the normal maximum level will not be required. Be certain to document these gain structure changes, so that other operators of the system can be cognizant of them and so that the gain may be easily restored to the settings previously determined.*

In Case of Difficulty

Symptom: No Sound

Possible Causes:

Power Off:

Make certain that the power switch pushbutton is on (in) and that the unit is connected to an active power line. Check the ES52000's fuse and replace it if necessary; if the fuse fails again, refer the unit to a qualified technician for service.

Power On, No Signal Audible:

Confirm that active audio lines are connected to the ES52000 input(s) according to the connection and wiring schemes shown in this manual. Also, confirm the integrity of the wiring from the ES52000 to the amplifiers and loudspeakers.

If audio is being fed to the ES52000 and the wiring is correct, check that the gain controls are advanced sufficiently to see activity in the input and output level indicators. If the gain controls are turned up and no signal is visible, turn the ES52000 off for approximately 5 seconds, then turn it on again to reset the digital circuitry.

If the signal is visible but there is no indicator activity on one or more outputs, check to make certain that the Mute mode has not been inadvertently activated on the non-functioning outputs.

If all input and output indicators are showing activity and the wiring to the amplifiers and speakers is intact, make certain that the amplifiers are turned on and that, if they have gain controls, all are set to maximum.

Symptom: Weak and/or Distorted Audio

Possible Causes:

Check that a clean signal is being fed to the ES52000. It is possible that the problem is originating earlier in the audio chain.

Confirm that the input and output wiring is correct. If only one side of an isolated (floating) symmetrical audio line (sometimes called "balanced") is connected to the ES52000 input, the resultant audio will be weak, distorted, and will have poor frequency response.

In Case of Difficulty

Symptom: Hum and/or Buzz

Possible Causes:

Check the input audio at an earlier stage in the chain to confirm that the noise is not already in the input signal.

Make certain that the grounding schemes of the audio signal path and the chassis' and power line mains of all units in the system are according to the recommendations on page 8 of this manual, and follow those troubleshooting guidelines to isolate and correct the problem.

Power amplifiers have large mains transformers which handle high currents, and, consequently, have significant magnetic fields surrounding them. The ES52000 does not contain low level circuitry which is sensitive to hum being induced from external magnetic fields. However, some low level equipment is susceptible to such hum induction. Therefore, as a general rule, low level equipment should not be mounted in close proximity to power amplifiers to avoid hum induction.

Be certain that all audio wiring except for loudspeaker lines are well shielded, and that low level wiring is not run parallel to and/or in close proximity to poorly shielded digital data lines or AC mains wiring, particularly high current and/or lighting lines. If the buzzing changes character or intensity when electrical lighting conditions change, the noise is being induced into the audio from the lighting equipment. It is always advisable to run lighting equipment from its own mains power source and the audio equipment from a separate source. The services of a qualified electrician may be required to solve such problems.

Symptom: Intermittent Audio

Possible Causes:

Check the other equipment and the wiring to make certain that the signal is not intermittent earlier in the chain, that the power amplifiers are not cycling through protection modes, and that the loudspeakers are solidly connected to the amplifier outputs.

Symptom: Mode and/or System Settings Not Operative

Possible Cause:

The unit may not have been turned off and on after the Mode or System switch positions were changed. These settings are read and interpreted by the ES52000's digital circuitry during its initialization procedure, which is activated when power is applied to the unit. If this is the case, turning the unit off for approximately 5 seconds and turning it back on again will re-initialize the unit, and the switch settings will be properly interpreted.

Specifications

Electrical:

Overall Frequency Response (two-way mode, equalization filters disabled):

10 Hz—19 kHz, ± 0.5 dB

Anti-Alias Filters:

Digital FIR on inputs and outputs, -5 dB @ 20 kHz, -80 dB @ 22 kHz

Maximum Output Levels:

Variable with system selection and output gain settings; compatible with input gain of typical professional power amplifiers.

Total Harmonic Distortion + Noise:

< 0.02% (measured 20 Hz—19 kHz, 0 dBu in) (typ. 0.005%)

Dynamic Range:

> 90 dB (measured on HF output)

Converter Rates:

Inputs: 2.82 MHz (64x oversampling)

HF/VHF Outputs:

353 kHz (8x oversampling)

LF/VLF Outputs:

88.2 kHz

Sampling Rates:

Inputs: 44.1 kHz

HF/VHF Outputs:

44.1 kHz

LF Output:

22.05 kHz

VLF Output:

11.025 kHz

Sample Width:

18 bits

Internal DSP Word Width:

24 bits

Output Muting:

Digital, 100 ms ramp up and down, controlled by front panel pushbuttons

Crossover Filters:

Digital FIR

Filter Slopes:

50—100 dB/octave, varies w/system selection

Passband Ripple:

0.0001 dB

Crossover Group Delay:

± 22 μ s

Propagation Time (Latency):

< 30 ms (system and mode dependent)

Equalization Filters:

Digital FIR, adaptively derived, system specific

Infrasonic High Pass Filter:

Analog, two pole, +2.5 dB boost @ 30 Hz, internally activated

Inputs:

Active balanced bridging

Connectors:

XL-type 3 pin female, pin 2 high

Outputs:

Unbalanced low impedance (optional output transformers may be field installed for symmetrical, floating outputs)

Connectors:

XL-type 3 pin male, pin 2 high

Front Panel Controls:

Input A Level

Input B Level

Power On/Off

Rear Panel Controls:

System Selector Switch

Mode Switch

Output Level Controls (4)

AC Power Requirements:

100–120/220–240 V AC, 50–60 Hz, 30 W

AC Line Cord:

Detachable, IEC Type

Specifications

Mechanical:

Front Panel:	2U (89 mm x 483 mm; 3 1/2 in x 19 in)
Depth Behind Panel:	381 mm (15 in), less connectors
Rear Panel Security Cover:	Included
Net Weight:	8.2 kg (18 lbs)

Options:

Low Frequency Output Transformers:	JBL Part No. 16-14550 (two required)
High Frequency Output Transformers:	JBL Part No. 16-13036 (two required)

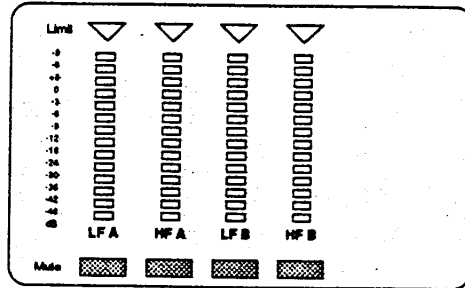


Figure 11: Stereo two-way output indicator configuration.

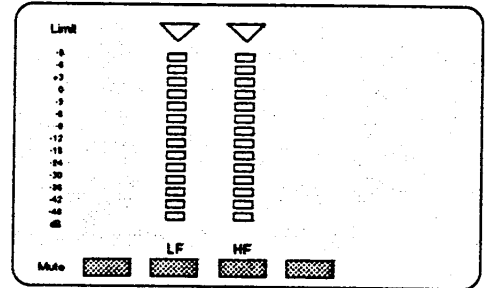


Figure 12: Mono two-way output indicator configuration.

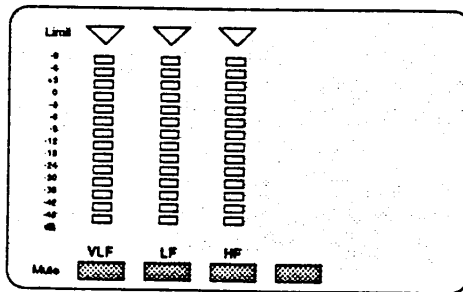


Figure 13: Mono three-way VLF output indicator configuration.

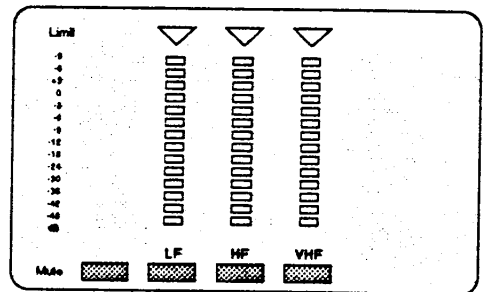


Figure 14: Mono three-way VHF output indicator configuration.

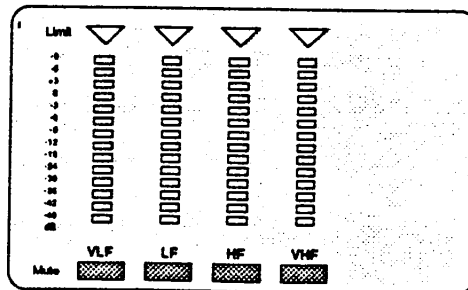


Figure 15: Mono four-way output indicator configuration.



Addendum to ES52000 Manual

Please note these performance improvements have been incorporated into your ES52000.

Page 10 Switch Settings - Two new system settings have been added: setting 8 is calibrated from use with one to three Array Series 4892 loudspeakers, setting 9 is calibrated from use with four to eight Array Series 4892 loudspeakers.

Pages 11 and 12 Amplifier gain calibration- Page 11 the infrasonic filter no longer needs to be disabled, on page 12 the correct setup frequency for the VLF band is 40 Hz.

Page 17 Specifications - Dynamic range has been increased to exceed 100 dB, typically in excess of 102 dB.

Page 17 Specifications - The infrasonic high pass filter response has been changed to - 3 dB @ 30 Hz.



Addendum to ES52000 Manual

Please note these performance improvements have been incorporated into your ES52000.

Page 10 Switch Settings - Two new system settings have been added:

setting 8 is for use with one to three Array Series 4892 loudspeakers,
setting 9 is for use with four to eight Array Series 4892 loudspeakers.

Pages 11 and 12 Amplifier gain calibration -

page 11: the infrasonic filter no longer needs to be disabled.

page 12: the correct setup frequency for the VLF band is 40 Hz.

Page 17: Specifications- Dynamic Range has been increased to exceed 100 dB, it is typically better than 102 dB.

Page 17: Specifications- The Infrasonic high pass filter response has been changed to -3 dB @ 30 Hz.

The SYSTEM and MODE switch type has been changed to accommodate future expansion. The rear-panel drawing on page 13 of this manual shows the old ten position switches. The new switches have sixteen positions.

The label fixed to your ES52000 shows the new switch positions.

IMPORTANT:

The System and Mode switches should be adjusted with a flat-blade trim-tool rather than a screwdriver.

A screwdriver has a wedged blade and will tend to slip-up and damage the switch head, making it difficult to see where the arrow point is.

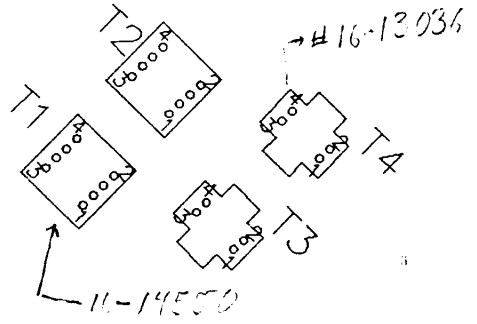
Please use the correct tool.

HISTORY		APPROVALS				harman electronics VISUAL AID		
REV	DATE	M.E.	Q.A.	SUPR.		PRODUCT.:	OP. #	STATION...
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						ADDENDUM OF VISUAL AIDS		ALL APPLIED
						TITLE: FOR ES 52000T ONLY		

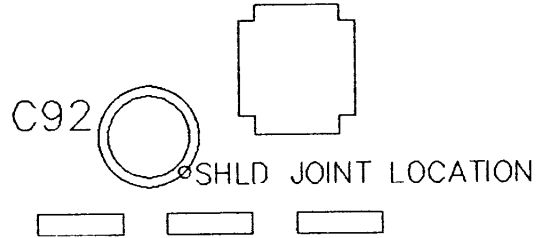
NOTE : ESD PROTECTION MUST BE WORN DURING THIS OPERATION

AQUISITION BOARD PRE-WAVE STAGE:

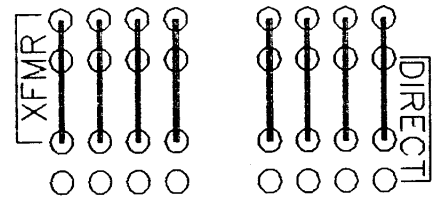
1. INSTALL (P/N 16-14550) OUTPUT XFRMR ON T1 & T2, OBSERVE POLARITY (NOTCH ON XFRMR INDICATES PIN #1).
2. INSTALL (P/N 16-13036) OUTPUT XFRMR ON T3 & T4, OBSERVE POLARITY (NOTCH ON XFRMR INDICATES PIN #1).



3. INSTALL (P/N 277778-001 SHLD CAP) OVER CAP C92, OBSERVE ORIENTATION (PER SKETCH). PUSH SHIELD TO THE BASE AND LEAVE ABOUT 1 - 2 m.m. CAP

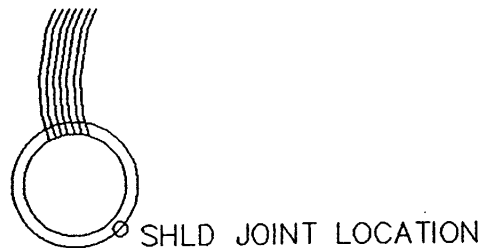


4. INSTALL (P/N 185-00000-00, RES-MF, 00HM, 1/6W) IN SLOTS MARKED 'XFMR', STRAIGHT (NOT CROSS) (PER SKETCH, 8 PLCS). (IF INSERTED FROM CS400 ALREADY, REMOVE THEM AND REDO).

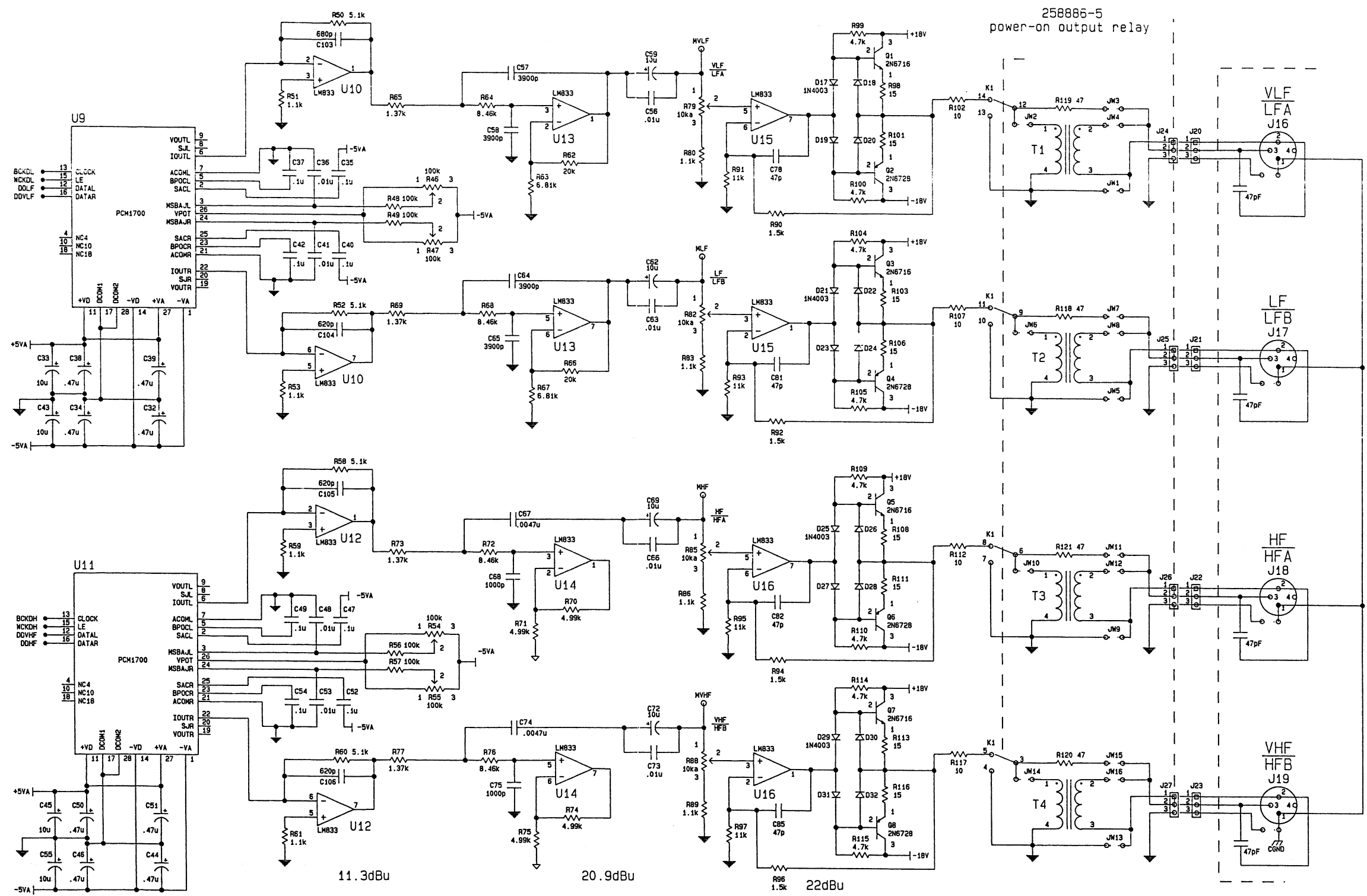


FINAL ASS'Y STAGE:

5. INSTALL (P/N 277789-001 SHLD XFRMR) OVER PWR XFRMR, OBSERVE ORIENTATION (PER SKETCH).
6. APPLY HOT MELT GLUE BETWEEN:
 - a. C92 AND SHIELD
 - b. PWR XFRMR AND SHIELD



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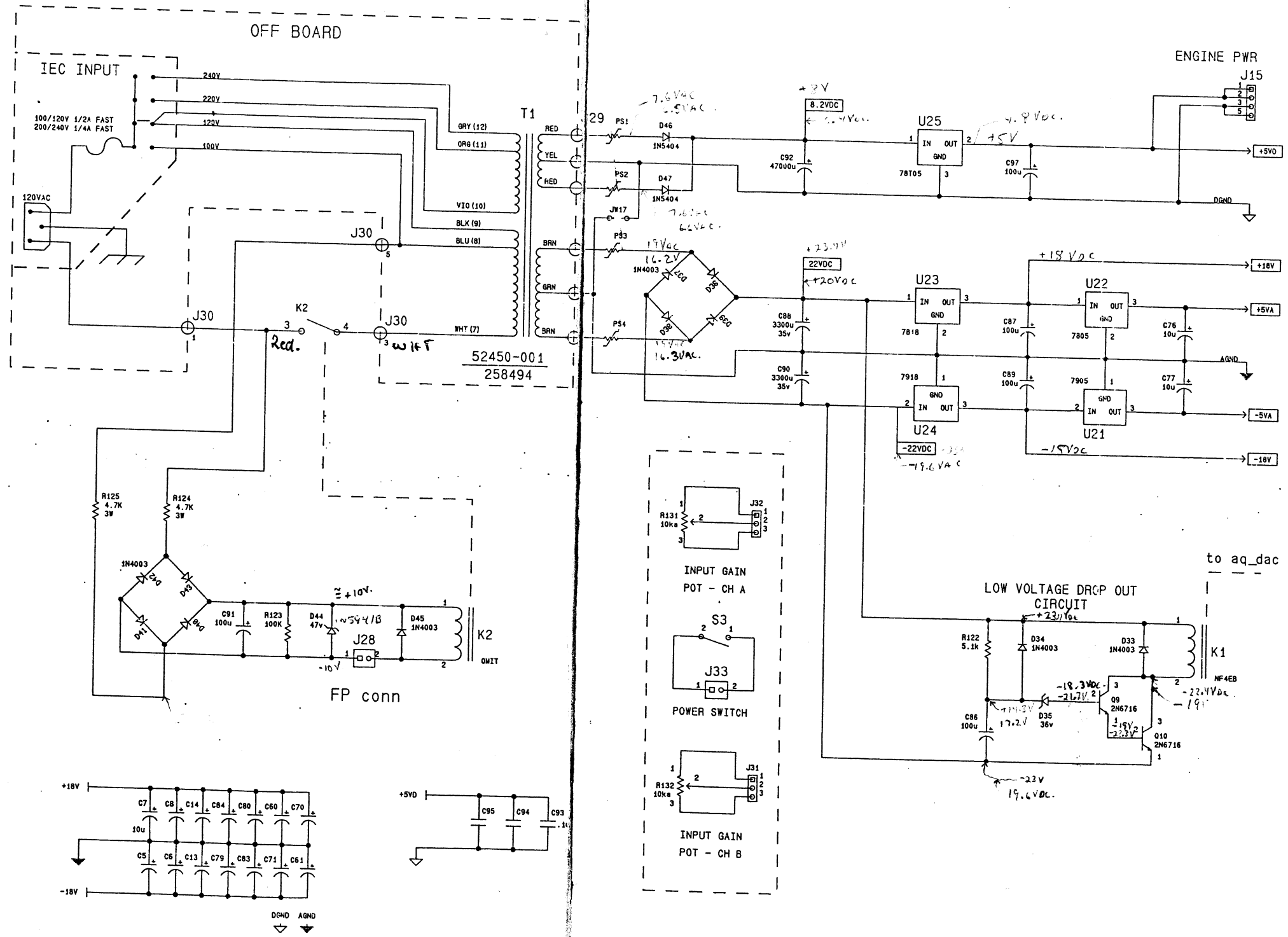
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- aq_dgt1 fp_led
- aq_micro fp_ovl
- aq_pwr

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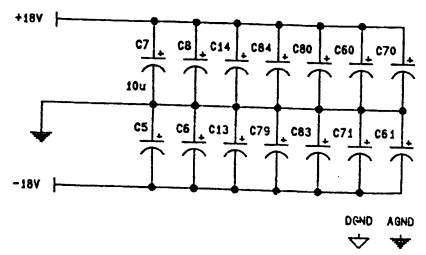
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DATE 1002
 8-30-93 NEW P.C. BOARD .PF 11-3.
 Repair 52K. OLD INPUT BOARD. OUTPUT WINS 1111
 REPA. 52K-T OLD INPUT 1111



MEASURE AT 5105VAC

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aq_dgtl	fp_led
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aq_pwr	

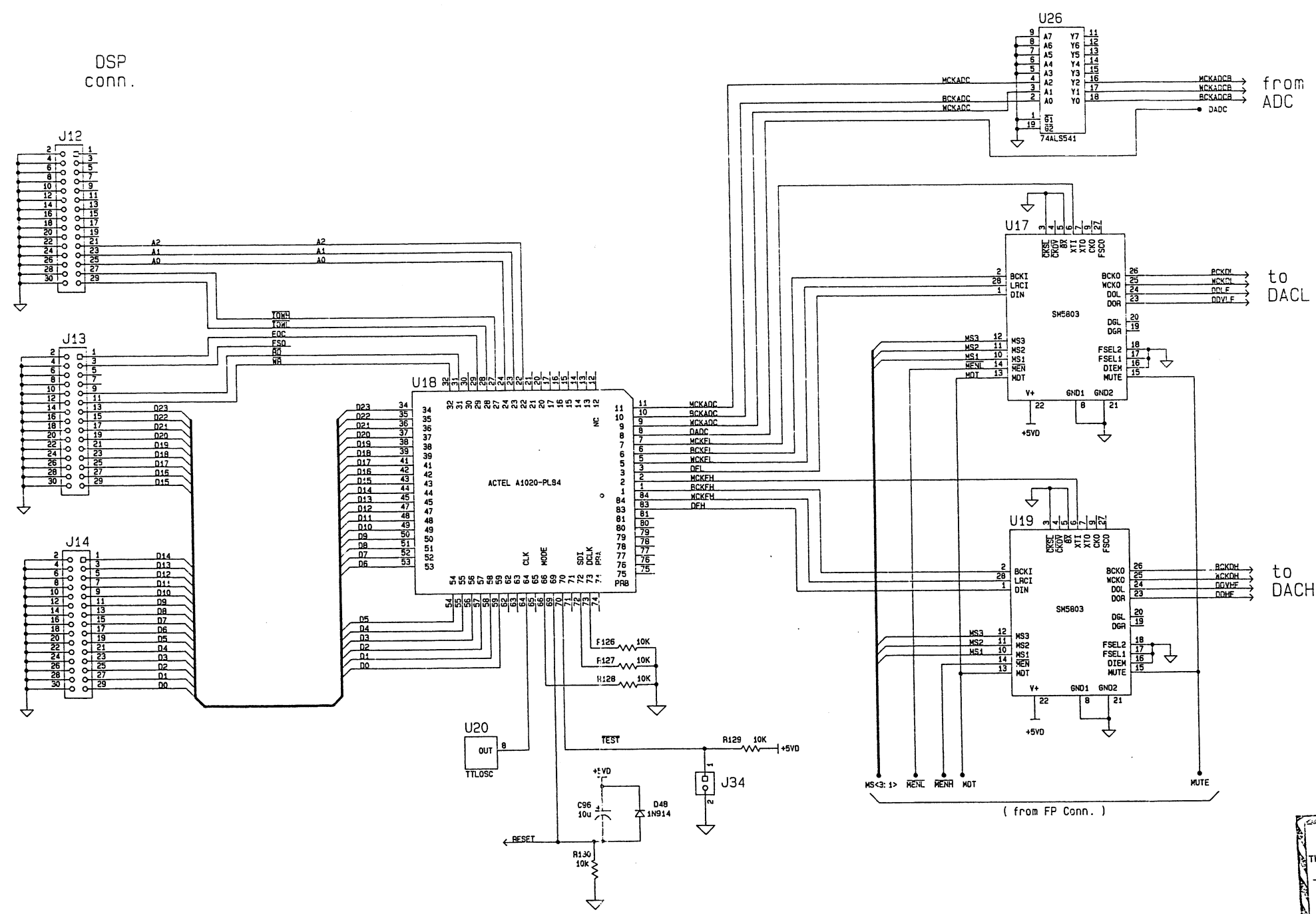


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FILE: 258866-1.SCH		

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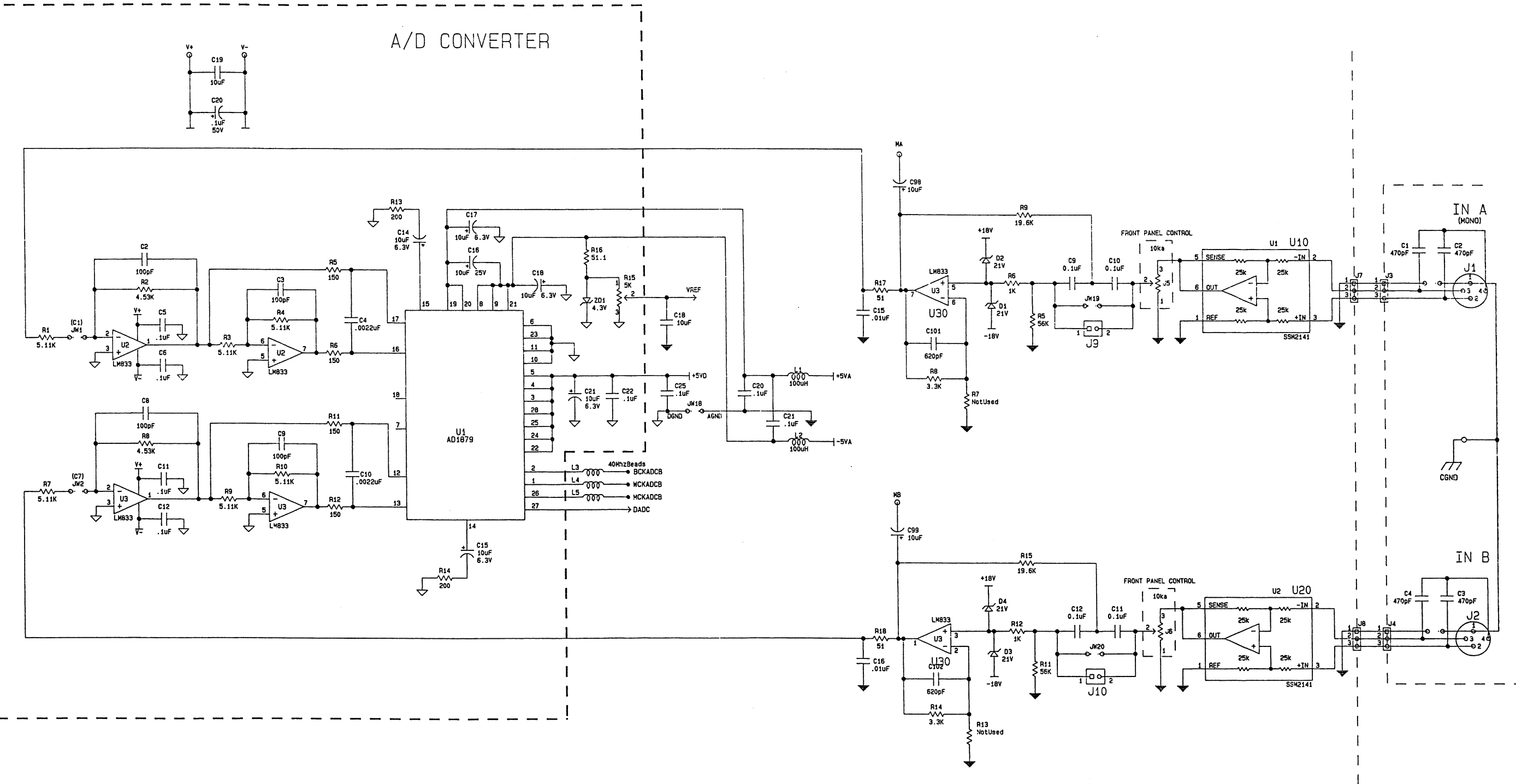
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					REV
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					SCALE
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					SHEET
					1 OF 5

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- aq_dgt1 fp_led
- aq_micro fp_ovl
- aq_pwr

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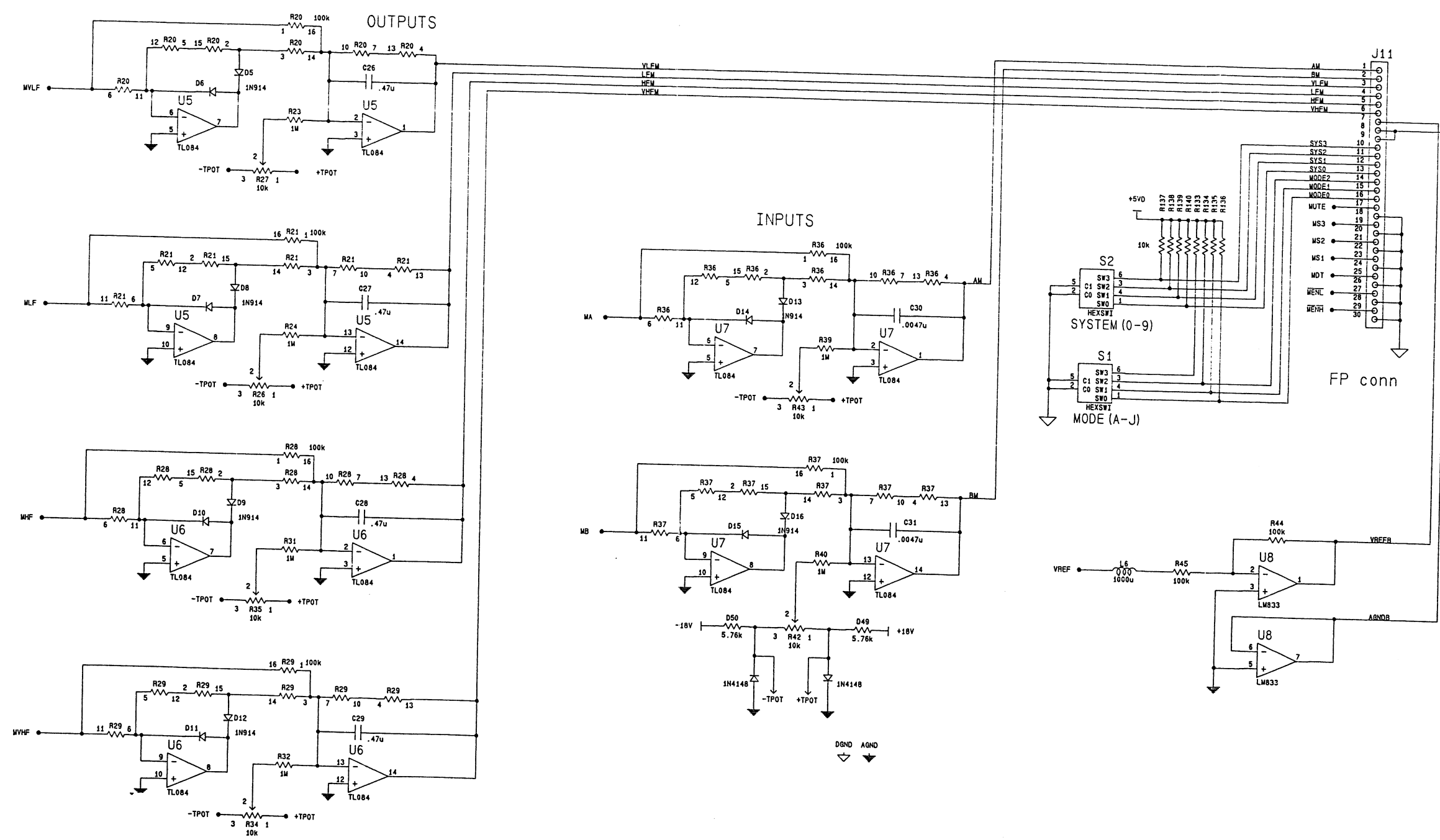
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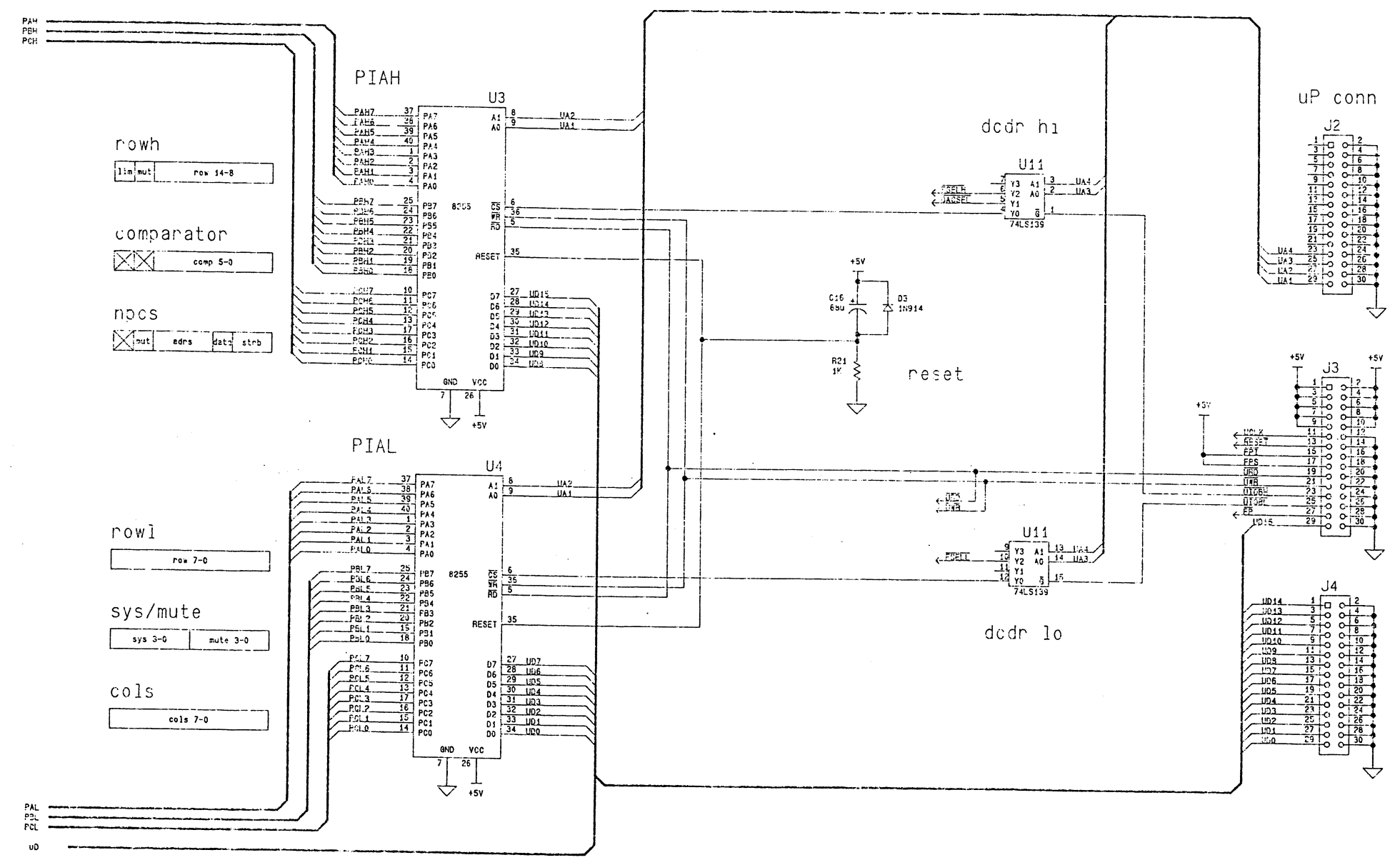
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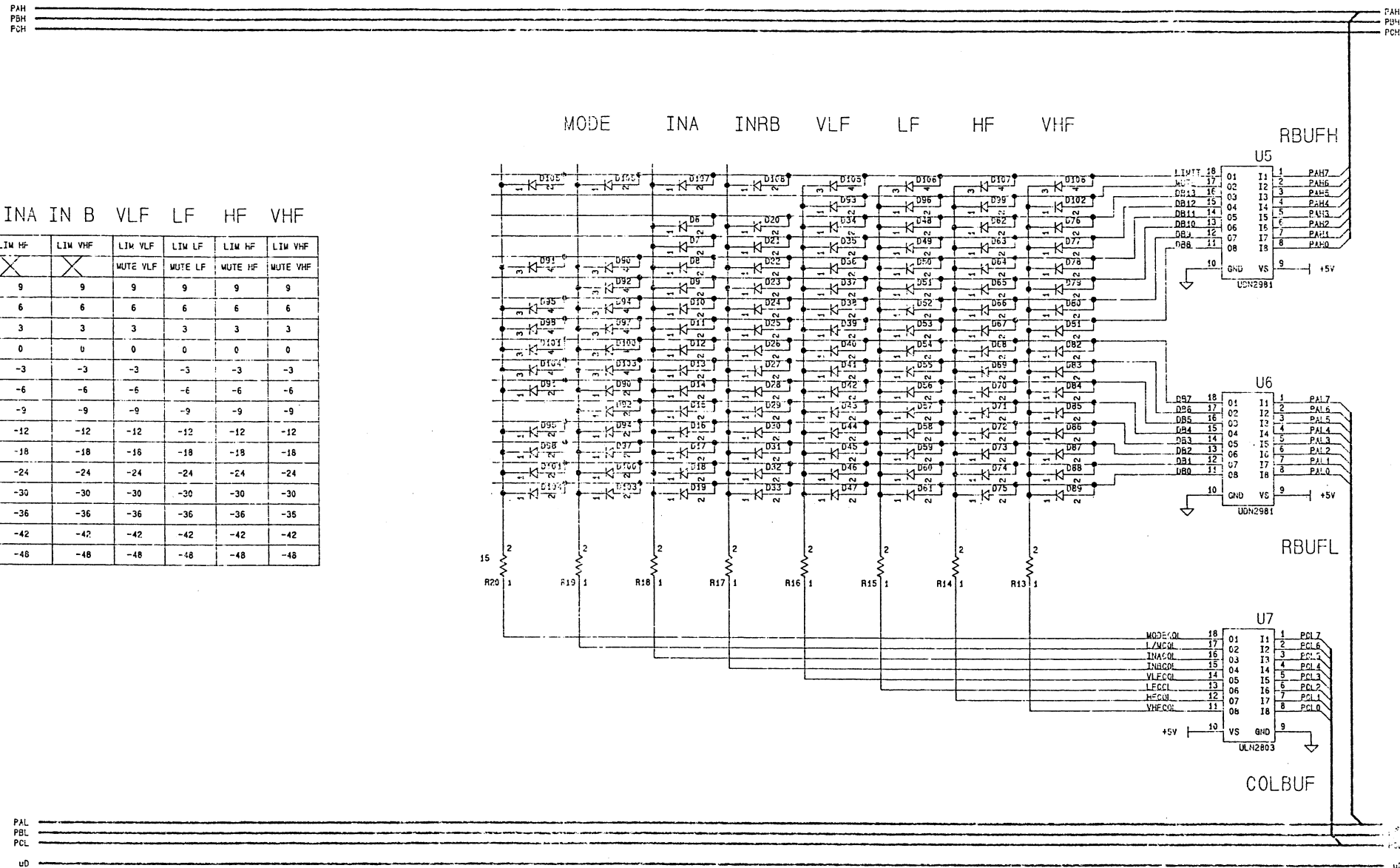
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MODE		INA	IN B	VLF	LF	HF	VHF
LIM VLF	LIM LF	LIM HF	LIM VHF	MUTE VLF	MUTE LF	MUTE HF	MUTE VHF
X	X	X	X	9	9	9	9
X	X	X	X	6	6	6	6
MONO IN	STER A IN	3	3	3	3	3	3
X	STER B IN	0	0	0	0	0	0
MONO VLF	STER A LO	-3	-3	-3	-3	-3	-3
MONO LF	STER A HI	-6	-6	-6	-6	-6	-6
MONO HF	STER B LO	-9	-9	-9	-9	-9	-9
MONO VHF	STER B HI	-12	-12	-12	-12	-12	-12
MONO IN	STER A IN	-18	-18	-18	-18	-18	-18
X	STER B IN	-24	-24	-24	-24	-24	-24
MONO VLF	STER A LO	-30	-30	-30	-30	-30	-30
MONO LF	STER A HI	-36	-36	-36	-36	-36	-36
MONO HF	STER B LO	-42	-42	-42	-42	-42	-42
MONO VHF	STER B HI	-48	-48	-48	-48	-48	-48

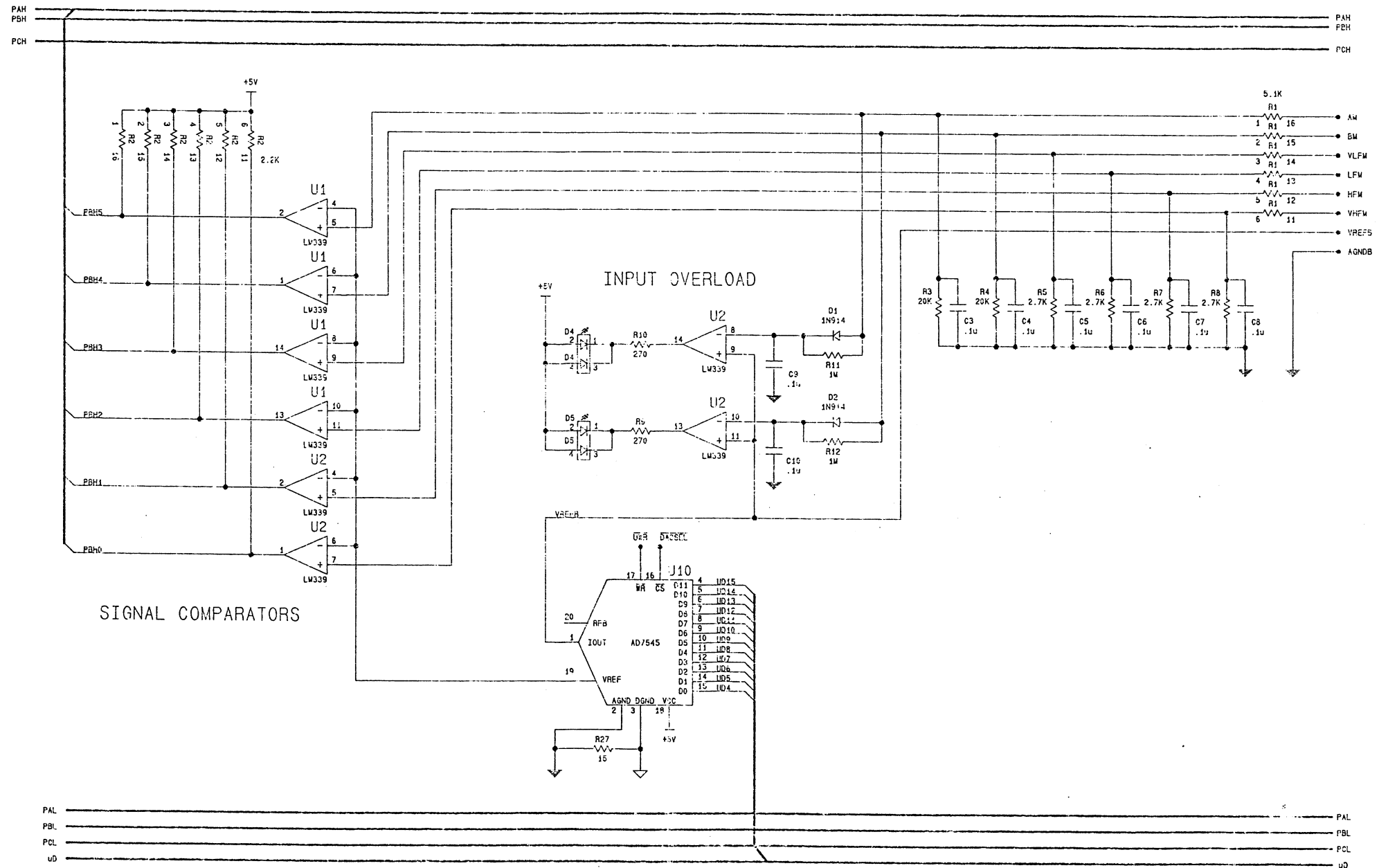
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- aq_dac fp_cnf
- aq_dgtl fp_led
- aq_micro fp_ovl
- aq_pwr

max: 50 mA pk @ 10% duty, 1kHz rate

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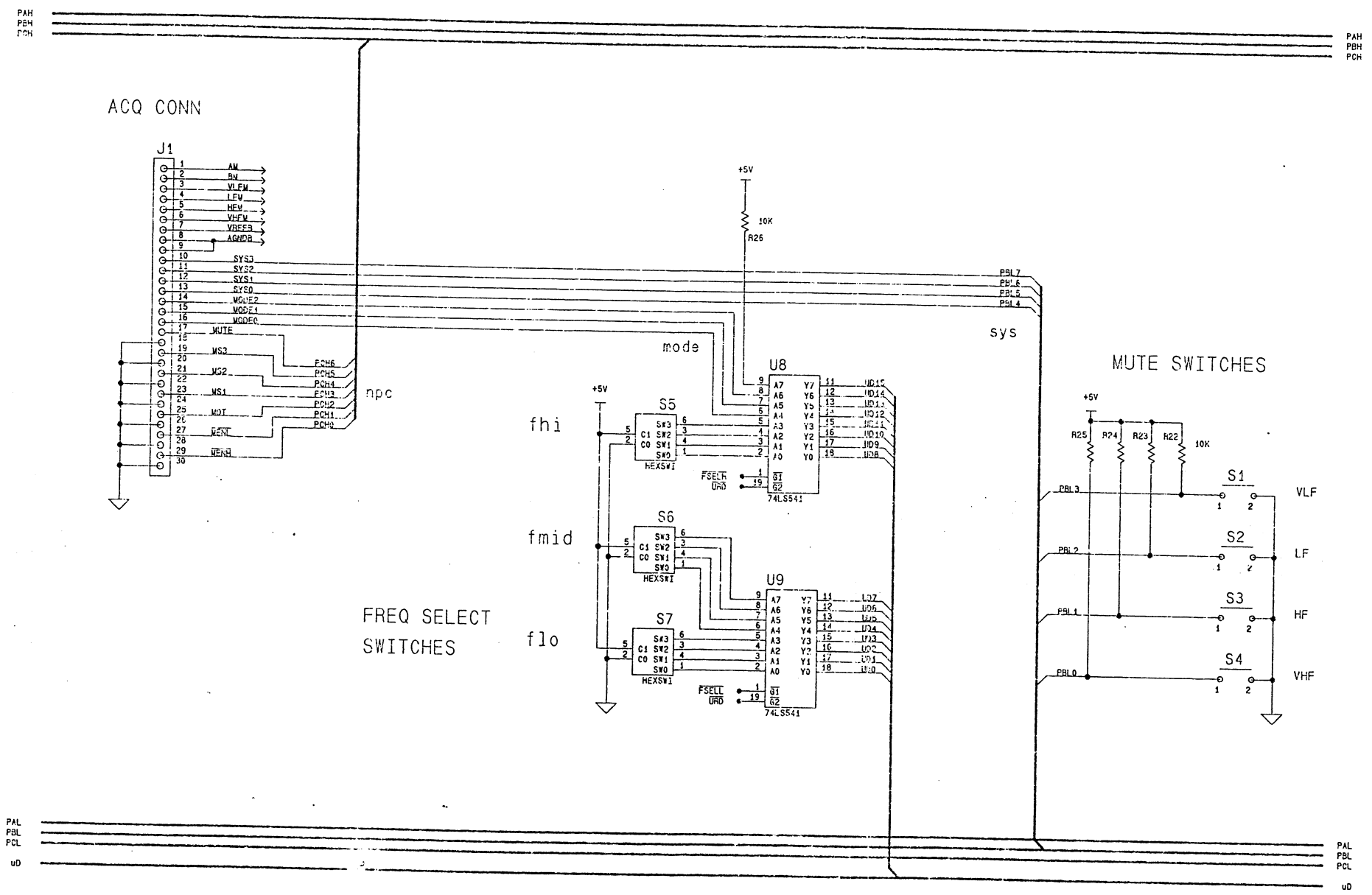


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- aq_micro fp_ovl
- aq_pwr

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TITLE ES52000, FP, PEAK/OVL			
SIZE D	DRAWING NO. 258888	REV 4	
SCALE NONE	SHEET 2	OF 4	
FILE 258888-2.SCH	PLOTTED 153	NO 6	DATE 1992

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SV3	SV2	SV1	SV0	MS0	MS1	MS2	MS3	svs/mute
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	cmp/mode
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		DB8	DB9	DB10	DB11	DB12	DB13	rowh

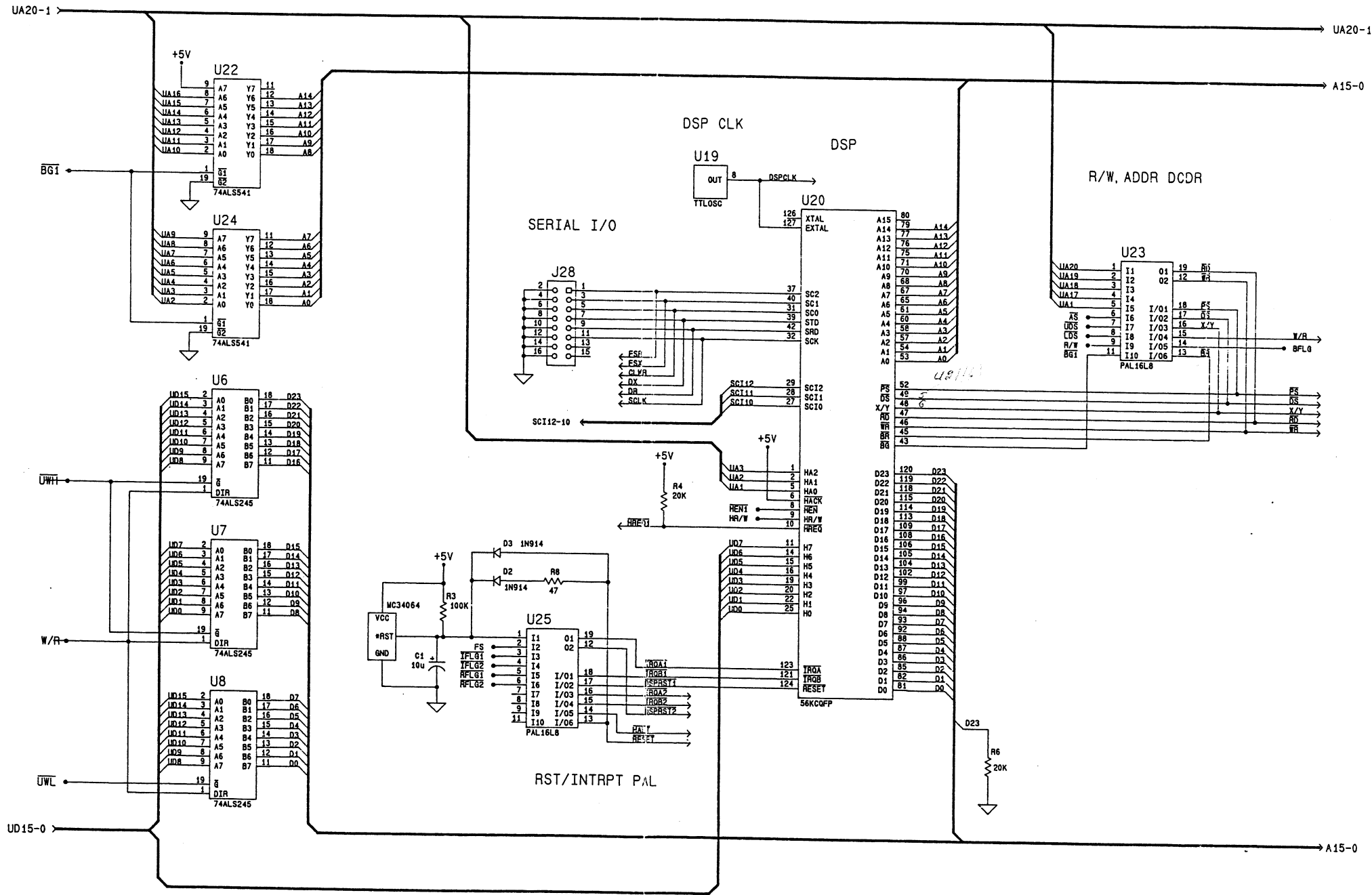
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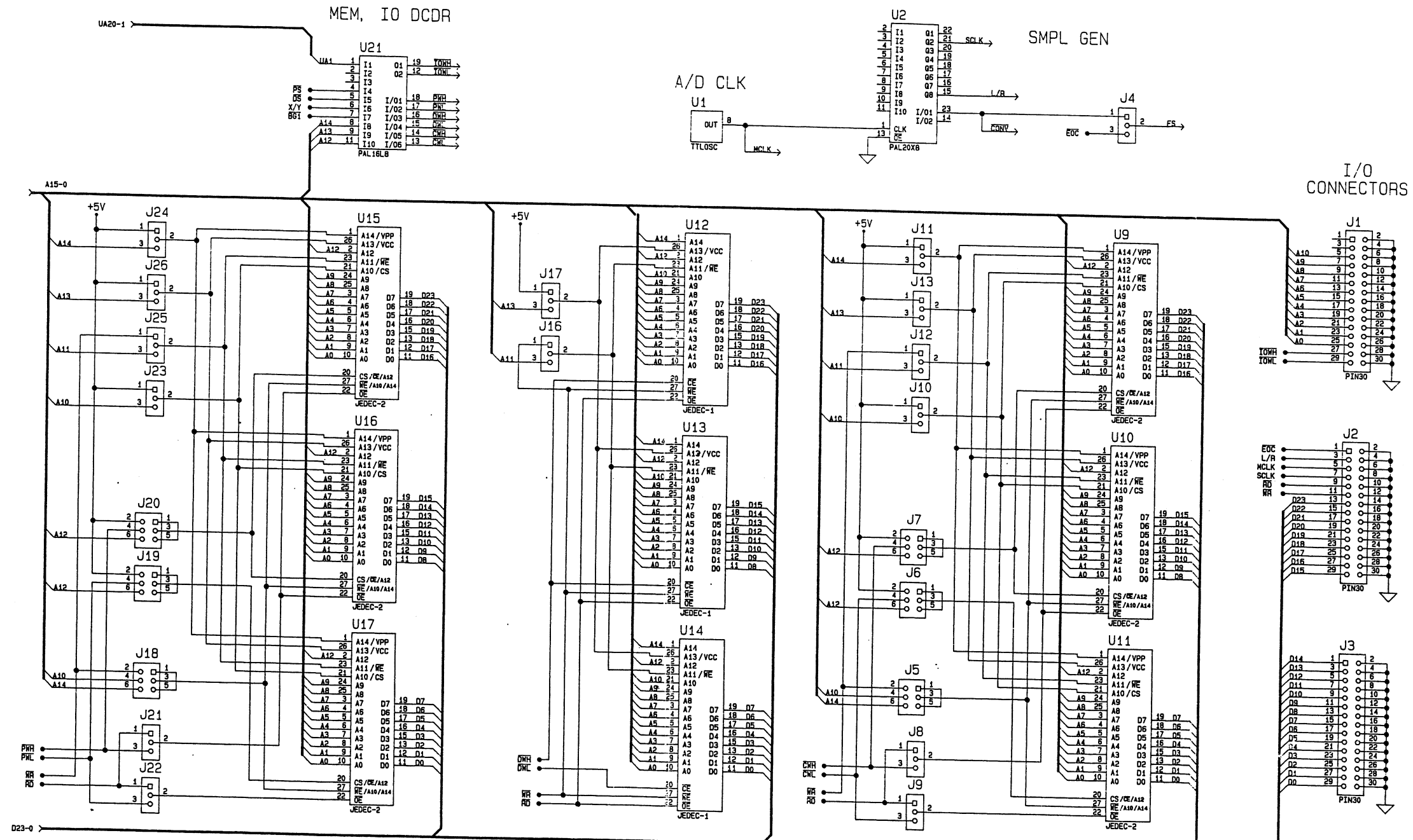
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H.E. DOZ [Signature]

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		APPROVAL		DATE	harman electronics A Harman International Company Northridge, California 91329, U.S.A.	
FRACTIONS	DECIMALS	ANGLES	DRAWN	M. BURCKHARDT	3/19/92	TITLE
± x	.xx ± x	± x	CHECKED	[Signature]	4/2/92	ES52000, DSP
MATERIAL	NA	MANUFACTURING	PRODUCT ASSURANCE	ENGINEERING	SIZE	D
FINISH	NA	SCALE	NONE	SHEET	1 OF 5	DRAWING NO. 258877 REV 3
NEXT ASSY	USED ON	FILE	258877-1.SOH	PLOTT:	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	APR 16 1992

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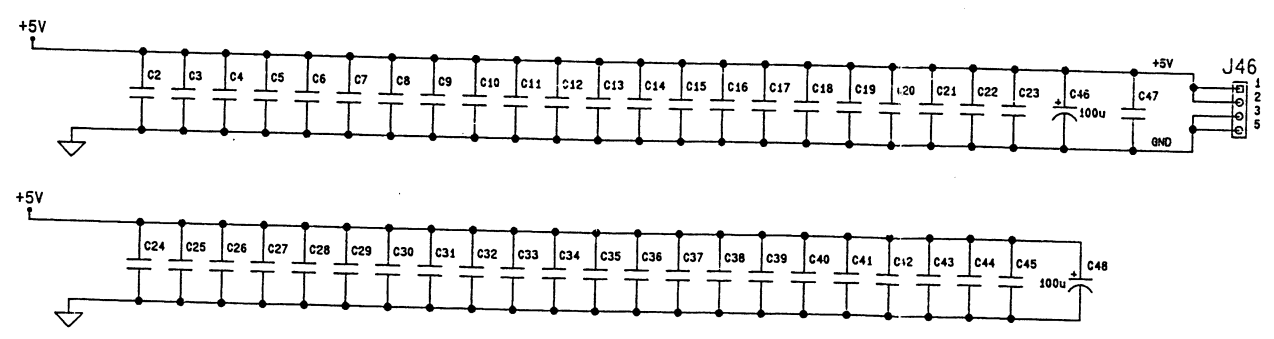
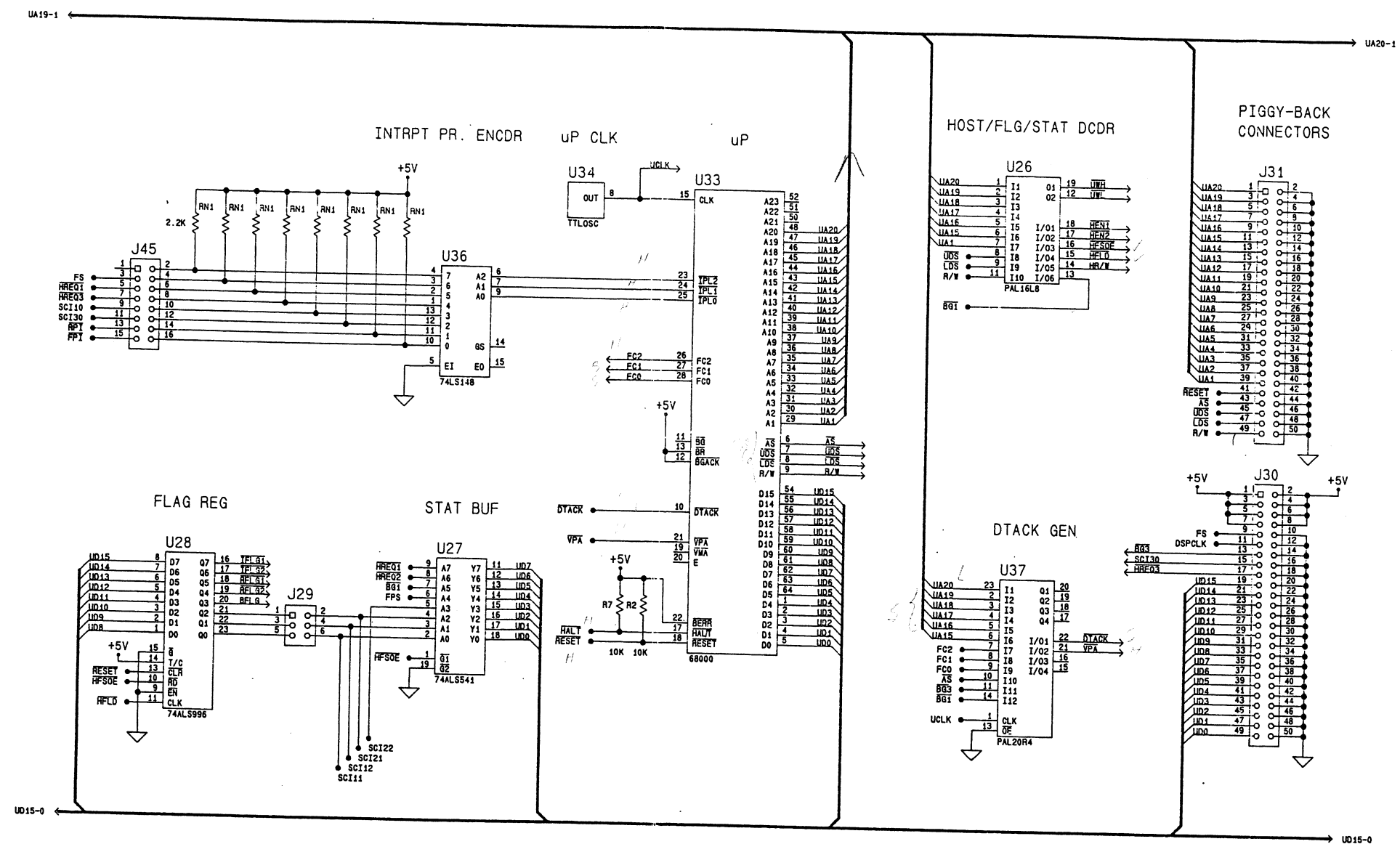
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H.E. [unclear]

harman electronics A Harman International Company Northridge, California 91329, U.S.A.	
TITLE ES52000 DSP, MEM I/O	
SIZE D	DRAWING NO. 258877
SCALE NONE	REV 3
SHEET 2 OF 5	FILE: 258877-2.SCH
1	PLOTTED: YES [] NO [] 2 APR 16 1992

D
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8 | 7 | 6 | 5 | 4 | 3 | 2

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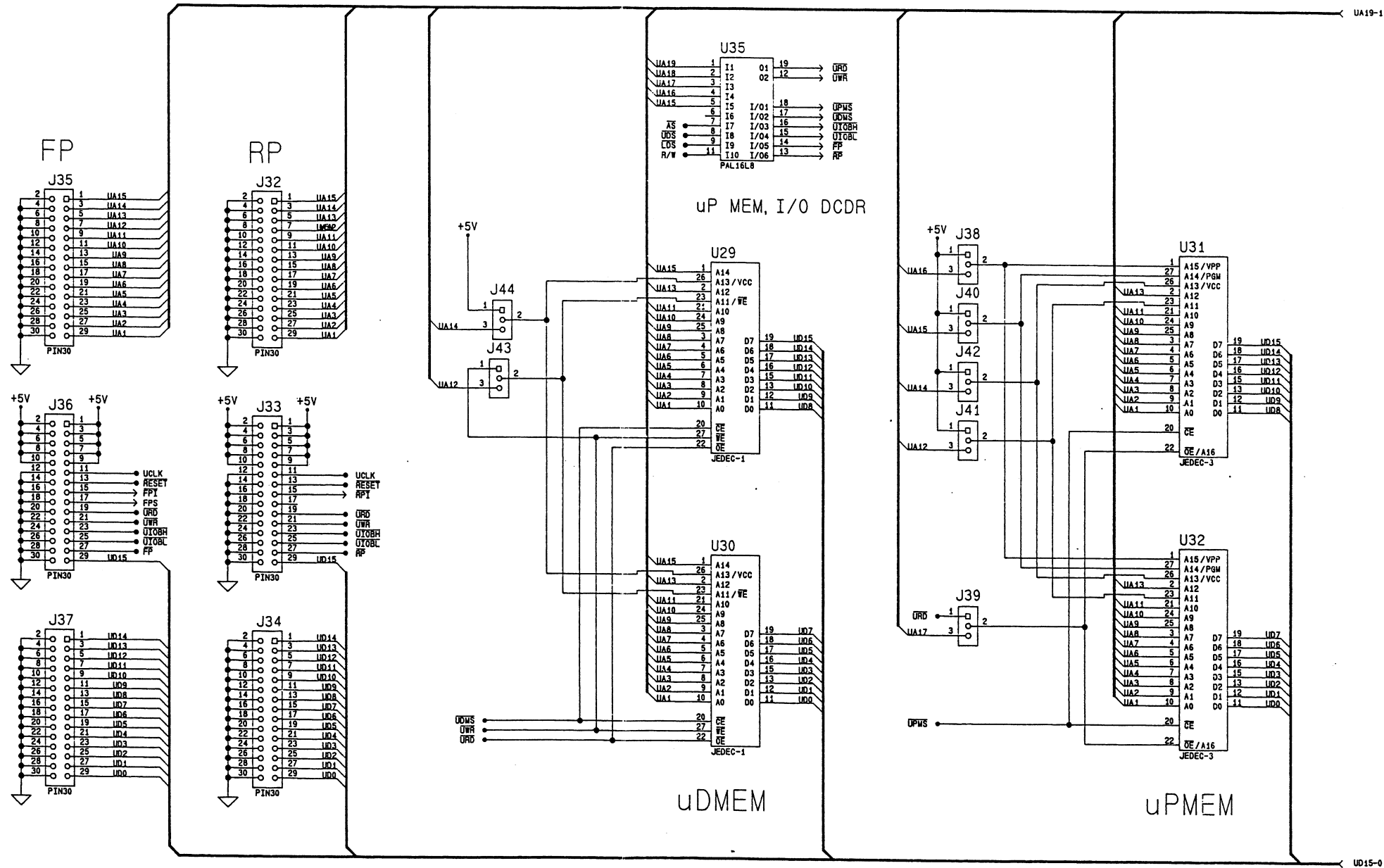
NOTE: All caps .1u except as indicated.

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harman electronics A Harman International Company Northridge, California 91329, U.S.A.		
TITLE ES52000, uP		
SIZE D	DRAWING NO. 258877	REV 3
SCALE NONE	SHEET 3 OF 5	
FILE: 258877-3.SCH 1 PLOTT: 2 APR 16 1992		

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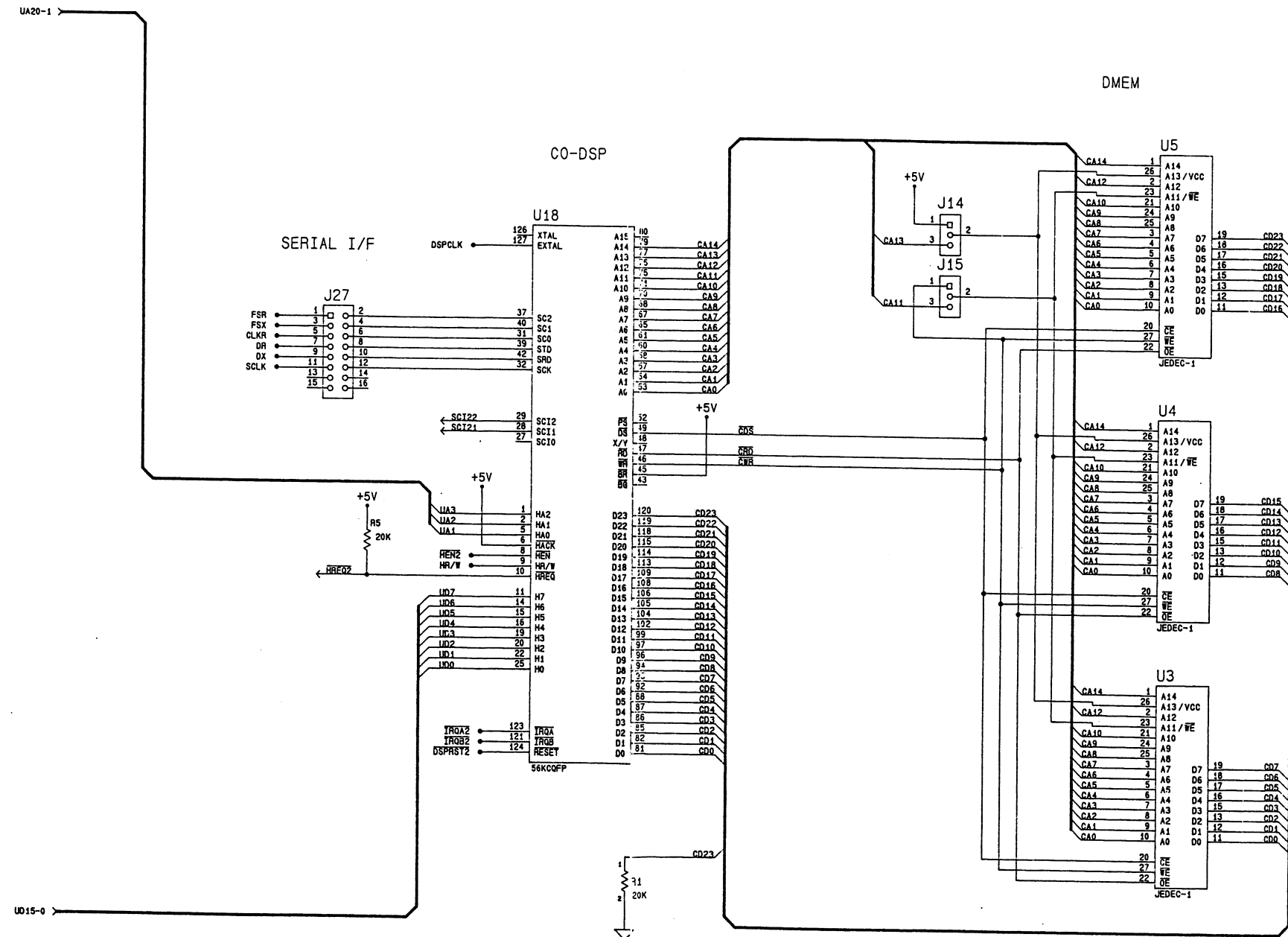
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TITLE ES52000, uPMEM, I/O		
SIZE D	DRAWING NO. 258877	REV. 3
SCALE NONE	SHEET 4 OF 5	
FILE: 258877-4.SOH	1	PLPPT: YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> 2 APR 16 1992

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TITLE ES52000, COPROC.		
SIZE D	DRAWING NO. 258877	REV 3
SCALE NONE	SHEET 5 OF 5	NO 5
FILE: 258877-5.SOH 1 PLOTT: YES [] NO [] 2 APR 16 1992		