



X2 SERVICE MANUAL

REV 0,1

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The Pass Labs X2 is a high performance audio preamplifier, intended for maximum performance in reproduction of music. It is a simple design, having only a single balanced gain stages consisting of balanced pairs of power Mosfets biased by a constant current sources.

Figure 1 shows the block diagram of one channel of the preamplifier. There are three unbalanced inputs and one balanced input. The balanced input is converted to single-ended via a differential amplifier. The signal from all four inputs is presented to the Select and Tape Mon switches. The wiper of the Select switch attaches to the input volume control, and its wiper feeds one input of a balanced gain stage. The output of the balanced gain stage is the output of the preamp.

Fig. 2 shows the schematic of the balanced input circuit. Mosfets Q101 and Q102 form a differential pair operated without feedback. They are biased by a constant current source Q3. Balanced input signals are presented to the Gates of Q101 and Q102 and the output signal appears at the Drain of Q102. The gain of this circuit is approximately unity.

Z101-104 protect the inputs from input voltages greater than 9 volts.

Fig 2 also shows the various voltages at different points in the circuit which are helpful in confirming proper operation. These voltages are not critical, and if the value measured is similar to the specified, the circuit will operate properly.

When using the preamplifier with a single-ended input, the negative input should be shorted to ground for best performance. This is accomplished by using shorting plug between pins 1 and 3 on the XLR input connector.

Fig 3 shows the schematic of the balanced output stage. It is similar to the input stage, except that it is biased slightly higher and has only a single input but dual outputs. It also has approximately 10 dB of gain when loaded by the 1.5 Kohm output resistors R316 and R317. The

preamp is shipped with the Gain jumpers shorted. With the output Gain jumpers open, the gain is approximately 17 dB.

The Relay switches shown in this schematic are controlled by the power supply and are used to mute the output on turn-on and when the supply voltage goes to low to regulate. A common problem which occurs in the X2 is when the preamp does not operate due to low line voltage. To fix this, either get a higher line voltage or short across one of the Zener diodes in the supply stack Z9 – Z17 to lower the regulated supply by 9.1 volts.

Fig 4 shows the detail of the wiring of the volume control. The volume control consists of a two pole selector switch with 23 positions which is wired with precision resistors to form an attenuating network for the input to the gain circuit.

Fig 5 shows the power supply schematic to Rev 0, and Fig 6 shows the schematic to Rev 1.

The dual power supply transformers each have dual primary windings which can be set up for 115 or 230 volts AC. These primary windings are shown in Fig 5 as parallel for 115 volts, but they may be wired in series on each transformer for 230 volts. Both transformer's primaries are wired in parallel for 115 or 230 volt operation.

The power supply is rated down to approximately 100 volts AC and 200 volts AC before the supply unregulates. For Japanese 100 volt operation, the transformers are wired for 120 volts and Zener Diode Z9 is shorted.

The output of the transformers is rectified to form a network of four 40 volt rails attached in series. The ground for the system is tapped to provide -40 volts, 0, and +120 volts unregulated.

The negative voltage is regulated to -32 volts by Zeners Z5-Z8 and P channel Mosfet follower Q2. The -32 volts is used to provide supply for the the current sources which bias the differential gain pairs of the audio circuits. Vref is formed at 9 volts referenced to the negative rail

for the purpose of setting up a bias voltage to control the current sources.

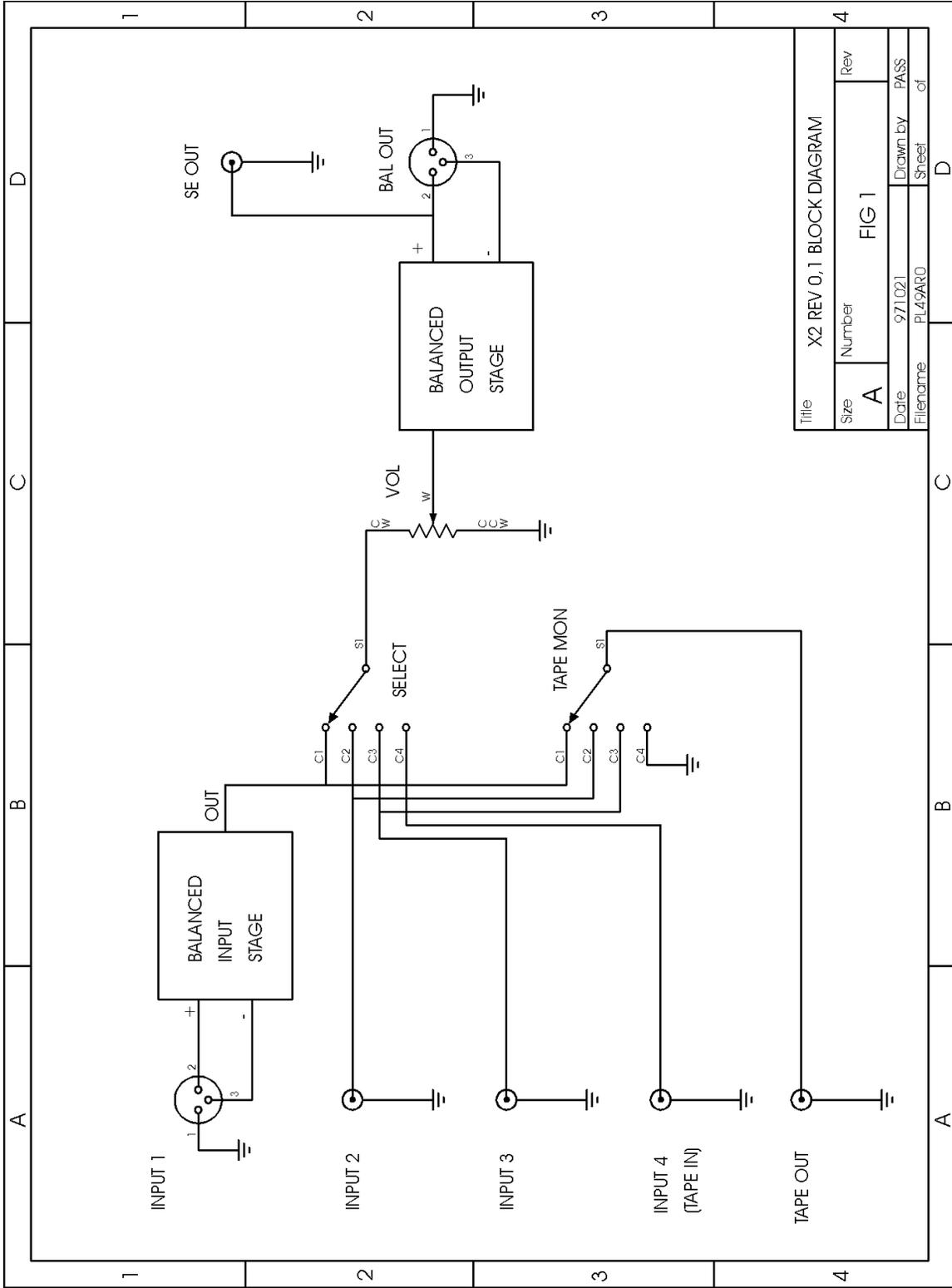
+REG voltage of approximately 85 volts is formed by Zener stack Z8 – Z17 and N channel Mosfet follower Q1 to provide the main regulated voltage for the audio circuits.

The output muting relay is controlled by the circuit of Q3 and Q4 and the surrounding components. Q3 conducts only when there is approximately 8 volts more unregulated voltage than unregulated output, insuring that the output relays will open only when adequate rail voltage exists for proper regulation. Q4 turns on after a short delay on turn-on. For the relays to un-mute the output, both Q3 and Q4 must be conducting.

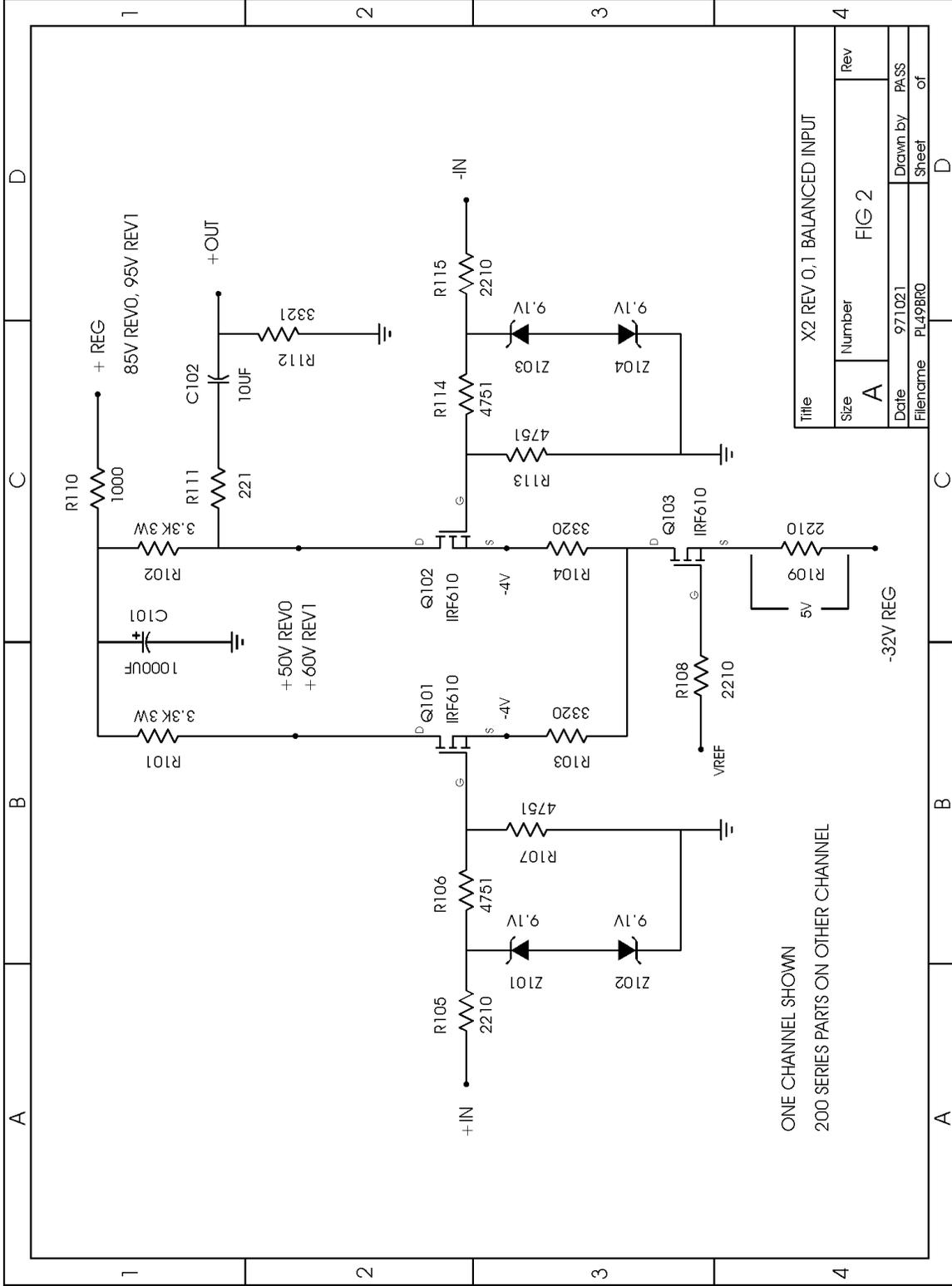
Fig 6 shows the supply schematic for Rev 1. It is very similar to Rev 2 except that the regulated positive rail voltage has been increased to 95 volts, and dual regulators Q1 and Q2 have been provided.

Fig 7 shows the board layout for Rev 0. Components 1-99 are power supply components. Components in the 100-199 range are the right channel input circuit, 200-299 are the left channel input circuit, 300-399 are the right channel output circuit, and 400-499 are the left channel output circuit.

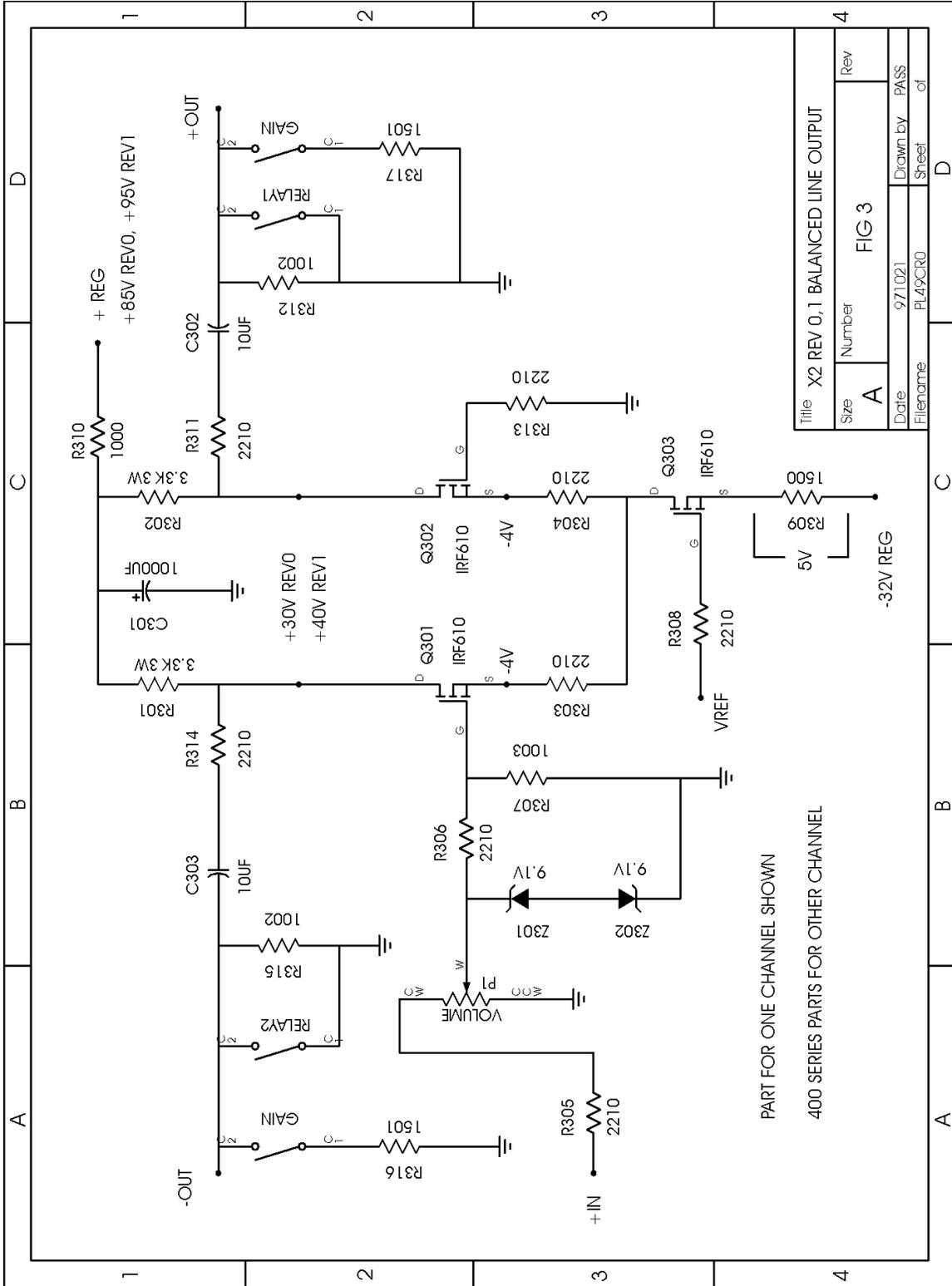
Fig 8 shows the board layout for Rev 1, where the same numbering scheme applies.



Title		X2 REV 0, 1 BLOCK DIAGRAM	
Size	Number	Rev	
A	FIG 1		
Date	971021	Drawn by	PASS
Filename	PL49AR0	Sheet	of



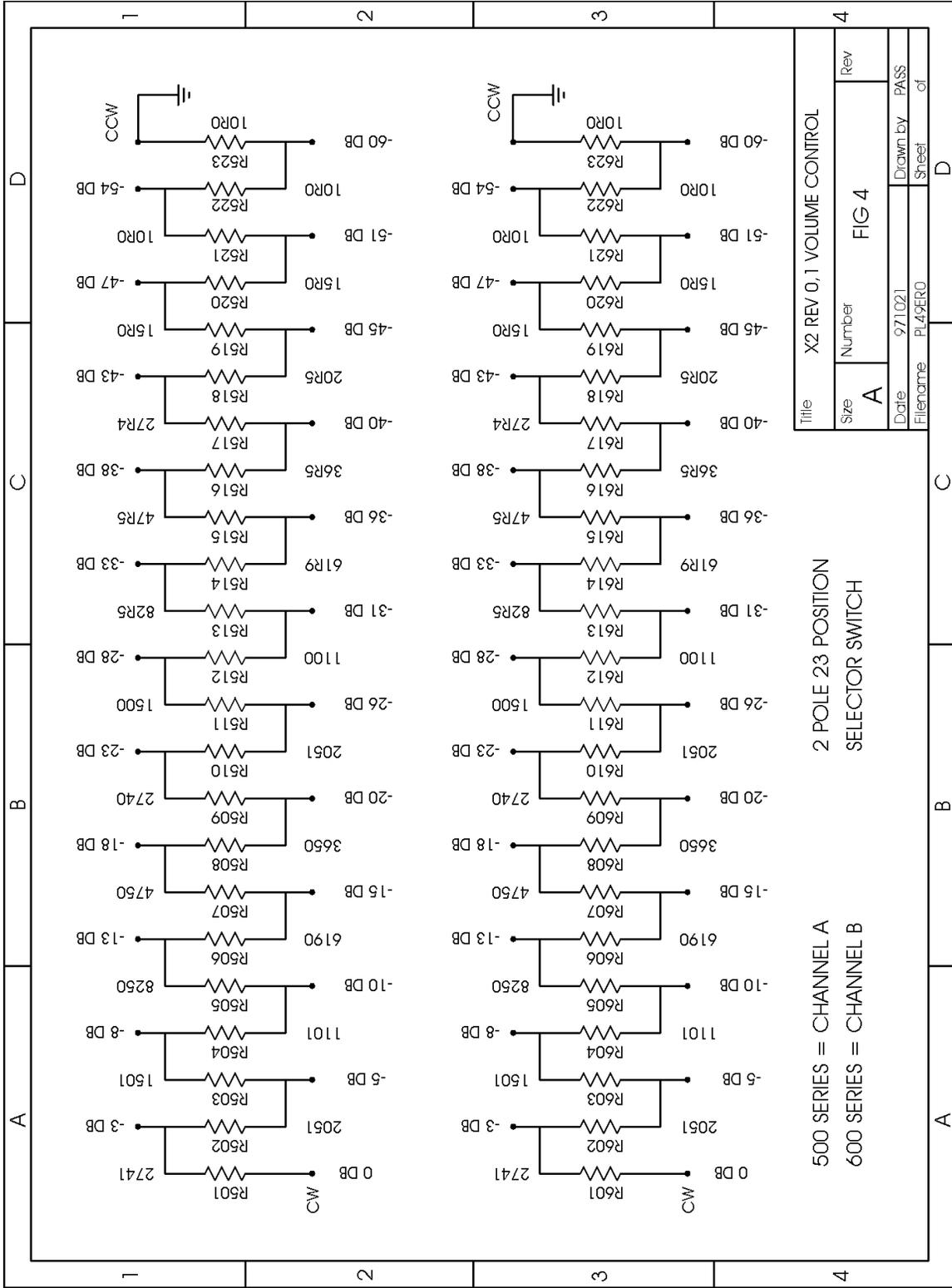
Title		X2 REV 0,1 BALANCED INPUT	
Size	Number	Rev	
A	FIG 2		
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Filename	PL49BR0	Sheet	of



PART FOR ONE CHANNEL SHOWN

400 SERIES PARTS FOR OTHER CHANNEL

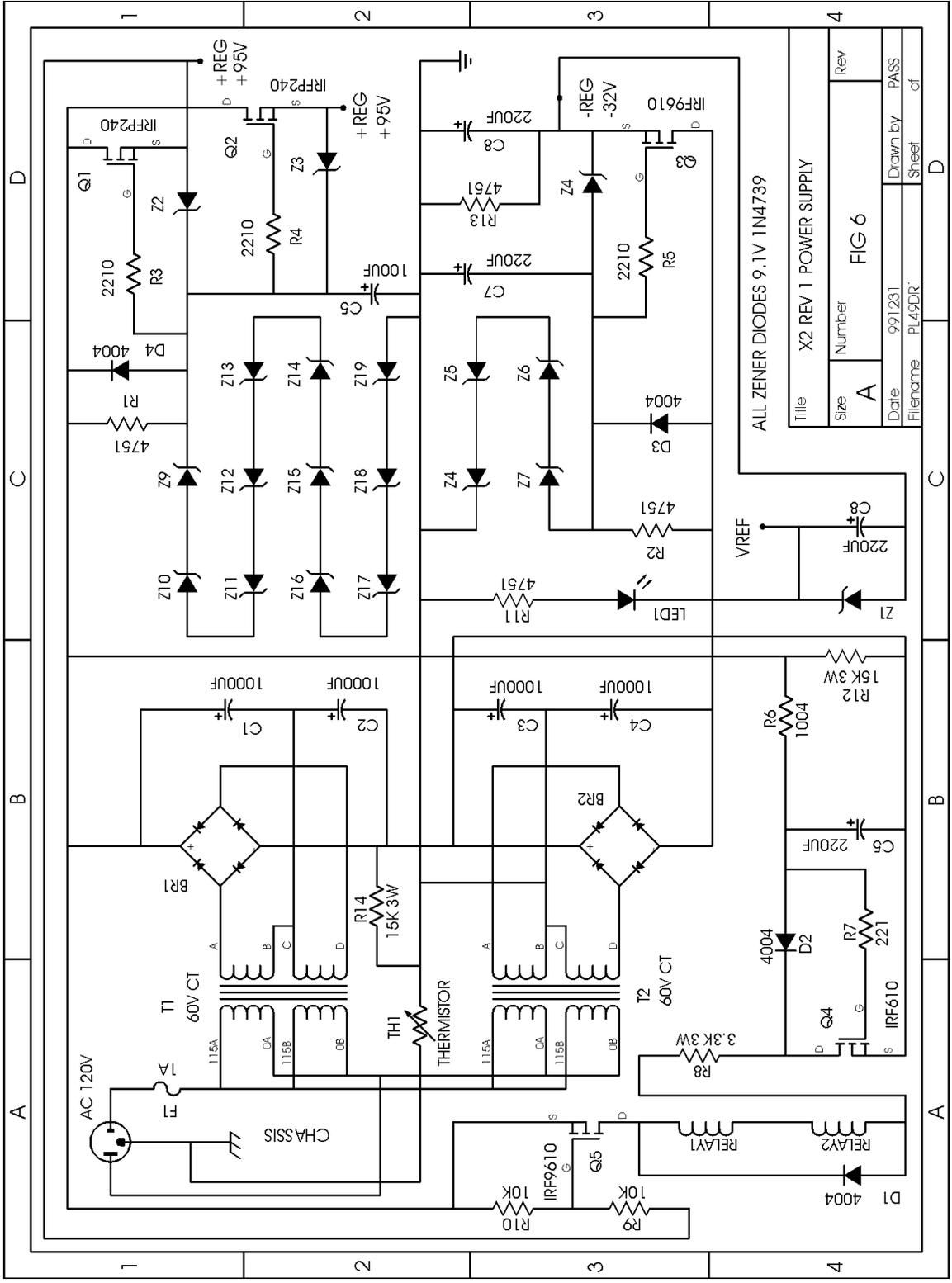
Title	X2 REV 0,1 BALANCED LINE OUTPUT		
Size	Number	Rev	
A	FIG 3		
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Title		X2 REV 0,1 VOLUME CONTROL	
Size	Number	Rev	
A	FIG 4		
Date	971021	Drawn by	PASS
Filename	PL49ER0	Sheet	of

2 POLE 23 POSITION
SELECTOR SWITCH

500 SERIES = CHANNEL A
600 SERIES = CHANNEL B



ALL ZENER DIODES 9.1V 1N4739

Title	X2 REV 1 POWER SUPPLY
Size	Number
A	FIG 6
Date	991231
Filename	PL49DIR1
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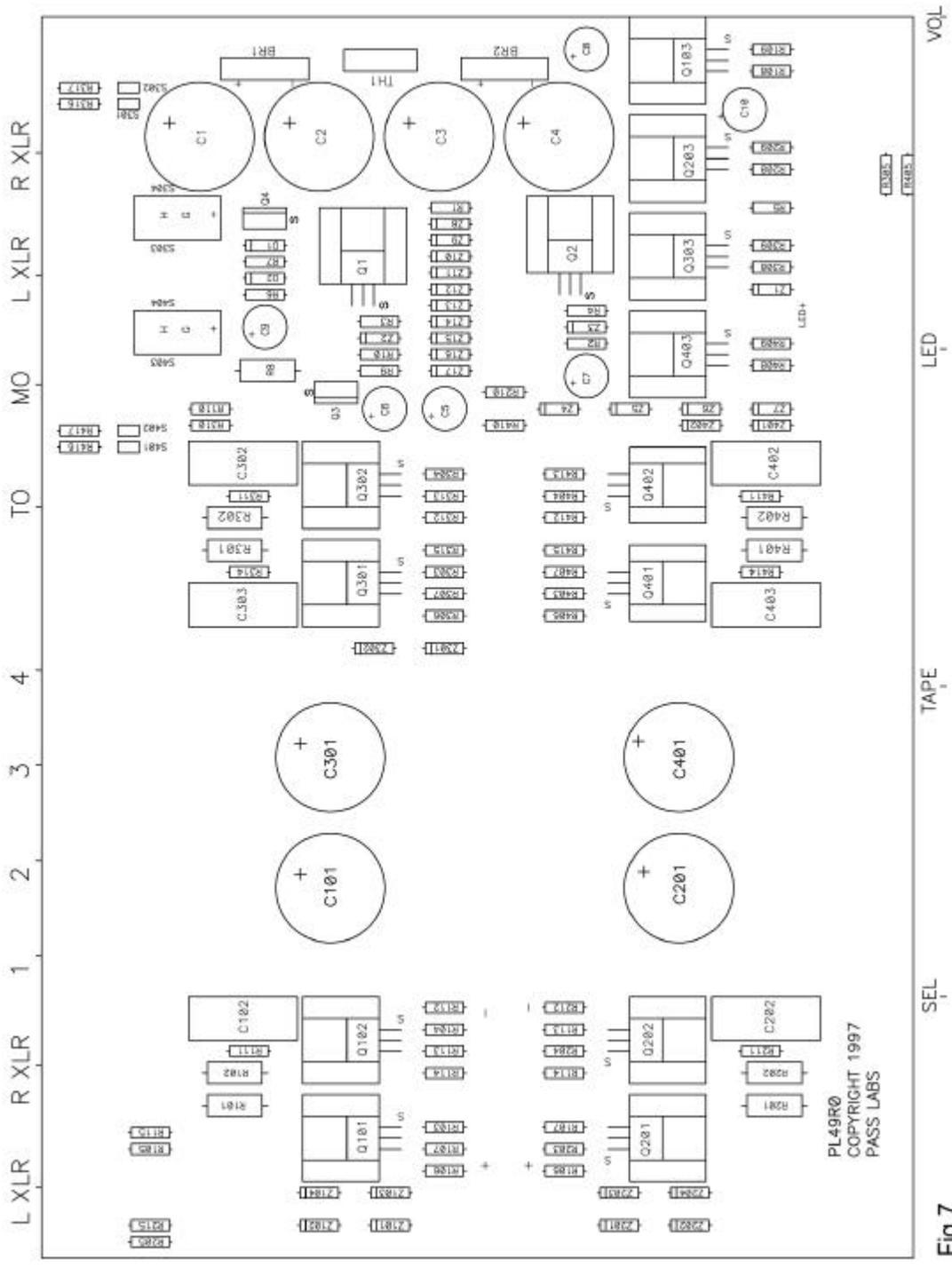


Fig.7

