

Kustom[®]



OWNER'S MANUAL

✓ **PUBLIC**

ADDRESS

SYSTEM



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P/N 006-0059-00

KUSTOM WARRANTY

All Kustom amplifiers, power units, mixers, and their associated components and parts, except as specified below, are guaranteed, by Kustom Electronics, Inc., to the original purchaser to be free of defects in material or workmanship for a period of five (5) years from the date of purchase.

— and —

All Kustom speaker cabinets and their associated components and parts, except as specified below, are guaranteed, by Kustom Electronics, Inc., to the original purchaser to be free of any defects in materials and workmanship for a period of one (1) year from the date of purchase.

— provided —

- (1) The original purchaser applies for a Kustom Warranty Card for the guaranteed product(s) within 10 days of the date of purchase; and,
- (2) Within the applicable period of this guarantee, the original purchaser delivers, at his own expense, the defective product(s) to an Authorized Kustom Dealer or Service Center for repair; or, where no such dealer or service center is nearby, obtains at his own expense from Kustom Electronics, Inc., an "Authorization Number" to return merchandise and ships, at his own expense, the defective product(s) to Kustom Electronics Customer Service, 909 W. Cherry, Chanute, Kansas 66720. The repaired product(s) will be returned freight prepaid.

Kustom Electronics, Inc., will, at its option, repair or replace the defective part(s) or product(s).

Excluded from coverage by this warranty are exterior surfaces and finishes, face panels, grill cloth, covers, knobs, handles, casters and appearance items.

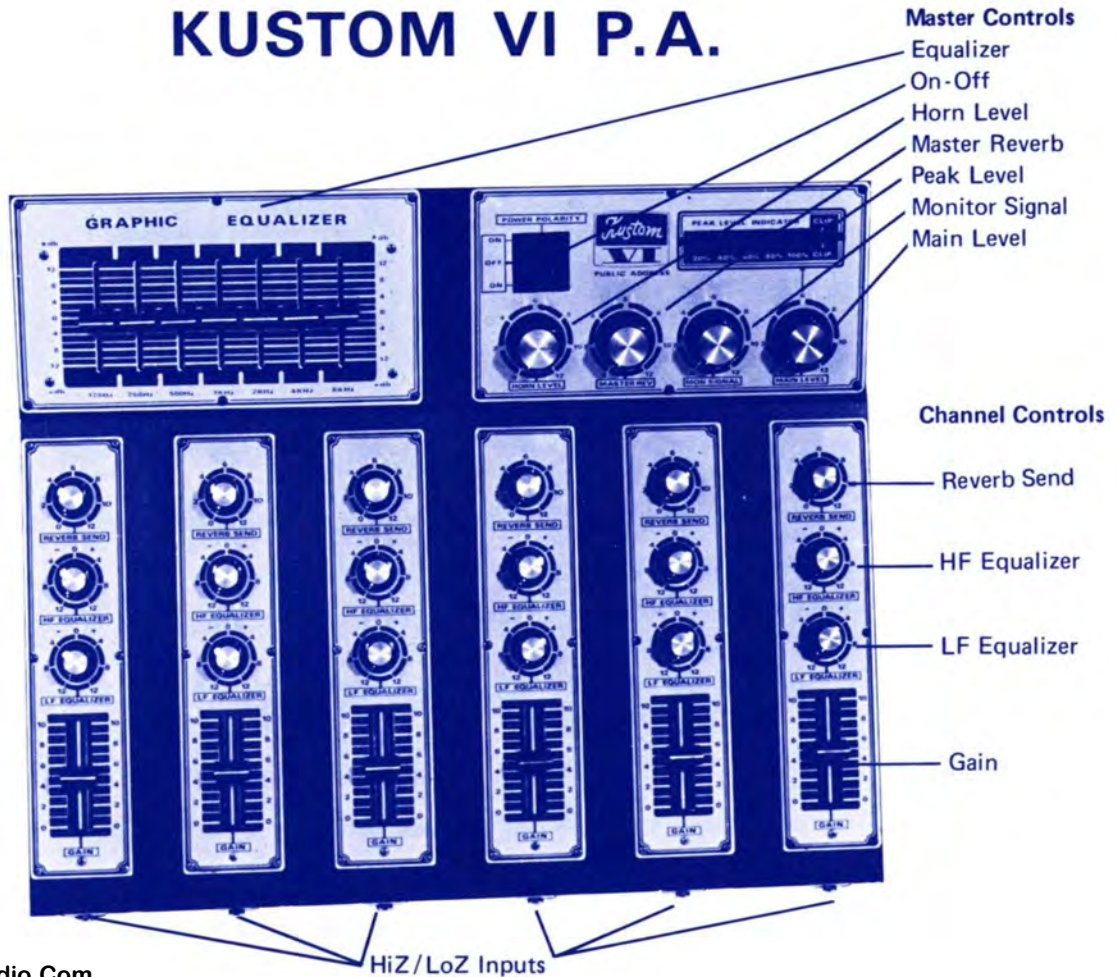
Any modification of the Kustom-manufactured product(s) such as the installation of substitute parts, rewiring or other changes to the system without written authorization from Kustom Electronics, Inc., will automatically void this warranty.

Kustom Electronics, Inc., shall not be liable for any direct, special, incidental or consequential damages incurred by reason of a breach of the above provisions, except as expressly provided above.

The provisions of this warranty shall be covered by the local laws of the state where the original purchaser shall purchase products covered hereby, and shall be enforceable only to the extent, and in the manner, permitted under such laws.

EXCEPT AS HEREIN EXPRESSLY PROVIDED, KUSTOM ELECTRONICS, INC., MAKES NO WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.

KUSTOM VI P.A.



INTRODUCTION

The Kustom VI PA is a high performance, reliable sound reinforcement system which will provide exceptional performance when operated properly. This instruction manual provides useful information which could prevent problems on a gig. A little time spent reading the manual could save a lot of time trying to find problems that do not exist.

GENERAL

The Kustom VI PA is a six-input mixer with a 200-watt RMS bi-amplifier built into the power unit for maximum portability. The standard speaker system consists of two horn-loaded, 15-inch bass speakers and two mid- and high-frequency horn arrays. For additional flexibility, a monitor system including two monitor slants and a graphic equalizer/power amplifier may be added.

The Kustom VI PA is equipped with a LED PEAK LEVEL INDICATOR, allowing the operator to detect extremely fast transients which would be unnoticed by the standard VU meter. The mixer output is 1.0 RMS volts when a 100% indication is shown.

BI-AMPLIFICATION

Bi-amplification is a relatively new term in the music market, although the technique has been used by the largest groups and large sound reinforcement companies for several years. When referring to bi-amplification in this manual, we shall be considering its use for PA and sound reinforcement purposes only. However, bi-amp can also be used for bass and guitar amplifiers.

The conventional passive crossover network unit simply splits the signal from the power amplifier into bands. These bands are considered as being above or below the crossover frequency which is usually 500Hz or 800Hz, depending upon the speaker system used. The high band is fed to the horn while the bass cabinet receives the low band. When the sound level required is relatively low and the amplifier power is high, this procedure is adequate.

In some passive crossover systems, the power loss in the network might approach 30%. A greater disadvantage to the conventional passive crossover network is seen in the following situation:

At one time or another, nearly everyone who has played in a band has plugged a microphone or guitar into a bass amplifier. The sound is usually fair until the bass player gets down on the strings. The bass sounds fine, but the voice or guitar sounds like it is being played through six layers of waxed paper. The end result is that the musicians "figure out" that the speakers are not right for PA or lead guitar use. This is a partial truth. The main problem is that the power amplifier just doesn't have enough power to achieve the loudness levels required.

This example vividly demonstrates PA system functions and requirements. For good sound balance in a PA system, approximately 10 times as much power is needed to amplify bass than is required to amplify lead guitar and voice parts.

A conventional crossover network directs approximately 50% of the power from the power amplifier to the low or bass speaker and the other 50% of the power to the horn or high frequency speakers. The "waxed paper" (or distorted sound) results from the bass notes consuming all the available power; power left over is used for the highs and sent to the horn or high frequency speakers.

As long as the amplifier has sufficient power, the sound will be good or excellent with a conventional amplifier-crossover-speaker system when modest sound levels are required.

A bi-amplified system means it employs two power amplifiers. A crossover still exists, but there is no power loss because it is connected in the circuit before the power amplifiers. The low frequency or bass output from the crossover is applied to one power amplifier (with an average output of between 100 and 150 watts RMS) and the high frequency output is applied to a second power amplifier (usually between 25 and 100 watts RMS).

The difference in power requirements for the high and low ends results from the fact that the high frequency speakers are usually much more efficient than the bass speakers and need less power. If the bass amplifier-vocal microphone example was done on a bi-amplified system, the sound would be perfect even when the total amplifier output power is unchanged. In a bi-amped system, the bass has 100 watts available for its speaker and the vocal has 25 watts available for its more efficient high-end speakers.

The previous explanation of bi-amplification is simple. Here's a more technical explanation:

Considering a conventional crossover network-power amp-speaker system with a power amplifier which can deliver 225 watts RMS into 8.0 ohms with program material which requires 100 watts RMS or 3.53 amps into the low end (28.28 volts into 8.0 ohm) and 25 watts RMS or 1.77 amps into the high end (14.14 volts into 8.0 ohm). In this single amplifier, the total current would be $1.77\text{A} + 3.53\text{A} = 5.30\text{A}$ and must be supplied by the single amplifier (Kirchhoff's Current Law). Its peak power capability, P , must equal $I^2 R = (5.30)^2 \cdot 8 = 225$ watts RMS for the single amplifier.

However, in the bi-amplifier case all the current is supplied by two separate power amplifiers. The peak power capability, P , of the high frequency amplifier need only be $= I^2 R = (1.77)^2 \bullet 8 = 25$ watts RMS. Similarly, for the low frequency amplifier, $P = (3.53)^2 \bullet 8 = 100$ watts RMS.

Therefore, it is obvious that two small power amplifiers of 25 watts and 100 watts will produce the same sound pressure levels using the same speaker components on a 225-watt RMS amplifier using conventional techniques. The peak power increase for a bi-amp system is approximately 2 to 1 and this does not include the power loss in the conventional crossover network.

INPUTS

The Kustom VI PA has two inputs per channel, one high-impedance of approximately 50K ohms, and one low-impedance of approximately 600 ohms. Only one input is operative at a time. For example, if a low impedance microphone is in use and a high impedance unit is plugged in, only the high impedance input will function. If microphone line lengths of over 20 feet are to be used, it is recommended that low-impedance microphones and cables be used to prevent high frequency response losses.

OUTPUTS

The Kustom VI PA is a state-of-the-art device and has outputs which are somewhat different than normally encountered in most PA equipment. Two outputs are provided for connection of the bass speaker cabinets (each cabinet is 8.0 ohms) and two outputs for connection of the high-frequency horn arrays.

WARNING

Be very careful to plug the speaker systems in the correct jacks. While no damage to the power amplifier will result, the mid- and high-frequency horn array will be permanently damaged if plugged into the bass speaker jacks.

The minimum load for the bass speaker jacks is 4.0 ohms while the minimum load for the high frequency horn jack is 8.0 ohms. The standard Kustom speaker systems are specially designed for this application and optimum results will be obtained when they are used. Although the power amplifier will not be damaged with abnormal loads, it is possible to produce distortion and over-heating. When the amplifiers overheat, a protective device in the unit will cause the mixer to turn off for several minutes. Normal operation will resume when the power amplifiers cool to their rated operating temperatures.

A line output level jack is provided for making recordings directly from the console. The low-impedance (600 ohms) output level is sufficient to drive almost any type of tape recorder. It may also be used to drive additional power amplifiers or bi-amp slave units when additional power and speakers are required.

The monitor output jack is of the low impedance type and is designed to drive Kustom III monitor slave power units and their associated speaker systems.

CONNECTION AND LOCATION

Place the mixer at the desired location. Ideally, the operator should man the console during the performance to make adjustments as required. If this is not possible, locate the console on the stage with easy access by the musician/operator. It is strongly recommended that the console not be placed on top of or in front of speaker cabinets (especially bass); this will cause vibration in the mixer's reverb spring assembly.

Connect the speaker cabinets to the CORRECT output jacks. Always plug the speaker cable into the mid- and high-frequency horn array cabinet first, and immediately plug the other end into the high-frequency horn speaker output jack on the console. Then the bass cabinets may be plugged into the console. As previously mentioned, permanent damage to the horn array will result if plugged into the bass cabinet output jack. Always use cables made of lamp-cord type wire #18 AGW or larger for speaker cables. A shielded microphone cable will melt and short out the power amplifier as well as cause a loss of high frequencies.

When connecting a Kustom monitor system to the console, a shielded microphone-type cord must be used. The monitor output is very low impedance and line lengths of up to 200 feet may be used before excessive high frequency losses are noted.

OPERATION

If possible, locate the speaker systems in front of and directed away from the microphones, greatly reducing the possibility of feedback. Feedback will occur with any type of PA system, regardless of size or price, whenever the loudness is increased past a critical point determined by microphone location, speaker placement, and room acoustics. Usually, little can be done to correct for poor room acoustics. However, with proper microphone selection and speaker placement, the possibility of feedback can be reduced.

For initial set-up, it is suggested that all low frequency and high frequency equalization controls be adjusted to the "0" or 12 o'clock position and the graphic equalizer slides be placed in the center of their operating range. This will place the console in an electrically "flat" frequency response state.

The following procedure of professional sound reinforcement techniques should be followed until the operator is thoroughly familiar with the mixer and its capabilities.

1. Adjust all equalization controls for a "flat" response as previously described.
2. Adjust the HORN LEVEL control to position 5.
3. Adjust the MAIN LEVEL control to position 5.
4. With program material into the first channel, adjust the channel GAIN control slides for the desired loudness.
5. Adjust the HORN LEVEL control for the desired balance between the bass speakers and the mid- and high-frequency horn arrays.
6. Adjust the channel equalization controls for the desired amount of equalization. Note the LED PEAK LEVEL indicator, as boosting of certain frequencies may have caused an overload condition.
7. Adjust the MASTER REVERB control to position 5.
8. Adjust the Channel REVERB SEND control for the desired amount of channel reverberation. Always use the MASTER REVERB control and the channel REVERB SEND controls as a team for the desired amount of reverberation. Having one control all the way open and the other nearly off is an indication of incorrect operation.
9. Adjust the total system for the desired sound pressure level or until feedback occurs. Always use the channel GAIN controls and the MAIN LEVEL control as a team. Again, having one control all the way open and the other nearly off is an indication of incorrect operation.

10. If feedback occurs, the graphic equalizer should be used to "notch out" the feedback frequency(s). Graphic equalization is a valuable tool if used correctly, but a real problem if used incorrectly. Professional sound engineers generally agree that the more graphic equalization used, the worse the sound will be. Some use the graphic equalizer for "room equalization". This practice is acceptable if the operator remembers that the "room" is not equalized at all locations, just at the point where his ears and the graphic equalizer are located. Rooms contain dead spots or locations where some frequencies disappear completely; this is a normal phenomenon and occurs in every type of enclosure from the smallest night club to the most professional recording studio.

The graphic equalizer is a valuable tool if used correctly. Always use one slide at a time and if desired results are not obtained, return it to the center position and proceed to the next slide.

11. Readjust the HORN LEVEL control if required for the desired bass and treble balance. No amount of channel equalization or graphic equalization will bring up the "high end" if the HORN LEVEL control is turned down or off.
12. After the main system is adjusted and a monitor system is in use, adjust the Channel I MONITOR SEND and MON LEVEL controls for the desired monitor levels. Follow the instructions contained in the Kustom III Monitor instruction manual when setting up the monitor system.

The preceding procedure is typical of the operation of a professional sound reinforcement system. All operating situations are not covered because every location and type of music is different.

GRAPHIC EQUALIZER

The seven-band (frequency) graphic equalizer section of your Kustom VI PA represents the ultimate in feedback and equalization control flexibility. Seven points (125Hz, 250Hz, 500Hz, 1.0KHz, 2.0KHz and 8.0KHz) are provided to allow for adjustment in the most critical portion of the audio spectrum. A maximum of $\pm 12.0\text{dB}$ of boost and cut is provided at each of these frequencies. As a point of interest, each of the frequencies represents the center point on the frequency at which maximum control action occurs. The actual control action at 125Hz, for example, is that the frequencies in the range of 60Hz to 200Hz are boosted or cut. This allows a smooth response to be obtained over a usable portion of the audio spectrum.

It is suggested that when first setting up a system for operation that all of the equalizer controls be adjusted to the center or flat position. This will eliminate the possibility of feedback, or if all controls are in the "cut" position, the apparent loss of signal level. Normal operating procedure is to use the individual channel tone controls to adjust for the desired sound, and then use the graphic equalizer to compensate for poor room acoustics and feedback.

There is no simple way to "equalize out" a room. The quickest (and often the best) method is to carefully listen to the system and make small adjustments to achieve the desired sound. It should be remembered that the sound that the operator hears and adjusts for is only in the one spot where he is located. At any other point in the room, the sound will be slightly different due to room acoustics (carpeting, reflections off walls, and many other factors).

When using the graphic equalizer for feedback control, find the feedback frequency by adjusting each of the equalizer controls. Once the frequency and corresponding control is located, adjust the equalizer only to the point at which the feedback stops. Once this point is reached, no further feedback control improvement will result, and the overall sound quality will be degraded.

MICROPHONES

CARDIOID MICROPHONE

The pickup pattern of a cardioid microphone — relatively dead at the sides and rear — tends to increase the working distance (the distance between the sound source and the microphone) beyond which:

1. The sound becomes over-reverberant.
2. The pickup of random background noise becomes excessive.
3. Sound system feedback results.

This increase in working distance is theoretically more than 1.7 to 1. For instance, if the maximum effective working distance of an omnidirectional microphone is 10 inches, then a cardioid microphone can be used at 17 inches with the same effectiveness!

The feedback-reducing characteristics of a cardioid microphone would seem to make a clear-cut case for the use of a cardioid microphone by professional performers. In marginal feedback situations, the cardioid will tend to produce a higher level in the room before system feedback, especially where high levels of direct speaker sound reaches the microphones from the sides or rear. This situation is often encountered in portable PA systems as well as other systems employing high-level stage monitors. Usually in such instances, the loudspeakers are closer to the microphones than would be desirable from a sound-system standpoint.

OMNIDIRECTIONAL MICROPHONE

In many systems where loudspeakers are located 20 to 40 feet away from the microphone — as at the top of a proscenium arch — a cardioid microphone is likely to show only negligible advantage with respect to feedback over an omnidirectional microphone. This is especially true where extremely close working distances are employed — say 1/8 to six inches.

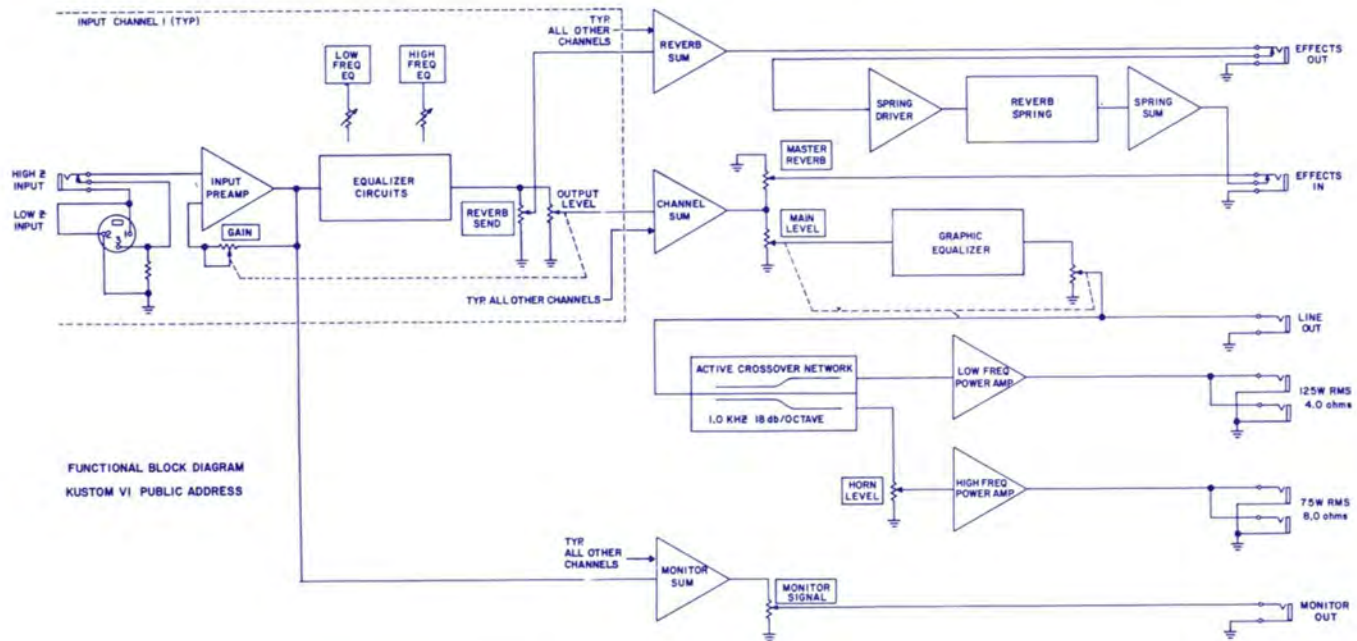
The omnidirectional microphone, where it can be used, has several advantages in its favor:

1. For a given price, an omnidirectional microphone generally has a smoother frequency response than its cardioid counterpart. Such smoothness of response is important because any roughness invites feedback.
2. An omnidirectional microphone is significantly less susceptible to breath pops than its cardioid counterpart.
3. An omnidirectional microphone is significantly less sensitive to mechanical shock than its cardioid counterpart.
4. An omnidirectional microphone is often more rugged than its cardioid counterpart.

TECHNICAL SPECIFICATIONS

Preamplifier gain measured at 1.0KHz. Equalizer controls maximum.	16.0dB
Signal-to-noise ratio.	Gain min. -84.0dB Gain max. -58.0dB
Nominal input impedance	
Low impedance	600 ohms
High impedance	50K ohms
Minimum input voltage required for rated output. Equalization controls adjusted for 12 o'clock position. Gain controls adjusted for maximum.	13mV RMS
Channel equalization control range:	
HF Equalization	± 12.0dB @ 10.0KHz
LF Equalization	± 10.0dB @ 50Hz
Graphic Equalizer	± 12.0dB @ each frequency

Frequency response measured with equalization controls indicating flat response.	$\pm 2.0\text{dB}$, 40Hz-17KHz
Total harmonic distortion at normal (100% indication) operating levels.	0.15%
Power output (low frequency power amplifier).	135 watts RMS @ 1.0% THD
Power output (high frequency power amplifier).	75 watts RMS @ 1.0% THD
Crossover frequency (active).	1.0KHz @ 18dB/octave
Absolute minimum speaker load impedance.	
Low frequency power amplifier	3.0 ohms
High frequency power amplifier	6.0 ohms
Line output at rated power	1.0V RMS
Monitor output level.	1.0V RMS
AC accessory receptacle maximum load.	200 watts





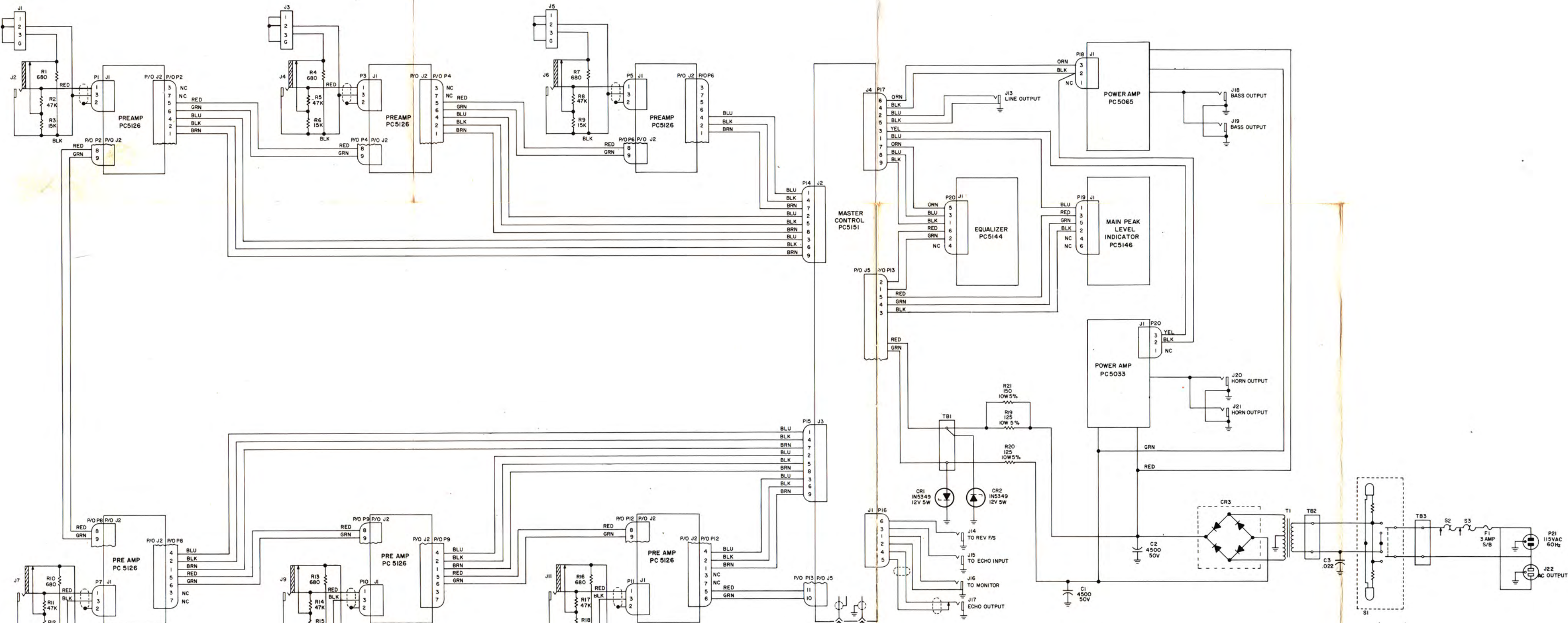
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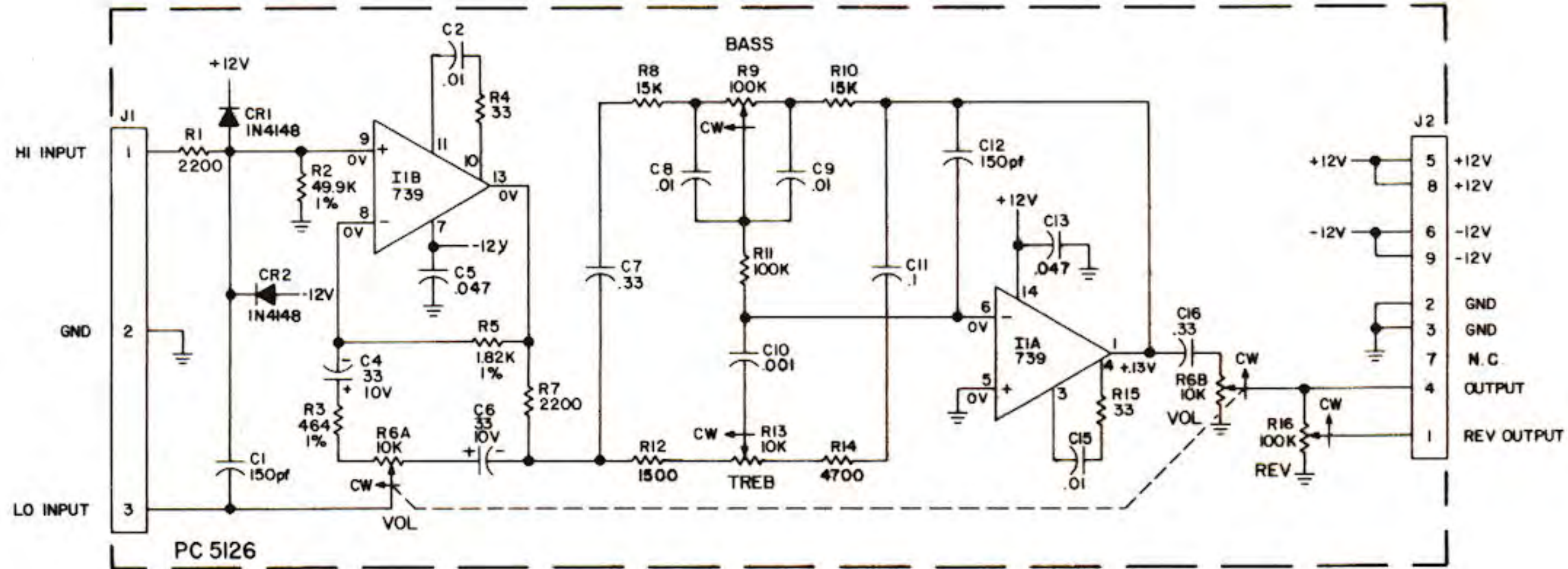
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J2, J4, J6, J7, J9, J11	030-1006-00	CR3	
J1, J3, J5, J8, J10, J12	030-2018-00	C2	
J22	030-2066-00	T1	
TB2, TB3	090-0072-00	S3	
CR1, CR2	007-5349-00	F1	
CR3	007-6018-00	R20	
T1	019-7017-00		
S2, S3	036-0001-00		
TB1	090-0093-00		
C1, C2	095-0014-01		
R19, R20	136-0000-13		
S1	031-0059-00		
F1	036-0005-00		
C3	106-0000-02		
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R2, R5, R8, R11, R14, R17	129-0473-15		
R3, R6, R9, R12, R15, R18	130-0153-15		

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REV.	UNIT	DATE

KUSTOM ELECTRONICS, INC. CHAMUTE, KANSAS 66730	
DATE: 7-74	TOLERANCES: NONE
NAME: KUSTOM	PART NUMBER: 002-0118-00
SCALE: NONE	DWG: I

KUSTOM VI
PUBLIC ADDRESS
P/N 006-0103-00



NOTES:

1. ALL RESISTORS ARE 1/2W, 10%, UNLESS NOTED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS NOTED.
3. VOLTAGE MEASUREMENTS ARE WITH POWER ON, NO SIGNAL, NO LOAD, AND MEASURED FROM COMMON GROUND.
4. FOR 002-5126-01 THE CW SIDE OF R6A & R6B WILL BE UP SIDE.

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- CR2
- I1
- J2

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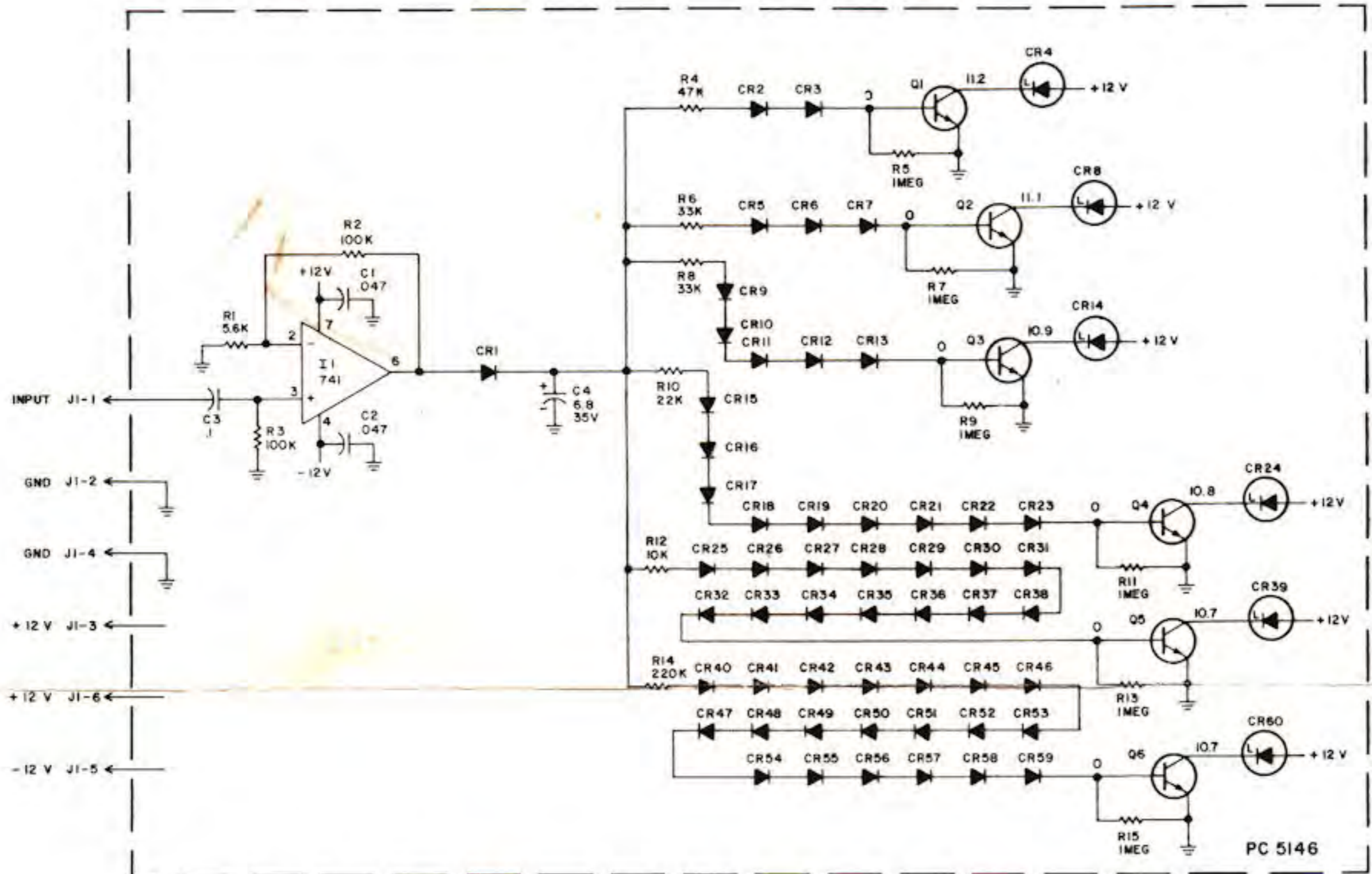
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- C14

SYMBOL
 CR1, CR2
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 J1
 J2
 C4, C6
 R6
 R9
 R13
 R16

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 007-7015-00
 030-2034-00
 030-2036-00
 096-1007-09
 133-0053-00 (133-0061-01 FOR - 01)
 133-0021-00
 133-0022-00
 133-0065-00

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REV	NO	DATE	BY	Kustom. ELECTRONICS, INC. CHANUTE, KANSAS 66730	
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2	1109	9-73	CMS	CHK J. Spahr	DATE 4-79
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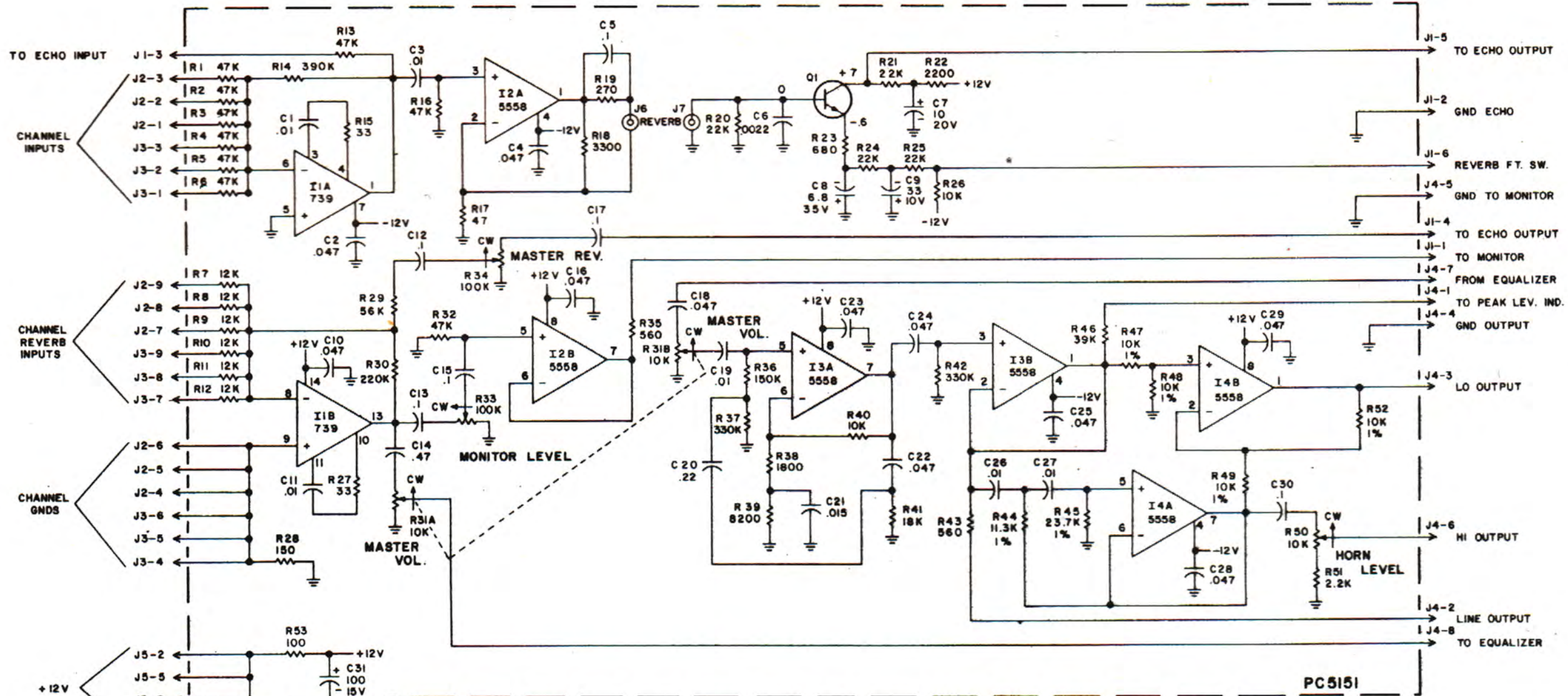
PC 5146

NOTES:

1. ALL RESISTORS ARE 1/2W, 10% UNLESS NOTED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ALL DIODES ARE IN4148 UNLESS NOTED.
4. VOLTAGES ARE WITH POWER ON, ALL CONTROLS FULL ON, NO SIGNAL, NO LOAD AND MEASURED FROM COMMON GROUND

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CHEKED BY B.G.	DATE 2-11-74	NAME PEAK LEVEL IND PC5146	
ENGINEER J. Jackson	SCALE NONE	SHT OF 1	PART NUMBER 002-5146-00
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2	JG	1-75	FR
3	JG	2-78	FR



PC5151

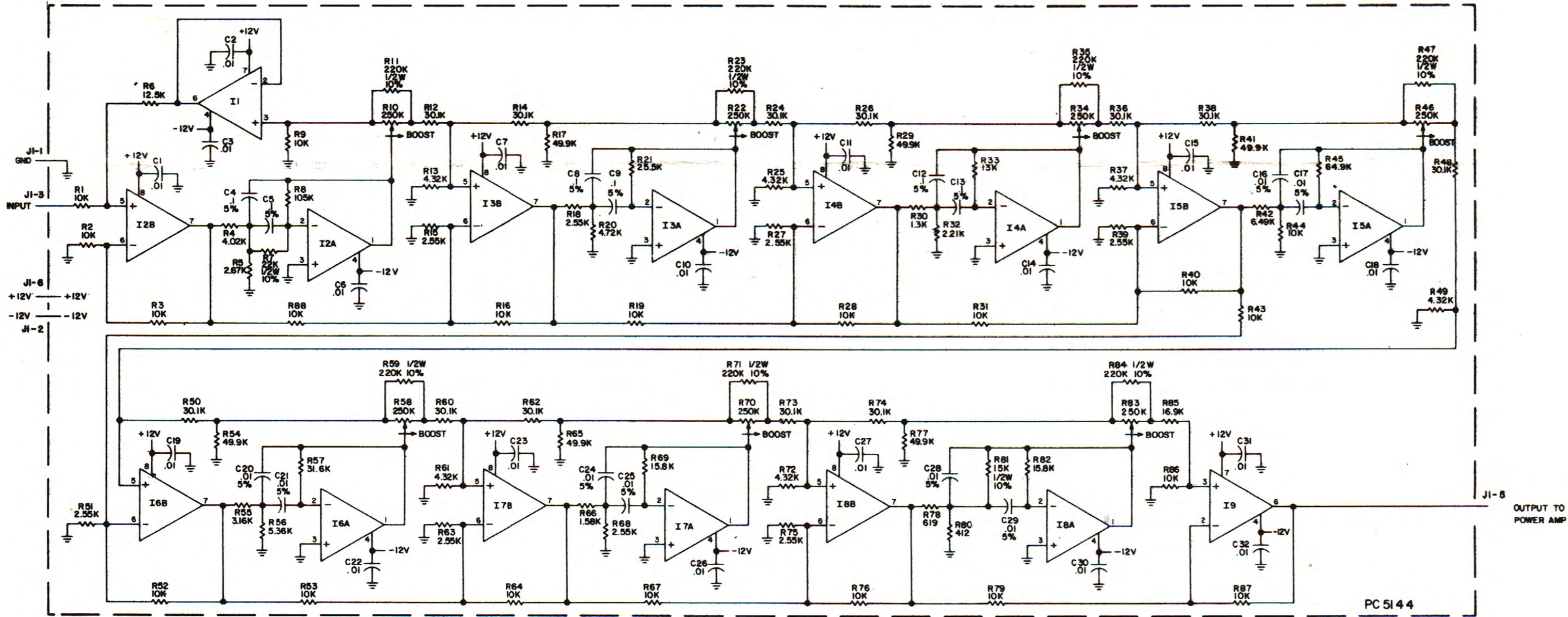
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C32	
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I4	
J7	

- NOTES:
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 2. ALL CAPACITORS ARE MICROFARADS UNLESS NOTED
 3. ALL TRANSISTORS SE4002 UNLESS NOTED
 4. VOLTAGES ARE WITH POWER ON, ALL CONTROLS FULL ON, NO SIGNAL, NO LOAD AND MEASURED FROM COMMON GROUND.

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J6, J7	030-1003-00
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C7	096-1007-08
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C31, C32	096-1007-17
C8	096-1007-29
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REV	1	DATE	7-74	BY	CM																								
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PART NUMBER	DESCRIPTION	ITEM																											
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DATE	SHEET	PART NUMBER																											
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NOTES:

1. ALL RESISTORS ARE 1/8W, 1%, PRECISION, UNLESS NOTED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS NOTED.

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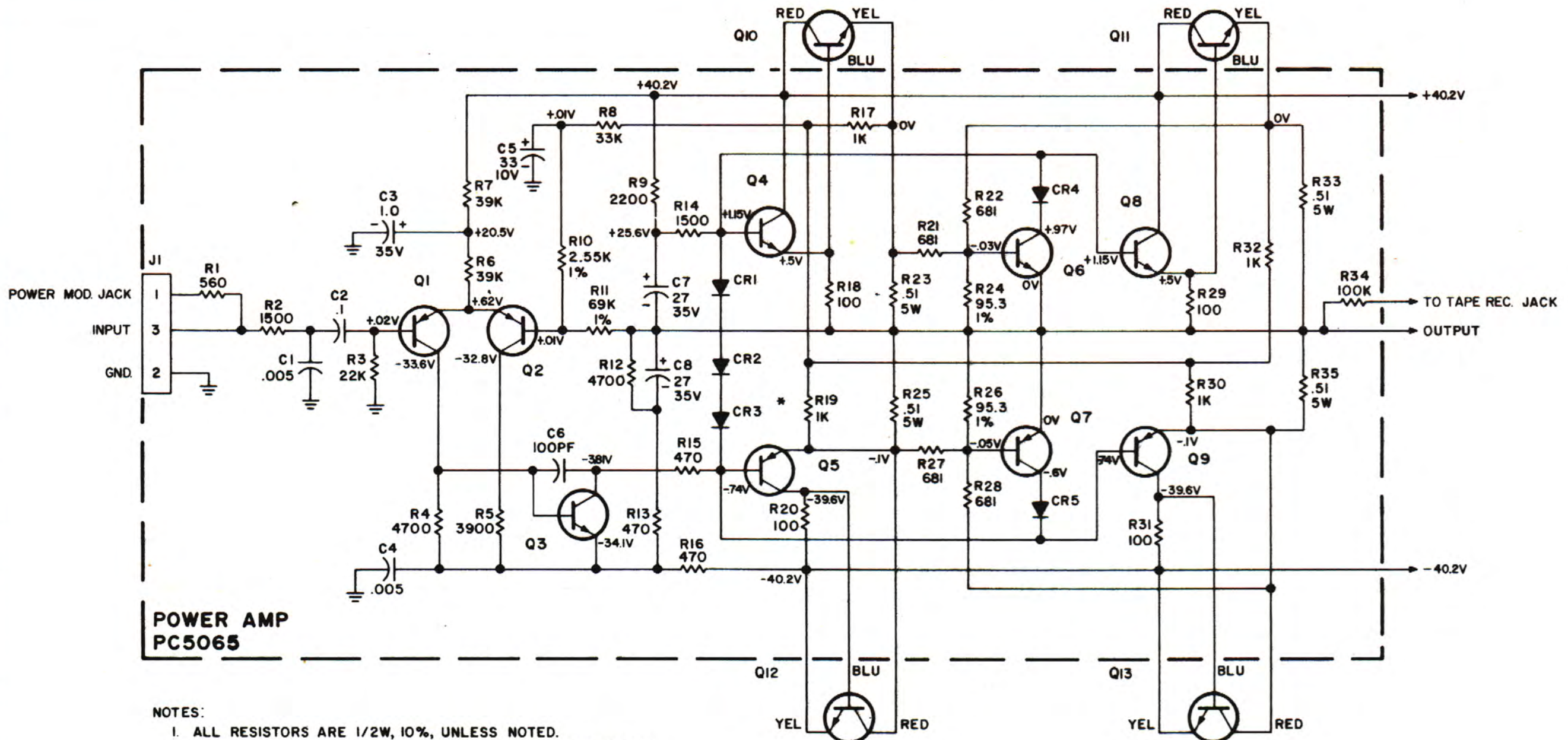
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DATE		BY		NAME		SCALE		PART NUMBER	
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Kustom ELECTRONICS, INC.
CHANUTS, KANSAS 66720

TOLERANCES: NONE
MATERIAL: NONE



**POWER AMP
PC5065**

NOTES:

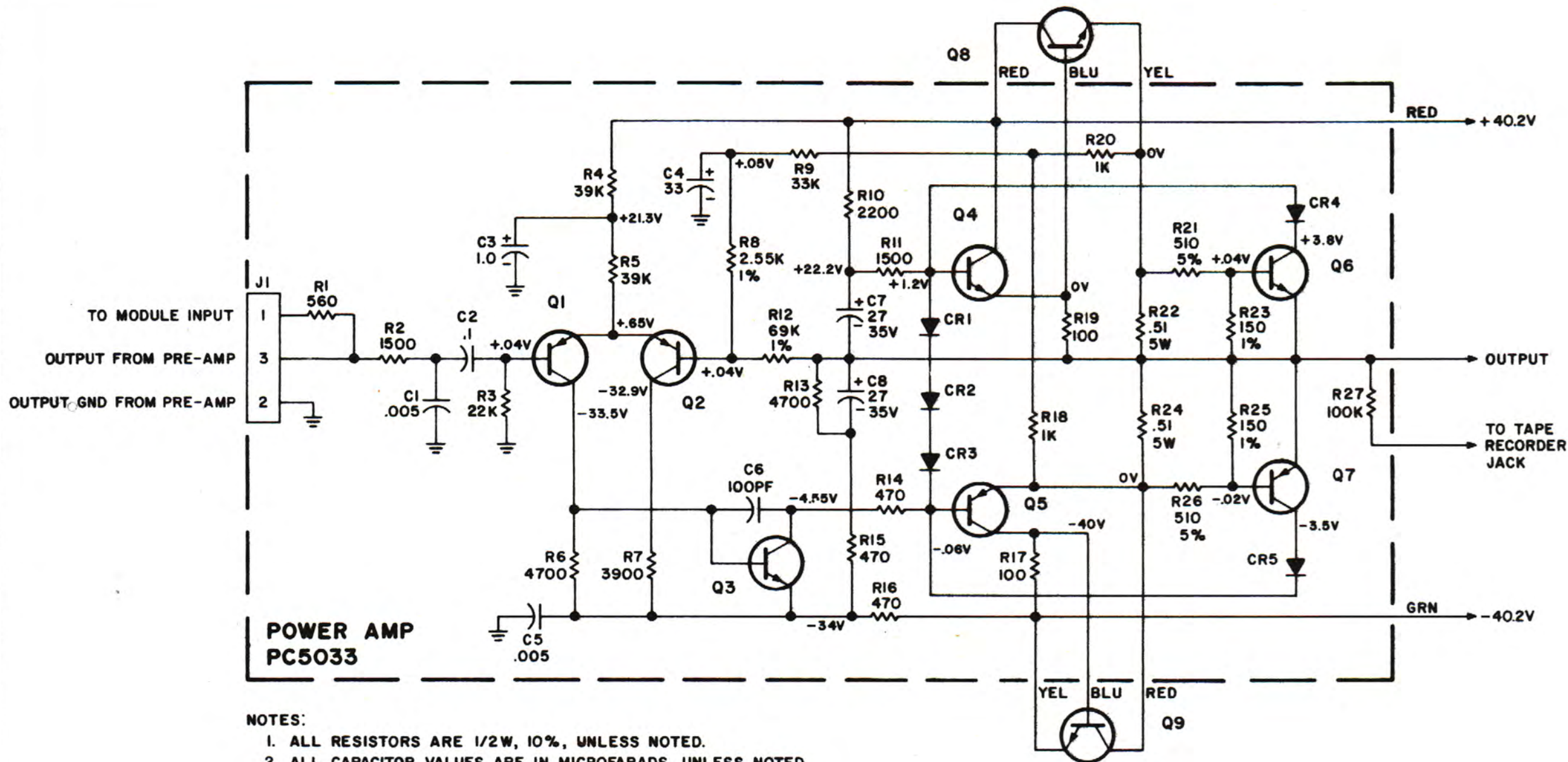
1. ALL RESISTORS ARE 1/2W, 10%, UNLESS NOTED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS NOTED.
- * 3. DIODE CR3 IS MOUNTED IN A CLIP ON THE CHASSIS.
4. TRANSISTORS Q10, Q11, Q12, & Q13 ARE MOUNTED IN A BRACKET ON THE CHASSIS.
5. VOLTAGE MEASUREMENTS ARE WITH POWER ON, NO SIGNAL, NO LOAD AND MEASURED FROM COMMON GROUND.

SYMBOL	KUSTOM PART NO.
CR1 & CR2	007-6011-00
CR3	007-6006-00
CR4 & CR5	007-6016-00
Q1 & Q2	007-0009-00
Q3	007-0002-00
Q4 & Q8	007-0011-00
Q5 & Q9	007-0012-00
Q6	007-0005-00
Q7	007-0006-00
J1	030-2034-00
Q10 THRU Q13	007-0000-00

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REV	CO	NO	DATE	BY
1	473	6-71	JTS	
2	488	7-71	JTS	
3	597	8-71	JTS	
4	581	10-71	LS	
5	1092	4-72	LS	

REV	PART NUMBER	DESCRIPTION	ITEM
	Kustom ELECTRONICS, INC. CHANUTE, KAN. 66720		
DRN	SPAIT5	DATE 5-71	TOLERANCES NONE
CHK		DATE	MATERIAL NONE
ENGR		NAME SCHEMATIC DIAGRAM - POWER AMP PC5065	
SCALE NONE	SHT OF 1	PART NUMBER 002-5065-00	



**POWER AMP
PC5033**

NOTES:

1. ALL RESISTORS ARE 1/2W, 10%, UNLESS NOTED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS NOTED.
3. DIODE CR3 IS MOUNTED IN A CLIP ON THE CHASSIS.
4. TRANSISTORS Q8 & Q9 ARE MOUNTED IN A BRACKET ON THE CHASSIS.
5. VOLTAGE MEASUREMENTS ARE WITH POWER ON, NO SIGNAL, NO LOAD, AND MEASURED FROM COMMON GROUND.

SYMBOL	KUSTOM PART NO.
CR1 & CR2	007-6011-00
CR3	007-6006-00
CR4 & CR5	007-6016-00
Q1 & Q2	007-0009-00
Q3	007-0002-00
Q4	007-0011-00
Q5	007-0012-00
Q6	007-0005-00
Q7	007-0006-00
Q8 & Q9	007-0000-00
J1	030-2034-00

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REV	CO	NO	DATE	BY
1	3	10	9-70	JTS
2	4	20	5-71	JTS
3	4	73	6-71	JTS
4	4	88	7-71	JTS
5	5	81	10-71	JLS
6	10	32	4-73	DR

REV	PART NUMBER	DESCRIPTION	ITEM
		Kustom ELECTRONICS, INC. CHANUTE, KAN. 66720	
DRN	SPAIT	DATE	TOLERANCES
		6-70	NONE
CHK		DATE	MATERIAL
			NONE
ENGR		NAME SCHEMATIC DIAGRAM - POWER AMP PC5033	
SCALE	SHT	PART NUMBER	
NONE	OF 1	002-5033-00	