

*Kustom*<sup>®</sup>



OWNER'S MANUAL

**SOUND**

**REINFORCEMENT**

**SLAVE**



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P/N 006-0085-00

# 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.

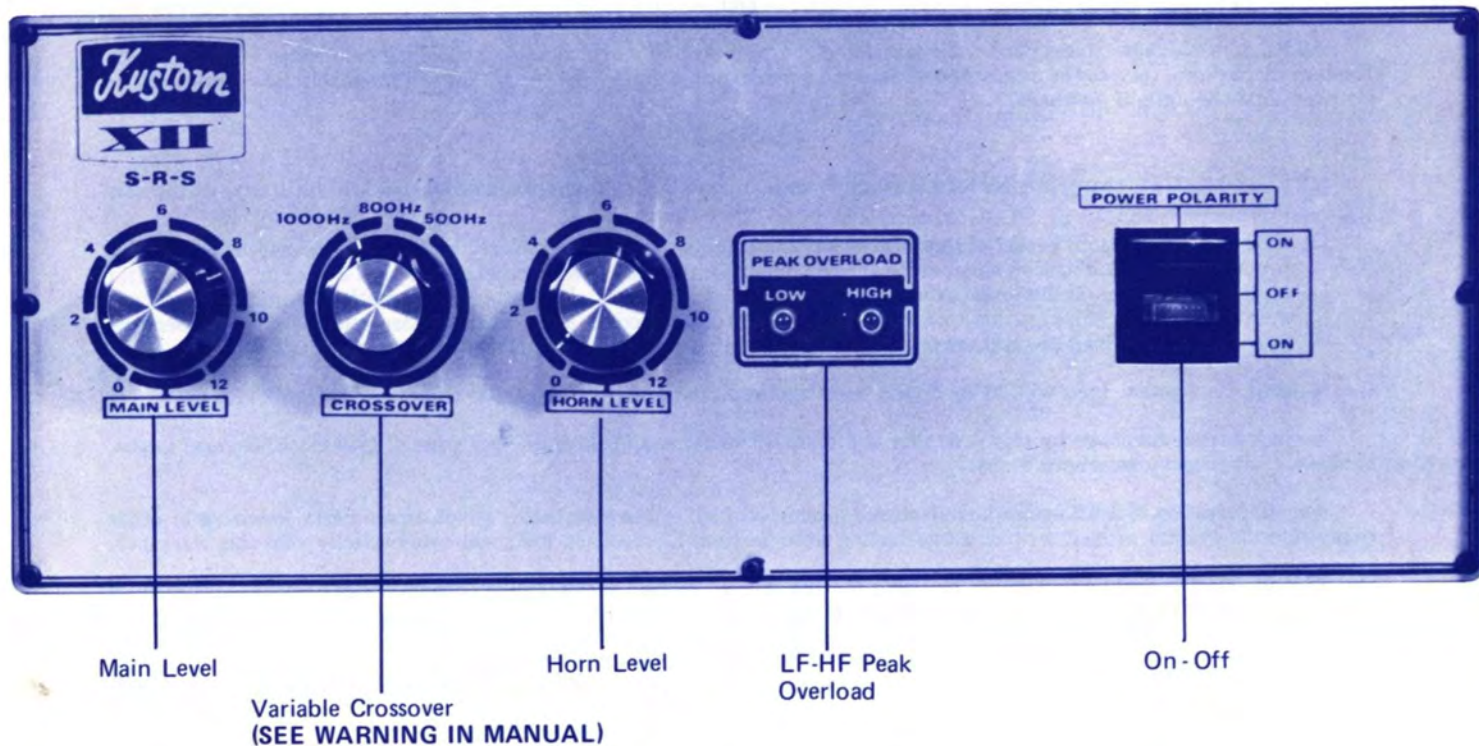
Any modification of the Kustom-manufactured product(s) such as the installation of substitute parts, rewiring or other changes to the system without written authorization from Kustom Electronics, Inc., will automatically void this warranty.

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 XII SRS



## **INTRODUCTION**

The Kustom XII SRS is a 400-watt RMS Bi-Amplifier Slave designed for use with high-power sound reinforcement systems. This instruction manual provides 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.

## **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 two 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 nearly 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 (horns and drivers) 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  $1.77A + 3.53A = 5.30A$  and must be supplied by the single amplifier (Kirchhoff's Current Law). Its peak power capability,  $P$ , must equal  $I^2R = (5.30)^2 \cdot 8 = 225$  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  $= I^2R = (1.77)^2 \cdot 8 = 25$  watts RMS. Similarly, for the low frequency amplifier,  $P = (3.53)^2 \cdot 8 = 100$  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.

## GENERAL

The Kustom XII SRS Bi-Amplifier Slave consists of an active crossover network, associated level controls and three power amplifiers (Refer to Functional Block Diagram). As indicated on the block diagram, the MAIN LEVEL control determines the signal input to the bi-amp. A buffer amplifier (unity gain) provides a low impedance line output for driving additional units or tape recorder.

Two active filters make up the crossover network. These are two-pole, 18dB/octave filters with selective crossover frequencies of 500, 800 and 1000Hz. The low pass filter section drives the low frequency power amplifiers directly. An LED (light-emitting diode) flashes whenever the power amplifiers are driven into clipping.

The output from the high pass filter section goes to the HORN LEVEL control, which must be adjusted for proper balance with the bass cabinets. An LED PEAK OVERLOAD indicator is also provided for the high-frequency power amplifier section.

## INPUTS

The Kustom XII SRS Bi-Amp Slave is equipped with two high-impedance input jacks which are wired in parallel. This allows the connection of up to 10 slaves in a monaural system and up to 20 slaves — 10 per side — in a stereo system.

Connect slaves from INPUT to INPUT, rather than from LINE OUT to INPUT when using more than one slave. If one slave in the series thermal cycles (cuts off until normal operating temperature is reached), and the slaves are connected INPUT to INPUT, only the cycling slave will be lost. However, if the series of slaves is connected LINE OUT to INPUT and one of the slaves cycles, power will be lost to all of the slaves following the cycling slave in the series.

## **OUTPUTS**

The Kustom XII SRS Bi-Amp Slave is provided with two outputs per amplifier section. Both low frequency power amplifiers will drive loads as low as 3.0 ohms at a power of 135 watts RMS. The high frequency power amplifier will drive a load as low as 3.0 ohms at a power of 130 watts RMS. Each power amplifier is completely protected against short circuit, open circuit, and mis-matched loads. If an improper load or a shorted speaker cord is accidentally used, the slave unit will thermal cycle until the problem is corrected. No permanent damage will result from improper loading.

A low-impedance (600 ohms) LINE OUTPUT jack is provided for driving additional slaves, although this is not recommended (see "INPUTS") or for connection of a tape recorder. The output at rated power is approximately 1.0 volt RMS.

## **LOCATION AND CONNECTION**

The bi-amp slave may be located up to 200 feet from the driving source (mixer console, tape deck, limiter, etc.) when properly shielded cable is used. However, the unit(s) should be placed as close as possible to the speaker cabinets to prevent power losses in the speaker cables.

Use shielded cable to connect slave to slave.

Use only speaker cable to connect the slave to the speaker cabinets. (Shielded cable used for this purpose will melt and short out.)

Connect slave units from INPUT to INPUT, as discussed in the "INPUT" section of the manual. However, if more than 10 slaves are employed, they must be connected from LINE OUTPUT to INPUT.



## OPERATION

When using the bi-amp slave for the first time, an initial level calibration will be required. When calibration has been completed, MAIN LEVEL and CROSSOVER frequency controls may be marked for future use and this step may be omitted from subsequent set-up procedure. HORN LEVEL must be reset at each gig to compensate for room acoustics.

Conduct the initial level calibration as follows: Adjust all operating controls to minimum V and CROSSOVER frequency control to 1000Hz. Adjust the driving source (mixer console, tape deck, limiter, etc.) for its normal operating level, indicated by "zero" on a VU meter or 100% on an LED array. With program material, adjust the MAIN LEVEL control on the bi-amp until the low frequency PEAK OVERLOAD LED indicates clipping on very high level material.

### WARNING!!!

At this time set the CROSSOVER frequency control to the **required** frequency as determined by the type of high-frequency horn system being used. Be absolutely sure of the crossover frequency as the life of the horn driver depends on it. If there is any doubt, use the 1000Hz position.

Now adjust the HORN LEVEL control as required by the playing environment for the correct balance between the bass and horn speaker systems. Observe the HIGH FREQUENCY PEAK OVERLOAD LED to ensure that the high frequency power amplifier is not clipping. Distortion is easily detectable on high frequency horn speaker systems.

Do not stack slave units on top of one another. Heat generated by each slave unit might cause thermal cycling if units are stacked. The recommended grouping is to stand the slaves on end, approximately 3.0 inches apart.

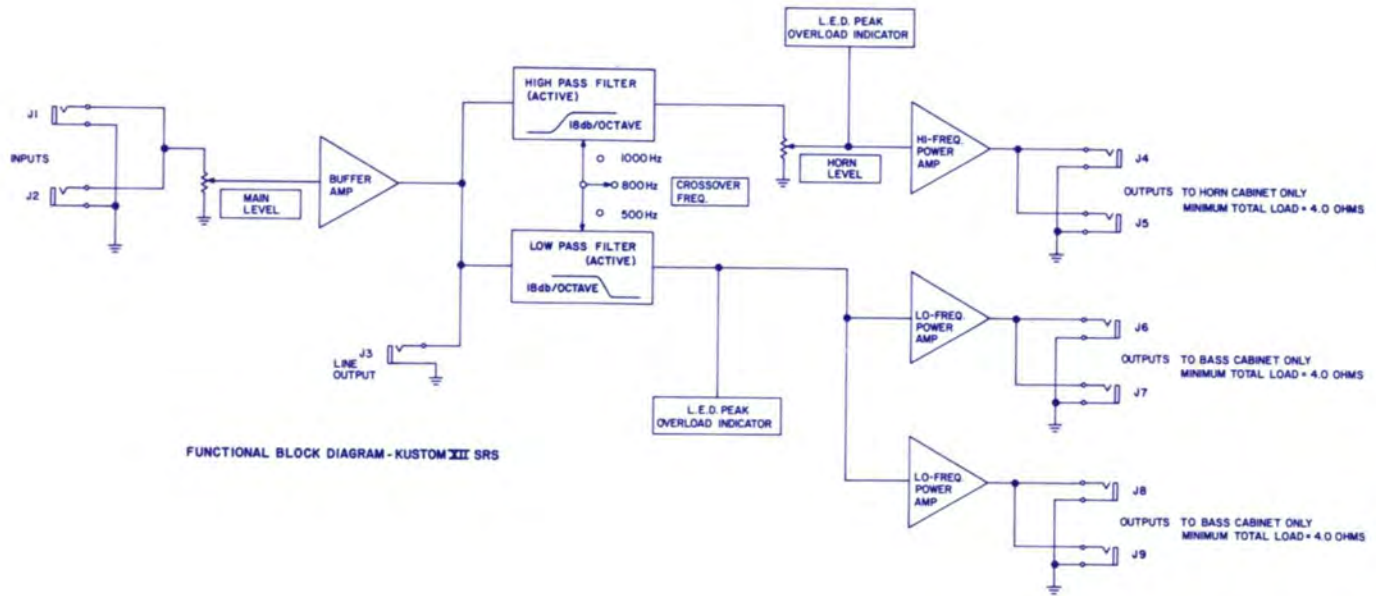
## **RACK MOUNTING**

The Kustom XII SRS may be rack mounted in a standard 19" rack frame. Two brackets and the required hardware are available as an option for the Kustom XII Slave. To rack mount the unit, remove the chassis from the cabinet and attach the brackets with the supplied hardware. Two standard rack spaces are occupied by each slave unit. Whenever two or more units are rack mounted, a fan should be used to keep the units at a reasonable operating temperature. All racks, fans, and related equipment are standard industrial items which may be purchased from almost any industrial electronics distributor.

## TECHNICAL SPECIFICATIONS

Power Output (each low frequency power amplifier)	138 Watts RMS @ 1.0% THD
Power Output (high frequency power amplifier)	138 Watts RMS @ 1.0% THD
Signal-to-Noise Ratio. Measured with Main Level and Horn Level controls maximum. Crossover frequency 800Hz.	78dB
Nominal Input Impedance	10K ohms
Frequency Response Horn Level control adjusted for equal level.	±1.5dB, 30Hz to 17KHz
Absolute Minimum Speaker Load Impedance:	
Low Frequency Power Amplifier	3.0 ohms
High Frequency Power Amplifier	6.0 ohms
Line Output at Rated Power	1.0 Volt RMS
AC Accessory Receptacle Maximum Load	200 Watts
Crossover Network (Active Frequencies)	500, 800, and 1000Hz
Crossover Rate	12dB Octave

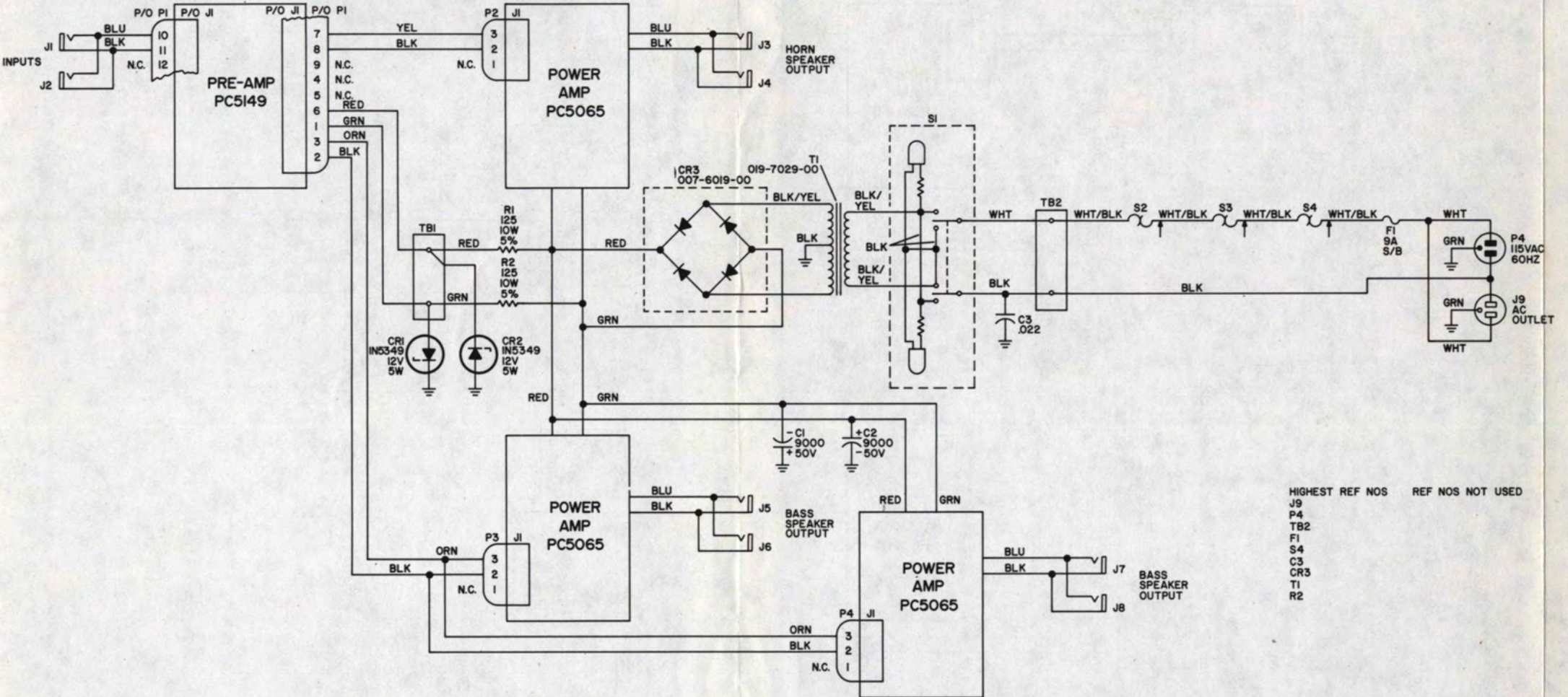
# FUNCTIONAL BLOCK DIAGRAM





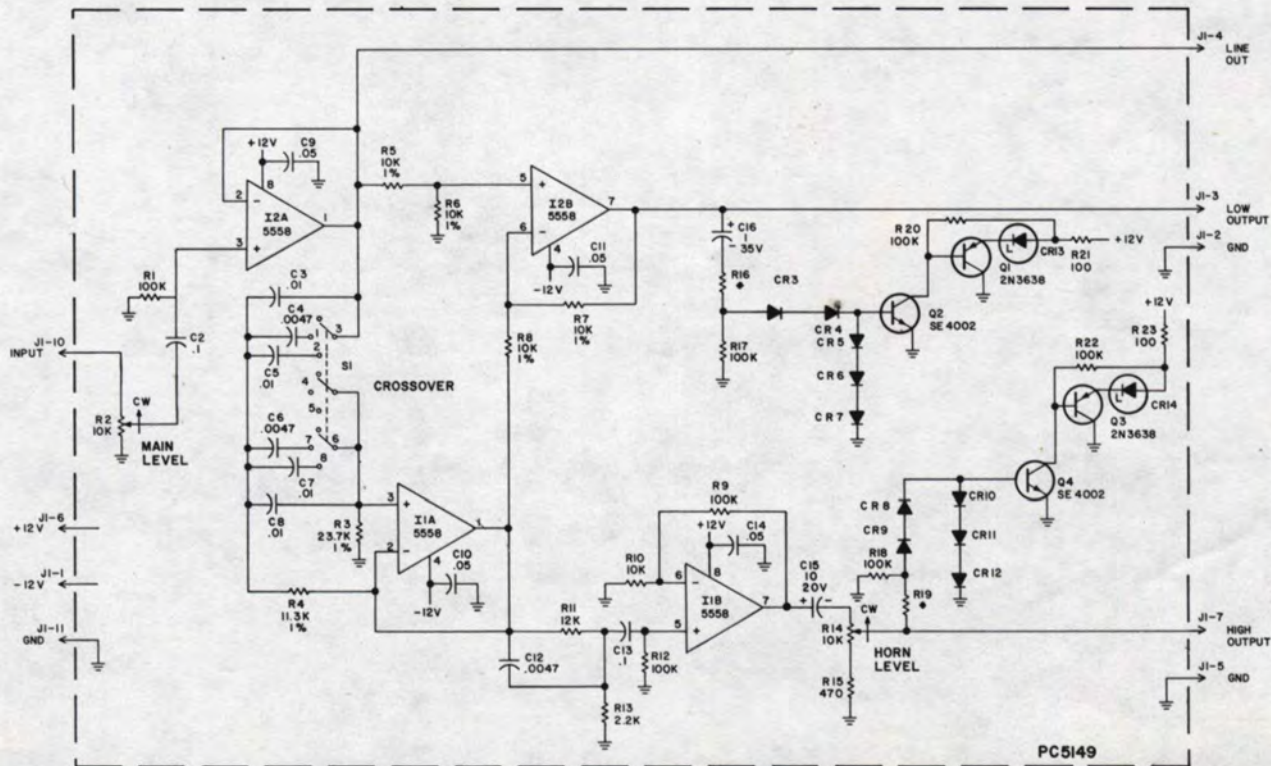
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1010 WEST CHESTNUT, CHANUTE, KANSAS 66720



- HIGHEST REF NOS    REF NOS NOT USED
- J9
  - P4
  - TB2
  - F1
  - S4
  - C3
  - CR3
  - T1
  - R2

REV	DATE	BY	Kustom. ELECTRONICS, INC.		TOLERANCES UNLESS NOTED: LOWBAR .XXX = 1.010 HOLES 1.008 BAR .XX = 1.03 ANGLES 11 degree
			CHANUTE, KANSAS 66720		
			DRN	DATE	NAME INTERCONNECT DIAG. KUSTOM XII SLAVE
			SCHLU	5-74	
			CHK		
					PART NUMBER 002-0131-00



PC5149

SYM	KUSTOM PART NOS.
Q1, Q3	007-0006-00
Q2, Q4	007-0008-00
CR13, CR14	007-6033-00
I1, I2	007-7023-00
C15	096-1007-08
C16	096-1007-23
R5, R6, R7, R8	125-1002-01
R4	125-1132-01
R3	125-2372-01
R2, R14	133-0022-00
S1	031-0033-00
J1	030-2040-00

NOTES:

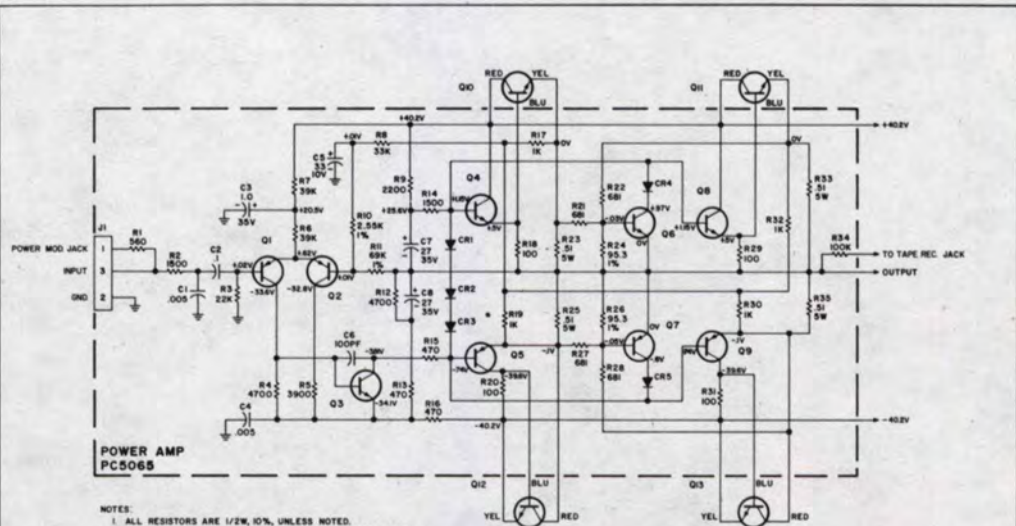
1. ALL RESISTORS ARE 1/2W, 10% UNLESS NOTED.
2. ALL CAPACITORS ARE MICROFARADS UNLESS NOTED.
3. ALL DIODES ARE TYPE IN4148 UNLESS NOTED.
4. FOR -00 VALUE IS 12K, FOR -01 VALUE IS 33K.

HIGHEST REF. NOS.	REF NOS. NOT USED
R23	C1
C16	CR1
CR14	CR2
Q4	
I2	
S1	

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P.C. PART NUMBER		DESCRIPTION		ITEM
Astoria		ELECTRONICS, INC.		
CHASUITL, S.A.S.		60720		
DESIGNED BY	DATE	TOLERANCES		
SHAY	4-74	NONE		
CHK'D BY	DATE			
J.G.	1-77			
NAME	CROSS OVER BD. PC5149			
WAVE	UNIT	PART NUMBER		
NONE	OF 1	002-5149-00		

REV.	UNIT	DATE



**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 Q0, Q1, Q2, & Q3 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	007-6006-00
Q1 & Q2	007-0009-00
Q3	007-0008-00
Q4 & Q8	007-0001-00
Q5 & Q9	007-0002-00
Q6	007-0005-00
Q7	007-0006-00
Q1	030-2034-00
Q10 THRU Q13	007-0000-00

REV	DATE	BY	CHKD
1	1/2/73	WJ	WJ
2	1/2/73	WJ	WJ
3	1/2/73	WJ	WJ
4	1/2/73	WJ	WJ
5	1/2/73	WJ	WJ
6	1/2/73	WJ	WJ
7	1/2/73	WJ	WJ
8	1/2/73	WJ	WJ
9	1/2/73	WJ	WJ
10	1/2/73	WJ	WJ

PART NUMBER	DESCRIPTION	ITEM
<b>Raytheon ELECTRONICS, INC.</b> CHANDLER, SAN. 8472X		
QTY	DESCRIPTION	MATERIAL
000	SCHEMATIC DIAGRAM - POWER AMP PC5065	002-5065-00
REV	DATE	BY
NONE	001	1

**KUSTOM XII  
SRS  
P/N 006-0106-00**

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