

EBS-1 and EBS-1H

Introduction

The Ameritron EBS-1 is an electronic bias system designed as an add-on for the AL-1200, 1500, and 82 amplifiers. It reduces heat by reducing quiescent current to very low values during periods when exciter output falls below 100 mW.

The EBS-1H is compatible with other amplifiers, including amplifiers up to twenty kilowatts from MF to VHF. The EBS-1H has an internal adjustment for bias voltage and an internal regulated reference.

The EBS-1 series features a remote detector board. The small, high impedance, detector board can be mounted near the source of RF, preventing the EBS-1 series from having any effect on input SWR. The switching and control board can be mounted any distance from the RF detector.

The switching time of the EBS-1 series is 20 μ S. This is several times faster than the rise time of voice waveforms, especially those restricted in rise time by the narrow bandwidth of a SSB transmitter. Normal rise time of a SSB transmitter is 300 μ S. The fast switching time of the EBS-1 series, plus the small bias change from near class B to normal class AB, insures bias switching does not add splatter or distortion to the transmitted signal.

CW rise time, about 1000 μ S, is much slower than SSB. The EBS-1 series also has no measurable effect on CW waveforms or signal bandwidth. An additional benefit of the EBS-1 series is the potential to reduce receiver noise on break-in CW between characters, in cases where diode-noise from the PA section quiescent current is audible.

The EBS-1 can be modified to the fully adjustable bias voltage system (EBS-1H) capable of high current operation. In the EBS-1H configuration, the EBS-1 will handle cathode currents up to 5 amperes and operating bias voltages up to 30 volts.

Description

The EBS-1 features a remote detector board that uses a pair of Schottkey diodes, driving a darlington transistor switch (Q5). Q5 is a fast-attack slow-decay switch, C10 sets the decay time with R4 limiting the charging current. Delay or "hang-time" is an additional period when bias remain at normal operating levels after drive power goes to zero.

In the zero-bias AL-1200, 1500, and 82 configuration, a C10 value of 0.33 μ F results in 150 mS of bias hang time. For adjustable bias operation, C10 should range from 2 to 10 μ F. An approximation for C10 is $C10 \mu F = \text{bias voltage}/3$.

Q7 and Q1 form a complementary switch, with extremely high gain. Q8, when installed along with associated components D3, R16, and R17, form an adjustable regulated bias system. Typical adjustment range of the EBS-1H bias control is 6 to 32 volts. Normal current or voltage rating is:

With Heatsink* Q1 only installed	Without Heatsink Q1	With Heatsink* on Q9-12 while installed	W/O Heatsink and Q9-12 installed
$I_{max}=10/E_b$	$I_{max}=2/E_b$	$I_{max}=40/E_b$	$I_{max}=8/E_b$
$E_{max}=10/I$	$E_{max}=2/I$	$E_{max}=40/I$	$E_{max}=8/I$

*Heatsink must be capable of dissipating 10 watts per transistor without temperature rising above 75 degrees C. When Q9-12 are installed it is not necessary to heatsink Q1.

Q9 through Q12 and associated components form a high current buffer. They allow higher cathode currents and voltages.

Note: Cathode current must include the total amount of plate, screen, and control grid current. Maximum open circuit voltage is 50 volts.

For drive power sample voltages below 100 volts peak, R19 on the detector board is omitted. If peak drive voltage sampled ever exceeds 140 volts, R19 must be included. Maximum peak sample voltage is 200 volts.

Installation AL-1200, 1500, 82

The correct board for this installation is the EBS-1. The EBS-1H contains several unnecessary components, although it will work if Zd x is shorted and the bias pot is set near minimum bias.

The bias and detector board mount on spacers near the square opening for the blower plenum chamber. Figure 1 shows the mounting position.

Some production runs of amplifiers do not have factory mounting holes. In those amplifiers, you must drill four .140-.156 inch (5/32 inch) diameter holes to clear the number six machine screws used to mount the boards.

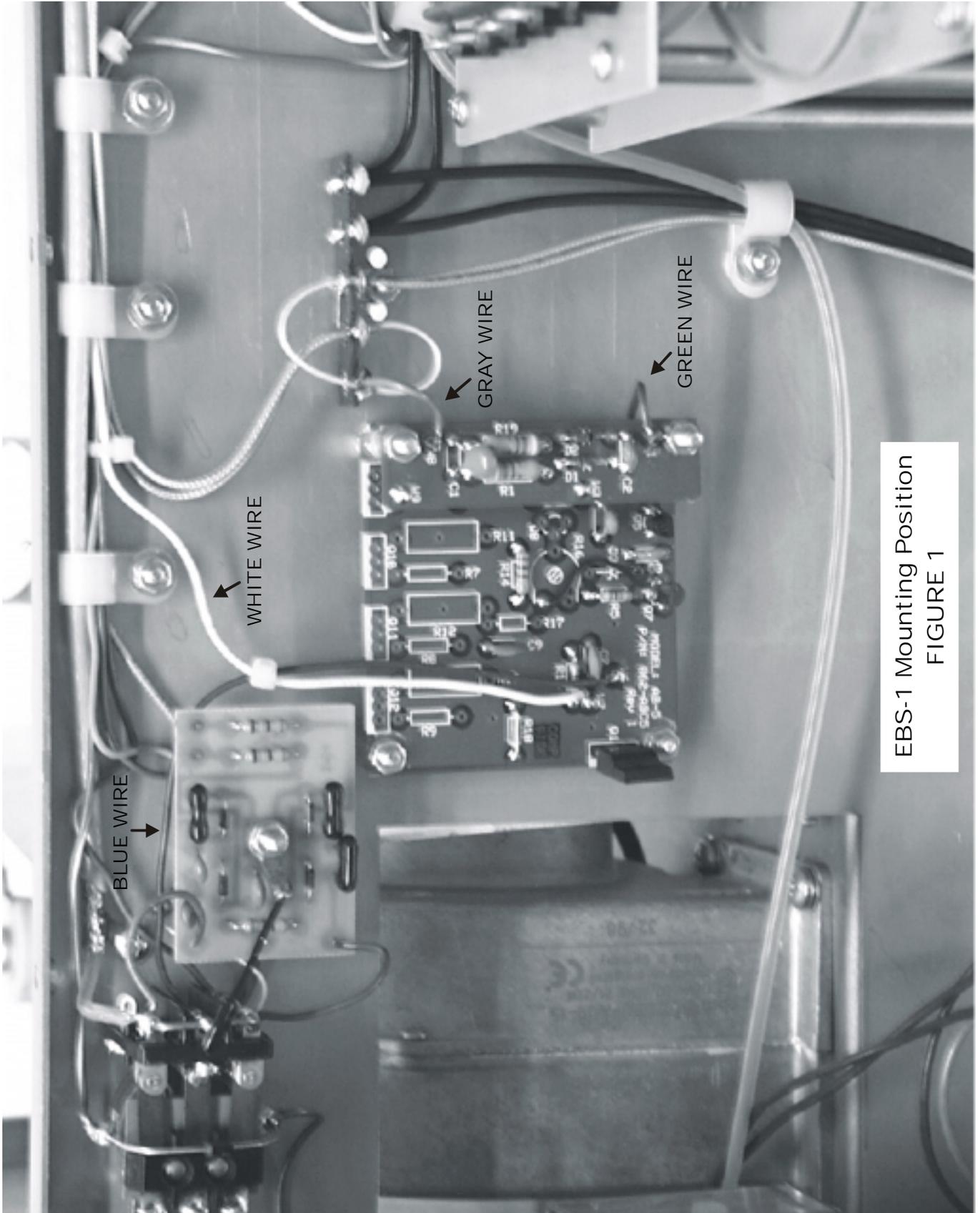
The template in Figure 2 can be used to drill the mounting hole location.

NEVER DRILL THE CHASSIS WITH TUBES INSTALLED. REMOVE THE TUBES AND TRANSFORMER BEFORE INSTALLING THIS BOARD. DO NOT SUBJECT THE AMPLIFIER TO MECHANICAL SHOCK OR SEVERE VIBRATION, ESPECIALLY WITH TUBES INSTALLED.

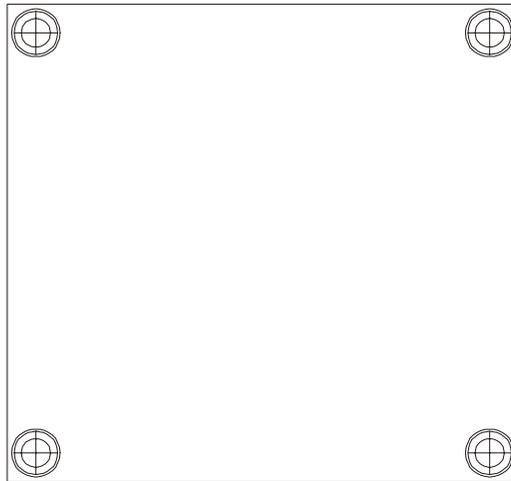
BEFORE REMOVING THE COVER, UNPLUG THE AMPLIFIER FROM THE POWER MAINS FOR AT LEAST TEN MINUTES.

ALWAYS GROUND THE ANODE TO THE CHASSIS BY PUSHING A WELL INSULATED SCREWDRIVER BLADE AGAINST THE CHASSIS FIRST AND THEN AGAINST THE ANODE CONNECTION.

FOR SAFETY, WE RECOMMEND CONNECTING THE HV TO GROUND THROUGH A CLIPLEAD WHENEVER WORKING ON THE AMPLIFIER.



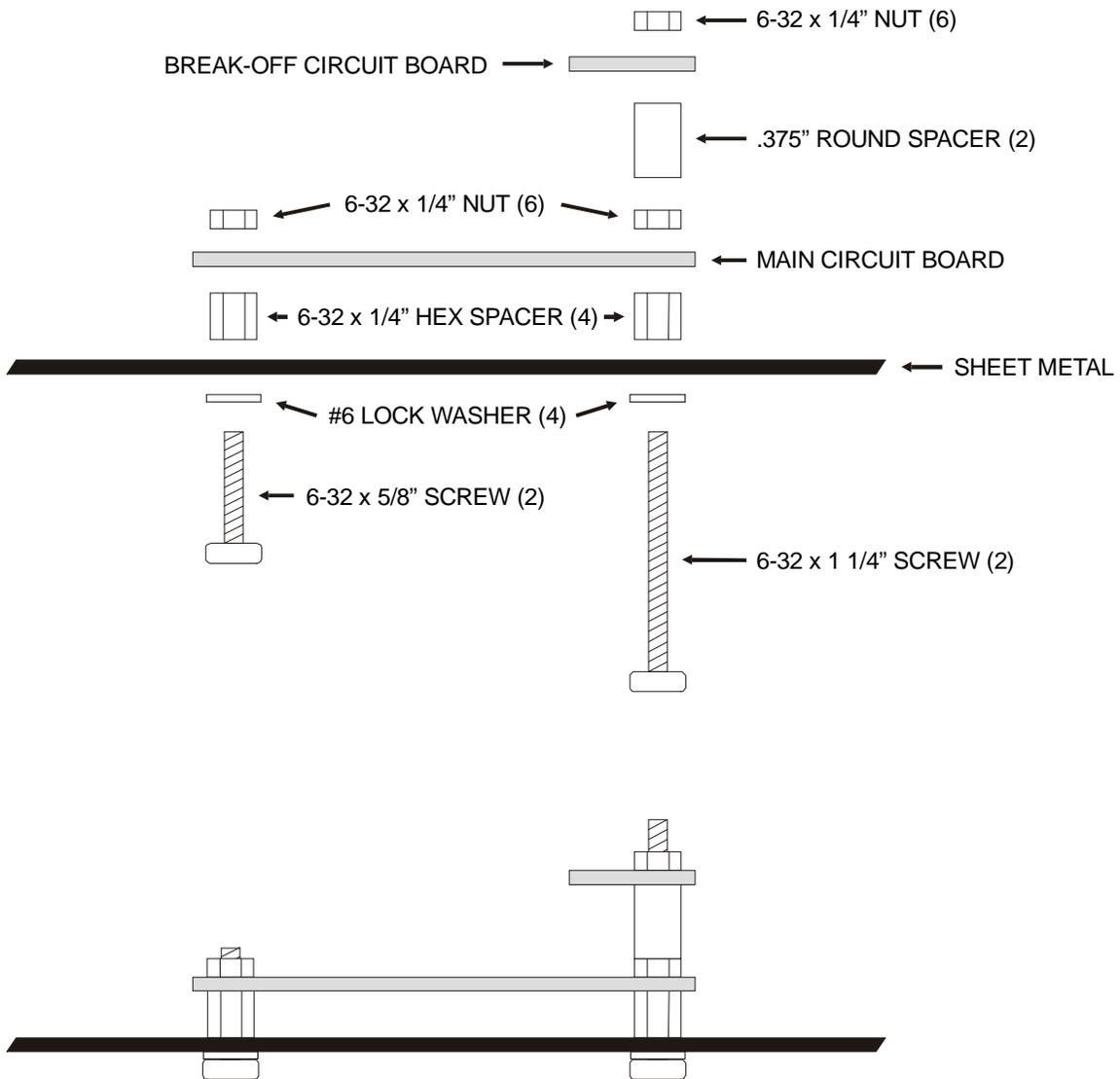
EBS-1 Mounting Position
FIGURE 1



**Drill Template
Figure 2**

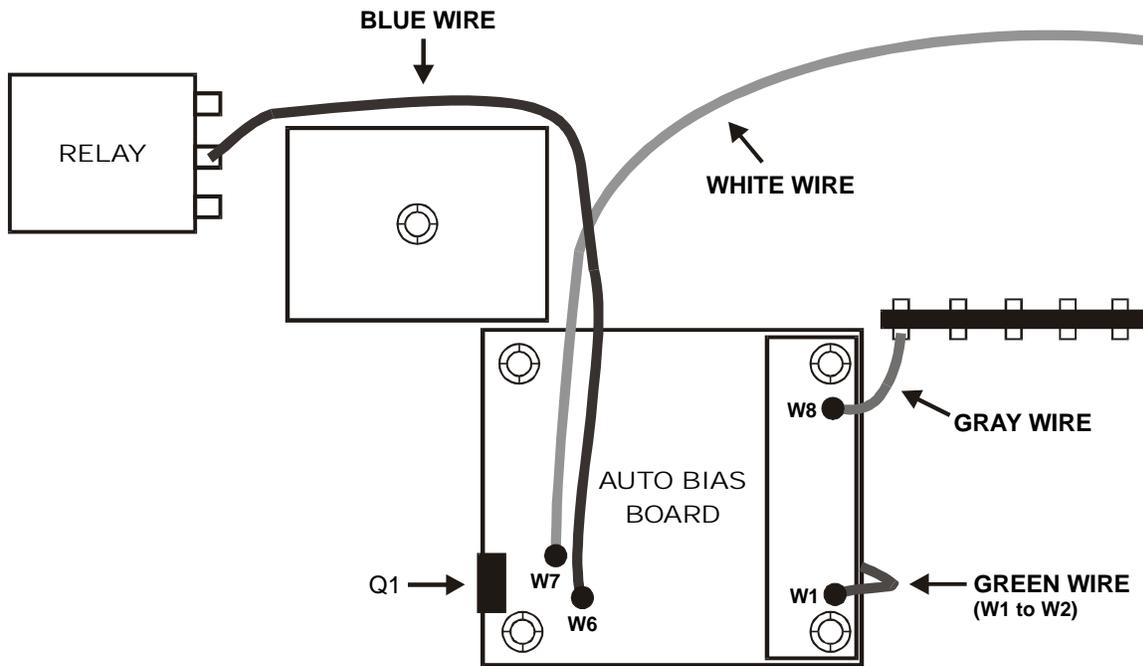
After drilling the holes:

1. The EBS-1 board includes a small gray wire, small green wire, and a long blue wire. Be sure the small gray wire is on the detector board and the green and blue wires are on the large board.
2. Unsolder the white wire from the center normally open contact of the antenna relay and pull it back out of the harness up to the edge of the nylon cable support near the rectifiers. This wire will connect to terminal W7.
3. Place the screws through the panel, heads and lockwashers on the tube side of the panel. Tape can be used to hold the screws in place, as you assemble the hardware stack. The long screws go in the two holes nearest the filter capacitors.
4. After placing the 1/4" spacers over the screws, install the circuit board. The component side of the board is up, and the power transistor (Q1) is near the square blower chamber inlet in the center panel. Secure the board with four #6 x 1/4" hex nuts.
5. Connect the white wire removed in step 2 to terminal W7. Lay the blue wire up towards the top edge of the center panel near the wiring harness. The green wire goes out towards the electrolytics.
6. Slide the two spacers for the detector board over the long screws, and slide the detector board over those same screws with terminal W1 nearest terminal W2 (green wire) on the main control board. The board should have component side out, be parallel to the edge of the main board, and overlap the main board (not hang out over the center panel). Mount the board with two #6 x 1/4" hex nuts.



**Assembly Drawings
Figure 3**

7. The green wire from W2 solders to terminal W1 of the detector board.
8. Route the blue wire over to the relay, keeping it from directly contacting the small circuit board near the relay and the wires from the relay going to that board. Solder the blue wire to the terminal where the white wire was removed (in step 2).
9. Solder the gray wire to the terminal strip containing the two parallel coaxial cable center conductors.
10. Solder the red MOV between the filament transformer terminal containing the bare wire to the zener diodes and the ground lug of the terminal strip.



**Wiring Diagram
Figure 4**

11. Double check everything, clean out all drilling or soldering materials, re-install the tube and transformer, and remove any HV safety grounds.

After reinstalling the cover and reconnecting the amplifier, you can check operation of the bias board by doing the following:

1. Key the amplifier, but do not apply drive. This is normally done by closing the MOX switch on your transceiver with the transceiver in the CW position, and NOT sending. PA anode current should be zero or close to zero.
2. Apply a small amount of RF drive, anything between 1/2 and one watt is enough. Idle current and operation of the SSB/CW switch should be normal. On some radios you might have to switch to SSB and slowly bring up the microphone gain while talking to get the fraction of a watt or so required.
3. In operation, approximately 100 milliwatts of exciter power should trigger the EBS-1 into full conduction. The EBS-1 also holds the quiescent current on after the drive is removed for a tenth of a second.

EBS-1 Schematic

EBS-1 Parts List

QTY	DESCRIPTION	REFERENCE	P/N
2	4.7K OHM 1 WATT RESISTOR	R1,R19	103-3470
1	100 OHM 1/4 WATT RESISTOR	R2	100-2100
1	10 OHM 1/2 WATT RESISTOR	R3	101-1100
2	10K OHM 1/4 WATT RESISTOR	R4,R5	100-4100
1	1K OHM 1/4 WATT RESISTOR	R15	100-3100
1	10 OHM 1/4 WATT RESISTOR	R14	100-1100
1	1M OHM 1/4 WATT RESISTOR		100-6100
3	.001 uF 1KV DISC CAPACITOR	C1,C2,C3	200-1100
2	.01 uF DISC CAPACITOR	C4,C5	200-2100
3	.1 uF DISC CAPACITOR	C6,C7,C9	200-3100
1	.33 uF MULTILAYE CAPACITOR	C10	220-3330
1	50V MOV		304-7050
2	1N270 DIODE	D1,D2	301-0270
1	MJF 3055 NPN POWER TRANSISTOR	Q1	305-3055J
1	MPSA05 NPN TRANSISTOR	Q5	305-0005
1	2N2907A PNP TRANSISTOR	Q7	305-2907
8	PCB POST	W1,W2,W3,W4,W6,W7,W8	720-2670
1	1.5" 20GA GREEN WIRE		871-2055-0150
1	7.5" 20GA BLUE WIRE		871-2066-0750
1	1.5" 20GA GRAY WIRE		871-2088-0250
2	6-32 x 5/8" SCREW		656-0625
2	6-32 x 1 1/4" SCREW		656-1250
4	6-32 x 1/4" HEX SPACER		716C-0250
2	#6 x .375" ROUND SPACER		715-1725-0375
4	#6 LOCK WASHER		711-0627
6	6-32 x 1/4" NUT		705-0632-1

EBS-1H Schematic

EBS-1H Parts List

QTY	DESCRIPTION	REFERENCE	P/N
2	4.7K OHM 1 WATT RESISTOR	R1,R19	103-3470
1	100 OHM 1/4 WATT RESISTOR	R2	100-2100
5	10 OHM 1/2 WATT RESISTOR	R3,R6,R7,R8,R9	101-1100
3	10K OHM 1/4 WATT RESISTOR	R4,R5,R17	100-4100
2	1K OHM 1/4 WATT RESISTOR	R15,R18	100-3100
1	10 OHM 1/4 WATT RESISTOR	R14	100-1100
1	1M OHM 1/4 WATT RESISTOR		100-6100
4	1.5 OHM 2 WATT RESISTOR	R10,R11,R12,R13	104-0150
1	50K TRIMPOT	R16	133-4500
3	.001 uF 1KV DISC CAPACITOR	C1,C2,C3	200-1100
2	.01 uF DISC CAPACITOR	C4,C5	200-2100
3	.1 uF DISC CAPACITOR	C6,C7,C9	200-3100
1	2.2 UF 100V ELECTROLYTIC	C10	270-4220
2	1N270 DIODE	D1,D2	301-0270
1	1N751A 5.1V ZENER DIODE	D3	301-0751
5	MJF 3055 NPN POWER TRANSISTOR	Q1,Q9,Q10,Q11,12	305-3055J
2	MPSA05 NPN TRANSISTOR	Q5,Q8	305-0005
1	2N2907A PNP TRANSISTOR	Q7	305-2907
8	PCB POST	W1,W2,W3,W4,W6,W7,W8	720-2670