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# Installation and Service Manual

## TA120 & TA242 Theatre Power Amplifier



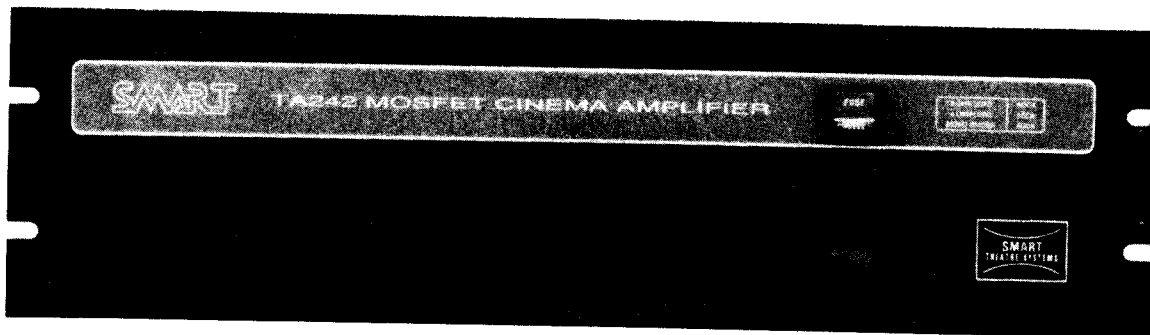
# SMART

**THEATRE SYSTEMS**

5945 Peachtree Corners East - Norcross, GA. 30071

1 (800) 45-SMART or (404) 449-6698

# TA120 AND TA242 THEATRE AMPLIFIER INSTALLATION



## INTRODUCTION

The SMART TA120 and TA242 theatre amplifiers combine the latest MOSFET technology with uniquely simple and effective circuitry to reduce distortion of all types, at all power levels, over the full audio spectrum, to the vanishing point. The conservative mode of operation accomplishes a new high in long term reliability and exceptional resistance to abusive operating conditions. The MOSFET design overcomes the serious limitations of conventional transistors - their tendency to self destruct under other than normal operating conditions. The TA series of amplifiers is so rugged it can deliver more than ten amperes into a short circuit.

The speed - measured as slew rate - of this design delivers unmatched transient linearity, revealing the most subtle sound shadings, textures, and nuances of the soundtrack material, surpassing the capabilities of most theatre loudspeakers by a wide margin.

The giant toroid power transformer and oversized bridge rectifier; the massive heatsinks; the conservative operating levels of the MOSFET devices - all are evidence of the design efforts to achieve exceptional reliability and state of the art sonic reproduction.

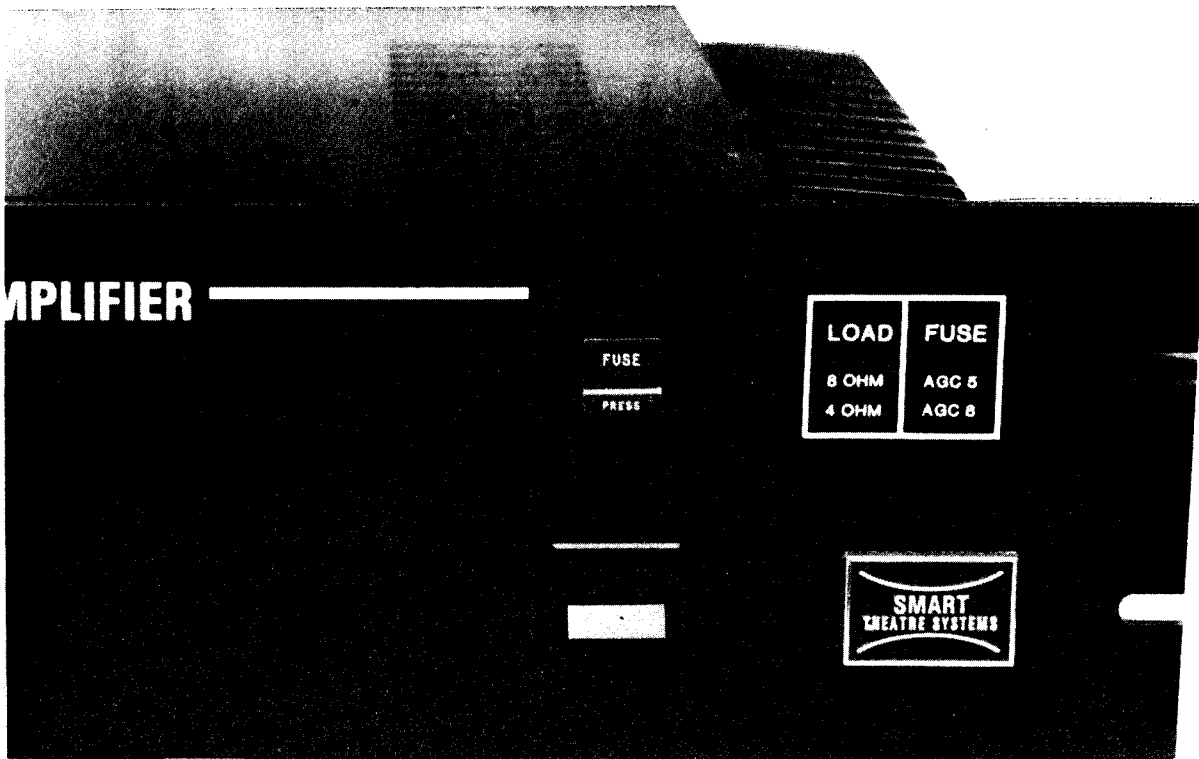
The fully complementary, symmetrical push-pull circuit, which is direct coupled throughout (except at the input) incorporates all silicon devices. Its unique self-protecting output stage prevents the thermal runaway which is a common threat to solid state amplifiers. The special design avoids the need for special protective devices that could compromise audio performance. Basic protective systems provide maximum security against malfunction damage to the amplifier or speaker. There is an AC fuse, B+ fuses, thermal breakers, and loudspeaker fuses. Nothing hinders the essential purity of the sound signal.

## INSTALLATION

The TA120 monaural amplifier needs 4 amperes of AC power and the TA242 dual channel amplifier 7 amperes. Make sure that any power switching panel that may be used to control the AC power of the equipment rack can handle the TOTAL AC REQUIREMENTS of the amplifiers. *If a switching panel cannot handle the AC current draw, then do not plug the amplifiers into the panel - but connect the AC line cords from each amplifier directly to the AC line and use the individual front panel power switches on each amplifier to turn the devices on and off.*

If the amplifier(s) are installed close to a high gain magnetic preamplifier, or stereo SVA processor, you should *check its position for freedom of hum pickup* from the field radiated by the power transformer. Although a toroid transformer minimizes such radiation, and the TA series amplifiers are in steel chassis, certain processors are more sensitive than others, and require separation from the amplifier. Often a few inches additional separation will eliminate the problem.

Be sure to provide sufficient ventilation for the amplifier. Unobstructed air circulation around the finned heat sinks and above the amplifier (near the vented top cover) is important for long, trouble-free life. *Never put anything on top of the vent cover perforations.* It is normal for the heat sinks and top to become warm when the amplifier is in use.



THE TA242 HAS THE MAIN FUSE ON THE FRONT PANEL

## IMPORTANT



The lightning flash with arrowhead, within an equilateral triangle, is intended to alert the user of the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

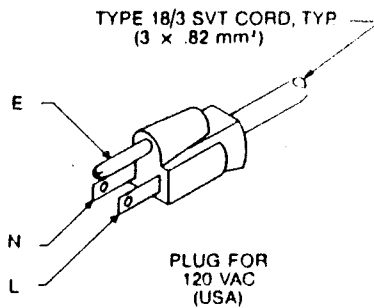
## CAUTION

**RISK OF ELECTRIC SHOCK  
DO NOT OPEN**

**CAUTION:**  
**TO PREVENT THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.**



The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.



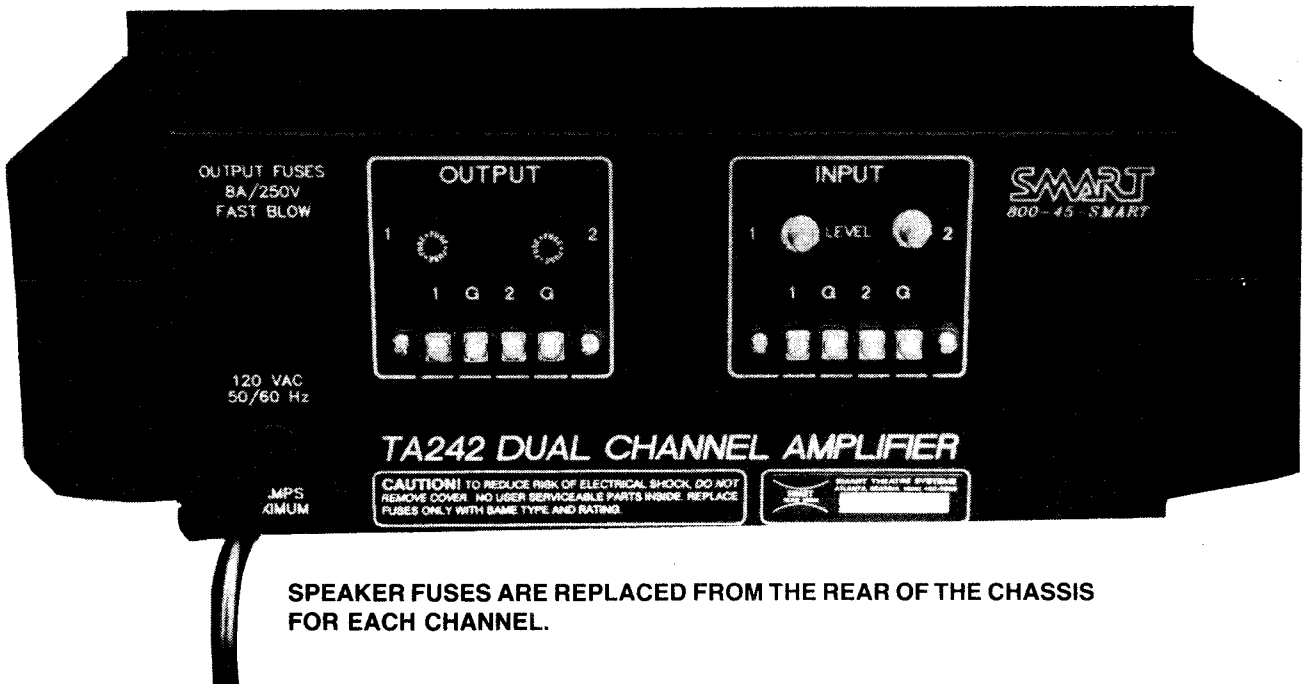
CONDUCTOR		WIRE COLOR	
		Normal	All
L	LINE	BROWN	BLACK
N	NEUTRAL	BLUE	WHITE
E	EARTH GND	GREEN-YELLOW	GREEN

AC MAINS LINE CORD DETAIL

## WARNING

Disconnect the power supplies from the AC power line before replacing components to avoid the danger of electrical shock.

## TA120 & TA242 AMPLIFIERS



**SPEAKER FUSES ARE REPLACED FROM THE REAR OF THE CHASSIS FOR EACH CHANNEL.**

### OPERATION

The amber pilot light which is integrated into the AC power switch on the front panel glows whenever the amplifier is turned on. The pilot light is neon and has an extremely long service life. A blown AC line fuse is the most likely cause of the pilot light to not be illuminated when the amplifier is turned on.

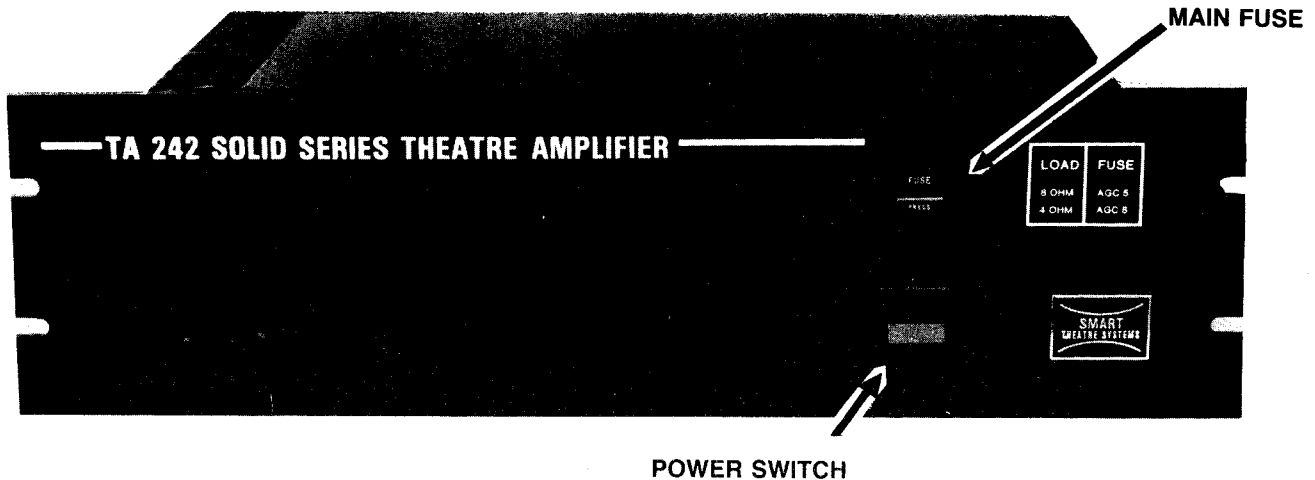
If the amplifier cycles on and off during normal operation check for a shorted, or abnormally low speaker impedance. The thermal circuit breaker *will reset automatically* when the load has been removed or corrected and the heat sink has returned to a normal temperature. Also, check for insufficient ventilation, an excessive input signal, or an input which may have dangerous signal content (such as oscillation). Because of the large heat sinks, it is unlikely that any normal signal will cause the amplifier to overheat.

A pair of 5 amp fast blow fuses are supplied in the speaker fuse holder(s). These fuses (along with the main AC fuse) are replaceable from the rear of the chassis. If the amplifier is to be operated at very high level into a low impedance load (4 ohms), *the speaker fuses may have to be increased to 8 amperes*. A typical application is the surround channel speaker string that may consist of many medium efficiency speakers wired in series-parallel. The fuses are used for speaker and amplifier protection and should not be increased above 8 amperes per channel.

**CAUTION: IF THE INTERNAL FUSES BLOW, SOME DISTORTED SOUND MAY RESULT. IF THE AMPLIFIER MALFUNCTIONS, ALWAYS CHECK FOR BLOWN FUSES FIRST.**

**AC REQUIREMENTS.** The AC power cord should be plugged into 120 volts, 50/60 Hz that can provide at least 7 amperes, or 840 watts. If a switching panel is used in the system to turn all equipment on and off at the same time, be sure the panel can handle the collective current requirements of the equipment. If your line (mains) voltage is different, be sure you have a suitable line-voltage correcting autotransformer or regulating line supply. The performance specifications of the TA series amplifiers are claimed at 120 volts AC.

Special 240 volt AC versions of the amplifiers are available for foreign country applications. Please contact the factory for details on pricing and delivery.

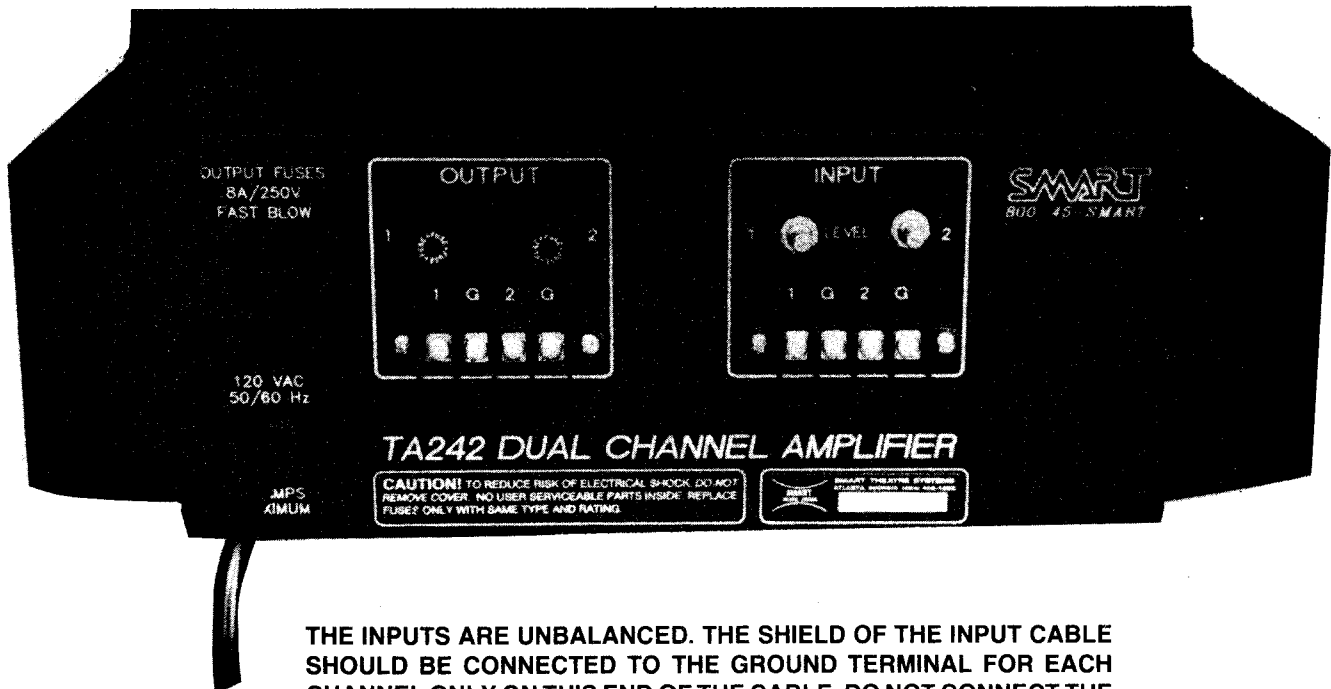


**A LARGER FUSE SHOULD BE USED WHEN THE SPEAKER LOAD IS 4  $\Omega$  TO HANDLE THE HIGHER POWER OUTPUT OF THE AMPLIFIER.**

**INPUT.** Conventional shielded audio cable should be used to connect the output of the processor or preamplifier to the input of the TA series theatre amplifiers. The input to each channel of the amplifier is unbalanced, with one input terminal grounded. Follow conventional professional wiring practice by *grounding the shield ONLY at the sending end of the cable*. Use two conductor shielded audio cable. One conductor of the twisted inner pair is joined to the shield and connected to the grounded output terminal at the processor. The other conductor is the "hot" audio lead, and connects the unbalanced output of the processor to the unbalanced input of the amplifier. *The shield is NOT connected to the amplifier input ground terminal - only the ground conductor of the twisted audio cable.* This procedure will aid in reducing ground loops in the system that can cause hum and the possibility of AC radiated equipment and switching noises.

Most booth processing equipment or preamplifiers have a low impedance output of 600 ohms or less. Cable lengths of up to 50 feet are permissible to the input(s) of the amplifier. Special low capacitance cables enable even greater distances between the processor and amplifier. If the amplifier is remote from the processor, you should avoid running the audio input cables parallel to AC lines - these should be crossed at right angles.

## TA120 & TA242 AMPLIFIERS



THE INPUTS ARE UNBALANCED. THE SHIELD OF THE INPUT CABLE SHOULD BE CONNECTED TO THE GROUND TERMINAL FOR EACH CHANNEL ONLY ON THIS END OF THE CABLE. DO NOT CONNECT THE OTHER END OF THE SHIELD TO ANY EQUIPMENT OR THE RACK.

**LEVEL CONTROLS.** The TA series amplifiers contain input level controls that allow individual power output settings for each channel of a stereophonic theatre sound system. The controls are located on the rear of the chassis. Clockwise rotation of each control increases the output level.

**OUTPUT(S).** The loudspeakers connect to the output terminals on the back panel of the amplifier for each channel of the system. Spade lugs may be connected to the speaker wires to provide a secure and positive electrical connection. Always be sure that no strands of wire are unsecured, and that the bared end of the wire is not too long to risk contacting other terminals or the steel chassis. It is highly recommended that you *test the speaker line with an impedance bridge or ohmmeter* to verify that the speaker wires are not shorted to each other, shorted to conduit, or open. Remember that one of the speaker output terminals is connected to ground at the amplifier chassis and will indicate continuity to other ground points in the equipment rack when measured.

It is important to maintain correct phasing of speakers in a multi-channel sound system. If a speaker phase is reversed in one or more channels, you will find poor stereophonic imaging and bass cancellation between stage speakers. Although surround speakers must be phased to each other, they do not need to be phased to the stage speakers due to the great physical distance in placement in the auditorium. Also, the surround channel of most stereo SVA decoders has a time delay to mask crosstalk. The electronic delay introduces an even greater time difference in the total system.



Select speaker wire of sufficient size to preserve the high damping factor of the amplifiers - and minimize power loss to the speakers. If the speaker load is 4 ohms (surround speakers), be sure to double the gauge of wire for the lower impedance.

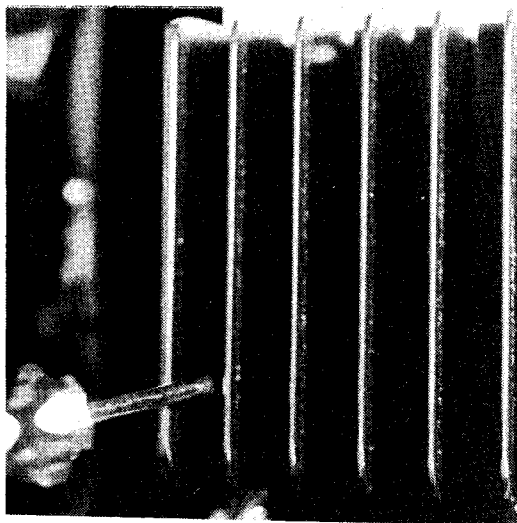
70 Volt line operation is desirable in some surround or lobby speaker operations. An external 70 Volt audio output transformer is available from SMART THEATRE SYSTEMS on special order. Please contact the factory for pricing and delivery. The transformer should be mounted on a blank 19 inch panel or inside the equipment rack. The output leads from the amplifier are connected to the transformer, and the output of the transformer is fed to the 70 volt line speaker string. If the amplifier is committed to 70 volt line operation - you **MAY NOT CONNECT A DIRECT SPEAKER LOAD** to the amplifier at the same time.

## SERVICE

Service instructions are included for use by qualified personnel only. To avoid electrical shock, do not perform servicing other than that described within the Operating Instructions unless you are qualified to do so. Refer all such servicing to qualified service personnel.

Repairs to this product should be performed in accordance with applicable safety standards, and should be performed only by a trained service technician.

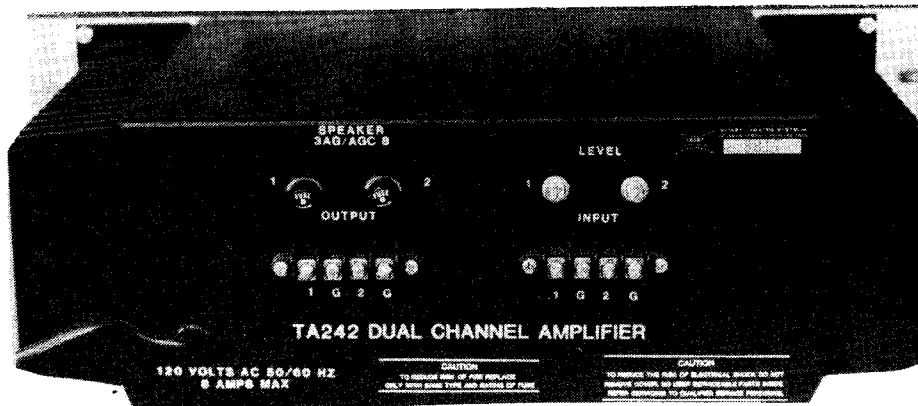
**OUTPUT MODULE SERVICE.** The SMART TA120 and TA242 amplifiers have field replaceable output modules. Each circuit module contains all the active circuitry for each amplifier channel. It is generally not necessary to replace an entire amplifier unit because of the modular design and construction of the TA series. See the section of this manual that refers to module replacement.



**4 HIDDEN SCREWS HOLD  
MODULE ON CHASSIS**

## TA120 & TA242 AMPLIFIERS

**POWER SUPPLY.** The power supplies in the TA120 and TA242 Theatre amplifiers are very reliable and rarely fail. The large toroid transformer, and 25 ampere diode bridge are heavy duty components and are selected for long life and trouble free operation. Check the output of the large filter capacitors with a voltmeter before replacing parts. Un-plugging the active amplifier modules or removing the B+ and B- fuses to each channel will allow you to examine the power supply separately. Turn the AC power off before connecting your service meter probes. Each of the large filter capacitors is referenced to ground. With you test lead connected to the positive terminal of the positive filter capacitor, a DC reading of 65 volts should be observed. Connecting your negative lead of the meter to the negative filter capacitor terminal should reveal -65 volts when the amplifier is not be driven with audio. These measurements will vary if the AC line voltage is not 120 VAC.



**REAR VIEW OF THE CHASSIS. NOTICE INPUT AND OUTPUT TERMINALS ARE SEPARATE. NEVER GROUP THE INPUT AND OUTPUT CABLES TOGETHER. KEEP THEM APART.**

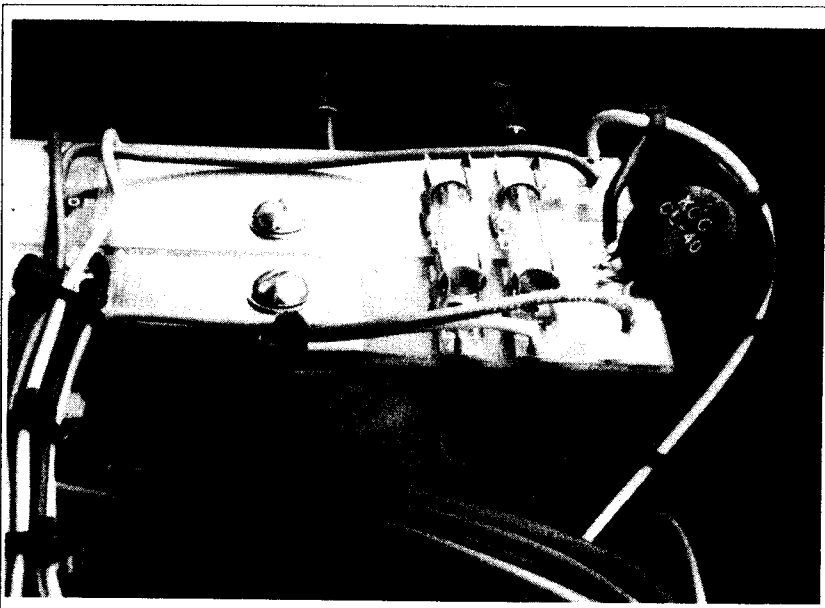
If a certain problem lies in the power amplifier, check the output signal of the amplifier. If a channel cycles on and off during normal operation, excessive temperature on the heat sinks has shut the amplifier down. After a few minutes of cooling, *the channel will re-activate automatically*. If it soon shuts down again, and there is sufficient ventilation and properly loaded, the malfunction is either internal, or the result of an excessive (and very likely inaudible) input signal. In that case, the cause must be investigated.

If the front panel power light is not illuminated, the main fuse on the rear panel of the chassis is probably open. If the fuse replacement does not correct the symptom, the amplifier has a power supply problem, and requires professional service.

A problem with only one channel (in the dual channel TA242) may be isolated by removing one set of B+ fuses in the amplifier chassis, and the other channel may still be left in service. A faulty active amplifier module may be returned to the factory for service or replacement. Shipping a module only reduces shipping weight and the likelihood of damage.

To remove a module, locate the four (4) 6-32 machine screws that secure the module to the steel chassis. They are located inside the heat sink fins near the ends of the module. Remove (and save) the screws. Pull the module straight out to the length of the connecting cable. Separate the Molex connector, and place a plastic bag and rubber band over the portion of the Molex connector that is in the chassis. This will allow you to operate the amplifier's surviving channel (in the dual channel model) without risk of shorting a cable to the power supply parts. We also recommend that the two B+ fuses are removed from the channel that was de-activated. When the replacement module is installed, the fuses must be replaced.

It is the theatre or serviceman's responsibility to ship the faulty components *prepaid* to the factory service department. Units shipped freight collect will not be accepted. Units that are repaired while in warranty will be returned prepaid to the owner. Factory date marks that have been deleted or altered will not be considered under warranty. Warranties are void if: A) The amplifier has been physically or electrically abused or used for some purpose for which it was not designed, or B) The amplifier has been modified without factory authorization.



An inrush current limiter (black disc in the photo) controls the flow of current to the large electrolytics capacitors during "turn on" of the power amplifier. In the unlikely event of a failure of this component, it may be removed from the circuit by shorting the leads of the disc. The amplifier will operate without this device, but the reason for adding it to the amplifier is to limit the sudden inrush of current from the power transformer, which may cause an audible noise during turn on.

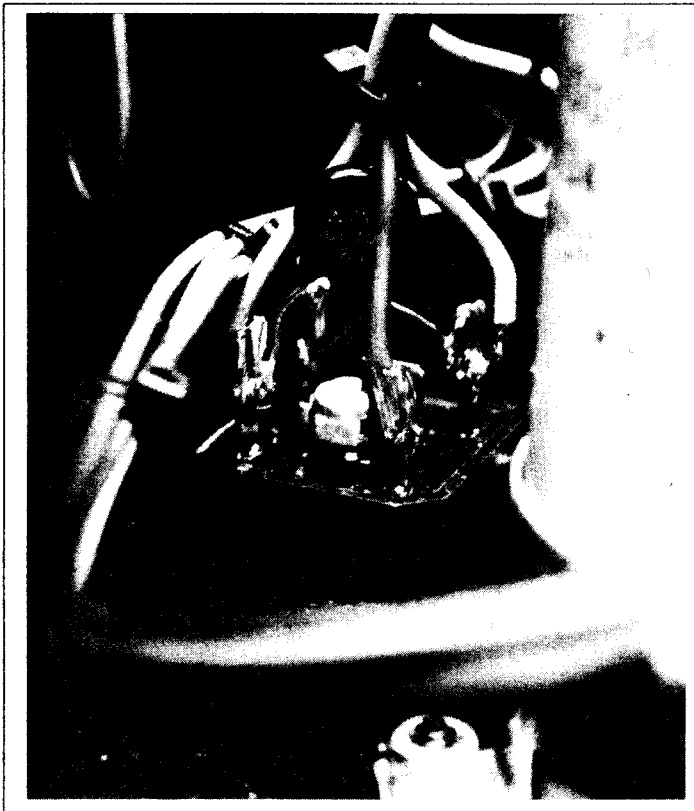
The catastrophic failure fuses for the amplifier are located on top of the power supply P.C. card. These fuses should not blow unless the amplifier is in serious trouble. Also, they may blow if a lightning strike enters the amplifier through the AC power line.

**SERVICING AN AMPLIFIER MODULE.** If you are certain that the problem is confined to one of the amplifier modules (comprising the circuit board, heat sink, and output MOSFETs), you may elect to return the module **ONLY** for factory repair. *Be sure the components on the circuit board are well protected* - by surrounding the component board with corrugated cardboard which projects beyond the components. If you have the proper replacement components and know-how, you may wish to repair the module. Be sure to replace components with the exact replacement value.

**ADJUSTMENTS FOR BIAS AND DC OFFSET.** The two bias potentiometers on each circuit board have been set by the factory and should not require adjustment for the life of the amplifier. In the event of repairs such as transistor replacement, the following procedure should be followed after removing the input and output connections to the amplifier.

**BIAS.** Turn the amplifier off. Remove the B+ fuse. This fuse is in line from the bi-polar power supply positive filter capacitor. Connect an ammeter's plus test lead to the fuse clip that comes from the capacitor. Connect the other ammeter test lead to the other side of the fuse clip. Avoid intermittent connections, and do not short the test leads together. Turn the amplifier on, and if possible, adjust the AC line voltage to 120 volts. Adjust P2, near the middle of the circuit board to 275 mA. Turn the amplifier off, and when the current drops to zero, then remove the ammeter and replace the fuse.

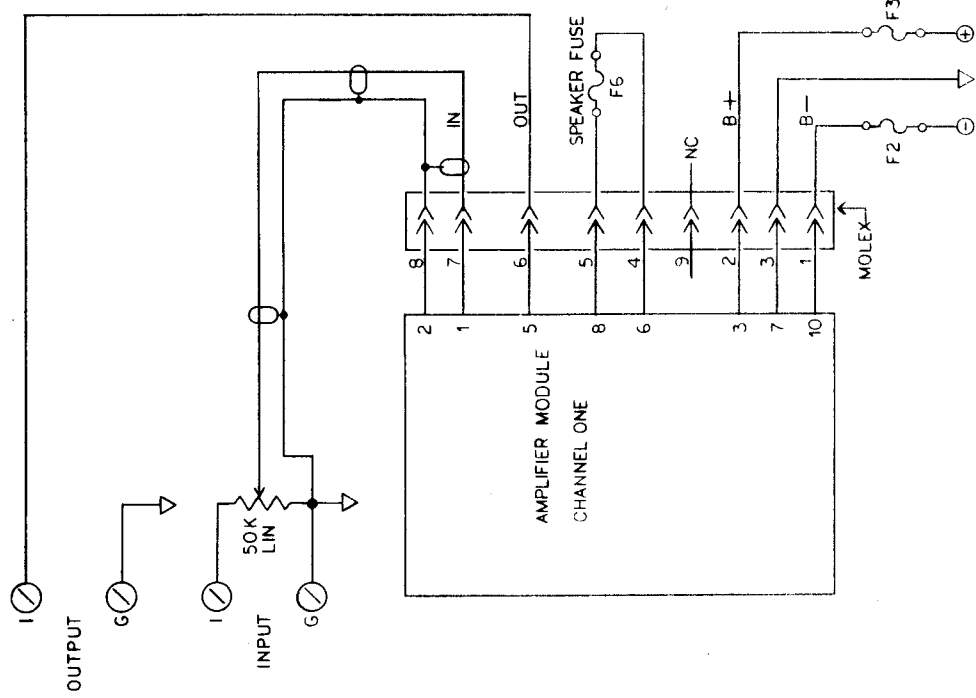
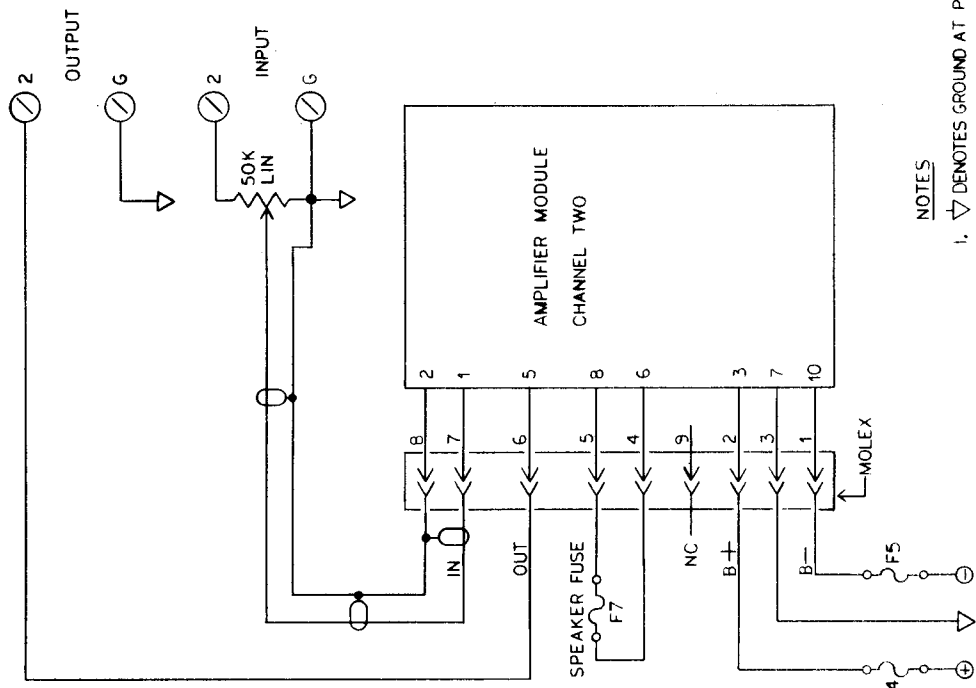
**OFFSET.** A DC voltmeter capable of resolving 10 mV variations is needed. Connect the meter to the output terminals of the selected channel, and adjust P1, near the top of the board, to zero volts. A small correction of the control will produce a large initial change, which will settle down in a few seconds. Repeat these small changes to achieve zero volts.



A MOV (metal oxide varistor) is soldered across the AC input terminals of the large diode rectifier bridge. The bridge is located on the bottom floor of the amplifier chassis, near the electrolytic capacitors. The MOV is used to suppress transient AC spikes that may travel from the AC power input line, through the transformer, and to the bridge. This device will short if blown by a large voltage spike.

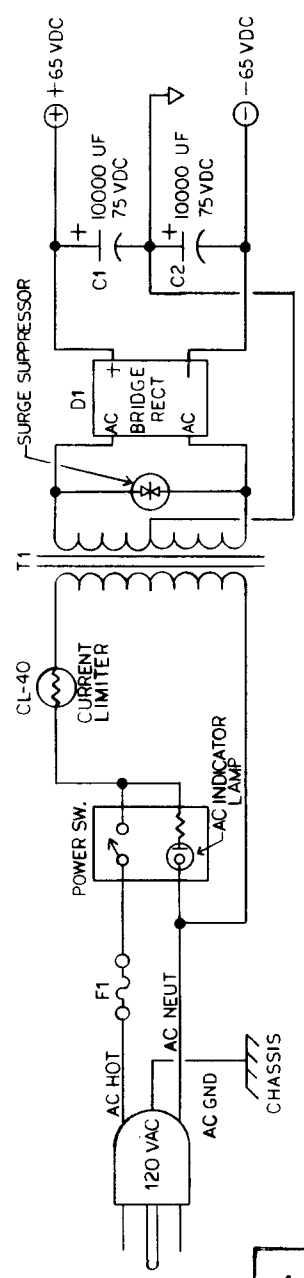
You may clip the MOV out of the circuit and the amplifier will operate without it. However, the protection device is no longer active. The amplifier may be operated in an emergency until the MOV can be replaced.

**DISTORTION.** If any of the internal power supply fuses blow out, *distortion will be heard* in the audio output of the affected amplifier channel. The fuses are mounted inside the chassis, and can be replaced by removing the rack panel mounting screws, sliding the amplifier forward, and removing the protective chassis top cover. *This procedure should be performed only by qualified service personnel.* Check to see that there is no damage to any of the components before replacing the fuses. If the fuses blow again, you may have a faulty component.

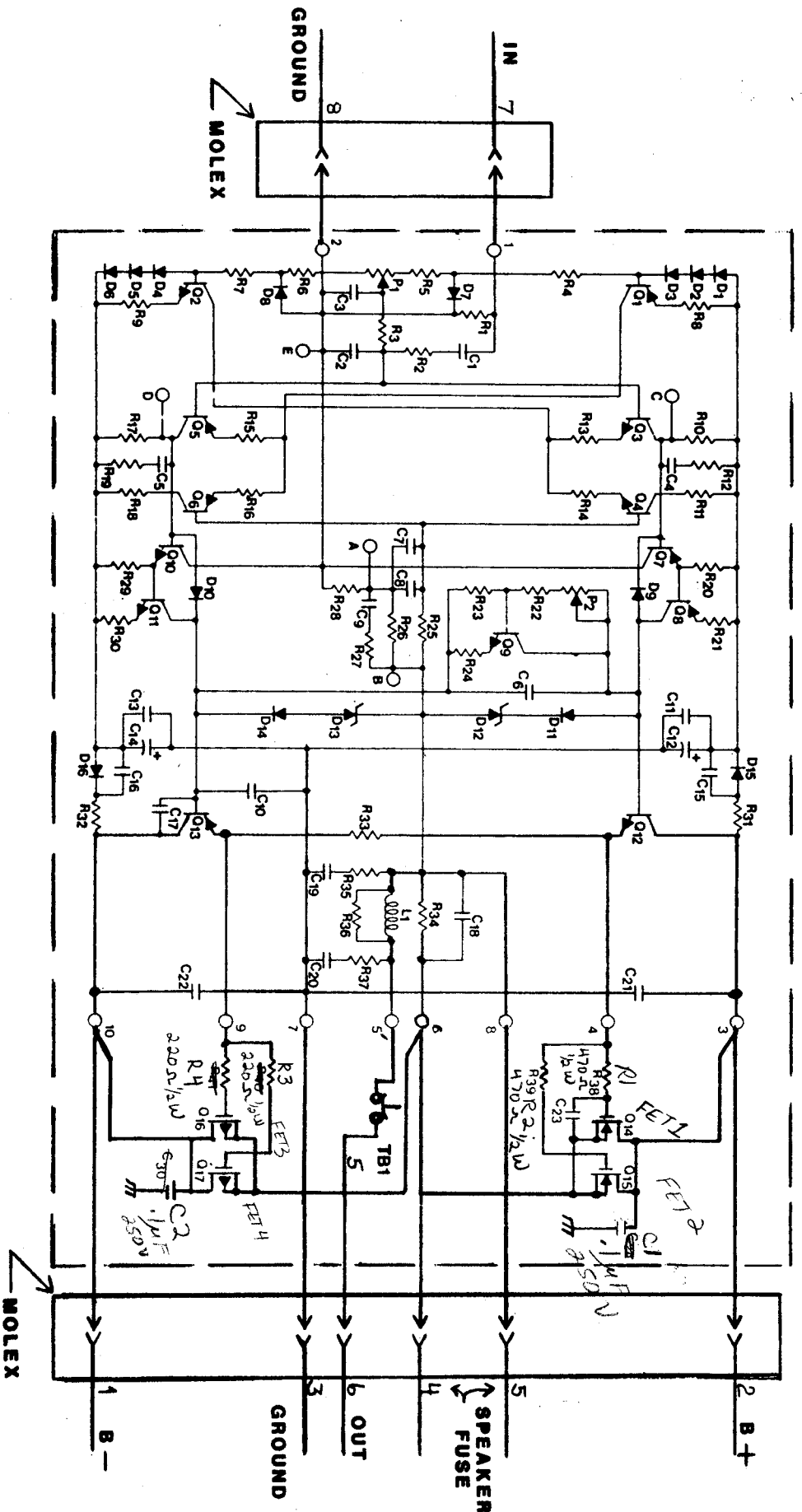


**NOTES**

1. ▽ DENOTES GROUND AT POWER SUPPLY
2. F1 IS AGC 5 WITH 8Ω LOAD, AGC 8 WITH 4Ω LOAD
3. F2-F7 ARE AGC 8
4. D1 IS 15 AMP 200 V BRIDGE
5. Ⓢ DENOTES SHIELDED CABLE



<b>SMART THEATRE SYSTEMS</b>	
DRAWN BY: OLN	REV: _____
DATE: 7-30-66	REV: _____
SHEET: 1 OF 2	
TITLE: SCHEMATIC - DUAL CHANNEL AMP	
MODEL: TA240 & TA242	DRAWING # 0242A500



**NOTES**

- 1) TB1 IS THERMAL BREAKER IN SERIES WITH LOAD
- 2) TYPICAL OF BOTH CHANNELS

SMART THEATRE SYSTEMS			
DRAWN BY:	DATE:	SHEET	OF 2
OLW	8/7/94	2	2
SCHEMATIC - MODULE			
TA240 & TA242		0242A500	

# TA120 & TA242 AMPLIFIERS

All resistors are 1/4 w carbon film unless specified otherwise.

R1	470,000 ohms	Part No.	C21	0.1 mfd, 250V, Film	CC125
R2	1,800 ohms	RC044	C22	0.1 mfd, 250V, Film	CC125
R3	47,000 ohms	RC023	C23	680 pF, 500V, Mica	CM121
R4	47,000 ohms	RC043	C24	.01 mfd, 100V, Polyester	CE111
R5	1,000 ohms	RC043	C25	10,000 mfd, 75V, Electrolytic	CL121
R6	1,000 ohms	RC015	C26	10,000 mfd, 75V, Electrolytic	CL121
R7	47,000 ohms	RC015	C27	.01 mfd, 1000V, Disc	CZ112
R8	560 ohms	RC015	C28	.39 mfd, 100V, Polyester	CE117
R9	560 ohms	RC043	C29	.005 mfd, 1000V, Disc	CZ113
R10	1,800 ohms	RC045	C30	.01 mfd, 100V, Film	CP135
R11	1,800 ohms	RC023	D1	IN4148 Diode	QD116
R12	270 ohms	RC023	D2	IN4148 Diode	QD116
R13	47 ohms	RC029	D3	IN4148 Diode	QD116
R14	47 ohms	RC039	D4	IN4148 Diode	QD116
R15	47 ohms	RC039	D5	IN4148 Diode	QD116
R16	47 ohms	RC039	D6	IN4148 Diode	QD116
R17	1,800 ohms	RC023	D7	IN4148 Diode	QD116
R18	1,800 ohms	RC023	D8	IN4148 Diode	QD116
R19	270 ohms	RC029	D9	FDH-400 Diode	QD121
R20	1,800 ohms	RC023	D10	FDH-400 Diode	QD121
R21	82 ohms	RC053	D11	IN4148 Diode	QD116
R22	560 ohms	RC045	D12	IN5240B 10V Zener Diode	QD111
R23	470 ohms	RC041	D13	IN5240B 10V Zener Diode	QD111
R24	10 ohms	RC013	D14	IN4148 Diode	QD116
R25	33,000 ohms	RC036	D15	IN4003 Diode	QD115
R26	3,300 ohms, 1W, metal film	RZ013	D16	IN4003 Diode	QD115
R27	1,000 ohms, 1/4W, metal film	RM021	D17	IN4003 Diode	QD115
R28	150 ohms, 1/4W, metal film	RM013	DB1	Diode Bridge, 25A	QD117
R29	1,800 ohms	RC023	P1	1,000 ohms trimpot	RP011
R30	82 ohms	RC053	P2	1,000 ohms trimpot	RP011
R31	47 ohms, 1/4W, carbon comp.	RZ011	F1	7A, 3AG	SF021
R32	47 ohms, 1/4W, carbon comp.	RZ011	F2	3A, 3AG	SF012
R33	220 ohms, 1/2W	RD114	F3	8A, 3AG	SF012
R34	2,200 ohms, 1/2W	RD115	F4	8A, 3AG	SF011
R35	10 ohms	RC013	F5	8A, 3AG	SF026
R36	1 ohm, 10W	RW012	T1	Power Transformer, Domestic	TA123
R37	10 ohms, 5W	RW013	T2	Power Transformer, International	TA124
R38	470 ohms, 1/2W	RD117	Q1	2N5401	QP122
R39	470 ohms, 1/2W	RD117	Q2	2N5550	QN128
R40	220 ohms, 1/2W	RD114	Q3	2N5550	QN128
R41	220 ohms, 1/2W	RD114	Q4	2N5550	QN128
R42	1 meg ohms, 1/2W	RD113	Q5	2N5401	QP122
C1	2 mfd, 50V, Film	CP115	Q6	2N5401	QP122
C2	330 pF, 630V, Film	CP134	Q7	2N5401	QP122
C3	.01 mfd, 250V, Film	CP135	Q8	2N5415	QP123
C4	.001 mfd, 250V, Film	CP136	Q9	NP2222	QN124
C5	.001 mfd, 250V, Film	CP136	Q10	2N5550	QN128
C6	.1 mfd, 250V, Film	CC125	Q11	2N3440	QN125
C7	.1 mfd, 250V, Film	CC125	Q12	2N3440	QN125
C8	220 mfd, 10V, Non-polar Electrolytic	CN112	Q13	2N5415	QP123
C9	150 pF, 630V, Film	CP133	Q14	2SK134	QN112
C10	330 pF, 630V, Film	CP134	Q15	2SK134	QN112
C11	.01 mfd, 250V, Film	CP135	Q16	2SJ49	QP112
C12	100 mfd, 100V, Electrolytic	CL122	Q17	2SJ49	QP112
C13	.01 mfd, 250V, Film	CP135	TB1	Thermal Breaker	SF024
C14	100 mfd, 100V, Electrolytic	CL122	TB2	Thermal Breaker	SF024
C15	.01 mfd, 250V, Film	CP135	L1	Output Inductor	TA112
C16	.01 mfd, 250V, Film	CP135			
C17	150 pF, 630V, Film	CP133			
C18	.01 mfd, 250V, Film	CP135			
C19	.01 mfd, 250V, Film	CP135			
C20	.1 mfd, 250V, Film	CC125			