PRICE $4.00

FEDERAL SIGNAL CORPORATION
Emergency Products

MODEL PA500U

AMPLIFIER

Series B

INSTALLATION AND SERVICE MANUAL

LIMITED WARRANTY

The Signal Division, Federal Signal Corporation (Federal), warrants each new product to be free from defects in material and workmanship, under normal use and service, for a period of two years on parts replacement and one year on labor from the date of delivery to the first user-purchaser.

During this warranty period, the obligation of Federal is limited to repairing or replacing, as Federal may elect, any part or parts of such product which after examination by Federal discloses to be defective in material and/or workmanship.

Federal will provide warranty for any unit which is delivered, transported prepaid, to the Federal factory or designated authorized warranty service center for examination and such examination reveals a defect in material and/or workmanship.

This warranty does not cover travel expenses, the cost of specialized equipment for gaining access to the product, or labor charges for removal and re-installation of the product. Lamps, flash tubes, or batteries are not covered under warranty.

This warranty does not extend to any unit which has been subjected to abuse, misuse, improper installation or which has been inadequately maintained, nor to units which have problems relating to service or modification at any facility other than the Federal factory or authorized warranty service centers.

THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL FEDERAL BE LIABLE FOR ANY LOSS OF PROFITS OR ANY INDIRECT OR CONSEQUENTIAL DAMAGES ARISING OUT OF ANY SUCH DEFECT IN MATERIAL OR WORKMANSHIP.

FEDERAL SIGNAL CORPORATION 290A2197B

SECTION I
GENERAL DESCRIPTION

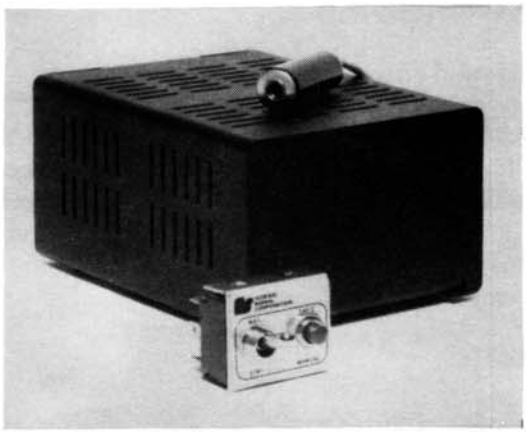

Figure 1. Model PA500U-012SB.

The Federal Model PA500U-012SB Amplifier is a precision built, reliable electronic siren incorporating state-of-the-art CMOS technology. The siren operates from a nominal 12Vdc, negative ground, electrical system. It is capable of operating with one 58-watt speaker or one 100-watt speaker. (The amplifier comes factory set for a 100-watt output.) The factory set output can be changed, as described in Section V of this manual.

The standard operating functions of this siren are Wail, Tap II, Yelp and manual peak-and-hold. The Tap II feature allows the driver to change the siren sound from wail to yelp via the vehicle's horn ring. This can also be accomplished by depressing the control head's pushbutton switch. Tap II provides an especially effective traffic clearing capability.

A bracket mounted control head controls siren operation. The siren also has provisions for public address (PA) operation. An optional Federal Model MNCT Microphone is required if it is desired to make use of the PA capability.

The siren can be installed in any convenient location that is dry and well ventilated, such as under the front seat or in the trunk. Installation instructions are contained in Section III.

The siren's power/control cable is terminated with bullet connectors. These connectors mate with connectors from the control head, power source and speaker to provide a quick, easy installation.

SECTION II
SPECIFICATIONS

Input Voltage	11Vdc to 16Vdc
Polarity	Negative ground only
Standby Current	30mA ± 5mA
Operating Temperature Range	-30°C to +65°C
Operating Current (14Vdc, Wail)	4.5 amperes (58 watt) 7.0 amperes (100 watt)
Frequency Range	500 to 1500Hz
Cycle Rate	Wail - 12 cycles/minute (nominal) Yelp - 180 cycles/minute (nominal)
Voltage Output (approx.)	45V p-p (58 watt) 60V p-p (100 watt)
Audio Frequency Range	300 to 10KHz
Harmonic Audio Distortion (300-3KHz)	10% max. all power levels from 1/2 to 50 watts
Input Voltage Required to Obtain 15Vrms across Speaker Load	0.5Vrms
Dimensions (HWD - less mtg. brkt.)	3.05" x 4.36" x 6.38"
Net Weight	4-1/2 pounds
Shipping Weight	6-1/2 pounds

SECTION III
INSTALLATION

SAFETY MESSAGE TO INSTALLERS OF ELECTRONIC SIRENS

The lives of people depend on your safe installation of Federal products. It is important to follow all instructions shipped with the products. In addition, listed below are some other important safety instructions and precautions you should follow:

- Read and understand all instructions before installing or operating this equipment.
- To properly install an electronic siren, you must have a good understanding of automotive electrical systems and emergency signalling procedures.
- DO NOT install equipment or route wiring or cord in the deployment path of an air bag.
- DO NOT connect this system to the positive terminal of the battery until installation is complete, and you have verified that there are no short circuits to ground.
- When drilling into a vehicle structure, be sure that both sides of the surface are clear of anything that could be damaged.
- In order for the electronic siren to function properly, the ground connection must be made to a solid chassis component and not to an insulated point.
- Locate the electronic siren so the vehicle, controls, and microphone can be operated safely.
- After testing is complete, provide a copy of this manual to all operating personnel.

Failure to follow all safety precautions and instructions may result in property damage, serious injury, or death to you or others.

3-1. UNPACKING.

After unpacking the siren, examine it for damage that may have occurred in transit. If the equipment has been damaged, file a claim immediately with the carrier stating the extent of the damage. Carefully check all envelopes, shipping labels and tags before removing or destroying them.

3-2. GENERAL.

The Model PA500U-012SB is a 12-volt electronic siren designed for undercover applications. The standard operating functions of this siren are Wail, Tap II, Yelp, Manual Peak-and-Hold and Public Address. The printed circuit board is conformal coated to reduce its susceptibility to damage from shock. The unit is designed for 100 watt applications.

An optional Model MNCT Microphone can be added to utilize the public address capability of the electronic siren.

3-3. INSTALLATION.

A. *Kit Contents List.*

Before attempting installation, insure that the following parts have been included:

Qty.	Description	Part No.
1	Switch, DPDT, Toggle	122A211
1	Switch, SPST, Pushbutton	122A228
1	Bracket, Switch Mounting	159B178
1	Cable Assy., Switch (Interface)	175A542
6	Receptacle, Bullet	224A226-01
2	Connector, Bullet	224A227-01
2	Screw,Rd.Hd.Mach., 8-32	7000A063-08
4	Screw,Hex.Hd., 1/4-20	7002A000-12
2	Screw,Thd.Form. Phillips, #8	7011A012-08
4	Screw ,Thd.Form. Slotted, 14A	7011A114-12
4	Screw, Thd. Form. Hex. Hd., #10	7011A135-08
2	Nut, Hex. ,8-32	7059A008
4	Nut, Hex. 1/4-20	7059A018
4	Nut, Hex., 15/32-32	7059A071
4	Lockwasher, Split, 1/4	7074A015
1	Legend Plate	8136C707A-11
1	Wirenut	8287A154
1	Bracket, Mounting	8536C1011

B. *Siren Chassis Mounting (see figure 2).*

1. Secure both mounting brackets to the chassis with #10 thread-forming hex. head screws (2 for each bracket), as shown in figure 2.

CAUTION

The Amplifier is NOT waterproof. It must be mounted in a location which is sheltered from falling rain, snow, standing water, etc. Also, it must be installed in an adequately ventilated area. Never install near heater ducts. Also, do not install the amplifier under the hood.

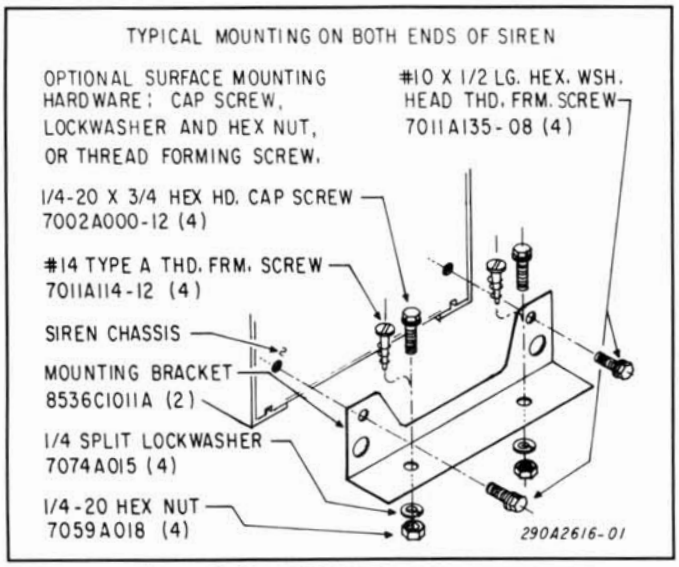

Figure 2. Mounting Bracket Installation.

2. Select a suitable mounting location for the Amplifier. Some possible mounting locations are: under the dash, under the front seat, or in the trunk (under the rear deck, near the rear seat speakers, if vehicle is so equipped). Keep in mind that the control cable is 10-feet long and the power cable is 8-feet long.

3. Using the chassis mounting brackets as templates, scribe four drill position marks at the mounting location.

CAUTION

When drilling holes in ANY part of a vehicle, insure that both sides of the mounting surface are clear of parts that could be damaged; such as brake lines, fuel lines, electrical wiring or other vital parts.

4. The chassis can be mounted using either of two types of mounting hardware.

a. First, four thread-forming 14A screws are provided. If the chassis will be secured via this method, drill 0.196 dia. (#9 drill) holes at the position marks.

b. The chassis can also be secured using the supplied four (each) 1/4-20 hex. head screws, split lockwashers and nuts. Drill 9/32-inch dia. holes at the position marks, if this hardware will be used.

5. Secure the chassis with the hardware selected in step 4.

C. *Control Head Installation.*

WARNING

When installing equipment inside air bag equipped vehicles, the installer MUST ensure that the equipment is installed ONLY in areas recommended by the vehicle manufacturer.

Failure to observe this warning will reduce the effectiveness of the air bag, damage the air bag, or potentially damage or dislodge the equipment, causing serious injury or death to you or others.

1. Peel off the protective paper backing from the legend plate. Carefully align the holes in the legend plate with the holes in the switch mounting bracket (see figure 3).

NOTE

Two equal sized mounting holes should be at the top of the bracket. Press the legend plate firmly against the bracket to insure that the plate adheres firmly to the bracket.

2. Select a suitable mounting location for the switch mounting bracket. Using the mounting bracket as a template, scribe two drill position marks at the mounting location.

CAUTION

When drilling holes in ANY part of a vehicle, insure that both sides of the mounting surface are clear of parts that could be damaged; such as brake lines, fuel lines, electrical wiring or other vital parts.

3. Drill mounting holes at the position marks. Secure the mounting bracket with two #8 thread-forming screws or two (each) 8-32 screws and hex nuts as shown in figure 3.

4. See figure 4. Install the toggle switch in the position marked WAIL/STBY. Observe the keyway. Install the pushbutton in the position

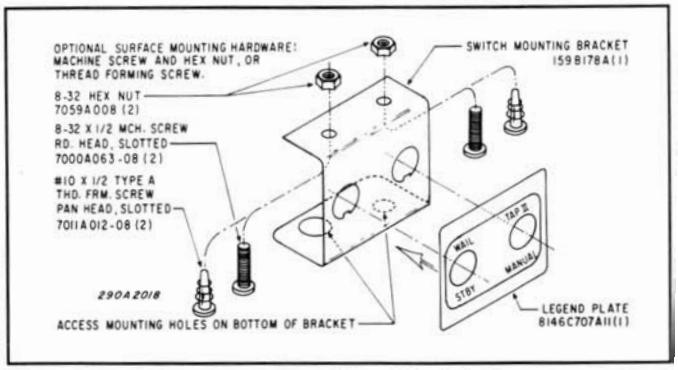

Figure 3. Control Head Installation.

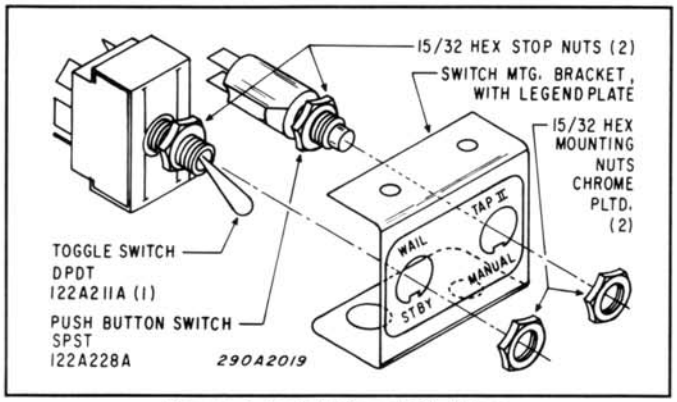

Figure 4. Installation of Switches.

marked TAP II/MANUAL. Note that two 15/32-32 hex nuts are used to secure each switch.

D. *Interface Cable Connections.*

WARNING

Do not connect the siren power lead to the battery at this time.

1. Connect the interface cable leads to the siren leads by mating like colored leads as shown in figure 5. The blue wire from the siren should be cut off and discarded.

2. Connect the other end of the interface cable to the control head switches and ignition accessory wire as shown in figure 5.

E. *Horn Ring Connections.*

To connect the vehicle horn ring circuit so that the horn ring controls the peak-and-hold function in the STBY mode and TAP II Yelp in the WAIL mode, proceed as follows (see figure 5):

NOTE

In order for horn ring transfer to operate, the vehicle's horn must switch to ground.

1. Locate the wire that connects the horn ring switch to the horn or horn relay. Cut this wire somewhere between the horn ring switch and the horn or horn relay.

2. Connect a wire from the horn ring switch to the wiper of the WAIL/STBY toggle switch.

3. Connect a wire from the horn or horn relay to the top contact of the WAIL/STBY toggle switch.

F. *Microphone.*

Route the microphone cable to the desired microphone location. Install a Federal Model MNCT* microphone (optional).

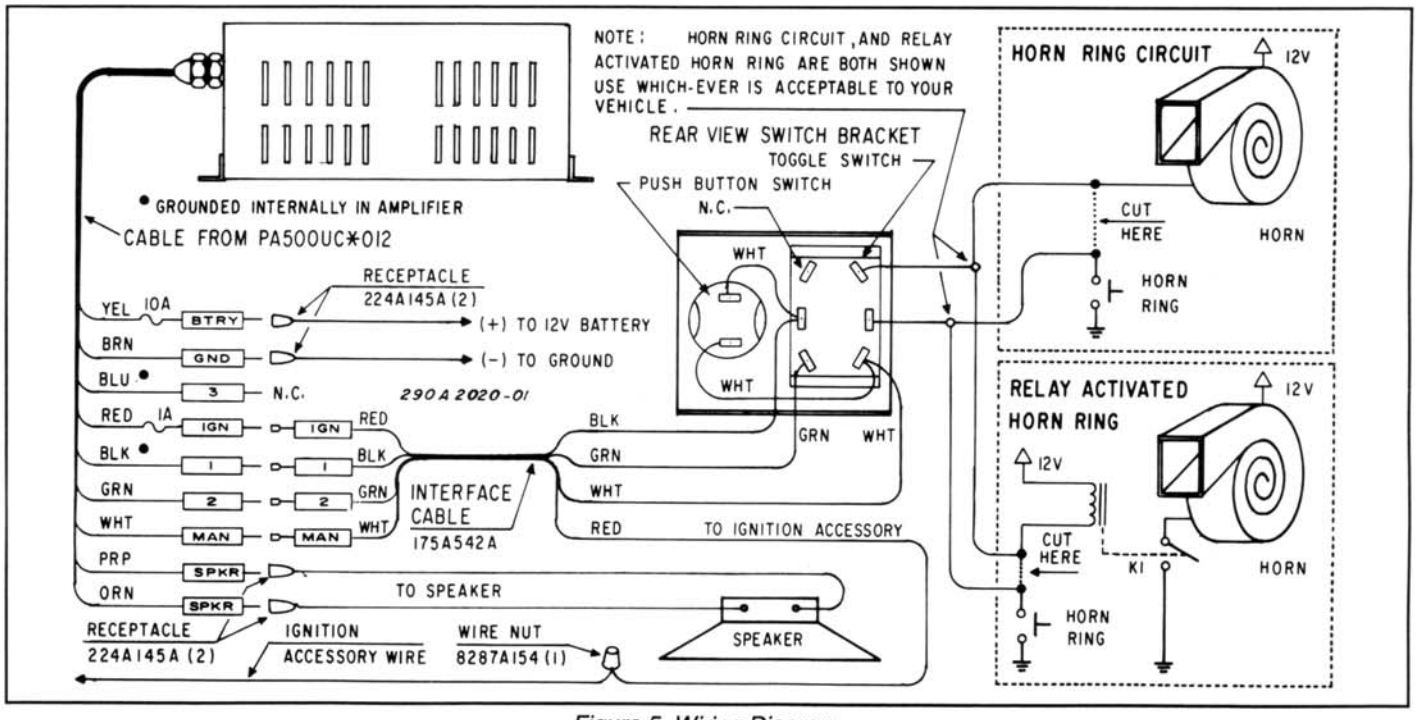

Figure 5. Wiring Diagram.

G. *Power Connection (see figure 5).*

WARNING

Failure to observe this WARNING may result in fire, burns or blindness.

If shorted to vehicle frame, high current conductors can cause hazardous sparks resulting in electrical fires or molten metal.

DO NOT connect this system to vehicle battery until ALL other electrical connections are made and mounting of all components is complete.

Verify that no short circuits exist, before connecting to the Positive (+) battery terminal.

NOTE

This siren operates from a 12Vdc negative ground power source only.

1. Locate the brown wire in the siren cable. Connect the brown wire directly to the vehicle frame as close as possible to the battery. Scrape paint away from the selected bolt hole to insure a good electrical connection to the chassis.

2. Locate the yellow wire with the l0-ampere fuse and fuseholder. Connect the yellow wire to the vehicle's positive battery terminal.

NOTE

If necessary , additional AWG16 or larger wire can be spliced to the power leads. Also, bullet receptacles are included in the kit to aid in making connections.

H. *Speaker Connections.*

CAUTION

This unit is designed to operate with one speaker and may be damaged if two speakers are connected. NEVER connect two speakers to the speaker connections.

The Model PA500U-012SB comes from the factory with its output set at 100 watts. The output may be decreased to 58 watts by performing the procedure described in Section V, paragraph 5-3.

CAUTION

Be sure a properly rated speaker is used with this siren. A 58 watt speaker will be damaged or destroyed if used with this siren, when its output is set at 100 watts.

Locate the purple and orange wires in the siren cable. Connect these wires to the speaker leads. Bullet receptacles are included in the kit to aid in making connections.

I. *Testing After Installation.*

After installation; test the electronic siren, including horn operation, to ensure that it is operating properly.

SAFETY MESSAGE TO OPERATORS OF FEDERAL SIGNAL ELECTRONIC SIRENS

The lives of people depend on your safe use of Federal products. Listed below are some important safety instructions and precautions you should follow:

- Read and understand all instructions in this manual before operating electronic siren.
- Although your warning system is operating properly, it may not be completely effective. People may not hear, see, or heed your warning signal. You must recognize this fact and continue driving cautiously.
- Situations may occur which obstruct your visual/audible warning signal when natural or man-made objects are between your vehicle and others, such as when you raise your hood or trunk lid. If these situations occur, be especially careful.
- All effective sirens and horns produce loud sounds which may cause, in certain situations, permanent hearing loss. You should take appropriate safety precautions such as wearing hearing protection.
- Your hearing and the hearing of others, in or close to your emergency vehicle, could be damaged by loud sounds. This can occur from short exposures to very loud sounds, or from longer exposures to moderately loud sounds. For hearing conservation guidance, refer to federal, state, or local recommendations. OSHA Standard 1910.95 offers guidance on "Permissible Noise Exposure."
- At the start of your shift, you should ensure that the light/sound system is securely attached to the vehicle and operating properly.
- Carefully inspect speaker to ensure that it is clear of any obstruction, such as mud or snow, which will reduce optimum sound propagation.
- If driving conditions require your full attention, you should avoid operating the siren controls.
- It is important that you fully understand how to safely operate this warning system before use

Failure to follow these safety precautions may result in property damage, serious injury, or death to you, to passengers, or to others.

SECTION IV
CIRCUIT DESCRIPTION

Refer to the block diagram (figure 6) and schematic diagram (figure 9) while reading this section

4-1. RATE OSCILLATOR AND VOLTAGE CONTROLLED OSCILLATOR.

The rate oscillator and voltage controlled oscillator (VCO) sections are the "heart" of the Model PA500 circuitry. Not only does the rate oscillator determine the cycling rate of each siren tone, but it also generates the control voltage that operates the VCO. The VCO generates a square-wave output whose frequency is directly proportional to the control voltage. The output of the VCO is coupled to the siren preamplifier

The siren rate oscillator consists of an LM555 timer configured as an astable oscillator. The astable oscillator (IC3) employs an analog switch (IC5C) to select the RC timing network which determines the astable oscillator's timing rate. IC5B, another analog switch, connects the discharge pin of IC3 to the RC timing network. When the peak function is called for, the control pin IC5-pin 5 goes to a logic "0" putting the switch in a high impedance state (OFF). Simultaneously, control pin IC5C-pin 6 goes to a logic "1" and allows the siren to charge at a yelp rate until the tone peaks.

IC1, a phase-locked loop, contains the voltage controlled oscillator. C8, R1, R5, R13 and the control voltage on IC1-pin 9 determines the output frequency. As the siren coasts down in the manual mode, the output of the VCO must be disabled to prevent frequencies lower than 350Hz from damaging the amplifiers output transistors. IC2, a voltage comparator, compares the VCO control voltage to the low frequency reference voltage set by R15 and R23. When the VCO control voltage drops below the reference, IC2-pin 7 goes to a logic "1" through OR gate IC4B. The VCO is also inhibited when the microphone push-to-talk input is selected. This logic level is gated through IC8D and IC4B to the VCO inhibit pin.

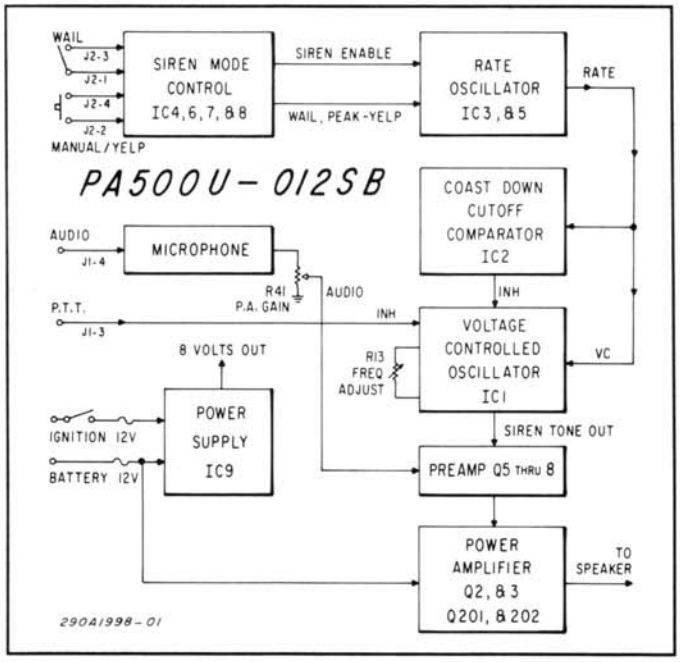

Figure 6. Block Diagram.

4-2. SIREN MODE CONTROL.

The wail mode is controlled by a logic "0" at IC8A. Through IC8A, the astable oscillator is enabled and the wail function is produced. While the wail mode is activated, the yelp mode may be selected by a logic "0" at IC8C. Through IC7 and IC8, flip-flop IC6 changes state and brings control pin IC5-pin 6 to a logic "1" thus switching in the necessary RC network to produce the yelp signal.

The manual mode is enabled with the siren in the standby mode and IC8C-pin 11 at a logic "0". IC4C, IC5B, IC5C and IC7B provide the necessary decoding for the manual mode.

4-3. AUDIO SECTION.

The amplifier system consists of MOSFET/ Bipolar complementary voltage and power gain amplifiers. The circuit consisting of Q5, Q6, Q7 and Q8 use both AC and DC feedback to insure stability and maximum linear signal swing. The overall mid-band voltage gain is set by the ratio of feedback resistor R43 and Q5 source resistor R16. Frequency compensation is set by the combination of C3, R28 and C27.

Audio signal levels are coupled to the amplifier through R41. An input voltage of approximately 250mV is required to drive the amplifier to full rated sine wave power. This level is produced by the transistorized MNCT* microphone in the PA mode.

The amplifier enable line uses a relay (K1) to disable the amplifier section, when neither siren or PA functions are needed.

Temperature compensation and bias current for minimizing crossover distortion is supplied by thermistor RT1 and the voltage divider (R1 and R12) across diode reference CR2. Q1 is used to switch the bias "on" during PA messages.

4-4. POWER SECTION.

The ignition line supplies B+ to the printed circuit board. Networks consisting of C18, CR6, CR7 and C17 provide input filtering for voltage regulator LM7808. B+ from the battery supplies bias to the output section consisting of T201, Q201 and Q202.

SECTION V
SERVICE AND MAINTENANCE

SAFETY MESSAGE TO PERSONNEL SERVICING FEDERAL SIGNAL ELECTRONIC SIRENS

The lives of people depend on your safe servicing of Federal products. It is important to follow all instructions shipped with the products. In addition, listed below are some other safety instructions and precautions you should follow:

- Read and understand all instructions in this manual before servicing this equipment.
- To properly service an electronic siren, you must have a good understanding of automotive electrical systems and emergency signalling procedures.
- All effective sirens and horns produce loud sounds which may cause, in certain situations, permanent hearing loss. You should take appropriate safety precautions such as wearing hearing protection.
- In order for the electronic siren to function properly, the ground connection must be made to a solid chassis component and not to an insulated point.

Failure to follow all safety precautions and instructions may result in property damage, serious injury, or death to you or others.

5-1. GENERAL.

Most of the electronic component parts used in the PA500U-012SB are standard items that are available at almost any radio or electronics supply outlet.

The factory can and will service your equipment or provide technical assistance with problems that cannot be handled satisfactorily and promptly locally.

If any unit is returned for adjustment or repair, it can be accepted only if we are notified by mail or telephone in advance of its arrival. Such notice should clearly indicate the service requested and give all pertinent information regarding the nature of the malfunction and, if possible, its cause.

Address all communications and shipments to:

Service Department
Federal Signal Corporation Signal Division
2645 Federal Signal Drive
University Park, IL 60466

1-800-433-9132
(In Illinois) 1-800-345-2185

When replacing small components, use care when soldering. Heat easily damages integrated circuits, transistors, capacitors and circuit boards. Therefore, it is advisable to use a heat sink on the component lead being soldered.

5-2. SERVICE.

A. *Removal for Servicing.*

To remove the electronic assembly, located inside the Amplifier chassis, for servicing; proceed as follows (see figure 7):

1. Remove the four #10 thread-forming hex head screws which secure the Amplifier chassis to the mounting brackets (two screws on each bracket). Lift the Amplifier away from the mounting brackets.

2. Remove the four hex head screws on the amplifier's bottom which secure the cover to the Amplifier chassis.

3. Remove the cover by sliding it away from the connector end of the chassis.

B. *Removal of Circuit Board.*

The PC Board is secured to the chassis by four Phillips head screws. Unplug the four wafer connectors before removing the screws.

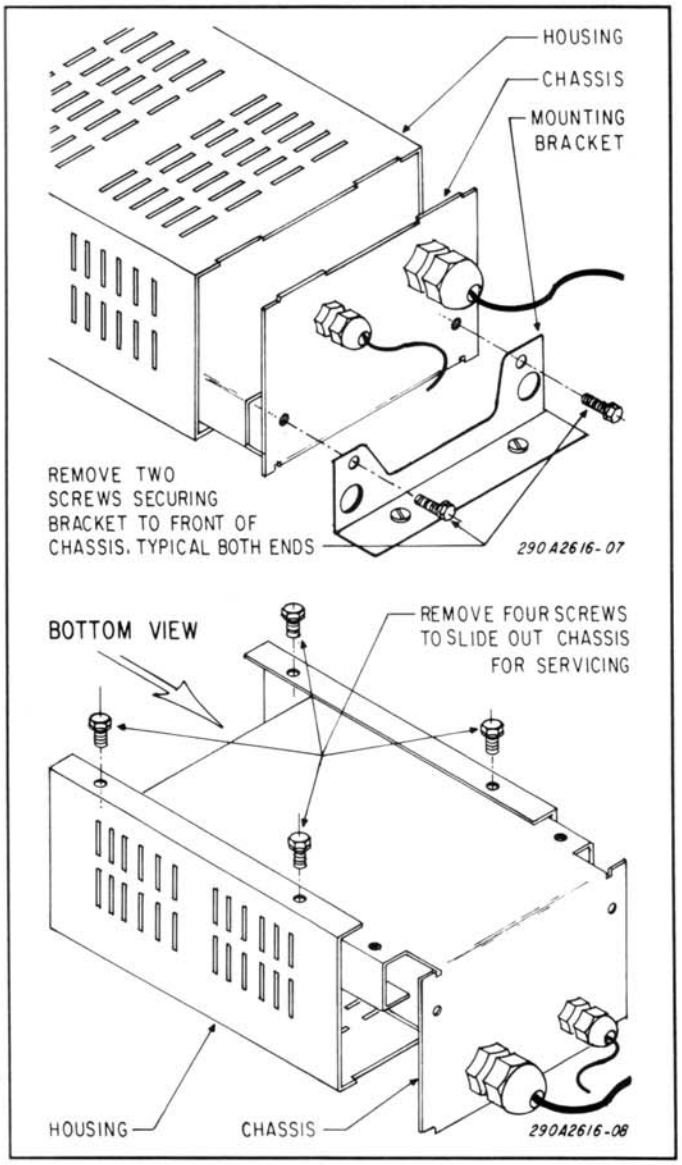

Figure 7. Chassis Removal.

C. *Replacement of Output Transistors.*

Failure of one or both of the output transistors (Q201, Q202) is usually the result of a defective speaker (short circuited voice coil). Rebroadcast of the unsquelched radio or music for long periods will also have a detrimental effect on the output transistors, and is therefore not recommended.

Federal recommends that both output transistors be replaced should only one device prove to be defective. This practice will insure long periods of service between failures.

When installing new output transistors, insure that the Sil-Pad insulators are installed between the heatsink and transistors.

CAUTION

Make certain that the speaker is not defective prior to installing the repaired PA500U-012SB.

D. *Testing.*

After servicing is complete, perform a test of all functions to ensure siren is operating properly.

5-3. MODIFICATIONS.

The following paragraphs describe modifications which can easily be made to the Model PA500U-012SB by a qualified service technician. Before any of the modifications can be made, remove the cover as described in paragraph 5-2.A.

A. *Output Power Modification.*

NOTE

The Model PA500U-012SB comes factory set for a 100-watt output.

Locate the 12-position terminal strip on the output PC board (see figure 11). Using a flat blade screwdriver, move the orange wire to the described position.

TB201, pin 1 for 58-watt output.
TB201, pin 2 for 100-watt output.

B. *Coast Down Elimination.*

The Model PA500U-012SB comes from the factory wired so that it will coast down after a siren function has been deactivated. To eliminate the coast down feature, and have the siren sound come to an abrupt stop when the siren function is deactivated, proceed as follows (see figure 10):

1. Remove the main PC board by unplugging J1, J2, J3 and removing the four PC board screws.

2. Cut jumper wire (JU2) labeled FAST PEAK.

3. Install jumper wire (JU1) at position labeled SLOW PEAK.

4. Install a 100-ohm, 1/4watt, resistor at position labeled CUTOFF.

5. Reinstall the PC board with the four screws removed in step 1. Install J1, J2 and J3. Insure that the polarization of the connectors is correct.

5-4. PA GAIN ADJUSTMENT.

The Model PA500U-012SB comes from the factory with the PA gain set to maximum. To decrease the gain setting, proceed as follows (see figure 10):

A. Remove the cover as described in paragraph 5-2.A.

B. Locate R41 (PA) on the main PC board.

C. Using a small flatblade screwdriver, rotate R41 counterclockwise to a desired volume setting.

D. Reinstall the cover.

5-5. TESTING.

After servicing, modification, or adjustment is completed; perform a test of all functions to ensure siren is operating properly.

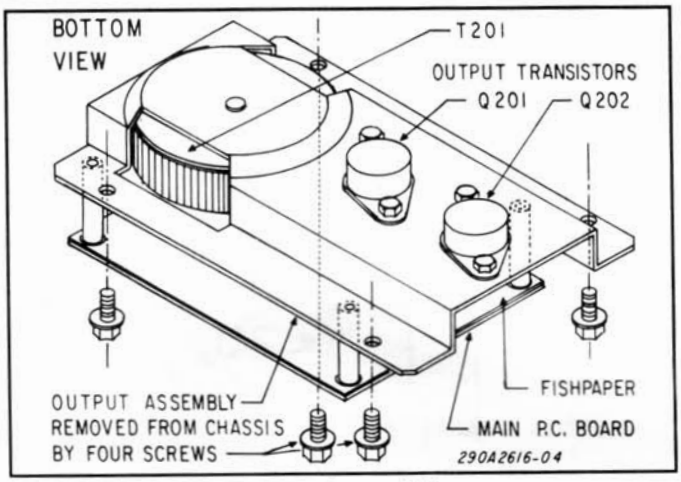

Figure 8. Internal View.

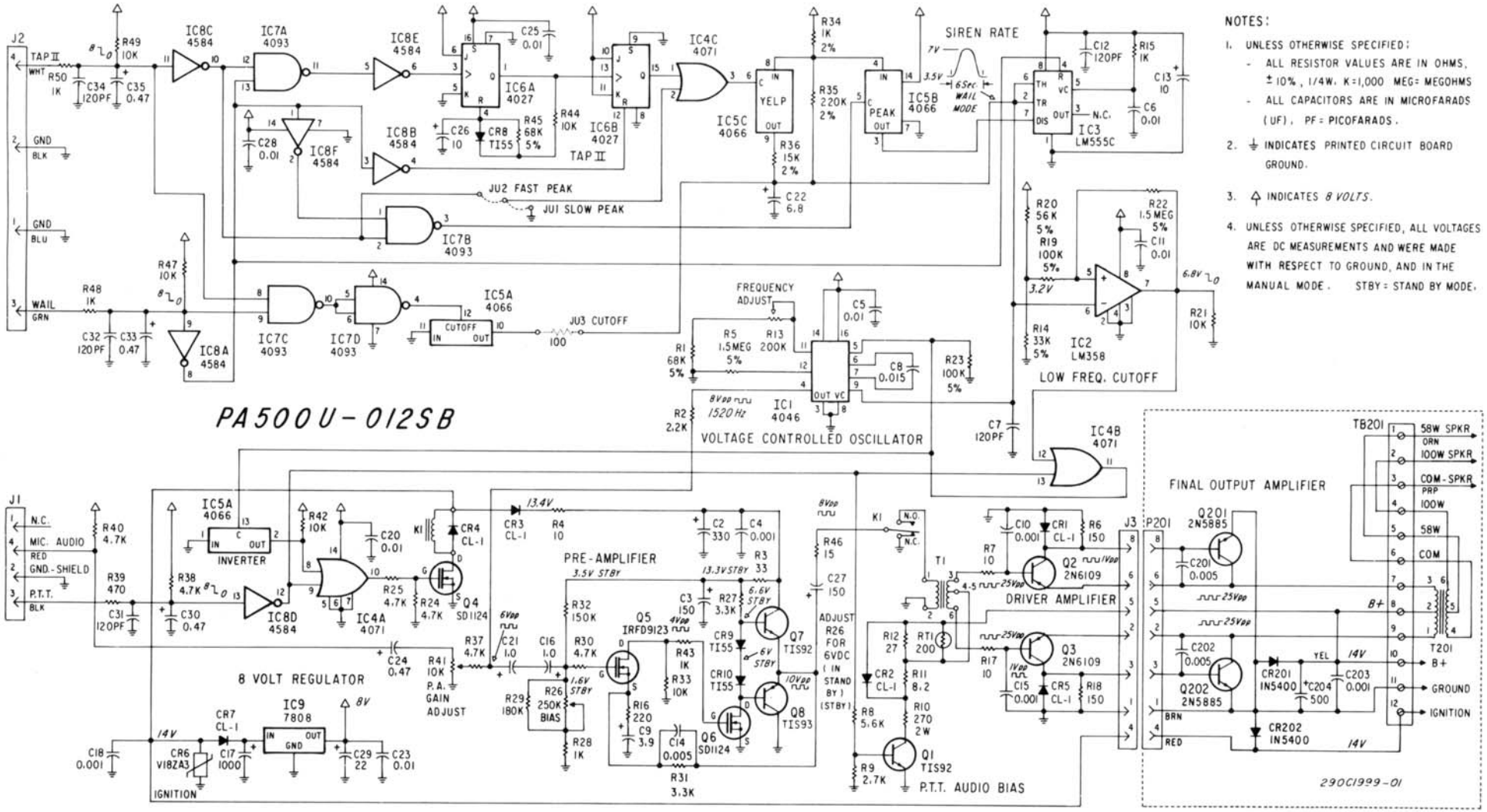

Figure 9. Model PA500U-012SB Schematic Diagram.

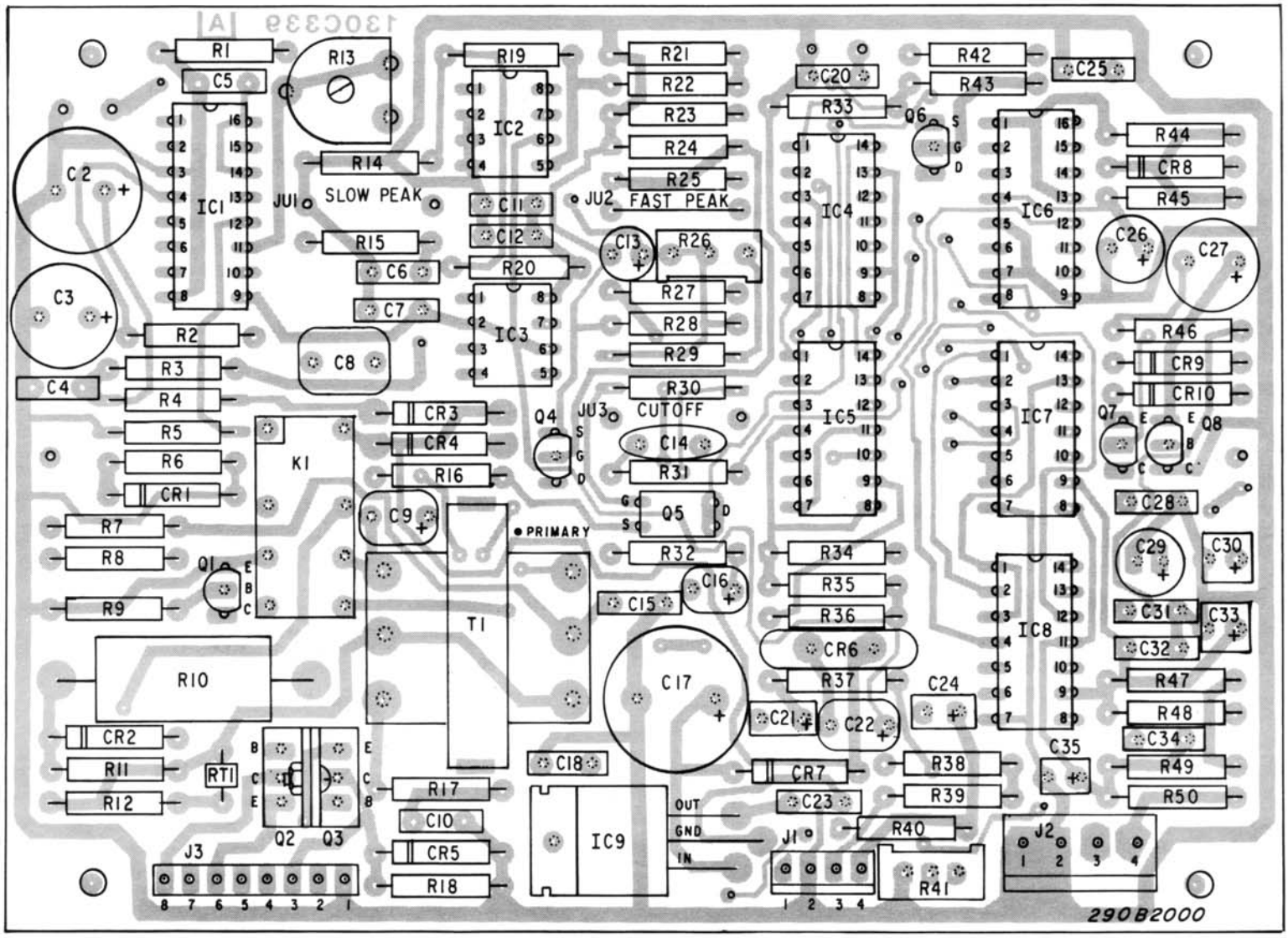

Figure 10. Main Board Component Location Diagram.

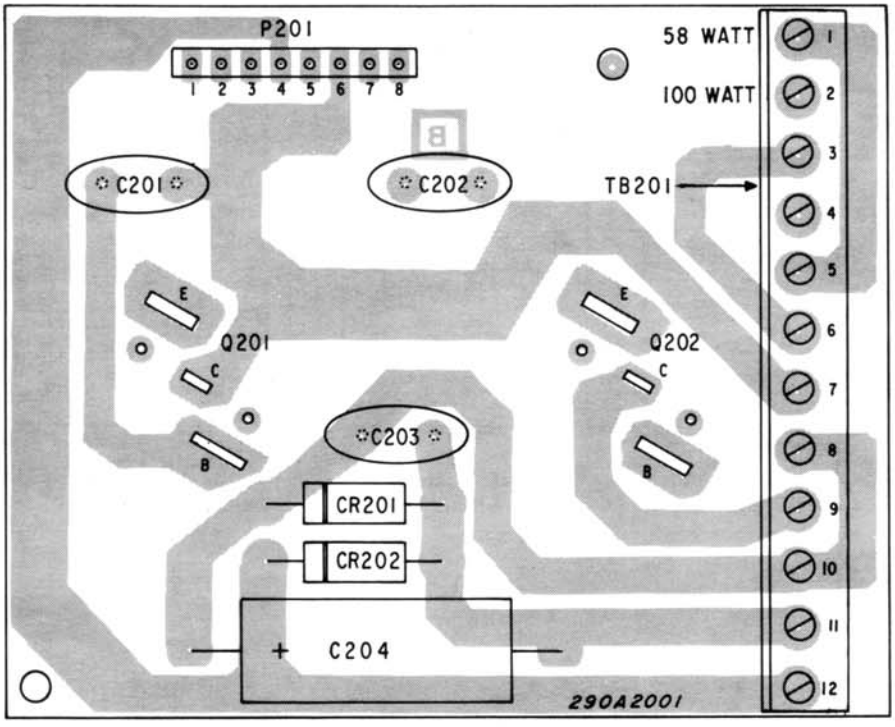

Figure 11. Output Board Component Location Diagram.

PARTS LIST MODEL PA500 AMPLIFIER

Schematic Symbol	Description	Part No.
	*RESISTORS	
R1	68K Ohm, 5%	100A261
R2	2200 Ohm	100A221
R3	33 Ohm	100A288
R4,7,17	10 Ohm	100A251
R5,22	1.5 Megohm, 5%	100A726
R6,18	150 Ohm	100A238
R8	5600 Ohm	100A253
R9	2700 Ohm	100A206
R10	270 Ohm, 2 Watt, WW	103A128
R11	8. 2 Ohm	100A743
R12	27 Ohm	100A250
R13	200K Ohm, Potentiometer	106A203A-03
R14	33K Ohm, 5%	100A771
R15,28,43, 48,50	1000 Ohm	100A233
R16	220 Ohm	100A219
R19,23	100K Ohm, 5%	100A262
R20	56K Ohm, 5%	100A704
R21,33,42, 44,47,49,	10K Ohm	100A207
R24,25,30, 37,38,40	4700 Ohm	100A224
R26	250K Ohm, Potentiometer	105A255
R27,31	3300 Ohm	100A209
R29	180K Ohm	100A706
R32	150K Ohm	100A226
R34	1000 Ohm, 2%	100A712
R35	220K Ohm, 2%	100A719
R36	15K Ohm, 5%	100A239
R39	470 Ohm	100A255
R41	10K Ohm, Potentiometer	105A263
R45	68K Ohm, 5%	100A261
R46	15 Ohm	100A291
	*Unless otherwisc specified; all RESISTORS are carbon type, ±10%, 1/4 Watt.	
	CAPACITORS	
C2	330UF, 50V, Electrolytic	108A153
C3,27	150UF, 16V, Electrolytic	108A147
C4, 10,15,18	0.001UF, Film	107A771
C5,6,11, 20,23,25,28	0.01UF, Film	107A767
C7,12,31,32,34	120PF, 200V, Mono.	107A1004
C8	0.015UF, 100V, Poly.	107A766
C9	3.9UF, 15V, Tantalum	107A642
C13,26	10UF, 16V, Electrolytic	108A143
C14,201,202	0.005UF, 100V, Disc	107A211
C16,21	1.0UF, 50V, Tantalum	107A649

Schematic Symbol	Description	Part No.
	CAPACITORS (Cont'd.)	
C17	1000UF, 35V, Electrolytic	108A149
C22	6.8UF, 15V, Tantalum	107A604
C24,30,33,35	0.47UF, 35V, Tantalum	107A645
C29	22UF, 16V, Electrolytic	108A144
C203	0.001UF, 100V, Disc	107A207
C204	500UF, 15V, Electrolytic	108A122
	DIODES	
CR1,2,3,4,5,7	CL-1 (ED3002S)	115B301
CR6	V18ZA3, Varistor	114A103
CR8,9,10	T155	115B101
CR201,202	1N5400	115A105
	INTEGRATED CIRCUITS	
IC1	MC14046BCP	128B079
IC2	LM358	128045
IC3	LM555N	128A043A-04
IC4	MC14071BCP	128B082
IC5	MC14066BCP	128047
IC6	MC14027BCP	128A044
IC7	CD4093BE	128B093
IC8	MC14584B	128A059
IC9	UA78M08CKC	128A097
	TRANSISTORS	
Q1,7	TIS92, NPN	125B132
Q2,3	2N6109, PNP	125B431
Q4,6	SD1124, FET	125A153
Q5	IRFD9123, FET	125A162
Q8	TIS93, PNP	125B133
Q201,202	2N5885, NPN	125B432
	MISCELLANEOUS	
T1	Transformer, Driver	120B145
T201	Transformer, Output	120B140A-01
RT1	Thermistor, 200-0hm	104A111
TB201	Terminal Strip, 12-position	229A164
J1	Connector, Wafer, 4-pin	140A202
J2	Connector, Wafer, 4-pin	140A212
J3,J201	Connector, Wafer, 8-pin	140A170
K1	Relay, 12V, DPDT	131A130A-01
	PC Board, Main (without parts)	130C339
	PC Board, Main (with parts installed)	200C906
	PC Board, Output (without parts)	130C338
	PC Board, Output (with parts installed)	200C905

255270B
REV. B 397
Printed in U.S.A.