

*Model PA300**
ELECTRONIC SIREN



INSTALLATION, SERVICE, AND OPERATING INSTRUCTIONS

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
Emergency Products

SECTION I

GENERAL DESCRIPTION



Figure 1-1. Model PA300* Electronic Siren.

The Federal Model PA300 (figure 1-1) is a precision built, efficient and economical, full-featured electronic siren of advanced design. It provides wail, yelp and hi-lo siren tones, as well as the Tap II feature, public address (PA), radio rebroadcast and an air horn sound.

The siren may be installed in positive or negative ground vehicles with 12-volt electrical systems. It is protected against failure modes (including reversed polarity) by a fuse that is replaceable without tools. No components protrude from the bottom of the siren to interfere with mounting arrangements.

A noise-cancelling microphone is wired-in to prevent loss or theft. It provides high quality voice

reproduction without feedback "squeal". The microphone push-to-talk switch overrides any siren signal for instant PA use. PA and radio volume are adjustable by means of a front panel GAIN control. Radio inter-connect wires are built-in. No additional cables are required.

The Model PA300's 100-watt output is designed to drive a single high power speaker.

The Tap II feature allows the driver to change the siren sound from wail to yelp (or vice-versa) via the vehicle's horn ring. Tap II provides especially effective traffic clearing capability. In addition to Tap II, additional alternate sounds can be activated in two other selector switch positions by depressing and holding the horn ring for as long as the alternate sound is desired. The charts in Section IV of this manual illustrate the operation of these features more fully.

Other special features of the Model PA300 include:

- High degree of reliability is achieved through the use of integrated circuits and silicon output transistors.
- Control panel is illuminated with non-glare lighting.
- Newly designed printed circuit board provides improved performance and durability under a wide range of environmental conditions.

SECTION II

SPECIFICATIONS

Input Voltage	11VDC to 16VDC (16V operation limited to 15 minutes).
Polarity	Negative or positive ground.
Standby Current	120ma. max. (not incl. panel light).
Operating Temperature Range	-30°C (-22°F) to +60°C (+149°F).
Operating Current (14VDC-Wail mode)	10 amperes, max.
Frequency Range	725 to 1575Hz.
Cycle Rate	Wail- 12 cycles/min. Yelp- 180 cycles/min. Hi-Lo- 60 cycles/min.
Voltage Output (approx.)	64V peak-to-peak.
Dimensions (HWD)	2-1/2" (6.35cm) x 6-1/2" (16.51cm) x 8-1/2" (21.59cm).
Net Weight (incl. microphone).	4-1/2 lbs. (2.04kg).
Shipping Weight	6-1/2 lbs. (2.94kg).

NOTE

The following parameters were obtained with the radio input potentiometer and GAIN control set at maximum.

Audio Frequency Range	300 to 10,000Hz.
Harmonic Audio Distortion (300-3,000Hz).	10% max. all power levels from 1/2 to 50 watts (frequency response ± 3 dB).
Input Impedance (Radio)	2000 ohms.
Input voltage required to obtain 20VRMS across speaker load (Radio)	0.55VRMS.

SECTION III INSTALLATION

SAFETY MESSAGE TO INSTALLERS OF ELECTRONIC SIRENS

WARNING

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

Before Installation

Qualifications

- To properly install an electronic siren: you must have a good understanding of automotive electrical procedures and systems, along with proficiency in the installation and service of safety warning equipment. Always refer to the vehicle's service manuals when performing equipment installations on a vehicle.

Sound Hazards

- 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."
- All effective sirens and horns produce loud sounds (120 dB) that may cause permanent hearing loss. Always minimize your exposure to siren sound and wear hearing protection. Do not sound the siren indoors or in enclosed areas where you and others will be exposed to the sound.
- Federal Signal siren amplifiers and speakers are designed to work together as a system. Combining a siren and speaker from different manufacturers may reduce the warning effectiveness of the siren system and may damage the components. You should verify or test your combination to make sure the system works together properly and meets federal, state and local standards or guidelines.

During Installation

- DO NOT get metal shavings inside the product. Metal shavings in the product can cause the system to fail. If drilling must be done near the unit, place an ESD approved cover over the unit to prevent metal shavings from entering the unit. Inspect the unit after mounting to be sure there are no shavings present in or near the unit.
- DO NOT connect this system to the vehicle battery until ALL other electrical connections are made, mounting of all components is complete, and you have verified that no shorts exist. If wiring is shorted to vehicle frame, high current conductors can cause hazardous sparks resulting in electrical fires or flying molten metal.
- Be sure the siren amplifier and speaker(s) in your installation have compatible wattage ratings.
- In order for the electronic siren to function properly, the ground connection must be made to the NEGATIVE battery terminal.

- Sound output will be severely reduced if any objects are in front of the speaker. If maximum sound output is required for your application, you should ensure that the front of the speaker is clear of any obstructions.
- Install the speaker(s) as far forward on the vehicle as possible, in a location which provides maximum signaling effectiveness and minimizes the sound reaching the vehicle's occupants. Refer to the National Institute of Justice guide 500-00 for further information.
- Mounting the speakers behind the grille will reduce the sound output and warning effectiveness of the siren system. Before mounting speakers behind the grille, make sure the vehicle operators are trained and understand that this type of installation is less effective for warning others.
- Sound propagation and warning effectiveness will be severely reduced if the speaker is not facing forward. Carefully follow the installation instructions and always install the speaker with the projector facing forward.
- DO NOT install the speaker(s) or route the speaker wires where they may interfere with the operation of air bag sensors.
- Installation of two speakers requires wiring speakers in phase.
- Never attempt to install aftermarket equipment, which connects to the vehicle wiring, without reviewing a vehicle wiring diagram - available from the vehicle manufacturer. Insure that your installation will not affect vehicle operation and safety functions or circuits. Always check vehicle for proper operation after installation.
- DO NOT install equipment or route wiring or cord in the deployment path of an air bag.
- Locate the control head so the vehicle, controls, and microphone can be operated safely.
- When drilling into a vehicle structure, be sure that both sides of the surface are clear of anything that could be damaged.

After Installation

- After installation, test the siren system and light system to ensure that it is operating properly.
- Test all vehicle functions, including horn operation, vehicle safety functions and vehicle light systems, to ensure proper operation. Ensure that installation has not affected vehicle operation or changed any vehicle safety function or circuit.
- After testing is complete, provide a copy of these instructions to the instructional staff and all operating personnel.
- File these instructions in a safe place and refer to them when maintaining and/or reinstalling the product.

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 Model PA300, 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 damage. Carefully check all envelopes shipping labels and tags before removing or destroying them.

3-2. MOUNTING BRACKET.

⚠ 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.

The PA300 comes equipped with a swinging bracket which enables it to be mounted in variety of positions. Positioning the bracket above the unit allows mounting to the underside of the dash. Positioning the bracket below the unit will permit mounting on any horizontal surface.

The unit should be mounted in a position that is both comfortable and convenient to the operator. Keep visibility and accessibility of controls in mind. To install the unit under the dash, determine the mounting location and proceed as follows (see figure 3-1).

CAUTION

The unit must be installed in an adequately ventilated area. Never install near heater ducts.

A. Use one of the mounting brackets as a template and scribe two drill positioning marks at the selected mounting location under the dash.

CAUTION

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

B. Drill two 1/4-inch diameter holes at the position marks.

C. Secure the mounting bracket to the dash with (2 each) 1/4-20 x 3/4 hex head screws, 1/4 split lockwashers and 1/4-20 hex nuts as shown in figure 3-1.

D. Secure the PA300 unit to the mounting bracket with black 1/4-20 x 7/16 hex head screws and 1/4 split lockwashers.

E. Tilt the unit to the desired position. Tighten the black 1/4-20 x 7/16 hex head screws.

3-3. POWER CABLE INSTALLATION.

The power cable included in the carton is equipped with a twelve-prong plug (P5) that mates with the connector (J5) on the rear of the electronic siren (see figure 3-2). The various wires on the connector must be connected as follows:

⚠ 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.

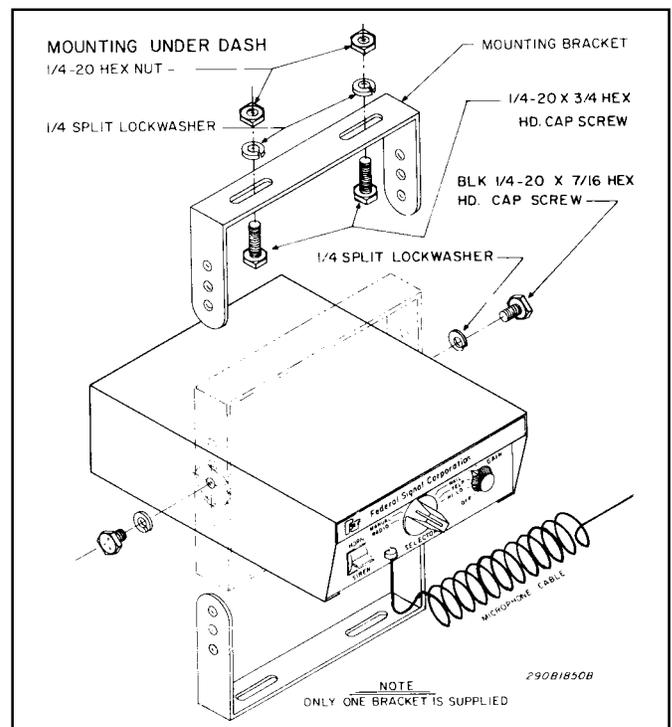


Figure 3-1. installation of PA300 Under Dash.

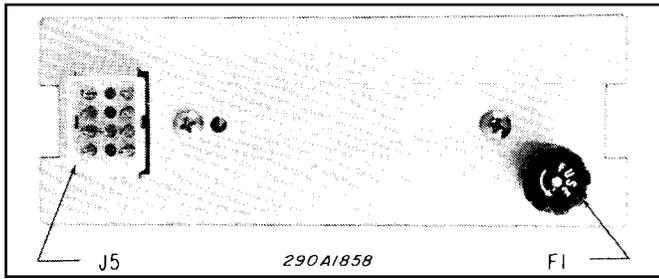


Figure 3-2. Rear View of PA300.

A. Speaker.

CAUTION

Connecting a low power speaker (58W), or two speakers, to the unit will damage the siren or speaker(s). Always use one 11-ohm, high power (100W) speaker.

The unit is designed to operate with one 11-ohm, high power (100W) speaker.

Connect the speaker leads (18 gauge wire) as shown in Control Cable Wiring Diagram, figure 3-3.

B. Radio.

To allow incoming radio messages to be rebroadcast over the outside speakers, connect the two brown zip cord leads (P5, pins 9 and 12) across the two-way radio's speaker.

C. Horn Ring.

In order to utilize the Tap II and Press-and-Hold features of the siren, the following procedure must be performed.

1. Locate the wire that connects the vehicle horn ring switch to the horn or horn relay. Cut this wire.

2. See figure 3-4. Splice the white/yellow control cable wire (P5, pin 7) to the horn ring side of the wire that was cut in step 1. Insulate the splice with the wire nuts (supplied).

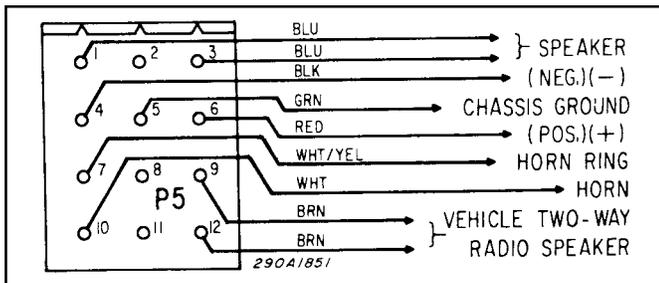


Figure 3-3. Control Cable Wiring Diagram.

CAUTION

The horn ring transfer circuit of the siren is capable of switching a maximum of 2-amperes. Some vehicles do not have a horn relay and, consequently, will draw more than 2-amperes when the vehicle horn is activated. Consult your vehicle service manual or a qualified mechanic to determine the current required to activate the horn. If it is **less** than 2-amperes, perform the procedure in step 3. If it is **greater** than 2-amperes, perform steps 4 through 10.

3. Splice the white control cable wire (P5, pin 10) to the horn side of the cut wire. Insulate the splice with a wire nut.

4. Obtain a SPST relay of sufficient contact current capacity to activate the vehicle horn. Refer to figure 3-4 while performing the following steps.

5. Mount the relay in a suitable location.

6. Connect the horn side of the wire cut in step 1 to the relay contact terminal.

7. Determine the "sense" of the vehicle's horn ring activation circuit, i.e., does the horn circuit require a switched positive voltage or switched ground for activation.

8. Connect the relay wiper terminal to the positive or negative potential determined in step 7.

9. Connect the white control cable wire to one end of the relay coil.

10. Connect the other end of the relay coil to the opposite potential of that connected to the wiper in step 8.

D. Connection to Power Source.

The PA300 can operate from any 12-volt positive or negative ground vehicle electrical system.

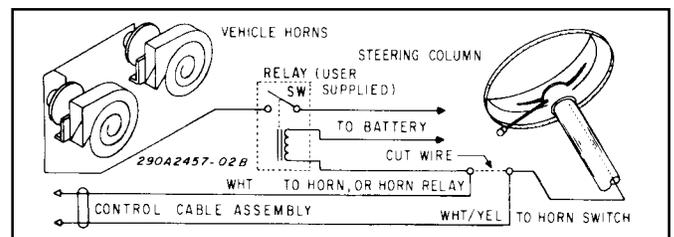


Figure 3-4. Horn Ring Connections.

Therefore, before making any electrical connections, determine the polarity of the vehicle electrical system ground.

Power for the siren can be obtained from the vehicle's power distribution center or directly from the vehicle battery. If power is going to be obtained directly from the vehicle battery, drill a hole in the vehicle firewall for the power lead to enter the engine compartment. Place a grommet or similar device in the hole to protect the wire against damage from rough edges.

CAUTION

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

If your vehicle has a negative ground electrical system, perform the procedure in paragraph 1. Perform the procedure in paragraph 2, if the vehicle has a positive ground system.

1. Negative Ground.

a. Connect the green (P5, pin 5) control cable lead to the vehicle chassis as close as practical to the siren. Scrape paint away from the selected bolt hole to ensure a good electrical connection to the chassis.

b. Route the red (P5, pin 6) and the black (P5, pin 4) control cable leads, through the previously drilled hole, into the engine compartment. Route the wires through existing clamps and holders toward the battery.

c. To protect the red wire when connected to the battery terminal, use an in-line fuseholder and 20-ampere fuse (not supplied). The fuseholder should be installed as close as practical to

the battery. If necessary, additional #14 gauge or heavier wire can be spliced to the red lead.

WARNING

If wires are shorted to the vehicle frame or each other, high current conductors can cause hazardous sparks resulting in electrical fires and molten metal.

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

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

Failure to observe this WARNING will result in fire, burns and blindness.

d. Connect the in-line fuseholder lead to the positive (+) battery terminal.

e. Connect the black wire to the negative terminal of the battery.

2. Positive Ground.

a. Connect the green (P5, pin 5) control cable lead to the vehicle chassis as close as practical to the siren. Scrape paint away from the selected bolt hole to ensure a good electrical connection to the chassis.

b. Route the black (P5, pin 4) and the red (P5, pin 6) control cable leads, through the previously drilled hole, into the engine compartment. Route the wire through existing clamps and holders toward the battery.

c. To protect the black wire when connected to the battery terminal, use an in-line fuseholder and 20-ampere fuse (not supplied). The fuseholder should be installed as close as practical to the battery. If necessary, additional #14 gauge or heavier wire can be spliced to the black lead.

⚠ WARNING

If wires are shorted to the vehicle frame or each other, high current conductors can cause hazardous sparks resulting in electrical fires and molten metal.

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

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

Failure to observe this WARNING will result in fire, burns and blindness.

- d. Connect the in-line fuseholder lead to the negative (hot) battery terminal.
- e. Connect the red wire to the positive terminal of the battery.

3-4. AIR HORN PRESS-AND-HOLD MODIFICATION.

The unit comes from the factory set so that the peak-and-hold sound will be heard when the Selector switch is set to MANUAL and the vehicle horn ring is activated. To change the sound to air horn, merely move jumpers JU1 and JU2 from the "PEAK" position on the P.C. board to the "AIR" position (see figure 3-5).

3-5. RELATIVE PA LOUDNESS ADJUSTMENT.

After the PA300 is completely installed in the vehicle, set the Selector switch to MANUAL. Depress

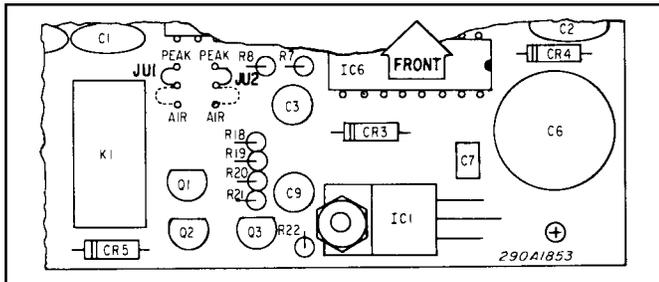


Figure 3-5. Press and Hold Modification.

the microphone push-to-talk switch, speak in a normal voice, and adjust the GAIN control for the desired sound level outside the vehicle. Turn-on the vehicle's two-way radio and adjust the volume to a comfortable listening level inside the vehicle. Then set the Selector switch to RADIO. Stand outside of the vehicle and note the radio rebroadcast loudness. If the sound volume is too loud or too soft, adjust R11 through the hole at the bottom of the siren (see figure 3-6) to the desired sound level.

After the adjustment is completed, the loudness of the radio rebroadcast and public address may be varied with the front panel GAIN control.

3-6. TESTING AFTER INSTALLATION.

⚠ WARNING

All effective sirens and horns produce loud sounds (120 dB) that may cause permanent hearing loss. Always minimize your exposure to siren sound and wear hearing protection. Do not sound the siren indoors or in enclosed areas where you and others will be exposed to the sound.

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

After testing is complete, provide a copy of this manual to all operating personnel.

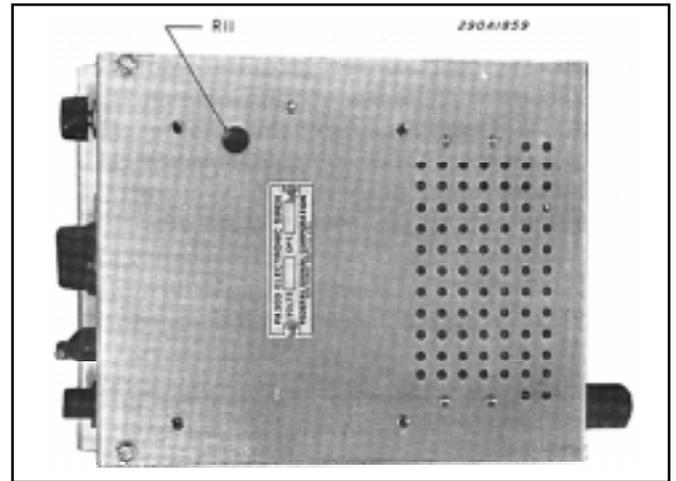


Figure 3-6. Relative PA Loudness Adjustment.

SECTION IV OPERATION

SAFETY MESSAGE TO OPERATORS OF FEDERAL SIGNAL ELECTRONIC SIRENS AND LIGHT/SOUND SYSTEMS

WARNING

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

Qualifications

- To properly use an electronic siren and speaker(s): you must have a good understanding of general vehicle operation, a high proficiency in the use of safety warning equipment, and thorough knowledge of state and federal UNIFORM TRAFFIC CODES.

Sound Hazards

- 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.”
- All effective sirens and horns produce loud sounds (120 dB) that may cause permanent hearing loss. Always minimize your exposure to siren sound, roll up your windows and wear hearing protection. Do not sound the siren indoors or in enclosed areas where you and others will be exposed to the sound. Only use the siren for emergency response situations.

Sound Limitations

- Before using the vehicle, check to see if the siren speakers are concealed from view. If the siren speaker is not in clear view on the front of the vehicle, use extra caution when operating the vehicle. A concealed siren speaker installation is less effective at warning others.
- Maximum sound output will be severely reduced if any objects are in front of the speaker. If your installation has obstructions in front of the speaker, drive even more cautiously.

- Frequently inspect the speaker to ensure that it is clear of any obstruction, such as mud or snow, which will reduce maximum sound output.

Signaling Limitations

- Be aware that the use of your visual and audible signaling devices does not give you the right to force your way through traffic. Your emergency lights, siren, and actions are REQUESTING the right-of-way.
- Although your warning system is operating properly, it may not alert everyone. 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 warning signal when natural or man-made objects are between your vehicle and others. This can also occur when you raise your hood or trunk lid. If these situations occur, be especially careful.

Driving Limitations

- At the start of your shift, you should ensure that the light/sound system is securely attached to the vehicle and operating properly.
- If the unique combination of emergency vehicle equipment installed in your vehicle has resulted in the siren controls being installed in a position that does not allow you to operate them by touch only, OPERATE CONTROLS ONLY WHILE YOUR VEHICLE IS STOPPED.
- If driving conditions require your full attention, you should avoid operating the siren controls while the vehicle is in motion.

Continuing Education

- File these instructions in a safe place and refer to them periodically. Give a copy of these instructions to new recruits and trainees.

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

4-1. GENERAL.

All controls utilized during normal operation of the Model PA300 are located on the front panel (see figure 4-1).

The wired-in noise cancelling microphone provides high quality voice reproduction in the public address mode. The microphone push-to-talk switch will override all siren functions, except radio rebroadcast, for instant PA use.

4-2. GAIN CONTROL.

The GAIN control is used to turn the siren on and off. Also, it is used to control the volume when the siren is used for public address or radio amplification. Clockwise rotation of the knob increases voice volume in the public address or radio amplification mode. The GAIN control does not control the volume of the siren signals.

The maximum clockwise setting of the control will be determined, in most cases by the point at which feedback or “squeal” occurs. This will depend upon the microphone gain, open windows, speaker placement, proximity of reflecting surfaces (building or other vehicles), etc. Adjust the GAIN control to a position just below the point at which feedback occurs or as desired.

4-3. SELECTOR SWITCH.

The Selector switch is a five-position rotary switch used to select the mode of operation. The following are positions on the Selector switch.

A. RADIO.

In this position, incoming radio messages are amplified by the siren and rebroadcast over the outside speaker.

B. MANUAL.

In this position, it is possible to operate the siren by activating the HORN/SIREN switch. The siren can also be activated by means of an auxiliary switch, such as the horn ring button (refer to paragraph 4-6).

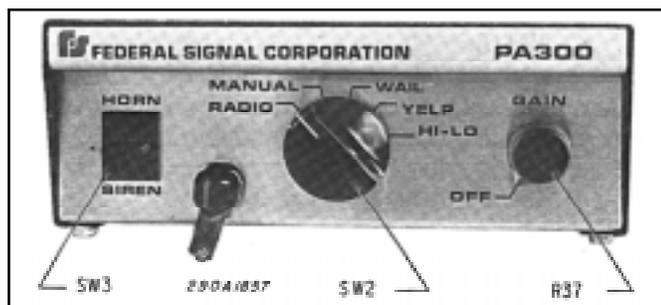


Figure 4-1. Front View.

C. WAIL.

In this position, the siren produces a continuous “wailing” sound, up and down in frequency.

D. YELP.

In this position; a continuous, rapid “warbled” tone is generated.

E. HI-LO.

In this position, a two-tone sound will be heard. This distinctive tone may be reserved for any special indication or situation.

4-4. HORN/SIREN SWITCH.

The HORN/SIREN switch, located on the left side of the front panel, activates the electronic air horn sound (up) or peak-and-hold sound (down) in any siren mode except radio.

4-5. TAP II FUNCTIONS.

Tap II allows the driver to change the siren sound via the vehicle’s horn ring. This feature is especially effective for clearing traffic. The chart below demonstrates how the horn ring can be used to change the siren sound:

TAP II FUNCTIONS

<u>Selector Switch Position</u>	<u>First Horn Ring Tap Produces</u>	<u>Second Horn Ring Tap Produces</u>
Wail Yelp	Yelp Wail	Wail Yelp

4-6. PRESS AND HOLD FUNCTIONS.

Additional alternate sounds can be activated in two other Selector switch positions, by depressing and holding the horn ring for as long as the alternate sound is desired. The chart below shows these additional “Press and Hold” functions:

PRESS AND HOLD FUNCTIONS

<u>Selector Switch Position</u>	<u>Press on Horn Ring Produces</u>	<u>Release of Horn Ring Produces</u>
Hi-Lo Manual	Air Horn Peak and Hold or Air Horn	Hi-Lo Coast down and silence or silence

SECTION V

CIRCUIT DESCRIPTION

5-1. GENERAL.

The Model PA300 circuitry can be divided into seven functional blocks. Refer to figure 5-1 and 6-4 while reading the following paragraphs.

5-2. RATE OSCILLATORS AND VOLTAGE CONTROLLED OSCILLATOR.

The heart of the Model PA300 circuitry is the rate oscillator and VCO sections. The rate oscillator not only determines the cycling rate of each siren tone, but also generates the control voltage that operates the voltage controlled oscillator (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's power output amplifier.

The siren rate oscillator consists of an LM555 dual timer configured as two astable oscillators. The first astable oscillator (IC12A) employs analog switches (IC10A, IC10B) to select the resistance for the RC timing network which determines the astable oscillator's cycling rate. IC10C, another analog switch, connects the discharge pin of IC12A to the RC timing network. When the peak function is called for,

the control pin (IC10-6) goes low putting the switch in a high impedance state (OFF), and allows the RC rate capacitor (C11) to charge as the siren tone peaks.

IC12B, another astable oscillator, generates the control voltage required to generate the air-horn sound. Normally, IC12B is held in the reset state (IC12-10 low) until the air horn control line is pulled high.

IC8C, a one-of-two analog switch, selects the siren or air horn control voltage from IC12A or IC12B. IC8B selects either the RC control voltage (manual, wail and yelp modes) or the square wave control voltage (hi-lo) derived from the output of IC12A. The voltage divider network of R27, R28, R29 and CR8 provides the DC level shifting of the IC12A output necessary to obtain the desired hi-lo tone frequencies.

IC13, a phase-locked loop, contains the voltage controlled oscillator. C21, R46, R47, R57, and the control voltage on pin 9 determine the output frequency.

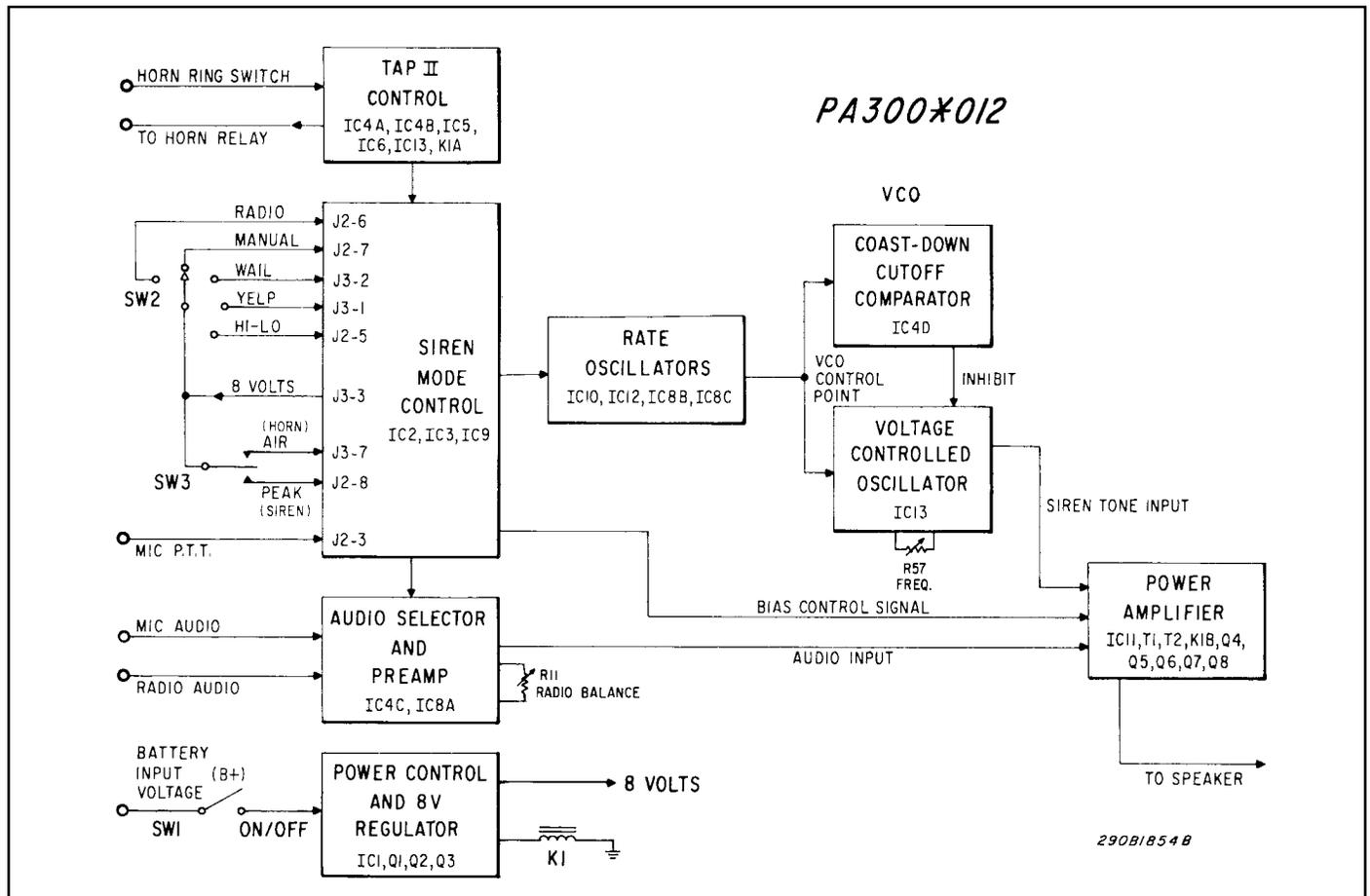


Figure 5-1. Functional Block Diagram.

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 amplifier's output transistors. IC4D, a voltage comparator, compares the VCO control voltage to the low frequency reference voltage set by R40 and R41. When the VCO control voltage drops below the reference, IC4-8 goes high and forces the inhibit pin of the VCO high through OR gate IC9D. The VCO is also inhibited when the radio or microphone push-to-talk input is selected. These logic inputs are gated through IC7B, IC9C and IC9D to the VCO inhibit pin.

5-3. SIREN MODE CONTROL.

The siren mode is controlled by the logic levels applied to J2-3, 5, 6, 7, 8 and J3-1, 2 and 7 (via Selector switch SW2), HORN/SIREN switch SW3, and the microphone push-to-talk switch. IC2 buffers the control inputs. IC3 and IC9 provide most of the decoding necessary to control the rate oscillator and analog switching of the audio and VCO control voltages.

5-4. TAP II CONTROL.

As long as power is applied to the siren circuitry, the vehicle's horn ring switch will be connected through P3-5 and K1A to the inputs of a window comparator consisting of IC4A and IC4B. A positive or negative horn ring contact will result in a logic "1" pulse of equal duration at the junction of CR1 and CR2.

When the siren is in the wail or yelp mode, the horn ring pulse passes to the input of IC6A, is "debounced", and then applied to toggle flip-flop IC6B. Every time the horn ring is operated, the output of IC6B (pin 5) changes state and inverts the state of the yelp control line. (The exclusive OR gate contained in IC13 functions as a controlled inverter where a logic "1" present on pin 3 forces the output (pin 2) to Y or "yelp not".)

If the Selector switch mode is changed during a Tap II operation, the circuitry consisting of IC7A, IC5B and IC7C resets the toggle flip-flop (IC6B) and allows the true state of the yelp control line to pass to the rate oscillator section. This is necessary to insure that the Selector switch position corresponds to the audible siren tone produced.

NOTE

The reset circuitry relies on the fact that the Selector switch is of the non-shorting type.

When the siren is in the manual mode, and JU1 and JU2 are left connected to "PEAK" (factory setting), the window comparator output will be passed through AND gate IC5C to activate the peak

siren function, as long as the horn ring switch is depressed.

If manual or hi-lo is the selected mode and JU1 and JU2 are set to "AIR", the window comparator output will be passed through AND gate IC5D to activate the air horn override circuitry (refer to paragraph 5-2).

5-5. AUDIO SELECTOR AND POWER AMPLIFIER.

The siren has two audio inputs: radio rebroadcast and microphone public address.

The radio input is derived from direct connection to the radio speaker. A fraction of the audio voltage developed across the radio balance potentiometer (R11) is applied to the input of a differential amplifier (IC4C). The differential amplifier eliminates any ground reference problem that may exist between the PA300 and various makes of radios. The microphone has a built-in transistor amplifier and therefore requires no external pre-amplifier. Resistor R14 serves as the collector bias resistor for the microphone's amplifier. The microphone output, derived from J2-1, and the radio audio from IC4C are selected via 1 of 2 analog switch IC8A. Normally, the microphone audio is gated through the multiplexer unless the Selector switch is set to the RADIO position. The selected audio is applied to IC11-2.

IC11 is an audio power amplifier integrated circuit which provides the necessary power gain to drive the push-pull amplifier stages beyond driver transformer T1. A biasing network consisting of TH1, CR15, Q4, R52, R53 and R54 is activated whenever the radio or the microphone push-to-talk switch is activated. This eliminates all "crossover" distortion associated with the push-pull output amplifier.

5-6. 8-VOLT REGULATOR, POWER CONTROL AND HORN RING TRANSFER.

When the GAIN control (on/off switch) is rotated clockwise, B+ is applied to the circuit board via J3-4 and J4-4. The networks consisting of CR4, C6 and CR10, R36, C17 provide filtering of the B+ voltage for the 8-volt regulator (IC1) and the audio amplifier (IC11). The large capacitances employed insure that all control logic remains stable and prevents "popping" noises heard through the loudspeaker when power is turned off.

Q1, Q2, Q3 and associated components form the power-on control circuitry. This network delays the activation of K1 approximately one-second after B+ is applied. During the interim, all siren control logic stabilizes allowing C15 to charge, bypassing the primary of driver transformer T1. This circuitry suppresses loud turn-on "thumps" from the loudspeaker and allows the vehicle horn ring switch to operate the siren's Tap II feature.

SECTION VI

SERVICE AND MAINTENANCE

SAFETY MESSAGE TO PERSONNEL SERVICING FEDERAL SIGNAL ELECTRONIC SIRENS

WARNING

The lives of people depend on your proper servicing of Federal products. It is important to read and 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 the electronic siren or speaker.
- To properly service an electronic siren or speaker: you must have a good understanding of automotive electrical procedures and systems, along with proficiency in the installation and service of safety warning equipment. Always refer to the vehicle's service manuals when performing service on a vehicle.
- Electronic circuit and speaker repairs must be performed by a qualified and competent electronic technician.
- 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."
- All effective sirens and horns produce loud sounds (120 dB) that may cause permanent hearing loss. Always minimize your exposure to siren sound and wear hearing protection. Do not sound the siren indoors or in enclosed areas where you and others will be exposed to the sound.
- DO NOT connect this system to the positive terminal of the battery until servicing is complete, and you have verified that there are no short circuits to ground.
- In order for the electronic siren to function properly, the ground connection must be made to the NEGATIVE battery terminal.
- After repair, test the electronic siren and speaker system to ensure that it is operating properly.

- Federal Signal siren amplifiers and speakers are designed to work together as a system. Combining a siren and speaker from different manufacturers may reduce the warning effectiveness of the siren system and may damage the components. You should verify or test your combination to make sure the system works together properly and meets both federal, state and local standards or guidelines.

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

6-1. GENERAL.

Most of the component electronic parts used in the Model PA300 are standard items that can be obtained from any TV or electronics supply shop. In order to reduce equipment down-time, Federal recommends that the entire printed circuit board (Part No. 200C860) be replaced. The printed circuit boards are relatively inexpensive allowing you to keep an adequate supply in your repair shop.

The diagrams in this section should be an aid to a repairman in isolating a malfunction and locating components.

The factory can and will service your equipment or assist you with technical problems, should any arise, that cannot be handled satisfactorily and promptly locally.

Communications and shipments should be addressed to:

Service Department
Federal Signal Corporation
2645 Federal Signal Drive
University Park, IL 60466
1-800-433-9132

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

6-2. SIREN.

A. General.

Any competent TV repairman or electronic technician should have little difficulty in tracing and

correcting a malfunction, should any occur. For emergency replacement of any of the small components, care must be used when soldering. Heat easily impairs transistors, capacitors and circuit boards. It is therefore advisable to use longnose pliers or a similar heat sink on the lead being soldered.

If IC13 or C21 are replaced, it may be necessary to adjust R57. With the Selector Switch set to MANUAL, hold the paddle switch in the SIREN position and adjust R57 for 1510 Hz \pm 10 Hz at the siren output.

B. *Removal for Servicing.*

When removing the chassis for servicing, loosen the two hexagon head screws on the underside of the unit, near the front edge. Slide the entire chassis out of the case as shown in figure 6-1.

C. *Removal of Circuit Board.*

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

D. *Replacement of Output Transistors.*

Failure of one or both of the output transistors (Q7, Q8) is usually the result of a defective speaker (short circuited voice coil). Rebroadcast of unquelled 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 ensure long periods of service between failures.

When installing new output transistors, ensure that the Sil-Pad insulators are installed between the heat-sink and transistors.

CAUTION

Make certain that the speaker is not defective prior to installing the repaired PA300.

6-3. TESTING AFTER SERVICE.

WARNING

All effective sirens and horns produce loud sounds (120 dB) that may cause permanent hearing loss. Always minimize your exposure to siren sound and wear hearing protection. Do not sound the siren indoors or in enclosed areas where you and others will be exposed to the sound.

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

After testing is complete, provide a copy of this manual to all operating personnel.

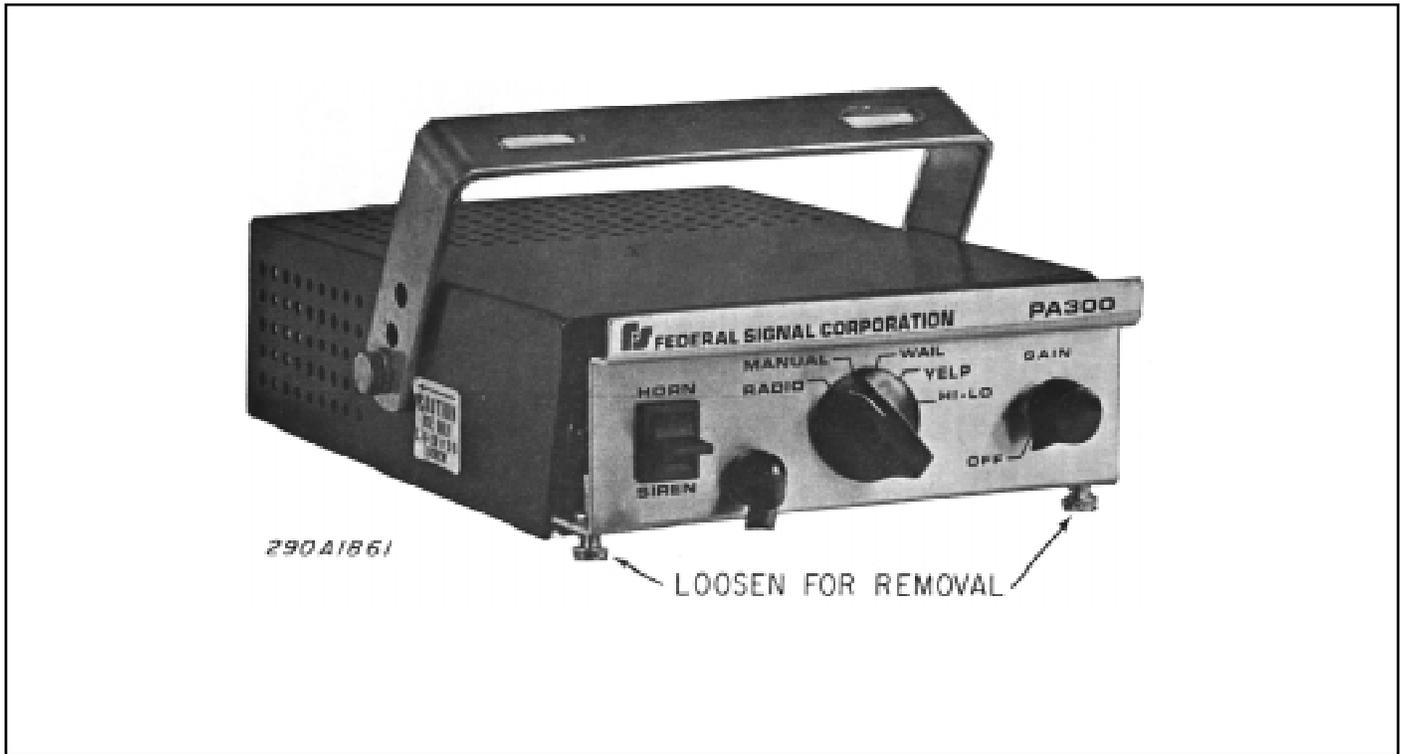


Figure 6-1. Chassis Removal.

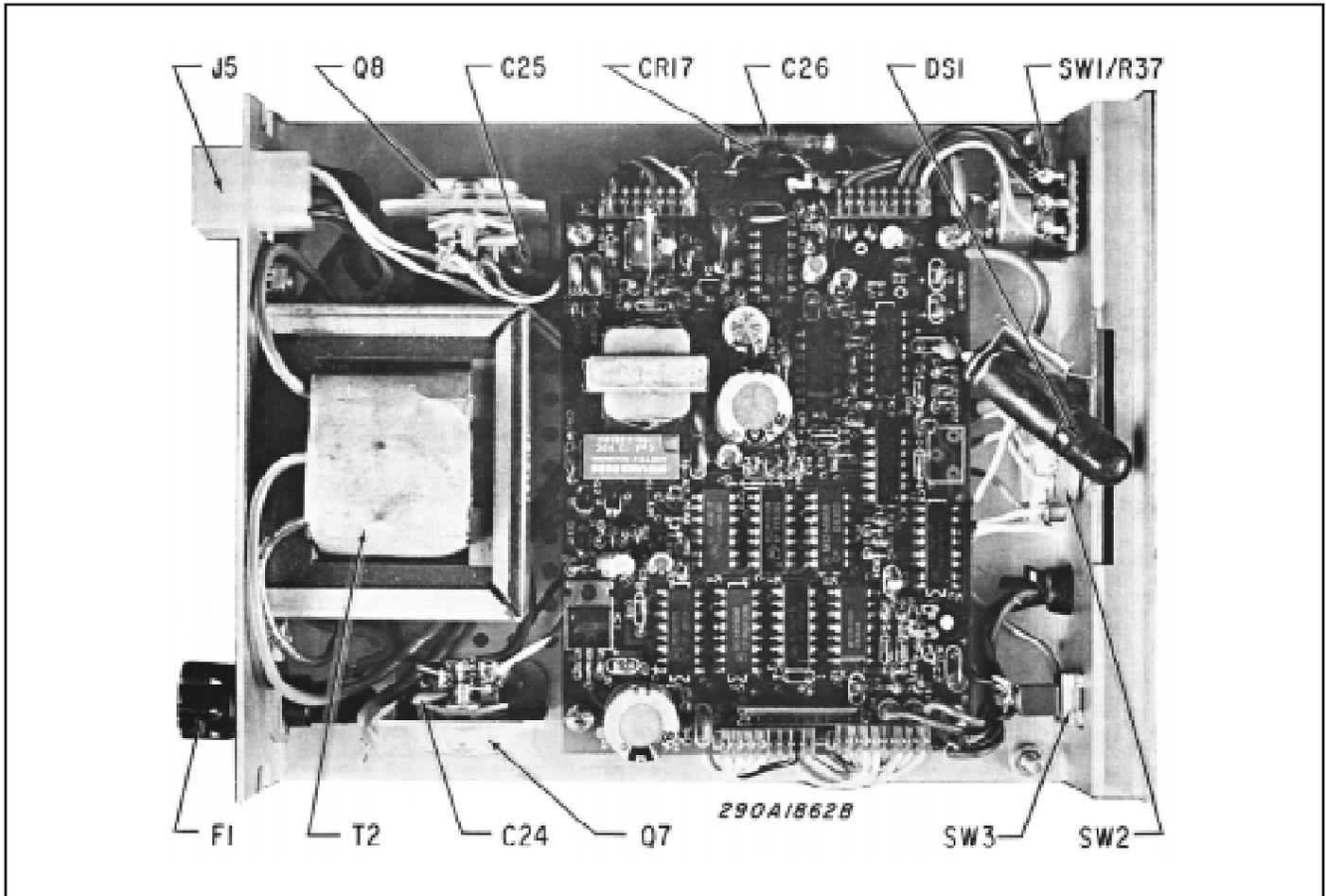


Figure 6-2. Internal View.

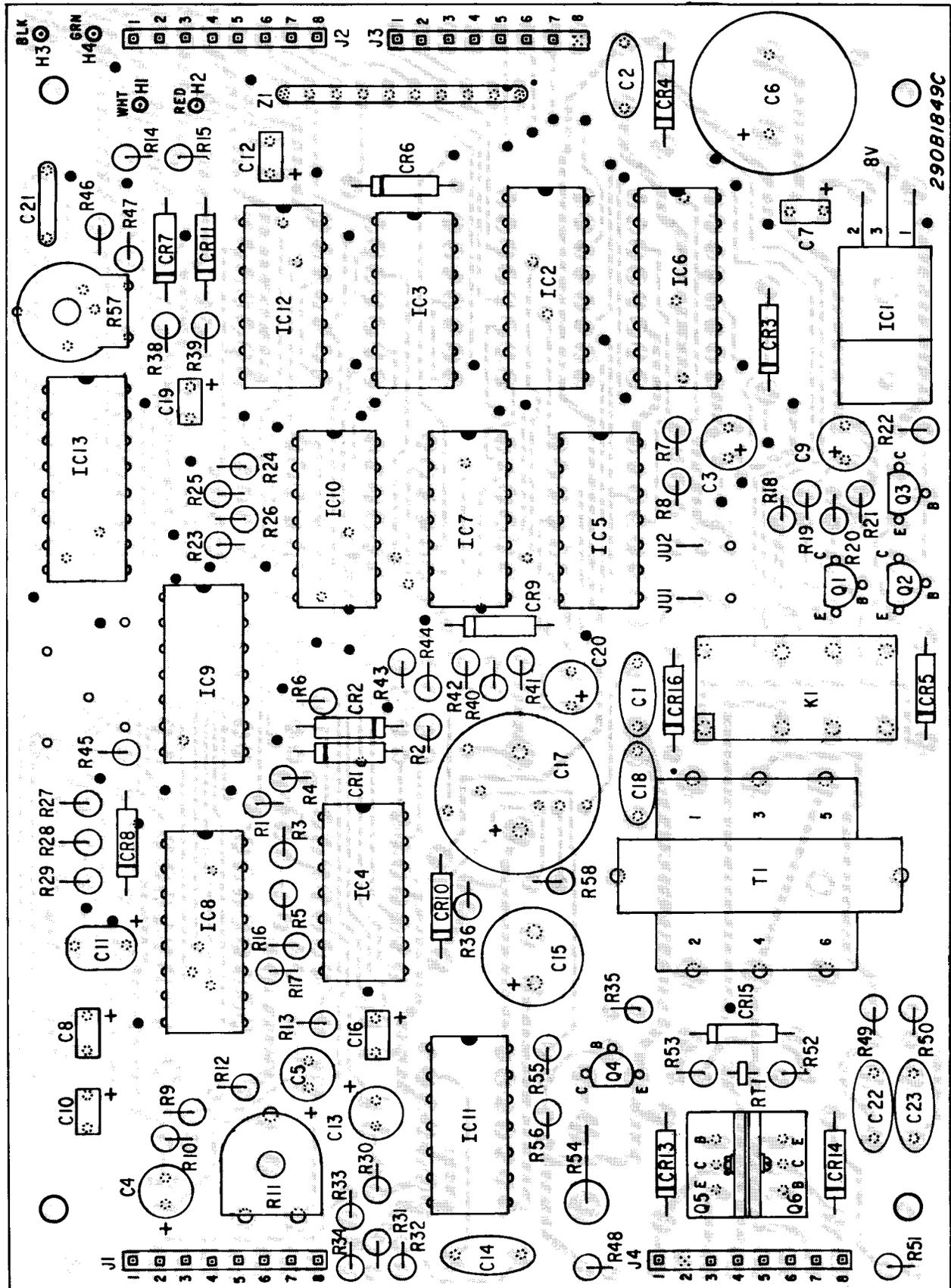


Figure 6-3. Component Location Diagram.

PARTS LIST

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
*RESISTORS			INTEGRATED CIRCUITS		
R1, 4, 14, 15	4700 Ohm	100A298	IC1	UA78M08CKC	128A097
R2, 5, 6, 42, 45	100K Ohm	100A262	IC2	CD4050BE	128A092A-01
R3	27K Ohm	100A244	IC3, IC9	MC14071BCP	128B082
R7, 17, 18, 19, 22, 33, 44	10K Ohm	100A257	IC4	LM324N	128A098
R8	68K Ohm	100A261	IC5	MC14081BCP	128A077
R9, 12	36K Ohm	100A275	IC6	MC14027BCP	128A044
R10, 13, 20	15K Ohm	100A239	IC7	MC14069UBCP	128A100
R11	2K Ohm, Potentiometer	106A203A-01	IC8	MC14053BCP	128A099
R16, 30	18K Ohm	100A258	IC10	MC14066BCP	128A047
R21, 55	5600 Ohm	100A253	IC11	LM380N	128A046
R23, 31, 32, 34, 38	1000 Ohm	100A233	IC12	NAT LM556	128A038-01
R24	4.7K Ohm, 2%	100A713	IC13	MC14046BCP	128B079
			TRANSISTORS		
R25	22K Ohm, 2%	100A797	Q1	TIS93, PNP	125B133
R26	82K Ohm, 2%	100A789	Q2, 3, 4	TIS92, NPN	125B132
R27, 41	33K Ohm	100A211	Q5, 6	2N6109, PNP	125B431
R28	47K Ohm	100A228	Q7, 8	2N5885, NPN, Power	125B432
R29	68K Ohm, 2%	100A775			
R35	27 Ohm	100A290	MISCELLANEOUS		
R36, 49, 50	10 Ohm	100A251	J1, 2, 3, 4	Connector, Wafer	140A170
R37	10K Ohm, Potentiometer, GAIN	106A116	J5	Connector, 12-pin	139A152
R39	10K Ohm	100A257	H1, 2, 3, 4	Terminal, Male	233A106
R40	56K Ohm	100A229	P5	Plug, 12-pin	140A154
R43, 47	1.5 Megohm	100A217	K1	Relay, 180 Ohm, 12V, DPDT	131A130A-01
R46	68K Ohm	100A261	Z1	Resistor Network, 9 x 10K	100A801
R48, 51	150 Ohm	100A238	RT1	Thermistor, 200 Ohm	104A111
R52	27 Ohm	100A290	T1	Transformer, Driver	120B145
R53	8.2 Ohm	100A234	T2	Transformer, Output	120C151A-01
R54	270 Ohm, 2 watt, Wirewound	103A128	F1	Fuse, 15A, 3AG, 32V	148A107
R56	2700 Ohm	100A256	DS1	Lamp, 14V, Green	149A121A
R57	200K Ohm, Potentiometer	106A203A-03	SW2	Switch, Rotary	122B215
R58	470 Ohm	100A248	SW3	Switch, Paddle	122A214
			TB1	Terminal, Strip	229A127
*Unless otherwise specified, all RESISTORS are carbon type, ±5%, 1/4 watt.			Microphone		
CAPACITORS			Socket, Transistor (Q7, Q8)		
C1, 2, 18, 22, 23	0.001UF, 500V, Disc	107A263	Socket, Lamp (DS1)		
C3, 20	10UF, 16V, Electrolytic	108A143	Holder, Fuse (F1)		
C4, 5, 13	2.2UF, 25V, Electrolytic	108A142	Knob, GAIN control		
C6, 17	1000UF, 35V, Electrolytic	108A149	Knob, Selector		
C7, 8, 12, 16	10UF, 10V, Tantalum	107A634	Insulator (Q7, Q8)		
C9	22UF, 16V, Electrolytic	108A144	Circuit Board (without parts)		
C10	0.1UF, 35V, Tantalum	107A1103	Circuit Board (with parts installed)		
C11	22UF, 15V, Tantalum	107A677A-02	Standoff		
C14	0.005UF, 100V, Disc	107A211	Bracket, Lamp		
C15	150UF, 16V, Electrolytic	108A147	Bracket, Mounting		
C19	0.22UF, Radial Tantalum	107A1101	Bracket, Transistor (Q7, Q8)		
C21	0.15UF, 5%, 100V, Poly	107A766	Accessory Kit		
C24, 25	0.005UF, 100V, Disc	107A211	Housing		
C26	500UF, 15V, Electrolytic	108A122	Wire Harness		
			175B434		
DIODES					
CR1, 2, 3, 6, 7, 8, 9, 11	TI55	115B101			
CR4, 5, 10, 13, 14, 15	ED3002S	115B301			
CR16	1N4738, 8.2V, Zener	115A232			
CR17	Rectifier, 6 amp. 50V	115A317			

