PRICE $2.00

SIGNAL DIVISION

Federal Signal Corporation

INSTALLATION AND SERVICE INSTRUCTIONS

MODEL PA-20A INTERCEPTOR ELECTRONIC SIREN SERIES 2E

NOTICE

SIRENS - STATE OF CALIFORNIA

If this PA20A electronic siren is to be operated within the State of California, the Hi-Lo Signal must be disabled. The following modification must be performed by the installer to insure compliance with the California Highway Patrol siren certification program on PA20A sirens installed after July 1st, 1978.

1. *Disconnect power connector and slide siren out of case (refer to paragraph 7-2.A. in this manual).*
2. *Locate resistor R14 on printed circuit board (see Figures 10 and 11 of this manual).*
3. *Solder a one inch piece of 24 GA. wire across R14, so that R14 is shorted out of circuit.*
4. *Reinstall siren into case and re-connect power connector.*
5. *Turn on power and set SELECTOR switch to HI-LO. Modification is correct if no siren sound is emitted.*

Warranty

The Federal Signal Corporation warrants each of its new electronic sirens to be free from defective material and workmanship for a period of one year from date of purchase. Federal Signal Corporation will remedy any defect which under normal installation and operation discloses such defect; provided the unit is delivered, transportation prepaid by owner, to our factory for examination and such examination reveals that in our judgment a defect in material and/or workmanship exists. In all cases, Federal Signal Corporation will be sole judge of what constitutes defective material and workmanship.

Defects of workmanship and material under this warranty will be corrected at no cost to you for labor and material.

This warranty does not extend to any electronic siren which has been subjected to abuse, misuse; improper installation or violation of any instructions supplied by us, nor extended to units which have been serviced or modified at any facility other than our factory.

This warranty takes precedence over all other warranties expressed or implied and no representative or other person is authorized to assume for Federal Signal Corporation any other liability in connection with the sale of our electronic sirens.

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FEDERAL SIGNAL CORPORATION

SECTION I

GENERAL DESCRIPTION

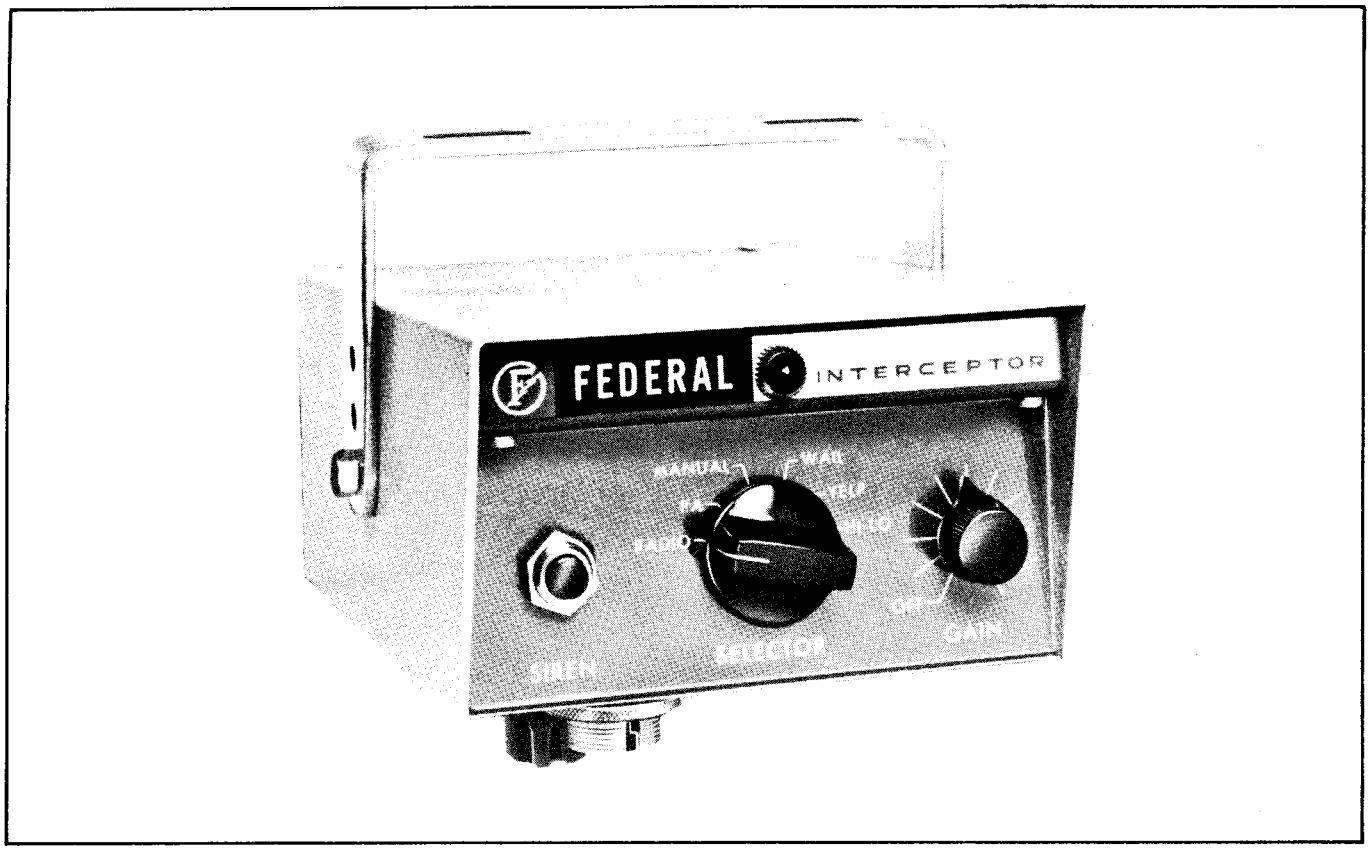


Figure 1. Model PA—20A (Interceptor) Electronic Siren.

The FEDERAL Model PA-20A (Interceptor) Electronic Siren is a precision built, compact, solid-state unit of advanced design. The unit provides three distinct siren sounds plus provisions for public address, manual siren operation and the amplification of radio messages. The Interceptor ordinarily comes equipped for use with a 12 VDC power source (positive or negative grounded system). Any 75 watt commercial speaker (11-ohm impedance) may be used with the PA-20A. Your FEDERAL dealer has a full line of speakers that can be used with the PA-20A. By use of an auxiliary switch, such as a horn ring or foot switch, the unit can be operated manually. The unit can still be operated manually by depressing the SIREN button, after the auxiliary switch is installed. The microphone plug-in convenience of the PA-20A allows the user to utilize the vehicle's two way radio microphone, or an independent microphone. Other features of the PA-20A include:

- Output isolation transformer to reduce the hazard of shorting the output transistors caused by instantaneous short-circuits across the load, i.e. rubbing of speaker coil.
- Blocking transistor to increase thermal stability.
- Blocking diode to prevent damage to the unit if the power leads are reversed.
- Silicon transistors for maximum reliability.
- Constructed to facilitate servicing.

SECTION II

SPECIFICATIONS

Input Voltage	10 VDC to 14.6 VDC
Standby Current	500 mA maximum (MANUAL position)
Operating Current	6 amperes (WAIL position, 1 speaker) 10 amperes (WAIL position, 2 speakers)
Operating Temperature	-30°C to + 65°C
Frequency Range	500 Hz to 1400 Hz
Cycle Rate	Wail - 10 cycles/ minute Yelp - 180 cycles/minute Hi-Lo- 45 cycles/ minute
Voltage Output (13.6 VDC input)	40 Vpp (11-ohm resistive load) 38 Vpp (5.5 ohm resistive load)
Audio Distortion	Less than 10% from 300 Hz to 3000 Hz at output power levels of 1/10 watt to 25 watts
Auxiliary switch leakage resistance	10K ohms, minimum
Size	2-3/4 (H) x 5-$\frac{1}{4}$ (W) x 7-$\frac{1}{4}$ (D) inches
Net Weight	4 pounds, 2 ounces
Shipping Weight	6 pounds

NOTE: The following parameters were obtained with the radio input potentiometer (R30) and GAIN control set at maximum. The voltages shown are needed to obtain the maximum sine wave output of 17 volts RMS.

Radio Input	Impedance, 1800 ohms Voltage, 0.55V RMS
Carbon Microphone Input	Impedance, 3500 ohms Voltage, 0.15V RMS
Magnetic Microphone Input	Impedance, 20K ohms Voltage, 0.03V RMS

SECTION III

INSTALLATION

3–1. UNPACKING.

After unpacking the Model PA-20A, 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. The radio interconnecting cable, if ordered, is packed in a separate carton. The packing carton in which the electronic siren is packed contains:

A. Model PA-20A Electronic Siren.
B. Mounting bracket.
C. Envelope containing mounting hardware.
D. Power Cable

3–2. MOUNTING BRACKET.

The electronic siren comes equipped with a swinging bracket which enables it to be mounted in a variety of positions (see figure 2). Positioning the bracket above the unit allows mounting to the underside of the dash. Positioning the bracket below the unit will permit mounting above the dash or on any horizontal surface. The unit should be mounted in a position that is both comfortable and convenient to the operator. After determining the mounting position, proceed as follows:

CAUTION: The unit must be installed in an adequately ventilated area. Never install in the path of air flow from heater ducts.

A. Use the mounting bracket as a template and mark two positioning holes.
B. Drill two $\frac{1}{4}$-inch mounting holes.
C. Mount the bracket with the $\frac{1}{4}$-20 x 3/4 hexagon head machine screws, $\frac{1}{4}$-20 hexagon nuts and $\frac{1}{4}$-inch split lock washers as shown in figure 3.

3–3. ELECTRONIC SIREN TO MOUNTING BRACKET.

The height of the unit above or below a surface may be adjusted by selecting a set of mounting holes in the bracket. Mount the unit to the bracket with the two $\frac{1}{4}$-20 x 5/16 hexagon head machine screws as shown in figure 3. The unit may be tilted to any convenient position.

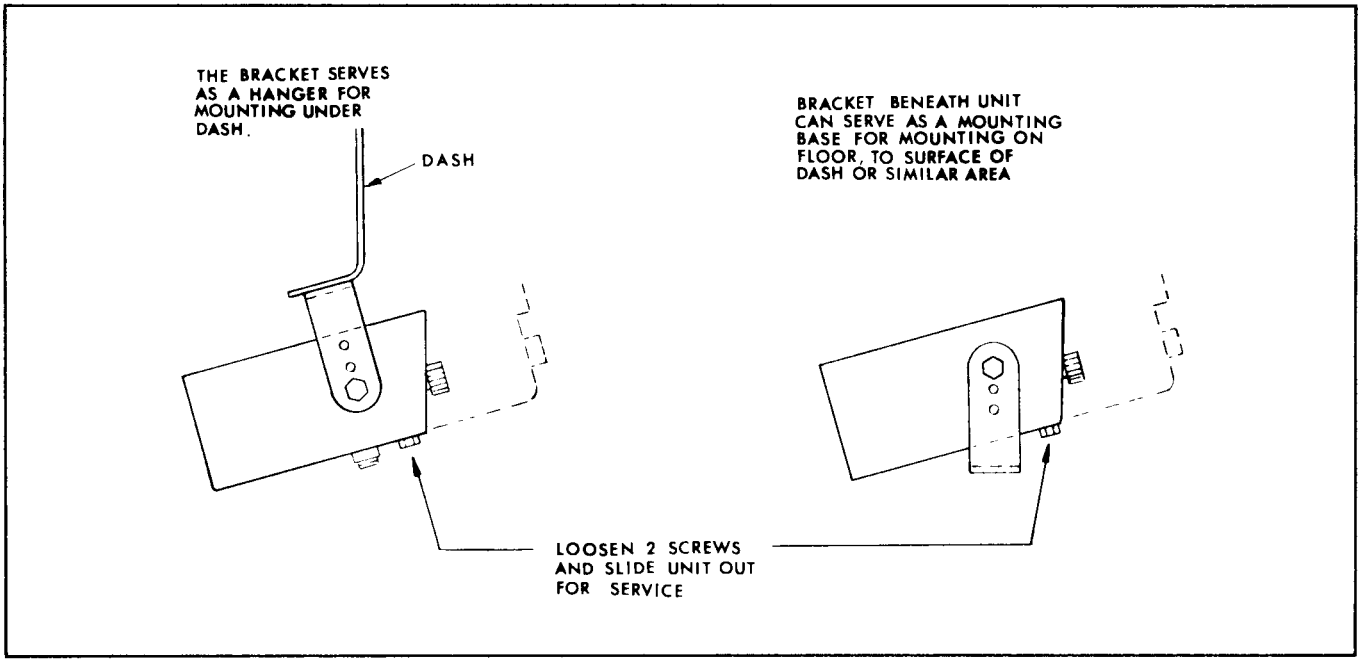


Figure 2. Positioning Unit in Mounting Bracket.

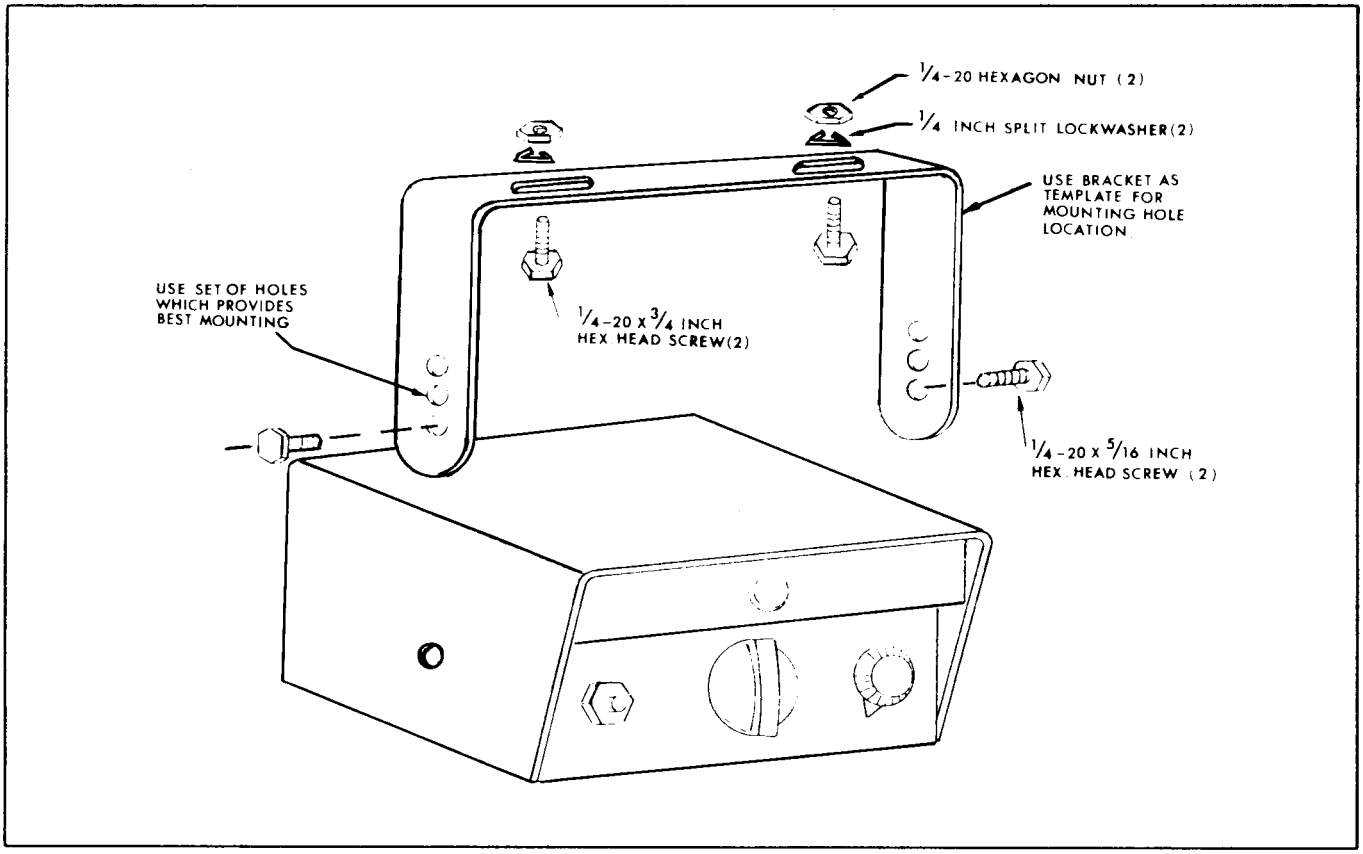


Figure 3. Installation of Mounting Bracket.

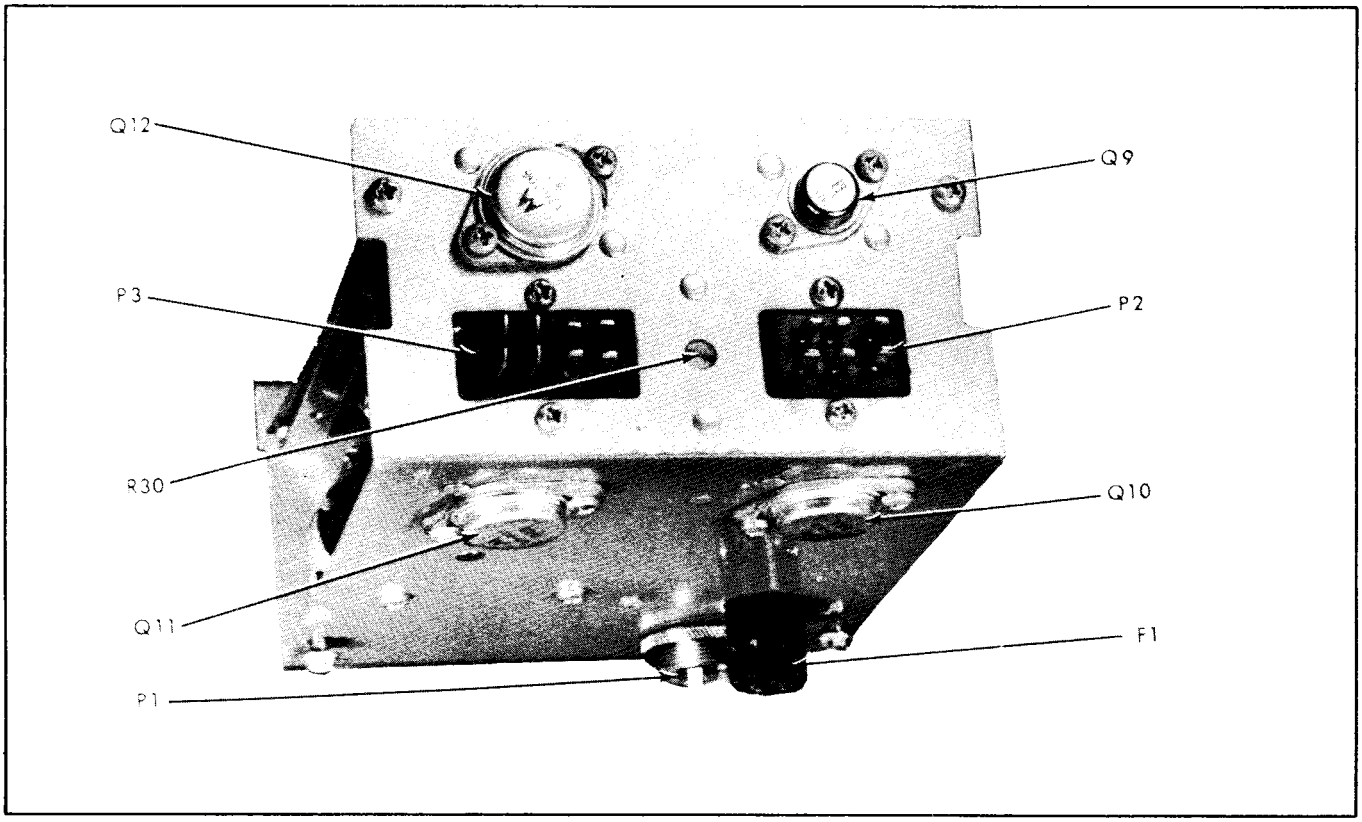


Figure 4. Rear View of Electronic Siren.

3–4. POWER CABLE INSTALLATION.

The power cable included in the amplifier carton is equipped with an eight prong plug that mates with the connector (P3) on the rear of the electronic siren (see figure 4). The various wires on the connector must be connected as described below.

A. Speaker.

The unit is designed to operate with one 11-ohm impedance speaker, or two 11-ohm impedance speakers connected in parallel.

Speakers are not included as part of the electronic siren. FEDERAL speakers are weatherproof and may be installed in any convenient location; on the roof, fender, behind the grille, etc. Any special mounting instructions applicable to the model of speaker you have selected will be found in the speaker carton. The 12-inch two conductor zip cord (P3, pins 5 and 6) should be connected to the speaker leads. Either wire may be connected to either speaker lead, since polarity is not a factor when using a single speaker. It is recommended that the wire splices be soldered and insulated with tape. If soldering equipment is not available, use the two nuts furnished with the speaker.

When two speakers are used, it is necessary to connect the speakers in parallel and in-phase for optimum performance. This can be accomplished by connecting the two speaker leads marked "1" to the same power cable lead, and the two speaker leads marked "2" to the other power cable lead (see figure 5).

B. Connection to Power Source.

The electronic siren will operate in vehicles having either a negative or positive grounded system. Take care to insure battery charging voltage does not exceed 14.6 VDC at any time. Operating power can be obtained by making connections directly at the battery terminal, or to the hot side of the ignition switch. Determine the type of vehicle ground system, and perform the applicable procedure described below. When the negative terminal of the battery is connected to the vehicle frame, the vehicle has a negative grounded system. When the positive battery terminal is connected to the vehicle frame, the vehicle has a positive grounded system.

1. Negative Ground Installation. Connect the red lead (P3, pin 1) to the positive (hot) side of the battery terminal or ignition switch. Connect the black lead (P3, pin 2) to the vehicle frame (see figure 6). When making connections directly to the battery terminal, proceed as follows:

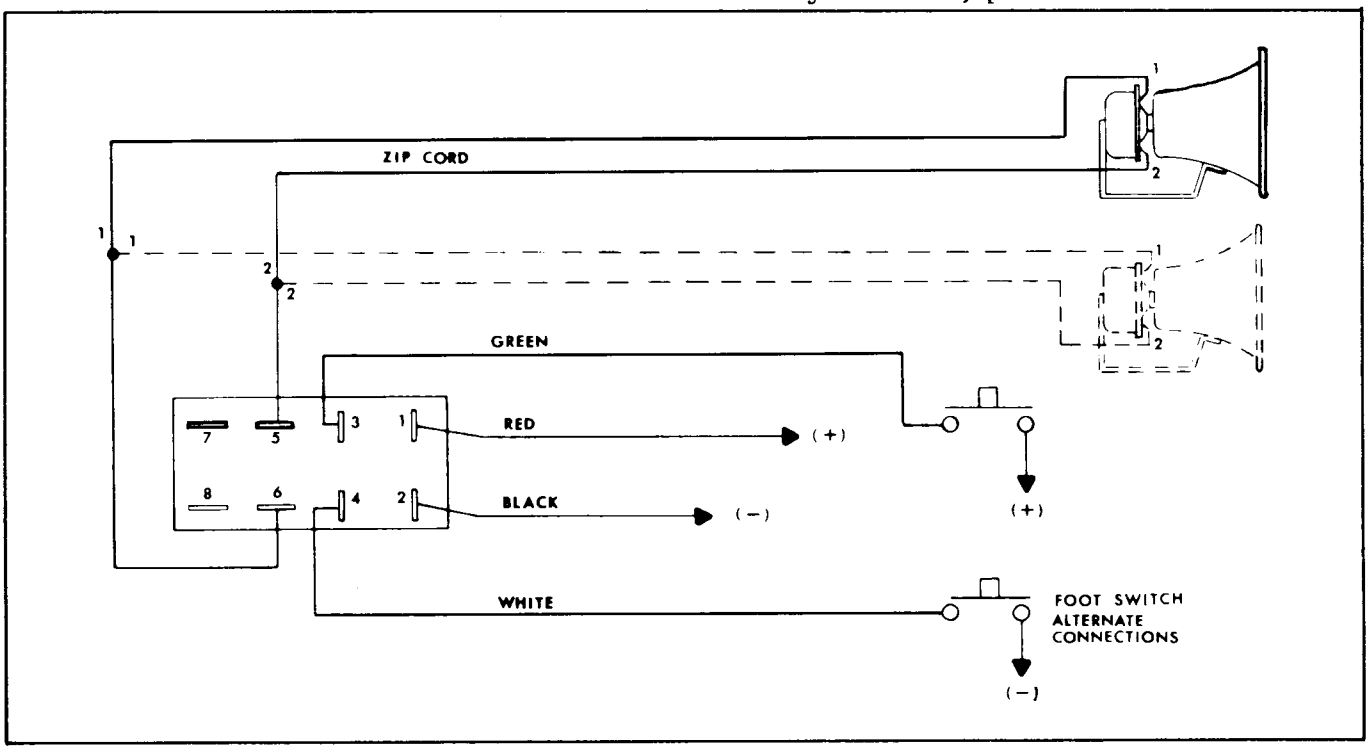


Figure 5. Power Cable Connections — Foot Switch Control.

a. Drill a $\frac{1}{2}$-inch hole through the firewall on the battery side of the vehicle.

b. Place a grommet in the newly drilled hole.

c. Feed the black and red leads through the grommet and connect as previously described.

NOTE

To protect the 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 to the battery as practical.

2. Positive Ground Installation. Connect the black lead to the negative (hot) side of the battery terminal or ignition switch. Connect the red lead to the vehicle frame.

C. Foot Switch.

A foot switch is provided to allow foot control of the siren in addition to the control provided by the front panel SIREN button. Find a convenient mounting position on the vehicle floorboard and proceed as follows:

1. Use the foot switch as a template and mark two positioning holes on the floorboard.

2. Drill two 0.128 diameter (#30) holes into the floorboard at the positioning marks.

3. Connect one terminal of the foot switch to the green lead (P3, pin 3), and the other terminal to the positive (hot) side of the battery terminal (negative grounded systems). As an alternate method, connect one terminal of the foot switch to the white lead (P3, pin 4) and the other terminal to the vehicle frame or other good ground point (see figure 5).

4. Mount the foot switch to the floorboard with the two #8 x 3/4 round head screws (supplied).

D. Horn Switch.

Included with the electronic siren is a SPDT switch (toggle switch) which when properly installed, allows the user to activate the siren by depressing the horn button. When installing the horn switch in a vehicle with a negative ground system with a grounded horn ring, connect as shown in figure 6. See figure 7 when installing the horn switch in a positive ground vehicle with a grounded horn ring, or in a negative ground vehicle with an ungrounded horn ring. Locate a convenient mounting position for the toggle switch (supplied) and proceed as follows:

1. Drill a $\frac{1}{2}$-inch diameter hole into the dash at the selected mounting location. Take care not to damage wires located behind the dash when drilling.

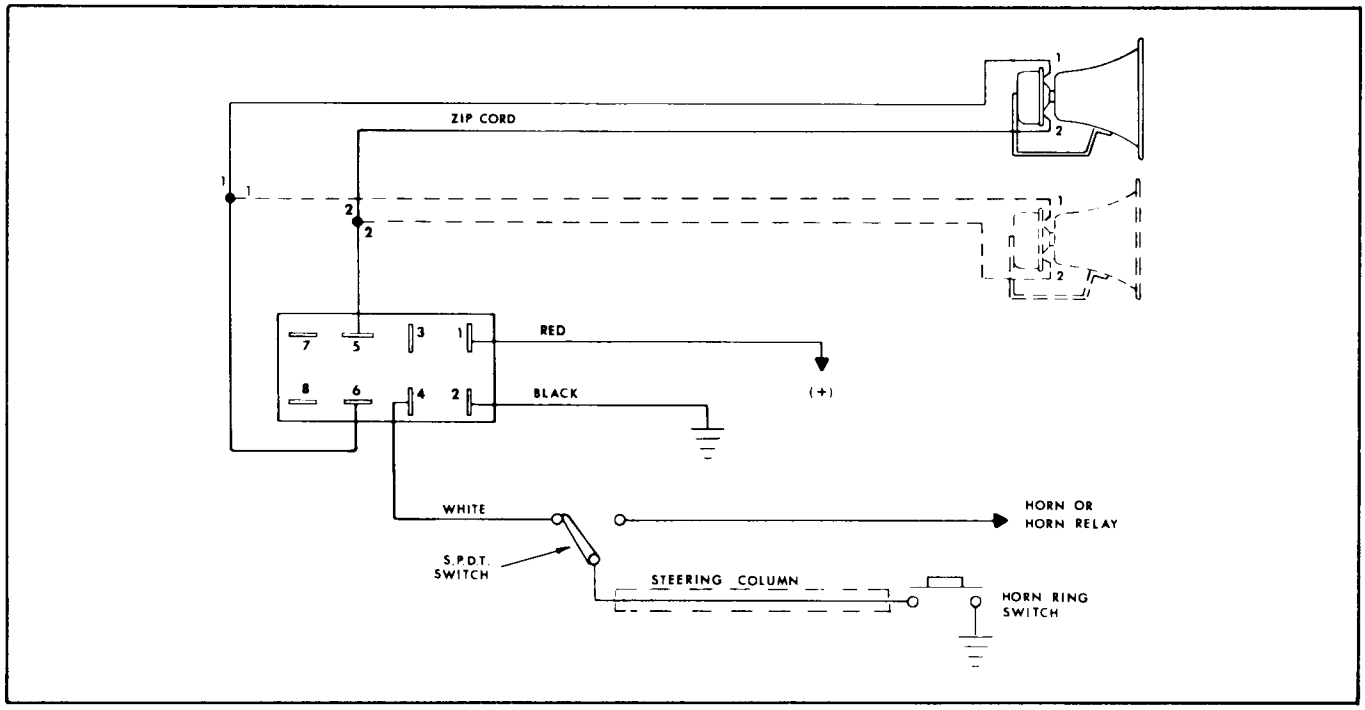


Figure 6. Power Cable Connections — Horn Ring Control (negative ground vehicle with grounded horn ring).

2. Connect a length of wire from one terminal of the toggle switch to the horn or horn relay. A screw terminal is usually provided on the horn relay. If a screw terminal is not provided, connect the wire to the lead that connects to the horn relay.

3. Connect the other terminal of the toggle switch to the white lead (P3, pin 4), if the vehicle has a negative ground system with a grounded horn ring (see figure 6). When the vehicle has a positive ground system with a grounded horn ring or a negative ground system with an ungrounded horn ring, connect this terminal of the toggle switch to the green lead (P3, pin 3) (see figure 7).

4. Connect the center terminal of the toggle switch to the horn ring switch as shown in figure 6 or 7.

5. Place the hexagon nut on the threaded portion of the toggle switch. Insert the threaded portion of the toggle switch through the hole in the dash and secure with the knurled nut.

3–5. RADIO INTERCONNECTING CABLE.

The radio interconnecting cable has a six prong connector that plugs into P2 at the rear of the electronic siren. After installation of the cable, the electronic siren has the provision to broadcast two-way radio messages over the loudspeaker. Also, the two-way radio microphone can be used to take advantage of the electronic siren's public address feature. Refer to the instruction sheet furnished with the radio interconnecting cable for proper connection.

3–6. MICROPHONE CONNECTION.

The electronic siren's public address feature can be utilized after the connection of a microphone. The two-way radio microphone can be used after the connections described in paragraph 3-5 have been made. The electronic siren has a receptacle at the bottom of the unit which is used to interconnect a separate microphone.

The unit will operate with a magnetic, controlled magnetic (noise cancelling), carbon or transistorized magnetic microphone. A slide switch (S3) located just inside the chassis, in the front and to the left of the pilot lamp (see figure 10), must be set according to the type of microphone used. When a controlled magnetic microphone is used, set the switch to the position marked "M". If a carbon or transistorized microphone is used, set the switch to the position marked "C".

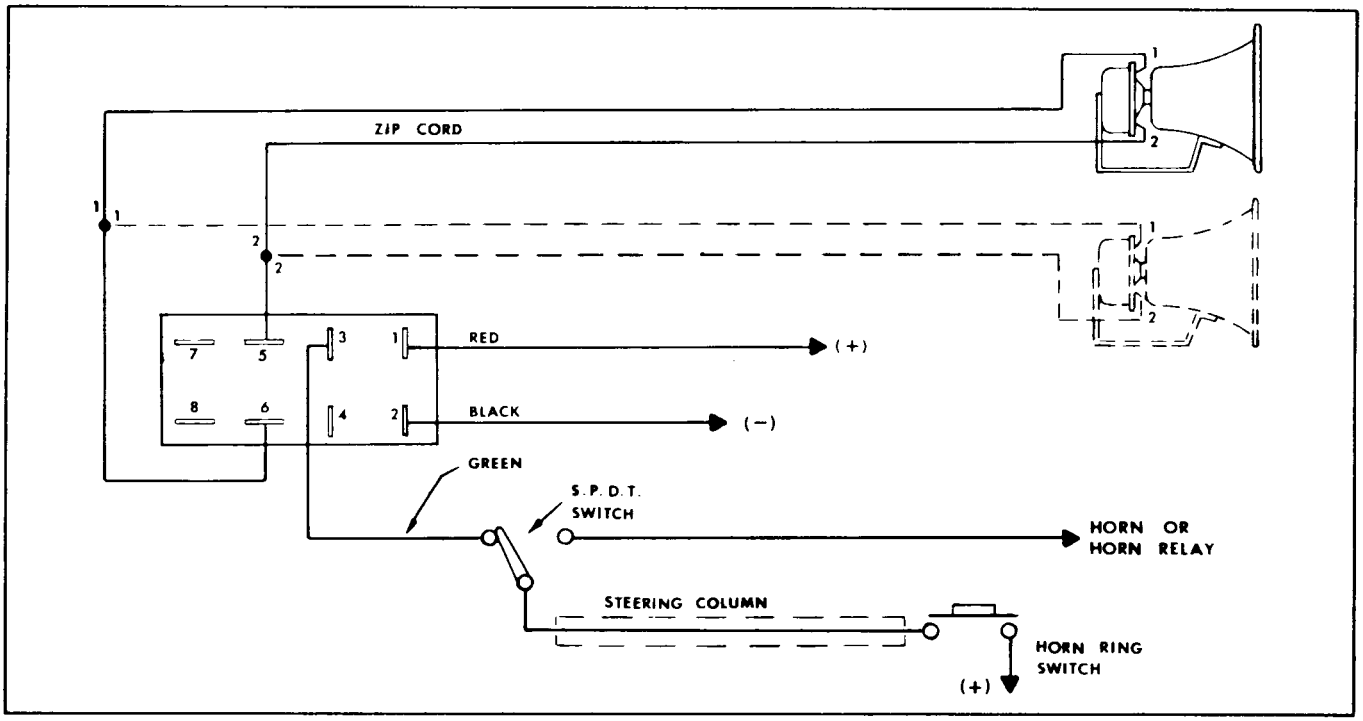


Figure 7. Power Cable Connections — Horn Ring Control
(positive ground vehicle with grounded horn ring or negative ground vehicle with ungrounded horn ring).

SECTION IV

CONTROLS

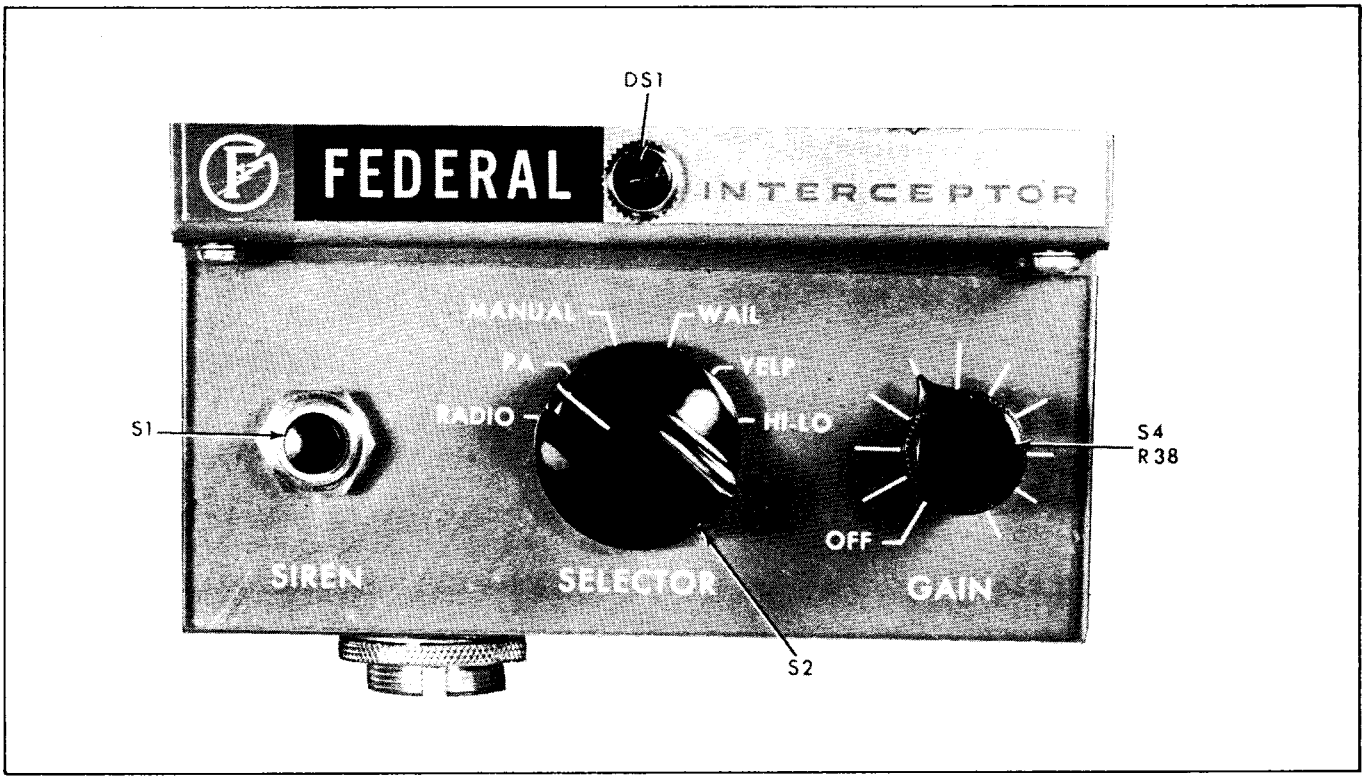


Figure 8. Front Panel View.

All controls utilized during normal operation of the electronic siren are located on the front panel (see figure 8).

4–1. GAIN CONTROL.

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

Radial lines around the knob can be used for setting the volume to a predetermined level. 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 (buildings or other vehicles), etc. Adjust the GAIN control to a position just below the point at which feedback occurs.

4–2. SIREN BUTTON.

The SIREN button, located on the left-hand side of the front panel, is used to activate the siren when the SELECTOR switch is in the MANUAL position.

4–3. SELECTOR SWITCH.

The SELECTOR switch is a six position rotary switch used to select the mode of operation. If a common microphone is used for the electronic siren and two-way radio, the switch will disconnect the microphone from the radio's transmitter section only when the switch is set to P.A. The following are positions on the SELECTOR switch:

A. RADIO.

In this position, incoming radio messages are amplified by the electronic siren. Volume can be controlled by the GAIN control. The radio volume may be adjusted to match the P. A. volume by means of the resistor control located on the rear panel of the electronic siren (see figure 4).

B. P. A.

In this position the electronic siren may be used as a public address system. Volume is controlled by the GAIN control. This is the only position in which the microphone is disconnected from the two-way radio's transmitter, if a common microphone is used for both the electronic siren and two-way radio.

C. MANUAL.

In this position it is possible to operate the siren by depressing the front panel SIREN button. The siren can also be activated by means of an auxiliary switch, such as a foot switch or horn ring button. Operation will be similar to that of a conventional electro-mechanical siren.

D. WAIL.

In this position the siren will produce a continuous "wailing" sound, up or down in frequency.

E. YELP.

In this position a continuous rapid "warbled" tone is generated.

F. HI-LO.

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

SECTION V

OPERATION

5–1. TURNING THE UNIT ON OR OFF.

To turn the unit on, rotate the GAIN control clockwise until a click is heard. The pilot lamp will illuminate. To turn the unit off, rotate the GAIN control fully counter-clockwise.

5–2. RADIO OR PA OPERATION.

Set the SELECTOR switch to RADIO or PA. Adjust the GAIN control to a position just below the point at which feedback occurs. When maximum volume in the P. A. position is required, hold the microphone close to your lips and speak in a loud voice. The radial lines around the GAIN control can be used for pre-setting the level.

5–3. WAIL, YELP OR HI–LO OPERATION.

Set the SELECTOR switch to the desired siren position.

5–4. MANUAL SIREN OPERATION.

Set the SELECTOR switch to the MANUAL position. Depress the SIREN button or, if connected, activate the auxiliary switch. To activate the siren from the horn ring switch, the toggle switch must be in the on position.

SECTION VI

THEORY OF OPERATION

6–1. GENERAL.

The major circuitry consists of a wail-yelp timing oscillator, hi-lo timing oscillator, sweep oscillator, microphone pre-amplifier, emitter follower, driver amplifier, and output amplifier. See figure 11.

6–2. WAIL – YELP TIMING OSCILLATOR.

In the WAIL or YELP position, Q1 and Q2 function as a timing oscillator. The output of the timing oscillator determines the frequency of operation of the sweep oscillator (Q5 and Q6). Initially, assume SELECTOR switch set to WAIL and Q1 on, C3 charges through R4 and the emitter-collector junction of Q1. When C3 is sufficiently charged, Q1 cuts off which turns on Q2. C3 discharges through R10. The charge and discharge of C3 determines the repetition rate (10 cycles/minute)in the WAIL mode. In the YELP mode, C4 has a similar function as C3. The repetition rate in the YELP mode in approximately 180 cycles/minute. An RC network (C6, R12 in WAIL and C5, R11 in YELP) develops a slowly rising and falling voltage having a triangular shape. This rising and falling voltage is applied to the sweep oscillator and determines the frequency of operation.

With the SELECTOR switch set to MANUAL, Q1 and Q2 no longer function as a timing oscillator. When a positive source is connected through an auxiliary switch to P3, pin 3 or when S1 is depressed, Q2 turns on and allows C6 to charge. While C6 charges, the sweep oscillator frequency increases. After releasing S1 or the auxilliary switch, Q2 turns off and C6 discharges through R12 causing the sweep oscillator frequency to decrease. The circuit will function in a similar manner when a negative source is connected through an auxiliary switch to P3 pin 4.

6–3. HI–LO TIMING OSCILLATOR.

The HI-LO timing oscillator functions only when the SELECTOR switch is set to the HI-LO position. When the switch is set to HI-LO, C7 charges through the base-emitter junction of Q3. When the C7 charge voltage reaches the trip point of Q4, it immediately discharges through the anode-cathode junction of Q4. The charge and discharge of C7 causes a rising and falling voltage, with a repetition rate of approximately 45 cycles/minute, which turns Q3 on and off. A square wave at the Q3 collector turns CR2 on and off. When CR2 is not conducting the low tone is generated, and when CR2 conducts (R15 in parallel with R13) the high frequency tone is generated. The square wave at the junction of R13 and R14 is applied to the sweep oscillator.

6–4. SWEEP OSCILLATOR.

The rising and falling voltages from the timing oscillators is applied to the junction of R24 and R25. The voltage at this point determines the bias voltage at Q5 and Q6, which function as an astable multivibrator. CR4 and CR5 are used to set the DC bias of the transistors. The output of the sweep oscillator is a series of square waves, frequency determined (500 Hz to 1400 Hz) by the bias voltage. This frequency increases when the bias voltage increases and decreases when the bias voltage decreases.

6–5. MICROPHONE PRE–AMP.

The microphone pre-amplifier is used only when S3 is set to the "M" position (magnetic microphone) and the SELECTOR switch is set to PA. The signal from a magnetic microphone is applied through S3 to the base of Q7. The low level signal is amplified by Q7, flows through S3, S2G and the GAIN control to the base of Q8.

6–6. EMITTER FOLLOWER AND DRIVER.

An output from the sweep oscillator, microphone pre-amplifier, carbon or transistorized microphone, or two-way radio is applied to the base of Q8. Transistor Q8 functions as an emitter follower,

providing a high input and low output impedance. The output of Q8 is applied to the driver (Q9) amplified and transformer coupled to the output stage.

6–7. OUTPUT AMPLIFIER.

Transistors Q10 and Q11 operate as a Class B, push-pull amplifier. The output of the amplifier is transformer coupled to the speaker. Transistor Q12 and diode CR6 provide protection should the power leads be reversed. Q12, along with resistors R46 through R49 help in preventing thermal runaway.

SECTION VII

SERVICE AND MAINTENANCE

7–1. SERVICE AND REPAIR.

Most of the component electronic parts used in the Interceptor are standard items that can be obtained from any radio or electronics supply shop.

To aid the repairman in isolating a malfunction and locating components, a top chassis view (figure 9), rear chassis view (figure 4), component location diagram (figure 10), and schematic diagram (figure 11) are provided. Any competent radio repairman or electronic technician should have no difficulty in tracing and correcting a malfunction, should any occur. When servicing the Interceptor, the voltage chart (table 1) and troubleshooting chart (table 2) can be useful in isolating a malfunction. 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.

When replacing output transistors, insure that a matched pair is used. Replace only with Federal part number 125B403 or Motorola 2N1560. Other transistors will burn-out after a very short time. Also,use heat sink compound on both sides of the mica. Insure that the mica is installed properly. Improper installation of mica could cause a short-circuit. Securely tighten transistor mounting screws.

NOTE

Most cases of defective output transistors are caused by a defective speaker (short-circuited voice coil). Make certain that the speaker is not defective prior to installing the repaired Interceptor.

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:

Customer Service Dept.
Federal Signal Corporation
136th and Western Avenue
Blue Island, Illinois 60406

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 nature of malfunction and, if possible, its cause.

7–2. MAINTENANCE.

A. Removal from Mounting Bracket.

When removing the Interceptor from the mounting bracket, loosen the two hexagon head screws on the underside of the unit, near the front edge (see figure 2). It is not necessary to remove the mounting bracket from location or the siren case from the bracket. Disconnect all plug-in connectors. Slide the entire chassis and control panel out of the case.

B. Removal of Circuit Board.

The board is attached to the chassis by four Phillips-head screws. Removing these screws permits the board to be pivoted out

of the chassis without breaking any of the electrical connections, and allowing ample access to all components.

C. Symmetry Adjustment.

The symmetry of the output waveform has been preadjusted at the factory and will not ordinarily require readjustment unless Q5 or Q6 have been replaced. To perform the symmetry adjustment, proceed as follows:

1. Remove the speaker leads connected between P3, pins 5 and 6. Connect an 11-ohm load across pins 5 and 6.

2. Connect an oscilloscope across pins 5 and 6.

3. Set the SELECTOR switch to WAIL, YELP or HI-LO. Adjust R21 for a perfect square wave on the oscilloscope.

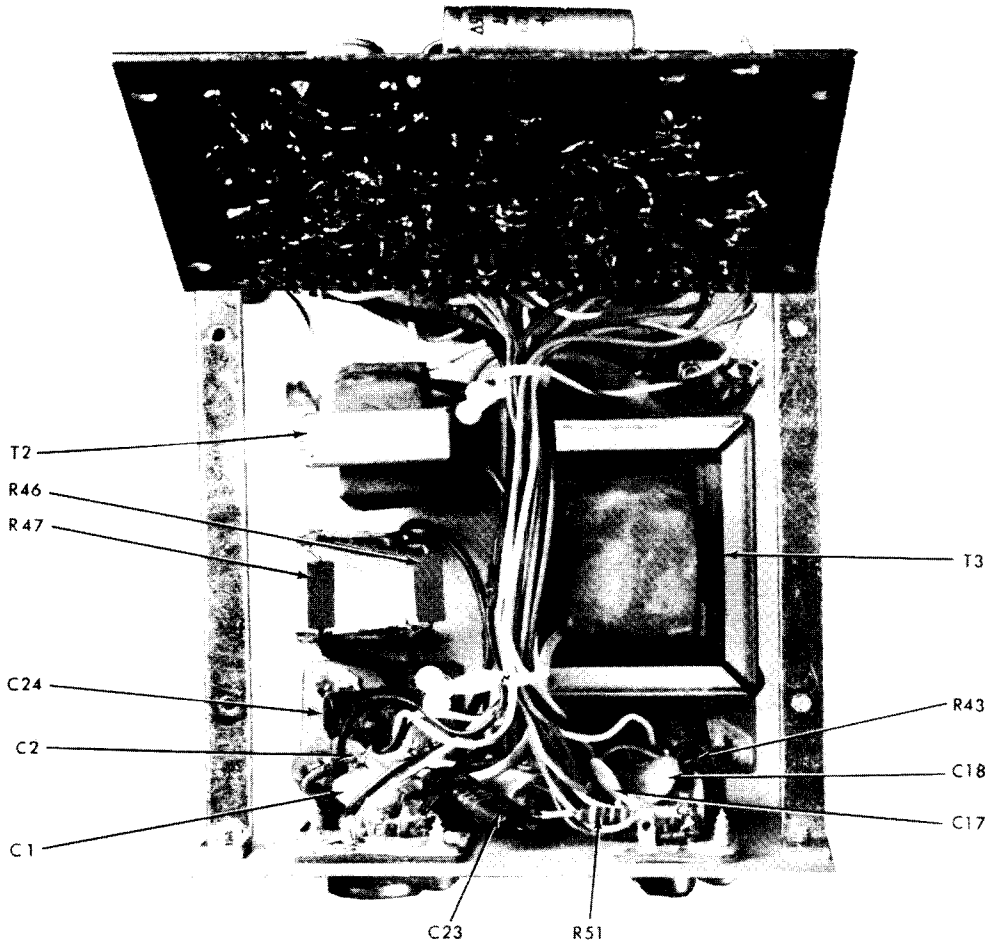
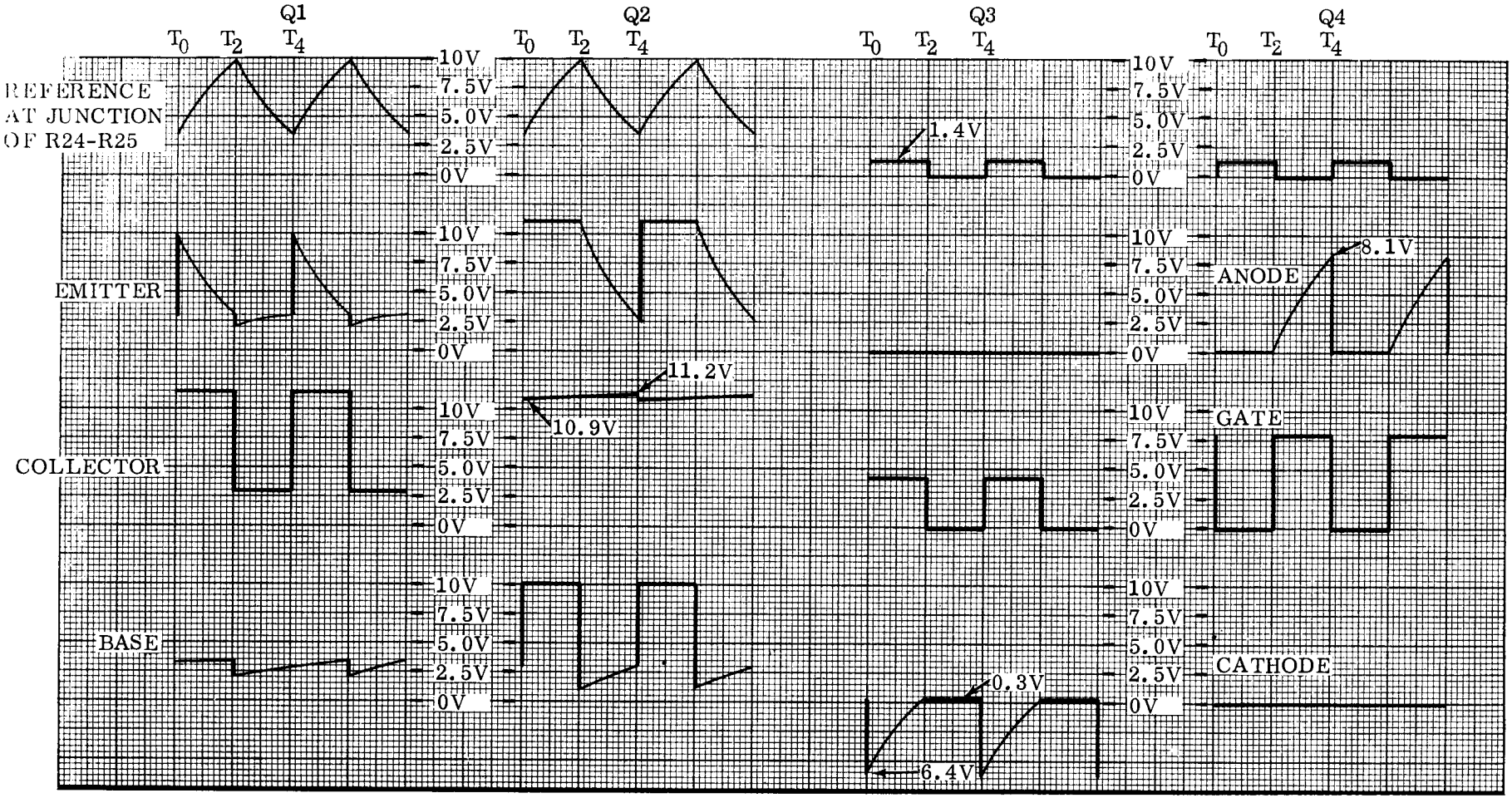


Figure 9. Top Chassis View.

Table 1. Voltage Chart.



	EMITTER	COLLECTOR	BASE
Q5	1.7 VDC	3.7 VDC	1.6 VDC
Q6	1.6 VDC	3.7 VDC	1.5 VDC
Q7	0.48 VDC	9.3 VDC	1.09 VDC
Q8	1.28 VDC 0.05 VAC	12.6 VDC 0.0 VAC	1.8 VDC 0.5 VAC
Q9	1.28 VDC 0.05 VAC	12.3 VDC 2.9 VAC	0.65 VDC 0.05 VAC
Q10	13.2 VDC 0.14 VAC	0.0 VDC 7.4 VAC	13.0 VDC 0.32 VAC
Q11	13.2 VDC 0.18 VAC	0.0 VDC 7.4 VAC	13.0 VDC 0.4 VAC
Q12	13.6 VDC 0.0 VAC	13.6 VDC 0.0 VAC	13.2 VDC 0.0 VAC

NOTES

1. GROUND CHASSIS TO B- BEFORE ATTEMPTING TO TAKE ANY MEASUREMENTS.
2. ALL MEASUREMENTS MADE WITH NEGATIVE LEAD OF OSCILLOSCOPE OR VTVM CONNECTED TO NEGATIVE POWER LEAD.
3. Q1,2,5 AND 6 MEASUREMENTS TAKEN WITH SELECTOR SWITCH SET TO WAIL.
4. Q3 AND Q4 MEASUREMENTS TAKEN WITH SELECTOR SWITCH SET TO HI-LO.
5. Q7 THROUGH Q12 DC MEASUREMENTS TAKEN WITH SELECTOR SWITCH SET TO RADIO AND NO SIGNAL INPUT.
6. Q8 THROUGH Q12 AC MEASUREMENTS TAKEN WITH SELECTOR SWITCH SET TO RADIO WITH AN INPUT SIGNAL OF 1 VRMS AT 1 KHz- GAIN CONTROL SET AT APPROXIMATE MID-POINT.

Table 2. Troubleshooting Chart.

TROUBLE	PROBABLE CAUSE
Fuse blows.	One or more output transistors (Q10, Q11) defective and/or defective blocking transistor Q12.
No siren in any position. Radio and P. A. function normally.	Open capacitor C15.
No siren. Unit "chirps" in YELP position.	Open capacitor C6 or C7.
Little or no volume in all positions.	Defective loudspeaker.
Low output in all positions.	Defective transistor Q10, Q11, or Q12.
Little or no volume in RADIO position. P.A. is OK.	Improper adjustment of R30.
Little or no output when magentic microphone is used.	Microphone transfer switch in "C"position. Open capacitor C11. Defective microphone.
No output from carbon or transistorized microphone.	Microphone transfer switch in "M" position.
No HI-LO. All other tones OK.	Defective transistor Q3 or Q4.
No radio or P. A. Siren tones OK.	Open capacitor C13 or C14.
Steady tone in all siren positions except MANUAL and HI-LO.	Defective resistor R3 or R5.
WAIL tone falls only. Manual tone only when SIREN button is held (does not coast down, but stops immediately when SIREN button is released).	Open capacitor C6.
WAIL tone rises to steady tone and holds. All other tones OK.	Open capacitor C3.
YELP tone falls only. All other tones OK.	Open capacitor C5.
Steady tone in YELP position. All other tones OK.	Open capacitor C4.
In MANUAL position, siren emits a steady or intermittent tone even though auxiliary switch (horn ring or foot) is not operated.	Defective transistor Q5 or Q6. Electrical leakage at auxiliary switch due to dirt or moisture. (Switch resistance should not be less than 10K ohms.)
Excessive noise in P. A. position only.	Short-circuit in microphone. There should be an open circuit between pin 2 and shell of microphone plug.
Buzz in loudspeaker when engine or radio is operated.	Open capacitor C20.
Short siren blast in MANUAL position. Sometimes heard when vehicle is being started.	Defective capacitor C8 and/or defective diode CR3.
Frequency of siren affected by flashing lights.	Voltage drop in power lead. Connect amplifier directly to battery terminal.

PARTS LIST

SCHEMATIC SYMBOL	DESCRIPTION	PART NUMBER
	* RESISTORS	
R1,28	1.5K ohm	100A220
R2,11,12	27K ohm, 5%	100A244
R3	10K ohm, 5%	100A257
R4	39K ohm, 5%	100A260
R5	18K ohm, 5%	100A258
R6	470 ohm	100A255
R7,29	1K ohm	100A233
R8,35	150 ohm	100A238
R9	8.2K, 5%	100A223
R10	100K ohm, 5%	100A262
R13	100K ohm	100A222
R14	10K ohm	100A207
R15,33	27K ohm	100A254
R16	330K ohm	100A212
R17	150K ohm	100A226
R18	3.3K ohm	100A209
R19,23,31 34,52	4.7K ohm	100A224
R20,22	2.7K ohm, 5%	100A256
R21	5K ohm, potentiometer	105A204
R24,25	68K ohm, 5%	100A261
R26,27	22K ohm, 5%	100A259
R30	500 ohm, potentiometer	105A229
R32,37	270K ohm	100A227
R36	22K ohm	100A208
R38	50K ohm, potentiometer	106A105
R41	680 ohm	100A231
R42	10 ohm	100A251
R43	1.8K ohm, $\frac{1}{2}$ watt	100A339
R44	120 ohm, 5%, 2 watt	103A105
R45	1.0 ohm, 1 watt	103A101
R46,47	0.05 ohm, 5 watt	103A208
R50	220 ohm	100A219
R51	3.3K ohm, $\frac{1}{2}$ watt	100A340

* Unless otherwise specified, all RESISTORS are in ohms, ± 10%, $\frac{1}{4}$ watt.

	TRANSISTORS	
Q1,2,3,5,6, 7,8	2N2925	125A119
Q4	D131TI, PUT	125C310
Q9	RCA 40316, Driver	125B410
Q10,11	2N1560, (Motorola only)	125B403
Q12	Blocking	125B406

SCHEMATIC SYMBOL	DESCRIPTION	PART NUMBER
	CAPACITORS	
C1,2,21	0.01 UF Ceramic Disc	107A223
C3,6	82 UF, 10V Tantalum	107A624
C4,5	4.7 UF, 15V Tantalum	107A678
C7	3.9UF Tantalum	107A642
C8,19,20	250 UF, 15V Electrolytic	108A107
C9,10	0.0068 UF, Mylar	107A413
C11,22	0.47 UF, Mylar	107B405
C12,17	0.005 UF, Ceramic Disc	107A211
C13,14	10 UF, 10V Tantalum	107A634
C15	0.1 UF, Mylar	107A406
C18	0.05 UF, Ceramic Disc	107A214
C23	0.22 UF, Mylar	107A414
C24	0.47 UF, Mylar	107A405
	DIODES	
CR1,2,3,4 5,7,8	TI51	115B101
CR6	1 Amp. Rectifier	115B301
	TRANSFORMERS	
T1	Transformer	120B123
T2	Driver Transf.	120B125
T3	Output Transf.	120B124
	SWITCHES	
S1	Pushbutton, SIREN	122A117
S2	Rotary, SELECTOR	122B140
S3	Slide	122B119
S4	ON-OFF, Part of R38	106A105
	MISCELLANEOUS	
P1	Microphone connector	139B134
P2	6-Pin Jones Plug	140A113
P3	8-Pin Jones Plug	140A114
F1	Fuse, 15 ampere, 3AG	148A107
DS1	Pilot lamp, #53	149B101
	Fuseholder	143A106
	Knob, Volume Control	141A102
	Knob, Function Switch	141A103
	Pilot lamp holder and jewel	147A104
	Terminal strip	229A115
	Circuit Board (with parts installed)	200D389

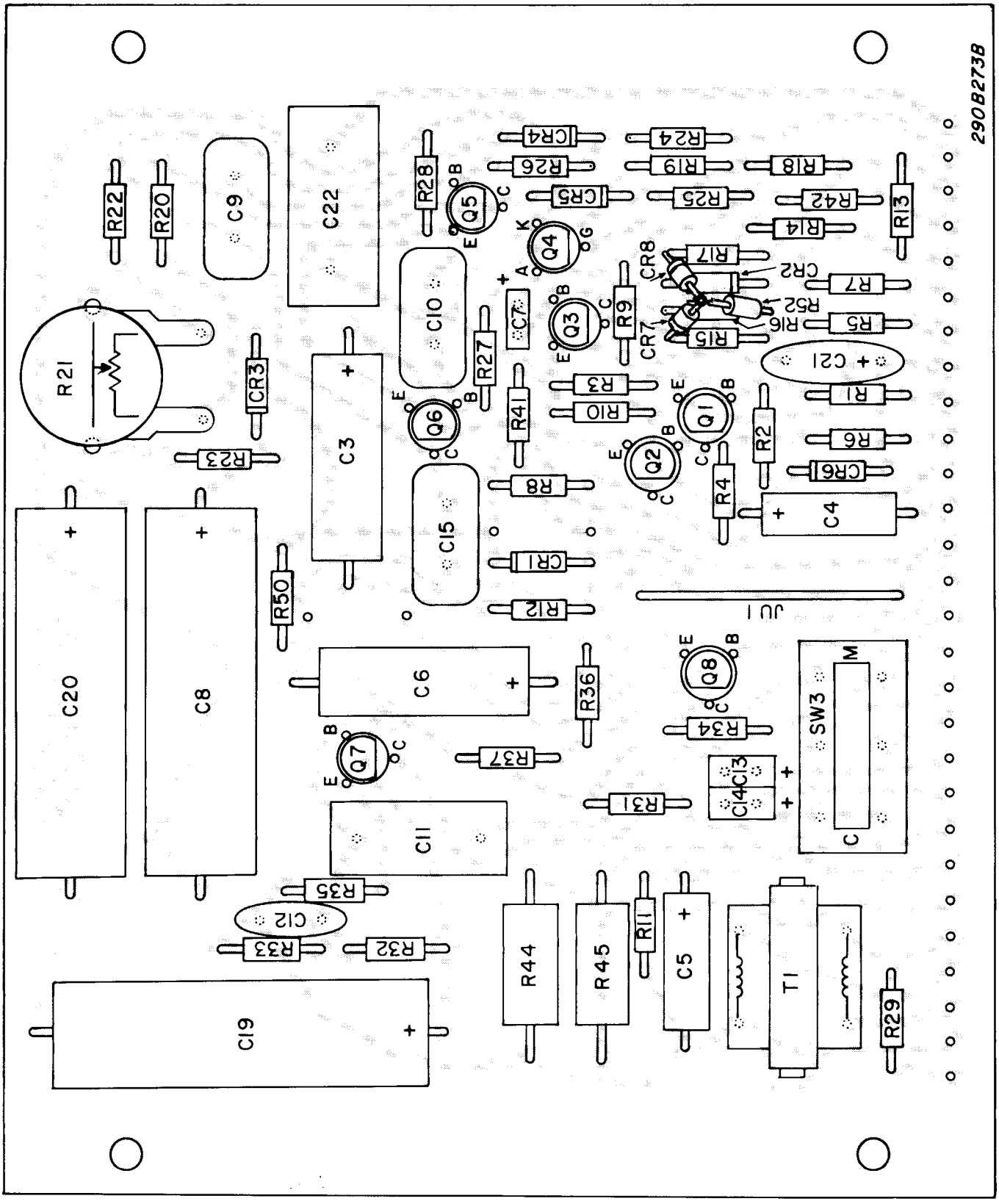
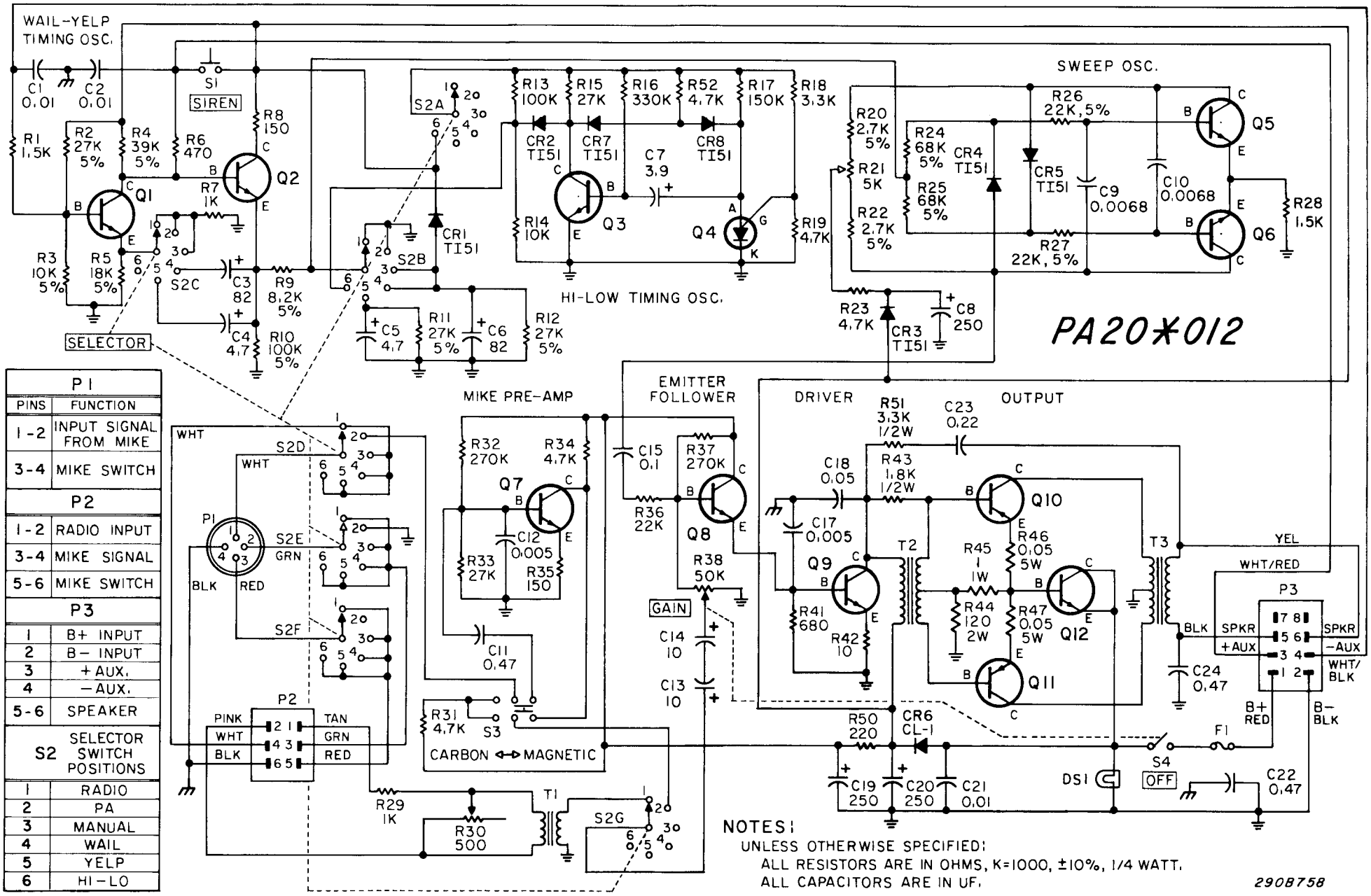


Figure 10. Component Location Diagram.



P1	
PINS	FUNCTION
1-2	INPUT SIGNAL FROM MIKE
3-4	MIKE SWITCH

P2	
1-2	RADIO INPUT
3-4	MIKE SIGNAL
5-6	MIKE SWITCH

P3	
1	B+ INPUT
2	B− INPUT
3	+ AUX.
4	− AUX.
5-6	SPEAKER

S2	SELECTOR SWITCH POSITIONS
1	RADIO
2	PA
3	MANUAL
4	WAIL
5	YELP
6	HI-LO

Figure 11. Schematic Diagram.

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