

PRICE \$2.00



SIGNAL DIVISION
Federal Signal Corporation

MODEL CC1X CONTROL CENTER

For Use With
MPA 1 and MPA 2

Series B

ELECTRONIC SIRENS

Purchase Order No. 21026

Issued June 29, 1982

California Highway Patrol



INSTALLATION AND SERVICE INSTRUCTIONS

SECTION I GENERAL DESCRIPTION

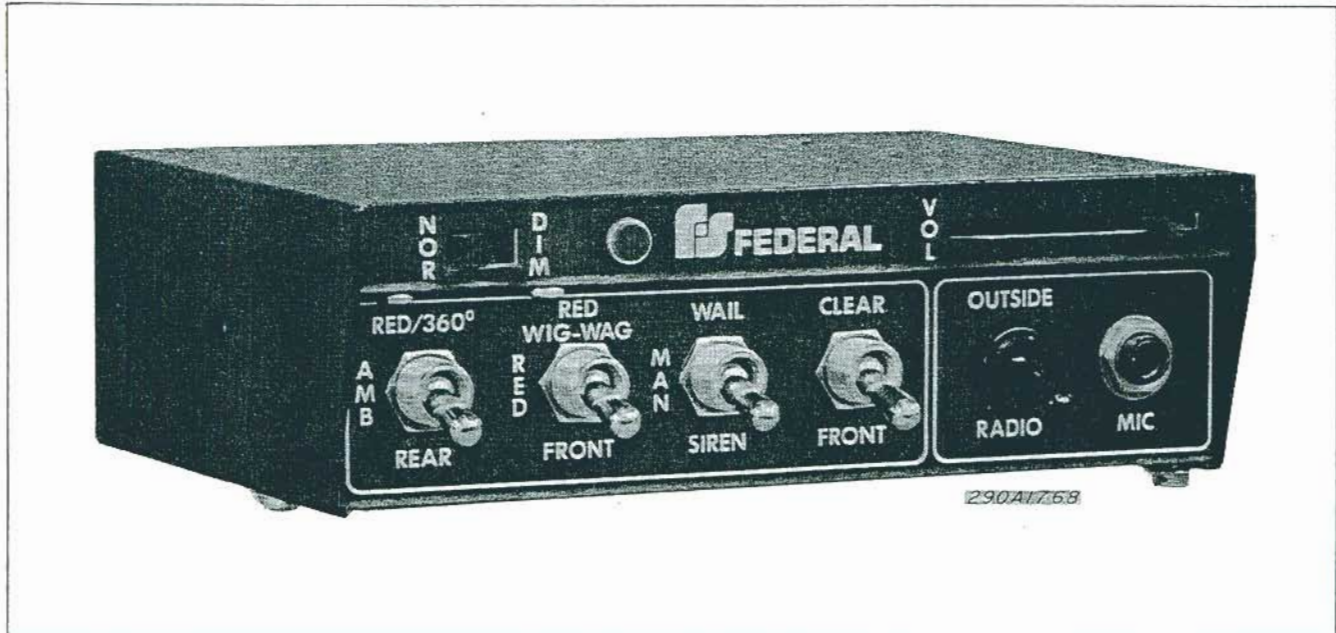


Figure 1-1. Model CC1 Control Center

The Federal Model CC1 Control Center is a versatile control unit that provides complete control of Models MPA1 and MPA2 electronic sirens. The CC1 is also capable of controlling a vehicle warning light system configured to California Highway Patrol specifications.

Front panel switches permit the control of five light circuits, four functions on two switches and one independent switch; two siren modes - Manual with Peak and Hold and Wail with TAP II

Yelp; Radio Rebroadcast and Public Address. There is an indicator lamp which illuminates whenever one of the front panel functions is selected. The intensity of the lamp has two levels - Normal and DIM, selectable via panel-mounted slide switch. The front panel illumination is controllable through a terminal on the rear of the unit.

The Peak and Hold function and TAP II Yelp are controlled by the vehicle Horn Ring circuit.

SECTION II

SPECIFICATIONS

2-1. ELECTRICAL

Input Voltage . . . . .	. 10VDC to 16VDC
Polarity . . . . .	. Negative Ground only
Standby Current . . . . .	. 0.0MA not including panel lamp

2-2. PHYSICAL

Dimensions (HWD) . . . . .	. 2 1/4" x 7" x 5 1/2" (5.7cm x 17.8cm x 14cm)
Weight . . . . .	. 3 lbs. (approximately) (1.36kg approx.)

2-3. ACCESSORIES

Model MNCT Transistorized, Noise-cancelling Microphone

2-4. CURRENT RATINGS (MAXIMUM)

RED . . . . .	. 33 Amps.
A1 . . . . .	. 6 Amps.
A2 . . . . .	. 6 Amps.
TD . . . . .	. 6 Amps.
WW . . . . .	. 24 Amps.
FR . . . . .	. 9 Amps.
B+ . . . . .	. 15 Amps.
RC . . . . .	. 3 Amps.

SECTION III

INSTALLATION

3-1. UNPACKING

After unpacking the Model CC1, 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

Before mounting the CC1, route all wiring to the mounting location, allowing 8 to 12 inches of extra wire at the Control Center location. Install the vehicle speakers and route the speaker leads (AWG18 wire) to the Control Center location. Run leads to the vehicle's horn ring circuit. Run the red power lead to the vicinity of the battery.

3-3. BRACKET MOUNTING

The CC1 is shipped with a swinging mounting bracket that makes it possible to mount the unit in a variety of positions. Positioning the bracket above the unit allows mounting on the underside of the dash. Positioning the bracket below the unit permits mounting on any horizontal surface or, in conjunction with Federal's TU70 Tunnel Mount, on the vehicle's transmission hump.

Mount the siren in a location that is convenient and comfortable to the operator and where it will not interfere with the safe operation of the vehicle. Keep visibility and accessibility of controls in mind when choosing a location. To install the bracket 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 the siren near heater ducts.

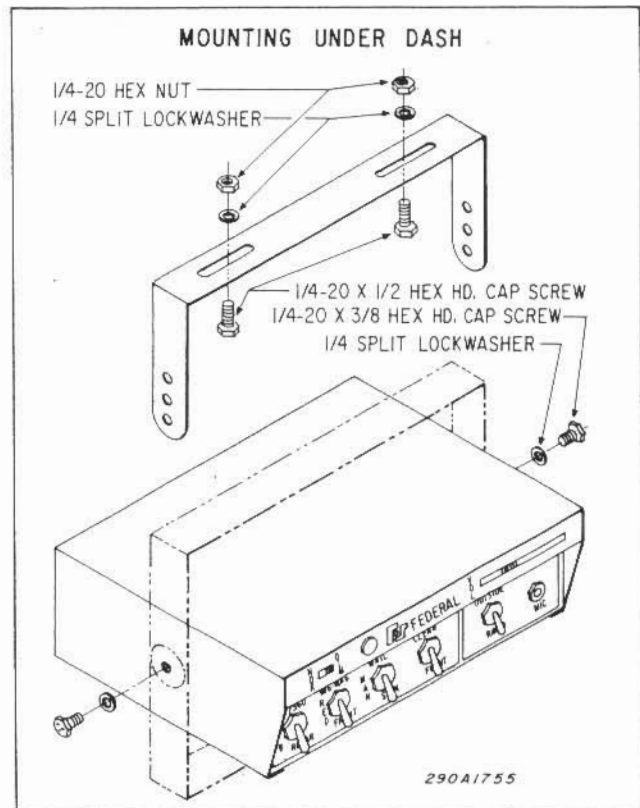


Figure 3-1. Installation of Model CC1 under the dash

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

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

C. Secure the mounting bracket to the dash using two each of the following: 1/4 - 20 x 1/2 hex head screws, 1/4" split lockwashers and 1/4 - 20 nuts as shown in figure 3-1.

D. Set the unit on the floor of the vehicle as close as possible to its final mounting location. Do NOT secure it to the mounting bracket at this time.

3-4. POWER/CONTROL CONNECTIONS

Before proceeding with this section, install the MPA siren as described in the

NOTE

Some units have these terminals labeled SPKR instead of FLA. The flasher connections can be made in the manner previously described using these terminals.

3-6. SPEAKER CONNECTIONS

CAUTION

Be sure the correct speaker (MPA1-58 watts, MPA2-100 watts) is used since a 58-watt speaker will be damaged or destroyed if used with a 100-watt siren.

Connect the speaker leads to the tan and brown wires coming from the control head end of the cable. Connect one lead to the tan wire and the other to the brown wire. Polarity does not matter. Insulate the splices.

3-7. RADIO CONTROL CIRCUIT

Proper connection of the radio control circuitry allows power to be supplied to the two-way radio whenever the vehicle ignition is on or when the RADIO/OUTSIDE switch is set to OUTSIDE (radio rebroadcast). To perform this connection, proceed as follows:

A. Connect a wire from the vehicle two-way radio relay control circuitry to the RC terminal on the rear of the control center. If necessary, refer to the two-way radio service manual to locate this wire in the radio.

B. If the two-way radio draws more than 3.0 amps of current, install a 12 VDC relay in the circuit. Connect one end of the relay coil to the RC terminal and ground the other end of the relay coil. Use the relay contacts to control power to the radio.

NOTE

FCC rules and regulations require the use of a key-lock switch to control the power to a mobile transmitter. Therefore, wire the CC1 radio control circuit to control power to the receiver only. Wiring to accomplish this kind of control varies with the type of two-way radio. Refer to the radio manufacturer's service manual.

3-8. RADIO INPUT CONNECTIONS

Connect a suitable two-wire cable (such as common lamp or "zip" cord) to the RADIO terminals on the rear panel. Connect the other end across the two-way radio's speaker voice coil terminals.

3-9. IGNITION CIRCUIT

Connect an AWG20 wire from the IGN terminal to the switched side of the vehicle ignition circuit. This terminal enables the siren and powers the RC terminal whenever the ignition is on.

3-10. HORN RING CONNECTIONS

To connect the vehicle horn ring circuit so that the horn ring controls the Peak and Hold function in the MANUAL mode and TAP II Yelp in the WAIL mode, proceed as follows. (Refer to figure 3-3).

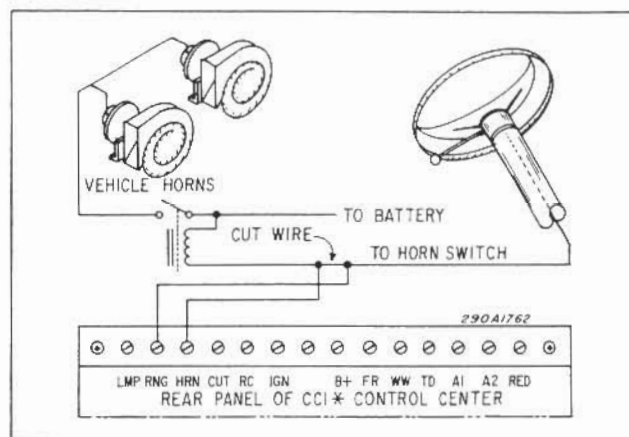


Figure 3-3. Horn Ring Connections

A. Locate the wire that connects the horn ring to the horns or horn relay. Cut this wire and, if necessary, splice extra wire to each end so these wires can be terminated on the control center rear panel.

B. Connect the wire that is connected to the horn ring switch to the rear RNG terminal.

C. Connect the wire from the horn relay or horn(s) to the HRN terminal. The siren automatically compensates for both positive and negative horn ring circuits without any adjustments.

3-11. LAMP CIRCUIT CONNECTIONS

The front panel illumination can be controlled through the LMP terminal on the rear of the control center. The panel lamp can be turned on to full intensity by applying +12VDC to the LMP terminal, or the intensity can be varied by connecting it to the vehicle panel illumination circuit.

3-12. REMOTE SIREN CUTOFF CONNECTIONS

The siren can be remotely turned "off" at any time by applying a ground to the CUT terminal on the rear of the control center.

CAUTION

If the siren is left in the WAIL position, it will begin to produce the WAIL sound immediately after the CUT terminal becomes ungrounded.

3-13. RELATIVE RADIO/PA LOUDNESS ADJUSTMENT

After the electrical wiring is completed, connect the AWG10 red wire to the positive battery terminal through the 100 ampere circuit breaker included in the accessory kit. Make certain that the terminal marked Battery, Bat. or +, is connected to the battery.

Plug the optional MNCT microphone into the jack marked MIC on the front panel. Depress the microphone push-to-talk switch; speak in a normal voice and adjust the front panel VOLUME control for the desired sound level outside of the vehicle. Turn on the two-way radio and adjust the volume for a comfortable listening level inside the vehicle. Set the RADIO/OUTSIDE switch to OUTSIDE. Stand outside the vehicle and note the radio rebroadcast loudness. If it is too loud or too soft, adjust R1. R1 is accessible through a hole in the rear panel marked RADIO GAIN. Adjust R1 to attain the desired level.

Secure the control center to the mounting bracket with 1/4" x 20 hex head screws and 1/4" split lockwashers. Tilt the unit to the desired position and tighten the screws.

When this adjustment is complete, the loudness of the radio rebroadcast and public address can be controlled with the front panel volume control.

SECTION IV OPERATION



Figure 4-1. Model CC1 Front View

As shown in figure 4-1, all CC1 operating controls are located on the front panel. The following functional descriptions of the control switches assumes the use of an emergency warning light system configured to California Highway Patrol specifications.

4-1. REAR-AMB-RED/360 SWITCH

This three-position toggle switch controls the rear amber and rear red or rotating lights. In the AMB position, the amber light is turned on. In the RED/360 position, the red or rotating light is turned on, and if selected, the amber light remains on (see paragraph 3-5D).

4-2. FRONT-RED-RED WIG-WAG SWITCH

This three-position toggle switch controls the front red and grille wig-wag lights. In the RED position, the front-facing red light is turned "on". In the RED wig-wag position, the front red light remains "on" and the wig-wag grille lights are activated. (A customer-supplied alternating flasher is assumed here for the wig-wag function).

4-3. SIREN-MAN-WAIL SWITCH

The three-position SIREN switch controls the audible warning functions, as well

as the horn ring. In the "down" position, no siren sounds are generated. If the horn ring circuit is connected as described in paragraph 3-10, pressing the horn ring will activate the vehicle horn. In the MAN position no siren sounds are generated unless the horn ring is pressed, at which time the Peak and Hold function is activated. In the WAIL position, the siren generates the WAIL siren signal. When the horn ring is pressed, the siren switches to the YELP siren signal. A second activation of the horn ring changes the signal back to WAIL.

4-4. FRONT-CLEAR SWITCH

This two-position switch controls the front-facing clear (take-down or spot) light. In the CLEAR position, the light is on. In the down position, the light is off.

4-5. RADIO-OUTSIDE SWITCH

This switch allows the operator to select rebroadcast of incoming radio messages through the outside speaker. If the two-way radio has been connected to the control head as described in paragraph 3-8, setting the switch to the "up" position will result in all incoming radio messages being rebroadcasted over the outside speaker.

4-6. PUBLIC ADDRESS OPERATION

To take advantage of the Public Address capability of the unit, an optional MNCT microphone must be plugged into the MIC jack on the front panel. PA is operational at all times and will override any siren signal or radio rebroadcast.

4-7. VOLUME CONTROL

The front panel slide volume control adjusts the output level of public address and radio rebroadcast. It does NOT affect siren signal output level.

4-8. NOR-DIM SWITCH

The NOR-DIM switch controls the intensity of the red "function-selected" indicator lamp. The NORmal position should be used for high ambient light situations. The DIM position will reduce the lamp intensity for night use.

4-9. FUNCTION-SELECTED INDICATOR

The red indicator lamp lights whenever a front panel control switch is in a position other than "off".

SECTION V CIRCUIT DESCRIPTION

5-1. GENERAL

Most of the circuitry in the Control Center consists of an audio pre-amplifier and horn ring switching/TAP II control. Refer to the schematic diagram, figure 6-1, while reading the following circuit description.

5-2.A. PRE-AMPLIFIER CIRCUIT (Units with SPKR marked on TB1.)

The Control Center pre-amplifier accepts audio from the two-way radio receiver or the microphone. The audio input is selected by SW106, the RADIO/OUTSIDE switch, on the front panel.

As shown in figure 6-1.A, SW106 is set to its normally off position. Consequently, Q101 is saturated, applying ground potential to IC101A-2. This prevents any audio that may be present from being applied to IC101-2.

When SW106 is set to the OUTSIDE position, ground potential is applied through CR101 and R102 to the base of Q101, cutting Q101 off. This allows balanced audio from the radio receiver to be applied to IC101A-3 and IC101A-2.

IC101A is an operational amplifier connected as a differential amplifier requiring two simultaneous inputs. The non-inverting input is coupled through R1, C102 and R108 to IC101A-3. The

inverting input is coupled through C103 and R109 to IC101A-2.

The amplified output of IC101A at IC101A-1 is applied through C105, R105, R106 and C104 to the inverting input of IC101B at IC101B-6. A sample of the output from IC101A is also coupled through R114 as negative feedback to IC101A-2, controlling the gain of IC101A.

IC101B further amplifies the signal from IC101A, and applies it to IC101B-7. This signal is then applied to the siren through the MIC HI lead of the interconnecting cables. A sample of the amplified output is coupled through R116 as negative feedback to control the gain of the amplifier.

PA audio, from the microphone, can be amplified whenever the microphone push-to-talk button is depressed. The microphone does not require a balanced input for proper operation. Therefore, the microphone input bypasses IC101A and is coupled through C101, R105, R106, C104 and R110 to IC101B-6.

The Control Center also includes several switching circuits for siren control and warning light control. These switches are connected to their respective circuits and devices through the terminal block TB201 on the rear panel and the interconnecting cable.

5-2.B. PRE-AMPLIFIER CIRCUIT (Units with FLA marked on TB1.)

The Control Center pre-amplifier accepts audio from the two-way radio receiver or the microphone. The audio input is selected by SW106, the RADIO/OUTSIDE switch, on the front panel.

As shown in figure 6-1.B, SW106 is set to its normally off position and the push-to-talk button of the microphone is not keyed. Consequently, Q101 is saturated, applying ground potential to the wiper of the volume control. This prevents any audio that may be present from being applied to the MIC HI output of the control head.

When SW106 is set to the OUTSIDE position, ground potential is applied through CR104 and R102 to the base of Q101, cutting Q101 off. This allows balanced audio from the radio receiver to pass through C104 and R110, and then be applied to IC101B-6 for amplification.

IC101A is an operational amplifier connected as a differential amplifier requiring two simultaneous inputs. The non-inverting input is coupled through R1, C102 and R108 to IC101A-3. The inverting input is coupled through C103 and R109 to IC101A-2.

The amplified output of IC101A at IC101A-1 is applied through C105, R105,

R106 and C104 to the inverting input of IC101B at IC101B-6. A sample of the output from IC101A is also coupled through R114 as negative feedback to IC101A-2, controlling the gain of IC101A.

IC101B further amplifies the signal from IC101A, and applies it to IC101B-7. This signal is then applied to the siren through the MIC HI lead of the interconnecting cables. A sample of the amplified output is coupled through R116 as negative feedback to control the gain of the amplifier.

PA audio, from the microphone, can be amplified whenever the microphone push-to-talk button is depressed. Keying the microphone push-to-talk button applies a ground through CR103 and R102 to the base of Q101 which allows the signal to be amplified as previously described. In addition, ground is applied through CR102 to IC101A-2 deactivating the radio input. The microphone does not require a balanced input for proper operation. Therefore, the microphone input bypasses IC101A and is coupled through C101, R105, R106, C104 and R110 to IC101B-6.

The Control Center also includes several switching circuits for siren control and warning light control. These switches are connected to their respective circuits and devices through the terminal block TB201 on the rear panel and the interconnecting cable.

5-3. HORN RING/SIREN CONTROL CIRCUIT DESCRIPTION

A. General

The horn ring/siren control circuitry determines the state of the siren output based on signals received from the SIREN switch on the front panel and the activation of the vehicle horn ring or other auxiliary switch.

B. Power Up

Application of power to the control head does not apply power to the siren control circuitry. Power to this circuit is controlled by any of three conditions: the vehicle ignition switch is on; the microphone push-to-talk switch is depressed; the RADIO/OUTSIDE switch is in the up position. Ignition control is a +12VDC signal applied through CR 217 and R209 to the base of Q202 and the cathode of zener regulator CR214. Because the base of Q202 is held at 11V by CR214, the transistor functions as a series regulator.

The microphone push-to-talk circuit activates the power-up sequence by providing a grounding signal through CR216 and R224 to the base of Q203, saturating Q203 and causing a +12VDC level to be applied to R209 which turns on the regulator as previously described. The RADIO/OUTSIDE switch applies ground through CR215 to R224 which turns on the regulator as described for the push-to-talk circuit.

During power-up the siren control circuit is initialized by the circuit comprised of Q206, R217, R216 and C205. When regulator Q202 is first turned on, voltage is applied to the emitter of Q206, through R217 to the base of Q206, and through R217 and R216 to C205. As a result, Q206 conducts and C205 begins charging through R216 and R217. Approximately 0.1 msec after power is applied, the charge on C205 cuts off Q206. The effect is a 0.1 msec pulse applied by Q206 to IC202-4. This pulse resets IC202, which causes IC202-1 to be at a logic low and IC202-2 to be at a logic high.

C. Horn Ring Switching

The horn ring circuit consists of relay K201, CR219, CR218, CR202 and switch SW2. In the down (OFF) position of SW2, K201 is not energized. Therefore, the normally closed contacts complete a circuit between the HRN and RNG terminals on the rear panel.

With SW2 in the center position or in the up position and +12VDC is applied to the IGN terminal, a positive voltage of approximately 10VDC is applied to CR218 or CR219 respectively, then applied through the diodes to the coil of K201, energizing the coil and closing the normally open contacts. This completes a circuit between the RNG terminal and the junction of CR211 and CR212. Energizing the relay opens the circuit between the HRN and RNG terminals.

D. Siren Enable

The siren functions are enabled only when the vehicle ignition applies a +12VDC to the IGN terminal. With +12VDC at the IGN terminal, voltage is applied through R218 to the base of Q207. Q207 then saturates, causing ground to be applied through R223 to the base of Q209. This turns on Q209, which applies voltage to the wiper of SW2, thus enabling the selection of siren functions. The siren enable can be overridden at any time by applying a ground to the CUT terminal. This grounds the base of Q207, which turns off both Q207 and Q209, disabling the siren functions.

E. Horn Ring Manual Control

When switch SW2 is set to the MAN position, +12VDC is applied to J1-5, to the siren manual circuit and the circuit is completed between the RNG terminal and the junction of CR211 and CR212 as previously described. Applying +12VDC to the RNG terminal causes CR212 to conduct, applying a positive voltage through R207 to the base of Q201. Q201 conducts, triggering IC201-2. As long as the +12VDC is maintained at the RNG terminal, Q201 will remain saturated, keeping C201 discharged through CR213.

With IC201-2 low, a high is found, at IC201-3 which is output through J1-11 to the siren Peak-and -Hold circuit. Applying a ground to the RNG terminal causes CR211 to conduct, grounding the emitter of Q201. Q201 is biased in such a way that it will again saturate, causing the high output at IC201-3 as described above. When either +12VDC or the ground is removed from the RNG terminal, Q201 cuts off, allowing R204 to charge C201. This is a debounce for the Horn Ring circuit and the high will remain at IC201-3 for the remainder of the time constant determined by C201 and R204.

F. Wail/Tap II Yelp

When SIREN switch SW2 is set to WAIL, +12VDC is applied to the emitters of Q204 and Q208. Because IC202 was initialized as described in 5-3B, Q208 is turned on and Q204 is cut off. Q208 applies a +10VDC to J1-9, which activates the siren WAIL circuit. If, as described in 5-5E, a positive or ground

is applied to the RNG terminal, a positive pulse is generated by IC201-3 and applied to IC202-3. This causes the outputs at IC202-1 and IC202-2 to toggle. IC202-1 goes to a logic high and IC202-2 goes to a logic low, causing Q208 to cut off and Q204 to turn on. Q204 will then apply +10VDC to J1-6, which activates the siren YELP circuitry. A second application of positive or ground to the RNG terminal will again toggle the outputs IC202-1 and IC202-2, returning the siren to the WAIL mode.

G. Radio Control

Radio control terminal RC is at a +12VDC whenever the IGN terminal is at +12VDC or RADIO/OUTSIDE switch SW 106 is in the up position. Power is applied through CR204 to the RC terminal from the IGN terminal. When SW106 is in the up position, a ground is applied to J102-8/P2-8, then through R213 to the base of Q205. Q205 is then saturated which applies +12VDC to the RC terminal through CR220.

SECTION VI

SERVICE AND MAINTENANCE

Most of the electronic component parts used in the CC1 are standard items that are available from almost any radio or electronics supply outlet.

The factory 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 phone 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

Any competent electronic technician should have little difficulty in tracing and correcting a malfunction. 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.

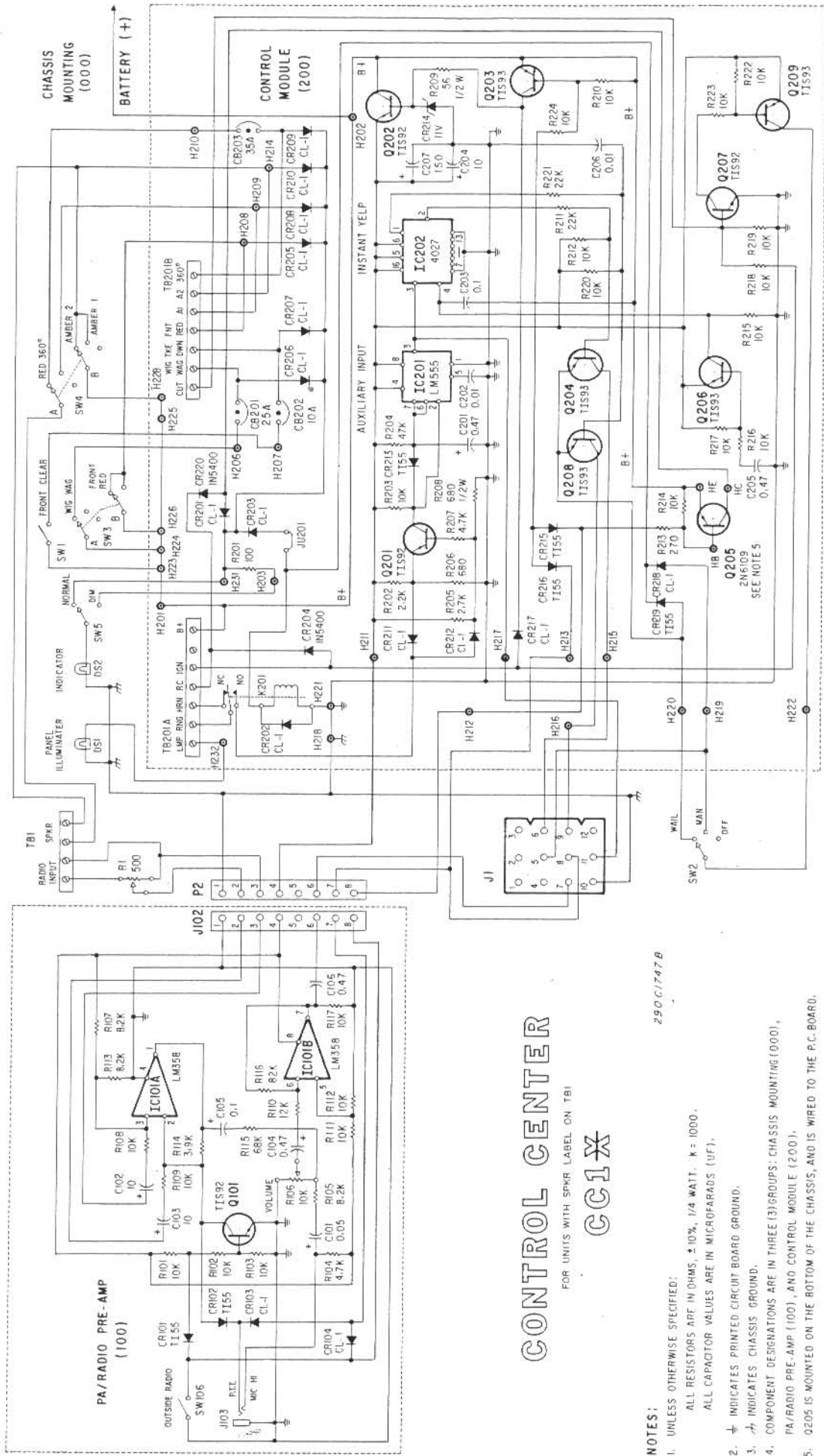


Figure 6-1A. Model CC1 Schematic Diagram (for units with SPKR label on TB1).

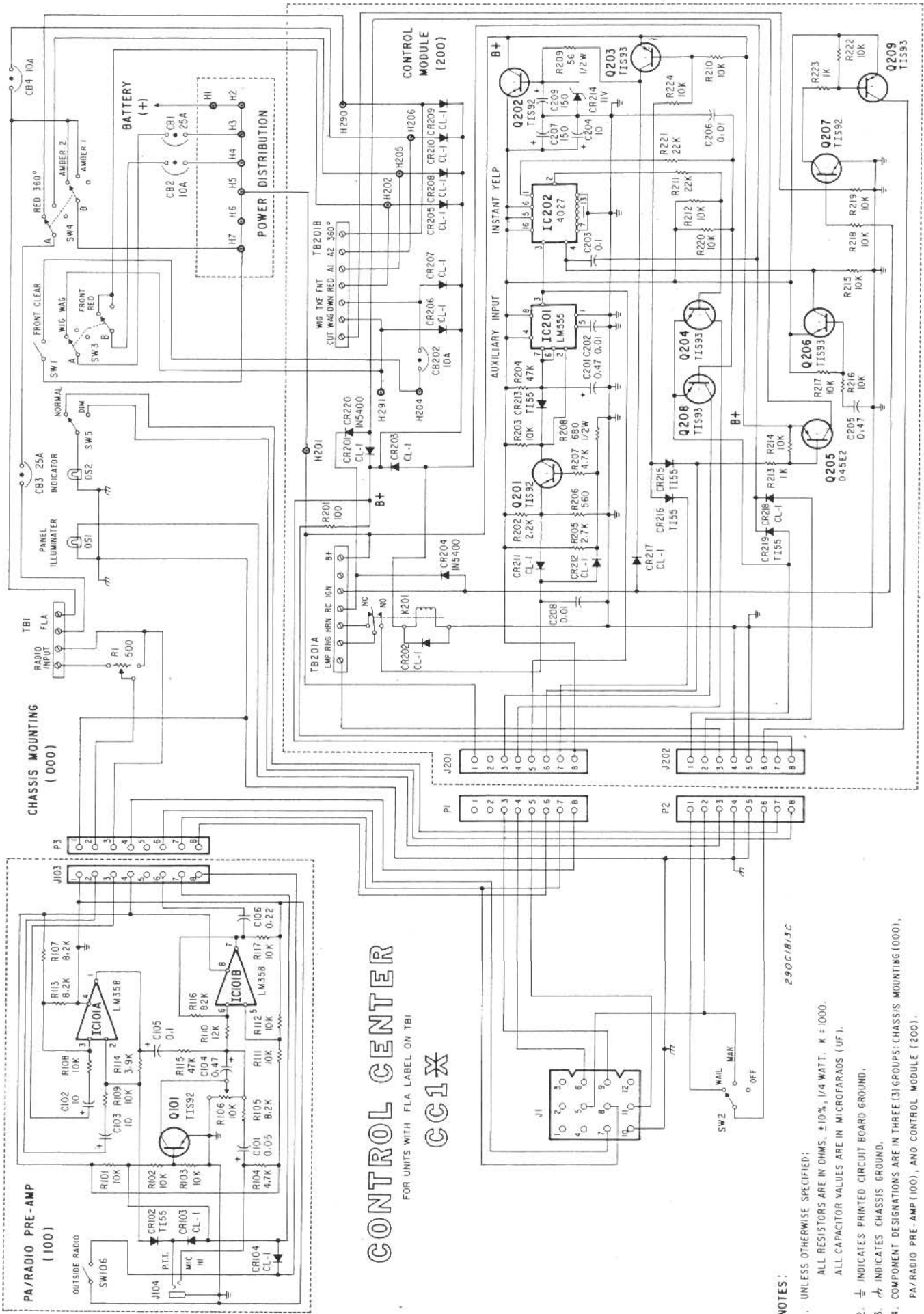


Figure 6-1B. Model CC1 Schematic Diagram (for units with FLA label on TBI).

NOTE: Diagrams on this page are for units with SPKR marked on TB1.

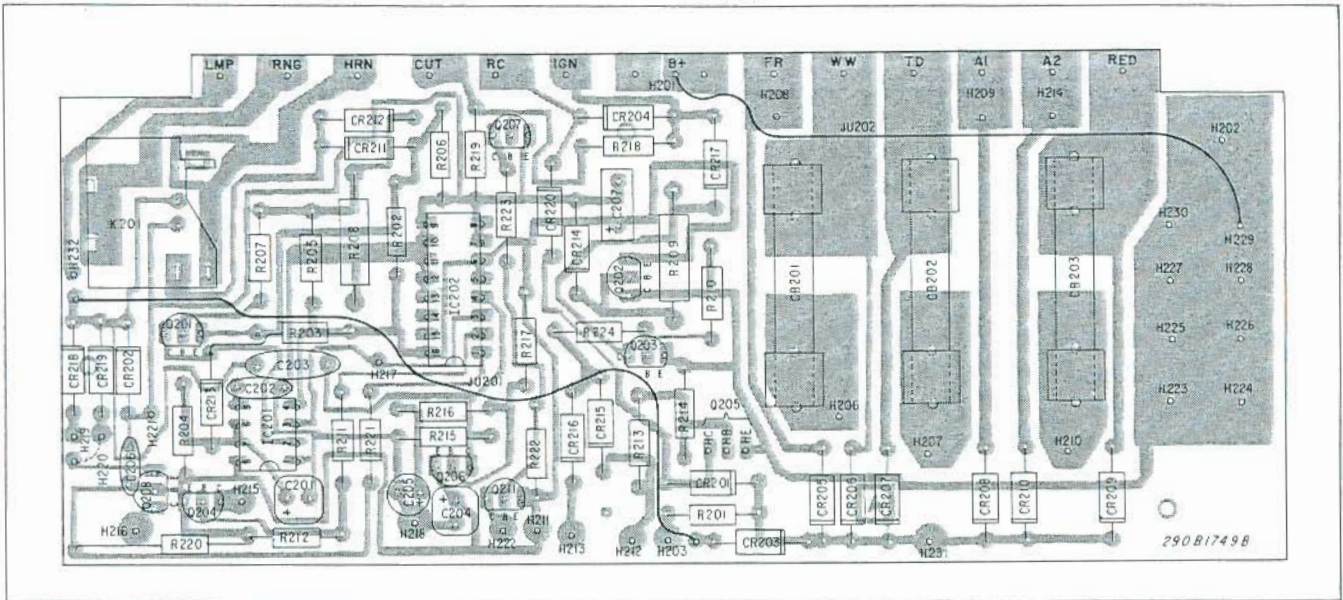


Figure 6-2A. Model CC1 Board Assembly Control Module Parts Location Diagram (for units with SPKR label on TB1).

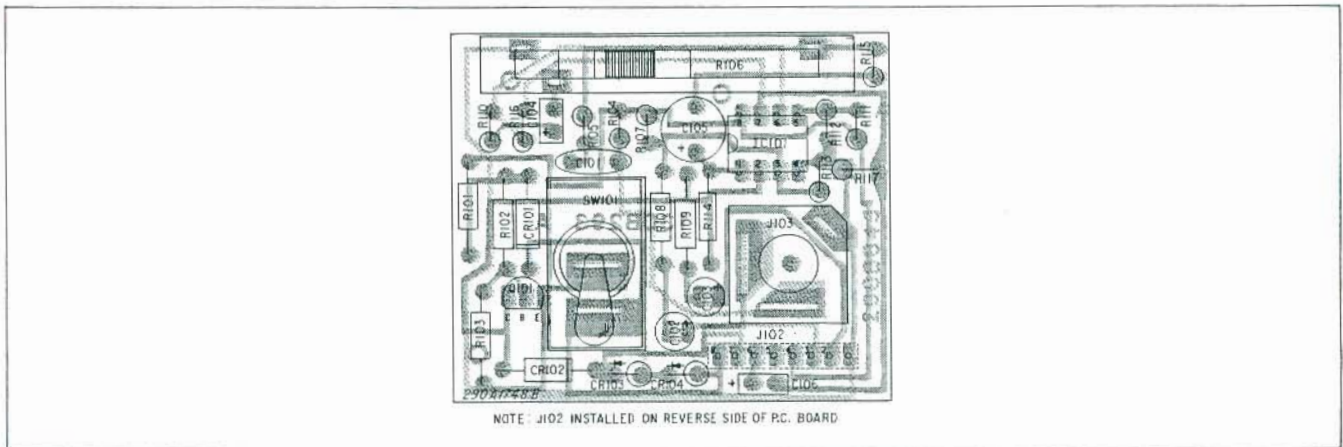


Figure 6-3A. PA/Radio Pre-Amp. PC Board Parts Location Diagram (for units with SPKR label on TB1).

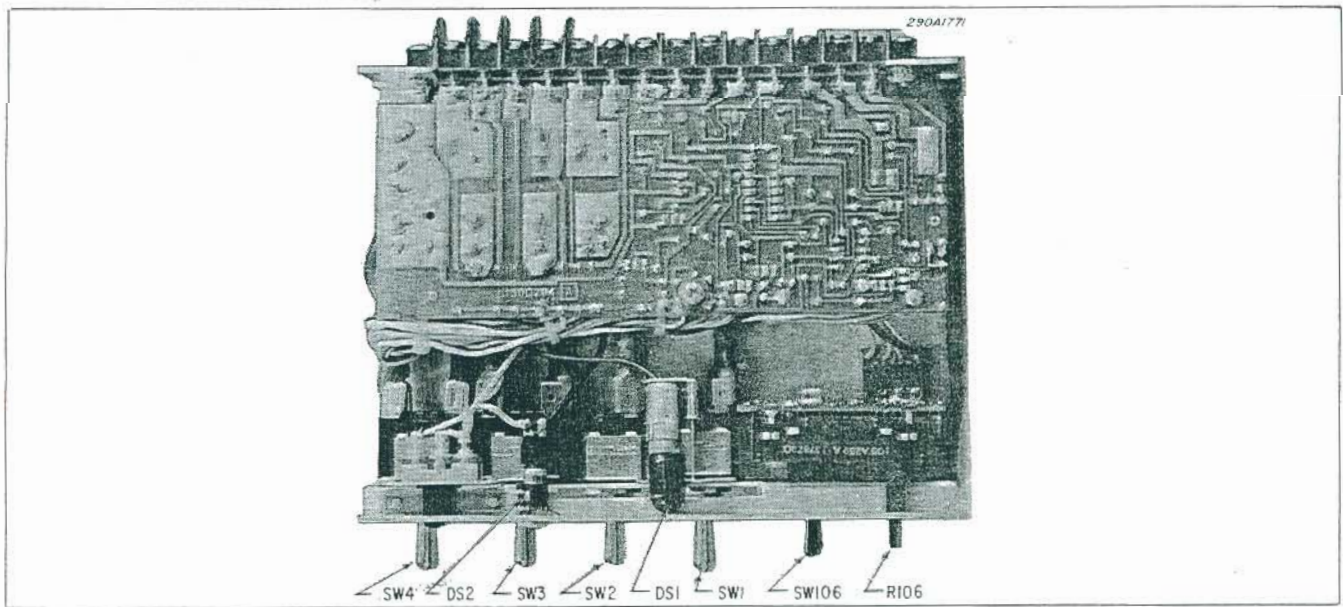


Figure 6-4A. Model CC1 Internal View (for units with SPKR label on TB1).

NOTE: Diagrams on this page are for units with FLA marked on TB1.

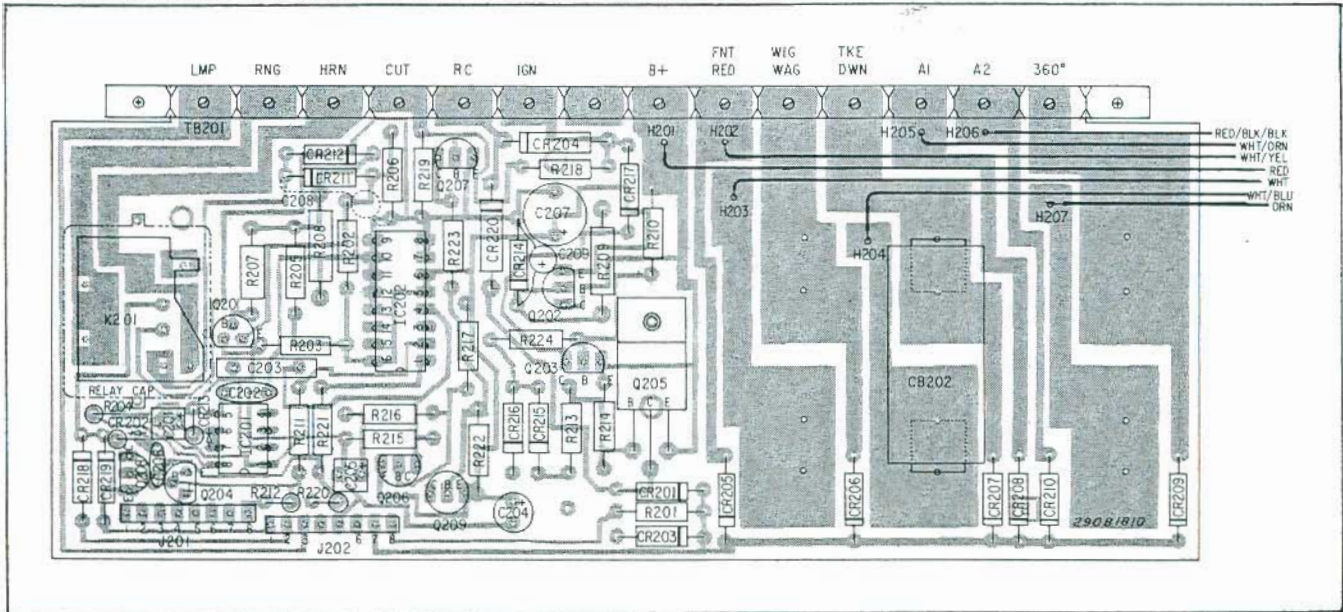


Figure 6-2B. Model CC1 Board Assembly Control Module Parts Location Diagram (for units with FLA label on TB1).

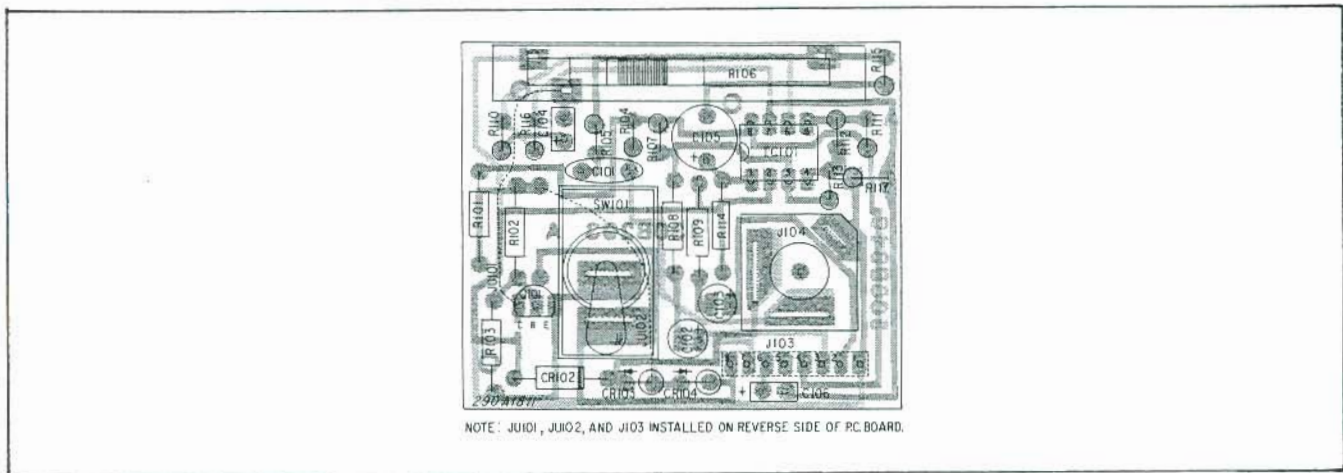


Figure 6-3B. PA/Radio Pre-Amp. PC Board Parts Location Diagram (for units with FLA label on TB1).

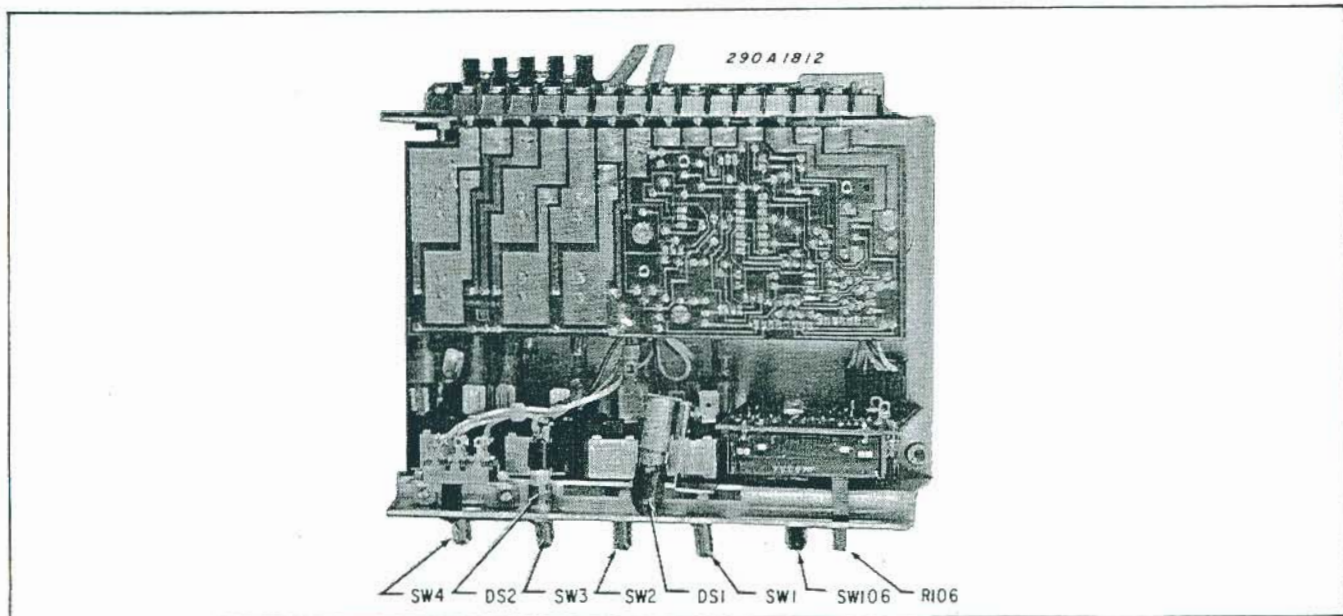


Figure 6-4B. Model CC1 Internal View (for units with FLA label on TB1).

CONTROL MODULE CIRCUIT BOARD
PARTS LIST
(For units with SPKR Label on TB1)

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
	RESISTORS*			SEMICONDUCTORS	
R201	100 Ohm	100A236	IC201	Integrated Circuit, LM555C	128A043A-02
R202	2.2K Ohm	100A221		Integrated Circuit, RCACD4027AE	128A044A
R203, 210, 212, 214, 215, 216, 217, 218, 219, 220, 222, 224	10K Ohm	100A207	Q201, 202, 207	Transistor, NPN, T1S92	125B132
R204	47K Ohm	100A228	Q203, 204, 206, 208, 209	Transistor, PNP, T1S93	125B133
R205	2.7K Ohm	100A206			
R206	680 Ohm	100A231	CR201, 202, 203, 205, 206, 207, 208, 209, 210, 211, 212, 217, 218	Diode, ED3002S (CL-1)	115B301
R207	4.7K Ohm	100A224			
R208	680 Ohm, 1/2 watt	100A313			
R209	56 Ohm, 1/2 watt	100A414			
R211, 221	22K Ohm	100A208	CR204, 220	Diode, IN5400	115A105
R213, 223	1000 Ohm	100A233	CR213, 215, 216, 219	Diode, T155	115B101
	*Unless specified otherwise, all resistors are carbon type, ±10%, 1/4 watt.		CR214	Diode, Zener, 11V, 1 watt	115A245
	CAPACITORS			MISCELLANEOUS	
C201, 205	0.47UF, 35V, Tantalum	107A645	K201	Relay, 12 volts Board PC, Control Module	8536A401A 130C294B
C202, 206	0.01UF, 25V, Disc	107A226	CB201	Circuit Breaker, 25 amp.	152A108-04
C203	0.1UF, 100V, Mylar	107A406	CB202	Circuit Breaker, 10 amp.	152A108-01
C204	10UF, 16V, Electrolytic	108A143A	CB203	Circuit Breaker, 35 amp.	152A108-06
C207	150UF, 16V, Electrolytic	108A147A	TB201	Terminal Block, 14-position	229A129

PA/RADIO CIRCUIT BOARD
PARTS LIST
(For units with SPKR Label on TB1)

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
	RESISTORS			CAPACITORS (CONT'D)	
R101, 102, 103, 108, 109, 111, 112, 117	10K Ohm	100A207	C104, 106	0.47UF, 35V, Tantalum	107A645
R104	4.7K Ohm	100A224	C105	0.1UF, 100V, Mylar	107A406
R105, 107, 113	8.2K Ohm	100A268		SEMICONDUCTORS	
R110	12K Ohm	100A269	IC101	Integrated Circuit, LM358	128A045A
R114	3.9K Ohm	100A273		Transistor, NPN, T1S92	125B132
R115	68K Ohm	100A135	Q101	Diode, T155	115B101
R116	82K Ohm	100A230	CR101, 102	Diode, ED3002S (CL-1)	115B301
R106	10K Ohm, Potentiometer	105A259	CR103, 104		
	*Unless otherwise specified, all resistors are carbon type, ±10%, 1/4 watt.				
	CAPACITORS		J103	Jack, phone, 3-conductor, 1/4", insulated	142A118A
C101	0.05UF, 25V, Disc	107A227	SW106	Switch, Toggle, SPST	122A175A
C102, 103	10UF, 16V, Electrolytic	108A143A		P.C. Board	130B293A

CHASSIS-MOUNTED COMPONENTS
PARTS LIST
(For units with SPKR Label on TB1)

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
R1	Potentiometer, 500 Ohm	105A229	SW5	Switch, riveted assembly	8537A530
SW1	Switch, DPDT	122A211	J1	Connector, Molex	139A152
SW2	Switch, one-circuit progressive	122A210	TB1	Terminal Block, 4-position	229A143
SW3, 4	Switch, two-circuit progressive	122A209	Q205	Transistor, PNP, DE45E2	125B442-01

CONTROL MODULE CIRCUIT BOARD
PARTS LIST
(For Units with FLA Label on TB1)

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
RESISTORS*			SEMICONDUCTORS		
R201	100 Ohm	100A236	IC201	Integrated Circuit LM555C	128A043A-02
R202	2.2K Ohm	100A221	IC202	Integrated Circuit RCACD4027AE	128A044A
R203, 210, 212, 214, 215, 216, 217, 218, 219, 220, 222, 224	10K Ohm	100A207	Q201, 202, 207	Transistor, NPN, TIS92	125B132
R204	47K Ohm	100A228	Q203, 204, 206, 208, 209	Transistor, NPN, TIS93	125B133
R205	2.7K Ohm	100A206	Q205	Transistor, PNP, DE45E2	125B442-01
R206	560 Ohm	100A274	CR201, 202, 203, 205, 206, 207, 208, 209, 210, 211, 212, 217, 218	Diode, ED3002S (CL-1)	115B301
R207	4.7K Ohm	100A224	CR204, 220	Diode, IN5400	115A105
R208	680 Ohm, 1/2 watt	100A313	CR213, 215, 216, 219	Diode, T155	115B101
R209	56 Ohm, 1/2 watt	100A414	CR214	Diode, Zener, 11V, 1 watt	115A245
R211, 221	22K Ohm	100A208			
R213, 223	1000 Ohm	100A233			

*Unless specified otherwise, all resistors are carbon type, ±10%, 1/4 watt.

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
CAPACITORS			MISCELLANEOUS		
C201, 205	0.47UF, 35V, Tantalum	107A645	K201	Relay, 12 volts Board PC, Control Module	8536A401A 130C294B
C202, 206, 208	0.01UF, 25V, Disc	107A226	CB202	Circuit Breaker, 10 amp	152A108-01
C203	0.1UF, 100V, Mylar	107A406	TB201	Terminal Block, 14-position	229A129
C204	10UF, 16V, Electrolytic	108A143A			
C207, 209	150UF, 16V, Electrolytic	108A147A			

PA/RADIO CIRCUIT BOARD
PARTS LIST
(For units with FLA Label on TB1)

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
RESISTORS			SEMICONDUCTORS		
R101, 102, 103, 108, 109, 111, 112, 117	10K Ohm	100A207	IC101	Integrated Circuit, LM358	128A045A
R104	4.7K Ohm	100A224	Q101	Transistor, NPN, TIS92	125B132
R105, 107, 113	8.2K Ohm	100A268	CR102	Diode, T155	115B101
R110	12K Ohm	100A269	CR103, 104	Diode, ED3002S(CL-1)	115B301
R114	3.9K Ohm	100A273			
R115	47K Ohm	100A228			
R116	82K Ohm	100A230			
R106	10K Ohm, Potentiometer	105A259			
*Unless otherwise specified, all resistors are carbon type, ±10%, 1/4 watt.			MISCELLANEOUS		
CAPACITORS			J103	Connector, Wafer	140A170
C101	0.05UF, 25V, Disc	107A227	J104	Jack, phone, 3-conductor 1/4", insulated	142A118A
C102, 103	10UF, 16V, Electrolytic	108A143A	SW106	Switch, Toggle, SPST, P.C. Board	122A175A 130B293A
C104	0.47UF, 35V, Tantalum	107A645			
C105	0.1UF, 100V, Mylar	107A406			
C106	0.22UF, 35V, Tantalum	107A1101			

CHASSIS-MOUNTED COMPONENTS
PARTS LIST
(For units with FLA Label on TB1)

Schematic Symbol	Description	Part No.	Schematic Symbol	Description	Part No.
R1	Potentiometer, 500 Ohm	105A229	TB1	Terminal Block, 4-position	229A143
SW1	Switch, DPDT	122A211	P1, 2, 3	Connector, Wafer	140A170
SW2	Switch, one-circuit progressive	122A210	CB1, 3	Circuit Breaker, 25 amp.	152A108-04
SW3, 4	Switch, two-circuit progressive	122A209	CB2, 4	Circuit Breaker, 10 amp.	152A108-01
SW5	Switch, riveted assembly	8537A530	DS1	Lamp, 14W, #1893	8107A085
J1	Connector, Molex	139A152	DS2	Lamp, Red	8536A028A-01