MOTOROLA

Systems 9000
Siren/Public Address Option for *SYNTOR X 9000* Radios

4316

THIS MANUAL HAS BEEN
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Instruction Manual

68P80101W10-A

MOTOROLA
Mobile Products Division

Systems 9000
Siren/Public Address Option for *SYNTOR X 9000* Radios

Contents

Diagrams

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Safe Handling of CMOS Integrated-Circuit Devices

Many of the integrated-circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open-circuit impedance, CMOS IC's are vulnerable to damage from static charges. Everyone involved in handling, shipping, and servicing them must be extremely careful not to expose them to such damage.

CMOS IC's do have internal protection, but it is effective only against overvoltages in the hundreds of volts, such as those that could occur during normal operations. Overvoltages from static discharge can be in the thousands of volts.

When a CMOS IC is installed in a system, the system's circuit elements distribute static charges and load the CMOS circuits. This decreases the vulnerability of the IC's to static discharge, but improper handling will probably cause static damage even when the IC's are so installed.

To avoid damaging CMOS IC's, take the following precautions when handling, shipping, and servicing them.

1. Before touching a circuit module, particularly after having moved around in the service area, touch *both* hands to a bare metal earth-grounded surface. This discharges any static charge you may have accumulated.

Note

Wear a conductive wrist strap (Motorola Part No. RSX-4015A) to minimize the buildup of static charges on your person while you are servicing CMOS equipment.

Warning

When wearing a conductive wrist strap, be careful near sources of high voltage. By grounding you thoroughly, the wrist strap also increases the danger of lethal shock from accidental contact with such a source.

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2. Whenever possible, avoid touching any electrically conductive parts of the circuit module with your hands.

3. Check the INSTALLATION and MAINTENANCE sections of the service manual and the notes on the schematic to find out whether or not you can insert or remove circuit modules with power applied to the unit, and act accordingly.

4. When servicing a circuit module, avoid carpeted areas, dry environments, and the wearing of static-generating clothing.

5. Be sure that all electrically powered test equipment is grounded. *Attach* the ground lead from the test equipment to the circuit module *before* connecting the test probe. Similarly, *disconnect* the test probe *before* removing the ground lead.

6. When you remove a circuit module from the system, lay it on a sheet of aluminum foil or other conductive surface connected to ground through 100,000 ohms of resistance.

Warning

If the aluminum foil is connected directly to ground, you may get a shock if you touch it and another electrical circuit at the same time.

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7. When soldering, be sure the soldering iron is grounded.

8. Before connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary during the replacement of an integrated-circuit device), be sure to discharge any static buildup on your person (see Procedure 1, above). Because you can have a voltage difference across your body, you should use only one hand if you must touch the board wiring or any of the pins on the CMOS device.

9. When replacing a CMOS integrated-circuit device, leave the device in its metal rail container or conductive foam until you are ready to insert it into the pronged circuit module.

10. Connect any low-impedance test equipment such as a pulse generator to CMOS device inputs after you have applied power the CMOS circuitry. Similarly, disconnect such low-impedance equipment before turning off the power.

11. Wrap CMOS modules in conductive material when transporting them from one area to another, even within the same room. Use wrapping material similar to that in which replacement modules are wrapped when they arrive from the factory. (You can also use aluminum foil.) *Never use nonconductive material for packaging these modules.*

Model Chart for Systems 9000 Siren/Public Address Option used on *SYNTOR X* 9000 Radios

CODE:

● = ONE ITEM SUPPLIED

ITEM	DESCRIPTION	W589AH	W589AK	W269AF	W269AH
	MODEL				
	DESCRIPTION	PUBLIC ADDRESS FOR *SYNTOR X* 9000 TRUNKED	PUBLIC ADDRESS FOR *SYNTOR X* 9000 CONVENTIONAL	SIREN/PA FOR *SYNTOR X* 9000 TRUNKED	SIREN/PA FOR *SYNTOR X* 9000 CONVENTIONAL
HKN4244A	NEGATIVE-GROUND T-CABLE	●		●	
HKN4246A	NEGATIVE-GROUND T-CABLE		●		●
HKN4265A	FUSED POWER CABLE	●	●	●	●
HLN5067A	PA PUSHBUTTON	●	●	●	●
HLN5077A	EXRD PUSHBUTTON	●	●	●	●
HLN5068A	SIREN PUSHBUTTON			●	●
HLN5069A	WAIL PUSHBUTTON			●	●
HLN5070A	HI-LO PUSHBUTTON			●	●
HLN5071A	MAN PUSHBUTTON			●	●
HLN5081A	YELP PUSHBUTTON			●	●
HLN1184A	SIREN/PA KIT	●		●	
HLN1185A	SIREN/PA KIT		●		●
HLN4916A	HARDWARE	●		●	
HLN4923A	HARDWARE		●		●
HLN4917B	SIREN/PA BOARD	●		●	
HLN4897B	SIREN/PA BOARD		●		●

Performance Specifications Electrical Characteristics

PARAMETER	MINIMUM	TYPICAL	MAXIMUM	CONDITIONS (SEE NOTES)
Current Drain	—	—	8.0 amps	@ 50 watts output with Public Address ON
Public Address Audio Distortion	—	—	10%	@ 50 watts output with 80 mV, 1 kHz signal
Public Address Rated Audio	50 watts	—	—	
Siren Rated Output	—	100 watts ±10%	—	@ 13.80 Vdc
Siren Rated Output	—	100 watts ±10%	—	@ 16.60 Vdc
Current Drain	—	—	13 amps	siren tones ON
Frequency Response	No more than ±3 dB variation			@ f = 200 Hz to f = 10 kHz; ref: 80 mV, 1 kHz signal

NOTES:

1. All tests to be conducted at 13.80 ±0.05 volts, with an 11-ohm ±10% load connected to a 100 watt speaker output, unless otherwise indicated.

2. Input Signal Sensitivity required for rated public address output is 80 mV RMS ±3 dB.

Siren Tones Frequency Limits

OPERATING MODE	FREQUENCY MINIMUM	FREQUENCY MAXIMUM	SWEEP PERIOD
OFF	0	0	N/A
WAIL	526 Hz	1504 Hz	5.25 Sec/cycle
YELP	526 Hz	1504 Hz	310 mSec/cycle
HILO	525 Hz	700 Hz	1.5 Sec/cycle
MANUAL*	Note 1	1504 Hz	Note 2
AIRHORN	N/A	N/A	14.15 mSec/cycle

*Data shown for MANUAL WAIL mode. In MANUAL YELP mode, specifications are the same as for YELP; MANUAL AIRHORN specifications are the same as for AIRHORN.

NOTES:

1. Goes down to 526 Hz and then mutes; no tolerance specified.

2. Manual sweep period depends on which manual mode is selected. In MANUAL WAIL mode, no sweep period applies since the duration of the wail is controlled by the operator. In the MANUAL YELP mode, there are either no tones (horn ring not pressed) or there are yelp tones (horn ring pressed)—a similar argument applies to the MANUAL AIRHORN.

1. Introduction

1.1 GENERAL

The Systems 9000 Siren/Public Address option consists of a Siren/PA unit and the cables needed to interface it to the mobile radio and controls. It is used with *SYNTOR X* 9000 Trunked and Conventional radios.

The Siren/PA is a solid-state, microprocessor controlled device that generates waveforms and amplifies those signals to create a variety of siren warning tones. It can deliver 65, 75, or 100 watts of siren power (square waves) to an 11-ohm speaker or 130 watts to two 11-ohm speakers. In the Public Address mode, it can deliver 50 watts of audio power (sine waves).

The Siren/PA option may be installed and operated with the following radio systems:

(1) *SYNTOR X* 9000 Conventional VHF/UHF/800 (HLN1185A)

(2) *SYNTOR X* 9000 Trunked/Conventional (HLN1184A)

Some features of the Siren/PA option can be reconfigured to provide functions that best suit the operator's needs. This is accomplished by reprogramming an EEPROM, located in the Conventional system's radio or in the Trunked system's control head.

The Siren/PA option is an external add-on to the existing *SYNTOR X* 9000 radio system that is installed in a housing which can accomodate the Siren/PA board and two additional Systems 9000 option boards. It interfaces with the radio's cable kit via a T-connector and is installed near the radio.

1.2 SIREN/PA FEATURES

Table 1 summarizes the features available in each operating mode:

Table 1. Siren/PA Features

FEATURE	AVAILABILITY HLN1185A	HLN1184A
WAIL/YELP/HI-LO TONES	YES	YES
SIREN MANUAL TONES	YES*	YES*
HORN RING OVERRIDES	YES	YES
PUBLIC ADDRESS	YES	YES
EXTERNAL RADIO	YES	YES
DIGITAL VOLUME	YES	YES
SIREN POWER CONTROL	YES	YES
SPEAKER SHORT DETECTION	YES	YES
MEMORY RETENTION ON PARTIAL POWER DOWN	YES	YES
REPROGRAMMING SIREN'S OPERATING STATUS	YES, WITH RADIO'S EEPROM	YES, WITH CONTROL HEAD EEPROM
POWER-UP SELF CHECK	YES	YES

* Reprogrammable with EEPROMS.

2. Siren/PA Operation

The Siren/PA is controlled by buttons on the *SYNTOR X* 9000 control head (see Figure 1). A unit may be equipped with a Public Address only, in which case the control head will have only two extra buttons—[ExRd] (External Radio) and [PA]. Equipped with both Siren and Public Address, the control head will have the additional [SIREN] button, plus [Wail], [Yelp], [HiLo], and [Man] buttons.

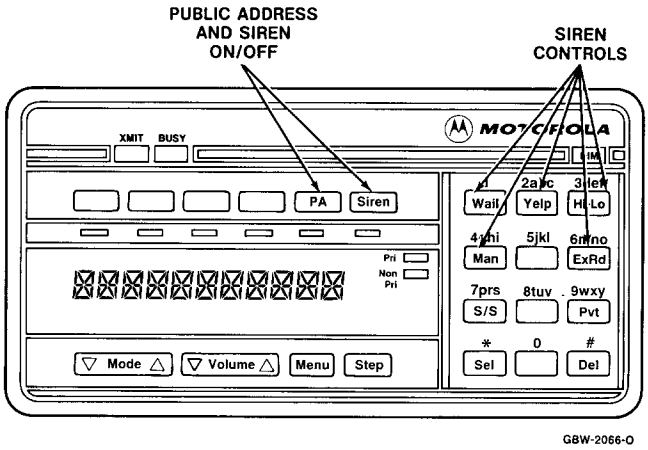


Figure 1. SYNTOR X *9000 Control Head with Siren/PA Option*

2.1 PUBLIC ADDRESS OPERATION

Momentarily press the [PA] button to turn on the Public Address. The indicator below the button will illuminate but the system is not really on until the PTT is activated. The display on the control head temporarily shows the preset Public Address volume. Use the [Volume] rocker switch to alter the PA volume level, which ranges from 0 to 15 on the display. This adjustment does *not* alter the radio's volume setting.

Press the PTT and speak into the microphone. Your voice (audio signals) will be amplified and broadcast over the Public Address speaker. As long as the Public Address is on, pressing the PTT will not key the radio to transmit. Release the PTT when you're finished speaking. When you've completed all announcements, press the [PA] button to deactivate the Public Address option.

If the Public Address and Siren options are both on at the same time, pressing the PTT will override any Siren function. Any siren tone or incoming radio signals (if in the External Radio mode) will be abruptly muted to give the Public Address priority operation.

2.2 EXTERNAL RADIO OPERATION

The External Radio feature operates similiarly to the Public Address feature—it amplifies audio signals over the Public Address speaker. Unlike the PA, it does not receive audio from the microphone, it receives the audio signals from messages coming through the radio's receiver and re-broadcasts them over the external speaker.

The External Radio feature operates with the *siren* feature activated, *not P.A.* It can be pre-selected or selected during the Siren operation. If [ExRd] is selected, any incoming radio messages will be re-broadcast over the external speaker. If the Siren is sounding and the [ExRd] button is pressed, the siren tone is muted abruptly and incoming radio messages are broadcast over the external speaker. The External Radio feature will remain operative until the [Siren] button is pressed again, or another siren function [Wail], [Yelp], etc. is selected.

For HLN1185A systems, radio volume and external radio volume are independent of each other. For HLN1184A systems, changing the radio volume will affect the external radio volume also.

2.3 SIREN OPERATION

The type of siren tone can be pre-selected before the Siren is turned on. Press the desired tone—[Wail], [Yelp], [HiLo], or [Man]. When you press the [Siren] button, the indicator below the button lights and the type of siren tone is shown in the display; simultaneously, the siren tone sounds. You can change the type of tone at any time during siren operation—simply press a different button and the tone will change.

If you have connected the "horn-ring" feature, you can change from one tone to another by pressing the vehicle's horn ring. This feature, programmed in the Control Head Vehicle Interface Ports, is activated through a Horn Ring Transfer Relay when the Siren is turned on. The following chart shows what effect the horn ring has on different tones:

ACTIVE TONE	CHANGES TO	HOW CHANGED
WAIL	YELP	Press and release the horn ring; press horn ring again to return to WAIL.
YELP	"Airhorn sound"	Press and hold the horn ring as long as you want to sound the "airhorn."
HILO	YELP	Press and release the horn ring; press horn ring again to return to HILO.

When the Siren is turned off, the relay is deactivated and the vehicle's horn ring returns to its normal function.

2.4 CONFIGURING THE SIREN/PA'S OPERATING STATUS

The Siren/PA can be configured to operate in different ways. A section of EEPROM memory contains digital information that controls the Siren/PA's operating status. The EEPROM for the HLN1185A is located in the radio and the EEPROM for the HLN1184A is located in the control head. An EEPROM programmer and Siren/PA software program is required for reprogramming.

The HLN1185A has two bytes of data that control the options. Each byte has eight memory locations (bits), each of which is in one of two conditions—set (>2.3 volts) or clear (<0.3 volts). The HLN1184A has a single byte of data to control its operating status. The following diagrams depict the structure of the data bits:

HLN1185A OPTIONS

Byte 1

Bit Number:	---7---	---6---	---5---	---4---	---3---	---2---	---1---	---0---
Bit Function:	SYSTEM LOOK-UP	FATAL ERROR	MANUAL AIRHORN	MANUAL YELP	MANUAL WAIL	IGN3 P.A.	IGN2 EXRD	IGN1 TONES

Byte 2

Bit Number:	---7---	---6---	---5---	---4---	---3---	---2---	---1---	---0---
Bit Function:	P.A. ONLY	SCNET MVS	NON-SIREN	NOT USED	PUBLIC ADDRESS VOLUME LEVEL DEFAULT SELECT LEVELS 0 TO 15.			

HLN1184A OPTIONS

Bit Number:	---7---	---6---	---5---	---4---	---3---	---2---	---1---	---0---
Bit Function:	P.A. ONLY	NON-SIREN	MANUAL AIRHORN	MANUAL YELP	MANUAL WAIL	IGN3 P.A.	IGN2 EXRD	IGN1 TONES

The following table further describes the bit functions and what effect each bit condition has on the Siren/PA's operation.

Table 2. Operating Status Bit Settings

BIT FUNCTION	BIT CLEAR	BIT SET
IGN1 TONES	Siren tones operable with ignition switch ON or OFF.	Siren tones operable *only* with ignition switch ON.
IGN2 EXRD	External Radio operable with ignition switch ON or OFF.	External Radio operable *only* with ignition switch ON.
IGN3 P.A.	Public Address operable with ignition switch ON or OFF.	Public Address operable *only* with ignition switch ON.
MANUAL WAIL*	Manual Wail does not operate.	Pressing horn ring activates a rising Wail that peaks at 1500 Hz and continues as long as horn ring is held; when horn ring is released, Wail falls until the siren mutes.
MANUAL YELP*	Manual Yelp does not operate.	Pressing horn ring activates a Yelp tone that continues as long as horn is held; when horn ring is released, siren immediately mutes.
MANUAL AIRHORN*	Manual Airhorn does not operate.	Pressing horn ring activates an airhorn sound that continues as long as horn ring is held; when horn ring is released, siren immediately mutes.
NON-SIREN	Airhorn and HiLo tones are allowed.	Disables HiLo and Airhorn tones. If HiLo control button is pressed, HiLo tones are *not* created and automatic Yelp will not override to Airhorn when horn ring is pressed.
P.A. ONLY	Allows use of both siren and public address.	Inhibits the use of all siren tone functions. If siren on/off switch is turned on only External Radio mode will operate.
	NOTE: THE REMAINING BIT FUNCTIONS APPLY ONLY TO SYSTEMS USING HLN1185A.	
FATAL ERROR	No effect on operation.	Error has been attributed to the siren option; causes total system shutdown.
SYSTEM LOOK-UP	Tells the radio that the siren is *not* part of its operating domain.	Tells the radio that the siren is a part of its operating domain and tells it to look at the other bits for complete siren operating status.
P.A. VOLUME DEFAULT (4 BITS)	This four-bit binary field is programmed to set the public address volume level for initial power-up. If no volume level is manually selected by the operator, the volume will default to whatever level is specified in this field.	
SCNET MVS	Routes all audio to the public address speaker when in the External Radio mode.	Prevents deciphered *Securenet* audio and Mobile Voice Storage message playback from being heard over the external speaker.

*These options are mutually exclusive; if one is set, the others cannot be set.

3. Theory of Operation

3.1 OPERATING CONFIGURATIONS

The operating modes and their characteristics are shown in Table 3.

Table 3. Operating Configurations

OPERATING MODE	CHARACTERISTICS
HLN1185A (used with Conventional radios)	1. Operating crystal frequency: 4.9152 MHz 2. Transmits and receives via SCI interrupts. Serial bus protocol based on CSMA/CD format. Bus operates at 9600 bps. Each data packet is 1.042 millisecond. 3. Error detection is based on calculating CRC's. Accuracy guaranteed up to 3 bit errors per message (5 data packets). 4. Incorporates 3 bus lines: Bus+, Bus−, and Bus Busy. 5. When the Watchdog Timer expires, the siren RESETS the entire radio system.
HLN1184A (used with Trunked radios)	1. Operating crystal frequency: 3.888 MHz. 2. Transmits and receives via SCI interrupts. Serial bus protocol based on CSMA/CD format.Bus operates at 949.22 bps. 3. Error detection based on calculating even parity for each transmitted/received byte. Accuracy up to 1 bit per byte of the message. 4. Incorporates 2 bus lines: Bus+ and Bus−. 5. When the Watchdog Timer expires, the siren RESETS *only* itself.

3.2 SOFTWARE

The Siren/PA software is located in the single-chip microprocessor U7 (see Figure 2). The microprocessor has 4k bytes of ROM space and 128 bytes of RAM. The processor handles all serial bus communications between the Siren/PA and the other devices that share the common bus.

3.2.1 Power-Up and Initialization Routines

When the Siren/PA option is powered-up, the processor initializes all its I/O ports (see the hardware description for I/O port descriptions). It proceeds through a SELF TEST which verifies its on-board ROM and RAM are valid. A ROM check-sum algorithm validates ROM; a double-inverting algorithm validates RAM.

3.2.2 Siren/PA Mode Select Routines

When the radio is turned on, the processor begins its background processing routine. Based on information obtained via the Serial Communications Interrupt (SCI) service, this portion of the software decides whether the Siren and the Public Address options are ON or OFF.

At the beginning of the routine, the system checks if the Public Address is ON or OFF. If ON, the next check senses whether the PTT is pressed or not. If it sees the PTT pressed, the microprocessor enables the power amplifier to broadcast audio through the Public Address speakers. If siren tones were being generated prior to the PTT, the microprocessor "mutes" the siren and gives the Public Address the first priority.

If the first check sees the Public Address OFF, the next check looks at the Siren. If the Siren is OFF, the microprocessor executes an OFF routine, keeping the power amplifier muted. If the Siren is ON, the microprocessor looks further to decide which Siren function to execute (Wail, Yelp, HiLo, Manual, or External Radio). If External Radio is the selected function, the routine checks the status of Audio Mute to either enable or disable the audio power amplifier.

3.2.3 Siren Polling Routines

The Siren frequency tables contain the complete frequency characteristics of any siren tone. A finite number of frequency values associated with each siren tone is stored as data in the frequency tables. For example, the Wail cycle has 254 frequency values that, if executed sequentially over a pre-determined time span, simulate a complete cycle of the siren Wail tone.

The Siren Polling routines are responsible for repeating and sustaining a siren tone that the operator has selected. Also, the siren polling routine must check for any operator-initiated change in the siren's operating status. Inputs including button presses to change siren tones, PA presses, Horn Ring presses, or PTT presses must be responded to instantaneously.

3.2.4 Siren Output Power and Public Address Volume Update Routines

The microprocessor looks at the system to determine whether a digital volume update or siren power level update should be sent to the digital volume preamp, U5. These updates are mutually exclusive, that is, only one can occur at a time. A digital volume update should be sent to U5 when the Public Address or External Radio is operating; a siren power level update, which should maintain a "window" of 100 watts $\pm 10\%$, should be sent when siren tones are being generated into an 11-ohm load.

Although the digital volume and siren power level updates each manipulate a distinctively different set of parameters and their end results are different, they share one common aspect—both write digitally to U5, through the same software routine, by shifting out 13 digital volume DATA bits.

The power level update, which affects *only* the siren's output, is actually a means of controlling the audio amplifier's gain by changing the digital volume level of U5.

The power level update is slightly more involved than the digital volume update. Before it writes new digital information to U5, the microprocessor confirms that a power level update is needed. If the siren is delivering 100 watts, no update occurs. However, variations in the primary voltage supply will cause fluctuations in the audio output level. These fluctuations are fed back to the microprocessor through Pins 31 and 32, POWER CONTROL 1 and POWER CONTROL 2, respectively. The software interprets that:

- when both pins go HIGH, audio output should be increased,
- when both pins go LOW, audio output should be decreased, and
- when Pin 31 is HIGH and Pin 32 LOW, 100 watts of power is registered and no updates are required.

Three microprocessor output lines write digital information to U5. Pin 22 controls the WRITE ENABLE (WE) line that is used as a latching signal to load data into U5. Pin 23 controls the CLOCK that synchronizes the shifting of the 13 bits of data to U5, and Pin 24 writes out the digital volume DATA for loading into U5.

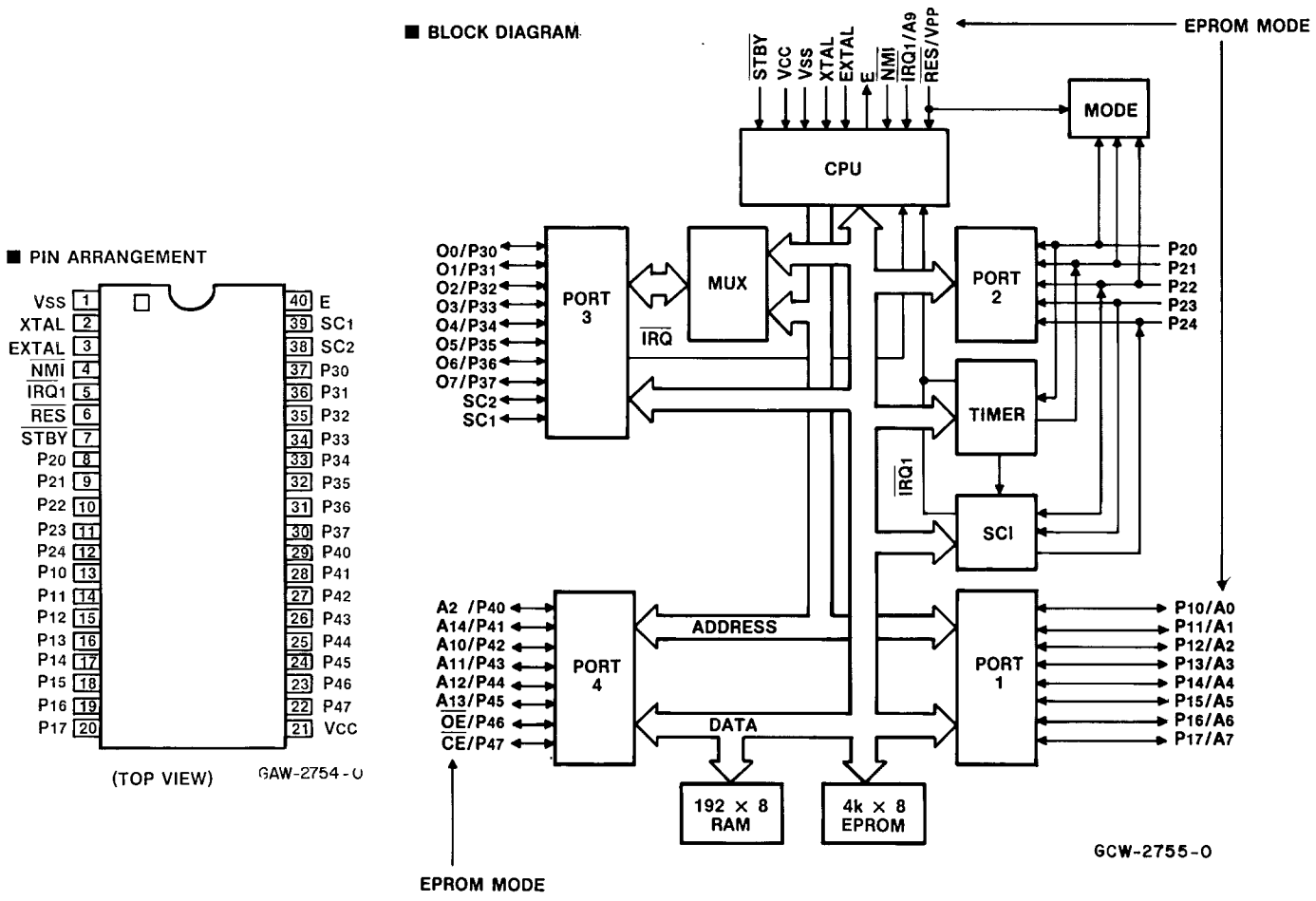


Figure 2. Microprocessor Pin Arrangement and Block Diagram

When the siren is in the OFF (muted) state, the digital volume level data (VOLUME) to U5 is continually refreshed every 53.4 microseconds. This occurs in case U5 glitches and corrupts its digital volume level data, thus preventing undesirable and unpredictable audio performance.

3.2.5 Speaker Short Detection Routine

This routine "protects" the Siren/PA in case of unexpected hardware failure. An analog sensing circuit in the Siren/PA detects powerful current surges usually found with short-circuit conditions. The short-circuit detection circuit outputs to the microprocessor at Pin 39. This microprocessor input, called SPEAKER SHORT input, functions as an IRQ1-based interrupt with priority second only to NMI. When the sensing circuitry sees a short, it pulls the normally-HIGH Pin 39 to a LOW state. An IRQ1 interrupt is triggered when the processor sees a NEGATIVE-FALLING EDGE at Pin 39.

When a short exists, the system performs a routine to "protect" itself from further harm. Since speaker shorts happen only when the Siren or Public Address is ON, the polling routine switches the siren to its OFF state and the control head displays "SPKR SHORT." The processor rechecks this condition every 1.333 seconds.

After a pre-determined "mute" period, the condition is cleared, resetting Pin 39 HIGH. If, after the time lapse, the short still exists, another falling edge triggers the interrupt for another "siren mute" condition of the same duration. The operator will hear a series of "beeps" as the siren attempts to come back ON at full power but is immediately restrained from doing so by repeated IRQ1 interrupts.

3.2.6 Power-Down Routine

When the control head's ON/OFF switch is switched OFF (losing SW B+) the Siren/PA is powered down and the processor is vectored into a Non-Maskable Interrupt (NMI) routine. The voltage level on the NMI input (Pin 4 of the microprocessor) is pulled low, thereby causing an NMI interrupt.

The primary function of the NMI routine is to clear the RAM Enable Bit which "saves" all current RAM settings and tri-states the I/O ports. Putting the I/O ports into high-impedance states prevents port damage while the microprocessor powers down. Program execution is in a dead loop causing the Watchdog Timer to stop tickling.

3.2.7 Serial Communications Interrupt (SCI)

The primary function on the Serial Communications Interrupt is to facilitate communications between the Siren/PA and any other devices or options on the serial bus.

3.3 HARDWARE

For a better understanding of the hardware used in the Siren/PA, use the block diagram and the schematic (See PBW-2740 and PEW-2743 at the back of the manual) to help trace the components through the Siren/PA system. The descriptions of the components detail how the components operate and identify any differences between the models covered by this manual.

3.3.1 Microprocessor (U7)

The Siren/PA's central processing unit us an eight-bit HD637B01VOC microprocessor, operating in the Single-Chip mode. It generates the siren waveform (square waves) and it controls, monitors, and coordinates most of the operating aspects of the Siren/PA. The processor has 4k bytes of internal ROM, 128 bytes of internal RAM, and 29 I/O lines. Its Serial Communications Interrupt (SCI) provides the communications link between itself and other devices that share the common serial bus. In HLN1185A, the microprocessor operates at a crystal frequency of 4.9152 MHz; in HLN1184A, it operates at 3.888 MHz.

Table 4 lists the I/O lines currently designated. Multi-function I/O lines are pointed out wherever they occur. Pin arrangement and the microprocessor block diagram are shown if Figure 2.

Table 4. Microprocessor Input/Output Lines Description

PIN	LABEL	DESCRIPTION
1	GND	Digital Ground
2	XTAL	Crystal input 1
3	EXTAL	Crystal input 2
4	NMI	Power-down detect line. NMI interrupt entered if this line is pulled LOW.
5	IRQ1	Not Used: line is always HIGH.
6	RESET	This line is pulled LOW to reset the microprocessor.
7	STANDBY	This line is held HIGH to keep RAM valid.
8	BUSY IN	Microprocessor input to read status of BUSY.
9	SIREN OCF	Output: siren square waves generated here.
10	BUSY OUT	Microprocessor output to control status of BUSY.
11	RXDATA	Receive Serial Data input.
12	TXDATA	Transmit Serial Data output line.
18–20	SIREN GROUP NUMBER	HLN1185A: used to select group number for Siren/PA HLN1184A: not used.
21	Vcc	UNSW 5V: Unswitched 5 volts DC.
22	WE	Write Enable line: Digital Volume Control.
23	CLOCK	Clock line: Digital Volume Control.
24	DATA	Data line: Digital Volume Control (input).
25	WATCHDOG	"Tickle" pulse output provided here for Watchdog Timer.
26	PA MUTE	Output from microprocessor to Mute/Unmute Power Amplifier.
27	PRE-AMP MUTE	Output from microprocessor to Mute/Unmute Pre-Amplifier.
28	FLT AUDIO	Output from microprocessor to Mute/Unmute Filtered Audio.
29	MIC HI	Output from microprocessor to Mute/Unmute Microphone.
30	SY90R SELECT	
31	POWER CONTROL 1	Input to microprocessor from Power Control Circuitry.
32	POWER CONTROL 2	Input to microprocessor from Power Control Circuitry.
33	BUSY IN ENABLE	HLN1185A only: Normally, an output; on reset, this becomes an input forcing microprocessor Pin 8 to pull HIGH to put microprocessor in SINGLE-CHIP mode.
35	ENCODE 2	Not used.
36	ENCODE 3	HLN1184A only: input line for Ignition Sense control.
37	ENCODE 4	HLN1184A only: input for PTT.
39	SPKR SHORT	Inputs microprocessor from Speaker Short Detection circuit.
40	E CLOCK	Microprocessor Clock Signals output.

NOTE: Missing numbers are not used in either HLN1185A or HLN1184A.

3.3.2 Bus Transceiver/Watchdog Timer (U1)

U1 is an eight-pin, dual operational amplifier that operates from the 9.6 V supply. Op-amp U1A is used in the bus transceiver circuitry to amplify the difference between BUS+ and Bus− inputs. Its output goes to Pin 11 of the microprocessor and is the SERIAL RXDATA line. U1B is used as a comparator in the WATCHDOG TIMER circuit.

3.3.2.1 Bus Transceivers (U1A)

The bus transceivers help ensure a noise free and reliable serial bus communications between the Siren/PA's microprocessor and other devices on the bus. Op-amp U1A accepts a differential input from the bus and converts it into a single-ended output seen at the microprocessor on the Serial Communications Receive Port (SERIAL RXDATA), Pin 11. In the transmit mode, a single-ended output from the Serial Communications Transmit Port (SERIAL TXDATA), Pin 12, is converted by Q1, Q2, Q5, and Q18 into a differential output for transmission over the bus. These transistors drive BUS+ and BUS− lines.

The output of U1A is divided down by R94 and R96 so that a zero to five volt transition is achieved. Transistor Q5 buffers SERIAL TXDATA from U7 when an option is transmitting data. Q2 is a phase splitter with Q1 and Q18 amplifying the differential data to be transmitted on the BUS+ and BUS− lines.

3.3.2.2 Watchdog Timer Circuit (U1B)

On power-up, capacitor C31 is discharged causing the output of the Watchdog Timer comparator to go low and forcing the microprocessor (U7) to be held in reset. (In HLN1185A models, the entire radio is reset; in HLN1184A, only the siren processor is reset.) The Watchdog Timer holds U7 in reset for approximately 140 milliseconds. By that time, C31 has charged significantly, allowing the output of the comparator to go HIGH and forcing U7 to come out of reset. After approximately 97 milliseconds, U7 will reset again. This continues indefinitely until a tickle pulse from Pin 25 of U7 is applied through R127 and C36 to the gate of the silicon controlled rectifier, CR1. The tickle pulse must occur at lease once every 94 milliseconds so that C31 always remains charged, ensuring the comparator's output is held HIGH. The comparator's reference voltage is provided by R101, R103, and R104. R104 also applies a hysterisis to the comparator.

The purpose of the Watchdog Timer in the Siren/PA is to provide it a means of resetting itself. For the microprocessor to reset, the software-generated "tickle" pulses from Pin 25 to the Watchdog Timer must stop for more than 94 microseconds, pulling the RESET line LOW (<0.3V). Reset can occur when:

(1) Software routines get "lost."
(2) A glitch alters the contents of U7's ROM or RAM.
(3) Five consecutive negatives acknowledge "NAKs" are encountered by the SCI routines (HLN1185A models only).
(4) A Reset opcode is sent by the Control Head (HLN1184A models only).
(5) A Memory Access opcode with reset is received (HLN1185A only).

3.3.3 Voltage Regulator (U2)

Fused, A+ power from the radio is applied to the Siren/PA and converted to unswitched +5 volts by voltage regulator U2, establishing a continuous +5 volt supply. UNSW +5V is used to keep U7 powered-up even after the Control Head has been turned off. It is also used by the Standby circuitry to put U7 into a standby mode (Pin 7 of U7 is pulled LOW) which effectively operates the processor at a lower current drain level but at the same time keeping its internal RAM valid.

3.3.4 Speaker Short Detection (U3)

This IC is an eight-pin dual op-amp, but only one of the op-amps are used in the Siren/PA circuit. U3A compares the voltage on C20 to the reference voltage set by R73 and R95. When the voltage across C20 exceeds the reference voltage, the comparator output goes LOW. U7 detects this negative transition (falling-edge trigger) and enters the "Speaker Short Detection" software routines (see paragraph 3.2.5 for Speaker Short Software discussion). When the current through R67 reaches approximately 15 amps, the comparator output goes LOW. R66 and C20 smooth the response across R67.

3.3.5 Power Control/Voltage Audio Ground/Switched +5V Comparator (U4)

U4 is a 14-pin quad op-amp. U4C and U4D operate as comparators in the power control circuit that regulates the amount of output power deleiverd to the siren's speakers (100 watts ±10%). The signal from the feedback winding (black lead) of transformer T1 is peak detected and then compared to two voltage references. Peak detection is done by R83, CR4, and C22. On positive peaks, C22 charges through R83 and CR4. The reference voltages are set by VR14 and resistors R90, R84, R85, and R74. Hysterisis is applied by R82 and R87. Diodes CR5 and CR6 are used to offset any temperature effects on CR4.

By using the peak detected signal and the reference voltages, the outputs of the comparators will be held LOW (<0.3V) or be pulled HIGH (>2.3V). These outputs are latched into microprocessor Pins 31

and 32. A software routine determines whether to increase the gain of U5 or to decrease it (see paragraph 3.2.4 for power control software routine discussion). This power control routine is only used to regulate the siren's output power. Software inhibits the regulation of audio power when in the Public Address or External Radio modes.

Op-amp U4B, in the Voltage Audio Ground circuitry, functions as a unity gain amplifier to provide an output voltage of one-half the 9.6 volt supply. This output is used as a bias voltage for other analog circuitry.

Op-amp U4A, in the SW +5V regulator, tracks the output of the continuous 5V regulator (UNSW +5V) by using the UNSW +5V as a reference for the amplifier. The output is then driven so that SW +5V reaches UNSW +5V. Q22 protects from overload current by turning off Q21 when excess current exists.

3.3.6 Custom Digital Volume Control Chip (U5)

U5, a digitally controlled amplifier, receives digital volume information from the microprocessor (U7) through three digital lines: WRITE ENABLE line (Pin 22 of U7), CLOCK line (Pin 23 of U7), and DATA line (Pin 24 of U7). U5 processes the information for controlling the gain of U5's amplifier. Pin 27 of U7 (PRE- AMP MUTE) is responsible for muting and unmuting U5.

3.3.7 Transmission Gates (U6)

U6 is a quad transmission gate that uses two gates, U6A and U6B, to control the MIC HI and FILTERED AUDIO inputs to amplifier U8A.

3.3.8 Summing Amplifier/Inverting Amplifier (U8)

U8 is a dual op-amp. U8A is a summing amplifier for MIC HI, FILTERED AUDIO, and SIREN OUTPUT. The output of this amplifier is AC coupled to Pin 15 of U5.

U8B is an inverting amplifier that amplifies the output of U5 (Pin 14). The output of this inverting amplifier drives the matched transistor pairs Q25–Q26 and Q27–Q28.

3.3.9 Audio Power Amplifier

The audio power amplifier amplifies siren square waveforms and Public Address audio signals. It also filters the audio signals to enhance the signal quality of its output into the audio transformer.

The amplifier consists of two matched pairs of transistors, Q25–Q26 and Q27–Q28, two pre-driver transistors, Q14 and Q16, and two driver transistors, Q15 and Q17. The matched transistor pairs deliver a DC current to bias the driver transistors Q15 and Q17. Q14 and Q16 are biased OFF at DC.

When an AC signal is applied by the inverting amplifier, U8B, transistors Q14 and Q16 turn ON to provide the necessary current gain. Q15's collector load is T1's primary windings, 2 and 7. Q17's collector load is T1's primary windings, 1 and 8. R46 provides power amplifier feedback from the feedback winding (black wire of T1). The siren speaker can be connected to either of these three outputs, depending on the amount of power required.

Transistors Q29, Q30, and Q31 function as the mute circuitry for the audio power amplifier. When muted, they prevent Q15 and Q17 from being biased ON. The mute circuitry is controlled by Pin 26 of U7 (PA MUTE).

3.3.10 Audio Transformer

The audio transformer couples the audio power amplifier output to an 11-ohm speaker. Equipped with three taps, the transformer can be wired for 65, 75, or 100 watts audio output. The transformer feeds back a signal to the Power Control circuitry to regulate the siren's output power level within a "power window" (e.g. 100 watts ±10%) and provides feedback for the power amplifier.

4. Installation, Assembly, and Disassembly

4.1 INSTALLATION

The Siren/PA should be mounted directly to a flat mounting surface. No mounting tray is required. A template for marking the mounting hole locations is in the back of this manual. Clearance requirements are indicated on the template drawing, but, before marking the mounting hole locations, place the Siren/PA in the intended mounting position to ensure adequate clearance.

(1) Choose a location where the mounting screws will not penetrate the gas tank, fuel lines, or other vital parts of the vehicle. The Siren/PA unit must be mounted on a flat surface using all four mounting screws. The raised shelf in some car trunks makes a good mounting location. The unit must be mounted near the radio so that the T-cable will reach between the radio and the Siren/PA. Consider the routing of the red power cable and a good location for the black chassis ground cable before selecting the mounting location.

(2) Locate and drill four mounting holes according to the location dimensions and hole specifications shown on the template drawing.

(3) Install the two front mounting screws, leaving the heads high enough above the mounting surface to permit the screw heads to properly engage in the mounting slots on the front of the Siren/PA (See Figure 3).

(4) Slide the front of the chassis onto the screws, adjusting screw height as necessary.

(5) After the front is properly engaged, install the two rear screws through the mounting holes in the heatsink; tighten the screws.

(6) Connect the red fused cable to the positive battery terminal and the black ground cable to the vehicle's chassis (See Figure 4).

(7) Disconnect the main radio cable and attach the T-cable between the Siren/PA and the radio. Connect the radio cable to the back of the T-connector.

(8) See paragraph 4.6 for speaker connections.

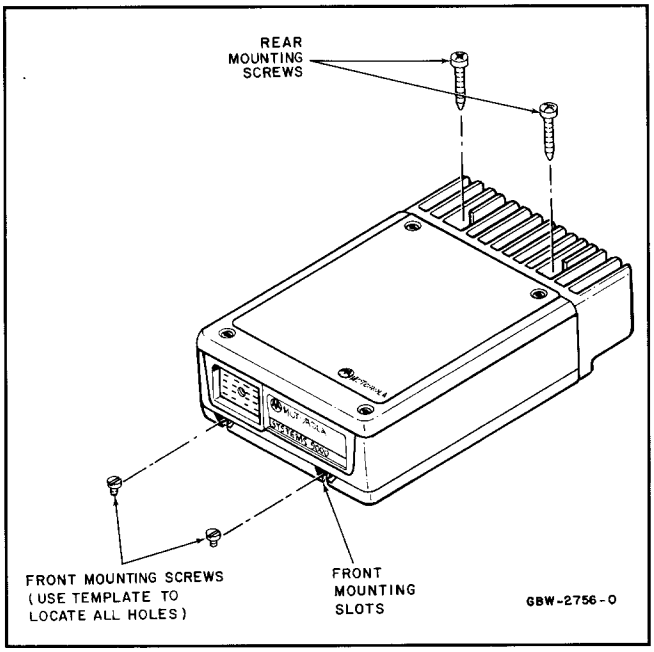


Figure 3. Installing the Siren/PA

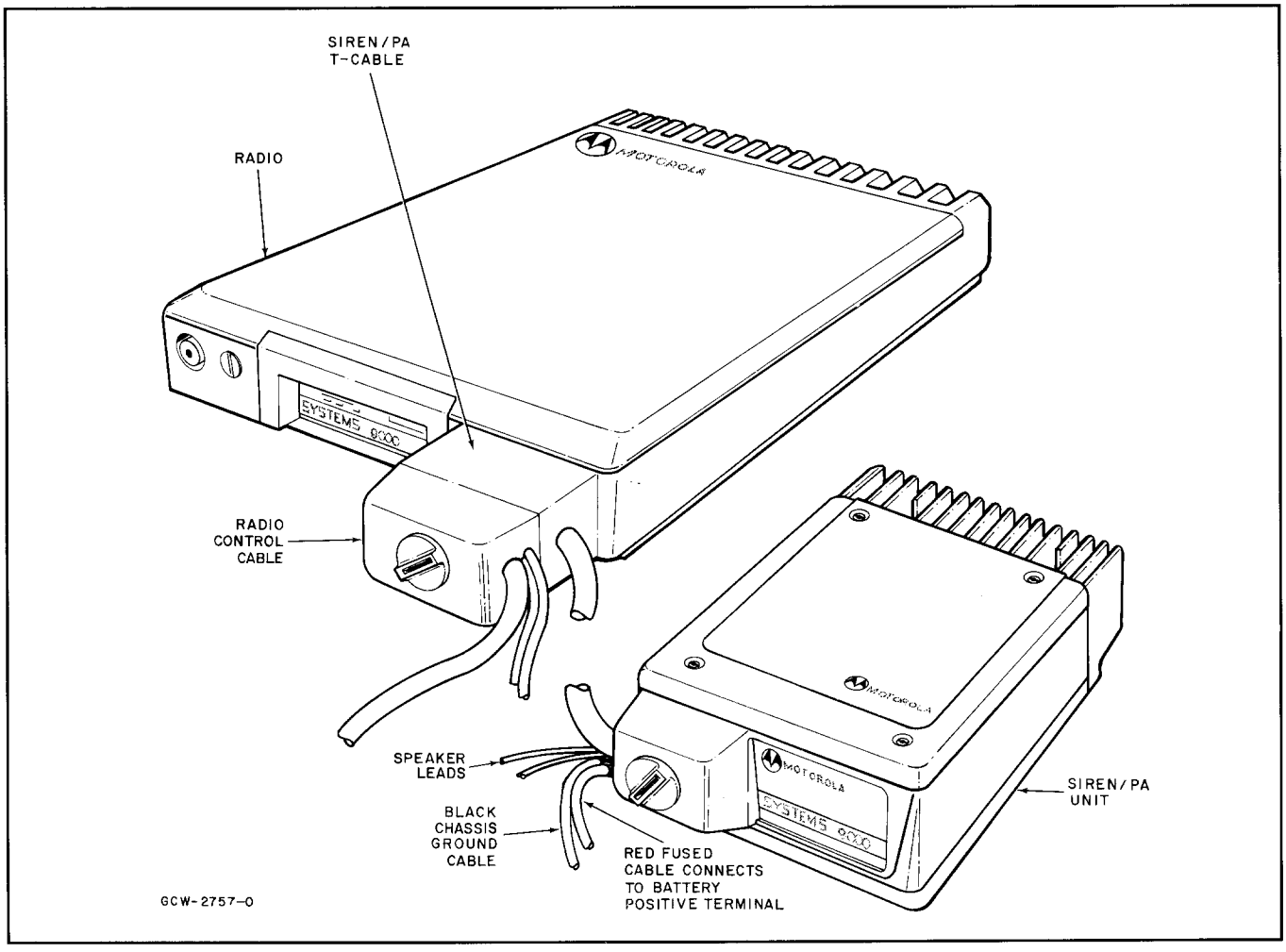


Figure 4. Siren/PA Cable Connections

4.2 DISASSEMBLY

Note

Item numbers in parenthesis ( ) refer to parts identified on the exploded view in the back of the manual (See PBW-2741).

(1) Place the Siren/PA on a workbench with the top cover (1) upward. Remove four cap screws (2) and remove the top cover (1) from the chassis (14).

(2) Remove the component side shield (6) by raising up on the handle (5).

(3) If optional PC boards are installed, remove them by gently pulling up on the board handles (8); the retaining spacers (38) snap apart, so be careful not to put excessive strain on the interconnect cable assembly (7). After the boards are removed from the spacers, disconnect the cable assembly.

(4) Remove the main PC Board as follows:

- Remove the screw (31) near the connector (25).
- Remove the screw (32) and bracket (35) that attach the bus assembly (22).
- Remove two screws (33) from either side of the PC Board (21).
- Remove seven screws (26) that attach the heatsink to the chassis; remove the heatsink bracket (10).

Caution

Use caution when handling the PC board with the heavier heatsink attached. Undue stress could damage the PC board.

- Move the bus assembly (22) toward the center of the PC board to allow for clearance; slide the PC board/heatsink assembly through the opening at the back of the chassis.

Note

When installing the PC board/heatsink assembly, be sure the gasket between the connector and the chassis wall is properly seated so that the integrity of the environmental seal is not jeopardized.

(5) Disassemble the PC board/heatsink assembly as follows:

- Slide the three transistor clips (27) and insulators (37) off the heatsink.
- Remove four screws (34) and lift off the two power transistors (29 and 40).
- Carefully turn the PC board/heatsink over and lay it on a soft protective surface. Remove the two transformer screws (2) and two PC board screws (34). The heatsink (30) can now be removed from the PC board.

4.3 ASSEMBLY

Reassemble the Siren/PA unit by following the reverse order of disassembly instructions.

4.4 INSTALLING OPTION BOARDS

Up to two different option boards may be installed on the main Siren/PA board. These smaller boards are shown in the exploded view (see item 9) and are protected by the component side shield (6).

To install an option board, remove the top cover (1) and the component side shield (6). Connect the cable (7) to the J2 connector on the main board. Align the option board's "snap-spacers" with those on the main board. Press down evenly on all four corners until the board "snaps" into place. Connect the appropriate option cable connector to the option board connector. Replace the component side shield (6) and the top cover (1).

4.5 PUSHBUTTON REMOVAL AND REPLACEMENT

The control head is assembled with all the pushbuttons for standard features and for options specified at the time of the initial customer order. If an option is requested after the initial order is placed, the button with the correct graphic symbol may need to be installed in the field. Install pushbuttons as follows:

(1) Check the operator manual for the correct button location.

(2) If another pushbutton (or plug key) is in that location, use a pliers to squeeze the button or plug and gently pull it from the control head.

(3) Insert the new pushbutton by placing it into the slot (with the graphic symbol oriented correctly) and press down gently until it snaps into place. If it does not immediately seat, again press the button, as if actuating the feature, until the button self-aligns.

4.6 SPEAKER CONNECTOINS

The Siren/PA is shipped pre-wired for 100-watt operation. It can be rewired for 65-watt, 75-watt, or 130-watt power levels.

To change to another power level, perform the following:

(1) Open the Siren/PA connector cover to gain access to the two-conductor speaker leads. Do not change the speaker common lead (Pin 20). The other lead is connected to Pin 35 (for 100-watt operation).

(2) Using an appropriate pin removal tool, extract Pin 35 and move it to one of the following:

Pin location 36 .....75-watt operation
Pin location 28 .65 or 130-watt operation

(3) For 65 or 75-watt operation, no further changes are required. Reassemble the connector.

(4) For 130-watt operation, you must *parallel* two 11-ohm speakers, each rated at 65 watts minimum. Proper phasing of the two speakers is important—when connecting two speakers in parallel, wire similar speaker terminals together to ensure maximum loudness and prevent "deadspots." For example, if the terminals are marked "1" and "2," connect the terminals marked "1" together and connect those wires to one speaker lead. Connect the terminals marked "2" together and connect those wires to the other speaker lead.

Caution

Before continuing, remember that under a high-line supply condition (16.6 V), up to 30% more power will go to the speaker(s) after the next step is complete. Do this *only* when your PA speakers are capable of handling the extra power.

(5) To configure the Siren/PA for maximum power output (130 watts), open the Siren/PA top cover and clip out R83, a 2.4 kilohm resistor. (If you re-configure from 130-watt speaker power to a lesser power-rated speaker, you must re-install R83.) Close the Siren/PA unit and reassemble the connector.

4.7 MANUAL SIREN CONTROL (HORN RING)

In order to make siren operation more convenient under emergency conditions, the vehicle's horn ring can be used to control siren functions. This convenience allows the driver to concentrate on road and traffic conditions.

The horn ring works like this: if you press the horn ring with the [Man] button selected, the manual tone programmed in the system's EEPROM sounds; if you press the horn ring when another siren tone is sounding, the tone abruptly changes to another tone. See SIREN OPERATION for a full description of the tones that sound when you press the horn ring during an active siren tone.

Figure 5 shows two ways to hook up the horn ring feature—the more common negative-contact system and an alternate positive-contact system. A third method—a momentary pushbutton—is shown in the third diagram in Figure 5.

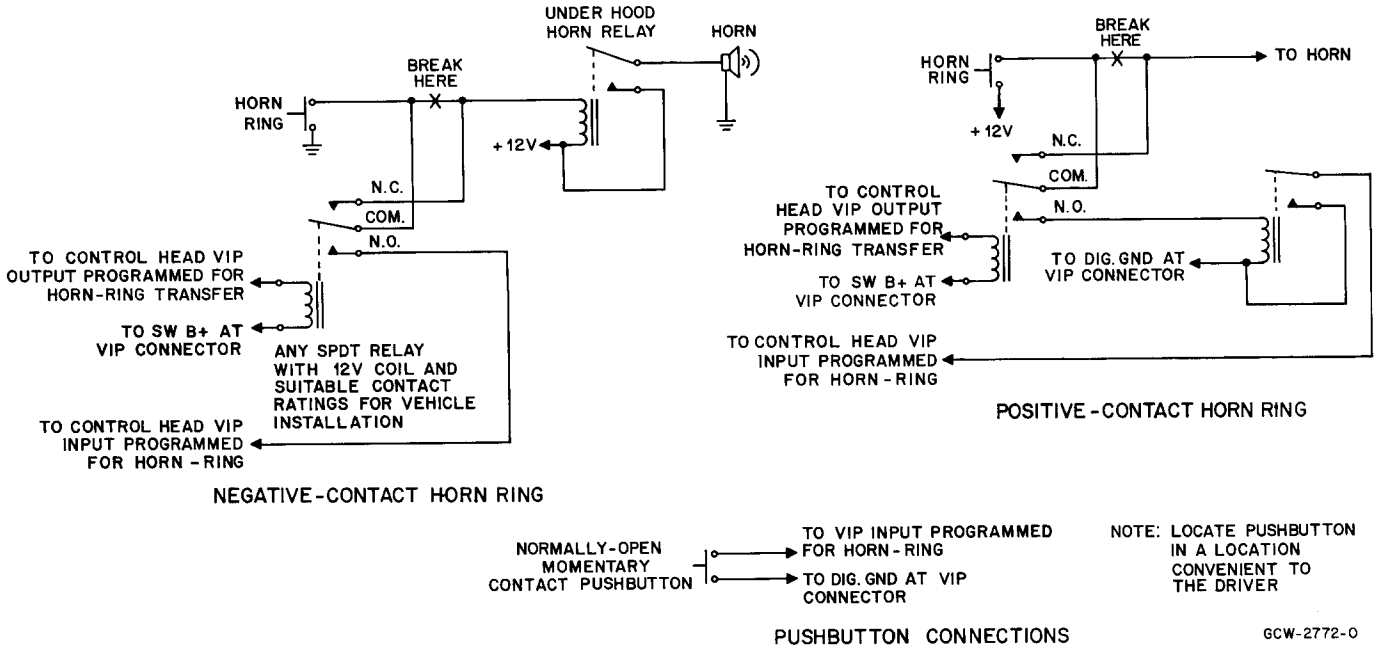


Figure 5. Siren/PA Horn Ring Connections

5. Maintenance and Troubleshooting

5.1 PUBLIC ADDRESS INPUT SENSITIVITY TESTS

a. Turn the Public Address ON.
b. Input a 80 mV RMS, 1 kHz test signal into the MIC input and adjust for maximum PA volume (hold volume rocker down until display indicates "PA VOL 15"). The unit under test should generate AT LEAST 50 watts RMS output, or 23.5 volts RMS across the 11-ohm load.
c. Adjust PA volume for exactly 50 watts output.
d. Measure distortion across 11-ohm load.
e. Measure corresponding input current.

5.2 FREQUENCY RESPONSE TEST

a. Turn the Public Address ON and input a 1 kHz tone at 80 mV RMS into the Mic input.
b. Set the PA volume at a convenient dB level at approximately 16 volts RMS across the 11-ohm load.
c. Set the signal generator for 80 mV RMS at 200 Hz. The output must not vary more than ±3 dB from the 1 kHz reference.
d. Set the signal generator for 80 mV RMS at 10 kHz. The output must not vary more than ±3 dB from the 1 kHz reference.

5.3 SIREN OUTPUT POWER CHECKS

a. Select any siren tone and turn the Siren ON.
b. Measure output voltage across the 11-ohm load with a true RMS voltmeter. Compute the power level.
c. Measure the corresponding supply current.

5.4 SIREN POWER CONTROL TESTS

a. Select any siren tone and turn Siren ON.
b. Set power supply to 16.6 Vdc.
c. Measure output voltage across the 11-ohm load with a true RMS voltmeter. Compute the power level.
d. Measure the corresponding supply current.
e. Set power supply to 13.8 Vdc.
f. Measure output voltage across the 11-ohm load with a true RMS voltmeter. Compute the power level.

5.5 SHORT CIRCUIT PROTECTION TEST

a. Select any siren tone and turn Siren ON.
b. Short the speaker leads together. The control head should display "SPKR SHORT."
c. Measure the corresponding supply current.
d. Remove the short.
e. Measure and supply current and compare to current measured previously.

5.6 POWER-DOWN OPERATION (STANDBY MODE)

a. Select any siren tone and turn Siren ON. Note which siren tone is sounding.
b. Slide the control head ON/OFF switch OFF.
c. Measure the corresponding supply current.
d. Slide the control head ON/OFF switch ON. On power-up, the siren should be silent, but when the Siren is turned ON, the mode selected above should again sound.

5.7 TROUBLESHOOTING

5.7.1 General

Troubleshooting procedures are outlined in the troubleshooting diagrams at the end of this section. Following that is the Siren/PA circuit board diagram, system schematic, waveform diagrams, and the parts list. Finally, cable assembly wiring diagrams and parts lists are also included.

5.7.2 Error Display

When power is turned on, the control head initiates a self-check routine. If no faults are found in the radio system, the display shows "SELF CHECK" followed by the mode name for normal operation. If it finds an error, one of two messages will appear--"ERROR WX/YZ" or "FAIL WX/YZ"--where WX and YZ represent number pairs defined as follows:

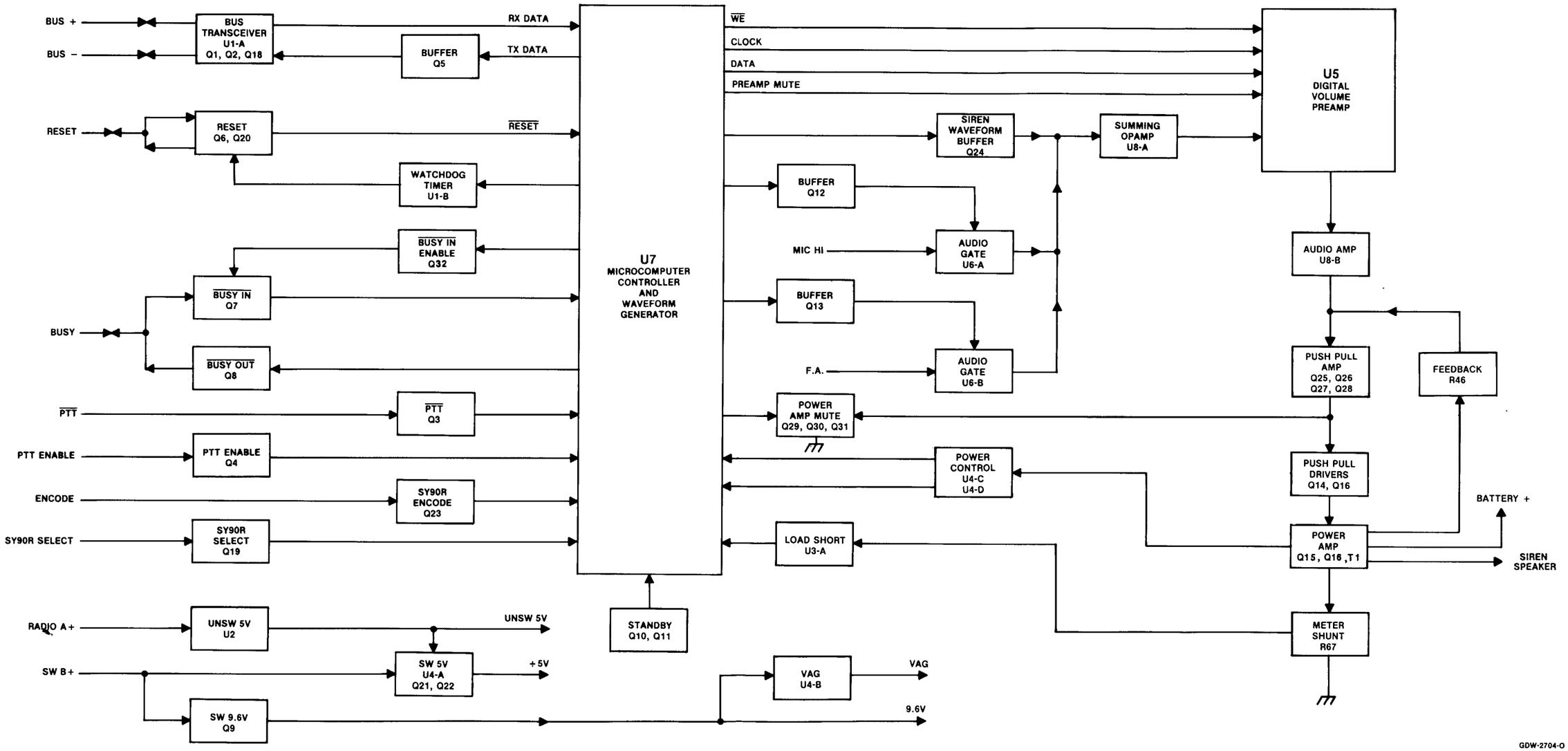
(1) The WX display area identifies the component in which the fault exists. Depending on the siren used, one of two codes displays to indicate a failure in the Siren part of the radio system: "06" appears in the WX area if a fault is located in the HLN1184A Siren; "08" appears in the WX area if a fault is located in the HLN1185A Siren.

(2) The YZ area displays a code that identifies the type of error.

While the location code (WX) does not necessarily pinpoint the problem board, use the display information and the troubleshooting guide for that board to find the problem. See Table 5 for interpretation of Siren-related fault codes.

Table 5. Fault Troubleshooting Guide

DISPLAY	DESCRIPTION	ACTION TO BE TAKEN
ERROR 06/01	HLN1184A RAM Failure	Replace U7
ERROR 06/02	HLN1184A ROM Failure	Replace U7
ERROR 06/03	HLN1184A RAM/ROM Failure	Replace U7
ERROR 08/01	HLN1185A ROM Failure	Replace U7
ERROR 08/08	HLN1185A RAM Failure	Replace U7
ERROR 08/09	HLN1185A RAM/ROM Failure	Replace U7
ERROR 08/10	HLN1185A BUS Failure	See SIREN ERROR Troubleshooting Chart
FAIL 08/90	HLN1185A Fatal Error	See SIREN ERROR Troubleshooting Chart



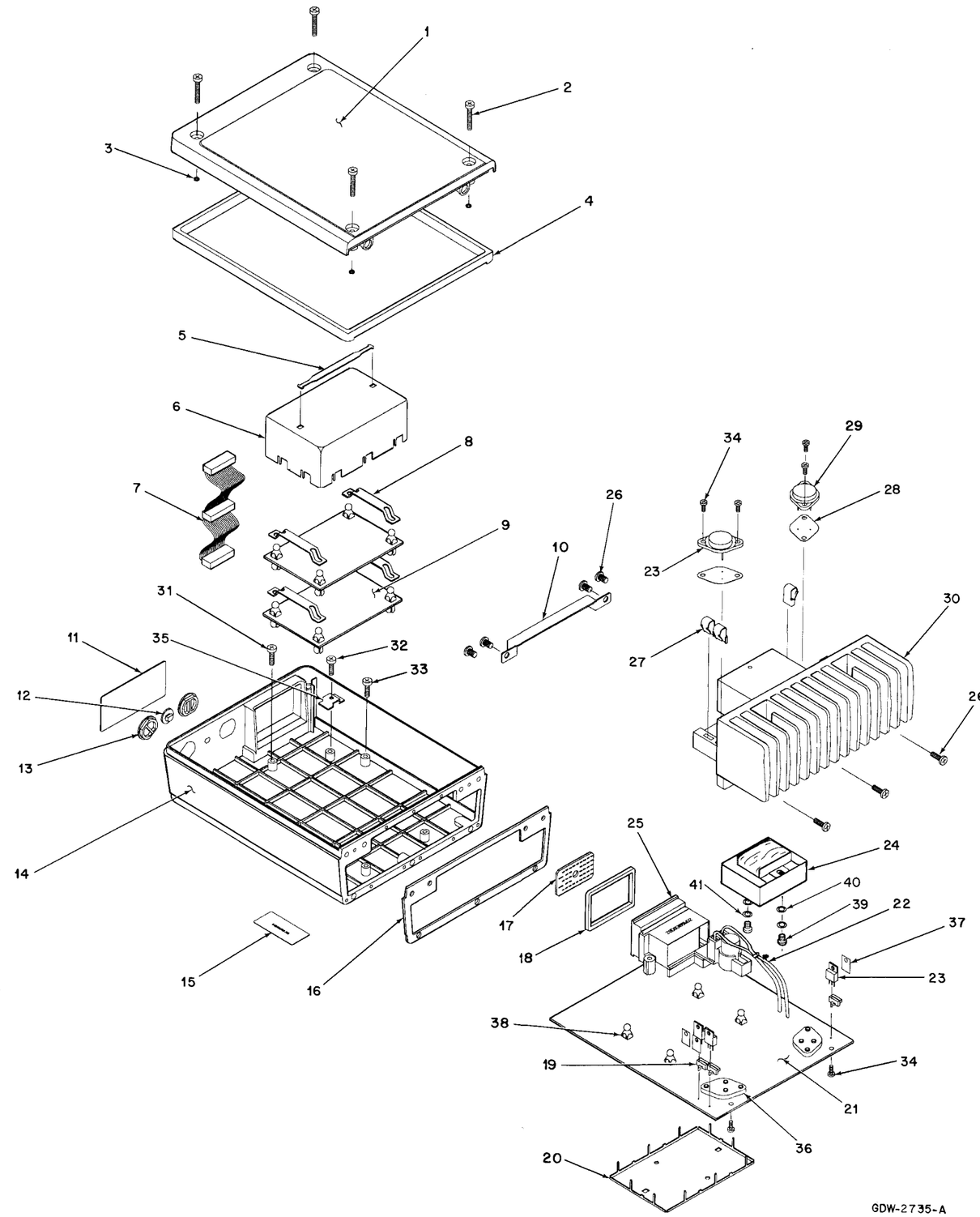
Siren/Public Address
Block Diagram
PBW-2740-O
3/14/86

parts list

HLN4916A/HLN4923A Siren Hardware — MXW-2749-A

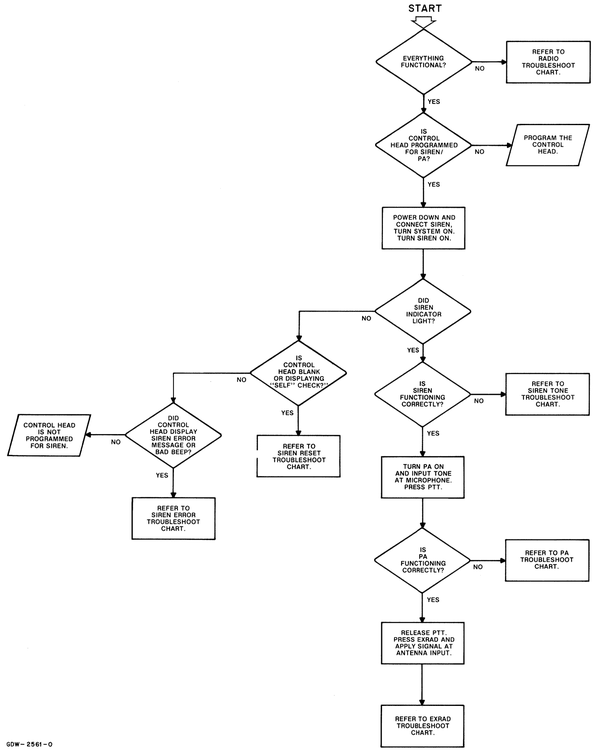
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	15-80120K01	top cover
2	03-10908B04	machine screw (M4 x 0.7 x 25), 6 used
3	42-10128A09	rubber retaining ring, 4 used
4	32-80123K01	chassis cover seal
5	55-84300B04	handle
6	26-80050K01	component side shield
7	—	cable (used only with optional PC boards)
8	—	handle (used only with optional PC boards)
9	—	PC board (option)
10	07-80003L01	chassis heatsink bracket
11	13-80124K01	escutcheon
12	38-80231K01	single D plug
13	38-80232K01	double D plug, 2 used
14	27-80121K01	siren/PA chassis
15	54-80282JXX	nameplate
16	32-80122K01	chassis heatsink seal
17	32-80072J01	face gasket
18	32-80234K01	connector seal
19	43-80218E01	transistor mounting spacer, 2 used
20	26-80051K01	solder side shield
21	84-80085K01	PC board assembly
22	01-80291K04	bus boss assembly
23	—	transistor, NPN (see electrical parts list)
24	25-80112K01	transformer
25	28-83485M02	connector
26	03-10920A25	cap screw (M4 x 0.7 x 10), 7 used
27	42-80074D04	TO-220 transistor mount clip, 3 used
28	14-80289K01	T03 transistor insulator, 2 used
29	—	transistor, PNP (see electrical parts list)
30	26-80119K01	siren/PA heatsink
31	03-10908A23	machine screw (M3 x 0.5 x 20)
32	03-10908A24	machine screw (M3 x 0.5 x 25)
33	03-10908A19	machine screw (M3 x 0.5 x 8), 2 used
34	03-10908A22	machine screw (M3 x 0.5 x 16), 6 used
35	07-80044L01	interconnection bracket
36	09-80236K01	transistor socket
37	14-83820M02	thermoconductor insulator, 3 used
38	43-80054K02	PC board support spacer, 4 used
39	03-10908A41	screw (M4 x 0.7 x 30), 4 used
40	04-00001720	flat washer, 12 used
41	04-00007651	lockwasher, 2 used

11/17/86



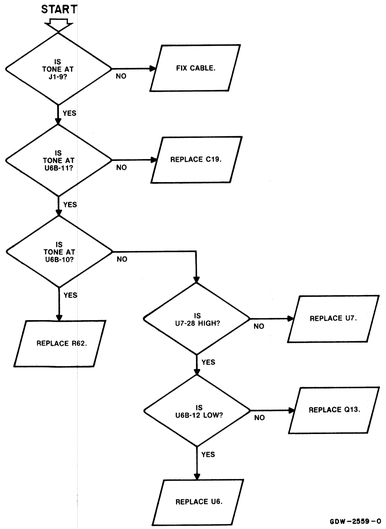
Siren/Public Address Mechanical
Exploded View and Parts List
PBW-2741-A
10/31/86

SYSTEM



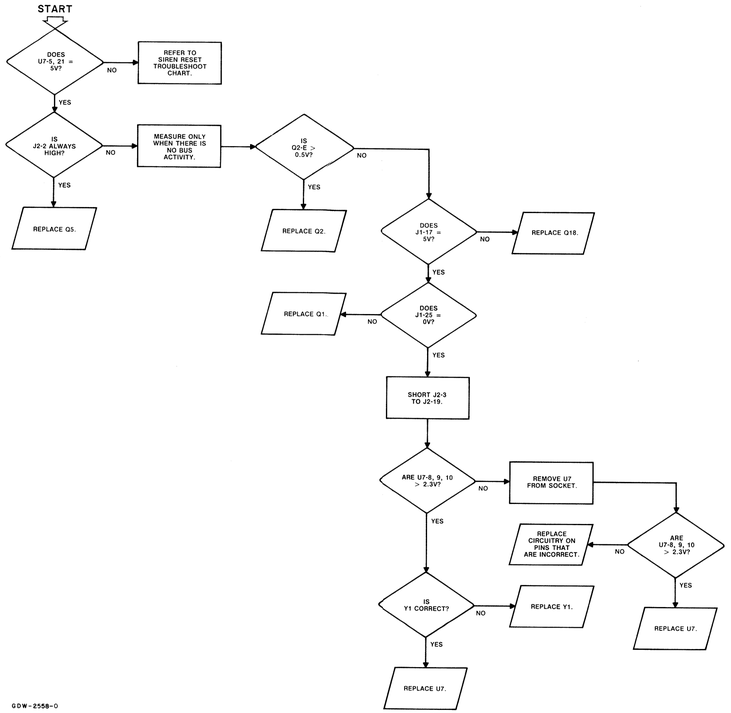
GDW-2561-O

EXTERNAL RADIO



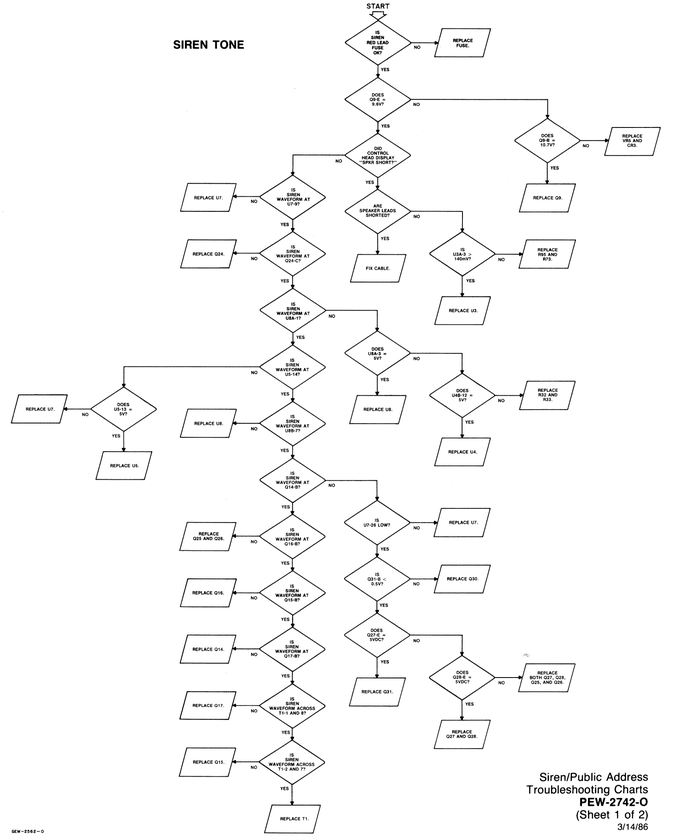
GDW-2559-O

SIREN ERROR



GDW-2558-O

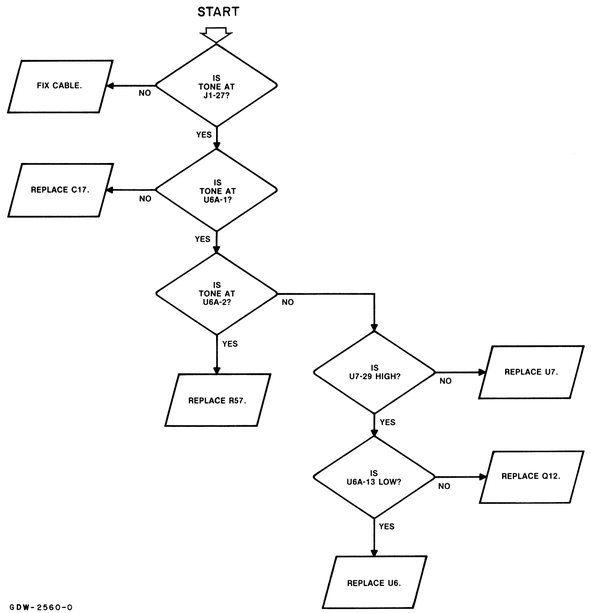
SIREN TONE



GDW-2562-O

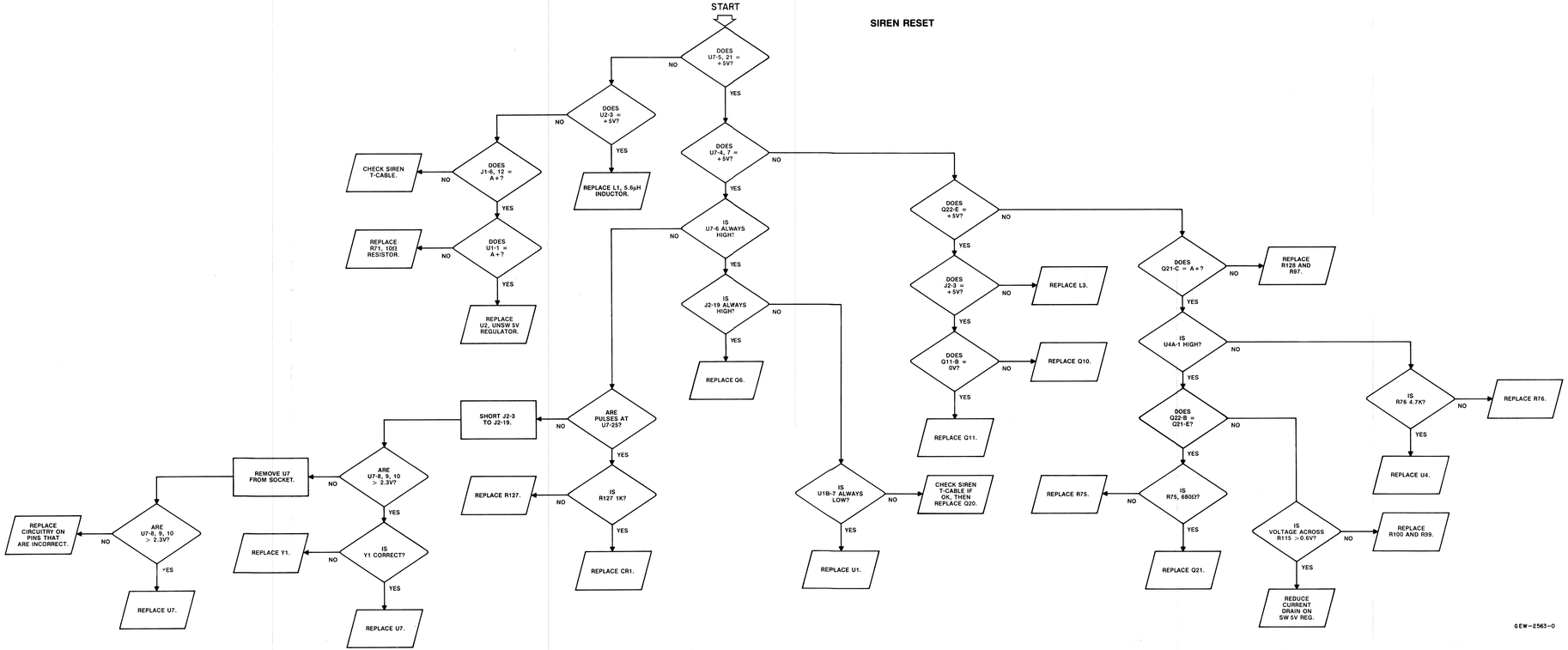
Siren/Public Address
Troubleshooting Charts
PEW-2742-O
(Sheet 1 of 2)
3/14/86

PUBLIC ADDRESS



GDW-2560-0

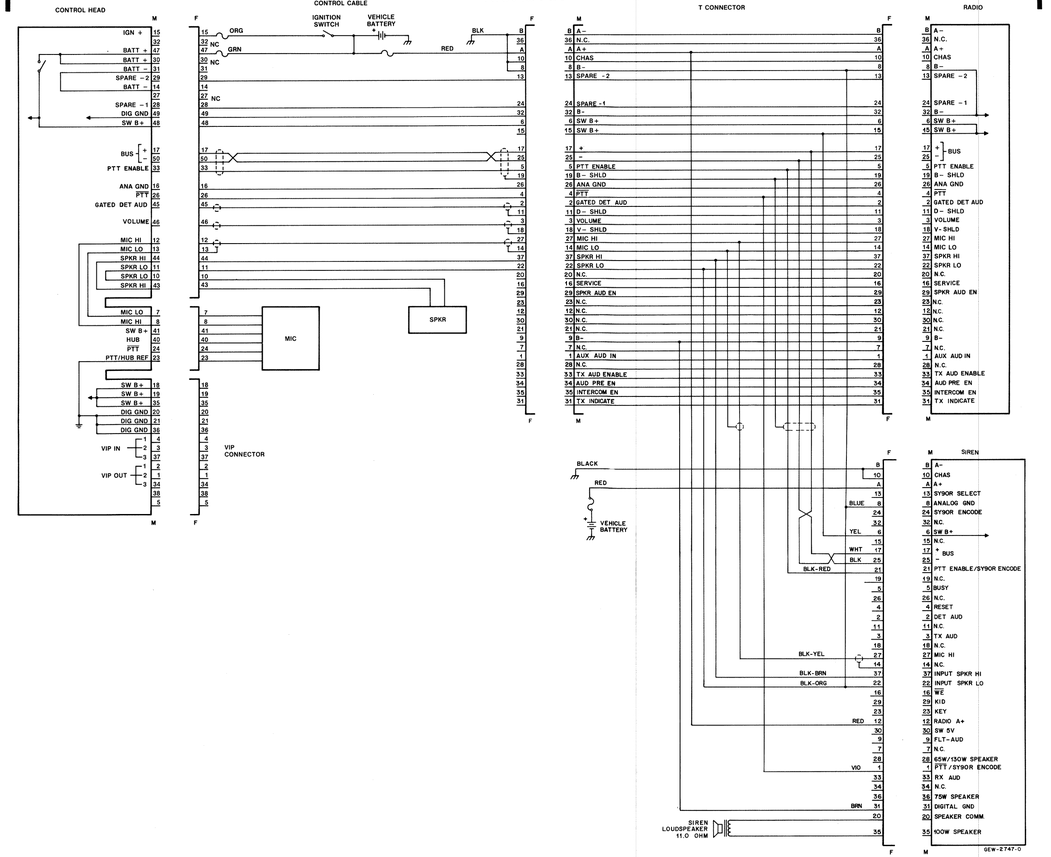
SIREN RESET



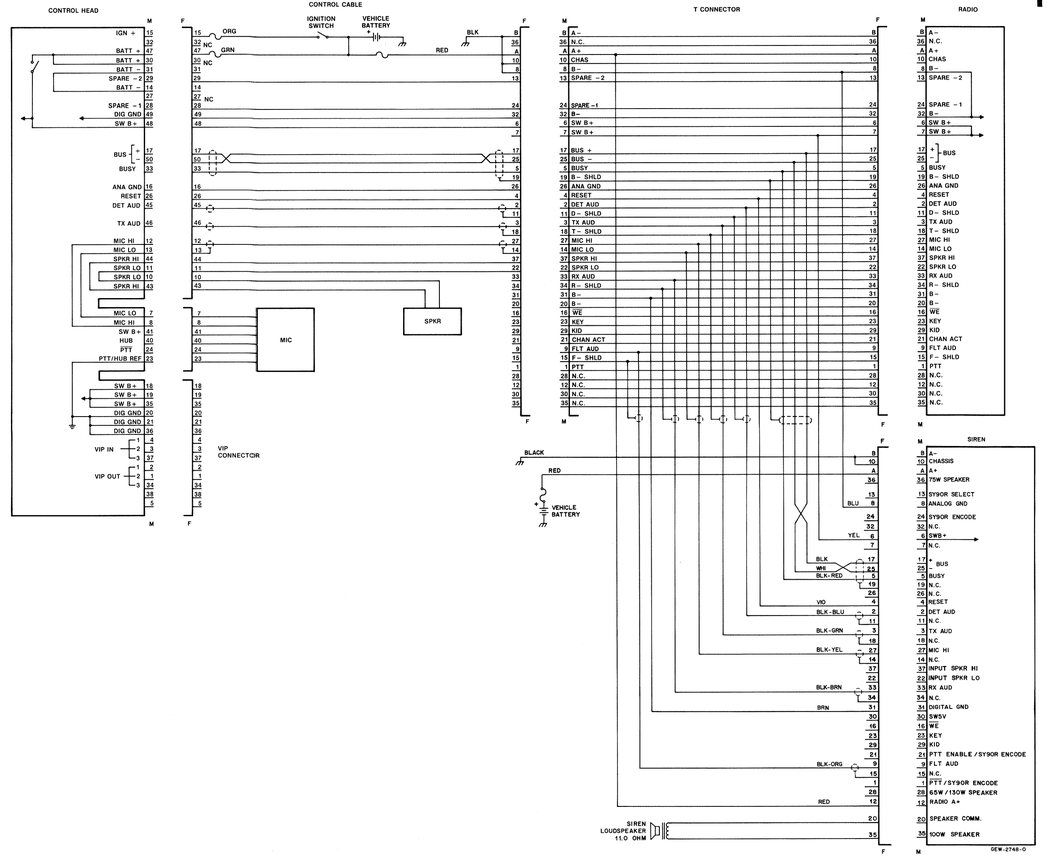
GEW-2563-0

Siren/Public Address
Troubleshooting Charts
PEW-2742-O
(Sheet 2 of 2)
3/14/86

HKN4244A



HKN4246A



parts list

HKN4244A T-Cable Siren/PA, Negative Ground (Used on HLN1184A)
HKN4246A T-Cable Siren/PA, Negative Ground (Used on HLN1185A) MXW-2751-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	01-80701T49	66" black lug and lead
	01-80743T46	T-cable (used on HLN1184A)
	01-80743T45	cable and receptacle (used on HLN1184A)
	01-80743T48	T-cable (used on HLN1185A)
	01-80743T47	cable and receptacle (used on HLN1185A)
	09-84151B03	contact
	09-84151B05	plated contact
	39-80162K02	T-signal contact
	03-10944B28	tapping screw (P3.63 × 1.34 × 25)
	15-80158K02	T-connector housing
	15-80159K02	T-connector cover
	29-84528B02	ring lug
	32-80004L02	cable connector gasket
	32-80058H03	housing gasket
	32-80072J01	face gasket
	39-80161K02	T-power contact
	42-10217A02	tie strap
	46-80010L01	contact guide
	01-80743T55	speaker cable
	09-84151B03	contact
	03-00140079	tapping screw (6-19 × ½)
	09-80227B01	power contact, female
	15-80216B01	back housing connector
	15-80217K01	front cable housing
	32-80004L01	cable connector gasket
	36-80220B05	connector knob
	42-10217A02	tie strap
	42-80156B01	retainer ring
	36-80220B06	connector knob
	30-00858553	12 strand red battery lead
	30-00858552	12 strand black ground

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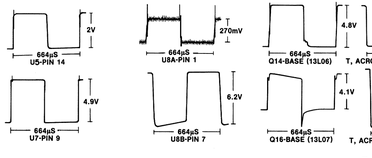
HKN4265A Fuse Cable MXW-2750-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	01-80743T57	fuse and wire
	29-84528B02	ring lug
	03-00400465	tapping screw (10-12 × ¾)
	09-84238F01	fuse
	38-84383D02	protective cap
	42-84275B01	fuse retainer
	65-00004165	tubular fuse, 15 amp, 32V

3/13/86

Siren/Public Address Negative-Ground
T-Cables Wiring Diagram and Parts List
PEW-2744-A
11/8/86



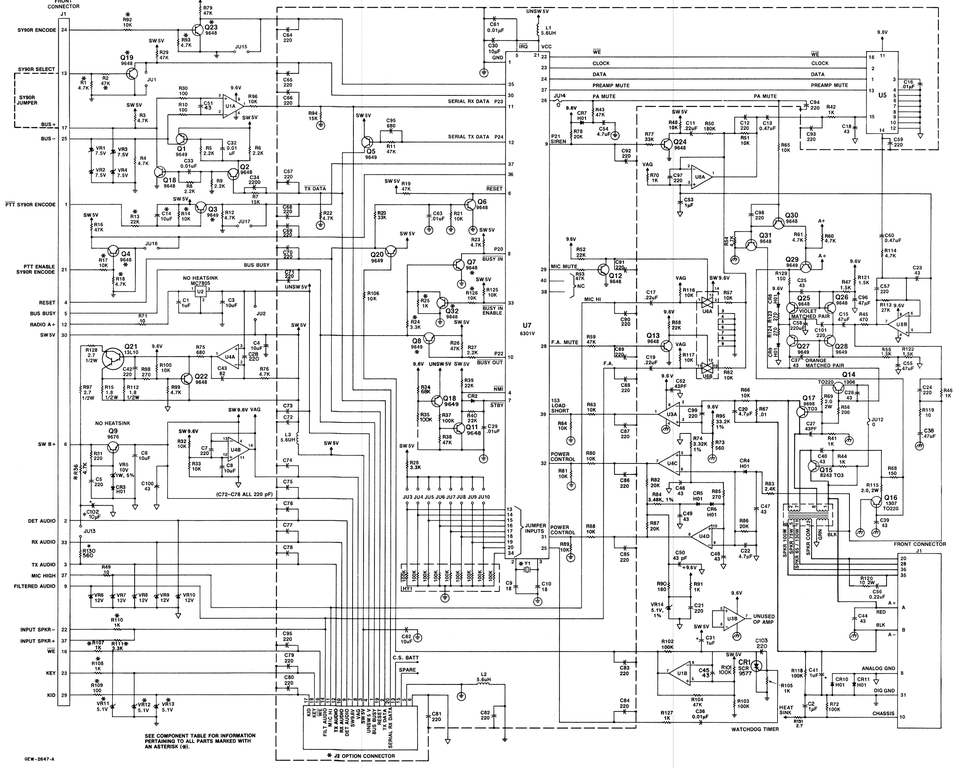
	U1	U2	U3	U4	U5	U6	U7	U8
SW 9.6V	8		8	4	11	14		8
UNSW 5V							21	
RADIO A+		1						
GROUND	4	2	4	11	5&12	7	1	4

IC	DESCRIPTION	IC	DESCRIPTION
U1	DUAL OP AMP	U5	DIGITAL VOL
U2	5V REGULATOR	U6	QUAD TRANS
U3	DUAL OP AMP	U7	MICROPROCESSOR
U4	QUAD OP AMP	U8	DUAL OP AMP

NOTES:

1. **VOLTAGES SHOWN ARE TYPICAL FOR SIREN MODES ONLY.**
2. **WAVEFORMS SHOWN ARE MEASURED WITH THE SYSTEM IN THE MANUAL MODE WITH OVERRIDE ON. OSCILLOSCOPE TIME BASE IS TWO MILLISECONDS PER DIVISION.**

GBW-2753-A



parts list

HLN4897B/4917B Systems 9000 Siren PA Board — MXW-2752-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed, pF ±5%, 100V unless otherwise stated
C1	23-11046C05	1 µF ±20%, 50V, electrolytic
C2	23-11013F57	1 µF ±20%, 35V, tantalum
C3, 4	23-11013D13	10 µF ±10%, 20V, tantalum
C5	21-11015B05	220 ±10%
C6	23-11013D13	10 µF ±10%, 20V, tantalum
C7	21-11015B05	220 ±10%
C8	23-11013D13	10 µF ±10%, 20V, tantalum
C9, 10	21-11014H31	18
C11	08-11061A15	.22 µF, 63V
C12	21-11015B05	220 ±10%
C13	08-11051A17	.47 µF, 63V
C14	23-11013D13	10 µF ±10%, 20V, tantalum (HLN4917A)
C15	23-11019A40	47 µF ±20%, 25V, electrolytic
C16	08-11051A07	.01 µF, 63V
C17	08-11061A15	.22 µF, 63V
C18	21-11014H40	43
C19	08-11051A15	.22 µF, 63V
C20	23-11013D05	4.7 µF ±20%, 20V, tantalum
C21	21-11015B05	220 ±10%
C22	23-11013D55	4.7 µF ±20%, 20V, tantalum
C23	21-11014H40	43
C24	21-11015B05	220 ±10%
C25-27	21-11014H40	43
C28	21-11015B05	220 ±10%
C29	08-11051A07	.01, 63V
C30	23-11013D13	10 µF ±10%, 20V, tantalum
C31	23-11013F57	1 µF ±20%, 35V, tantalum
C32, 33	08-11051A07	.01 µF, 63V
C34	08-11051A03	.0022 µF, 63V
C35	21-11015B11	680 ±10%
C36	08-11051A07	.01 µF, 63V
C37	21-11014H40	43
C38	08-11051A17	.47 µF, 3V
C39, 40	21-11014H40	43
C41	23-11013F57	1 µF ±20%, 35V, tantalum
C42	21-11015B05	220 ±10%
C43	21-11014B47	82
C44-52	21-11014H40	43
C53	23-11013F57	1 µF ±20%, 35V, tantalum
C54	23-11048C08	4.7 µF ±20%, 50V, electrolytic
C55	23-11019A40	47 µF ±20%, 25V, electrolytic
C56	08-11061A15	.22 µF, 63V
C57	21-11015B05	220 ±10%
C58	23-84666F14	2200 µF +150, −10%, 16V, electrolytic
C59	21-11015B05	220 ±10%
C60	08-11051A17	.47 µF, 63V
C61	21-11015B13	1000 ±10%
C62	23-11013D13	10 µF ±10%, 20V, tantalum
C63	08-11051A07	.01 µF, 63V
C64-95	21-11015B05	220 ±10%
C96	23-11019A40	47 µF ±20%, 25V, electrolytic
C97-99	21-11015B05	220 ±10%
C100	21-11014H40	43
C101	21-11015B05	220 ±10%
C102	23-11013D13	10 µF ±10%, 20V tantalum
CR1	48-80182D22	**diode (see note)** SCR, type M8222
CR2-11	48-8365-4H01	silicon
HY1	01-80201E41	**hybrid (see note)** 100k ohms, resistor network
J1	01-80472T06 or 28-83485M03	**connector receptacle** connector front connector, 37 contact
J2	09-80269B05	dual in-line IC socket (HLN4897A)
J5	09-80269B01	dual in-line IC socket
J7	09-80269B04	dual in-line IC socket
JU12	06-11009B23	resistor jumper
JU14	06-11009B23	resistor jumper
L1–3	24-80138G04	**coil** 5 .6 µH
Q1	48-80182D12	**transistor (see note)** PNP, type M8ZD12
Q2	48-80182D11	NPN, type M8ZD11
Q3	48-80182D12	PNP, type M8ZD12 (HLN4917A)
Q4	48-80182D11	NPN, type M8ZD11 (HLN4917A)
Q5	48-80182D12	PNP, type M8ZD12
Q6	48-80182D11	NPN, type M8ZD11
Q7	48-80182D11	NPN, type M8ZD11 (HLN4897A)
Q8	48-80182D12	PNP, type M8ZD12 (HLN4897A)
Q9	01-80742T01	transistor and socket
Q10	48-80182D12	PNP, type M8ZD12
Q11–13	48-80182D11	NPN, type M8ZD11
Q14	01-80742T04	transistor and socket
Q15	48-80182D43	PNP type 8243
Q16	01-80742T03	transistor and socket
Q17	48-80869698	NPN type 9698
Q18	48-80182D11	NPN, type M8ZD11
Q19	48-80182D11	NPN, type M8ZD11 (HLN4917A)
Q20	48-80182D12	PNP, type M8ZD12

COMPONENT	HLN1184A	HLN1185A
C16	IN	OUT
J2	OUT	IN
Q5	IN	OUT
Q6	IN	OUT
Q7	OUT	IN
Q8	OUT	IN
Q19	IN	OUT
Q22	IN	OUT
Q23	OUT	IN
R2	OUT	IN
R3	IN	OUT
R16	IN	OUT
R17	OUT	IN
R18	IN	OUT
R24	OUT	IN
R25	OUT	IN
R92	IN	OUT
R100	OUT	IN
R106	OUT	IN
R110	IN	OUT
R111	IN	OUT
R126	OUT	IN
VR11	OUT	IN
VR12	OUT	IN
VR13	IN	OUT
Y1	3.8860 MHz	4.9152 MHz
X1N	IN	OUT
X1N2	IN	OUT
X1N3	IN	OUT

NOTE:
UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 10%. ALL CAPACITOR VALUES ARE IN PICOFARADS. ALL INDUCTOR VALUES ARE IN MICROHENRIES.

DIGITAL GROUND
ISOLATED DIGITAL GROUND
ANALOG GROUND
SIREN GROUND

MXW-2752-A (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q21	01-80742T05	transistor and socket
Q22	48-80182D11	NPN, type M8ZD11
Q23	48-80182D11	NPN, type M8ZD11 (HLN4918A)
Q24	48-80182D11	NPN, type M8ZD11
Q25, 26	01-80734T06	transistor and clip
Q27, 28	01-80734T05	transistor and clip
Q29	48-80182D12	PNP, type M8ZD12
Q30, 31	48-80182D11	NPN, type M8ZD11
Q32	48-80182D11	NPN,type M8ZD11 (HLN4897A)
R1	06-11009A65	**resistor, fixed, Ω ±5%, ¼ W** unless otherwise stated 4.7k
R2	06-11009A89	47k (HLN4917A)
R3, 4	06-11009A03	4.7k
R5, 6	06-11009A57	2.2k
R7	06-11009A97	100k
R8, 9	06-11009A57	2.2k
R10	06-11009A25	100
R11	06-11009A53	4.7k
R12	06-11009E65	4.7k
R13	06-11009E81	22k (HLN4917A)
R14	06-11009E73	10k (HLN4917A)
R15	06-80037G11	1.8, ½ W, FF
R16	06-11009E89	47k
R17	06-11009E73	10k (HLN4917A)
R18	06-11009E65	4.7k (HLN4917A)
R19	06-11009A89	47k
R20	06-11009A85	33k
R21	06-11009A73	10k
R22, 23	06-11009A65	4.7k
R24	06-11009A61	3.3k (HLN4897A)
R25	06-11009A69	1k (HLN4897A)
R26	06-11009A89	47k
R27	06-11009A57	2.2k
R28	06-11009A61	3.3k
R29	06-11009E89	47k
R30	06-11009A25	100
R31	06-11009A33	220
R32, 33	06-11009E73	10k
R34	06-11009A93	68k
R35	06-11009A97	100k
R36	06-11009E65	4.7k
R37	06-11009A97	100k
R38	06-11009A89	47k
R39, 40	06-11009A81	22k
R41, 42	06-11009A49	1k
R43	06-11009A89	47k
R44	06-11009A49	1k
R45	06-11009A41	470
R46	06-11009A49	1k
R47	06-11009E53	1.5k
R48	06-11009A73	10k
R49	06-11009A01	10
R50	06-11009F04	180k
R51	06-11009A73	10k
R52	06-11009A81	22k
R53	06-11009A89	47k
R54	06-11009E65	4.7k
R55	06-11009A53	1.5k
R56	06-11009A33	200
R57	06-11009A73	10k
R58	06-11009E81	22k
R59	06-11009A89	47k
R60, 61	06-11009A65	4.7k
R62	06-11009E73	10k
R63-66	06-11009A73	10k
R67	17-80165C01	shunt
R68	06-11009A29	150
R69	17-80336G03	2, 2 W, FWW
R70	06-11009A49	1k
R71	06-11009E01	10
R72	06-11009E97	100k
R73	06-11009A43	60
R74	06-11049R45	3.32k ±1%, ¼ W, FMF
R75	06-11009E45	680
R76	06-11009E65	4.7k
R77	06-11009E85	33k
R78	06-11009A80	20k
R79	06-11009E89	47k
R80, 81	06-11009A73	10k
R82	06-11009E80	20k
R83	06-11009A58	2.4k
R84	06-10621C47	3.48k ±1%, ¼ W, FMF
R85	06-11009E35	270
R86	06-11009E80	20k
R87	06-11009A80	20k
R88, 89	06-11009A73	10k
R90	06-11009E30	160
R91	06-11009E49	1k
R92	06-11009A73	10k (HLN4917A)
R93	06-11009E65	4.7k (HLN4917A)
R94	06-11009A77	15k
R95	06-11049D42	33.2k ±1%, ¼ W, FMF
R96	06-11009E73	10k
R97	06-80037G11	2.7, ½ W, FF

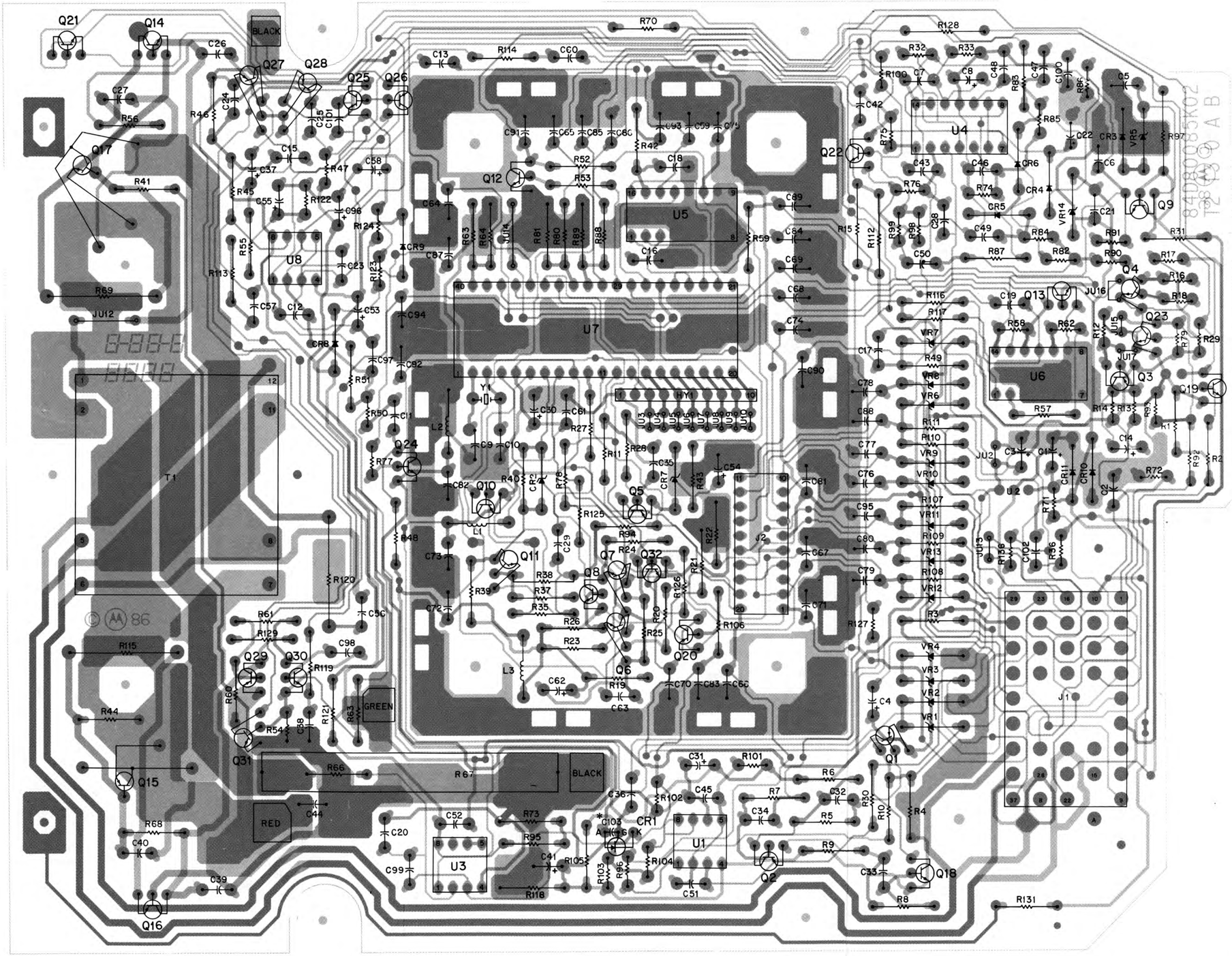
MXW-2752-A (3)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R98	06-11009E35	270
R99	06-11009E65	4.7k
R100	06-11009E73	10k
R101–103	06-11009E97	100k
R104	06-11009E89	47k
R105	06-11009A49	1k
R106	06-11009A73	10k
R107, 108	06-11009A49	1k (HLN4897A)
R109	06-11009A25	100 (HLN4897A)
R110	06-11009A49	1k (HLN4917A)
R111	06-11009A61	3.3k (HLN4917A)
R112	06-80037G07	1.8, ½ W, FF
R113	06-11009A83	27k
R114	06-11009A65	4.7k
R115	17-80336G03	2, 2W, FWW
R116, 117	06-11009A73	10k
R118	06-11009A97	100k
R119	06-11009A01	10
R120	17-80336G08	10, 2W, FWW
R121, 122	06-11009A53	1.5k
R123, 124	06-11009E35	270
R125, 126	06-11009A73	10k
R127	06-11009E49	1k
R128	06-80037G11	2.7, ½ W, FF
R129	06-11009A29	150
R130	06-11009E43	560
R131	06-80036G11	2.7
U1	51-80254D01	**integrated circuit (see note)** dual op amp
U2	01-80711T66	voltage regulator and spacer
U3	51-83629A16	dual op amp
U4	51-83629M09	quad op amp
U5	51-83977M60	9-bit digital volume control
U6	51-80073C05	quad bilateral switch
U7	01-80742T52	microprocessor (HLN4917A)
U7	01-80743T34	microprocessor (HLN4897A)
U8	51-83629M16	dual op amp
VR1–4	48-82256C44	**voltage regulator (see note)** 7.5V zener
VR5–10	48-82256C67	10.5V zener
VR11–12	48-80007E02	12V zener
VR11–13	48-80007E01	5.1V zener (HLN4897A)
VR14	48-80007E09	5.1V zener
Y1	01-80740T43	**crystal (see note)** 3.8864 MHz crystal and pad (HLN4917A)
Y1	01-80740T36	4.9152 MHz crystal and pad (HLN4897A)
Y1	48-80113K02	3.8864 MHz (HLN4917A)
Y1	48-80113K03	4.9152 MHz (HLN4897A)

11/04/86

note: For best performance, order diodes, transistors, and integrated circuits by Motorola part number.

Siren/Public Address
Schematic, Circuit Board Diagram,
Waveforms, and Parts List
PEW-2743-A
(Sheet 1 of 2)
10/31/86



COMPONENT SIDE VIEW

SOLDER SIDE GEW-3889-O
COMPONENT SIDE GEW-3890-O
OVERLAY GEW-3891-O

* C103 IS A SOLDER SIDE COMPONENT

Siren/Public Address
Schematic, Circuit Board Diagram,
Waveforms, and Parts List
PEW-2743-A
(Sheet 2 of 2)
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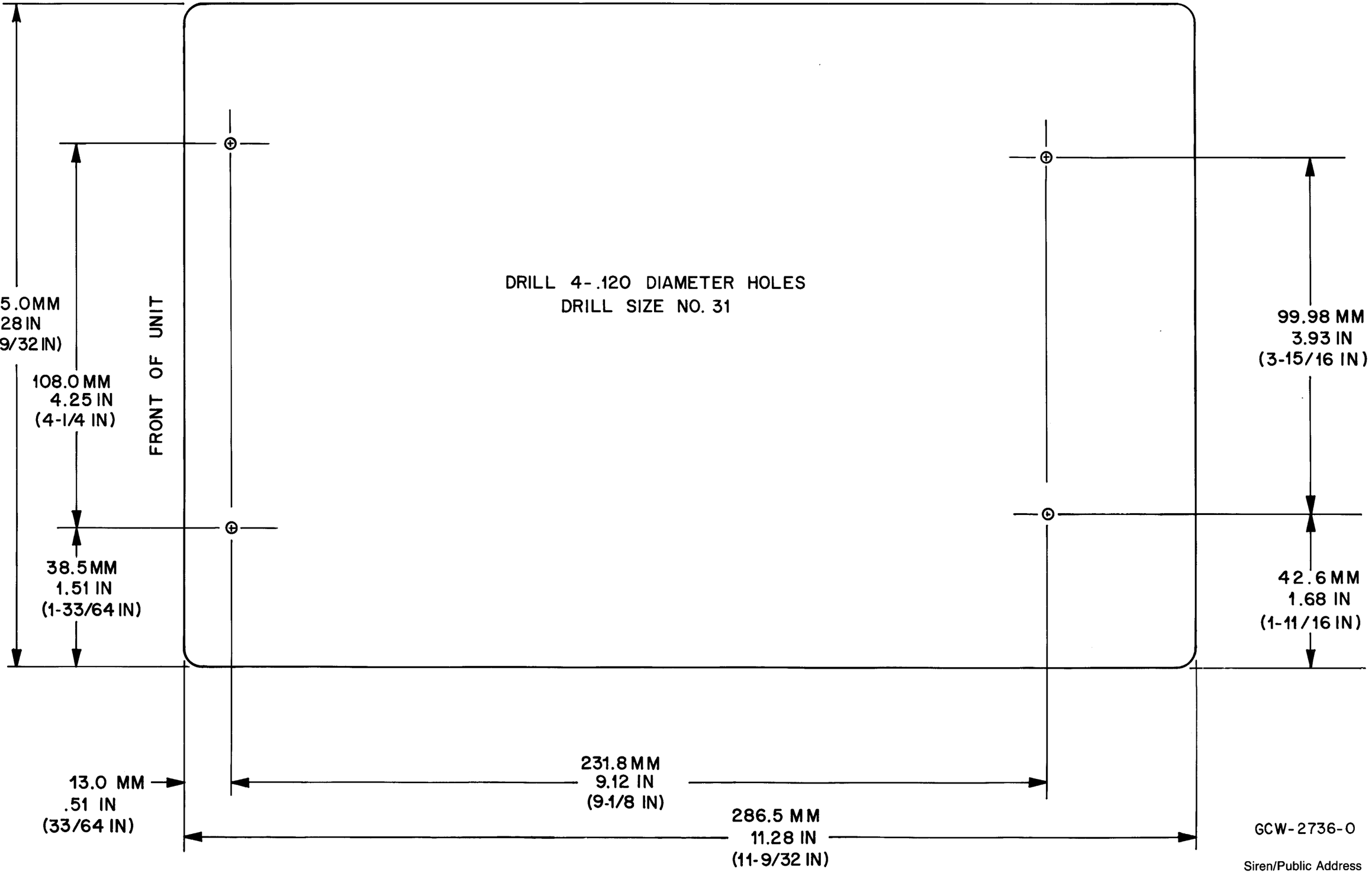

GCW-2736-O

END OF DOCUMENT

Siren/Public Address
Mounting Template
PBW-2745-O
3/14/86