



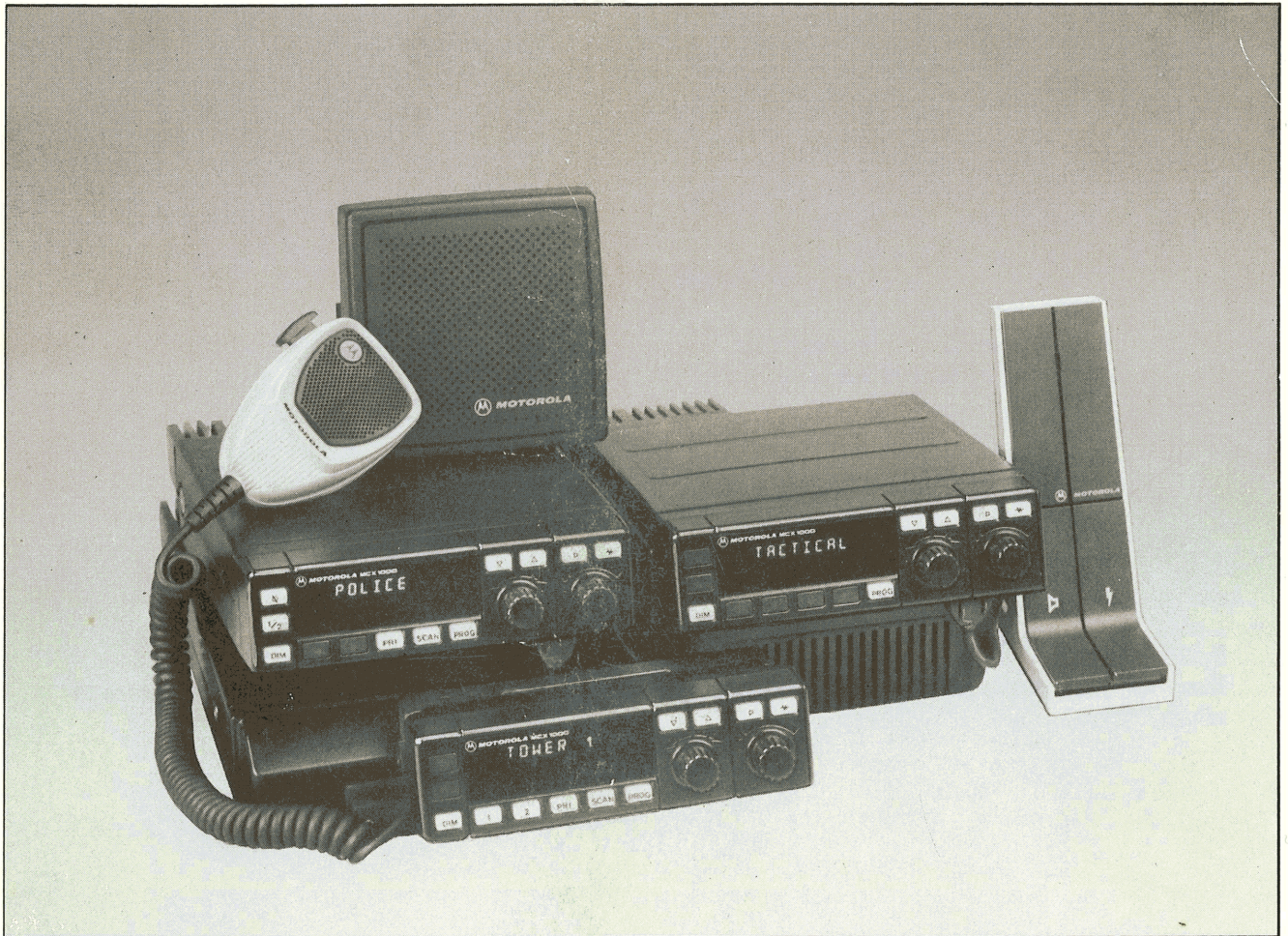
MOTOROLA LIMITED

Communications Division

MCX1000™

TWO-WAY FM RADIO

136-162, 146-174 MHz
30/40 WATTS RF POWER



VHF Service Manual

68P02901A92

Issue O

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SERVICE MANUAL ORDERING INFORMATION

Further copies of this VHF Service Manual (68P02901A92) may be purchased by contacting either your local Motorola Service Representative or the nearest Motorola Area Parts Office. Area Parts Office addresses are located on page vii/viii.

WARNING

RESTRICTED USE OF GLASS-MOUNT ANTENNAS

Non-Metallic Vehicles - DO NOT install any glass-mount antenna on fiberglass or other non-metallic vehicles in mobile systems with transmit output power in **excess of seven (7) watts** because such installations may result in the exposure of the vehicle occupants to excessive radio frequency energy levels.

Metal Body Vehicles - In metal body vehicles, it is mandatory that the Motorola supplied glass-mount antenna installation instructions covering location of the antenna at the top of the front or rear window and cable routing be followed **exactly as described** to ensure that vehicle occupants are not exposed to excessive radio frequency energy levels.

If installations of this type have already taken place, notify your local Motorola Service Representative immediately so that appropriate corrective action can be taken.

WARNING

**UNSAFE USE OF CONVERTED MOBILE
EQUIPMENT FOR PORTABLE APPLICATIONS**

Motorola two-way radio products which have been designed for mobile operation **should not** be used as battery operated portable units. In such use there is the danger that the user or other persons will be exposed to excessive radio frequency energy levels. This warning applies to all two-way radio equipment radiating in excess of seven (7) watts rf power. Motorola strongly recommends that any product which converts high power equipment for portable operation **not be used**.

NOTE

In mobile installations, consider the occupants' safety when choosing a location for the radio. Do not mount the radio overhead or on a sidewall unless special precautions are taken. Otherwise the radio could become unfastened in an automobile accident and injure the occupants.

Refer to the appropriate sections of this product service manual for additional pertinent safety information.

SERVICE

Motorola's National Service Organization offers a nation-wide installation and maintenance program for communications equipment users. This organization includes hundreds of authorized Motorola Service Stations (MSS) located throughout the United States and Canada, each manned by one or more trained and licensed technicians.

Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola

Service Representative, or write :

- in the United States

National Service Manager
Motorola Communications and Electronics, Inc.
1303 E. Algonquin Road
Schaumburg, Illinois 60196

- in Canada

National Service Manager
Motorola Limited
3125 Steeles Avenue East
North York, Ontario
M2H 2H6



REPLACEMENT PARTS ORDERING

ORDERING INFORMATION

Motorola maintains a number of parts offices strategically located throughout North America. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Division products.

Orders for all parts except crystals, active filters and channel elements should be sent to the nearest area parts centre. Orders for instruction manuals should also be sent to the area parts centre.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits and chassis. If the component part number is not known, the order should include the

number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements and active filters should be sent to the Component Product Sales & Service address listed below. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the model number of the unit in which the part is used.

Orders for active filters should specify type number and frequency, should identify the owner/operator of the communications system on which these items are to be used and should include any serial numbers stamped on the components being replaced.

COMPONENT PRODUCT SALES & SERVICE OFFICE (crystals, active filters, channel elements and reeds)

All Mail Orders
Motorola, Inc.
Component Product Sales & Service
P.O. Box 66191, O'Hare International Airport
Chicago, IL 60666

Correspondence
Motorola, Inc.
Component Product Sales & Service
2553 N. Edgington Street, Franklin Park, IL 60131
Tel: 312-451-1000, TWX: 910-227-0799

AREA PARTS OFFICES

Western Area Parts
1170 Chess Drive, Foster City, CA 94404
Tel: 415-349-3111, TWX: 910-375-3877

Pacific-Southwestern Area Parts
P.O. Box 85036, San Diego, CA 92138
Street Address:
9980 Carroll Canyon Road, San Diego, CA 92131
Tel: 619-578-8030, TWX: 910-335-1633

Gulf States Area Parts
P.O. Box 73115, 1140 Cypress Station, Houston, TX 77090
Tel: 713-537-3636, TWX: 910-881-6392

Southwestern Area Parts
P.O. Box 819049, 3320 Belt Line Road, Dallas, TX 75234
Tel: 214-888-6777, TWX: 910-860-5505

Midwest Area Parts
1313 E. Algonquin Rd., Schaumburg, IL 60196
Tel: 312-576-7430, TWX: 910-693-0869

Southeastern Area Parts
P.O. Box 368, Decatur, GA 30031
Street Address:
5096 Panola Industrial Blvd., Decatur, GA 30031
Tel: 404-987-2232, TWX: 810-766-0876

Rocky Mountain Area Parts
20 Inverness Place East, Englewood, CO 80112
Tel: 303-790-2323, TWX: 910-935-0785

East Central Area Parts
12955 Snow Road, Parma, OH 44130
Tel: 216-433-1560, TWX: 810-427-9424

Eastern Area Parts
85 Harristown Road, Glen Rock, NJ 07452
Tel: 201-670-9673, TWX: 710-988-5614

Mid-Atlantic Area Parts
7230 Parkway Drive, Hanover, MD 21076
Tel: 301-796-8763, TWX: 710-862-1941

National Accounts
Railroad, Airlines, and Telephone Sales
1313 E. Algonquin Rd., Schaumburg, IL 60196
Tel: 312-576-6520, TWX: 910-693-0869

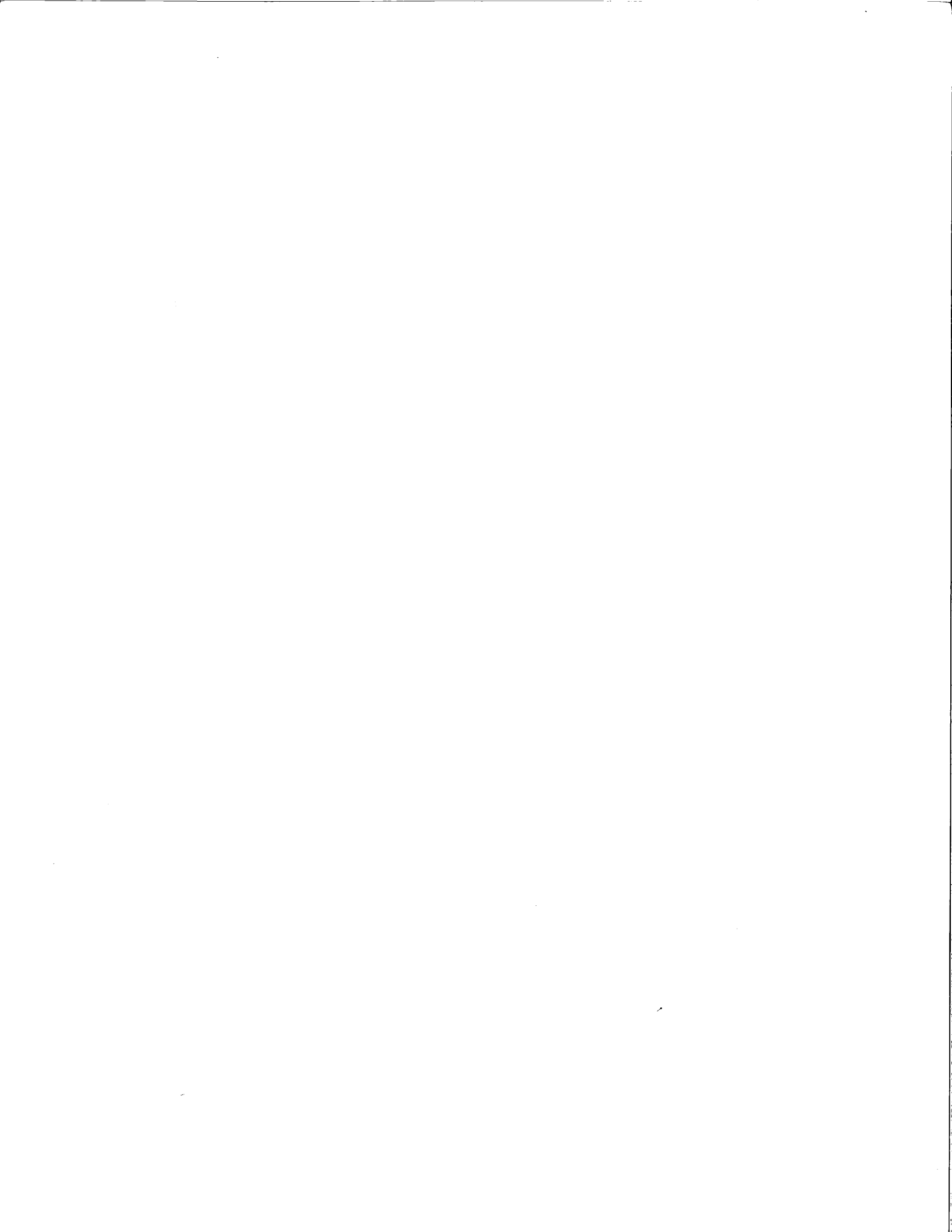
All Canadian Orders
Motorola, Ltd., National Parts Department
3125 Steeles, Ave. E., North York, Ontario M2H 2H6
Tel: 416-499-1441, TWX: 610-491-1032,
Telex: 06-526258

National Data Services

1171 West 17th Street, Tempe, AZ 85281
Tel: 602-994-6472, TWX: 910-951-1334

All Countries Except U.S. & Canada

Motorola, Inc., International Parts Department
1313 E. Algonquin Rd., Schaumburg, IL 60196, U.S.A.
Tel: 312-576-7241, TWX: 910-693-0869
Telex: 722443, Cable: MOTOL PARTS





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Communications Division

MCX1000™

TWO-WAY FM RADIO

136-162, 146-174 MHz

30 / 40 Watts RF Power

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SECTION 1. INTRODUCTION

1.1 SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains the required service information for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Manual Revisions. Revisions reflecting the latest engineering changes in the equipment are inserted into the manual before shipment from Motorola.

1.2 RADIO SET MODEL CHART

The Radio Set Model Chart (Figure 1-1) gives a complete breakdown of each radio model. This model breakdown listing consists of tanapas and kits. (A tanapa contains a group of kits whereas a kit contains piece parts and groups of piece parts called assemblies.)

1.3 TANAPA BREAKDOWN CHART

The Tanapa Breakdown Chart (Figure 1-2) describes the kits which are contained in each tanapa used in the radio. The parts lists for kits are located with the appropriate schematic diagrams and board details or with the radio exploded view. See the List of Figures for a complete listing of all parts lists and drawings.

1.4 PERFORMANCE SPECIFICATIONS

The Performance Specifications Chart (Figure 1-3) describes the mechanical, electrical and electronic characteristics of the MCX1000 Radio Set.

1.5 METRIC MEASURE

Unless indicated otherwise, measurements given in this manual are in metric units, with imperial units following in brackets.

TANAPA BREAKDOWN CHART

MBTLN2324B Chassis	VLN1108A Control Head (dash mount models)
Contains: -MBTRN4602A Tx Feed Through Plate -MBTRN4603A Chassis Hardware -MBTRN5365A Power Interconnect Board	Contains: -VLN4667A Display Board -VLN4668A Dash Control Head Micro-computer Board -VLN4670A Dash Control Head Hardware
MBTLN2334B 30 Watt Power Amplifier	VLN1109A Control Head (remote mount models)
Contains: -MBTLD9151A 30 W VHF P A Hybrid -MBTRN4905A 30 W Heat Sink Hardware	Contains: -VLN4667A Display Board -VLN4669A Remote Control Head Micro-computer Board -VLN4671A Remote Control Head Hardware
VLD1051A Dual Front End (Range 1) VLD1052A Dual Front End (Range 2)	VMN1016A Mobile Microphone
Contains: -MBTRN5001A Dual Front End Hardware -VLN4553A Coils and Hardware -VLN4554A Housing Assembly	Contains: -VLN4765A Microphone Board -VLN4712A Microphone Hardware
VLD1081A VCO	VMN1017A DTMF Microphone
Contains: -VLD4081A Hybrid VCO Standard VHF R1 -VLN4628A VCO Hardware	Contains: -VLN4383A Logic Board -VLN4823A Beeper Board -VLN4386A Touch Tone Keypad -VLN4713A Hardware
VLD1082A VCO	VMN1018A Base Station Microphone
Contains: -VLD4082A Hybrid VCO Standard VHF R2 -VLN4628A VCO Hardware	Contains: -VLN4824A Microphone Board -VLN4714A Microphone Hardware

Figure 1-2 Tanapa Breakdown Chart

SECTION 1. INTRODUCTION

GENERAL

No. of Modes/Zones:	56/8 or 128/24
Squelch Option:	Carrier Squelch, Private Line and Digital Private Line are standard and available in the same radio unit.
Primary Power:	13.6 V Nominal, Negative Ground
Channel Resolution:	Multiples of 5.0 KHz or 6.25 KHz
Frequency Range:	136-162, 146-174 MHz
RF Power Output:	40 Watts typical, for U. S. 30 Watts, Canada (EIA)
Receive Current	
at Rated Audio:	1.8 A
Transmit Current	
at Rated Power:	8 A (at 30 Watts)
Standby Current:	1 A

TRANSCEIVER DIMENSIONS AND WEIGHT

	Front Mount	Remote Mount
Length mm (inches)	291 (11.5)	295 (11.6)
Width mm (inches)	179 (7.0)	179 (7.0)
Height mm (inches)	51 (2.0)	51 (2.0)
Weight kg (lb)	3.7 (8.0)	4.0 (8.1)

CONTROL HEAD DIMENSIONS AND WEIGHT

Length (depth) mm (inches)	61.5 (2.4)
Width mm (inches)	179 (7.0)
Height mm (inches)	51 (2.0)
Weight (with microphone) kg (lb)	1.22 (2.9)
Speaker Weight kg (lb)	.77 (1.7)

TRANSMITTER (specifications at 30 Watts output)

Output Impedance:	50 ohms
Frequency Stability:	$\pm 0.0005\%$; optional $\pm 0.0002\%$ From -30°C to $+60^{\circ}\text{C}$ ambient ($+25^{\circ}\text{C}$ reference)
Spurious and Harmonics:	85 dB below carrier
Modulation:	(16F3) ± 5 KHz
Audio Sensitivity:	80 mV nominal for 60% system deviation
FM noise:	50 dB
Audio Response:	$+1/-3$ dB from 300 to 3000 Hz
Audio Distortion:	3% at 1000 Hz at 60% deviation
Frequency Separation:	26 or 28 MHz

RECEIVER

Audio Output:	EIA: 5 Watts at 3% distortion
Input Impedance:	50 ohms
EIA Modulation	
Acceptance:	± 7 KHz
Frequency Stability:	$\pm 0.0005\%$; optional $\pm 0.0002\%$ From -30°C to $+60^{\circ}\text{C}$ ambient ($+25^{\circ}\text{C}$ reference)
Receiver Channel	
Spacing:	30 KHz or 25 KHz (EIA)
Sensitivity	
(20 dB Quieting):	0.35 μV
EIA SINAD:	0.28 μV
Selectivity:	90 dB (30 KHz spacing) 85 dB (25 KHz spacing)
Intermodulation:	80 dB
Spurious and	
Image rejection:	85 dB
Squelch Sensitivity:	Carrier squelch (fixed): 10 dBQ Tone coded squelch (fixed): 6 dBQ Digital coded squelch (fixed): 6 dBQ
Frequency Separation:	12 MHz
	Note: Receiver separation of up to 20 MHz possible with some performance degradation.

VIBRATION AND SHOCK METHODS

TEST: Vibration	
Standard:	MIL810D
Method:	514.3
Procedure:	Curve NAVMAT P-9492
Radio	
Performance:	Meets or exceeds published specifications following vibration.
TEST: Shock	
Standard:	MIL810D
Method:	516.3
Procedure:	III
Radio	
Performance:	Meets or exceeds published specifications following shock.

Figure 1-3 Performance Specifications for the MCX1000 Radio



MOTOROLA LIMITED

Communications Division

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

2.1 OVERVIEW OF THE RADIO

2.1.1 GENERAL DESCRIPTION

The MCX1000 is a multiple frequency, multiple zone capable, synthesized FM mobile radio. It is a 30/40 watt radio, available in the VHF frequency range of 136 to 174 MHz and in the UHF frequency range of 403 to 430 MHz. and 440 to 470 MHz. MCX1000 is available in front mount (Figure 1), remote mount (Figure 2) or base station (Figure 3) configurations.

The radio has an eight character vacuum fluorescent alpha-numeric display. Modes*, zones*, codes and tones can be named with such titles as "FIRE", "POLICE", etc., or whatever best communicates to you the meaning of that mode.

The MCX1000 uses an EEPROM (Electrically Erasable Programmable Read Only Memory Device). This enables the personality of the radio to be changed in the field. For example, mode names may be redefined, frequencies added, deleted or changed, or other radio characteristics altered.

* In any discussion involving the MCX1000 Radio, the terms "mode" and "zone" are often used. Their definitions follow.

MODE- A mode consists of a Transmit or Receive frequency plus a collection of personality parameters; i.e. PL/DPL codes, slaved singletone, busy mode lockout, alphanumeric mode name. The word "channel" is often used synonymously with the word "mode" though the correct definition of "channel" is only a transmit and receive frequency that does not carry personality parameters.

ZONE- A zone is a collection of modes often used for geographical grouping.

2.1.2 ELECTRICAL CHARACTERISTICS

The MCX1000 radio has excellent transmitter and receiver performance specifications and a sophisticated channel scan monitoring system. Accelerated Life Testing (ALT) of radio sets in the design stage helps to ensure reliability.

The MCX1000 incorporates the latest in advanced surface mount microprocessor technology. The radio is capable of combining Private-Line, Digital Private-Line and Carrier Squelch modes all in one radio model. Digital capable models of the MCX1000 are available to provide a radio capable of handling Securecom voice encryption. The radio's design is flexible enough to allow changes to its option package as your communication needs grow and evolve. Finally, the Digital MCX1000 is able to handle high speed data transmissions.

2.1.3 MECHANICAL CHARACTERISTICS

The radio has a die cast metal chassis. Top and bottom covers are constructed from aluminum. The control head is made of a polycarbonate compound able to withstand the toughest environments as well as temperature extremes. The radio has the ability to survive MIL Std 810C and 810D for shock and vibration.

The modular construction of the MCX1000, the simple mechanical design of its parts, and the ease with which the radio can be assembled translates into reduced down time and reduced servicing costs.

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

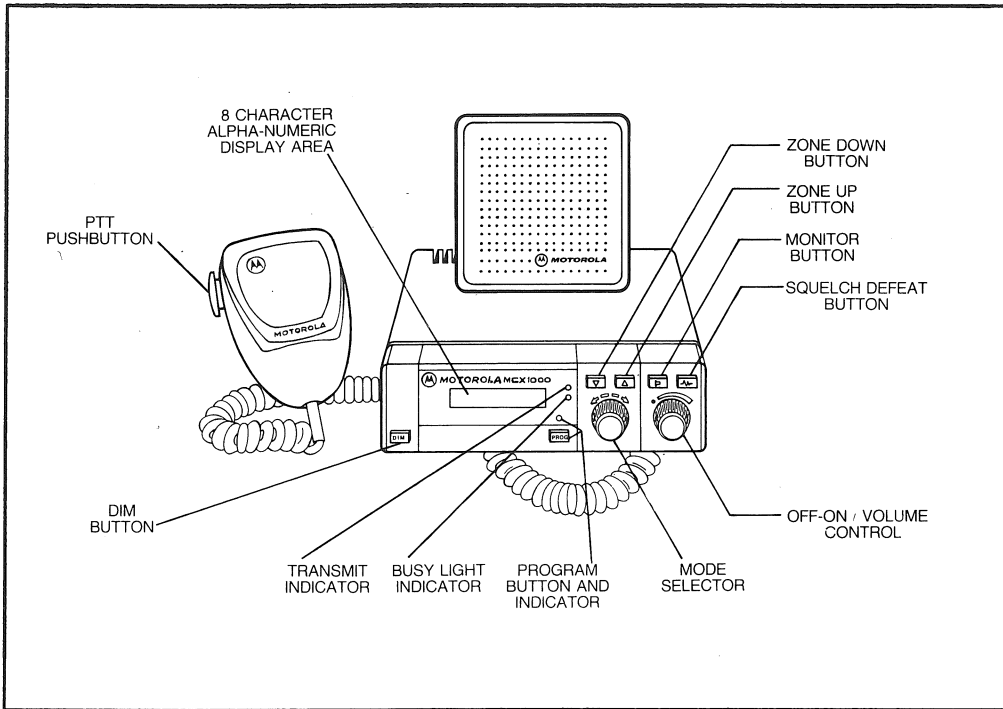


Figure 2-1 Front Mount MCX1000 Radio

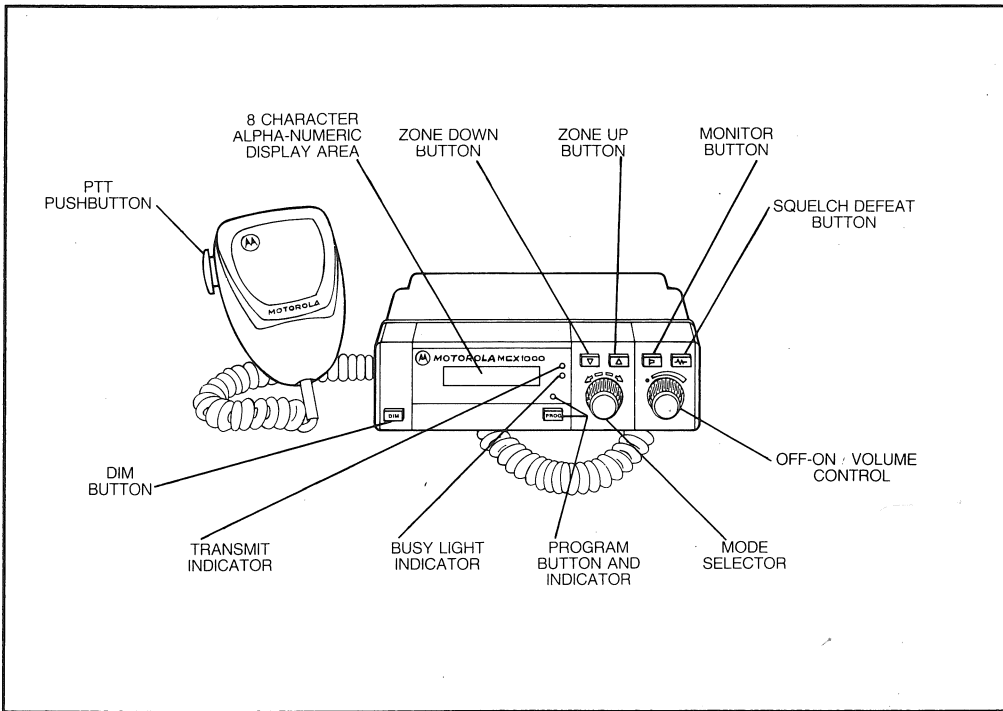


Figure 2-2 Remote Mount MCX1000 Control Head

2.1.4 MCX1000 STANDARD RADIO OFFERING

MCX1000 is available in the following model configurations:

- VHF or UHF
- Front Mount or Remote Mount
- 56 mode/8 zone or 128 mode/24 zone
- Non-Digital or Digital capable modulation

All Models

All MCX1000 mobile radio models come standard with the following:

- 8 character alph-numeric display
- Transmit indicator
- Busy Light Indicator
- Squelch Button
- Monitor Button
- Dim Button
- Rotary Volume and Mode Controls
- Zone Up and Down Buttons
- Program Button and Indicator
- 30/40 watts power output
- 56 mode/8 zone OR 128 mode/24 zone capability (depending on model ordered)
- Multiple coded squelch capability accomodating Carrier Squelch, PRIVATE-LINE and DIGITAL PRIVATE-LINE in one radio model
- 60 second duration Time-Out-Timer
- Broad transmit and receive bandwidths
- EEPROM field reprogramming capability
- Survives MIL Std 810C and MIL Std 810D for shock and vibration

- Operates from a 12 VDC negative ground
- User programmability from the front panel (Program Button)
- Microphone with hang-up clip
- Unity gain 1/4 wave antenna
- Mounting tray and hardware
- Owner's manual- English

Front Mount Models

- Speaker with 8 ft. (2.4 meter) cable
- 10 ft. (3.0 meter) negative ground cable kit

Remote Mount Models

- Control Head with 17 ft. (5.2 meter) plug in cable
- Speaker with 17 ft. (5.2 meter) cable
- 18 ft. (5.5 meter) negative ground cable kit

MCX1000 Options

Options are listed in point form below. For a description of these options, refer to Section 2.6 in this manual.

OPTIONS INTERNAL TO THE RADIO

- Omit user programming from the radio's front panel
- 2 ppm stability
- Fast lok synthesizer
- Lower Range VHF, 136 to 162 MHz.
- Omit Time-Out-Timer
- Non-standard Time-Out-Timer
- Omit Alert Tone

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

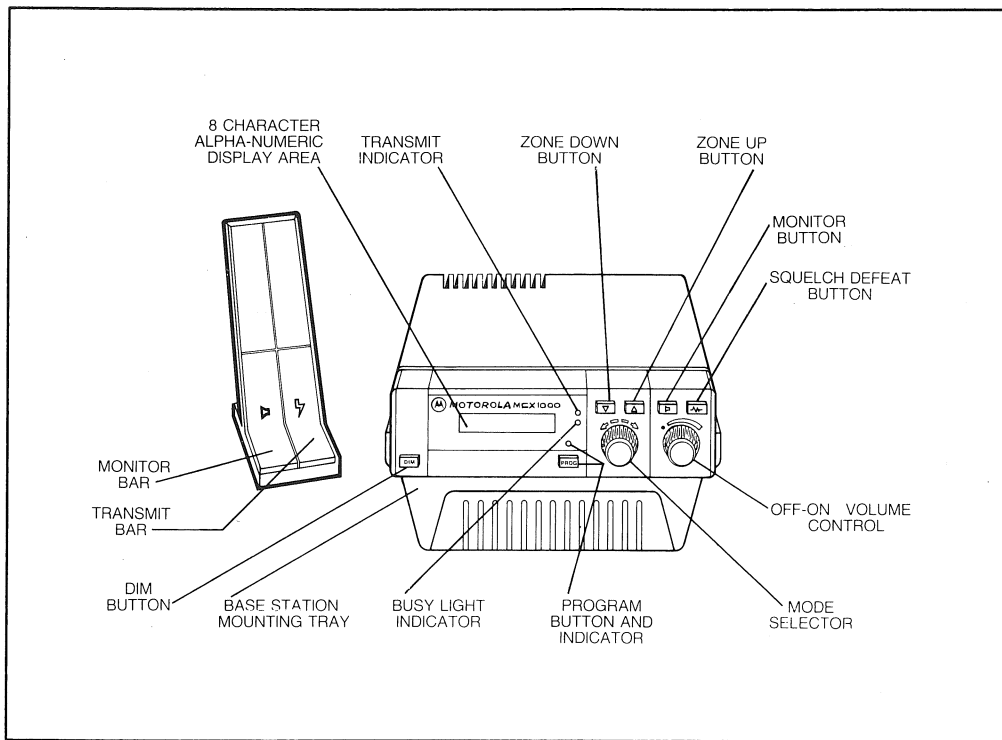


Figure 2-3 MCX1000 Base Station

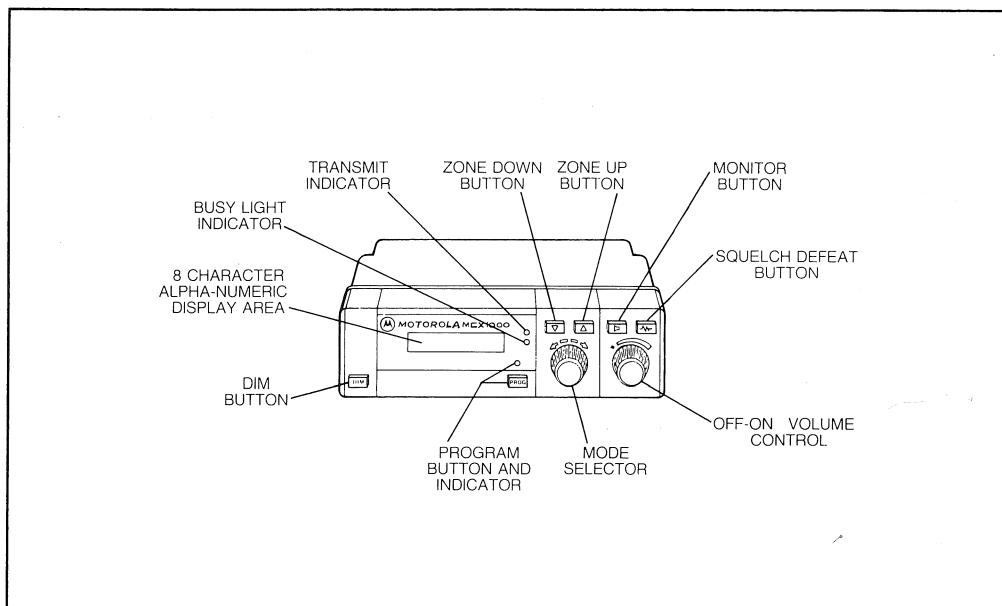


Figure 2-4 Standard MCX1000 Radio Controls

- Disable Lighting

Scan Options

- Operator selectable scan
- Add 2 level priority
- Priority to follow mode selector switch
- Omit spontaneous priority

Singletone Signalling

- Singletone to follow mode selector switch
- Selectable singletone
- Dual singletone
- Singletone with non-standard duration

PL/DPL Signalling

- Selectable PL/DPL
- Transmit Inhibit on Busy Mode

MDC Signalling

- Unit Identification and Emergency Alert (MDC1200 and MDC600)
- Emergency Alert activated by pushbutton on control head
- Emergency Alert activated by hidden pushbutton
- Emergency Alert activated by hidden footswitch

General

- 56 Mode Operation (UXA models only)
- Railroad Requirement (UXA models only)

Encryption

Voice encryption is available for the Digital MCX1000 Radio in several option configurations. Refer to Section 2.7 for a description of the encryption options.

OPTIONS AND ACCESSORIES EXTERNAL TO THE RADIO

- Base station operation
- Omit base station power supply and cables
- DTMF microphone
- Spare control head
- Omit antenna, cable and connectors
- Broadband antenna
- Omit mobile microphone
- Omit speaker
- Omit battery cable
- Omit mounting tray and installation kit
- Omit all accessories
- Mounting tray with right hand lock
- Hinged mounting bracket
- Security Housing
- Ignition switch transmitter control
- Remote mounting kit
- Service Manual

2.2 OPERATING INSTRUCTIONS

2.2.1 STANDARD MCX1000 CONTROLS

Figure 2-4 illustrates the controls that are standard on every MCX1000 Radio. A brief description of each of the standard controls is included below.

Alpha-Numeric Display Area

The alpha-numeric display is capable of displaying up to 8 characters, and will show all 26 letters (upper case only) and numbers (0-9 inclusive).

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

Busy Light Indicator

This indicator is lit whenever there is a carrier present on the selected mode

Transmit Indicator

This indicator is lit whenever the transmitter is keyed.

Zone Select Buttons

The Zone Buttons are used to move radio operation from one zone to another. Initially the factory programs the radio so that the zone names displayed are ZONE A, ZONE B etc. The first time either of the zone buttons is pressed, the radios display changes from showing the name of the "mode" it is operating on to the name of the "zone" it is currently operating in. Pressing the Zone Up Button a second time within three seconds causes the radio to advance one zone and display the new zone name. (If the Zone Up Button is pressed and held, the radio and its display advance through zones at a rate of three zones per second.) The Zone Down Button works in the opposite manner. An audio tone will be heard as the radio changes from one zone to another. The zone name being displayed will revert back to the mode name in 3 seconds, or will revert immediately when the mode selector switch is rotated.

Monitor Button

Pushing the Monitor Button will cause the radio to show the status of the PL or DPL operation in the display. If PL or DPL is enabled, the display will show "MON OFF". If PL or DPL is disabled to monitor the channel activity, the display will show "MONITOR". Pressing the Monitor Button a second time within three seconds will change the PL or DPL status. In addition, an audio tone will be heard to acknowledge the change in PL or DPL status.

Squelch Defeat Button

If the radio is squelched, pushing the squelch button will cause the radio to become unsquelched. The radio audio will remain unsquelched until the squelch button is again pushed. This is useful for setting speaker volume.

Off/On Volume Rotary Control

This control is used to turn the radio ON and OFF and to set the volume. Fully counter-clockwise is OFF; the volume is increased with clockwise rotation. Information which has been programmed from the front panel will be retained in the radio memory when the radio is turned off.

Mode Selector Rotary Control

Turning the Mode Selector Switch will cause the mode and the mode name in the radios display to change. Initially the factory programs the radio so that the mode names displayed are MODE 1, MODE 2 etc. The selector has no end stop, and an audio tone is heard when the last mode is passed and the rotary sequence is repeated.

Program Button

This button is used to place the radio in the program mode of operation; ie., when the radio is to be reconfigured from the front panel. The Program button is used to initiate the assignment of modes to zones and the configuring of scan lists within zones. (See Section 2.3 for further information). It is also used to temporarily delete a mode from the scan list while the radio is scanning.

If the Omit User Programming From the Front Panel option is ordered, the Program button cannot be used as described above. Alternatively, Service Programming may limit this buttons use to either initiate the assignment of modes to zones or configure the scan lists within zones.

Program Indicator

This LED is lit whenever the radio is in the programming mode of operation.

Dim Button

This button is used to alter the light intensity of the display. Consecutive pushes of the DIM Button will step the display panel through three light intensities ; BRIGHT, DIM and DIMMEST. The addition of a fourth light intensity (OFF position) is an option on the MCX1000. This OFF position turns off the display panel as well as the backlighting of all buttons on the radio. The

Disable Lighting option may be useful when the radio is being used in a surveillance application.

2.2.2 TO TURN THE RADIO ON

Turn the off-on/volume control clockwise until a click is heard. Depending on the installation, you may also be required to turn on the ignition switch of your vehicle.

2.2.3 TO RECEIVE

Use the following sequence to set the volume control of your radio to a comfortable listening level.

1. Turn the radio on.
2. If no audio is heard, press the squelch button.
3. Adjust the volume control to the desired level.
4. Press the squelch button again to again mute the audible background noise.

Note- For Digital MCX1000 Radios with Encryption: If the incoming message is encrypted with a key that is different from the radio key, noise will be heard from the speaker. In radios equipped with the Proper Code option, the noise will not be heard unless the microphone is off-hook or the Monitor function enabled.

2.2.4 TO TRANSMIT

NOTE

For mobiles equipped with the "Ignition Switch Transmitter Control" option, the transmitter cannot be operated unless the vehicle ignition switch is turned on.

Non-digital MCX1000 Radios

1. Before starting transmission, monitor all traffic on the selected mode to ensure that it is not in use. In order to monitor with a PL/DPL radio, remove the mobile microphone from its hang up clip or push the monitor button, or depress and hold the monitor bar on a base station microphone.
2. If the mode is clear, you may transmit your

message. To do this, hold the microphone approximately 2 inches from your mouth, depress and hold the push-to-talk (PTT) button (or Transmit bar on base stations), and speak into the microphone. The Transmit Indicator lights. After finishing your message, release the PTT pushbutton to receive a reply.

3. After completing the call, place the mobile microphone in the microphone hangup clip. For base stations, depress the Monitor paddle to resume scanning.

Digital MCX1000 Radios with Encryption

CLEAR/CODED SELECT BUTTON SYMBOL



1. Press the Clear/Coded Select Button to choose either clear voice or encrypted voice operation. The word "CLEAR" or "CODED" appears on the display. Also, the Clear/Coded Indicator lights when coded operation is selected. On models with the Dual Code option, select the desired code for transmitting by pressing the Code Select Button (1\2). The word "CODE 1" or "CODE 2" appears on the display for one second. The Code Select Indicator lights when you have selected code 2.
2. Before starting transmission, monitor all traffic on the selected mode to ensure that it is not in use. Remove the mobile microphone from its hangup clip or depress the Monitor bar on the base station microphone. If the mode is clear, you may transmit your message.
3. Hold the microphone approximately 2 inches from your mouth, depress and hold the push-to-talk (PTT) pushbutton (or Transmit bar on base stations) and speak into the microphone. The Transmit Indicator lights. On dual code radios, the selected code, "CODE 1" or "CODE 2", is displayed for one second when the transmitter is keyed. The transmitted audio is either encrypted or non-encrypted, depending upon the selected operation. If the transmitted audio of an encryption capable radio is non-encrypted, a short tone or beep is heard immediately after the microphone is keyed. After finishing your message, release the PTT pushbutton to receive a reply.

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4. (Mobile units only) After completing the call, place the microphone in the microphone hangup clip.

2.2.5 TO TURN RADIO SET OFF

Turn the off-on/volume control completely counterclockwise until a click is heard. (In mobile installations in which the green wire is connected to the accessory side of the ignition switch, the radio may also be turned off by turning off the vehicle ignition switch).

2.2.6 OPTIONAL MCX1000 CONTROLS

Scanning Controls

OPERATOR SELECTABLE SCAN (See Figure 2-5)

To Operate Scan Function.

If you are already operating in the zone you wish to scan:

1. Make sure that the microphone is in the hangup clip (on hook). Press the SCAN button. The word "SCANNING" will appear on the display, the Scan indicator will light, and the receiver will commence scanning all modes in the scan list of the zone.

2. When an active mode with the correct signalling code is detected, the scanner stops, the alpha-numeric display indicates this mode, and the operator hears the call. To respond to the call, lift the microphone off-hook during the call or within 2

seconds of the end of the call. If the microphone is not lifted off-hook within this time period, the radio resumes scanning.

3. With the microphone off-hook, converse in the normal manner. At the end of the conversation, place the microphone on-hook. The radio will resume scanning.

4. It is possible to temporarily delete a mode from the scan sequence because of annoying heavy traffic. While the scanner is on and stopped on the mode to be deleted (microphone on-hook), press the PROG (program) button. The scanner will now skip that mode until the scanner is turned off or the microphone is taken off-hook. Other modes may be deleted as required until there is only one mode remaining.

If you are not already in the zone you wish to scan:

Using the Zone Up or Zone Down buttons, move to the zone you wish to scan as indicated by the alpha-numeric display. The zone name will remain on the display for 3 seconds, and then the display will change to the last selected mode in the zone. Then perform steps 1, 2, 3 and 4 just discussed above.

TWO LEVEL PRIORITY SCAN (See Figure 2-6)

If your radio is equipped with priority scan and the scanner is turned on, a call on the first level priority mode overrides any other call that you are listening to, and a call on a second level priority mode overrides any call except a first level priority

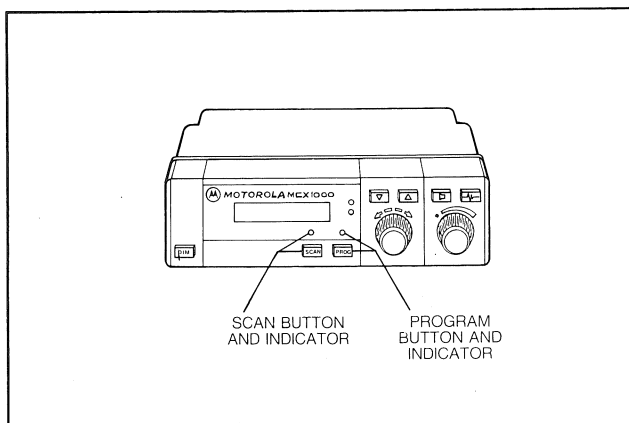


Figure 2-5 MCX1000 Scan Radio

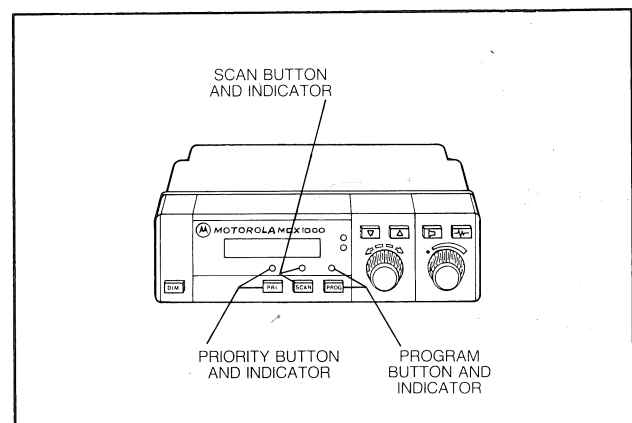


Figure 2-6 MCX1000
with Two-Level Priority Scan

call. When this occurs, the Priority indicator lights, the radio's display shows the name of the priority mode, and an alert tone is heard in the speaker, followed by the verbal priority message. **NOTE:** The Priority indicator will flash if the message received is on the second level priority mode. If the message received is on the first level priority mode, the Priority LED will light continuously.

With priority scan (unless MBB316 "Omit Spontaneous Priority" has been ordered), the last mode transmitted on is temporarily assigned to the second level priority status. The reassignment lasts for a period of 60 seconds after the microphone is placed on hook. The reassignment period assures that the operator hears any follow-up messages.

Your radio can be routed to its first level priority mode within a zone quickly and easily when you are not scanning or when the microphone is "Off Hook". To access your first level priority mode, push the PRIORITY button. The radio and its display immediately moves to the first level priority mode and a tone is heard. If there is no first level priority mode, the radio moves to the second level priority mode, and a tone is heard.

2.2.7 SELECTABLE PL/DPL

Up to 16 (56 mode, 8 zone models) or 32 (128 mode, 24 zone models) PL/DPL codes may be selected on the MCX1000. To change the PL/DPL code of an MCX1000 radio, the shaded arrow buttons on the radios front panel are employed. (See Figure 2-17. Note that these button locations change when radios have the encryption option.) Use these buttons to call up the desired PL/DPL code. Codes will be shown on the radios alphanumeric display. When at the desired code, simply wait 3 seconds for the radios display to revert back to showing the mode name. This 3 second wait can be avoided by turning the Mode Selector switch one notch in either direction so as to call up the mode name immediately. The radio now carries the new PL/DPL code.

2.2.8 SINGLETONE SIGNALLING

Singleton to Follow Mode Selector Switch
(See Figure 2-14)

A single one second encode tone is transmitted from the radio when the Singleton

button (marked with a musical note) on the radios front panel is pushed. Holding the Singleton button depressed beyond the one second timed interval causes the radio to transmit the singleton for as long as the button is depressed.

Selectable singleton
(See Figure 2-15)

Up to 10 (56 mode, 8 zone models) or 32 (128, 24 zone models) encode tones may be selected for transmission on the MCX1000. A singleton is selected through a sequence of button pushes involving the Program button (see Programming Selectable Singleton). By depressing the Singleton button (marked with a musical note) on the radios front panel, the selected tone is transmitted. The standard transmission time is one second. Holding the Singleton button depressed beyond the one second timed interval causes the radio to transmit the singleton for as long as the button is depressed.

Dual Singleton (See Figure 2-16)

An MCX1000 Radio having the Dual Singleton option is capable of transmitting two independent encode tones by means of the "1" or "2" buttons on the radios front panel. To send a Singleton transmission, the desired tone button is pressed. The standard transmission time is one second. Holding a Dual Singleton button depressed beyond the 1 second timed interval causes the radio to transmit the Singleton for as long as the button is depressed.

2.2.9 MDC SIGNALLING

MDC1200 and MDC600 Signalling - Unit Identification and Emergency Alert

Each time the Push-to-talk button on the microphone is depressed, a specific pre-programmed burst of data is transmitted to the base station, identifying the radio unit.

MDC Signalling - Emergency Alert Activated by a Pushbutton on the Control Head
(See Figure 2-18)

Pressing the unlabeled "Emergency" button on the radios front panel sends a silent data burst

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

to the base station informing it of the radios identity and emergency status. The red emergency indicator and the PTT indicator are both illuminated to indicate that the message is being transmitted.

MDC Signalling - Emergency Alert Activated by a Hidden Pushbutton

Activating a hidden pushbutton sends a silent data burst to the base station informing it of the radios identity and emergency status. So that attention is not drawn to the radio, with this option the red emergency indicator and the PTT indicator are not illuminated while the emergency data signal is being transmitted.

MDC Signalling - Emergency Alert Activated by a Hidden Footswitch

Activating a hidden footswitch sends a silent data burst to the base station informing it of the radios identity and emergency status. So that attention is not drawn to the radio, with this option the red emergency indicator and the PTT indicator are not illuminated while the emergency data signal is being transmitted.

2.3 PROGRAMMING THE RADIO FROM THE FRONT PANEL

Programming the MCX1000 radio is initiated by pressing the "PROG" button on the radio's front panel. (See Figure 2-4) In response, the PROG indicator will light. The next step involves pushing the function button you wish to program i.e., "Zone", "Scan" or "Singletone". The programming of each of these functions shall be described individually.









NOTE

While being programmed, the radio will transmit or receive messages on the currently selected mode.

NOTE

When in the normal mode of operation, only those zones which have mode content can be accessed. When in the programming mode, all of the radio's zones can be accessed.

In the following programming procedures, reference is made to buttons on the radios front panel. Below is a summary of the front panel button symbols.

ZONE UP BUTTON	
ZONE DOWN BUTTON	
SINGLE TONE BUTTON	
PL/DPL UP BUTTON	
PL/DPL DOWN BUTTON	
ENCRYPTION BUTTON	
MONITOR BUTTON	
SQUELCH DEFEAT BUTTON	

Front Panel Button Symbols

The charts on the following pages describe the three front panel programming procedures as follows :

●Zone Programming Instructions

Modes are grouped into Zones by following the Zone Programming Instructions. Zones may define geographical operating areas, or be used for grouping special types of modes such as those equipped for placing telephone calls. Each Zone can have a unique 8 digit alphanumeric name. Initially the Zone names are "ZONE A", "ZONE B" etc.

●Scan Programming Instructions

Within the set of Modes which have been grouped into a Zone, specific Modes can be selected to be scanned. This selection is made by programming from the front panel by following the Scan Programming Instructions.

●Selectable Singletone Programming Instructions

ZONE PROGRAMMING INSTRUCTIONS
(FOR PROGRAMMING FROM THE RADIO FRONT PANEL)

INSTRUCTION		RADIO'S RESPONSE
Step 1	Press the PROG button.	PROG indicator lights.
Step 2	Press the Zone Up or Zone Down button.	"PROGZONE" appears momentarily on the display followed by the zone name (appears in a flashing state).
Step 3	Use the Zone Up or Zone Down button to access the zone you wish to program.	The name of the zone to be programmed appears flashing in the display. A tone is heard each time the zone is changed.
Step 4	Rotate the Mode Selector switch to select the mode to be programmed into the zone.	The mode appears flashing in the display if not currently in the zone; the mode will appear steady (not flashing) if currently in the zone.
Step 5	To add a mode which is currently not in the zone (i.e. the mode display is flashing), press either the Zone Up or the Zone Down button once.	Mode name changes from flashing to steady and is added to the zone.
	To remove a mode which is currently in the zone (i.e. the mode display is steady), press either the Zone Up or Zone Down button once.	Mode name changes from steady to flashing and is removed from the zone.
Step 6	Rotate the Mode Selector to select another mode to be added or removed from the zone and repeat Steps 5 and 6 until the zone has been programmed.	
Step 7	Once programming of the zone is complete, press PROG button to exit from programming.	PROG indicator will go off. The zone name will appear on the display for 3 seconds followed by the last selected mode name.
Step 8	Repeat Steps 1 through 7 to program additional zones if required.	

NOTE:

If all modes are removed from a zone, that particular zone cannot be selected with the Zone Up or Zone Down buttons except when programming the radio.

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SCAN PROGRAMMING INSTRUCTIONS
(FOR PROGRAMMING FROM THE FRONT PANEL)

	INSTRUCTION	RADIO'S RESPONSE
Step 1	Turn the scanner off by pressing the SCAN button.	Scan indicator turns off.
Step 2	Use the Zone Up or Zone Down button to access the zone whose scan you wish to program.	The name of the zone whose scan list you wish to program appears in the display for 3 seconds followed by the currently selected mode.
Step 3	Press the PROG button followed immediately by the SCAN button.	"PROGSCAN" appears momentarily on the display followed by the zone name. The zone name appears for 1 second followed by the name of the last selected mode in the zone.
Step 4	Rotate the Mode Selector switch to select the mode which you plan to add or remove from the scanning sequence.	<p>The Scan indicator will light if this mode is in the scan list; the Scan indicator will not light if this mode is not in the scan list.</p> <p>NOTE: For radios with MBB424 "Add 2 Level Priority" - if the mode is the first level priority mode, the Priority indicator will light steadily; if the mode is the second level priority mode, the Priority indicator will flash.</p>
Step 5	<p>The SCAN button is used to toggle the selected mode in or out of the scan list as indicated by the Scan indicator.</p> <p>if Scan indicator is off, press the SCAN button.</p> <p>if Scan indicator is on, press SCAN button</p> <p>NOTE: If the radio is equipped with MBB424 "Add 2 Level Priority", the PRI button can be used to add a mode to the scan list as well as designate its priority status.</p>	<p>Scan indicator on, mode added to scan list</p> <p>Scan indicator off, mode removed from scan list.</p>

CONTINUED ON NEXT PAGE

SCAN PROGRAMMING INSTRUCTIONS
(FOR PROGRAMMING FROM THE FRONT PANEL)

INSTRUCTION		RADIO'S RESPONSE
Step 5. Continued	<p>if Scan indicator is off, press PRI button once.</p> <p>if Scan indicator is off, press PRI button twice.</p> <p>NOTE: The PRI button, when pressed, sequences the priority status of the selected mode through three states, Priority 1, Priority 2, and non-priority. There can only be one Priority 1 and one Priority 2 mode assigned in a zone.</p>	<p>Scan indicator and Priority indicator on, mode entered in scan list and designated Priority 1.</p> <p>Scan indicator on and Priority indicator flashing, mode entered in scan list and designated Priority 2.</p> <p>If priority (first and second) is already assigned, pressing the PRI button will have no effect (but a tone will be heard). You must first remove the priority status on the other programmed mode before priority can be reassigned to a new mode.</p> <p>If only one level of priority has been assigned (first or second) to another mode, pressing the PRI button will alternate between two states; non-priority and the unassigned priority level only.</p>
If more Scan Program changes are required:	Repeat Steps 4 and 5 until the scan list for the selected zone is complete.	
If Scan Programming is required in other zones:	Repeat Steps 3 through 6 to program scan lists in other zones.	
To complete:	<p>Once the scan list for the zone is complete, press the PROG button to exit from programming.</p> <p>NOTE: Scan lists and priority assignments can be programmed while programming a zone by performing Step 5, above, immediately after Step 5 in "Programming a <u>Zone</u>"</p>	Program indicator goes off; radio and display reverts back to last mode used.

SELECTABLE SINGLETONE PROGRAMMING INSTRUCTIONS
(FOR PROGRAMMING FROM THE FRONT PANEL)

	TO CHANGE THE SINGLETONE	RADIO'S RESPONSE
Step 1	Press the PROG button.	Program indicator lights.
Step 2	Press the SELECTABLE SINGLETONE button. (See Figure 2-15)	"PROGTONE" appears momentarily in the display followed by the name of the last singletone selected. If no singletone has been previously selected, the name of the first selectable singletone programmed into your radio will appear .
Step 3	Use the Mode Selector to select the singletone you wish to send.	The singletone name will appear in the display.
Step 4	Press the PROG button to exit from programming.	Program indicator turns off. Radio and display revert back to last mode used.
To Operate:	Press SELECTABLE SINGLETONE button to send singletone.	Singletone transmission is heard.

2.4 INSTALLATION

2.4.1 FRONT MOUNT RADIO SETS

1. Depending on the option ordered, front-mount radios may be mounted using either standard or optional trays alone or in conjunction with a floor mounting adaptor (refer to Figure 2-7).
2. If a tray is used alone, mount it securely by means of the four (10 X 3/4") screws provided.
3. If a tray is used with a mounting adaptor, first mount the adaptor, using the four (10 X 1-1/2") screws provided. After mounting the adaptor, adjust its angle as desired and then mount the tray on the floor-mounting adaptor, using the studs to align the fixture; four mounting screws are provided.
4. Install the radio into the mounting tray (depending on the type of tray ordered) using either the two mounting screws or the latches.

2.4.2 REMOTE-MOUNT RADIO SETS

1. Mount the control head in the desired spot, using the mounting bracket provided.

2. Install the mounting tray at the desired location, using the four (10 X 3/4") screws provided.

3. Install the remote transceiver into the mounting tray, using either the mounting screws or latches (depending on the tray ordered).

4. Route the cable assembly from the control head to the transceiver; insert the cable connector into its mate on the transceiver and secure the connector using the screws provided.

2.4.3 ALL MODELS

1. Install the loudspeaker in the desired location and connect it to the transceiver.
2. For mobile units, mount the microphone hangup clip at the selected position. (See Note following.) For base station applications, the base microphone should be directly connected to the front of the unit.
3. Mount the antenna and route the coaxial cable to the radio set.
4. Install the dc power cable in accordance with the instructions provided in Figures 2-8 through 2-12. MBB113 is the "Ignition Control of PTT" option.

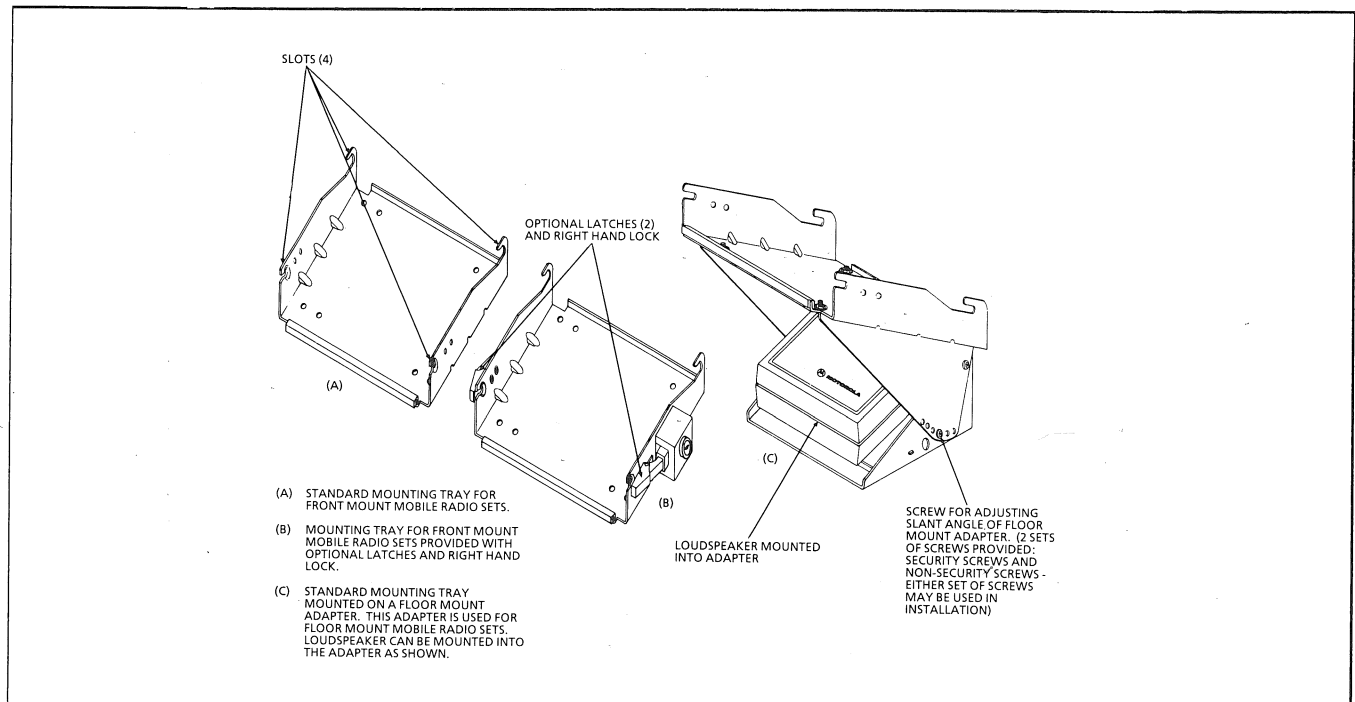


Figure 2-7. Mounting Trays and Floor Mounting Adapter

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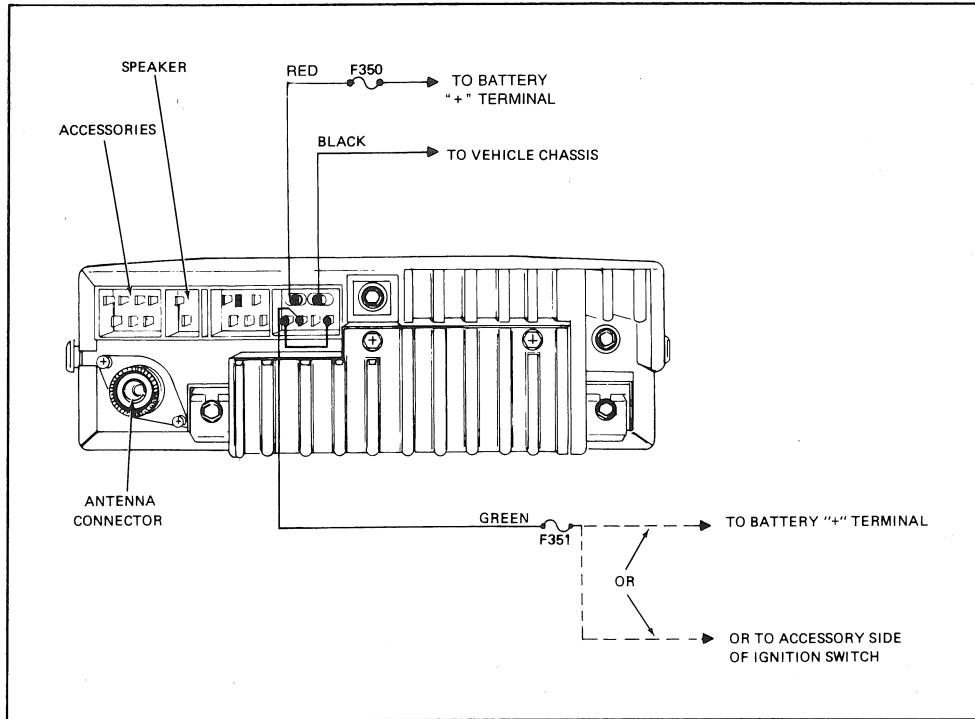


Figure 2-8 Power Lead Connections for Mobile Radios (Without the MBB113 Option)

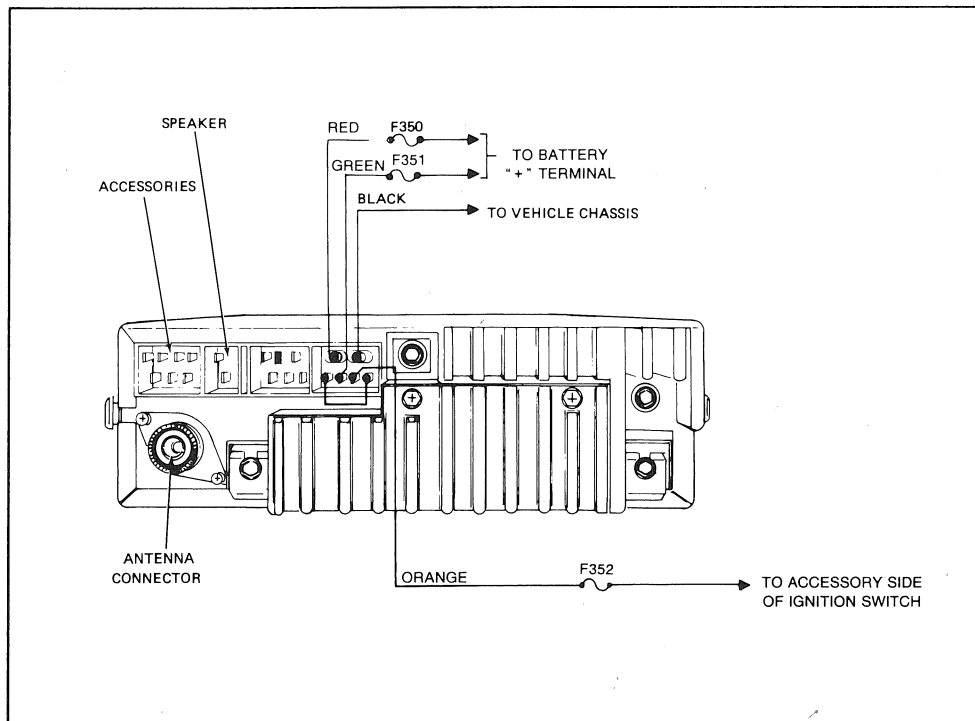


Figure 2-9 Power Lead Connections for Mobile Radios with the MBB113 Option

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

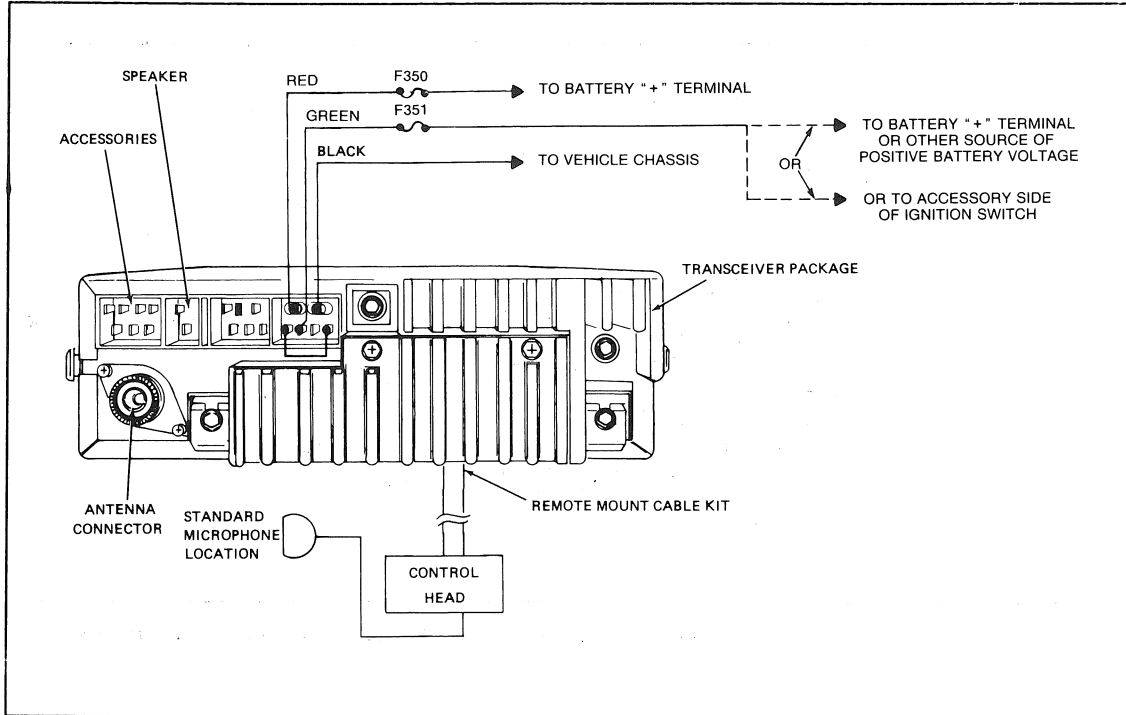


Figure 2-10 Power Lead Connections for Remote Mount Radios (Without the MBB113 Option)

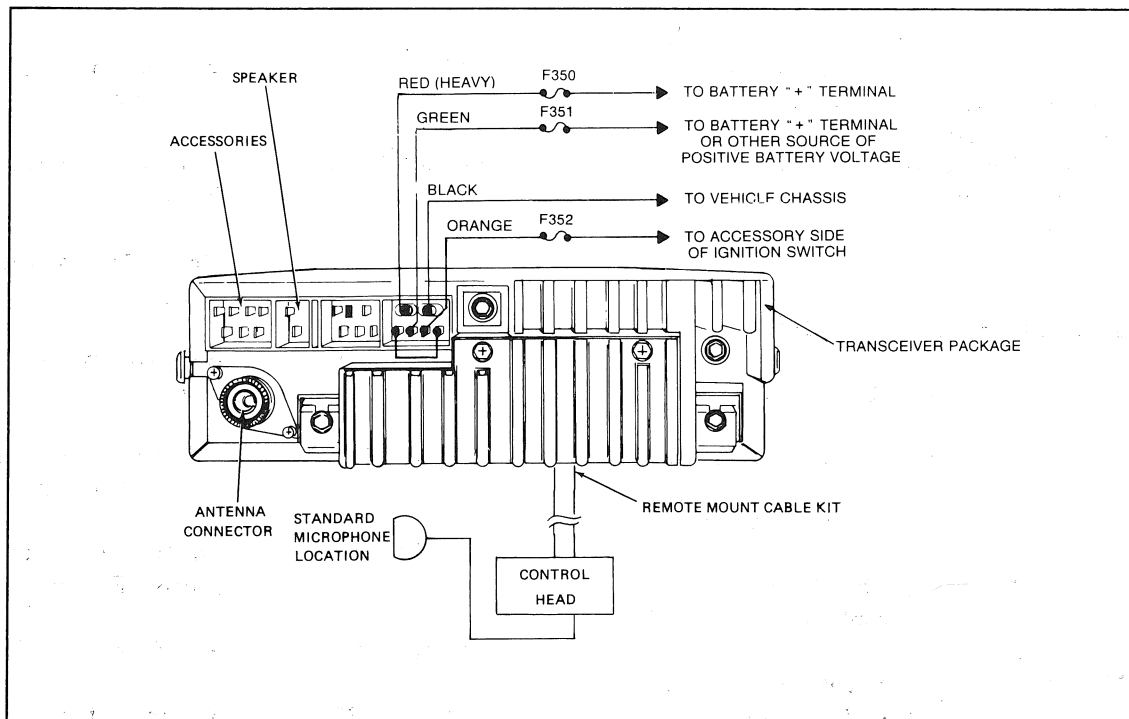


Figure 2-11 Power Lead Connections for Remote Mount Radios with the MBB113 Option

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

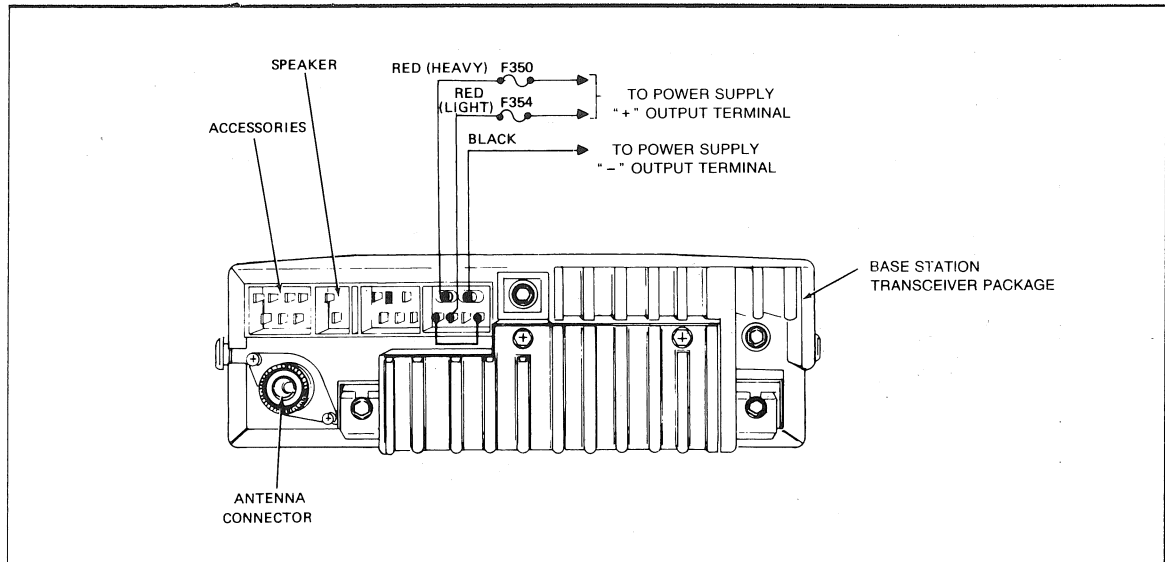


Figure 2-12 Power Lead Connections for Base Station Applications

NOTE:

If the hangup clip is not mounted on a grounded metal surface, connect the supplied wire from the hangup clip to a car chassis ground. **The hangup clip must be electrically grounded to operate the OFF-HOOK function of the microphone.**

VKN4139

Main radio cable 8 ft with connector (control head to radio)

VKN4140

Main radio cable 17 ft with connector

MBTKN8158

Mobile 10 ft power cable and fuses

VKN4151

Mobile 18 ft power cable and fuses

MBTKN8199

Base 10 ft power cable and fuses

MBTKN8160

Ignition switch transmitter control-Front mount

MBTKN8197

Ignition switch transmitter control-Remote mount

MBTRN4675

Standard mounting tray

MBTRN4679

Mounting tray with right hand lock

VLN4777

Hinged mounting bracket

V1022

Spare Control Head

2.5 LIST OF ACCESSORIES

MODEL #	DESCRIPTION		
VMN1016	Standard palm microphone		
VMN1017	DTMF microphone		
VMN1018	Base station desk top microphone		
MBTSN6032	Standard 5 Watt speaker with 17 ft cable		
MBTRN4898	Mounting tray with built-in speaker		
VPN1013	Power Supply, 120 V AC		

MBTRN4671	Tuning Tool
MBTRN4778	Tuning Probe Adaptor

vehicles are polled and rapid receiver and transmitter turn on response is required.

Field Retrofit Kits

Field retrofit kits are available from Motorola that allow digital versions of the MCX1000 Radio to be converted to voice encryption operation. For more information on the available encryption options, see Section 2.7 in this manual.

2.6 DESCRIPTION OF RADIO OPTIONS

2.6.1 GENERAL OPTIONS

MBB978 Omit User Programming From the Radios front Panel

This option makes programming of the radio by its user from the radio's front panel impossible. The user would be unable to change the modes included in a zone and the modes that are scanned. The program button would not appear on the front panel of the radio. Should this option be ordered, a field programmer would be required to reprogram the radio. If selectable singletone is included in the radio, the program button is present but can be used only to select singletone. User programming of zones and scan lists is still inhibited in this case.

MBB460 2 PPM Stability

The MCX1000 comes standard with 5 ppm stability. This option improves the frequency accuracy of the radio, an option especially important when the radio is used as part of a data transmission system.

MBB462 Fast-Lok Synthesizer

The "lock" time of the standard synthesizer is 110 milliseconds. With this option, the time is decreased to less than 3 milliseconds. The higher "lock" speed is required for units with the Priority Scan option -MBB424 (and is included as part of MBB424) and is strongly recommended for systems where many channels are being scanned. It is also recommended for large mobile data systems where

MBB310 Lower Range VHF Option

The VHF MCX1000 Radio is available for operation in Range I (136-162 MHz) or Range II (146-174 MHz) bands. When all transmit and receive frequencies are in the same sub-band overlap area (146-162 MHz), Range II (146-174 MHz) boards will be supplied as standard.

This option (MBB310) should be used when all present frequencies are in the "overlap" area but future user applications require Range I (136-162 MHz) capability.

MBB75 Omit Time-Out-Timer

Deletes the 60 second timer that is standard on the radio.

MBB287 Non-Standard Time-Out-Timer

This option alters the time period from the standard 60 seconds to one of the following choices: 30, 90, 120, 150, 180, or 210 seconds.

MBB289 Omit Alert Tone

This option removes all the alert tones that are heard when zones are selected and when the mode selector is rotated past the last mode. Alert tones will still be heard while programming from the front panel.

MBB366 Disable Lighting

This option adds an OFF position to the DIM button function. The OFF position will turn off all lighting on the front panel of the control head including the backlighting of all buttons. There is no visible indication that the radio is operating when the dimmer is in the off position.

MBB20 DTMF Microphone (See Figure 2-13)

Deletes the regular mobile microphone and replaces it with a TOUCH-CODE encode microphone. The DTMF microphone allows the transmission of standard dual tone multi-frequency

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

(DTMF) signals, which are used for remote signalling applications and mobile telephone operations.

2.6.2 SCAN OPTIONS

MBB423 Operator Selectable Scan

This option provides the SCAN button on the radio's front panel and the ability of the radio to perform the scan function within each of its zones. NOTE: Upon receipt of his radio, the user will have to select and program the modes to be scanned within each zone from the radios front panel (see Programming the Scan). For diagram and instructions on how to operate the scan function, please refer to section 2.2.5.

MBB424 Add 2 Level Priority

This option provides the PRIORITY button on the radio's front panel and the ability of the radio to perform the priority scan function within each of its zones. NOTE: Upon receipt of his radio, the user will have to select and program priority to the modes in the scan list within each zone from the radios front panel. For diagram and instructions on how to operate Two Level Priority Scan, refer to section 2.2.6.

MBB315 Priority to Follow Mode Selector Switch

This feature permits the user to manually select the desired first level priority mode by rotating the mode selector switch to the desired mode and then switching on the scanner.

MBB316 Omit Spontaneous Priority

Spontaneous Priority is standard on the MCX1000 radio. With Spontaneous Priority, the last mode transmitted on is assigned secondary priority status for 60 seconds once the microphone is placed on hook. This feature ensures that a delayed continuation of a conversation will be monitored and not missed. If another mode has previously been programmed with secondary priority status in the scan sequence, the radio will scan with two secondary priority modes for 60 seconds after the microphone is placed on hook. MBB316 "Omit Spontaneous Priority" deletes this feature.

2.6.3 SINGLETONE SIGNALLING OPTIONS

MBB312 Singletone to Follow Mode Selector Switch (See Figure 2-14)

A single one second encode tone is sent from the radio when the "Singletone" pushbutton (marked

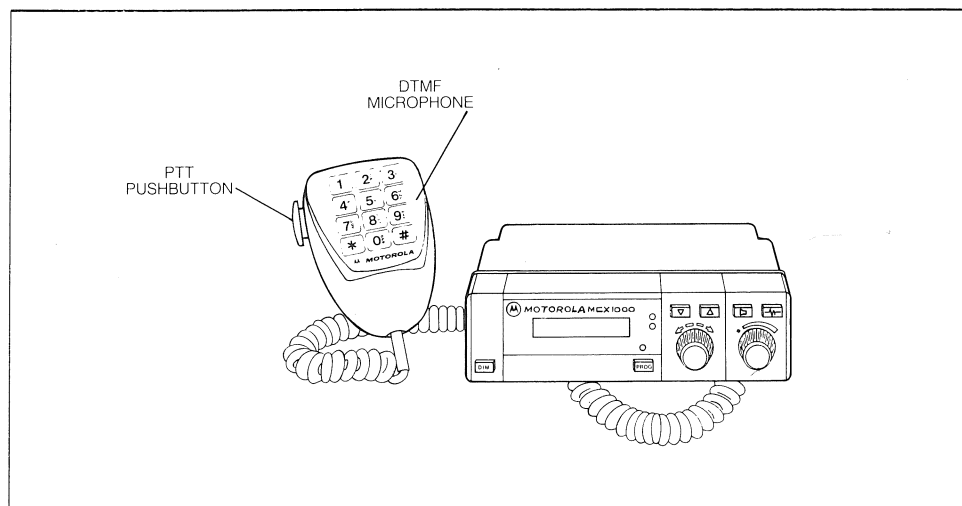


Figure 2-13 MCX1000 Mobile Radio with DTMF Microphone

with a musical note) on the radio's front panel is pushed. Holding the "Singletone" pushbutton depressed beyond the 1 second timed interval causes the radio to transmit the singletone for as long as the button is depressed.

MBB313 Selectable Singletone (See Figure 2-15)

Up to 10 (56 mode, 8 zone models) or 32 (128 mode, 24 zone models) encode tones may be selected for transmission on the MCX1000. A singletone is selected through a sequence of button pushes involving the Program Button (see Programming Selectable Singletone). By depressing the "Singletone" button (marked with a musical note) on the radio's front panel, the selected tone is transmitted. The standard transmission time is one second. Holding the "Singletone" button depressed beyond the 1 second timed interval causes the radio to transmit the singletone for as long as the button is depressed.

MBB487 Dual Singletone (See Figure 2-16)

Two independent encode tones can be sent from the radio by means of the "1" or "2" buttons on the radio's front panel. The standard transmission time is one second. Holding a dual singletone button depressed beyond the 1 second timed interval causes the radio to transmit the singletone for as long as the button is depressed.

MBB801 Singletone With Non-Standard Duration

This option alters the standard singletone time duration from 1 second (MBB312, MBB313, or MBB487) to one of the following choices: 0.25, 0.5, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, or 5.0 seconds.

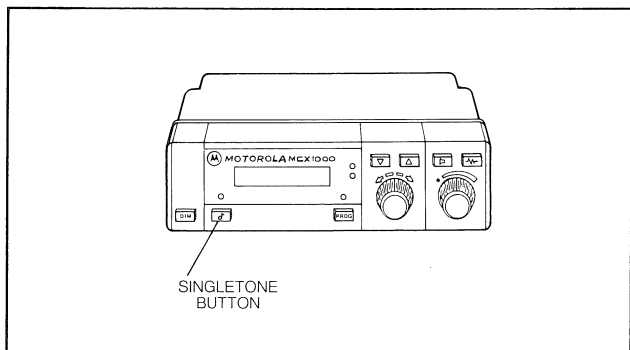


Figure 2-14 MCX1000 Radio with Singletone to Follow Mode Selector Switch

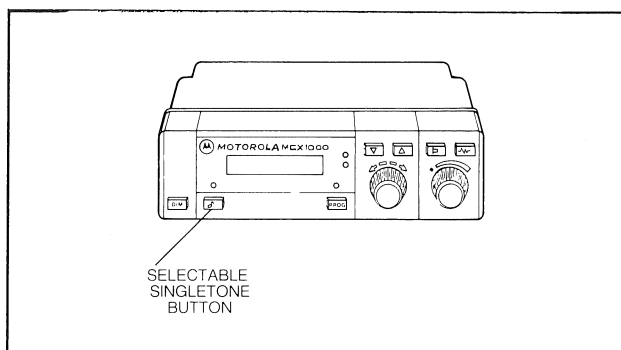


Figure 2-15 MCX1000 Radio with Selectable Singletone

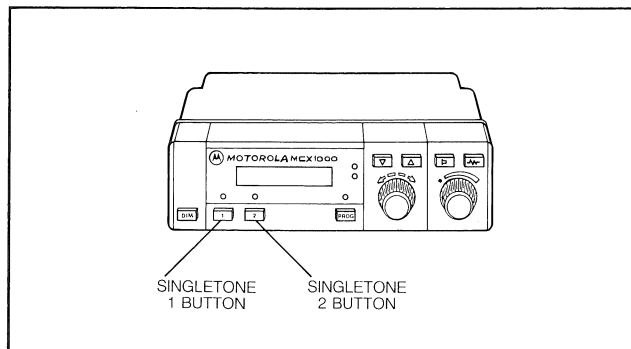


Figure 2-16 MCX1000 Radio with Dual Singletone

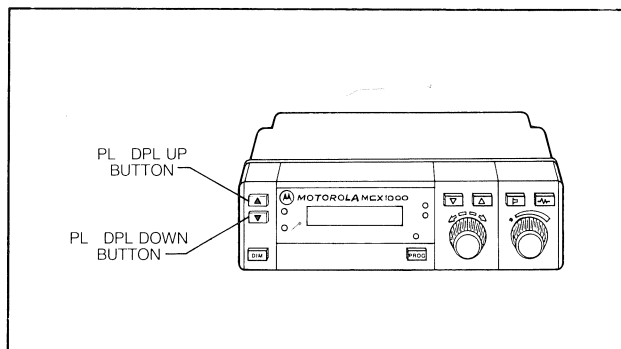


Figure 2-17 MCX1000 Radio with Selectable PL / DPL

SECTION 2. INSTALLATION AND OPERATION OF THE RADIO

2.6.4 PRIVATE-LINE / DIGITAL PRIVATE LINE OPTIONS

MBB463 Selectable PL/DPL (See Figure 2-17)
(PL/DPL button positions change with encrypted radios)

Changing the radios PL/DPL code involves the use of the shaded arrow buttons on the front panel of the radio. Use the up or down buttons to call up the desired code. (Codes will be shown on the radio's display). When you reach the code you desire, wait 3 seconds for the radio's display to revert back to its mode name (this wait may be eliminated by turning the mode selector switch 1 click in either direction). The radio now carries the PL/DPL code you have just assigned. **NOTE:** This option may be desired if the radio is used on a shared community repeater.

MBB334 Transmit Inhibit on Busy Mode

This option prevents the radios transmitter from keying on an active mode when the wrong PL code is present on the carrier. When the mode is busy with the proper PL code, the Busy Indicator will light steadily. When the mode is busy with the wrong PL code, the Busy Indicator will flash, and if the transmitter PTT is operated, a tone will be heard indicating that the transmitter is inhibited at that time.

The monitor button is disabled with this option so that the receiver audio can be heard only when the proper PL code is present. The squelch button will produce an audible tone when pressed so that the volume level may be adjusted.

This option eliminates interference possible when radio users share the same repeater.

2.6.5 MDC SIGNALLING OPTIONS

MBB708 MDC-1200 Signalling- Unit Identification

Each time the push-to-talk button on the microphone is depressed, a specific pre-programmed burst of data is transmitted to identify the radio unit. During a short period of time, a tone can be heard from the speaker. When the tone ends, the voice message can begin.

MBB452 MDC600 Signalling-Unit Identification

Each time the push-to-talk button on the microphone is depressed, a specific pre-programmed burst of data is transmitted to identify the radio unit. During a short period of time, a tone can be heard from the speaker. When the tone ends, the voice message can begin.

MBB873 MDC Signalling- Emergency Alert Activated by Pushbutton on Control Head (See Figure 2-18)

Pressing the unlabeled "Emergency" pushbutton on the radios front panel sends a unique silent data transmission to the base station informing it of the radios identity and emergency status. In addition, each time the push-to-talk button on the microphone is pressed, a data burst (different from the emergency burst) is transmitted to identify the radio unit without emergency status. Either MDC600 or MDC1200 signalling is used, depending on the MDC Unit Identification option ordered with the radio.

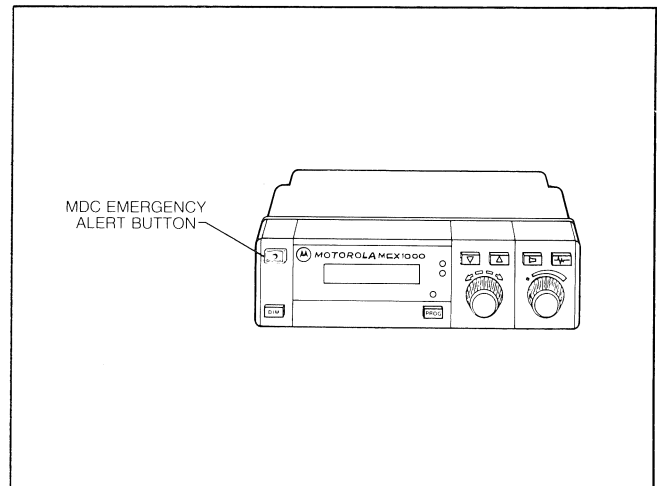


Figure 2-18 MCX1000 Radio with MDC Emergency Alert Activated by Pushbutton on Control Head

MBB688 MDC Signalling-Emergency Alert Activated by Hidden Pushbutton

Activating a hidden pushbutton sends a unique silent data transmission to the base station informing it of the radios identity and emergency

status. In addition, each time the push-to-talk button on the microphone is pressed, a data burst (different from the emergency burst) is transmitted to identify the radio unit without emergency status. Either MDC600 or MDC1200 signalling is used, depending on the MDC Unit Identification option ordered with the radio.

MBB470 MDC Signalling-Emergency Alert Activated by Hidden Footswitch

Activating a hidden footswitch sends a unique silent data transmission to the base station informing it of the radio's identity and emergency status. In addition, each time the push-to-talk button on the microphone is pressed, a data burst (different from the emergency burst) is transmitted to identify the radio unit without emergency status. Either MDC600 or MDC1200 signalling is used, depending on the MDC Unit Identification option ordered with the radio.

2.6.6 MANUAL OPTIONS

MBB292 French Instruction Manual (Canadian Option Only)

A French Instruction Manual is substituted for the English Instruction Manual that is normally shipped with every radio.

BB206 Service Manual

This option adds a service manual (1 per every 10 radios ordered).

2.6.7 INSTALLATION OPTIONS

MBB665 Base Station Operation

This option converts the standard front mount mobile "package" model into a 12 "Volt DC base station by omitting all the mobile accessories and adding a base station power supply, base station power cables and fuses, base station tray with built-in speaker, and base microphone.

MBB32 Omit Base Station Power Supply and Cables

The option deletes the base station power supply and cables that are part of MBB665.

V1022 Spare Control Head

This accessory consists of a kit composed of a universal remote mount control head and all possible buttons.

MBB70 Omit Antenna, Cable and Connectors

This option removes the antenna, cable and connectors from the MCX1000 radio package.

MBB652 Broadband Antenna

This option replaces the standard unity gain 1/4 wave antenna with a 1/4 wave broadband antenna. A broadband antenna is recommended if the range of transmit frequencies is beyond the span of 139 MHz to 153 MHz, below 146 MHz to above 161 MHz, or below 155 MHz to above 172 MHz.

MBB297 Mounting Tray With Right Hand Lock

This option replaces the standard mounting tray with a mounting tray that has 2 latches plus a right hand lock.

MBB475 Hinged Mounting Bracket

The hinged mounting bracket is recommended for floor-mount mobile radio sets. Two pairs of screws are provided with the hinged mounting bracket, namely security screws and non-security screws. Either set of screws may be used in the installation.

MBB113 Ignition Switch Transmitter Control

This option permits the transmitter to be controlled through the vehicle ignition switch, preventing unauthorized transmission in unattended vehicles.

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MBB335 Remote Mounting Kit

This option shortens the length of the speaker and control head cables on remote mount models from 17 ft (5.2m) to 8 ft (2.4m).

MBB71 Omit Mibile Microphone

This option removes the standard palm microphone from the MCX1000 radio package.

MBB87 Omit Speaker

This option removes the mobile speaker and its cable from the MCX1000 radio package.

MBB161 Omit Battery Cable

This option removes the power cable from the remote mount MCX1000 radio package.

MBB65 Omit Mounting Tray and Installation Kit

This option removes the mounting tray and associated hardware from the MCX1000 radio package.

MBB90 Omit All Accessories

This option removes the antenna, cable and connectors, palm microphone, speaker, power cable, mounting tray and installation kit from the MCX1000 Radio package.

2.7 OPTIONS UNIQUE TO DIGITAL CAPABLE RADIOS (UXA MODELS)

MBB236 56 Mode Operation

This option changes the radios maximum number of operating modes from 128 to 56 and the number of zones from 24 to 8.

MBB981 Railroad Requirement

This option replaces the dual front end receiver with a single front end receiver (4MHz) and allows two independent encode tones to be sent from the radio by means of the "1" and "2" buttons on the radios front panel.

Factory Installed Encryption

This option adds hardware (extended chassis and boards) and a specific voice encryption module to the radio depending on the type of encryption ordered.

Dual Code Select

This option allows the user to select between two encryption codes for transmission. The dual code select option is available only with a specific type of voice encryption option.

Proper Code Detect

This option causes the radio to mute if the receiving signal has the wrong encryption code.

Spare Encryption Module

Ordering this option adds a spare encryption module to the package that ships with your radio. NOTE: LIMIT OF 1 KIT FOR EVERY RADIO ORDERED.

Field Installed Encryption

Ordering this option provides the hardware (extended chassis and boards) and a specific voice encryption module to the radio depending on the type of encryption ordered.

Security Housing Mounting Tray-Front Mount

This option provides a lockable front mounting tray which automatically erases the electronic key when tampered with.

Security Housing Mounting Tray-Trunk Mount

This option provides a lockable mounting tray for the remote mount radio which automatically erases the electronic key when tampered with.

2.8 OPTION COMPATIBILITY CHART

Before ordering radio options, refer to Figure 2-19 to determine option compatibility. Also, Figure 2-19 indicates the options that must be ordered together.



MOTOROLA LIMITED

Communications Division

SECTION 3. MAINTENANCE AND ALIGNMENT

3.1 RADIO DESCRIPTION

3.1.1 GENERAL

The MCX1000 VHF Radio operates in the range of 136-162 or 146-174 MHz and has transmit capabilities of 30/40 Watts rf output. It is available in a dash mount, remote mount or base station configuration. The MCX1000 Radio receives all control signals from its own microcomputer board.

The radio chassis is constructed of rugged cast metal with separate top and bottom covers. The back of the chassis contains the connectors for external power, antenna, external option connections, and a heat sink for power transistor cooling.

The radio control head contains all controls and indicators as well as the microphone connector.

Compartments inside the chassis isolate the PA, receiver front end, frequency synthesizer, microcomputer / analog interface, and main board from each other. Additional shields are mounted over sensitive components on the main board, and compartment shields are used over the synthesizer and power amplifier compartments.

The top and bottom cover are easily removed. Most of the internal boards are connected to other radio circuitry with plug-in connectors, and may easily be removed from the radio for service or replacement by removing appropriate screws and pulling from the radio.

The chassis is designed so that most boards are readily accessible by removing the top cover, bottom cover, and PA shield. The main assemblies for the radio are listed below.

- power amplifier interconnect board
- 30 watt heat sink

- synthesizer board
- synthesizer interconnect board
- VCO hybrid assembly
- main board
- front panel interconnect board
- dual front end
- harmonic filter hybrid
- low level amplifier hybrid
- 10 watt power amplifier hybrid
- 30 watt power amplifier hybrid
- analog interface board
- remote interface board (remote mount models)
- command board (2K or 8K)
- display board
- dash or remote control head microcomputer board
- power interconnect board

See Figures 3-1 and 3-2 for the location of the board assemblies listed above. For boards not shown, refer to subsections 3.1.2 through 3.1.13 for board locations.

3.1.2 POWER AMPLIFIER (PA) INTERCONNECT BOARD

The PA interconnect board provides physical mounting and electrical interconnection of the :

- low level amplifier hybrid
- 10 watt power amplifier hybrid
- harmonic filter / antenna switch hybrid

The PA interconnect board is located on the bottom of the chassis, adjacent to the rear wall. All transmitter circuits except push-to-talk (PTT) logic, transmit audio/instantaneous deviation control (IDC), and transmit power and level control are located on these hybrids. This board cannot be removed. Replacement of components on this board, if necessary, should be done from the exposed side of the board.

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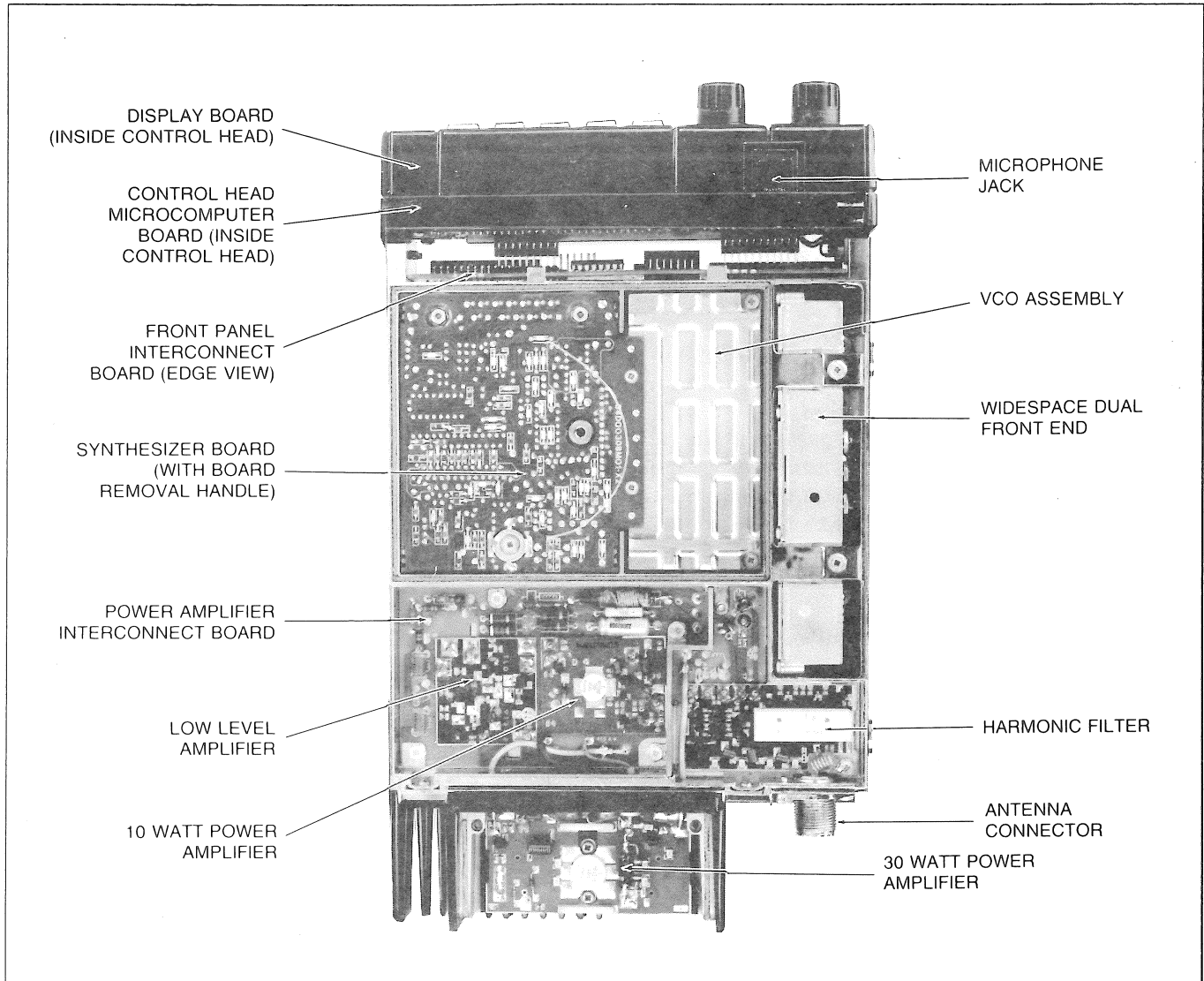


Figure 3-1 MCX1000 Radio Bottom View with Cover Removed

3.1.3 30 WATT HEAT SINK

The heat sink is attached to the rear of the radio set chassis, and houses the 30 watt power amplifier hybrid.

3.1.4 30 WATT POWER AMPLIFIER

The power amplifier is mounted inside the external heat sink and is accessed by removing the bottom cover of the heat sink.

3.1.5 FREQUENCY SYNTHESIZER

The frequency synthesizer consists of two assemblies : the synthesizer board and the VCO.

The two assemblies are located side by side on the bottom of the radio set and are accessed by removing the synthesizer cover. The synthesizer board contains :

- a reference oscillator
- frequency selection logic circuits
- miscellaneous buffering, filtering, and control circuitry.

The VCO assembly contains :

- the voltage controlled oscillator circuit,
- buffer,
- range shift circuitry,

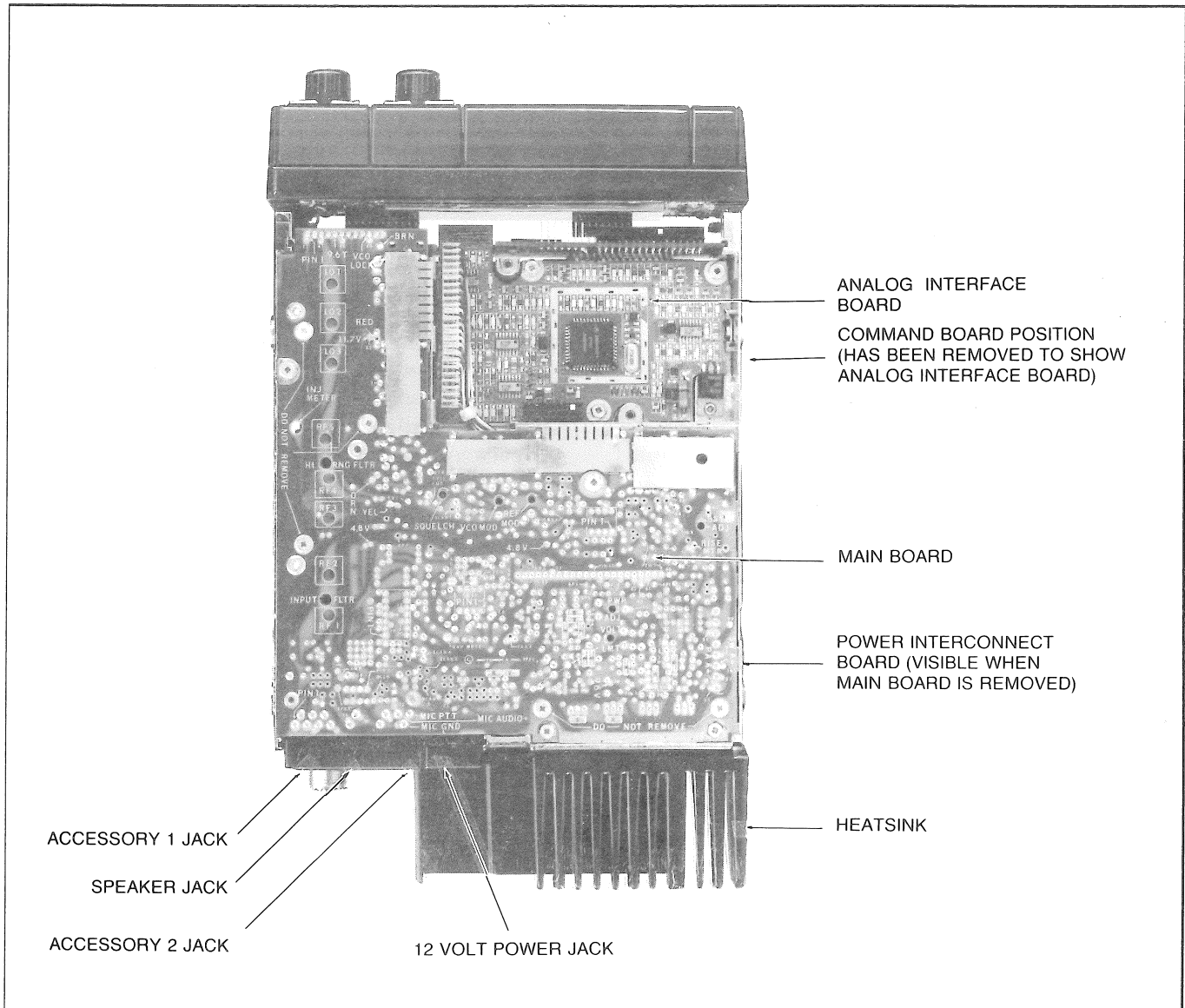


Figure 3-2 MCX1000 Radio Top View with Cover Removed

- varactor diodes, which produce frequency modulation of the VCO.

3.1.6 MAIN BOARD

The main board is located on the top of the radio set in the rear. The main board contains all receiver circuits, voltage regulation circuits, and the following transmitter circuits :

- push-to-talk logic
- transmit audio / IDC
- transmit power and level control

3.1.7 FRONT PANEL INTERCONNECT BOARD

The front panel interconnect board provides for the connections between the front panel, power interconnect board, synthesizer board, main board, analog interface board and command board. The front panel interconnect board is located in a slot at the front of the radio chassis and is accessible by removing the radio control head (in dash mount models) or removing the radio remote transceiver front cover (in remote mount models).

SECTION 3. MAINTENANCE AND ALIGNMENT

3.1.8 POWER INTERCONNECT BOARD

The power interconnect board provides power distribution for the radio. This board is located below the main board and to the rear of the front panel interconnect board. The power interconnect board cannot be removed. Replacement of components on this board, if necessary, should be done from the exposed side of the board,

3.1.9 DUAL FRONT END

The front end contains the rf amplifier, mixer, and tuned filters which provide selectivity. The front end is attached to the main board. A dual front end board is standard in each radio model.

3.1.10 COMMAND BOARD

The command board is located on the top of the radio set at the front, in the space not taken by the main board. The command board is the main controller for the radio. Its memory contains the personality data for the radio and it controls the serial bus, synthesizer and volume control IC. It also controls the microcomputer on the analog interface board

3.1.11 REMOTE INTERFACE BOARD

The remote interface board allows the radio set to be mounted in a remote location such as under the seat or in the trunk, and be controlled from the vehicle dashboard. This board is located at the front of the radio chassis and is accessible by removing the radio remote transceiver front cover (in remote mount models).

3.1.12 ANALOG INTERFACE BOARD

The analog interface board is located underneath the command board. It is accessible after removal of the command board from the radio. A microcomputer on the analog interface board interfaces the main microcomputer (located on the command board) to the radio circuitry. The analog interface board also provides transmit PL and singletone, audio gating and filtering.

3.1.13 DISPLAY BOARD

The display board is mounted vertically in the control head and is located directly on the front panel. As its name implies, it holds all displays and display drivers. Also mounted on this board are all front panel pushbuttons and indicator LED's.

3.1.14 DASH / REMOTE CONTROL HEAD MICROCOMPUTER BOARD

Depending upon model, either a dash control head microcomputer board or a remote control head microcomputer board will be present in each radio. This board is mounted vertically in the control head directly behind the display board. The control head microcomputer controls the display board and interfaces to the radio. It scans the keyboard and sends information from the keyboard to the radio. As well, it receives data from the radio and places this information in the display. All front panel LED's are controlled from this board.

3.2 RECOMMENDED TEST EQUIPMENT FOR MAINTENANCE AND ALIGNMENT

Refer to Figure 3-3 for a listing of test equipment needed to perform maintenance and alignment to the MCX1000 Radio Set.

NOTE

All test equipment, with the exception of the DPL test set, tuning tool kit, tuning probe adapter, and dc power supply may be replaced by the Motorola R2001 System Analyzer.

Figure 3-4 contains a listing of additional equipment used to verify radio specifications. Note that the equipment listed in Figure 3-4 is not required for maintenance and alignment.

3.3 FIELD PROGRAMMING

The MCX1000 Radio uses an EEPROM (Electrically Erasable Programmable Read Only Memory) to store information on modes, zones, signalling codes and tones, signalling durations and Time-Out-Timer durations.

3.3.1 SERVICE PROGRAMMING WITH A RADIO SERVICE PROGRAMMER

The MCX1000's EEPROM can be reprogrammed in the field without ever removing the EEPROM from the radio. To program, an IBM PC, XT, AT or PC Convertible computer is connected through a Radio Interface Box ("RIB") to the radio's microphone connector. Once the computer is connected to the radio, the prompts provided by the software guide the operator through all the steps required for programming.

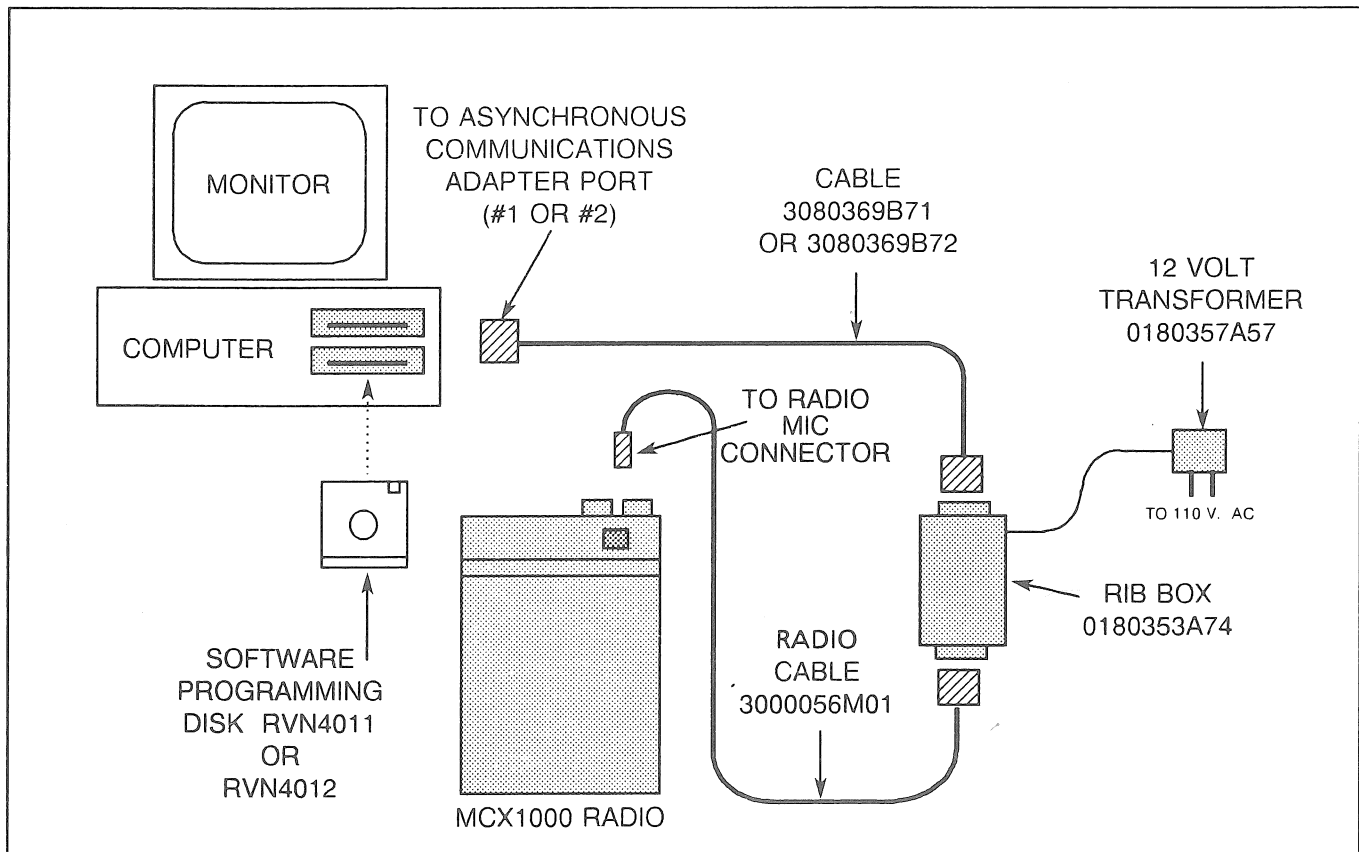
3.3.2 REQUIRED EQUIPMENT

The items in the table at right are required for reprogramming an MCX1000 Radio. All items except the computer are available through Motorola National Parts.

3.3.3 FIELD PROGRAMMING CONNECTIONS

The diagram below shows the connections among the computer, radio interface box and the MCX1000 Radio.

DESCRIPTION	PART NUMBER
Computer	IBM PC, XT, AT or PC Convertible with min. 512K RAM, IBM DOS 3.0 or higher, and an Asynchronous Communications Adapter
RIB (Radio Interface Box)	0180353A74
Computer Cable from RIB to :	
● IBM PC, XT or PC Convertible	3080369B71
● IBM AT	3080369B72
Radio Cable from RIB to MCX1000	3000056M01
Software Programming Disk	5 1/4" - RVN4011 3 1/2" - RVN4012
12 Volt Transformer	0180357A57



Field Programming Connections Diagram

SECTION 3. MAINTENANCE AND ALIGNMENT

3.3.4 ELECTRONIC ENCRYPTION "KEY" TRANSFER

Follow the steps below to set the Encryption Key on radios equipped with Voice Encryption.

1. Turn the radio on and set the off-on/volume control to a comfortable listening level.
2. Connect the cable from the Code Inserter to the Keyload Connector.
3. Press the push-to-transfer switch on the Code Inserter. The transfer is completed when a tone is heard from the speaker, and the message "bEPPP" appears on the Code Inserter display.

3.4 SAFE HANDLING OF CMOS INTEGRATED CIRCUITS / REMOVAL AND REPLACEMENT OF CHIP COMPONENTS

The following precautions should be observed when handling, removing or replacing integrated circuits and chip components.

CAUTION 1.

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. Motorola Publication Number 68P81106E84, "SAFE HANDLING OF CMOS INTEGRATED CIRCUIT DEVICES" contains information pertinent to the safe handling of these devices. To obtain this publication, fill in and mail the self mailer titled Available Background Reference Publications at the back of this manual.

CAUTION 2.

DO NOT remove or insert any circuit boards or integrated circuits while power is applied.

CAUTION 3.

Connect a wrist-type grounding strap to the chassis before opening the chassis.

CAUTION 4.

Special techniques are used when installing or removing chip type components. If these techniques are not implemented correctly, serious damage may occur to the circuit and / or the performance of the circuitry associated with the chip components may be degraded. Motorola Publication Number 68P81113E77, "Removal and Replacement of Chip Components on Circuit Boards" contains detailed information on this subject. To obtain this publication, fill in and mail the self mailer titled Available Background Reference Publications at the back of this manual.

SECTION 3. MAINTENANCE AND ALIGNMENT

General Type	Application	Recommended Model	Minimum Specifications
AC-DC VOM	DC voltage measurements, general	Motorola T1009	Measurement range: 0-15 Vdc Sensitivity: 20,000 ohms / volt
DC Multimeter	DC voltage readings requiring a high input resistance meter	Motorola R1037 or R1038	Measurement range: 0-15 Vdc Input resistance: 11 megohms
AC Voltmeter	Audio voltage measurements	Motorola S1053	Measurement range: 0-10 Vac
RF Voltmeter	RF voltage measurements	Motorola S1339	Measurement range: 100 uV-3V from 1 MHz-512 MHz Inputs: 50 ohm and high imp.
Tuning Probe Adapter	Dual Front End Alignment	Mototola MBTRN4778	
Oscilloscope	Waveform observation	Motorola R1028 or R1029	Vertical sensitivity: 5 mV-10 V / division, Horizontal time base: 0.2 usec. - .5 sec / div.
RF Wattmeter	Transmitter output power measurement	Motorola S1350 with appropriate element and T1013 RF Dummy Load	Measurement range : 0-250 Watts
Frequency Meter	Transmitter frequency measurement	Model R2001 Service Monitor with high stability oscillator (X suffix) option. Frequency calibration recommended every 6 months or less.	Measurement range: 134-174 MHz Frequency resolution: 10 Hz
Deviation Meter	Transmitter modulation deviation measurement	Motorola R2001 Service Monitor with RTC4000 Deviation Meter and SLN6381 Audio Frequency Synthesizer (<i>audio synthesizer required only for DPL radios</i>)	Measurement range: 0-10 kHz deviation Frequency range: 134-174 MHz
RF Signal Generator	Receiver alignment and troubleshooting	Motorola R2001 Service Monitor with attenuator	Frequency range: 134-174 MHz Output Level: 0.1 uV-100,000 uV Must be capable of at least ± 3 kHz deviation when modulated by 1 kHz tone
Audio Signal Generator	Audio circuit troubleshooting	Motorola S1067	Frequency range: 20 Hz-20 kHz Output level: 50 mV-1 V
PL Tone Generator (for PL models only)	Tone-coded Private-Line decoder troubleshooting	Motorola R1100	Frequency range: 10 Hz-9999 Hz Output level: 0-3 V rms
DPL Test Set (for DPL models only)	Digital Private-Line encoder-decoder troubleshooting	Motorola SLN6413	

Sheet 1

Figure 3-3 Recommended Test Equipment for MCX1000 Radio Servicing (Sheet 1)

SECTION 3. MAINTENANCE AND ALIGNMENT

General Type	Application	Recommended Model	Minimum Specifications
Speaker/Load	Receiver alignment and measurement	TSN6031A Speaker Kit with RPX4134A Modification Kit	
Tuning Tool Kit	Receiver and transmitter alignment	Motorola TRN 4671A	
DC Power Supply	DC power for shop service	Motorola R1011	1-20 Vdc, 0-40 A
Front Panel Extender Cables	Troubleshooting	Motorola RTK4036A	
Metric Nutdriver Kit	Radio Assembly / Disassembly	RSX4048A	

Sheet 2

Figure 3-3 Recommended Test Equipment for MCX1000 Radio Servicing (Sheet 2)

General Type	Application	Recommended Model	Minimum Specifications
Distortion Analyzer	Distortion and SINAD measurements	Hewlett-Packard Model 331A	Average-responding detector
Low Noise RF signal generators (2 used)	Receiver Intermodulation and Adjacent-Channel Selectivity measurements	Hewlett-Packard Model 8640B with option H60, "Low Single Sideband Noise"	SSB noise > 142 dB / $\sqrt{\text{Hz}}$ below carrier (20 kHz offset 1 Hz bandwidth)
Broadband Signal Combiner, 50 ohms	Receiver Intermodulation and Adjacent-Channel Selectivity measurements	Anzac T-1000	25 dB minimum isolation
Three - port resistive combiner, 50 ohms	Three-generator Intermodulation measurements	Measurements M501 or equivalent	
Psophometer	CEPT method SINAD measurements	Hewlett-Packard Model 3556A	
Spectrum Analyzer	Transmitter spurs and harmonics	Hewlett-Packard Model 141T Mainframe with 8554L and 8552A Heads	60 dB (minimum) dynamic range (30 kHz bandwidth) ; storage and/or manual scan capability are desirable
20 dB thru line pad, 50 ohms	Transmitter spurs and harmonics		
10 dB thru line pad, 50 ohms	Transmitter spurs and harmonics		
Tunable notch filter, 50 ohms	Transmitter spurs and harmonics		40 dB minimum notch depth, tunable 136-174 MHz

Figure 3-4 Recommended Test Equipment for Radio Specifications Verification

3.5 RADIO SET DISASSEMBLY / ASSEMBLY

3.5.1 GENERAL

The MCX1000 Exploded View and Mechanical Parts Lists (Figure 3-12), MCX1000 Radio-Bottom View (Figure 3-1) and MCX1000 Radio-Top View (Figure 3-2) may be used as reference.

Many of the assemblies may be removed / replaced by carefully disconnecting / connecting the cables and removing / securing the attaching hardware. Refer to the following paragraphs for procedures applicable to specific assemblies involving special precautions and steps that may not be obvious.

The power interconnect board and the power amplifier interconnect board cannot be removed. Replacement of components on these boards, if necessary, should be done from the exposed side of the board. The leads of the replacement part must be properly trimmed prior to insertion to avoid short-circuits to the chassis. It is recommended that a spacer be placed between the board and chassis, if possible, to prevent solder from flowing below the board and touching the chassis.

During reassembly of the radio, it is very important to tighten all screws to the correct torque. Correct torque is essential for reliable electrical and mechanical performance. Too little torque may result in intermittent ground connections, microphonics, or insufficient heat sinking. Too much torque may cause stripping of the threads in the chassis. Recommended screw torque specifications for all fasteners in the MCX1000 radio are listed in Figure 3-5

Before a screw is reinserted, check the threads for foreign material. If the threads are damaged or if foreign material is present which cannot be removed, the screw should be discarded and a new one inserted. Damaged or clogged threads on a screw may damage the threads in the chassis.

CAUTION

The hybrid assemblies are not field repairable. Attempts to repair a hybrid module will void the warranty.

Screw Size	Application	Maximum Torque
M2.5 x .45	30 Watt final transistor; main board heat sink devices	6 ± 1 In-Lbs. (0.7 ± 0.1 Nm)
M4.0 x .70 x 9.0	30 Watt heat sink to chassis mtg.; top and bottom cover screws	20 ± 2 In-Lbs. (2.3 ± 0.2 Nm)
M3.0 x .50 x 10.0	Synthesizer cover	14 ± 2 In-Lbs. (1.6 ± 0.2 Nm)
M3.0 x .50 x 12.0	VCO assembly	12 ± 2 In-Lbs. (1.4 ± 0.1 Nm)
M3.0 x .50 x 8.0	All other applications not listed above	12 ± 2 In-Lbs. (1.4 ± 0.1 Nm)
	10 Watt RF final mtg. stud	5 ± 1 In-Lbs (0.6 ± 0.1 Nm)

Figure 3-5 Screw Torque Specifications

3.5.2 VCO ASSEMBLY REPLACEMENT

To replace the VCO Assembly, perform the following steps.

1. Remove three screws holding synthesizer board in casting.
2. Use pull string on synthesizer board to remove board from casting. Pull straight up to avoid bending the connector pins.
3. Remove the four screws holding the VCO in place. Lift VCO out of compartment.

SECTION 3. MAINTENANCE AND ALIGNMENT

4. Place new VCO in compartment. Replace the four screws that secure the VCO and tighten to 12 ± 2 inch-pounds.

CAUTION

DO NOT over-tighten the screws in Step 4. The screw threads in the casting could be stripped if too much torque is applied.

5. Replace synthesizer board and screws. Tighten to 12 ± 2 inch-pounds.

3.5.3 SYNTHESIZER BOARD REPLACEMENT

To replace the Synthesizer Board, perform the following steps.

1. Remove three screws (five screws in Fast-Lok version) holding synthesizer board in casting.
2. Use pull string on synthesizer board to remove board from casting. Pull straight up to avoid bending the connector pins.

NOTE

Only the divider/phase detector IC U115 is socket mounted and therefore field replaceable. Replacement is described below.

3. Use an integrated circuit extraction tool to remove the IC U115 from its socket.
4. When replacing U115 with a new IC, note that the IC pins may have to be bent slightly to line up with the socket holes.
5. Replace the IC with firm pressure directed toward the centre of the IC. Be sure to observe correct orientation as indicated by the circuit board legend.
6. Replace synthesizer board and screws. Tighten screws to 12 ± 2 inch-pounds.

3.5.4 SYNTHESIZER RF AMPLIFIER BOARD (Used only with Fast-Lok Synthesizer)

To replace the Synthesizer RF Amplifier Board, perform the following steps.

1. Remove the Synthesizer Board as described above (section 3.5.3).
2. Remove the screw holding the RF Amplifier Board in position.
3. Unsolder the pin between the RF Amplifier Board and the VCO interconnect board (unsolder at the RF Amplifier Board end)
4. Unsolder the connections to the RF Amplifier Board from J357 (receive injection) and the transmit injection coax. Take care not to damage the plated through holes into which these connections are soldered.
5. Lift the RF Amplifier Board straight up to remove it from the synthesizer compartment.
6. Reverse the above steps to replace the board. Screw should be tightened to 12 ± 2 inch-pounds.

3.5.5 TRANSMITTER MODULE REPLACEMENT

General

The following general procedures should be used to ensure safe replacement of a defective module, and proper transmitter operation.

- Use a low power soldering iron (approximately 40 watts)
- Use only 2% silver solder on all hybrids.
- Use "solder wick" or a bulb type solder sucker to remove and clean solder from connection pins.
- The transmitter alignment procedure should be performed after any transmitter hybrid is replaced.

CAUTION

Before installing a transmitter hybrid module, make sure all connection pins are straight, and have no solder fillet around the base that would prevent the hybrid from sitting flat. Failure to do so could damage the hybrid and void the warranty.

Low Level Amplifier

To replace the Low Level Amplifier, perform the following steps.

1. Unsolder the six connection pins.
2. Using a small screwdriver remove the module by alternately lifting at the two circuit board cutout locations. Do not pull on any hybrid components. Lift module straight up to prevent damage to transistor on underside of board; the transistor is secured in a clip.
3. Clean the six connection pins and circuit board pads of any excess solder and straighten the pins if necessary.
4. Place the new module over the pins to check for alignment.
5. Press Q201 into heat sink using the blunt end of a non-metallic tuning tool. Apply pressure directly on top of Q201. When seated properly there should be no more than 0.05 inches gap between the module and the circuit board.
6. Bridge solder between the six connection pins and their associated hybrid pads so solder is wicked around 25% of the pins.

10 Watt Amplifier

To replace the 10 Watt Amplifier, perform the following steps.

1. Unsolder the five connection pins.
2. Remove the main board (see main board removal / replacement procedure).

3. Remove the transistor stud nut.
4. From the main board side, gently tap on the stud of the transistor to remove the module.
5. Clean the five connection pins and circuit board pads of any excess solder and straighten the pins if necessary.
6. Install the new module being careful to check for pin alignment. Be sure to apply thermal compound to the stud of the transistor where it contacts the chassis.
7. Replace the transistor stud nut and tighten to a torque of 5 ± 1 inch-pounds.
8. Bridge solder between the five connection pins and their associated hybrid pads so solder is wicked around 25% of the pins.

30 Watt Amplifier

To replace the 30 Watt Amplifier, perform the following steps.

NOTE

All soldering in the removal of this module is done at the hybrid end of the wires and coaxial cables.

1. Unsolder the input and output coaxial cables so they are clear of the hybrid.
2. Unsolder the jumper going to thermistor RT1400 at the hybrid end.
3. Unsolder the feed network L1403 at the hybrid end.
4. Unsolder the ground lug next to thermistor RT1400.
5. Remove the two screws holding transistor Q1400
6. Remove the module.
7. Put thermal compound on the flange of the new module device where it contacts the heat sink.

SECTION 3. MAINTENANCE AND ALIGNMENT

8. Slide the new module into the heat sink making sure it clears all connecting wires and cables.
9. Install the Q1400 mounting screws and torque to 6 ± 1 inch-pounds.
10. Reconnect all wires and coaxial cables.

Harmonic Filter

To replace the Harmonic Filter, perform the following steps.

1. Unsolder the centre conductor of the high power PA output coax where it goes into the PA interconnect board. Next unsolder the coaxial shield and lift it from between the two ground pins. Clean excess solder from pins and centre conductor hole.
2. Unsolder the five connector pins.
3. Remove the wall between the harmonic filter and 10 watt amplifier.
4. Remove the screw in the corner next to the antenna connector.
5. Unsolder the jumper from the antenna connector to the hybrid. Remove the coil-capacitor-lug assembly if necessary. Remove the module.
6. Clean the five connector pins and circuit board pads of any excess solder and straighten the pins if necessary.
7. Install the new module, being careful to check for pin alignment.
8. Replace the wall between the filter and 10 watt amplifier. Torque screws to 12 ± 2 inch-pounds.
9. Replace the corner screw making sure it goes through the ground lug. Torque to 12 ± 2 inch-pounds.
10. Resolder the jumper going to the antenna pad on the hybrid. Resolder the coil-capacitor assembly to the antenna connector if

necessary. All leads in this area must be less than 1/8 inch in length.

11. Bridge solder between the five connection pins and their associated hybrid pads so solder is wicked around 25% of the pins.
12. Resolder the high power PA coaxial cable to the PA interconnect board.

3.5.6 MAIN BOARD REMOVAL / REPLACEMENT

Main Board Removal

To remove the Main Board, perform the following steps.

1. Remove radio top and bottom covers.
2. Remove four screws securing main board to chassis; two of the screws pass through the heat sink adjacent to edge of board.

NOTE

DO NOT remove two screws securing main board to heat sink. These two screws are identified by the legend DO NOT REMOVE on the main board.

3. Remove the two screws on bottom of radio securing the front end to chassis crossbars.
4. Remove main board by lifting alternately:
 - Rear connector, J350
 - Front of board near 12-pin connector, P355.
 - Side of board near 8-pin connector P351 by placing finger or non-marring tool in slot on side of chassis.
5. Lift main board part way, avoiding thermal grease on heat sink.
6. Remove 22-pin connector J352, by pulling straight out to avoid bending pins of P352.
7. (For remote mount radios only) Remove 4-pin connector, J380, located near rear connector J350.

8. Disconnect two coaxial cables from connectors under the board. Use gas pliers to twist slightly, while pulling straight up.
9. Lift main board completely away from chassis.
10. Wipe thermal grease from heat sink with cloth or tissue, to avoid contact with clothing and hands while servicing board.
6. Place main board in chassis. Simultaneously align front 12-pin connector, side 8-pin connector, and rear connector into slot in chassis. Push board fully down into chassis. Avoid pinched wires.
7. Install two screws securing heatsink to chassis. Tighten to 12 ± 2 inch-pounds.

Main Board Replacement

To replace the Main Board, perform the following steps.

1. Plug front-end antenna coaxial cable (ANT) into connector on power interconnect board, observing legend (cable towards front of radio).

CAUTION

Seat plug fully into socket. Wrong orientation of connector, or failure to seat plug fully, will damage main board components.

2. Plug injection coaxial cable (INJ) into connector on chassis. Observe orientation legend stamped into chassis.

CAUTION

Seat plug fully into socket. Wrong orientation of connector, or failure to seat plug fully, will damage main board components.

3. (For remote mount radios only) Install 4-pin connector J380. Connector is keyed; wires come out toward front of radio.
4. Install 22-pin connector J352. Connector is not keyed; orange dot on connector and square pad on main board indicate pin 1; wire length prohibits backwards insertion. Be sure connector is not offset one or two pins to either side.
5. Apply thermal grease to heatsink and chassis if it was wiped off during servicing.

CAUTION

Correct torque is essential to ensure proper radio performance. Too little torque may result in intermittent ground connections. Too much torque may cause stripping of the casting threads.

8. Install remaining two screws securing main board to mounting bosses. Tighten to 12 ± 2 inch-pounds.
9. Install two screws on bottom of chassis securing front end casting to chassis crossbars. Tighten to 12 ± 2 inch-pounds.
8. Replace radio top and bottom covers. Tighten screws to 20 ± 2 inch-pounds.

Dual Front End

The Dual Front End Assembly is attached to the main board. See the Main Board removal / replacement procedures above if access to the Dual Front End is required.

3.5.7 CONTROL HEAD DISASSEMBLY / ASSEMBLY (REMOTE MOUNT MODELS)

Remote Mount Control Head Microcomputer Board

To replace the Remote Mount Control Head Microcomputer Board, perform the following steps.

SECTION 3. MAINTENANCE AND ALIGNMENT

1. Remove the two screws from the back of the control head. Also remove the two screws which pass through the back housing into the rear cable connector.
2. Carefully separate the front and back housing of the control head. Remove the four screws holding the control head microcomputer board in the back housing.

CAUTION

Use care when separating the front and back housing of the control head. The two halves are joined internally by means of short flex cables.

3. The flex connectors must be unsoldered from the control head microcomputer board if its replacement becomes necessary.
4. The control head microcomputer board is replaced by reversing the above steps.

Display board

To replace the Display Board, perform the following steps

1. Remove the volume and channel selector knobs using the following procedure.
 - Wrap each knob with foam to protect it.
 - A small vice should be used to firmly grip each knob (one at a time).
 - Pull firmly on the control head to separate the knob from its shaft.
2. Remove the nuts and knurled washers exposed by the removal of the two knobs mentioned above (on the front of the display panel).
3. Remove the two screws from the back of the control head.
4. Carefully separate the front and back housing of the control head.
5. Remove the five screws that hold the display board in the front housing.

CAUTION

Use care when separating the front and back housing of the control head. The two halves are joined internally by means of short flex cables.

NOTE

Hold the control head face down when removing the display board so that the front panel buttons won't fall out and get lost. Also, part of the button mechanism may stick to the display board. This part should be replaced in its proper position behind the light pipes in the control head.

CAUTION

Take care not to touch the black carbon pads behind the rubber membranes of the button mechanism. Also, do not touch the gold plated etching on the surface of the display board.

6. With the control head face down, the display board may be carefully removed from the front housing.
7. The display board is replaced by reversing the above steps.

3.5.8 CONTROL HEAD DISASSEMBLY / ASSEMBLY (DASH MOUNT MODELS)

The Control Head on a dash mount model radio contains both the Control Head Microcomputer board and the Display board. Steps for their removal and replacement are described below.

Dash Mount Control Head Microcomputer Board

To replace the Dash Mount Control Head Microcomputer Board, perform the following steps.

1. Remove the radio top and bottom covers.
2. Remove the four screws (two on each side of the radio) that fasten the control head to the main radio chassis.
3. Carefully pull the control head from the radio chassis.
4. Remove the screws holding the microcomputer board in place in the control head. Be sure to remove the screw fastening the regulator to the control head, as the regulator is soldered to the display board.
5. The microcomputer board may now be carefully pulled from the control head.

NOTE

The microcomputer board is attached to the display board by short flex cables. These are soldered in place.

6. For complete removal of the microcomputer board from the radio, the display board to which it is attached must also be removed. Instructions for display board removal follow in the next section.
7. Replace the microcomputer board by reversing the above steps.

Display Board

To replace the Display Board, perform the following replacement steps.

1. Remove the radio top and bottom covers.
2. Remove the four screws (two on each side of the radio) that fasten the control head to the main radio chassis.

3. Carefully pull the control head from the radio chassis.
4. Remove the volume and channel selector knobs using the following procedure.
 - Wrap each knob with foam to protect it.
 - A small vice should be used to firmly grip each knob (one at a time).
 - Pull firmly on the control head to separate the knob from its shaft.
5. Remove the nuts and knurled washers exposed by the removal of the two knobs mentioned above (on the front of the display panel).
6. The control head microcomputer board must now be removed. (This will allow access to the display board.) The previous section describes the required steps. Note that some of the steps have already been performed.
7. Microcomputer board removal exposes two screws that fasten the adapter sleeve to the control head. Remove these two screws.
8. Swing the adapter sleeve away from the control head so that it unlatches from its other two points of attachment.
9. The adapter sleeve may now be removed by moving the microcomputer board diagonally through the adapter sleeve opening.
10. Remove the five screws that hold the display board in the front housing.

NOTE

Hold the control head face down when removing the display board so that the front panel buttons won't fall out and get lost. Also, part of the button mechanism may stick to the display board. This part should be replaced in its proper position behind the light pipes in the control head.

11. With the control head face down, the display board may be carefully removed from the front housing.

CAUTION

Take care not to touch the black carbon pads behind the rubber membranes of the button mechanism. Also, do not touch the gold plated etching on the surface of the display board.

12. The display board is replaced by reversing the above steps.

3.5.9 COMMAND BOARD

To replace the Command Board, perform the following steps.

1. Remove the top cover and the two screws holding the command board in the casting.
2. Use the pull string to carefully lift the command board straight up from the casting. Care should be taken to avoid bending the connector pins of the two connectors mounted on this board.
3. To replace this board, reverse the above steps.

3.5.10 ANALOG INTERFACE BOARD

To replace the Analog Interface Board, perform the following steps.

1. Remove the command board first. See section preceding. The analog interface board is located underneath the command board.
2. Remove the plug attached to the analog interface board.
3. Remove the four screws that hold the analog interface board in the casting. Note that one of these four screws passes through the 5 volt regulator.
4. The board may now be lifted from its position. Take care not to bend the pins of the connector that attaches this board to the front panel interconnect board.

5. This board is replaced by reversing the above steps.

3.5.11 REMOTE INTERFACE BOARD

To replace the Remote Interface Board, perform the following steps.

1. Remove the top and bottom covers.
2. Remove the four screws (two on each side) that attach the radio remote transceiver front cover to the main chassis casting.
3. The remote transceiver front cover (including the attached Remote Interface board) may now be pulled from the main chassis casting.
4. To remove the Remote Interface board from the front cover, the following six screws must be removed; two screws that fasten the Remote Interface board to the front cover, two screws holding the remote cable jack and two screws (inside the front cover) that fasten the two transistors to the front cover.
5. This board is replaced by reversing the above steps.

3.5.12 FRONT PANEL INTERCONNECT BOARD

This board is soldered to the power interconnect board and cannot be easily removed.

The following boards plug into the front panel interconnect board:

- Main board
- Command board
- analog interface board
- synthesizer board
- Remote interface board (on remote mount models)
- Dash mount control head microcomputer board (on dash mount models)

Removing the boards mentioned above will leave the Front Panel Interconnect board fully exposed within the main chassis casting.

3.6 TRANSMITTER ALIGNMENT

The transmitter of the MCX1000 Radio should be aligned before the receiver. The procedures below should be performed in the sequence shown.

- transmitter alignment
- oscillator frequency adjustment
- deviation adjustment

Refer to Figure 3-6 which shows the various test points which are to be referred to in the procedure. Also refer to the pertinent schematic diagrams and circuit board details located in this manual.

3.6.1 POWER LEVEL ADJUSTMENT

NOTES

1. Key the radio only while making an adjustment.
 2. The adjustments should be performed with a "receive" supply voltage of 13.8 volts and a "transmit" supply voltage of 13.6 volts.
1. Preset R236 (voltage limit potentiometer) by turning it fully clockwise. Preset R245 (power adjust potentiometer) by turning it fully counterclockwise.

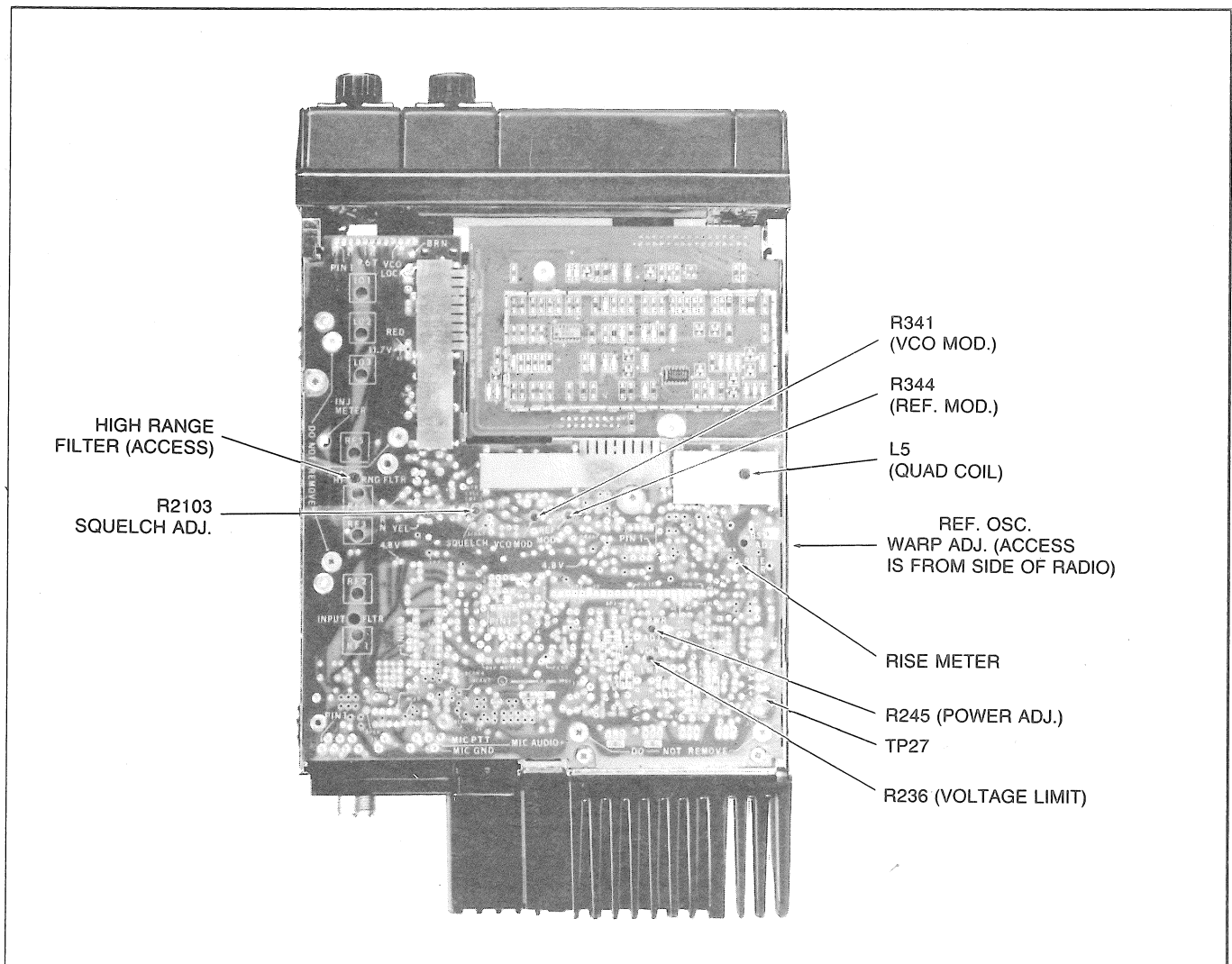


Figure 3-6 MCX1000 Radio Alignment Test Points

SECTION 3. MAINTENANCE AND ALIGNMENT

2. Select any transmit channel. Key the radio and adjust R245 (power adjust potentiometer) for a power level of 40 Watts (in Canada set power level at 31 Watts) at a voltage of 13.6 volts.
 3. Switch through all the transmit channels and record the channel which gives the minimum power level.
 4. Switch through all the transmit channels while observing the dc voltage indication at TP27 (P351-2). Record the voltage level and channel for the channel that gives the highest voltage level. If this voltage level is greater than 10 V dc, proceed to Step 8; do not perform Steps 5,6 and 7.
 5. On the channel with the highest voltage level found in Step 4, turn R245 clockwise until the dc voltage level increases approximately 3 volts, but do not exceed 12 volts.
1. Insert a Diagnostic Test Plug into the microphone jack on the Control Head.
 2. Enter the diagnostic mode by switching the radio from "off" to "on".
 3. Press the DIM button repeatedly until the word "RADIOTST" shows in the Control Head display.
 4. Remove the Diagnostic Test Plug and plug the microphone into the microphone jack.
 5. Press the PROG (program) button once. The radio beeps to indicate it is in the Radio Diagnostic mode and the radio display shows (for a 3 second period) the current version number of the radio software.
 6. Push the Monitor button repeatedly until the display shows the phrase "PL OFF"
 7. Set the mode selector switch to channel 1 and key the transmitter to transmit an unmodulated carrier.
 8. Adjust reference oscillator (channel element) warp adjustment (see Figure 3-6) until the proper frequency indication ± 100 Hz is obtained.

NOTE

A 3 volt increase may not be possible on some models. In this case, reduce the radio power supply voltage (not lower than 10.8 Vdc) while monitoring TP27, until a voltage level approximately 3 volts higher than the voltage recorded in Step 4 is obtained.

6. Adjust R236 for a dc voltage level that is 2 volts higher than the level recorded in Step 4.
 7. Reset power supply voltage to 13.6 volts (if necessary).
 8. Switch to the channel that was determined in Step 3. and repeat Step 2. on this channel.
 9. Verify that all the transmit channels now have the proper output power level.
9. Set the channel selector switch to channel 2 and check the transmit frequency.
 10. Repeat the procedure until all the channels have been checked.
 11. Reset the radio by turning it off and then on again.

NOTE

If step 8. cannot be performed due to insufficient transmitter power output, perform steps 1 and 2 of section 3.6.1.

3.6.2 OSCILLATOR FREQUENCY ADJUSTMENT

CAUTION

Make sure the radio antenna connector (J300) is terminated into 50 ohms.

3.6.3 DEVIATION ADJUSTMENT

NOTE

It is important that deviation be checked on all the transmit channels to ensure that no over-deviation occurs on any channel.

1. Begin deviation adjustment by performing steps 1 to 5 in Section 3.6.2 (Oscillator Frequency Adjustment).
2. Push the monitor button repeatedly until the display shows the phrase "TX DPL".
3. Set the channel selector switch to any available channel on the radio set.
4. Turn R344 (REF MOD potentiometer) to a mid-position setting.
5. Connect the audio oscillator output leads to the microphone audio input, as explained below:
 - hot lead to J4200 - 6
 - ground lead to J4200 - 3
6. Set the audio oscillator to 1000 Hz and adjust its output level to 800 mV rms.
7. Using the appropriate rf load, key the transmitter and observe the deviation level. Readjust audio oscillator level as in Step 6 if necessary.
8. Adjust R341 (VCO MOD potentiometer) until the rated system deviation level of 4.6 kHz is obtained.

NOTE

For PL/DPL radios, DO NOT defeat PL and/or DPL output.

9. Set the radio set to the other transmit channels and record the deviation level obtained on each. Make a note of the channel having the highest deviation level. If more than one channel produces the same maximum deviation level, note the channel with the highest frequency among those having the maximum deviation level.
10. Set the radio to the channel noted in Step 9.

Adjust R341 (VCO MOD potentiometer) to obtain the correct deviation of 4.6 kHz.

11. Disconnect the audio oscillator. From the recorded data of Step 9, calculate the average level of deviation for all the transmit channels. Select a channel that has an average level of deviation. If more than one channel has an average level of deviation, select the higher frequency channel.
12. (For DPL models only) Connect a direct-coupled input lead of an oscilloscope to the digital output of a standard test receiver. Adjust the REF MOD potentiometer (R344) until the best eye pattern symmetry is obtained. Refer to Figure 3-7. Check all other channels equipped with DPL and verify that all the eye patterns are similar.

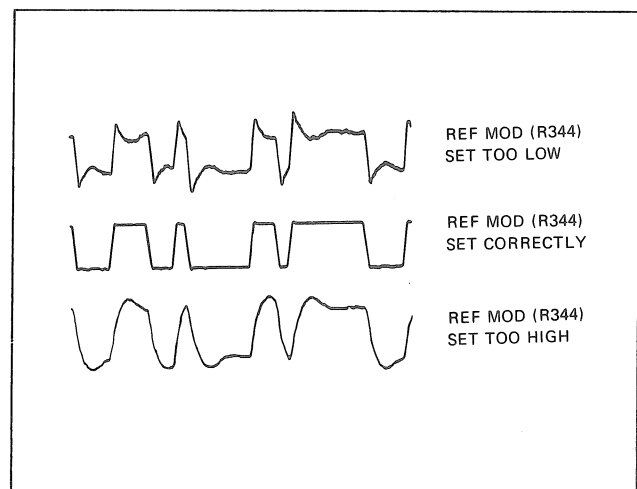


Figure 3-7 Examples of "Eye Pattern" Symmetry

13. Repeat Steps 5, 10, 11, 12.
14. Check the deviation level on all the transmit channels and verify that it does not exceed 4.6 kHz.
15. Reset the radio by turning it off and then on again.

3.7 RECEIVER ALIGNMENT

Receiver alignment should be performed after transmitter alignment is complete.

3.7.1 RF DECK ALIGNMENT (WIDESPACE DUAL FRONT END)

In the following procedure, radios in the 136 to 162 MHz frequency range are referred to as Range 1 radio sets, and radios in the 146-to 174 MHz range are referred to as Range 2 radio sets. The terms high and low range refer to the ranges of the switched filters within the rf deck, the actual frequency ranges are determined by the requirements of the particular radio.

NOTE

The rf input coils (L701, L702, L703) are covered with a strip of tape (refer to figure 3-8.). These coils are computer set at the factory during assembly and **MUST NOT BE FIELD ADJUSTED**. If a replacement rf deck is purchased from Motorola, these coils will be preset by the factory. There should never be any reason to readjust these coils.

1A. (Range 1 radios only) Carefully turn the slugs of coils L704, L705, L706, L707, L708 and L709 (Figure 3-8) counterclockwise until the adjusting screws just protrude from the radio chassis wall.

1B. (Range 2 radios only) Carefully turn the slugs of coils L704, L705, L706, L707, L708 and L709 clockwise until the adjusting screws are flush with the torque nut on the rf deck housing.

2. Refer to label on the cover of the radio for tune-up frequencies for both high and low range switched filters. If the label is not supplied or is missing, contact your Motorola representative for information. The tune-up frequency is not necessarily the midpoint of the frequency range.

3. Set the channel selector switch to any channel programmed into the radio.

4. Connect an ac voltmeter across the audio output of the radio set. The audio output must be terminated in either the recommended 2-ohm speaker / audio load (refer to test equipment list), or a 2-ohm resistor.

5. Depress the squelch button and monitor button (if used) so that noise is heard in the speaker.

6. Adjust the volume control until a comfortable noise level is reached. If a 2-ohm load is used, adjust the volume control for an indication of approximately 1 volt across the load.

7. Adjust L5 (quad coil) (Figure 3-6) until maximum noise level is obtained from the

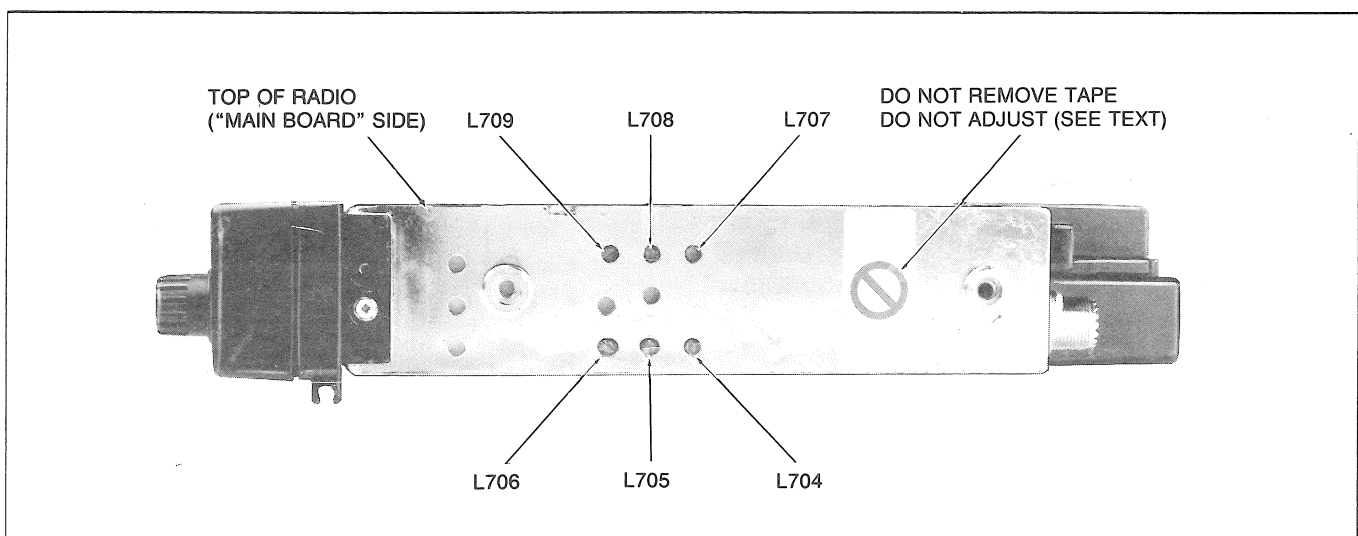
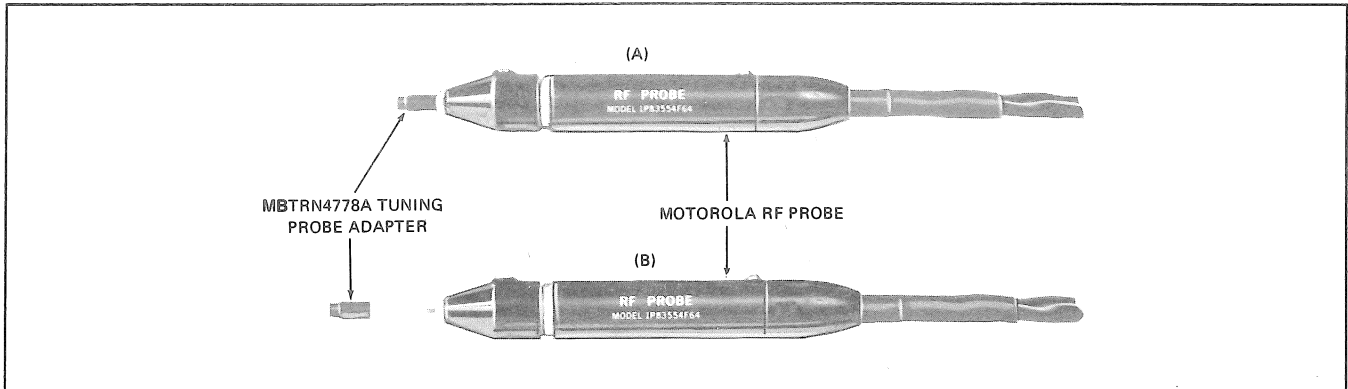


Figure 3-8 Widespace Dual Front End Alignment Points



*Figure 3-9 MCX1000 Alignment Probe
(A) RF Probe with Tuning Adapter in Position
(B) RF Probe and Tuning Adapter Separated*

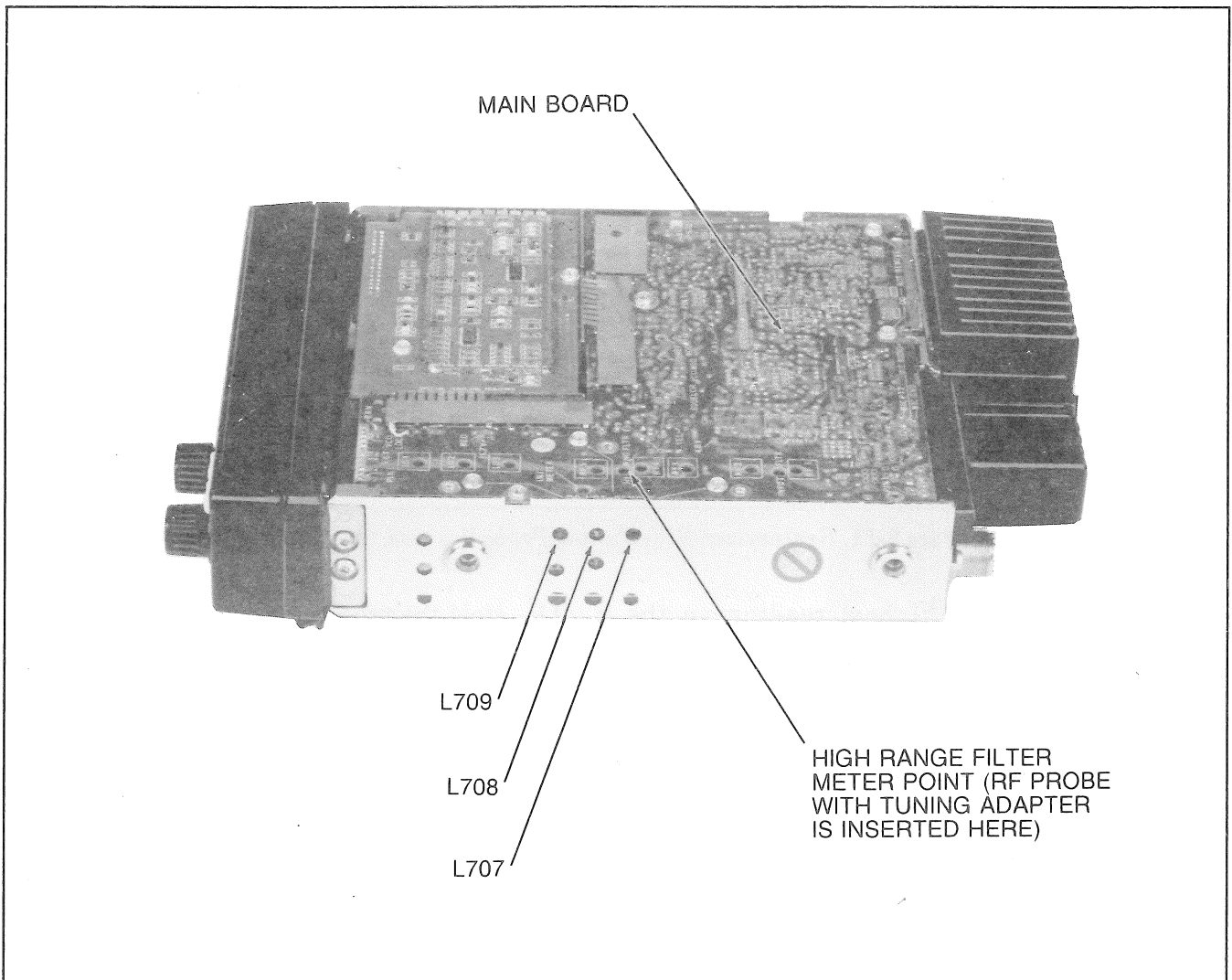


Figure 3-10 Main Board Side Tuning Probe Position (High Range)

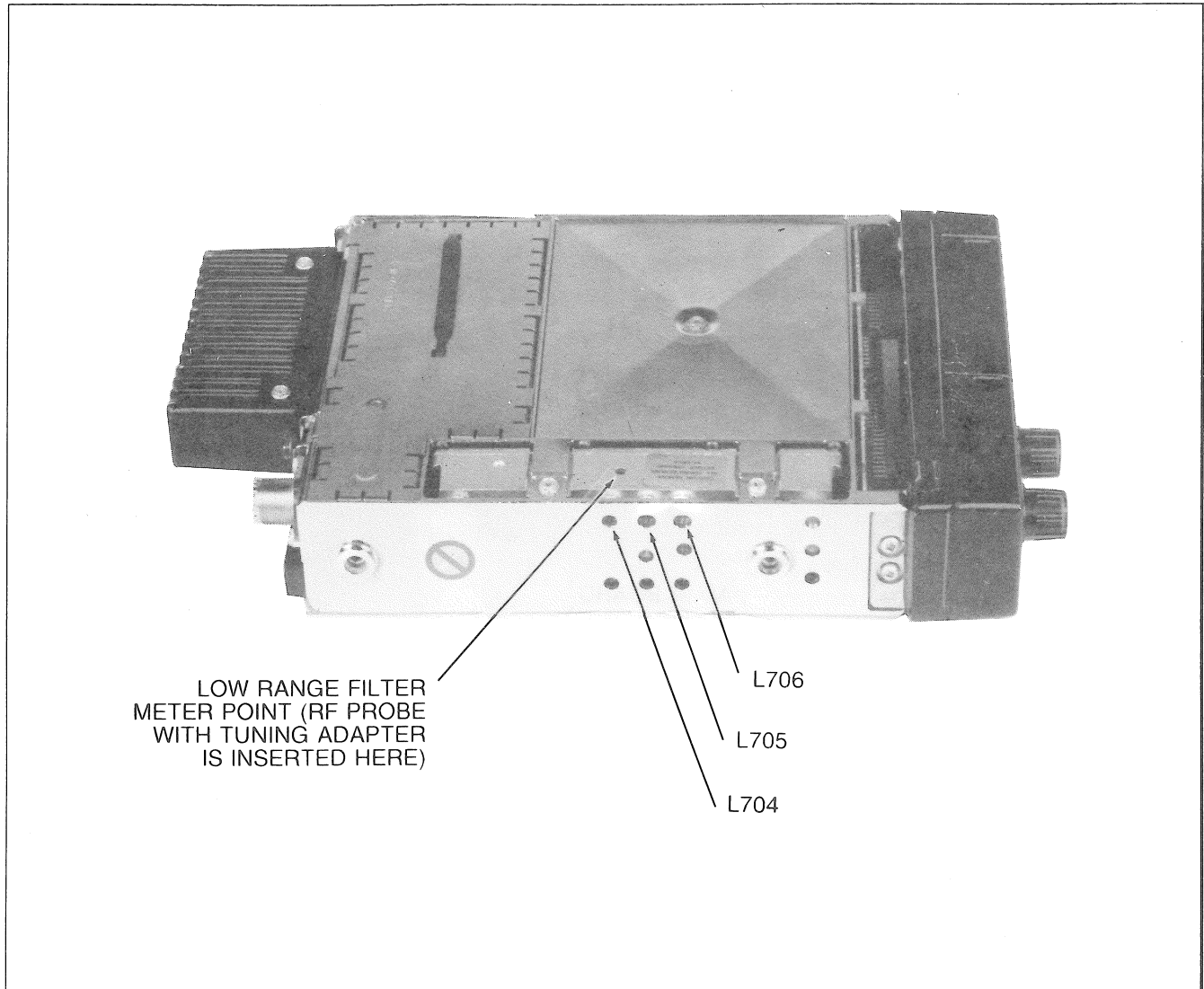


Figure 3-11 Synthesizer Side Tuning Probe Position (Low Range)

8. Set the rf generator to the high range tune-up frequency, and set the channel selector to the *highest operating frequency*.
9. Press the tuning probe adapter (Motorola # TRN4778) onto the probe of the rf voltmeter as shown in Figure 3-9.
10. Place the radio into the position shown in Figure 3-10. and insert the test probe adapter tip through the hole in the main board and into the tuning hole of the first cavity (L707) of the high range switched filter.
11. Hold the probe in position and turn L707 in (clockwise) for Range 1 radios or out (counterclockwise) for Range 2 radios until a peak in the voltmeter reading is obtained.
12. Hold the probe in position and turn L708 in the same direction (turned in Step 11) until a dip in the voltmeter reading is obtained.
13. Hold the probe in position and turn L709 in the same direction (turned in Step 11) until a peak in the voltmeter reading is obtained. The high range switched filter is now tuned.
14. Set the signal generator to the low range tune-up frequency, and the channel selector switch to the *lowest operating frequency*.

15. Place the radio in the position shown in Figure 3-11 and place the test probe adapter tip into the hole of the first cavity (L704) of the low range switched filter.
16. Hold the probe in position and turn L704 in (clockwise) for Range 1 radios or out (counterclockwise) for Range 2 radios until a peak in the voltmeter reading is obtained.
17. Hold the probe in position and turn L705 in the same direction (turned in Step 16) until a dip in the voltmeter reading is obtained.
18. Hold the probe in position and turn L706 in the same direction (turned in Step 16) until a peak in the voltmeter reading is obtained. Both switched filters are now tuned. Continue with the Receiver Adjustments section (4.2).

3.7.2 RECEIVER ADJUSTMENTS

Receiver adjustments are made after RF deck alignment is complete.

1. Set the signal generator to provide an output of 1 mV at 1 kHz modulation at a deviation of 2.76 kHz. With the volume control set for a comfortable listening level, very slowly adjust L5 (quad coil) until a maximum tone level is obtained from the speaker (or a maximum indication across a 2-ohm load, if such a load is used).
2. Set the generator to provide an unmodulated, on-frequency output signal that causes 10 dB of noise quieting.
3. Turn R2103 (SQUELCH ADJ. potentiometer) fully counterclockwise and set the squelch pushbutton on the front panel to the OUT position.
4. Turn R2103 clockwise until the speaker noise mutes; then *very slowly* turn it counterclockwise until the speaker noise just stays unmuted.
5. Reduce the signal generator output level to zero and then *very slowly* increase it until the speaker unmutes. Verify that the noise quieting (at squelch opening) is between 9 and 11 dB.
6. Check radio on all channels for 20 dB quieting sensitivity. The quieting level should not exceed 0.35 uV on any channel.

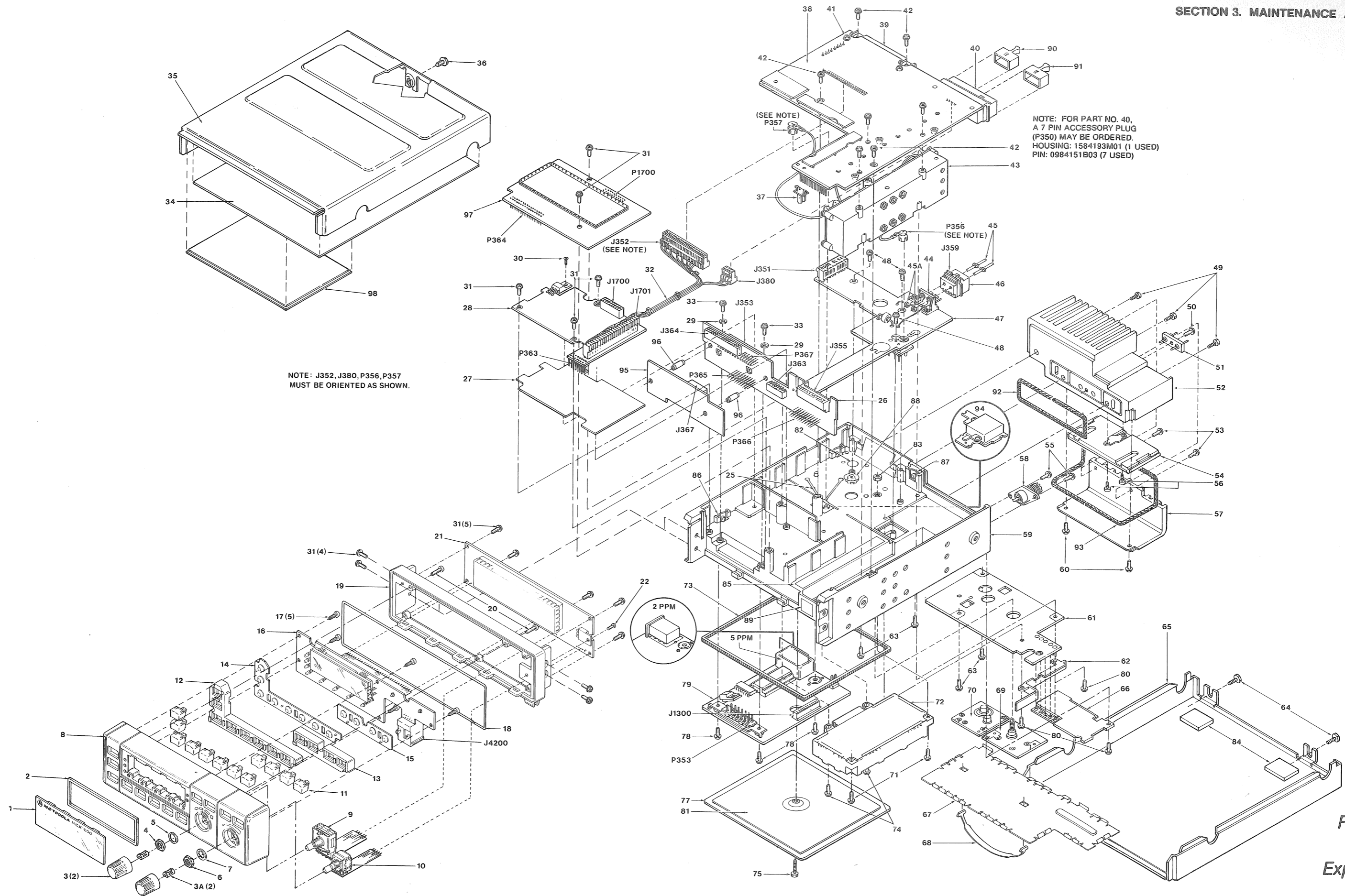


Figure 3-12
Radio Set
Exploded View
(Sheet 1)

SECTION 3. MAINTENANCE AND ALIGNMENT

parts list

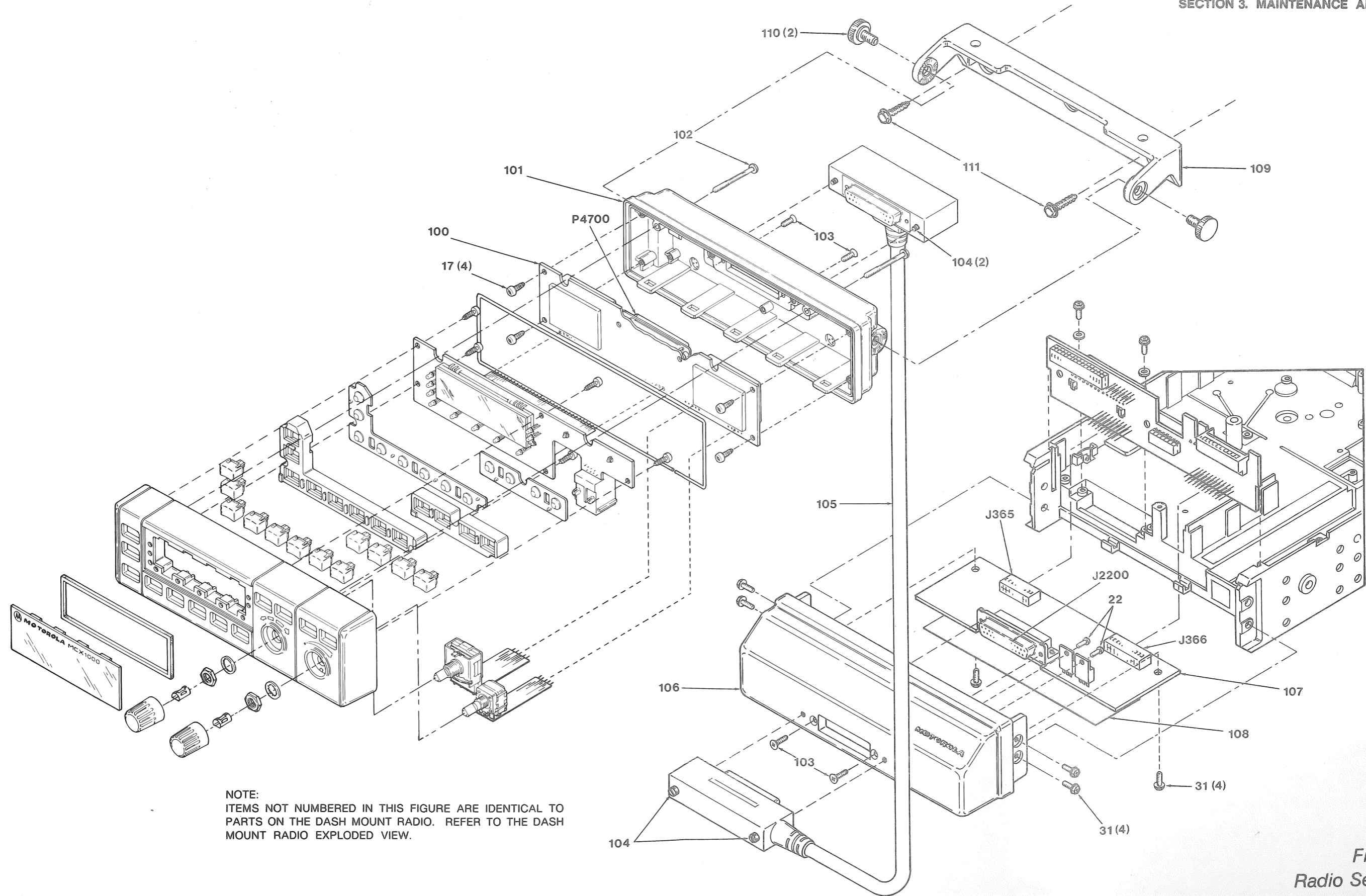
RADIO SET MECHANICAL PARTS (DASH MOUNT VERSION)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	6100018M01	LENS C/H B	56	0384208M04	SCREW, washer M2.5 X 0.45 X 8.0
2	3200044M01	GASKET LENS	57	1584141M01	COVER, heatsink
3	3600017M01	KNOB VOLUME/CHANNEL SW (2 used)	58	0982442E09	J300 CONNECTOR, antenna
3A		SPRING CLIP (P/O 3600017M01)	59	2784061M01	CHASSIS
		(2 used)	60	0384208M01	SCREW, washer M3 X 0.5 X 8.0
4	284218M02	NUT, M9 X 0.75	61		BOARD PA interconnect
5	484219M02	LOCKWASHER, #9 internal	62	2684102M01	SHIELD, wall transmitter
6	284218M01	NUT, M7 X 0.75	63	0384208M01	SCREW, washer M3 X 0.5 X 8.0
7	484219M01	LOCKWASHER, #7 internal	64	0384208M12	SCREW, Phillips M4 X 0.7 X 9.0
8	1500331M01	PLASTIC HOUSING C/H FRONT	65	1584174M01	COVER, bottom
9	4000100M02	ROTARY SW 24 POS, 1 OF 3	66		HYBRID, harmonic filter
10	1800028M01	POT, 2K-20-.05W linear	67	2684176M01	SHIELD, PA
11	3800026M01	SQUELCH BUTTON	68	5584300B01	HANDLE
11	3800026M02	MONITOR BUTTON	69		HYBRID, 10 W PA
11	3800026M03	ARROW BUTTON (2 used)	70		HYBRID, low level amplifier
11	3800026M10	DIM BUTTON	71	0384208M01	SCREW, washer M3 X 0.5 X 8.0
11	3800026M13	PROG BUTTON	72		HYBRID, VCO
12	6100017M01	LIGHT PIPE "L" SHAPE	73	3284178M01	GASKET, rf (19 inches)
13	6100017M02	LIGHT PIPE STRAIGHT	74	0384208M01	SCREW, washer M3 X 0.5 X 8.0
14	7500029M01	SILICON KEYPAD L SHAPED	75	0384208M11	SCREW, washer M3.5 X 0.6 X 14.0
15	7500029M02	SILICON KEYPAD STRAIGHT	76	2684103M01	SHIELD, synthesizer (std lock models)
16		DISPLAY BOARD	77	1584147M01	COVER, synthesizer
17	0310945A11	SCRTPG P3.12X1.27X8 STARSLTPAN (5 used)	78	0384208M01	SCREW, washer M3 X 0.5 X 8.0
18	3280058H03	GASKET HOUSING	79		BOARD, synthesizer VHF
19	4300069M01	SLEEVE, DASH	80	0384208M01	SCREW, washer M3 X 0.5 X 8.0
20	0310907A20	SCRMCH M3X0.5X10 INTSTAR PAN (2 used)	81	1484170M01	INSULATOR, synthesizer cover
		DASH MOUNT C / H MICRO. BOARD	82	4383779N01	INSERT, chassis plug
21		SCR M2.5X0.45X6 STL	83	027003	NUT, 8-32 X 5/16 X 1/8"
22	0384208M03	WSHRLCK 4 INT STL CAD (2 used)	84	7582200H03	PAD, 2 used
	0400009761	CABLE, solid coaxial	85	1484172M01	INSULATOR, power board
25	3084177M01	EYELET, 2 used	86	6484169M01	PLATE NUT, cover side; 4 used
	and 2910208A08	BOARD, front panel interconnect	87	6484168M01	PLATE NUT, cover rear; 3 used
26		INSULATOR, option area	88	4282604H01	CLIP, transistor
27	1484184M01	ANALOG INTERFACE BOARD	89	1484171M01	INSULATOR
28		WASHER, flat synthesizer connector	90	1582221N01	COVER, connector (microphone)
29	0482318N01	SCREW, M2.2 X 0.45 X 6.0	91	1582222N01	COVER, connector (accessory)
30	384208M03	SCREW T.T M3.0-0.5X8	92	3284178M01	GASKET, rf (11.6 inches)
31	0384208M01	CABLE, assembly (refer to associated circuit board parts list)	93	3284178M01	GASKET, rf (8.3 inches)
32		SCREW, washer; M3 X 0.5 X 8.0	94		BOARD, synthesizer rf amplifier (Fast-Lok models)
33	0384208M01	INSULATOR, top cover	95		MDC600/1200 FILTER BOARD
34	1484173M01	COVER, top	96	4300070M01	STANDOFF, PLASTIC (2 used)
35	1584175M01	SCREW, Phillips M4 X 0.7 X 9.0	97		COMMAND BOARD
36	0384208M12	GUIDE, printed circuit	98	7582200H01/03	PAD, FOIL
37	4684135M01	BOARD, main	99	0384208M03	SCREW T.T M2.5-0.45X6.0
38		HEATSINK			
39	2684104M01	J350 (refer to main board parts list)			
40		SCREW, washer M3 X 0.5 X 8.0			
41,42	0384208M01	BOARD, dual front end			
43		HOUSING connector base dc			
44	1584143M01	TERMINAL, round			
45	2984167M01	NUT, terminal M3			
45A	0284334M01	HOUSING, connector cover dc			
46	1584144M01	BOARD, power interconnect			
47		SCREW, washer M3 X 0.5 X 8.0			
48	0384208M01	SCREW, Phillips M4 X 0.7 X 9.0			
49	0384208M12	SCREW, washer M3 X 0.5 X 8.0			
50	0384208M01	PLATE, feed-thru			
51	6484188M01	HEATSINK (30 W)			
52	2684142M01	SCREW, washer M3 X 0.5 X 8.0			
53	0384208M01	HYBRID, 30 W PA			
54		SCREW, washer M3X 0.5 X 8.0			
55	0384208M01				

RADIO SET MECHANICAL PARTS (REMOTE MOUNT VERSION)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
17	0310945A11	SCR TPG P3.12X1.27X8 STAR SLT PAN
22	0384208M03	SCR M2.5X0.45X6 STL
31	0384208M01	SCREW TT M3.0-0.5X8
100		REMOTE MOUNT C / H MICRO. BOARD
101	1500332M01	PLASTIC HOUSING C / H BACK
102	0300039M01	SCREW, CAPTIVE (2 used)
103	0300140295	
	or 0300140143	SCR MCH 4-40X1/2 STARFLT STL (2 used)
104	0300038M01	CAPTIVE SCREW (2 used)
105	3000053M01	17 FT. REM. CONTROL CABLE
106	6400247M01	REMOTE RADIO FRONT COVER
107		REMOTE INTERFACE BOARD
108	1482125N02	FRONT PANEL INSULATOR
109	0784891M01	BRACKET, TRUNNION
110	180761D701	CONTROL HEAD MOUNTING KNOB
111	03140147 or 03140148	SCREW, TPG 10-32 X 3/4
		SCREW, TPG 10-32 X 1-1/2

Figure 3-12
Radio Set Exploded
View (Sheet 2)



NOTE:
ITEMS NOT NUMBERED IN THIS FIGURE ARE IDENTICAL TO
PARTS ON THE DASH MOUNT RADIO. REFER TO THE DASH
MOUNT RADIO EXPLODED VIEW.

Figure 3-12
Radio Set Exploded
View (Sheet 3)



SECTION 4. RADIO FUNCTIONAL BLOCK DIAGRAMS AND CABLE KITS

4.1 RADIO FUNCTIONAL BLOCK DIAGRAM

The overall radio functional block diagram is shown in Figure 4-1. Note that the following blocks are detailed in other sections of this manual :

- Section 5. Control Head

In Section 5 of this manual, the Control Head Functional Block Diagram contains information on the boards listed below.

- Display Board
- Dash or Remote Mount Microcomputer Board

- Section 6. Radio Microcomputer System

In Section 6 of this manual, the Radio Microcomputer System Functional Block Diagram contains information on the boards listed below.

- Command Board
- Analog Interface Board
- Front Panel Interconnect Board
- Remote Mount Interface Board (remote mount models only)
- MDC600 / 1200 Filter Board (used only with MDC600 / 1200 Signalling option)

- Section 7. Synthesizer and VCO

In Section 7 of this manual, the two Synthesizer and VCO Functional Block Diagrams

(for standard and Fast-Lok synthesizers) contain information on the boards listed below.

- Synthesizer Board
- VCO Assembly (sealed unit, not field repairable)

4.2 AUDIO BLOCK DIAGRAMS

Receiver Audio Block Diagram

Figure 4-2 Receiver Audio Block Diagram indicates the audio path (both voice and data information) for the MCX1000 Radio Set in receive mode.

Transmitter Audio Block Diagram

Figure 4-3 Transmitter Audio Block Diagram indicates the audio path (both voice and data information) for the MCX1000 Radio Set in transmit mode.

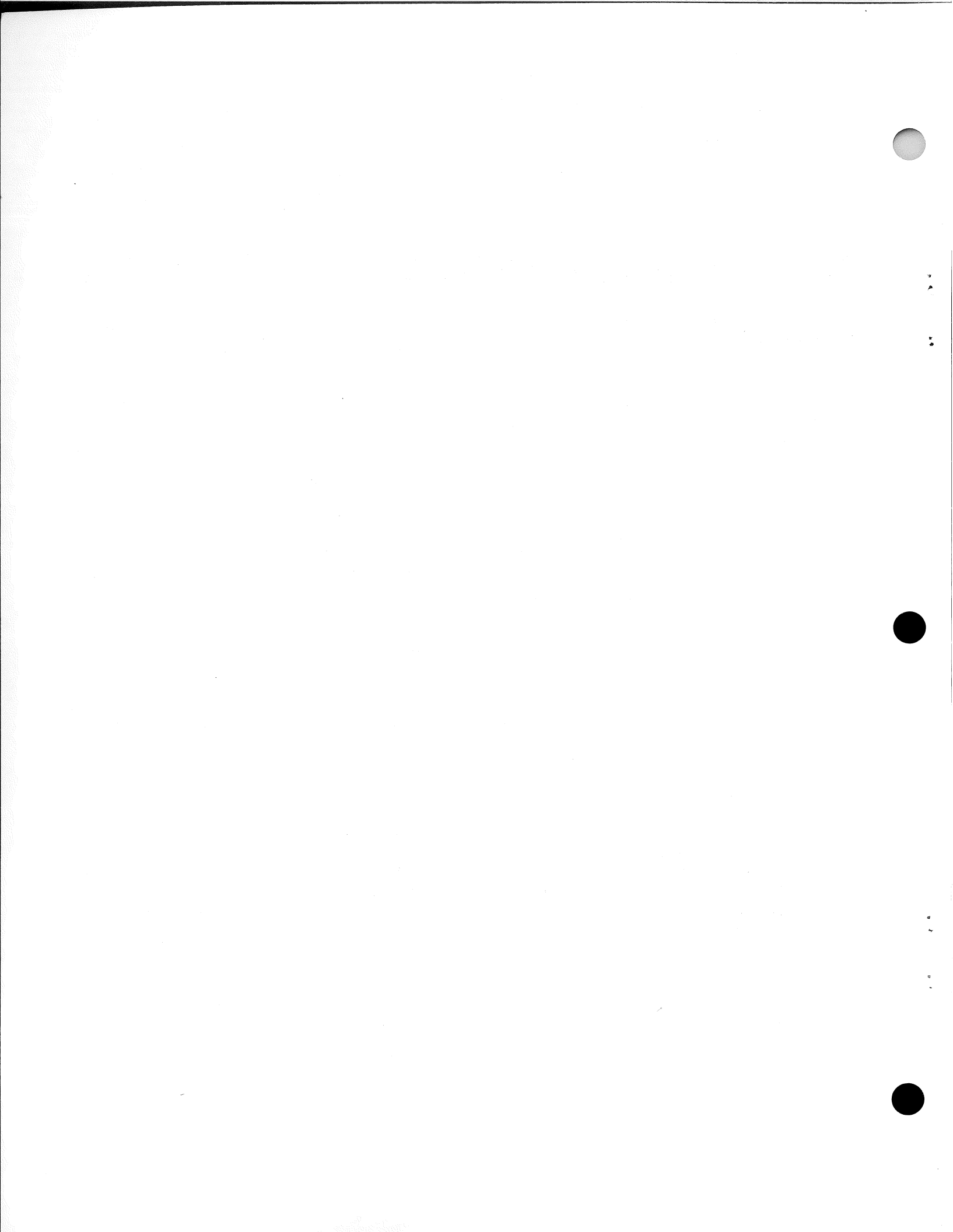
4.3 CABLING DIAGRAMS

Remote Control Head Cable

Figure 4-4 shows the schematic diagram of the MCX1000 Radio Set Remote Control Head Cable (used only in the remote mount radio) to connect the Control Head to the main radio chassis.

Radio Internal Cable

Figure 4-5 shows the schematic diagram of the MCX1000 Radio Set Internal Cable.



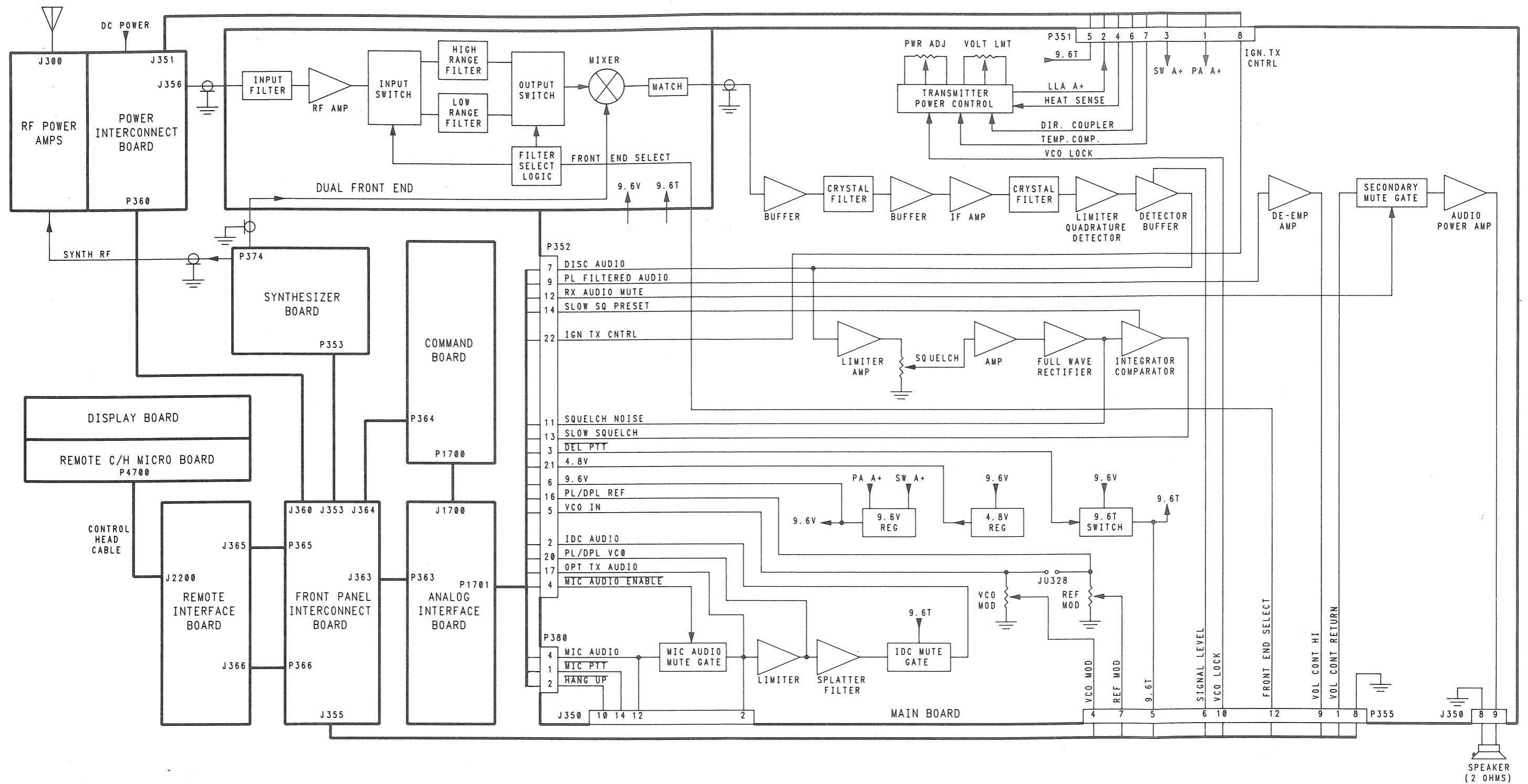


Figure 4-1
Radio Functional Block Diagram (Sheet 1.)



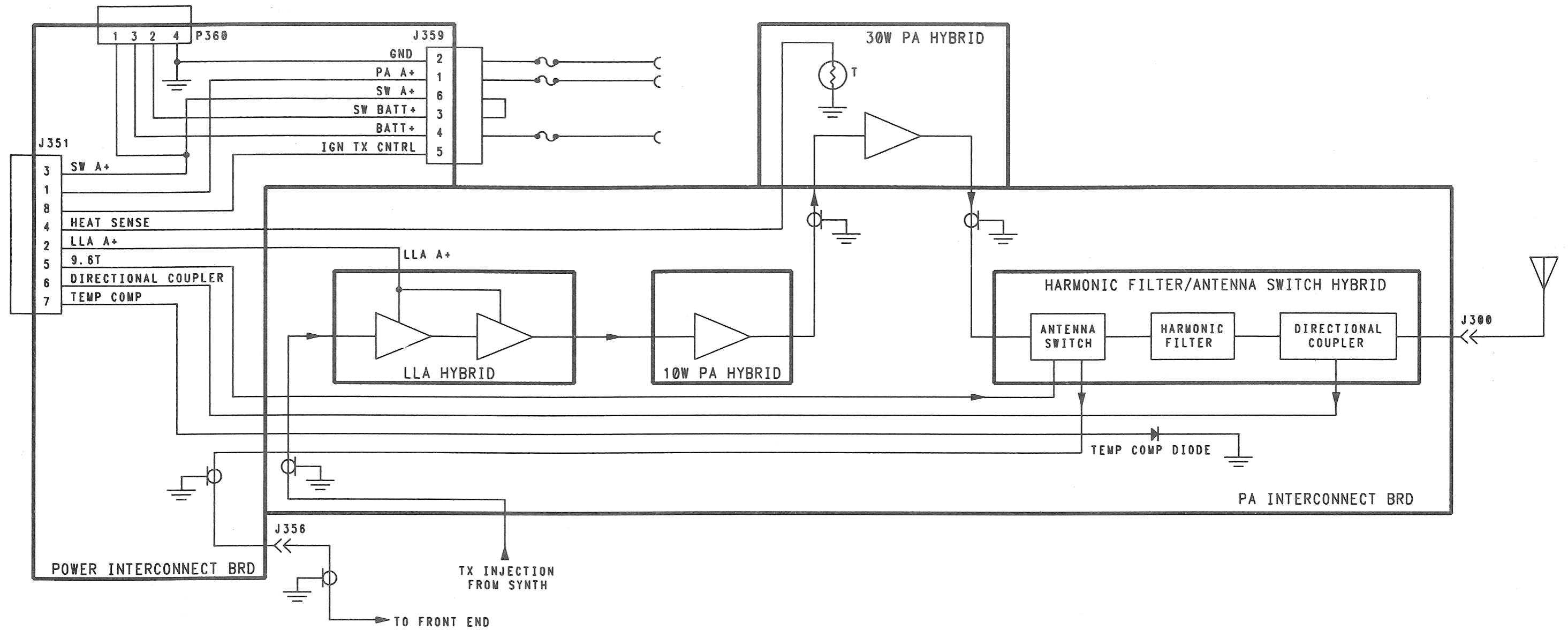


Figure 4-1
Radio Functional Block Diagram (Sheet 2.)
(Power Amplifier Section)



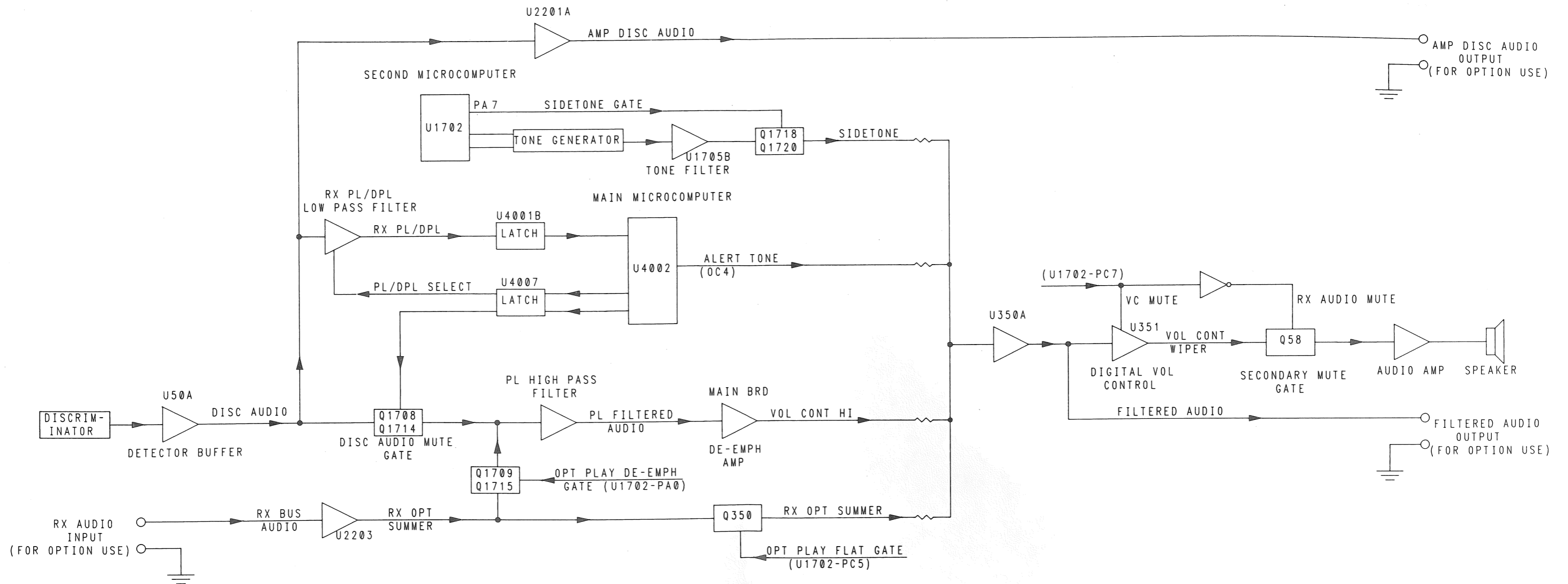


Figure 4-2 Receiver Audio Block Diagram

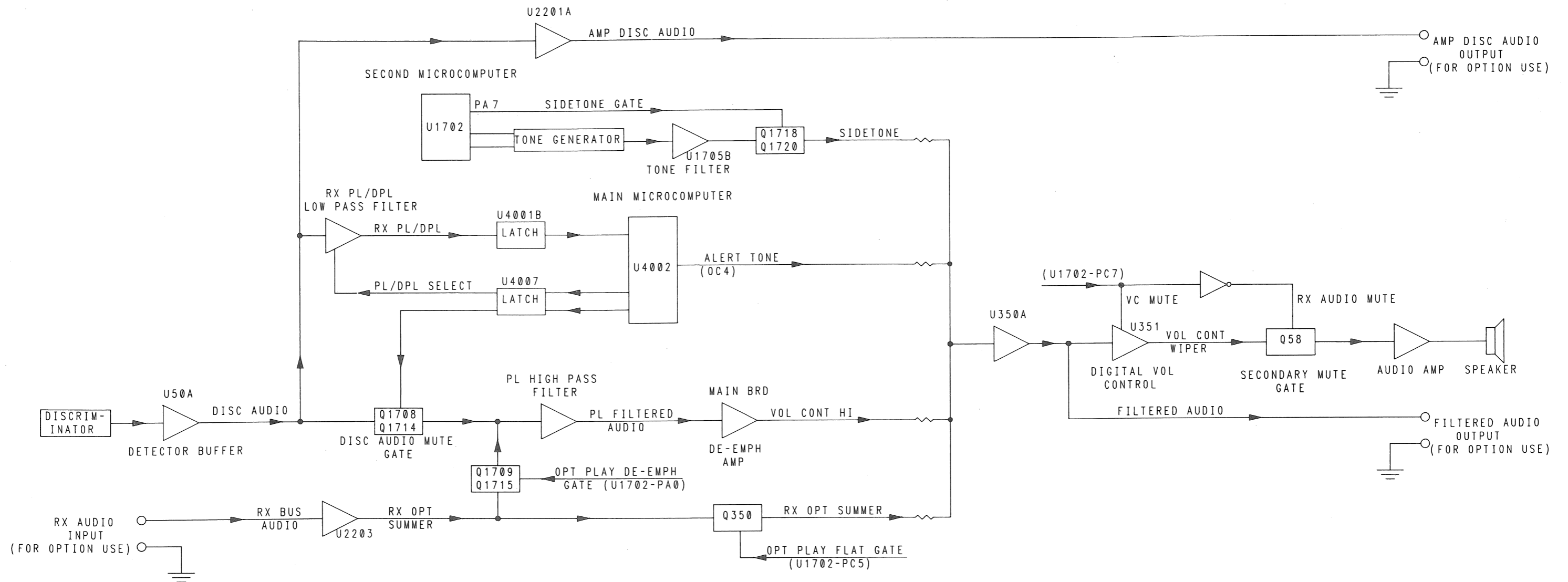


Figure 4-2
Receiver Audio Block Diagram

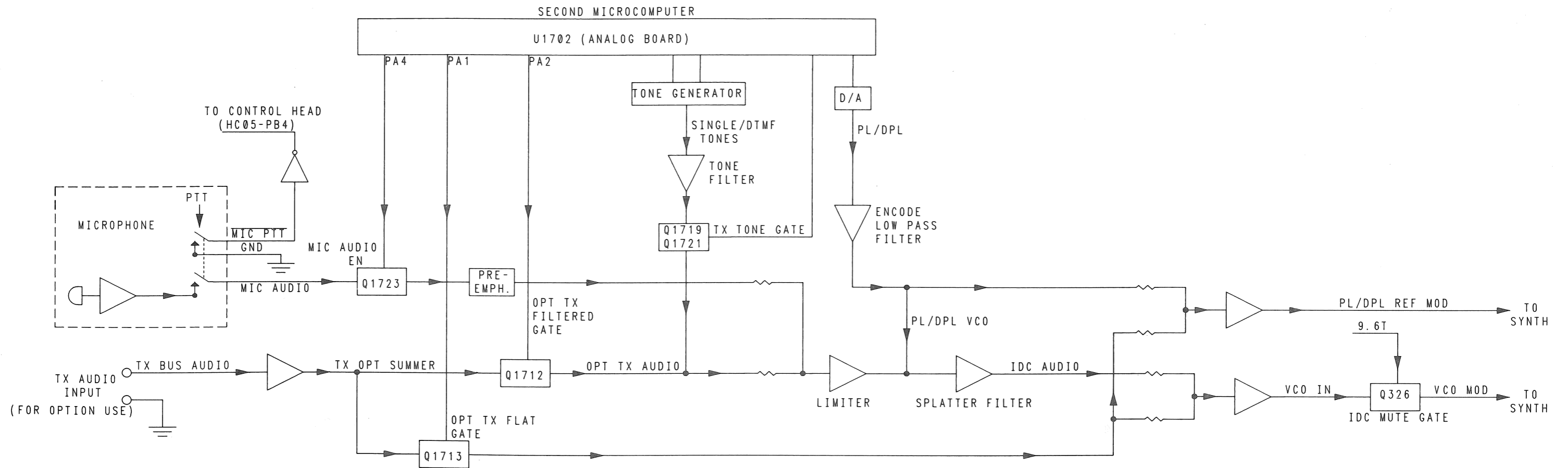
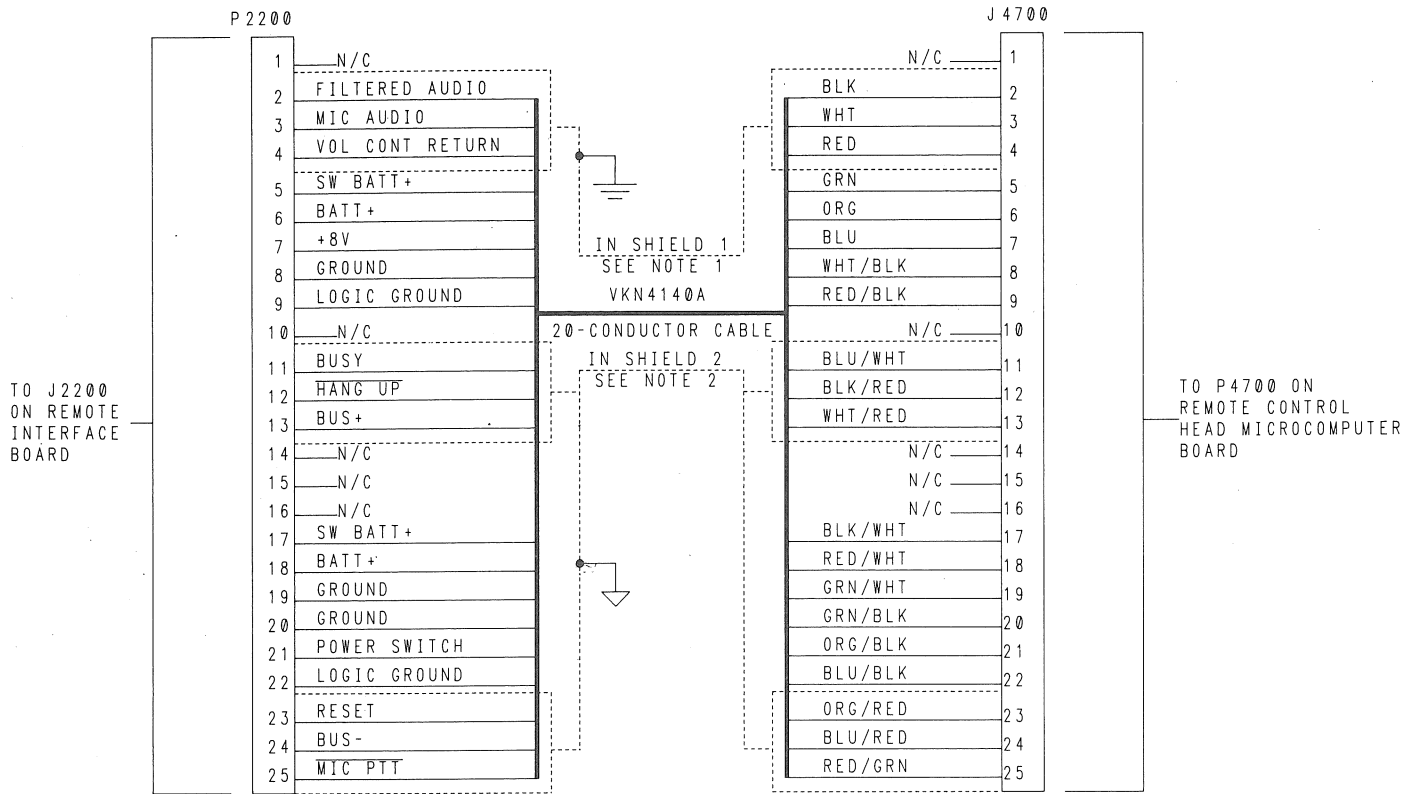


Figure 4-3
Transmitter Audio Block Diagram



**SECTION 4. RADIO FUNCTIONAL BLOCK DIAGRAMS
AND CABLE KITS**



NOTES:

1. SHIELD 1 IS CONNECTED TO PIN 19 (GROUND)
2. SHIELD 2 IS CONNECTED TO PIN 22 (LOGIC GND)

parts list

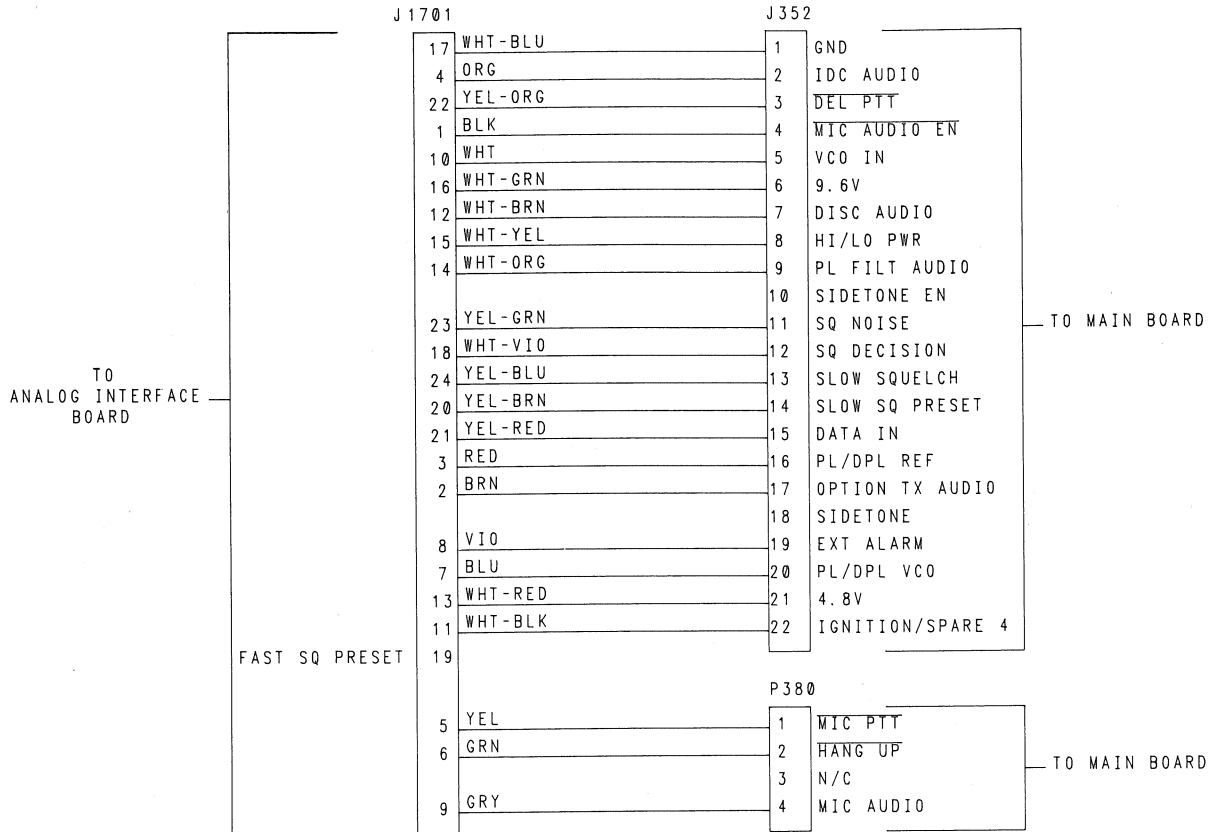
VKN4140A 17 FT REMOTE CONTROL CABLE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
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3000053M01		17 FT REMOTE CTRL CBL
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*Figure 4-4
Remote Control Head Cable*

**SECTION 4. RADIO FUNCTIONAL BLOCK DIAGRAMS
AND CABLE KITS**



parts list

VKN4147A INTERNAL RADIO CABLE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	0900075M02	FEM CONNECTOR IDC 4 PIN
	0900075M10	CONNECTOR FEM IDC 24 PIN (2)
	2284835F01	KEYING PIN WHITE (4 used)
		Wire, PVC
	3010286M10	#26 STR WHITE
	3010286L62	#26 STR WHITE
	3010286L83	#26 WHT-ORG
	3010286L75	#26 STR YEL-BLK
	3010286L61	#26 STR YEL
	3010286L69	#26 STR VIO
	3010286L68	#26 STR BLU
	3010286L77	#26 STR YEL-GRN
	3010286L81	# 26 WHT-BLK
	3010286L99	# 26 WHT-VIO
	3010286L64	# 26 STR WHT-RED
	3010286L86	# 26 STR WHT-BLU
	3010286L85	# 26 STR WHT-GRN
	3010286L84	# 26 STR WHT-YEL
	3010286M11	# 26 STR RED
	3010286L60	# 26 STR ORG
	3010286L67	# 26 STR BLK
	3010286L66	# 26 STR BRN
	3010286L92	# 26 STR YEL-ORG
	3010286L93	# 26 STR YEL-BLU
	3010286L70	#26 STR GRY
	3010286L82	#26 STR WHT-BRN
	3010286L76	#26 STR YEL-RED

*Figure 4-5
Radio Set Internal Cable*



SECTION 5. CONTROL HEAD

5.1 CONTROL HEAD

The Control Head contains two boards; the Control Head Display Board and the Control Head Microcomputer Board.

The main functional blocks of the Control Head are highlighted in Figure 5-1.

Schematics which support the discussion below are inserted at the end of this section.

5.2 CONTROL HEAD DISPLAY BOARD

(Figures 5-2, 5-3 and 5-4)

The Display Board contains the following major blocks;

- LED indicators
- Vacuum Florescent Display (VFD)
- Keypad

Voltage requirements for the display board are +5V, +8V and +42V. These three voltages are obtained from the Control Head Microcomputer Board.

The microphone connector (J4200) contains all needed microphone connections as well as serial bus lines BUS+ , BUS- and the BUSY line from the control head microcomputer. These latter lines allow the radio EEPROM to be reprogrammed without opening the radio. In addition, the control head and / or radio can be system tested with an external serial bus controller.

5.2.1 LED Indicators

Indicator LED's DS4201 to DS4209 and

DS4216 are controlled by commands on the serial bus from the radio microcomputer. The LED's are not controlled directly by the keys beside them on the control panel. Dimming is accomplished by software pulse width modulation of the LED driver transistors. Four dimming levels are selectable by using the dim key : full on, dim 1, dim 2, full off.

5.2.2 VFD

The 8 character VFD (vacuum florescent display) is multiplexed such that only one character is selected at any given time. The characters are refreshed at 250 Hz. The display driver IC's U4200 and U4201 are simple serial to parallel converters with a high voltage output stage. This high voltage (42 volts) comes from the high voltage switching generator residing on the control head microcomputer board.

A typical display cycle for the VFD is :

1. The control head microcomputer disables the VFD driver by making W4200-20 (strobe) high, thus turning off the display.
2. The microcomputer loads serial data into the display drivers (U4200, U4201) utilizing W4200-22 (clock) and W4200-21 (data) .
3. The microcomputer then enables the new data to be displayed by making W4200-20 (strobe) low. Dimming is accomplished by software pulse width modulation of the W4200-20 (strobe) line.

Backlight LED's DS4210 to DS4215 provide illumination for the keys in dim light. The backlights are not dimmed but are on at all times except at the full off dimming level.

5.2.3 Keypad

The control head keys each send a signal to the control head microcomputer by grounding two unique lines of the six available (W4200-27 to 32). The microcomputer debounces and decodes a keypush and sends this information to the radio via the serial bus.

5.3 CONTROL HEAD MICROCOMPUTER BOARD (REMOTE MOUNT VERSION)

(Figures 5-8 to 5-10)

The Dash Mount and the Remote Mount Control Head Microcomputer Boards are similar. They contain the following major circuits:

- Volume control
- On-off switch
- Mode (channel) selector switch
- Microcomputer
- Bus interface
- Watchdog timer
- High voltage supply

5.3.1 On-Off, Volume

The on-off volume switch controls a power transistor in the main radio chassis which provides power to the radio. The radio then generates the +8 volts required by the control head. The volume control pot supplies a 0 - 5 volt DC signal to pin 4 of plug P4700 which is then digitized by the radio and used to operate a digital volume control IC.

5.3.2 Mode Selector Switch

The rotary mode selector switch is connected to the control head microcomputer via pins 19, 20 and 21 on U4700. The microcomputer determines the rotation direction (up or down) and sends this information to the radio via the serial bus.

The +5 volt source is provided by U4701 pin 1, SOIC 5 V regulator.

5.3.3 High Voltage Supply

The 42 volts required by the VFD is generated by the high voltage switching generator. The 555

timer (U4704) along with transistors Q4712 and Q4713 form a chopper which feeds step-up transformer T4700. The diode bridge consisting of CR4704 to CR4707, rectifies the output and provides approximately +42 V. This generator also produces a filament voltage of 2.3 Vac biased at 5.6 V by zener VR4710. To light a particular segment, the anode and grid of the VFD are made 36 volts higher (42 V - 5.6 V) than the filament.

5.3.4 Watchdog Timer

The power up/watchdog reset circuit comprises comparator U4702A, SCR Q4701 and associated circuitry. Upon power up the output of the comparator goes low and then high, thereby resetting the microcomputer (U4700). Thereafter, under normal circumstances, this circuit must be constantly "tickled" by the microcomputer to keep the comparator output high so that the microcomputer is not reset again.

5.3.5 Bus Interface

The Bus+ and Bus- lines comprise the serial bus. These two lines along with the BUSY line control all communication between the control head, the radio and any other microprocessor controlled option which might be added. The Bus+ and Bus- lines form a differential pair with 5 volts between them (when one is high the other is low). These two lines form a bidirectional data path between the control head, radio and other options. The BUSY line is idle (U4700 pins 39 and 41 are high) when the control head is not sending a message. When a message is to be sent, the microcomputer causes BUSY to go high (U4700 pin 25 pulls low).

When trouble shooting a microcomputer board for a suspected serial bus fault, BUS+, BUS- and BUSY may be easily tested. Directions for this test are located on the schematic diagram of the Control Head Microcomputer Board. (both the dash and remote mount versions)

5.3.6 Other Information

The Microphone PTT and HANGUP lines are read, the information encoded and sent as a serial bus message to the radio.

5.4 CONTROL HEAD MICRO-COMPUTER BOARD (DASH MOUNT VERSION)

(Figures 5-5 to 5-7)

The Dash Mount Control Head Microcomputer Board is similar to the Remote Mount Control Head Microcomputer Board. The differences are described below.

1. The bus interface circuit for the Dash Mount Control Head Microcomputer Board becomes

Rx DATA and Tx DATA instead of BUS+ and BUS-.

2. The Dash Mount Control Head Microcomputer Board does not contain a 5 V regulator.
3. The Dash Mount Control Head Microcomputer Board does contain an 8 V regulator (U4405).

The 8 V regulator for the Remote Mount Control Head Microcomputer Board resides on the Remote Interface Board.



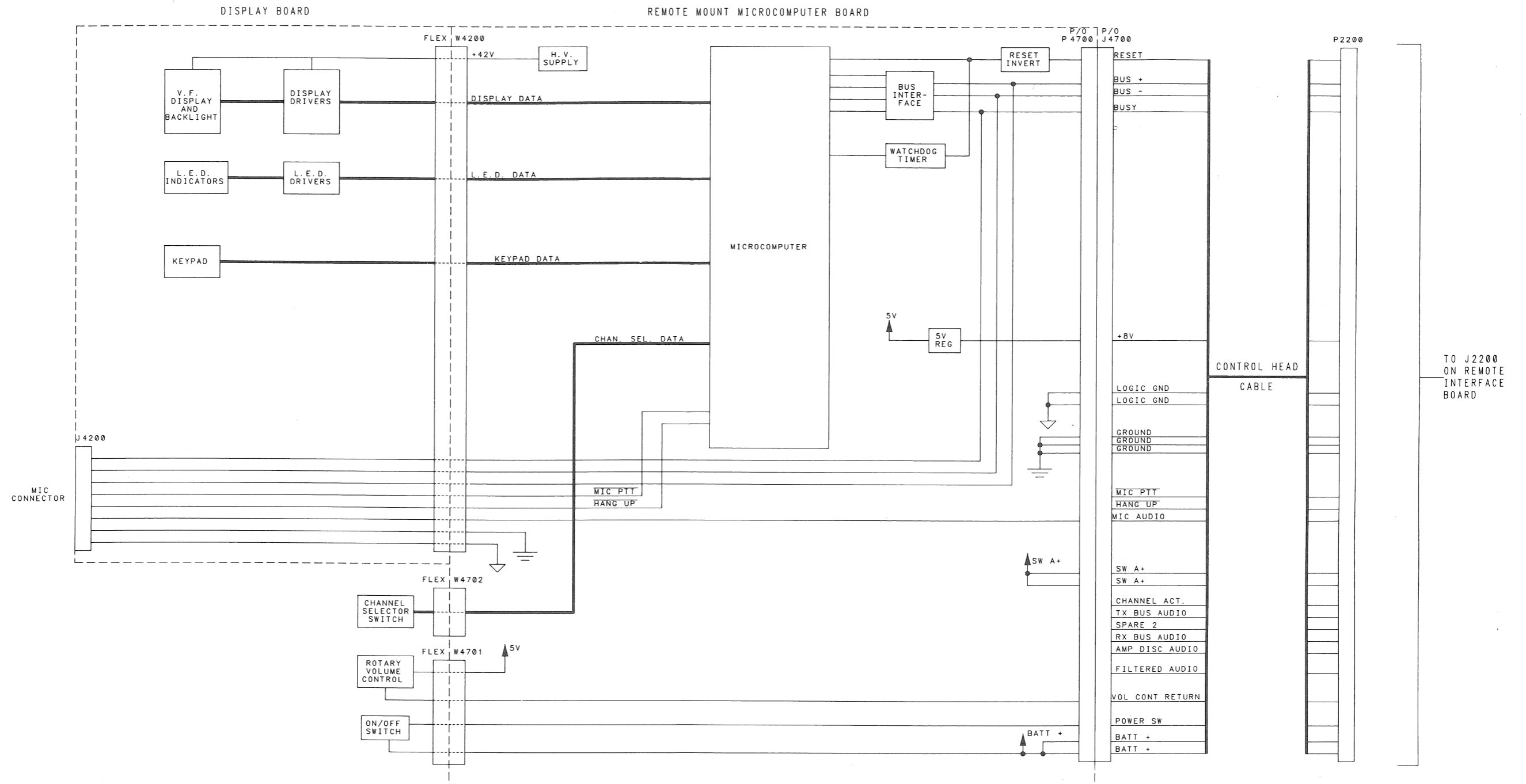
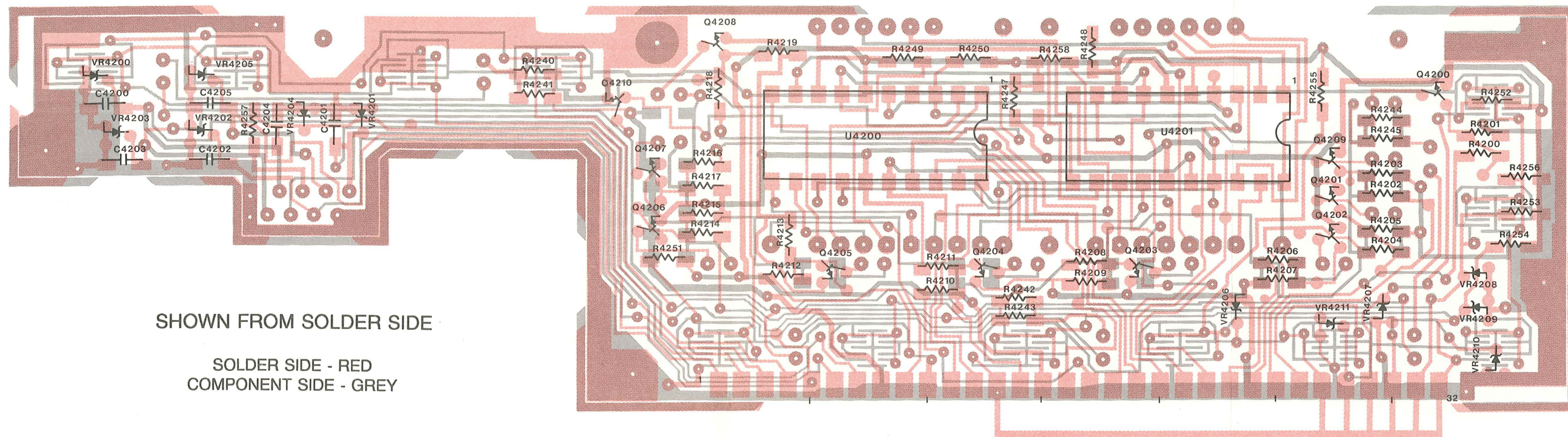
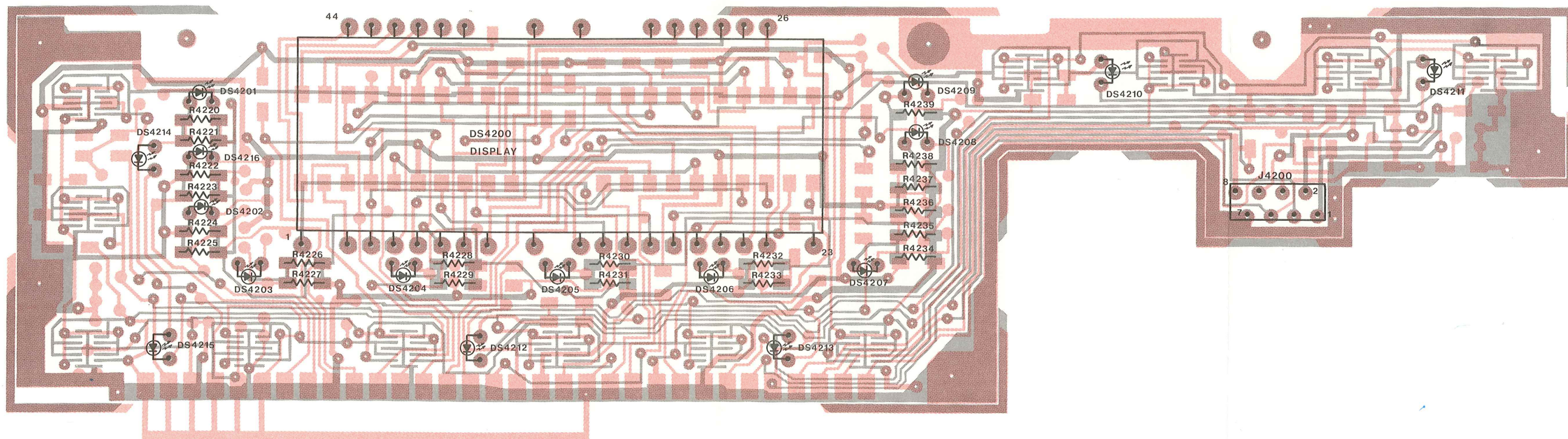


Figure 5-1
Control Head Block Diagram



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY



SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

31H00193M-0

Figure 5-2
Display Board - Board Details

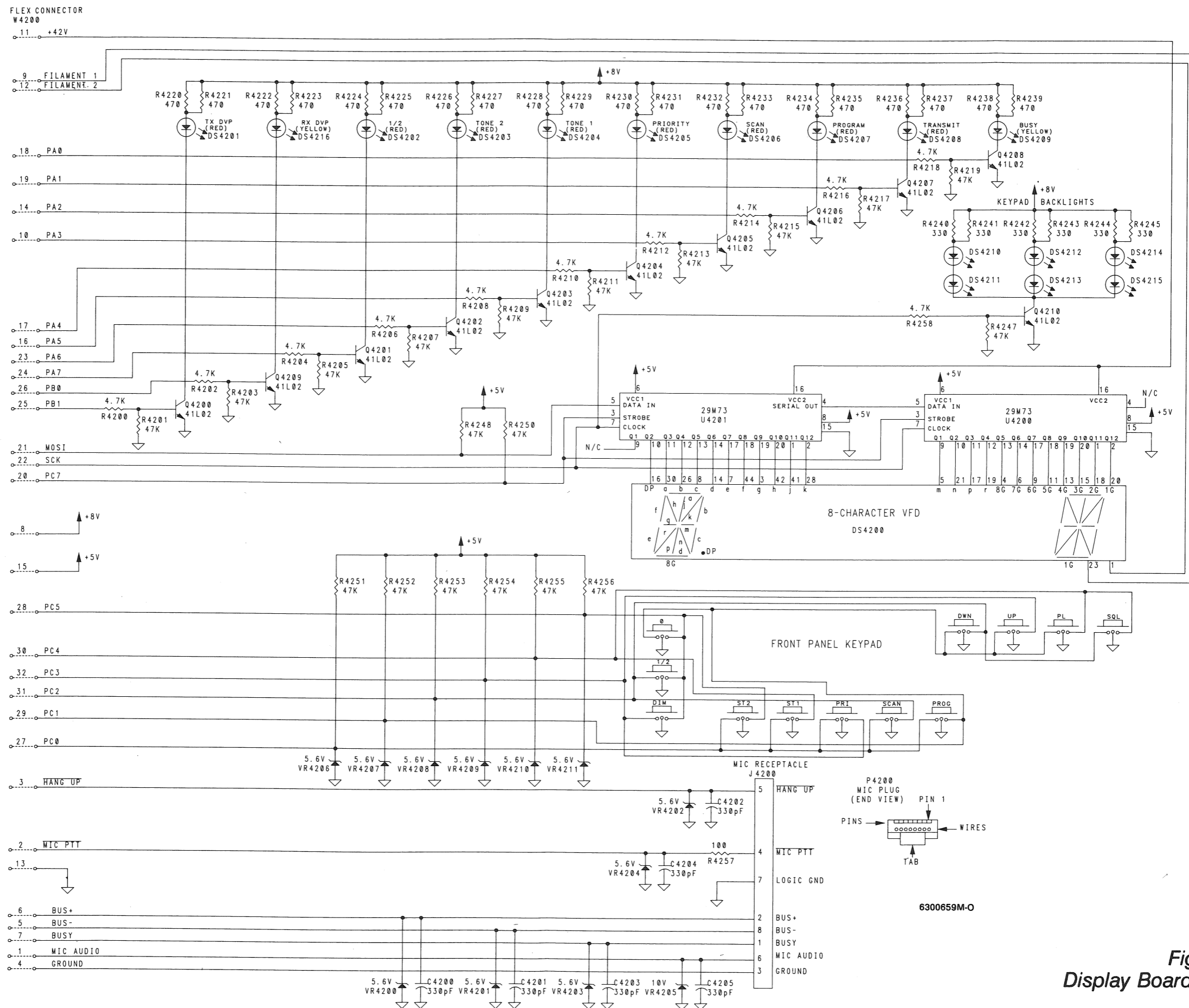


Figure 5-3
Display Board Schematic Diagram

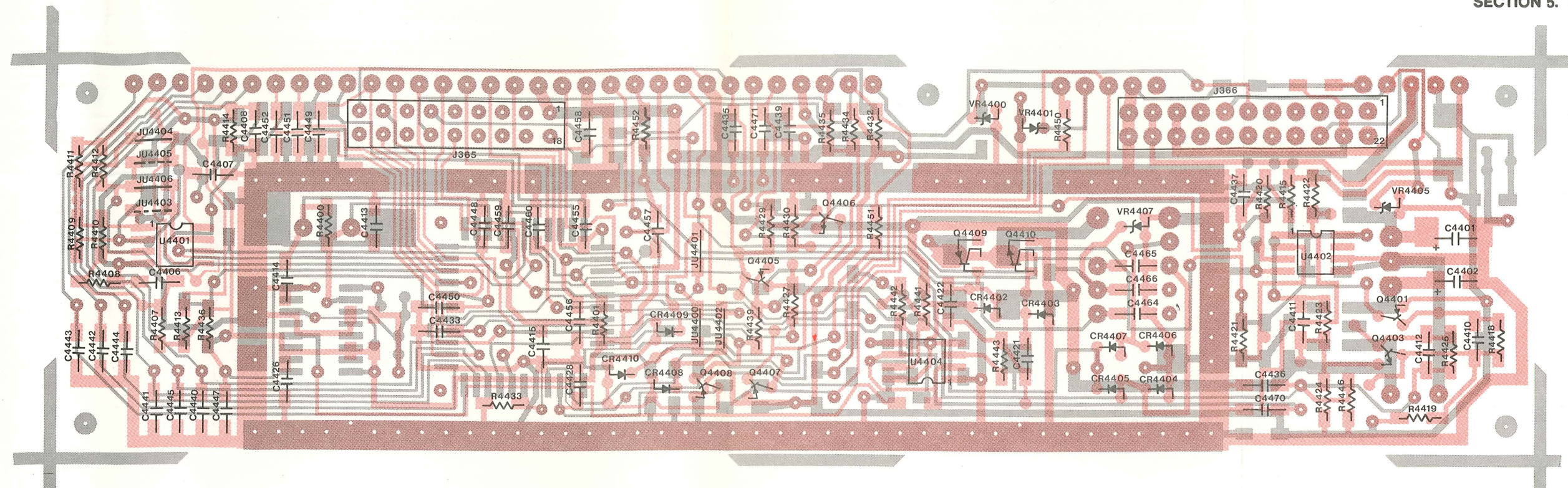
SECTION 5. CONTROL HEAD

parts list

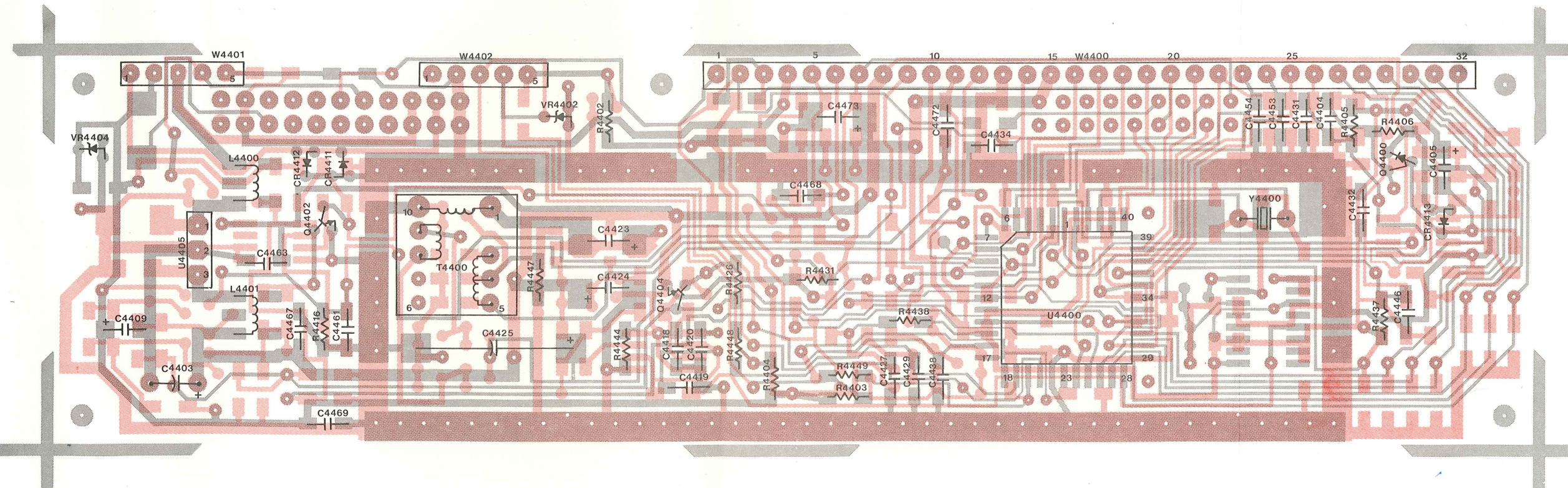
VLN4667A DISPLAY BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Capacitor, chip, pf			
C4200	2111031A51	330-5-NP0-50V	R4214	0600015M65	4.7K
C4201	2111031A51	330-5-NP0-50V	R4215	0600015M89	47K
C4202	2111031A51	330-5-NP0-50V	R4216	0600015M65	4.7K
C4203	2111031A51	330-5-NP0-50V	R4217	0600015M89	47K
C4204	2111031A51	330-5-NP0-50V	R4218	0600015M65	4.7K
C4205	2111031A51	330-5-NP0-50V	R4219	0600015M89	47K
		LED	R4220	0600015M41	470
DS4200	7200004M01	VFD 8 CHARACTER	R4221	0600015M41	470
DS4201	4808111B09	RED	R4222	0600015M41	470
DS4202	4808111B09	RED	R4223	0600015M41	470
DS4203	4808111B09	RED	R4224	0600015M41	470
DS4204	4808111B09	RED	R4225	0600015M41	470
DS4205	4808111B09	RED	R4226	0600015M41	470
DS4206	4808111B09	RED	R4227	0600015M41	470
DS4207	4808111B09	RED	R4228	0600015M41	470
DS4208	4808111B09	RED	R4229	0600015M41	470
DS4209	4808111B10	YELLOW	R4230	0600015M41	470
DS4210	4880246K04	GREEN	R4231	0600015M41	470
DS4211	4880246K04	GREEN	R4232	0600015M41	470
DS4212	4880246K04	GREEN	R4233	0600015M41	470
DS4213	4880246K04	GREEN	R4234	0600015M41	470
DS4214	4880246K04	GREEN	R4235	0600015M41	470
DS4215	4880246K04	GREEN	R4236	0600015M41	470
DS4216	4808111B10	YELLOW	R4237	0600015M41	470
		Receptacle	R4238	0600015M41	470
J4200	0900078M01	8PIN (MICROPHONE) P/O VLN4670A/71A, DASH/REMOTE HARDWARE KITS	R4239	0600015M41	470
		Transistor	R4240	0600015M37	330
Q4200	4880141L02	NPN SOT-23 MMBT3904	R4241	0600015M37	330
Q4201	4880141L02	NPN SOT-23 MMBT3904	R4242	0600015M37	330-
Q4202	4880141L02	NPN SOT-23 MMBT3904	R4243	0600015M37	330
Q4203	4880141L02	NPN SOT-23 MMBT3904	R4244	0600015M37	330
Q4204	4880141L02	NPN SOT-23 MMBT3904	R4245	0600015M37	330
Q4205	4880141L02	NPN SOT-23 MMBT3904	R4247	0600015M89	47K
Q4206	4880141L02	NPN SOT-23 MMBT3904	R4248	0600015M89	47K
Q4207	4880141L02	NPN SOT-23 MMBT3904	R4250	0600015M89	47K
Q4208	4880141L02	NPN SOT-23 MMBT3904	R4251	0600015M89	47K
Q4209	4880141L02	NPN SOT-23 MMBT3904	R4252	0600015M89	47K
Q4210	4880141L02	NPN SOT-23 MMBT3904	R4253	0600015M89	47K
		Resistor, chip, 5%, 1/8 W	R4254	0600015M89	47K
R4200	0600015M65	4.7K	R4255	0600015M89	47K
R4201	0600015M89	47K	R4256	0600015M89	47K
R4202	0600015M65	4.7K	R4257	0600015M49	1K
R4203	0600015M89	47K			
R4204	0600015M65	4.7K			
R4205	0600015M89	47K			
R4206	0600015M65	4.7K			
R4207	0600015M89	47K			
R4208	0600015M65	4.7K			
R4209	0600015M89	47K			
R4210	0600015M65	4.7K			
R4211	0600015M89	47K			
R4212	0600015M65	4.7K			
R4213	0600015M89	47K			
		Integrated Circuit			
			U4200	5183629M73	VFD DRIVER SN75512A
			U4201	5183629M73	VFD DRIVER SN75512A
		Zener Diode			
			VR4200	4880140L07	CHIP 5.6V MMBZ5232
			VR4201	4880140L07	CHIP 5.6V MMBZ5232
			VR4202	4880140L07	CHIP 5.6V MMBZ5232
			VR4203	4880140L07	CHIP 5.6V MMBZ5232
			VR4204	4880140L07	CHIP 5.6V MMBZ5232
			VR4205	4880140L15	SOT-23 MMBZ5240 10V
			VR4206	4880140L07	CHIP 5.6V MMBZ5232
			VR4207	4880140L07	CHIP 5.6V MMBZ5232
			VR4208	4880140L07	CHIP 5.6V MMBZ5232
			VR4209	4880140L07	CHIP 5.6V MMBZ5232
			VR4210	4880140L07	SOT 5.6V
		Non-referenced item			
				7500030M01	VFD PAD

Figure 5-4
Display Board Parts List



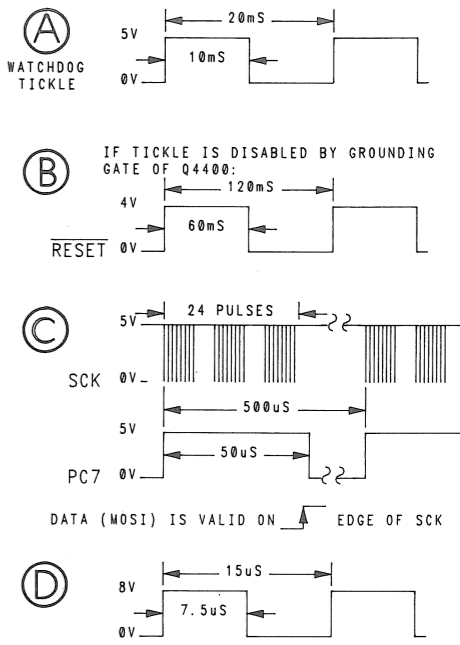
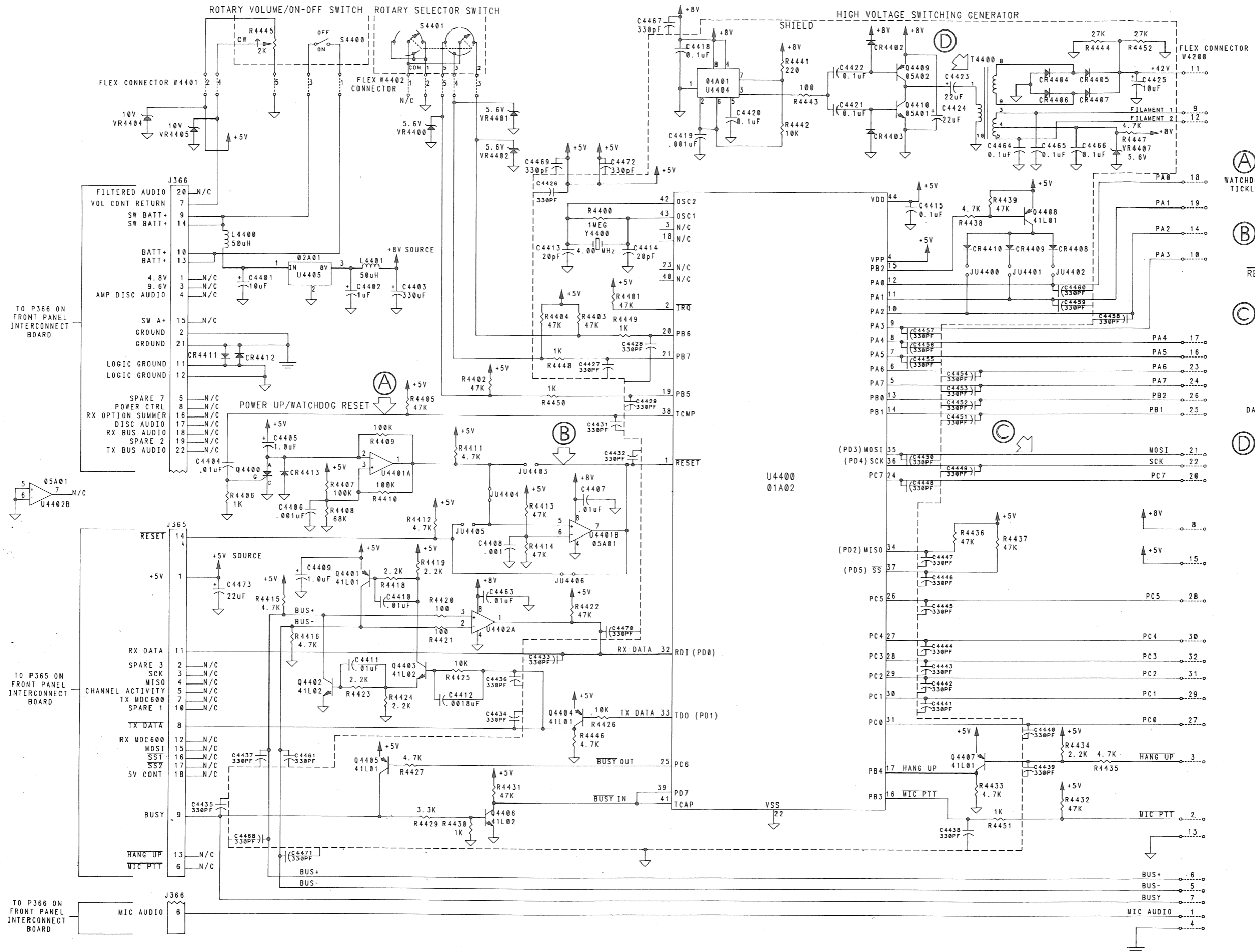
SHOWN FROM SOLDER SIDE SOLDER SIDE - RED



SHOWN FROM COMPONENT SIDE SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 5-5
Dash Mount Control Head
Microcomputer Board
-Board Details

31H00203M-O



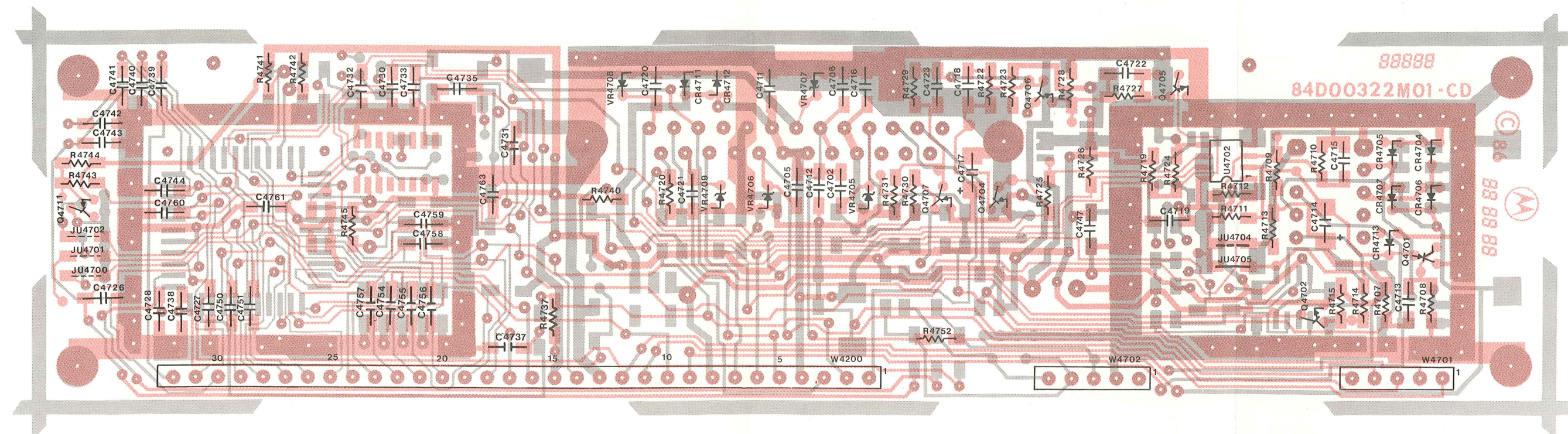
JUMPER TABLE

JU4400	NORMALLY OUT
JU4401	NORMALLY OUT
JU4402	NORMALLY OUT
JU4403	NORMALLY OUT
JU4404	NORMALLY IN
JU4405	NORMALLY OUT
JU4406	NORMALLY IN

6300666M-O

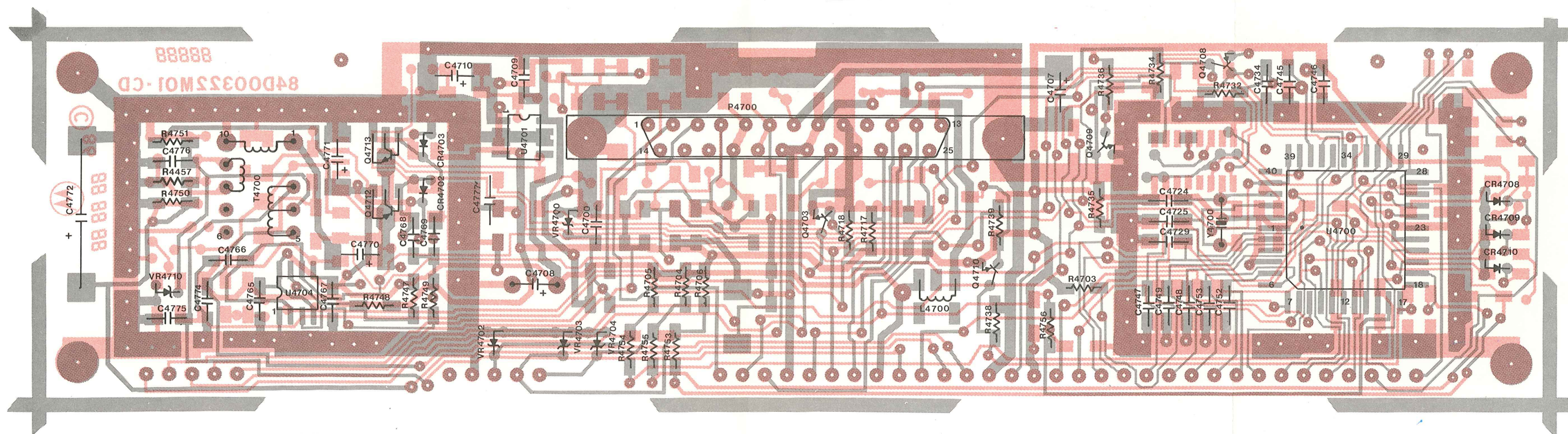
SEE FIGURE 5-6 (SHEET 2) FOR SERIAL BUS FAULT TEST

Figure 5-6 Dash Mount Control Head Microcomputer Board Schematic Diagram (Sheet 1)



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

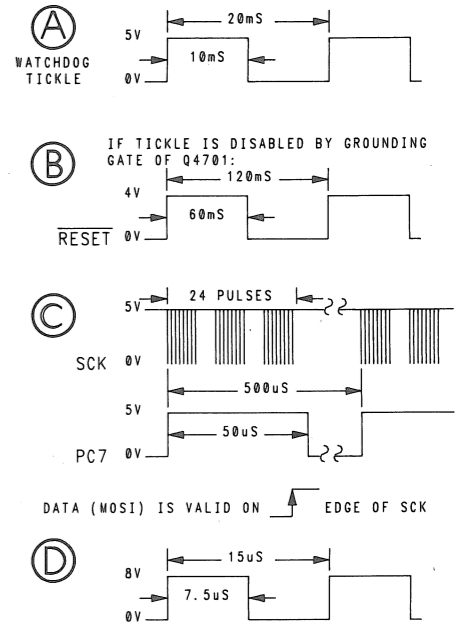
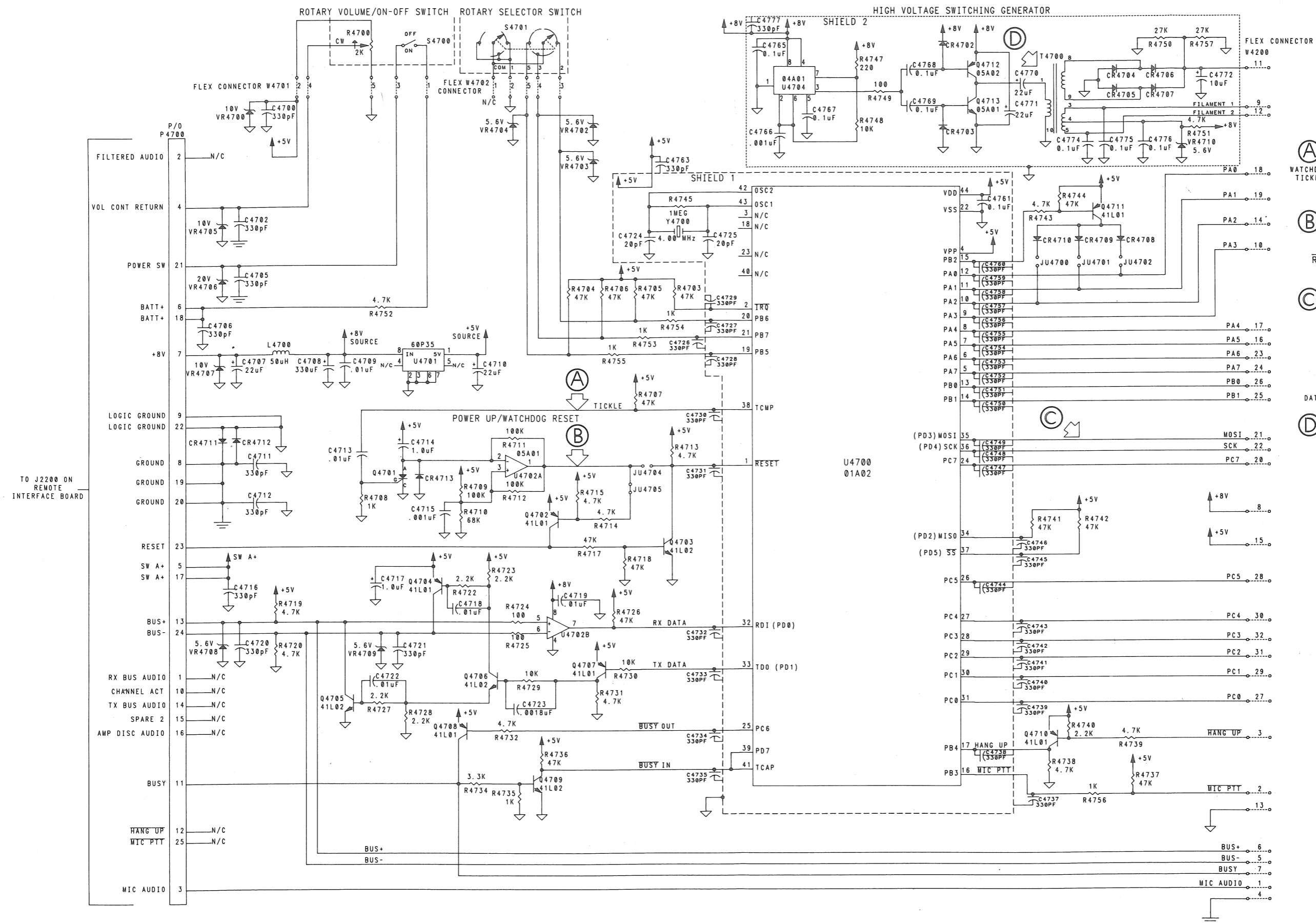


SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

31H00194M-O

Figure 5-8
Remote Mount Control Head
Microcomputer Board
- Board Details



JUMPER TABLE

JU4700	NORMALLY OUT
JU4701	NORMALLY OUT
JU4702	NORMALLY OUT
JU4704	NORMALLY OUT
JU4705	NORMALLY IN

6300660M-O

SEE FIGURE 5-9 (SHEET 2) FOR SERIAL BUS FAULT TEST

Figure 5-9 Remote Mount Control Head Microcomputer Board Schematic Diagram (Sheet 1)



6.1 RADIO MICROCOMPUTER SYSTEM

The radio microcomputer system consists of the Command Board and the Analog Interface Board. The MDC600/1200 Signalling Filter Board is included if this option is ordered. Connections between the radio microcomputer system and the rest of the radio are provided by the Front Panel Interconnect Board (Figures 6-8, 6-9, 6-10) and the Remote Interface Board used on remote mount radios (Figures 6-11, 6-12, 6-13).

The main functional blocks of the radio microcomputer system are highlighted in Figure 6-1.

Schematics which support the discussion below are inserted at the end of this section.

6.2 COMMANDBOARD

(Figures 6-2, 6-3, 6-4)

Software which is used in the microcomputer U4002 resides in the PROM IC U4004 (programmable read only memory). Operational data (such as frequencies, PL codes, scan lists, zone lists, singletones, MDC signalling information and other user modifiable parameters) resides in EEPROM U4005 and the EEPROM within microcomputer U4002 itself.

User settings are contained in the 2K RAM IC U4006.

There are three latches on this board. Their functions are:

1. Latch U4010 passes frequency information to the synthesizer.

2. Latch U4007 passes control signals to circuitry on the Analog Interface Board.

3. Latch U4003 is used to latch address information from microcomputer U4002. The microcomputer U4002 data bus is multiplexed with the eight least significant address bits (AD0-AD7). The lower order address bits pass through latch U4003 while at the same time the higher order address bits pass directly to memory IC's U4004, U4005 and U4006. After the address is latched, the address bus becomes a data bus. Now data either passes out of the microcomputer U4002 or out of the memory IC's depending on whether a read or write cycle is in progress.

The address decoding for the latches and memory devices is accomplished by the bipolar PROM U4009.

The reset circuit is contained in quad comparator U4000 and resets the microcomputer if either the 13.8 Vdc, 5 Vdc or 5 Vdc continuous supply voltages drop below optimum levels.

The serial bus (which terminates at pins 20 and 21 on microcomputer U4002) is the prime means of communication with the control head and with radio options.

Transmit data (exiting by the TX DATA line) is brought back into microcomputer U4002 on the RX DATA line by means of a bus transceiver (located on the remote interface board of a remote mount radio and on the Control Head Microcomputer Board of a dash mount radio). Microcomputer U4002 then compares the incoming data with the outgoing data to make sure it matches.

The volume control return line will carry a 0-5 volt DC signal depending on the volume control setting. This voltage is converted in microcomputer U4002 to a digital signal which is then sent to the digital volume control IC located on the Front Panel Interconnect Board. The serial peripheral interface lines (MISO (master in , slave out), MOSI (master out, slave in), SCK (serial clock), and SS (slave select)) are used to carry the volume control information.

6.3 ANALOG INTERFACE BOARD

(see Figures 6-5, 6-6, 6-7)

Microcomputer U1702 on the Analog Interface Board communicates with microcomputer U4002 by means of the serial peripheral interface lines mentioned above. Microcomputer U1702 acts as a slave to the main microcomputer U4002 . It drives such hardware lines as the secondary mute (primary mute gate is on the main microcomputer board), and lines which control the audio gates in the receive and transmit path. Also contained are control lines for squelch and external alarm. Most audio shaping is done on this board.

Microcomputer U1702 drives two Digital to Analog converters. One is for the singletone path which is brought out on pins 17, 19, 20 and 21 of U1702 and applied to a five pole filter (part of U1705) and through two audio gates (Q1718, Q1719); one for sidetone and the other for transmit audio. The other Digital to Analog converter is for PL , the path being from pins 13, 14, 15 and 16 on U1702 through another three pole filter (part of U1705) and on to the VCO.

IC U1703 is the receive PL high pass filter and the receive PL low pass filter for the PL decoder.

Two comparators are utilized for the squelch; U1701A for channel activity and U1701B for squelch noise.

U1704A and B perform the transmit audio summing for the VCO.

6.4 FRONT PANEL INTERCONNECT BOARD

(see Figures 6-8, 6-9, 6-10)

The Front Panel Interconnect Board provides

for connections among the following :

- Power Interconnect Board
- Synthesizer Board
- Main Board
- Command Board
- Analog Interface Board
- Dash Mount Control Head Microcomputer Board (on dash mount models only)
- Remote Interface Board (on remote mount models only)
- MDC600/1200 Filter Board (if the MDC Signalling option is ordered)

In addition, this board contains a 5 V regulator which provides a 5 V continuous supply when the radio is switched off. This voltage is used to power the random access memory IC (U4006) and the internal RAM of microcomputer U4002 on the Command Board.

Also the digital volume control IC (U351) is located on this board. This IC receives volume level information via a digital signal from microcomputer U4002 on the Command Board (through lines MISO, MOSI, SCK and SS) and sets the volume level accordingly on pin 1 of J 355 (volume control wiper).

6.5 REMOTE INTERFACE BOARD

(see Figures 6-11, 6-12, 6-13)

Most of the Control Head functions in the remote mount models operate in the same manner as the Control Head functions in front mount models. The only difference is that these functions are performed through the Remote Control Head Cable.

Several functions, however, require processing by the Remote Interface Board.

1. A bidirectional inverter (transistors Q2200 to Q2204) carries the reset signal between the microcomputers on the Command Board and the Remote Control Head Microcomputer Board.

2. The RX (receive) DATA and TX (transmit) DATA lines (pins 8 and 11, J365 on Remote Interface Board) are processed by the bus driver circuit (U2200, Q2206, Q2207 and Q2208) to become the Bus + and Bus- lines (pins 13 and 24, J2200). The Bus+ and Bus- lines then proceed to

the Remote Mount Control Head Microcomputer Board.

3. Dual op amp U2201 acts as an audio buffer for audio signals on both the FILTERED AUDIO (pin 20, J366) and the DISC AUDIO (pin 17, J366) lines. U2203 acts as an audio buffer for audio signals on the RX BUS AUDIO (pin 1 J2200) line.

4. The power to the radio chassis is controlled by transistor Q2209 which is mounted on the Remote Interface Board. This transistor and associated circuitry is driven via the on-off switch mounted on the Control Head.

5. Regulated 8 volts to power circuitry in the control head is obtained from U2202.

6.6 MDC 600 / 1200 SIGNALLING SYSTEM

(Figures 6-10 and 6-11)

The MDC-600/1200 Signalling System is an option which may be ordered for the MCX1000 radio.

This system is a general purpose data control and information system specifically designed for land mobile operations. It identifies transmitters automatically, and has Emergency Alert capability. A typical system consists of a base station console (with a video display terminal) and several mobile units installed in vehicles. Information needed to operate the system is programmed into each radio and the base station console.

The signalling system uses PSK modulation and demodulation at 600 bps on a 1500 Hz carrier (MDC600 Signalling), or MSK modulation and demodulation at 1200 bps (MDC1200 Signalling). Data is transferred in short bursts or "packets". The sensitivity of the system is better than or equal to the sensitivity required for the reception of intelligible voice.

This system requires the addition of a filter board in the MCX1000 mobile radio. The microcomputer in the MCX1000 mobile performs all of the data modulation, demodulation, encoding, and decoding, and as well, contains the control logic and management functions.

The system can address up to 9,999 unique unit identification codes, 100 group codes, and 10 fleet codes. Each mobile is programmed with a unique unit number, group number, and fleet number. These numbers are used to identify and address the mobile units. All data packets contain the unit number or a combination of group and fleet numbers.

As an option, MDC-600/1200 signalling units may have a special detection algorithm to mute the audio during any data reception. This feature makes the data nearly transparent to listeners of radios equipped with MDC-600/1200 signalling.

Acknowledgement and re-transmission logic makes the basic functions reliable and automatic. The receiving unit acknowledges certain commands issued from the mobile or base unit automatically. The sending unit re-transmits automatically if it does not receive an acknowledgment.

Every mobile MDC-600/1200 unit can have an optional emergency alert switch added. This feature incorporates multiple transmission with acknowledge.

6.6.1 PROGRAMMING THE SYSTEM

All the features and parameters of the system that are utilized by the mobile radio are programmed into the radio microcomputer. This programming may be accomplished using the Field Programmer, which is available as an accessory. With it the customer may program his own mobile ID codes as well as other parameters of the system. The Field Programmer is discussed in section 3.4 of this manual.

6.6.2 SYSTEM FUNCTIONS

Automatic Unit Identification

There are no switches associated with this function. Each unit sends out a unique unit identification code at the beginning of every voice transmission. The microphone PTT switch triggers the transmission of the ID data packet at key-up. This data packet makes the base station console display the transmitting unit's unique

SECTION 6. RADIO MICROCOMPUTER SYSTEM

identification number. An option is available to trigger the transmission of the ID data packet on de-key as well.

Sidetone

This feature permits the operator to hear a continuous tone as data is being sent. The operator can then adjust to any long system delay to prevent the loss of the first part of the voice transmission. This function is easily disabled once the operator has become accustomed to operating with such a delay.

Radio Check

This feature checks the complete RF link to

and from a selected mobile. The console sends a command that causes the mobile to return a "handshake" signal back to the console. This requires no action from the mobile operator.

Emergency Alert

Emergency Alert is an optional feature activated by an external switch. It has absolute priority over any other radio functions currently in progress. In this mode, the mobile unit sends up to 20 data packets. Once a sequence is in progress, only two things can halt it; an acknowledge from the base or removal of power from the mobile unit. During an emergency sequence, the mobile unit gives no visible or audible evidence of transmission.

RADIO B BLOCK DIAGRAM

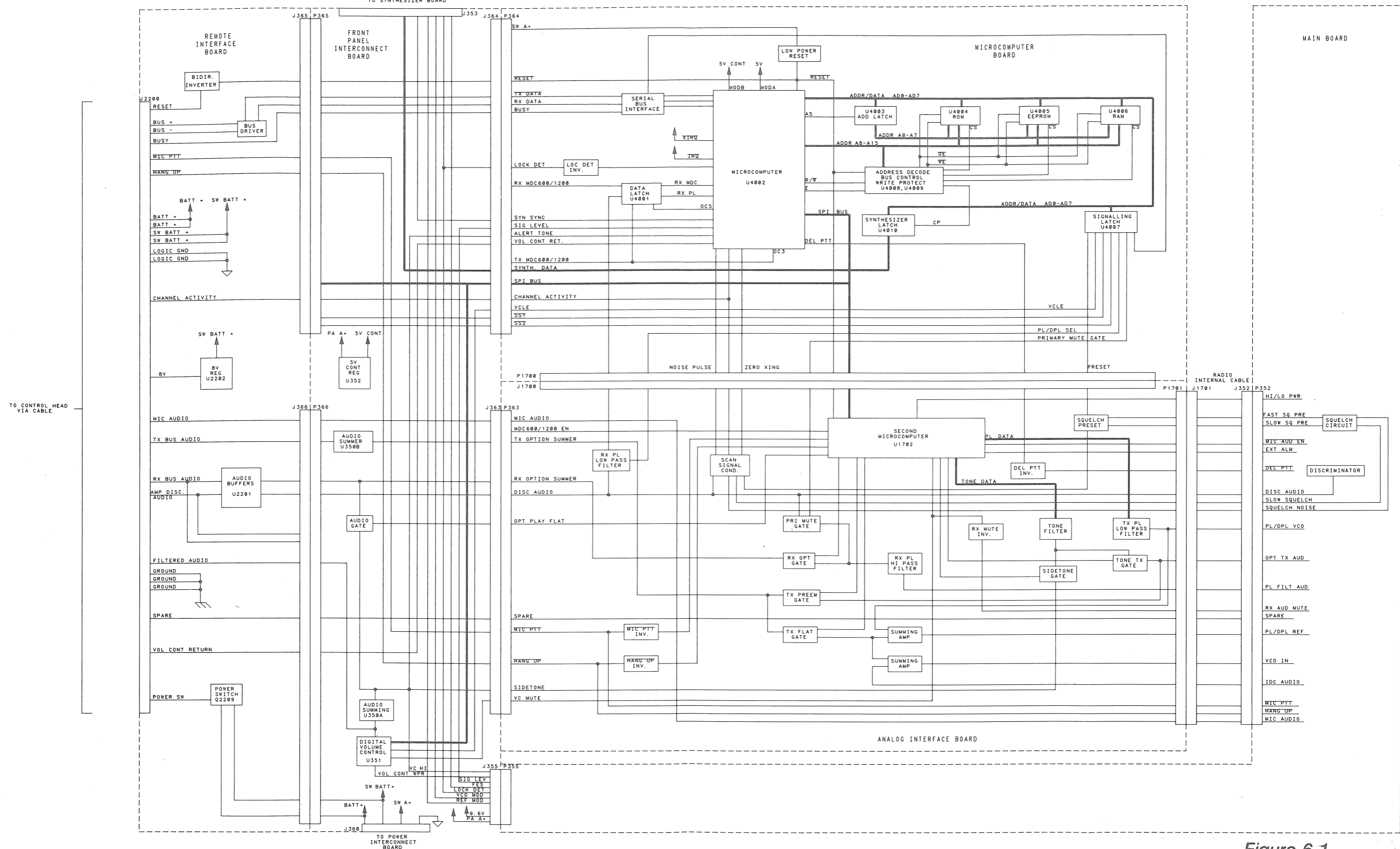
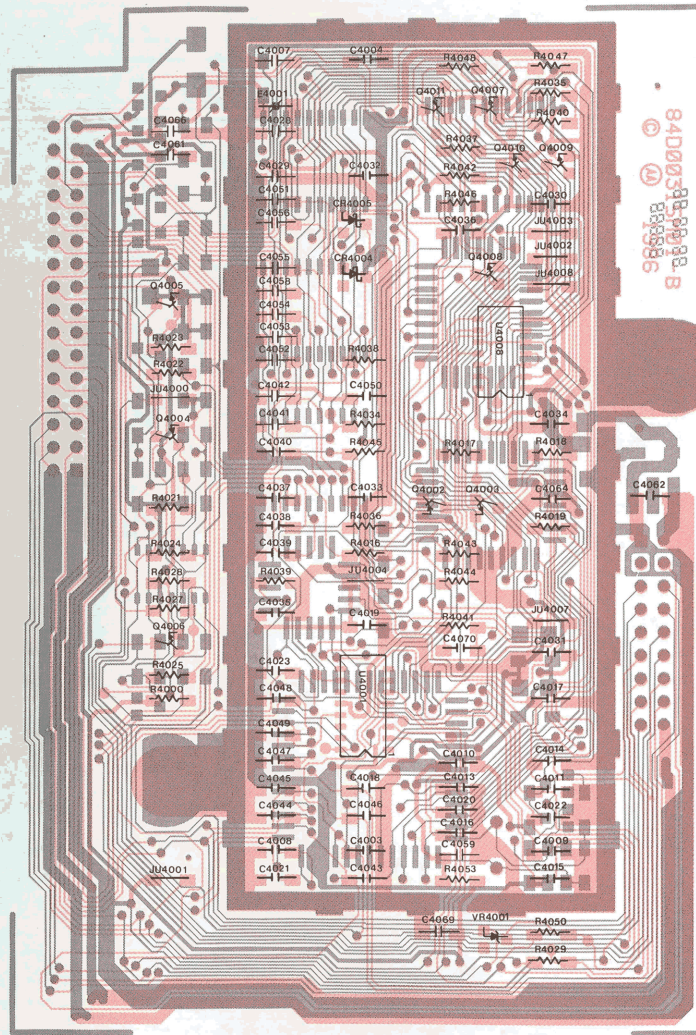
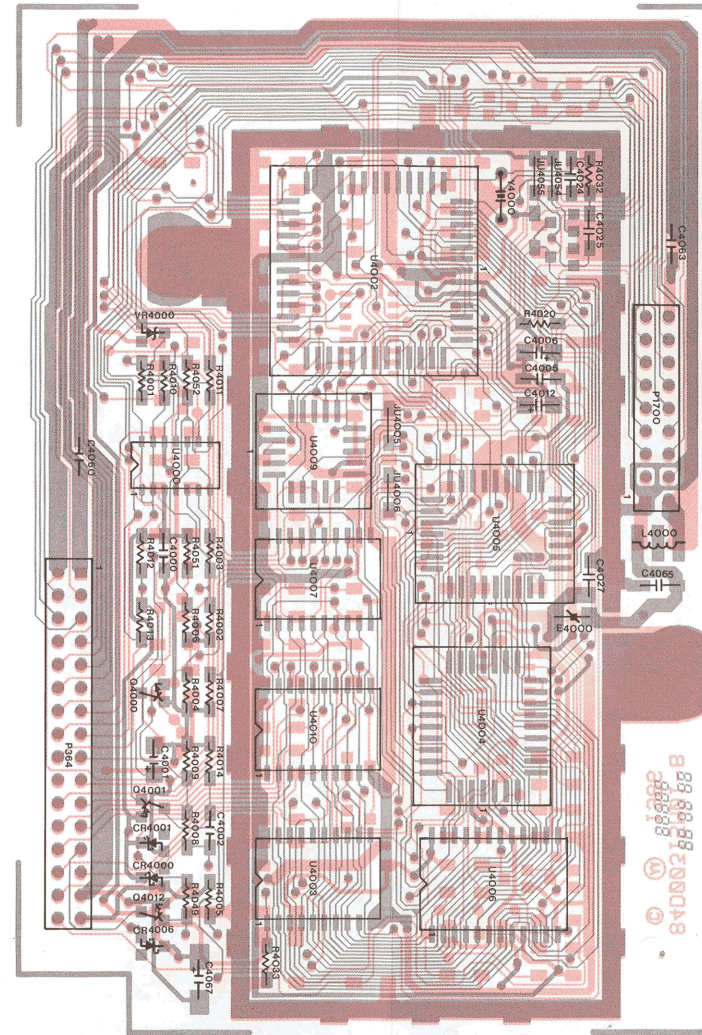


Figure 6-1
Radio Microcomputer System
Functional Block Diagram



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY



SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 6-2
Command Board
- Board Details

31H00187M-O

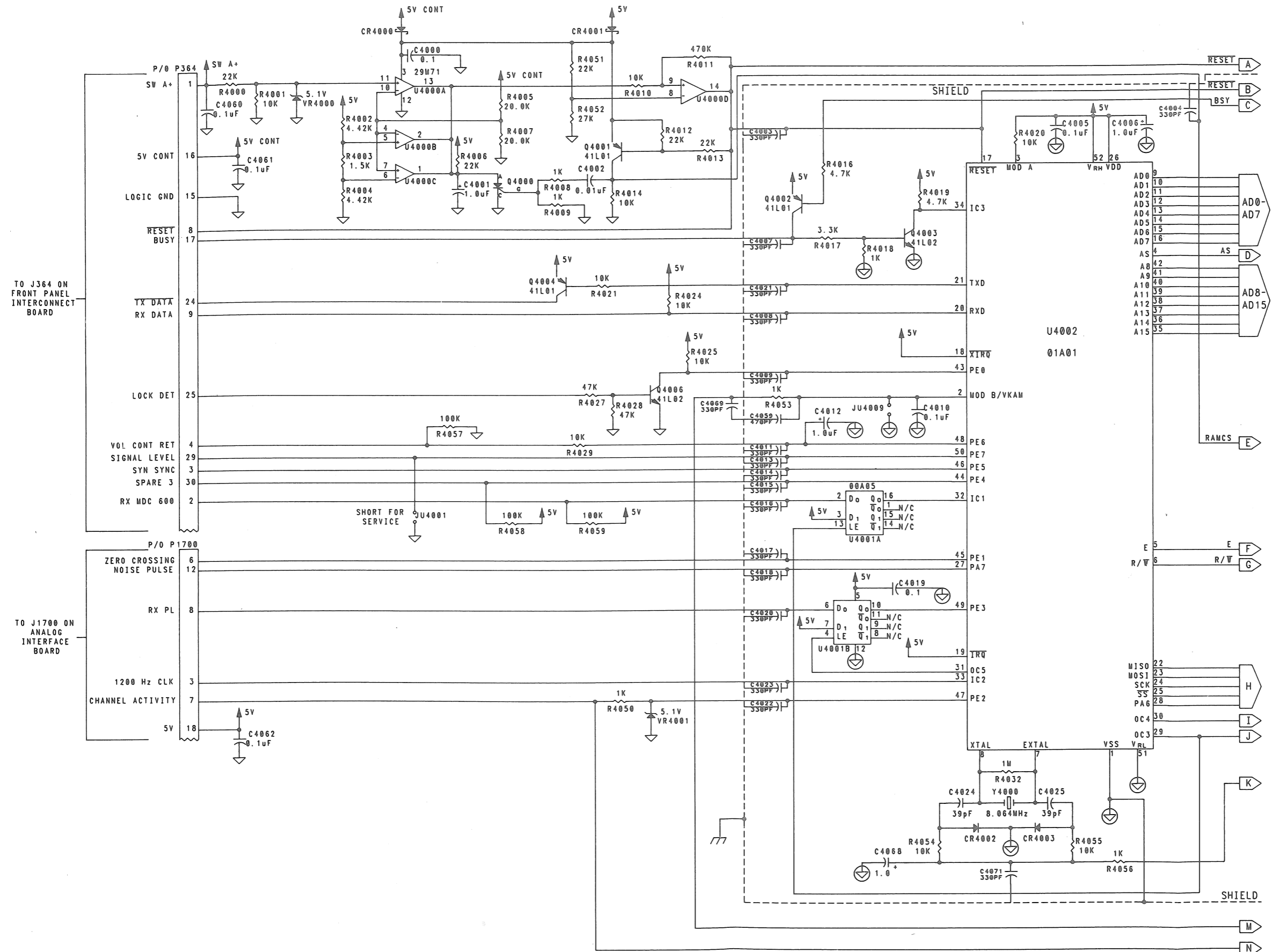


Figure 6-3
Command Board
Schematic Diagram
(Sheet 1)

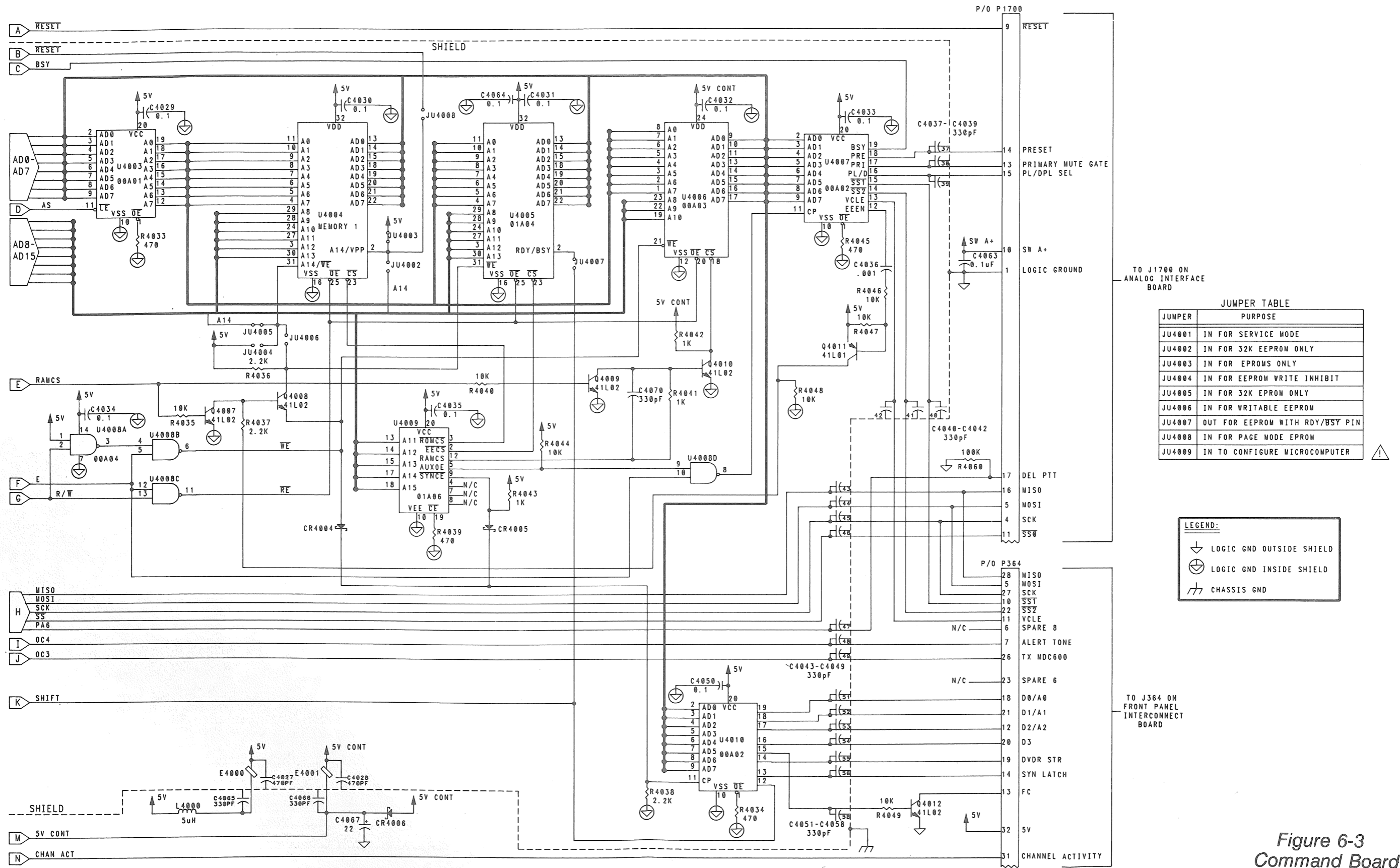


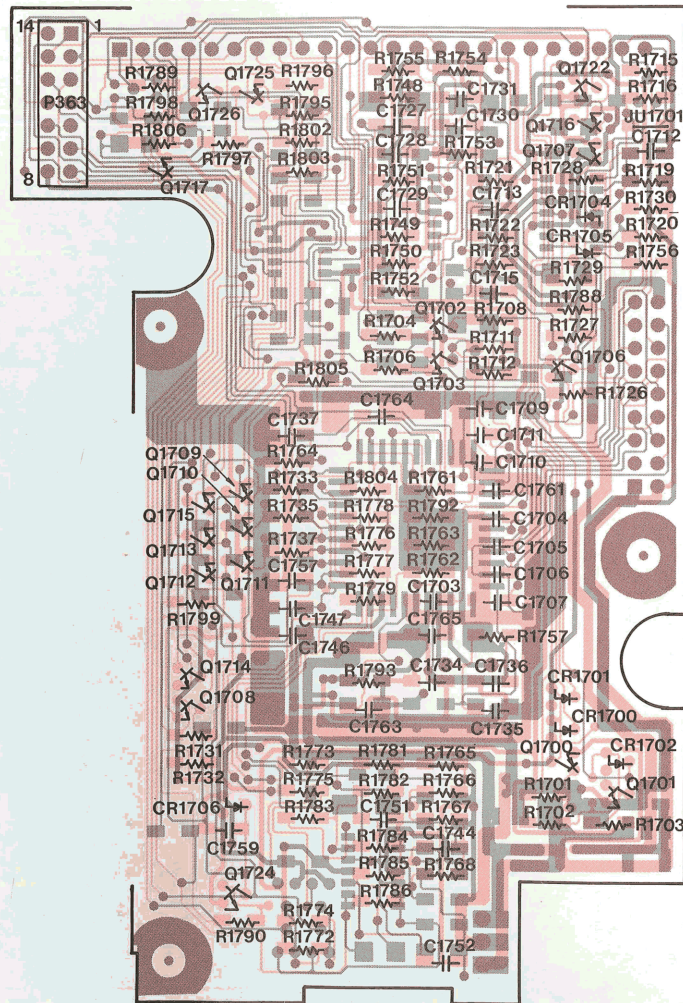
Figure 6-3
Command Board
Schematic Diagram
(Sheet 2)

parts list

VLN4666A COMMAND BOARD 2K EE
VLN4707A COMMAND BOARD 8K EE

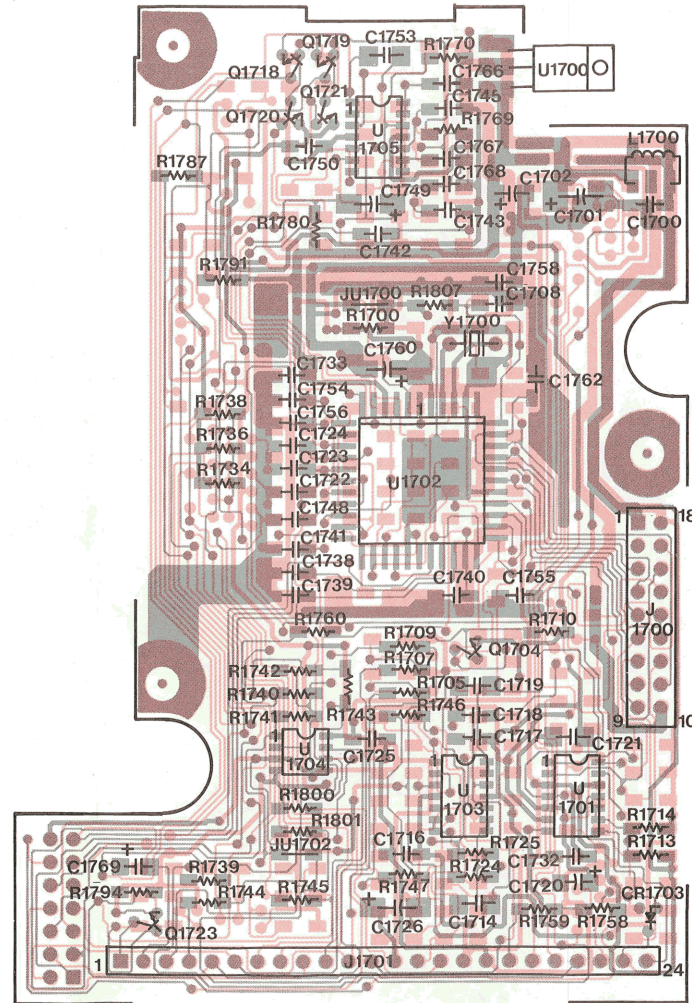
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1405160A01	TEFLON INSULATOR			Ferrite Bead Chip	R4036	0600015M57	2.2K-5-1/8W
	2600080M01	SHIELD TOP MICROCOMPUTER	E4000	7602000A02	55 OHM	R4037	0600015M57	2.2K-5-1/8W
	2600081M01	SHIELD BOTTOM MICROCOMPUTER	E4001	7602000A02	55 OHM	R4038	0600015M57	2.2K-5-1/8W
	2600094M01	SHIELD			Diode	R4039	0600015M41	470-5-1/8W
		Capacitor, chip, pf (unless stated otherwise)			Diode	R4040	0600015M73	10K-5-1/8W
C4000	2160521F37	.1uf -20-X7R-25V	CR4000	4802003A02	HC SOT-23	R4041	0600015M49	1K-5-1/8W
C4001	2362998D09	CAP TANT CHIP 1.0uf -20-35V	CR4001	4802003A02	HC SOT-23	R4042	0600015M49	1K-5-1/8W
C4002	2111032A21	.01uf -10-X7R-50V	CR4004	4802003A02	HC SOT-23	R4043	0600015M49	1K-5-1/8W
C4003	2111031A51	330-5-NP0-50V	CR4005	4802003A02	HC SOT-23	R4044	0600015M73	10K-5-1/8W
C4004	2111031A51	330-5-NP0-50V	CR4006	4802003A02	HC SOT-23	R4045	0600015M41	470-5-1/8W
C4005	2160521F37	.1uf -20-X7R-25V			Jumper	R4046	0600015M73	10K-5-1/8W
C4006	2362998D09	CAP TANT CHIP 1.0uf -20-35V			Jumper	R4047	0600015M73	10K-5-1/8W
C4007	2111031A51	330-5-NP0-50V	JU4003	0600016M23	CHIP ZERO OHM	R4048	0600015M73	10K-5-1/8W
C4008	2111031A51	330-5-NP0-50V	JU4005	0600016M23	CHIP ZERO OHM	R4049	0600015M73	10K-5-1/8W
C4009	2111031A51	330-5-NP0-50V	JU4054	0600016M23	CHIP ZERO OHM	R4050	0600015M49	1K-5-1/8W
C4010	2160521F37	.1uf -20-X7R-25V	JU4055	0600016M23	CHIP ZERO OHM	R4051	0600015M81	22K-5-1/8W
C4011	2111031A51	330-5-NP0-50V			Coil	R4052	0600015M83	27K-5-1/8W
C4012	2362998D09	CAP TANT CHIP 1.0uf -20-35V			Coil	R4053	0600015M49	1000-5-1/8W
C4013	2111031A51	330-5-NP0-50V	L4000	2402001A01	5 UH 1A. S.M. CHOKE			Integrated Circuit
C4014	2111031A51	330-5-NP0-50V			Connector	U4000	5183629M71	QUAD COMP LM339D SOIC
C4015	2111031A51	330-5-NP0-50V			Connector	U4001	5102000A05	DUAL LATCH 74HC75D SOIC
C4016	2111031A51	330-5-NP0-50V			Connector	U4002	5102001A01	MICRO P MC68HC11A8 PLCC
C4017	2111031A51	330-5-NP0-50V			Connector	U4003	5102000A01	OCTAL LATCH 74ALS573ADW SOIC
C4018	2111031A51	330-5-NP0-50V	P1700	2900026M07	STAKE PINS LONG	U4004	0102700A35	EPROM 0TP 32KX8 TN27C256 PLCC
C4019	2160521F37	.1uf -20-X7R-25V	P364	2900026M01	STAKE PINS	U4005	5167403B01	EEPROM 2KX8 X2816BJI-25 PLCC (VLN4666A only)
C4020	2111031A51	330-5-NP0-50V			Transistor		5162500B01	EEPROM 8K X 82864A PLCC (VLN4707A only)
C4021	2111031A51	330-5-NP0-50V			Transistor	U4006	5102000A03	CMOS RAM FLAT PACK TC5517AF
C4022	2111031A51	330-5-NP0-50V			Transistor	U4007	5102000A02	OCTAL D F/F 74HC574 SOIC
C4023	2111031A51	330-5-NP0-50V	Q4000	4802000A01	SCR SOT-23	U4008	5102000A04	QUAD NAND 74HC00 SOIC
C4024	2111031A26	30PF-5-NP0-50V	Q4001	4880141L01	PNP SOT-23	U4009	0102700A23	BI PROM 32X8 TBP385032 PLCC
C4025	2111031A26	30PF-5-NP0-50V	Q4002	4880141L01	PNP SOT-23	U4010	5102000A02	OCTAL D F/F 74HC574 SOIC
C4027	2111059D52	470-5-NP0-50V	Q4003	4880141L02	NPN SOT-23			Diode, zener
C4028	2111059D52	470-5-NP0-50V	Q4004	4880141L01	PNP SOT-23	VR4000	4880140L06	SOT23 5.1V
C4029	2160521F37	.1uf -20-X7R-25V	Q4005	4880141L02	NPN SOT-23	VR4001	4880140L06	SOT23 5.1V
C4030	2160521F37	.1uf -20-X7R-25V	Q4007	4880141L02	NPN SOT-23			Crystal
C4031	2160521F37	.1uf -20-X7R-25V	Q4008	4880141L02	NPN SOT-23	Y4000	4802001A01	8.0640 MHZ LOW PROFILE
C4032	2160521F37	.1uf -20-X7R-25V	Q4009	4880141L02	NPN SOT-23			
C4033	2160521F37	.1uf -20-X7R-25V	Q4010	4880141L02	NPN SOT-23			
C4034	2160521F37	.1uf -20-X7R-25V	Q4011	4880141L01	PNP SOT-23			
C4035	2160521F37	.1uf -20-X7R-25V	Q4012	4880141L02	NPN SOT-23			
C4036	2111032A09	.001uf -10-X7R-50V			Resistor, chip			
C4037	2111031A51	330-5-NP0-50V			Resistor, chip			
C4038	2111031A51	330-5-NP0-50V	R4000	0600015M81	22K-5-1/8W			
C4039	2111031A51	330-5-NP0-50V	R4001	0600015M73	10K-5-1/8W			
C4040	2111031A51	330-5-NP0-50V	R4002	0602002A57	4.42K-1-1/8W			
C4041	2111031A51	330-5-NP0-50V	R4003	0600015M53	1.5K-5-1/8W			
C4042	2111031A51	330-5-NP0-50V	R4004	0602002A57	4.42K-1-1/8W			
C4043	2111031A51	330-5-NP0-50V	R4005	0602003A21	20.0K-1-1/8W			
C4044	2111031A51	330-5-NP0-50V	R4006	0600015M81	22K-5-1/8W			
C4045	2111031A51	330-5-NP0-50V	R4007	0602003A21	20.0K-1-1/8W			
C4046	2111031A51	330-5-NP0-50V	R4008	0600015M49	1K-5-1/8W			
C4047	2111031A51	330-5-NP0-50V	R4009	0600015M49	1K-5-1/8W			
C4048	2111031A51	330-5-NP0-50V	R4010	0600015M73	10K-5-1/8W			
C4049	2111031A51	330-5-NP0-50V	R4011	0600016M14	470K-5-1/8W			
C4050	2160521F37	.1uf -20-X7R-25V	R4012	0600015M81	22K-5-1/8W			
C4051	2111031A51	330-5-NP0-50V	R4013	0600015M81	22K-5-1/8W			
C4052	2111031A51	330-5-NP0-50V	R4014	0600015M73	10K-5-1/8W			
C4053	2111031A51	330-5-NP0-50V	R4016	0600015M65	4.7K-5-1/8W			
C4054	2111031A51	330-5-NP0-50V	R4017	0600015M61	3.3K -5-1/8W			
C4055	2111031A51	330-5-NP0-50V	R4018	0600015M49	1K-5-1/8W			
C4056	2111031A51	330-5-NP0-50V	R4019	0600015M65	4.7K-5-1/8W			
C4058	2111031A51	330-5-NP0-50V	R4020	0600015M73	10K-5-1/8W			
C4059	2111059D52	470-5-NP0-50V	R4021	0600015M73	10K-5-1/8W			
C4060	2160521F37	.1uf -20-X7R-25V	R4024	0600015M73	10K-5-1/8W			
C4061	2160521F37	.1uf -20-X7R-25V	R4025	0600015M73	10K-5-1/8W			
C4062	2160521F37	.1uf -20-X7R-25V	R4027	0600015M89	47K-5-1/8W			
C4063	2160521F37	.1uf -20-X7R-25V	R4028	0600015M89	47K-5-1/8W			
C4064	2160521F37	.1uf -10-X7R-50V	R4029	0600015M73	10K-5-1/8W			
C4065	2111031A51	330-5-NP0-50V	R4032	0600016M22	1M-5-1/8W			
C4066	2111031A51	330-5-NP0-50V	R4033	0600015M41	470-5-1/8W			
C4067	2362998D40	22-20-6.3V	R4034	0600015M41	470-5-1/8W			
C4069	2111031A51	330-5-NP0-50V	R4035	0600015M73	10K-5-1/8W			
C4070	2111031A51	330-5-NP0-50V						

Figure 6-4
Command Board Parts List



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
 COMPONENT SIDE - GREY

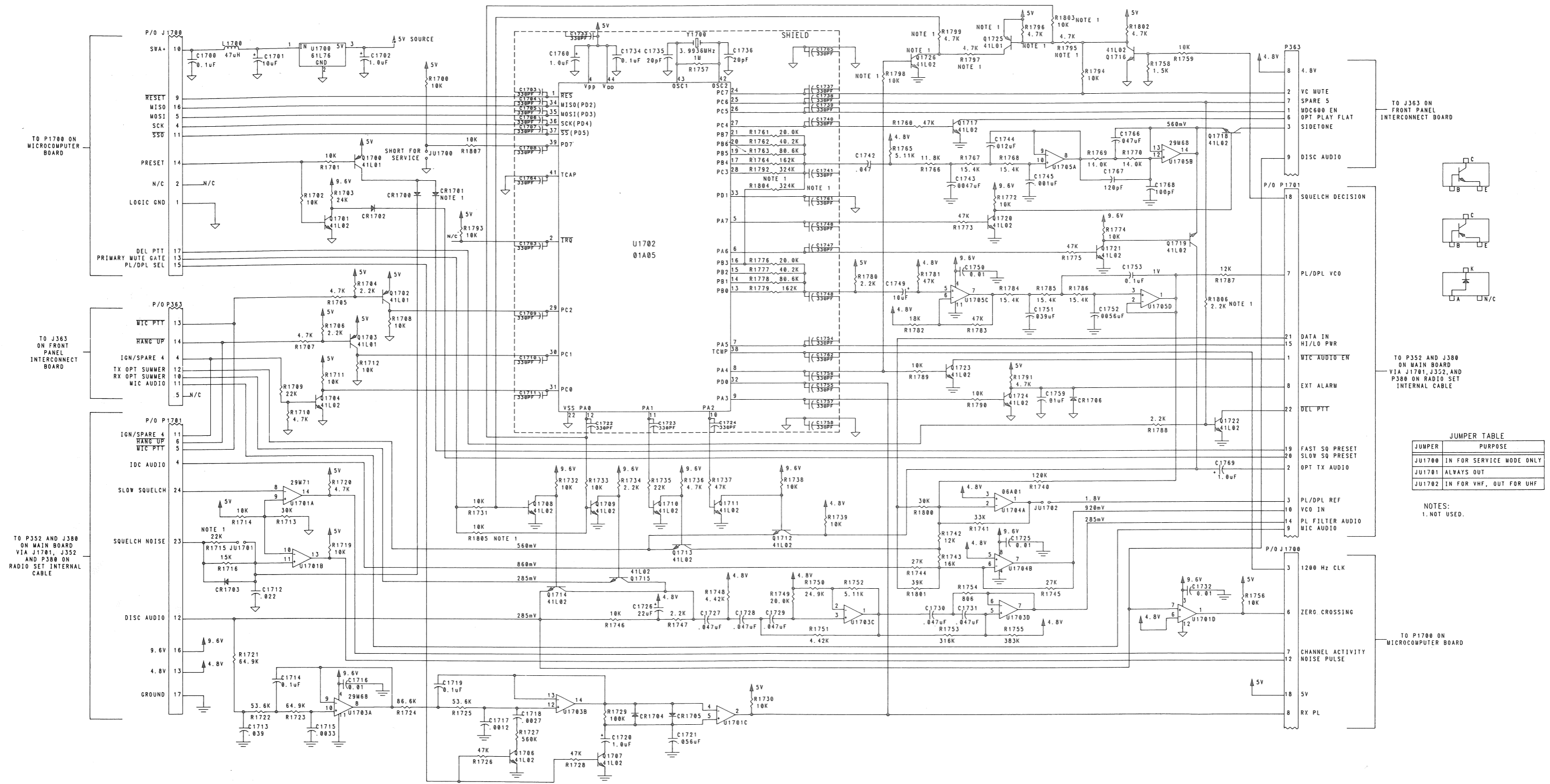


SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
 COMPONENT SIDE - GREY

31H00188M-A

Figure 6-5
 Analog Interface Board
 - Board Details

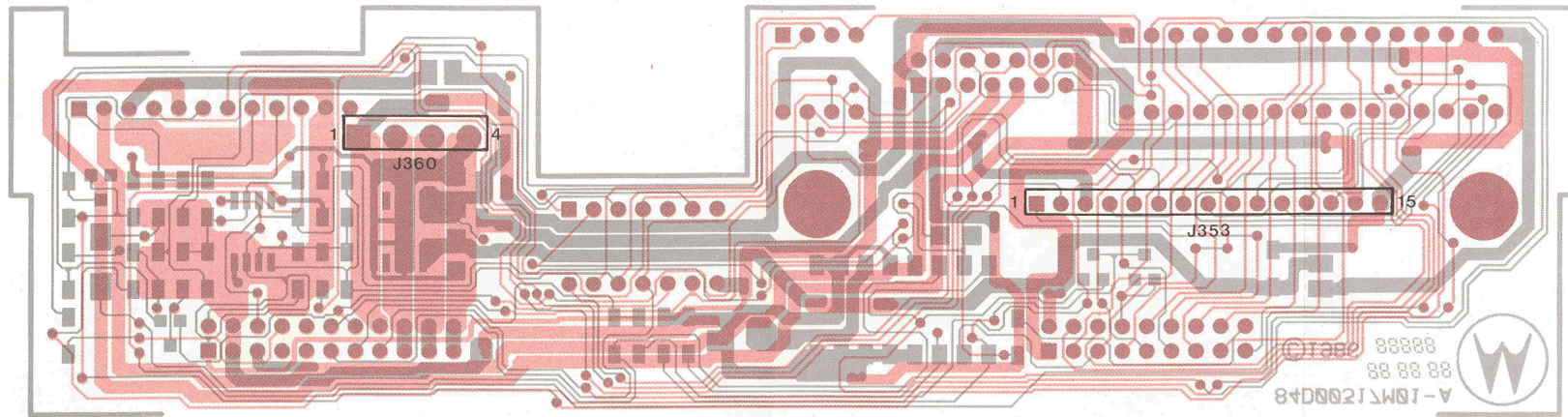


JUMPER TABLE

JUMPER	PURPOSE
JU1700	IN FOR SERVICE MODE ONLY
JU1701	ALWAYS OUT
JU1702	IN FOR VHF, OUT FOR UHF

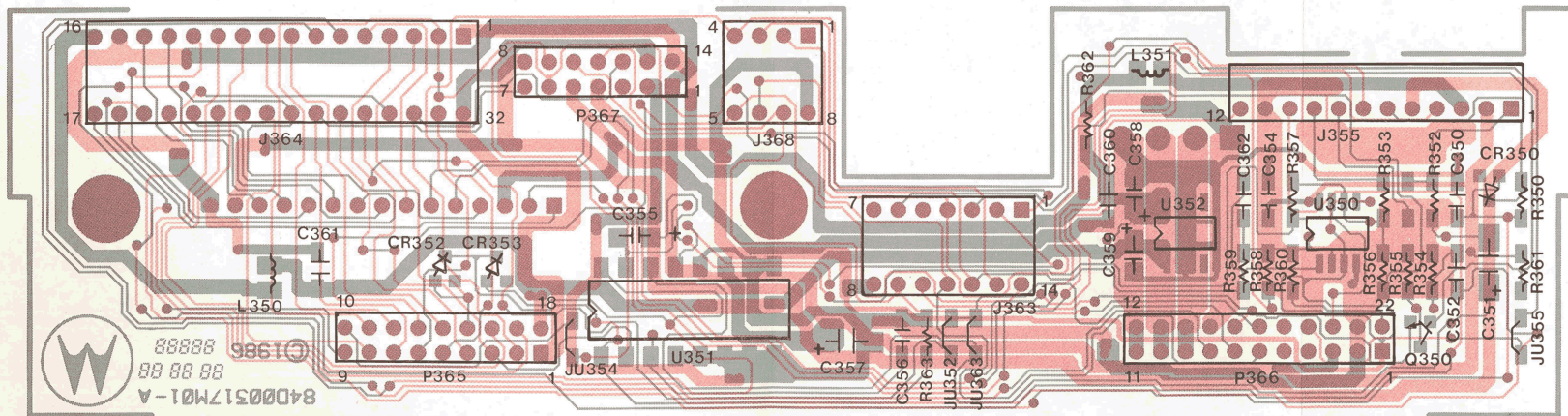
NOTES:
1. NOT USED.

Figure 6-6
Analog Interface Board
Schematic Diagram



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

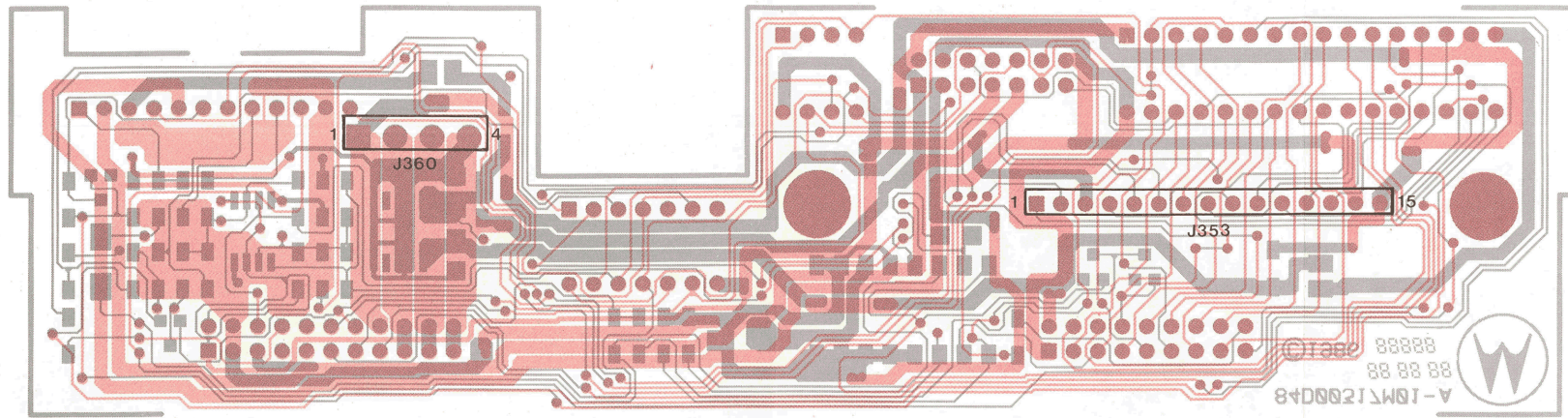


SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

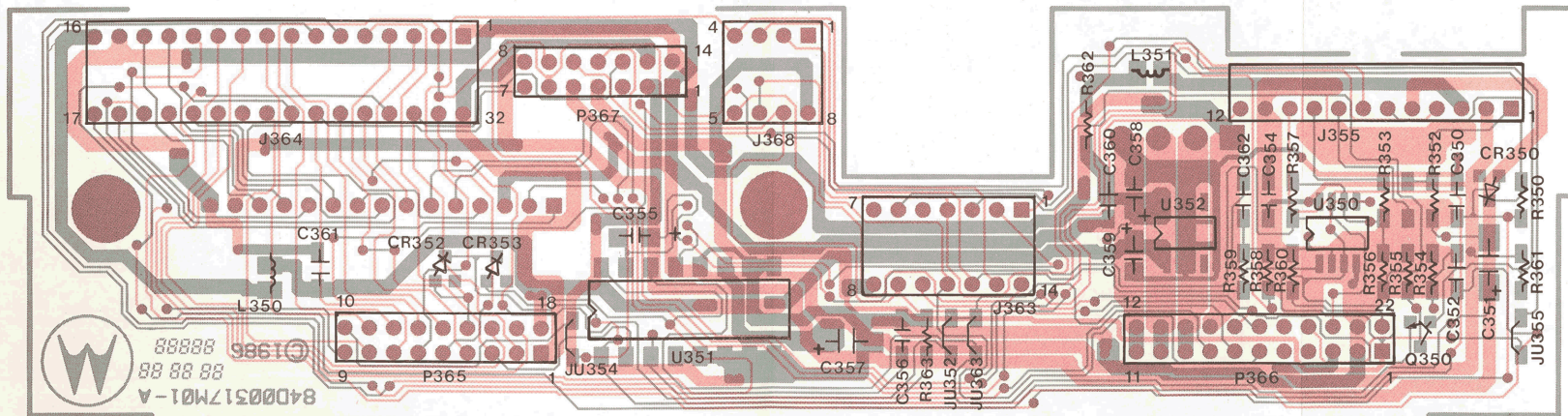
31H00189M-O

Figure 6-8
Front Panel Interconnect Board
- Board Details



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY



SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

31H00189M-O

Figure 6-8
Front Panel Interconnect Board
- Board Details

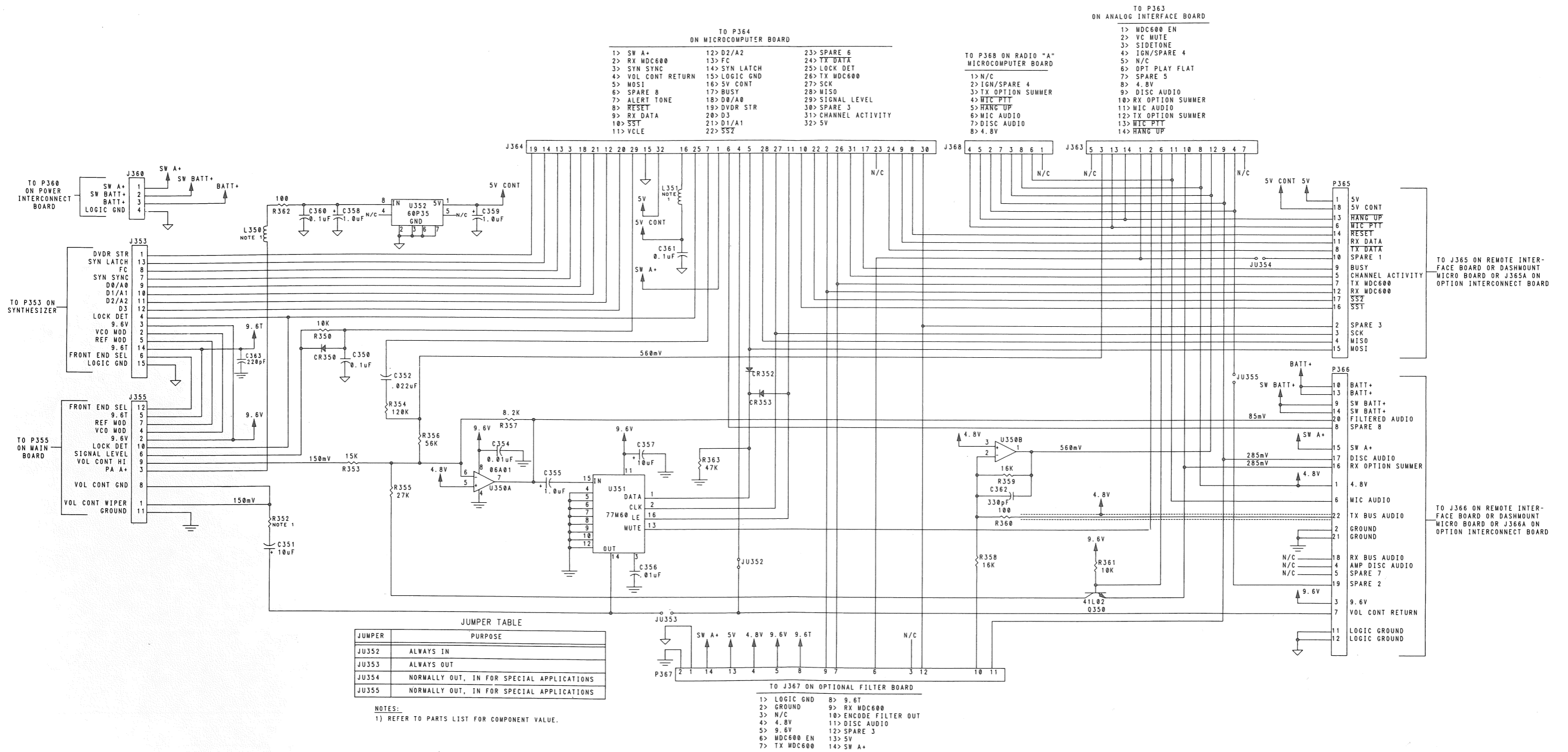


Figure 6-9
 Front Panel Interconnect Board
 Schematic Diagram

6300655M-O

SECTION 6. RADIO MICROCOMPUTER SYSTEM

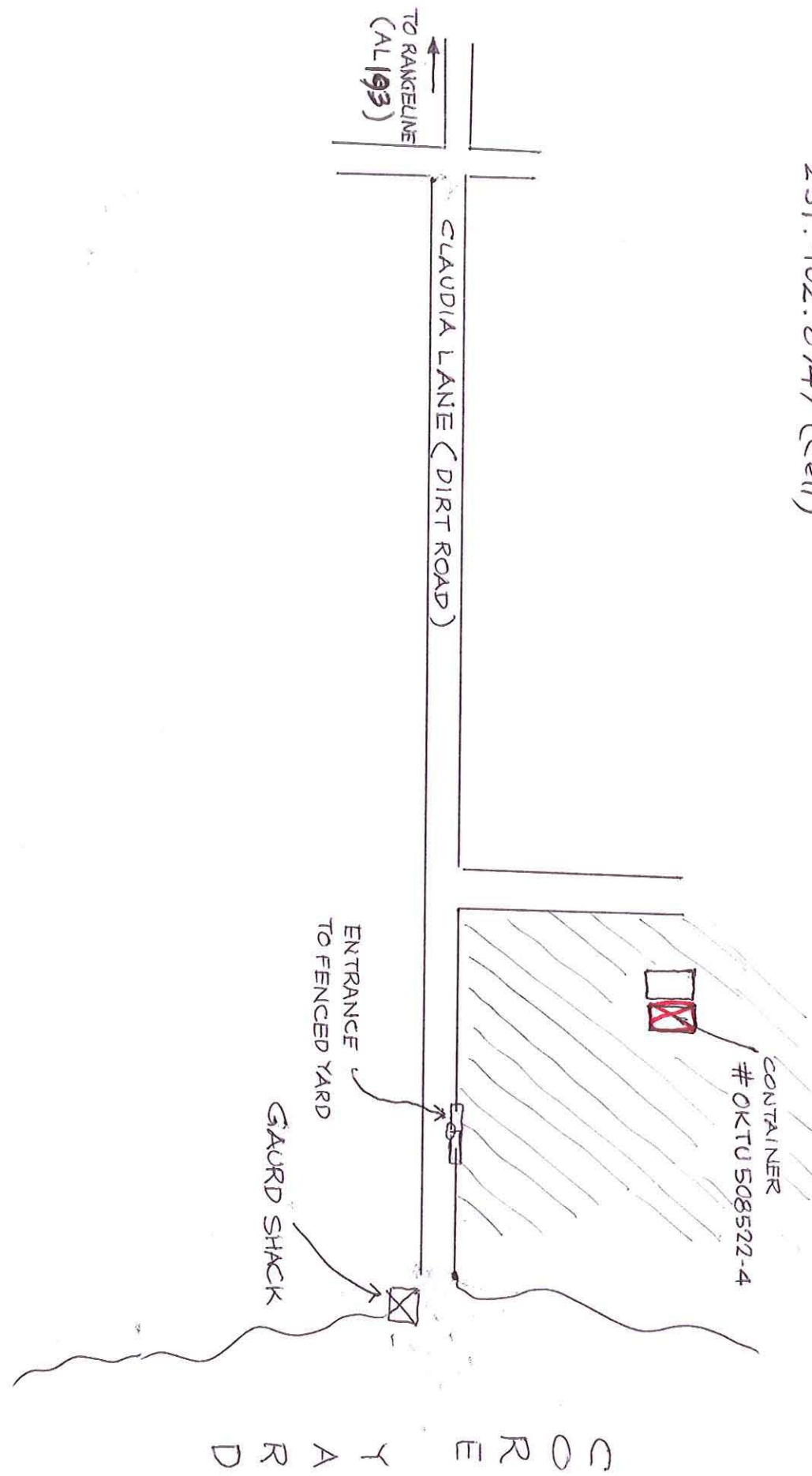
parts list

VLN4663A FRONT PANEL INTERCONNECT BOARD

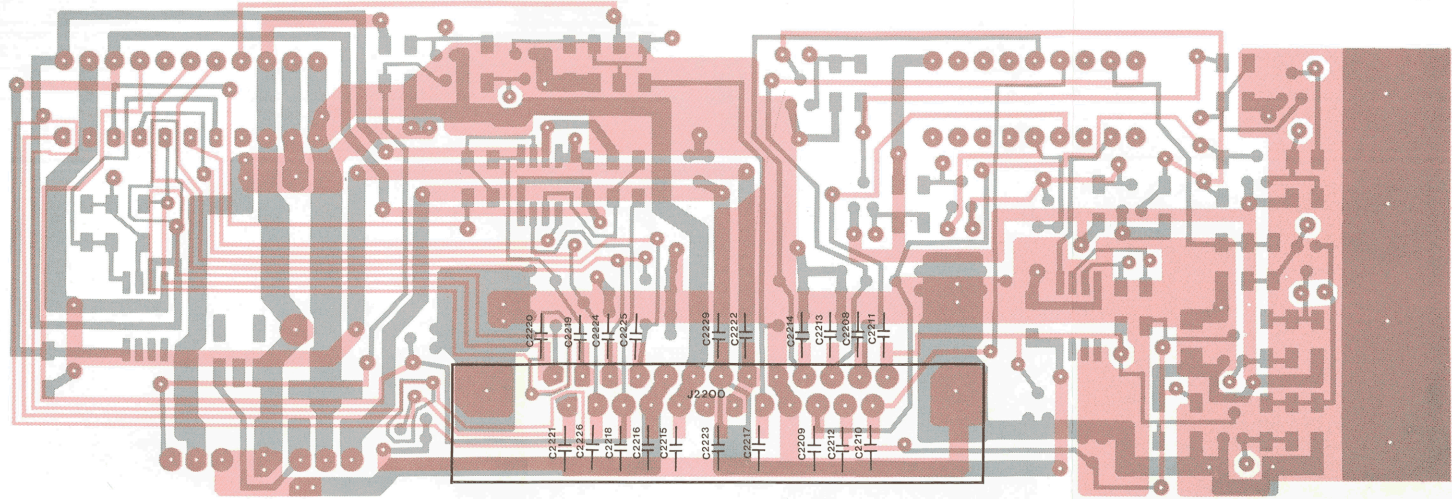
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor ,chip, uf (unless stated otherwise)		
C350	2160521F37	0.1 -20-X7R-25V
C351	2362998D33	tant 10-20-16V
C352	2111032A25	.022-10-X7R-50V
C354	2111032A21	.01-10-X7R-50V
C355	2362998D09	tant 1.0-20-35V
C356	2111032A21	.01-10-X7R-50V
C357	2362998D33	tant 10-20-16V
C358	2362998D09	tant 1.0-20-35V
C359	2362998D09	tant 1.0-20-35V
C360	2160521F37	0.1 -20-X7R-25V
C361	2160521F37	0.1 -20-X7R-25V
C362	2111031A51	330 pf -5-NPO-50V
C263	2111022M50	CER DISC 220pf -5-P350-N1000
Hot diode		
CR350	4802003A01	MMBD914
CR352	4802003A01	MMBD914
CR353	4802003A01	MMBD914
Connector		
J353	0102700A29	synthesizer
J355	0982846L03	12 pin fem right angle
J360	2883878M01	4 pin male right angle
J363	0900076M03	14POS 2X7 HORIZ
J364	0900076M08	FEM 32POS 2X16 horiz
Jumper chip		
JU352	0600016M23	zero ohm
L350	0600016M23	zero ohm
L351	0600016M23	zero ohm
Stake pins		
P365	2900026M07	long
P366	2900026M07	long
P367	2900026M01	
Transistor		
Q350	4880141L02	NPN SOT-23 MMBT3904
Resistor (chip type) $\pm 5\%$ 1/8 W		
R350	0600015M73	10K
R351		NOT USED
R352	0600016M23	zero ohm
R353	0600015M77	15K
R354	0600015M99	120K
R355	0600015M83	27K
R356	0600015M91	56K
R357	0600015M71	8.2K
R358	0600015M78	16K
R359	0600015M78	16K
R360	0600015M25	100
R361	0600015M73	10K
R362	0600015M25	100
R363	0600015M89	47K
Integrated circuit		
U350	5102006A01	dual op amp MC1458 S01C
U351	5183977M60	digital volume control SC7760PH
U352	5182760P35	volt reg. 5V 76R13

Figure 6-10
Front Panel Interconnect Board
Parts List

CONTAINER IS IN
CORE YARD, THEODORE, AL
MORGAN MILES
251.665.2417
251.402.8747 (cell)

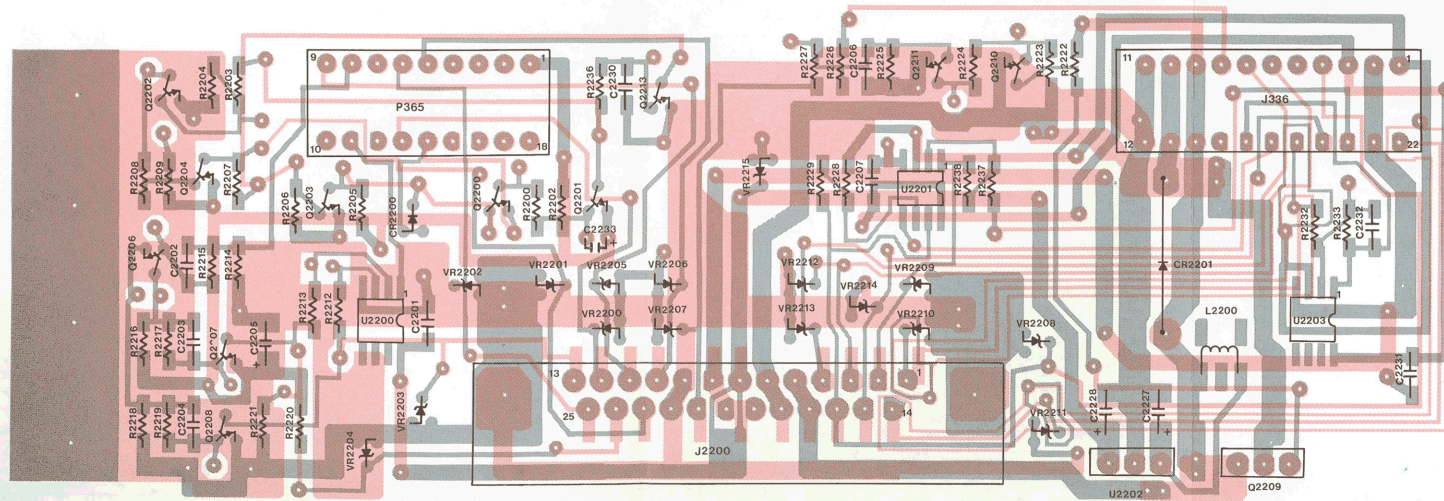


88 88 88
88888 © M 1986



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY



SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

88888 © M 1986
88 88 88
A B C - 10M81C00D48

Figure 6-11
Remote Interface Board
- Board Details

31H00190M-O

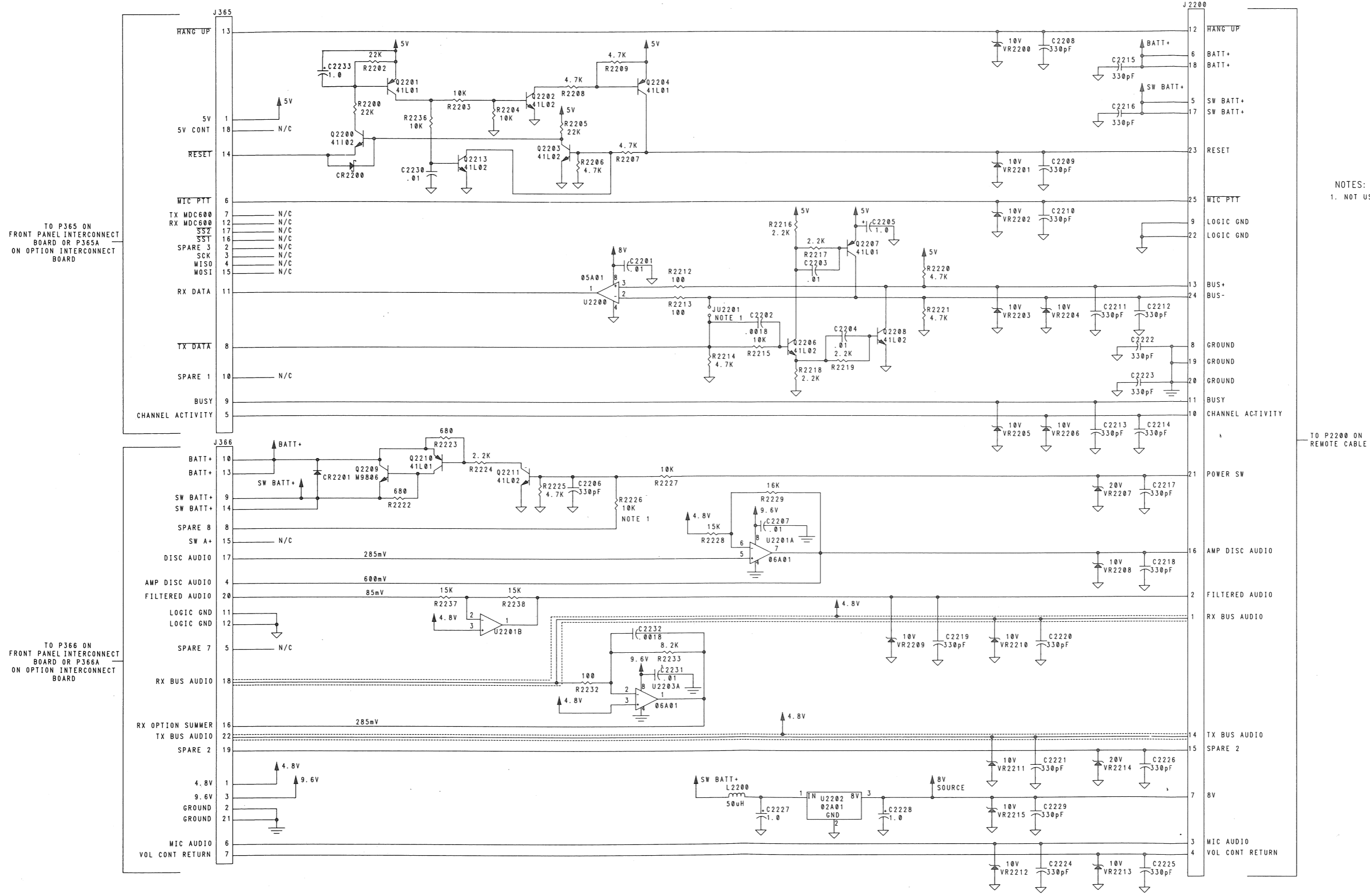


Figure 6-12
Remote Interface Board
Schematic Diagram

6300656M-O

SECTION 6. RADIO MICROCOMPUTER SYSTEM

parts list

VLN4665A REMOTE INTERFACE BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Capacitor, chip, pf. 5%, NPO,50V (unless stated otherwise)			
C2201	2111032A21	.01uf-10-X7R-50V	R2206	0600015M65	4.7K-5-1/8W
C2202	2111032A12	.0018uf-10-X7R-50V	R2207	0600015M65	4.7K-5-1/8W
C2203	2111032A21	.01uf-10-X7R-50V	R2208	0600015M65	4.7K-5-1/8W
C2204	2111032A21	.01uf-10-X7R-50V	R2209	0600015M65	4.7K-5-1/8W
C2205	2362998D09	CAP TANT CHIP 1.0uf-20-35V	R2212	0600015M25	100-5-1/8W
C2206	2111031A51	330	R2213	0600015M25	100-5-1/8W
C2207	2111032A21	.01uf-10-X7R-50V	R2214	0600015M65	4.7K-5-1/8W
C2208	2111031A51	330	R2215	0600015M73	10K-5-1/8W
C2209	2111031A51	330	R2216	0600015M57	2.2K-5-1/8W
C2210	2111031A51	330	R2217	0600015M57	2.2K-5-1/8W
C2211	2111031A51	330	R2218	0600015M57	2.2K-5-1/8W
C2212	2111031A51	330	R2219	0600015M57	2.2K-5-1/8W
C2213	2111031A51	330	R2220	0600015M65	4.7K-5-1/8W
C2214	2111031A51	330	R2221	0600015M65	4.7K-5-1/8W
C2215	2111031A51	330	R2222	0600015M45	680 OHMS-5-1/8W
C2216	2111031A51	330	R2223	0600015M45	680 OHMS-5-1/8W
C2217	2111031A51	330	R2224	0600015M57	2.2K-5-1/8W
C2218	2111031A51	330	R2225	0600015M65	4.7K-5-1/8W
C2219	2111031A51	330	R2227	0600015M73	10K-5-1/8W
C2220	2111031A51	330	R2228	0600015M77	15K-5-1/8W
C2221	2111031A51	330	R2229	0600015M78	RES 16K CHIP 5-1/8W
C2222	2111031A51	330	R2232	0600015M25	100-5-1/8W
C2223	2111031A51	330	R2233	0600015M71	8.2K-5-1/8W
C2224	2111031A51	330	R2236	0600015M73	10K-5-1/8W
C2225	2111031A51	330	R2237	0600015M77	15K-5-1/8W
C2226	2111031A51	330	R2238	0600015M77	15K-5-1/8W
C2227	2362998D09	CAP TANT CHIP 1.0uf-20-35V			Integrated Circuit
C2228	2362998D09	CAP TANT CHIP 1.0uf-20-35V	U2200	5102005A01	DUAL COMPARATOR S01C
C2229	2111031A51	330	U2201	5102006A01	DUAL OP AMP S01C
C2230	2111032A21	.01uf-10-X7F-50V	U2202	5102002A01	REG 8V 3A TO220
C2231	2111032A21	.01uf-10-X7F-50V	U2203	5102006A01	DUAL OP AMP S01C
C2233	2384538G01	SOL TANT 1.0-20-35V			Diode, zener
		Diode	VR2200	4811058B02	SOT-23 MMBZ5240 10V
CR2200	4802003A02	HC SOT-23	VR2201	4811058B02	SOT-23 MMBZ5240 10V
CR2201	4882525G19	SLCN 25G19 100V	VR2202	4811058B02	SOT-23 MMBZ5240 10V
		Connectors	VR2203	4811058B02	SOT-23 MMBZ5240 10V
J2200	0900077M01	25PIN PLASTIC D-SUB	VR2204	4811058B02	SOT-23 MMBZ5240 10V
J365	0900076M01	18PIN FEM BERG#65000-209	VR2205	4811058B02	SOT-23 MMBZ5240 10V
J366	0900076M07	FEM 22PIN BERG#65000-211	VR2206	4811058B02	SOT-23 MMBZ5240 10V
		Choke	VR2207	4880140L25	20.0 VOLT
L2200	2402000A02	50 uH	VR2208	4811058B02	SOT-23 MMBZ5240 10V
		Transistor	VR2209	4811058B02	SOT-23 MMBZ5240 10V
Q2200	4880141L02	NPN SOT-23 MMBT3904	VR2210	4811058B02	SOT-23 MMBZ5240 10V
Q2201	4880141L01	PNP SOT-23 MMBT3906	VR2211	4811058B02	SOT-23 MMBZ5240 10V
Q2202	4880141L02	NPN SOT-23 MMBT3904	VR2212	4811058B02	SOT-23 MMBZ5240 10V
Q2203	4880141L02	NPN SOT-23 MMBT3904	VR2213	4811058B02	SOT-23 MMBZ5240 10V
Q2204	4880141L01	PNP SOT-23 MMBT3906	VR2214	4880140L25	20.0 VOLT MMBZ5250
Q2206	4880141L02	NPN SOT-23 MMBT3904	VR2215	4811058B02	SOT-23 MMBZ5240 10V
Q2207	4880141L01	PNP SOT-23 MMBT3906			
Q2208	4880141L02	NPN SOT-23 MMBT3904			
Q2209	4800869806	M9806			
Q2210	4880141L01	PNP SOT-23 MMBT3906			
Q2211	4880141L02	NPN SOT-23 MMBT3904			
Q2213	4880141L02	NPN SOT-23 MMBT3904			
		Resistor, chip (unless stated otherwise)			
R2200	0600015M81	22K-5-1/8W			
R2202	0600015M81	22K-5-1/8W			
R2203	0600015M73	10K-5-1/8W			
R2204	0600015M73	10K-5-1/8W			
R2205	0600015M81	22K-5-1/8W			

Figure 6-13
Remote Interface Board Parts List

parts list

VLN4733A MDC600 / 1200 FILTER BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
------------------	-------------------	-------------

Capacitor, chip, uf (unless stated otherwise)		
C5000	2102000A31	.0039-5-10V-X7F
C5001	2102000A31	.0039-5-10V-X7F
C5002	2111031A47	220pf-5-50V
C5005	2111031A47	220pf-5-50V
C5003	2102000A43	.012-5-X7F-50V
C5004	2102000A43	.012-5-X7F-50V
C5006	2111032A21	.01-10-X7R-50V
C5007	2102000A47	.018-5-X7R-50V
C5008	2111031A47	220pf-5-50V
C5009	2102000A27	.0027-5-X7R-50V
C5010	2362980D09	1.0-20-35V
C5011	2111032A21	.01-10-X7R-50V

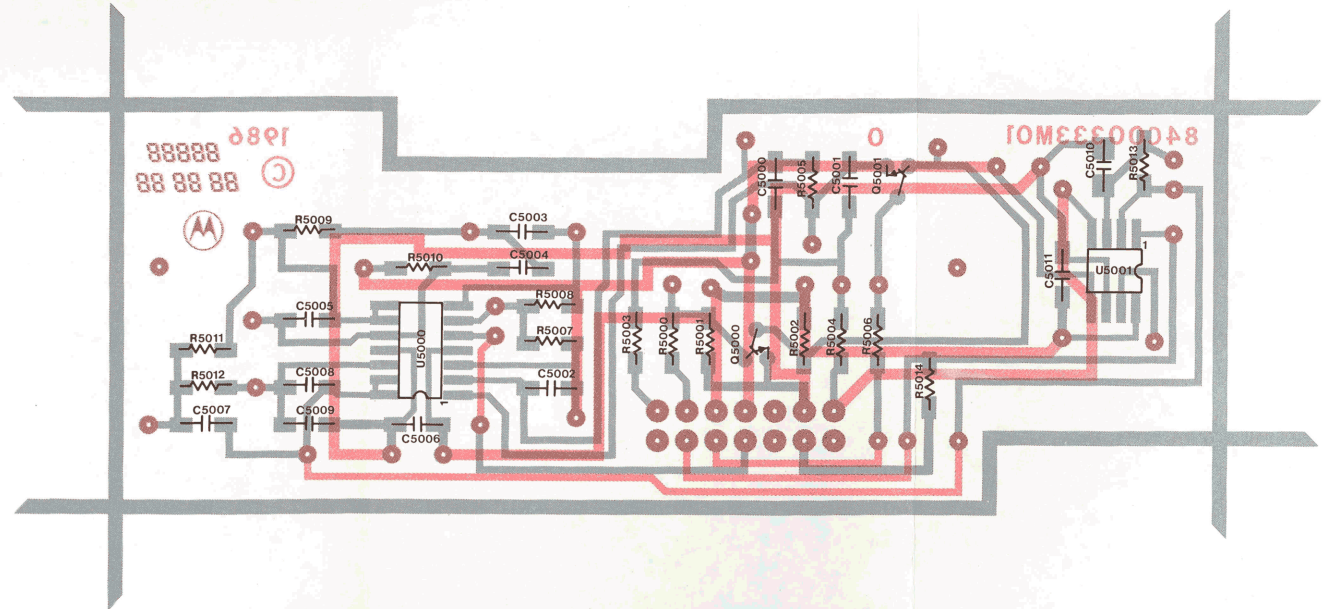
Resistor, chip, 5%, 1/8 W		
R5000	0600015M73	10K
R5001	0600015M73	10K
R5002	0600015M73	10K
R5003	0600015M89	47K
R5003	0600015M76	13K
R5005	0600015M91	56K
R5006	0600015M25	100
R5007	0600015M81	22K
R5008	0600015M81	22K
R5009	0600015M75	12K
R5010	0600015M92	24K
R5011	0600015M76	13K
R5012	0600015M76	13K
R5013	0600015M81	22K
R5014	0600015M73	10K

Transistor		
Q5000	4880141L02	NPN, 503-23 MMBT390
Q5001	4880141L02	NPN, 503-23 MMBT390

Quad op-amp		
U5000	5183629M68	MC3403D

Dual comparator		
U5001	5102005A01	LM2903D

Connector		
J367	0900076M11	female, 14 pin
Standoff		
	4300070M01	9MM x 6.3 MM



SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 6-16
MDC600 Filter Board Parts List

31H00204M-O

Figure 6-14
MDC600 Filter Board
- Board Details

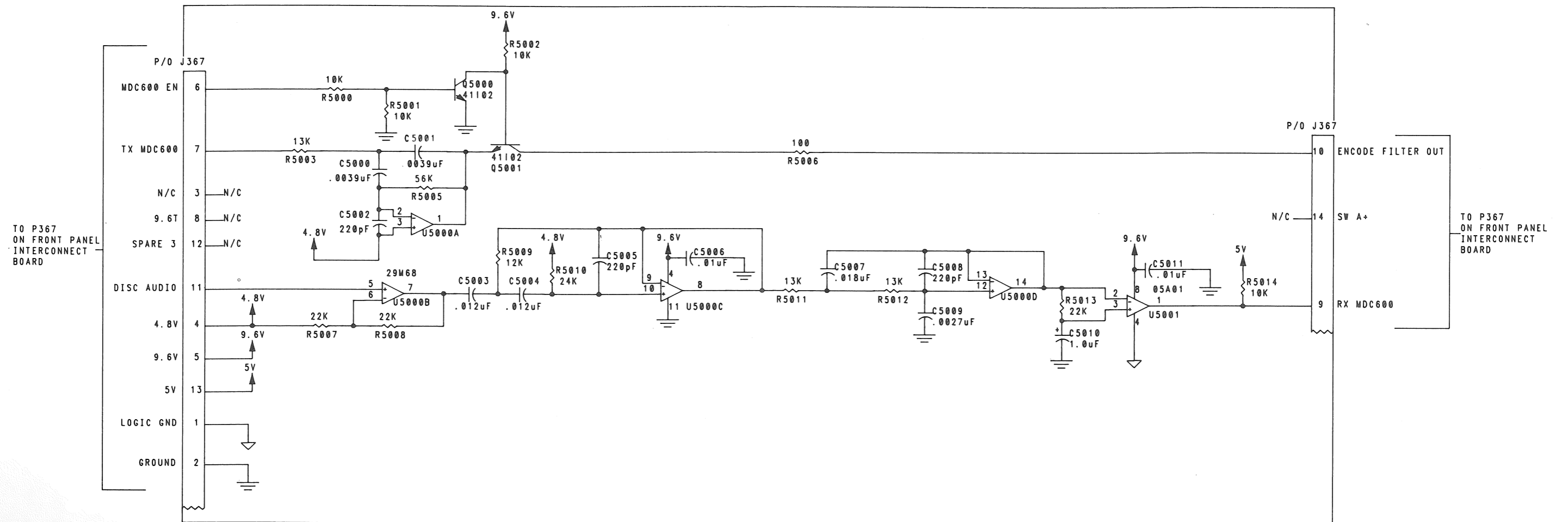


Figure 6-15
MDC 600 / 1200 Filter Board
Schematic Diagram

6300669M-O



MOTOROLA LIMITED

Communications Division

SECTION 7. FREQUENCY SYNTHESIZER AND VCO

7.1 STANDARD LOCK FREQUENCY SYNTHESIZER

The main functional blocks of the Frequency Synthesizer and VCO are highlighted in Figure 7-1.

Schematics and board details which support the discussion below are inserted at the end of this section. (Figures 7-2 and 7-3)

The Synthesizer Board circuit may be broken up into eight functional blocks as follows :

- 14.4 MHz reference oscillator
- latch circuit
- divider / phase detector (U115)
- lock detect switch circuit
- charge pump and loop filter circuit
- frequency shift logic circuit
- VCO buffers and transmit / receive injection switch
- VCO AGC (automatic gain control)

The Voltage Controlled Oscillator Assembly (VCO) is a sealed unit and field servicing is not recommended. However, a brief description of its operation is included.

7.1.1 14.4 MHz REFERENCE OSCILLATOR

The 14.4 MHz reference oscillator is a high accuracy, temperature compensated crystal reference oscillator. The output of the reference oscillator is applied to divider / phase detector U115 to generate the reference frequency used to control the VCO frequency. Low frequency audio signals from the transmit audio circuit are applied to the

reference modulation input. Note that a 2 PPM Reference Oscillator is optional.

7.1.2 LATCH CIRCUIT

The latch transfers data regarding receive and transmit frequencies from the main radio microcomputer to the divider / phase detector U115.

7.1.3 DIVIDER / PHASE DETECTOR

Divider/phase detector U115 contains the negative feedback, phase-locked-loop circuitry that controls the VCO frequency. The divider/phase detector contains a reference divider, a loop divider, and a phase detector. The reference divider divides the 14.4 MHz reference oscillator signal and applies it as the reference frequency input to the phase detector. The loop divider divides the negative feedback input, which is the buffered VCO rf signal. This signal is applied as the loop frequency input to the phase detector. The phase detector calculates the phase difference of the two frequencies and generates error pulses on the UP and DOWN output lines that are proportional to this phase difference. The UP and DOWN error pulses are applied, via the charge pump and loop filter circuit, to the VCO steering line (which controls the VCO frequency) to complete the feedback loop.

The divider/phase detector also supplies a data output to the frequency shift logic circuit, which in turn controls the VCO sub-range frequency required by the selected mode (channel).

A signal is also sent to the dual front end by the divider/phase detector so that the correct frequency range filter is selected.

SECTION 7. FREQUENCY SYNTHESIZER AND VCO

7.1.4 LOCK DETECT SWITCH CIRCUIT

The lock detect switch circuit (Q154, Q155 and Q156) generates a lock detect output signal that disables the receiver (in the receive mode) or the transmitter (in the transmit mode) if the synthesizer frequency goes out-of-lock.

7.1.5 CHARGE PUMP AND LOOP FILTER

The circuit (Q151, Q152 and Q153) changes the UP or DOWN error pulses from divider / phase detector U115 to a corresponding DC voltage. The DC voltage is filtered to become the VCO steering line voltage.

7.1.6 FREQUENCY SHIFT LOGIC CIRCUIT

The frequency shift logic circuit (Q171, Q172 and U171) controls the switching of the VCO to the sub-range frequencies at which it operates for a selected mode (channel).

7.1.7 VCO BUFFERS AND TRANSMIT / RECEIVE INJECTION SWITCH

The buffers (Q190 and Q192) receive the VCO rf feedback signal from the VCO. The buffered signal is applied to the loop divider in divider / phase detector U115 to generate the loop frequency used to control the VCO frequency. The buffers also feed the VCO rf feedback signal to either the transmit or receive injection ports on the synthesizer interconnect board.

7.1.8 VCO AGC CIRCUIT

The VCO AGC circuit consists of transistors Q188 and Q189. The circuit stabilizes the VCO gain by maintaining a constant rf level in the VCO tank circuit.

7.2 FAST-LOK FREQUENCY SYNTHESIZER (Optional)

The main functional blocks of the Fast-Lok Frequency Synthesizer and VCO are highlighted in Figure 7-4.

Schematics and board details which support the discussion below are inserted at the end of this section (Figures 7-5 to 7-8).

The Fast-Lok Frequency Synthesizer circuit may be broken up into nine functional blocks as follows:

- 14.4 MHz reference oscillator
- latch circuit
- divider
- phase detector
- adaptive loop filter
- frequency shift logic circuit
- VCO AGC
- synthesizer RF (buffer) amplifier (separate circuit board)
- lock detect switch

The VCO for the Fast-Lok Synthesizer is also a sealed unit. It operates in the same manner as the VCO for the Standard Lock Synthesizer.

7.2.1 14.4 MHz REFERENCE OSCILLATOR

The 14.4 MHz reference oscillator is a 5 PPM, high accuracy, temperature compensated crystal oscillator. The output of the reference oscillator is applied to divider U115 to generate the reference frequency used to control the VCO frequency. Low frequency audio signals from the transmit audio circuit are applied to the reference modulation input. Note that a 2 PPM Reference Oscillator is optional.

7.2.2 LATCH CIRCUIT

The latch transfers data regarding receive and transmit frequencies from the main radio microcomputer to the divider IC U115.

7.2.3 DIVIDER

Divider U115 contains the negative feedback, phase-locked-loop circuitry that controls the VCO frequency. The divider contains a reference divider and a loop divider. The reference divider divides the 14.4 MHz reference oscillator signal and applies it as the reference frequency input to the phase detector. The loop divider divides the negative feedback input, which is the buffered VCO rf signal.

This signal is applied as the loop frequency input to the phase detector.

The divider also supplies a data output to the frequency shift logic circuit, which in turn controls the VCO sub-range frequency required by the selected mode (channel).

A signal is also sent to the dual front end by the divider so that the correct frequency range filter is selected.

7.2.4 PHASE DETECTOR

Phase detector U140 compares the reference and loop frequency outputs of the divider circuit and uses this information to generate a dc control signal, called the steering line voltage, that is coupled through the adaptive loop filter to tune the VCO.

The phase detector also monitors the status of the frequency change (FC) line (P353-8) and uses this information to generate the control signal for the adaptive loop filter and the lock detect switch.

The phase detector also generates a control signal (sync.) which ensures that the frequency reference data transferred to the synthesizer is synchronized with the reference frequency output of the divider IC.

7.2.5 ADAPTIVE LOOP FILTER

The adaptive loop filter, which is connected to the phase detector output line (U140-15), is a low pass filter in the steering line between the phase detector and the VCO. This filter removes noise and variations in the steering line level to prevent unwanted modulation of the VCO.

The adaptive loop filter is controlled by the phase detector to operate in either of two modes, either the Adapt or the Receive / Transmit mode. The Adapt mode is entered during any period when the synthesizer changes frequency. In this mode the filter response is removed to allow the synthesizer loop to change to new frequencies quickly.

The Receive/Transmit mode is entered when the synthesizer is locked on frequency.

7.2.6 FREQUENCY SHIFT LOGIC CIRCUIT

The frequency shift logic circuit consists of transistors Q155 and Q156, and IC U155. The circuit controls the switching of the VCO to the sub-range frequencies at which it operates for a selected mode (channel).

7.2.7 LOCK DETECT SWITCH CIRCUIT

The lock detect switch circuit (Q142) generates a lock detect output signal that disables the receiver (in the receive mode) or the transmitter (in the transmit mode) if the synthesizer frequency goes out-of-lock.

7.2.8 VCO AGC CIRCUIT

The VCO AGC circuit consists of transistors Q170 and Q171. The circuit stabilizes the VCO gain by maintaining a constant rf level in the VCO tank circuit.

7.2.9 SYNTHESIZER RF AMPLIFIER BOARD

RF buffer Q190 amplifies the VCO rf output supplying the transmit / receive injection switch as well as providing the VCO frequency feedback signal to divider U115 via buffer transistor Q116 on the synthesizer board. The transmit / receive injection switch consists of PIN diodes CR190 and CR191 and transmit / receive injection switch Q191. Signal transmission through either injection port is controlled by the 9.6T keying voltage applied to Q191. A high 9.6T keying voltage (transmit mode) turns off transistor Q191, forward biasing CR191 and routing the VCO rf to the transmit injection port at connector P374-1. From this port, the signal is fed, via a coaxial cable, to the low level amplifier in the transmitter. A low 9.6T keying voltage (receive mode) turns on transistor Q191, forward biasing CR190, routing the VCO rf to the receive injection port at connector J357. From this port, the

signal is fed as the receiver injection signal to the mixer in the receiver dual front end.

7.3 VOLTAGE CONTROLLED OSCILLATOR

(Figure 7-9)

The VCO Assembly circuit may be broken up into four functional blocks as follows :

- VCO steering line
- PIN (diode) switches
- VCO modulator
- VCO

7.3.1 VCO STEERING LINE

The dc voltage on the VCO steering line determines the operating frequency of the VCO within the sub-range selected by the frequency shift logic circuit. The dc voltage is applied to the network of varactor diodes that control the frequency of the VCO.

The varactor diode network consists of CR1301 through CR1304. The dc voltage level present on the VCO steering line determines the capacitance of the varactor diodes. The capacitance of the varactor diodes determines the reactance of the VCO tank circuit, and therefore the operating frequency. Capacitor C1307 couples the varactor diode network to the VCO tank circuit, via the VCO transmission line.

7.3.2 PIN (DIODE) SWITCHES

The PIN diodes switch the VCO to the proper sub-range operating frequency by removing or inserting capacitive or inductive elements of the VCO tank circuit, via the transmission line. When the PIN diodes are off (reverse biased), they effectively create an rf open circuit between the capacitive or inductive elements and the transmission line. When the PIN diodes are on (forward biased), they effectively create an rf short circuit to the transmission line, inserting the capacitive or inductive elements into the VCO tank circuit.

7.3.3 VCO MODULATOR

The VCO is modulated with the VCO

modulation signal by varactor diode CR1300. The VCO modulation signal increases and decreases the capacitance of CR1300, thus changing the frequency of the VCO.

To compensate for any drift in VCO frequency and to maintain a constant modulation level, a second varactor diode (CR1305) is used. This varactor diode is connected in series with varactor diode CR1300 and in parallel with the varactor diode network CR1301 to CR1304.

To compensate for frequency shifts, the dc bias on varactor diode CR1300 is varied. This is accomplished by a modulation compensation network composed of resistors R1310, R1311, and R1312; and diodes CR1307, CR1308 and CR1309. The network is controlled by the S1, S2 and S3 frequency range shift signals.

7.3.4 VCO

The VCO generates frequency modulated transmit injection and stable receive injection frequencies. The operating frequency range of the VCO extends from 21.4 MHz below the radio operating frequency (to provide low-side receiver injection at the lowest radio operating frequency) continuously to the highest radio operating frequency. The VCO also provides a feedback signal at the injection frequency that is used by divider / phase detector U115 on the synthesizer board to generate the loop frequency signal.

Transistor Q1300 is the amplifying element of a grounded-gate oscillator which operates at the desired injection frequency.

The VCO tank circuit consists of capacitors C1309, C1313, and C1327, the transmission line, and the capacitive and inductive elements inserted into, or removed from, the VCO tank circuit by the PIN switching diodes.

The VCO rf output signal from the tank circuit is coupled through capacitor C1308 to the transmission line and then to the VCO output buffer Q1330. The output buffer feeds the VCO rf signal to the transmit/receive rf buffer on the synthesizer board.

VHF STANDARD LOCK SYNTHESIZER

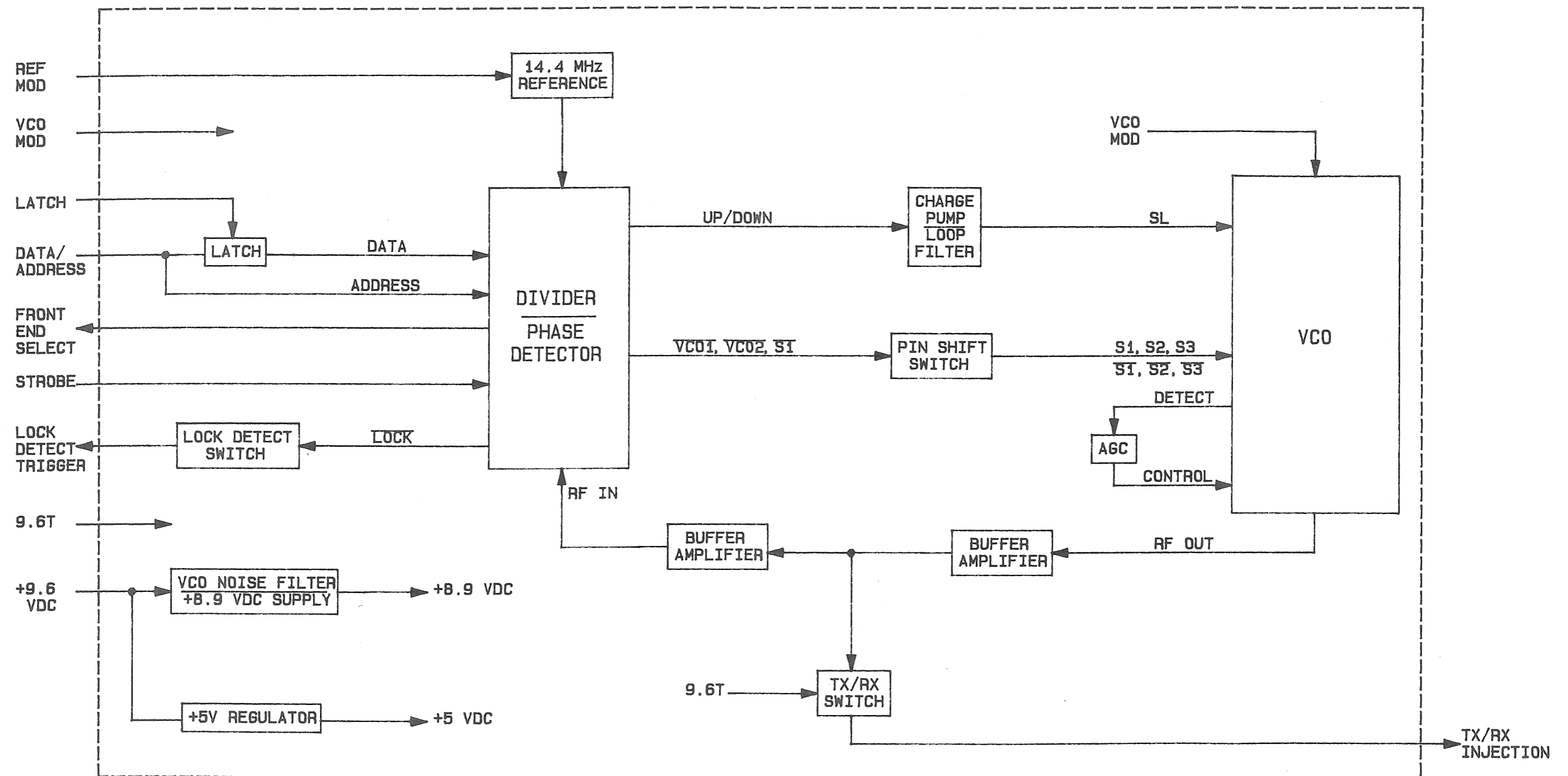
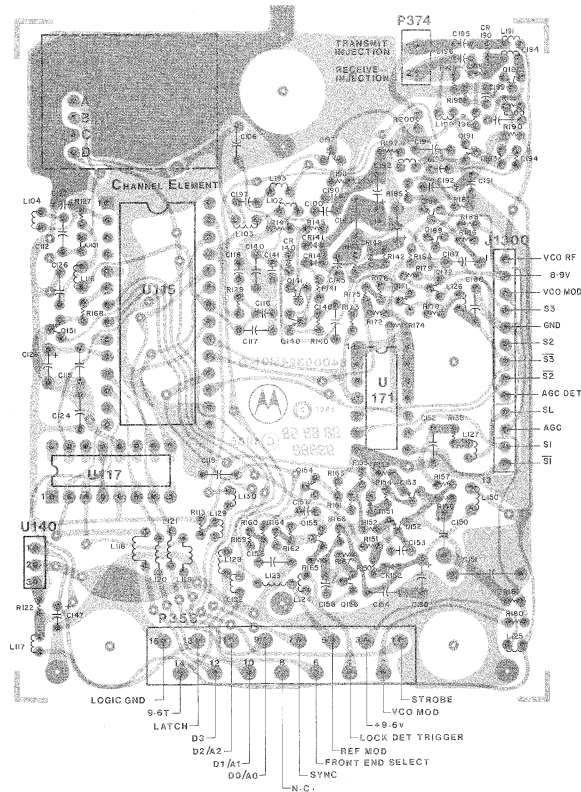


Figure 7-1
Standard Lock Frequency Synthesizer
and V.C.O. - Block Diagram

SHOWN FROM COMPONENT SIDE

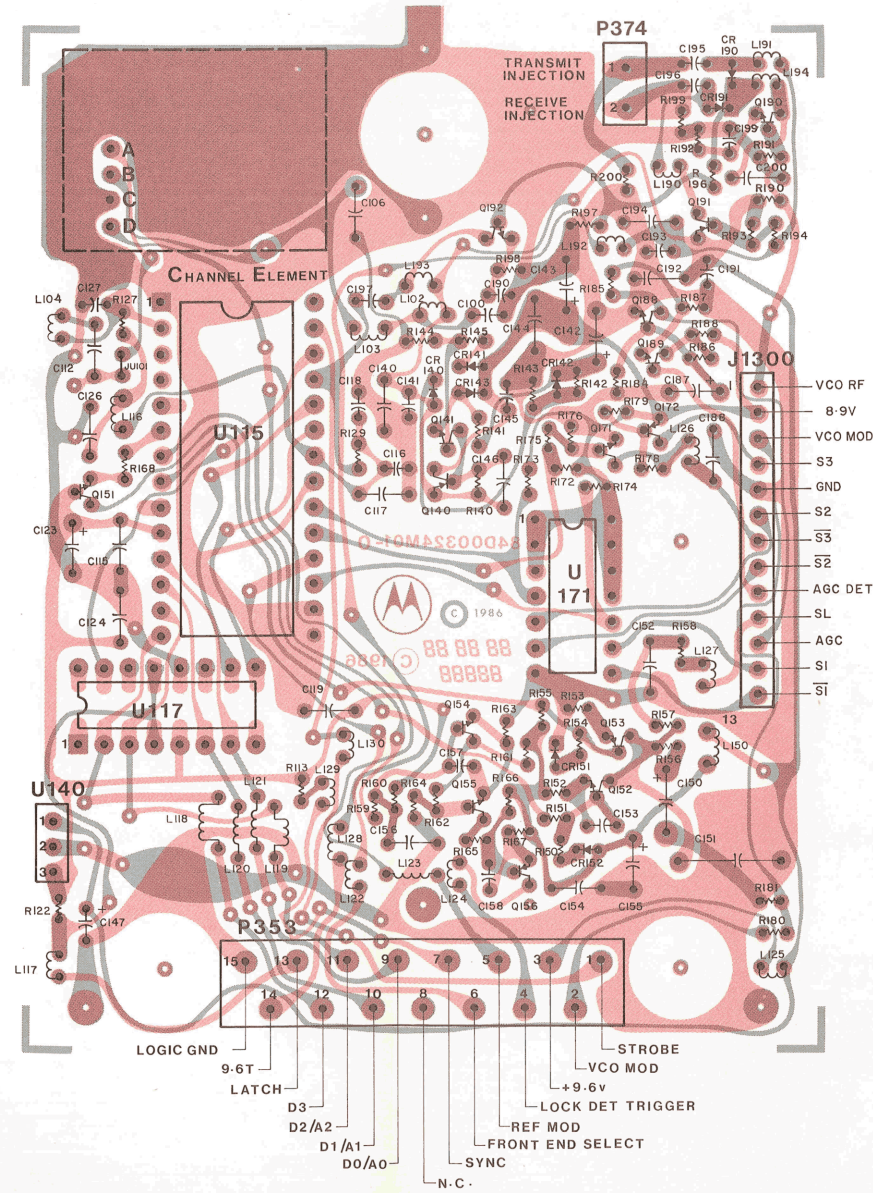
SOLDER SIDE - RED
COMPONENT SIDE - GREY

31H00198M-0

Figure 7-2
Standard Lock Frequency Synthesizer Board
- Board Details

SHOWN FROM COMPONENT SIDE

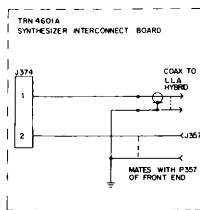
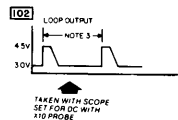
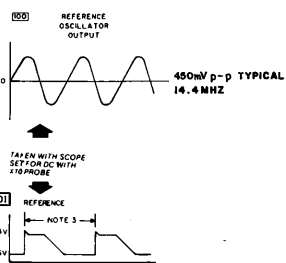
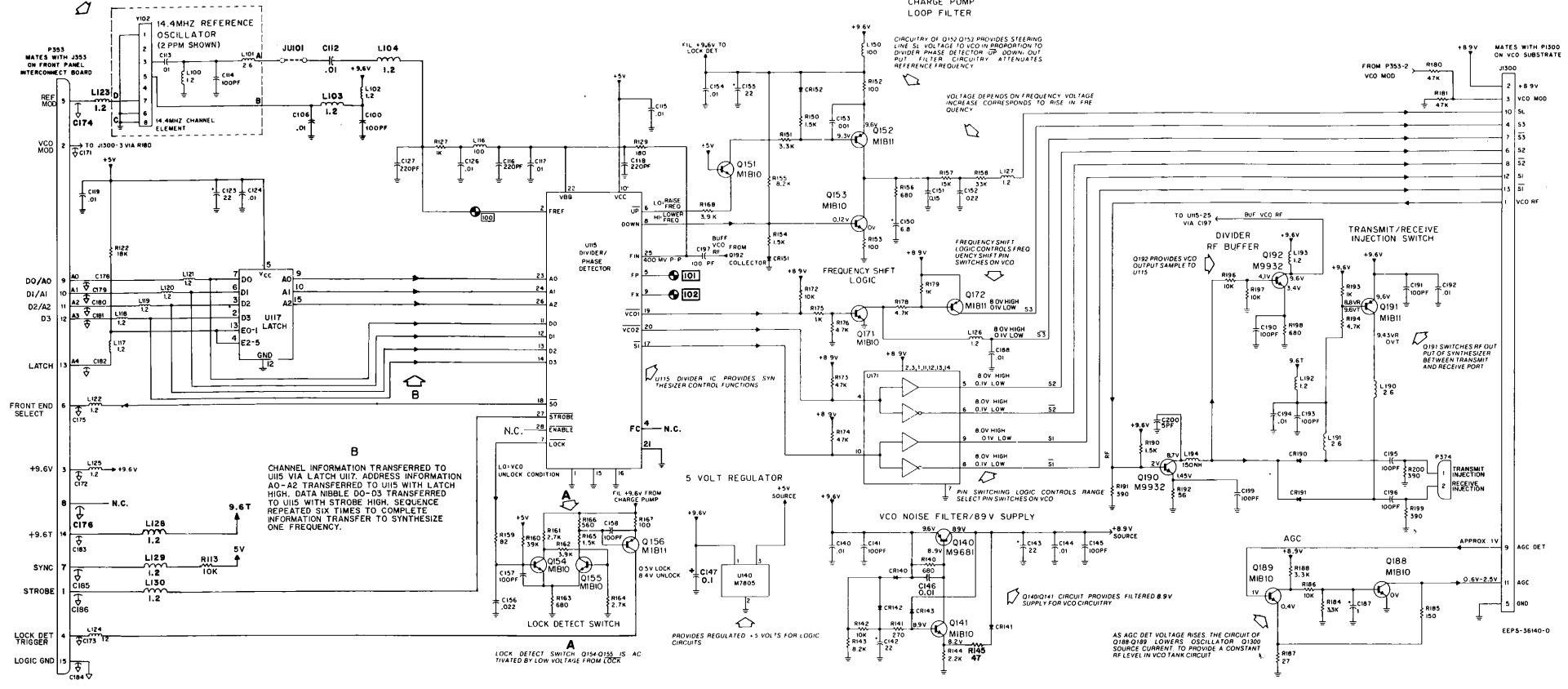
SOLDER SIDE - RED
COMPONENT SIDE - GREY



31H00199M-O

Figure 7-2
Standard Lock Frequency Synthesizer Board
- Board Details

A SAMPLE OF THE COMPOSITE AUDIO SIGNAL FREQUENCY MODULATES THE 14.4 MHz OSCILLATOR TO PREVENT THE PHASE DETECTOR FROM DEFEATING THE DIRECT AUDIO MODULATION OF THE VCO.



NOTES:

- UNLESS OTHERWISE NOTED, RESISTOR VALUES ARE IN OHMS, CAPACITORS VALUES ARE MICROFARADS, INDUCTOR VALUES ARE IN MICROHENRIES.
- VOLTAGE DESIGNATION:
T = TRANSMIT
R = RECEIVE
- PERIOD FOR WAVEFORMS AT TEST POINTS 101 AND 102 IS AS FOLLOWS:

160 USEC AT 6.25 KHZ CHANNEL SPACING
200 USEC AT 5 KHZ CHANNEL SPACING
240 USEC AT 4.166 KHZ CHANNEL SPACING

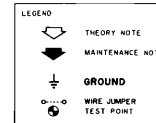


Figure 7-3
Standard Lock Frequency
Synthesizer Board
Schematic Diagram (Sheet 1)

8300650M-O

parts list

VLN4695A STANDARD LOCK SYNTHESIZER VHF 5 PPM
VLN4696A STANDARD LOCK SYNTHESIZER VHF 2 PPM

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Capacitor, uf (unless otherwise stated)
C100	2111026F42	CER DISC 100pf-5-P350-N1000
C106	2111025A01	CER DISC .01-20-25V
C112	2111025A01	CER DISC .01-20-25V
C115	2111025A01	CER DISC .01-20-25V
C116	2100026M37	CER PLT 220pf-10
C117	2111025A01	CER DISC .01-20-25V
C118	2100026M37	CER PLT 220pf-10
C119	2111025A01	CER DISC .01-20-25V
C121	2111026F42	CER DISC 100pf-5-P350-N1000
C123	2384538G13	TANT 22-20-20V
C124	2111025A01	CER DISC .01-20-25V
C127	2100026M37	CER PLT 220pf-10
C128	2111025A01	CER DISC .01-20-25V
C140	2111025A01	CER DISC .01-20-25V
C141	2111026F42	CER DISC 100pf-5-P350-N1000
C142	2311019A27	ALU 22-20-25V
C143	2311019A27	ALU 22-20-25V
C144	2111025A01	CER DISC .01-20-25V
C145	2111026F42	CER DISC 100pf-5-P350-N1000
C146	2111025A01	CER DISC .01-20-25V
C147	2384538G03	TANT .1-20-35V
C150	2384538G22	TANT 6.8-10-20V
C151	0884637L21	MTLZ POLYEST .15-10-100V
C152	0811023A17	POLYEST .022-5-50V
C153	0811017B01	POLYEST .001-10-50V
C154	2111025A01	CER DISC .01-20-25V
C155	2311019A27	ALU 22-20-25V
C156	0811023A17	POLYEST .022-5-50V
C157	2111026F42	CER DISC 100pf-5-P350-N1000
C158	2111026F42	CER DISC 100pf-5-P350-N1000
C187	2311019A09	ALU 1.0-20-50V
C188	2111025A01	CER DISC .01-20-25V
C190	2111026F42	CER DISC 100pf-5-P350-N1000
C191	2111026F42	CER DISC 100pf-5-P350-N1000
C192	2111025A01	CER DISC .01-20-25V
C193	2111026F42	CER DISC 100pf-5-P350-N1000
C194	2111025A01	CER DISC .01-20-25V
C195	2111026F42	CER DISC 100pf-5-P350-N1000
C196	2111026F42	CER DISC 100pf-5-P350-N1000
C197	2111026F42	CER DISC 100pf-5-P350-N1000
C199	2111026F42	CER DISC 100pf-5-P350-N1000
C200	2111022G17	CER DISC 4.7-.25-NPO-50V
		Diode
CR140	4884399M01	SLCN
CR141	4884399M01	SLCN
CR142	4884399M01	SLCN
CR143	4884399M01	SLCN
CR151	4884399M01	SLCN
CR152	4884399M01	SLCN
CR190	4883510F06	10F06
CR191	4883510F06	10F06
		Connector
J116	0980269B03	SKT DUAL IN LINE IC
J1300	0984321M01	RECP CKT BD MTG
		Coil
L102	2482723H27	RF 1.2 UH
L103	2482723H27	RF 1.2 UH
L104	2482723H27	RF 1.2 UH
L116	2482549D37	CHK RF
L117	2482723H27	RF 1.2 UH
L118	2482723H27	RF 1.2 UH
L119	2482723H27	RF 1.2 UH
L120	2482723H27	RF 1.2 UH
L121	2482723H27	RF 1.2 UH
L122	2482723H27	RF 1.2 UH
L123	2482723H27	RF 1.2 UH
L124	2482723H27	RF 1.2 UH

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L125	2482723H27	RF 1.2 UH
L126	2482723H27	RF 1.2 UH
L127	2482723H27	RF 1.2 UH
L128	2482723H27	RF 1.2 UH
L129	2482723H27	RF 1.2 UH
L130	2482723H27	RF 1.2 UH
L150	2482549D37	CHK RF
L190	2482723H39	RF 2.6 UH
L191	2482723H39	RF 2.6 UH
L192	2482723H27	RF 1.2 UH
L193	2482723H27	RF 1.2 UH
L194	2482723H22	RF .15 UH
		Plug
P374	2882040K03	2 PIN
		Crystal Oscillator
PS*	4882230P01	30P01
	*(VLN4695A)	
		Channel element board
PS*	0180731D24	BD CHAN ELE 2 PPM
	*(VLN4696A)	
		Miscellaneous items
PS	0783091N01	BRKT SYNZR REAR MTG
PS	1000801234	FLAT WIRE
PS	1482299P01	INS
		Transistor
Q140	4811043A10	48R00869681
Q141	4802081B10	M1B10
Q151	4802081B10	M1B10
Q152	4802081B11	M1B11
Q153	4802081B10	M1B10
Q154	4802081B10	M1B10
Q155	4802081B10	M1B10
Q156	4802081B11	M1B11
Q171	4802081B10	M1B10
Q172	4802081B11	M1B11
Q188	4802081B10	M1B10
Q189	4802081B10	M1B10
Q191	4802081B11	M1B11
Q190	4811043A16	48R00869932
Q192	4811043A16	48R00869932
		Resistor,FCF ± 5%, 1/4W
R113	0611020A73	10K
R122	0611020A79	18K
R127	0611020A49	1000
R129	0611020A31	180
R130	0611020A81	22K
R140	0611020A45	680
R141	0611020A35	270
R142	0611020A73	10K
R143	0611020A71	8200
R144	0611020A57	2200
R145	0611020A17	47
R150	0611020A53	1500
R151	0611020A61	3300
R152	0611020A25	100
R153	0611020A25	100
R154	0611020A53	1500
R155	0611020A71	8200
R156	0611020A45	680
R157	0611020A77	15K
R158	0611020A85	33K
R159	0611020A23	82
R160	0611020A87	39K
R161	0611020A59	2700

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R162	0611020A63	3900
R163	0611020A45	680
R164	0611020A59	2700
R165	0611020A53	1500
R166	0611020A43	560
R167	0611020A25	100
R168	0611020A63	3900
R172	0611020A73	10K
R173	0611020A89	47K
R174	0611020A89	47K
R175	0611020A49	1000
R176	0611020A65	4700
R178	0611020A65	4700
R179	0611020A49	1000
R180	0611020A89	47K
R181	0611020A89	47K
R184	0611020A61	3300
R185	0611020A29	150
R186	0611020A73	10K
R187	0611020A11	27
R188	0611020A61	3300
R190	0611020A53	1500
R191	0611020A39	390
R192	0611020A19	56
R193	0611020A49	1000
R194	0611020A65	4700
R196	0611020A73	10K
R197	0611020A73	10K
R198	0611020A45	680
R199	0611020A39	390
R200	0611020A39	390
		Integrated circuit
U117	5100073M01	LATCH
U171	5183627M53	BI
U140	5183629M17	BI
U115	5184768F63	MONO 68F63 SYNZR

Frequency Shifting of VCO Sub-Range Frequencies (Range 1 VHF)

Frequency Range Select Signals			VCO Sub-Range (Range 1 VHF)
S1 VCO Pin 12	S2 VCO Pin 6	S3 VCO Pin 4	
0	0	1	114.6-120.599
0	0	0	120.6-126.599
0	1	1	126.6-132.499
0	1	0	132.5-138.399
1	0	1	138.4-144.299
1	0	0	144.3-150.199
1	1	1	150.2-156.099
1	1	0	156.1-162.0

Frequency Shifting of VCO Sub-Range Frequencies (Range 2 VHF)

Frequency Range Select Signals			VCO Sub-Range (Range 2 VHF)
S1 VCO Pin 12	S2 VCO Pin 6	S3 VCO Pin 4	
0	0	1	124.6-130.599
0	0	0	130.6-136.799
0	1	1	136.8-142.999
0	1	0	143.0-149.199
1	0	1	149.2-155.399
1	0	0	155.4-161.599
1	1	1	161.6-167.799
1	1	0	167.8-174.0

Figure 7-4
Standard Lock Frequency
Synthesizer Board
Parts List

Figure 7-3
Standard Lock Frequency
Synthesizer Board
Schematic Diagram (Sheet 2)

VHF FAST LOCK SYNTHESIZER

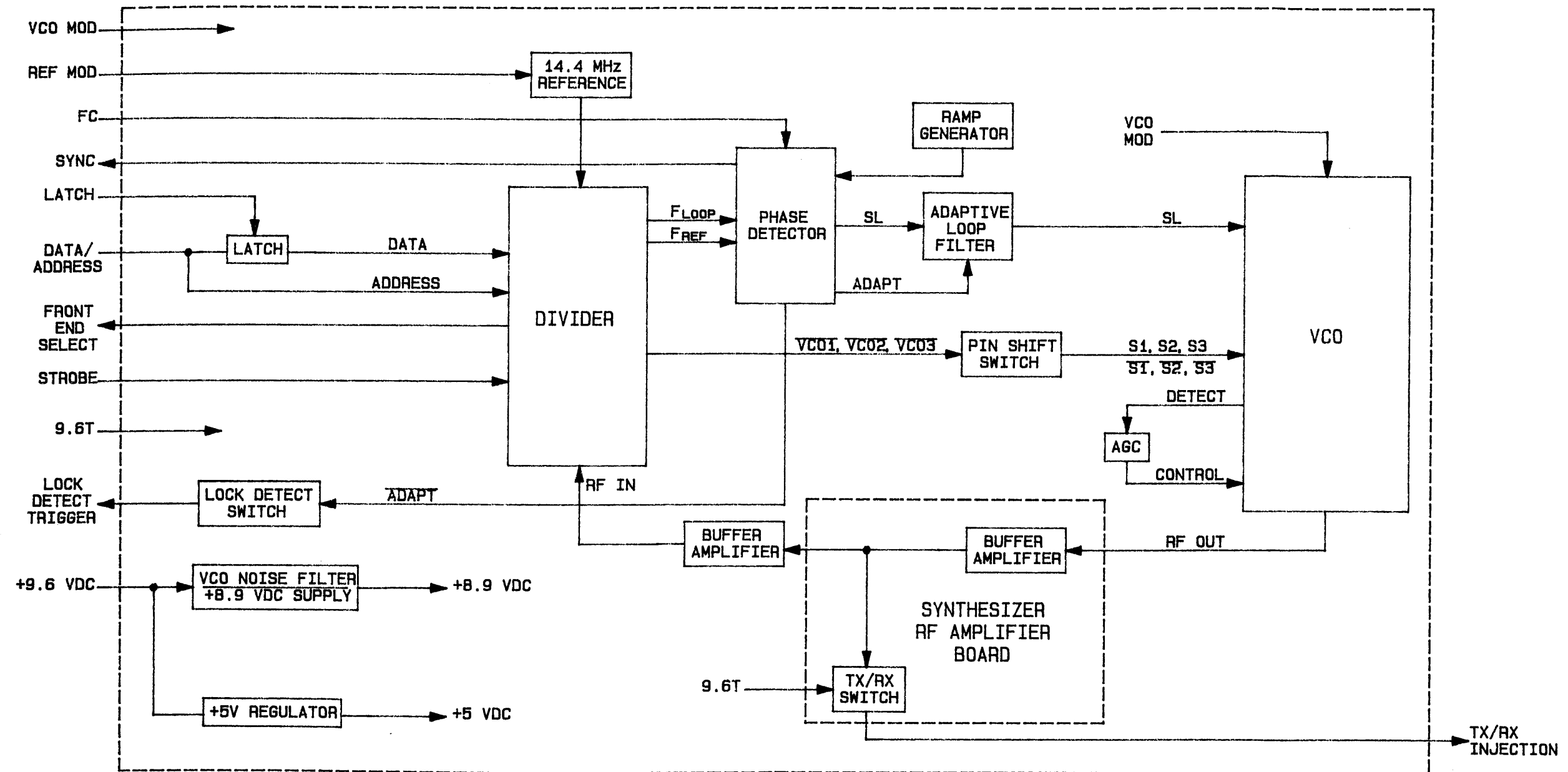
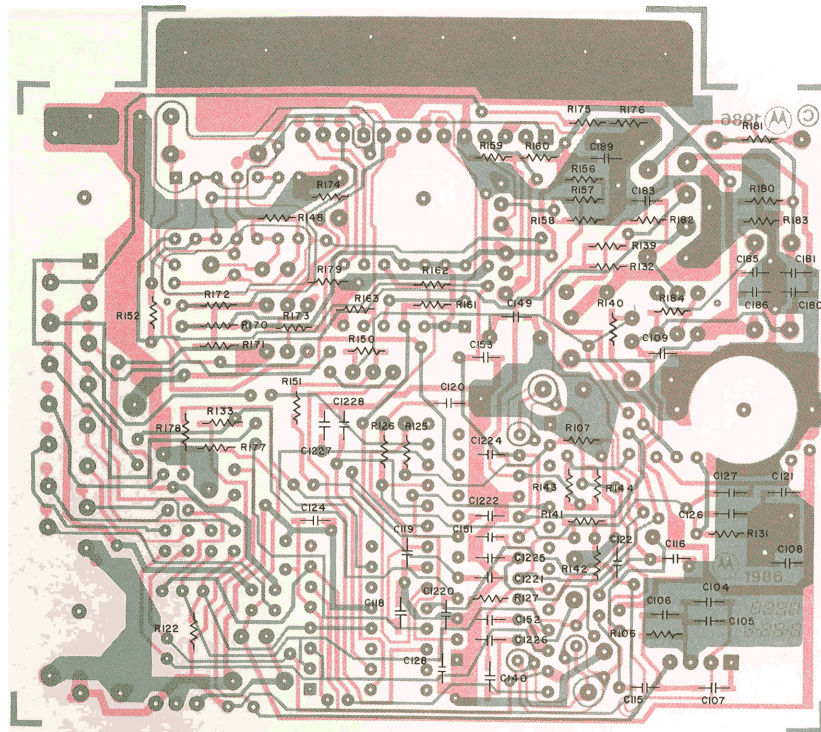
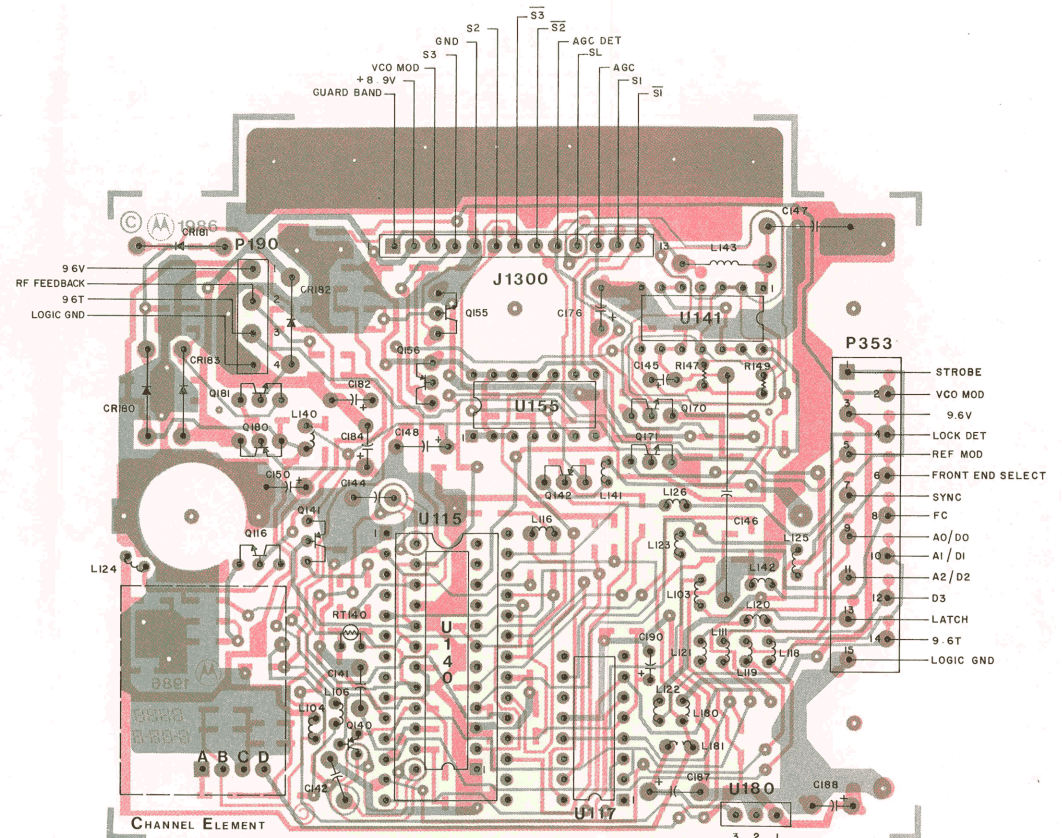


Figure 7-5
Fast-Lok Frequency Synthesizer
and V.C.O. - Block Diagram



SHOWN FROM SOLDER SIDE

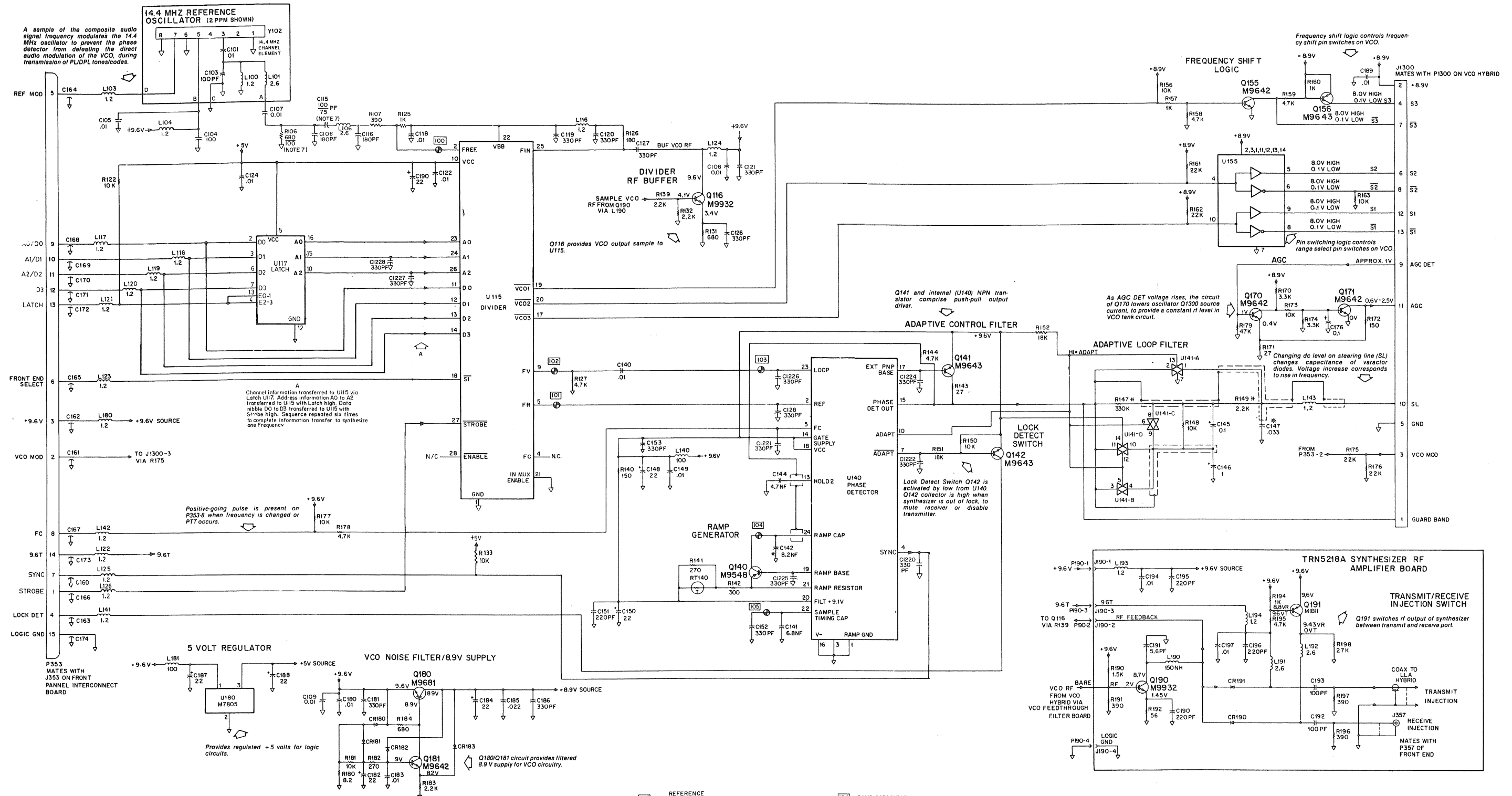
SOLDER SIDE - RED
COMPONENT SIDE - GREY



SHOWN FROM COMPONENT SIDE

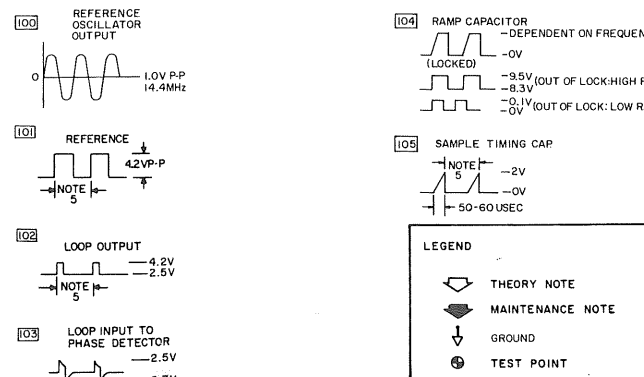
SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 7-6
Fast-Lok Frequency Synthesizer Board
- Board Details



NOTES:

- Unless otherwise noted, resistor values are in ohms, capacitor values are in microfarads, inductor values are in microhenries.
- All resistors, except those marked with an asterisk (*) are chip components mounted to solder side of circuit board.
- All capacitors are chip components mounted to solder side of circuit board, except electrolytic (polarized) capacitors, and those marked with an asterisk (*).
- Voltage designations:
 T = Transmit
 R = Receive
- Period for waveforms at test points 101, 102, 103, and 105 are as follows:
 160 usec at 6.25 kHz channel spacing
 200 usec at 5 kHz channel spacing
 240 usec at 4.166 kHz channel spacing
- Dashed lines denote guard band shields, which consist of plotting around portions of circuitry.
- This component is sensitive to the reference oscillator used.
 The format is $\frac{2PPM}{SPPM}$



6300625M-0

Figure 7-7
 Fast-Lok Frequency Synthesizer
 Board Schematic Diagram

SECTION 7. FREQUENCY SYNTHESIZER AND V.C.O.

parts list

VLN4699A FAST-LOK SYNTHESIZER 5 PPM
VLN4700A FAST-LOK SYNTHESIZER 2 PPM

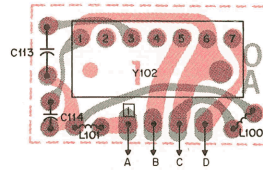
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Capacitor, pf (unless stated otherwise)
C104	2111031A39	100-5-NPO-50V
C105	2111032A21	.01uf-10-X7R-50V
C106	2111031A45	180-5-NPO-50V
C107	2111032A21	.01uf-10-X7R-50V
C108	2111032A21	.01uf-10-X7R-50V
C109	2111032A21	.01uf-10-X7R-50V
C115	2111031A39	100-5-NPO-50V (VLN4700A only)
C115	2111031A45	180-5-NPO-50V (VLN4699A only)
C116	2111031A45	180-5-NPO-50V
C118	2111032A21	.01uf-10-X7R-50V
C119	2111031A51	330-5-NPO-50V
C120	2111031A51	330-5-NPO-50V
C121	2111031A51	330-5-NPO-50V
C122	2111032A21	.01uf-10-X7R-50V
C124	2111032A21	.01uf-10-X7R-50V
C126	2111031A51	330-5-NPO-50V
C127	2111031A51	330-5-NPO-50V
C128	2111031A51	330-5-NPO-50V
C140	2111032A21	.01uf-10-X7R-50V
C141	0811023B11	POLYEST .0068uf-10-50V
C142	0880027B03	POLYP 8200-5-100V
C144	0880027B02	POLYP 4700-5-100V
C145	2384538G03	.1uf-20-35V TANT
C146	0883862M05	MTLZ POLYP 1uf-10-100V
C147	0883765N01	MTLZ POLYP .033uf-10-125V
C148	2311013C56	22uf-20-15V TANT
C149	2111032A21	.01uf-10-X7R-50V
C150	2311019A27	22uf-20-25V ALU
C151	2111031A47	220-5-NPO-50V
C152	2111031A51	330-5-NPO-50V
C153	2111031A51	330-5-NPO-50V
C176	2384538G03	.1uf-20-35V TANT
C180	2111032A21	.01uf-10-X7R-50V
C181	2111031A51	330-5-NPO-50V
C182	2311019A27	22uf-20-25V ALU
C183	2111032A21	.01uf-10-X7R-50V
C184	2311013C56	22uf-20-15V TANT
C185	2111032A25	.022uf-10-X7R-50V
C186	2111031A51	330-5-NPO-50V
C187	2311013C56	22uf-20-15V TANT
C188	2311013C56	22uf-20-15V TANT
C189	2111032A21	.01uf-10-X7R-50V
C190	2311037A27	22uf-20-25V ALU
C1220	2111031A51	330-5-NPO-50V
C1221	2111031A51	330-5-NPO-50V
C1222	2111031A51	330-5-NPO-50V
C1224	2111031A51	330-5-NPO-50V
C1225	2111031A51	330-5-NPO-50V
C1226	2111031A51	330-5-NPO-50V
C1227	2111031A51	330-5-NPO-50V
C1228	2111031A51	330-5-NPO-50V
		Diode
CR180	4883654H01	SLCN
CR181	4883654H01	SLCN
CR182	4883654H01	SLCN
CR183	4883654H01	SLCN
		Coil
L103	2482723H27	RF 1.2UH
L104	2482723H27	RF 1.2UH
L106	2482723H39	RF 2.6UH
L116	2482723H27	RF 1.2UH
L117	2482723H27	RF 1.2UH
L118	2482723H27	RF 1.2UH
L119	2482723H27	RF 1.2UH
L120	2482723H27	RF 1.2UH
L121	2482723H27	RF 1.2UH
L122	2482723H27	RF 1.2UH
L123	2482723H27	RF 1.2UH
L124	2482723H27	RF 1.2UH
L125	2482723H27	RF 1.2UH
L126	2482723H27	RF 1.2UH

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L140	2482549D37	RF 100UH
L141	2482723H27	RF 1.2UH
L142	2482723H27	RF 1.2UH
L143	2482723H27	RF 1.2UH
L180	2482723H27	RF 1.2UH
L181	2482549D37	RF 100UH
		Connector
J1300	0984321M01	CKT BD MTG RECP (13 CONT) (VLN4699A only)
P353	0100955M02	ASSEM FEED THRU PLTE
P190	2882040K04	4 PIN PLUG
U115	0982071K09	RECP 14 CONT
U115	0982071K09	RECP 14 CONT
		Transistor
Q116	4800869932	M9932
Q140	4800869548	M9548
Q141	4800869643	M9643
Q142	4800869643	M9643
Q155	4800869642	M9642
Q156	4800869643	M9643
Q170	4800869642	M9642
Q171	4800869642	M9642
Q180	4800869681	M9681
Q181	4800869642	M9642
		Resistor, chip, 5%, 1/8W (unless stated otherwise)
R106	0600015M45	680 (VLN4700A only)
R106	0600015M25	100 (VLN4699A only)
R107	0600015M39	390
R122	0600015M73	10K
R125	0600015M49	1000
R126	0600015M31	180
R127	0600015M65	4700
R131	0600015M45	680
R132	0600015M57	2200
R133	0600015M73	10K
R139	0600015M57	2200
R140	0600015M29	150
R141	0600015M35	270
R142	0600015M3C	300
R143	0600015M11	27
R144	0600015M65	4700
R147	0611020B10	330K -1/4W FCF
R148	0600015M73	10K
R149	0611020A57	2200 -1/4W FCF
R150	0600015M73	10K
R151	0600015M79	18K
R152	0600015M79	18K
R156	0600015M73	10K
R157	0600015M49	1000
R158	0600015M65	4700
R159	0600015M65	4700
R160	0600015M49	1000
R161	0600015M81	22K
R162	0600015M81	22K
R163	0600015M73	10K
R170	0600015M61	3300
R171	0600015M11	27
R172	0600015M29	150
R173	0600015M73	10K
R174	0600015M61	3300
R175	0600015M81	22K
R176	0600015M81	22K
R177	0600015M73	10K
R178	0600015M65	4700
R179	0600015M89	47K
R180	0600015M71	8200
R181	0600015M73	10K
R182	0600015M35	270
R183	0600015M57	2200
R184	0600015M45	680

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Thermister
RT140	0683600K02	1K
		Integrated Circuit
U115	5183977M37	77M37
U117	5100073A01	LATCH
U140	5183977M46	
U141	5180073C02	QUAD CMOS BILATERAL SW
U155	5183627M53	BI
		Non-referenced Items
	0783091N01	REAR MTG SYNZR BRKT
	2900026M02	TERM POST (15 used)
	0180731D24	CHAN ELE BD 2 PPM (VLN4700A only)
	4882230P01	XTAL OSC 30P01 (VLN4699A only)

Figure 7-8
Fast-Lok Frequency Synthesizer Board
Parts List

2 PPM CHANNEL ELEMENT BOARD

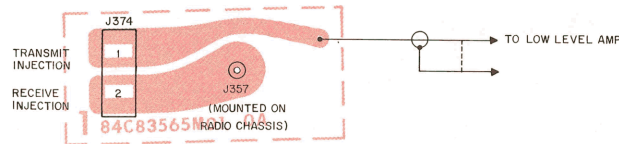


SHOWN FROM COMPONENT SIDE

31H00208M-0

SOLDER SIDE - RED
COMPONENT SIDE - GREY

SYNTHESIZER INTERCONNECT BOARD



SHOWN FROM SOLDER SIDE

31H00209M-0

SOLDER SIDE - RED
COMPONENT SIDE - GREY

parts list

0180731D24 2 PPM CHANNEL ELEMENT BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor		
C113	2111025A01	CER DISC .01uf-20-25V
C114	2184511B01	CER PLT 100PF-10-N750
Coil		
L100	2482723H27	RF 1.2 UH
L101	2482723H39	RF 2.6 UH
Reference oscillator		
	5180291B02	KXN1096A
Pad		
	7584112M01	CHANNEL ELEMENT (2 used)

VLN4624A SYNTHESIZER INTERCONNECT BD VHF STD LOCK

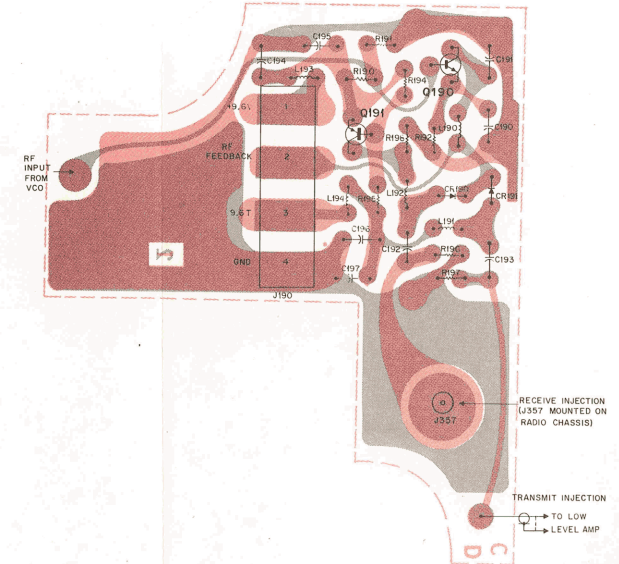
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	2910134A29	LUG CONNECTOR (2 USED)

Figure 7-9
2 PPM Channel Element Board &
Synthesizer Interconnect Board
- Board Details & Parts Lists

VLN4633A SYNTHESIZER RF BUFFER BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor		
C190	2100026M37	CER PLT 220pf-10
C191	2184511B75	CER 5 6pf-25-N750
C192	2100026M24	CER PLT 100pf-10-N2200
C193	2100026M24	CER PLT 100pf-10-N2200
C194	2100021M01	CER DISC .01uf-10-50V
C195	2100026M37	CER PLT 220pf-10
C196	2100021M01	CER DISC .01uf-10-50V
C197	2100026M37	CER PLT 220pf-10
Diode		
CR190	4883510F06	10F06 0.7 OHM AT 3 MA
CR191	0180766D70	DIODE & SLEEVE ASSEM
Connector		
J190	2910134A29	LUG (4 USED)
Coil		
L190	2482723H22	.150UH
L191	2482723H39	2.6UH
L192	2482723H39	2.6UH
L193	2482723H27	1.2UH
L194	2482723H27	1.2UH
Transistor		
Q190	4800869932	M9932
Q191	4802081B11	M1B11
Resistor		
R190	0660075A53	1500
R191	0180766D67	390 RESISTOR & SLEEVE ASSEM.
R192	0180766D68	56 RESISTOR & SLEEVE ASSEM.
R194	0180766D69	1000 RESISTOR & SLEEVE ASSEM.
R195	0660075A65	4700
R196	0660075A39	390
R197	0180766D67	390 RESISTOR & SLEEVE ASSEM.
R198	0660075A83	27K
Mechanical Parts		
	0783090N01	BRACKET, MOUNTING
	1483090N01	INSULATOR, RF BUFFER, SIDE
	1483090N02	INSULATOR, RF BUFFER, TOP
	2683092N01	SHIELD, CAN
	2682845M01	SHIELD, FAST LOCK
	0102700A14	BOARD ASSEMBLY includes: BOARD, LUG,CONN (2910134A29)
	0700305M01	LUG MTG BRACKET

SYNTHESIZER RF AMPLIFIER BOARD



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

31H00210M-0

Figure 7-10
Synthesizer RF Amplifier Board
- Board Details & Parts list

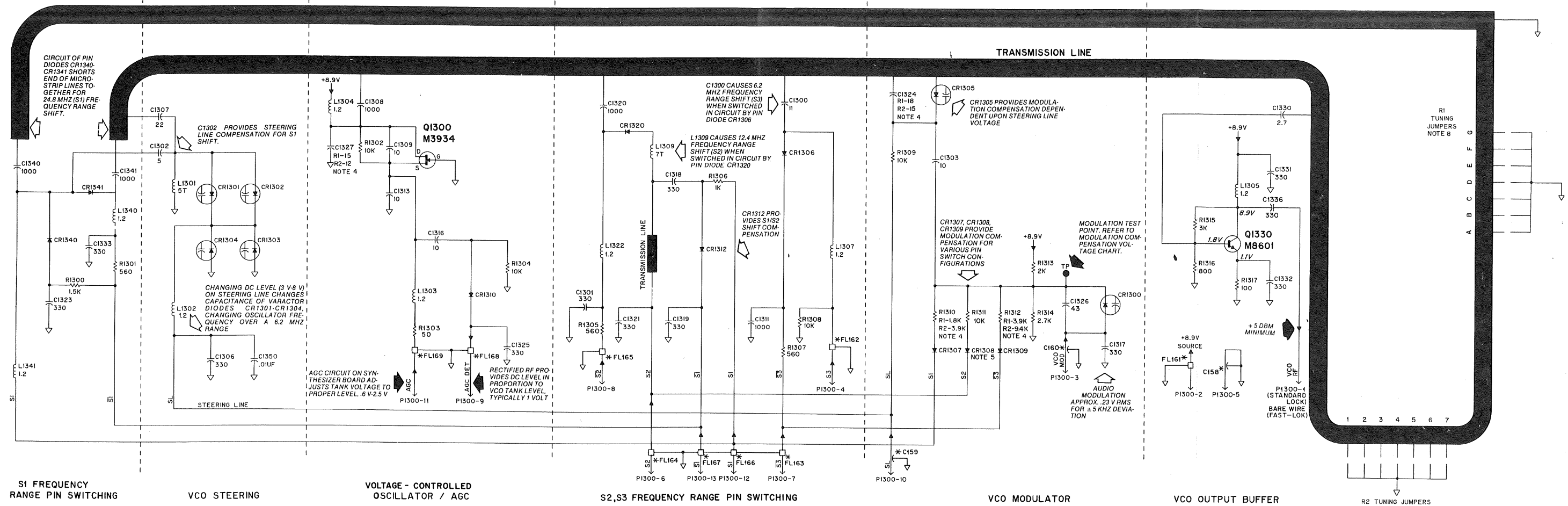


Figure 7-11
Voltage Controlled Oscillator
Board Schematic Diagram

6300681M-O



SECTION 8. RECEIVER AND TRANSMITTER

8.1 GENERAL

This section contains schematic diagrams, board details and parts lists for the boards listed below.

- Receiver Widespaced Dual Front End Assembly Figures 8-1 to 8-3
- Main Board Figures 8-4 to 8-7
- Harmonic Filter Hybrid Assembly Figures 8-8, 8-13 and 8-14
- Transmitter Low Level Amplifier Hybrid Assembly Figures 8-11, 8-13 and 8-14
- Transmitter 10 Watt Amplifier Hybrid Assembly Figures 8-10, 8-13 and 8-14
- Transmitter 30 Watt Amplifier Hybrid Assembly Figures 8-12, 8-13 and 8-14
- Transmitter Power Amplifier Interconnect Board Figures 8-9, 8-13 and 8-14
- Power Interconnect Board Figures 8-15 and 8-16

8.2 WIDESPACED DUAL FRONT END

(Figures 8-1 to 8-3)

The Widespaced Dual Front End is housed in a metal casting that is mounted to the main board. Except for the helical filters, circuit components are mounted on an amplifier board and a mixer board, located inside the casting.

The Widespaced Dual Front End (D.F.E.) provides coverage by switching between two, 6MHz

wide, tuneable helical filters. Each filter can be tuned to any desired 6 MHz wide frequency band within the frequency range of the radio. Switching is controlled by the front end select signal supplied by the frequency synthesizer circuit. The D.F.E. generates the receiver i-f signal using the receiver rf signal from the antenna switch in the transmitter circuits and the receiver injection signal from the frequency synthesizer circuit. The receiver rf is filtered by an input filter, amplified by rf amplifier Q750, and applied to an input diode switch. The input diode switch, together with an output diode switch, determine which rf frequency range is selected. (When the front end select signal is high, the front end logic circuit switches the input and output diode switches to a high range condition.)

The amplified rf signal will pass through either the low or high range filter before proceeding to the mixer. Also applied to the mixer, via an injection filter, is the receiver injection signal. The mixer combines the two signals to produce the 21.4 MHz receiver i-f signal that is applied to the receiver circuits on the main board.

8.3 MAIN BOARD

The Main Board circuits are described in two parts; receiver circuits and transmitter circuits.

8.3.1 MAIN BOARD RECEIVER CIRCUITS (Figures 8-4, 8-5 and 8-6)

The Main Board contains the following receiver circuits:

- i-f
- limiter / quadrature detector
- low level audio

SECTION 8. RECEIVER AND TRANSMITTER

- audio muting
- audio power amplifier
- squelch

I-F Circuit

The i-f circuit consists of two buffers, an i-f amplifier, and a series of crystal filters cut to a fundamental frequency of 21.4 MHz. The receiver i-f signal from the D.F.E. is applied through first buffer Q1 to four pole crystal filter Y1. The filtered i-f output from Y1 is buffered again by Q2, amplified by U1, and further filtered by two pole crystal filters Y2A and Y2B. The amplified and filtered i-f output from Y2B is applied to limiter / quadrature detector U2.

Limiter / Quadrature Detector U2

Limiter/quadrature detector U2 is an integrated circuit that recovers the audio from the frequency modulated carrier. The limiter/quadrature detector buffers the recovered audio and applies it to the low level audio circuit. In PL / DPL models, it also supplies a sense signal to the busy light circuit to control the busy light on the front panel.

Low level Audio Circuit

The low level audio circuit consists of detector audio buffer U50A and de-emphasis amplifier U50B. The recovered audio from the limiter/quadrature detector is applied through U50A to U50B. The recovered audio from U50A is also applied as the optional receive audio to the PL / DPL circuits. The PL / DPL circuits, in turn, inject the PL filtered audio signal into the recovered audio path between U50A and U50B. The recovered audio is amplified and de-emphasized by U50B and is applied to primary mute gate Q50 in the audio muting circuit.

Audio Muting Circuit

Primary mute gate Q50 and secondary mute gate Q58 form the audio muting circuit. Audio inputs to the circuit are the recovered audio from the low level audio circuit and the sidetone / alert

tone from the PL / DPL circuits. The sidetone / alert tone is inserted into the circuit, via the volume control, which is between Q50 and Q58.

The audio muting circuit gates the receiver audio on and off in response to five signals :

- high lock detector (VCO lock) signal from the frequency synthesizer;
- the 9.6T keying voltage from the transmitter PTT logic circuit;
- the sidetone enable signal from the PL / DPL or time-out timer;
- the receive audio mute signal from the PL / DPL circuits;
- or the squelch mute signal developed by the receiver squelch circuit.

When no mute signal is applied to the audio mute line, series mute gate Q50 is on and shunt mute gate Q58 is off. This allows receiver audio from the low level audio circuit to be applied through the volume control to the audio power amplifier. If the audio mute line is driven high, the audio is muted.

To allow the sidetone / alert tone to be inserted into the audio path when the recovered audio is muted, the sidetone enable signal is activated (goes low). This allows the sidetone / alert tone to be routed through the volume control to the audio power amplifier.

Audio Power Amplifier

The audio power amplifier consists of transistors Q51 through Q57. It supplies up to five watts of audio power to the speaker.

Squelch Circuit

The recovered audio output from detector buffer U50A in the low level audio circuit is applied to audio-captured limiter / noise amplifier U2100A. The output from U2100A is applied through SQ (squelch adjust) potentiometer R2103 (which adjusts the noise quieting level at which the squelch

operates) to a second amplifier , U2100B. The amplified output from U100B is detected by a full wave rectifier to produce an average dc voltage at the output of the third amplifier, U2100C. The output voltage at U2100C is proportional to the receiver quieting level. This dc quieting level voltage is then compared to a fixed dc reference voltage by integrator / comparator U2100D. At this point the squelch signal is output to the Analog Interface Board using the SCAN 4 line (to pin 14 , P352; Slow Sq. Preset) and the SCAN 2 line (to pin 11, P352; Sq. Noise). After processing by the Analog Interface Board circuitry, the appropriate signal is applied to pin 12, P352. A high signal turns Q2102 on, muting the receiver audio.

Q2102 is also controlled by the receive audio mute signal supplied by the PL / DPL circuits. When a valid PL / DPL code is detected, the PL / DPL circuits provide an active low. This prevents Q2102 from muting the receive audio.

8.3.2 MAIN BOARD TRANSMITTER CIRCUITS

(Figures 8-4, 8-6 and 8-7)

The transmitter circuits are mounted on the Main Board and the PA Interconnect Board.

The Main Board contains the following circuits :

- transmit audio / IDC (instantaneous deviation control)
- transmit power level and control
- Part of PTT circuit

Transmit Audio / IDC

The transmit audio / IDC circuit processes the microphone audio to ensure that the proper level of audio drive is supplied to the VCO Assembly in the frequency synthesizer circuits. The low frequency PL / DPL encode signal is combined with the microphone audio and is routed, via IDC deviation control and compensation circuits, to the VCO Assembly. A second VCO reference modulation signal is routed to the 14.4 MHz reference oscillator in the frequency synthesizer circuits (DPL radios only).

Microphone audio is applied to mic mute gate Q325 , via connector P350-12 (front mount radios) or connector J380-4 (remote mount radios). The mic mute gate applies the audio to limiter U325A, via a pre-emphasis network. Transmit audio from options or accessories can also be injected into the input path of U325A , without pre-emphasis, via connectors J350-2 or P352-17. The output from U325A is applied to the input of splatter filter U325B. Inserted into this audio path is the PL / DPL VCO modulation tone input from the PL / DPL circuits.

The output from the splatter filter is applied to the IDC mute gate Q326, which is open in the receive mode. The IDC audio , which carries information above 50 Hz, is routed to the frequency synthesizer circuits to drive the VCO hybrid.

The signal source used to modulate the 14.4 MHz reference oscillator is the PL / DPL reference modulation signal generated in the PL/DPL circuits. This signal, carrying information below 50 Hz, is routed to the reference oscillator.

Transmit Power and Level Control Circuit

The control circuit provides power leveling and protection from excessive temperature or excessive reflected rf power for the final power amplifier circuits. This is accomplished by reducing the gain of the low level amplifier. The circuit also disables the rf drive (by removing the LLA A+ voltage) if the frequency synthesizer goes out of lock.

The transmit power and level control circuit consists of transistors Q225, Q226, Q227, Q228 and differential amplifier U300B. A temperature compensation monitoring signal is developed by negative coefficient diode CR1451, mounted near the directional coupler. A heat sense signal is developed by a thermistor located in the 30 watt power amplifier. The rf output power is monitored at the directional coupler. The directional coupler signal is a dc voltage that represents the weighted sum of the forward and reflected power. If any of these signals indicate a fault, the voltage variation on the directional coupler signal line is compared by differential amplifier U300B to a fixed dc reference.

The amplifier then causes the control circuit to reduce the LLA A+ voltage, hence the rf output power, until the fault is stabilized. PWR ADJ potentiometer R245 presets the rf output level by setting a dc reference voltage for the differential amplifier. Voltage limit potentiometer R236 sets an upper limit on the LLA A+ voltage available to the LLA, to prevent damage to the 10 watt PA due to overdrive from the LLA.

PTT

Part of the PTT circuit resides on the Main Board. When a request to transmit is made, the DEL PTT (delayed push to talk) line (on P352-3) goes low to turn on Q302 which then provides the 9.6T voltage required by the transmitter circuits. Q307 is turned off at this time. Under receive conditions, the DEL PTT line is high, thus turning on Q307 and turning off Q302.

8.4 HARMONIC FILTER / ANTENNA SWITCH

(Figures 8-8, 8-13 and 8-14)

The harmonic filter / antenna switch attenuates harmonics of the transmitter during transmit mode and attenuates higher frequency spurious responses of the receiver during receive mode. It also switches the antenna between the transmit signal path and receive signal path.

When the transmitter is in the transmit mode, the final rf output is routed through the transmit port of the antenna switch, the harmonic filter, and directional coupler to the antenna. In the receive mode, the receive rf from the antenna is directed through the directional coupler and harmonic filter to the receive port of the antenna switch. The receive rf is then routed to the front end of the receiver. The directional coupler signal monitors the forward versus reflected power allowing the transmit power level and control circuit to keep the rf output power level within the preset level.

8.5 TRANSMITTER LOW LEVEL AMPLIFIER HYBRID ASSEMBLY

(Figures 8-11, 8-13 and 8-14)

The low level amplifier is a two stage, non-linear amplifier that supplies the rf drive for the 10 watt power amplifier. The input to this amplifier is the transmit injection signal from the frequency synthesizer circuits. The signal is amplified by amplifiers Q200 and Q201 to produce the rf drive output. The gain of this amplifier is controlled by the LLA A+ operating voltage supplied by the transmit power level and control circuit.

8.6 TRANSMITTER 10 WATT AMPLIFIER HYBRID ASSEMBLY

(Figures 8-10, 8-13 and 8-14)

The 10 watt power amplifier consists of a single, non-linear stage Q250 that supplies the rf drive signal to the 30 watt amplifier. Operating power is supplied by the PA A+ voltage.

8.7 TRANSMITTER 30 WATT AMPLIFIER HYBRID ASSEMBLY

(Figures 8-12, 8-13 and 8-14)

The 30 watt amplifier consists of a single, non-linear stage, Q1400. Operating power is supplied by the PA A+ voltage. Temperature protection is provided by a thermistor located near the amplifier. The final rf output from the amplifier is applied to the harmonic filter / antenna switch.

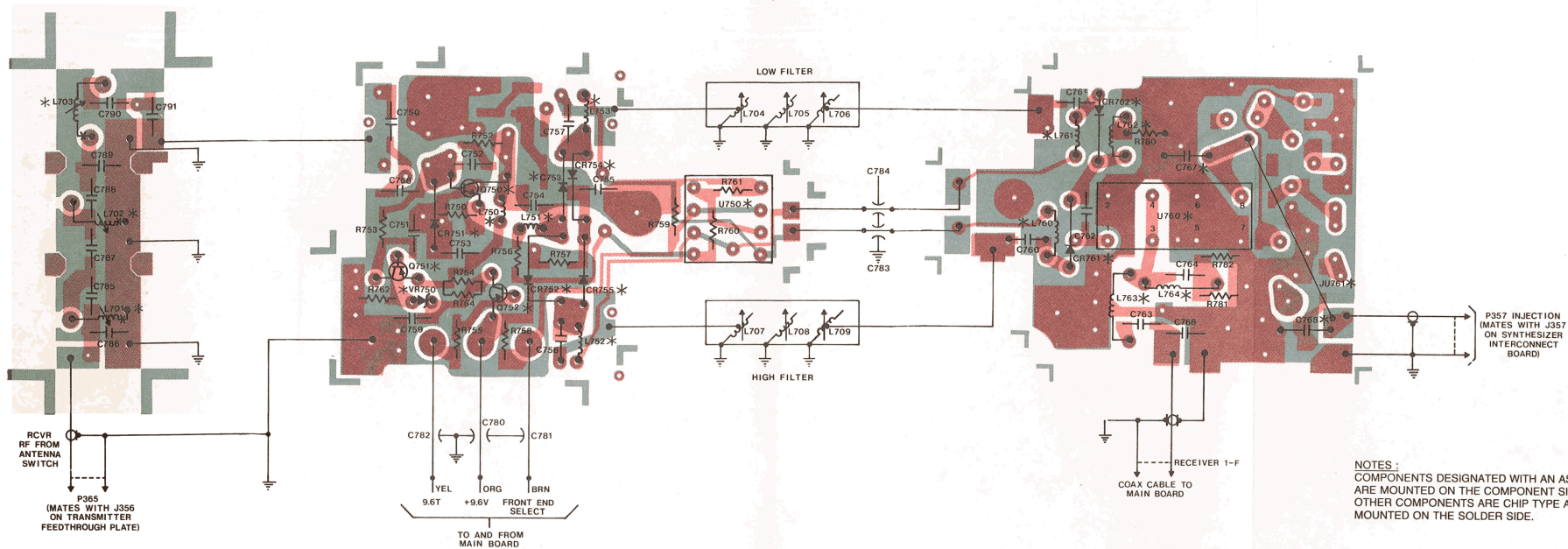
8.8 TRANSMITTER POWER AMPLIFIER INTERCONNECT BOARD

(Figures 8-9, 8-13 and 8-14)

The Transmitter Power Amplifier Interconnect Board contains and connects the low level amplifier hybrid, the 10 watt amplifier hybrid and the harmonic filter hybrid. The rf output from the 10 watt amplifier drives the 30 watt amplifier, which is mounted in the external heatsink.

8.9 POWER INTERCONNECT BOARD
(Figures 8-15 and 8-16)

The Power Interconnect Board provides power distribution for the radio set and feedthrough interconnect from the Main Board to the power amplifier circuitry.



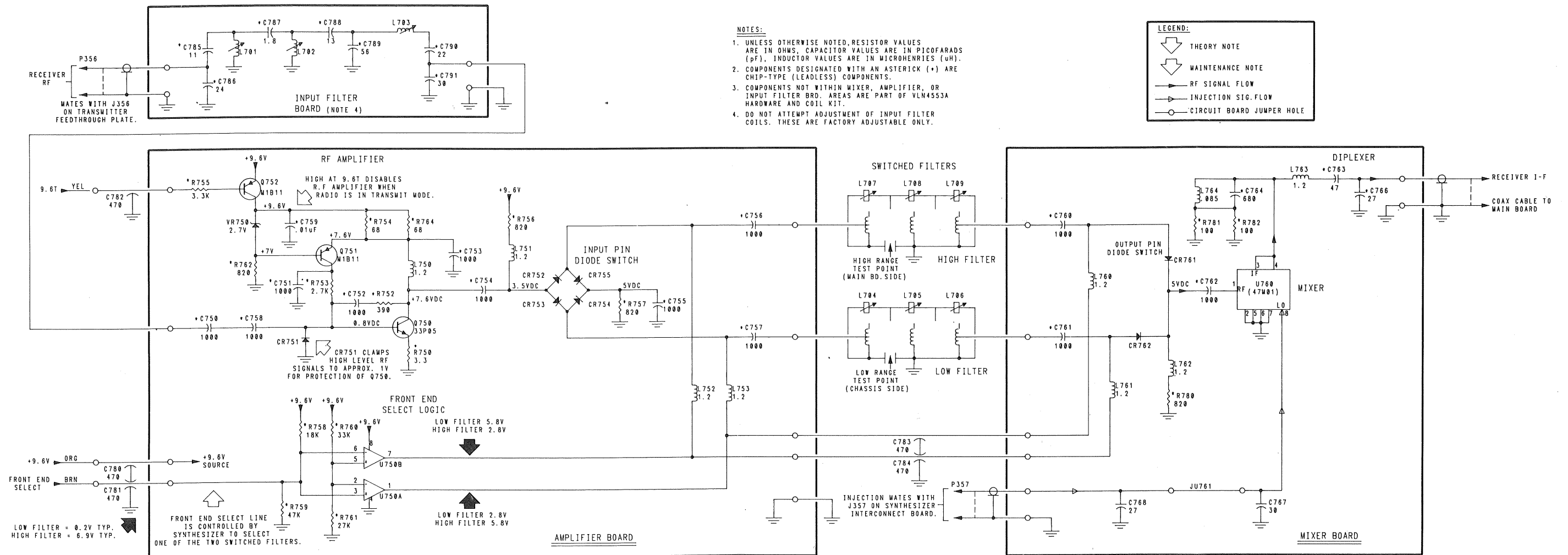
X DENOTES LONG LEAD OF COILS. (TOP END)

SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
 COMPONENT SIDE - GREY

Figure 8-1
 Widespace Dual Front End Boards
 - Board Details

31H00169M-O



6300643M-O

Figure 8-2
Widespace Dual Front End Boards
Schematic Diagram

parts list

VLN4553A DUAL FRONT END HARDWARE AND COIL KIT

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, (chip type) pF (unless stated otherwise)		
C750 thru C758	2111032A09	.001uF - 50V
C759	2111032A21	.01uF -10-50V
C760 thru C762	2111032A09	.001uF-50V
C763	2111031B31	47-5-N150-50V
C764	2111031F59	680-5-N750-50V
C766	2111031A25	27-5-NPO-50V
C767	2111022H38	CER DISC 30-5-N150-50V
C768	2111022H37	CER DISC 27-5-N150-50V
C780 thru C784	2184874K01	470-20-250V feed-thru
C785	2111031A16	11-5-NPO-50V
C786	2111031A24	24-5-NPO-50V
C787	2111031A04	1.8 ± .25pF-NPO-50V
C788	2111031A18	13-5-NPO-50V
C789	2111031A33	56-5-NPO-50V
C790	2111031A23	22-5-NPO-50V
C791	2111031A26	30-5-NPO-50V
Diode, silicon		
CR751	4883654H01	PIN
CR752,753	4800083M01	PIN
CR754,755	4800082M01	PIN
CR761,762	4800083M01	PIN
Coil		
L701 thru L703	2400083M01	INPUT FILTER
L704	2400078M13	SWITCHED, HELICAL LOW
L705	2400078M14	SWITCHED, HELICAL LOW
L706	2400078M15	SWITCHED, HELICAL LOW
L707	2400078M23	SWITCHED, HELICAL HIGH
L708	2400078M24	SWITCHED, HELICAL HIGH
L709	2400078M25	SWITCHED, HELICAL HIGH
L750 thru L753	2482723H01	CHOKE 1.2 UH
L760 thru L763	2482723H01	CHOKE 1.2 UH
L764	2482723H13	CHOKE .085 UH
Connector, plug		
P356,357	2882365D03	MALE, SINGLE CONTACT (phono)
Transistor		
Q750	4882233P05	NPN, TYPE 33P05
Q751,752	4802081B11	PNP, TYPE M1B11
Resistor (chip type) ±5%, 1/8 W		
R750	0600016M13	3.3
R752	0600015M39	390
R754,764	0600015M21	68
R755	0600015M61	3.3K
R756,757	0600015M47	820
R758	0600015M79	18K
R759	0600015M89	47K
R753	0600015M59	2.7K
R760	0600015M85	33K
R761	0600015M83	27K
R762	0600015M47	820
R780	0600015M47	820
R781,782	0600015M25	100
Integrated Circuit		
U750	5180067C03	DUAL OP AMP
U760	5100047N01	MIXER HIGH BARRIER, TPEM4701

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Voltage regulator		
VR750	4882256C33	DIODE, SILICON ZENER, 2.7V
Mechanical parts		
	0384208M01	SCREW, MACHINE, M3x0.5x8 (2 used)
	0384208M03	SCREW, MACHINE, M2.5x0.5x6 (6 used)
	1584118M01	HOUSING, PRESELECTOR BASE
	0180768D81	INJECTION CABLE ASSEMBLY INCLUDES CABLE, COAXIAL, 9" USED REFER P356
	30859004	ANTENNA CABLE ASSEMBLY INCLUDES CABLE, COAXIAL RG178B/U 6" USED. REFER P357
	0180768D82	OUTPUT CABLE ASSEMBLY INCLUDES CABLE, COAXIAL RG178B/U 3.5" USED

VLN4554A HOUSING ASSEMBLY (DUAL FRONT END)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	02844773E02	NUT, TENSION (6 used)
	0384589G05	SCREW, 8-32x0.55 (6 used)
	1584119M03	PRESELECTOR HOUSING

MBTRN5001A HARDWARE (DUAL FRONT END)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	0384208M03	SCREW, MACHINE, M2.5x0.5x6 (11 used)
	5400056M01	WARNING LABEL

Figure 8-3
Widespace Dual Front End Boards
Parts List

DETAIL P355

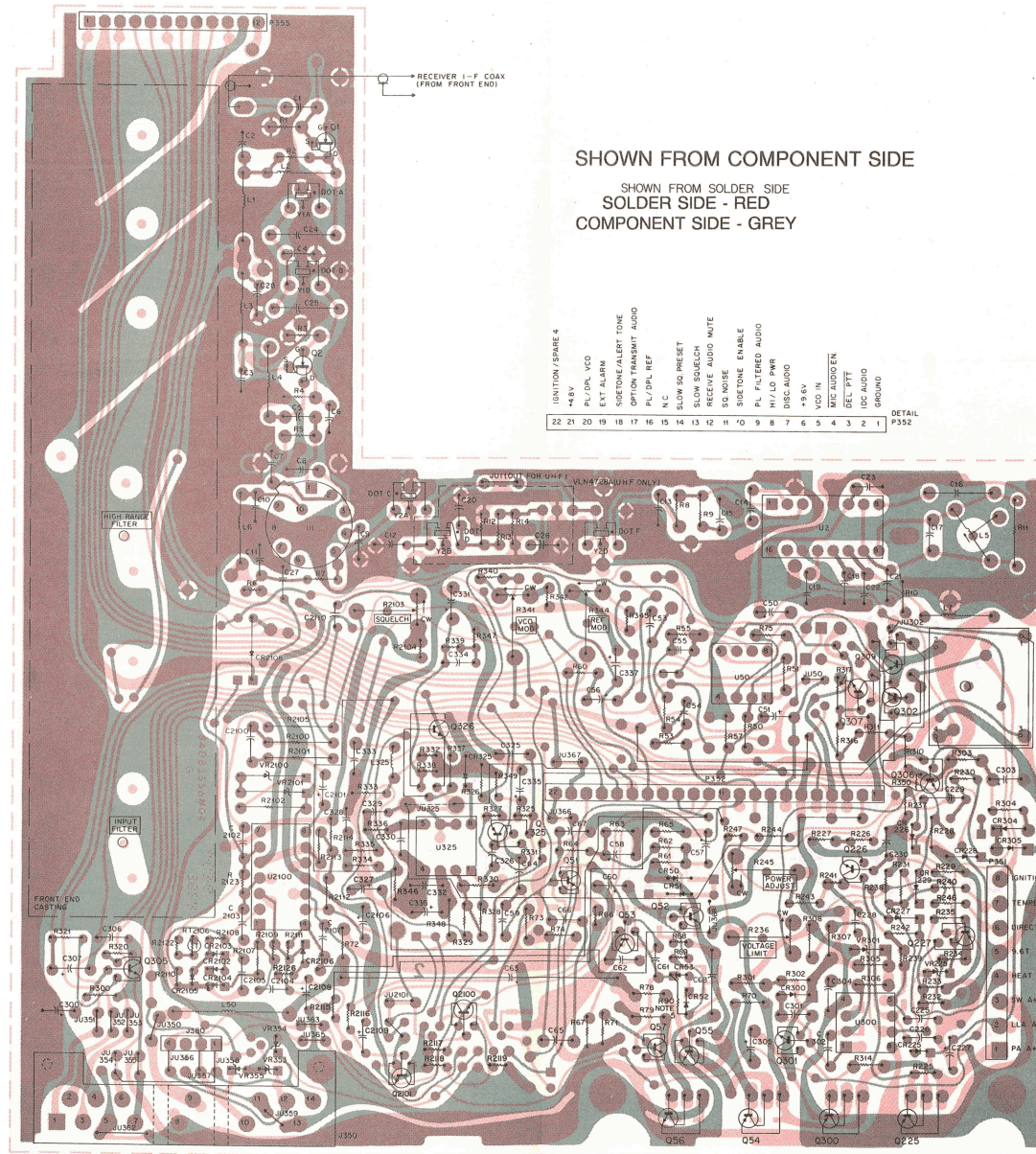
1	VOL CONT WIPER
2	+9.6V
3	PA A+
4	VCO MOD
5	9.6T
6	SIGNAL LEVEL
7	REF MOD
8	VOL CONT GROUND
9	VOL CONT HI
10	LOCK DET
11	GROUND
12	FRONT END SELECT

DETAIL J390

4	MIC AUDIO +
3	KEY
2	HANG-UP
1	MIC PTT

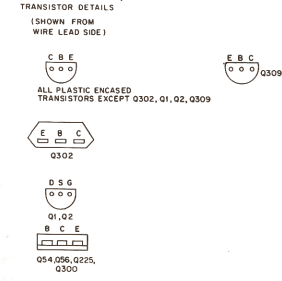
DETAIL J350

1	OPTION RECEIVE AUDIO
2	OPTION TRANSMIT AUDIO
3	EXT ALARM
4	OPTION AUDIO GROUND
5	OPTION DC GROUND
6	PTT
7	SW A+
8	SPKR LO
9	SPKR HI
10	HANG UP SWITCH
11	AUDIO GROUND
12	MIC AUDIO +
13	GROUND
14	MIC PTT



SHOWN FROM COMPONENT SIDE
 SHOWN FROM SOLDER SIDE
 SOLDER SIDE - RED
 COMPONENT SIDE - GREY

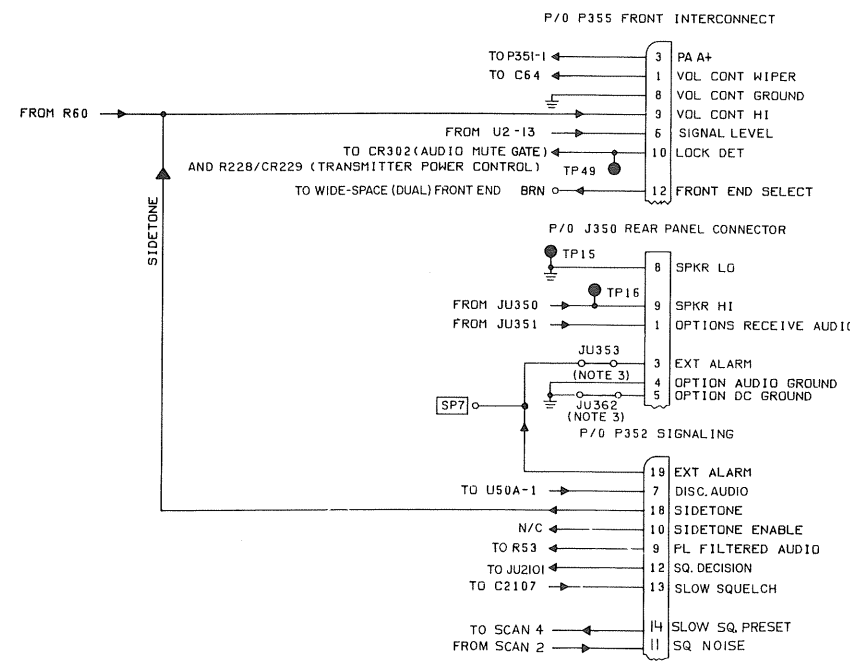
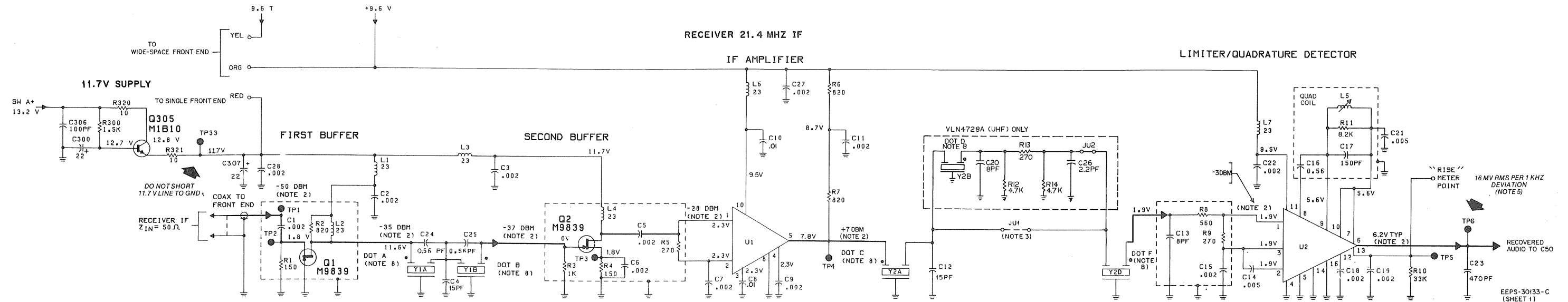
1	GROUND
2	100 AUDIO
3	DEL. PTT
4	MIC AUDIO IN
5	VCO IN
6	+9.6V
7	DISC AUDIO
8	PL FILTERED AUDIO
9	SIDETONE ENABLE
10	RECEIVE AUDIO MUTE
11	SLOW SQUELCH
12	SLOW SQ PRESET
13	N.C.
14	PL/DPL REF
15	OPTION TRANSMIT AUDIO
16	SIDETONE/ALERT TONE
17	EXT ALARM
18	PL/DPL VCO
19	+4.8V
20	IGNITION/SPARE 4



- NOTES:
- TEST POINTS AND SPARE PADS ARE IDENTIFIED ON CIRCUIT BOARD.
 - NOT USED.
 - DOTTED LINE JUMPERS (---) ARE "OUT" TO REMOVE THE JUMPERS, CUT THE FLATING. SOLID LINE JUMPERS (—) ARE "IN".
 - PIN "1" OF INTEGRATED CIRCUITS AND CONNECTORS AND "CATHODE" OF DIODES DESIGNATED BY SQUARE PADS.
 - R90 IS LOCATED ON THE SOLDER SIDE.

31H00212M-O

Figure 8-4
 Main Board - Board Details



NOTES :

- Unless otherwise noted, resistor values are in ohms, capacitor values are in microfarads, inductor values are in microhenries.
- Measured with -50 dBm 21.4 MHz unmodulated signal at i-f input or with an unmodulated on-channel signal at the antenna input at a level of -53 dBm.
- Refer to Jumper Table.
- Measured with squelch adjust control R2103 set for opening sensitivity of 10 dB quieting.
- Measured with 1 mV on-channel signal at antenna input modulated with 1 kHz tone at 3 kHz deviation.
- Mounted on heat sink, must be insulated from ground.
- Note 7. is omitted.
- Crystal filter coding-- VHF RADIO DOT C is BLUE, DOT F IS VIOLET
UHF RADIO DOT C is BLUE, DOT D is VIOLET. DOT F is BLUE.

RECEIVER JUMPER TABLE

JUMPER	FUNCTION	LOCATION
JU1	IN (FOR VHF) OUT (FOR UHF)	Y2
JU2	IN (FOR UHF) NOT APPLIC. (VHF)	Y2
JU50	IN	U50A
JU350	IN	J350-9
JU351	IN	J350-1
JU353	IN	J350-3
JU362	IN	J350-5
JU366	OUT	Q58-B
JU2101	IN	Q2102-B

TP9 MUTE VOLTAGE CHART

CONDITION	TP9 VOLTS DC
Unsquelled	0 V
Carrier Squelch Mute	9.0 V
Transmit	9.0 V
VCO Unlocked	9.0 V

INTEGRATED CIRCUIT CHART

REFERENCE NUMBER	TYPE NUMBER	V-PIN	V+ PIN	DESCRIPTION
U1	29M47	8	10	Wideband Amp
U2	M6184	4 / 14	11	Limiter/Quadrature Detector
U50	09M33	4	8	Dual Op Amp
U2100	29M06	7	11	Quad Op Amp

Figure 8-5
Main Board / Receiver
Schematic Diagram
(Sheet 1)

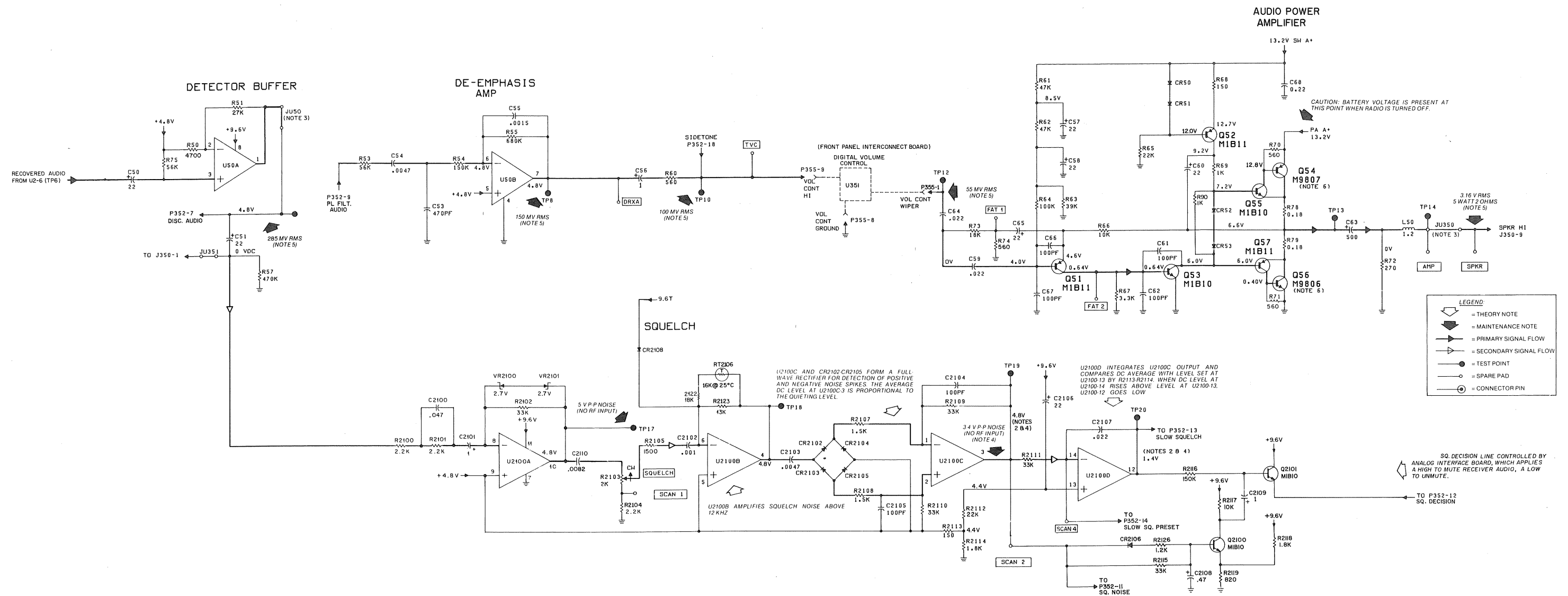
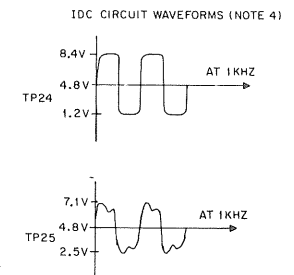
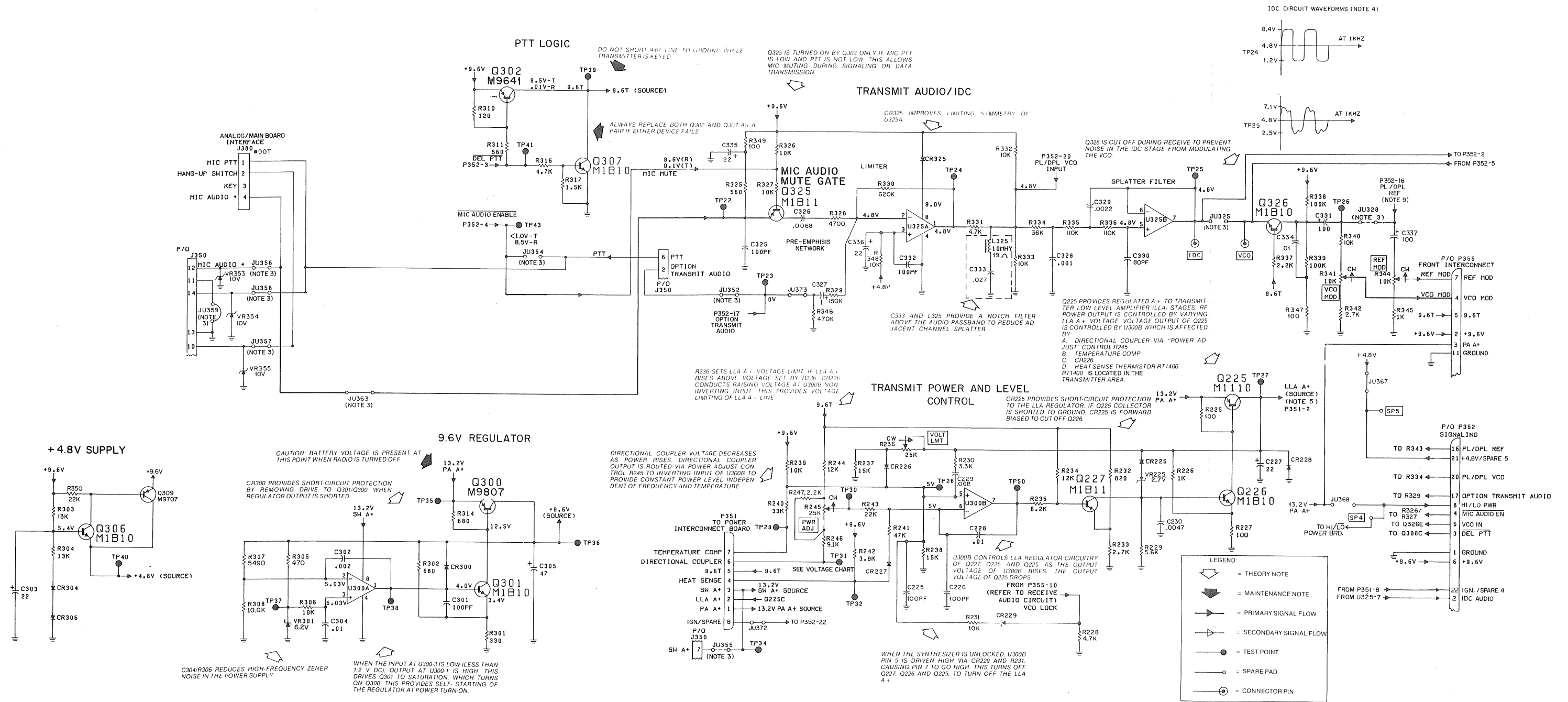


Figure 8-5
Main Board / Receiver
Schematic Diagram
(Sheet 2)

6300674M-O



SEE FIGURE 8-7 (SHEET 2)
FOR NOTES AND TRANSMITTER
JUMPER TABLE

Figure 8-7
Main Board / Transmitter
Schematic Diagram
(Sheet 1)

6300675M-O

SECTION 8. RECEIVER AND TRANSMITTER

NOTES :

1. Unless otherwise noted, resistor values are in ohms, capacitor values in microfarads, inductor values are in microhenries.
2. Note 2. is omitted.
3. Refer to Jumper Table.
4. Measured with 800 millivolts rms, 1 kHz input to "MIC AUDIO +" input (J350-12) with "MIC PTT" (J350-14) grounded.
5. LLA refers to low level rf amplifier stage.
6. Voltage notations :
 (T) = Transmitter Keyed
 (R) = Receive (Transmitter unkeyed)

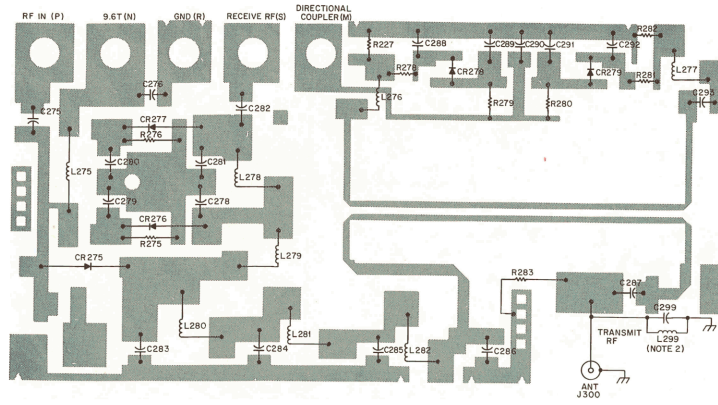
TRANSMITTER JUMPER TABLE

JUMPER	FUNCTION	LOCATION
JU302	OUT	Q309
JU325	OUT	U325B-7
JU328	OUT (FOR VHF) IN (FOR UHF)	R340
JU352	IN	J350-2
JU354	OUT	J350-6
JU355	IN	J350-7
JU356	IN	J350-12
JU357	IN	J350-10
JU358	IN	J350-14
JU359	IN	J350-11
JU363	IN	Q325-E
JU365	IN	J380-1
JU367	IN	P352-21
JU368	OUT	P352-8

TP31 VOLTAGE CHART

OUTPUT POWER	TP31 VOLTAGE
0 Watts	2.0 V
30 Watts	1.3 V

Figure 8-7
 Main Board / Transmitter
 Schematic Diagram
 (Sheet 2)

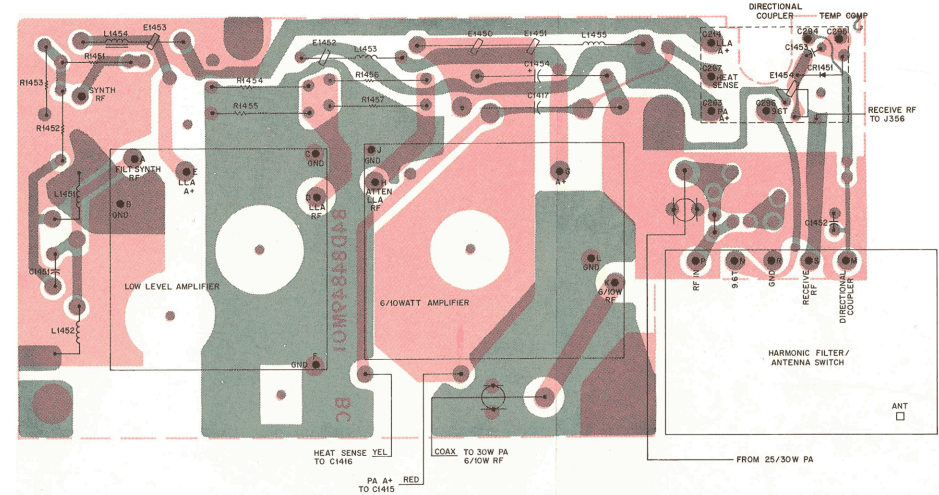


SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 8-8
Harmonic Filter Hybrid Assembly
- Board Details

31H00213M-O

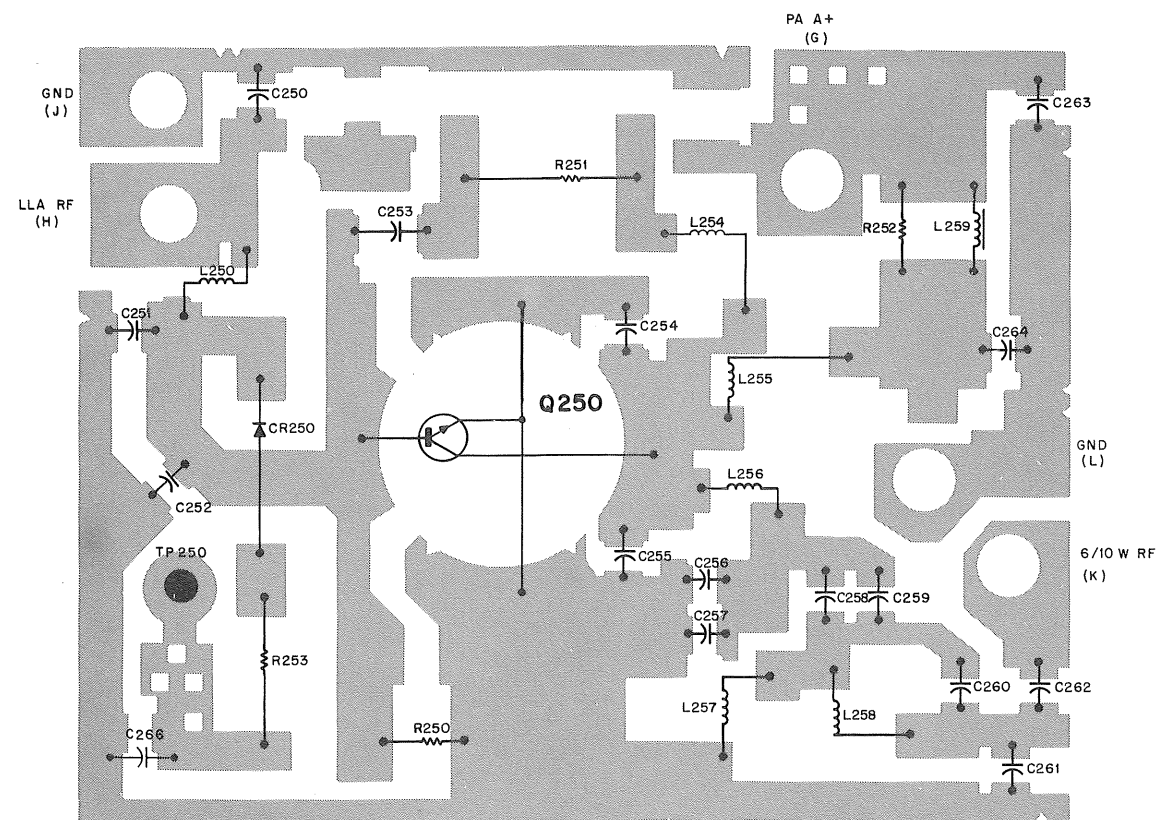


SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 8-9
30 Watt P A Interconnect Board
- Board Details

31H00214M-O



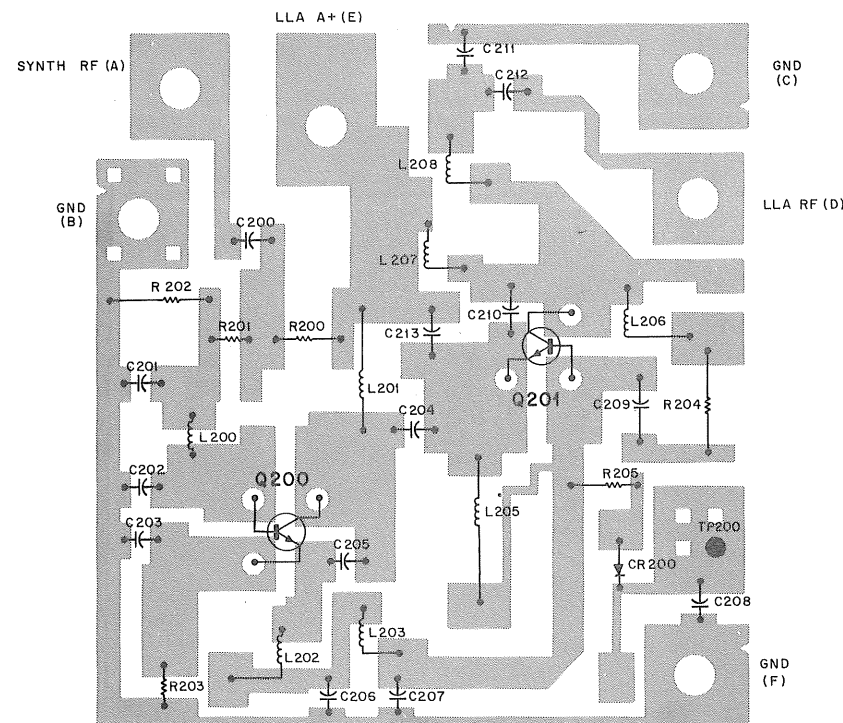
NOTE
ALL RESISTORS SHOWN ON THIS BOARD
ARE SCREENED ON SUBSTRATE; THEY ARE
NOT SERVICEABLE.

SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 8-10
10 Watt Power Amplifier Hybrid
- Board Details

31H00215M-O



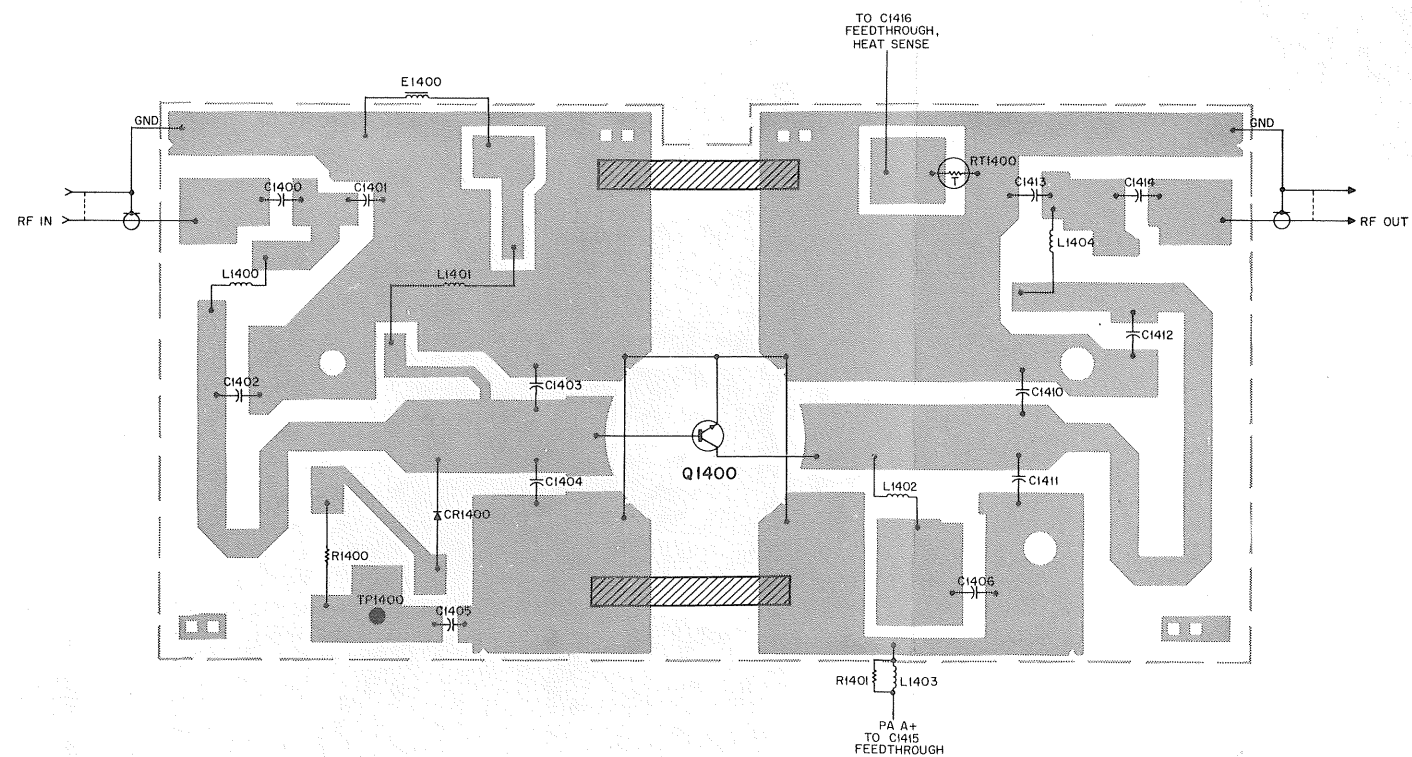
SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

NOTE:
ALL RESISTORS SHOWN ON THIS
BOARD ARE SCREENED ON THE
SUBSTRATE, HENCE THEY ARE NOT
SERVICEABLE.

Figure 8-11
Low Level Amplifier Hybrid
- Board Details

31H00216M-O



SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 8-12
30 Watt Power Amplifier Hybrid
- Board Details

31H00217M-O

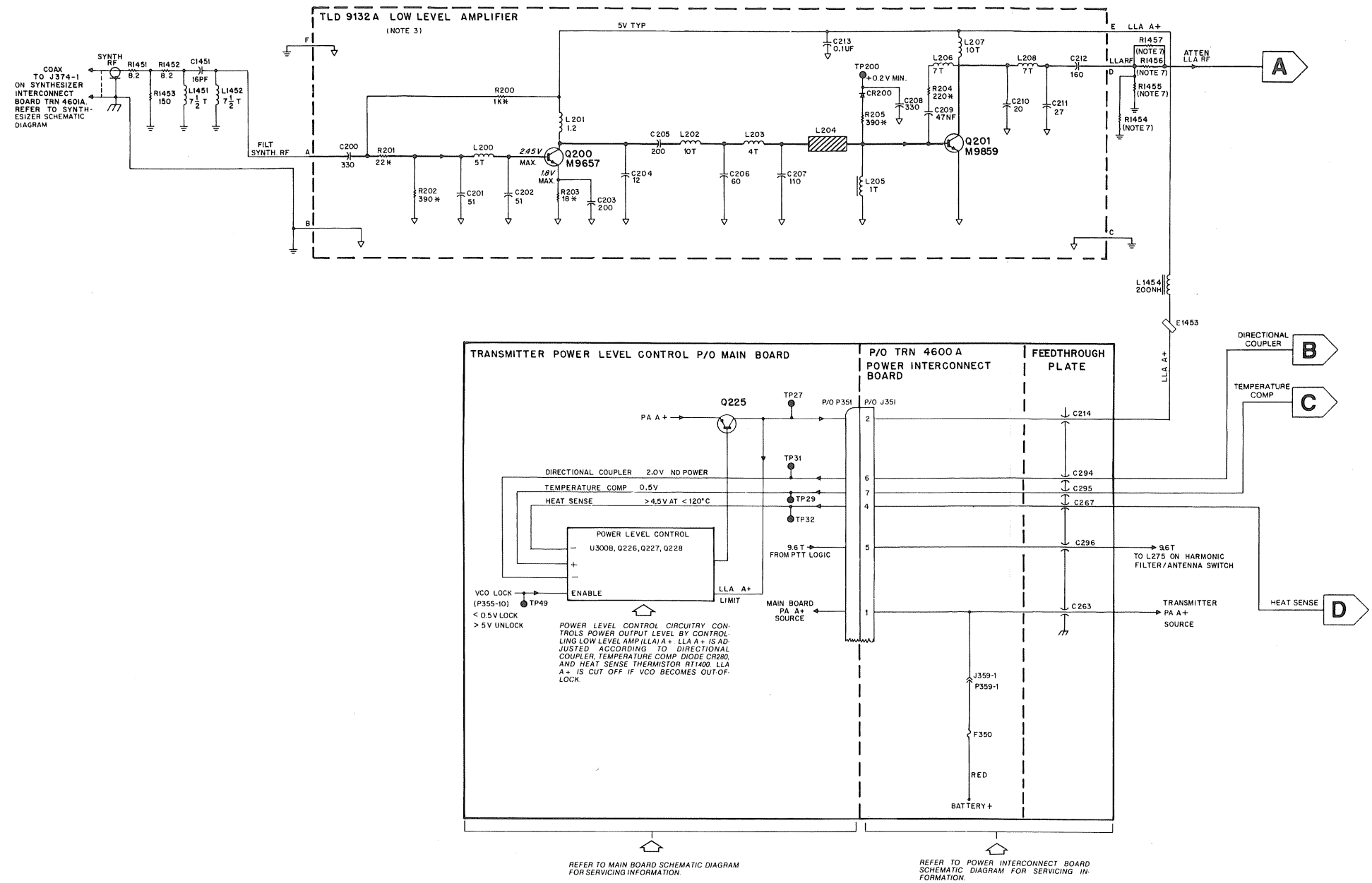
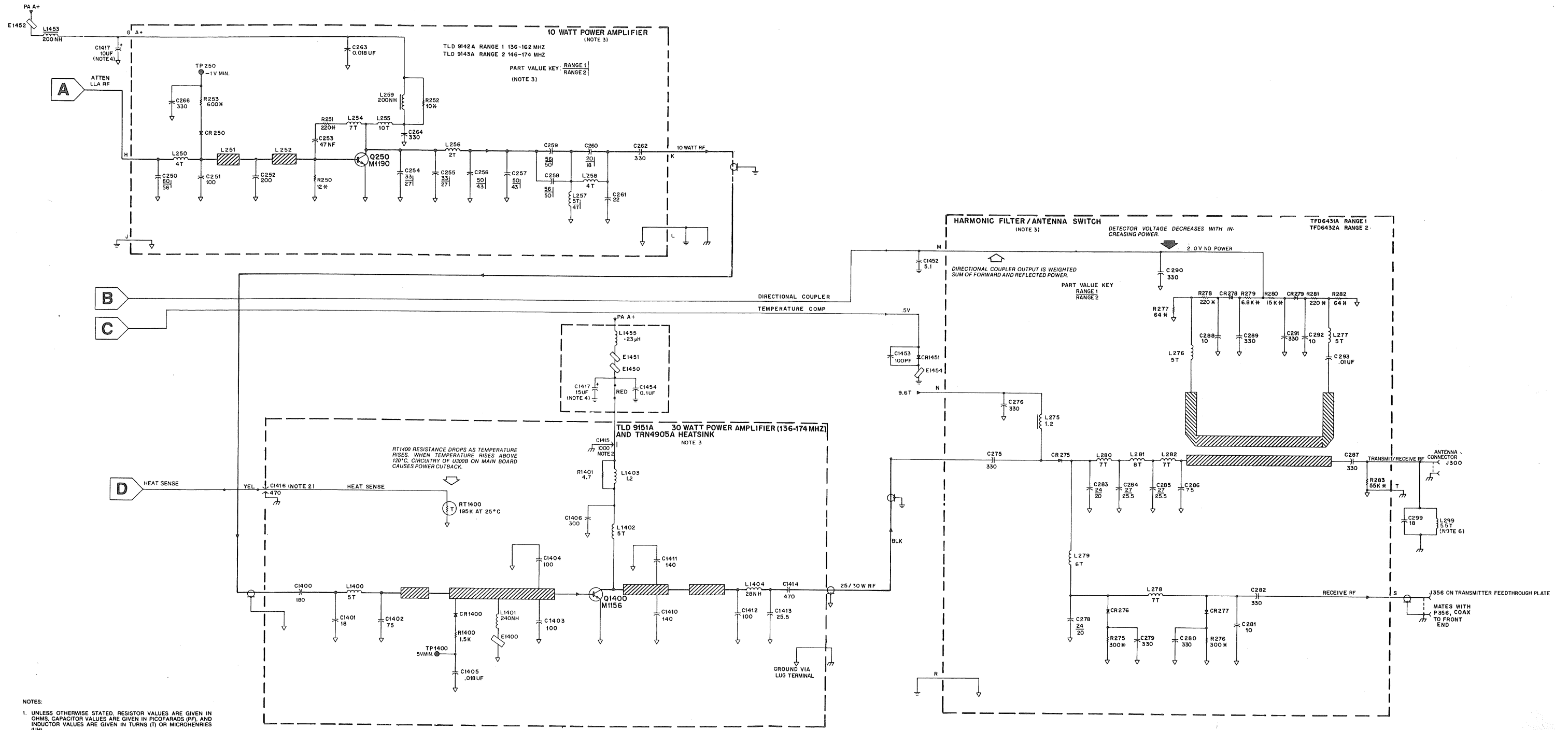
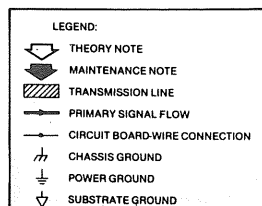


Figure 8-13
Power Amplifier
Schematic Diagram
(sheet 1)



- NOTES:
- UNLESS OTHERWISE STATED, RESISTOR VALUES ARE GIVEN IN OHMS, CAPACITOR VALUES ARE GIVEN IN PICOFARADS (PF), AND INDUCTOR VALUES ARE GIVEN IN TURNS (T) OR MICROHENRIES (UH).
 - FEEDTHROUGH CAPACITORS C1415 AND C1416 ARE MOUNTED ON POWER AMPLIFIER HEATSINK.
 - ALL RESISTORS DENOTED WITH (*) ARE SCREENED ON SUBSTRATE AND ARE THEREFORE NON-SERVICEABLE.
 - C1417 IS CONNECTED TO L280 IN #10 WATT MODELS ONLY, TO L1405 IN 25/30 WATT MODELS ONLY.
 - NOT USED.
 - L299 AND C299 ARE MOUNTED FROM CENTER PIN OF ANTENNA JACK J300 TO A CHASSIS LUG. REFER TO RADIO SET HARDWARE KIT PARTS LIST IN MECHANICAL PARTS SECTION OF THIS MANUAL.
 - REFER TO PARTS LIST FOR COMPONENT VALUE.



EEPS-30176-B

6300677M-O

Figure 8-13
Power Amplifier
Schematic Diagram
(sheet 2)

SECTION 8. RECEIVER AND TRANSMITTER

parts list

MBTLD9151A P.A. HYBRID 30 W. VHF

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, pf		
C1400	2111059D51	CHIP 180-5-NPO-50V
C1401	2111059D86	CHIP 18-2-NPO 50V
C1402	2111059D73	CHIP 75-5-NPO-50V
C1403	2111059C21	CHIP 100-5-50V
C1404	2111059C21	CHIP 100-5-50V
C1405	2184547A23	CER CHIP 18,000-20-X7R-50V
C1406	2111059D74	CHIP 300-5-NPO-50V
C1410	2111059C41	140-5-50V
C1411	2111059C41	140-5-50V
C1412	2111059C21	CHIP 100-5-50V
C1413	2111059C10	CHIP 25.5-5-50V
C1414	2111059D52	CHIP 470-5-NPO-50V
Diode		
CR1400	4883654H01	SLCN
Ferrite Bead		
E1400	0180739D84	FLT FT
Coil, Air		
L1400	2484331M02	22 AWG 5 TNS
L1401	2484331M42	22 AWG 11 TNS
L1402	2484331M03	22 AWG 5 TNS
L1404	2484331M43	20 AWG 4 TNS
Transistor		
Q1400	4884411L56	NPN 11L56
Resistor		
R1400	0660075A53	1500-5-1/8
Thermistor		
RT1400	0600867628	TMTR

MBTRN4905A 30W HEAT SINK HARDWARE KIT

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor (both capacitors below are located on feedthru plate 0180731D25)		
C1415	2182812H03	CER FEEDTHRU 1000 pf- + 100-0
C1416	2184874K01	CER FEEDTHRU
Coil (both coil and resistor below are contained in assembly 0180760D55)		
L1403	2482190C15	RF 1.2UH (wound on R1401)
Resistor		
R1401	0600125B61	FC 4.7-5-1/2
Miscellaneous parts		
	0180731D44	30W PA LUG & COAXIAL CABLE
	0180734D15	3" COAX INPUT ASSEMBLY
	1584141M01	HEAT SINK COVER

MBTFD 6432A HARMONIC FILTER HYBRID 30 W R2 VHF

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, Chip type, pf		
C275	2111059D98	330-10-NPO-50V
C276	2111059D98	330-10-NPO-50V
C278	2111059D89	20-2-NPO-50V
C279	2111059D98	330-10-NPO-50V
C280	2111059D98	330-10-NPO-50V
C281	2111059D76	10-5-NPO-50V
C282	2111059D98	330-10-NPO-50V
C283	2111059C35	20-5-50V
C284	2111059C10	25.5-5-50V
C285	2111059C10	25.5-5-50V
C286	2111059C29	7.5-.25pF-50V
C287	2111059D98	330-10-NPO-50V
C288	2111059D76	10-5-NPO-50V
C289	2111059D98	330-10-NPO-50V
C290	2111059D98	330-10-NPO-50V
C291	2111059D98	330-10-NPO-50V
C292	2111059D76	10-5-NPO-50V
C293	2111059B11	10,000-20-X7R-50V
Diode		
CR275	4883510F04	10F04 1 OHM AT 50 MA
CR276	4883510F04	10F04 1 OHM AT 50 MA
CR277	4883510F04	10F04 1 OHM AT 50 MA
CR278	48R02006A01	HOT CAR 39C35 4V
CR279	48R02006A01	HOT CAR 39C35 4V
Coil		
L275	2482723H49	RF 1.2 UH
L276	2484331M05	AIR 24AWG 5 TNS
L277	2484331M05	AIR 24AWG 5 TNS
L281	2484331M27	AIR 24AWG 8 TNS
L279	2484331M30	AIR 24AWG 6 TNS
L278	2484331M32	AIR 24AWG 7 TNS
L280	2484331M35	AIR 24AWG 7 TNS
L282	2484331M37	AIR 24AWG 7 TNS

MBTLD9143A 10 WATT PA HYBRID R2 VHF

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, chip, pf, 5%, NPO, 50V (unless stated otherwise)		
C250	2111059D85	56
C251	2111059D59	100
C252	2111059D68	200
C253	2184547A22	47000 - 10 -X7R -25V
C254	2111059D57	27
C255	2111059D57	27
C256	2111059D88	43
C257	2111059D88	43
C258	2111059D91	50
C259	2111059D91	50
C260	2111059D86	18 - 2%
C261	2111059D61	22
C262	2111059D98	330 - 10%
C263	2184547A23	18000 -20 -X7R -50V
C264	2111059D98	330 - 10%
C266	2111059D98	330 - 10%
Coil		
L250	2484331M16	air 22AWG 4 turns
L254	2484331M17	air 24 AWG 7 turns
L255	2484331M18	air 24 AWG 10 turns
L256	2484331M22	air 24 AWG 2 turns
L257	2484331M13	air 22AWG 4 turns
L258	2484331M10	air 22AWG 4 turns
L259	2482723H46	RF .2 UH
Diode		
CR250	4883654H01	silicon
Transistor		
Q250	4884411L90	NPN 11L90

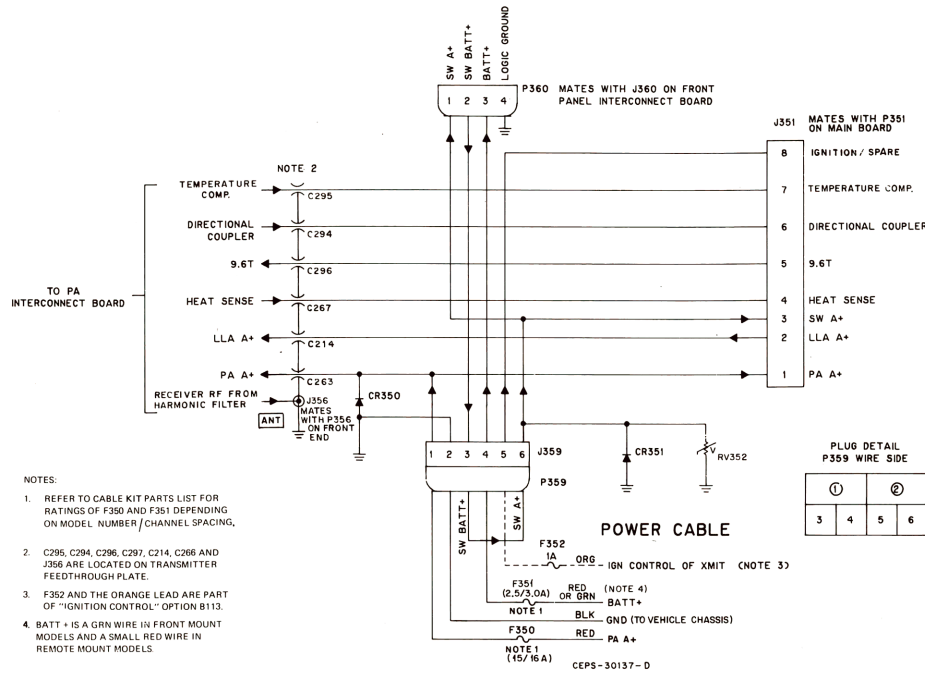
MBTLD9132A LL AMPLIFIER HYBRID VHF

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, chip, pf, 5%, NPO, 50V (unless stated otherwise)		
C200	2111059D98	330, 10%
C201	2111059D58	51
C202	2111059D58	51
C203	2111059D68	200
C204	2111059D77	12
C205	2111059D68	200
C206	2111059D80	60 , 2%
C207	2111059D81	110
C208	2111059D98	350, 10%
C209	2184547A22	47000 -10 -X7R -25V
C210	2111059D89	20, 2%
C211	2184873H23	27, MONO
C212	2111059D84	160
C213	2111059B24	.1uf -20% -X7R -25V
Coil		
L200	2484331M11	air 28 AWG 5 turns
L201	2482723H49	1.2 UH RF
L202	2484331M12	air 28 AWG 10 turns
L203	2484331M13	air 22 AWG 4 turns
L205	0180702T04	formed wire and bead
L206	2484331M14	air 24 AWG 7 turns
L207	2484331M12	air 28 AWG 10 turns
L208	2484331M15	air 28 AWG 7 turns
Transistor		
Q200	4800869657	M9657
Q201	4800869859	NPN 69859
Diode		
CR200	4883654H01	silicon

MBTRN4696A P.A. INTERCONNECT BOARD , HI POWER

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, pf (unless otherwise stated)		
C1417	2383908L02	CAP ALU 15 -10 + 75 25V
C1451	2111022G35	CAP CER DISC 16-5-NPO-50V
C1452	2184511B06	CAP CER PLT 5.1-5-NPO
C1453	2184511B01	CAP CER PLT 100-10-N750
C1454	0882317B01	CAP POLYEST .1uf-10-100V
Diode		
CR1451	4883654H01	SLCN
Coil		
E1454	7683960B01	CORE FERRITE
L1451	2483884G04	COIL
L1452	2483884G04	COIL
L1453	2482723H11	COIL RF .2UH
L1454	2482723H11	COIL RF .2UH
L1455	2484346A02	CHK RF .23UH
Resistor		
R1451	06124B67HB	8.2-5-1/4
R1452	06124B67HB	8.2-5-1/4
R1453	0611009C29HB	FCF 150-5-1/4
R1454	0600125A48	FC 910-5-1/2
R1455	0600125A48	FC 910-5-1/2
R1456	0600125A01	FC 10-5-1/2
R1457	0600125A01	FC 10-5-1/2

Figure 8-14
Power Amplifiers Parts Lists



NOTES:

- REFER TO CABLE KIT PARTS LIST FOR RATINGS OF F350 AND F351 DEPENDING ON MODEL NUMBER / CHANNEL SPACING.
- C295, C294, C296, C297, C214, C266 AND J356 ARE LOCATED ON TRANSMITTER FEEDTHROUGH PLATE.
- F352 AND THE ORANGE LEAD ARE PART OF "IGNITION CONTROL" OPTION 8113.
- BATT+ IS A GRN WIRE IN FRONT MOUNT MODELS AND A SMALL RED WIRE IN REMOTE MOUNT MODELS.

parts list

MBTKN8158C POWER CABLE (DASH MOUNT RADIO)

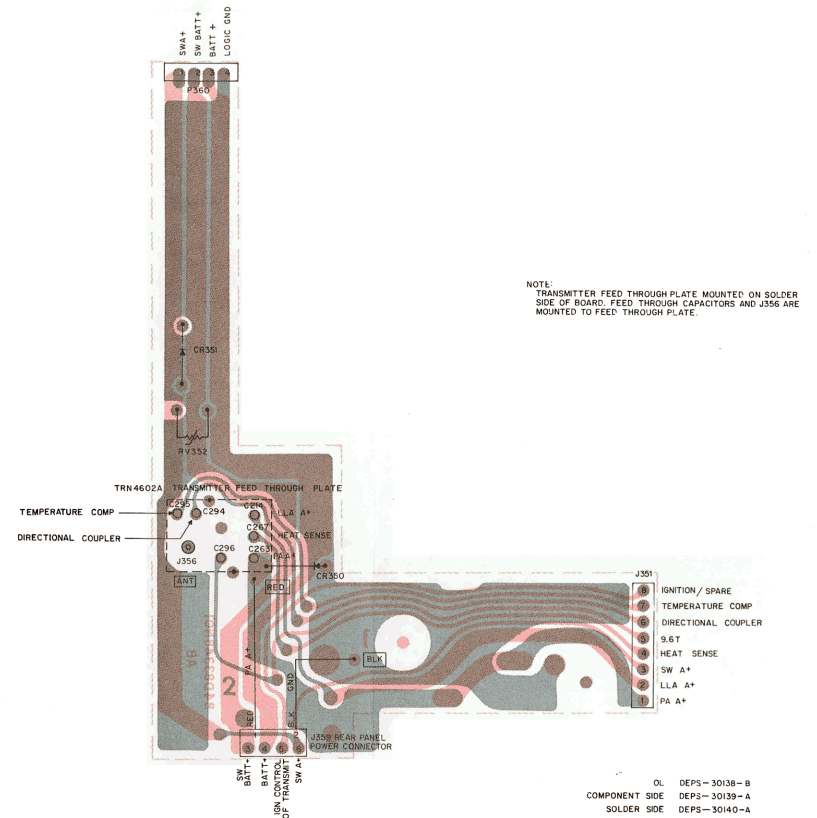
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F350	65-4165	fuse: 15A
F351	65-20404	3A; 250 V
mechanical parts		
P359	15-84192M01	HOUSING, connector; 6-contact
	14-82883A01	INSULATOR, fuseholder; 2 used
	42-82884A01	CLIP, fuseholder; 2 used
	1-80733D11	ASSEMBLY, black wire and terminal; Includes: TERMINAL, female (small); 2 used
	9-84151B03	TERMINAL, female (small); 2 used
	1-80733D12	ASSEMBLY, red wire and terminal (short) Includes: CLIP, fuse holder
	42-82884A01	CLIP, fuse holder
	29-82607B03	LUG, ring
	14-82882A01	BODY, fuse holder
	41-82885A01	SPRING, fuse holder
	1-80733D13	ASSEMBLY, red wire and terminal (long) Includes: TERMINAL, female (large)
	29-84151L05	TERMINAL, female (large)
	1-80733D14	ASSEMBLY, green wire and terminal (short) Includes: CLIP, fuse holder
	42-82884A01	CLIP, fuse holder
	29-865065	LUG, ring
	14-82882A01	BODY, fuse holder
	41-82885A01	SPRING, fuse holder
	1-80733D15	ASSEMBLY, green wire and terminal (long) Includes: TERMINAL, female (small)
	9-84151B03	TERMINAL, female (small)
	1-80733D17	ASSEMBLY, black wire and terminal (long) Includes: TERMINAL, female (large)
	29-84151L05	TERMINAL, female (large)

MBTRN5365A POWER INTERCONNECT BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR350	4882525G13	25G13 100V
CR351	4882525G19	25G19 100V
Varistor		
RV352	0600017M01	

6300678M-O

Figure 8-15
Power Interconnect Board
Schematic Diagram / Parts List



NOTE: TRANSMITTER FEED THROUGH PLATE MOUNTED ON SOLDER SIDE OF BOARD. FEED THROUGH CAPACITORS AND J356 ARE MOUNTED TO FEED THROUGH PLATE.

SHOWN FROM COMPONENT SIDE
SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

31H00218M-O

Figure 8-16
Power Interconnect Board
- Board Details



SECTION 9. ACCESSORY INFORMATION

9.1 GENERAL

This section provides information on the common accessories used with the MCX1000 Radio Set. These are:

- Mobile Microphone
- Base Microphone
- Touch-Code Encoder Microphone
- Mobile Speaker
- Base Station Mounting Tray and Speaker
- Base Station Power Supply

9.2 MOBILE MICROPHONE

The Mobile Microphone, model VMN1016A, includes:

- VLN4765A Microphone Board
- VLN4712A Microphone Hardware

An exploded view, schematic diagram, board details and parts list for the VMN1016A Mobile Microphone may be found in Figures 9-1 to 9-4.

The VMN1016A Mobile Microphone comes as standard equipment with each MCX1000 Mobile Radio Set.

9.3 BASE MICROPHONE

An exploded view, schematic diagram, board details and parts list for the VMN1018A Base microphone may be found in Figures 9-5 to 9-8.

9.3.1 DESCRIPTION

The VMN1018A Base Microphone permits convenient operation of the MCX1000 Radio Set

when it is used as a base station. The monitor switch on the microphone performs the same function as the monitor button which is removed from the radio front panel when the radio is used with this microphone. In addition, the monitor switch performs the on/off hook function in carrier squelch scan systems. The push-to-talk switch on the microphone performs the same function as the push-to-talk button on the mobile microphone.

The base microphone contains a microphone and preamplifier circuit board, and a dual-action "transmit" switch.

All electrical components are mounted vertically in the housing with the microphone cartridge at the top and the switches at the bottom.

9.3.2 OPERATION

When operating the Base Microphone, it is important to monitor the mode (channel) to be used before transmitting. Monitoring is performed by pressing the monitor switch to stop the scanner and/or disable PL/DPL squelch, and listening for mode (channel) activity before pressing the PTT switch.

NOTE

If the PTT switch is pressed before the monitor switch, the radio automatically reverts to the off-hook mode and remains there until the monitor switch is pressed.

9.3.3 THEORY OF OPERATION

PL/DPL Squelch Scan

Pressing the monitor switch triggers U5021, a flip-flop in the microphone, to toggle the hang-up switch line. This function is equivalent to taking a mobile microphone off hook or replacing it on hook. When the scan switch is on, the monitor switch on the microphone performs the scan off-hook function (the scanner stops and reverts to the off-hook mode). The conversation then takes place in the carrier squelch mode. If the scan switch on the radio is switched off, the monitor switch performs the coded squelch/carrier squelch function.

Carrier Squelch Scan

Pressing the monitor switch on the microphone triggers U5021, a flip-flop in the microphone, to toggle the hang-up switch line. This function is equivalent to taking a mobile microphone off hook or replacing it on hook.

9.3.4 MAINTENANCE

Disassembly / Assembly

1. At the rear of the microphone, remove the four screws that secure the front cover to the housing; then remove the front cover.
2. On the bottom of the microphone, remove the four screws that secure the baseplate to the housing; then remove the baseplate.
3. Located on the underside of the dual action transmit switch is the pivot shaft. Remove the shaft retainer clip from the pivot shaft.
4. Remove the microphone cord from the U shaped slot at the rear of the base of the microphone.
5. Slide both halves of the pivot shaft toward the centre, releasing the shaft from the retaining holes in the housing.
6. Swing the lower edge of the printed circuit board (including switches) forward to disengage the upper portion of the circuit

board from the housing. Remove the circuit board.

7. To assemble, reverse the order of the above steps.

9.3.5 TESTING

Test equipment required:

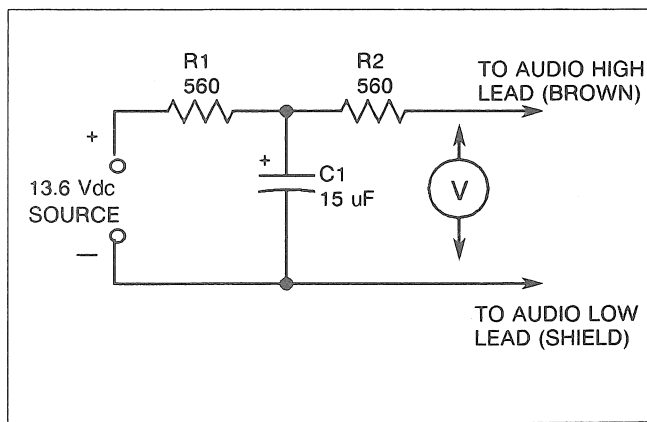
- S-1063 Motorola Solid State DC Multimeter or equivalent.
- S-1053 Motorola Solid State AC Voltmeter or equivalent.
- R-1004 Motorola General Purpose Dual Trace 15 MHz Oscilloscope.

Test Procedure:

NOTE

Potentiometer R5021 is factory set and field adjustment is not required.

The audio portion of the microphone can be tested either while connected to its associated equipment or to the test setup as shown in the diagram below.



Test Setup

Basic testing consists of checking resistances and dc voltages against the schematic diagram. Dynamic testing can be accomplished by speaking into the microphone and using an oscilloscope or ac voltmeter to monitor the amplification (gain) of the various stages.

parts list

VLN4712A MICROPHONE HARDWARE KIT

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	1580137D05	HOUSING, MICROPHONE FRONT
2	3880144D03	BUTTON, MICROPHONE
3	8400337M01	MICROPHONE BOARD
4	3000054M01	CABLE, MICROPHONE
5	NOT USED	
6	0384208M01	SCR M3 x 0.5 x 8 STL
7	NOT USED	
8	NOT USED	
9	NOT USED	
11	NOT USED	
12	0102700A27	HOUSING, MICROPHONE REAR ASSEMBLY NOT FIELD REPAIRABLE. INCLUDES PARTS WITH REFERENCE SYMBOL #'S 10, 13, 14
10		
13		
14		
15	NOT USED	
16	NOT USED	
17	0300140001	SCREW, TPG, 6-19X7/8 PHLPAN STL (3 USED)
18	NOT USED	
19	0580148D01	MIC CTRG GROMMET
20	3580089D01	MIC BAFFLE
		Non-referenced item
	3910184A10	PLUG, CONTACT (4 used for connections to PC board)

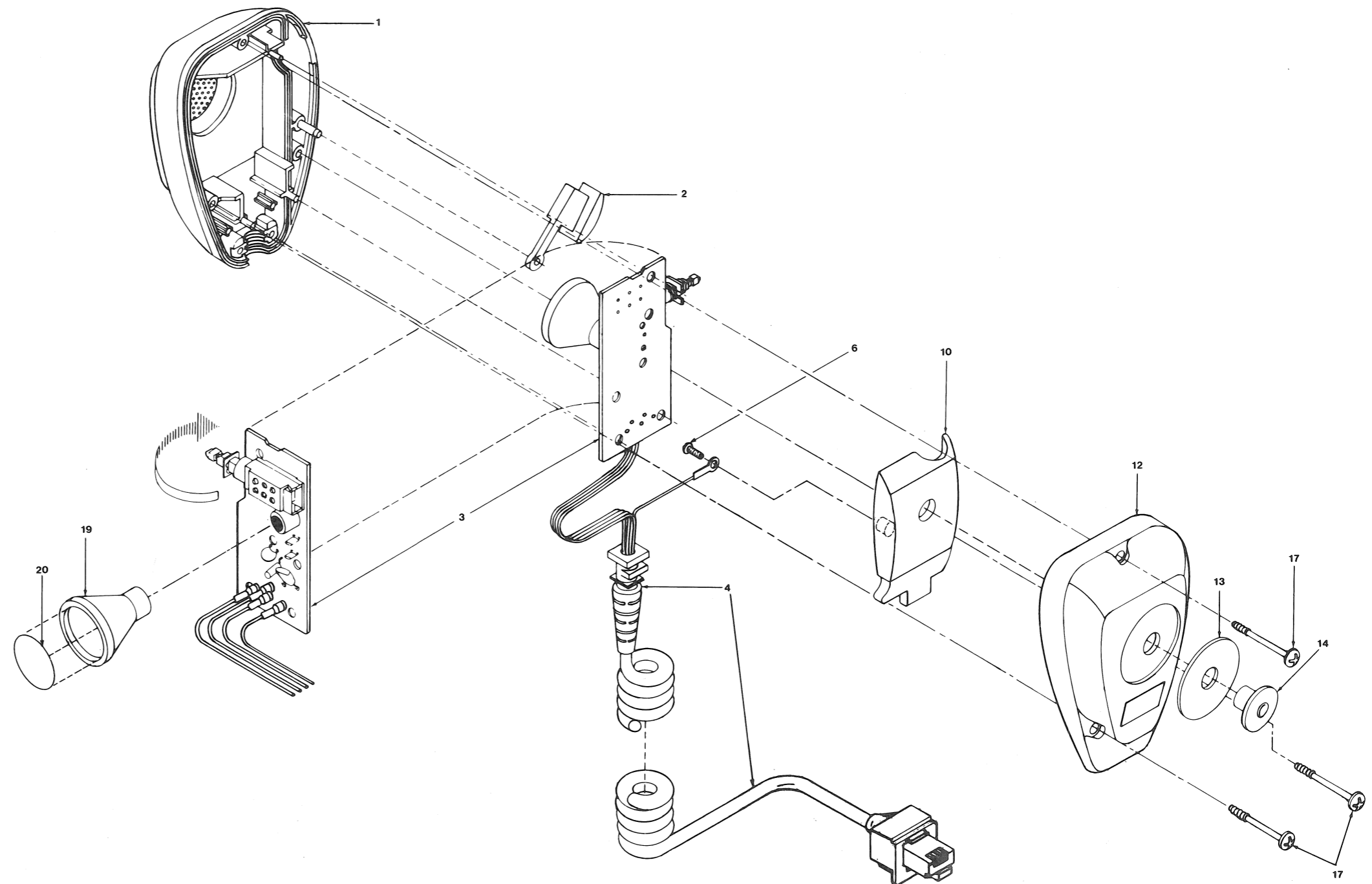


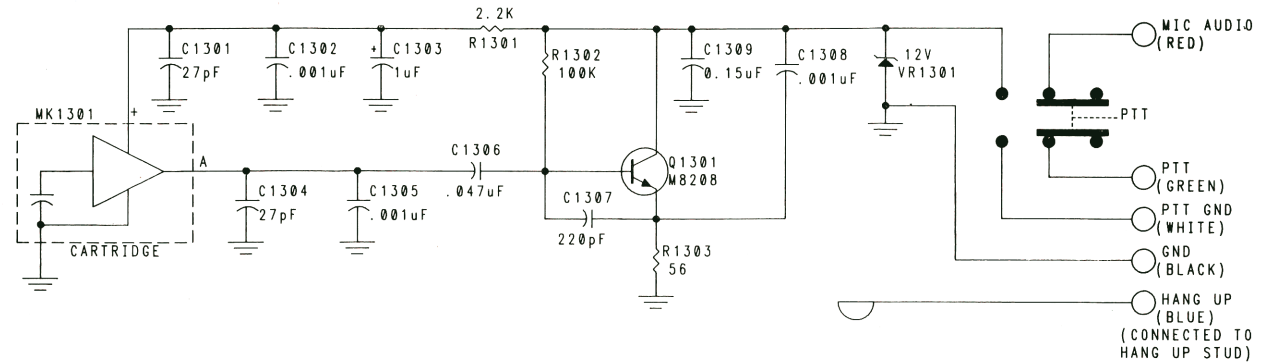
Figure 9-1
Mobile Microphone Exploded View

parts list

VLN4765A MICROPHONE BOARD

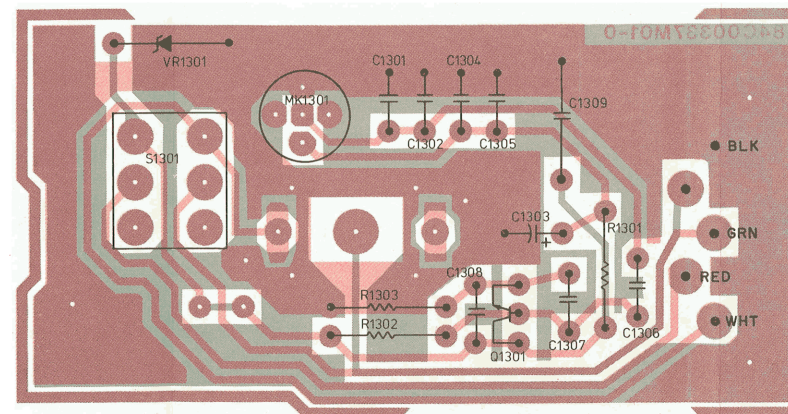
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, $\mu\text{F} \pm 5\%$, 50 V (unless otherwise stated)		
C1301	2111038H05	27 pF
C1302	2111039B13	1000 pF $\pm 10\%$
C1303	2311019A09	1 $\pm 20\%$
C1304	2111038H05	27 pF
C1305	2111039B13	1000 pF $\pm 10\%$
C1306	0811017A14	.047
C1307	2111038P50	220 pF
C1308	2111039B13	1000 pF $\pm 10\%$
C1309	0884637L21	.15 $\pm 10\%$ 100 V
Diode		
CR1301	4880007E02	ZENER 12 V $\pm 5\%$
Cartridge		
MK1301	5080088E01	MICROPHONE, ELECTRET
Transistor		
Q1301	480069642	M9642
Resistor, fixed $\pm 5\%$ 1/4 W		
R1301	0811009C57HB	2200
R1302	0811009C97HB	100K
R1303	0811009C19HB	56
Switch		
S1301	4080065E02 3910184A10	MOMENTARY, PUSHBUTTON TYPE CONT PLUG (4)
Non-referenced Items		
0580148D01	GROMMET, MICROPHONE CARTRIDGE	
1484360C01	INSULATOR, SWITCH	

Figure 9-3
Mobile Microphone Parts List



6300673M-O

Figure 9-2
Mobile Microphone Schematic Diagram



SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

3100207M-O

Figure 9-4
Mobile Microphone Board - Board Details

parts list

VLN4714A BASE STATION MICROPHONE HARDWARE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
------------------	-------------------	-------------

1	0210101A69	NUT SPR STL CAD
2	0300138809	SCR MCH 4-40X5/16 PHLBIN STL
3	0300140047	SCR TPG 4-20X5/8 PHLPAN STL
4	0410058B10	WSHR TEF
5	1500325M02	HSNG
6	1582976M05	COV FRONT
7	1582978M05	COV REAR
8	3884184E09	BTN RELEASE (left)
9	3884192E07	BTN RELEASE (right)
10	4284725E01	CLIP RETAINER
11	4784193E01	SHAFT
12	4784194E01	SHAFT EXTENSION
13	6482977M01	PLT BASE
	7584722E01	PAD BASE PLT

Non-referenced items

0300135676	SCR TPG 4-40X1/4 PHLHEX SST
3000055M01	CORD MIC W/CONN
3782633B13	GROM RBR
4084711E03	SW LEAF
4282143C05	CLP CBL

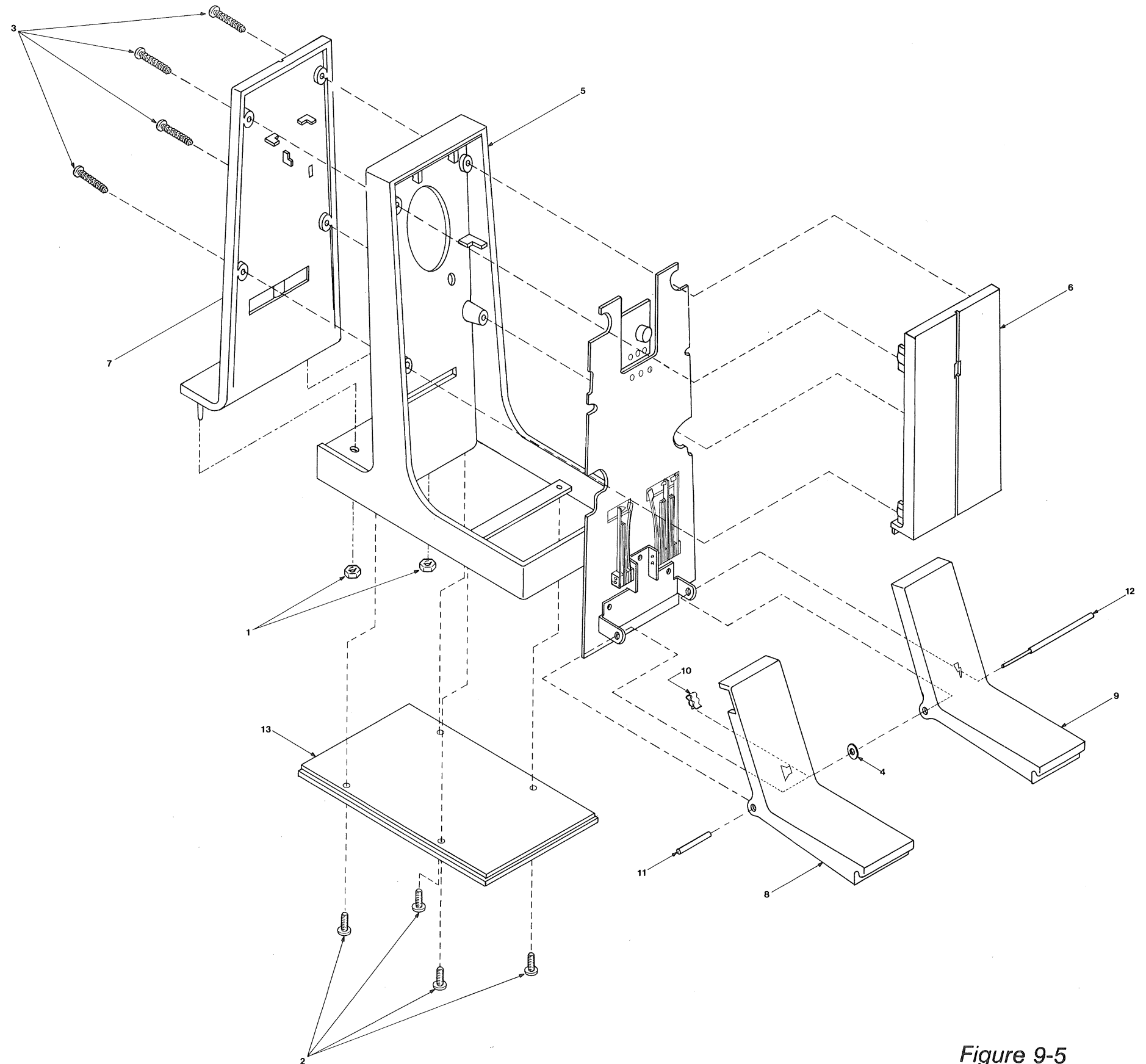


Figure 9-5
Base Microphone Exploded View

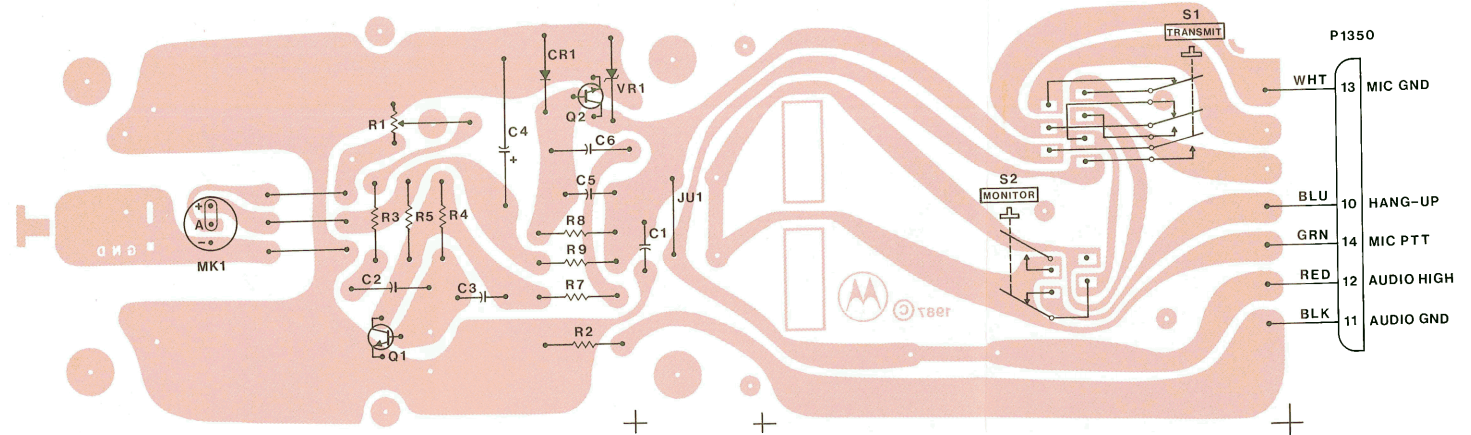


Figure 9-7
Base Microphone Board - Board Details

parts list

VLN4824A BASE STATION MICROPHONE BOARD

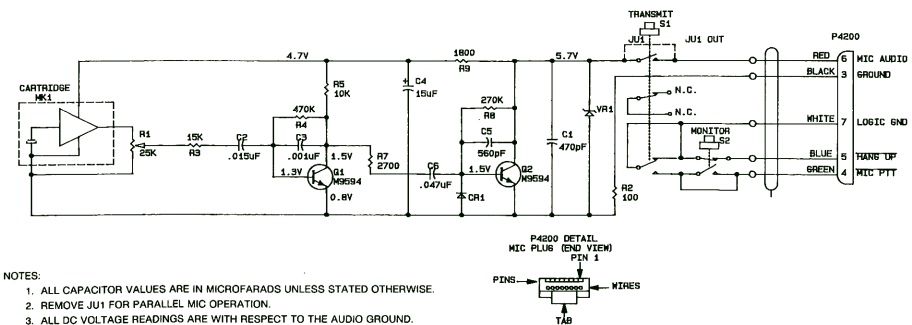
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, uf (unless stated otherwise)		
C1	2182187B45	CER DISC 470pf-10-500V
C2	0884637L08	MTLZ POLYEST .015-10-400V
C3	2182187B44	CER DISC 1000-10-100V
C4	2384665F09	ALU 15 -10 + 150 25V
C5	2182187B06	CER DISC 560-10-X5F-500V
C6	0884637L12	MTLZ POLYEST .047-10-250V
Diode		
CR1	4883854H01	SLCN
Microphone Cartridge		
MK1	5082825M02	
Transistor		
Q1	4800869594	NPN 69594
Q2	4800869594	NPN 69594
Resistor ,FCF, 5%, 1/4W (unless stated otherwise)		
R1	1884944C02	VAR 25K-20-10W
R2	0611009C25HB	100
R3	0611009C77HB	15K
R4	0611009D14HB	470K
R5	0611009C73HB	10K
R7	0611009C59HB	2700
R8	0611009D08HB	270K
R9	0611009C55HB	1800
Zener		
VR1	4882256C38	56C38 9.1V
Non-referenced Item		
	3910184A10	PLUG CONNECTOR (5 used)

Figure 9-6
Base Microphone Parts List

SHOWN FROM COMPONENT SIDE
CBE
000
(PIN SIDE)

SOLDER SIDE - RED
COMPONENT SIDE - GREY

31H00219M-0



NOTES:

1. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS STATED OTHERWISE.
2. REMOVE JU1 FOR PARALLEL MIC OPERATION.
3. ALL DC VOLTAGE READINGS ARE WITH RESPECT TO THE AUDIO GROUND.

6300687M-0

Figure 9-8
Base Microphone Board
Schematic Diagram

9.4 TOUCH-CODE ENCODER PALM MICROPHONE

The Touch-Code Encoder Palm Microphone, model VMN1017A, includes :

- VLN4383A Logic Board
- VLN4384A Beeper Board
- VLN4386A TT Keypad
- VLN4713A Hardware

The main functional blocks of the Touch-Code Encoder Microphone are highlighted in Figure 9-9

The exploded view, schematics and board details for the Logic and Beeper Boards are found in Figures 9-10 to 9-17.

9.4.1 DESCRIPTION

The model VMN1017A Touch-Code Encoder Microphone for use in the MCX1000 Radio allows the transmission of dual-tone, multi-frequency (DTMF) signals, used for remote signaling applications and mobile telephone operations. This microphone is used in place of the standard palm microphone. No modifications to the radio set are required.

Normal voice transmission is accomplished by pressing the push-to-talk (PTT) button and speaking directly towards the small opening in the keypad. Pressing any keypad button generates either continuous or timed (jumper selectable) DTMF tones. At the same time a keypad button is pressed, the automatic push-to-talk circuitry in the microphone is enabled which keys the radio set transmitter. A single frequency beep tone (sidetone) is also generated. This tone provides feedback to the operator indicating the required time a keypad button must be held down for proper system timing when the microphone is operated in the timed DTMF mode.

During DTMF tone transmission, the microphone is disabled to eliminate background noise from interfering with the signaling tones.

9.4.2 INSTALLATION

The Touch-Code Encoder Palm Microphone is a direct replacement for the MCX1000 radio set palm microphone. The microphone plugs into the

mating receptacle on the radio set or on the control head in the normal manner.

The Touch-Code encoder deviation (preset at the factory), should be checked during installation. Refer to the maintenance section following for details.

9.4.3 OPERATION

Microphone Mode

The microphone is operated in the normal manner. Lift and hold the microphone about two inches from the lips. Press the PTT button and speak clearly into the opening on the keypad. Release the PTT button to listen.

Touch-Code Mode

Timed Tones Operation (JU3 installed in Position B)

The digits of the operator's selected DTMF signal are entered through the keypad by firmly pressing a finger on one keypad button at a time. In this mode, the operator must hold the keypad button down for the first digit of the DTMF signal (and for each successive digit) until the sidetone beep stops. Holding the keypad button down for a longer time does not increase the DTMF tone duration. Releasing the keypad button before the sidetone beep stops produces a shortened DTMF signal and may prevent proper digit recognition by the system decoder.

NOTE

DO NOT press the microphone PTT button since the auto push-to-talk circuitry within the microphone is enabled whenever a keypad button is pressed. Pressing the microphone PTT button and a keypad button at the same time will prevent DTMF tone generation.

Continuous Tones Operation (JU3 installed in Position A)

Use of the keypad and auto push-to-talk functions are the same as mentioned in the previous paragraph. In this manner of operation, the DTMF signal and sidetone beep are generated continuously (as long as the keypad button is held

SECTION 9. ACCESSORY INFORMATION

down) and for as long as the auto push-to-talk timer in the microphone is active. The minimum time a keypad button must be held down depends upon the decoder or telephone interconnect used at the receiving end of the system. Once the auto push-to-talk timer times out, the radio set transmitter dekeys and continued attempts to generate the remaining DTMF signal tones are meaningless.

9.4.4 DEVIATION ADJUSTMENT

The Touch-Code feature of the microphone has been factory adjusted to provide proper deviation. Readjustment may be required if either the radio set transmitter or the microphone are serviced. The radio set must be adjusted for proper Instantaneous Deviation Control (IDC) prior to checking Touch-Code deviation.

1. Adjust a service monitor (Motorola R-1200A or equivalent) to the radio set transmitter frequency.
2. Prior to checking Touch-Code deviation, disable all other sources of modulation such as Private-Line, Digital Private-Line, or low speed data.
3. Press the # button on the keypad and observe the Touch-Code deviation on the service monitor. Correct deviation is 3 kHz.
4. A hole which allows access to tone deviation potentiometer R32 is located on the rear housing to the right of the nameplate. A long tuning tool, Motorola Part No. 66-84974L01, is required.
5. Adjust tone deviation potentiometer R32 for 3 kHz deviation of the DTMF signal (if required).
6. When setting deviation, it is important to set the level during the 1.2 seconds immediately following actuation of the # button. This is necessary since accurate setting of deviation can only be achieved if the automatic push-to-talk feature is enabled when the deviation level is set.

9.4.5 TIPS FOR USING THE ENCODER MICROPHONE

DTMF signaling was originally developed for telephone signaling on telephone lines and there are certain constraints on its adaptability to mobile radio. However, improved reliability will result if the simple precautions below are followed.

1. Limit placing your calls whenever possible to areas of optimum system coverage (full quieting). Calls made in noisy (fringe) areas may not be reliably placed.
2. Whenever possible, initiate your calls when the vehicle is not moving. Dialing when the vehicle is moving may not only be distracting for the driver, but reduces the reliability of the signaling due to weak signal (dead spot) or noise interference encountered with two-way radios in moving vehicles.

9.5 MOBILE SPEAKER ILLUSTRATED PARTS LIST

Two mobile speaker kits are available. They are:

- MBTSN6031A Speaker (Dash Mt. Radio)
- MBTSN6032A Speaker (Remote Mt. Radio)

Figure 9-18 contains the Illustrated Parts List for the Mobile Speaker. A mobile speaker is included with every mobile radio.

9.6 BASE STATION MOUNTING TRAY AND SPEAKER ILLUSTRATED PARTS LIST

- MBTRN4898A Base Station Speaker Tray

Figure 9-19 contains the Illustrated Parts List for the Base Station Mounting Tray and Speaker. The MCX1000 Radio mounts conveniently on top of this tray for ease of operation during base station use. This tray and speaker is included when the base station option is ordered. Option information is contained in Section 2 of this manual.

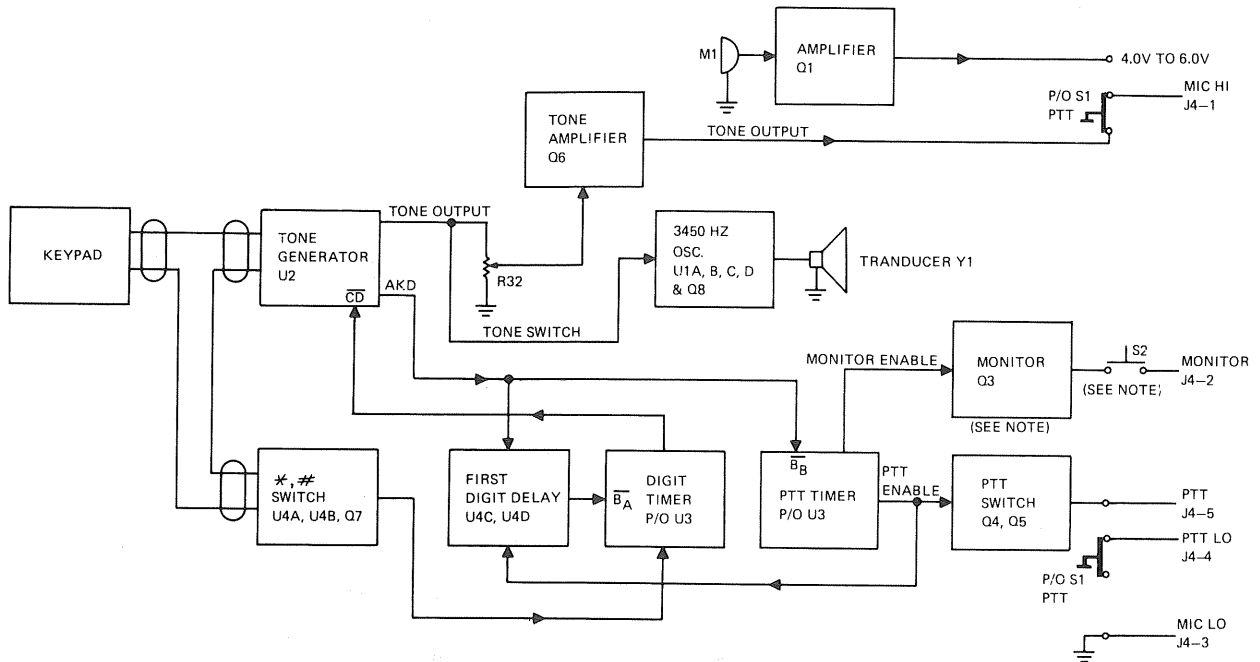


Figure 9-9
Touch-Code Encoder Microphone
Functional Block Diagram

parts list

VLN4386A DTMF MICROPHONE TOUCH TONE KEYPAD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
3	0780188F02	FRM KEY PAD
5	2880085E09	CONN MALE HEADER (2)
4	4580192F01	ACTR KEY PAD
6	8400288M01	BD KEY PAD

VLN4713A DTMF MICROPHONE HARDWARE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	1580185F01	HSNG MIC FRONT
2	3880144D03	BTN MIC
6A		LOGIC BOARD
7	3000057M01	CBL MIC
8	4280188G01	RETNR O RING (4)
9	4380187F01	SPACER PC BD MIC (4)
10		TRANSDUCER ASSY P/O VLN4384A
11		GASKET P/O VLN4384A, 0180725T82
12		SPACER P/O VLN4384A, 0180725T82
MK1		CONDENSER P/O VLN4384A, (ASSEMBLY # 0180725T82)
13		S2 SWITCH, P/O VLN4384A
14		CONTACT BTN P/O VLN4384A, 4080252E02
15		S1 SWITCH P/O VLN4384A
16		P3, P/O VLN4384A, 0980237F01
17		BEEPER BOARD
18	0180730T59	REAR HSNG ASSEMBLY
19		ABOVE ASSEMBLY NOT FIELD REPAIRABLE. CONSISTS OF PARTS WITH REFERENCE SYMBOL #'S 18, 19, 20, 21, 23, 24, 25
20		
21		
23		
24		
25		
22		P1, P2, P/O VLN4383A
26	3280253E02	GSKT SW PL
27		J3, P/O VLN4383A
28	0380076E05	SCR METRIC HI LO (3)
29	0300140085	SCR TPG 4-20X3/8 PHLPAN STL (4)
30		J4, P/O VLN4384A
		Non-referenced items
	3300201M04	NAMEPLATE
	3580089D02	BAFFLE FELT MIC
	0100851093	MIC MOUNTING

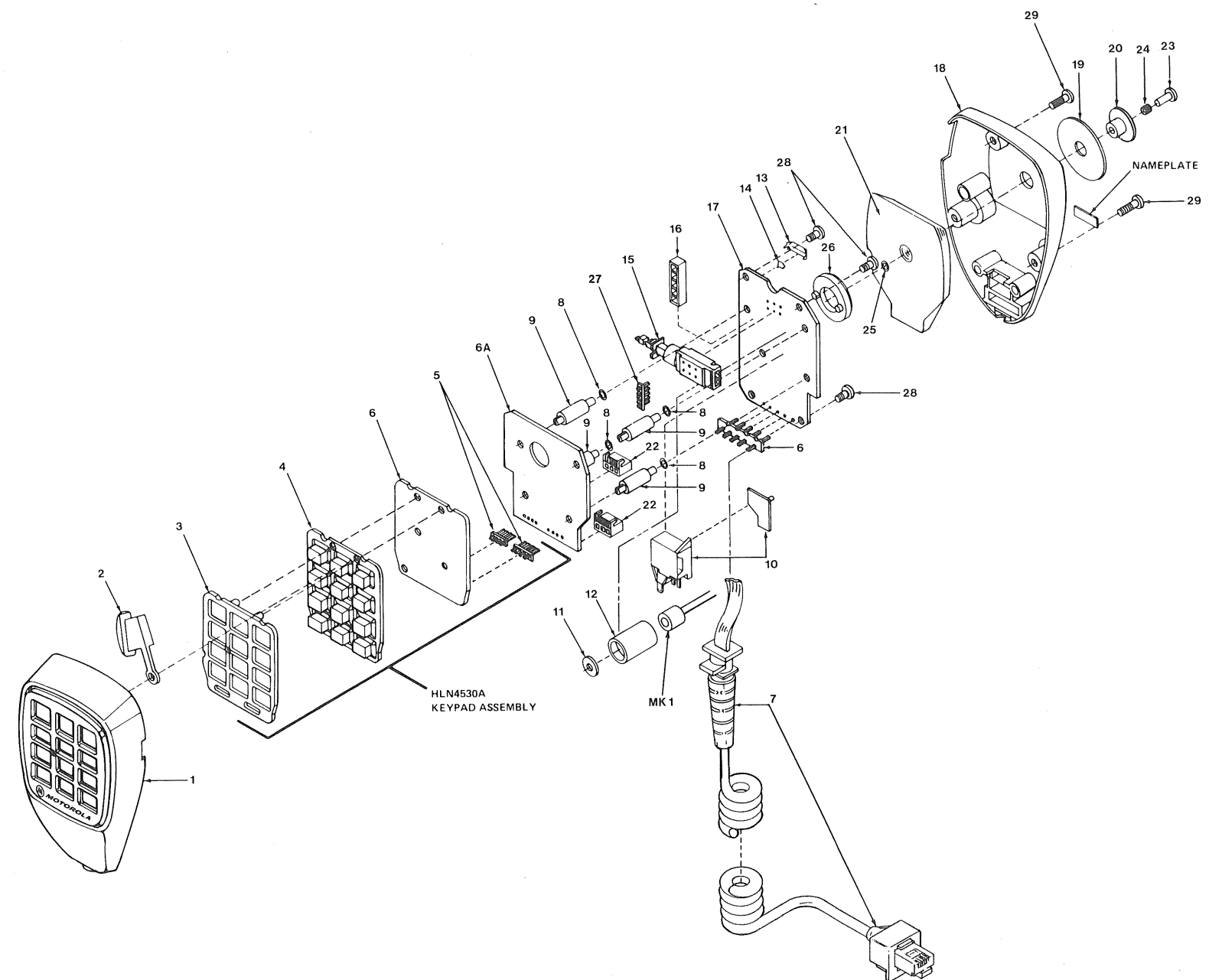
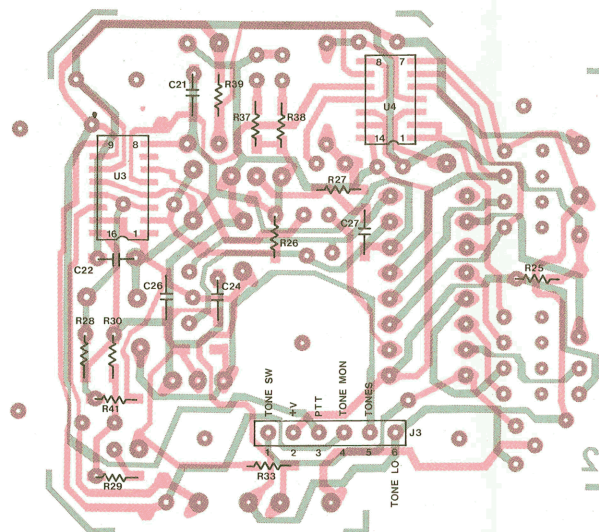


Figure 9-10
Touch-Code Encoder Microphone
Exploded View

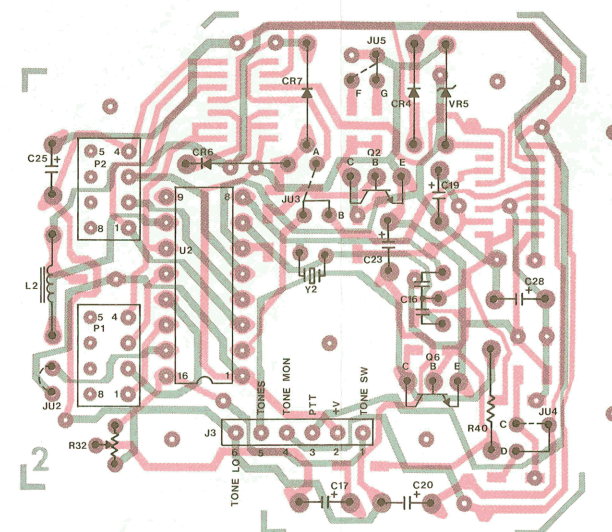
parts list

VLN4383A DTMF MICROPHONE LOGIC BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Resistor, chip, 5% 1/8W. (unless stated otherwise)
R25	0600015M97	100K
R26	0600015M89	47K
R27	0600015M97	100K
R28	0600016M02	150K
R29	0600016M14	470K
R30	0600016M16	560K
R32	1805501C03	POT CKT BD
R33	0600015M63	3900
R37	0600016M15	510K
R38	0600016M04	180K
R39	0600016M08	270K
R40	0611009A55HB	FCF 4.7K 1/4W.
R41	0600016M20	820K 1/4 W.
		Capacitor, chip, uf (unless stated otherwise)
C17	2311013F57	TANT 1 20 35V
C18	2111032A21	CHIP .01 10 X7R 50V
C19	2311013D05	TANT 2.2 10 20V
C20	2311013D05	TANT 2.2 10 20V
C21	2111032A09	CHIP .001 10 X7R 50V
C22	2111032A09	CHIP .001 10 X7R 50V
C23	2311013D15	TANT 15 10 20V
C24	2111032A09	CHIP .001 10 X7R 50V
C25	2311013D05	TANT 2.2 10 20V
C26	2111032A09	CHIP .001 10 X7R 50V
C27	2111032A09	CHIP .001 10 X7R 50V
C28	2311013F57	TANT 1 20 35V
		Connector
J3	2880085E08	CONN MALE HEADER
P1	0980238F01	RECP 4 PIN CKT BD MTNG
P2	0980238F01	RECP 4 PIN CKT BD MTNG
		Coil
L2	2482723H27	RF 1.2uH GRN
		Transistor
Q6	4800869642	M9642
Q7	4800869643	M9643
		Resonator
C16Y2	4800112M01	CERAMIC
		Diode
CR4	4883654H01	SLCN
CR6	4883654H01	SLCN
CR7	4883654H01	SLCN
VR5	4882256C03	ZENER 4.70V
		Integrated Circuit
U2	5180065C11	TN GENR
U3	5180073C09	CMOS DUAL MONOSTABLE
U4	5180073C08	CMOS QUAD NAND GATE SOIC



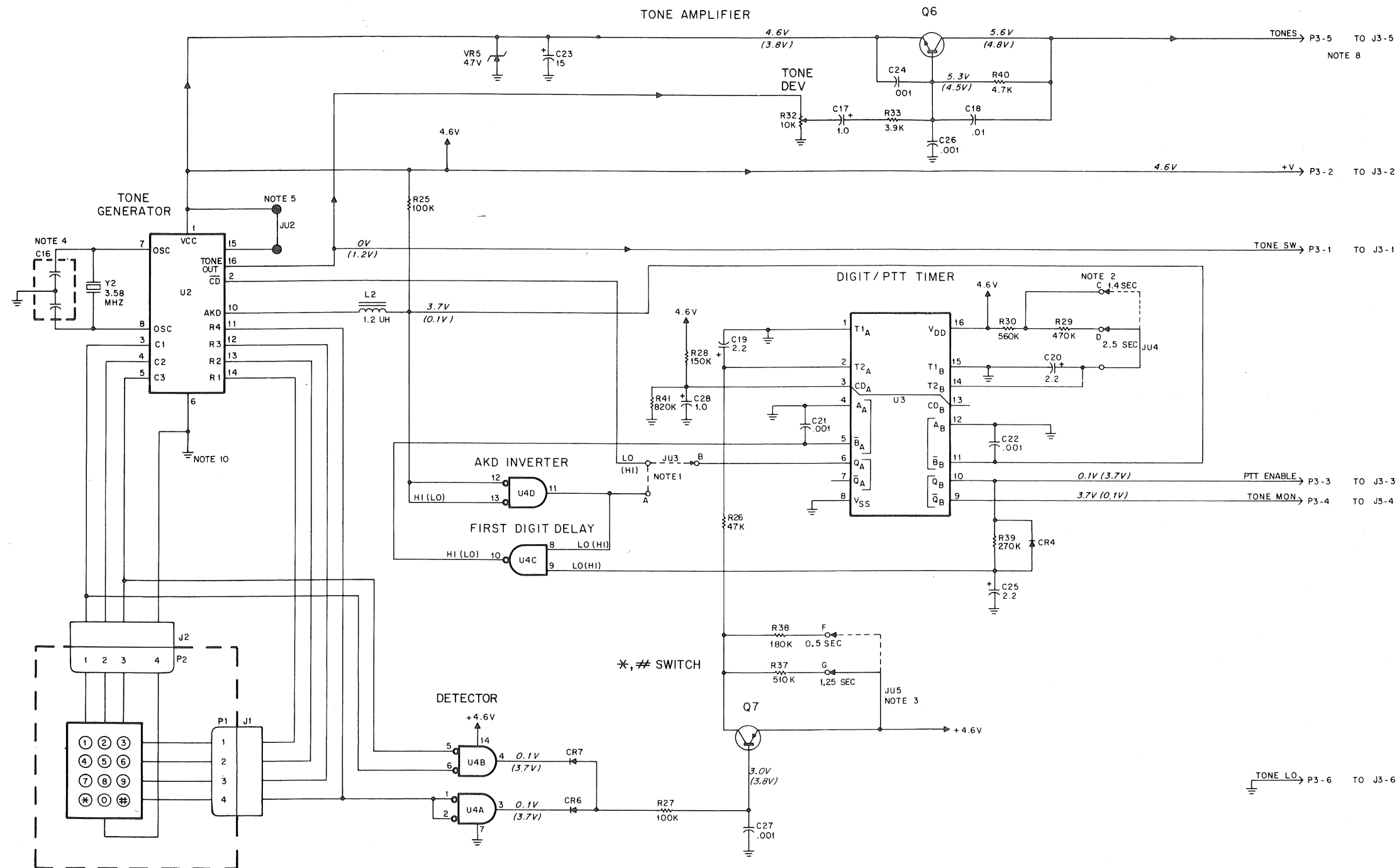
SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREYFigure 9-12
Touch-Code Encoder Microphone
Tone / Logic Board Parts ListFigure 9-11
Touch-Code Encoder Microphone
Tone / Logic Board- Board Details

31D00130M-O



NOTES:

1. Placing JU3 in Position A defeats timed tone operation. In Position A, tone duration lasts as long as touch-pad key is pressed. In Position B, tone duration is controlled by timer U3.
2. Placing JU4 in Position C selects a PTT hold time of 1.4 seconds. Placing JU4 in Position D selects a PTT hold time of 2.5 seconds.
3. Placing JU5 in Position F selects a *, # time of .5 second. Placing JU5 in Position G selects a *, # time of 1.25 seconds.
4. Y2 and C16 are a matched set and must be replaced as a pair. See parts list.
5. Pressing two keypad buttons in the same row or column will generate the single tone for that row or column. Removing jumper JU2 will inhibit any tone generation if more than one keypad button is pressed.
6. Voltages indicated as (0.1V) are active voltages (when either PTT or keypad buttons are depressed). Standby voltages are shown without parenthesis.
8. P3 connects to J3 on Mic / Beeper Board
9. Unless otherwise indicated, resistor values are in ohms, and capacitor values are in microfarads.
10. The ground symbol on this diagram is actually referenced to mic lo, not radio set ground.

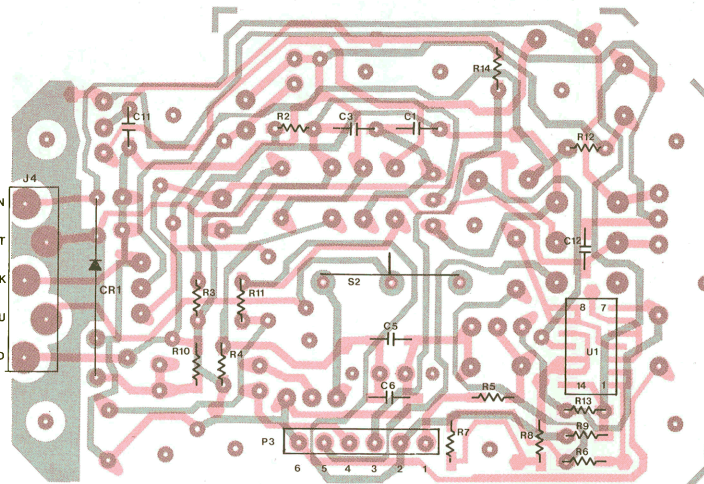
Figure 9-13
Touch-Code Encoder Microphone
Tone / Logic Board Schematic Diagram

6300679M-O

parts list

VLM4823A DTMF MICROPHONE BEEPER BOARD

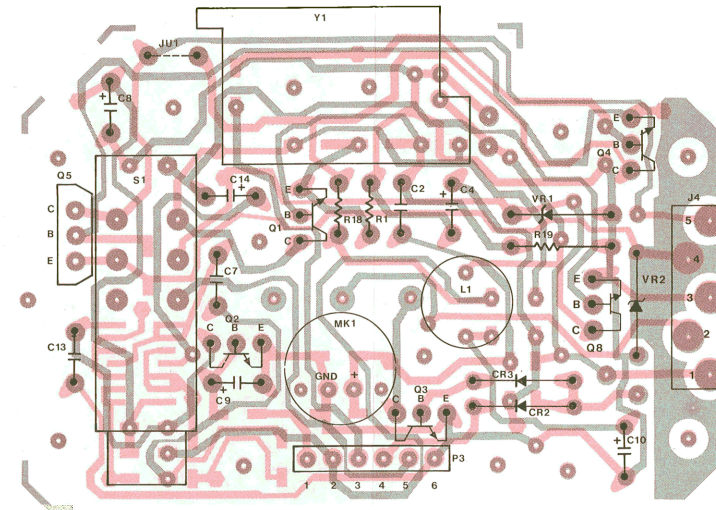
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Capacitor, uf (unless stated otherwise)		
C1	2111032A09	CHIP .001 .10 X7R 50V
C2	0811051A07	MTLZ POLYEST 01 5 63V
C3	2111031A47	CHIP 220 pf 5 NPO 50V
C4	2311013D13	TANT 10 10 20V
C5	2111032A09	CHIP .001 .10 X7R 50V
C6	2111031A25	CHIP 27 pf 5 NPO 50V
C7	0811051A05	MTLZ POLYEST .0047 5 63V
C8	2311013D13	TANT 10 10 20V
C9	2311013F57	TANT 1 20 35V
C10	2311013C12	TANT 27 10 15V
C11	2111032A09	CHIP .001 .10 X7R 50V
C12	2111032A21	CHIP .01 10 X7R 50V
C13	0811051A11	MTLZ POLYEST .047 5 63V
C14	2311013F57	TANT 1 20 35V
Diode		
CR2	4883654H01	SLCN PTT LO WHT
CR3	4883654H01	SLCN
CR9	4883654H01	SLCN
VR1	488256C54	ZENER 12V MIC LO BLK
VR2	488256C54	ZENER 12V MON BLU
Connector		
J4	3910184A10	PLUG (5 used) GRN
P3	0980237F01	RECP 6 PIN CKT BD WHT
Coil		
L1	2480108G02	CHK AUDIO 110MH
Transistor		
Q1	4800869594	NPN 69594
Q2	4800869642	M9642
Q3	4800869642	M9642
Q4	4800869642	M9642
Q5	4800869640	M9640
Q8	4800869642	M9642
Resistor, chip, 5%, 1/8 W (unless stated otherwise)		
R1	0611020A19	FCF 56 1/4 W.
R2	0600016M10	330K
R3	0600015M49	1000
R4	0600015M57	2200
R5	0600015M85	33K
R6	0600015M77	15K
R7	0600015M51	1200
R8	0600015M83	27K
R9	0600015M33	220
R10	0600015M85	33K
R11	0600015M61	3300
R12	0600015M77	15K
R13	0600016M14	470K
R14	0600015M77	15K
R18	0611020A46	FCF 750 1/4 W.
Switch		
S1	4080065E02	MOMENTARY
	4080252E01	CONT
S2	4080252E02	SW CONT BTN
Non-referenced items		
	0180725T32	TRANSDUCER PIEZO BEEPER
	0180725T82	MIC CET
Integrated Circuit		
U1	5180073C08	IC CMOS QUAD NAND GATE SOIC



SHOWN FROM SOLDER SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 9-15
Touch-Code Encoder Microphone
Microphone / Beeper Board Parts List



SHOWN FROM COMPONENT SIDE

SOLDER SIDE - RED
COMPONENT SIDE - GREY

Figure 9-14
Touch-Code Encoder Microphone
Microphone / Beeper Board - Board Details

31D00131M-0

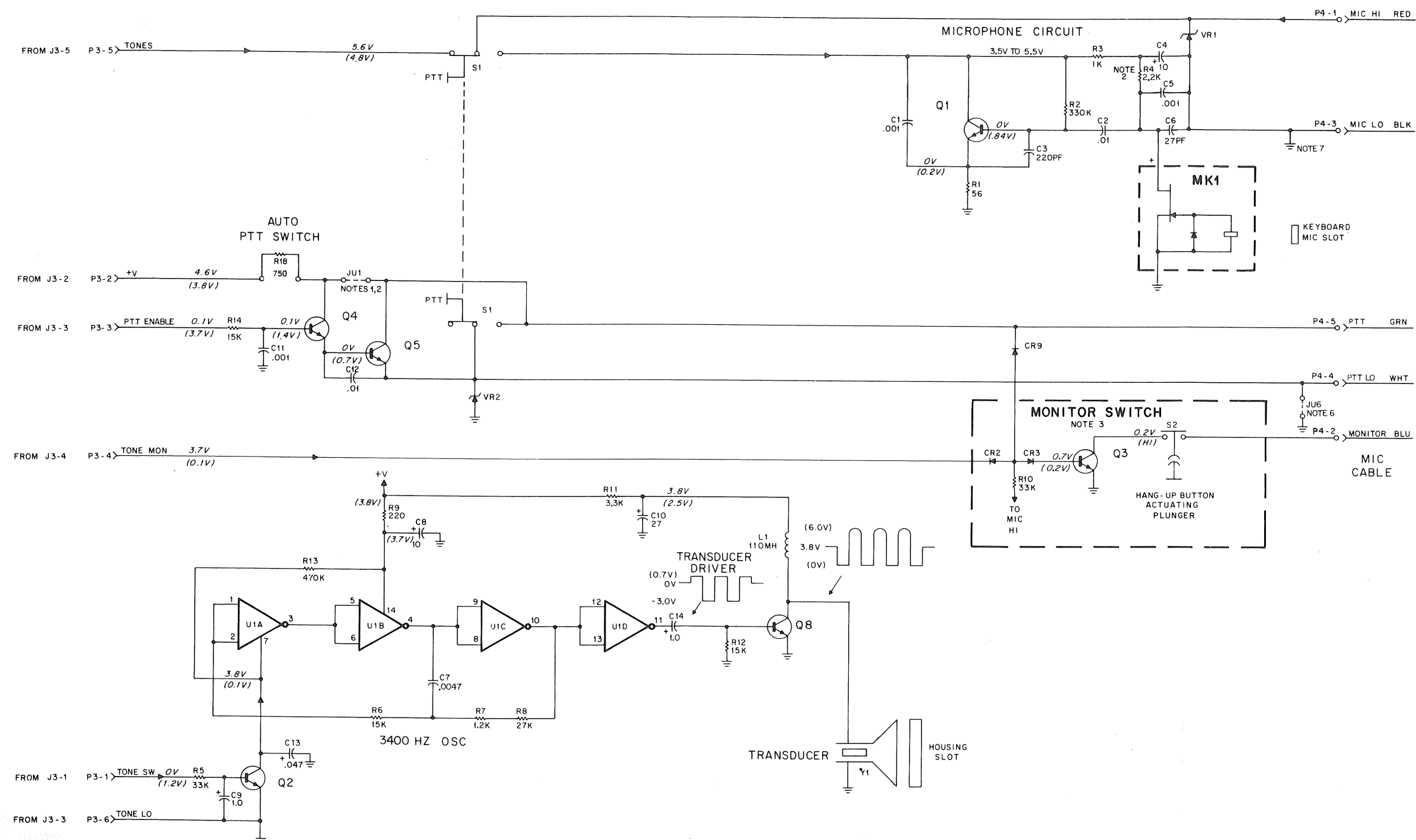
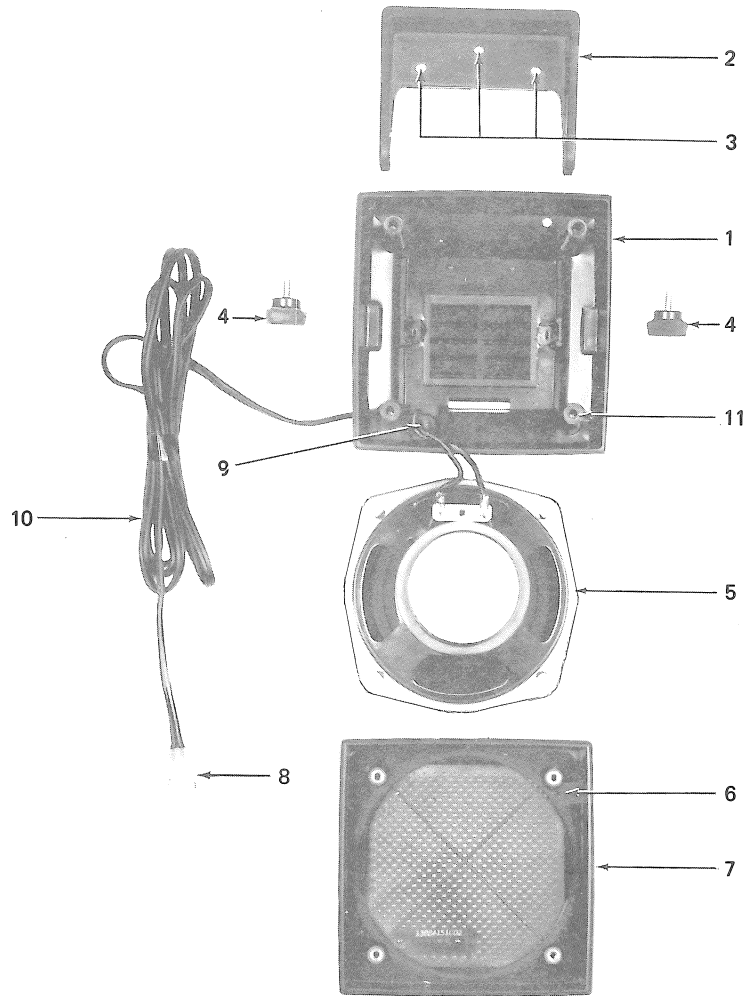


Figure 9-16
Touch-Code Encoder Microphone
Microphone / Beeper Board
Schematic Diagram



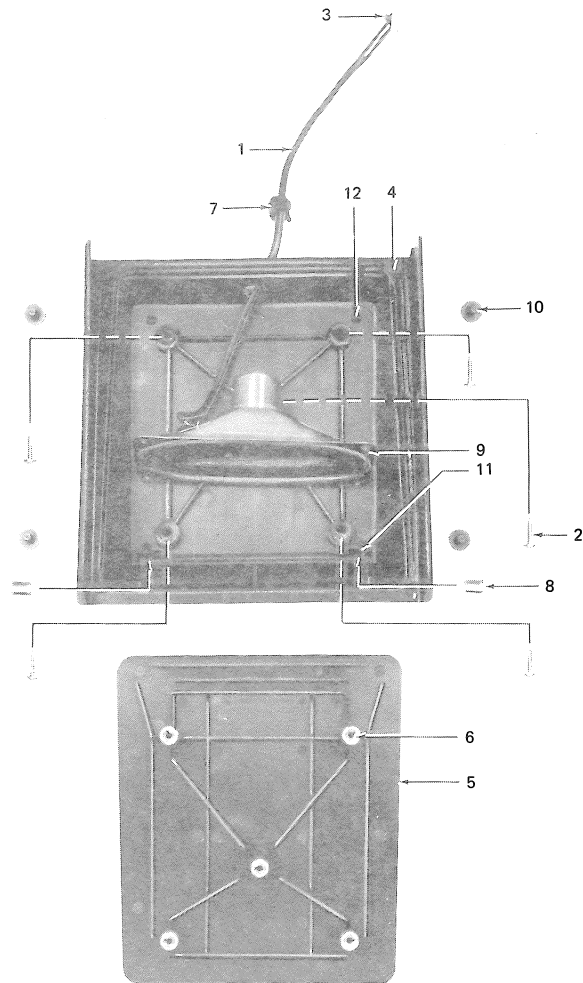
parts list

MBTSN6032A MOBILE SPEAKER

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	15-84981B10	COVER, rear
2	7-84568B02	BRACKET, trunnion
3	3-136756	SCREW, tapping: 10-16 X 5/8"; (3 used)
4	3-84244C03	SCREW, wing: 2 used
5	5000009M01	SPEAKER, dynamic: 5"; 2 ohm
6	32-84564B01	GASKET, speaker
7	13-82671M05	BEZEL, speaker
8	14-84566B01	HOUSING, connector: 2 position
9	42-82018H05	RETAINER, cable
10	1-80731D32	ASSEMBLY, cable (MBTSN6031A); includes
	9-84151B03	CONTACT, receptacle: female; 2 used
	30-83155H01	CABLE, 2-conductor; 8 feet
	or 1-80734D90	ASSEMBLY, cable (MBTSN6032A); includes
	9-84151B03	CONTACT, receptacle; female: 2 used
	30-83155H01	CABLE, 2 conductor; 17 feet
11	3-140001	SCREW, tapping: 10-16 X 5/8"; (4 used)
	33-83102N03	NAMEPLATE (MBTSN6031A)
	33-82102N06	NAMEPLATE (MBTSN6032A)

Figure 9-17
Mobile Speaker Illustrated Parts List

SECTION 9. ACCESSORY INFORMATION



parts list

MBTRN4898A BASE STATION SPEAKER TRAY

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	180735D98	cable with connector pins
2	0300122916	screw (5 req'd)
3	1484566B01	cable connector housing
4	1582086N01	housing
5	1582087N01	cover
6	3882132N01	clamp on nut (5 req'd)
7	4282018H18	cable grommet
8	4282105N01	speaker clip (2 req'd)
9	5084401D01	speaker
10	5582104N01	detent button (4 req'd)
11	7582172N01	speaker pad (2 req'd)
12	7583951F01	bumper foot (4 req'd)
	3382102N07	nameplate

Figure 9-18
Base Station Speaker Tray
Illustrated Parts List

9.7 BASE STATION POWER SUPPLY

The Base Station Power Supply, model VPN1013A, includes :

- VLN4581A Regulator board
- ACHLN4662A Power Supply Chassis

9.7.1 DESCRIPTION

Motorola Model VPN1013A Base Station Power Supply is a 120 / 220 / 240 VAC regulated power source providing a nominal DC output of 13.8 volts at 12 amperes maximum (intermittent duty service). This power supply is intended for the MCX1000 Radio in fixed station applications.

This compact power supply may be mounted on a desk or table top. The enclosure is a vented steel housing painted to match the associated radio equipment. An AC power ON-OFF switch and fuse are located on the front panel. A 6-pin receptacle is provided for 13.8 VDC power output connections. Note that a cable kit for DC power connection to the radio equipment is not provided with the power supply but must be ordered separately.

The power supply circuitry includes a power transformer, bridge rectifier assembly, capacitive filter, and series transistor regulator. The two regulator power transistors are mounted on an efficient heat radiator to ensure a safe operating temperature. Overload protection for the primary circuit is provided by the fuse on the front panel. Fuse rating depends on the primary voltage used. Refer to the notes on the accompanying schematic diagram for details. A three - conductor line cord provides 120 volt ac primary power connections to the power supply. The line cord plug must be removed and a proper connection made to the power source for 220 or 240 volt ac operation.

9.7.2 PRE-OPERATIONAL CONNECTIONS AND ADJUSTMENTS

Transformer Tap Connections

Refer to the power supply schematic diagram and verify proper connections at terminal block TB2 located on top of the power supply on the regulator board mounting bracket. The terminals of terminal block TB2 are numbered on the protective fibre cover for the terminal block. Refer to the table below.

POWER SOURCE	JU1	BLK-WHT WIRE
120 VAC	Between TB2-1 and TB2-4	To TB2-3
220 VAC	Not used	To TB2-2
240 VAC	Not used	To TB2-1

Transformer Tap Connections

Voltage Adjustment Procedure

1. Check that the power transformer tap connections are correct for the specific power source voltage being used. See chart above.
2. Connect a Motorola solid-state dc multimeter (or equivalent) between floating ground and terminal 8 of TB1 (junction of RED-GRN wires). Terminal strip TB1 is located on the regulator board mounting bracket.
3. Connect the Motorola radio equipment to the power supply and turn both units "on". During "transmit" conditions the volt-meter should read 13.8 volts.
4. If the A+ voltage is not 13.8 volts, adjust control R9 for a voltmeter reading of 13.8 volts. This control is accessible through the hole in the regulator circuit board.

parts list

VLN4581A REGULATOR BOARD

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Capacitor, uf 10% 50V
C1	882905G02	.022
C2	2383210A08	100 + 150-10%, 25V.
C3,4	882905G02	.022
		Diode
CR5	4882392B03	silicon
		Transistor
Q1,2	48869642	NPN, type M9642
		Resistor 5% 1/2 W (unless stated otherwise)
R1	6125A41	470
R2	6125A53	1.5K
R3	6125A13	33
R4	1762177B40	200, 5W
R5,6	6126C41	470 10%, 1W
R7,8	6125A49	1K
R9	1884944C04	variable, 500 ohms
R10	6125C51	1.2K, 10%
		Zener diode
VR1	4883696E01	silicon, 6.8V, 5%

Figure 9-19
Power Supply
Regulator Board Parts List

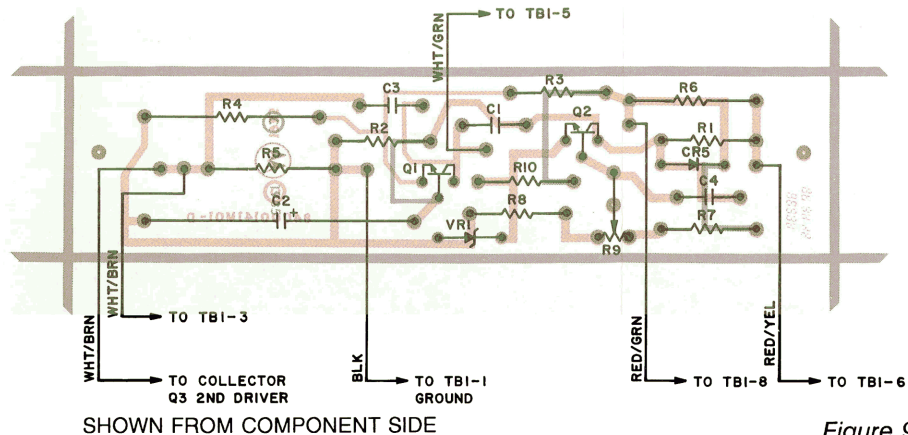


Figure 9-20
Power Supply Regulator
Board - Board Details

SOLDER SIDE - RED
COMPONENT SIDE - GREY

31B00172M-O

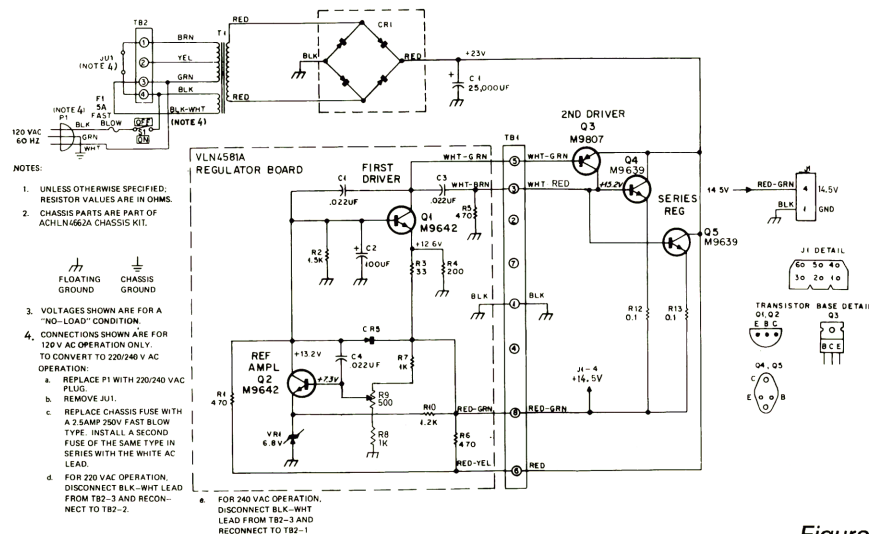


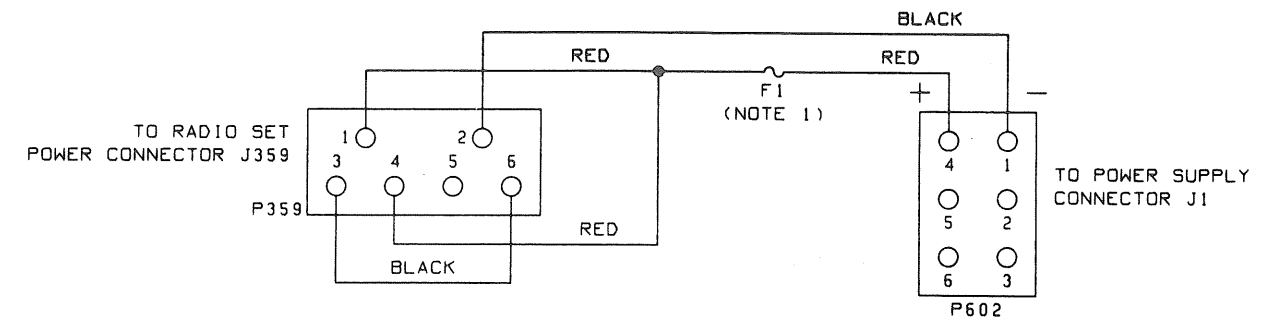
Figure 9-21
Power Supply Regulator
Board Schematic Diagram

6300437M-O

parts list

ACHLN4662A POWER SUPPLY CHASSIS

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		Capacitor			
C1	2382464C10	25,000 uF, +75 -10%, 40V	2121841		nut, hex: 6-32x5/16x7/64" 2 req'd
		Diode	3134168		screw, tapping 4-40x1/4" 2 req'd
CR1	4884751H02	Silicon bridge rectifier assembly	3134268		screw, tapping 4-40x7/16" 2 req'd
		Connector	3138341		screw, machine 6-32x5/8" 2 req'd
J1		receptacle includes: 1510183A53 insulator, 6 -contact 2982336A01 contact, female, 2 req'd	4114057		washer, flat: .125x.312x .032"
F1	6552293	Fuse cartridge, fast-blow type, 5 A	4821633		washer, shoulder
P1	3083212F01	Line cord includes ac plug	783095F02		circuit board bracket
		Transistor	1483275L01		insulator, prot.
Q3	48869807	PNP, M9807	1484268A01		transistor insulator
Q4, 5	48869639	NPN, M9639	1484525G01		transistor insulator, TO66 Base
		Switch	295261		soldering lug; 2 req'd
S1	4084241G04	slide, DPST	295369		soldering lug
		Resistor, fixed	1500333M03		housing cover
R12, 13	1782177B50	0.1, 10%, 7 W	100719M04		chassis assembly, includes
		Transformer	2982336A01		female terminal
T1	2584638C02	power, pri: res 4.9 ohms 240 volt configuration sec: res 0.035 ohms	910454A04		connector
		Terminal strip	2982336A01		female terminal
TB1	3100202M01	8 terminals; no. 2 & 7 mtg.	29812979		crimp terminal lug
TB2	3100173M01	4 terminals; screw	27009		nut, 10-32x3/8"
		Fuseholder	29627		hex nut (2req'd) 4-40x3/16x3/32"
XF1	982083C01	extracter post type	3135031		machine screw, 10-32x3/4"
		Non-referenced items	32979		machine screw, 6-32x3/8" (3req'd)
	37134371	tubing, heatshrink: 1" length 2 used	37346		machine screw, 6-32x3/4"
	100719M03	heat sink assembly	3136143		tapping screw 8-32x1/4" (4 req'd)
	29824456	lug, ring tongue	3139085		machine screw, 4-40x5/16" (2 req'd)
	4474216	washer, insulator, 2 req'd	3490773		machine screw, 6-32x9/16" (4 req'd)
	14865854	insulator, transistor	42645		lock washer, #6 split (4 req'd)
	2984489B01	lug, transistor, 2 req'd (used with Q4, Q5)	47657		lock washer, #8 split (4 req'd)
	27005	nut, hex; 6-32 x 1/4 x 3/32 (10 req'd)	4114583		lock washer, #4 split (2 req'd)
	32977	screw, machine; 6-32 x 1- 1/8" 4 req'd	482418B88		insulator washer
	47569	washer, flat; 145x.312x.027" 2 req'd	783158L01		bracket
	47650	washer, lock; #6 (split) 2 req'd	1384639D05		escutcheon
	484496C01	washer, shoulder; 4 req'd	2783252N01		chassis
	2684923B06	heat sink	4282018H01		cable retainer
	295248	lug soldering: #6; 2 req'd	7584215A02		recessed bumper
	31490181	terminal strip: #1 mtg; 2 req'd	32979		machine screw, 6-32x3/8" (4 req'd)
	100719M02	diode bracket assembly includes 29824456 lug, ring tongue 29812979 lug, crimp terminal	3139854		tapping screw 6-32x3/8" (8 req'd)
			3134168		tapping screw 4-40x1/4" (2 req'd)
			3138216		tapping screw 10-32x3/8" (3 req'd)
			42645		lock washer #6 split (4 req'd)
			4210217A02		lock washer #6 split (4 req'd)
			3136139		cable harness strap (3 req'd)
			37467		lock screw 6-32x5/8" (2 req'd)
			47652		tapping screw 8-18x3/8" (4 req'd)
					lock washer #10 ext. tooth



- NOTES :
1. F1 IS 10 AMPS
 2. CONNECTORS SHOWN FROM WIRE SIDE

parts list

MBTKN8199A BASE STATION POWER CABLE KIT

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F1	65-10266 or 65-15270	fuse: 10 amp 6 amp
P359	15-84192M01	connector, plug: HOUSING, 6-contact
P602	15-10183A52	HOUSING, 6-contact
		mechanical parts
	1-80737D31	assembly power cable; includes:
	14-82883A01	CAP, fuse holder
	42-82884A01	CLIP, fuse
	29-82335A01	TERMINAL, male
	30-84396L02	CABLE, 2-conductor
	37-134370	TUBING, heatshrink; 3/4" (BLK)
	37-134371	TUBING, heatshrink; 3/8" (BLK)
	9-82845L01	CRIMP, connector
	1-80737D32	ASSEMBLY, red wire and lug; includes:
	9-84151B03	RECEPTACLE, single contact
	1-80737D33	ASSEMBLY, red wire and lug; includes:
	14-82882A01	BODY, fuseholder
	29-82335A01	TERMINAL, male
	41-82885A01	TERMINAL, fuseholder
	42-82884A01	CLIP, fuseholder

Figure 9-22
Power Supply Chassis
Parts List

Figure 9-23
Base Station
Cable Kit Details



MOTOROLA INC.

AVAILABLE BACKGROUND REFERENCE PUBLICATIONS

Seven reference publications are available to provide background information needed to service some of the newer Motorola products more effectively. The information in these publications is not duplicated in our instruction manuals. To obtain your free copy, check the ones you want and return this self-mailer to us.

Check item desired:

- Basic Logic Circuit Guide** 68P81105E88
Describes the basic logic circuits used in Motorola Communications digital equipment and the logic notational scheme used in our instruction manuals.
- "Digital Private-Line" Binary-Coded Squelch** 68P81106E83
Contains fundamentals of "Digital Private-Line" system operation, circuit operation and servicing techniques.
- Safe Handling of CMOS Integrated Circuit Devices** 68P81106E84
Describes special handling techniques needed to prevent irreparable damage from static charges encountered with normal handling of CMOS devices.
- Reducing Noise Interference in Mobile Two-Way Radio Installations** 68P81109E33
Defines the major sources of noise encountered in a mobile radio installation and suggests methods of remedying them.
- Anti-Skid Braking Precautions** 68P81109E34
Provides installation suggestions and a detailed checkout procedure for installation of mobile radios in vehicles with anti-skid braking systems.
- Removal and Replacement of Chip Components on Circuit Boards** 68P81113E77
Contains general information and repair procedures relative to chip-type (leadless) components.
- Lightning Protection Recommendations** 68P81111E17
Provides general information concerning lightning protection for equipment sites. Also, provides a quick reference of available lightning protection kits.

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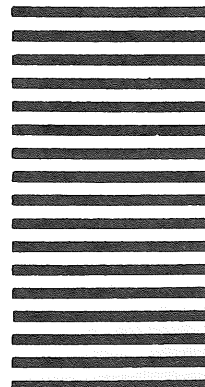


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