RITRON, INC.

RPM-MRM-050

RITRON MODEL RPM-050

PROGRAMMABLE

FM MOBILE TRANSCEIVER

MAINTENANCE/REPAIR/OPERATING MANUAL

FOR USE BY AUTHORIZED SERVICE/MAINTENANCE PERSONNEL ONLY

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IMPORTANT INFORMATION

OPERATING/PROGRAMMING INSTRUCTIONS FOR RPM RADIOS MANUFACTURED WITH PREVIOUS VERSION OF MICROCONTROLLER SOFTWARE: Units manufactured with a previous version of the microcontroller software do not have some of the features described in this manual. The operating/programming sections in this manual cover radios built with MCU (microcontroller) part #314B0004.

However, the instructions in this manual for basic operation and programming are accurate for all RPM radios. Radios built with MCU #314B0003 work very much like those manufactured with the enchanced software (#314B0004.)

Service personnel can determine whether any RPM model is a "Rev. 4" radio (contains the "04" MCU), using optional programming kit model RPT-PCPK. Or, the technician can open the radio and check the part number marked on top of the MCU. If the part number is 314B0004, the enhanced features are installed.

PROGRAMMING CAUTION: DO NOT USE VERSIONS OF THE PROGRAMMING SOFTWARE EARLIER THAN 1.6R14 TO PROGRAM A REV. 4 RADIO ("04" MCU INSTALLED). OTHERWISE, DATA IN THE MICROCONTROLLER WILL BE CORRUPTED AND THE RADIO LEFT INOPERATIVE.

SURFACE MOUNT REPAIR: RITRON surface mount products require special equipment and servicing techniques. Improper servicing techniques can cause permanent damage to the printed circuit board and/or components, which is not covered by RITRON's warranty. If you are not completely familiar with surface mount component repair techniques, RITRON recommends that you defer maintenance to qualified service personnel.

PRECAUTIONS FOR HANDLING CMOS DEVICES: This radio contains complementary metal-oxide semiconductor (CMOS) devices, which require special handling techniques. CMOS circuits are susceptible to damage by electro-static or high voltage charges. Damage can be latent, with no failure appearing until weeks or months later. For this reason, take special precautions any time you disassemble the radio. Follow these precautions, which are even more critical in low humidity environments.

1) Storage/transport - CMOS devices that will be stored or transported must be placed in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are used for other semiconductors.
2) Grounding - All CMOS devices must be placed on a grounded bench surface. The technician that will work on the radio/CMOS circuit must be grounded before handling the radio. Normally, the technician wears a conductive wrist strap in series with a 100 KΩ resistor to ground.
3) Clothing - Do not wear nylon clothing while handling CMOS circuits.
4) Power off - Remove power before connecting, removing or soldering a PC board that contains CMOS devices.
5) Power/voltage transients - Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices, making sure that no voltage transients are present.
6) Soldering - Use a grounded soldering iron for soldering CMOS circuitry.
7) Lead-straightening tools - When straightening CMOS leads, provide ground straps for the tool used.

WARNING: When "jump starting" another vehicle, first disconnect power from the RPM mobile to avoid blowing the radio's internal reverse protection diode.

1. MODEL RPM-050 SPECIFICATIONS

1.1 GENERAL

FCC ID:	AIERPM-050
FCC RULE PARTS:	15, 22, 74, 90
FREQUENCY RANGE:	30 to 38 MHz standard or 38 to 50 MHz standard
MAX. FREQ. SEPARATION:	2 MHz
RF CHANNELS:	16
SCANNING:	7 channels per second Programmable multiple scan lists, Priority and Normal
SYNTHESIZER RESOLUTION:	5 KHz (12.5 KHz optional)
FREQUENCY STABILITY:	+/-5 PPM (-30° to +60° C)
TONE/CODE SIGNALING:	CTCSS (Quiet-Call) Digital Coded Squelch (Digital Quiet-Call) Two Tone Sequential (Paging Quiet-Call)
POWER SUPPLY:	+10.5 to 14.5 VDC external
CURRENT REQUIREMENTS:	All measurements made @ +13.5 VDC
Standby: *Receive:* *Transmit:*	250 mA 400 mA 10 A
CONTROLS:	Volume/On-Off, Monitor, Channel Select Microphone hang-up - Monitor circuit
INDICATORS:	Digital Channel Display Transmit Activated/Channel Busy Lamp Monitor Lamp
ANTENNA CONNECTOR:	SO-239, 50 Ω
MICROPHONE CONNECTOR:	Modular jack, 6-conductor
EXT. SPEAKER CONNECTOR:	3.5 mm jack
ACCESSORY CONNECTOR:	9-pin (optionally installed on rear panel)
WEIGHT:	2.5 lbs. (40 oz.)
DIMENSIONS:	2.1" H x 5.8" W x 7.4" D

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

1.2 RECEIVER

RECEIVING SYSTEM:	Fixed tuned, dual conversion superheterodyne
I.F. SYSTEM:	10.7 MHz/455 KHz
SENSITIVITY:	0.25 µV maximum @ 12 dB SINAD
NOISE SQUELCH SENSITIVITY:	Programmable (per channel), factory set for 12 dB SINAD
SELECTIVITY (EIA):	-75 dB @ 20 KHz
SPURIOUS REJECTION:	-75 dB
IMAGE REJECTION (EIA):	-80 dB minimum
INTERMODULATION (EIA):	-75 dB
MODULATION ACCEPTANCE:	+/- 7.5 KHz maximum
FM HUM AND NOISE:	Better than 45 dB
AUDIO OUTPUT:	4 Watts to internal speaker, 6 Watts to external speaker jack (2 Ω)

1.3 TRANSMITTER

RF POWER OUTPUT:	60 Watts Low power adjustable 5 to 40 Watts (per channel)
MODULATION:	Type 16K0F3E (+/- 5 KHz for 100% modulation)
SPURIOUS AND HARMONICS:	Better than -65 dBc
AUDIO RESPONSE:	Meets FCC requirements
MODULATION SENSITIVITY:	10 to 12 mV for 60% maximum deviation @ 1 KHz
TIME-OUT TIMER:	3 minutes, programmable

1.4 MICROPHONE

TYPE:	Handheld, omni-directional dynamic (with coiled cord and modular plug)
SENSITIVITY:	-72 +/- 4 dB @ 1 KHz (0 dB = 1V/microbar)
FREQUENCY RESPONSE:	200 Hz to 5 KHz
IMPEDANCE:	500 Ω +/- 30% @ 1KHz
MONITOR CIRCUIT:	No ground required for hang-up clip

2. INTRODUCTION

2.1 GENERAL

RITRON's RPM mobile radio is programmable, and can transmit and receive on any one of up to 16 channels in a FM communications band (UHF or VHF available). This radio includes channel select and monitor push-buttons, and a single digit display. Each channel may be programmed to operate using communications industry standard signaling formats: Quiet-Call, Digital Quiet-Call and Paging Quiet-Call.

2.1.1 INSPECTION

Make sure the RPM package includes a mobile radio and two boxes. One box contains the microphone and attached cord. The other box holds radio and microphone brackets, a DC power cable, an in-line fuse assembly and installation hardware. See the installation instructions in the hardware box for a complete list of parts included. Inspect the equipment immediately after delivery and report any damages to the shipping company.

2.1.2 MODEL IDENTIFICATION

The radio model, serial and FCC identification numbers appear on a label attached to the mobile's rear panel. The model number shown below is "RPM-050-M." This means that the unit will operate in the VHF FM band, on frequencies from 30 to 38 MHz. Model RPM-050-N is for use on frequencies from 38 to 50 MHz.

FIG-1: RPM MOBILE FCC LABEL

STANDARD MODEL	BAND	FREQ. RANGE (MHZ)	NO. CHANNELS
RPM-050-M	VHF	30 to 38	16
RPM-050-N	VHF	38 to 50	16
RPM-150	VHF	150 to 165	16
RPM-450	UHF	450 to 470	16
RPM-050-M-OP	VHF	30 to 38	16
RPM-050-N-OP	VHF	38 to 50	16
RPM-150-0P	VHF	150 to 165	16
RPM-450-0P	UHF	450 to 470	16

2.2 FCC REGULATIONS

2.2.1 LICENSING

The FCC requires the radio owner to obtain a station license for his radios before using the equipment to transmit, but does not require an operating license or permit. The station licensee is responsible for proper operation and maintenance of his radio equipment, and for ensuring that transmitter power, frequency and deviation are within the limits specified by the station license. This includes checking the transmitter frequency and deviation periodically, using appropriate methods.

2.2.2 SAFETY STANDARDS

The FCC (with its action in General Docket 79-144, March 13, 1986) has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment. RITRON follows these safety standards, and recommends that you observe them also:

- DO NOT operate a mobile radio transmitter when someone outside the vehicle is within two feet of the antenna.
- DO NOT operate the transmitter of a fixed radio (base station, microwave, rural telephone RF equipment) or marine radio when someone is within two feet of the antenna.
- DO NOT operate any radio transmitter unless all RF connectors are secure and any open connectors are properly terminated.
- DO NOT operate radio equipment near electrical blasting caps or in an explosive atmosphere.
- DO NOT press the Push-To-Talk button except when you intend to transmit.
- GROUND ALL RADIO EQUIPMENT according to RITRON's installation instructions.
- Repair of RITRON products should be performed only by RITRON authorized personnel.

3. INSTALLATION

FAILURE TO COMPLY WITH THE WARNING, CAUTION AND IMPORTANT STATEMENTS ON THE FOLLOWING PAGES COULD RESULT IN DAMAGE TO THE RADIO THAT WILL VOID THE WARRANTY!

3.1 SAFETY PRECAUTIONS

3.1.1 RADIO MOUNTING LOCATION

Consider driver and passenger safety when you choose a location for the radio. Do not mount the unit overhead or on a sidewall unless you take special precautions, such as securing the radio with a retaining strap.

Improper installation increases the possibility that a car accident could dislodge the radio and make it a dangerous projectile.

3.1.2 VEHICLE OPERATION

3.1.2.1 ELECTRONIC SYSTEMS

Check the vehicle's service manual for possible warnings about operating a two-way radio in a vehicle equipped with an electronic ignition or anti-skid braking system.

3.1.2.2 LIQUEFIED PETROLEUM (LP) GAS FUEL SYSTEM

Radio installation in a vehicle fueled by liquefied petroleum (LP) gas (with the LP gas container stored in a sealed-off space, such as the trunk) must conform to NFPA (National Fire Protection Association) standard 58:

- Any space that contains radio equipment must be isolated by a seal from the space in which the LP gas container and its fittings are located.
- Remote (outside) fitting connections must be used.
- The container space must be vented to the outside.

3.1.2.3 BATTERY POWER

Avoid leaving the radio turned on for long periods when the engine is off, which could run down the vehicle's battery.

3.1.3 ANTENNA LOCATION

3.1.3.1 NON-METAL BODY VEHICLES

Do not install any kind of antenna closer than two feet from any vehicle occupant in vehicles whose body is made of a material other than metal (such as fiberglass). Otherwise, occupants can be exposed to radio frequency energy levels higher than recommended by the ANSI (American National Standards Institute).

3.1.3.2 METAL BODY VEHICLES

Be sure to follow the installation instructions for glass mount antennas; it is important to correctly place the antenna along the front or rear window and to route the cable as directed. Installation mistakes can subject vehicle occupants to RF levels higher than judged safe by the ANSI.

3.2 PREPARATION

IMPORTANT: THE RITRON MOBILE CAN BE OPERATED ONLY IN NEGATIVE GROUND ELECTRICAL SYSTEMS! A negative ground system has the negative (-) battery terminal connected to the vehicle motor block. If you cannot find this connection, consult the vehicle owner's manual to determine the ground system type. Most late model U.S. and foreign made cars and small trucks use a negative ground electrical system. However, some older cars and newer large trucks use a positive ground system.

3.2.1 MOBILE RADIO PACKAGE CONTENTS

Make sure that all of the items listed below are included in the radio package, which holds a mobile transceiver and two boxes of equal size. One box contains the microphone and attached cord. The other includes hardware for installing: 1) the DC power cable, 2) the mobile radio and 3) the microphone hang-up clip.

3.2.1.1 DC POWER CABLE

Parts for power cable installation - ten foot DC cable with attached fuse holder assembly (1), 10 A fuse (1), 20 A fuse (1), ring lug (2), plastic tie (2).

3.2.1.2 MOBILE RADIO

Parts for radio installation - radio mounting bracket (1), Phillips head sheet metal screw #10 x 3/4" (4), lock washer (4), flat washer (4), slotted head washer hex nut screw #10-32 x 5/8" (2), rubber washer 11/8" DIA. (2).

3.2.1.3 MICROPHONE HANG-UP CLIP

Parts for hang-up clip installation - hang-up clip (1), Phillips head self-tapping screw #6 x 3/8" (2).

3.2.2 RECOMMENDED TOOLS

- PHILLIPS #2 SCREWDRIVER
- TORX SCREWDRIVER, T25
- 5/16" HEX NUT DRIVER
- ELECTRIC DRILL
- 19/32" DIAMETER DRILL BIT
- 9/64" DIAMETER DRILL BIT
- 7/64" DIAMETER DRILL BIT
- HAMMER
- CRIMPING TOOL
- WIRE CUTS

3.2.3 MOUNTING LOCATIONS

Before you begin installation, inspect the vehicle and decide how and where to mount the antenna, radio and microphone. Plan wire and cable runs to provide maximum protection from pinching and crushing.

3.2.3.1 ANTENNA

3.2.3.1.1 Permanent Mount

The best place to mount the antenna is in the center of a large, flat conductive surface, such as the vehicle's roof. A large trunk lid also provides a good antenna location. If you use the trunk lid, connect grounding straps between the lid and vehicle chassis! See the antenna installation instructions for directions.

3.2.3.1.2 Glass Mount

Position a glass mounted antenna as high as possible in the center of the rear window or windshield. Consult the antenna installation guide for further instructions.

3.2.3.1.3 Magnet Mount

The magnet mounted antenna should be attached to the center of the vehicle's roof or trunk lid. If you use the trunk lid, connect grounding straps between the lid and vehicle chassis! Refer to the antenna installation sheet for details.

3.2.3.2 RADIO MOUNTING BRACKET

The radio mounting bracket permits attaching the mobile to a variety of surfaces, and requires a flat mounting surface (6" x 2" minimum) with adequate clearance for inserting the radio. Be certain the mounting surface can support the radio's weight. Leave enough space around the radio for air flow cooling, and make sure the user can easily reach and view the mobile's operating controls and access rear panel connections. The mounting bracket and radio must not impair vehicle operation. Although the bracket can be fixed to a plastic dashboard, the mounting screws should penetrate into the dashboard's supporting metal frame.

3.2.3.3 MICROPHONE HANG-UP CLIP

The microphone clip may be attached to any metal or plastic surface strong enough to withstand continued microphone use; a hang-up clip to ground connection is not required. Mount the clip within easy reach of the driver, mindful that using the microphone must not impair vehicle operation. Although the hang-up clip can be mounted to a plastic dash board, the mounting screws should penetrate into the dash board's supporting metal frame.

3.3 PROCEDURE

FAILURE TO COMPLY WITH THE WARNING, CAUTION AND IMPORTANT STATEMENTS ON THE FOLLOWING PAGES COULD RESULT IN DAMAGE TO THE RADIO THAT WILL VOID THE WARRANTY!

3.3.1 DC POWER CABLE

WARNING: THE RITRON MOBILE CAN BE OPERATED ONLY IN NEGATIVE GROUND ELECTRICAL SYSTEMS! DO NOT CONNECT THE RADIO TO THE POWER CABLE UNTIL INSTALLATION IS COMPLETE.

TO INSTALL THE POWER CABLE, FOLLOW THE STEPS BELOW:

1) Inspect the vehicle and determine how and where to run the power cable to provide maximum protection from pinching, crushing and excessive heat.

2) Drill a 19/32" hole (or use an existing, empty hole) in the driver's side of the firewall for passing the power cable into the engine compartment. Be careful not to damage existing vehicle wires. A rubber grommet (not provided) may be installed in the access hole to help protect the cable.

3) From inside the vehicle, feed the cable leads and fuse assembly through the access hole and into the engine compartment. Refer to FIG-2 on next page. Leave as much space as possible between the power cable and the vehicle's wiring (the power cable red and black wires may be twisted together).

4) Route the power cable through the engine compartment to the battery. If the battery is located on the passenger's side, the cable should cross the compartment in front of the engine as shown in FIG-2. If the battery is located on the driver's side, run the cable straight to the battery. Install the cable as far as possible from the vehicle's electronic modules and wiring.

5) Install one ring lug onto the fuse assembly lead, the other lug onto the power cable black lead (stripped end).

6) Place the fuse assembly close to the battery, away from heat-generating engine components. Mount the fuse assembly using the plastic ties provided.

7) Connect the power cable black lead (with ring lug attached) to the vehicle's negative (-) battery terminal, or to the jump start block on vehicles so equipped.

   CAUTION: Avoid disconnecting the battery-to-engine block ground, which might damage the vehicle and/or radio. An in-line fuse (not included) may be installed near the battery in the black lead.

8) Connect the fuse assembly lead (ring lug attached) to the positive (+) battery terminal. Check that the fuse assembly contains a 20 Ampere fuse. (RPM-150 and RPM-450 installations require a 10 A fuse.)

   IMPORTANT: Failure to connect the power cable leads directly to the battery (via the fuse) can produce severe alternator noise in the radio.

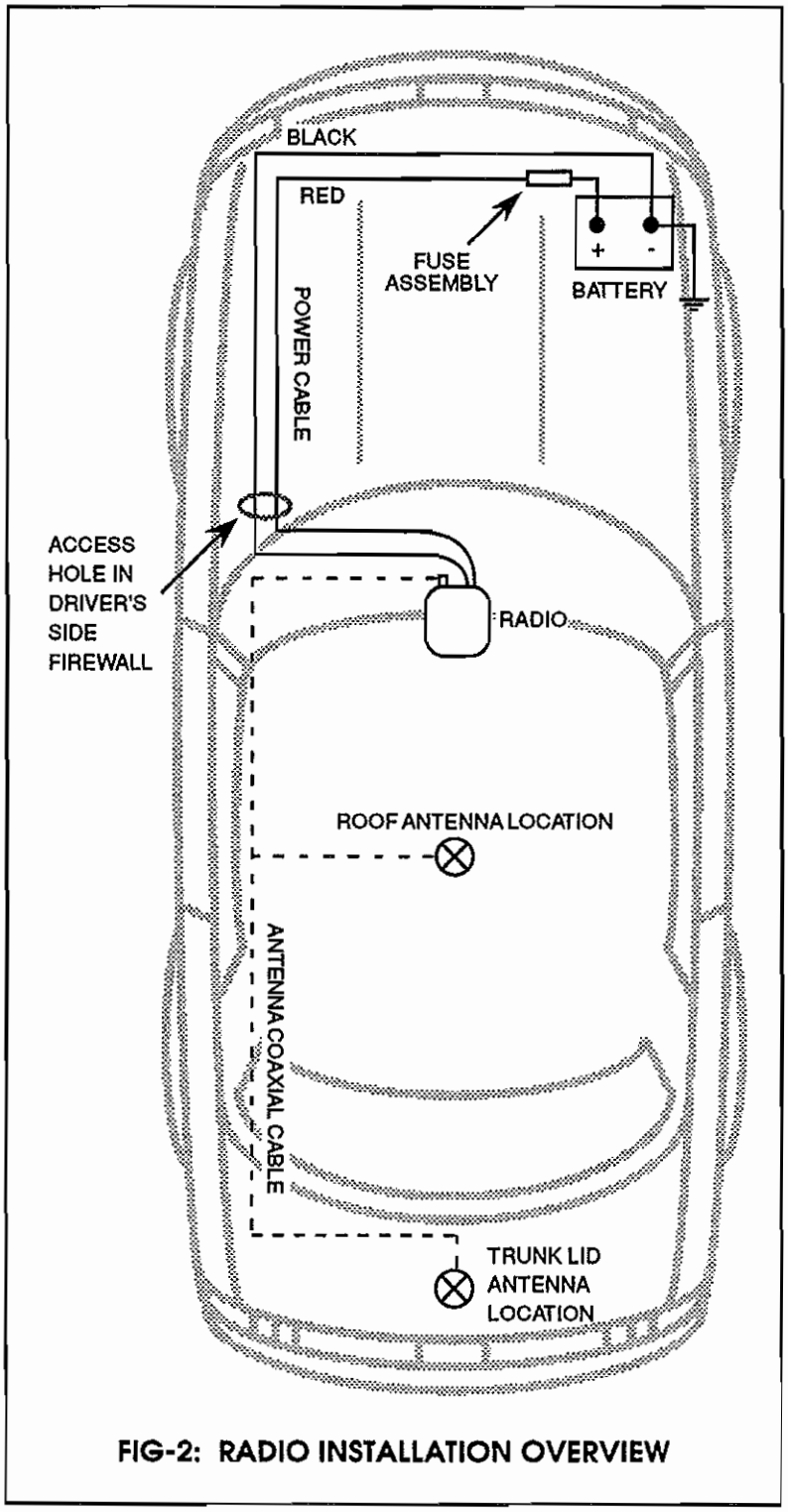

FIG-2: RADIO INSTALLATION OVERVIEW

3.3.2 OPTIONAL IGNITION SWITCH CONTROL

An ignition switch control may be installed (not included with the radio), which automatically applies power to the mobile when the car is started. Power is removed when the ignition is shut off.

TO INSTALL THE IGNITION CONTROL, READ THE INSTRUCTIONS BELOW:

Connect a 12 volt contactor to the power cable red lead, at the vehicle's battery. Refer to FIG-3. The contactor coil (Radio Shack # 275-218) should be driven through an in-line fuse from an accessory circuit or ignition circuit that is not powered during cranking (the fuse Ampere rating should be approximately twice the nominal current of the contactor - see the manufacturer's specifications). The contactor coil must return to the negative (-) battery terminal.

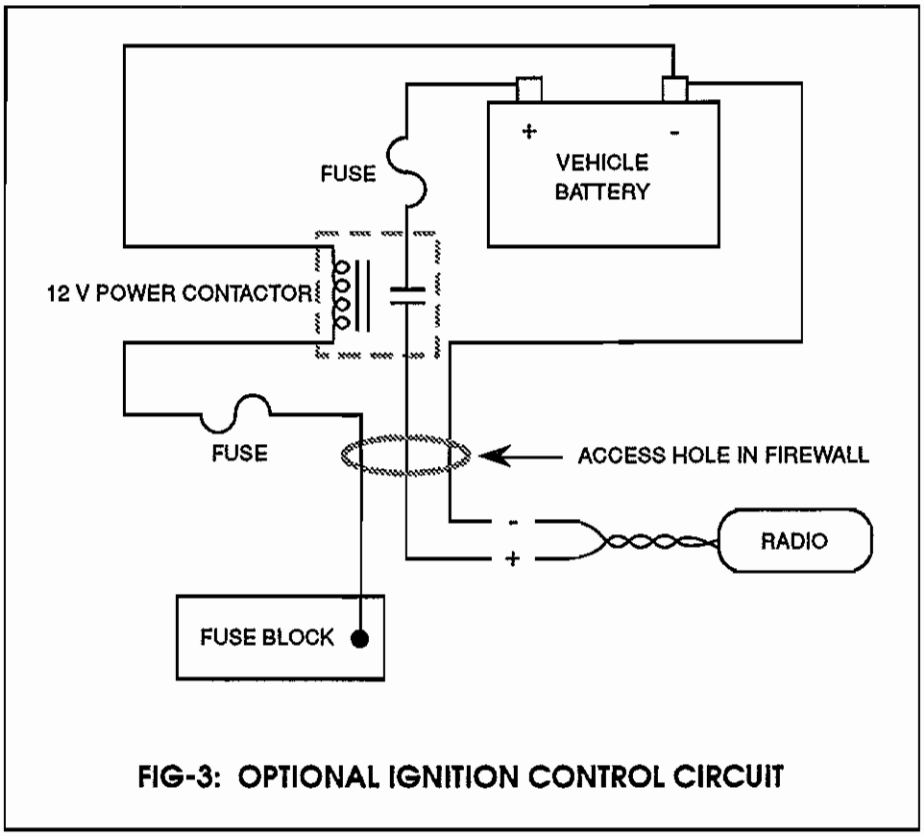

FIG-3: OPTIONAL IGNITION CONTROL CIRCUIT

3.3.3 ANTENNA

Mount the antenna according to the instructions included with the antenna kit. Avoid routing the antenna coaxial cable near vehicle wiring.

IMPORTANT: It is absolutely essential that the antenna be tuned to the proper frequency using a VSWR bridge or thru-line Wattmeter. This must be done after the antenna has been installed. Failure to do so will result in poor performance and damage to the radio.

3.3.4 RADIO MOUNTING BRACKET

TO INSTALL THE RADIO BRACKET, FOLLOW THE PROCEDURE BELOW:

1) Select a mounting location for the unit, either on the transmission hump or under the dash. See FIG-4.

2) Using the bracket as a template, mark drilling points on the mounting surface.

3) Centerpunch the marks you have made and drill a 9/64" hole at each.

4) Secure the bracket to the mounting surface with the #10 Phillips head sheet metal screws (4), lock washers (4) and flat washers (4) supplied.

   NOTE: Securing the radio mounting bracket with only two screws may be sufficient for some applications.

5) Place the radio in the mounting bracket and attach it with the rubber washers (2) and #10 hex nut screws (2) provided (refer to FIG-4).

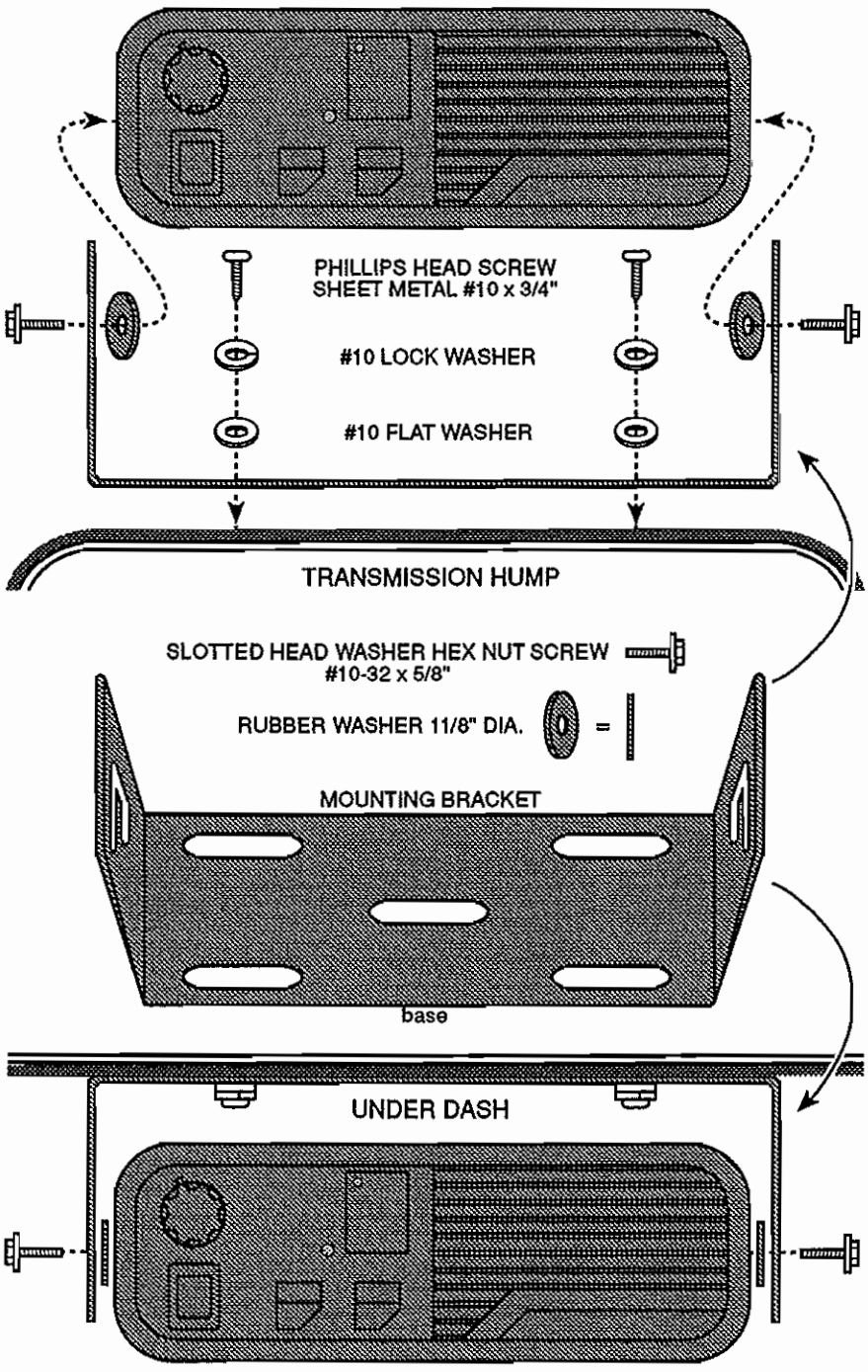

FIG-4: RADIO MOUNTING LOCATIONS

3.3.5 MICROPHONE HANG-UP CLIP

TO INSTALL THE HANG-UP CLIP, SEE THE STEPS BELOW:

1) Select a mounting location for the microphone hang-up clip, within easy reach of the mobile radio user.

2) Using the clip as a template, mark drilling hole positions on the mounting surface.

3) Centerpunch the marks you have made and drill a 7/64" hole at each.

4) Secure the clip with the #6 Phillips head self-tapping screws (2) provided.

5) Hang-up the radio microphone in its clip as shown in FIG-5.

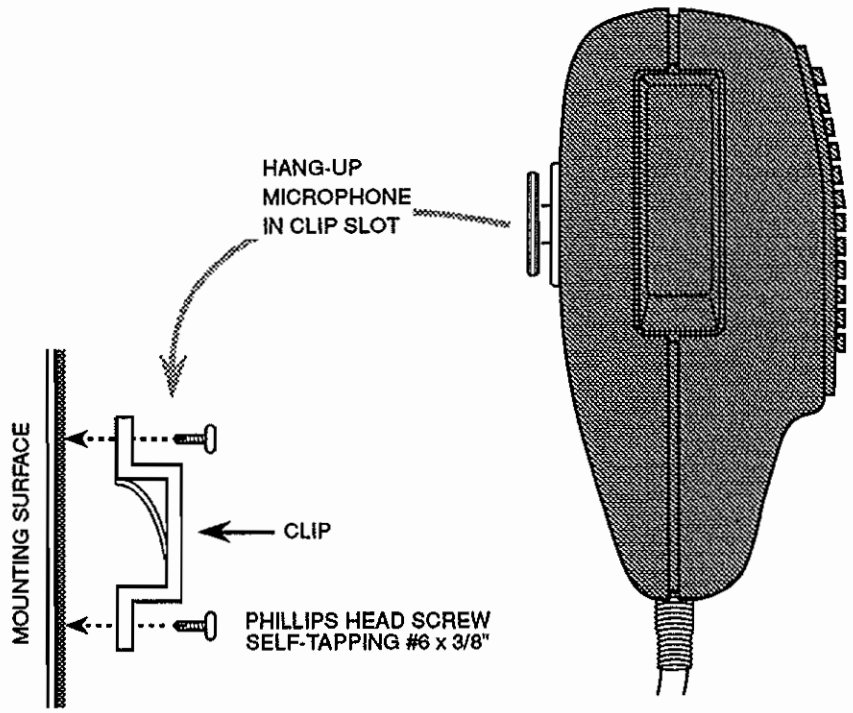

FIG-5: MICROPHONE HANG-UP CLIP

3.3.6 FINAL CONNECTIONS

1) Fasten the antenna cable connector to the mobile rear panel antenna connector. See FIG-6 below.

2) Plug the microphone cord into the radio front panel connector.

3) Plug the DC cable into the radio back panel power connector.

THE MOBILE IS NOW READY FOR OPERATION!

WARNING: When "jump starting" another vehicle, first disconnect power from the RPM mobile to avoid blowing the radio's internal reverse protection diode.

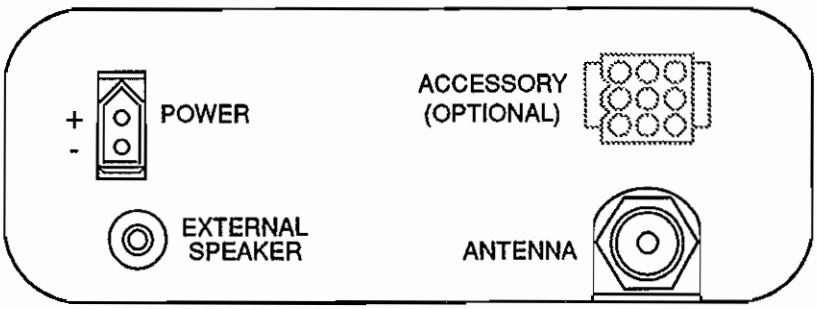

FIG-6: REAR PANEL

4. STANDARD FEATURES

- 16 RECEIVE/TRANSMIT CHANNELS
- THE FOLLOWING ARE PROGRAMMABLE ON A PER CHANNEL BASIS:

  RECEIVE FREQUENCY

  TRANSMIT FREQUENCY

  CHANNEL SCANNING (NORMAL/PRIORITY)

  TONE CODED SQUELCH (QUIET-CALL)

  DIGITAL CODED SQUELCH (DIGITAL QUIET-CALL)

  PAGING DECODE (PAGING QUIET-CALL)

  SPECIAL FEATURES (INCLUDING TX BUSY AND MONITOR LOCK OUT)
- NOISE BLANKER
- ROTARY ON-OFF/VOLUME CONTROL
- AUTOMATIC TRANSMITTER TIME-OUT
- EASY-TO-READ DIGITAL DISPLAY
- PUSH-BUTTON CHANNEL SELECTOR
- ON-HOOK PUSH-BUTTON MONITORING
- TRANSMIT/CHANNEL BUSY INDICATOR
- LONG-RANGE TRANSMITTER
- COMPACT SIZE
- RUGGED "UNI-BODY" ALUMINUM CASE
- MILITARY GRADE PRINTED CIRCUIT BOARD
- LOW DISTORTION MICROPHONE WITH COIL CORD
- MICROPHONE INDEPENDENT HOOK-SWITCH CIRCUIT
- HIGH VOLUME FRONT-FACING SPEAKER
- EXTERNAL SPEAKER JACK
- RADIO MOUNTING BRACKET AND HARDWARE
- MICROPHONE HANG-UP CLIP AND HARDWARE
- +12 VDC POWER CABLE WITH IN-LINE FUSE
- LIMITED ONE YEAR FACTORY WARRANTY
- RPM USER MANUAL

5. ACCESSORIES

5.1 ITEMS LIST

Programming kits are for use by authorized service/maintenance personnel only.

DESCRIPTION	ITEM NO.
Programming Kit for RPM and RTX radios (via PTT button)	RPT-PK
Includes: 1) 1 - RPM/RTX Programming and Operating Manual 2) 2 - Programming plugs (one for RPM, one for RTX) 3) 1 - Cloning cable (6-pin modular to 6-pin modular connector) 4) 2 - Cloning cable adaptors (6-pin modular connector to 3.5 mm plug)	
Programming Kit for RPM and RTX radios (via PC compatible computer)	RPT-PCPK
Includes: 1) 1 - Software installation instructions 2) 2 - Programming software diskette, 3.5" (5.25" format available) 3) 1 - PC/radio adapter cable (DB-25F connector to 6-pin modular connector) 4) 1 - PC cable adapter (6-pin modular connector to 3.5 mm plug)	
Factory programming of channels, codes and features is also optional.	
Hand Microphone (replacement)	RM-4
Desktop Microphone	RM-6
Hand Microphone with 12-button Touch Tone Keypad	RM-5TT
Power Supply (+12 VDC, desktop, with adaptor cable)	RPS-12
External Speaker with 10 ft. cord	RSP-5
Installation Kit for RPM radio (replacement)	RPMK-12
Includes: 1) 1 - Mobile radio mounting bracket 2) 1 - 12 VDC power cable with in-line fuse 3) 1 - Microphone hang-up clip 4) Hardware and installation instructions	
Trunking Interface Ready Option	OPT-TIR
Maintenance/Repair/Operating Manual (For Models RPM-150/RPM-450)	RPM-MRM-A
User Manual	RPM-UM

5.2 RM-5TT HAND MICROPHONE WITH TOUCH TONE KEYPAD

The optional RM-5TT is a combination hand microphone and Touch Tone keypad. Using the keypad, you can send Touch Tone digits. In conjunction with other equipment in your radio system, Touch Tone can enable you to:

1) Answer or originate telephone calls.

2) Page specific portable or mobile radios.

3) Control remote electrical equipment.

5.2.1 RM-5TT MICROPHONE FEATURES

- Ground-Independent Hook-switch Circuit (works on any surface)

  The microphone hang-up clip does not have to be grounded to enable coded squelch.

- Lighted Key Pad

- Sidetone

  Each key entry (dialing) sounds in the microphone speaker.

- Keypad Activated Transmit

  Pressing a key automatically activates the radio transmitter.

5.2.2 HOW TO USE THE RM-5TT MICROPHONE

When a Touch Tone key is pressed, the attached mobile radio transmitter is automatically activated and Touch Tones are broadcast with the radio signal.

1) When dialing, press the first digit of the number slightly longer - for about one second - to allow for any system delays.

2) As long as more digits are pressed within two seconds, the transmitter will remain on.

3) For best results, do not press the PTT switch on the side of the microphone while dialing.

For more details, refer to the manual provided with your telephone interconnect or other radio system equipment.

5.3 TRUNKING INTERFACE OPTION: OPT-TIR

IMPORTANT: THE PC PROGRAMMING KIT (RITRON MODEL: RPT-PCPK, VERSON 1.2 OR HIGHER) ALLOWS RPM RADIOS TO BE PROGRAMMED WITH A PC COMPATIBLE COMPUTER, AND IS REQUIRED TO PROGRAM TRUNKING CHANNELS. Additionally, the radio must be version 2 or higher. (The radio's microcontroller part number must be 314B0003 or higher.) The PC programmer kit includes cables and software.

This option for the RPM series mobile radio provides a factory-installed wiring harness that is designed to accommodate a trunking radio controller manufactured by a third party. The trunking controller is installed inside of the RPM radio case and connected in series with the RPM microphone PTT, channel selector, receiver audio squelch and other control and signaling points. The RPM mobile equipped with option OPT-TIR and an internal trunking controller is a fully integrated, user-friendly package.

6. RADIO CONTROLS & ACCESSORY CONNECTORS

6.1 ON-OFF/VOLUME CONTROL

The on-off/volume control knob switches power on and off, and adjusts volume. Refer to FIG-7.

6.2 CHANNEL DISPLAY

This digital display indicates the channel number -OR- during a channel contents readout, radio frequency/ Quiet Call data or a scan list.

6.3 CHANNEL SELECT BUTTON

You can move forward or backward through the channels. Pressing the channel button increases the channel number. Pressing and holding the channel button while toggling the monitor button decreases the channel number.

With the radio in operating mode, changing channels moves the digital display to the next programmed channel. With the unit in programming mode, the display goes to the next channel, programmed or empty.

6.4 SPEAKER

An internal speaker is mounted behind the front panel grille. An external speaker may be plugged into the rear panel external speaker jack, which disconnects audio to the front speaker.

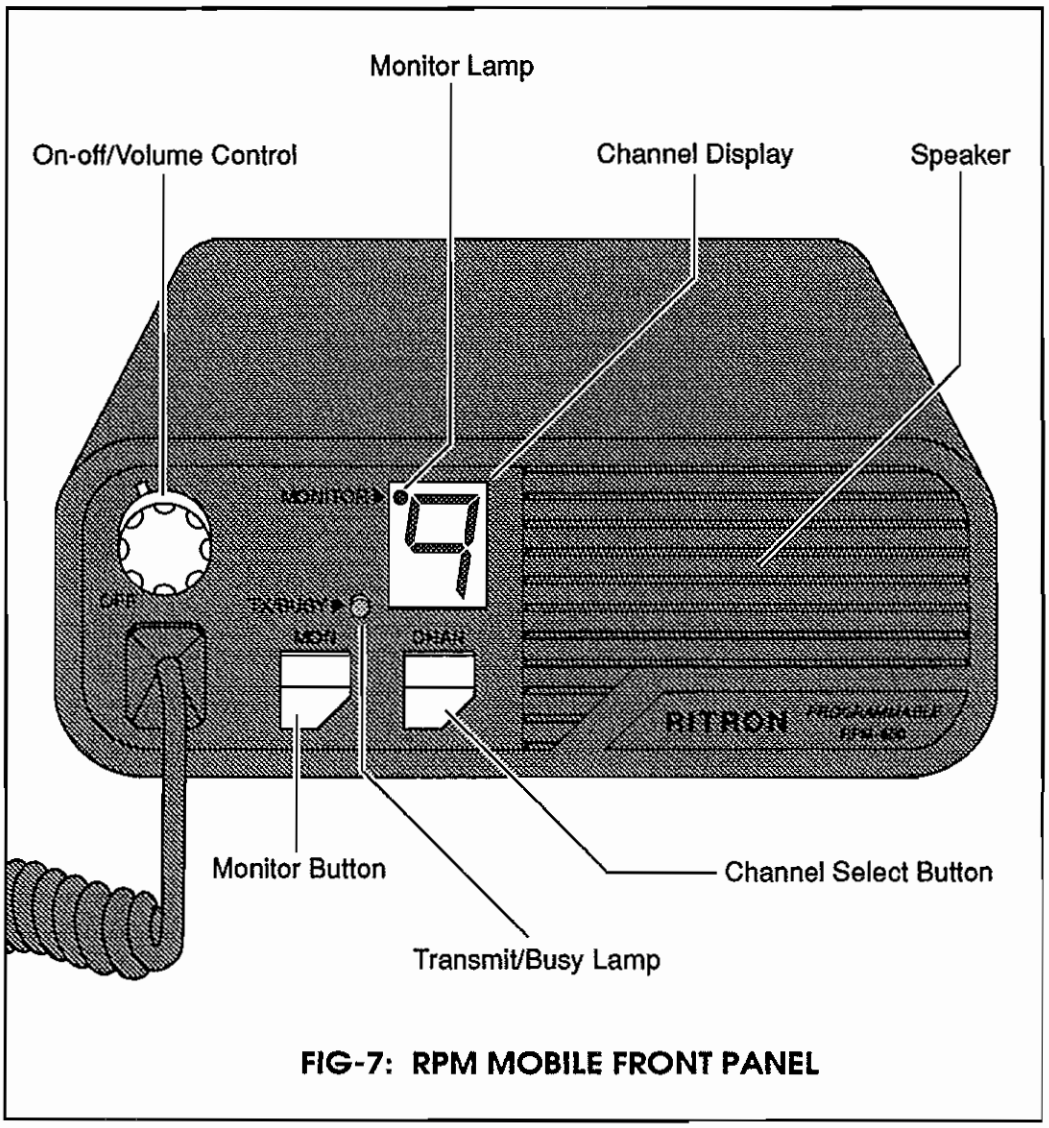

FIG-7: RPM MOBILE FRONT PANEL

6.5 MONITOR BUTTON

Pressing the monitor button lets you hear all radio traffic on the channel. The monitor button can be programmed to operate in different ways, as described on page 18.

6.6 MONITOR LAMP

The monitor lamp (FIG-7) lights when the unit is in monitor mode.

6.7 MICROPHONE HANG-UP

The microphone hang-up controls receiver squelch and monitor functions, through a hook-switch circuit inside of the microphone. The microphone is ON-HOOK when it is in its hang-up clip, as shown below. The microphone is OFF-HOOK when it is out of its hang-up clip.

6.8 PUSH-TO-TALK BUTTON

Pressing the microphone Push-To-Talk (PTT) button activates the radio transmitter (FIG-8). Talk into the microphone while the PTT is held down.

6.9 TX/BUSY LAMP

The transmit/busy lamp flashes red if the channel is in use, and stays lighted while the transmitter is activated.

6.10 MICROPHONE PLUG-IN

The microphone cord is connected to the radio front panel via a modular plug. When inserting the plug, align it with the lock-tab down. The cord may be removed by pressing up on the underside of the rubber cover to unseat the plug's lock-tab. Note that the cover is attached to the plug and should not be peeled off.

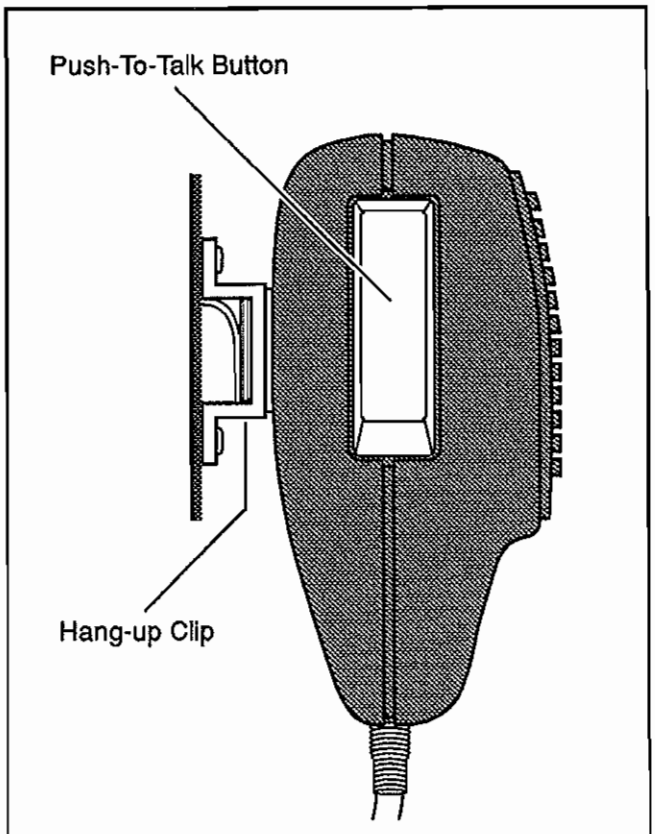

FIG-8: RPM MICROPHONE ON-HOOK

7. OPERATION

7.1 WHAT THE RADIO TONES MEAN

RITRON programmable radios respond to certain instructions by sounding a tone or series of tones. These tones can tell you whether a radio is working as you expect.

7.1.1 POWER ON SELF CHECK "OK"

Switch on the radio by rotating the on-off/volume control knob clockwise out of the "click" position. The unit then runs a quick "self test." When the internal system checks confirm basic functions, the radio sounds a brief "confirmation tone" to indicate that the unit is in *OPERATING MODE* and ready for use.

7.1.2 ERROR TONES

However, if the self test detects a diagnostic error, an error tone sounds. One low-pitched tone means that the radio microcontroller is not working as it should. Alternating tones (the second is lower pitched) indicate that the radio frequency synthesizer is malfunctioning. If you get one of these messages, turn off the radio and try again. If you cannot correct a problem, consult an authorized RITRON service facility or the RITRON Repair Department.

Repeating error tones occur if you press the Push-To-Talk button while a "Receive Only" channel is selected. This is because a "Receive Only" channel does not contain a transmit frequency, which must be present for the radio to broadcast. The error tone repeats until you release the PTT.

One low tone sounds and the transmitter automatically shuts off if you hold the PTT button down continuously for a specified time (normally, three minutes). This transmitter time-out feature may be turned off or adjusted with the optional PC programming kit (model RPT-PCPK).

7.2 ERROR DISPLAYS

In addition to sounding an error tone, the RPM mobile displays a diagnostic message if an error is detected during the power on self check. If an "E" followed by a "2" appears, the channel data is flawed and should be re-programmed. An "E" followed by a "1" signifies a microcontroller malfunction. If any of these messages occur, turn off the radio and try again. If you cannot correct a problem, consult an authorized service facility or the factory.

7.3 CHANNEL SELECTION (IN OPERATING MODE)

Refer to page 15, section 6.3. The radio emits a short tone each time you press the channel button, providing an audible marker. Additionally, when the channel number "rolls-over" from the highest to the lowest programmed channel number, a "double tone" sounds. This allows you to select channels without looking at the radio (useful if the mobile is installed under the driver's seat).

7.4 OPERATING MODES

7.4.1 RECEIVE MODE

The radio can receive broadcasts while the microphone Push-To-Talk button is not being pressed. Whether or not you hear these broadcasts depends upon the volume and squelch settings.

You can adjust the volume as follows. Rotate the on-off/volume control clockwise about one third. Then press and hold the monitor button. After about four seconds, you should hear a rushing sound (noise) and any broadcasts on the channel. Set the volume as desired. Restore squelch by releasing the monitor button.

7.4.1.1 SQUELCH

HOW TO:

Squelch Noise - the mobile automatically squelches noise.

Squelch All Broadcasts On The Channel Except Those Carrying Your Quiet Call Code - hang up the microphone and use the monitor button according to the Monitor section below.

Squelch removes background noise and mutes interference from other licensees. There are two types of squelch used in RITRON programmable radios. First is carrier squelch. This quiets noise and lets you hear all broadcasts on your channel strong enough for the radio to detect.

Second is Quiet Call (coded) squelch. When a radio frequency is shared by several licensees in an area, coded squelch keeps other licensees' broadcasts from disturbing users in your radio network. When you monitor, coded squelch is off and you can hear all traffic on the channel, similar to a telephone "party-line."

7.4.1.2 MONITOR

HOW TO:

Hear All On-channel Broadcasts Within Range - take the microphone off-hook OR leave the microphone on-hook and use the monitor button according to the Monitor section below.

IMPORTANT: In order for the radio to work as described below, the microphone must be on-hook. Taking the microphone off-hook activates monitoring.

The way the monitor button works is dealer-programmable. There are two options available. The first is MOMENTARY operation, which means that you must press and hold the monitor button to hear all broadcasts on the channel. Release to stop monitoring. Then, only messages that carry your Quiet Call code will sound.

The second option is TOGGLE operation. Toggle (press and release) the monitor button to switch between Quiet Call (coded) squelch and monitoring. For channels programmed with Paging Quiet Call, toggling the monitor button advances the radio to another monitor mode (see the PQC section below).

To determine which operating option is programmed for a radio, use the programming kit software, or, perform this test: 1) Select a standard transmit and receive channel that is not programmed with Paging Quiet Call or Channel Monitor Lock Out, 2) Press and release the monitor button, 3) Press and release the monitor button again.

If each time you pressed the monitor button you heard two tones, the unit is programmed for Momentary monitor operation. If you heard one tone and then two tones, or vice versa, the radio is programmed for Toggle monitor operation. This completes the test.

NOTE: Earlier model RPM radios do not sound multiple beeps when you change the monitor mode. Also in earlier models, Quiet Call squelch is automatically turned on when a channel is selected.

7.4.1.2.1 Monitoring A Channel Programmed With Quiet Call

IF THE RADIO IS PROGRAMMED FOR TOGGLE MONITOR OPERATION - To monitor a channel programmed with QC (Quiet Call) squelch, press and release the monitor button until you hear two beeps. Then, you can hear all radio traffic on the channel until you press the monitor button again (one beep sounds) to resume QC squelch.

IF THE RADIO IS PROGRAMMED FOR MOMENTARY MONITOR OPERATION - To monitor a channel programmed with QC squelch, press and hold the monitor button. You will hear two beeps, followed by all radio traffic on the channel. Release this button to restore Quiet Call squelch.

7.4.1.2.2 Monitoring A Channel Programmed With Paging Quiet Call

IF THE RADIO IS PROGRAMMED FOR TOGGLE MONITOR OPERATION - To monitor a channel programmed with QC and PQC (Paging Quiet Call), press and release the monitor button until you hear three beeps. Then, you will be able to hear all broadcasts on the channel.

If you press the monitor button again, one beep sounds. The radio will stay quiet unless paged. Unless programmed to work otherwise, the radio will not detect incoming messages coded with the channel's assigned QC code until you take the microphone off-hook (to transmit) and then replace the microphone. This allows you to answer a page and then have a two-way conversation with the caller who transmits your QC code.

After being paged, the radio must be reset to mute the receiver. To do this, return the microphone to its clip. Then press and release the monitor button until one beep sounds.

Pressing the monitor button again causes the radio to sound two beeps. Then, QC coded calls meant for you will be heard. If the radio receives a page, it will sound an alert tone. You will be able to hear and reply to QC messages without missing a page.

IF THE RADIO IS PROGRAMMED FOR MOMENTARY MONITOR OPERATION - To monitor a channel programmed with PQC, press and hold the monitor button. Three beeps will sound. You will hear any broadcasts on the channel until you release the monitor button. After that, you will hear only calls that carry your QC code.

The radio will ring if paged, regardless of the squelch status. However, anytime you press the monitor button, receive a page or take the microphone off-hook, PQC squelch is disabled. In order to quiet the radio until it is paged, switch to another channel and then back, or turn the radio off and then on.

When you press the monitor button and two beeps sound, you will hear pages and calls that carry your QC code.

7.4.2 TRANSMIT MODE

Before transmitting, make sure the channel is not in use. Check the transmit/busy lamp, which flashes if the channel is busy. This occurs regardless of any code signaling programmed.

To transmit, take the microphone off-hook. Press and hold the microphone Push-To-Talk button while you talk, with the microphone two or three inches away. Speak in a normal tone, since talking louder will not improve the listener's reception. Pressing the microphone PTT button activates the transmitter only if the channel was programmed with a transmit frequency.

RITRON programmable radios feature a transmitter time-out function, which automatically stops a continuous transmission that lasts for a specified time. (This time may be adjusted by authorized service personnel, using the RPT-PCPK programming kit.) The unit sounds a tone when the transmitter shuts off.

7.5 PROGRAMMABLE OPTIONS

RPM mobile radios may be operated with options that are programmed on a per channel basis, including Quiet Call code signaling, scanning and special features.

7.5.1 QUIET CALL CODE SIGNALING

HOW TO:

Turn On Quiet Call Squelch - hang up the microphone and use the monitor button according to the Monitor section.

Turn Off Quiet Call squelch - take the microphone off-hook or, use the monitor button according to the Monitor section.

Turn Off Quiet Call For Receive Mode - program the channel accordingly.

Code signaling lets you screen out broadcasts from other systems on the channel. RITRON pro-grammable radios come from the factory ready to operate with three communications industry standard signaling formats, including Quiet Call (QC), Digital Quiet Call (DQC) and Paging Quiet Call (PQC). Generally, "Quiet Call" refers to the entire family of RITRON signaling formats (QC, DQC and PQC), unless specified otherwise.

7.5.1.1 QUIET CALL (QC)

Quiet Call is RITRON's tradename for what the communications industry calls sub-audible tone, tone squelch or CTCSS (Continuous Tone Coded Squelch System). A group can use a unique Quiet Call code to avoid the bother of "radio traffic" from other licensees. Units with Quiet Call squelch turned on stay quiet unless they detect the appropriate code on a broadcast.

Channels programmed with Quiet Call automatically transmit a code with your voice when you press the PTT button. This allows your message to be heard. Note that other nearby licensees on your channel can hear your transmissions unless they have another code enabled.

7.5.1.2 DIGITAL QUIET CALL

Digital Quiet Call is RITRON's tradename for digital coded squelch. DQC works the same as QC, except that a digital code is broadcast with your call. Units programmed with the correct code "recognize" the call and allow the message to be heard.

7.5.1.3 PAGING QUIET CALL

7.5.1.3.1 General

Paging Quiet Call (PQC) is RITRON's tradename for its selective paging system. Each radio or group of radios may have a unique PQC code. Any channel that contains an operating frequency can be programmed with one of these codes. (A channel programmed with PQC may also contain a QC code.) With a PQC channel selected and the radio set to receive a page, the radio speaker stays quiet until the programmed PQC code is received. A ringing tone announces an incoming call. (If the radio is programmed for momentary monitor operation, the channel's assigned QC code will also open squelch.)

Each Paging Quiet Call code is broadcast as a unique pair of audible tones, with the first tone sent for one second, and the second tone for two seconds. PQC codes can be originated by a base station paging encoder, a telephone (via a RITRON RR-454 Repeater Plus/RP-200 system), or a RITRON programmable radio equipped with a Touch Tone encoder keypad.

7.5.1.3.2 The All-Call Code

Radios operated with PQC respond to a special All-Call code, as well as to their individual codes. This allows one page to be heard by all "PQC units" on the channel. The RPM mobile can transmit an All-Call page.

HOW TO:

Send An All-Call Page -

1) Select a channel programmed with Paging Quiet Call.

2) Turn off the radio.

3) Press and hold the PTT button while switching on the radio. Continue to hold down the PTT for six seconds.

4) Release the PTT.

5) Hold down the PTT and deliver your message.

NOTE: An All-Call page can be sent through a repeater, to call all radios on the channel that are set to receive a page. This is possible because the radio can now transmit All-Call paging and Quiet Call tones together. (Quiet Call activates the repeater.) An All-Call page can also be transmitted directly to other nearby units when the RPM mobile is switched to the "talk-around" frequency, which bypasses the repeater.

7.5.1.3.3 Call Indicator Reset

If the mobile radio has been selectively signaled by Paging Quiet Call or an accessory connected to the selective signaling input, the "C" that appears on the display may be cleared by pressing the monitor button or, by taking the microphone off-hook.

7.5.2 SCANNING (NORMAL/PRIORITY)

HOW TO:

Scan -

1) Hang up the microphone.

2) Select the channel that contains a scan list.

Stop Scanning - take the microphone off-hook or, press and release the channel or monitor button.

7.5.2.1 GENERAL

Scanning automatically lets you listen to broadcasts on different radio channels (frequencies). You may choose the channels to be scanned by creating a "scan list." This list of channel numbers is stored in a radio channel. **A channel cannot hold both a scan list and a radio frequency.**

7.5.2.2 HOW SCANNING WORKS

When you select a channel that contains a scan list, the radio pauses, sounds a tone, and then repeatedly checks each channel of the scan list in turn. Channels are scanned in the order that they were programmed into the list. When a broadcast is received on a channel being scanned, scanning stops to let you hear communications on that channel. Scanning resumes when the transmission ends.

Using the monitor button does not interrupt scanning. Additionally, scanning automatically continues after you make a call and hang-up the microphone.

NOTE: When you call another unit, say which channel you are using. Then other users can determine on which channel to reply.

7.5.2.3 PRIORITY SCANNING

Priority scanning lets you monitor other channels without missing a call on your priority channel, which the radio periodically checks for activity even while scanning has stopped on another channel. Priority scanning works only if the scan list programmed is a Priority Scan List, not a Normal Scan List. (You can find out which kind of scan list is programmed for a channel by doing a "Channel Contents Readout.")

NOTE: The radio must be in programming mode in order to readout channel data.

7.5.2.4 BUSY CHANNEL DELETE

If a channel in the scan list is so busy that you want to temporarily delete that channel from the list, press the monitor button while scanning is stopped on the channel to be deleted. (The priority channel in a Priority Scan List is an exception, and cannot be removed.) The monitor status will not change. The deleted channel will be skipped in the scan list until you switch channels. You may delete more than one channel in the list.

The microphone must be in its hang-up clip for scan to function. If the microphone is off-hook, any channel selected that holds a scan list is skipped.

BUSY CHANNEL DELETE (CON'T.)

While the mobile scans, each channel number of the scan list is displayed in turn. If you take the microphone off-hook OR press the channel or monitor button, scanning stops - on the last active channel for Normal Scan Lists, or on the priority channel for Priority Scan Lists. (However, whether the radio stops on the last active or priority channel is programmable using the optional programming kit.) To continue scanning, hang up the microphone.

7.5.3 SPECIAL FEATURES

Each radio channel can be "dealer or factory" programmed to operate with any combination of special features. The features listed below are "PTT programmable." Other features are available, but require a PC to set. (For a list, see section 8.10.)

7.5.3.1 RECEIVER SQUELCH TIGHTNER FACTOR

This feature reduces distant "co-channel" and other interference for channels that are not programmed with Quiet Call.

Carrier squelch is set for maximum sensitivity at the factory, but may be adjusted (by authorized service personnel) to mute weak signals.

7.5.3.2 CHANNEL MONITOR LOCK OUT

This function may be programmed to keep the radio user from listening to other licensees on a shared channel. The transmit/busy lamp indicates whether the channel is busy. QC or DQC must be used with this option.

7.5.3.3 BUSY CHANNEL TRANSMIT INHIBIT

Busy Channel Transmit Inhibit keeps the radio from broadcasting if the channel is busy, and is often used in conjunction with Channel Monitoring Lock Out. If you press the PTT when the channel is busy with a signal not intended for your radio (not carrying your Quiet Call code), this feature sounds a "busy" tone in the speaker and keeps the transmitter turned off.

7.5.3.4 REDUCED TRANSMIT POWER

This feature allows for reduced transmitter power on individual channels, which might be required by the radio owner's FCC license.

7.5.3.5 PAGING QUIET CALL TRANSPOND

If you receive a page and do not answer within three seconds, this feature automatically keys your radio's transmitter and sends an "acknowledgement" tone to the calling party.

7.6 TROUBLESHOOTING

If you have trouble operating the radio, review the radio controls and operation sections. If you think the radio is malfunctioning, check the table below.

	PROBLEM	POSSIBLE SOLUTIONS
7.6.1	**GENERAL**	
	Front panel lamps do not light.	Replace the DC power cable fuse.
		The DC cable is not properly connected. (Refer to the installation section of this manual.
	Reception is poor.	The antenna is installed incorrectly - see the antenna installation guide.
		The antenna is damaged.
		Move to a different location. (See note 1 on page 25.)
	"Noise" sounds in the radio speaker.	Press and release the monitor button. (Note 2.)
	You cannot hear calls from other radios.	Press and release the monitor button. (Note 2.)
		Be certain that your radio receives on the same frequency as the caller transmits. (Note 3.)
	Your calls cannot be heard in other radios.	Make sure that your radio transmits on the receive frequency of the radio(s) you want to call. (Note 3.)
7.6.2	**ERROR TONES**	
	An error tone sounds when the radio is first switched on.	See page 17, "Error Tones."
	Repeating tones occur when you press the PTT button.	The channel is "Receive Only," or the TX Inhibit feature is on. (Note 4.)
	An error tone sounds while you are talking (and the transmitter shuts off).	The Transmit Time Out Timer has ended your broadcast. See page 17, "Error Tones."
7.6.3	**QUIET CALL (QC, DQC AND PQC)**	
	You cannot screen out calls from users outside of your Quiet Call group.	Make sure that the channel is programmed with Quiet Call.
		Toggle the monitor button to select Quiet Call (coded) squelch. (Note 2.)

TROUBLESHOOTING

PROBLEM	POSSIBLE SOLUTIONS
QUIET CALL (CON'T.)	
You cannot hear Quiet Call messages while in Quiet Call (coded) squelch.	Confirm that the channel is programmed to detect the same code as the calling radio(s) transmits. (Note 5.)
Others in your Quiet Call group cannot hear your Quiet Call messages.	Verify that you transmit the same code as the radio(s) you call are programmed to detect. (Note 5.)

7.6.4

NOTES

1) Reception can often be improved by travelling a short distance. The strength of a radio broadcast and therefore its coverage is decreased by distance and obstructions (natural and man-made). This includes hills, valleys, foliage, buildings, basements and other metal or concrete structures. The best range and coverage is obtained across flat terrain, with line-of-sight visibility and no obstructions.

2) If noise sounds in the radio speaker, press and release the monitor button to activate carrier squelch. Otherwise, this button toggles Quiet Call (coded) squelch on and off.

3) If you want to hear a call, you must select a channel that is programmed to receive the caller's transmit frequency. If you want to call another unit, you must select a channel that is programmed to transmit the other radio's receive frequency. However, if you use a repeater, your channel must be programmed to work with the repeater's transmit and receive frequencies. (A channel can hold two separate radio frequencies, one for receive, the other for transmit.)

4) If you get repeating error tones when you press the PTT, the channel might be programmed for "Receive Only." If so, the channel does not contain a transmit frequency, and cannot be used to transmit. Repeating tones also sound if the Busy Channel Transmit Inhibit feature is activated and another user's radio signal is present on the channel.

5) In order for radios to communicate using Quiet Call, they must be programmed with the same Quiet Call code. Each code is unique, and your radio will respond only to the code programmed for the channel selected. Note that a channel may have been programmed to transmit one code, and detect another code.

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Repair Department
505 West Carmel Drive
Carmel, IN 46032
Phone: 317/846-1201
FAX: 317/846-4978

8. PROGRAMMING THE RADIO

8.1 SETUP FOR PROGRAMMING WITH THE PUSH-TO-TALK

1) Switch off the radio.

2) Remove the mobile's front panel.

   A) Using your thumb and index finger, pull off the volume control knob.

   B) Remove the front panel by carefully lifting the plastic hold-down flaps at the sides of the unit with a dime or similar object.

3) Insert the SERVICE PROGRAMMING KEY into its socket as shown on the next page, in the programming position.

4) Replace the unit's front panel and on-off/volume control knob.

5) Connect the mobile to a +12 VDC source and turn on the radio.

   The speaker will sound a "triple tone" (three short ascending tones) to indicate that the mobile is in *PROGRAMMING MODE.*

8.2 RETURNING TO NORMAL OPERATION

AFTER YOU FINISH PROGRAMMING, follow the steps below:

1) Switch off the mobile.

2) Remove the radio's front panel.

3) Remove the programming key.

4) Replace the unit's front panel and on-off/volume control knob.

5) Turn on the radio to resume normal operation.

   The speaker will emit a short tone to indicate that the unit has successfully completed a self-test and is in *OPERATING MODE.*

8.3 CHANNEL SELECTION (IN PROGRAMMING MODE)

Pressing and releasing the channel select button advances the digital display to the next channel. The speaker emits a confirmation tone each time you press the channel button, providing an audible marker. Additionally, when the channel select "rolls-over" from the highest channel number to channel 0, a "double tone" sounds.

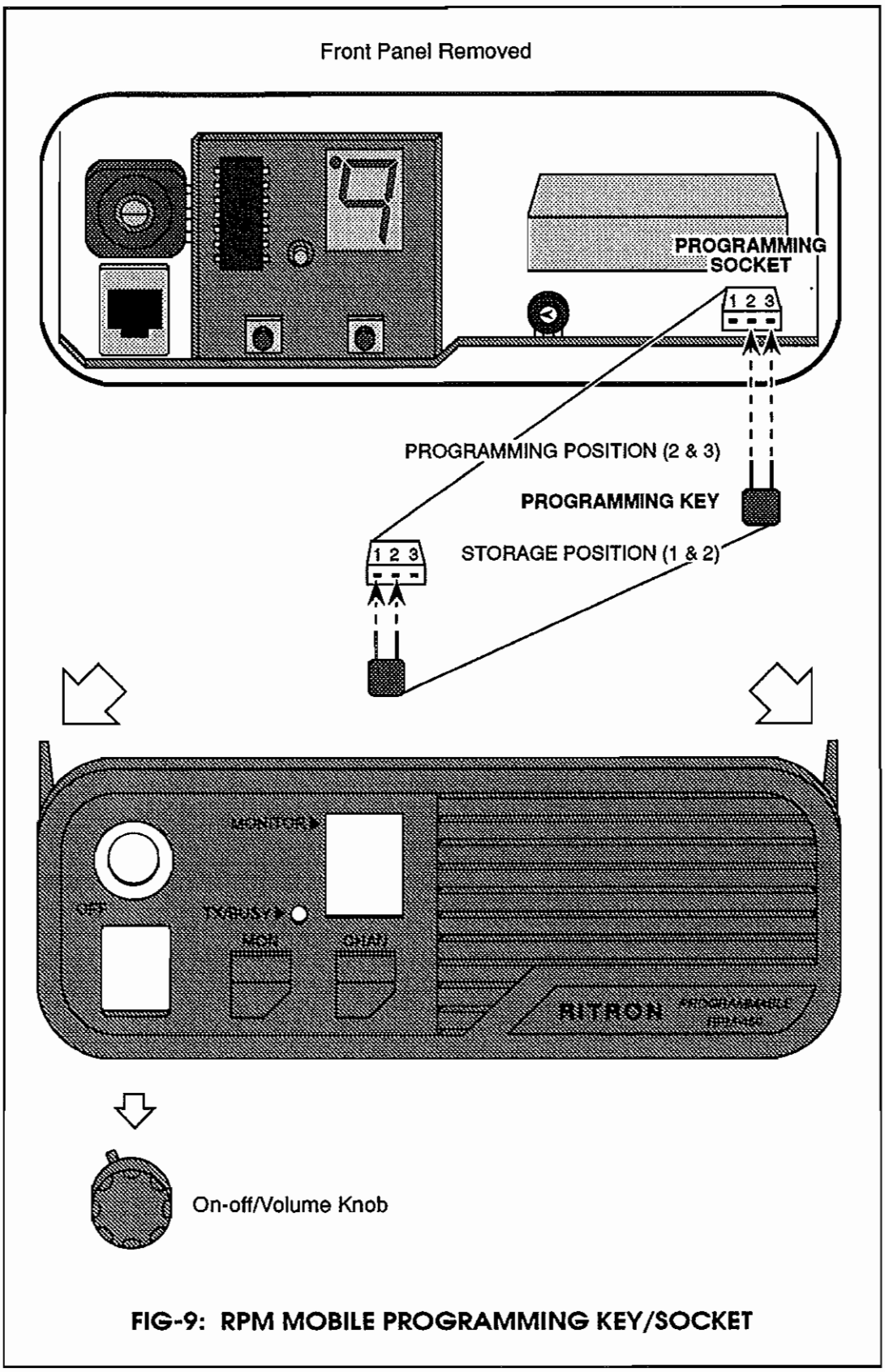


FIG-9: RPM MOBILE PROGRAMMING KEY/SOCKET

8.4 CHANNEL CONTENTS READOUT (IN PROGRAMMING MODE)

8.4.1 TO DETERMINE DATA ALREADY PROGRAMMED

1) Select the channel you want to readout.

2) Press and release the monitor button.

The radio then responds in one of two ways:

Case #1 - When the monitor button is pressed and released and the channel is EMPTY, the unit signals with a triple tone. The channel is ready to be programmed.

Case #2 - When the monitor button is pressed and released and the CHANNEL IS ALREADY PROGRAMMED, the readout begins. A channel may contain radio frequency/Quiet Call data. Or, it may hold a scan list. However, a channel may not contain both.

8.4.1.1 RADIO FREQUENCIES AND QUIET CALL CODES

The unit presents frequency/code data in this order: 1) The RX (receive) frequency, 2) The TX (transmit) frequency and, 3) any Quiet Call code. The channel number then returns.

RX and TX frequencies are six digits each. Quiet Call (QC) codes are two digits, and Digital Quiet Call codes three digits. Paging Quiet Call codes, also three digits, appear with a QC prefix (for a total of five digits).

Each frequency or code is displayed one digit at a time, while the speaker emits a number of tones equal to the digit shown. A pause in the tones separates digits. A dash (-) on the channel display and a longer pause between tones separates the RX frequency from the TX frequency, and the TX frequency from the code.

EXAMPLE: A channel is already programmed with 030.125 MHz for both the RX and TX frequencies, and with "07" for the QC code. When the monitor button is pressed and released:

1) The channel display shows a "0," while the unit sounds ten tones.

2) After a pause of about one second, a "3" appears, while the unit emits three more tones.

3) This process continues, one digit of the frequency at a time, until the last digit of 030.125, "5," is indicated.

4) Following the last digit of the RX frequency displayed, a dash appears.

5) The TX frequency is then indicated in the same manner as the RX frequency.

6) Following the last digit of the TX frequency displayed, a dash appears.

7) Next, the QC code is represented like the RX and TX frequencies. A "0" appears first, accompanied by ten short tones. A "7" is displayed next while seven tones sound.

8) After the frequencies and code programmed for the channel have been indicated, the front panel displays a dash (-), followed by the channel number. The unit sounds a triple tone.

8.4.1.2 SCAN LISTS

A scan list readout starts with an "8," followed by a "1" OR a "2," and then each channel to be scanned. The first digit ("8") means that the channel holds a scan list; the second digit (a "1" or a "2") identifies the list as a Priority ("1") or Normal ("2") Scan List. The first two digits and the channels of the scan list are presented one at a time - the speaker issues a number of tones equal to the digit/channel.

NOTE: Readouts for scan lists that contain an odd number of channels indicate an extra alphanumeric character at the end of the list. A "F" follows the last channel, although the radio does not actually scan channel F (16).

Channel F (16) cannot be included in a scan list. However, F can hold a scan list.

8.4.1.3 SPECIAL CASES

8.4.1.3.1 "Receive Only" Channels

If the channel is "Receive Only," the channel display shows the transmit frequency as six ones ("1"), each "1" accompanied by a tone.

8.4.1.3.2 Quiet Call Codes

- If no Quiet Call code is programmed, only a dash (-) and the channel number follows the RX and TX frequencies.
- Quiet Call codes may include an optional extra digit that conveys a special instruction to the radio's microcontroller:

  A "9" added to the end of a QC or DQC entry turns off Quiet Call squelch during receive (and makes the channel "encode only").

  A "1" added to the end of a DQC entry "inverts" the code when the radio receives. A "2" inverts the DQC code when the radio transmits.

  Two separate Quiet Call codes can be stored on one channel. One QC code is for receive mode, the other for transmit.

  During a channel readout, the two Quiet Call codes follow the receive and transmit frequencies. The first two-digit QC code is for decode, the second for encode. An "8" comes after the second code to identify the entry for the radio's microcontroller.

8.4.1.4 SPECIAL FEATURES

A channel contents readout does not indicate any special features programmed, such as the receiver squelch tightner factor.

NOTE: Special features may be read using RITRON's optional PC programming kit (model RPT-PCPK) and a PC compatible computer. The programming software included in the kit allows you to print out a complete list of each channel's data.

8.4.2 TO STOP A CONTENTS READOUT

Press and release the monitor button during the readout. Or, change channels.

The channel contents readout sequence then halts and the speaker sounds a triple tone. The radio is ready for any further instructions.

8.5 ERASING CHANNEL CONTENTS

It is not necessary to erase the channel contents before programming new data. Entering a new radio frequency or scan list automatically clears the channel of all data.

IMPORTANT: Do not erase all radio channels - leave at least one channel programmed.

8.5.1 TO ERASE ALL CONTENTS

1) Select the channel you want to erase.

2) Press and hold the PTT (Push-To-Talk) button.

3) Press and release the monitor button.

4) Release the PTT. A triple tone signals that all data for the channel has been erased.

8.5.2 TO ERASE ONLY QUIET CALL CODE DATA

HOW TO:

Erase A Quiet Call Code-

1) Enter "00" (or "44," which is No Tone).

2) Press and release the monitor button.

---

1) Select the channel you want to clear of Quiet Call data.

2) Program "00."

   A) Enter a "0," by pressing and releasing the PTT button ten times WITHOUT PAUSING.

      The radio emits a tone to indicate that it is ready for the next digit.

   B) Enter another "0."

   C) Press and release the monitor button.

      The radio sounds a triple tone when Quiet Call data has been erased.

8.6 PROGRAMMING NEW CHANNEL CONTENTS WITH THE PUSH-TO-TALK

CHANNEL CONTENTS ARE PROGRAMMED ONE DIGIT AT A TIME, by pressing and releasing the microphone's PTT (Push-To-Talk) button a number of times equal to the digit's value. A pause of more than about one second causes the radio's microcontroller to immediately accept the digit as complete. The speaker then sounds a "ready" tone prompt.

CHANNEL CONTENTS ARE STORED BY PRESSING AND RELEASING THE MONITOR BUTTON. When the monitor button is pressed to store valid data, the speaker emits a "triple tone."

8.6.1 GUIDELINES

- Follow the setup and RETURNING TO NORMAL OPERATION instructions on page 26.
- THE RADIO'S OPERATING BAND is determined by model, as explained on page 3. The radio will not operate on frequencies outside of the limits specified (although the radio will allow you to program frequencies in the wrong band).
- While entering a digit, DO NOT pause after releasing the PTT. A pause tells the radio that you are finished entering the digit.
- To enter the digit "0," press the PTT ten times.
- To enter the following channels into a scan list, press the PTT this number of times:
  A = 11 b = 12 c = 13 d = 14 E = 15 F = 16
- YOU MUST ENTER ALL RADIO FREQUENCIES AS SIX DIGITS. You cannot skip zero ("0") digits. For instance, you must enter a zero for each of the last two digits in 031.150 MHz.

  For 12.5 KHz offset channels (7-digit frequencies), enter only the first six digits. Offset channels cannot be programmed for standard VHF models.
- You may add or change a Quiet Call code for a channel without erasing the radio frequencies, simply by programming the new code.
- Programming a radio frequency: 1) erases any Quiet Call codes saved on the channel and, 2) causes any special features stored on the channel to default to their standard settings (defaults for PTT programmable special features are called out on page 39).

8.6.2 ENTRY MISTAKES

8.6.2.1 INVALID ENTRIES

AN ERROR TONE MEANS THAT YOU HAVE TRIED TO SAVE AN INVALID ENTRY. No programming changes are made. The triple tone follows to indicate that the radio is ready for another entry. Attempting to save seven digits for a radio frequency, for instance, provokes an error tone (remember that all radio frequencies are entered as six digits). THE TABLE ON THE NEXT PAGE GIVES VALID ENTRIES.

8.6.2.2 PRESSING THE PTT

If you press the PTT seven times when you intended six, for example, or just lose count, DO NOT press the monitor button to store channel data. To start over without saving any data, move to another channel and then back again.

8.6.3 VALID PROGRAMMING ENTRIES

THE TABLE BELOW LISTS VALID PROGRAMMING ENTRIES. If you get an error tone while programming, you probably tried to save an INVALID entry. Check the table. The example column reflects only a few of the radio frequencies and codes available.

The radio's microcontroller counts the number of digits in an entry to determine what you are programming (for exceptions, see note 3). This table shows how the radio interprets the number of digits in an entry.

NUMBER OF DIGITS	INTERPRETATION	EXAMPLE
1	Carrier Squelch Tightner Factor 0-7	3
2	QC (Quiet Call)	12
3	QC Encode Only	129
3	DQC (Digital Quiet Call)	071
4	DQC Encode Only	0719
4	DQC with Inversion	0711
5	QC decode and QC encode (see note 6)	12208
5	QC and PQC (Paging Quiet Call)	12323
5	Special Features	92212
6	RX/TX Frequency	030125
7	No Interpretation	-------
8	RX/TX Frequency and QC	03012512
9	RX/TX Frequency and QC Encode Only	030125129
9	RX/TX Frequency and DQC	030125071
10	RX/TX Frequency and DQC Encode Only	0301250719
10	RX/TX Frequency and DQC with Inversion	0301250711
11	RX/TX Frequency, QC and PQC	03012512323
12	RX Frequency and TX Frequency	041500044125
13	No Interpretation	----------
14	RX Frequency, TX Frequency and QC	04150004412512
15	RX Frequency, TX Frequency and QC Encode Only	041500044125129
15	RX Frequency, TX Frequency and DQC	041500044125071
16	RX Frequency, TX Frequency and DQC Encode Only	0415000441250719
16	RX Frequency, TX Frequency and DQC with Inversion	0415000441250711
17	RX Frequency, TX Frequency, QC and PQC	04150004412512323
18	RX Frequency, TX Frequency, QC and PQC, Encode Only	041500044125123239

NOTES

1) Where "RX/TX Frequency" appears in the interpretation column, the same radio frequency is used for both receive and transmit.

2) For "Receive Only" channels, the transmit frequency is entered as six ones ("111111").

3) An entry that begins with an "8" is interpreted as a scan list. A "9" introduces special features.

4) A channel must already contain a radio frequency before special features can be programmed for that channel.

5) A "9" added to the end of a QC or DQC entry turns off Quiet Call coded squelch. Quiet Call then operates in transmit mode only ("encode only").

NOTES (CON'T.)

6) An "8" suffix means that two separate QC codes are used. The first QC code entered is for decode, the second for encode.

7) A "1" added to the end of a DQC entry inverts the code for receive (RX). A "2" inverts the code for transmit (TX). The examples in the table use the RX inversion.

8) PQC codes that include six digits total (a 2-digit QC code, 3-digit PQC code, plus the encode only "9") may be entered only as shown in the table. Otherwise, the radio will interpret the 6-digit PQC entry as a radio frequency.

8.6.4 BASIC PROGRAMMING INSTRUCTIONS

TO PROGRAM:

8.6.4.1 The Same Frequency For RX and TX

1) Select the channel you want to program.

2) Enter the 6-digit radio frequency, one digit at a time. Remember to pause between digits.

3) Press and release the monitor button.

8.6.4.2 Different Frequencies For RX and TX

1) Select the channel you want to program.

2) Enter the 6-digit RX frequency, one digit at a time. Pause between digits.

3) Enter the 6-digit TX frequency, one digit at a time.

4) Press and release the monitor button.

8.6.4.3 For "Receive Only"

IMPORTANT: For a "Receive Only" channel, six ones ("111111") are programmed as the transmit frequency. This disables the transmitter for that channel.

1) Select the channel you want to program.

2) Enter the 6-digit RX frequency, one digit at a time. Pause between digits.

3) Enter the "No Transmit" sequence ("111111"), one digit at a time.

4) Press and release the monitor button.

8.6.4.4 A Quiet Call Code

1) Select the channel you want to program.

2) Refer to the Quiet Call code chart on the next page and find the QC code for the tone desired.

   For example, to program a tone of 203.5 Hz, locate "203.5 Hz" under the "Frequency (Hz)" column. The corresponding QC code for 203.5 Hz ("32") appears on the same line under the QC code column.

3) Enter the 2-digit QC code, one digit at a time. Remember to pause between digits.

4) Skip this step unless you want QC to operate in transmit mode only (encode only).

   IF SO, enter a "9."

   The radio will transmit the QC code, but will "receive" any on-frequency signal, regardless of Quiet Call squelch.

5) Press and release the monitor button.

QUIET-CALL CODES AND FREQUENCIES
(CODES 39 - 51 AVAILABLE FOR REV. 4 RADIOS ONLY)

QC Code	Tone Code	Freq. (Hz)	QC Code	Tone Code	Freq. (Hz)	QC Code	Tone Code	Freq. (Hz)
01	XZ	67.0	18	3Z	123.0	36	–	233.6
02	XA	71.9	19	3A	127.3	37	–	241.8
03	WA	74.4	20	3B	131.8	38	–	250.3
04	XB	77.0	21	4Z	136.5	39	–	69.4
05	SP	79.7	22	4A	141.3	40	–	159.8
06	YZ	82.5	23	4B	146.2	41	–	165.5
07	YA	85.4	24	5Z	151.4	42	–	171.3
08	YB	88.5	25	5A	156.7	43	–	177.3
09	ZZ	91.5	26	5B	162.2	44	–	No Tone
10	ZA	94.8	27	6Z	167.9	45	–	183.5
11	ZB	97.4	28	6A	173.8	46	–	189.9
12	1Z	100.0	29	6B	179.9	47	–	196.6
13	1A	103.5	30	7Z	186.2	48	–	199.5
14	1B	107.2	31	7A	192.8	49	–	206.5
15	2Z	110.9	32	M1	203.5	50	–	229.1
16	2A	114.8	33	–	210.7	51	–	254.1
17	2B	118.8	34	–	218.1	52	Do Not Use	
			35	–	225.7	53	Programmable	

DIGITAL QUIET-CALL CODES

Normal	Invert	Normal	Invert	Normal	Invert	Normal	Invert
023	047	143	412	315	423	532	343
025	244	152	115	331	465	546	132
026	464	155	731	343	532	565	703
031	627	156	265	346	612	606	631
032	051	162	503	351	243	612	346
043	445	165	251	364	131	624	632
047	023	172	—	365	125	627	031
051	032	174	074	371	734	631	606
054	413	205	263	411	226	632	624
065	271	223	134	412	143	654	743
071	306	226	411	413	054	662	466
072	245	243	351	423	315	664	311
073	506	244	025	431	723	703	565
074	174	245	072	432	516	712	114
114	712	251	165	445	043	723	431
115	152	261	732	464	026	731	155
116	754	263	205	465	331	732	261
125	365	265	156	466	662	734	371
131	364	271	065	503	162	743	654
132	546	306	071	506	073	754	116
134	223	311	664	516	432		

TO PROGRAM:

8.6.4.5 A Digital Quiet Call Code

IMPORTANT: Digital Quiet Call cannot be used on the same channel with Quiet Call or Paging Quiet Call.

1) Select the channel you want to program.

2) Refer to the Digital Quiet Call code chart on the previous page and select a code ("Normal" or the "Invert" of normal).

3) Enter the 3-digit DQC code, one digit at a time. Pause between digits.

4) Skip this step unless you want DQC to operate in transmit mode only (encode only).

   IF SO, enter a "9."

5) Skip this step unless you want to invert the code in either receive or transmit mode.

   If you HAVE NOT programmed DQC to operate in transmit mode only (step 4), you may enter a digit that instructs the radio to invert the DQC code.

   A) TO RECEIVE the invert of the DQC code, enter a "1."

      The radio will "receive" on-frequency signals that carry the DQC code invert, and transmit the DQC code entered in step 3.

   B) TO TRANSMIT the invert of the DQC code, enter a "2."

      The radio will transmit the DQC code invert, and "receive" on-frequency signals that carry the DQC code entered in step 3.

6) Press and release the monitor button.

8.6.4.6 A Paging Quiet Call Code

IMPORTANT: The PQC code cannot be programmed without entering a QC code prefix at the same time. To use PQC without QC, program "44" for the 2-digit QC prefix.

1) Select the channel you want to program.

2) Enter a 2-digit QC code, one digit at a time. Pause between digits.

3) Refer to the Paging Quiet Call code chart on the next page and select a PQC code.

   NOTE: Code 444 is the All-Call code.

4) Enter the 3-digit PQC code, one digit at a time.

5) Skip this step unless you want QC to operate in transmit mode only (encode only).

   IF SO, enter a "9."

6) Press and release the monitor button.

PAGING QUIET CALL CODES AND FREQUENCIES

PQC Code	Std. Code	Lo Freq. (Hz)	Hi Freq. (Hz)	PQC Code	Std. Code	Lo Freq. (Hz)	Hi Freq. (Hz)
111	300	330.5	569.1	311	340	410.8	569.1
112	301	330.5	600.9	312	341	410.8	600.9
113	302	330.5	634.5	313	342	410.8	634.5
114	303	330.5	669.9	314	343	410.8	669.9
121	304	330.5	707.3	321	344	410.8	707.3
122	305	330.5	746.8	322	345	410.8	746.8
123	306	330.5	788.5	323	346	410.8	788.5
124	307	330.5	832.5	324	347	410.8	832.5
131	310	349.0	569.1	331	350	433.7	569.1
132	311	349.0	600.9	332	351	433.7	600.9
133	312	349.0	634.5	333	352	433.7	634.5
134	313	349.0	669.9	334	353	433.7	669.9
141	314	349.0	707.3	341	354	433.7	707.3
142	315	349.0	746.8	342	355	433.7	746.8
143	316	349.0	788.5	343	356	433.7	788.5
144	317	349.0	832.5	344	357	433.7	832.5
211	320	368.5	569.1	411	360	457.9	569.1
212	321	368.5	600.9	412	361	457.9	600.9
213	322	368.5	634.5	413	362	457.9	634.5
214	323	368.5	669.9	414	363	457.9	669.9
221	324	368.5	707.3	421	364	457.9	707.3
222	325	368.5	746.8	422	365	457.9	746.8
223	326	368.5	788.5	423	366	457.9	788.5
224	327	368.5	832.5	424	367	457.9	832.5
231	330	389.0	569.1	431	370	483.5	569.1
232	331	389.0	600.9	432	371	483.5	600.9
233	332	389.0	634.5	433	372	483.5	634.5
234	333	389.0	669.9	434	373	483.5	669.9
241	334	389.0	707.3	441	374	483.5	707.3
242	335	389.0	746.8	442	375	483.5	746.8
243	336	389.0	788.5	443	376	483.5	788.5*
244	337	389.0	832.5	444	377	483.5	832.5

* May be programmed to any 300 - 1200 Hz tone pair using the PC Programmer software.

NOTE: Each PQC code (except All-Call) is transmitted as a pair of audible tones. No two codes use the same pair. The "Lo Frequency" (Tone A) is transmitted first, the "Hi Frequency" (Tone B) second.

The All-Call code is transmitted as a single tone for a duration of four seconds.

TO PROGRAM:

8.6.4.7 A Scan List (Normal/Priority)

IMPORTANT:

1) A channel cannot hold both radio frequency/Quiet Call data AND a scan list. Programming a scan list automatically erases any radio frequency, Quiet Call code OR scan list already on the channel.

2) Each scan list must contain at least two channels (for Priority Scan Lists, this means the priority channel plus one other channel). The radio will scan only channels that are programmed with a radio frequency.

NOTE: Channel "F" cannot be included in a scan list. However, F (16) can hold a scan list.

TO PROGRAM A PRIORITY SCAN LIST, FOLLOW STEPS 1 - 6. FOR A NORMAL SCAN LIST, SKIP STEPS 3 - 6.

1) Select an empty channel.

2) Enter an "8," which tells the radio's microcontroller that the channel will contain a scan list.

For a Priority Scan List

3) If you are programming a Priority Scan List, enter a "1."

4) Enter the priority channel number.

5) Enter the other channels to be scanned, one at a time.

6) Press and release the monitor button.

For a Normal Scan List

7) If you are programming a Normal Scan List, enter a "2."

8) Enter the channels to be scanned, one at a time.

9) Press and release the monitor button to store the list.

TO PROGRAM:

8.6.4.8 Special Features

8.6.4.8.1 *A Receiver Squelch Tightner Factor:*

1) Enter a single digit factor from "0" to "7."

   The squelch threshold tightner may be programmed for any factor from "0" to "7." A "0" = maximum sensitivity; weaker signals will be heard. A "7" = minimum sensitivity; weaker signals will not be heard.

2) Press and release the monitor button.

8.6.4.8.2 *Other Special Features:*

The special features below may be programmed for any channel that already contains radio frequencies. A blank channel will not save any special features programming.

CHANNEL MONITOR LOCK OUT	REDUCED TRANSMITTER POWER
BUSY CHANNEL TRANSMIT INHIBIT	PAGING QUIET CALL TRANSPOND

YOU MUST SET ALL FOUR FEATURES to activate any of these special features. To program, follow the steps below.

1) First, enter a "9," which tells the microcontroller that you are programming special features.

2) Enter a single digit for Channel Monitoring Lock Out (OFF = "1" ON = "2").

3) Enter a single digit for Busy Channel Transmit Inhibit (OFF = "1" ON = "2").

4) Enter a single digit for the Transmitter Power Factor (FULL PWR = "1" REDUCED PWR = "2").

5) Enter a single digit for Paging Quiet Call Transpond (OFF = "1" ON = "2").

6) Press and release the monitor button.

8.6.4.8.3 *Special Features Defaults:*

Programming a RADIO FREQUENCY causes all special features stored on the channel to default to their standard settings.

SPECIAL FEATURE	STANDARD SETTING	EQUIVALENT DIGIT ENTRY
Squelch Tightner Factor	Maximum sensitivity	0
Channel Monitor Lock Out	Off	1
Busy Channel Transmit Inhibit	Off	1
Reduced Transmitter Power	Full power	1
Paging Quiet Call Transpond	Off	1

8.7 CLONING

Cloning allows authorized service personnel to easily copy all channel data from one radio into another, saving time spent entering identical channel contents via the PTT into each unit.

The radio's "personality," however, cannot be cloned. Personality data controls operation for all channels, and includes options such as the transmitter time-out time. A radio's personality may be copied to another radio using a PC compatible computer and optional programming kit model RPT-PCPK. Personality data should not be copied between Rev. 3 and Rev. 4 radios, or between RPM mobiles and RTX handhelds. Doing so will render the "slave" radio inoperable.

TO COPY ALL CHANNEL DATA FROM ONE RADIO TO ANOTHER, FOLLOW THE STEPS BELOW. FIG-10 on the next page illustrates cloning.

WARNING: Using an incorrectly wired substitute for the RITRON cloning cable will damage the radio(s)! DO NOT use a standard telephone cable in place of the cloning cable.

8.7.1 RPM MOBILE TO RPM MOBILE

1) Turn off both mobiles and disconnect the microphones from their front panel jacks.

2) Remove the programming key from each radio. (Or, place the key in its storage position as shown on page 27.)

3) Connect both radios to a common +12 VDC source, such as a battery or power supply. (Refer to FIG-10.)

4) Connect a RITRON RPM cloning cable between the microphone jacks of the two mobiles.

5) The order in which the radios are turned on determines which is the master and which is the slave. Switch on the unit that contains the channel data you wish to copy (the master). The unit sounds a tone. Failure to turn on the master first causes channel data to flow in the wrong direction.

6) Turn on the slave unit. Both radios emit a triple tone. The master displays a "d," and the slave an "L."

7) When the "d" on the master disappears and the units repeatedly sound the "finished" tone, turn off the slave first. Then turn off the master. The slave is now programmed with the same channel contents as the master.

8) Disconnect the cloning cable and plug the microphones into their front panel jacks.

8.7.2 RPM MOBILE TO RTX HANDHELD

NOTE: The RTX portable, unlike the mobile radio, will not sound any tones during cloning.

1) Turn off both radios. Disconnect the microphone from the mobile's front panel jack.

2) Remove the programming key (plug) from each radio.

3) Connect the mobile to a +12 VDC source, such as a battery or power supply.

4) Connect a cloning cable adapter to one end of the cloning cable, by mating the adapter's modular socket to the cable's modular plug. The adapter is a short cable (approx. 9") with a 6-pin modular socket at one end, and a 3.5 mm plug at the other.

RPM MOBILE TO RTX HANDHELD (CON'T.)

5) Insert the cloning cable/adapter 3.5 mm plug into the RTX handheld's audio jack.

6) Insert the cloning cable modular plug into the RPM mobile's microphone jack.

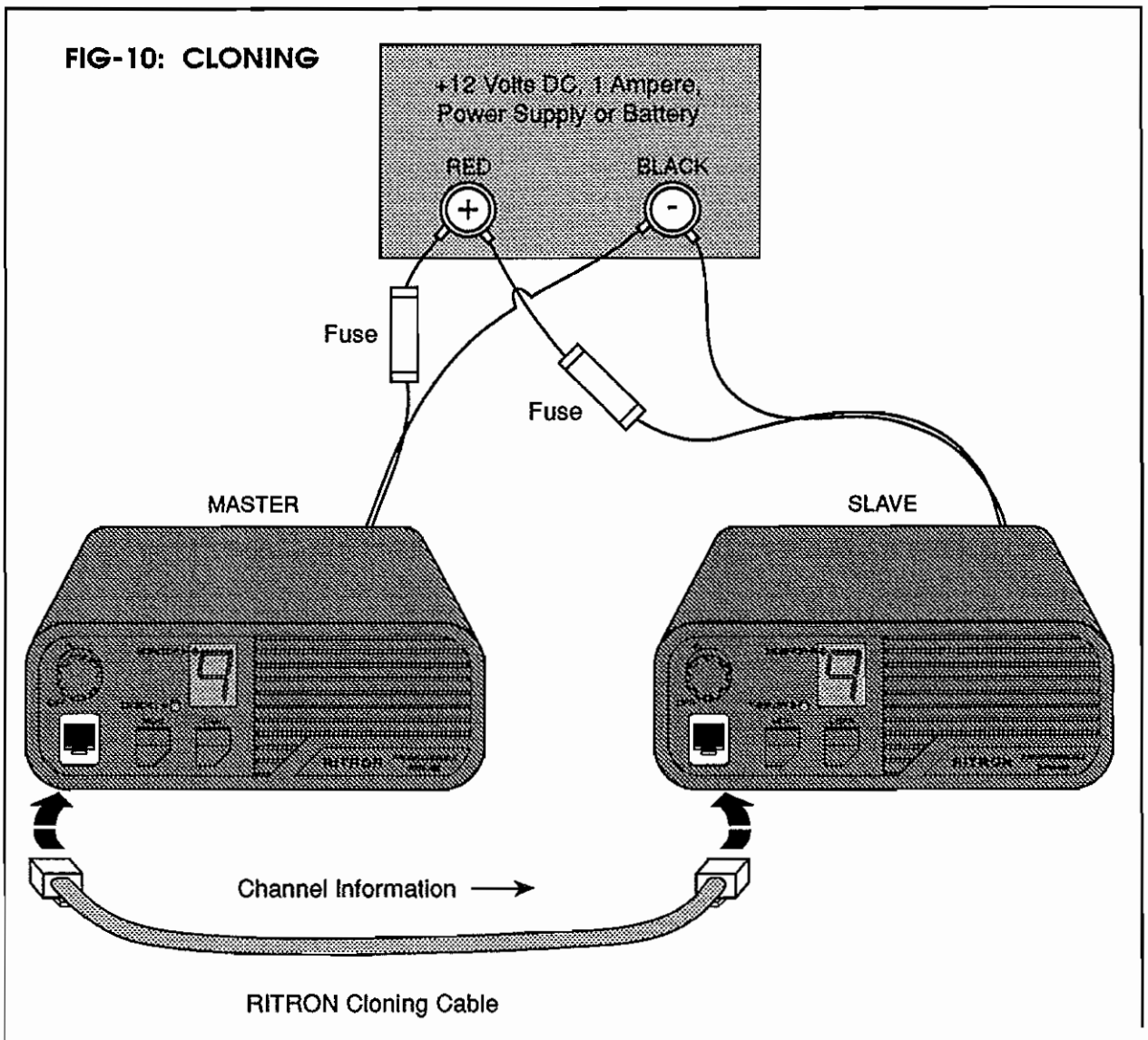
7) The order in which the radios are turned on determines which is the master and which is the slave. Switch on the unit that contains the channel data you wish to copy. This is the master. (If the master is a RPM mobile, it will sound a tone.) Failure to turn on the master first causes channel data to flow in the wrong direction.

8) Turn on the slave. The mobile radio will emit a triple tone, and display a "d" if it is the master, or a "L" if it is the slave.

9) When the RPM mobile repeatedly sounds the "finished" tone, turn off the slave first. Then turn off the master. The slave is now programmed with the same channel contents as the master.

10) Disconnect the cloning cable and plug the microphone into the mobile's front panel jack.

FIG-10: CLONING



8.8 PC COMPUTER PROGRAMMING KIT

RITRON's programming kit (model RPT-PCPK) allows programming of RPM mobile and RTX handheld radios with a PC compatible computer.

RITRON's adapter cable connects the radio to a computer's serial communications port. Once the cable is hooked up, the user inserts the diskette provided into his computer's floppy disk drive and loads a software program. This program transfers data between radio and computer memory, and includes on-screen instructions and help. Radio data may be saved to the computer's hard disk to program other radios.

8.8.1 PRECAUTIONS

Always determine the Rev. of the radio you are programming before you download a file into the radio's memory. This is easily done by following the on-screen instructions and reading the radio's memory (buffer).

Please observe the following precautions while using the PC programming kit. Otherwise, data in the radio microcontroller will be corrupted and the radio left inoperative.

- Do not save Rev. 3 radio personality data files to Rev. 4 radios.
- Do not save RPM mobile personality files to RTX handhelds, and vice versa.
- Do not use versions of the programming software earlier than 1.6R14 to program Rev. 4 radios.

8.8.2 THE RPT-PCPK KIT INCLUDES:

1) RITRON Transceiver Programmer software, which is contained on one 3.5" diskette (the 5.25" format may be ordered).

2) Installation instructions (RITRON #01454947) and a registration form.

3) RITRON PC to radio adapter cable, which is terminated at one end with a DB-25F connector, at the other end with a modular plug. The DB-25 plugs into the computer's serial port, the modular plug into the RPM mobile's microphone jack.

4) An adapter for use with RTX portables. This adapter mates the modular plug to a 3.5 mm plug, for connection to the handheld's audio jack.

8.8.3 THE RPT-PCPK KIT REQUIRES:

A PC compatible computer with DOS 3.2 or later. The computer must have a RS-232 serial port available. A hard disk drive is recommended.

8.9 COMPUTER SOFTWARE COPYRIGHTS

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8.10 PROGRAMMABLE FEATURES TABLES

The tables below indicate whether each feature may be programmed with the PTT (Push-To-Talk) button or a PC computer. (If you will use a PC, RITRON programming kit model RPT-PCPK is required.)

Additional PC-programmable features are available for Revision 4 and later radios. If you plan to program these radios using the programming kit, refer to the on-screen instructions built into the RPT-PCPK software for an updated list. (Features are still being added to better provide for a wide variety of customer preferences.)

WARNING: Do not use versions earlier than 1.6R14 of this software to program RPM and other Rev. 4 radio models! Otherwise, the radio data can be corrupted.

8.10.1 FEATURES PROGRAMMABLE PER CHANNEL

These features are programmed for individual channels.

FEATURE	RANGE	STANDARD SETTING	PC	PTT
Transmit (TX) Frequency	-	-	√	√
Receive (RX) Frequency	-	-	√	√
Scan List	-	-	√	√
Carrier Only, No Tones or Codes	-	-	√	√
Quiet Call (CTCSS)	-	-	√	√
Quiet Call Encode Only	-	-	√	√
Digital Quiet Call (DCS)	-	-	√	√
Digital Quiet Call Inverted	-	-	√	√
Digital Quiet Call TX Invert	-	-	√	√
Digital Quiet Call RX Invert	-	-	√	√
Digital Quiet Call Encode Only	-	-	√	√
Quiet Call and Paging Quiet Call	-	-	√	√
Quiet Call Encode Only and Paging Quiet Call	-	-	√	√
Paging Quiet Call Only	-	-	√	√
Quiet Call With Separate Decode/Encode	-	-	√	√
Squelch Tightner Factor	0-7	0	√	√
Busy Channel Transmit Inhibit	Y-N	N	√	√
Channel Monitor Lock Out	Y-N	N	√	√
Scan Resume Delay	Y-N	Y	√	-
Paging Quiet Call Transpond	Y-N	N	√	√
When PTT Is Released	Normal, Reversal	Normal	√	-
Reduced Transmitter Power	Y-N	N	√	√
Transmit Time Out Timer	Y-N	Y	√	-
Special Mode Output	Y-N	N	√	-
Channel Readout Allowed	Y-N	Y	√	-

8.10.2 FEATURES PROGRAMMABLE PER RADIO

These features are programmed for the radio using a PC computer and programming kit model RPT-PCPK. All channels are set together.

FEATURE	RANGE	STANDARD SETTING	PC	PTT
Transmit Time Out Time	0-255 s	180 s	√	-
Transmit Hang Time For Quiet Call	0-983 ms	150 ms	√	-
Transmit Hang Time For Digital Quiet Call	0-983 ms	183 ms	√	-

FEATURES PROGRAMMABLE PER RADIO (CON'T.)

FEATURE	RANGE	STANDARD SETTING	PC	PTT
Quiet Call Tone Reversal Default	Y-N	Y	√	-
Special Quiet Call Encode Code	Any Code	FF	√	-
Paging Quiet Call Alert	Y-N	Y	√	-
Paging Quiet Call Special 1st Tone (443)	300-1200 Hz	483.6 Hz	√	-
Paging Quiet Call Special 2nd Tone (443)	300-1200 Hz	788.6 Hz	√	-
Paging Quiet Call All-Call Enable	Y-N	Y	√	-
Scan Resume Delay Time	0-4 s	2 s	√	-
Priority Scan Look Time	0-4250 ms	1833 ms	√	-
Busy Channel Transmit Inhibit Over-Ride Time	0-127.5 s	4.5 s	√	-
Priority When Off Hook Enable	Y-N	Y	√	-
Number Of Allowable Channels	1-16	16	√	-

8.10.3 DESCRIPTIONS OF FEATURES

Busy Channel Transmit Inhibit - Refer the the Special Features section.

Busy Channel Transmit Inhibit Over-Ride Time - If the Busy Channel TX Inhibit feature is programmed for your channel, and you want to reply to an incoming call that was broadcast via a repeater, you normally would not be able to transmit until the repeater hang time ended. (The hang time is the time that the repeater's transmitter stays on after the receiver ceases to detect an incoming call.) The over-ride option allows you to transmit a reply to a call, regardless of whether the channel is busy (with the repeater's hang time signal).

Carrier Only, No Tones or Codes - One radio frequency is used to transmit and receive. Quiet Call is not programmed for the channel.

Channel Monitor Lock Out - Refer the the Special Features section.

Digital Quiet Call (DQC) - This operates the same as Quiet Call (CTCSS), except that a digital code, instead of a sub-audible tone, is used for coded communications.

Digital Quiet Call Encode Only - The code programmed for the channel is transmitted with your calls. However, Digital Quiet Call is turned off during receive mode. All communications on the channel sound in the speaker.

Digital Quiet Call Inverted - The code programmed for the channel is inverted for receive and transmit modes. The Digital Quiet Call chart lists codes, normal and inverted.

Digital Quiet Call RX Invert - The code is inverted for receive mode only.

Digital Quiet Call TX Invert - The programmed code is inverted for transmit mode.

Number Of Channels - This value should be changed only in order to update older RPM mobiles from 10 to 16 channel capacity.

Paging Quiet Call All-Call Enable - The radio's All-Call decode feature may be enabled or disabled.

Paging Quiet Call Automatic Squelch Reset - The radio may be programmed to automatically reset to paging mode after receiving a page. This mutes all activity on the channel except another page. Normally, QC squelch would be activated after the radio decoded a page, allowing broadcasts coded with the correct sub-audible tone to be heard.

DESCRIPTIONS OF FEATURES (CON'T.)

Paging Quiet Call Channel Default To Monitor - Normally, when a channel programmed with Paging Quiet Call is selected manually or in a scan list, the radio is muted until the proper paging code is received. A Paging Quiet Call channel can be optionally programmed so that when selected the receiver is not muted. This enables the user to select or scan the channel and hear radio traffic coded with his Quiet Call tone, and yet have the radio ring if paged on that channel.

Paging Quiet Call Decode And Carrier Squelch - Once the radio receives a page, Quiet Call squelch is activated to mute unwanted communications on the channel. However, the radio may be programmed to ring and then enter carrier squelch following a page.

Paging Quiet Call Message Alert Ring - Once the radio decodes a Paging Quiet Call signal, it will sound a short ringing tone every minute as a reminder that a call has been received. This reminder is cancelled by pressing the monitor, PTT or changing channels.

Paging Quiet Call Only - If the channel is programmed with PQC, the unit can receive pages, and transmit the All-Call page.

Paging Quiet Call Special 1st Tone (443) - Any 300 - 1200 Hz frequency pair that has 2 second, 2 second signaling timing may be substituted for Paging Quiet Call code 443. This is the first tone of that pair.

Paging Quiet Call Special 2nd Tone (443) - This is the second tone of the frequency pair used to replace PCQ code 443.

Paging Quiet Call Transpond - Refer the the Special Features section.

Power Strobe - Enabling this option allows the radio to go into battery saver mode when the radio remains idle.

Priority Channel Alert Beep In Scan Mode - This feature may be enabled such that when the radio is scanning (a Priority Scan List) and a signal on the priority channel is received, the handheld will emit an alert beep.

Priority Scan Look Time - During priority scanning, the radio's microcontroller regularly checks the priority channel for activity. The look time is the time between these checks. A lower value means that the priority channel is checked more frequently.

Programmable Quiet Call Tone - Quiet Call Code 53 is used to represent a special "tunable" Quiet Call code that may be set using the PC programmer. The range of this tone is 30 to 250 Hz in 0.1 Hz steps. The Quiet Call decoder bandwidth is 1% wide and might false on adjacent tones. Contact Ritron for assistance in programming this code.

Quiet Call (CTCSS) - Programming a Quiet Call code allows you to screen out transmissions that do not carry your code. Your code is broadcast when you press the PTT to make a call.

Quiet Call Encode Only - The Quiet Call code programmed for the channel is transmitted with your calls. However, Quiet Call is turned off during receive mode, allowing all traffic on the channel to be heard.

Quiet Call and Paging Quiet Call (PQC) - If PQC is programmed on a channel with Quiet Call, the radio can receive pages while that channel is selected. In addition, the mobile can transmit the All-Call page.

Quiet Call Encode Only and Paging Quiet Call - This option works exactly the same as the one listed above, except that Quiet Call is deactivated during receive mode.

DESCRIPTIONS OF FEATURES (CON'T.)

When PTT Is Released (PTT Release Options For Quiet Call Encode) - This option enables the radio to match various methods for eliminating the squelch tail (noise burst) at the end of a transmission. You may program the radio to do the following when the PTT is released: 1) reverse the phase of the encode tone and leave the transmitter on for the turn-off time or, 2) turn off the tone and leave the transmitter on for the turn-off time.

Quiet Call Tone Reversal Default - This sets Quiet Call tone phase reversal as the default method of squelch tail elimination for the radio.

Quiet Call With Separate Decode/Encode - One Quiet Call (QC) code is activated during receive mode, a second QC code during transmit mode.

Receive Frequency - The radio frequency that receives broadcasts from other units.

Reduced Transmitter Power - Refer the the Special Features section.

Scan List - A list of channels that the radio automatically monitors when the channel that contains the list is selected.

Scan Resume Delay Time - After the radio has stopped on a busy channel and the broadcast ends, this is the time the radio waits to resume scanning. This delay allows the user to hear the rest of a paused conversation on the channel, or to reply before scanning resumes. The standard delay time is two seconds.

Scan Resume Delay - This is normally enabled, in which case the radio waits the Scan Resume Delay Time before scanning continues. However, this feature may be disabled if required.

Special Mode Output - This output, which terminates inside of the RPM radio, can be used to switch on and off accessories on a per channel basis. Consult the factory for details.

Special Quiet Call Encode Code - A channel can reference this code as its Quiet Call (sub-audible) encode frequency. This enables channels with Paging Quiet Call (two-tone sequential) decode to have separate Quiet Call encode/decode frequencies.

Squelch Tightner Factor - Refer the the Special Features section.

Transmit Channel Revert For Scan Modes - RPM mobiles can be programmed so that if the PTT is pressed while scanning, the radio will transmit on either the last active channel or the priority channel in the scan list. This is determined on a per channel (scan list) basis.

Transmit Frequency - The radio frequency that is transmitted while you press the Push-To-Talk button.

Transmit Hang Time For Digital Quiet Call - This is the time that the Digital Quiet Call turn-off code is transmitted after the PTT is released.

Transmit Hang Time For Quiet Call - This is the time that either no Quiet Call tone or the phase reversed Quiet Call tone is transmitted after the PTT is released.

Transmit Time Out Time - This is the time that you can press the PTT continuously before the Transmit Time Out Timer shuts off the transmitter. (The timer must be turned on.)

Transmit Time Out Timer - This feature automatically shuts off the transmitter (ending your call) if you hold down the PTT button continuously for a specified time. This time can be set to as much as 255 seconds, or the feature turned off. The radio speaker sounds a tone when the transmitter shuts off.

MODEL RPM-050 (LOW VHF) MAINTENANCE/REPAIR

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9. RPM-050 THEORY OF OPERATION

Refer to the RPM-050 schematics while reading this section.

9.1 POWER SUPPLY

The RPM-050 is powered by an external source (+V BATT) via the battery connector (P402, J402). Zener diode CR402 clamps any high amplitude spikes on the supply line, and causes fuse F401 to blow if the supply rises above +18 Volts. Battery voltage is tied to the on/off volume control (R/SW601), which applies +V SW to the radio circuitry.

C362 and C363 provide filtering for IC304, an +8 Volt regulator that supplies the VCO, reference oscillator and IC301. Voltage regulator IC302 provides +5 VDC for synthesizer controller IC301.

Regulator IC103 applies +5 VDC to microcontroller IC102, shift register IC101, the MF6 low-pass filter, bilateral switches IC203 and IC201 of the audio conditioning circuit, and IC202D. A resistive divider (R240 and R241) provides approximately +2 Volts for audio conditioning circuitry.

A low-voltage reset circuit (Q101, R112 and R120) protects against internal EE memory loss due to battery voltage fluctuations below about +9 Volts, by shutting off the microcomputer. A DC level below +5 Volts at the regulator (IC103) output can cause the CPU to randomly execute instructions that might include an "erase sequence." Q101 turns off when this voltage drops below +5 Volts. R113 then pulls IC102 pin 18 "low" to reset the microcomputer.

9.2 FREQUENCY SYNTHESIZER

9.2.1 VCO/BUFFER AMPLIFIER

Q308, L303, varactor CR304 and associated components form the VCO (Voltage Controlled Oscillator), a resonant circuit that oscillates at approximately 40 MHz. Varying the voltage at the cathode of CR304 changes the varactor's capacitance, which in turn alters the VCO output frequency; for example, when the voltage at CR304 is increased (normally, the charge in C324-327 provides this voltage), CR304's capacitance decreases, which increases the VCO output frequency. +8 VDC is tied to the collector of Q308 through the power supply filter (R345 and C337). C342 couples the oscillator signal to buffer amplifier Q309. C335, C336 and C344 function as RF bypass capacitors. The amplified signal at Q309's collector is decoupled by C345 and applied both to synthesizer IC301 pin 8 (via R349 and C346) and to buffer amplifier Q310. The buffered VCO signal at Q310's collector then feeds through C352 and R356 as local oscillator injection into the source of Q502, the receiver 1st mixer.

9.2.2 SYNTHESIZER CONTROLLER

IC301 contains a digital phase detector that works as follows - when an operating channel is changed or the receive/transmit mode switched, either of which selects a new synthesizer operating frequency, microcomputer IC102 (pin 52) clocks new data into IC301's internal buffer (pin 10) in synchronization with clock pulses that appear at IC301 pin 9 (signals from the microprocessor are usually too fast to observe with an oscilloscope). Until all data is loaded into the buffer, the synthesizer continues to function at the previous operating frequency.

Once all new data is loaded into the buffer, a single pulse from IC102 appears at IC301 pin 11 that instructs the synthesizer controller to latch and execute the new data. IC301 utilizes internal circuitry to determine whether the present VCO output frequency is correct by comparing the phase and frequency of the pre-scaler output and the 16 MHz reference oscillator. IC301 produces a negative-going pulse at pin 15 if the VCO frequency is too low. This IC generates a positive pulse at pin 16 if the VCO frequency is too high.

The charge pump (Q305, Q306 and associated components) and loop filter (C324-C327 and R329-R331) then transform the pulses into a DC voltage for application to the VCO. The synthesizer system is "locked" when the phase and frequency of both the reference and the divided VCO signal are the same.

9.2.3 REFERENCE OSCILLATOR

The 16 MHz reference oscillator connected between IC301 pins 2 and 3 is built around crystal Y301, varactor CR301 and tuning capacitor C306. A temperature compensation circuit (R305-307, CR302 and variable thermistor R308) provides the synthesizer controller with a constant 16 MHz reference frequency.

9.2.4 OSCILLATOR MODULATION

When the unit is in transmit, gate IC203B passes modulation to the reference oscillator via C320 and IC203A to the VCO via C319. R310 routes modulation through C321 and R320 to the cathode of varactor CR303. Because CR303 is coupled to the VCO through C330, modulation causes the VCO frequency to vary. C320 applies modulation to the reference crystal to provide for the addition of any Quiet-Call or Digital Quiet-Call signals. If modulation were not applied to the reference, QC and DQC encode tones would be distorted as the synthesizer attempted to track them.

9.2.5 BANDSWITCH

Because the RPM-050 utilizes a single oscillator for both transmit and receive modes, the oscillator's frequency range must shift approximately 10.7 MHz when the unit is switched between transmit and receive. When the radio is in receive mode, a bandswitch circuit (Q307, R335-337, C333 and CR305) places L304 in parallel with the VCO tank circuit, decreasing the tank's inductance and so shifting the VCO tuning range about 10.7 MHz.

CR305 is forward biased while the RPM-050 is in receive mode, and reverse biased in transmit mode. When receiver B+ is applied to R335 and R336, CR305 switches on and current flows through Q307 to ground. CR307 acts like a short circuit, incorporating L304 into the oscillator circuit. When the RPM-050 is keyed, the receiver B+ line drops to 0 VDC and CR307 shuts off, turning off Q307. L304 is removed from the oscillator circuit, decreasing the VCO output frequency approximately 10.7 MHz.

9.2.6 SOURCE-FOLLOWER BUFFER

The source lead of FET Q304 applies a DC voltage, which "tracks" the VCO (source lead voltage = VCO voltage + approximately 1 Volt), to a varactor in the modulation circuit. Q304 isolates the VCO from the varactor.

9.3 RECEIVER

9.3.1 RF AMPLIFIER

A received signal from the antenna first passes through a low-pass filter (C424-430, L415-417). K401 then applies the RF signal to a 2-pole tank circuit, whose center frequency depends upon C501 and C502. Q501 amplifies the signal. L506 applies collector voltage to the stage. C506 supplies an RF bypass for L506. C508 couples the amplified RF signal into a 2-pole filter, whose bandpass shape further sharpens front-end response. The signal is then applied to the gate of common-source JFET Q502, the 1st mixer.

9.3.2 1ST MIXER

The RF input signal drives the gate of mixer Q502, while the VCO signal at Q310's collector drives the source. A resonant tank circuit (T501) emphasizes the 10.7 MHz difference frequency component of the mixer output, which is coupled to IF amplifier Q504. Q505 is a noise blanker switch that removes noise from the signal. T504 couples the signal to a 10.7 MHz four-pole crystal filter (YF501, C515 and YF502). R509 applies the filter output to the base of Q503, a grounded-emitter buffer amplifier that provides stable gain. R511, C519 and C521 then match the signal to IC501 pin 16.

9.3.3 FM RECEIVER SUBSYSTEM

A multi-function integrated circuit, IC501 and associated components, forms the FM-receiver subsystem. This subsystem performs the functions of: 1) 2nd local oscillator (10.245 MHz), 2) 2nd mixer, 3) 2nd IF amplifier, 4) FM detector and 5) noise amplifier.

IC501 pins 1 and 2, 10.245 MHz crystal Y501, and feedback capacitors C522 and C523 comprise the 2nd local oscillator - which provides low-side injection (10.245 MHz). The 10.7 MHz signal at IC501 pin 16 and the 2nd local oscillator output are mixed, with the resulting 455 KHz mixer output appearing at IC501 pin 3. Two 455 KHz, 4-pole ceramic filters, YF503 and YF504, connect the balanced-mixer output to the input of the limiting IF amplifier at IC501 pin 5. IC501 pin 6 is the decoupled input to the IF amplifier, IC501 pin 7 the limited IF output signal. An internal quadrature detector, whose center frequency is determined by T501, detects the FM IF signal. One input of the quadrature detector connects internally to the IF signal at IC501 pin 7, while the other detector input is the phase-shifted signal from quadrature coil T502 at IC501 pin 8. Demodulated audio appears at pin 9, where a low-pass filter (R513 and C528) removes spurious quadrature output. Audio then simultaneously enters both the voice/tone conditioning circuit and a noise filter/amplifier (R514, C529, C530, R516, R520 and the amplifier internal to IC501 at pins 10 and 11) whose bandpass is centered at 8 KHz.

9.3.4 CARRIER SQUELCH

The noise amplifier output at IC501 pin 11 is rectified and filtered to produce a DC voltage called the RSSI (Received Signal Strength Indication) that is inversely proportional to receive signal strength. CR504 serves as a voltage-doubling detector. C533 integrates the detected signal, while R518 and C534 filter it. R516 and thermistor R520 comprise a temperature compensation network. R521 and CR502 form a threshold bias circuit that keeps CR504 slightly biased on, maintaining a constant noise output independent of ambient temperature. The RSSI is applied to IC102 pin 9 for carrier detect. The microcontroller enables carrier detect by comparing the RSSI with a "squelch set" voltage (adjusted with R136) at pin 12.

9.3.5 VOICE/TONE CONDITIONING IN RECEIVE MODE

After R513 and C528 remove 455 KHz elements at the demodulated audio output (IC501 pin 9), the signal travels from the receiver board through J501 to the main board. There, C222 couples the signal to IC201A. The received signal then follows two separate paths: one for sub-audible (QC and DQC) tone detection, the other for voice band (which includes PQC tones) audio conditioning.

9.3.5.1 VOICE BAND

When the transmitter shuts off, IC102 pin 35 goes "low," opening the bilateral gate switch from IC201B pin 3 to ground. Pin 3, which is tied through R235 to +5 Volts, then pulls "high" and toggles gate IC201A, allowing received audio to reach high-pass filter/amplifier circuit, IC202B, IC202C and associated components. The amplified signal, with frequencies below about 250 Hz (sub-audible tones) attenuated, exits IC202B pin 7 and is routed to: A) IC203C, a bilateral gate and; B) the input of a limiter (IC202A and associated components) via C213 and R229. Audio passes through gate IC203C when squelch is enabled and a "high" at IC102 pin 45 toggles the gate. R213 and C212 provide de-emphasis, and with C211 and potentiometer R601, direct the signal to audio amplifier IC601 and associated circuitry. R229 lowers signal gain and removes pre-emphasis before applying audio to limiter IC202A. The "squared" output then feeds to IC102 pin 22 for PQC (Paging Quiet-Call) decode.

9.3.5.2 SUB-AUDIBLE

Audio also passes through IC201C, which is turned on unless the radio transmitter is keyed. The signal travels through IC202D and enters pin 8 of IC204A, a 6-pole low-pass filter that attenuates frequencies above approximately 250 Hz. The output at pin 3 is further conditioned by IC204C, a limiter that squares the signal to drive the QC (Quiet-Call) detector resistor/capacitor bridge at IC102 pins 36-39. The microcomputer compares the QC detector bridge outputs at pins 13 and 14 to decode the correct sub-audible (QC) tone. Pin 47 serves as the DQC (Digital Quiet-Call) input.

9.3.6 AUDIO AMPLIFIER

R601, the volume level control, attenuates voice band audio passed through "squelch gate" IC203C to audio amplifier IC601. C601 DC isolates the audio amplifier input, while C602 provides RF bypassing. C606 couples the output at pin 4 to the front panel jack "RX Audio" line through R602, and to the speaker (SP601) via J601. With a load impedance of 4 Ω, the maximum output at pin 4 is about 5 Watts.

9.4 ANTENNA SWITCHING/LOW-PASS FILTER

A low-pass filter comprised of C424-430 and C415-417 removes harmonics from the transmitter output before applying the RF signal to the antenna port. Received signals pass through the low-pass filter before entering the receiver RF input circuitry.

Relay K401 and associated components form the antenna switching circuit, which isolates the transmitter output from the antenna when the RPM-050 is in "receive" mode. Incoming signals from the antenna pass through the low-pass filter, then K401 and J501 to the receiver board.

When the unit is switched into "transmit," Q314 applies +V TX to K401. Now, K401 isolates transmitter power from the receiver RF amplifier, Q501.

9.5 TRANSMITTER KEYING

Q313 and Q314 form a voltage regulator that supplies amplifier transistor Q312 and the antenna switching circuit. When the user presses the PTT (Push-to-Talk) button, microcontroller IC102 pulls the transmit enable line at pin 35 "high." This "high" is routed to Q313, forward biasing the base-emitter junction and causing current to flow from the +V SW line to ground through R365, Q313 and R366. R368 and C361 create enough of a time delay to allow the synthesizer to lock on frequency before the power amplifier turns on. The resulting voltage (about +12 Volts) at Q313's collector switches on Q314, which in turn applies +V TX to Q312 via R361, Z305 and L308. When the user releases the PTT button, the microcontroller holds the transmitter "high" about 180 ms while sending any tone-related turn-off codes. Then the microcomputer switches pin 35 "low," which turns off the regulator, releases the transmitter and switches off Q315. Q315's collector is no longer pulled to ground, allowing +5 VDC via R361 to forward bias Q316's base-emitter junction. Q317 then turns on and connects +V RX to the receiver circuitry.

9.6 TRANSMITTER POWER AMPLIFIER

Q312 and associated components further amplify the VCO signal at Q310's collector before feeding it via C354 to the 60 Watt, RF power amplifier. L404 matches the signal to the base of Q402. The output at Q402's collector, which measures about +38 dBm (5 W), is then coupled into the base of Q403, a 60 Watt power amplifier. The resulting 60 Watt signal is then matched to 50 Ω for application to the switching circuit.

9.7 POWER CONTROL CIRCUIT

"Reduced power channels" may be programmed as described in the PROGRAMMING SPECIAL FEATURES section of this manual. All low power channels have the same power output, which is adjustable for between 2 and 60 Watts.

The power control circuit works as follows: current through final transistor Q402 is measured as a voltage across R411. This current is proportional to power output. With the channel programmed for low power, IC102 pin 24 is "low," which turns off Q408 and "removes" the transistor from the circuit. In transmit, Q314 applies +V TX to Q407, which then switches on. This draws current through differential pair Q405 and Q406. Variable resistor R420 adjusts power output. Increasing the power draws more current through R411, lowering voltage at the base of Q405. Q405 then begins to turn off, decreasing current through the base of Q404. As a result, Q404 supplies less current to driver transistor Q402, which reduces RF power applied to Q403. Power output goes down. The power control circuit works in a similar manner to prevent power from falling below the reduced power setting.

9.8 NOISE BLANKER

RF at approximately 20 MHz is amplified by IC502. The signal is then AM detected by CR503. Q507 and Q508 shape the detected noise and provide pulses to RF switch Q505, which then removes noise from the receiver path.

9.9 SPEECH AMPLIFIER

9.9.1 GENERAL

RPM-050 speech amplifier filter circuits are shared with the receiver. The same high-pass filter/amplifier (IC202B, C and associated components) used for "receive" voice band conditioning is used for the "transmit" voice band. Similarly, the low-pass filter (IC204A) used for sub-audible tone decode filtering is also used for sub-audible tone encode. Altering circuit configuration with bilateral gates IC201A, B, C, D and IC203B and C permits utilizing the same audio filtering system for both receive and transmit modes.

9.9.2 VOICE/TONE CONDITIONING IN TRANSMIT MODE

When the user presses the PTT button, IC102 pin 35 goes "high," turning on the transmitter via Q312 and closing bilateral switches IC201B, IC201D, IC203A, IC203B and IC203D. C202 couples microphone audio to pin 9 of IC201D, which passes the signal into filter/amplifier circuitry (via C203-5) that attenuates frequencies below approximately 250 Hz and above 3 KHz.

9.9.2.1 VOICE BAND

Q202 amplifies the audio signal and applies it to a high-pass filter/amplifier (IC202B, IC202C and associated components), which attenuates frequencies below about 250 Hz and further amplifies the signal (about four times). Audio exits IC202B pin 7 and passes through bilateral transmission gate IC203D, which is switched on by the TX Enable line. C213 and R216 provide pre-emphasis and apply the audio, which is then summed with any tones generated by microcontroller IC102 at pin 46, to limiting amplifier IC202A. Amplified another 100 times, symmetrically clipped audio (3.5 Vp-p) appears at IC202A pin 1, where it is then fed into a 3-pole, 3 KHz low-pass filter composed of Q201 and associated components. The filtered output takes a path through voice deviation potentiometer R224 and C220 to the VCO. R228 sets the level of the sub-audible signal, which passes through gates IC203B and IC204B to the VCO.

9.9.2.2 SUB-AUDIBLE

Microcontroller IC102 switches off bilateral gate IC201C when the radio is in transmit, disconnecting received audio from the low-pass filter. IC102 generates sub-audible/digital encode tones (at pin 33), which are conditioned by IC202D and applied to pin 8 of 250 Hz low-pass filter IC204A.

The microcontroller sets the low-pass filter's corner frequency to approximately 250 Hz (IC102 pin 43 "floats" in tri-state mode), or to about 150 Hz (pin 43 pulls to ground) by switching C226 into the circuit. The 150 Hz corner frequency operates when a QC tone below 125 Hz or a DQC tone is encoded.

9.10 SHIFT REGISTER (LED DISPLAY)

IC101 is a serial-in parallel-out shift register that functions as a 7-segment (plus the monitor indicator) display buffer. When the microcomputer detects conditions that require a display change, it clocks a new 8-bit data word into IC101 - data pulses are applied to pin 1 (via IC102 pin 52) in synchronization with clock pulses applied to pin 8 (via IC102 pin 51). Data entering IC102 is quickly clocked into the register and latched. The parallel output appears at IC101 pins 3-6 and 10-13 to drive the 7-segment numeric LED display.

9.11 MICROCONTROLLER (IC102) PIN DESCRIPTIONS

Pins not listed below are not used.

PIN	DESCRIPTION
3	CHANNEL SELECT. The microcontroller reads the input at pin 3 to determine the operating channel. RPM mobile radios require a 10KΩ pull-up resistor and a momentary switch closure to ground to increment channels 0 through F.
4	PROGRAM KEY.
5	SYNTHESIZER LOCK DETECT (A/D). The frequency synthesizer is considered locked if pin 5 is greater than +3.3 VDC (as derived from the synthesizer's lock detect output at IC301 pin 9), and unlocked if less than that value. The microcontoller program checks the lock detect line 180 ms after the synthesizer is programmed, and if the synthesizer is out of lock, sends an error tone. If the synthesizer remains out of lock, the tones continue; if the synthesizer locks, the tones cease and normal operation resumes.
7	GND (A/D).
8	+5 VDC REFERENCE (A/D).
9	RSSI - RECEIVED SIGNAL STRENGTH INDICATION (A/D). The RSSI, a DC voltage derived from rectified demodulated noise, is applied to the microcomputer at pin 9 for carrier detect. The RSSI level should increase with increasing noise on the channel.
10	+V Supply (A/D), +5 VDC.
12	SQUELCH SET (A/D). The microcomputer divides the voltage input here by two and compares it to the voltage applied to the RSSI input. When the RSSI voltage is less than this value, carrier detect is enabled. After detecting a carrier, the the RSSI input must rise to this value plus a threshold voltage to disable carrier detect. The default voltage hysteresis constant is +0.8 VDC, but may be changed by serial programming.
13-14	QC DETECT INPUT (A/D). Microcomputer software utilizes two A/D inputs, pins 13 and 14, as a differential comparator to measure the output of the QC DETECT bridge.

PIN	DESCRIPTION
15	6 K EE PROM PROGRAMMING VOLTAGE +5 VDC (I). Used only in "special software units."
16	4 MHZ OSCILLATOR INPUT (I). Connected to the reference oscillator crystal network.
17	4 MHZ OSCILLATOR OUTPUT (O). Connected to the reference oscillator crystal network.
18	RESET\ (IN). When pin 18 is pulled "low," microcomputer operations stop. A low-voltage reset circuit pulls pin 18 "low" when +V SW is less than 9.5 Volts. This ensures that the microcontroller does not erase internal EE memory due to improper program execution with an "out of spec" supply voltage.
19	INT\(IN). Factory use only.
22	PQC DECODE (I). This input receives Paging Quiet-Call signals for decoding (via IC202A).
24	HIGH/LOW POWER OUT (O). This output selects transmitter power (model RPM-050 only).
25	SPECIAL MODE OUT. PROGRAMMABLE PER CHANNEL.
26	EXTERNAL SELECTIVE SIGNALING INPUT (I). An external device, such as a Touch Tone decoder, may be used to apply an open collector pull-to-ground (upon decode) to pin 26. The mobile then responds as if it received a valid PQC code, and registers a "C" on the channel display.
28	TX/BUSY INDICATOR (I/O). When the mobile switches into transmit mode, pin 28 is driven "high" to light the TX/BUSY LED. In receive mode, pin 28 pulses at a one second rate to indicate the channel is busy.
29	HANG UP SWITCH (I/O). Pin 29 connects to the microphone hang-up button and a 100 KΩ pull-up resistor tied to +5 VDC. When the hang-up button is removed from ground (e.g. the microphone is lifted from its cradle) pin 29 goes "high," enabling the user to monitor all on-channel transmissions (regardless of any tone signaling in use).
30	SELECTIVE SIGNALING DECODE OUT (O). When the microcontroller receives an external signaling input at pin 26 or decodes the unit's programmed PQC code, pin 30 goes "high" to drive an external device.
31	DISPLAY SHIFT REGISTER ENABLE (I/O). Pin 31 is a "clock clamp." When data from the microcomputer is intended for synthesizer controller IC301 and not shift register IC101, this line is clamped to ground, preventing clock pulses from reaching IC101 pin 8. When data is intended for shift register IC101, pin 31 is tri-stated, which allows clock pulses from IC102 pin 51 to pass. NOTE: Both synthesizer and shift register clock pulses occur rapidly and are difficult to display on a non-storage type oscilloscope.
32	SPEAKER "BEEP" OUTPUT (I/O). Alerting tones exit this pin for application to the audio amplifier.
33	QC ENCODE (I/O). Pin 33 applies either Quiet-Call or Digital Quiet-Call tones to the low-pass filter (IC204A). The QC encode line is tri-stated when the unit is not encoding one of these formats.

PIN	DESCRIPTION
35	TRANSMIT ENABLE (I/O). Pin 35 pulls "high" to disable the receiver, toggle bilateral transmission gates, switch the VCO operating range, activate the transmitter and, switch-in a pre-emphasis/ gain network connected to the 300 Hz high-pass filter output.
36-39	QC DETECT (I/O). The four lines at pins 36-39 drive a resistor/capacitor bridge used in Quiet-Call decoding.
40	USER EE PROM PROGRAMMING VOLTAGE (I). Pin 40 can aid in troubleshooting; during an EE write cycle this pin toggles "high."
41	SUPPLY RETURN (I), GND.
42	SYNTHESIZER SHIFT REGISTER LATCH (O). Following an operating frequency change (which includes a receive/transmit mode transition), pin 42 sends a single positive pulse to the synthesizer IC, latching the new serial data into IC301.
43	LP FILTER SLEW CONTROL (I/O). The filter slew control decreases the low-pass corner frequency to improve decode and encode waveform purity. Pin 43 appears tri-stated while the mobile decodes or encodes Quiet-Call tones above 141.3 Hz, and as an "active low" for QC tones below 141.3 Hz and Digital Quiet-Call.
45	RX AUDIO ENABLE (I/O). A "low" at pin 45 opens switch IC203C, preventing receive signals from reaching the audio amplifier. For example: if the microcontroller must generate a "beep," it first pulls pin 45 "low" to open switch IC203C and mute received audio ("beeping" tones follow another route to the audio amplifier). When the monitor button is pressed for two seconds, the microcomputer pulls pin 45 "high" to close IC203C and pass audio.
46	PQC ENCODE (I/O). Pin 46 is tri-stated unless the microcomputer is generating the Paging Quiet-Call All-Call tone (483.5 Hz). Turning on the unit while holding the PTT button sends the All-Call page.
47	DQC DECODE INPUT (I/O). The limited sub-audible data is applied here for DQC decode.
48	MONITOR (I/O). A "low" on the monitor line, which is tied to a contact closure to ground (SW102) and to +5 VDC via a pull-up resistor, defeats the tone squelch requirement that only a programmed tone can unsquelch audio. A momentary closure toggles between monitor and tone squelch modes. Pressing and holding the monitor button for more than about two seconds defeats carrier squelch and directs receiver noise to the audio amplifier.
49	PTT SWITCH (I/O). Switching pin 49 "low" instructs the software to pull the transmit enable line "high."
50	SERIAL DATA IN (I). Pin 50 links the microcontroller to communications from an external data terminal, or to a personal computer running a communications program. Pin 50 serves as the DATA IN line for cloning operations.
51	SERIAL DATA CLOCK (O). The line at pin 51 toggles in the center of each bit period sent via the serial data out line, and clocks data to the display and synthesizer shift registers.
52	SERIAL DATA OUT (O). Pin 52 supplies serial data out for: 1) Synthesizer IC301 (125 Kbits/sec, binary, w/clock) 2) Display shift register IC101 (125 Kbits/sec, binary, w/clock) 3) External Communications (1200 bits/sec, ASCII, asynchronous) 4) Cloning operations

10. RPM-050 ALIGNMENT PROCEDURE

10.1 RECOMMENDED TEST EQUIPMENT

1) 0 to 15 VDC, 15 Amp current-limited power supply
2) FM service monitor (to 50 MHz)
3) Oscilloscope (to 20 MHz)
4) FM deviation meter
5) RF Wattmeter, 100 Watts full scale
6) Frequency counter (to 50 MHz)
7) VTVM or DMM
8) Square wave reference generator
9) SINAD measuring device.
10) Service programming key (red plug)

10.2 RADIO PREPARATION

1) Carefully pull the volume knob off of the front panel.
2) Remove the three #6 screws from the bottom of the case.
3) Remove the front and back panels.
4) Remove the nut that holds the on/off volume control to the case.
5) Slide the radio PC board and front panel out of the radio case through the back.
6) Turn off the mobile and carefully turn the holddown tabs on the synthesizer box until the lid can be removed. Remove the lid.
7) Connect the power supply (@ approx. +13.0 VDC) to the 2-pin power connector on the back of the unit.
8) Connect an RF signal generator to the antenna connector on the back of the unit.
9) Switch on the unit and program the channels below as shown. For each, enter a RX/TX frequency that the radio owner (licensee) will use. (If not applicable, choose radio frequencies within the appropriate sub-band, 30 to 38 MHz or 38 to 50 MHz).

CHANNEL	RX/TX FREQUENCY (MHZ)	QUIET-CALL TONE OR SPCL. FEATURE	QUIET-CALL CODE OR SPCL. FEATURE
3	User Freq.	none	none
4	User Freq.	97.4 Hz	11
5	User Freq.	203.5 Hz	32
6	User Freq.	071 (DQC)	071
7	User Freq.	349 Hz/832.5 Hz (PQC)	44144
8	User Freq.	Low Power	91122

If another user's carrier signal causes interference, an alternate frequency within 1 MHz may be used.

RADIO PREPARATION (CON'T.)

IMPORTANT: The radio must be re-tuned if a channel is re-programmed with a radio frequency that is more than 1 MHz away from the frequency that was on the channel when the radio was tuned.

10) Turn off the RPM-050. Remove the programming key or place it in the storage position of the programming socket.

10.3 SYNTHESIZER

If the radio emits an error tone when the radio is powered on, the synthesizer is probably out-of-lock. (Alternating tones sound, with the second lower pitched.) This is normal if the channel is programmed with a frequency from an extreme end of the band.

The out-of-lock tones usually result if a channel has been programmed with a new frequency that is more than 1 MHz away from the frequency that was on the channel when the radio was tuned. The synthesizer should be aligned even if it is not out-of-lock.

11) Turn on the radio to place it in operating mode. (The programming key must be removed or in the storage position.)

12) Select channel 3.

13) Connect a high impedance voltmeter or oscilloscope to the source of Q304 (at R325).

14) The voltage at this point should measure between 0 and +8 Volts.

15) Note the exact position of VCO coil L303. Adjust L303 until the voltage at Q304 is +5.0 (+/- 0.5) VDC..

IF THE VOLTAGE ADJUSTS FOR +5 VOLTS:

Replace the synthesizer box lid, but do not turn the holddown tabs. Go to the next step.

IF THE VOLTAGE DOES NOT ADJUST:

Rotate L303 back to its original position before troubleshooting.

10.4 REFERENCE FREQUENCY

16) Set the service monitor receiver to the receive frequency (programmed for channel 3) + 10.7 MHz. This is the L.O. frequency. The monitor should be able to receive the L.O. signal with a short antenna.

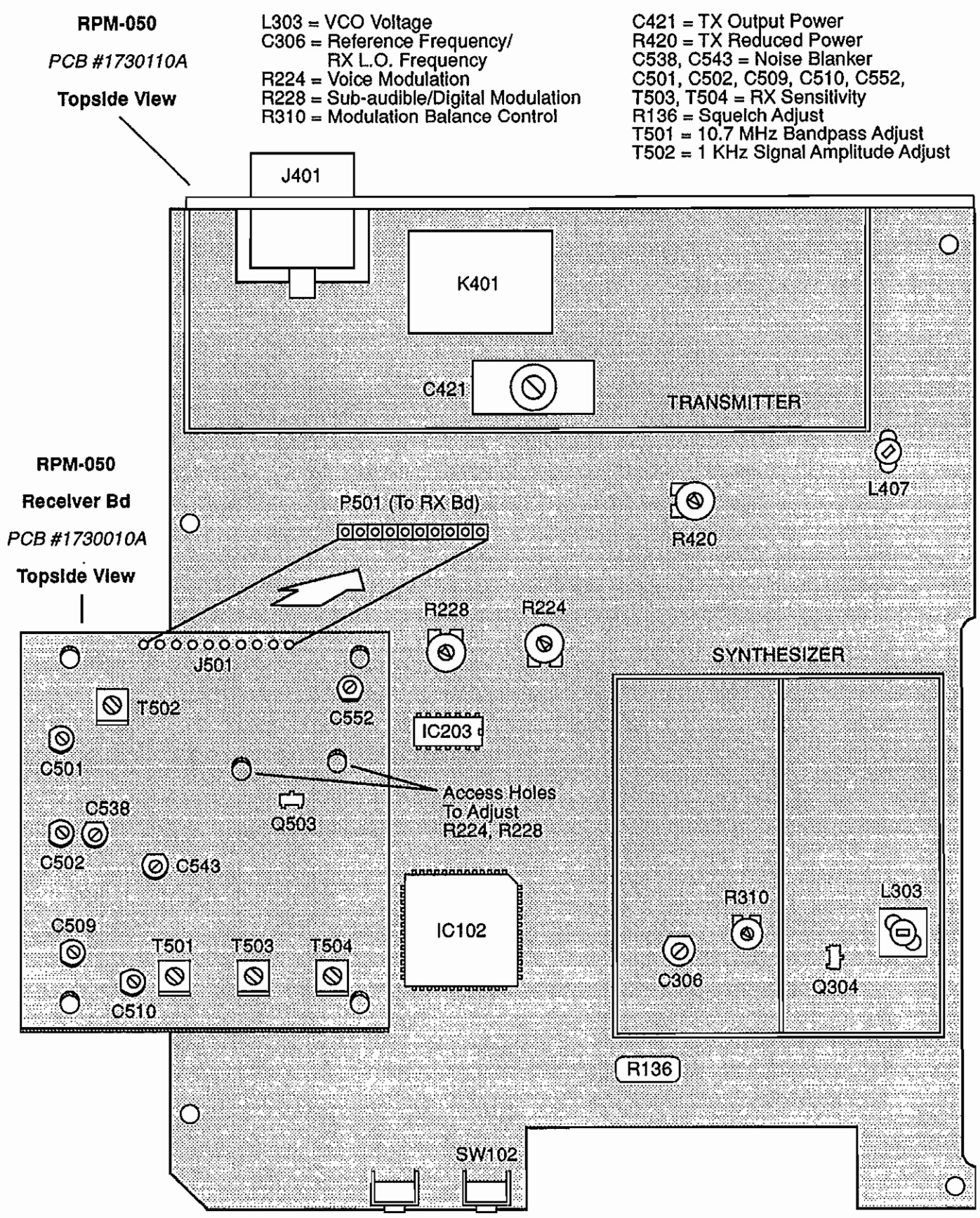
17) Align C306 to center the frequency. C306 may be adjusted through an opening in the synthesizer lid.

10.5 MODULATION BALANCE CONTROL

Normally, the balance control should not require re-alignment. The purpose of the balance adjustment is to prevent sub-audible (Quiet-Call) and DQC (Digital Quiet-Call) encode signals from being distorted.

18) Rotate both R228 (sub-audible/digital modulation) and R224 (voice modulation) fully counter-clockwise. Each potentiometer is accessible through holes in the receiver board.

19) Set R310 about midway.


RPM-050
PCB #1730110A
Topside View
L303 = VCO Voltage
C306 = Reference Frequency/ RX L.O. Frequency
R224 = Voice Modulation
R228 = Sub-audible/Digital Modulation
R310 = Modulation Balance Control
C421 = TX Output Power
R420 = TX Reduced Power
C538, C543 = Noise Blanker
C501, C502, C509, C510, C552, T503, T504 = RX Sensitivity
R136 = Squelch Adjust
T501 = 10.7 MHz Bandpass Adjust
T502 = 1 KHz Signal Amplitude Adjust
J401
K401
C421
TRANSMITTER
L407
RPM-050
Receiver Bd
PCB #1730010A
Topside View
P501 (To RX Bd)
R420
R228
R224
J501
SYNTHESIZER
T502
C552
IC203
C501
Access Holes To Adjust R224, R228
Q503
C538
C502
C543
IC102
R310
L303
C306
Q304
C509
T501
T503
T504
C510
R136
SW102

20) Connect a 10 KΩ resistor in series with a 22 µF electrolytic capacitor between IC203B pin 3 and a square wave reference generator.

21) Set the square wave generator to 30 Hz, 1 Vp-p.

22) Connect an appropriate 50 Ω load to the mobile's antenna port (J401).

23) Set the service monitor receiver for the transmit frequency programmed for channel 3.

24) Switch off power to the mobile and lift away the synthesizer box lid. Turn on the radio.

25) Press and hold the microphone PTT to transmit. The mobile's TX/Busy LED should light when the transmitter is activated.

26) Observe the received waveform on the service monitor. Adjust modulation balance resistor R310 (inside the synthesizer box) for the "best" square wave.

27) Disconnect the square wave signal. Key the transmitter and listen to the recovered audio. Any high pitched 5 KHz audio indicates that R310 has been set wrong and must be readjusted.

28) Replace the synthesizer box lid and turn the holddown tabs. Proceed with the transmitter alignment.

10.7 TRANSMITTER

29) Connect a Wattmeter to the antenna port (J401).

30) Press and hold the microphone PTT to key the transmitter. The TX/Busy LED should light.

31) Using an alignment tool or small screwdriver, adjust C421 for maximum output power. Check the amount of current drawn. If the current is over 11 Amperes, adjust the power down slightly to lower the current. Adjust L407 for maximum power.

32) Unkey the transmitter.

33) Select channel 4 (remember that channel 4 is programmed with a 97.4 Hz tone).

34) Set the service monitor receiver to the frequency programmed for channel 4.

35) With the transmitter keyed, apply a loud continuous voice to the microphone while adjusting R224 for +/- 4.4 KHz deviation, as indicated on the deviation meter. R224 and R228 can be reached through holes in the receiver PC board.

36) With the transmitter keyed and no sound applied to the microphone, adjust R228 for 600 Hz deviation.

37) Unkey the transmitter.

NOTE: To set power for all "reduced power" channels with one adjustment, select any channel programmed for low power (CH 8). With the transmitter keyed, adjust R420 until the Wattmeter reads the desired value. The output level for "high power" channels will remain unchanged.

10.8 NOISE BLANKER

The noise blanker is set at the factory and should not require re-alignment. RPM-050 radios leave the factory with the noise blanker turned on.

The noise blanker can be turned off for selected channels using the PC programmer. From within the computer program, set the special mode bit to "N" for channels that you want the noise blanker disabled.

38) If alignment is necessary, apply 22 MHz signal at -40 dBm, AM modulated with 1 KHz at 100% or greater.

39) Adjust C538 and C543 for the maximum DC level at R531.

10.9 RECEIVER

40) Connect a SINAD measuring device to the speaker terminals on the front panel.

41) Select channel 3.

42) Set the service monitor receiver to check the receiver L.O. frequency (L.O. frequency = receive frequency + 10.7 MHz). Adjust C306 for the correct frequency.

43) Set the service monitor RF signal generator to the receive frequency programmed for channel 3.

44) Set the generator to modulate the signal with 1KHz @ 3KHz deviation. Set the generator output to 1000 μV.

45) Adjust R136 fully counter-clockwise to "open" squelch.

46) At this point, a 1 KHz tone should be heard in the speaker. If not, increase the signal level.

47) Decrease the generator output and adjust C501, C502, C509, C510, C552, T501, T503 and T504 for best SINAD.

48) Set the generator output to 2000 μV.

49) Frequency modulate the generator with a 15 Hz signal, and set the deviation to +/-15 KHz.

50) Connect the 15 Hz signal directly to the HORIZONTAL input of an oscilloscope, and set the horizontal sweep to EXTERNAL.

51) Connect the VERTICAL input of the oscilloscope to Test Point 43 (collector of Q503).

52) Adjust T501 for a 10.7 MHz bandpass waveform.

53) Set the signal generator for a frequency modulated 1KHz sine wave at +/-7.5 KHz deviation. Set the output for 2000 μV.

54) Connect the oscilloscope to the radio speaker on the front panel.

55) Adjust T502 for a maximum amplitude of the 1 KHz sine wave.

56) Decrease the deviation of the modulated 1 KHz signal to +/-3 KHz.

RECEIVER (CON'T.)

57) Decrease the signal generator output and adjust C501, C502, C509, C510, C552, T501, T503 and T504 for best 12 dB SINAD. The 12 dB SINAD should be 0.25 µV worst case. Do not adjust C538 or C543.

58) Press and release the monitor button (SW102).

59) Set the generator output for a reading of 12 dB SINAD.

60) Turn R136 clockwise until no signal is heard in the speaker.

61) Slowly rotate R136 counter-clockwise until a signal is heard in the speaker.

This completes the alignment procedure.

62) Switch off the radio and disconnect power. Remove the oscilloscope, Sinad measuring device and signal generator leads from the radio.

CAUTION: RITRON surface mount products require special servicing techniques. Improper servicing techniques can cause permanent damage to the printed circuit board and/or components, which is not covered by RITRON's warranty.

11. RPM-050 VOLTAGE CHARTS

MEASUREMENT CONDITIONS: Supply @ +13.0 VDC, unit in operating mode, volume control @ minimum, microphone connected, readings taken with channel 8 programmed and selected.

KEY: ALL MEASUREMENTS ARE IN VOLTS DC, UNLESS AS INDICATED BELOW.

GND = GROUND

SQ = SQUAREWAVE

SINE = SINEWAVE

TRI = TRI-STATED WAVEFORM

SAW = "SAWTOOTH" WAVEFORM

NC = NOT CONNECTED

--- = NOT RELEVANT

[ ] = SPECIAL NOTE (SEE THE EXPLANATION BELOW)

A MEASUREMENT SHOWN AS TWO VALUES SEPARATED BY THE SYMBOL (/) INDICATES A READING FOR EACH OF TWO CONDITIONS.

SPECIAL NOTES [ ] EXPLANATION:

[1] The measured value depends upon signal strength. This reading was taken with no signal applied.

[2] This reading was taken with a 100 µV signal and 123 Hz sub-audible tone @ 500 Hz applied.

[3] Paging Quiet-Call input- with no signal present, random square waves appear. With a 10 µV signal and 1 KHz modulaton applied, this pin shows a 3.5 Vp-p clipped square wave.

[4] This pin measures "high" in full power transmit, "low" in reduced power transmit.

[5] External signaling input - normally measures a logic "high." When an external device pulls this pin "low," the microcontroller generates a "ring" tone in the speaker and latches a "C" on the display.

[6] "Switch" output used to excite the CTCSS decode circuit. To see the output, connect the pin to +5 VDC through a 10 KΩ resistor. No signal is applied to the receiver. A square wave at the CTCSS frequency should appear.

[7] Measurements at this pin depend upon the CTCSS tone programmed. The pin reads "low" for CTCSS tones below 141.3 Hz. For tones at 141.3 Hz and above, this line is open and the clock oscillation via IC204 pin 9 appears.

[8] The microcomputer pulls this pin "high" to open channel audio. The pin is "low" at all other times.

[9] The All-Call frequency (483.5 Hz) is generated at this pin.

[10] A square wave appears when voice is applied to the microphone.

IMPORTANT: Because the RITRON mobile is constructed with grounding "sub-planes," use a system ground in the same proximity as the circuit being measured. All readings indicated as GND are true system ground.

DEVICE	PIN	MEASUREMENTS			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q101					Low Voltage Detector
	E	5.6	5.6	5.6	
	B	5	5	5	
	C	5.6	5.6	5.6	
Q201					Low-pass Darlington
	E	3.2	3.2	3.2	
	B	2	2	2	
	C	GND	GND	GND	
Q202					Microphone Pre-amplifier
	E	GND	GND	GND	
	B	0.6	0.6	0.6	
	C	0.8	0.8	0.8	
Q304					Modulation Linearization
	D	8	8	8	
	G	2-7	2-7	2-7	
	S	3-8	3-8	3-8	
Q305					Charge Drain For VCO
	E	0	0	0	
	B	0	0	0	
	C	2-7	2-7	2-7	
Q306					Charge Pump For VCO
	E	8	8	8	
	B	8	8	8	
	C	2-7	2-7	2-7	
Q308					VCO Oscillator Transistor
	E	2.5	2.5	2.5	
	B	3.1	3.1	3.1	
	C	6.5	6.5	6.5	
Q309					VCO Buffer/Amplifier
	E	GND	GND	GND	
	B	0.7	0.7	0.7	
	C	5.5	5.5	5.5	
Q310					Synthesizer Output Buffer
	E	GND	GND	GND	(+10 dBM output)
	B	0.7	0.7	0.7	
	C	4.5	4.5	4.5	
Q312					1st TX Amplifier
	E	GND	GND	GND	(output = 25 dBM) TX
	B	0	0.7	0	
	C	0	11	0	

DEVICE	PIN	MEASUREMENTS			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q313					Power Switch Driver
	E	0	1	0	
	B	0	1.7	0	
	C	13	12.3	13	
Q314					TX Power Switch
	E	13	13	13	
	B	13	12.3	13	
	C	0	12.8	0	
Q315					TX Enable Inverter
	E	GND	GND	GND	(logic "low" for TX)
	B	0	0.7	0	
	C	2.4	0.1	2.4	
Q316					RX Switch/Regulator
	E	1.8	0	1.8	
	B	2.4	0.1	2.4	
	C	12.4	13	12.4	
Q317					RX +10 Volt Regulator
	E	13	13	13	
	B	12.5	13	12.5	
	C	10	0	10	
Q402					2nd TX Amplifier
	E	GND	GND	GND	(output = 6 Watts)
	B	0	—	0	
	C	0	12	0	
Q403					Final TX Amplifier
	E	GND	GND	GND	(output = 60 Watts)
	B	0	—	0	
	C	13	—	13	
Q404					High/Low Power Switching
	E	13	13	13	Circuit (Q404 - Q408)
	B	13	12.1	13	(All measurements in high
	C	0	12.8	0	power)
Q405					
	E	11	11	11	
	B	11.5	11.5	11.5	
	C	13	12.3	13	
Q406					
	E	11	11	11	
	B	11.5	1.3	11.5	
	C	13	13	13	

DEVICE	PIN	MEASUREMENTS			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
Q407					High/Low Power Switching
	E	0	1.6	0	Circuit (Q404 - Q408)
	B	0	2.3	0	(All measurements in high
	C	11	11	11	power)
Q408					
	E	0	1	0	
	B	0	1.7	0	
	C	11.5	1.3	11.5	
Q501					RX RF Amplifier
	E	GND	GND	GND	
	B	0.8	—	0.8	
	C	4.8	—	4.8	
Q502					RX Mixer
	D	9.9	—	9.9	
	G	0	—	0	
	S	0.8	—	0.8	
Q503					IF Amplifier
	E	GND	GND	GND	
	B	0.7	—	0.7	
	C	1.2	—	1.2	
Q504					IF Amplifier
	D	10	0	10	
	G	GND	GND	GND	
	S	GND	GND	GND	
Q505					Noise Blanker Switch
	D	GND	GND	GND	
	G	0	0	0	
	S	GND	GND	GND	
Q506					Noise Blanker On/Off
	E	GND	GND	GND	
	B	0	0	0	
	C	0.7	0	0.7	
Q507					Noise Blanker
	E	GND	GND	GND	
	B	0.7	0	0.7	
	C	10	0	10	
Q508					Noise Blanker
	E	10	0	10	
	B	10	0	10	
	C	0	0	0	

DEVICE	PIN	MEASUREMENTS			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC101					Channel Display Data Latch
	1	5	—	5	Data In
	2	5	—	5	
	3	4.4	—	4.4	Segment Drive Voltage
	4	4.4	—	4.4	(Pins 3 - 6)
	5	4.4	—	4.4	
	6	4.4	—	4.4	
	7	GND	GND	GND	
	8	0	—	0	Clock In
	9	5	—	5	
	10	4.4	—	4.4	Segment Drive Voltage
	11	4.4	—	4.4	(Pins 10 - 14)
	12	4.4	—	4.4	
	13	4.4	—	4.4	
	14	5	—	5	
IC102					Microcontroller
	1	NC	NC	NC	NC
	2	NC	NC	NC	NC
	3	5/0	—	—	Channel Selector
	4	5	5	5	
	5	5	5	5	Synthesizer Lock Detect
	6	NC	NC	NC	
	7	GND	GND	GND	
	8	5	5	5	Regulated +5 Volts
	9	0 - 1	—	1.5 [1]	Carrier Squelch RSSI Input
	10	5	5	5	Regulated Supply
	11	NC	NC	NC	
	12	0 - 5	—	0 - 5	Squelch Threshold Set
	13	TRI [2]	—	—	QC/DQC Detect Input
	14	TRI [2]	—	—	(Pins 13 - 14)
	15	5	5	5	
	16	SINE	SINE	SINE	Oscillator In
	17	SINE	SINE	SINE	Oscillator Out
	18	5	5	5	Microcontroller Power Reset
	19	5	5	5	Stop Microcontroller
	20	NC	NC	NC	
	21	NC	NC	NC	
	22	SQ [3]	—	—	PQC Input
	23	5	5	5	
	24	0 [4]	5	0	High/Low Power
	25	—	—	—	Special Mode Out
	26	5 [5]	—	—	Ext Selective Signaling Input

DEVICE	PIN	MEASUREMENTS			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC102					Microcontroller (con't.)
	27	5	5	5	
	28	SQ	4.5	0	Transmit/Busy Lamp Driver
	29	5/0	5	5/0	Microphone Hang-up Switch
	30	5	—	—	Selective Sig. Decode Out
	31	0	0	0	Clock "Clamp" for Chan Display
	32	0	0	0	Speaker "Beep" Output
	33	—	TRI	—	QC Pseudo-Sine Wave or
	34	—	—	—	DQC Output
	35	0	5	0	Transmitter Enable
	36	SQ [6]	—	—	Sub-audible Filter Switch (QC
	37	SQ [6]	—	—	Detect) Pins 36 - 39
	38	SQ [6]	—	—	
	39	SQ [6]	—	—	
	40	NC	NC	NC	
	41	GND	GND	GND	
	42	0	0	0	Syn Shift Register Latch
	43	0/SAW [7]	0/SAW [7]	0/SAW [7]	Low-pass Filter Slew
	44	—	—	—	
	45	0/5 [8]	—	0	RX Audio Enable (Sq Output)
	46	—	SQ [9]	—	PQC All-Call Tone Output
	47	—	—	—	
	48	5/0	—	5/0	Monitor Switch
	49	5	0	5	PTT Switch
	50	5	0	5	Serial Port Data In
	51	0	—	—	Serial Data Clock Output
	52	5	—	—	Serial Data Output
IC103					Power Reset +5 Volt Regulator
	1	13	13	13	In
	2	GND	GND	GND	
	3	5	5	5	Out
IC201					Configuration Switch
	1	1.7	—	—	RX Audio (Pins 1 and 2)
	2	1.7	0.8 [1]	1.7	
	3	5	0	0	TX Inverter (Pins 3 and 4)
	4	GND	GND	GND	
	5	0	5	0	
	6	0	5	0	
	7	GND	GND	GND	
	8	1.7	1	1.7	TX Modulation Switch
	9	—	0.8	—	(Pins 8 and 9)
	10	1.7	—	—	RX to Sub-audible Filter Switch

DEVICE	PIN	MEASUREMENTS			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC201					Configuration Switch (con't.)
	11	1.7	—	—	(Pins 10 and 11)
	12	5	0	5	
	13	5	0	5	
	14	5	—	—	Supply
IC202					Audio Conditioning Amplifier
	1	—	SQ [10]	—	Modulation Limiter/PQC
	2	1.7	—	—	
	3	1.7	—	—	Squaring in RX (Pins 1 - 3)
	4	5	—	—	
	5	1.7	—	—	3-Pole High-pass Filter (no. 2)
	6	1.7	—	—	(Pins 5 - 7)
	7	1.7	—	—	
	8	1.7	—	—	3-Pole High-pass Filter (no. 1)
	9	1.7	—	—	(Pins 8 - 10)
	10	1.7	—	—	
	11	GND	GND	GND	
	12	1.7	—	—	+1.75 Volt Buffer
	13	1.7	—	—	(Pins 12 - 14)
	14	1.7	—	—	
IC203					Configuration Switch
	1	1.7	1.7	1.7	RX/TX Volt. Stabilizer
	2	1.7	1.7	1.7	Pins 1 and 2)
	3	1.7	1.7	1.7	Modulation to VCO Enable
	4	1.7	1.7	1.7	Switch (Pins 3 and 4)
	5	0	5	0	
	6	5	0	0	
	7	GND	GND	GND	
	8	1.7	—	—	RX Audio Path Squelch Switch
	9	1.7	—	—	(Pins 8 and 9)
	10	1.7	1.7	1.7	TX Pre-emphasis Enable
	11	1.7	1.7	1.7	(Pins 10 and 11)
	12	0	5	0	
	13	0	5	0	
	14	5	5	5	
IC204					Switched Capacitor Filter
	1	1.8	1.8	1.8	Comparator Reference In
	2	2	2	—	Comparator Out
	3	1.7	1.7	1.7	Filter Out
	4	1.7	1.7	1.7	Mixer Amplifier Out
	5	1.7	1.7	1.7	Analog Gnd In
	6	5	5	5	Supply

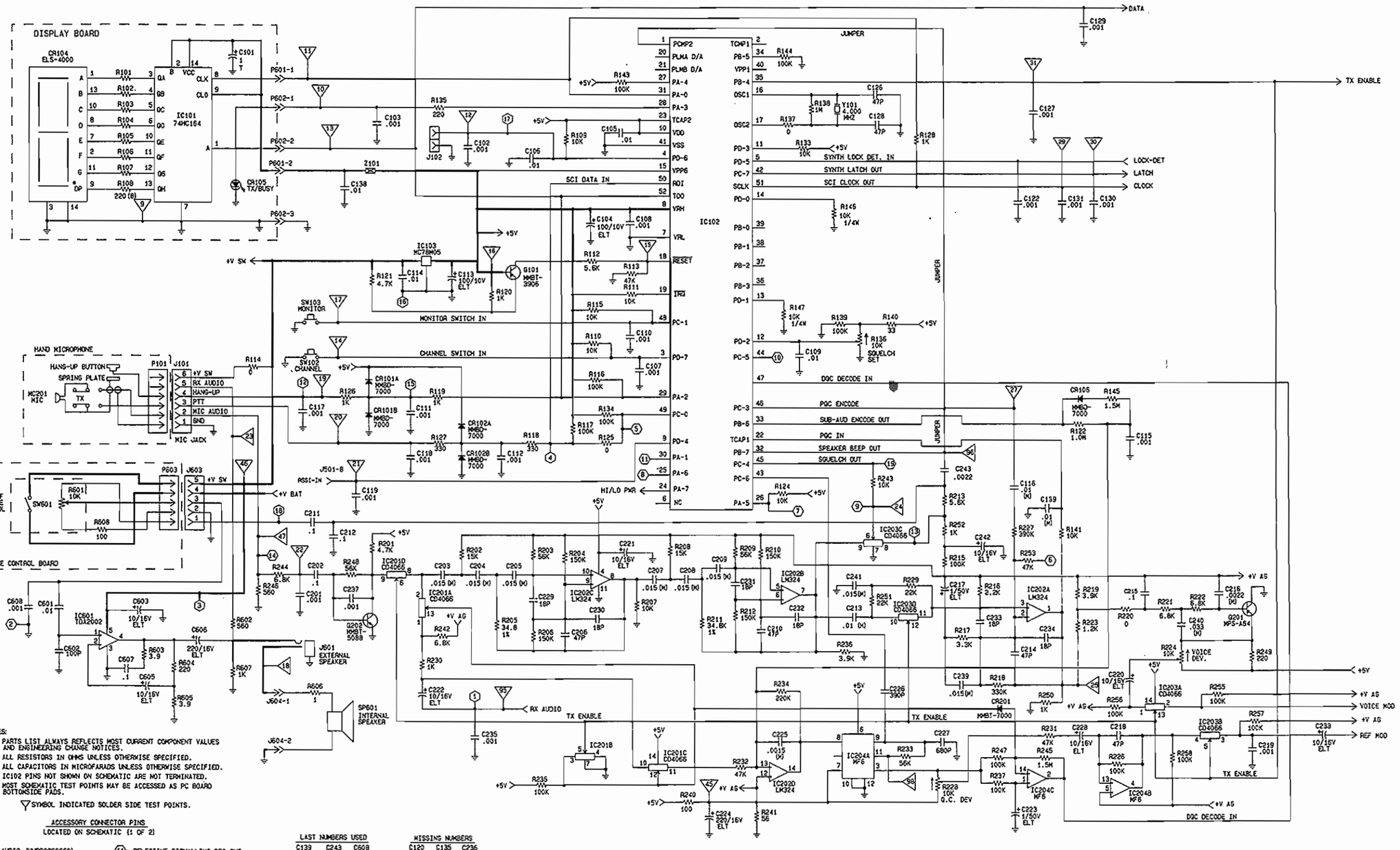
DEVICE	PIN	MEASUREMENTS			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC204					Switched Capacitor Fltr (con't.)
	7	1.7	1.7	1.7	Reference In
	8	1.7	SINE	1.7	Signal Input
	9	SAW	SAW	SAW	Clock Input
	10	GND	GND	GND	
	11	SQ	SQ	SQ	Clock Onput
	12	GND	GND	GND	
	13	1.7	1.7	1.7	Mixer Input
	14	2[1]	2[1]	2[1]	Comparator In
IC301					Synthesizer Controller
	1	SINE	SINE	SINE	Oscillator In
	2	SINE	SINE	SINE	Oscillator Out
	3	NC	NC	NC	
	4	5	5	5	Supply
	5	NC	NC	NC	
	6	GND	GND	GND	
	7	5	5	5	Lock Detect Out
	8	2.5	2.5	2.5	RF In
	9	0	0	0	Clock
	10	5	5	5	Data Latch
	11	0	0	0	
	12	NC	NC	NC	Programming Pins (12 -14)
	13	NC	NC	NC	
	14	NC	NC	NC	
	15	8	8	8	
	16	0	0	0	
IC302					Low Power +5 Volt Regulator
	1	8	8	8	Regulator Input
	2	GND	GND	GND	
	3	5	5	5	+5 Volt Regulated Output
IC304					+8 Volt Regulator
	1	13	13	13	Regulator Input
	2	GND	GND	GND	
	3	8	8	8	+8 Volt Regulated Output
IC501					IF Subsystem
	1	5.2	—	5.2	10.245 MHz Osc Trans Base
	2	4.6	—	4.6	10.245 MHz Osc Trans Emitter
	3	5	—	5	10.7 MHz to 455 KHz Mixer Out
	4	5.2	< 0.6	5.2	+5 Volt Supply
	5	1	—	1	455 KHz IF Input
	6	1	—	1	IF Amplifier Bypass
	7	1	—	1	455 KHz IF Output

DEVICE	PIN	MEASUREMENTS			FUNCTION
		RECEIVE	TRANSMIT	STANDBY	
IC501					IF Subsystem (con't.)
	8	5.2	—	5.2	Quadrature In
	9	2.7	—	2.7	Recovered Audio
	10	2	—	2	Noise Filter Input
	11	2.1	—	2.1	Noise Filter Output
	12	NC	NC	NC	NC
	13	NC	NC	NC	NC
	14	NC	NC	NC	NC
	15	GND	GND	GND	
	16	2	—	2	IF In
IC502					Video Amplifier
	1	10	0	10	
	2	10	0	10	
	3	GND	GND	GND	
	4	5	0	5	
	5	5	0	5	
	6	5	0	5	
	7	GND	GND	GND	
	8	10	0	10	
IC601					Audio Amplifier
	1	1.3	1.3	1.3	
	2	0.8	0.8	0.8	
	3	GND	GND	GND	
	4	6.5	6.5	6.5	
	5	13	13	13	

12. SCHEMATIC TEST POINTS (Δ) IDENTIFICATION

SCHEMATIC & COORDINATES		TEST POINT	DESCRIPTION
SCHEM 1	D8	Δ 1-8	CHANNEL INDICATOR DISPLAY SEGMENTS A-G and decimal point.
	C8	Δ9	DISPLAY BOARD GND.
	D7	Δ10	TX/BUSY INDICATOR LED.
	D7	Δ11	CHANNEL DATA CLOCK INPUT. Although all data is sent to the channel board, clock pulses are delivered only when a display change is required.
	D6	Δ12	PROGRAMMING KEY. This test point is used during factory alignment to load test data.
	D7	Δ13	DISPLAY/SYNTHESIZER/SERIAL PORT DATA. All three types of data are present at Δ13, but data is only latched in IC101 when clock pulses (at Δ11) are sent simultaneously.
	C6	Δ14	CHANNEL SELECT.
	C5	Δ15	MASTER RESET. Pulling this pin to ground causes system reset. Q101 forces this point "low" if the supply falls below +9 Volts.
	C6	Δ16	MICROCONTROLLER/DISPLAY BOARD SUPPLY VOLTAGE. +5 Volts.
	C6	Δ17	MONITOR SWITCH.
	B7	Δ18	SPEAKER AUDIO.
	C7	Δ19	HANG-UP SWITCH. Ground Δ19 to hang-up.
	C6	Δ20	TRANSMITTER CONTROL LINE. Δ20 pulls to Ground for TX.
	B6	Δ21	RELATIVE SIGNAL STRENGTH IN (RSSI). Voltage reflects signal strength.
	B7	Δ22	MODULATION INPUT. Test modulation can be applied through this test point via a series resistor.
	C7	Δ23	OUTPUT AUDIO. This point shows attenuated speaker audio.
	B4	Δ24	SQUELCH OUTPUT. This point is "low" when the unit is squelched, "high" when unsquelched. Δ24 may be forced "high" (+5 Volts) or "low" without damaging the circuit.
	B3	Δ25	AUDIO CONDITIONING AMPLIFIER OUTPUT.
	C3	Δ27	PAGING QUIET-CALL OUTPUT.
	D3	Δ29	SERIAL COMMUNICATIONS CLOCK OUTPUT. This clock is used for both synthesizer and display board data transfers. Due to the high transfer rate, clock pulses are difficult to measure.

SCHEMATIC & COORDINATES		TEST POINT	DESCRIPTION
SCHEM 1	D2	Δ30	A single pulse on this line signals the transfer of synthesizer data from the input data latch of IC301 into its working registers. Until this pulse occurs, the synthesizer acts as if no new data has been provided. When the pulse at Δ30 appears, the synthesizer loads and executes the new data. When serial data is intended for the display board rather than the synthesizer, the microprocesor does not deliver a pulse to Δ30.
	D3	Δ31	TRANSMITTER ENABLE. When the PTT button is pressed, IC102 raises the voltage at Δ31 to +5 Volts, which turns on the transmitter.
SCHEM 2	C7	Δ33	SUPPLY TO SYNTHESIZER. +5 Volts.
	D6	Δ34	SUB-AUDIBLE MODULATION.
	C5	Δ35	BUFFERED TRACKING VOLTAGE.
	D4	Δ36	SUPPLY TO SYNTHESIZER IC. +18 Volts.
	D2	Δ37	SWITCHED TX VOLTAGE. Measures +12 Volts in TX, 0 Volts in RX.
	D2	Δ38	SWITCHED RX VOLTAGE. Reads +10 Volts in RX, 0 Volts in TX.
	C3	Δ39	+V SUPPLY VOLTAGE.
	C3	Δ40	SYSTEM GND.
	A2	Δ41	SUPPLY TO IF. Measures +6.7 Volts in RX, +0.6 Volts or less in TX.
	C7	Δ42	LOCK DETECT OUT. This is an integrated pulse which signals the microprocessor if the synthesizer has locked.
SCHEM 1	A5	Δ45	$+V_{AG}$ AUDIO CONDITIONING REFERENCE VOLTAGE. Measures approximately +1.7 Volts.
	B7	Δ46	+V SWITCHED.
	B7	Δ47	MICROPHONE AUDIO.
SCHEM 2	B8	Δ94	HIGH/LOW POWER.
	A3	Δ95	DEMODULATED RECOVERED AUDIO.
SCHEM 1	C3	Δ96	SPEAKER BEEP OUT.
	A4	Δ98	FILTER CLOCK OUTPUT. The period of this square wave determines the cut-off frequency of the low-pass filter. This signal's frequency is about 100 times the cut-off frequency.
SCHEM 2	D2	Δ99	TX ENABLE.



NOTES:

1. PARTS LIST ALWAYS REFLECTS MOST CURRENT COMPONENT VALUES AND ENGINEERING CHANGE NOTICES.
2. ALL RESISTORS IN OHMS UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
4. IC102 PINS NOT SHOWN ON SCHEMATIC ARE NOT TERMINATED.
5. MOST SCHEMATIC TEST POINTS MAY BE ACCESSED AS PC BOARD BOTTOMSIDE PADS.

▽ SYMBOL INDICATED SOLDER SIDE TEST POINTS.

ACCESSORY CONNECTOR PINS
LOCATED ON SCHEMATIC (1 OF 2)

1. RX AUDIO (UNPROCESSED)
2. GROUND
3. +V SW
4. PTT SW
5. PTT IN
6. AUX MODULATION INPUT
7. EXT. SELECTIVE SIGNALLING INPUT
8. SPECIAL MODE OUT
9. SQUELCH OVERIDE IN
10. TRUNK PULSE OUT
11. SELECTIVE SIGNALLING DEC OUT
12. HANG-UP
13. RX AUDIO
14. MIC AUDIO
15. MONITOR
16. GROUND
17. TRUNK PULSE IN
18. AUDIO IN
19. SQUELCH OUT

LAST NUMBERS USED

C139	C243	C608
R147	R258	R608
Q101	Q202	IC601
IC103	IC204	
CR106		

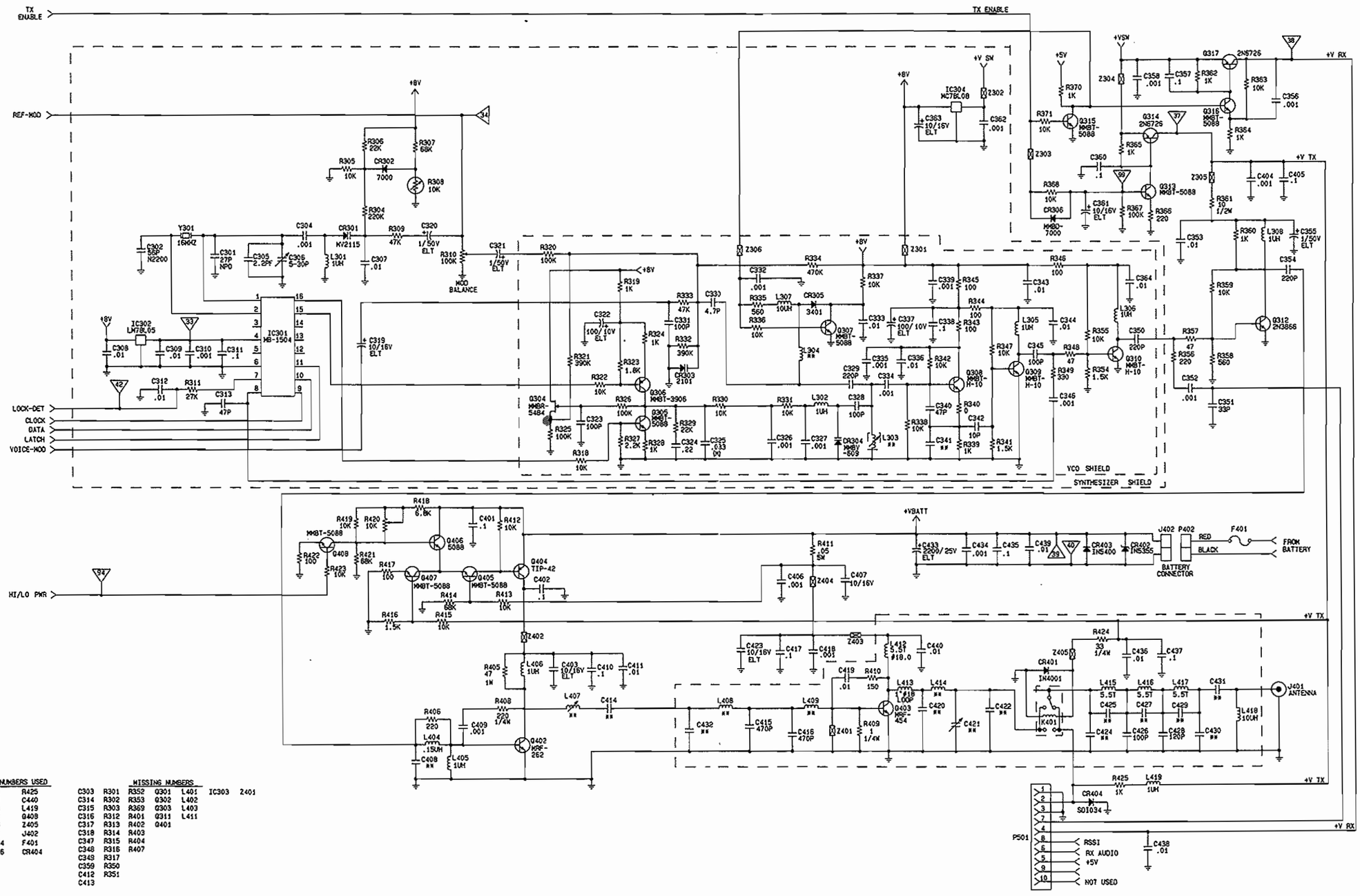
MISSING NUMBERS

C120	C135	C236
C121	C136	R238
C123	R123	R239
C124	R129	CR202
C125	R130	C604
C132	R131	
C133	R132	
C134		

TOPSIDE PARTS PLACEMENT /W REF.DES. 1730112E
TOPSIDE PARTS PLACEMENT /W VALUES 1730113E
BOTTOMSIDE PARTS PLACEMENT 1730114E
P.C. BOARD 1730110C

LAST ECN #2231

REV	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES	CONTRACT NO.	RITRON, INC. 505 W. CARMEL DR. CARMEL IN. 46032
ECO		APPROVALS / DATE	DWG. NAME: MOBILE XCVR MODEL: RPM-050
	MATERIAL	DRAWN D.L.WILSON 09-27-93	
DWG	FINISH	CHECKED	SIZE D · FSCM NO. · DWG. NO. 1730111E · REV E
	DO NOT SCALE DRAWING	ISSUED	PLOT: 12/07/94 · SCALE · 0111CTE1.SCH · SHEET 1 OF 2

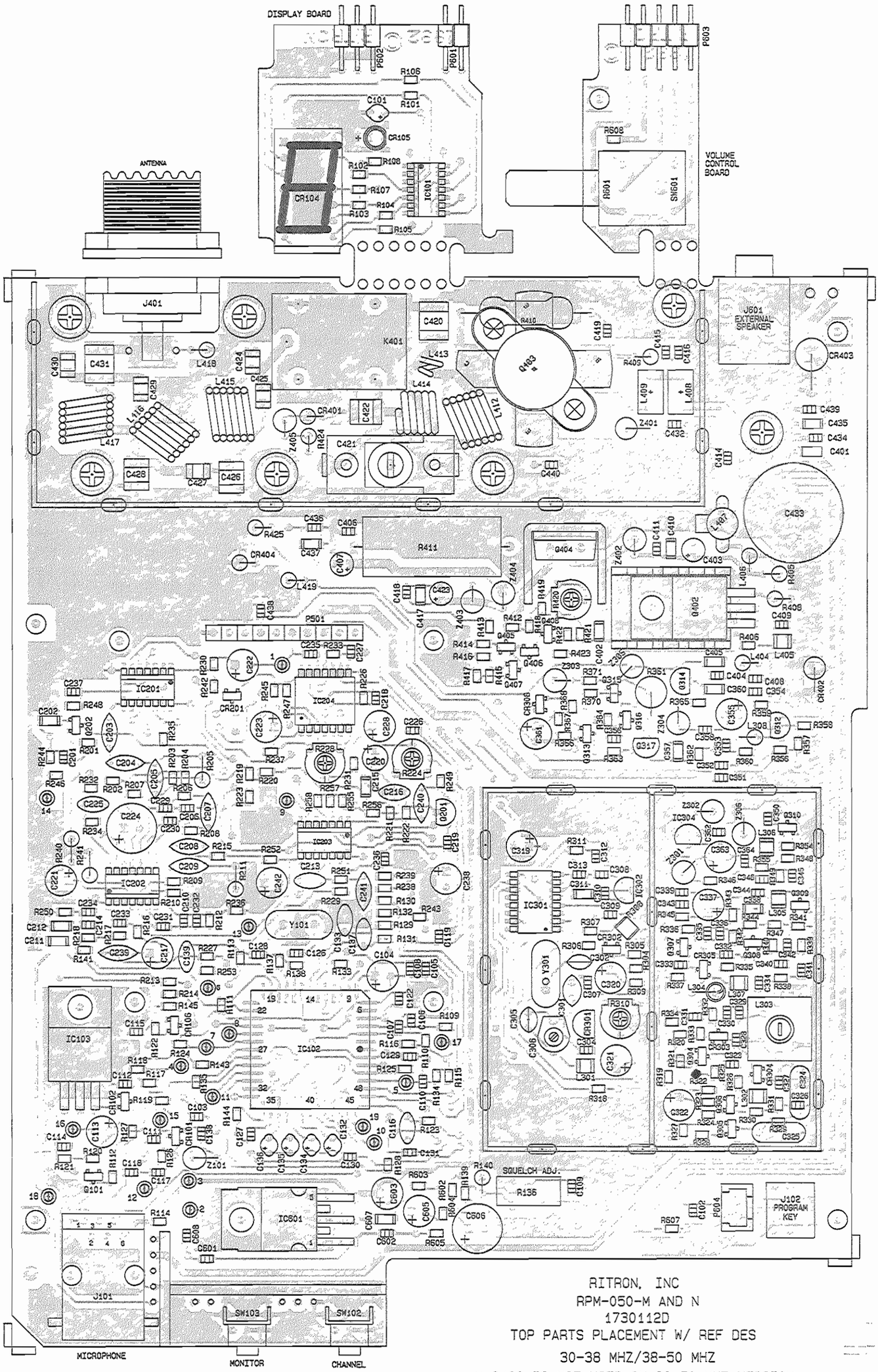


LAST NUMBERS USED						MISSING NUMBERS				
R371	R425	C303	R301	R352	Q301	L401	IC303	Z401		
C364	C440	C314	R302	R353	Q302	L402				
L308	L419	C315	R303	R369	Q303	L403				
Q317	Q408	C316	R312	R401	Q311	L411				
Z306	Z405	C317	R313	R402	Q401					
Y301	J402	C318	R314	R403						
IC304	F401	C347	R315	R404						
CR306	CR404	C348	R316	R407						
		C349	R317							
		C359	R350							
		C412	R351							
		C413								

**REF.DES.	C341	C408	C414	C420	C421	C422	C424	C425	C427	C429	C430	C431	C432	L303	L304	L407	L408	L409	L413	L414	R409
RPM-050-N 30-38 MHZ	68 0805 CHIP	180 0805 CHIP	180 0805 CHIP	1200 MICA CHIP	SMC 31000	100 MICA CHIP	47 MICA CHIP	27 MICA CHIP	33 MICA CHIP	15 MICA CHIP	33 MICA CHIP	680 MICA CHIP	470 0805 CHIP	12.5T	.47	4.5T	.625"	1"	1.5T .15"ID 18 GA.	5.5T .187"ID 18 GA.	1 OHM
RPM-050-N 38-50 MHZ	47 0805 CHIP	120 0805 CHIP	100 0805 CHIP	680 MICA CHIP	SMC 30500	NOT USED	56 MICA CHIP	10 MICA CHIP	18 MICA CHIP	10 MICA CHIP	39 MICA CHIP	220 MICA CHIP	220 0805 CHIP	8.5T	.39	4.5T	.625"	.625"	1.5T .125"ID 18 GA.	5.5T .150"ID 18 GA.	NOT USED

LAST ECN #2231

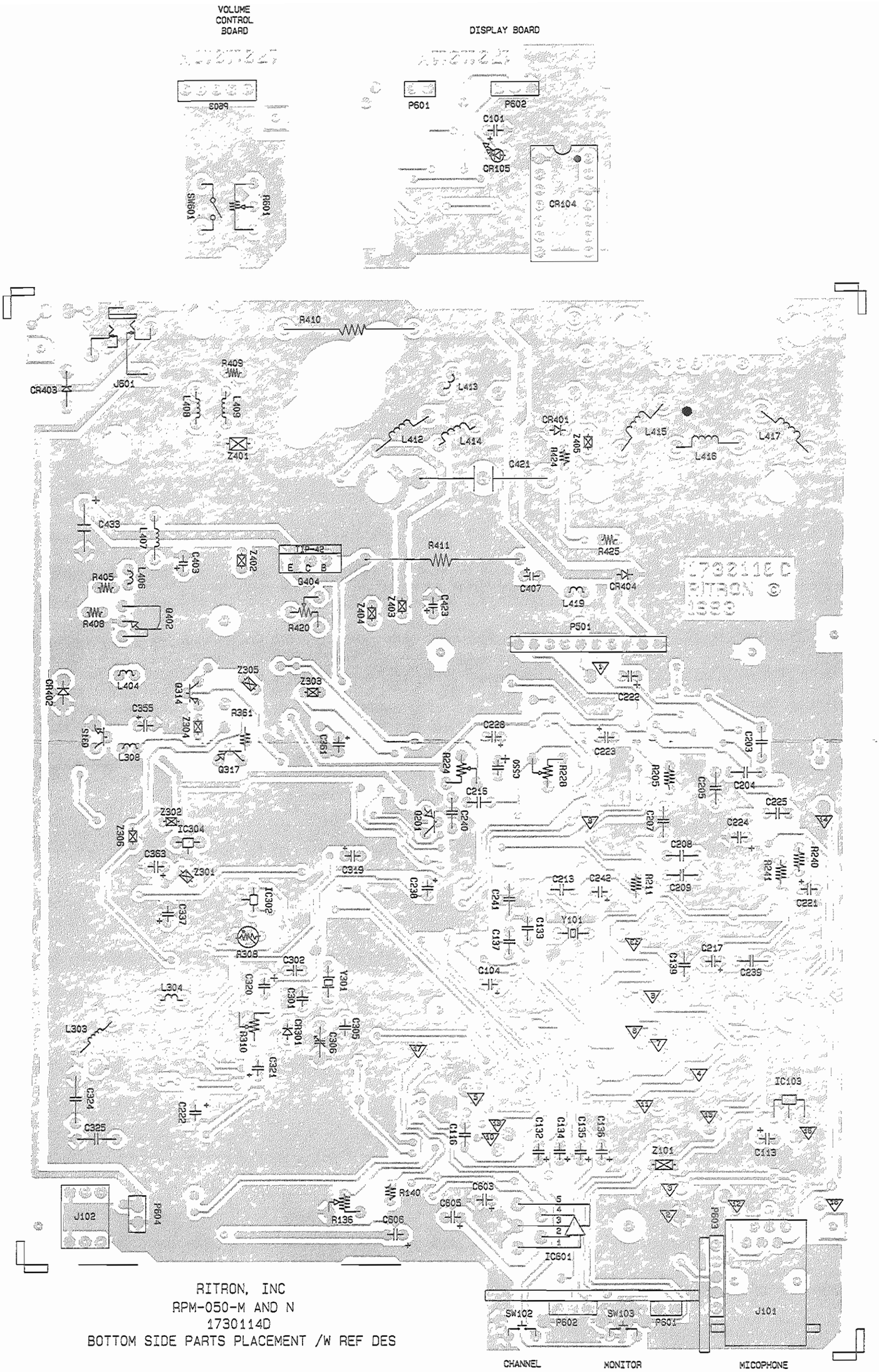
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES	CONTRACT NO.	RITRON, INC. 505 W. CARMEL DR. CARMEL, IN. 46032	
	APPROVALS / DATE	DWG. NAME: MOBILE XCVR MODEL: RPM-050	
MATERIAL	DRAWN D.L.WILSON 09-27-93		
FINISH	CHECKED	SIZE D	FSCM NO. PLOT: 12/07/94
DO NOT SCALE DRAWING	ISSUED	DWG. NO. 1730111E	REV E
		SCALE	0111CTE2.SCH SHEET 2 OF 2



LAST ECN #2130 09-27-93

RITRON, INC
RPM-050-M AND N
17301120
TOP PARTS PLACEMENT W/ REF DES
30-38 MHZ/38-50 MHZ

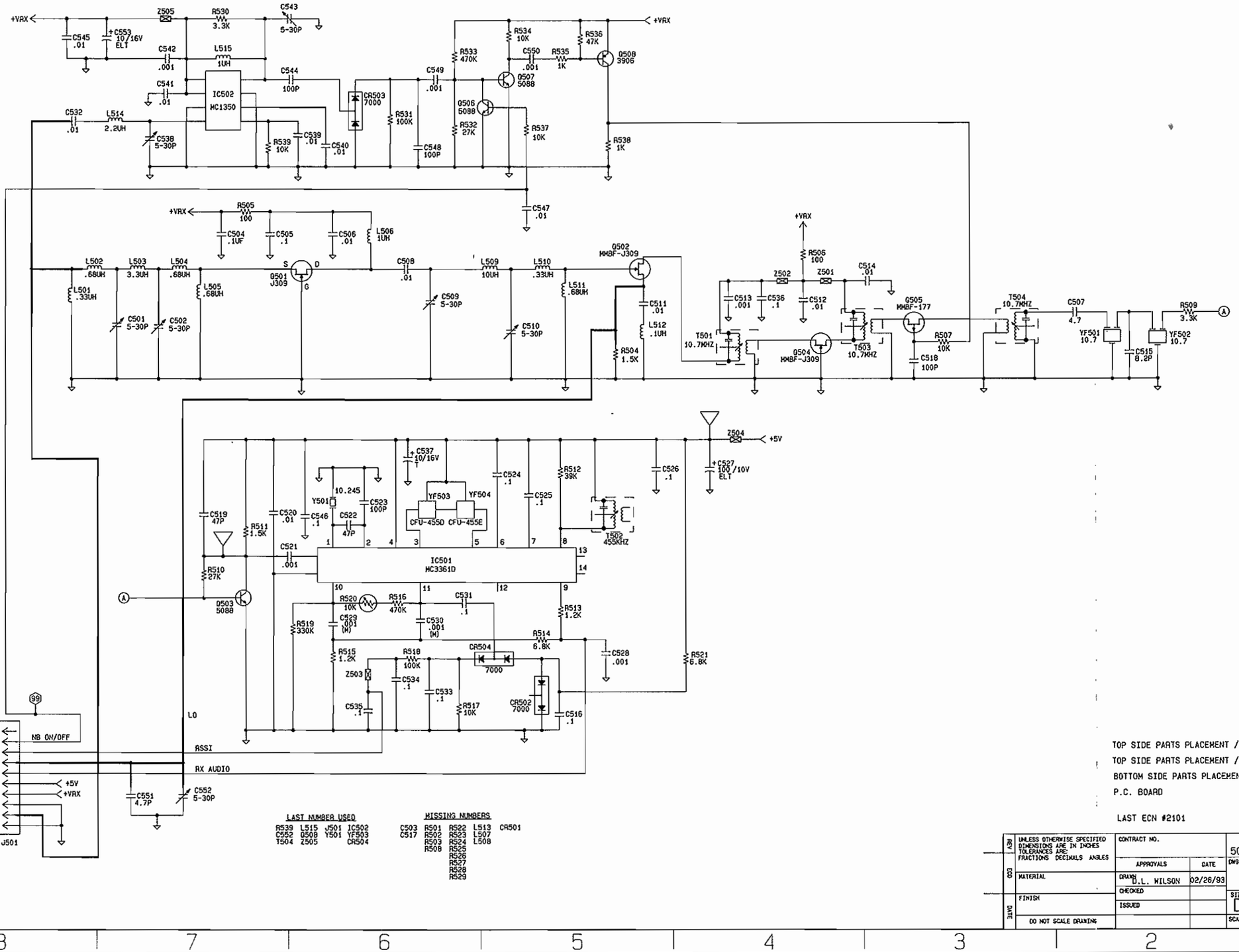
* C422 IS NOT USED ON 38-50 MHZ VERSION
* R409 IS NOT USED ON 38-50 MHZ VERSION
* L414 USE P/N #01801031 ON 30-38 MHZ VERSION
USE P/N #01801032 ON 38-50 MHZ VERSION
* L304 USE P/N #01800209 ON 30-38 MHZ VERSION
USE P/N #01800102 ON 38-50 MHZ VERSION



RITRON, INC
RPM-050-M AND N
1730114D
BOTTOM SIDE PARTS PLACEMENT /W REF DES

TOP SIDE PARTS PLACEMENT /W REF.DES.	1730112D
TOP SIDE PARTS PLACEMENT /W VALUES	1730113D
SCHEMATIC	1730111D
P.C. BOARD	1730110C

09-27-93 LAST ECN #2130



LAST NUMBER USED

R539	L515	J501	IC502
C552	Q508	Y501	YF503
T504	Z505		CR504

MISSING NUMBERS

C503	R501	R522	L513
C517	R502	R523	L507
	R503	R524	L508
	R508	R525	CR501
		R526	
		R527	
		R528	
		R529	

TOP SIDE PARTS PLACEMENT /W REF.DES	1730012D
TOP SIDE PARTS PLACEMENT /W VALUES	1730013D
BOTTOM SIDE PARTS PLACEMENT	1730014D
P.C. BOARD	1730010D

LAST ECN #2101

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN B.L. WILSON	02/26/93
CHECKED	
ISSUED	

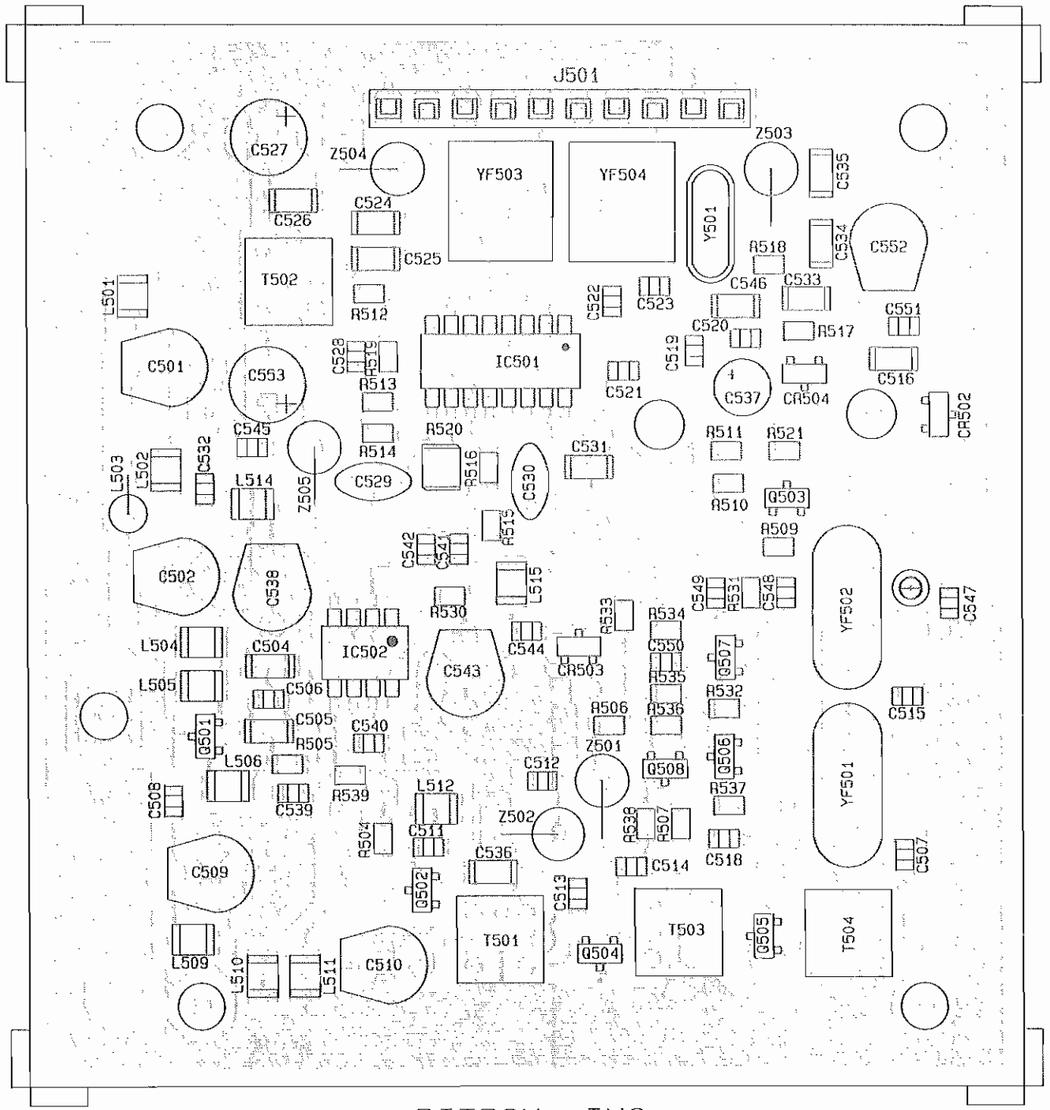
RITRON, INC.
505 W. CARMEL DR. CARMEL, IN. 46032

DWG. NAME MODEL: RPM-050
RECEIVER BOARD SCHEMATIC

SIZE D | FSCM NO. FILE: 011DTD | DWG. NO. 1730011D | REV D

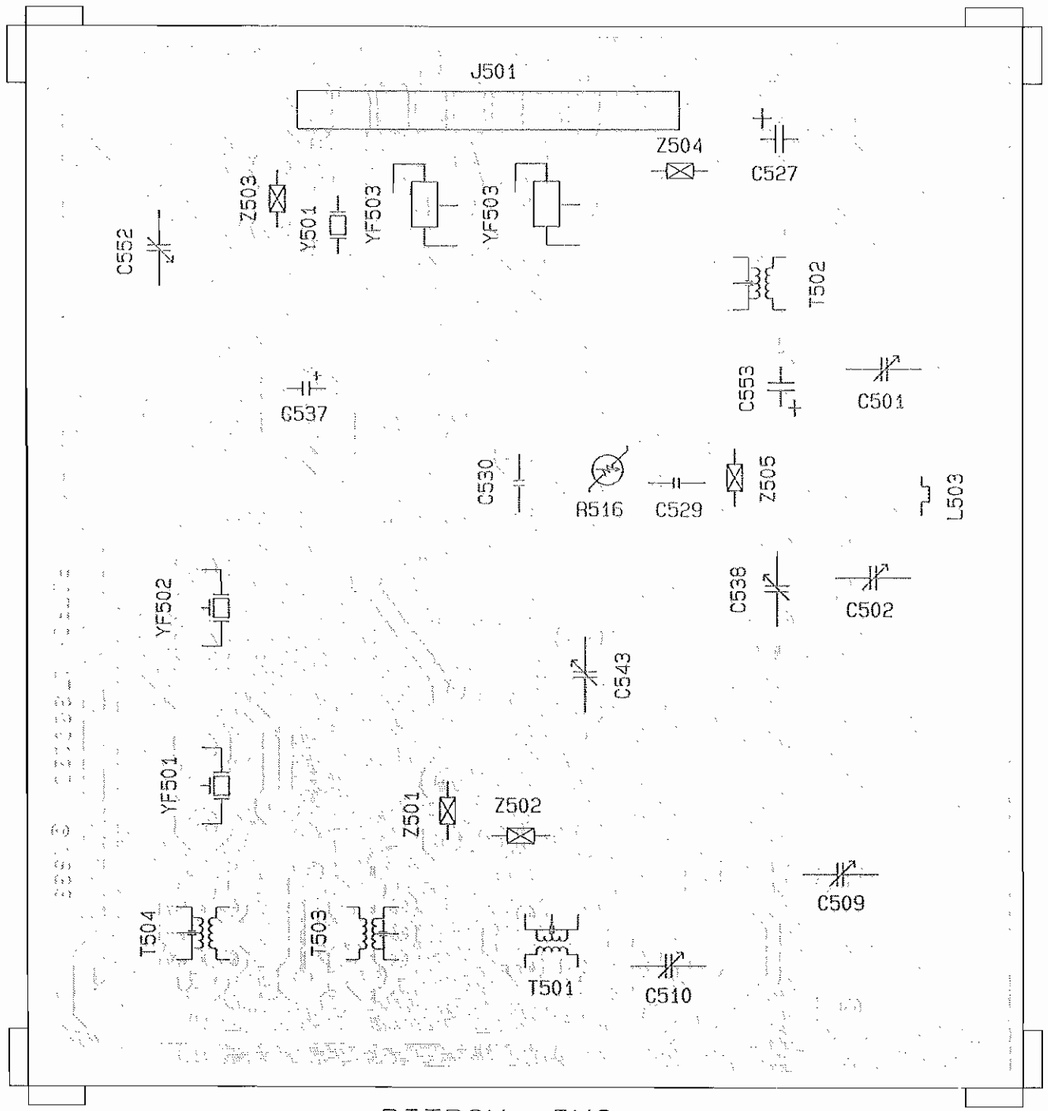
SCALE N/A | SHEET 1 OF 1

TOP SIDE PARTS PLACEMENT/VALUES	1730013D
BOTTOM SIDE PARTS PLACEMENT	1730014D
SCHEMATIC	1730011D
P.C. BOARD	1730010D



RITRON, INC.
1730012D
RECEIVER BOARD
TOP PARTS PLACEMENT W/ REF DES

TOP SIDE PARTS PLACEMENT/REF.DES.	1730012D
TOP SIDE PARTS PLACEMENT/VALUES	1730013D
SCHEMATIC	1730011D
P.C. BOARD	1730010D



RITRON, INC.
1730014D
RECEIVER BOARD
BOTTOM PARTS PLACEMENT W/ REF DES

15. RPM-050 PARTS LIST

15.1 RPM-050 MAIN PC BD SCHEMATIC REFERENCE PARTS LIST

NOTE: This parts list reflects the most current component values (through ECN 2231). If a component value given in the schematic differs from that in the parts list, the parts list should be considered correct.

REF#	RITRON#	DESCRIPTION
CAPACITORS, CHIP, 0805, 50V, UNLESS STATED OTHERWISE		
C 101	01502007	1 µF TANT 35V 20%
C 102	15111102	.001 µF X7R
C 103	15111102	.001 µF X7R
C 104	01503110	100 µF ELT 10V
C 105	15111103	.01 µF X7R
C 106	15111103	.01 µF X7R
C 107	15111102	.001 µF X7R
C 108	15111102	.001 µF X7R
C 109	15111103	.01 µF X7R
C 110	15111102	.001 µF X7R
C 111	15111102	.001 µF X7R
C 112	15111102	.001 µF X7R
C 113	01503110	100 µF ELT 10V
C 114	15111103	.01 µF X7R
C 115	15111102	.001 µF X7R
C 116	01501050	.01 µF MYLAR 100V10%
C 117	15111102	.001 µF X7R
C 118	15111102	.001 µF X7R
C 119	15111102	.001 µF X7R
C 122	15111102	.001 µF X7R
C 126	15110470	47 pF NPO
C 127	15111102	.001 µF X7R
C 128	15110470	47 pF NPO
C 129	15111102	.001 µF X7R
C 130	15111102	.001 µF X7R
C 131	15111102	.001 µF X7R
C 138	15111103	.01 µF X7R
C 139	01501050	.01 µF MYLAR 100V 10%
C 201	15111102	.001 µF X7R
C 202	15121104	.1 µF X7R 1206
C 203	01501062	.015 µF MYLAR 100V 10%
C 204	01501062	.015 µF MYLAR 100V 10%
C 205	01501062	.015 µF MYLAR 100V 10%
C 206	15110470	47 pF NPO
C 207	01501062	.015 µF MYLAR 100V 10%
C 208	01501062	.015 µF MYLAR 100V 10%
C 209	01501062	.015 µF MYLAR 100V 10%
C 210	15110470	47 pF NPO
C 211	15121104	.1 µF X7R 1206
C 212	15121104	.1 µF X7R 1206
C 213	01501050	.01 µF MYLAR 100V 10%
C 214	15110470	47 pF NPO
C 215	15121104	.1 µF X7R 1206
C 216	01501041	.0022 µF MYLAR 100V 10%
C 217	01503002	1 µF ELT
C 218	15110470	47 pF NPO
C 219	15111102	.001 µF X7R
C 220	01503006	10 µF ELT 16V
C 221	01503006	10 µF ELT 16V
C 222	01503006	10 µF ELT 16V
C 223	01503002	1 µF ELT
C 224	01503011	220 µF ELT 16V
C 225	01501065	.0015 µF MYLAR 100V 10%
C 226	15110391	390 pF NPO
C 227	15110681	680 pF NPO
C 228	01503006	10 µF ELT 16V
C 229	15110180	18 pF NPO
C 230	15110180	18 pF NPO
C 231	15110180	18 pF NPO
C 232	15110180	18 pF NPO
C 233	15110180	18 pF NPO
C 234	15110180	18 pF NPO
C 235	15111102	.001 µF X7R
C 236	15111102	.001 µF X7R
C 237	15111102	.001 µF X7R
C 238	01503006	10 µF ELT 16V
C 239	01501062	.015 µF MYLAR 100V 10%
C 240	01501053	.033 µF MYLAR 100V 10%
C 241	01501062	.015 µF MYLAR 100V 10%
C 242	01503006	10 µF ELT 16V
C 243	15111222	.0022 µF NPO
C 301	01510020	27 pF NP0 CERDIS
C 302	01510924	56 pF N2200 CER D .1 LEAD SPC
C 304	15111102	.001 µF X7R
C 306	01550006	5-30 pF VAR CER
C 307	15111103	.01 µF X7R
C 308	15111103	.01 µF X7R
C 309	15111103	.01 µF X7R
C 310	15111102	.001 µF X7R
C 311	15121104	.1 µF X7R 1206
C 312	15111103	.01 µF X7R
C 313	15110470	47 pF NPO
C 319	01503006	10 µF ELT 16V
C 320	01503002	1 µF ELT
C 321	01503002	1 µF ELT
C 322	01503110	100 µF ELT 10V
C 323	15110101	100 pF NPO
C 324	01501071	.22 µF MLPOLY 5 %
C 325	01501053	.033 µF MYLAR 100V 10%
C 326	15111102	.001 µF X7R
C 327	15111102	.001 µF X7R
C 328	15110101	100 pF NPO
C 329	15110221	220 pF NPO
C 330	151104A7	4.7 pF
C 331	15110101	100 pF NPO
C 332	15111102	.001 µF X7R
C 333	15111103	.01 µF X7R
C 334	15111102	.001 µF X7R
C 335	15111102	.001 µF X7R
C 336	15111103	.01 µF X7R
C 337	01503110	100 µF ELT 10V
C 338	15121104	.1 µF X7R 1206
C 339	15111102	.001 µF X7R
C 340	15110470	47 pF NPO
C 342	15110100	10 pF NPO
C 343	15111103	.01 µF X7R
C 344	15111103	.01 µF X7R
C 345	15110101	100 pF NPO
C 346	15111102	.001 µF X7R
C 350	15110221	220 pF NPO
C 351	15110330	33 pF NPO
C 352	15111102	.001 µF X7R
C 353	15111103	.01 µF X7R
C 354	15110221	220 pF NPO
C 355	01503002	1 µF ELT

REF #	RITRON #	DESCRIPTION
C 356	15111102	.001 µF X7R
C 357	15121104	.1 µF X7R 1206
C 358	15111102	.001 µF X7R
C 360	15121104	.1 µF X7R 1206
C 361	01503006	10 µF ELT 16V
C 362	15111102	.001 µF X7R
C 363	01503006	10 µF ELT 16V
C 364	15111103	.01 µF X7R
C 401	15121104	.1 µF X7R 1206
C 402	15121104	.1 µF X7R 1206
C 403	01503006	10 µF ELT 16V
C 404	15111102	.001 µF X7R
C 405	15121104	.1 µF X7R 1206
C 406	15111102	.001 µF X7R
C 407	01503006	10 µF ELT 16V
C 408	15110181	180 pF NPO
C 409	15111102	.001 µF X7R
C 410	15121104	.1 µF X7R 1206
C 411	15111103	.01 µF X7R
C 414	15110181	180 pF NPO
C 415	15110471	470 pF NPO
C 416	15110471	470 pF NPO
C 417	15121104	.1 µF X7R 1206
C 418	15111102	.001 µF X7R
C 419	15111103	.01 µF X7R
C 420	15545102	1000 pF MICA 2220 500V
C 421	01550025	130-450 pF VAR COMP MICA
C 422	15535101	100 pF NPO 1812 500V MICA
C 423	01503006	10 µF ELT 16V
C 424	15525470	47 pF NPO 1210 500V MICA
C 425	15525270	27 pF MICA 1210 500V
C 426	15535101	100 pF NPO 1812 500V MICA
C 427	15525330	33 pF MICA 1210
C 428	15535121	120 pF MICA 1812 500V
C 429	15525150	15 pF NPO 1210 500V MICA
C 430	15525330	33 pF MICA 1210
C 431	15545681	680 pF NPO 2220 500V MICA
C 432	15110471	470 pF NPO
C 433	01503208	2200 µF ELT 25V
C 434	15111102	.001 µF X7R
C 435	15121104	.1 µF X7R 1206
C 436	15111103	.01 µF X7R
C 437	15121104	.1 µF X7R 1206
C 438	15111103	.01 µF X7R
C 439	15111103	.01 µF X7R
C 440	15111103	.01 µF X7R
C 601	15111103	.01 µF X7R
C 602	15110101	100 pF NPO
C 603	01503006	10 µF ELT 16V
C 605	01503006	10 µF ELT 16V
C 606	01503011	220 µF ELT 16V
C 607	15121104	.1 µF X7R 1206
C 608	15111102	.001 µF X7R

DIODES

CR101	48A1005C	MMBD7000 DUAL SOT-23 5C
CR102	48A1005C	MMBD7000 DUAL SOT-23 5C
CR104	02450101	7 SEG GRN LED COM CATH .4
CR105	02450006	MINIATURE RED LED
CR106	48A1005C	MMBD7000 DUAL SOT-23 5C
CR201	48A1005C	MMBD7000 DUAL SOT-23 5C
CR301	04810015	MV-2115 VARI CAP
CR302	48A1005C	MMBD7000 DUAL SOT-23 5C
CR303	48C1004G	MMBV-2101L VVC SOT-23 4G\\
CR304	48C1005L	VVC 40 pF SOT-23 (5L) MMBV609L
CR305	48A1004D	MMBV3401TI UHF SOT-23 (4D)
CR306	48A1005C	MMBD7000 DUAL SOT-23 5C
CR401	04810003	1N4001 50 VOLT/1AMP
CR402	04820119	1N5355A ZENER 18V 5W
CR403	04810024	1N5400-3AMP-50PIV-PWR REC
CR404	04810032	PIN UHF 10W DO-34PKG

INTEGRATED CIRCUITS

IC101	31120164	IC SO-14 DIGITAL 74HC164
IC102	314B0004	MICRO FOR PROG RADIO
IC103	03131016	MC78MO5CY 5 V REG (TO-220)
IC201	31124066	QUAD ANLOG SW MC14066 SO-14
IC202	31020324	OP AMP QUAD GENERAL
IC203	31124066	QUAD ANLOG SW MC14066 SO-14
IC204	31020001	MF6 6-POLE FILTER IC SO
IC301	31330001	UHF SYNTHESIZER MB1504
IC302	03131012	MC78L05CP 5V REGULATOR
IC304	03131013	MC78L08CP 8 VOLT REG
IC601	03131050	8 WATT AUDIO AMP (TDA2002)

CONNECTORS

J 101	02100310	6-PIN MODULAR PHONE JACK
J 102	21433030	CONNECTOR 3 POSITION PC MNT
J 401	02100330	UHF REAR MNT BULKHD RECEPT
J 402	02100325	DC PWR CONNECTOR PLUG
J 601	02100053	3.5MM STEREO JACK PNEL MNT
J 603	02100302	MICRO-MINI HEADER MMP2S-1

JUMPERS

JU101	06001048	#30 AWG GREEN KYNAR
JU102	06001048	#30 AWG GREEN KYNAR

RELAY

K 401	04500009	12 VOLT 5 AMP SPDT

INDUCTORS

L 301	18110102	1.0 µH CHIP
L 302	18110102	1.0 µH CHIP
L 303	01850092	12.5T CW VARIABLE COIL NO TAB
L 303	02500003	10MM SHIELD CAN AURA
L 304	01800102	.39 µH WILCO
		(L304 not present in RPM-050-M)
L 305	18110102	1.0 µH CHIP
L 306	18110102	1.0 µH CHIP
L 307	18110103	10 µH CHIP
L 308	01800213	1 µH MOL FCW COIL .250 a
L 404	01800101	.15 µH PHE FCW COIL .250 aR
L 405	18110102	1.0 µH CHIP
L 406	01800145	1 µH PHE FCW COIL .250 aR
L 407	01850044	4.5T CBJVSW COIL .25 r R
L 408	01800304	12.7 nH 1/2T LP .197 LS #22 AWG
L 409	01800304	12.7 nH 1/2T LP .197 LS #22 AWG
L 412	01801030	5.5T AIRFCW. .25ID #18
L 413	01802111	1.5T .15 ID #18 (RPM-050-M)
L 413	01802085	1.5T .125 ID #18 (RPM-050-N)
L 414	01801031	4.5T AIRFCW. .20ID #18
L 415	01801030	5.5T AIRFCW. .25ID #18

REF #	RITRON #	DESCRIPTION
L 416	01801030	5.5T AIRFCW. .25ID #18
L 417	01801030	5.5T AIRFCW. .25ID #18
L 418	01800225	10 µH MOL FCW COIL .250 a
L 419	01800213	1 µH MOL FCW COIL .250 a

HEADER CONNECTORS

P 601	21331022	RIGHT ANGLE .1CTRS 2 PIN
P 602	21331032	RIGHT ANGLE .1 CTRS 3 PIN
P 603	21331052	RIGHT ANGLE .1 CTRS 5 PIN
P 603	02100301	MICR0-MINI SOCKET MMH2-1

TRANSISTORS

Q 101	4801002A	MMBT3906L PNP SOT-23 2A
Q 201	04800008	MPS-A64 PNP DARLINGTON
Q 202	4801001Q	MMBT-5088 SOT-23 1Q
Q 304	4841006B	NFET GP SOT-23 (6B) MMBF5484
Q 305	4801001Q	MMBT-5088 SOT-23 1Q
Q 306	4801002A	MMBT3906L PNP SOT-23 2A
Q 307	4801001Q	MMBT-5088 SOT-23 1Q
Q 308	4821003E	MMBT-H10 VHF SOT-23 (3E)
Q 309	4821003E	MMBT-H10 VHF SOT-23 (3E)
Q 310	4821003E	MMBT-H10 VHF SOT-23 (3E)
Q 312	04800030	MPS-3866 NPN RF MED PWR
Q 313	4801001Q	MMBT-5088 SOT-23 1Q
Q 314	04800018	2N6726 PNP PWR
Q 315	4801001Q	MMBT-5088 SOT-23 1Q
Q 316	4801001Q	MMBT-5088 SOT-23 1Q
Q 317	04800018	2N6726 PNP PWR
Q 402	04801008	MRF262 NPN VHF AMP TO-220 5 W
Q 403	04801037	MRF-454 80WATT 30-50MHZ
Q 404	04800019	TIP-42 40V 6A PNP PWR
Q 405	4801001Q	MMBT-5088 SOT-23 1Q
Q 406	4801001Q	MMBT-5088 SOT-23 1Q
Q 407	4801001Q	MMBT-5088 SOT-23 1Q
Q 408	4801001Q	MMBT-5088 SOT-23 1Q

RESISTORS, CHIP, 0805

R 101	47100221	220 Ω
R 102	47100221	220 Ω
R 103	47100221	220 Ω
R 104	47100221	220 Ω
R 105	47100221	220 Ω
R 106	47100221	220 Ω
R 107	47100221	220 Ω
R 108	47100221	220 Ω
R 109	47100103	10 KΩ
R 110	47100103	10 KΩ
R 111	47100103	10 KΩ
R 112	47100562	5.6 KΩ
R 113	47100473	47 KΩ
R 114	47100000	ZERO Ω
R 115	47100103	10 KΩ
R 116	47100104	100 KΩ
R 117	47100104	100 KΩ
R 118	47100331	330 Ω
R 119	47100102	1 KΩ
R 120	47100102	1 KΩ
R 121	47100472	4.7 KΩ
R 122	47100105	1M Ω
R 124	47100103	10 KΩ
R 125	47100000	ZERO Ω
R 126	47100102	1 KΩ
R 127	47100331	330 Ω
R 128	47100102	1 KΩ
R 133	47100103	10 KΩ
R 134	47100104	100 KΩ
R 135	47100221	220 Ω
R 136	04750004	10K TRIM POT VERT MINI
R 137	47100000	ZERO Ω
R 138	47100105	1M Ω
R 139	47100104	100 KΩ
R 140	04700115	33 Ω 1/4W 5%
R 141	47100103	10 KΩ
R 143	47100104	100 KΩ
R 144	47100104	100 KΩ
R 145	47100155	1.5M 1/10W
R 146	04700145	10 KΩ 1/4 W 5% CF
R 147	04700145	10 KΩ 1/4 W 5% CF
R 201	47100472	4.7 KΩ
R 202	47100153	15 KΩ
R 203	47100563	56 KΩ
R 204	47100154	150 KΩ
R 205	04732496	34.8 KΩ 1% METAL FILM 1/4 IST
R 206	47100154	150 KΩ
R 207	47100103	10 KΩ
R 208	47100153	15 KΩ
R 209	47100563	56 KΩ
R 210	47100154	150 KΩ
R 211	04732496	34.8 KΩ 1% METAL FILM 1/4 IST
R 212	47100154	150 KΩ
R 213	47100562	5.6 KΩ
R 215	47100104	100 KΩ
R 216	47100222	2.2 KΩ
R 217	47100332	3.3k Ω
R 218	47100334	330K 1/10W
R 219	47100392	3.9 KΩ
R 220	47100000	ZERO Ω
R 221	47100682	6.8 KΩ 1/10W 5%
R 222	47100682	6.8 KΩ 1/10W 5%
R 223	47100122	1.2 KΩ
R 224	04750049	10K PIHER POT MINI
R 226	47100104	100 KΩ
R 227	47100394	390 KΩ
R 228	04750049	10K PIHER POT MINI
R 229	47100223	22 KΩ
R 230	47100102	1 KΩ
R 231	47100473	47 KΩ
R 232	47100473	47 KΩ
R 233	47100563	56 KΩ
R 234	47100224	220 KΩ
R 235	47100104	100 KΩ
R 236	47100392	3.9 KΩ
R 237	47100104	100 KΩ
R 240	04700121	100 Ω 5% 1/4W CF
R 241	04700118	56 Ω 1/4W 5% CF
R 242	47100682	6.8 KΩ 1/10W 5%
R 243	47100103	10 KΩ
R 244	47100682	6.8 KΩ 1/10W 5%
R 245	47100155	1.5M 1/10W
R 246	47100561	560 Ω
R 247	47100104	100 KΩ
R 248	47100563	56 KΩ
R 249	47100221	220 Ω
R 250	47100102	1 KΩ
R 251	47100223	22 KΩ

REF #	RITRON #	DESCRIPTION
R 252	47100102	1 KΩ
R 253	47100473	47 KΩ
R 255	47100104	100 KΩ
R 256	47100104	100 KΩ
R 257	47100104	100 KΩ
R 258	47100104	100 KΩ
R 304	47100224	220 KΩ
R 305	47100103	10 KΩ
R 306	47100223	22 KΩ
R 307	47100683	68 KΩ
R 308	04750100	10 KΩ THERMISTOR
R 309	47100473	47 KΩ
R 310	04750050	100K PIHER POT MINI
R 311	47100273	27 KΩ
R 318	47100103	10 KΩ
R 319	47100102	1 KΩ
R 320	47100104	100 KΩ
R 322	47100103	10 KΩ
R 323	47100182	1.8 KΩ
R 324	47100102	1 KΩ
R 325	47100104	100 KΩ
R 326	47100104	100 KΩ
R 327	47100222	2.2 KΩ
R 328	47100102	1 KΩ
R 329	47100223	22 KΩ
R 330	47100103	10 KΩ
R 331	47100103	10 KΩ
R 332	47100394	390 KΩ
R 333	47100473	47 KΩ
R 334	47100474	470 KΩ
R 335	47100561	560 Ω
R 336	47100103	10 KΩ
R 337	47100103	10 KΩ
R 338	47100103	10 KΩ
R 339	47100102	1 KΩ
R 340	47100000	ZERO Ω
R 341	47100152	1.5 KΩ
R 342	47100103	10 KΩ
R 343	47100101	100 Ω
R 344	47100101	100 Ω
R 345	47100101	100 Ω
R 346	47100101	100 Ω
R 347	47100103	10 KΩ
R 348	47100470	47 Ω
R 349	47100331	330 Ω
R 354	47100152	1.5 KΩ
R 355	47100103	10 KΩ
R 356	47100221	220 Ω
R 357	47100470	47 Ω
R 358	47100561	560 Ω
R 359	47100103	10 KΩ
R 360	47100102	1 KΩ
R 361	04710008	10 Ω 1/2W 5% CF
R 362	47100102	1 KΩ
R 363	47100103	10 KΩ
R 364	47100102	1 KΩ
R 365	47100102	1 KΩ
R 366	47100221	220 Ω
R 367	47100104	100 KΩ
R 368	47100103	10 KΩ
R 370	47100102	1 KΩ
R 371	47100103	10 KΩ
R 405	04710848	47 Ω 1W METAL FILM
R 406	47100221	220 Ω
R 408	04700125	220 Ω 1/4W 5% CF
R 409	04700099	1 Ω 1/4W 5% CF (RPM-050-M)
R 409	04720009	0 Ω 1/4W 5% CF (RPM-050-N)
R 410	04720016	150 Ω 2W CF
R 411	04720051	.05 Ω .5W 10% WIREWOUND
R 412	47100103	10 KΩ
R 413	47100103	10 KΩ
R 414	47100683	68 KΩ
R 415	47100103	10 KΩ
R 416	47100152	1.5 KΩ
R 417	47100101	100 Ω
R 418	47100682	6.8 KΩ 1/10W 5%
R 419	47100103	10 KΩ
R 420	04750049	10K PIHER POT (MINI)
R 421	47100683	68 KΩ
R 422	47100101	100 Ω
R 423	47100103	10 KΩ
R 424	04700115	33 Ω 1/4W 5%
R 425	47100102	1 KΩ
R 601	04750053	10 KΩ POT SPSTSW AUD PCMNT
R 602	47100561	560 Ω
R 603	471003A9	3.9 1/10W
R 604	47100221	220 Ω
R 605	471003A9	3.9Ω 1/10W
R 606	04720049	1 Ω 2W 10%
R 607	47100102	1 KΩ
R 608	47100101	100 Ω

SPEAKER

SP601	05500027	1.75 X 3.0 OVAL 4W ALNIC

SWITCHES

SW102	05100042	SPST MOMENT MINI PC 260GM
SW103	05100042	SPST MOMENT MINI PC 260GM

CRYSTALS

Y 101	02300058	4.000MHZ AT-49
Y 301	02300093	16.000MHZ HC-44/UM-1

FERRITE BEADS, ON AXIAL LEADS, UNLESS STATED OTHERWISE

Z 101	01801029	FAIR-RITE BEAD
Z 301	01801029	FAIR-RITE BEAD
Z 302	01801029	FAIR-RITE BEAD
Z 303	01801029	FAIR-RITE BEAD
Z 304	01801029	FAIR-RITE BEAD
Z 305	01801029	FAIR-RITE BEAD
Z 306	01801029	FAIR-RITE BEAD
Z 402	01801029	FAIR-RITE BEAD
Z 403	01801029	FAIR-RITE BEAD
Z 404	01801029	FAIR-RITE BEAD
Z 405	01801029	FAIR-RITE BEAD

15.2 RPM-050 RECEIVER PC BD SCHEMATIC REFERENCE PARTS LIST

REF#	RITRON#	DESCRIPTION
CAPACITORS, CHIP, 0805, 50V, UNLESS STATED OTHERWISE		
C 501	01550006	5-30µF VARCER 2
C 502	01550006	5-30µF VARCER 2
C 504	15121104	.1µF X7R 1206
C 505	15121104	.1µF X7R 1206
C 506	15111103	.01µF X7R
C 507	151104A7	4.7µF
C 508	15111103	.01µF X7R
C 509	01550006	5-30µF VARCER 2
C 510	01550006	5-30µF VARCER 2
C 511	15111103	.01µF X7R
C 512	15111103	.01µF X7R
C 513	15111102	.001µF X7R
C 514	15111103	.01µF X7R
C 515	151108A2	8.2µF NPO
C 516	15121104	.1µF X7R 1206
C 518	15110101	100µF NPO
C 519	15110470	47pF NPO
C 520	15111103	.01µF X7R
C 521	15121104	.1µF X7R 1206
C 522	15110470	47pF NPO
C 523	15110101	100 pF NPO
C 524	15121104	.1µF X7R 1206
C 525	15121104	.1µF X7R 1206
C 526	15121104	.1µF X7R 1206
C 527	01503110	100µF ELT 10V 10%
C 528	15111102	.001µF X7R
C 529	01501040	.001µF MYLAR 100V 10%
C 530	01501040	.001µF MYLAR 100V 10%
C 531	15121104	.1µF X7R 1206
C 532	15111103	.01µF X7R
C 533	15121104	.1µF X7R 1206
C 534	15121104	.1µF X7R 1206
C 535	15121104	.1µF X7R 1206
C 536	15121104	.1µF X7R 1206
C 537	01502013	10 µF TANT 16V
C 538	01550006	5-30µF VARCER 2
C 539	15111103	.01µF X7R
C 540	15111103	.01µF X7R
C 541	15111103	.01µF X7R
C 542	15111102	.001µF X7R
C 543	01550006	5-30µF VARCER 2
C 544	15110101	100 pF NPO
C 545	15111103	.01µF X7R
C 546	01503006	10µF ELT 16V
C 547	15111103	.01µF X7R
C 548	15110101	100 pF NPO
C 549	15111102	.001µF X7R
C 550	15111102	.001µF X7R
C 551	151104A7	4.7µF
C 552	01550006	5-30µF VARCER 2
DIODES		
CR502	48A1005C	MMBD7000 DUAL DIODE SOT-23
CR503	48A1005C	MMBD7000 DUAL DIODE SOT-23
CR504	48A1005C	MMBD7000 DUAL DIODE SOT-23
INTEGRATED CIRCUITS		
IC501	31010007	MC1350D AMPLIFIER
IC502	31030001	MC3361BD IF SUBSYSTEM SOT-16

REF#	RITRON#	DESCRIPTION
CONNECTOR		
J 501	2143B100	10-POS BOTTOM ENTRY
INDUCTORS, CHIP, UNLESS STATED OTHERWISE		
L 501	18110331	.33 µH
L 502	18110681	.68 µH
L 503	01800219	3.3 µH MOL FCW
L 504	18110681	.68 µH
L 505	18110681	.68 µH
L 506	18110102	1 µH
L 509	18110103	10 µH
L 510	18110331	.33 µH
L 511	18110681	.68 µH
L 512	18110101	.1 µH
L 514	18110222	2.2 µH
L 515	18110102	1.0 µH
TRANSISTORS		
Q 501	4841006U	MMBFJ309OT-23
Q 502	4841006U	MMBFJ309L N-CHAN RF SOT-23
Q 503	4801001Q	MMBT-5088 SOT-23
Q 504	4841006U	MMBFJ309L N-CHAN RF SOT-23
Q 505	4841006Y	MMBF-J177 P-CHAN FET SOT-23
Q 506	4801001Q	MMBT-5088 SOT-23
Q 507	4801001Q	MMBT-5088 SOT-23
Q 508	4801002A	MMBT3906 SOT-23
RESISTORS, CHIP, 0805, 1/10W, 5%, UNLESS STATED OTHERWISE		
R 504	47100152	1.5 KΩ
R 505	47100101	100 Ω
R 506	47100101	100 Ω
R 507	47100103	10 KΩ
R 509	47100332	3.3 KΩ
R 510	47100273	27 KΩ
R 511	47100152	1.5 KΩ
R 512	47100393	39 KΩ
R 513	47100122	1.2 KΩ
R 514	47100682	6.8 KΩ
R 515	47100122	1.2 KΩ
R 516	47100474	470 KΩ
R 517	47100103	10 KΩ
R 518	47100104	100 KΩ
R 519	47100334	330 KΩ
R 520	04750100	10 KΩ THERMISTOR
R 521	47100682	6.8 KΩ
R 530	47100332	3.3 KΩ
R 531	47100104	100 KΩ
R 532	47100273	27 KΩ
R 533	47100474	470 KΩ
R 534	47100103	10 KΩ
R 535	47100102	1 KΩ
R 536	47100473	47 KΩ
R 537	47100103	10 KΩ
R 538	47100102	1 KΩ
R 539	47100103	10 KΩ

REF #	RITRON #	DESCRIPTION
TRANSFORMERS		
T 501	05600035	10.7 MHz IF 5MM
T 502	05600018	455 KHZ IF 5MM
T 503	05600035	10.7 MHz IF 5MM
T 504	05600035	10.7 MHz IF 5MM
CRYSTAL		
Y 501	02300043	10.245MHZ HC-44/UM-1
FILTERS		
YF501	02301001	10.7 MHz 2-POLE MONO
YF502	02301001	10.7 MHz 2-POLE MONO
YF503	02301008	CERAMIC CFU-455E2
YF504	02301008	CERAMIC CFU-455E2
FERRITE BEADS		
Z 501	01801029	ON AXIAL LEADS
Z 502	01801029	ON AXIAL LEADS
Z 503	01801029	ON AXIAL LEADS
Z 504	01801029	ON AXIAL LEADS
Z 505	01801029	ON AXIAL LEADS

15.3 RPM-050 HARDWARE PARTS LIST

HD1	21433030	3-POS CONN PC MT
HD2	25100200	BRCKT RPM MT REV D
HD101	02800105	8" X 1/16" CABLE TIE
HD102	02500115	BRCKT METAL MIC HANG UP
HD103	02100101	DIP SOCKET 14-PIN
HD104	02100326	DC PWR CONNECTOR CAP
HD105	02100327	DC PWR CONNECTOR PIN
HD106	02100301	MICRO-MINI SOCKET MMH21
HD107	01410001	PLASTIC BAG 4"*6"*.002"
HD108	02100328	DC PWR CONTACT SOCKET
HD109	02600016	HEAT SINK SUPPORT REV. E
HD110	02801005	4-40 1/4" PHILLIPS PAN
HD113	02801008	6 X 1/4" PPHMS SLF-TAP/TYPE 25
HD129	02801043	#8-32 X 3/16" PPHMS ZP
HD130	02802003	4-40 X 1/4" X 3/32" HEX NUT
HD131	02802016	HEX NUT #8-32 X 11/32"X 1/8"
HD132	02803004	#4 INTRNL TOOTH LOCKWSHR
HD135	02803007	#8 INT TOOTH LOCK WSHR
HD136	06001006	WIRE #18AWG/IRPVC RED (IN)
HD137	06001007	WIRE #18AWG/IRPVC BLK (IN)
HD138	06001093	22 AWG SOLID BLK PVC IN
HD139	06001096	14 AWG STRNDED SAE TYP I BLK
HD140	06001097	14 AWG STRNDED SAE TYP I RED
HD142	13082000	PANEL BACK RPM-450
HD143	13085000	WRAP RPM-450 REV H
HD147	13087000	PANEL SIDE RPM-450
HD150	14222008	INLAY OGO RPM-450 REV D
HD151	14230026	LBL ACCSSRY CONN REV B
HD152	14230028	RPM DC PWR CABLE "+" LBL
HD153	14230029	RPM DC PWR CABLE "GND" LBL
HD154	14312001	RPM IND. SHIP BOX KRAFT
HD155	14312002	RPM ACC'Y SHIP BOX KRAFT
HD156	14312003	RPM ACC'Y CLAY WHITE BOX
HD157	14352001	RPM INSRT FOR IND. BOX KRAFT
HD158	21148001	SPLICE PG BUTT INS #14-16,
HD159	21158001	RNG TRMNL CRIMP #14 3/8 HOLE
HD161	21202001	TRMNL MLE .058 DIA. TIN PLATE
HD175	25100221	BRCKT RPM MNT PAINTED BLK
HD180	25100700	BRCKT VOLUME CONTROL REV B
HD186	25600900	CONTROL WSHR REV C
HD187	25601000	WSHR RUB/CLOTH MNTING BKT
HD189	25601100	SYNTH SHIELD INSLTOR REV C
HD190	25700100	SHIELD SYNTH REV C
HD192	25700300	SHIELD VCO REV D
HD193	25700400	SHIELD PWR REV D
HD194	25700600	LID SYNTH REV D
HD195	25700800	LID PWR REV C
HD196	25701300	GROUND STRAP EV B
HD197	25701800	VCO PAD CUP SHIELD REV A
HD198	25800100	KNOB VOLUME RPM SERIES
HD199	26200700	HEATSINK REV A
HD200	28110600	SCREW #6X.375 TYP A SLFTAP
HD201	25702100	DRAWN VCO SHIELD
HD204	28110901	SCREW CUS 10-32 HEX HEAD 5/8
HD206	28140001	SCREW #10-12X.75 PHPH A BLK
HD210	28141601	SCREW #6-32 PPHMS BLK OX 25
HD210	28141602	SCREW #6-32 PPHSTL YEL
HD213	28311901	#10 SPLIT WSHR MED BLK OXIDE
HD217	28321601	INT. TOOTH LCKWSHR #6 BLK OX
HD220	28341901	WSHR FLAT #10 BLK OX 7/16 OD
HD222	28721001	STNDOFF PLSTIC .116/.187D
HD223	28722001	STNDOFF 1/4 HEX ALUM REV B
HD224	51811201	BDY HALF HI TMP; IN-LINE FSE
HD226	51811202	SPRING; IN-LINE FSE HOLDER
HD228	51811203	RIVET; IN-LINE FUSE HOLDER
HD230	28340501	#5 X 1/4 X 1/32 STL WSHR ZINC
HD232	28810001	RIVT 1/8" CSK ALUM BDY ST
HD234	26200400	PAD THERMAL INTERFACE
HD235	99000020	THERMAL INTERFACE PAD
HD239	28341901	WSHR FLAT #10 BLK OX 7/16 OD
HD244	06001105	22 AWG SOLID GREEN WIRE
HD501	02500003	10MM SHIELD CAN AURA
HD998	02100325	DC PWR CONN PLUG
HD999	02100302	MICRO-MINI HEADER MMP2S-1
HW103	02100101	DIP SOCKET 14-PIN
HW197	25701800	VCO PAD CUP SHIELD REV A
HW244	02100327	DC POWER CONNECTOR PIN
HW245	02100327	DC POWER CONNECTOR PIN
HW246	25702400	SHIELD RX BOARD

FRONT PANEL ASSEMBLY

HD141	13081004	PLASTIC FRONT PANEL
HD144	13086000	GUIDES PANEL RPM-450
HD176	25100500	CLAMP SPEAKER REV D
HD181	25600400	CLOTH SPEAKER GRILL REV A
HD182	25600800	PANEL GASKET
HD125	02801009	4 X 1/4" PPHMS SLF-TAP/TYPE 25
HW247	02100303	CONNECTOR CONTACTS
HW248	06001010	WIRE RED #24 STR
HW249	06001011	WIRE BLK #24 STR

(FOR SPEAKER, SEE MAIN PC BOARD SCHEMATIC REFERENCE PARTS LIST)

ACCESSORIES TECHNICAL INFORMATION

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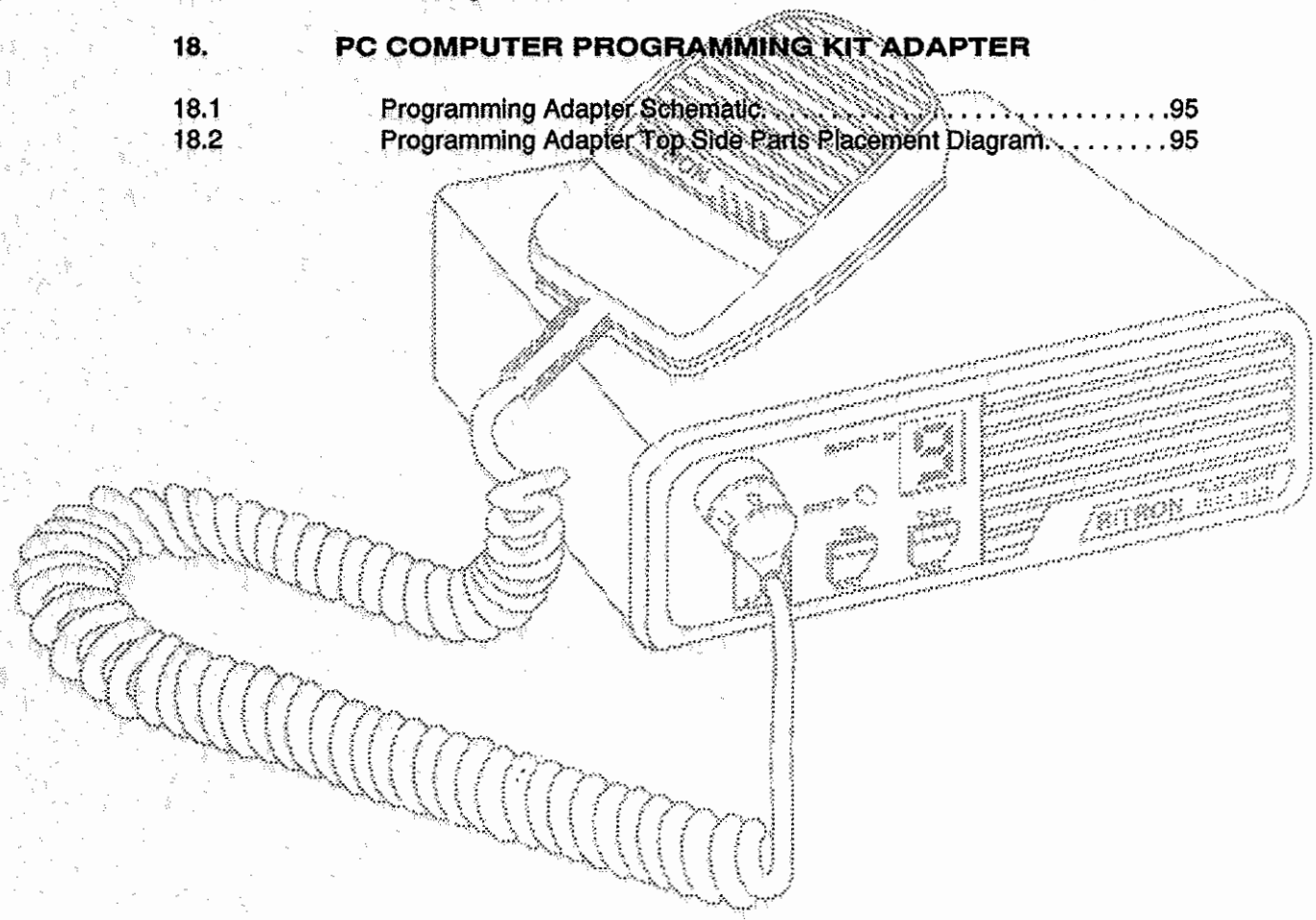
18.2	Programming Adapter Top Side Parts Placement Diagram	95

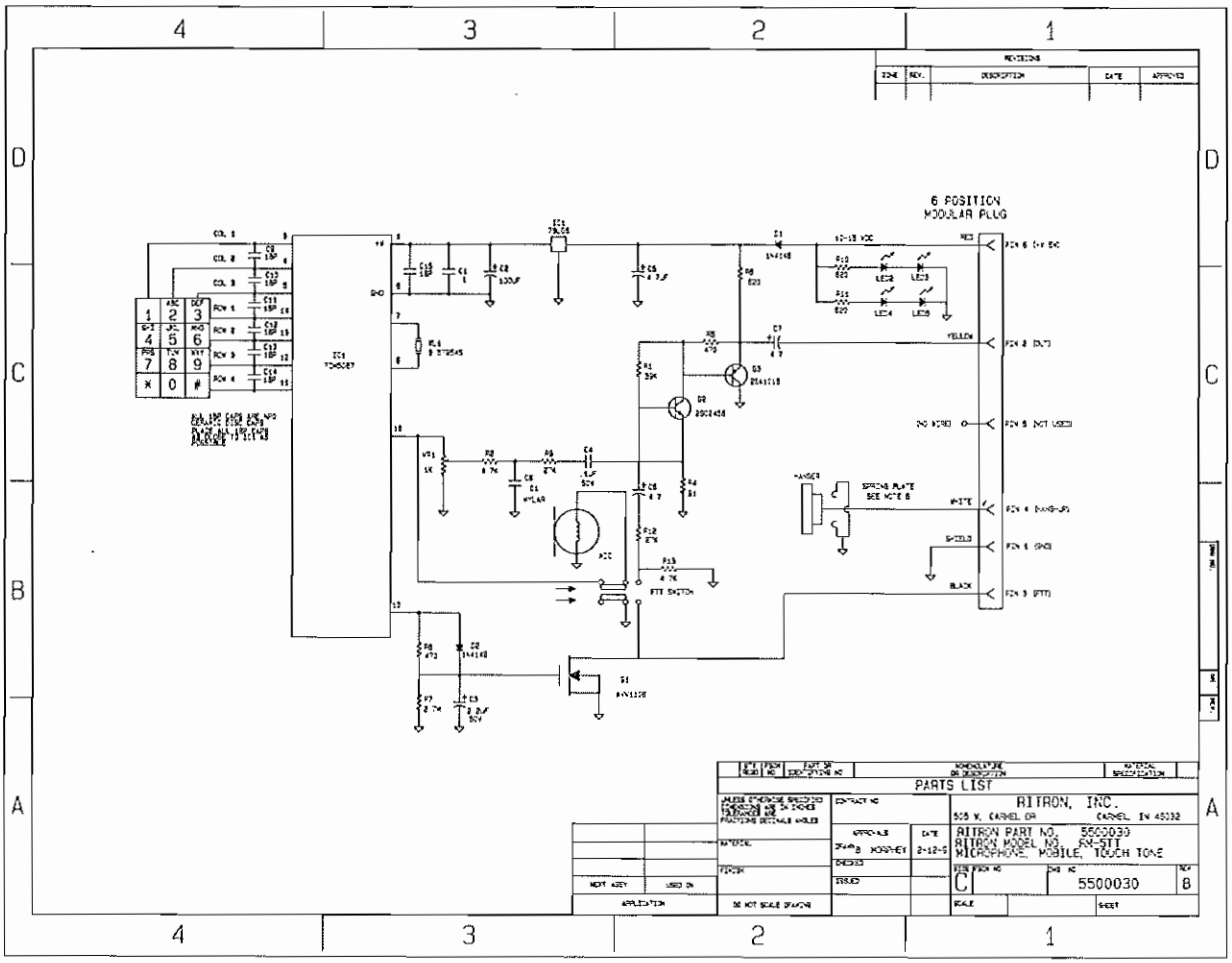


16. RM-5TT HAND MICROPHONE WITH TOUCH TONE

16.1 RM-5TT ELECTRICAL SPECIFICATIONS

IMPORTANT: The Touch Tone output level is factory preset for proper modulation and should not require adjustment.

OPERATING VOLTAGE:	+7 to +12 VDC
IMPEDANCE:	500 Ω +/- 30% @ 1 KHz
DIRECTIVITY:	Omni-directional
SENSITIVITY:	-72 + 4 dB @ 1 KHz (0 dB = 1 V/Microbar)
FREQUENCY RESPONSE:	200 Hz to 5 KHz
TOUCH TONE OUTPUT:	Factory set to 2.1 mV RMS +/- .15 mV across 470 Ω (adjustable, 0 to 4 mV)
OPERATING TEMPERATURE:	-30° C to +55° C



17. TRUNKING INTERFACE OPTION: OPT-TIR

17.1 OPERATION WITH OPT-TIR INSTALLED

17.1.1 TRUNKING CHANNELS

Trunking channels can be selected only by the trunking controller. These channels are programmed with receive, transmit and tone frequencies, but are marked as trunking channels and cannot be selected with the channel button. In "non-trunking" systems, the radio user must manually advance to a channel and glance at the TX/Busy lamp before transmitting. In trunking systems, the controller will automatically check any programmed trunking channels for a carrier signal, and select a channel that is not busy. All the caller has to do is take his microphone off-hook and transmit, unless the mobile sounds a busy tone to indicate that all trunking channels are occupied. In that case, the caller must wait for the next available channel.

17.1.2 TRUNKING LIST CHANNEL

A Trunking List channel holds a list of Trunking Channels (conventional dispatch channels may be included), and is similar to a RPM Scan List channel. When the user selects a Trunking List channel (using the channel button) and the microphone is on-hook, the radio beeps and the Trunking Controller is activated. The Trunking Controller intercepts the microphone PTT line, selects channels and determines when to unmute the speaker audio. Consult the technical documentation included with the controller for details.

17.2 OPT-TIR CONNECTORS

RPM radios manufactured with the OPT-TIR option come with the following connectors installed:
1) a 20-pin socket for hook up to a trunking controller interface board and; 2) a 9-position rear panel accessory socket, with 3 wires installed.

IMPORTANT: If no trunking controller is installed, a jumper must be present between pins 12 and 14 of the 20-pin socket.

Wire colors are indicated below as follows - background/stripe colors.

17.2.1 OPT-TIR 20-PIN SOCKET

Pin	Wire Color	Description	RPM PCB Accessory Connector Pin
1	WHT/ORG	Trunk Pulse/CH 1	17
2	WHT	CAS Input, Carrier	19
3	WHT/BLK	Special Mode	8
4	VIO	Audio Enable	9
5	-	CH 3	-
6	-	Trunk Stop	-
7	-	CH 4	-
8	YEL	Dispatch Enable	10
9	GRN	Audio Input	1
10	GRY	Hook Switch IN	12
11	WHT/YEL	Horn Honk	-
12	BRN	PTT Input	4
13	-	Freq Lock	-
14	ORG	PTT Output	5
15	-	SQ 2	-
16	WHT/BLU	Buzzer Out	18
17	BLU	DTMF Out	6
18	WHT/GRN	Program Enable	-
19	BLK	Ground	2
20	RED	+12 VDC	3

17.2.2 OPT-TIR 9-PIN ACCESSORY CONNECTOR SOCKET

Pin	Wire Color	Description	Connection
3	Blk	Ground	RPM PCB Accessory Connector Pin 16
6	Wht/Grn	Program Enable	To 20-pin Socket Pin 18
7	Wht/Yel	Horn Honk	To 20-pin Socket Pin 11

The OPT-TIR option rear panel accessory connector serves two functions. First, this connector can be used to place the installed trunking controller board in programming mode. The trunking controller can then be loaded with unit address codes and other information for the specific trunking system. For example, you would program one popular trunking controller as follows:

1) Using the PC programmer, program the RPM mobile with the trunking channels, a trunking list channel and at least one dispatch channel.

2) Switch off the radio, disconnect the PC programmer and place the RPM's programming key in the storage position (or remove the key).

3) Connect a wire jumper between pins 6 and 3 of the 9-pin accessory connector. Refer to FIG-11.

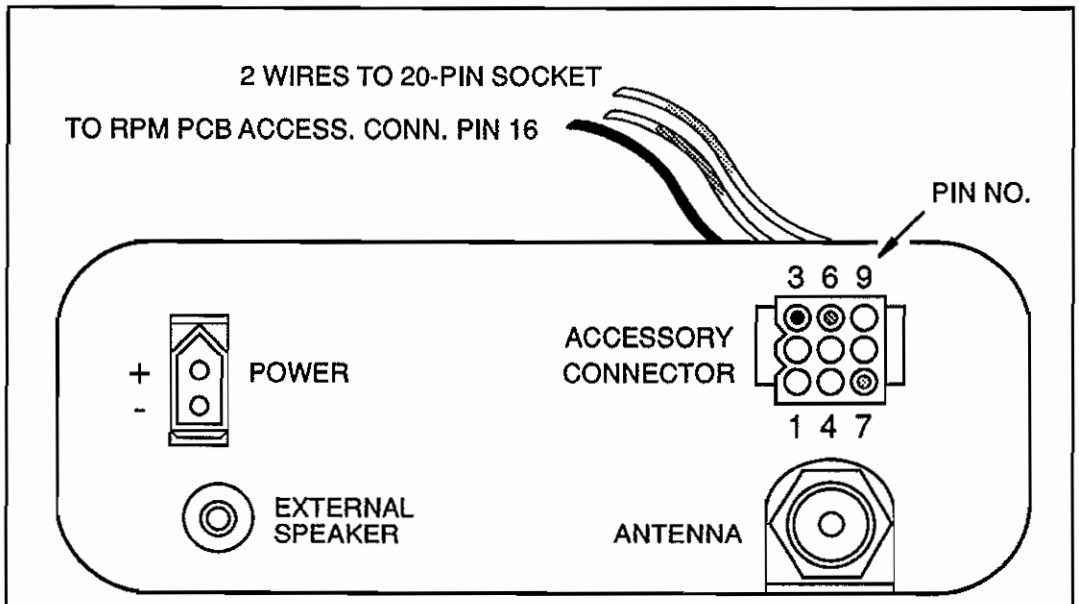


FIG-11: ACCESSORY CONNECTOR SOCKET (REAR PANEL)

4) Turn on the unit. A series of beeps should sound in the speaker to indicate that the trunking controller is in the proper programming mode. Remove the jumper wire from the RPM's 9-pin accessory connector.

5) Using the channel button, select the dispatch channel.

6) Connect a service monitor, set to generate on the dispatch channel's receive frequency, to the radio antenna jack. Using the service monitor's Touch Tone encoder, send the digits required to program the trunking controller.

Consult your specific trunking controller's documentation to verify these steps.

Second, the rear panel accessory socket can also be used to connect the trunking controller's horn activate output to the vehicle's horn relay circuit. Refer to the wiring diagram below.

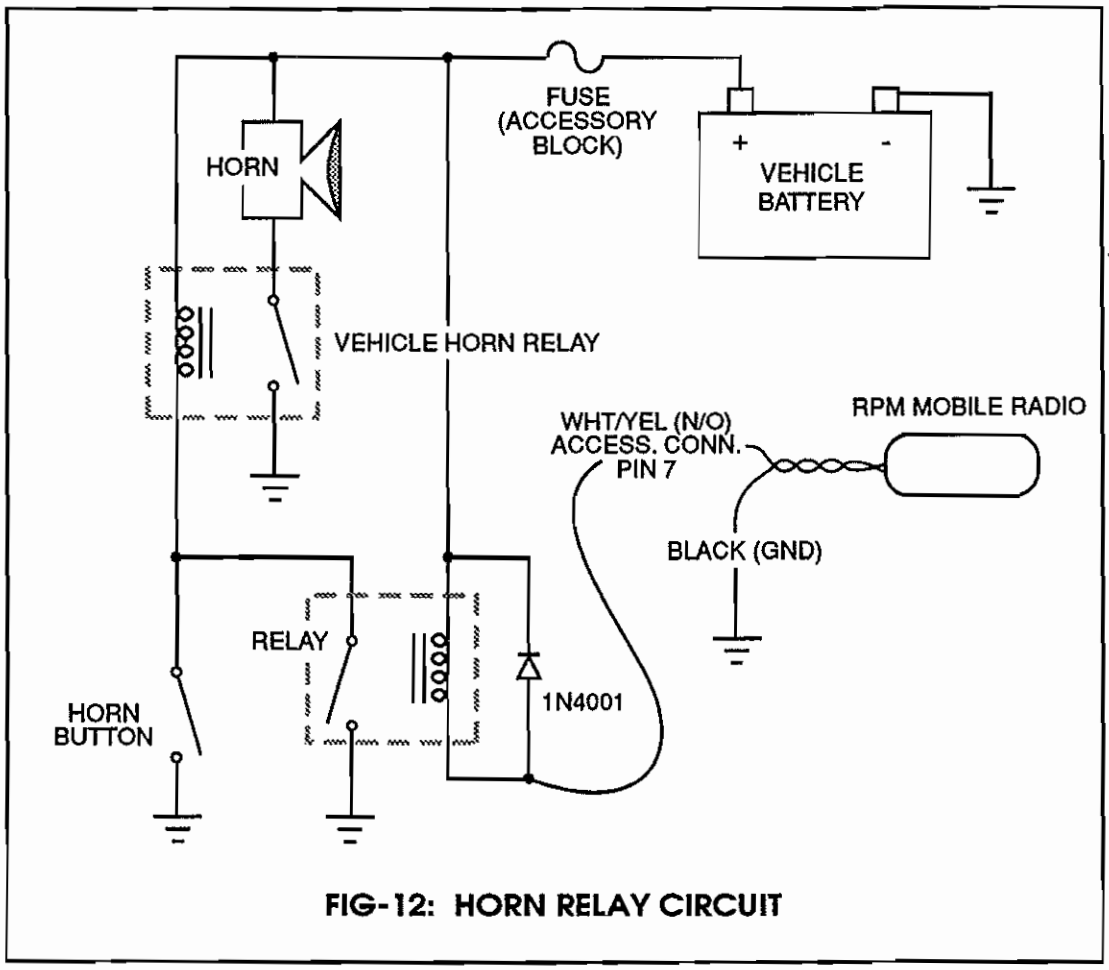
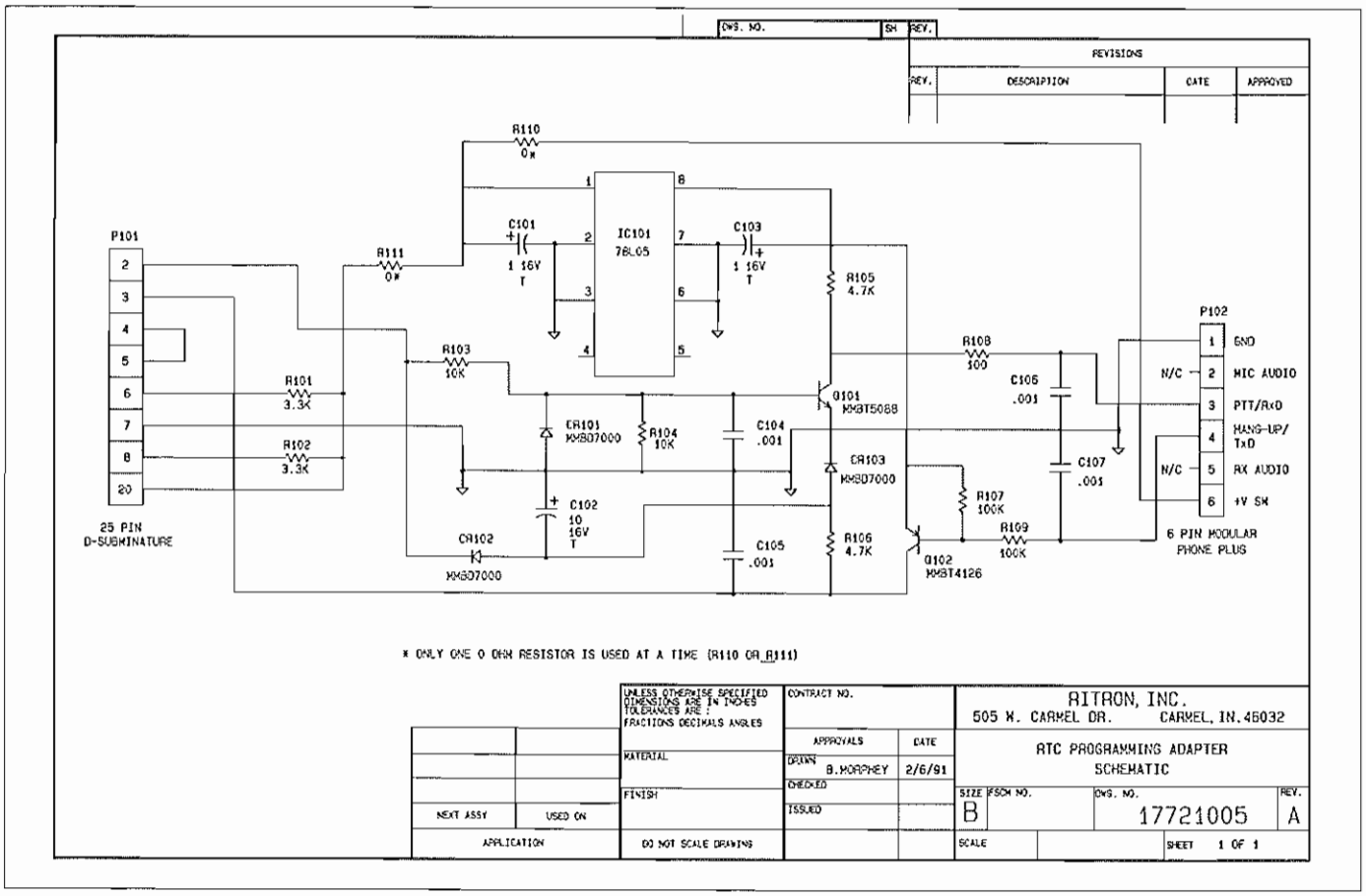


FIG-12: HORN RELAY CIRCUIT

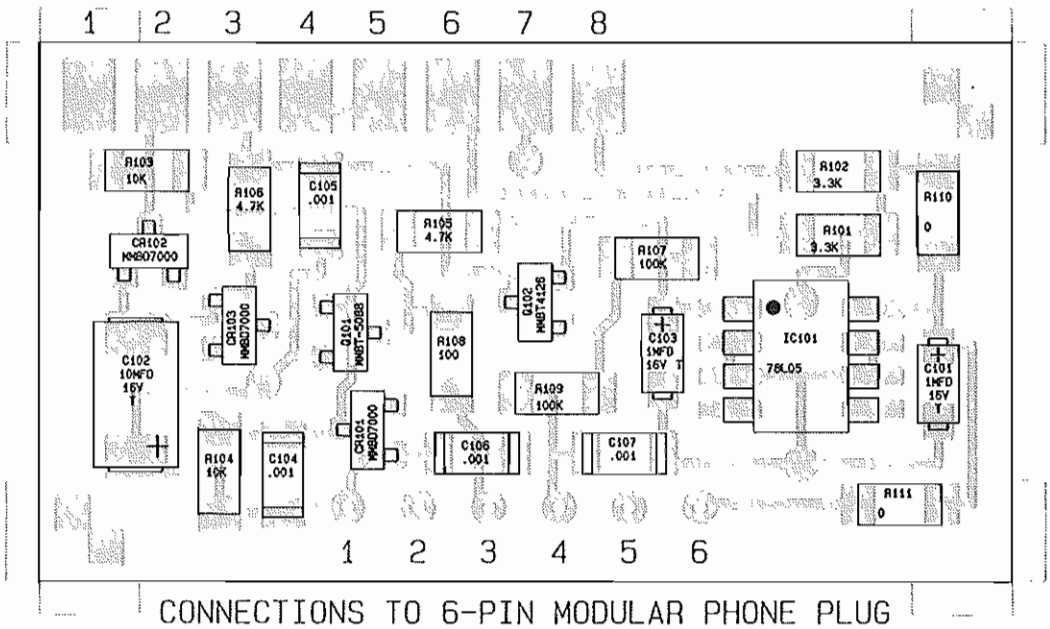
17.3 TRUNKING CONTROLLER PIN-OUTS

Verify that the pin descriptions of your trunking controller connector are compatible with the RPM 20-pin socket. Refer to the instructions packaged with your controller.

18. PC COMPUTER PROGRAMMING KIT ADAPTER



CONNECTIONS TO 25-PIN SUB-D CONNECTOR



CONNECTIONS TO 6-PIN MODULAR PHONE PLUG

TOP SIDE PARTS PLACEMENT
17021005 REV.A
RITRON INC., CARMEL, IN