SynCom

VHF-FM TRANSCEIVER

MAINTENANCE MANUAL

LIMITED

WARRANTY

General Aviation Electronics, Inc. (Genave), warrants this product to be free from material defects for a period of 90 days from the date of purchase, provided the warranty registration card properly filled out is returned by the purchaser to Genave within 10 days after purchase. This warranty is limited to the original retail purchaser and is not extended to second owners of the product.

Our obligation under this warranty is limited to replacement of any parts (except periodic maintenance items such as bulbs, fuses, etc.) which, upon our examination, appear to us to be defective in materials or workmanship. The parts will be replaced within 45 days after receipt of the unit, provided the unit is delivered to the Factory (Customer Service Dept., General Aviation Electronics, 4141 Kingman Drive, Indianapolis, Indiana 46226) within 90 days after the date of purchase, shipping prepaid. All shipping costs and labor charges shall be born by the purchaser

The owner may elect to have the unit repaired at an authorized Genave repair facility in which case Genave, within 45 days after receipt of the unit, will replace only those defective parts returned shipping prepaid to the Factory (Customer Service Dept., General Aviation Electronics, 4141 Kingman Drive, Indianapolis, Indiana 46226). Purchaser shall bear any and all other costs including but not limited to labor, transportation and freight.

This warranty does not apply to defects, malfunction, or breakage due to improper installation or to the servicing thereof by other than an authorized Genave dealer nor to units that have been damaged by lightning or other acts of God, excess current, or any units that have had serial number altered or removed. Abuse, misuse, tampering, submersion in water or willful destruction of the unit will also void this warranty.

This warranty gives you specific legal rights. You also have implied warranty rights. In the event of a problem with warranty service or performance, you may be able to go to a small claims court, a State court, or a Federal District court.

Genave offers this warranty in lieu of any and all other guarantees or warranties, either EXPRESSED or IMPLIED, including but not limited to warranties of merchantibility and/or fitness for a particular purpose. Any implied warranties are specifically and expressly limited to the 90-day period specified herein. Damages for breach of any warranties, either expressed or implied are limited to replacement of any defective parts as specified herein and any other incidental or consequential damages are expressly excluded.

General Aviation Electronics, 4141 Kingman Drive, Indianapolis, Indiana 46226—Area 317 - 546-1111

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GENERAL AVIATION ELECTRONICS, INC.

4141 Kingman Drive, Indianapolis, Indiana 46226

AREA (317) 546-1111

Specifications subject to change without notice

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

Sections 1, 2, and 3 of this manual contain all the information normally required to license, install, and operate the Genave SynCom VHF communications transceiver.

The maintenance manual includes all the above information, and adds Section 4 (Theory of Operation, Alignment Procedures, and Schematics). Section 5 lists replacement electronic parts, as well as major mechanical components.

1-2. DESCRIPTION

This VHF-FM transceiver is designed to provide reliable, high-quality two-way communications in the various Public Safety, Industrial, and Business Radio Services. The unit is capable of transmitting and receiving frequency modulated (16F3) radio signals on either of two frequency bands: 150 - 159.995 MHz or 160.7 to 170.695 MHz.

The Genave SynCom radio is a VHF-FM transceiver utilizing a single quartz crystal and frequency synthesizer to determine the operating frequency(ies). A front-panel mounted rotary switch can select either of two simplex channels or one semi-duplex channel.

Simple internal adjustments allow the transceiver frequencies to be set-up as desired; thus, if a frequency change is required, delays caused by crystal procurement are eliminated.

> NOTE: These adjustments MUST be made by or under the immediate supervision and responsibility of a person holding a first- or second-class radiotelephone operator license, who shall be responsible for the proper functioning of the station equipment.

If frequency synthesizer "unlocks," the transmitter is "locked-out" to prevent inadvertent operation on an unauthorized frequency. In this event, the TX indicator WILL NOT glow when the microphone push-to-talk switch is depressed.

The unit is completely solid-state, employing the latest in semiconductor and integrated-circuit technology. The frequency synthesizer utilizes only one quartz crystal to enable operation on all business frequencies within the two ranges, 150 - 159.995 & 160.7 - 170.695 MHz.

The transmitter provides a minimum RF output of 20 watts from 150.0 - 159.995 MHz, and a minimum of 15 watts from 160.7 - 170.695 MHz. A large heat sink increases transmit-power stability. The unit is designed to work into a 50-ohm antenna, using a standard UHF co-axial connector (83-1SP or PL259).

The receiver is a crystal-controlled, dual-conversion superheterodyne employing an 8-pole monolithic crystal filter for good selectivity. A single integrated circuit performs limiting and detection functions. A 10.7 MHz 1st IF provides good image rejection, while the 455 kHz 2nd IF improves receiver stability. A broadband (6 MHz) receiver front end, normally set for 150 to 156 MHz, is utilized.

A 15-pin male plug mounted on rear panel of the SynCom transceiver is designated as an "Accessory Connector," and mates with a 15-pin female connector to provide a convenient method of connecting power or optional accessories to the unit. Standard wiring of the accessory connector utilizes only five pins, leaving the remainder available for options or customized installation.

The internal speaker can be disconnected and replaced by an external speaker via connections to the rear-panel plug.

The SynCom transceiver is designed to operate on +13.75 volts DC power (negative ground). For mobile operation, the power source may be a battery or the vehicle electrical system. The Genave Model PSI-10 or PSI-31 power supply can be utilized when it is desired to operate the instrument from a 117 volt, 50-60 Hz source.

Provisions are made within each transceiver for the addition of an optional SA-1 Subaudible-Tone Encoder/Decoder. This subaudible-tone system keeps the receiver squelched until a signal containing the proper subaudible, continuous tone is received. The SA-1 board generates the subaudible tone used to modulate the transmitter to activate the receivers in the system, and also decodes incoming signals. Note that all operating channels installed in a SynCom transceiver must utilize the same tone frequency -- there are no provisions for changing frequency of subaudible tone on one channel only. A ceramic resonator on the SA-1 printed-circuit board determines the frequency of subaudible tone being used.

NOTE: If subaudible-tone system is used, the carrier is automatically modulated by the subaudible tone during entire time that transmission is taking palce. Also, the operating frequency must be monitored to ascertain that it is NOT in use prior to originating a call. This monitoring is accomplished automatically by any of the Genave microphones utilized with the subaudible tone system.

The instrument is enclosed in an easily removed, two-piece plastic case to protect the unit from physical damage, as well as from dust and dirt in the air.

1-3. SPECIFICATIONS

GENERAL:

Front-Panel Size:	3-3/8" (8.57 cm) x 9-3/4" (24.76 cm)
Over-all Dimensions:	3-3/8" (8.57 cm) x 9-3/4" (24.76 cm) x 12" (30.48 cm)
Power Supply:	13.75 VDC, negative ground; 11.5 VDC, minimum
Frequency Range:	150.0 - 159.995 MHz; 160.7 - 170.695 MHz
Frequency Stability:	.0005%
Number of Channels:	2 simplex, or 1 semi-duplex (both freqs in one band)
Temperature Range:	-30°C to +60°C
Weight:	Approx. 6 lbs. (2.72 kg)

RECEIVER:

Sensitivity:	0.25 µV typ., 0.35 uV max. for 12 dB Sinad; 0.45 µV typ., 0.55 uV max. for 20 dB quieting
Input Bandwidth:	6 MHz
Image:	70 dB, or better
Spurious:	65 dB, or better
Intermod:	70 dB, or better
Selectivity:	±7.5 kHz
Adjacent Channel Reject:	60 dB
Modulation Acceptance:	7.5 kHz
Squelch Threshold:	0.2 µV, or less
Tight Squelch Threshold:	2 µV, maximum
Audio Output Power:	5 Watts; 4 Watts for 15% distortion
Hum and Noise Level:	Better than 35 dB below rated putput
Frequency Stability:	.001%

1-3. SPECIFICATIONS (Cont'd)

TRANSMITTER:

Frequency:	150.0 - 159.995 MHz; 160.7 - 170.695 MHz
Power Output:	25 Watts Typ; 150.0 - 159.995 MHz -- 20 Watts min. 160.7 - 170.695 MHz -- 15 Watts min.
Output Impedance:	50 ohms
Current Drain:	6.5 amps
Deviation:	4 kHz, minimum; 5 kHz, maximum
Spurious:	-57 dB (25 Watts)
Frequency Stability:	.0005%
Frequency Accuracy:	±200 Hz
Subaudible Deviation:	1 kHz ±200 Hz
Subaudible Freq. Tolerance:	±0.3 Hz

1-4. EQUIPMENT LISTS

Section 2 of this manual contains lists of equipment normally supplied with each SynCom transceiver, as well as equipment required but NOT supplied, and optional equipment available.

1-5. OPERATING & LICENSING THE SYNCOM

Complete operating instructions, and technical information needed for the F.C.C. station-license application, is given in Section 3 of this manual.

SECTION II
INSTALLATION MANUAL

2-1. ANTENNA INSTALLATION WARNING

WARNING: Each year a number of persons are electrocuted while installing radio antennas; therefore, use extreme caution when installing antenna/antenna-support for use with this transceiver. Observe following precautions:

a. Do NOT attempt to erect antenna while a thunderstorm is gathering.

b. If installing antenna in vicinity of overhead wires, use a wooden ladder rather than metallic.

c. Do NOT allow antenna, mast, or cable to touch electric signs or overhead electric wires --- even if only 120 or 240-volt wiring.

d. If antenna or mast starts to fall toward overhead wires, get completely away. If the antenna comes to rest against electrical wires, do NOT attempt to remove it, but call local power company.

e. REMEMBER - UNDER THE RIGHT CONDITIONS, ANY CONTACT WITH AN ELECTRICAL CIRCUIT CAN BE LETHAL.

2-2. INTRODUCTION

This section provides installation data and recommendations for fixed, mobile, or portable operation of the SynCom VHF transceiver. For complete technical specifications of the unit, refer to Section 1-3 (Specifications) in this manual.

2-3. EQUIPMENT SUPPLIED

a. SynCom Communications Transceiver, with hand microphone and hang-up mounting clip.

b. Mounting Bracket, with thumbscrews and washers.

c. Accessory Connector, 15-pin female.

2-4. EQUIPMENT REQUIRED, BUT NOT SUPPLIED

a. Vehicle or Base Antenna, 50-ohm.

b. Antenna Cable, RG-8A/U or RG-58A/U, as required.

c. Co-axial Connector, PL-259 (83-1SP).

d. Cabling for Power and Audio wiring, as required.

2-5. OPTIONAL EQUIPMENT AVAILABLE

a. SA-1 Subaudible-Tone PC Board.

b. PSI-10 or PSI-31 AC Power Supply.

c. PSI-21 Portable Power Pack.

d. Desk-Microphone, G-11

2-6. PRE-INSTALLATION CHECK

Visually inspect the unit for any obvious external damage - such as broken knobs, dents, damaged microphone or radio case. Any damage NOT related to shipping must be reported to General Aviation Electronics, Inc., 4141 Kingman Drive, Indianapolis, Ind., (46226), Telephone (317) 546-1111, as soon as possible.

If the packing case shows damage, make a notation to that effect on the express receipt or freight bill. Report to the transportation company any damage due to shipping, and file a claim promptly.

2-7. INSTALLATION PLANNING

The unit has been pre-aligned at the factory, and is programmed for the receive and transmit frequencies listed on tag attached to the instrument. If it is necessary to change these frequencies, programming procedures contained in Section 4 of the SynCom maintenance manual must be performed by a licensed technician who shall be responsible for proper functioning of the station equipment.

If SynCom transceiver is equipped with optional SA-1 (Subaudible-Tone Squelch System), the subaudible-tone frequency will be listed on tag attached to the unit, and also on a label affixed to inside of transceiver. If it becomes necessary to readjust subaudible-tone frequency from factory-set frequency, refer to "Tone-Frequency Adjustment" procedure in Section 4 of SynCom maintenance manual.

Before starting transceiver installation, determine desired mounting method and location; ascertain that required AC or DC power is available; determine location for antenna installation and routing of co-ax cable to transceiver rear-panel mounted antenna connector.

NOTE: In choosing an operating location for the instrument, remember that F.C.C. Rules require that: "Each transmitter shall be so installed and protected that it is not accessible to or capable of operation by persons other than those duly authorized by the licensee," and, that "The operating position must be under the control and supervision of the licensee."

The transceiver may be mounted in any convenient position; unit performance is NOT affected by the mounting position. However, the unit should NOT be mounted directly above a hot-air register or radiator.

2-8. FIXED OR MOBILE INSTALLATION

1. Refer to Figure 2-1. If mounting yoke has been installed on transceiver, remove yoke temporarily. For fixed operation, yoke may be repositioned on bottom side of unit to function as a supporting stand.

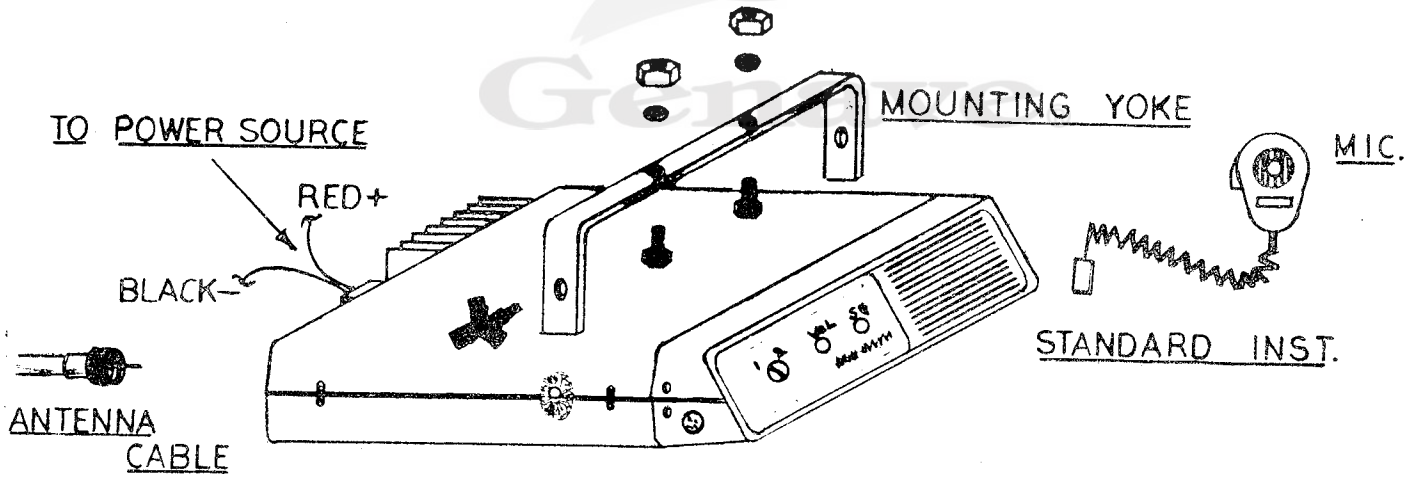


Figure 2-1. Typical Installation

For either fixed or mobile operation, the yoke may be secured in the desired location (under dash or shelf, on console or desk top, or overhead, etc.) with appropriate screws or bolts through two holes provided in the mounting yoke.

2. Connect color-coded power leads, terminated in the rear-panel 15-pin connector, to a power source. For fixed operation, the source may be a well-regulated, low-ripple AC power supply, such as the Genave Model PSI-10 or PSI-31. For mobile operation, the source may be a battery or the vehicle's electrical system. This transceiver is designed to operate ONLY on a supply having a negative ground.

   Be SURE to connect RED power lead to +13.75 volts, and BLACK lead to ground (-13.75 volts). If it is necessary to extend power leads, use #14, or heavier, gauge insulated copper wire.

   If supply polarity is reversed accidentally, the unit will be inoperative. In this event, check wiring polarity (RED to positive, and BLACK to negative); then, check the protective fuse located on transceiver main circuit board just below rear-panel power connector. A blown fuse should be replaced ONLY with a 3AG 10-amp fuse.

3. The 15-pin receptacle has a jumper connected between pins 2 and 10 to activate the internal speaker in the SynCom transceiver. If an external speaker is to be used, remove the jumper and connect speaker leads between pins 2 and 7 of the 15-pin female receptacle. See Figure 2-2.

4. The SynCom transceiver is equipped with a plug-in microphone receptacle which allows use of either a standard Genave hand microphone or desk-style microphone interchangeably. Accessory connector and mi-

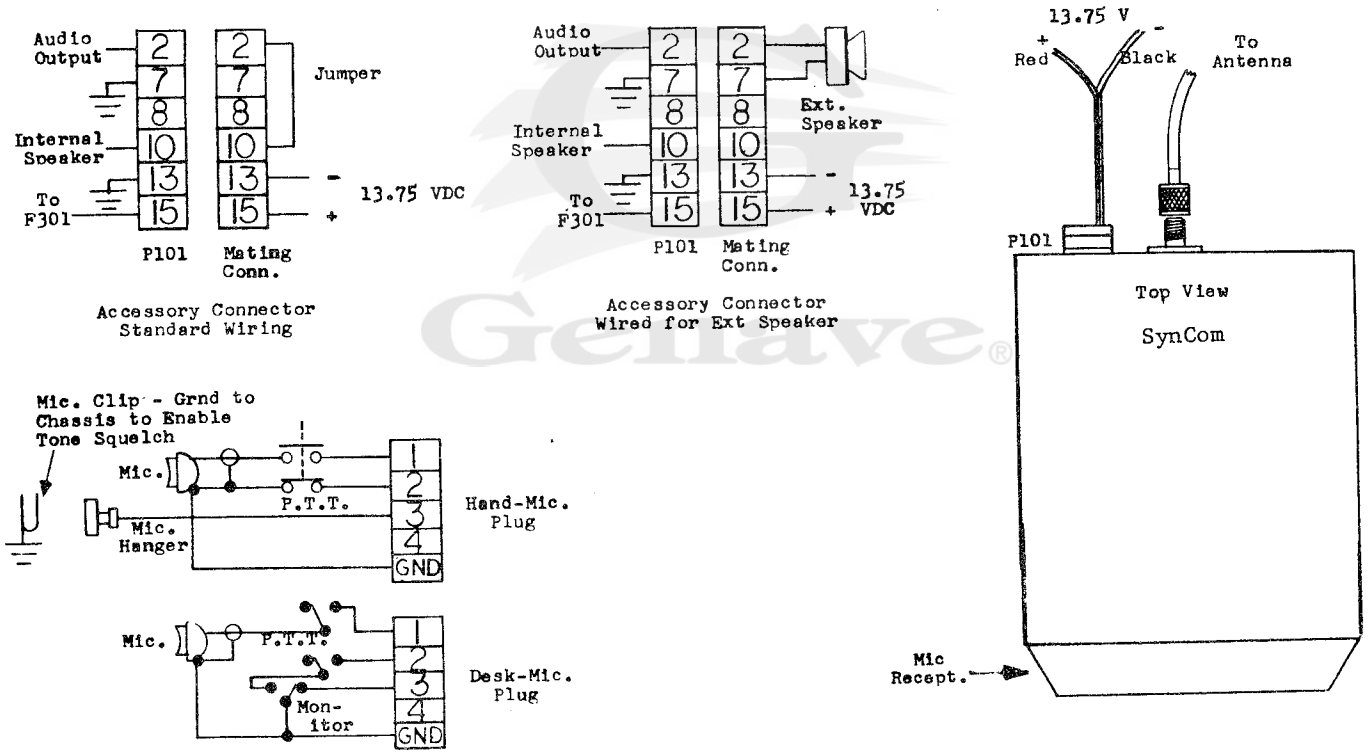


Figure 2-2. Accessory Connector & Mic. Wiring

crophone receptacle connections are described in Sections 2-10 & 2-11 below.

NOTE: If standard hand microphone is used with "subaudible-tone option," the microphone-mounting clip should be attached to the desired mounting surface; then, clip MUST BE electrically connected to SynCom chassis ground in order to provide "hang-up" receiver squelching.

5. After any optional or custom wiring has been completed, replace transceiver in mounting yoke, and tighten both thumbscrews.

6. Connect microphone to transceiver, and connect 15-pin receptacle to mating rear-panel plug.

7. Install co-axial connector on antenna cable as shown in Section 2-12, and connect antenna cable to rear-panel mounted antenna receptacle.

NOTE: The SynCom transceiver is designed to match standard 50-ohm VHF communications antennas. In the interest of maximum efficiency, the antenna system should exhibit low VSWR.

2-9. PORTABLE OPERATION

1. The easiest method of portable operation with the SynCom is to utilize a Genave PSI-21 Portable Power Pack. The PSI-21 unit includes a rechargeable battery and AC-powered charger.

2. Portable operation of the transceiver requires the same basic considerations as fixed or mobile operations; that is, connections to a power source, antenna system, and microphone.

2-10. ACCESSORY CONNECTOR - P101

The 15-pin male plug mounted on rear panel of the SynCom transceiver is designated as an "Accessory Connector," and mates with a 15-pin female connector to provide a convenient method of connecting power or optional accessories to the unit. Standard wiring of the accessory connector utilizes five pins, leaving ten pins available for options or customized installation. Figure 2-2 illustrates standard wiring of the accessory connector and the microphone receptacle. The connections to the accessory connector pins are described below:

Pin 1 - No Connection.

Pin 2 - High-level audio output from receiver section of the transceiver; this audio is applied either to the internal speaker or to an external 4-ohm speaker, as determined by wiring of the accessory connector. To use the internal speaker, a jumper is connected between pins 2 and 10 of the female connector; to connect an external speaker, the speaker leads are connected between pins 2 and 7 of the 15-pin female connector.

Pin 3 - No Connection.

Pin 4 - No Connection.

Pin 5 - No Connection.

Pin 6 - No Connection.

Pin 7 - A chassis ground - particularly intended for audio circuitry such as an external speaker, tone-squelch enable, etc.

Pin 8 - No Connection.

Pin 9 - No Connection.

Pin 10 - Input connection to the internal 4-ohm speaker in transceiver. This pin is normally jumpered to pin 2.

Pin 11 - No Connection.

Pin 12 - No Connection.

Pin 13 - Chassis ground, and DC-input negative connection. The female connector has a BLACK lead, some four feet long, attached to this pin for connection to the DC-power input source.

Pin 14 - No Connection.

Pin 15 - DC-input voltage positive connection. The female connector has a RED lead, approx. four feet in length, attached to this pin for connection to the DC-power source.

2-11. MICROPHONE RECEPTACLE

The microphone receptacle is a 5 conductor jack (4 pins plus shell) mounted on left-hand side of SynCom control unit. Internal connections are factory-made to this receptacle so that standard Genave hand microphones, or desk-style microphones can be used interchangeably. The connections to the microphone receptacle pins are described below:

Pin 1 - Microphone-audio connection to input of transmitter-modulator circuitry.

Pin 2 - Microphone push-to-talk switch connection. When this switch is closed, the keying relay is energized which applies power to transmit circuitry and switches antenna from receiver to transmitter.

Pin 3 - Tone-squelch enable connection. If transceiver is NOT equipped with SA-1 Subaudible-Tone Option, this pin has no function; however, if tone-squelch option is used, this pin must be connected to ground for the tone-squelch circuitry to squelch the receiver. Removing ground from this pin disables the tone squelch - allowing the frequency to be monitored.

The method of grounding pin 3 is dependent upon type microphone being used: The hand microphone grounds this pin via the mic. hanger and mic. mounting clip; whereas, the desk-style microphone grounds pin 3 through contacts on the Monitor Switch. Refer to Figure 2-2.

Pin 4 - No Connection.

GND --- Provides a chassis-ground connection for microphone audio and push-to-talk circuits.

2-12. ANTENNA CONNECTOR ASSEMBLY

For maximum efficiency, the antenna should be fed with low-loss 50-ohm co-axial cable. The loss per 100 feet at 144 MHz is shown in Table 2-1 for several popular types of co-ax cable;

Table 2-1.

Cable Type	Impedance	dB Loss
RG58/A-AU	53-ohms	5.7 dB
RG58 Foam	50-ohms	4.1 dB
RG8/A-AU	52-ohms	2.5 dB
RG8 Foam	50-ohms	2.2 dB

2-12-1. Connector Assembly - General

The procedure for installing a PL-259 (83-1SP) antenna connector is dependent upon type co-axial cable used - the PL-259 is installed directly on 0.405" OD cable such as RG8/A, whereas, the plug requires an adapter when used with the 0.195" OD cable such as RG58/A. The procedures for both cable types are given below, and shown in Figure 2-3.

2-12-2. RG8 Cable Procedure

1. Trim end of cable flush; remove vinyl jacket from 1-1/8" of cable as shown in Figure 2-3(1). Do NOT nick braid.

2. Bare 3/4" of center conductor. Trim braided shield 1/16" and tin. Slide coupling ring on cable. See Figure 2-3 (2).

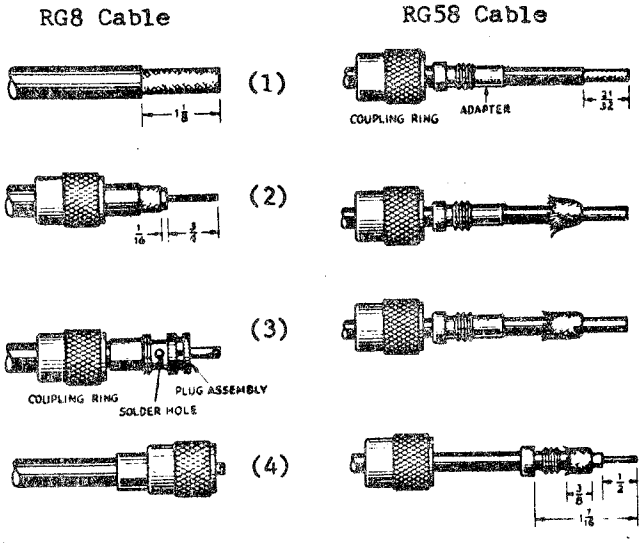


Figure 2-3. Connector Assembly.

3. Screw plug assembly on cable; solder plug assembly to braid through solder holes; solder center conductor to plug assembly center pin.

2-12-3. RG58 Cable Procedure

1. Trim end of cable flush; remove vinyl jacket from 21/32" of cable as shown in Figure 2-3 (1). Do NOT nick braid. Slide coupling ring and adapter on cable.

2. Fan braid slightly and fold back over cable. See Figure 2-3 (2).

3. Compress braid around cable, Figure 2-3 (3), and position adapter to dimension given in Figure 2-3 (4). Press braid over adapter sleeve and trim to dimension shown.

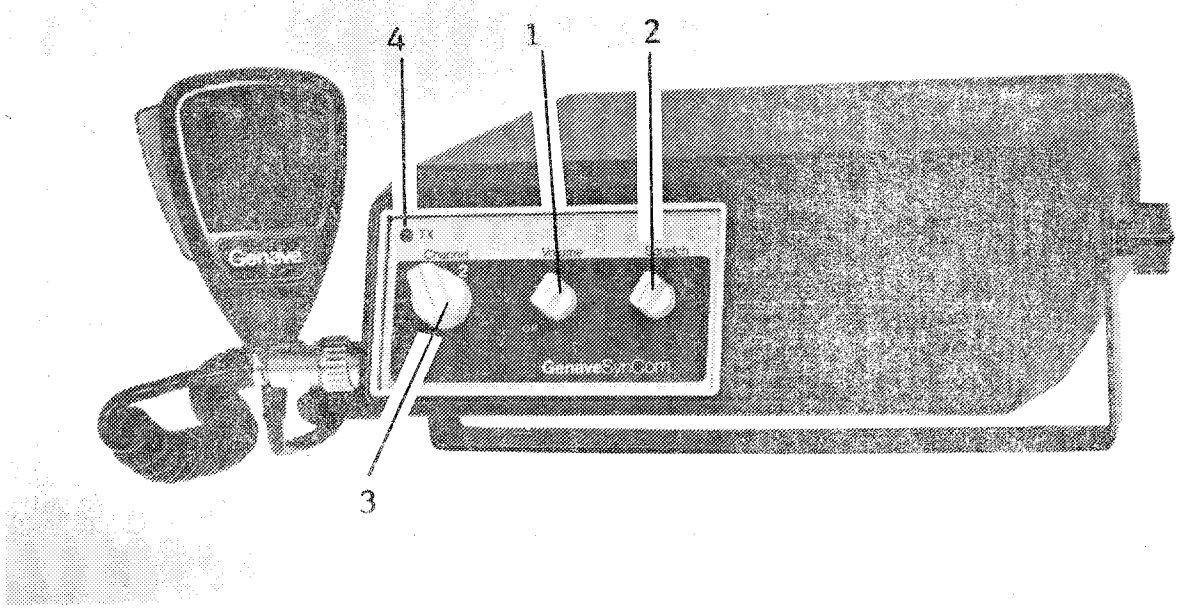
4. Bare 1/2" of center conductor as shown -- do NOT nick the conductor. Pre-tin exposed center conductor.

5. Screw plug assembly onto adapter sleeve, and solder braid to plug assembly through solder holes. Next solder center conductor to plug assembly center pin.

6. Screw coupling ring on plug assembly.

SECTION III

OPERATING MANUAL



3-1. OPERATING CONTROLS

For reliability and operating convenience, only essential operating controls are installed on the unit's front panel. The functions of these controls are as follows:

1. Volume control/On-Off switch
2. Squelch control
3. Channel-Selector switch
4. Transmit-Indicator lamp

The push-to-talk button on the microphone also functions as an operating control. Unit operation is quite simple, as explained below:

3-2. OPERATING INSTRUCTIONS

1. Turn VOLUME (#1) and SQUELCH (#2) controls fully counterclockwise.

2. Rotate CHANNEL SELECTOR (#3) to desired operating frequency.

3. Rotate VOLUME control clockwise until switch clicks; this turns ON transceiver.

4. If transceiver is equipped with the SA-1 subaudible-tone option, it is necessary to deactivate tone-controlled squelch by removing microphone from its hanger or, by depressing MONITOR button on desk-style microphone. This breaks "tone enable" ground, and disables tone-squelch system.

5. Now, rotate VOLUME control clockwise to adjust receiver volume to desired level.

6. Turn SQUELCH control clockwise until background noise just disappears.

   NOTE: Do NOT attempt to adjust the SQUELCH control if a signal is being received.

7. To transmit, depress the microphone pushbutton. If unit is equipped with subaudible-tone system, it is important to monitor channel before transmitting to insure that it is clear. The hand microphone circuitry is designed in such manner that receiver squelching is deactivated when microphone is removed from its

hanger; while the G-11 desk-style microphone is designed so that its TRANSMIT button will not function unless MONITOR switch has also been depressed.

8. The TRANSMIT-INDICATOR lamp (#4) will illuminate when transmitter is operating; then, hold microphone 3 to 6 inches from your mouth, and talk in a normal voice.

9. Release TRANSMIT pushbutton to listen.

NOTE: The squelch circuit, which is adjusted by front-panel control, quiets receiver in the absence of an incoming signal on the assigned operating frequency; however, any station in your vicinity, operating on this frequency, will be heard. With the tone-squelch system, however, only transmitted signals carrying the proper subaudible tone are heard, as explained previously.

3-3. LICENSING INFORMATION

Licensing requirements vary with the service for which this unit will be used; however, all services require the station transmitter to be licensed.

NOTE: While the seller or installing agency may assist in filing the license application, the responsibility lays solely with the prospective licensee to assure that transmitting equipment is covered by a valid station license PRIOR TO BEGINNING OPERATION.

Further, all transmitter adjustments or tests during or coincident with the installation, servicing, or maintenance of a radio station, which may affect the proper operation of such station, shall be made by or under the immediate supervision and responsibility of a person holding a first- or second-class commercial radio operator license, either radiotelephone or radiotelegraph, who shall be responsible for the proper functioning of the station equipment.

In addition to the STATION license, the FCC Rules normally require OPERATORs to hold some type of authorization. The minimum class of operator authorization required for each specific classification of station is set forth in the appropriate FCC rule part. The most common authorization permitted by Rules under which the SynCom is approved, is the "restricted radiotelephone operator permit (FCC Form 753).

The following technical information is intended to aid SynCom users in completing the application for radio station authorization. Only technical data pertaining to the transceiver are shown below; all other station particulars must be furnished by the licensee:

Transmitter Input Power:	60 watts
Transmitter Output Power:	25 watts
Type of Unit:	Transceiver
Type Acceptance/Model No:	T-7044000
Frequency Range (MHz):	150 - 159.995
	160.7 - 170.695
Frequency Tolerance:	.0005%
Emmission:	16F3
Approved under Rule Part Numbers	21, 74, 81, 89, 91, 93

For additional information on filling out the appropriate application forms, consult the F.C.C. instruction sheet provided with that form. NOTE THAT SOME FORMS MAY BE COMPLETED EITHER BY PRINTING IN INK, OR BY TYPING; WHEREAS, TYPING IS MANDATORY FOR CERTAIN F.C.C. APPLICATION FORMS. Two of the more common forms used to apply for a license for the SynCom VHF transceiver are F.C.C. forms 400 or 425, depending upon the usage and/or geographic location of the proposed station. To determine which form is required, contact nearest FCC Field Engineering Office as listed below -- they will also supply the appropriate forms.

The procedures for obtaining necessary licenses are found in the Federal Communications Commission Rules and Regulations. Any of these volumes may be purchased from the Supt. of Documents, U.S. Government Printing Office, Washington, D.C., 20402.

3-3-1. F.C.C. Rule Part Numbers

The services and the corresponding F.C.C. rule part numbers, under which the SynCom can be used, are as follows:

Domestic Public Radio Services (Other than Maritime Mobile)
- F.C.C. Rules & Regulations, Volume VII, Part 21
  - Domestic Public Land Mobile Radio Service
  - Rural Radio Service

Experimental, Auxiliary, and Special Broadcast,
- F.C.C. Rules & Regulations, Volume III, Part 74
  - Remote Pickup Stations

Stations on Land in the Maritime Services
- F.C.C. Rules & Regulations, Volume IV, Part 81
  - Public Coast Station
  - Marine Utility Stations
  - Fixed Stations Associated with the Maritime Mobile Service
  - Stations Operated in the Land Mobile Service for Maritime Purposes

Public Safety Radio Services
- F.C.C. Rules & Regulations, Volume V, Part 89
  - Local Government Radio Service
  - Police Radio Service
  - Fire Radio Service
  - Highway Maintenance Radio Service
  - Forestry-Conservation Radio Service
  - Special Emergency Radio Service

Industrial Radio Services
- F.C.C. Rules & Regulations, Volume V, Part 91
  - Power Radio Service
  - Petroleum Radio Service
  - Forest Products Radio Service
  - Motion Picture Radio Service
  - Relay Press Radio Service
  - Special Industrial Radio Service
  - Business Radio Service
  - Manufacturers Radio Service
  - Telephone Maintenance Radio Service

Land Transportation Radio Services
- F.C.C. Rules & Regulations, Volume V, Part 93
  - Motor Carrier Radio Service
  - Railroad Radio Service
  - Taxicab Radio Service
  - Automobile Emergency Radio Service

3-3-2. F.C.C. Field Engineering Offices

ALASKA, ANCHORAGE 99510
G-63 U.S.P.S. and Courthouse Bldg.
Box 644, 4th and F Streets

CALIFORNIA, LONG BEACH
Room 501
3711 Long Beach Blvd.

CALIFORNIA, SAN DIEGO 92101
Fox Theatre Bldg.
1245 7th Ave.

CALIFORNIA, SAN FRANCISCO 94111
323-A Customhouse
555 Battery St.

COLORADO, DENVER 80202
Suite 2925, The Executive Tower
1405 Curtis St.

DISTRICT OF COLUMBIA, WASHINGTON 20554
Room 411
1919 M St. NW.

FLORIDA, MIAMI 33130
Room 919
51 Southwest 1st Ave.

FLORIDA, TAMPA 33607
ADP Building, Suite 601
1211 N. Westshore Blvd.

GEORGIA, ATLANTA 30309
440 Massell Bldg.
1365 Peachtree St. NE.

HAWAII, HONOLULU 96808
502 Federal Bldg.
Box 1021, 355 Merchant St.

ILLINOIS, CHICAGO 60604
3935 New Federal Bldg.
230 South Dearborn St.

LOUISIANA, NEW ORLEANS 70130
829 F. Edward Herbert Federal Bldg.
600 South St.

MARYLAND, BALTIMORE 21201
819 Federal Bldg.
31 Hopkins Plaza

MASSACHUSETTS, BOSTON 02109
1600 Customhouse
165 State St.

MICHIGAN, DETROIT 48226
1054 Federal Bldg.
231 West LaFayette St.

MINNESOTA, ST. PAUL 55101
691 Federal Bldg. and U.S. Courthouse
316 North Robert St.

MISSOURI, KANSAS CITY 64106
1703 Federal Bldg.
601 East 12th St.

NEW YORK, BUFFALO 14202
1307 Federal Bldg
111 West Huron St.

NEW YORK, NEW YORK 10014
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1782 Federal Office Bldg.
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PENNSYLVANIA, PHILADELPHIA 19106
James A. Byrne Federal Courthouse
601 Market St.

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William Penn Highway

PUERTO RICO, HATO REY 00918
747 Federal Bldg.

TEXAS, DALLAS 75242
13E7 Earle Cabell Federal Bldg.
1100 Commerce St.

TEXAS, HOUSTON 77002
5636 New Federal Office Bldg.
515 Rusk Ave.

VIRGINIA, NORFOLK 23502
Military Circle
870 North Military Highway

WASHINGTON, SEATTLE 98174
3256 Federal Bldg.
915 2d Ave.

SECTION IV

MAINTENANCE MANUAL

4-1. INTRODUCTION

The frequency-synthesized VHF business-band transceiver is designed to transmit and receive 16F3 emissions in either of two frequency ranges: 150 - 159.995 MHz or 160.7 - 170.695 MHz. The unit provides a typical power output of 25 watts into a 52-ohm load.

Basically, the receiver is a dual conversion superheterodyne, utilizing an output from the synthesizer for the 1st L.O. injection. An 8-pole monolithic crystal filter provides good selectivity, while a single integrated circuit performs limiting and detection functions. In conjunction with the following circuit description, refer to the block diagram of Figure 4-1, and to the transceiver synthesizer and main PC board schematics in this Section.

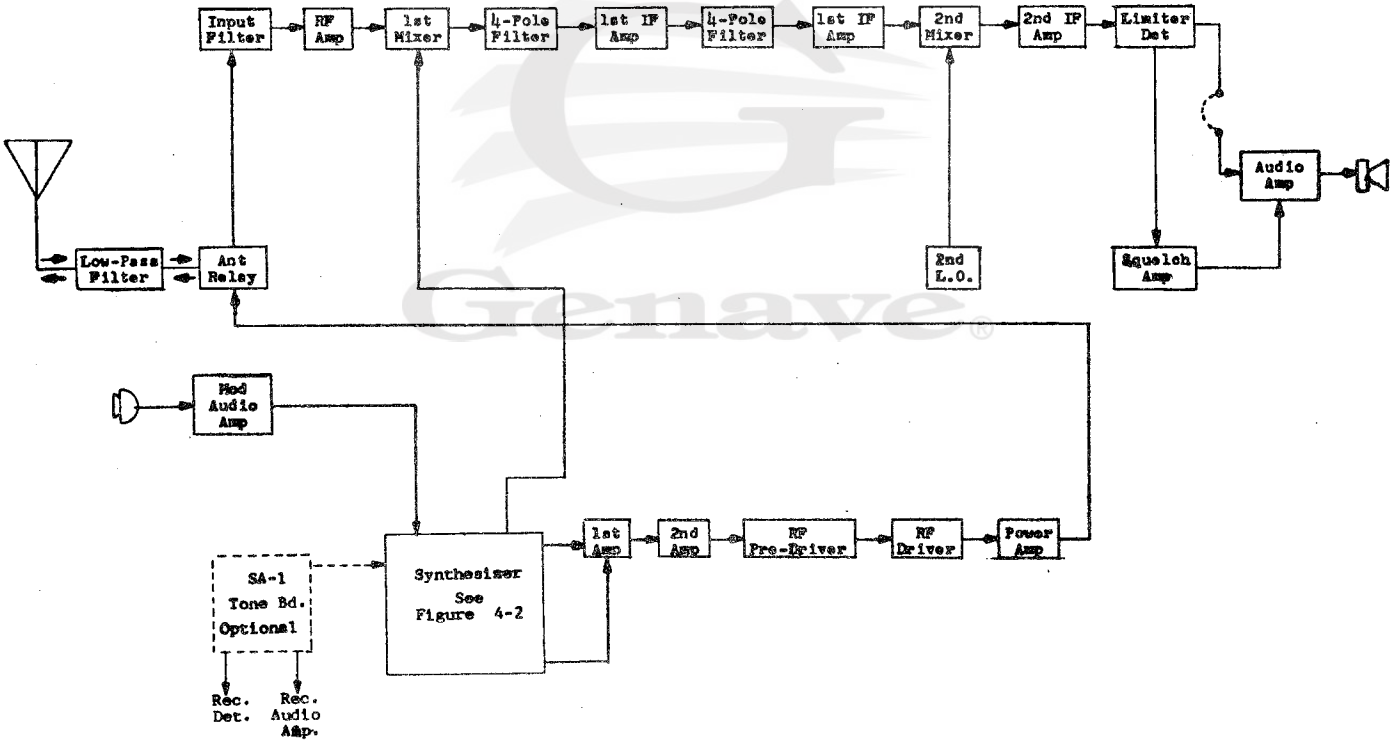


Figure 4-1. Block Diagram

4-2. THEORY OF OPERATION - SYNTHESIZER

The frequency synthesizer generates all required frequencies for operation of the transmitter and receiver sections in the VHF-FM Business-Band Transceiver. See block diagram, Figure 4-2.

4-2-1. Reference Oscillator

IC403 (4060A) is a dual-purpose oscillator and divider. A portion of IC403 is used as a 3.2 MHz crystal oscillator and the remaining portion is a divider which divides the signal down from 3.2 MHz to 25 kHz at pin 6.

IC404 (74C90) further divides the 25 kHz signal down to 5 kHz, which is used as a reference input signal to phase-detector IC401 pin 1.

The 3.2 MHz crystal is temperature controlled when the ambient temperature drops below approximately 0°C. RT401, R465, and Q411 control current flow through resistors R463 and R464 which are used to heat the 3.2 MHz crystal, Y401.

4-2-2. Voltage-Controlled Oscillator

IC402 is a voltage-controlled oscillator (VCO) which produces the VHF signal for the synthesizer. The VCO output is amplified, buffered by Q405, Q406, and Q407, and then applied to the receiver and transmitter sections on the unit main PC board.

4-2-3. Counters - Prescaler

The synthesizer consists of two groups of counters: Group "A" (IC406B and IC-415) and group "B" (IC409, IC411, and IC413). "A" counter group controls the length of time prescaler IC405 divides by 11. In operation, the prescaler IC-405 divides the VCO output by 11 until "A" counter reaches a "zero" state. IC407 (12014) consists of a Zero detector which controls the modulus of prescaler IC405 -- Logic HIGH (1) for ÷10, and logic LOW (0) for ÷11.

IC406 provides a divide by 2, which allows prescaler to divide either by 20 or 21. Once "A" counter reaches a zero-state, the state of "B" counter equals B - A. The modulus of the prescaler then changes to divide by 10, or in operation, a divide by 20 at output of IC406 pin 5, until the remaining counter B - A is decremented to zero.

4-2-4. Phase Detector

IC401 (4044) compares the 5 kHz reference (pin 1) with the output from the counter chain (pin 3), and supplies a variable voltage to varicap CR405 via loop filter Q403 and Q404. Q401, Q402, CR401, CR402, and CR403 comprise an "out-of-lock" detector, which is used to inhibit transmitter output, should synthesizer fail to lock.

4-2-5. Offset Programmer

The VCO frequency is increased by 10.7 MHz for "high-band" transmit and "low-band" receive functions, by utilizing offset-programming chips IC410, IC412, and IC414 (12021s). These chips provide a digital means of increasing frequency. Offset-programmers IC410, IC412, and IC414 consist of a logic implementation of a four-pole, two-position switch controlled by the "enable-input" from IC408 pin 3.

Each chip has two groups of inputs: One group (pins 1, 13, 15, and 11) determining the transmission frequency, and is programmable with either logic state of the "enable" line. The other input group (pins 10, 12, 14, and 2) determines the offset frequency (10.7 MHz), and is controlled by the enable line -- logic "1" for NO offset, or logic "0" for 10.7 MHz offset. In operation when PTT line at pin 1 of IC408 is a logic "0," the chip becomes a buffer gate that follows the clock input at pin 10. $\overline{Q}$ line (pin 3 of IC408) produces a constant logic "1" which DOES NOT enable offset. A logic "1" on PTT line at pin 1 of IC408 turns IC408 into a flip-flop and divides by two both Q and $\overline{Q}$ outputs (pins 5 and 3 respectively).

This switching logic allows 10.7 MHz frequency information "hard-wired" at input pins 10, 12, 14, and 2 (IC410, IC412, and IC414) to be enabled into programmable counter chips.

Transistor Q410 is used to invert logic at PTT (key) line input to pin 1 of IC408 (12020), when transceiver is used on the high-band, 160.7 to 170.695 MHz.

4-2-6. Synthesizer Power Supply

The synthesizer receives a 13.75-volt DC input from the transceiver main PC board. The 13.75-volt input is applied directly to the crystal-heater transistor Q411 through the crystal-heater resistors R463 and R464.

The incoming 13.75 volts is applied through R456 to a 10-volt Zener diode, CR408. This regulated 10-volt supply is then applied to C-MOS reference oscillator/divider chips IC403 and IC404.

Four 3-terminal solid-state regulators supply +5 volts to the various integrated circuit chips on the synthesizer board. Separate regulators are used for the various 5-volt supplies to provide isolation and decoupling between the stages, and thus eliminate undesirable interaction and coupling between synthesizer stages.

Regulator IC420 (78L05CP) supplies 5 V to VCO IC402; IC419 (78L05CP) supplies 5 V to phase detector IC401 (MC4044); IC418 (MC78H05P) supplies 5 V to the prescaler IC405; as well as to IC415 and IC406; while IC417 (MC78H05P) supplies 5 V to remainder of synthesizer.

4-2-7. Reserved

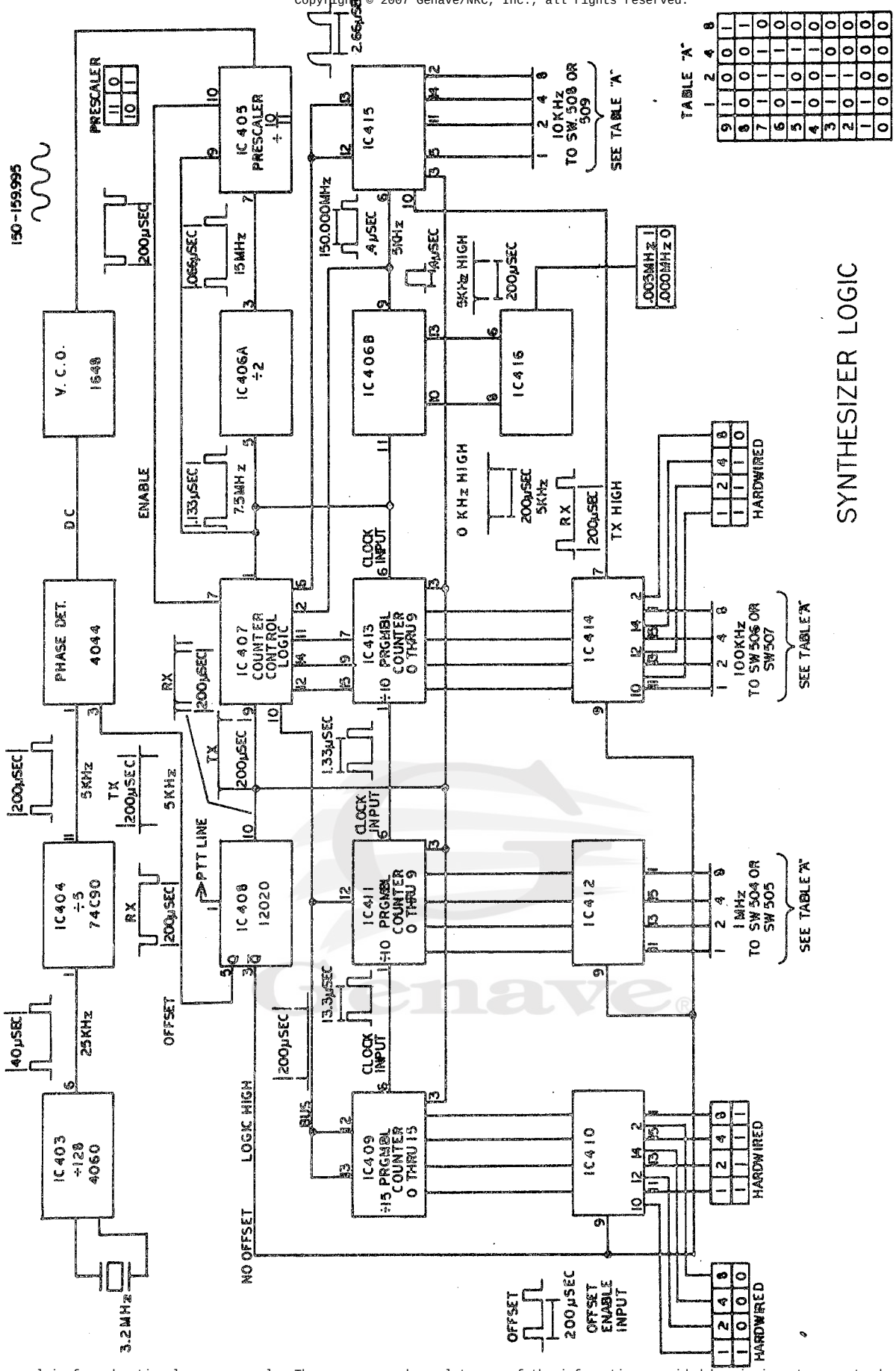


Figure 4-2. Synthesizer Block Diagram

4-3. THEORY OF OPERATION - RECEIVER

4-3-1. Low-Pass Filter

From antenna connector J201, the received signal is applied to a low-pass filter comprised of C232, L214, and C231. After the signal leaves the low-pass filter, it is routed to pin 15 of T/R relay K301. In the "receive" mode, pin 14 of the T/R relay feeds the incoming signal to the receiver input filter.

4-3-2. Input Filter and RF Amplifier

The receiver-input filter consists of a double-tuned circuit, L101, C102, L102, and C103, with the output tap on L102 coupled to RF amplifier Q101. The RF amplifier output is applied to another double-tuned circuit comprised of L103, C106, C109, and L104; then, the tap on L104 is coupled to a second RF amplifier, Q102. The output of Q102 is applied to a double - tuned circuit consisting of L105, C111, L106, and C114. The output tap on L106 routes the amplified signal to a dual-gate FET first mixer.

NOTE: The values of double-tuned circuit coupling capacitors, C158, C108, and C112, are selected to provide a 6 MHz bandwidth.

4-3-3. First Mixer Injection

The injection siganl from the synthesizer is connected to gate 2 of dual-gate 1st mixer Q103. To receive between 150.0 and 159.995 MHz, the injection frequency is 10.7 MHz ABOVE the desired "receive frequency," while to receive frequencies between 160.7 and 170.695 MHz, the injection frequency is 10.7 MHz BELOW the desired "receive" frequency.

4-3-4. First Mixer and First IF Amp.

The 10.7 MHz difference signal produced in the first mixer is coupled by T101 to a 4-pole monolithic crystal filter consisting of FL101 and FL102. The output of the filter is transformer coupled by T102 to first stage Q104 of the first IF amplifier. The output of Q104 is coupled by T103 to another 4-pole monolithic crystal filter consisting of FL103 and FL104. The output of the filter is then transformer coupled by T104 to the second stage, Q105, of the first IF amplifier.

4-3-5. Second Mixer/Autodyne Converter

The output of Q105 is transformer coupled by T105 to the second mixer, Q106, which operates as an autodyne converter with crystal Y123 oscillating at 10.245 MHz to produce a second IF of 455 kHz.

4-3-6. Second IF Amplifier

Transformer T106 applies the resultant 455 kHz difference frequency to IC101, which functions as a high-gain 455 kHz IF amplifier.

4-3-7. Limiter, Detector, and Squelch

The output of IC101 is coupled by T107 to IC102 pins 1 and 2 - IC102 performs the limiting and detection functions in the receiver. C130 sets the de-emphasis level in the detection circuitry, while T108, R121, and C131 form the quadrature detector. Detected audio on pin 8 of IC102 is fed through C132 and R122 to the audio amplification circuits via pin 14 on IC102. At the same time, detected audio from pin 8 is also applied to a noise amplifier consisting of Q107 and its associated circuitry. The amplfied noise from Q107 is fed to the voltage - doubling detectors CR103 and CR104. The detected noise then charges C137 and biases the base of Q108. The Squelch control, R504, determines the authority of the detected-noise level on base of Q108 - as Q108 turns ON, it pulls pin 6 of IC103 to ground. This action turns IC103 OFF, and completely silences the receiver.

4-3-8. Audio Amplifier

Volume control R505 sets the level of audio fed to audio amplifier IC103. R132 and C143 perform the frequency-response shaping of the audio amplifier

while C145, C146, and C148 provide feedback to various stages within IC103. Audio output from pin 12 of IC103 is applied through C150 to the speaker.

4-4. THEORY OF OPERATION - TRANSMITTER

4-4-1. Modulator Audio Amplifier

The modulator audio amplifier in the unit is built around a single integrated circuit, IC301. This IC is a dual operational amplifier, and is shown on the schematic as IC301A and IC301B. Audio output of the ceramic microphone is amplified by IC301A - a 6 dB per octave rising characteristic is given to the audio frequencies by loading the 1500 pF microphone capacitance with bias resistor R302. IC301 also provides the clipping function required for limiting modulation by saturating symmetrically against supply voltage and ground. Regulated-supply voltage for the modulator is obtained by applying 13.75 VDC primary power through R310 and across 6.8-volt zener diode CR301.

Output from IC301A is applied to IC301B which acts as an active, 2-pole, Chebyshev low-pass filter with a cutoff frequency of 3 kHz. R308 and C312 add a third pole to the filter, which gives the required -18 dB per octave rolloff above 3 kHz. R309 controls audio level applied to modulator varactor diode CR406. C313 provides an audio return for R309.

4-4-2. Buffer Amplifiers

RF output from the synthesizer is amplified by Q201 and Q202. Transistor Q201 also disables the transmitter in case the synthesizer "unlocks." Should the synthesizer go out of a phase-locked condition, Q408 is turned on by the lock indicator and pulls the base of Q201 to ground, thus disabling the transmitter.

4-4-3. RF Predriver

The 150 to 170.695 MHz signal from final buffer Q202 is applied to the base of Q203 which is the first RF power amplifier. This Class C stage increases the RF signal from 50 milliwatts to approximately 500 milliwatts at its output. This output is coupled to the following driver stage by a filter network formed by L204, C210, C235, and L203. This circuit provides both filtering of any undesired spurious responses, and impedance matching into driver stage.

4-4-4. RF Driver

Q204 and associated circuitry function as a Class C RF Driver.

L205, C213, L206, C216, and C217 form a frequency - selective matching network, which also reduces any undesired outputs from driver stage.

4-4-5. Final Power Amplifier

Q205 functions as the final power amplifier, and develops 25-watts of RF-output power when full drive is applied from Q204. C221, C225, and L208 comprise a resonant matching network which matches the output of Q205 to the 52-ohm antenna impedance. The remainder of components up to output connector J201 form an eliptic-function filter which reduces level of all spurious outputs to less than -13 dBm.

4-4-6. Power Supply

Power to operate unit is obtained from the 13.75 VDC external power source through input connector J101, F301, and SW510. The 13 VDC line supplies power to operate relay K301, audio output, synthesizer, and 9.7-volt regulator.

The synthesizer VCO, reference oscillator, and counters are all operated from 5-volt IC regulators to ensure stability and isolation between sections of the synthesizer, and to virtually eliminate "close-in" spurious responses.

Voltages for receiver RF, mixer, and IF stages are obtained from a zener-diode stabilized pass-transistor regulator, which consists of R131, R135, CR107, and Q109. The output of this regulator is approximately 9.7 volts DC.

NOTE: To quiet receiver audio during transmission, the microphone push-to-talk switch also grounds pin 6 of audio amplifier IC103 through CR105.

4-5. DISASSEMBLY

4-5-1. Top and Bottom Cover Removal

Prior to performing any service work on the instrument, the plastic top cover must be removed. The bottom cover need not be removed, unless it is necessary to gain access to bottom-side of main PC board. To remove either cover, remove two 6/32 x 3/8" screws (D) securing each side of cover to transceiver chassis; then, slide cover back and lift it off unit.

4-5-2. Access to Synthesizer Board

With unit top cover removed, the component side of synthesizer board is accessible for waveform measurements or frequency adjustment. Note that shield covers are tack-soldered in place.

To gain access to bottom-side of synthesizer board, remove four screws securing PC board to shield (see Figure 4-3); then, loosen pivot screws (B) one or two turns. Pivot board forward as required.

4-5-3. Access to Main PC Board

To reach component side of main board for alignment purposes, remove the two screws (C) securing shield to heatsink, and remove two #4 x 1/4" sheet - metal (A) screws. Loosen pivot screws (B) one or two turns; now pivot shield and synthesizer board forward as required.

NOTE: Synthesizer board and shield may be pivoted forward as one unit. It is NOT necessary to remove the screws holding PC board to shield unless access to bottom of PC board is required.

4-5-4. Control Head Removal

In order to obtain access to SA-1 Tone Board or the Programming Board, both located in transceiver control head, remove two #8-32 oval-head screws from each side of head; then, pull head forward and remove from front of transceiver chassis.

The SA-1 tone board mounts on the programming board by means of two plugs -- P501 and P502. To remove SA-1 from control head, carefully grasp tone board by its ends, and gently but firmly rock board while pulling it up and off mating pins on programming board. Normally the 4-pin receptacle will disengage first. To reinstall SA-1, reverse the removal procedure.

Access to the programming switches is obtained simply by removing the SA-1 board (if used); however, if the simplex/duplex jumpers must be changed, the programming board must be removed from control head. To remove programming board, loosen three screws which secure mounting clips (Figure 4-4); now slide clips in until small control panel is released. Pull panel forward from control housing. Slide squelch, volume, and freq.-selector knobs off their shafts, and remove four Phillips-head, self-tapping screws which secure programming board to control panel. The board can now be lifted off panel to facilitate installation of jumpers.

4-6. RESERVED

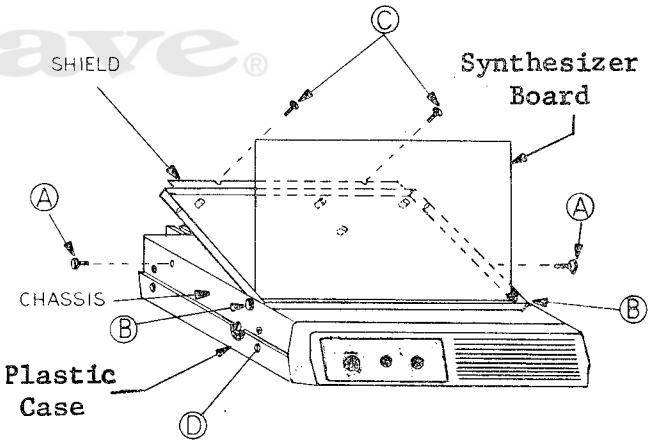


Figure 4-3. Disassembly

4-7. CHANNEL PROGRAMMING - GENERAL

The SynCom transceiver may be internally programmed for operation on a maximum of two SIMPLEX channels, or one SEMI-DUPLEX channel, by changing two jumpers on programming board mounted in control head. Refer to Figure 4-4 for location of jumpers.

Frequency programming is accomplished by means of six 10-position, rotary BCD switches and two 2-position SPDT slide switches mounted on programming board. Refer to Figure 4-4 for location of programming switches on PC board. Access to Simplex/Duplex jumpers and the Programming switches is obtained by removing control head from transceiver as given in Section 4-5 of this manual.

As indicated previously, the transceiver is capable of operating on either frequency range: 150.0 - 159.995 MHz, or 160.7 - 170.695 MHz. The SynCom MUST BE programmed so that all transmit/receive frequencies, either simplex or semi-duplex, are in the same frequency range. The desired frequency range is selected by a jumper arrangement on the Synthesizer PC board. See Figure 4-5 for location of frequency-range jumpers on PC board. To gain access to synthesizer board, remove instrument top cover; then, follow instructions given in Section 4-5 of this manual.

NOTE: The SynCom transceiver is shipped from factory with programming jumpers installed to provide SIMPLEX operation, with synthesizer board jumpered to provide operation on the "low-band" (150 - 159.995 MHz), and the receiver input filter adjusted for 150 - 156 MHz.

To adjust frequency switches to select a desired frequency for channel 1, for example 154.315 MHz, proceed as follows: The 100-MHz digit (1) and the 10-MHz digit (5) are preset, thus no selection is required for these digits. Use a slotted alignment tool and rotate SW504 (1-MHz digit) so that its arrow indicator points to "4"; then, use the slotted tool to rotate SW506 (100-kHz) so it indicates "3". Next, use slotted tool to rotate SW508 (10-kHz digit) so it indicates "1." Now slide switch SW-502 to its 5-kHz position. The switches are now set to 154.315 MHz.

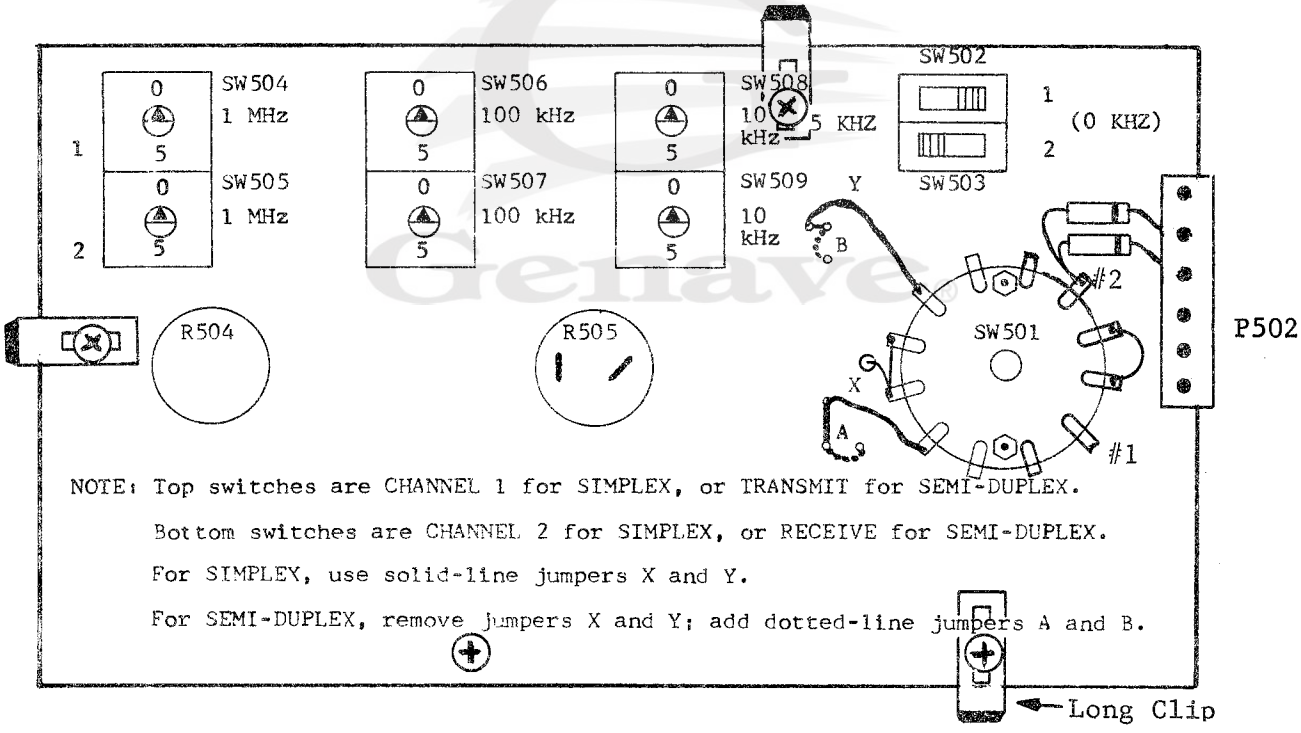
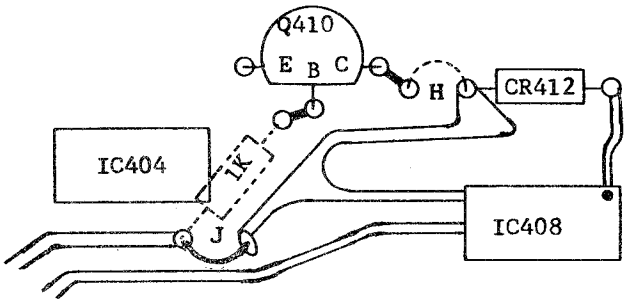


Figure 4-4. Programming Board, Component Side.

NOTE: To program SA-1 TONE SQUELCH, see Section 4-11 in this manual.



For "low-band," use jumper J; omit 1K resistor and jumper H (shown dotted).

For "high-band," add jumper H and 1K resistor; remove jumper J.

Figure 4-5. Freq. Range Jumpers-Synthesizer Board.

4-7-1. Programming Simplex Frequencies (Low-Band)

1. First, determine frequency(ies) to be used.

2. Gain access to large compartment on synthesizer board by following procedure in Section 4-5.

3. Determine that synthesizer is set for "low-band" operation; that is, jumper J is installed, but 1K resistor and jumper H are omitted. See Figure 4-5.

4. Remove control head from transceiver as described in Section 4-5. See that "simplex" jumpers X and Y are installed from channel switch to PC board and jumpers A and B are omitted as shown in Figure 4-4.

5. Now set SW504, SW506, SW508, and SW502 for the 1 MHz, 100 kHz, 10 kHz, and 5 kHz digits respectively, of the frequency to be designated as channel 1, as detailed in 4-7 above. For SA-1 info, see Sec. 4-11.

6. Repeat step 5, using SW505, SW507, SW509, and SW503 for the frequency to be designated as channel 2, if used.

7. Re-assemble transceiver, and check operation on programmed frequencies.

4-7-2. Programming Simplex Frequencies (High-Band)

1. Determine frequency(ies) to be programmed into transceiver.

2. Gain access to large compartment on synthesizer board by following procedure in Section 4-5.

3. Determine that synthesizer is set for "high-band" operation; that is, jumper H and the 1K resistor are installed, but jumper J is omitted. See Figure 4-5.

4. Remove control head from transceiver as described in Section 4-5. See that "simplex" jumpers X and Y are installed from channel switch to PC board and jumpers A and B are omitted as shown in Figure 4-4.

5. Now subtract 10.7 MHz from each of frequencies determined in step 1 above.

6. Using one of frequencies obtained in step 5, set SW504, SW506, SW508, and SW502 for the 1 MHz, 100 kHz, 10 kHz, and 5 kHz digits respectively, of the frequency to be designated as channel 1, as given in Section 4-7 above.

7. Repeat step 6, using SW505, SW507, SW509, and SW503 for the remaining frequency determined in step 5, if used. This is channel 2.

8. Realign receiver input filter to cover frequency range required by frequency(ies) in step 1 above.

9. If unit is equipped with SA-1 tone squelch, see Sec. 4-11 for programming information.

10. Re-assemble transceiver, and check operation on programmed frequencies.

4-7-3. Programming Semi-Duplex Freqs. (Low-Band)

1. Determine transmit and receive frequencies to be programmed into the transceiver.

2. Gain access to large compartment on synthesizer board by following procedure in Section 4-5.

3. Determine that synthesizer is set for "low-band" operation; that is, jumper J is installed, but 1K resistor and jumper H are omitted. See Figure 4-5.

4. Remove control head from transceiver as described in Section 4-5. See that "semi-duplex" jumpers A and B are installed, but that jumpers X and Y from channel switch to PC board are removed. Refer to Figure 4-4.

5. Using "transmit" frequency found in step 1 above, set SW504, SW506, SW-508, and SW502 for the 1 MHz, 100 kHz, 10 kHz, and 5 kHz digits respectively, as detailed in Section 4-7 above.

NOTE: When transceiver is programmed for semi-duplex operation, the front-panel channel-selector switch is disabled.

6. Using "receive" frequency found in step 1 above, set SW505, SW507, SW-509, and SW503 for the 1 MHz, 100 kHz, 10 kHz, and 5 kHz digits, respectively, as detailed in Section 4-7.

7. Re-assemble transceiver, and check operation on programmed frequency.

4-7-4. Programming Semi-Duplex Freqs. (High-Band)

1. Determine transmit and receive frequencies to be programmed into the transceiver.

2. Gain access to large compartment on synthesizer board by following procedure in Section 4-5.

3. Determine that synthesizer is set for "high-band" operation; that is, jumper H and the 1K resistor are installed, but jumper J is omitted. See Figure 4-5.

4. Remove control head from transceiver as described in Section 4-5. See that "semi-duplex" jumpers A and B are installed, but that jumpers X and Y from channel switch to PC board are removed. Refer to Figure 4-4.

5. Now, subtract 10.7 MHz from the "transmit" frequency, and also from the "receive" frequency, found in step 1 above.

6. Using "transmit" frequency obtained in step 5, set SW504, SW506, SW508, and SW502 for the 1 MHz, 100 kHz, 10 kHz, and 5 kHz digits respectively, as given in Section 4-7 above.

NOTE: When transceiver is programmed for semi-duplex operation, the front-panel channel-selector switch is disabled.

7. Using "receive" frequency obtained in step 5, set SW505, SW507, SW509, and SW503 for the 1 MHz, 100 MHz, 10 kHz, and 5 kHz digits, respectively, as given in Section 4-7.

8. Realign receiver input filter to cover frequency range required by "receive" frequency in step 1.

9. Re-assemble transceiver, and check operation on frequencies programmed into transceiver.

4-8. SYNTHESIZER ADJUSTMENT

Remove top cover from instrument, and refer to Synthesizer Component Layout for adjustment locations.

1. Disconnect plugs P403 and P404 from mating jacks at right-hand side of synthesizer PC board.

2. Connect frequency counter to either jack, J403 or J404, on synthesizer board.

3. Set frequency-selector switches to 150.000 MHz, and turn unit ON.

4. Depress push-to-talk button on microphone, and adjust trimmer C441 on synthesizer board for a reading of 150.000 MHz if unit is programmed for "low-band" operation or, a reading of 160.700 MHz if unit is programmed for "high-band" use.

   CAUTION: BE SURE frequency is within ±.0005% of 150.000 or 160.700 MHz, as applicable.

5. Disconnect frequency counter from transceiver, and reconnect P403 and P404 to synthesizer jacks.

   NOTE: This is the only adjustment required for proper frequency operation of synthesizer.

4-9. RECEIVER ALIGNMENT

Remove two screws (C) and two sheet-metal screws (A) as outlined in Disassembly Procedure (Section 4-5) in this manual; then, pivot shield and synthesizer PC board forward to gain access to receiver adjustments.

4-9-1. RF & Input Filter Alignment

1. With transceiver OFF, connect RF-output cable of sweep generator to transceiver antenna connector J201. Connect a high-impedance detector (Figure 4-6) to gate 1 of 1st mixer Q103; then, connect detector output to oscilloscope vertical input.

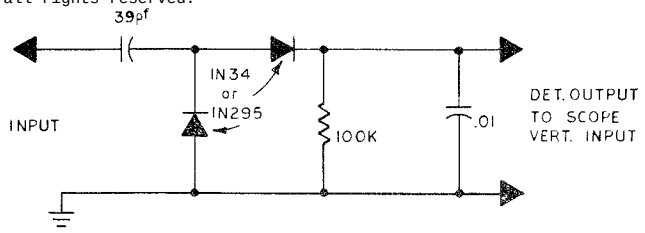


Figure 4-6. High-Impedance Detector

2. Remove mixer injection signal by disconnecting P404 from J404 on the synthesizer board.

3. Set sweep generator to sweep a 6 MHz band which includes the "receive" frequencies on which the transceiver is to be used. Use an RF-generator to produce the necessary markers.

   NOTE: Factory-setting of the input filter is 150 to 156 MHz.

4. Turn transceiver power switch ON. Set scope vertical attenuator to its most sensitive position; then, set sweep generator RF-output level low enough to prevent overdriving transceiver RF amplifier.

5. Adjust C102, C103, C106, C109, C111 and C114 to give a 6-MHz bandpass similar to that shown in Figure 4-7 below.

6. Turn unit power switch OFF, disconnect test equipment, and reconnect P404 to J404 on synthesizer board.

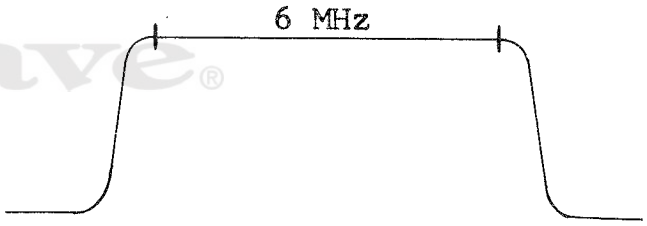


Figure 4-7. Input-Filter Response

4-9-2. 10.7 MHz & 455 kHz IF Alignment

1. Connect a high-impedance detector (Figure 4-6) to drain of FET amplifier Q105; then, connect detector output to scope vertical input. Set scope vertical attenuator to its most sensitive position.

2. The connection point for the sweep-input signal depends upon frequency range of sweep generator being used: If generator covers 10.7 MHz, the sweep signal can be applied through a 39 pF capacitor to gate 1 of mixer Q103; however if generator covers operating frequency of the transceiver, the sweep signal can be applied directly to antenna input connector J201. Turn transceiver power switch ON.

NOTE: During alignment of the monolithic crystal filters, keep sweep-signal input level low enough to prevent overdriving the detector -- signal level at the detector should be approximately 10 - 20 mV. Set generator sweep width for approximately 25 kHz at a sweep rate of not more than 40 Hz.

3. Adjust T101, T102, T103, T104, and T105 for a bandpass response similar to that shown below. The ripple should not exceed 2 dB, and in most cases will be 1 dB or less.

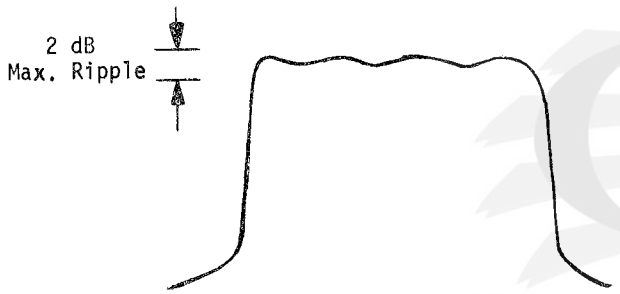


Figure 4-8. IF Response

4. Turn transceiver power OFF, and disconnect sweep generator, detector, and scope.

NOTE: After the 10.7 MHz crystal filters have been properly aligned using a swept signal, DO NOT change adjustments of T101 through T105.

5. Connect an AC voltmeter across unit speaker terminals; turn squelch and volume controls fully counterclockwise.

6. Apply a 10.7 MHz CW signal by either of the following methods:

(1) Inject an accurate 10.7 MHz CW signal into gate 1 of mixer Q103 through a 39 pF capacitor. Remove mixer injection signal by disconnecting P404 from J404 on synthesizer.

(2) Connect a sig. generator, set to desired "receive" frequency, to antenna connector J201, and connect a frequency counter to pin 1 of IF IC101. Turn instrument power switch ON, and increase generator output until 2nd IF is read on counter. "Fine-tune" signal generator until 2nd-IF frequency reads 455 kHz.

7. Disconnect RF generator from transceiver, and with transceiver power switch ON, adjust volume control for a 0.5-volt noise level on the AC voltmeter.

8. Reconnect signal generator to the transceiver, and increase unmodulated signal from signal generator until noise level drops to 0.25 VAC on voltmeter.

9. Now, adjust T106 and T107, in that order, for maximum quieting as indicated on the AC voltmeter.

Decrease RF input, as necessary, to maintain a usable reading on AC voltmeter during alignment. Repeat step 9 until no further quieting is obtained.

10. Turn transceiver power OFF and disconnect AC voltmeter. Now, connect an oscilloscope across speaker terminals, and turn transceiver power switch ON.

11. FM modulate signal generator with a 1-kHz tone at ±5 kHz deviation. Adjust generator RF output to a 10-microvolt level and adjust scope-input sensitivity to cover about 3/4 of scope screen vertically with the 1-kHz tone.

12. Adjust T108 for maximum amplitude of the 1-kHz tone on scope screen.

13. Turn transceiver power switch OFF, and disconnect all test equipment from unit. If method #1 used for alignment, reconnect P404 on synthesizer board.

4-9-3. RF Input for 20-dB Quieting

1. Connect FM signal generator to antenna connector J201, and connect an AC voltmeter across unit speaker terminals. Turn transceiver power switch ON.

2. Turn signal-generator modulation OFF, and set generator RF attenuator for minimum output. Set generator and transceiver to desired operating frequency.

3. Adjust transceiver volume control so that receiver background noise indicates -10 dB on AC voltmeter.

4. Slowly increase setting of FM signal generator RF attenuator, until AC VTVM indicates -30 dB. Note RF level shown on signal-generator attenuator. This is the RF input required to produce 20 dB receiver quieting; an input of -112 dBm (0.45 µV) will quiet receiver 20 dB. Check additional frequency(ies) as desired.

4-9-4. Squelch Operation

1. Set signal generator to desired "receive" frequency, and modulate generator with a 1 kHz tone at ±5 kHz deviation. Set RF attenuator to minimum RF output.

2. Turn squelch control fully clockwise. Receiver audio control should be set for maximum volume. Receiver is fully squelched, and should be completely silent.

3. Reduce DC-input voltage to approximately 11 volts, and note that receiver is still fully squelched. Return DC input to 13.75 VDC, set volume control at midrange, and adjust squelch control fully counterclockwise; then, set squelch clockwise until receiver background noise just disappears.

4. Increase setting of signal generator RF attenuator until the squelch just fully opens. The RF attenuator should show -121 dBm (0.2 µV) or better.

4-9-5. Minimize 1/2 IF Response

The following steps minimize receiver response to signals which differ from the selected frequency by 5.35 MHz (1/2 IF):

1. Set receiver to desired operating frequency; then set FM signal generator 5.35 MHz ABOVE the receiver frequency, with an output of 400 to 500 µV, modulated with a 1 kHz tone at ±3 kHz deviation.

2. Adjust trimmer C114 (input of 1st mixer) for a null (minimum received signal). The receiver should now require MORE THAN 500 µV input for a 12 dB SINAD.

3. Check receiver sensitivity at all programmed "receive" frequencies to assure that receiver passband is still within specifications.

4-9-6. Audio-Output Power

1. Set FM signal generator on desired "receive" frequency, and modulate generator with a 1-kHz tone at ±5 kHz deviation. Set RF attenuator in the vicinity of 5 µV.

2. Turn volume control fully clockwise. The AC VTVM should indicate not less than 4 volts (4 watts).

3. Modulate generator with 500-Hz tone at ±5 kHz deviation, and note that AC VTVM indicates at least 4 volts with transceiver volume control fully clockwise.

4. Modulate signal generator with a 3-kHz tone at ±5 kHz deviation. Again

the AC VTVM should indicate at least 4 volts at maximum setting of the transceiver volume control.

5. Turn OFF transceiver power switch, and disconnect signal generator and AC VTVM from transceiver.

4-10. TRANSMITTER ALIGNMENT

4-10-1. Equipment Required

To properly align the T-7044000 transmitter, the following test equipment, or its equivalent, is required:

a) Power meter, 35 watts @ 158 MHz; or, Relative Output Indicating Device (Figure 4-9) with 50-ohm dummy load.

b) Frequency counter, DC to 165 MHz; or other accurate frequency measuring device.

c) Deviation meter, to read at least ±5 kHz.

d) Power supply, filtered, 13.75 VDC at 8 amps minimum.

e) VTVM - any accurate instrument.

f) Audio generator, to supply 1700 Hz.

g) Oscilloscope, DC to 5 MHz.

4-10-2. Preparation for Alignment

1. Attach a 50-ohm dummy load to the transceiver RF-output connector through a power meter or relative output indicating device (Figure 4-9).

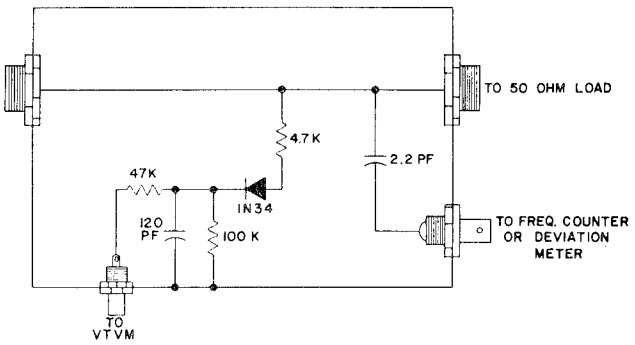


Figure 4-9. Relative Output Indicator

2. Preset deviation potentiometer (R309) to its lowest setting (potentiometer rotated toward receiver side of mainboard).

3. Connect unit to a 13.75-volt DC power source.

4-10-3. Frequency and Power Alignment

1. Before starting to align transmitter, refer to programming instructions in Section 4-7 of this manual and program transceiver to operate on desired frequency(ies).

NOTE: The signal peak-voltage measuremnets in the following steps of this section are made with a VTVM and DC probe. Key transmitter only when adjustments are being made.

2. Connect DC probe to emitter of Q-203, key transmitter, and adjust C206 for a peak reading at the operating frequency. Adjust VTVM attenuator for an "onscale" reading.

3. If the relative output indicating device of Figure 4-9 is used, connect VTVM DC probe to the relative output terminal labeled "To VTVM." Otherwise, observe wattmeter or other relative output indicator.

4. Preset C217 by tightening its adjustment screw down firmly; then, backing it off 1/2 turn.

5. Key transmitter and adjust C213, C217, C221, C225, C210, C235, and C206 for maximum relative output indication on the operating frequency. Repeat this step as necessary.

4-10-4. Power Measurement Procedure

1. Select a channel with the channel-selector knob.

2. Key transmitter and note power output on selected channel. The power should be 20 watts, or more, from 150.0 to 159.995 MHz, or a minimum of 15 watts from 160.7 - 170.695 MHz.

3. Repeat step 2 for the second transmit frequency, if used.

4-10-5. Subaudible- and Carrier-Deviation Adjustment

1. Connect deviation meter to "Freq. Counter/Deviation meter" output of the relative output indicating device.

2. Select desired operating frequency with channel-selector switch; then, if subaudible-tone squelch is used, key transmitter and adjust "Subaudible Dev. Adj." R113 (located on SA-1 subaudible-tone board) to produce an output deviation of ±1 kHz, as indicated on the deviation meter.

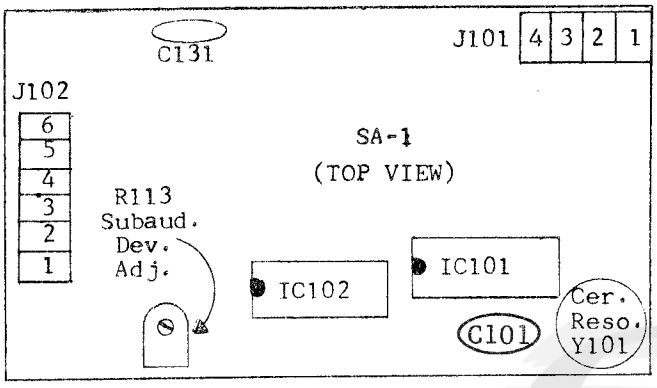


Figure 4-10. Subaudible-Tone Board

3. Do NOT key transmitter during this step. Feed a 1700-Hz audio signal into transceiver microphone. Set Mic. Gain potentiometer R304 to maximum resistance (max. gain) by rotating wiper toward receiver side of main circuit board. Connect oscilloscope vertical-input lead to pin 1 of IC301, and adjust Symmetry potentiometer R302 until displayed waveform limits symmetrically on both top and bottom of waveform.

4. Key transmitter, observe frequency-deviation meter, and increase 1700 Hz microphone audio input until no further increase in deviation is indicated. The modulator stage is now saturated.

5. Set deviation potentiometer, R309, as follows:

   Without subaudible tone: Set R309 for a deviation reading of ±5 kHz with the 1700 Hz tone applied to microphone.

   With subaudible tone: Set R309 for a combined subaudible and 1700 Hz tone deviation reading of ±5 kHz.

6. Switch deviation meter to the + and - positions, and check amount of deviation in each position.

7. For normal operation, mic. gain potentiometer R304 is set at mid-range. If unit is to operate in an area having a high acoustic noise level, mic. gain can be reduced by rotating gain potentiometer away from the maximum gain position. This will help reduce amount of noise being transmitted along with the voice.

4-10-6. Reserved

4-11. SA-1 SUBAUDIBLE-TONE PROGRAMMING

The following paragraphs contain all the information normally required to install an SA-1 Subaudible-Tone Board in a Genave SynCom transceiver, or to change the subaudible-tone frequency in an existing SA-1/SynCom installation.

In conjunction with the following information, reference should be made to the SA-1 Service Manual for Theory of Operation, Schematics, and Parts Lists for the SA-1 tone board.

4-11-1. Initial Installation

SA-1 tone boards shipped from the factory with the resonator installed have been pre-tuned, and are ready for installation.

First, determine which operating channel(s) are to employ tone squelch. If two simplex channels are programmed into the transceiver, the tone squelch may be used on both channels, or may be used on only one channel by installing two diodes in transceiver control head to "inhibit" tone squelch on channel where it is not desired.

> NOTE: If tone squelch is to be used on two operating channels, the same subaudible frequency must be used on each channel; there are no provisions for changing tone frequency as the channel selector is rotated.

Next, gain access to programming board in transceiver control head by removing control head as explained in Sec. 4-5 of this manual. It is NOT necessary to remove programming board from control head to install SA-1 tone board.

Install squelch programming diodes (if required) as follows: If tone squelch is to be used on all programmed frequencies, then no diodes need be installed. If channel #1 (on front-panel channel-selector switch) is to use tone squelch, but channel #2 is NOT, then install two 1N4148 silicon diodes from SW501 (#2) to P502 pin 2 and P502 pin 3 exactly as shown in Figure 4-5. Note that cathode (banded-end) of each diode connects to P502.

> NOTE: Solder diodes to appropriate pins on P502 BELOW the plastic pin support. If diodes are soldered to pins ABOVE the support, the copper tracks on the SA-1 board may short against the diode leads.

If channel #2 (on front-panel channel-selector switch) is to use tone squelch but channel #1 is NOT, install two 1N-4148 diodes from SW501 (#1) to P502 pin 2 and P502 pin 3 (refer to Figure 4-4).

Prior to installing SA-1 tone board in control head, REMOVE JUMPER WIRE CONNECTED DIRECTLY BETWEEN PIN 4 (Audio In) of P501 and PIN 6 (Audio to Vol. Cont.) of P502 ON PROGRAMMING BOARD; then, the two receptacles on tone board are carefully aligned with the corresponding plugs on control head programming board. Push SA-1 tone board down until it is fully seated on connecting pins. Next, it is only necessary to set subaudible deviation and the combined tone-voice deviation as outlined in Sec. 4-10-5, and check rec. operation.

After deviation has been adjusted, and unit is working properly, re-assemble transceiver.

4-11-2. Changing Tone Frequency

If it is necessary to change tone frequency from the factory-set value, proceed as follows:

With control head removed from transceiver, remove SA-1 tone board from the programming board by gently, but firmly, rocking SA-1 board while pulling it up and off mating plugs; then, remove ceramic resonator and capacitor C101. Refer to Figure 4-10.

> NOTE: The resonator determines tone frequency; therefore, a different resonator is required for each discrete subaudible-tone frequency. Refer to Table 2-1 in SA-1 Service Manual for list of EIA subaudible frequencies and Genave P/N for the corresponding resonators.

Now, select division ratio for SA-1 oscillator/multiplier by soldering a jumper on bottom side of PC board between IC101 and IC102 as follows: If subaudible tone is below 131.8 Hz, connect pin 8 of IC102 to pin 14 of IC101; but if frequency is above 136.5 Hz, connect pin 8 of IC102 to pin 6 of IC-101.

Install new resonator on SA-1 board. On newer production units, the resonator leads plug into socket pins; whereas, in earlier runs the resonator leads were soldered in place.

Temporarily replace SA-1 in position on programming board and connect transceiver to its power source. Measure the subaudible-tone frequency at pin 3 of P502 (6-pin plug). BE SURE TRANSCEIVER IS SET ON FREQUENCY EMPLOYING TONE SQUELCH. Now, select a capacitor for C-101 which will provide correct tone frequency at pin 3. For resonators shipped prior to June 1, 1978, C101 will fall between 390 pF and 690 pF; whereas, C101 will be 0 to 100 pF for resonators shipped after June 1, 1978.

After correct value for C101 is determined, solder C101 in place on the SA-1 board; then, carefully replace tone board in control head. Check receiver and transmitter operation as outlined below.

If another unit with the correct subaudible tone frequency is available, it may be used for on-the-air testing; otherwise, set a signal generator to a 10 μV level on the appropriate operating frequency with ±1 kHz deviation at the desired subaudible-tone frequency. With test signal (from antenna or signal generator) applied to receiver, note that receiver unsquelches and operates normally.

The transmitter subaudible deviation should be 1 kHz ±200 Hz, as given in Section 4-10-5 of this manual.

After transmitter and receiver are found to be operating properly, reassemble unit, and complete records.

4-12. SCHEMATICS AND COMPONENT LOCATION DIAGRAMS

This section of the SynCom Maintenance Manual contains schematics of the unit main PC board, the synthesizer board, and the control head, as well as component location diagrams for the main board, and the synthesizer.

Refer to the component location drawings for location of adjustments called out in the transmitter and receiver alignment procedures.

NOTE: For troubleshooting purposes, voltages are shown on synthesizer and main board schematics, while synthesizer waveforms are given on Synthesizer Block Diagram, Figure 4-2.

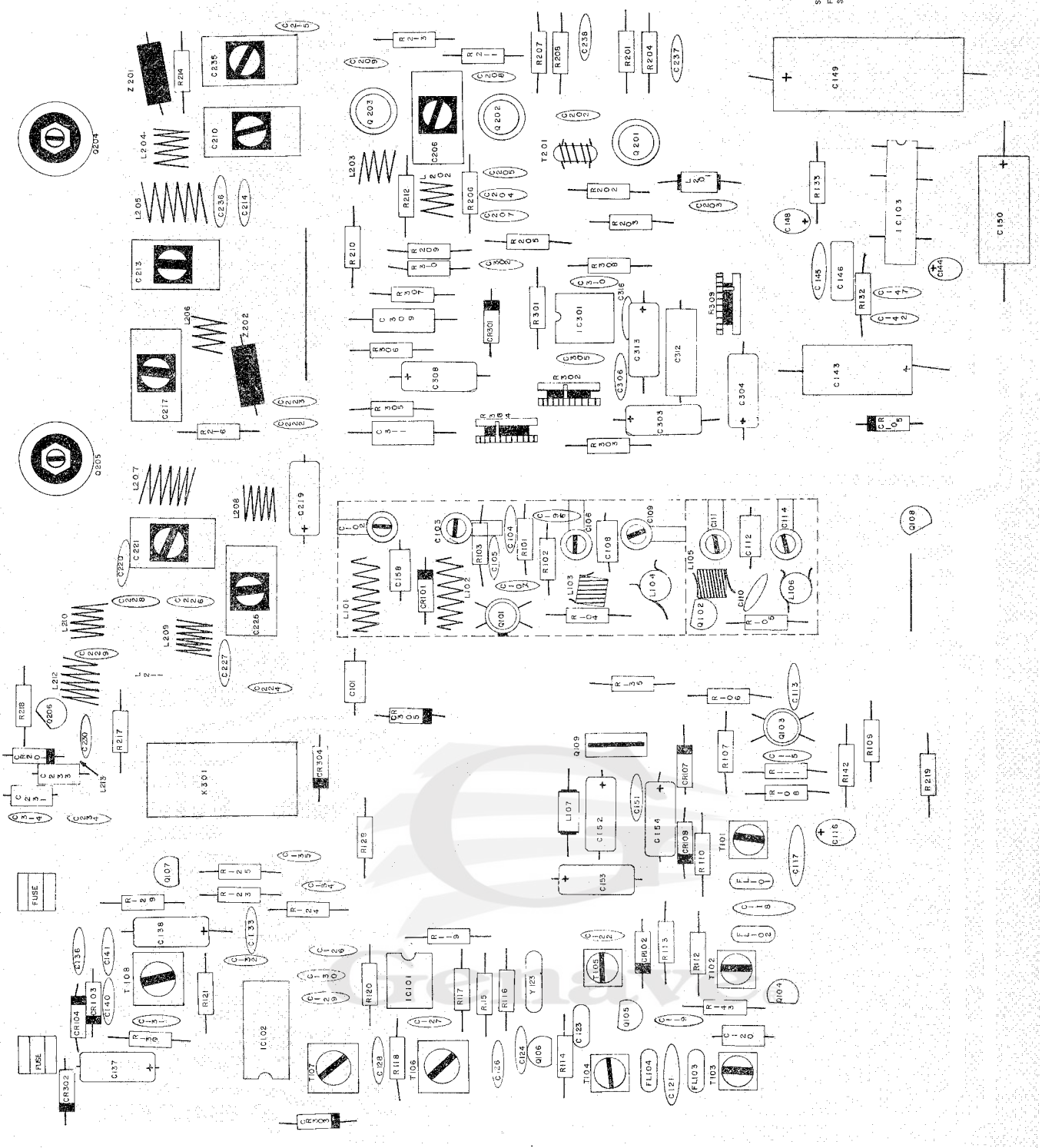
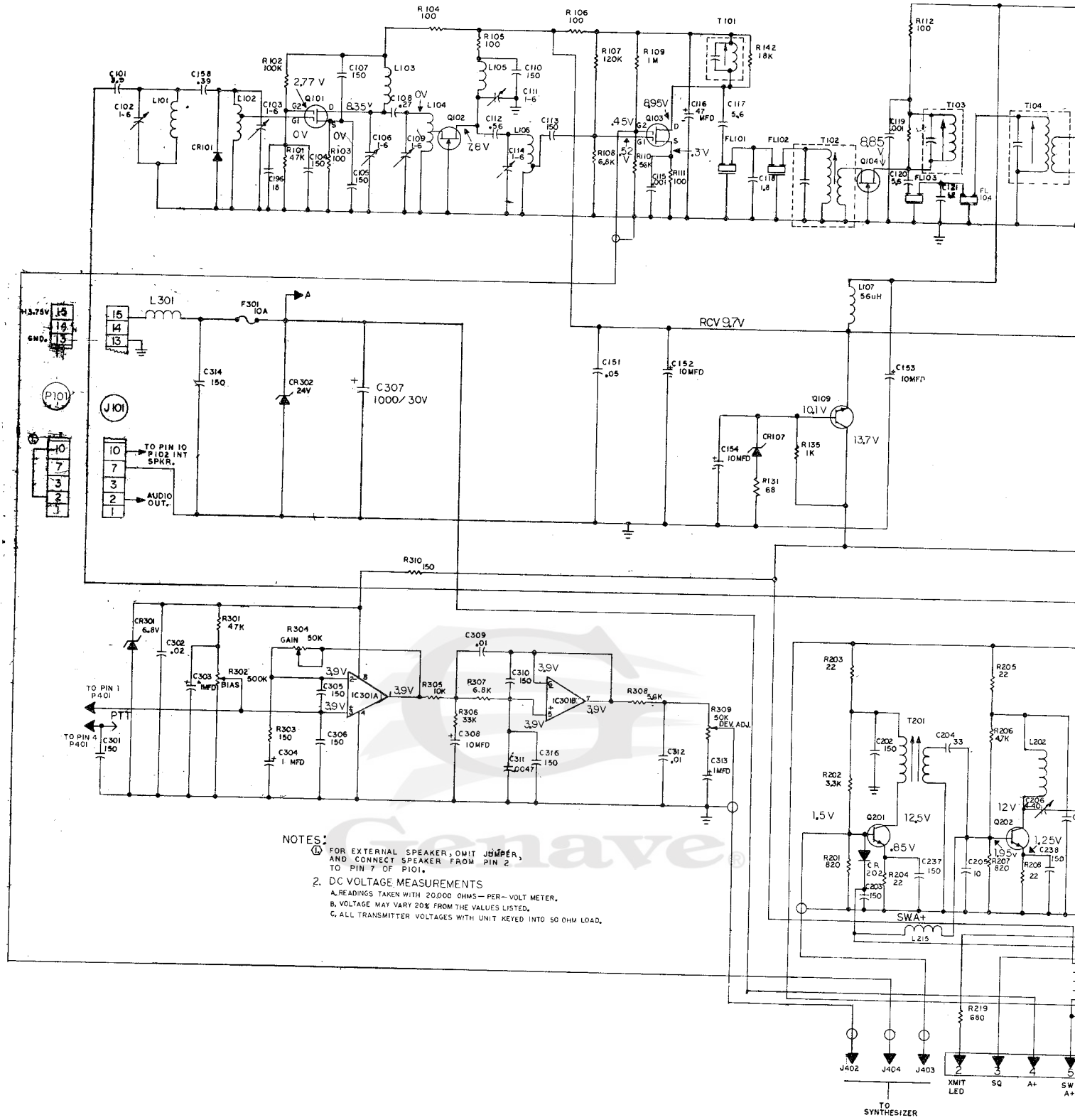


Figure 4-11. Main Board Component Location (Top View)



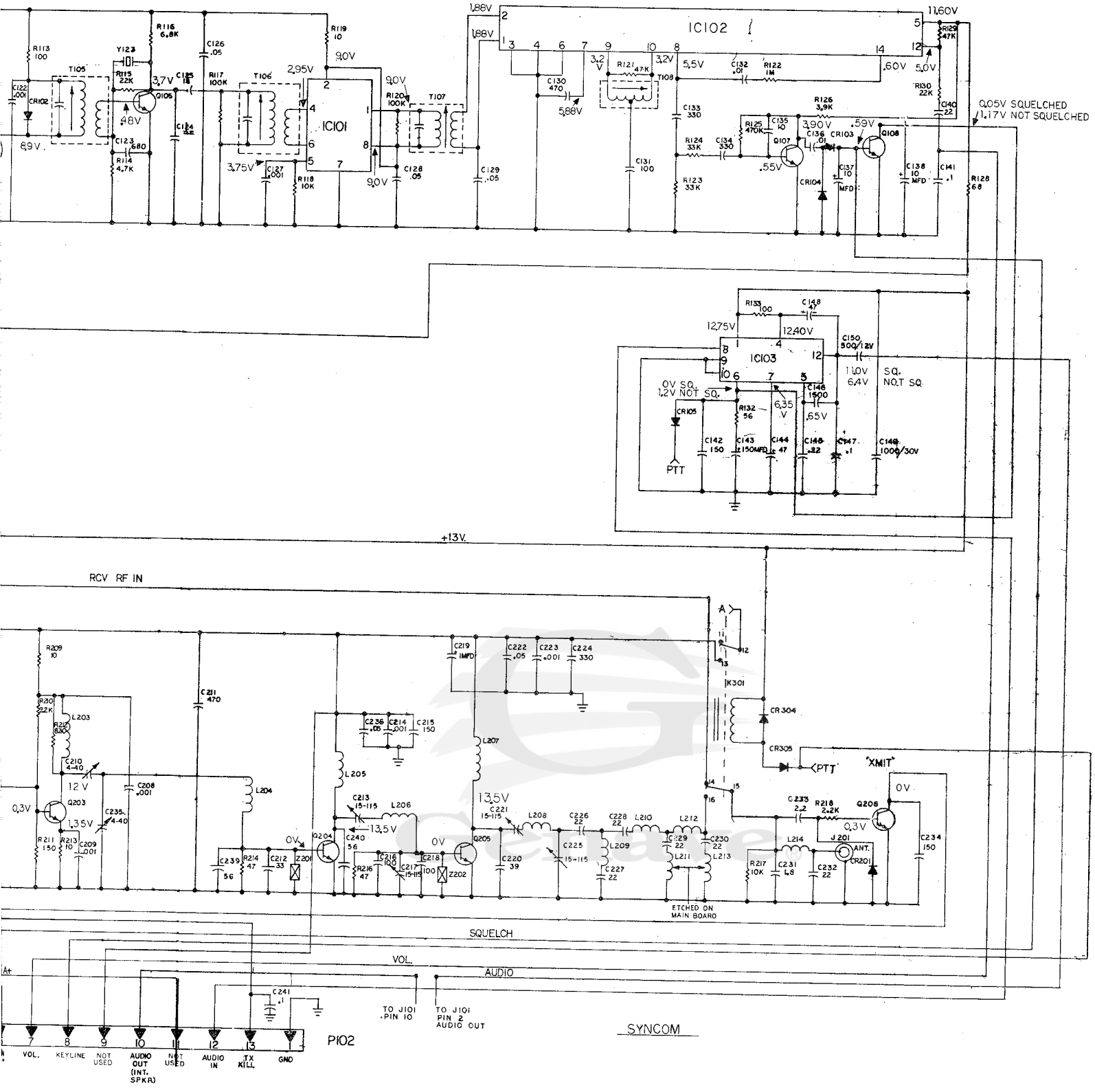


Figure 4-12 Main Board Schematic

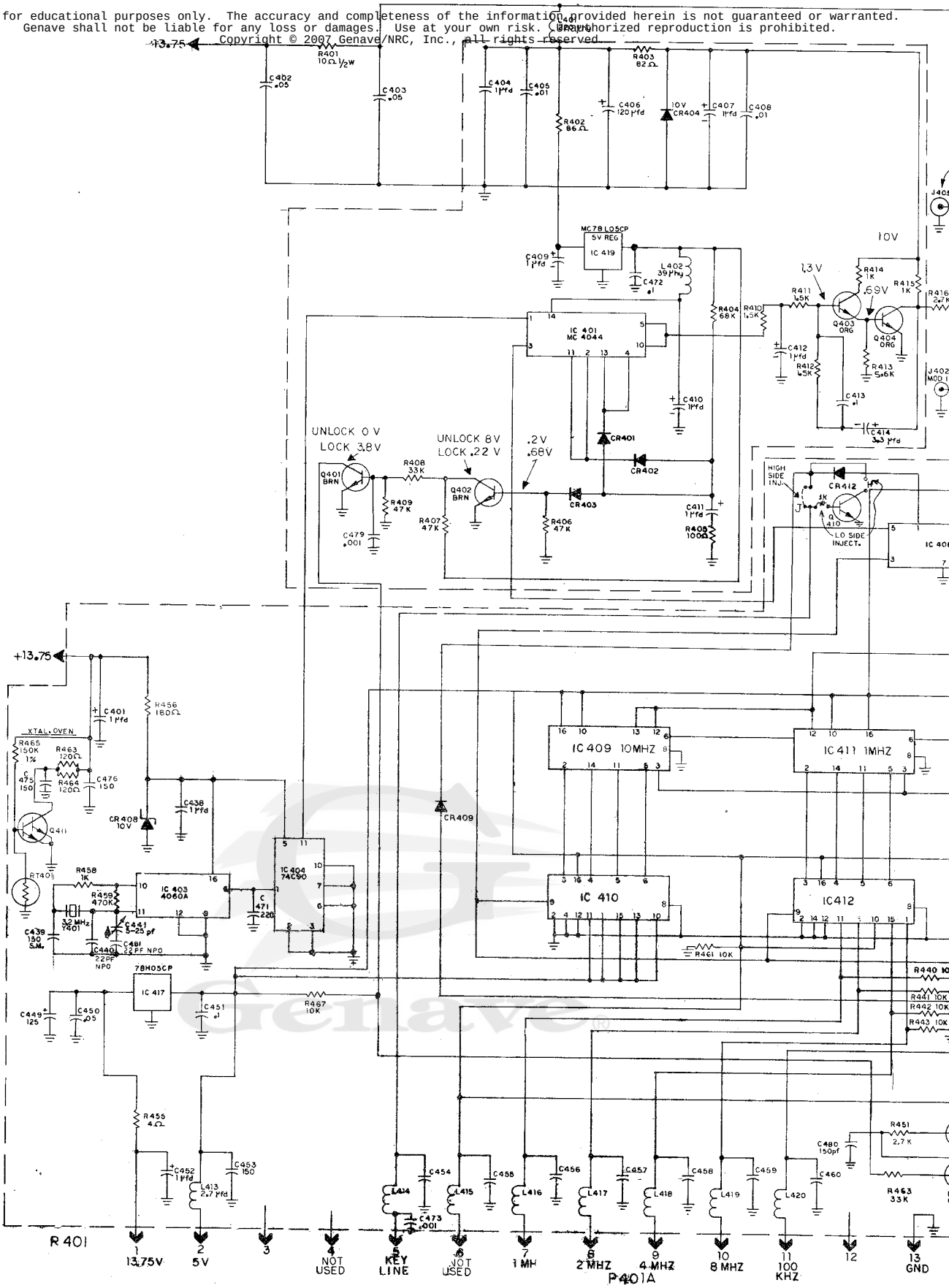
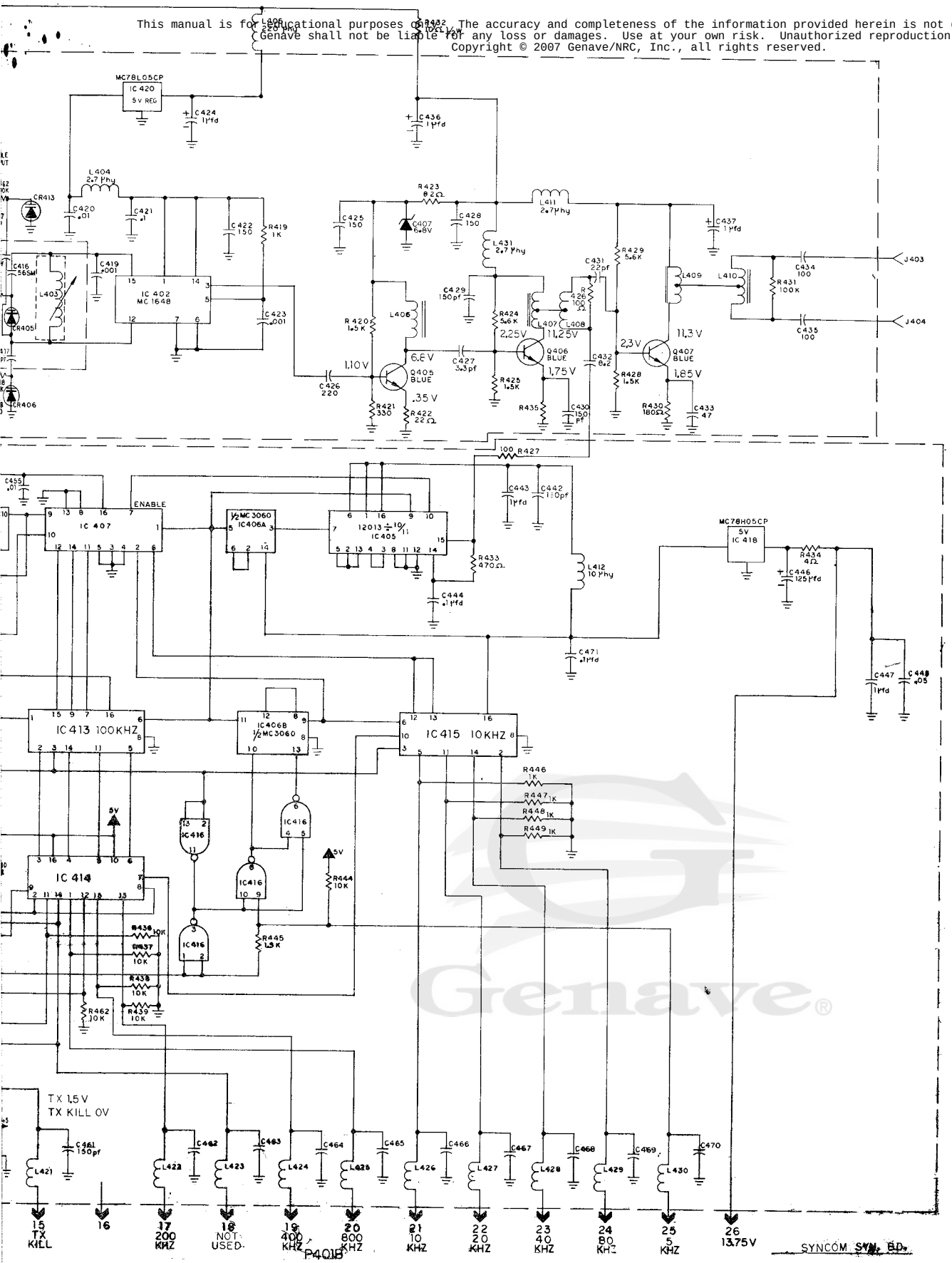


Figure 4-13. Synthesizer Schematic



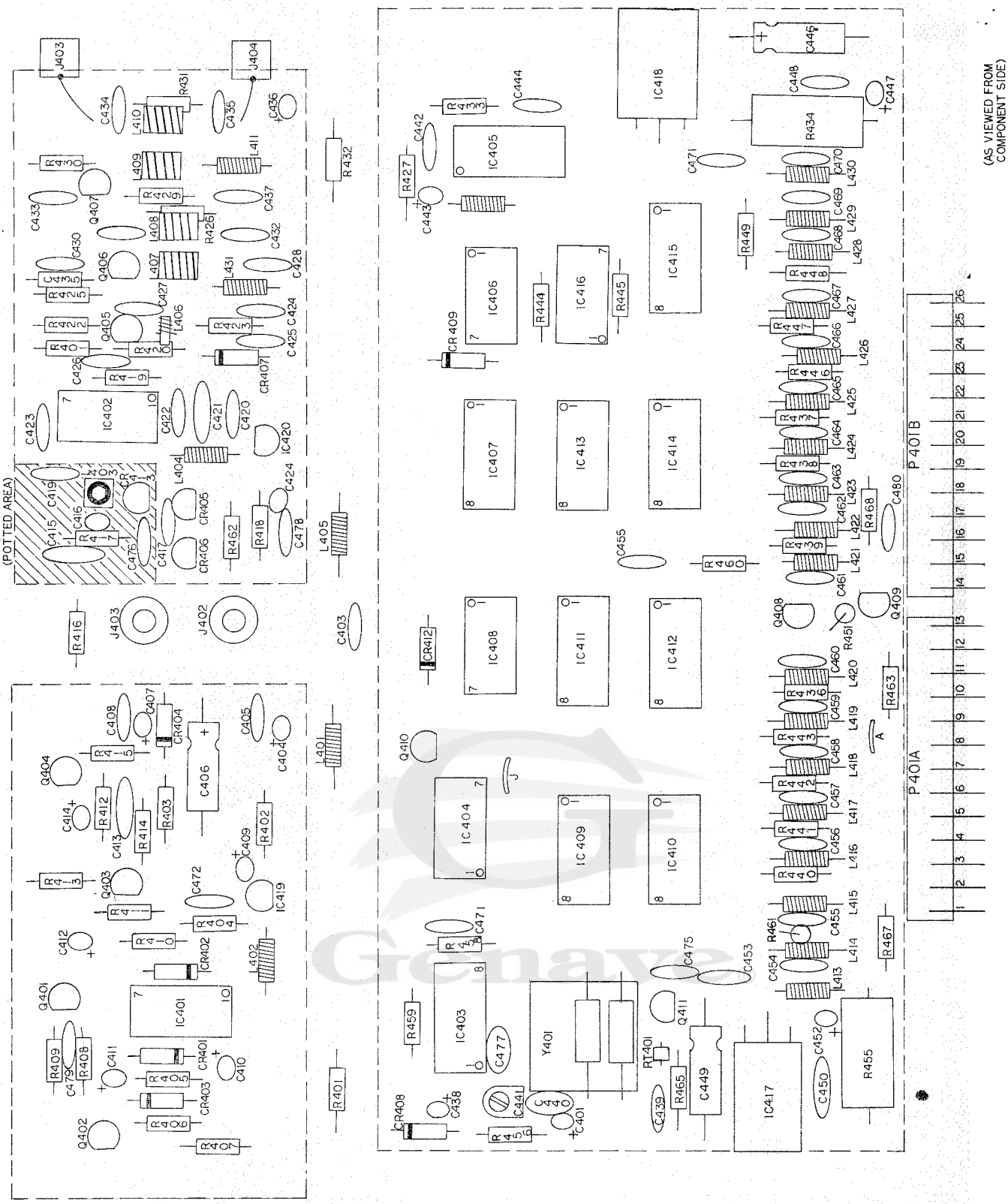


Figure 4-14. Synthesizer Component Location
Top View

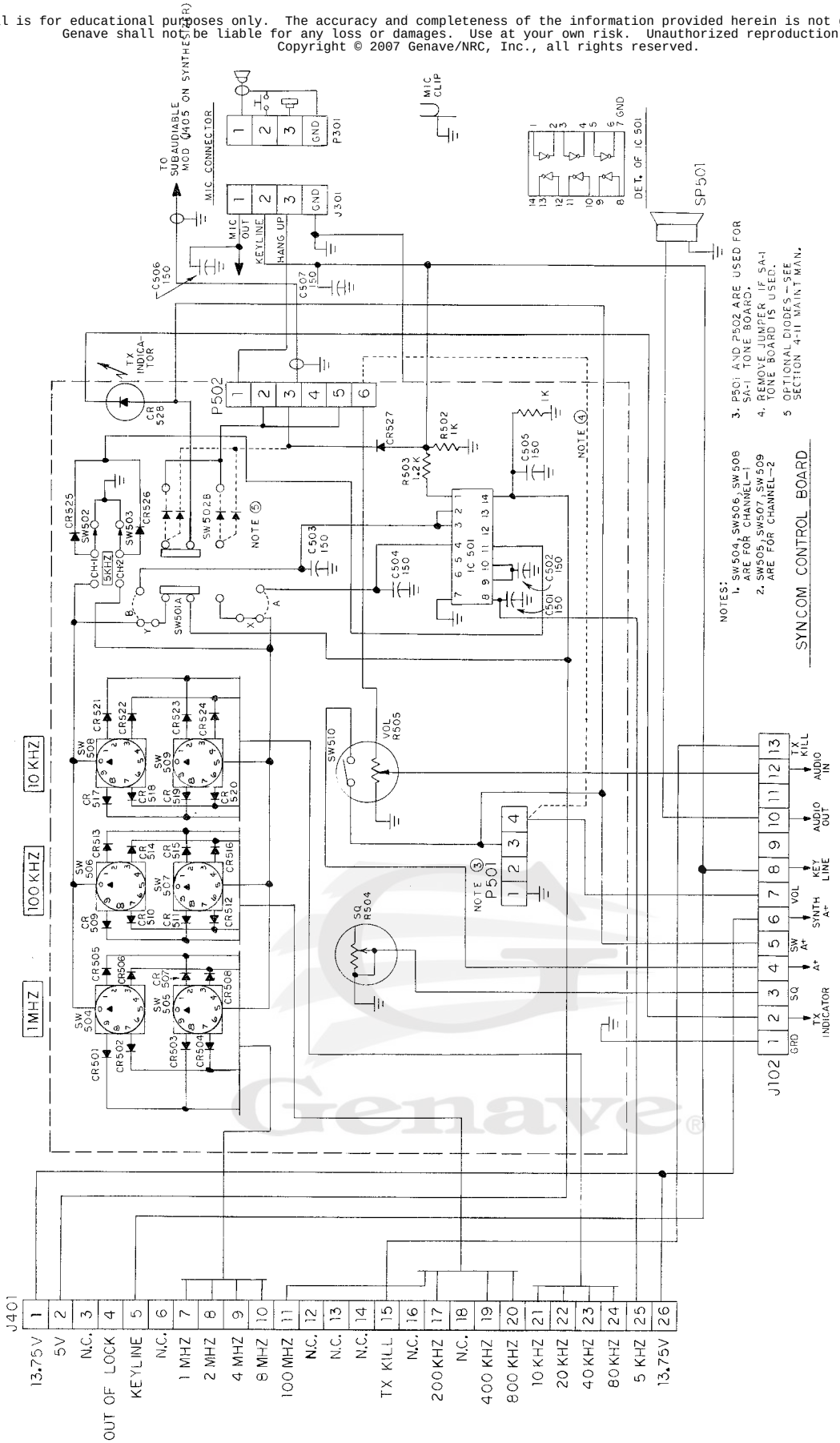


Figure 4-15 Control Head Schematic

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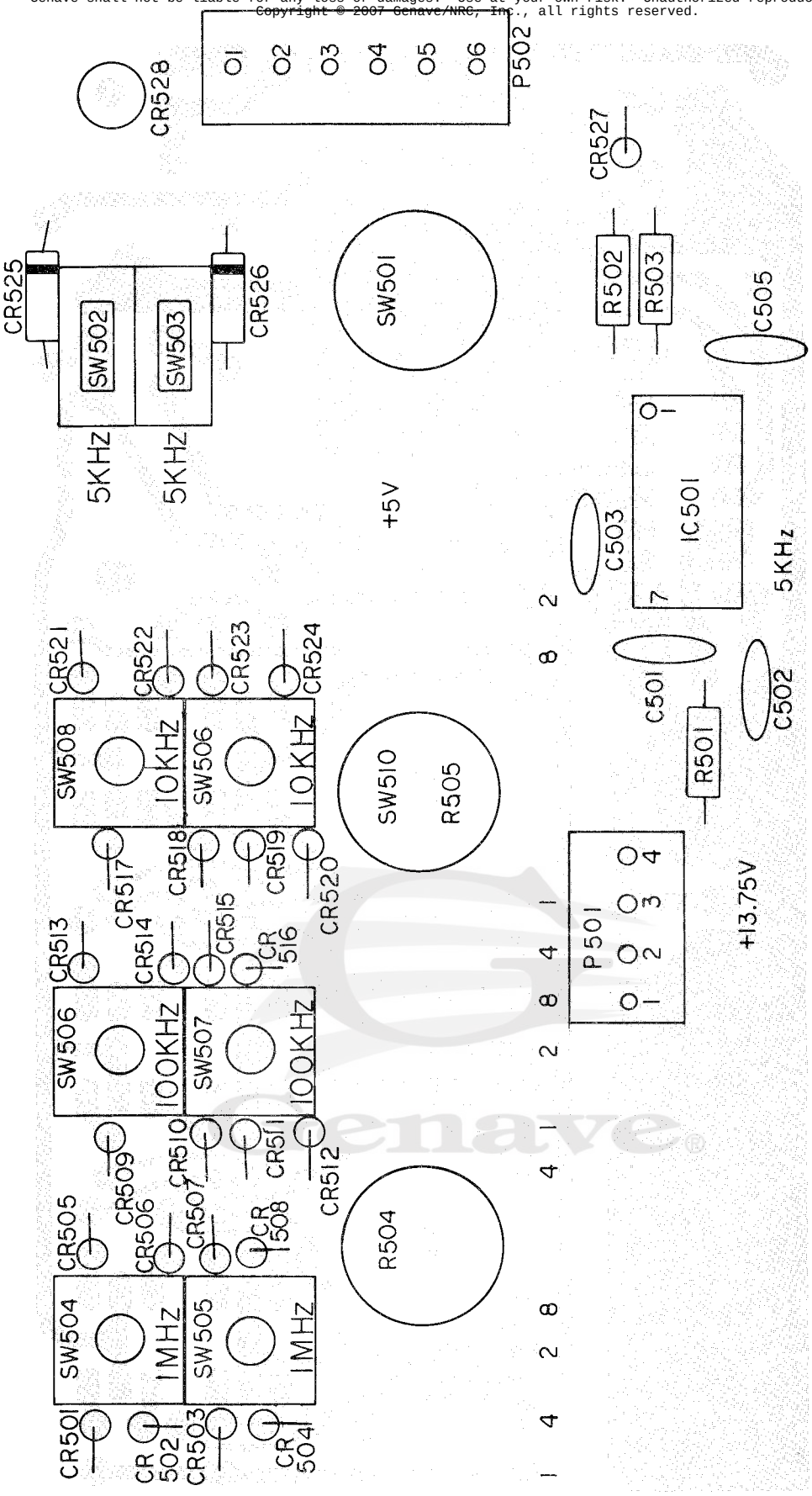

Figure 4-16. Control Head Component Location

SECTION V
PARTS LIST

5-1. INTRODUCTION

This section contains a list of all replaceable electronic parts for the SynCom transceiver, as well as major mechanical components.

The first column in the Parts List contains component reference numbers. The three-digit circuit reference on the schematic is represented in the REFERENCE NUMBER column by the last one or two digits. The first digit represents the assembly, or section, of unit in which the part is located.

The assembly or section number (100, 200, ...) is indicated next to the reference number heading; that is, CAPACITORS C100, or CAPACITORS C200.

In general, the following system of numbering is used; 100-series numbers pertain to receiver items; 200-series numbers indicate transmitter parts; 300-series are amplifier/modulator; 400-series numbers are for synthesizer components; and 500-series items are used in control head.

Genave part numbers for replaceable items appear in the Part Number column, while a brief description for each part is shown in the Description column.

Reference Number	Part Number	Description
CAPACITORS C100		
1	1510015	Gimmick, 2.2 pF, + 10%
2, 3, 6, 9 11, 14	1570120	Trimmer, 1-6 pF
4, 5, 7, 10, 13, 24, 42	1520028	Y5E, Disc, 150 pF ±10%
8	1510004	Gimmick,,27 pF, ±10%
12	1510008	Gimmick, .56 pF, ± 10%
15, 19, 22, 27	1520071	Z5P, Disc, .001 µF, ±10%
16, 44, 48	1541009	Elect, 47 µF, 16 V
17, 20	1510026	NPO, Gimmick, 5.6 pF
18, 21	1510014	NPO, Gimmick, 1.8 pF, ±10%
23	1530007	Sil., Mica, 680 pF, ±10%
25	1520010	NPO, Disc, 18 pF
26, 28, 29, 51	1520054	M25, Disc, .05µF, +80-20%,25 V

Reference Number	Part Number	Description
CAPACITORS C100 (Cont'd)		
30	1520042	Y5E, Disc, 470 pF
31	1520022	N220, Disc, 100 pF, ±10%
32, 36, 39	1520051	Y5U, Disc, .01 µF, ±20%, 25V
33, 34	1520037	Y5E, Disc, 330 pF, ±10%
35	1520007	NPO, Disc, 10 pF, ±10%
37, 38, 52, 53, 54	1540014	Elect, 10 µF, 25V
40, 47	1520055	Y5E, Disc, .1 µF, +80-20%, 12V
41	1520083	Y5E, Disc, .033 µF, ±20%
43	1540023	Elect, 150 µF, 16V
45	1520057	Magna, Disc, .22 µF, +80_20%
46	1500004	Poly,.0015 µF, ±10%, 630V
49	1540038	Elect, 1000 µF, 30V
50	1540049	Elect, 500 µF, 12V
55	1520014	NPO, Disc, 39 pF
56, 57	Not Assigned	
CAPACITORS C200		
1	1520015	N1500, Disc, 47 pF, ±10%
2, 3, 15, 34, 37, 38	1520028	Y5E, Disc, 150 pF, ±10%
4, 12	1520013	NPO, Disc, 33 pF, ±10%
5	1520007	NPO, Disc, 10 pF, ±10%
6, 10, 35	1560403	Trimmer, 4-40 pF
7, 36	1520054	M25, Disc, .05 µF, +80-20%, 25V
8, 9, 14, 23	1520071	Z5P, Disc, .001 µF, ±10%
11	1520042	Y5E, Disc, 470 pF

Reference Number	Part Number	Description
CAPACITORS C200 (Cont'd)		
13, 17, 21 25	1560406	Trimmer, 15-115 pF
16, 18	1520022	N220, Disc, 100 pF, ±10%
19	1540002	Elect, 1 µF, 35V
20	1520014	NPO, Disc, 39 pF
22	1520054	M25, Disc, .05 µF, +80-20, 25V
24	1520037	Z5E, Disc, 330 pF, ±10%
26, 27, 28, 29, 30, 32	1520011	NPO, Disc, 22 pF
31	1510014	NPO, Gimmick, 1.8 pF, ±10%
33	1510015	NPO, Gimmick, 2.2 pF, ±10%
39, 40	1520018	N220, Disc, 56 pF, ±10%
41	1520059	Cer, Disc, .1 µF, +80-20%, 12V
CAPACITORS C300		
1, 5, 6, 10, 14, 16	1520028	Y5E, Disc, 150 pF, ±10%
2	1520053	M25, Disc, .02 µF, ±10%, 25V
3, 4, 13	1540002	Elect, 1 µF, 35V
7	1540038	Elect, 1000 µF, 30V
8	1540014	Elect, 10 µF, 25V
9, 12	1500018	Mylar, .01 µF, ±10%, 100V
11	1500013	Mylar, .0047 µF, ±10%
7, 15, 17, 18	Not Assigned	
CAPACITORS C400		
1, 4, 7, 9, 10, 11, 12, 24, 37, 38, 43, 47, 52	1550002	Tant., 1 µF, 35V
2, 3, 48, 50	1520054	M25, Disc, .05 µF, +80-20%, 25V
5, 8, 20, 45	1520051	Y5U, Disc, .01 µF, ±20%, 25V

Reference Number	Part Number	Description
CAPACITORS C400 (Cont'd)		
6, 46, 49	1540023	Elect, 150 µF, 16V
13, 15, 21, 44, 51, 72	1520055	Magna, Disc,.1µF, +80-20%, 12V
14	1550003	Tant, 3.3 µF, 35V
16	1530013	Sil. Mica, 56 pF, ±5%
17	1520001	NPO, Disc., 2.2 pF, ±10%
18, 22, 25, 28, 30 42, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 74, 75, 76, 77, 80	1520028	Y5E, Disc, 150 pF, ±10%, 25V
19, 23, 73, 79	1520071	Z5P, Disc, .001 µF, ±10%, 1000V
26, 71	1520034	Y5E, Disc, 220 pF, ±10%, 25V
27	1520197	NPO, Disc, 3.3 pF, ±10%, 25V
31, 40, 81	1520011	NPO, Disc, 22 pF, ±10%
32	1520006	NPO, Disc, 8.2 pF, ±10%
33	1520015	N1500, Disc, 47 pF, ±10%
34, 35	1520022	N220, Disc, 100 pF, ±10%
39	1530017	Sil. Mica, 150 pF, ±5%, 500V
29, 53	Not Assigned	
41	1570009	Trimmer, 3-18 pF
78	1510008	Gimmick, .56 pF, ±10%
CAPACITORS C500		
1, 2, 3, 4, 5	1520028	Y5E, Disc, 150 pF, ±10%, 25V
FILTERS FL100		
1, 2, 3, 4	2303504	Monolythic Crystal 10.7 MHz, 4P

Reference Number	Part Number	Description
DIODES CR100		
1, 2, 5	4810017	Sil. 1N4148
3. 4	4810021	Gen. Purpose 1N34A
7	4810008	Zener, 10V, 1W
8, 9, 10, 11 12, 13	Not Assigned	
DIODES CR200		
1	4810017	Sil. 1N4148
DIODES CR300		
1	4810007	Zener, 6.8V, ±5%
2	4810011	Zener, 24V, 1W
3, 4, 5	4810013	Gen. Purpose 100 PRV, 1A
7, 8, 9, 10	Not Assigned	
DIODES CR400		
1, 2, 3, 4 12	4810017	Sil. 1N4148
5	4810034	Varicap MV2210
6, 13	4810027	Varicap MV2201
7	4810007	Zener, 6.8V
8	4810008	Zener, 10V
9, 10, 11	Not Assigned	
DIODES CR500		
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27	4810017	Sil. 1N4148

Reference Number	Part Number	Description
INTEGRATED CIRCUITS IC100		
1	3130017	R.F. Amp MC1350P
2	3130024	Quad Det. CA3075
3	3130020	Audio Amp. CA810
4, 5, 6	Not Assigned	
INTEGRATED CIRCUITS IC300		
1	3130012	Op Amp N5558
2, 3, 4	Not Assigned	
INTEGRATED CIRCUITS IC400		
1	3134044	MC4044P, Phase Detector
2	3130028	MC1648P, VCO
3	3130027	MC4060AE, Divider
4	3130046	MM74C90N, Divider
5	3130031	MC12013AL, Prescaler
6	3130047	MC3060L, Flip - Flop
7	3130030	MC12014L, Counter Control
8	3130029	MC12020L, Offset Control
9	3130032	MC4018P, Programmable Hexadecima
10,12, 14	3130035	MC12021P, Offset Programmer
11, 13, 15	3130033	MC4016P, Programmable Decade Cnt
16	3130042	MC7400P, Quad, 2-input Gate
17, 18	3130037	MC7805CP, 5V, 1 Amp., Regulator
19, 20	3130036	MC78L05CP, 5V, Regulator
INTEGRATED CIRCUITS IC500		
1	3130373	MC7404, Hex Inverter

Reference Number	Part Number	Description
CONNECTORS (JACKS) J100		
2	2100259	Molex 13 Pin
CONNECTORS (JACKS) J400		
2, 5	2100261	Molex, phono
3, 4	2100019	Socket, phono
CONNECTORS (PLUGS) P400		
1 A & B	2100257	Molex, 13 Pin
CONNECTORS (PLUGS) P500		
1	2100070	Molex, 4 Pin
INDUCTORS L100		
1	1800226	Coil, 7T
2	1800225	Coil, 7T, TAP 3T
3	1800116	Coil, 4 1/2T
4	1800117	Coil, 6 1/2T, 1 1/4T
5	1800118	Coil, 6 1/2T
6	1800125	Coil, 3 1/4T, 5 1/2T TAP at 3 1/4T
7	1800332	Choke 56 µH
8, 9, 10	Not Assigned	
INDUCTORS L200		
1, 15	1800124	Choke, 2.7 uH, Wilco 27G
2, 12	1800203	Coil, 3 1/2T
3, 4, 6, 8, 10	1800201	Coil, 2 1/2T LHH
5	1800202	Coil, 2 1/2T RHH
7, 9	1800204	Coil. 4 1/2T
11. 13	Etched on P.C. Board	
14	1800205	Coil, 2T

Reference Number	Part Number	Description
INDUCTORS L200 (Cont'd)		
16, 17, 18, 19	Not Assigned	
INDUCTORS L300		
1	1800247	Choke, .65 mH, 7A
2, 3	Not Assigned	
INDUCTORS L400		
1, 5	1800360	Coil, 220 µH
2	1800364	Coil, 39 µH
3	1800319	Coil, 1 1/2 T
4, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	1800124	Coil, 2.7 µH
6	1800367	Coil, Torroid, 5 T
7, 8, 9, 10	1800366	Coil, 4 T, center-tapped
12	1800365	Choke, 10 µH
TRANSISTORS Q100		
1, 3	4800068	MOSFET, Dual Gate 3N201
2	4805486	J FET, N-Channel 2N5486
4, 5	4805484	J FET, N-Channel 2N5484
6	4800026	Sil. NPN MPS 3693
7, 8	4800028	Sil. NPN, Red Dot MPS 6514S
9	4800018	Sil. NPN, Audio MPS-U01
10, 11, 12	Not Assigned	
TRANSISTORS Q200		
1, 2, 3,	4804427	Sil NPN 2N4427
4	4806080	Sil NPN RF Power 2N6080

Reference Number	Part Number	Description
TRANSISTORS Q200 (Cont'd)		
5	4806082	Sil NPN RF Power 2N6082
6	4800051	Sil NPN Darlington MPSA13
7, 8, 9	Not Assigned	
TRANSISTORS Q400		
1, 2, 8, 9, 10	4800007	Sil NPN Brown Dot SPS1423 2N4264
3, 4	4800029	Sil NPN Orange Dot MPS6513
5, 6, 7	4800024	Sil NPN Blue Dot MPS3563
11	4800051	Sil NPN Darlington MPSA13
RESISTORS R100		
1, 21, 29	4700045	47K, ±10%, 1/2W
2	4700047	100K, ±10%, 1/2W
3, 4, 5, 6, 11, 12, 13, 33	4700013	100Ω, ±10%, 1/2W
7	4700050	120K, ±10%, 1/2W
8, 10, 16	4700035	6.8K, ±10%, 1/2W
9, 22	4700058	1M, ±10%, 1/2W
14	4700033	4.7K, ±10%, 1/2W
15, 30	4700041	22K, ±10%, 1/2W
17, 20	4700049	100K, ±10%, 1/2W
18	4700037	10K, ±10%, 1/2W
19	4700003	10Ω, ±10%. 1/2W
23, 24	4700043	33K, ±10%, 1/2W
25	4700057	470K, ±10%, 1/2W
26	4700032	3.9K, ±10%, 1/2W
28, 31	4700011	68Ω, ±10%, 1/2W
32	4700010	56Ω, ±10%, 1/2W

Reference Number	Part Number	Description
RESISTORS R100 (Cont'd)		
35	4700025	1K, ±10%, 1/2W
27, 34, 36, 37, 38, 39, 40	Not Assigned	
RESISTORS R200		
1, 7, 12	4700024	820Ω, ±10%, 1/2W
2	4700031	3.3K, ±10%, 1/2W
3, 4, 5, 8	4700006	2.2Ω, ±10%, 1/2W
6	4700033	4.7K, ±10%, 1/2W
9, 13	4700003	10Ω, ±10%, 1/2W
10, 18	4700029	2.2K, ±10%, 1/2W
11	4700015	150Ω, ±10%, 1/2W
14, 16	4700009	47Ω, ±10%, 1/2W
17	4700037	10K, ±10%, 1/2W
19	4700023	680Ω, ±10%, 1/2W
15, 20, 21, 22, 23	Not Assigned	
RESISTORS R300		
1	4700045	47K, ±10%, 1/2W
2	4760039	500K, Var., ±20%
3, 10	4700015	150Ω, ±10%, 1/2W
4, 9	4760021	50K, Var., ±20%
5	4700037	10K, ±10%, 1/2W
6	4700043	33K, ±10%, 1/2W
7	4700035	6.8K, ±10%, 1/2W
8	4700034	5.6K, ±10%, 1/2W
11, 12, 13, 14	Not Assigned	

Reference Number	Part Number	Description
RESISTORS R400		
1, 32	4700003	10Ω, ±10%, 1/2W
2	4710007	68Ω, ±5%, 1/4W
3, 23	4710049	82Ω, ±10%, 1/4W
4	4710068	68K, ±5%, 1/4W
5, 26, 27, 31	4710008	100Ω, ±5%, 1/4W
6, 7, 9, 17	4710035	47K, ±5%, 1/4W
8, 63	4710033	33K, ±5%, 1/4W
10, 11, 12, 20	4710019	1.5K, ±10%, 1/4W
13, 24, 29	4710026	5.6K, ±5%, 1/4W
14, 15, 19, 46, 47, 48, 49, 57, 58, 68	4710017	1K, ±5%, 1/4W
16, 51	4710022	2.7K, ±5%, 1/4W
18, 62	4710063	100K, ±10%, 1/4W
21	4710012	330Ω, ±5%, 1/4W
22	4710004	22Ω, ±5%, 1/4W
25, 28, 45	4710019	1.5K, ±10%, 1/4W
30, 35, 56	4710010	180Ω, ±5%, 1/4W
33	4710013	470Ω, ±10%, 1/4W
36, 37, 38, 39, 40, 41, 42, 43, 44, 60, 61, 67	4710029	10K, ±5%, 1/4W
34, 55	4740016	4Ω, ±10%, 5W
59	4710039	470K, ±10%, 1/4W
64	4700014	120Ω, ±10%, 1/2W
65	4720014	150K, ±1%, 1/4W
52, 53, 54, 66	Not Assigned	

Reference Number	Part Number	Description
RESISTORS R500		
1	4710029	10K, ±5%, 1/4W
2	4710017	1.0K, ±5%, 1/4W
3	4710018	1.2K, ±5%, 1/4W
4	4760051	25K, Var., Squelch
5	4760057	25K, Var., Audio Taper with SW510
SWITCHES SW500		
1	5100128	4 Pole, 2 Pos., rotary
2, 3	5100098	Slide, SPDT, CH15W, 43-000-121
4, 5, 6, 7, 8, 9	5100137	BCD, 10 pos., micro DIP
TRANSFORMERS T100		
1, 2, 3, 4	5600098	10.7 MHz, IF Blue
5	5600046	10.7 MHz, IF Orange
6, 7, 8	5600012	455 kHz IF
9, 10	Not Assigned	
TRANSFORMERS T200		
1	5600099	Buffer Trans.
2	Not Assigned	
CRYSTALS Y400		
1	2302452	XTAL, 3.2 MHz, .0005%, wire leads
MISCELLANEOUS		
RT401	4760034	Thermistor, 10K Fenal JA41J1
K301	4500008	Relay, 4 PDT
Z201, 2	1800063	Choke
F301	5140021	Fuse, 10 Amp

Reference Number	Part Number	Description
MISCELLANEOUS (Cond't)		
	2510241	Bracket, mounting
	2400025	Thumbscrew, (knob)
	2820010	Washer, nylon (for thumbscrew)
	2510236	Bracket, head mounting
	2502088	Cover, top/bottom
	2510268	Front, plastic
	1325077	Microphone
SP501	1320025	Speaker, 3.5", 3.2Ω
	1870003	Core, Ferrite Bead, 57-0180