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MODEL SBE-32CB

SERVICE MANUAL

SBE®

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SECTION 1
GENERAL

1.1 CUSTOMER SERVICE

The SBE Technical Services Department functions as a source of information on the application, installation and use of SBE products. In addition, the Technical Services Department provides technical consultation on service problems and availability of local and factory repair facilities.

In any communications to the Technical Services Department, please include a complete description of your problems or needs, including model and serial numbers of the unit or units in question, accessories being used, any modifications or attachments in use, or any non-standard installation details.

For assistance on any of the above matters, please contact SBE, Incorporated, Technical Services Department, 220 Airport Boulevard, Watsonville, California 95076. Phone: 408/722-4177.

1.2 PARTS ORDERS

SBE original replacement parts are available from the Factory Parts Department at 1045 Main Street, Watsonville, California 95076.

When ordering parts, please supply the following information:

Model number of the unit.
Serial number of the unit.
Part number.
Description of the part.

1.3 FACTORY RETURNS

Repair services are available locally through SBE Certified Service Stations across the country. A list of these Service Stations is available upon request from the Technical Services Department. Do not return any merchandise to the Factory without authorization from the Factory.

SECTION 2

SPECIFICATIONS

2.1 GENERAL

Channels:	23
Frequency Range:	26.965 to 27.255 MHz
Frequency Control:	Single Crystal, Digitally Synthesized
Frequency Tolerance:	±.003%
Operating Temperature Range:	-20°C to +50°C
Humidity:	95%
Input Voltage:	11.7V DC to 15.9V DC, positive or negative ground.
Microphone:	Dynamic
Size:	2.5″H (60mm), 6-3/4″W (170mm), 9-3/8″D (240mm)
Weight:	5 lbs., 2.27 Kg.

2.2 TRANSMITTER

Power Output:	4 Watts (Maximum)
Modulation:	95-100%
Modulator Response:	300 Hz to 2500 Hz, +3 -10db
Output Impedance:	50Ω, Unbalanced
Output Indicator:	Back lit front panel meter

2.3 RECEIVER

Sensitivity:	0.5 microvolt for 10db S+N/N ratio.
Selectivity:	50db @ ± 10KHz, 60cb @ ± 20KHz, 65db @ ± 30KHz
IF Frequencies:	10 MHz, 455 KHz
Receiver Delta Tune:	±750 Hz, Nominal
Automatic Gain Control:	Less than 10db change in audio output for signal inputs from 10-500,000μV

Squelch Threshold:	0.5μV
Audio Power Output:	Greater than 3.5 watts @ 10% T.H.D.
Built-in Speaker:	8Ω, 3-1/2" Round
External Speaker:	(Not Supplied) 4 or 8Ω. Disables internal speaker when connected.
Spurious Rejection:	
Image:	-40db or better
IF:	-70db or better
Others:	-50db or better

2.4 MISCELLANEOUS

PA System: 3.5 watts into an external 8Ω speaker. The front panel PA gain control allows the operator to control the PA speaker volume when the CB/PA switch is in the PA position. When the CB/PA switch is in the PA position, the PA speaker also monitors the receiver.

SECTION 3
INSTALLATION

GENERAL

The first step in installation of the mobile transceiver is selection of antenna and transceiver mounting positions.

The selection of an antenna and its mounting position is the most critical factor in determining the end performance of an installation. Generally, the most satisfactory installation position for most vehicles is the center of the passenger compartment roof. As a second choice, the trunk can be a satisfactory antenna mounting point, especially on those cars where the trunk is large and flat. Due to increased susceptibility to ignition noise, mounting the antenna in the hood area is discouraged. Follow antenna manufacturer's recommendations carefully during installation.

The SBE-32CB is supplied with a universal mounting bracket and microphone holder. The transceiver may be mounted in any position and on any rigid surface, such as underneath an automobile dashboard, truck roof or vertically on a boat bulkhead.

The transceiver should be mounted with accessibility and operation convenience in mind.

CAUTION: Avoid mounting the transceiver in the direct air stream of the vehicle's heater. Temperatures in this area can exceed 150° F and can result in serious damage to the unit.

It is recommended that the mounting bracket be installed on the transceiver and mounting clearances checked, with the unit held in the desired mounting position. It is especially important to leave sufficient space behind the unit for antenna and accessory cable connections.

When the most desirable mounting installation point has been decided upon, a pencil or other marking device should be used to outline the mounting bracket on the mounting surface. The transceiver should then be removed from the mounting bracket and the bracket held against the dash or other mounting surface, in the position marked, so that mounting holes may be marked and drilled.

CAUTION: Be sure to check behind the dash or other mounting surface to insure against damage of wiring and other devices before drilling any holes.

Install the microphone holder on the radio or other mounting surface as desired.

Install any accessories at this time, including external speaker, public address speaker, etc.

This unit is designed for either 12 volt positive or negative ground systems. In either system, the positive battery terminal always connects to the red supply wire, and the negative battery terminal always connects to the black supply wire. If the transceiver's power lead must be lengthened, use No. 14 or larger wire.

CAUTION: When using this radio in a positive ground system, it is important that none of the accessories are electrically connected to the vehicle's chassis (external speakers, P.A. speakers, etc.). Positive ground installations must utilize an additional 2 ampere fuse in the negative (black) supply lead to avoid possible damage to the transceiver. NOTE: The transceiver power lead may be connected to the accessory section of the ignition switch if desired. However, due to the possible presence of high-level noise from the ignition and accessories, this connection may not be desirable. In cases where excessive noise is present on the accessory line, a direct connection to the battery is recommended.

3.2 ANTENNA TUNING

The final step in installation is to trim the antenna for minimum S.W.R. The recommended method of antenna tuning is to use an in-line wattmeter or S.W.R. bridge to adjust the antenna for minimum reflected power on channel 11. A properly tuned antenna system will present a suitable load to the transceiver and will insure that maximum power is transfered from the radio to the antenna. If the antenna system in use presents a poor load, as indicated by a high S.W.R. reading, transmitter range will be substantially reduced and damage to the transmitter final amplifier transistor may occur. Poor S.W.R. can usually be corrected by altering the antenna's electrical length in accordance with the manufacturer's instruction. Extremely high S.W.R. readings may be indicative of a defective transmission line, antenna, or connections.

To determine whether the antenna should be lengthened or shortened, test the S.W.R. on channels 1 and 23. If the S.W.R. is the highest on channel 23, the antenna is too long and if highest on channel 1, the antenna is too short. When the antenna system has been tuned correctly, channel 11 should have the lowest S.W.R. and channels 1 and 23 will be slightly higher.

3.3 FINAL CHECK

Test drive the vehicle and make an operational check-out of the transceiver to insure proper operation of it and all the accessories installed. At this time, note any degradation of performance due to vehicle noise and take appropriate action to correct any noise suppression and deficiencies as outlined in the following section.

3.4 NOISE SUPPRESSION

The first step in assuring minimum ignition noise is to insure that the engine ignition system is in a good state of tune, and all factory original noise suppression devices are installed and operational. This includes an inspection of distributor points and condenser. Check to see that the spark plugs are clean and properly adjusted. The condition of the ignition wiring should be checked (radio resistor type ignition wire is standard on most late model vehicles and should be installed on vehicles not so equipped). The distributor cap should be checked for traces of carbon tracking or signs of arcing. Resistor type spark plugs are helpful in further reducing ignition noise and are standard as original equipment on many late model vehicles.

Alternator noise may be minimized by the installation of an alternator line filter, available from radio parts distributors.

Installation of bonding straps in the engine compartment will further reduce ignition noise. Short lengths of metal strap or heavy shield braid between the engine and frame, engine and fire wall, alternator and frame, exhaust pipe and frame, or hood to frame, will in many cases, greatly reduce ignition noise. Extremely high ignition noise levels or noise levels that become worse after a period of time are usually indicative of deterioration of the vehicle's electrical system. In some cases, interference may be caused by dash instruments including gasoline gauges, heater blowers and fans, etc. This interference may often be reduced by the installation of bypass capacitors from the terminals of the interfering instruments to ground. .01 microfarad capacitors of the ceramic disc variety rated at 500 working volts DC are recommended for this purpose.

For further information on the suppression of ignition noise in the automotive and marine environment, the Champion Spark Plug Company publication "Giving Two Way Radio Its Voice" is highly recommended. This publication is available from the automotive technical service department Champion Spark Plug Company, Post Office Box 910, Toledo, Ohio 43661. This publication is also available, at no charge, from the SBE Technical Services Department, upon request.

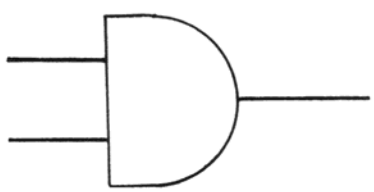
SECTION 4
CIRCUIT DESCRIPTION

4.1 OVERVIEW

Digital Circuit Theory

The SBE-32CB incorporates both analog and digital circuitry. The "conventional" RF, IF and AF stages or COMMUNICATIONS is analog while the FREQUENCY SYNTHESIZER and CHANNEL SELECTOR are digital. Except for the diode AND gate in the CHANNEL SELECTOR, the SBE-32CB utilizes TTL logic. This logic is located on dual-in-line chips that operate on 4.8 to 5.4 volts. "High," "true" or "logic one" is defined as greater than 2 volts while "low," "false" or "zero" is defined as less than 0.8 volts.

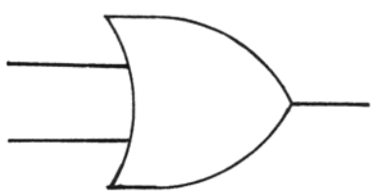
TTL inputs act as highs when unconnected. Normally TTL outputs go high and low without the need for external circuitry. Open collector outputs, however, require an external resistor going to Vcc to pull the output high. When several open collector outputs share the same pull-up resistor they are said to be "wire ANDed" since any output low will cause all outputs to go low. The open collector NAND gates IC-4 in the SBE-32CB SYNTHESIZER are wire ANDed.



AND Gate

All inputs must be high for a high output.

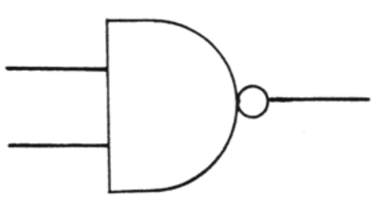
A diode AND gate is used in the CHANNEL SELECTOR of the SBE-32CB to load the UP-DOWN COUNTER.



OR Gate

Any input high produces a high output.

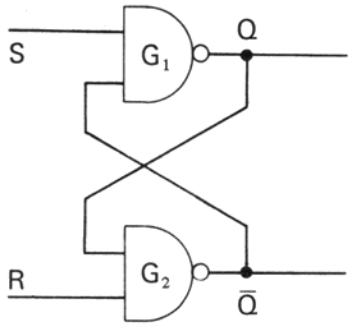
Both AND and OR gates are used symbolically in the SBE-32CB CHANNEL SELECTOR block diagram to represent functions performed by several logic elements.



NAND Gate

All inputs must be high for a low output.

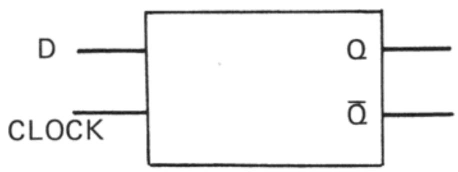
NAND gates are used extensively throughout both the FREQUENCY SYNTHESIZER and CHANNEL SELECTOR in the SBE-32CB.



Cross Connected NAND Flip-Flop (FF)

Low input to S (Set), Q is then high and $\overline{Q}$ is low. Q will remain high and $\overline{Q}$ will remain low after low is removed from S. A low pulse on R (Reset) will drive $\overline{Q}$ high and Q low.

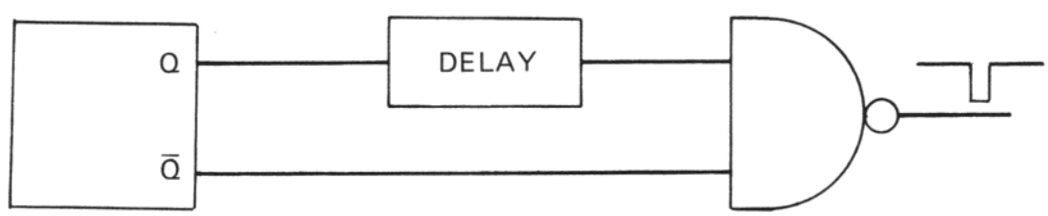
NAND flip-flops are used in the CHANNEL SELECTOR of the SBE-32CB.



D-FLOP

State of D input is transferred to Q output as clock input goes from low to high.

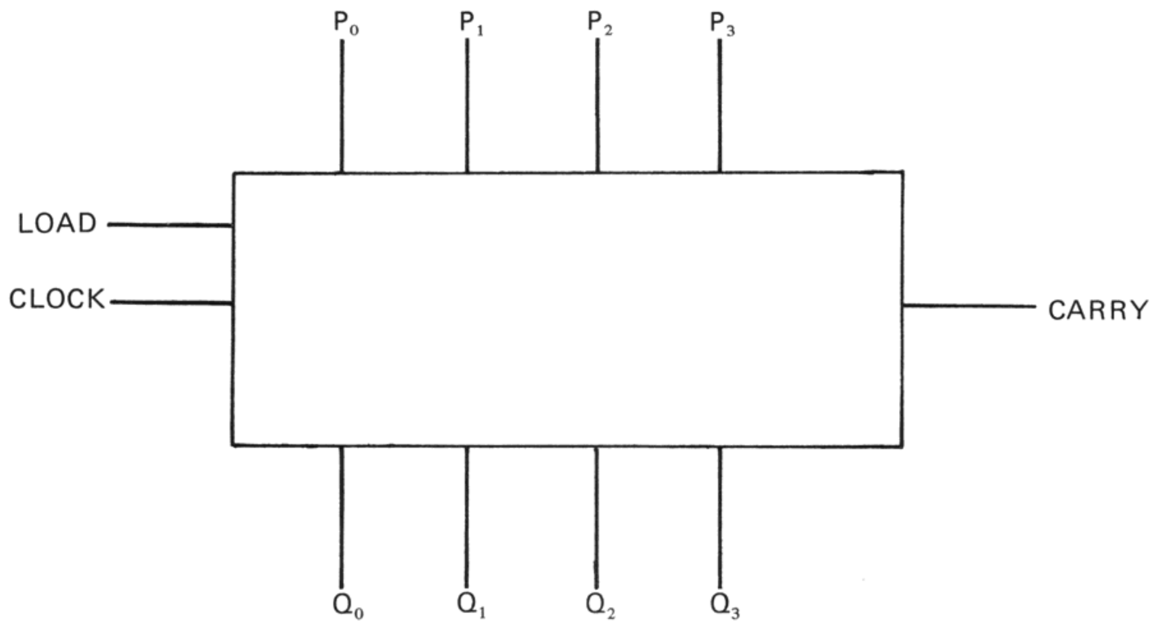
If the $\overline{Q}$ output of a D-FLOP is connected to the D input, the Q and $\overline{Q}$ will change states on every other clock pulse. The flop will "toggle" or divide-by-two, that is, it will put one pulse out Q or $\overline{Q}$ for every two clock pulses. Two D-FLOPS are cascaded to form a divide-by-four in the SBE-32CB SYNTHESIZER (IC-7).

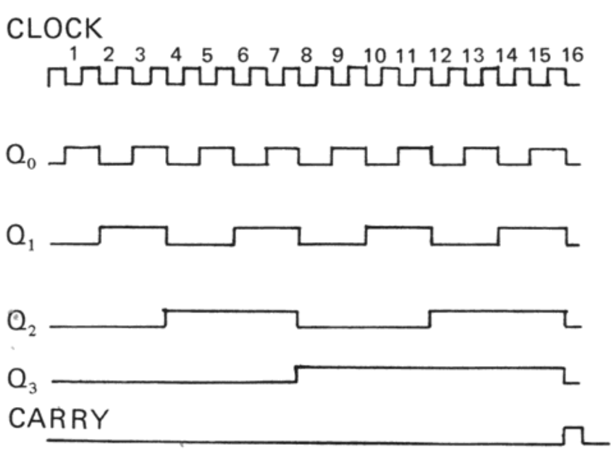


Pulse Forming

When the FLOPs $\overline{Q}$ output goes high, the NAND gate's inputs are both high for the length of the delay during which a low pulse is generated at the output of the NAND gate. The delay can be produced by a capacitor or by the propagation delay of logic elements.

The output of REFERENCE DIVIDER in the SYNTHESIZER of the SBE-32CB forms a pulse by the D-FLOP outputs IC-7 pins 8 & 9 which feed a NAND gate in IC-8. C157 delays the pulse out of pin 9. The propagation delay of four NAND gates (IC-14) in the CHANNEL SELECTOR is used in conjunction with either FF-1 or FF-2 to form the UP or DN pulses respectively.





BINARY COUNTER

Each positive pulse causes Q_0 to change states. Every other pulse changes Q_1 etc. (See chart at left.)

PRESET COUNTERS can be loaded with the P_0, P_1, P_2, P_3 input which then appears on the respective Q outputs.

UP DOWN COUNTERs have two clock inputs — one for counting up and the other for counting down.

Binary counters are used in both the SYNTHESIZER and CHANNEL SELECTOR. Preset counters are used in the PROGRAMMABLE DIVIDER section of the SYNTHESIZER. An up-down preset counter is used in the CHANNEL SELECTOR to count channels.

A ROM (READ ONLY MEMORY) is an IC having a defined set of outputs for each set of inputs. ROMs are used in the CHANNEL SELECTOR.

4.2 INTRODUCTION

The SBE-32CB is an AM transceiver with dual-conversion receiver using 10.7 MHz and 455 KHz IFs.

Refer to the block and schematic diagram while following the circuit description.

4.3 RECEIVER

GENERAL

In receive mode, the RF signal is fed from the antenna to the RF AMP Q1. The amplified RF signal is then fed to Q2 – the 1st MIXER – where it is mixed with an injection signal 10.7 MHz below the receive channel frequency. T2 and C113 select the 10.7 MHz 1st IF which is then fed to the 2nd MIXER D2 together with an injection signal 455 KHz lower. Ceramic filter FIL-1 selects the 455 KHz 2nd IF which is then fed to 1st and 2nd IF amplifiers Q3 and Q4. The amplified IF signal is then fed to S METER detector D11, AGC detector D6 and D7, and AUDIO detector D8 and D9. After passing through the AUTOMATIC NOISE LIMITER, the detected audio signal is fed to the wiper of potentiometer VR1 – the volume control. The audio signal developed on the top of VR1 is fed to the tone control network C201, C202, R201 and VR4 which then feeds the first audio amplifier stage Q14. The output of Q14 feeds the audio driver Q15 which is transformer coupled to push-pull speaker amplifier Q16 and Q17.

AUTOMATIC GAIN CONTROL

The AGC reduces the gain of the 1st IF amplifier Q3 in response to a strong signal by lowering its bias voltage. The rectified output of D6 and D7 is filtered by R119 and C126 to produce the AGC voltage which is then fed through R113 to the base of Q3.

AUTOMATIC NOISE LIMITER

The ANL circuit prevents impulse noise, such as ignition noise, from being amplified. The audio output voltage from the detector diodes D8 and D9 is attenuated to about 1/3 by voltage divider R120 and R121 and fed to the cathode of D10 – the ANL diode. The audio output from the detector is also fed through R122 to C132 where it is filtered and then fed through R123 to the anode of D10. Since the audio signal is positive, the signal at the anode of D10 is normally more positive than the cathode and the diode is forward biased providing a low impedance path for the audio. When a noise pulse appears in the output of the detector, the time constant of R123 and C132 prevents the anode from responding as fast as the cathode. The cathode of D4 is thus driven more negative than the anode causing D10 to become reversed biased. D10 then becomes a high impedance that blocks the noise.

SQUELCH CIRCUIT

The squelch circuit shuts the audio off when the received signal is less than the threshold level as determined by the squelch control VR3. The 2nd IF signal is AC coupled from the secondary of T6 through C301 to the cathode of D15. A DC bias is applied to the signal from the wiper on VR3. An IF signal thus produces a negative voltage at the base of Q11 which tends to turn it off. When Q11 is turned off, Q12 is turned on and Q13 is turned off. With Q13 off, the audio amp Q14 is properly biased to amplify audio. Moving the wiper on VR3 so as to make the DC component more positive, turns Q11 and Q13 on. Q13 then back biases Q14 and shuts the audio off. Thus moving the wiper on VR3 more positive increases the threshold level a signal must overcome to "break squelch" – turn Q11 off and permit Q10 to amplify audio.

S METER

The S METER indicates the relative strength of the RX signal. The IF signal from T6 is rectified by D11, filtered by C803 and fed through S METER ADJ VR7 to meter M-1.

4.4 TRANSMITTER

GENERAL

The output of the VOLTAGE CONTROLLED OSCILLATOR Q21 (16-17 MHz see Table 5-5) is fed to Q22 – the 1st VCO BUFFER – and then to Q23 – the 2nd VCO BUFFER. The output of Q23 is fed to the TX MIXER Q5 together with a 10.2381 MHz signal from the REFERENCE OSCILLATOR Q9. The sum of the frequencies is selected and fed to the TX BUFFER Q6. The output of Q6 is fed to the TX DRIVER Q7 and then to the TX FINAL Q8. Modulation is accomplished by feeding the MIC output to the audio amplifier Q14, Q15, Q16 and Q17, and taking modulated B+ from the bottom secondary of the audio output transformer T9 and using it to drive Q7 and Q8 – the TX DRIVER and FINAL.

AUTOMATIC MODULATION LIMITER

The AML regulates the gain of the audio amplifier so as to accommodate a wide range of voice levels. The audio output signal is fed from the bottom secondary of T9, the audio output transformer, through D19, C213 and AML ADJ VR9. D17 rectifies the signal, and R207 and C206 filter it producing an average DC level which is fed to the emitter of Q14 – the 1st AUDIO AMP. As the sound level into the MIC increases, this DC level will increase and reduce the gain of the audio amplifier.

RFO METER

The RFO METER indicates TX power output. TX RF is sampled from the antenna by C801. The RF is then rectified by D12, filtered by C802 and fed through RFO METER ADJ VR6 to meter M-1.

PA GAIN

The PA GAIN circuit permits the MIC input level to be varied in PA mode, but not in TX mode. In TX mode, the positive voltage, developed on C802 to drive the RFO meter, is fed through R901 to the base of Q901. Q901 is turned on, forward biasing D901 while Q902 is turned off, reverse biasing D902. Thus the audio signal from the MIC in TX mode is fed through C903, D901, C217, D16 to the base of Q14 – the 1st AUDIO AMP. In PA mode D901 is reverse biased while D902 is forward biased. The MIC signal is then fed through PA GAIN adjust VR2 before being fed to the audio amplifier.

DIGITAL FREQUENCY SYNTHESIZER

The DFS produces the necessary frequencies to transmit and receive on all 23 citizen band channels from one crystal controlled REFERENCE OSCILLATOR Q9. The crystal X1 in oscillator Q9 is in series with varactor D14. In TX mode a forward bias across D14 causes Q9 to oscillate at 10.2381 MHz; in RX mode a reverse bias adjustable by DELTA TUNE control VR5 causes it to oscillate around 10.240 MHz. The output of Q9 is fed to a 10 stage binary counter formed by IC-5, -6, -7 and -8 which divides the frequency by 1024 to produce about 10 KHz in RX mode and 9.998 in TX mode. This signal is compared by a PHASE-FREQUENCY and LOSS-OF-LOCK DETECTOR IC-9 with the signal from the PROGRAMMABLE COUNTER formed by IC-1, -2, -3 and -4 which is driven by oscillator Q21. When the output of the 10 stage counter is not in phase with that of the PROGRAMMABLE COUNTER the LOSS-OF-LOCK DETECTOR outputs a signal that disables the transceiver. The FREQUENCY DETECTOR produces an error voltage which is added to the bias on varactor D26, and varies the frequency of the VCO (VOLTAGE CONTROLLED OSCILLATOR) Q21. The output of the PROGRAMMABLE COUNTER is thus brought into frequency and phase lock with the 10 stage counter. While the 10 stage counter divides by 1024 (2^{10}), the programmable counter is determined by the A, B, C, D, & E inputs from the CHANNEL SELECTOR. The A, B, C, D, & E inputs are determined by the particular channel selected. (See Table 5-15.)

PROGRAMMABLE DIVIDER

The PROGRAMMABLE DIVIDER divides the output frequency of the VCO Q21, such that when Q21 is operating at the proper frequency, the PROGRAMMABLE DIVIDER's output will be equal in frequency and phase to the output of the REFERENCE DIVIDER. While the ratio of the REFERENCE DIVIDER is fixed at 1024, the ratio of the PROGRAMMABLE DIVIDER is determined by the channel selected by the CHANNEL SELECTOR. (See Table 5-15.) Three 4-bit counters, IC-1, -2 & -3 are cascaded to form a 12-bit counter. The count outputs of IC-1 & -2 are fed to open collector NAND gates in IC-4. The outputs of these NAND gates are wire ANDed to drive the $\overline{PE}$ (Preset Enable when low) and an input of the PHASE-FREQUENCY COMPARATOR. In TX mode pin 10 of G2 is grounded. This disables it such that G1 determines the terminal count and stuffs the counter with the channel select code. Pin 10 is high in RX mode permitting G2 to determine the terminal count. Thus the channel select code sets the initial count and G1 in TX mode or G2 in RX mode determines terminal count. Counting is therefore cyclical and each cycle is accompanied by a preset pulse which is the programmed divide ratio.

CHANNEL SELECTOR

The CHANNEL SELECTOR selects the operating channel for the SBE-32CB in response to the UP and DN buttons located on the MIC HEAD. The CHANNEL SELECTOR feeds the DIGITAL FREQUENCY SYNTHESIZER and the display circuitry in the MIC HEAD.

The UP or DN button on the MIC HEAD sets FF-1 or FF-2 respectively. Setting FF-1 produces a low pulse out pin 8 of IC-11 which is differentiated by C4, R15 & R16 and then used to pulse the up count on the 8-stage binary counter IC-12 & IC-13. Likewise, setting FF-2 will pulse the DN count. If either the UP or DN button is held, C1 will charge and fire PUT CR1. The PUT will then initiate UP or DN pulses as long as the button is pressed. The output of the counter feeds two ROMs – IC-16 and IC-17. IC-17 converts the count to BCD which is then fed to the MIC HEAD display circuitry. IC-16 converts the count to the channel select code which is fed to the DIGITAL FREQUENCY SYNTHESIZER. (See Table 5-5.) IC-16 produces a low output on pin 7 when the count is 23 and a low output on pin 9 when the count is **1**. Otherwise, pin 7 and 9 are high. The output on pin 7 of IC-16 drives pin 1 on IC-18 low which then drives pin 9 on IC-15 high enabling an UP pulse to load the counter with the inputs at the preset (pins 1, 9, 10, 15). Since pin 3 of IC-15 is low a **1** is loaded. Likewise, a **1** output from the counter enables a DN pulse to load it, but since pin 3 of IC-15 is now high a 10111 or 23 is loaded.

A **1** is loaded when the unit powers up. In the off position, S4 forward biases the base of Q27 discharging C2. When S4 is turned on, Vcc pulls the anode of SCR CR2 high. C2 charges; CR2 fires and the anode goes low. This initial high anode pulse feeds pin 5 of IC-18 and is inverted out pin 6 and loads a **1** in the counter.

SYNCHRONOUS UP/DOWN PRESETTABLE 4-BIT BINARY COUNTER

The two M53200P (IC-12 & IC-13) UP/DOWN COUNTERs are used in the SBE-32CB CHANNEL SELECTOR for generating the channel number. The count up or down is triggered by a low-to-high pulse edge. By feeding the borrow of IC-12 to the DN of IC-13 and the carry of IC-12 to the UP of IC-13, these counters are cascaded to form an 8-bit binary counter. When the $\overline{LD}$ input is driven low, the preset inputs are loaded, and override the count. It is necessary for counting that pin 16 (Vcc), pin 11 ($\overline{LD}$) be high and pin 14 (clear) and pin 8 (GND) be low. When either the UP or DN (pin 4 or 5 respectively) is pulsed the other must be high. (See Table 5-17, -18.)

BINARY TO BCD CONVERTER

The M53385P (IC-17) converts the binary input from the counter to BCD. (See Table 5-21.)

PROGRAMMABLE READ ONLY MEMORY

The M547305 PROM converts the binary inputs from the counter to channel-select-codes and indicates to the counter preset logic if the counter output is 1 or 23. (See Table 5-20.)

BCD TO 7-SEGMENT DRIVER

The 7447 converts the BCD to 7-SEGMENT and drives the LED channel display in the MIC HEAD.

FIG. 4-1 TRANSCEIVER BLOCK DIAGRAM

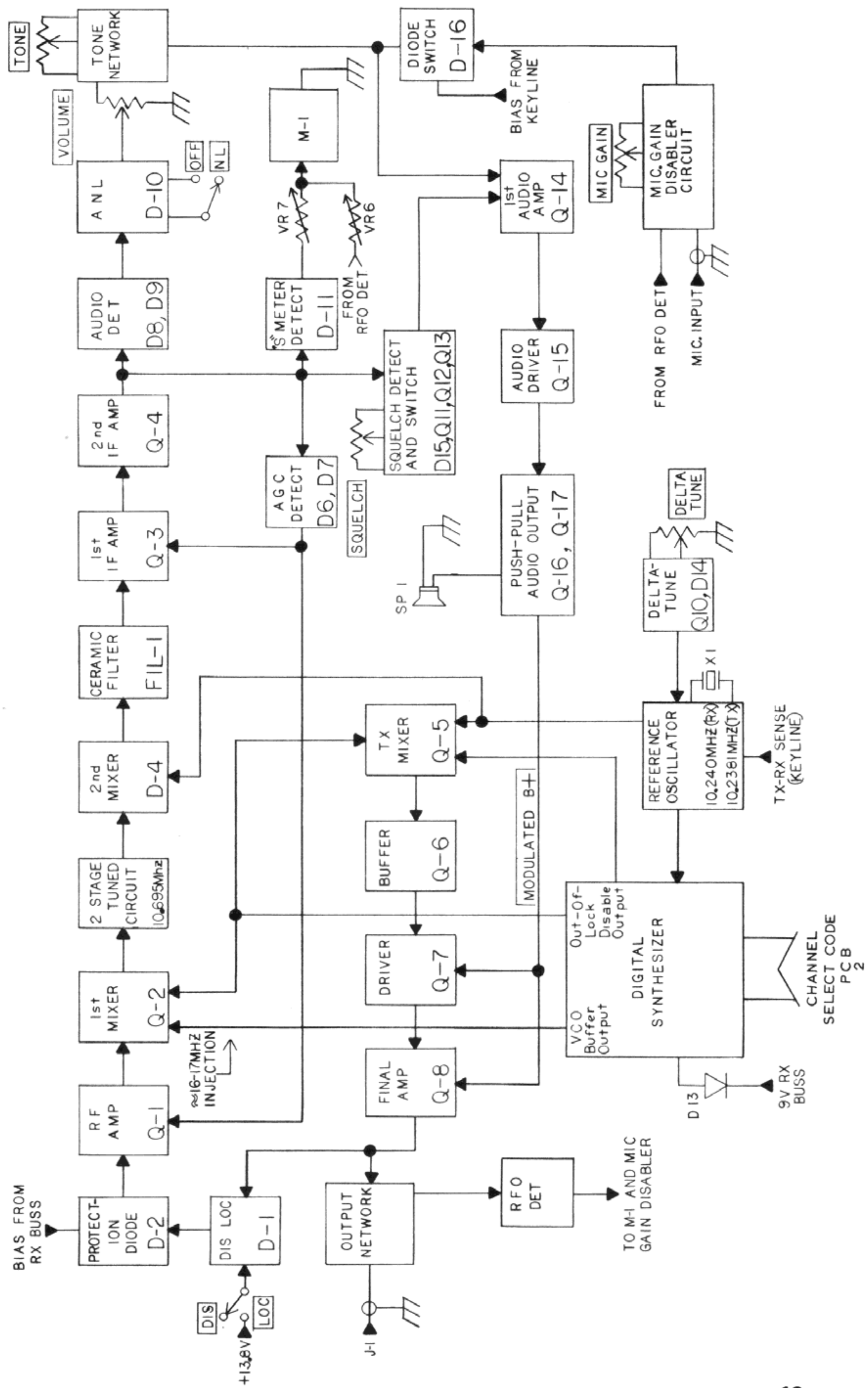


FIG. 4-2 SYNTHESIZER BLOCK DIAGRAM

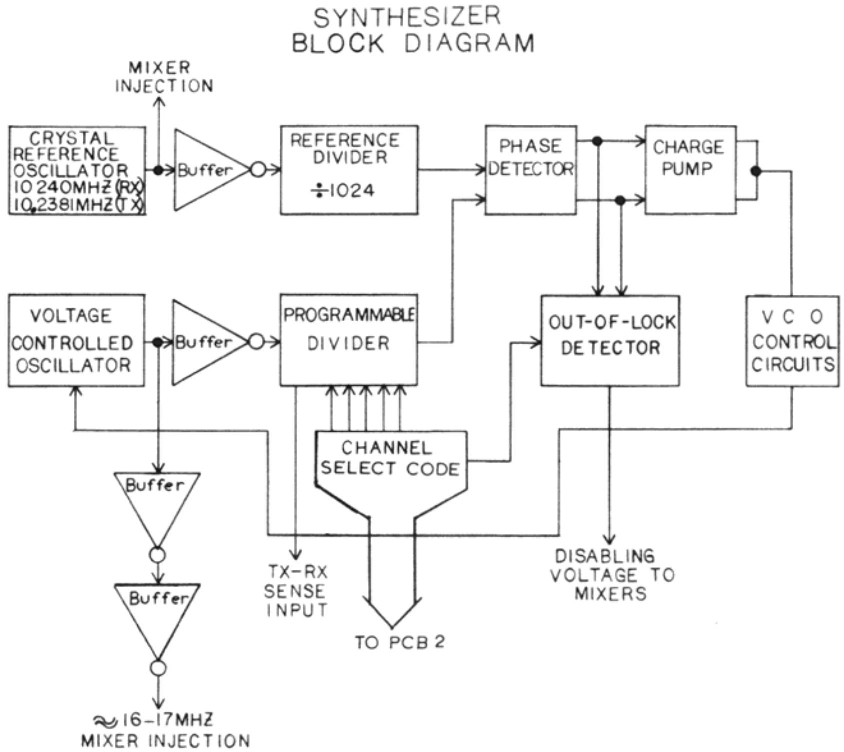
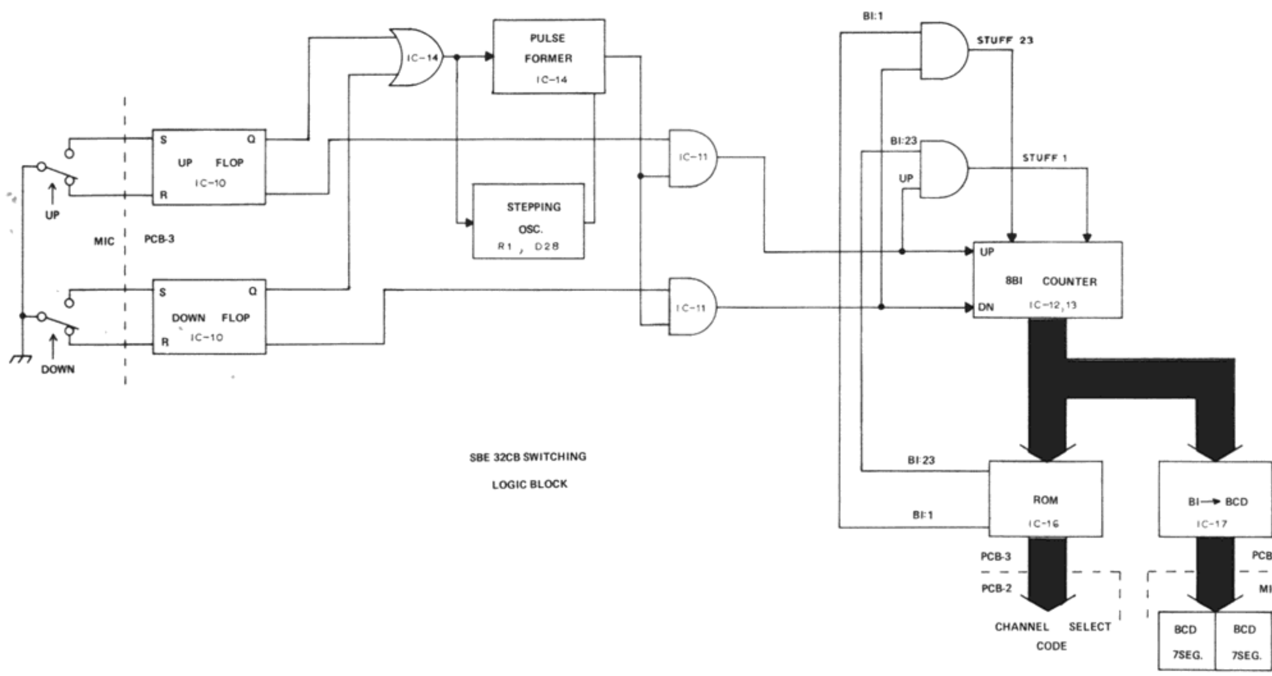


FIG. 4-3 CHANNEL SELECTOR BLOCK DIAGRAM



SECTION 5

SERVICING

5.1 INTRODUCTION

Read this section carefully before attempting any repair of the SBE-32CB. Refer to the circuit description, block and schematic diagrams. The transistor and IC case diagrams are shown on the schematic diagram. Refer to these diagrams before checking transistors or ICs. Component layout prints are provided to aid troubleshooting and alignment. **Use only recommended replacement parts.** Refer to the parts list in the back of this book. **Never replace blown fuses with higher rated ones or fast acting with slow blow.** To check operation of the unit, refer to Table 5-2, PERFORMANCE VERIFICATION PROCEDURE. Figures 5-3, 5-4, TRANSMITTER TEST CONNECTION and RECEIVER TEST CONNECTION respectively, show the proper manner to connect the unit to test instruments for performance verification or alignment. Table 5-1 lists RECOMMENDED TEST INSTRUMENTS. Tables 5-6, 5-9 show proper TRANSMITTER ALIGNMENT PROCEDURE and RECEIVER ALIGNMENT PROCEDURE respectively. Figure 5-10, ALIGNMENT LAYOUT is placed next to the alignment procedures to show alignment adjustments at a glance.

5.2 TEST SIGNALS

OSCILLOSCOPE WAVEFORMS are shown which were taken at various points in the SBE-32CB during normal operation into a dummy load. CHECK POINT numbers next to the waveform pictures correspond to numbers in boxes on both the schematic diagrams and component layout drawing. Some waveforms are shown on the schematic diagrams. The waveforms on the CHANNEL SELECTOR schematic are shown for auto scan mode. Figure 5-7 shows RF amplification through a properly aligned transmitter. Figure 5-8 shows 50%, 100% and overmodulation respectively. Notice that the waveform at the drain of Q5 – the TX MIXER – contains several frequency components. Also notice that the waveform at the collector of Q8 – the TX FINAL – is unsymmetrical (Figure 5-7C). This is proper since the TX FINAL operates class C for greater efficiency. Figure 5-7d shows how the output should look at the dummy load.

VOLTAGE MEASUREMENTS are shown on the schematic diagram for normal operation. All voltages were measured with a voltmeter having 10MΩ input impedance. Voltage measurements on high impedance RF points should be taken through a choke. While any choke about 100μH is suitable, SBE part 8000-00011-0018 (150μH) may be ordered from the factory. Mini-test clips are very useful for making voltage measurements in hard to reach places.

RECEIVER INJECTION VOLTAGES are given in Table 5-11 together with CHECK POINT numbers which correspond to numbers in boxes on both the schematic diagram and component layout drawing. This table specifies the voltage level, carrier frequency and particular points in the receiver string at which a 30% – 1 KHz modulated signal injected through a .01 MFD capacitor should produce at least 2 VAC of audio across the speaker or 8Ω load plugged into the speaker jack, EXT SP. While the value of this capacitor is not critical, capacitive coupling of the signal generator to the circuit is necessary to prevent grounding out the transistor biases.

Before setting up to measure RECEIVER INJECTION VOLTAGES, small hand-held "all purpose signal generators" can be used to provide a quick check of the receiver string. Basically, these devices generate pulses rich in harmonics from AF to RF to test whether a stage is working.

AGC VOLTAGES versus RF INPUT LEVEL are shown in Table 5-13. This table should be consulted before any adjustments are made on the squelch circuit since squelch is a function of AGC.

Table 5-12, SYNTHESIZER TROUBLESHOOTING PROCEDURE, should be used as a guide to locating problems in the FREQUENCY SYNTHESIZER.

Table 5-14, DEFECT IN CHANNEL SELECT CODE, shows which channels are affected by failure of the SYNTHESIZER to respond to a bit of the CHANNEL SELECT CODE. This may be a failure of a voltage to appear on an input pin of an IC or **it may also be a defect in the input of the particular IC.**

FREQUENCY MEASUREMENTS are shown which were taken at various points in the FREQUENCY SYNTHESIZER during normal operation and are shown on both the schematic diagram and component layout drawing. If the frequencies are wrong then ascertain where the ratios are wrong. Start by measuring the frequency of the REFERENCE or PROGRAMMABLE DIVIDER'S DRIVER Q24 or Q25 respectively. Divide the "normal" frequency by the "wrong" frequency. Using this ratio as a multiply-constant, go through the divider multiplying frequencies by this constant. A defect in a divider is indicated whenever the constant times the wrong frequency does not equal the normal frequency. This technique is greatly facilitated by a pocket calculator with memory.

LOGIC FUNCTION TABLES (5-15 through 5-21) show the logic states in the CHANNEL SELECTOR during normal operation. The high, low or pulse states are best determined with a logic probe. The Hewlett Packard HP 1052T logic probe is recommended. This probe is bright and can be seen at any angle. An oscilloscope can be used to determine high or low levels; a high should be greater than 2 volts and a low less than 0.8 volts.

Before removing an IC, try to make certain that it is the trouble. Use a low wattage soldering iron and solder wick. Make certain that all of the IC's pins are free before attempting to remove it from the board.

A blown fuse should only be replaced by one of the proper rating and type. If the fuse blows again, replace it, but place an Ω meter at the power terminals in place of the supply. Make certain that the + side of the Ω meter is connected to the red power wire of the SBE-32CB. Some VOMs place the – side of the Ω meter out the red test jack. Observe that D22 protects the unit from a reversed supply.

A fuse may blow only when the unit is connected in a vehicle because the vehicle has a positive ground and there is a short from the PCB ground to the chassis, or a grounded speaker was plugged into EXT SP J2.

The second harmonic trap (L10 and CV1) is adjusted at the Factory; field adjustment should not be attempted without proper equipment.

FIG. 5-1 RECOMMENDED TEST INSTRUMENTS

TEST INSTRUMENT	REQUIRED SPECIFICATIONS	USE	RECOMMENDED INSTRUMENT TYPE
R.F. Signal Generator	Output frequency: 26.965 to 27.255 MHz. Output level calibrated from .1 microvolts to 500,000 microvolts. Internal modulation capability of 30% minimum at 1 KHz. (Calibrated)	Receiver service and alignment.	Hewlett-Packard Model 606A or B. Wavetek Model 3000.
Oscilloscope	Vertical bandwidth of 25 MHz or greater at 3db point. Triggered sweep capability.	Transmitter and receiver test and alignment.	Tektronics Model T932. Tektronics Model 465. Hewlett-Packard Model 180. Phillips Model PM3260E.
Frequency Counter	Frequency range DC to 30 MHz. Sensitivity: 10mv R.M.S. at 30 MHz. Overall timebase accuracy ±.002%, 6 digit resolution.	Transmitter frequency check and synthesizer troubleshooting.	Heath-Schlumburger Model SM128A
Wattmeter	5 watts full scale into 50 ohm load ±5% accuracy.	Measure power output and S.W.R.	Bird Model 43 with type 5A element. (May be terminated with antenna load
AC VTVM	-40 to +20db range.	Measure audio output.	Heath Model IM-21.
Audio Oscillator	400 Hz to 4000 Hz output: Adjustable level, 0-1 volt output impedence 600 ohm.	Audio and modulator tests.	Hewlett-Packard Model 204C. Heath Model SG18A.
DC Power Supply	13.8 volt DC ±10% at 2 amperes.	Primary supply voltage for servicing.	Heath Model SP2720 (SBE Model SBE-1AC may be used if available.)
Logic Probe	TTL: High, low and pulse.	Troubleshooting logic.	Hewlett-Packard Model 10525T.

FIG. 5-2 PERFORMANCE VERIFICATION PROCEDURE

RECEIVER

STEP 1

Connect unit to 13.8 volt DC supply.

STEP 2

Set generator frequency to 27.115 MHz with 30% modulation at 1 KHz. Connect the signal generator to the antenna jack of the transceiver.

STEP 3

Set channel selector switch to channel 13, the DIS/LOC switch to distance position, CB/PA switch to CB position, noise limiter switch to NL position and delta tune to mid-position.

STEP 4

Set signal generator output at 1μV and verify 5 volts AC audio across external speaker jack using 8Ω resistive load.

STEP 5

Turn off the signal generator modulation and verify a 10db or greater reduction in audio output.

STEP 6

Increase generator output to 100μV. Check for "S" meter indication of approximately "S9".

STEP 7

Observe meter lamp and channel selector lamp to insure that both are operational.

STEP 8

Reset generator output to 1μV. Rotate delta tune control to both extremes, verify a slight decrease in audio output and "S" meter reading at both extremes, return delta tune to center position.

STEP 9

Increase signal generator output to 200μV. Rotate squelch knob fully clockwise and verify full squelch of the receiver with an input of 200μV (tight squelch may be adjusted with VR8).

(continued)

STEP 10

Decrease generator output to 1μV, adjust squelch control to the point that the receiver is just muted. Increase signal generator output by 1/2μV and verify that the squelch opens.

STEP 11

Set CB/PA switch in the PA position. Connect an external speaker or 8Ω load across PA jack and observe the audio output while speaking into the microphone.

TRANSMITTER

STEP 1

Connect the unit to 13.8 volt DC supply. Set channel selector to channel 13, CB/PA switch to CB position. Connect standard microphone to the microphone input jack. Connect wattmeter and dummy load to antenna jack. Key the transmitter and check that the transmit lamp comes on. Observe an output of 3 watts or greater on the wattmeter. Observe a nominal internal RFO meter reading of approximately 2/3 scale. (RFO may be adjusted by VR6.)

STEP 2

Whistle into microphone with transmitter keyed and verify that 100% modulation capability is obtained.

STEP 3

Connect counter through 10X probe to wattmeter load and check the transmit frequencies on all channels.

SYNTHESIZER

STEP 1

Check voltage on emitter of Q26 for 4.8-5.4 VDC and TP3 for about 2.7 VDC. If not see Fig. 5-12.

STEP 2

Check waveform at the collector of Q23. If waveform is not present or is substantially reduced in amplitude, go to Fig. 5-12. If waveform appears normal, go to Step 3.

STEP 3

Monitor the output frequency of the syntheziser at the collector of Q23 (coupled to the counter with the 10X oscilloscope probe) in both transmit and receive modes. Check to see that the output frequency on each channel agrees with the frequencies listed in Table 5-5. If the output frequencies are wrong in either mode, on any channel, refer to Table 5-14.

FIG. 5-3 TRANSMITTER TEST CONNECTION

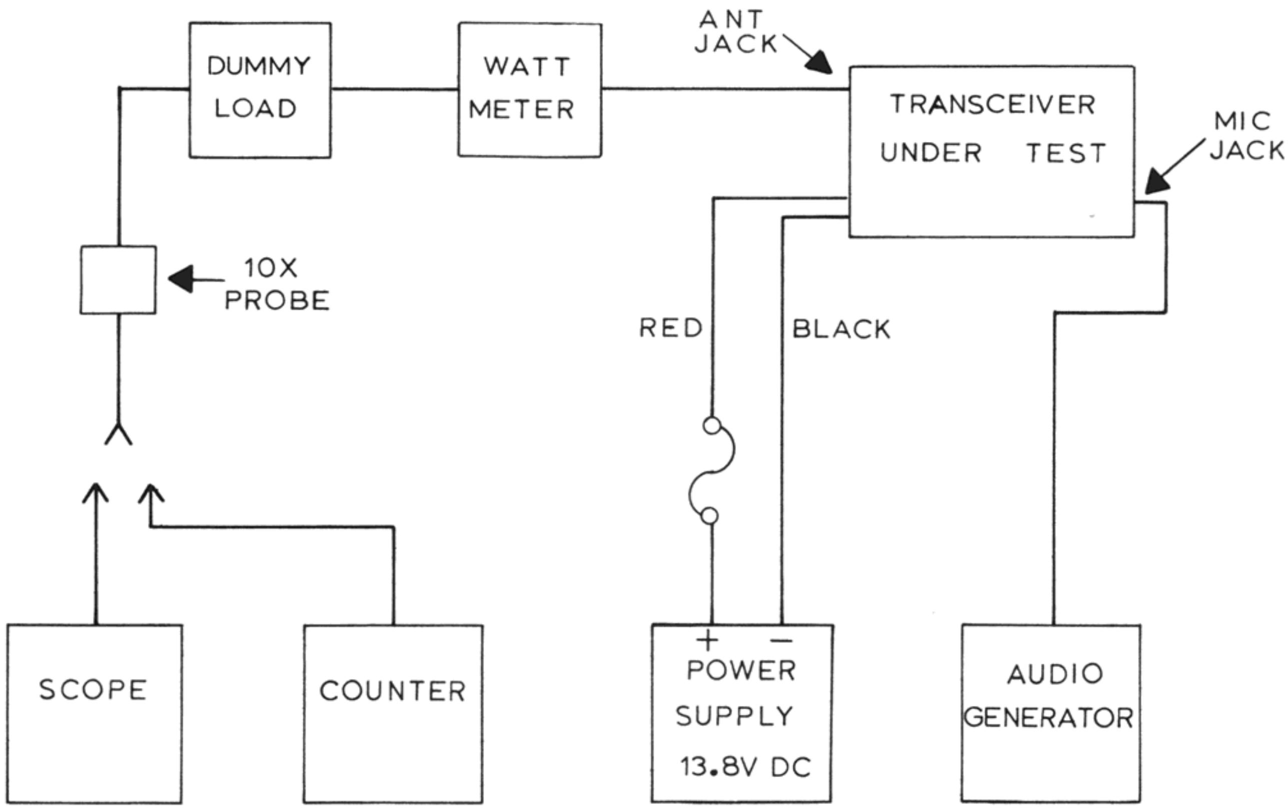


FIG. 5-4 RECEIVER TEST CONNECTION

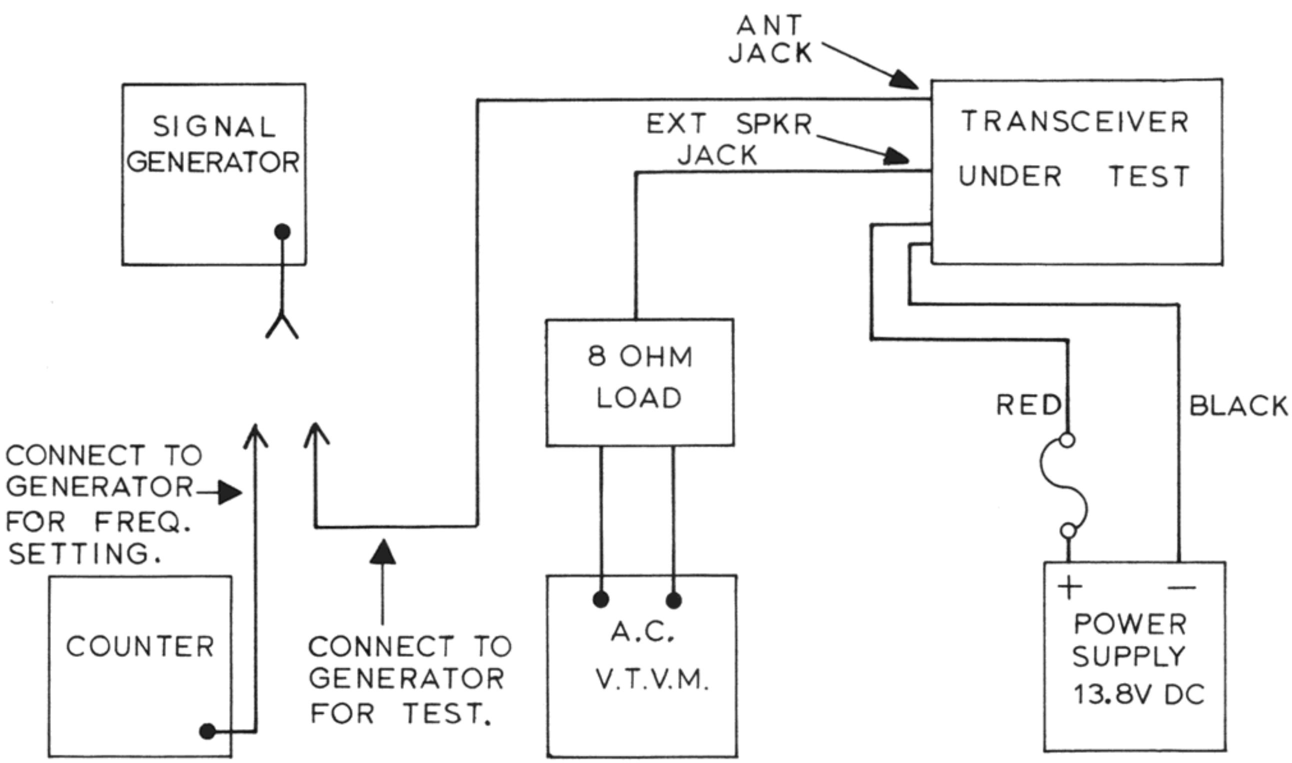


TABLE 5-5 DIGITAL SYNTHESIZER FREQUENCY SCHEME

VCO Frequency		CHANNEL SELECT CODE					Channel	
		IC-2	IC-1					
Transmit MHz	Receive MHz	Pin 3	Pin 6	Pin 5	Pin 4	Pin 3	No.	Frequency
16.727	16.270	1	1	1	1	0	1	26.965
16.737	16.280	1	1	1	0	1	2	26.975
16.747	16.290	1	1	1	0	0	3	26.985
16.767	16.310	1	1	0	1	0	4	27.005
16.777	16.320	1	1	0	0	1	5	27.015
16.787	16.330	1	1	0	0	0	6	27.025
16.797	16.340	1	0	1	1	1	7	27.035
16.817	16.360	1	0	1	0	1	8	27.055
16.827	16.370	1	0	1	0	0	9	27.065
16.837	16.380	1	0	0	1	1	10	27.075
16.847	16.390	1	0	0	1	0	11	27.085
16.867	16.410	1	0	0	0	0	12	27.105
16.877	16.420	0	1	1	1	1	13	27.115
16.887	16.430	0	1	1	1	0	14	27.125
16.897	16.440	0	1	1	0	1	15	27.135
16.917	16.460	0	1	0	1	1	16	27.155
16.927	16.470	0	1	0	1	0	17	27.165
16.937	16.480	0	1	0	0	1	18	27.175
16.947	16.490	0	1	0	0	0	19	27.185
16.967	16.510	0	0	1	1	0	20	27.205
16.977	16.520	0	0	1	0	1	21	27.215
16.987	16.530	0	0	1	0	0	22	27.225
17.017	16.560	0	0	0	0	1	23	27.255

REFERENCE OSCILLATOR Q10
TX = 10.238 MHz
RX = 10.240 MHz

TX: VCO + 10.238 MHz = (CHAN. FREQ.)

RX: (CHAN. FREQ.) – VCO – 10.240 = 455 KHz IF

FIG. 5-6 TRANSMITTER ALIGNMENT PROCEDURE

INITIAL SET-UP

Connect the test equipment to the unit as shown in Figure 5-3. Set the delta tune control to the center position. Set the CB/PA switch in the CB position. Set the channel selector to channel 13.

STEP 1

With no modulation, key the transmitter and adjust coils and transformers L3, L4, T7, L6, L8, L9 and L13 for maximum power output.

STEP 2

With the transmitter keyed, observe the output envelope on the oscilloscope. Turn on the audio oscillator and set its output frequency to 1 KHz. Increase oscillator output while observing the modulation envelope on the oscilloscope. Set the audio oscillator output to a level that results in slight distortion of the positive peaks of the modulation.

STEP 3

Adjust L6 counterclockwise until approximately 100% negative modulation is seen on the oscilloscope waveform. (See Fig. 5-8).

STEP 4

Adjust the audio oscillator's level for 50% modulation. Read level on AC VTVM and increase level until the AC VTVM reads 8 times as great (about 18db). Adjust VR9 for 100% modulation.

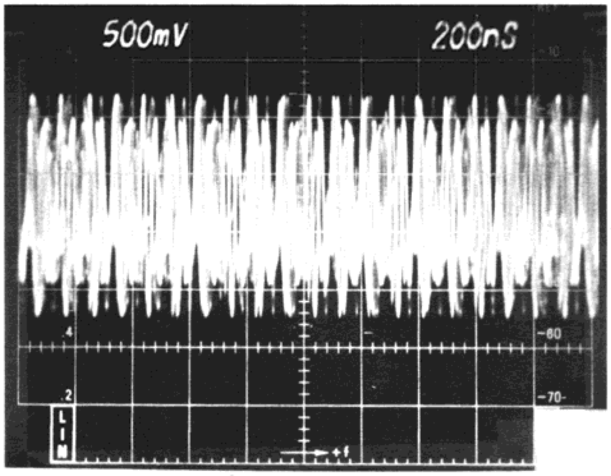
STEP 5

Remove audio oscillator. Adjust VR6 until RFO METER reads the same as wattmeter.

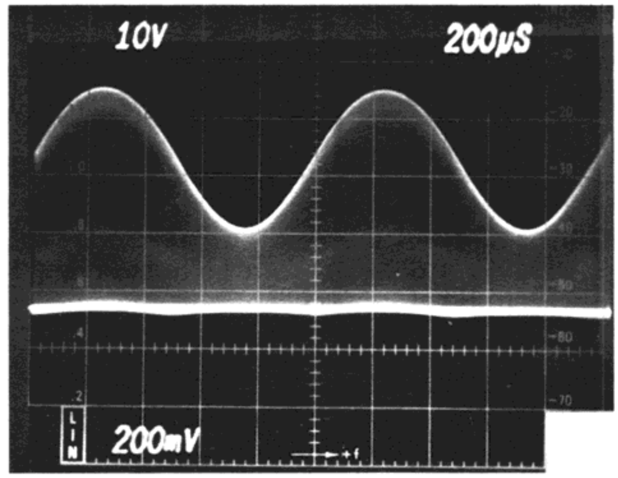
STEP 6

Connect the frequency counter to the output of the transceiver. Key the transmitter with no modulation and note the frequency. If the frequency is more than 100 Hz from the channel frequency, adjust L11 for the correct channel frequency.

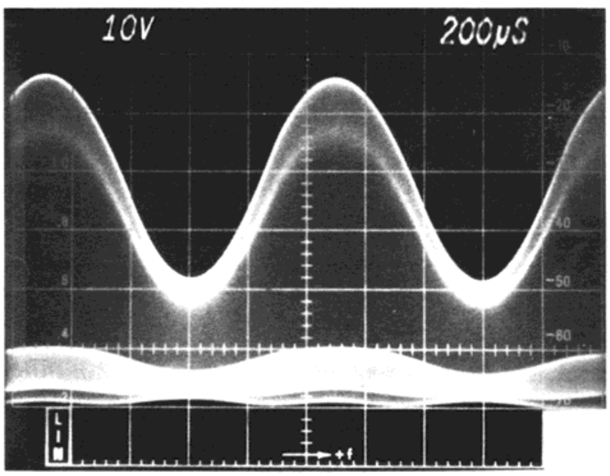
FIG. 5-7 TRANSMITTER ALIGNMENT WAVEFORMS



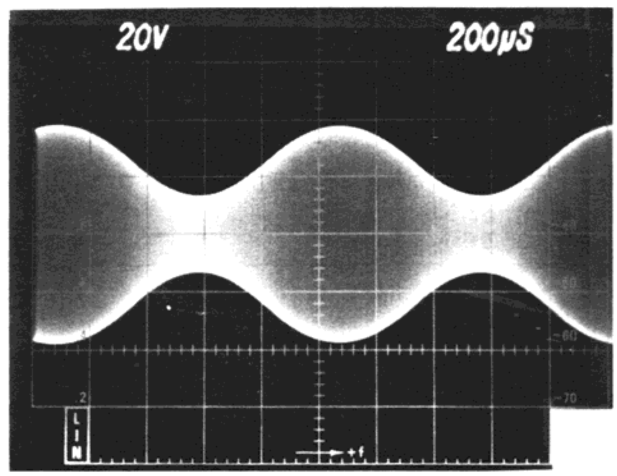
(a) TX MIXER DRAIN



(b) DRIVER COLLECTOR

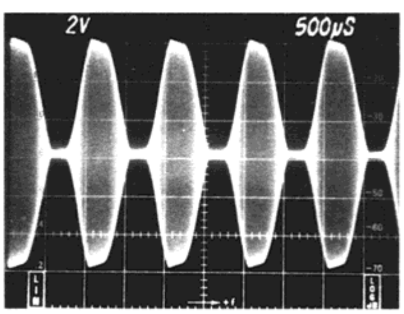


(c) FINAL COLLECTOR

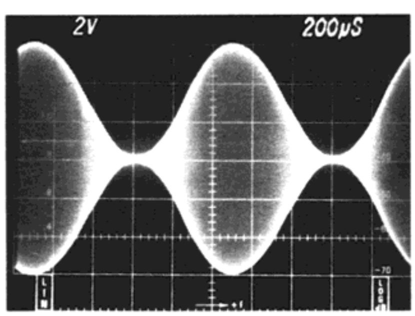


(d) RF OUTPUT

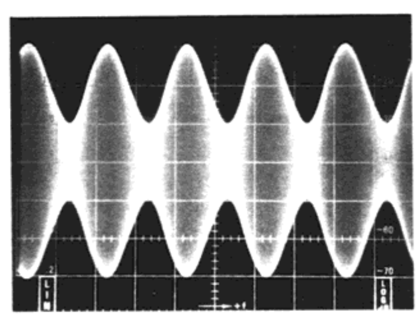
FIG. 5-8 MODULATION WAVEFORMS



OVERMODULATION



100% MODULATION



50% MODULATION

FIG. 5-9 RECEIVER ALIGNMENT PROCEDURE

INITIAL SET-UP

Connect the test equipment to the unit as shown in Figure 5-4. Set the local-distance switch on the front panel to the distance position. Adjust the volume control to maximum, clock-wise. Set the delta tune control to the center position. Set the CB/PA switch in the CB position. Set the noise limiter switch in the off position. Turn the squelch control fully counter clock-wise. Set the channel selector on channel 13.

STEP 1

Set the output level of the signal generator to a level sufficient to provide 3 volts of audio as measured on the audio voltmeter. Adjust in turn the following: T1, L1, T2-1, T2-2, T3, T4, T5, and T6 for maximum indication on the voltmeter. If at any time during the alignment procedure the audio level increases to more than 5 volts, reduce the generator output level to result in an audio output level of 3 volts.

STEP 2

Repeat the above procedure until a nominal 5 volts or more is available at the audio output with an input of 1 microvolt.

STEP 3

Adjust the audio output level with the volume control to result in a reading of 0db on the voltmeter. Adjust the slug of T1 counter-clockwise for a reduction of 1db in audio output. Remove the generator input from J1. Adjust the volume control to obtain a useable reading of the background noise level. On the voltmeter, switch the channel selector to channel 1 and note the noise level. Switch to channel 23. The noise level should be within 2db of the channel 1 reading. If the difference between 1 and 23 is greater than 2db, adjust L2.

STEP 4

Set the generator output to 100 microvolts. Adjust VR7 for a reading of "9".

STEP 5

Rotate squelch control fully clockwise. Increase generator output to 300 microvolts. Squelch should break. If squelch fails to break, adjust VR8 to break squelch at 300 microvolts.

FIG. 5-10 ALIGNMENT LAYOUT

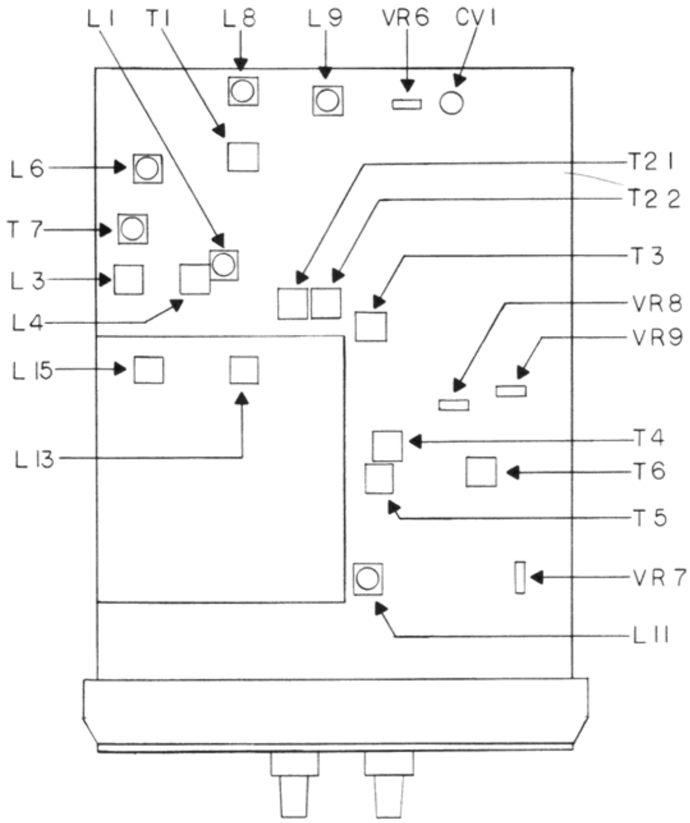


TABLE 5-11 RECEIVER INJECTION VOLTAGES

All injection voltages are at 30% – 1 KHz modulation at the specified frequency fed through a .01 MFD capacitor, and should produce at least 2 VAC audio output measured across the speaker or across an 8Ω load connected at EXT SP J2. N.L. – OFF. Delta tune – centered. DIS/LOC – DIS. Typical audio output voltages are given.

INJECTION POINT	INPUT LEVEL	AUDIO VOLTAGE	FREQUENCY
ANT JACK J1	1μV	4.6V	27.085 MHz
Q1 gate 2 – CP1*	3μV	4.1V	27.085 MHz
Q2 gate 2 – CP2	30μV	5.2V	27.085 MHz
TP–2	100μV	3.6V	10.695 MHz
Q3 base – CP3	30μV	4.9V	455 KHz
Q4 base – CP4	1000μV	3.6V	455 KHz

*CHECK POINT numbers correspond to numbers in boxes on the schematic diagrams.

FIG. 5-12 SYNTHESIZER TROUBLESHOOTING PROCEDURE

STEP 1

Check emitter of Q26. If not 4.8-5.4 volts, check D27 and Q26.

STEP 2

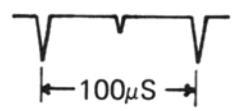
Set to channel 13. Check TP3. If not 2.7 volts, adjust L14 and try to bring to 2.7 VDC.

STEP 3

Check collectors of Q24 for 10.24 MHz and Q25 for 16.42 MHz.

STEP 4

Check IC-5 pin 11 for 640 KHz, IC-6 pin 11 for 40 KHz, IC-7 pins 8 & 9 for 10 KHz and IC-9 pins 1 & 3 with scope for 100μS pulses.



STEP 5

Check IC-1 pin 2 for 16.420 MHz, pin 14 for 8.22 MHz, pin 13 for 4.11 MHz, pin 12 for 2.06 MHz, pin 11 for 1.03 MHz, IC-2 pin 15 for 70 KHz and pin 11 for 10.03 KHz.

STEP 6

Check IC-9 pin 5 for 1.7 VDC, pins 2 & 3 for DC level (pulses indicate out-of-lock). Pulses on pin 5 indicate defective IC.

STEP 7

Check emitter of Q20 for $\sim$1.4 voits and collector of Q23 with scope for 1.5 volt PP pulses on 5 VDC. (16.42 MHz)

TABLE 5-13 AGC VOLTAGES versus RF INPUT LEVEL

	INPUT LEVEL (1)	AGC VOLTAGES
Measured with 10MΩ input at Anode of D6.		
N.L. OFF	OPEN ANT	+0.72
DIS/LOC – DIS	1μV	+0.48
CB/PA – CB	10μV	0.00
Delta tune – centered	100μV	–0.34
	1000μV	–0.51
(1) Channel Frequency at Antenna Jack.	10,000μV	–0.59

TABLE 5-14 DEFECT IN CHANNEL SELECT CODE

SELECT CODE	CHANNELS AFFECTED	TX RF OUTPUT FREQUENCIES
IC-1 pin 3 stays L	2, 5, 7, 8, 10, 13, 15, 16, 18, 21, 23	10 KHz High
stays H	1, 3, 4, 6, 9, 11, 12, 14, 17, 19, 20, 22	10 KHz Low
IC-1 pin 4 stays L	1, 4, 7, 10, 11, 13, 14, 16, 17, 20	20 KHz High
stays H	2, 3, 5, 6, 8, 9, 12, 15, 18, 19, 21, 22, 23	20 KHz Low
IC-1 pin 5 stays L	1, 2, 3, 7, 8, 9, 13, 14, 15, 20, 21, 22	40 KHz High
stays H	4, 5, 6, 10, 11, 12, 16, 17, 18, 19, 23	40 KHz Low
IC-1 pin 6 stays L	1, 2, 3, 4, 5, 6, 13, 14, 15, 16, 17, 18, 19	80 KHz High
stays H	7, 8, 9, 10, 11, 12, 20, 21, 22, 23	80 KHz Low
IC-2 pin 3 stays L	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	160 KHz High
stays H	13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23	160 KHz Low

TABLE 5-15 CHANNEL SELECT CODE PCB-2

Channel #s	PIN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	WIRE
IC-1	3	L	H	L	L	H	L	H	H	L	H	L	L	H	L	H	H	L	H	L	L	H	L	H	A
	4	H	L	L	H	L	L	H	L	L	H	H	L	H	H	L	H	H	L	L	H	L	L	L	B
	5	H	H	H	L	L	L	H	H	H	L	L	L	H	H	H	L	L	L	L	H	H	H	L	C
	6	H	H	H	H	H	H	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	D
IC-2	3	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	E

TABLE 5-16 IC-10 PCB-3

PIN #	
1	H EXCEPT WHEN UP BUTTON DEPRESSED
2	H EXCEPT WHEN UP BUTTON DEPRESSED
3	L EXCEPT WHEN UP BUTTON DEPRESSED
4	L EXCEPT WHEN UP BUTTON DEPRESSED
5	L EXCEPT WHEN UP BUTTON DEPRESSED
6	H EXCEPT WHEN UP BUTTON DEPRESSED
7	L
8	H EXCEPT WHEN DOWN BUTTON DEPRESSED
9	L EXCEPT WHEN DOWN BUTTON DEPRESSED
10	L EXCEPT WHEN DOWN BUTTON DEPRESSED
11	L EXCEPT WHEN DOWN BUTTON DEPRESSED
12	H EXCEPT WHEN DOWN BUTTON DEPRESSED
13	H EXCEPT WHEN DOWN BUTTON DEPRESSED
14	H

TABLE 5-17 COUNTER IC-12 PCB-3

Channel #'s / PIN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
2	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H
3	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
4	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
5	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
6	L	L	L	H	H	H	H	L	L	L	L	H	H	H	H	L	L	L	L	H	H	H	H
7	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L
8	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
9	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
10	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
11	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
12	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
13	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
14	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
15	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
16	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

TABLE 5-18 COUNTER IC-13 PCB-3

Channel #'s / PIN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
2	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
3	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H
4	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
5	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
6	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
7	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
8	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
9	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
10	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
11	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
12	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
13	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
14	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
15	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
16	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

TABLE 5-19 IC-14 PCB-3

PIN #	
1	H EXCEPT L IN AUTO SCAN
2	H (L PULSES IN AUTO SCAN)
3	L EXCEPT H IN AUTO SCAN
4	L EXCEPT H IN AUTO SCAN
5	H (L PULSES IN AUTO SCAN)
6	H (L WITH H PULSED DURING AUTO SCAN)
7	L
8	H EXCEPT L IN AUTO SCAN
9	L EXCEPT H IN AUTO SCAN
10	L EXCEPT WHEN DOWN OR UP BUTTON DEPRESSED
11	L EXCEPT WHEN DOWN OR UP BUTTON DEPRESSED
12	H EXCEPT WHEN UP BUTTON DEPRESSED
13	H EXCEPT WHEN DOWN BUTTON DEPRESSED
14	H

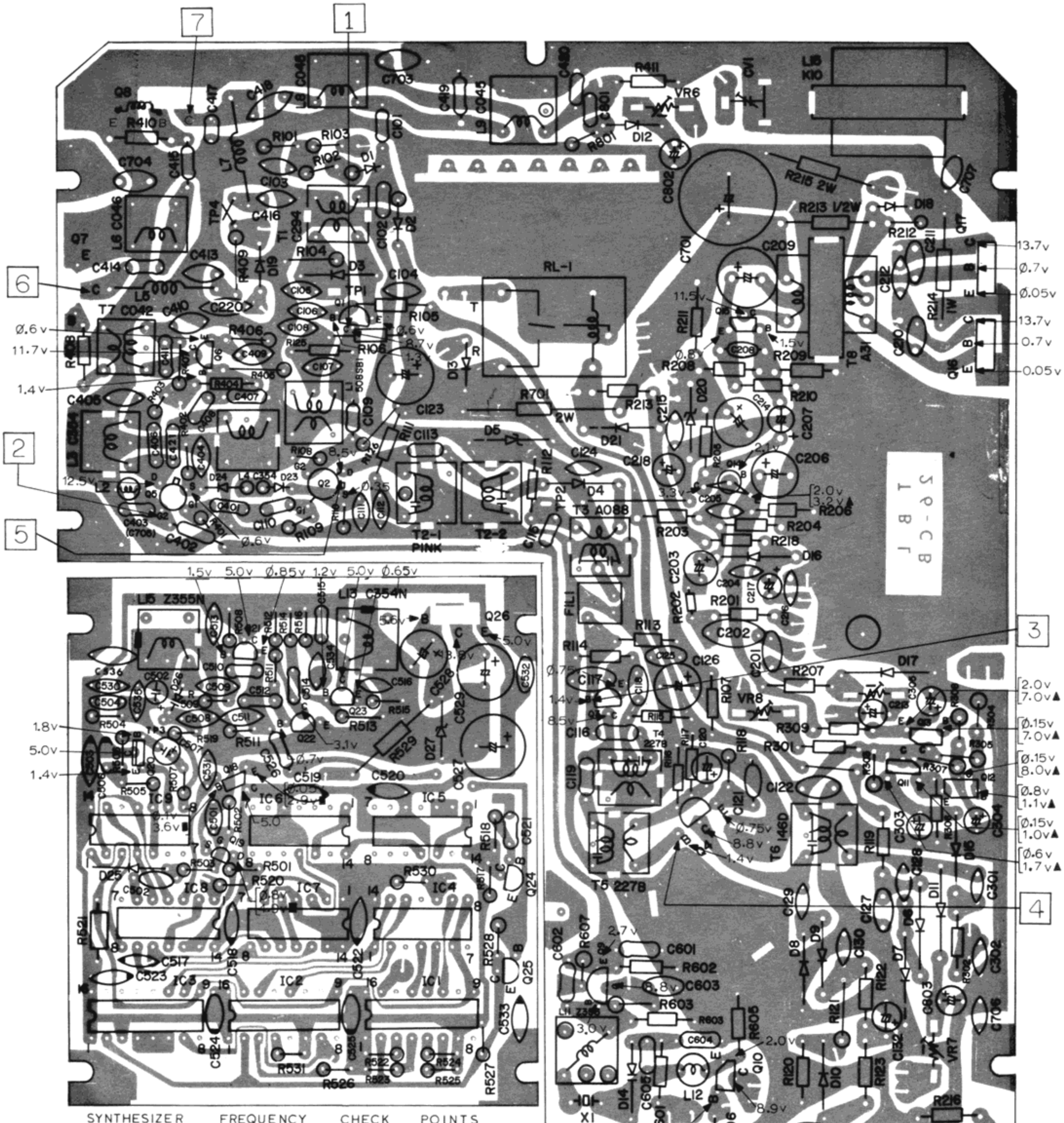
TABLE 5-20 ROM PROGRAM IC-16 PCB-3

Channel #'s / PIN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	L	H	L	L	H	L	H	H	L	H	L	L	H	L	H	H	L	H	L	L	H	L	H
2	H	L	L	H	L	L	H	L	L	H	H	L	H	H	L	H	H	L	L	H	L	L	L
3	H	H	H	L	L	L	H	H	H	L	L	L	H	H	H	L	L	L	L	H	H	H	L
4	H	H	H	H	H	H	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L
5	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L
6	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
7	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
8	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
9	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
10	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
11	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H
12	L	L	L	H	H	H	H	L	L	L	L	H	H	H	H	L	L	L	L	H	H	H	H
13	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L
14	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H
15	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
16	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

TABLE 5-21 ROM PROGRAM IC-17 PCB-3

Channel #'s / PIN #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	L	H	H	L	L	H	H	L	L	L	L	H	H	L	L	H	H	L	L	L	L	H	H
2	L	L	L	H	H	H	H	L	L	L	L	L	L	H	H	H	H	L	L	L	L	L	L
3	L	L	L	L	L	L	L	H	H	L	L	L	L	L	L	L	L	H	H	L	L	L	L
4	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	L	L	L	L
5	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H
6	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
7	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
8	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
9	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
10	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H
11	L	L	L	H	H	H	H	L	L	L	L	H	H	H	H	L	L	L	L	H	H	H	H
12	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L
13	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H
14	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
15	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
16	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

FIG. 5-22 COMPONENT LAYOUT PCB-1



SYNTHESIZER FREQUENCY CHECK POINTS

Collector Q24	10.24MHZ	IC 1 pin 11	1.03MHZ
Collector Q25	16.42MHZ	IC 2 pin 15	70KHZ
IC 1 pin 2	16.42MHZ	IC 2 pin 11	10.3KHZ
IC 1 pin 14	8.22MHZ	IC 5 pin 11	640KHZ
IC 1 pin 13	4.11MHZ	IC 6 pin 11	40KHZ
IC 1 pin 12	2.06MHZ	IC 7 pins 8&9	10KHZ

▲ FULLY SQUELCHED VOLTAGE

■ OUT-OF-LOCK VOLTAGE

SBE-32CB FORMULA D TOUCH/COM PARTS LIST

SYMBOL #	PART #	DESCRIPTION
C1	8000-00042-005	Capacitor, Fixed, 0.68mfd, 35V, Elect.
C2	8000-00004-047	Capacitor, Fixed, 10mfd, 16V, Elect.
C3	8000-00004-020	Capacitor, Fixed, 100pfd, Mica
C4	8000-00004-020	Capacitor, Fixed, 100pfd, Mica
C101	8000-00004-016	Capacitor, Fixed, 24pfd, Mica
C102	Not Used	
C103	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C104	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C105	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C106	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C107	8000-00012-011	Capacitor, Fixed, 30pfd, N330, Cer.
C108	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C109	8000-00004-021	Capacitor, Fixed, 47pfd, Mica
C110	8000-00011-008	Capacitor, Fixed, 5pfd, Mica
C111	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C112	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C113	8000-00011-012	Capacitor, Fixed, 1pfd, Mica
C114	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C115	8000-00004-041	Capacitor, Fixed, 150pfd, Mica
C116	8000-00011-012	Capacitor, Fixed, 1pfd, Mica
C117	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C118	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C119	8000-00004-007	Capacitor, Fixed, 10pfd, Mica
C120	8000-00038-015	Capacitor, Fixed, 4.7mfd, 25V, Elect.
C121	8000-00004-018	Capacitor, Fixed, 0.1mfd, Mylar
C122	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C123	8000-00004-044	Capacitor, Fixed, 220mfd, 16V, Elect.
C124	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C125	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C126	8000-00038-015	Capacitor, Fixed, 4.7mfd, 25V, Elect.
C127	8000-00004-018	Capacitor, Fixed, 0.1mfd, Mylar
C128	8000-00004-011	Capacitor, Fixed, 0.001mfd, Cer.
C129	8000-00004-011	Capacitor, Fixed, 0.001mfd, Cer.
C130	8000-00004-011	Capacitor, Fixed, 0.001mfd, Cer.
C131	8000-00004-203	Capacitor, Fixed, 0.02mfd, Mylar
C132	8000-00004-045	Capacitor, Fixed, 0.22mfd, Elect.
C133	8000-00004-047	Capacitor, Fixed, 10mfd, 16V, Elect.
C201	8000-00006-072	Capacitor, Fixed, 0.047mfd, Mylar
C202	8000-00006-072	Capacitor, Fixed, 0.047mfd, Mylar
C203	8000-00038-015	Capacitor, Fixed, 4.7mfd, 25V, Elect.
C204	8000-00004-011	Capacitor, Fixed, 0.001mfd, Cer.
C205	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C206	8000-00004-009	Capacitor, Fixed, 47mfd, 16V, Elect.
C207	8000-00024-087	Capacitor, Fixed, 1mfd, 50V, Elect.
C208	8000-00004-018	Capacitor, Fixed, 0.1mfd, Mylar
C209	8000-00004-044	Capacitor, Fixed, 220mfd, 16V, Elect.
C210	8000-00011-007	Capacitor, Fixed, 0.005mfd, Mylar
C211	8000-00011-007	Capacitor, Fixed, 0.005mfd, Mylar
C212	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C213	8000-00024-087	Capacitor, Fixed, 1mfd, 50V, Elect.

SYMBOL #	PART #	DESCRIPTION
C214	8000-00004-009	Capacitor, Fixed, 47mfd, 16V, Elect.
C215	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C216	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C217	8000-00004-045	Capacitor, Fixed, 0.22mfd, Elect.
C218	8000-00004-047	Capacitor, Fixed, 10mfd, 16V, Elect.
C219	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C220	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C301	8000-00004-011	Capacitor, Fixed, 0.001mfd, Cer.
C302	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C303	8000-00024-087	Capacitor, Fixed, 1mfd, 50V, Elect.
C304	8000-00024-087	Capacitor, Fixed, 1mfd, 50V, Elect.
C305	8000-00004-047	Capacitor, Fixed, 10mfd, 16V, Elect.
C401	8000-00004-002	Capacitor, Fixed, 15pfd, Mica
C402	8000-00004-021	Capacitor, Fixed, 47pfd, Mica
C405	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C406	8000-00004-024	Capacitor, Fixed, 30pfd, Mica
C407	8000-00004-017	Capacitor, Fixed, 500pfd, Mica
C408	8000-00004-026	Capacitor, Fixed, 40pfd, Mica
C409	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C410	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C411	8000-00038-012	Capacitor, Fixed, 130pfd, Mica
C413	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C414	8000-00004-006	Capacitor, Fixed, 24pfd, Mica
C415	8000-00004-020	Capacitor, Fixed, 100pfd, Mica
C416	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C418	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C419	8000-00004-027	Capacitor, Fixed, 220pfd, Mica
C420	8000-00038-013	Capacitor, Fixed, 160pfd, Mica
C421	8000-00011-012	Capacitor, Fixed, 1pfd, Mica
C422	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C501	8000-00004-203	Capacitor, Fixed, 0.02mfd, Mylar
C502	8000-00004-011	Capacitor, Fixed, 0.001mfd, Cer.
C503	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C504	8000-00006-072	Capacitor, Fixed, 0.047mfd, Mylar
C505	8000-00004-045	Capacitor, Fixed, 0.22mfd, Elect.
C506	8000-00004-203	Capacitor, Fixed, 0.02mfd, Mylar
C507	8000-00004-042	Capacitor, Fixed, 1.0mfd, Elect.
C508	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C509	8000-00030-006	Capacitor, Fixed, 20pfd, N750, Cer.
C510	8000-00004-020	Capacitor, Fixed, 100pfd, Mica
C511	8000-00038-014	Capacitor, Fixed, 47pfd, N470, Cer.
C512	8000-00011-008	Capacitor, Fixed, 5pfd, Mica
C513	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C514	8000-00011-008	Capacitor, Fixed, 5pfd, Mica
C515	8000-00004-020	Capacitor, Fixed, 100pfd, Mica
C516	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C517	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C518	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C519	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C520	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C521	8000-00004-021	Capacitor, Fixed, 47pfd, Mica
C522	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.

SYMBOL #	PART #	DESCRIPTION
C523	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C524	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C525	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C526	8000-00004-024	Capacitor, Fixed, 30pfd, Mica
C527	8000-00032-003	Capacitor, Fixed, 470mfd, 16V, Elect.
C528	8000-00004-046	Capacitor, Fixed, 100mfd, 16V, Elect.
C529	8000-00004-044	Capacitor, Fixed, 220mfd, 16V, Elect.
C530	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C531	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C532	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C533	Not Used	
C534	8000-00004-011	Capacitor, Fixed, 0.001mfd, Cer.
C535	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C536	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C537	8000-00006-080	Capacitor, Fixed, 0.04mfd, Cer.
C601	8000-00004-041	Capacitor, Fixed, 150pfd, Mica
C602	8000-00006-061	Capacitor, Fixed, 330pfd, Mica
C603	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C604	8000-00004-041	Capacitor, Fixed, 150pfd, Mica
C605	8000-00004-002	Capacitor, Fixed, 15pfd, Mica
C701	8000-00004-049	Capacitor, Fixed, 1000mfd, 16V, Elect.
C702	8000-00004-048	Capacitor, Fixed, 0.001mfd, Feed Thru
C703	8000-00004-018	Capacitor, Fixed, 0.1mfd, Mylar
C704	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C705	Not Used	
C706	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C707	8000-00004-003	Capacitor, Fixed, 0.04mfd, Mylar
C708	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C709	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C801	8000-00011-008	Capacitor, Fixed, 5pfd, Mica
C802	8000-00024-087	Capacitor, Fixed, 1mfd, 50V, Elect.
C803	8000-00024-087	Capacitor, Fixed, 1mfd, 50V, Elect.
C901	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C902	8000-00004-018	Capacitor, Fixed, 0.1mfd, Mylar
C903	8000-00011-002	Capacitor, Fixed, 2.2mfd, 16V, Elect.
C904	8000-00011-002	Capacitor, Fixed, 2.2mfd, 16V, Elect.
C905	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
C906	8000-00004-001	Capacitor, Fixed, 0.01mfd, Cer.
CR1	8000-00042-014	PUT, NT102
CR2	8000-00042-015	SCR, CRO2AM-1
CV-1	8000-00004-204	Capacitor, Var., 10pfd, Trimmer, Cer.
D1	8000-00038-008	Diode, WG713
D2	8000-00038-008	Diode, WG713
D3	Not Used	
D4	8000-00038-009	Diode, 1N60FM
D5	8000-00011-043	Diode, BZ090
D6	8000-00038-009	Diode, 1N60FM
D7	8000-00038-008	Diode, WG713
D8	8000-00038-009	Diode, 1N60FM

SYMBOL #	PART #	DESCRIPTION
D9	8000-00038-009	Diode, 1N60FM
D10	8000-00004-064	Diode, 1S84
D11	8000-00038-009	Diode, 1N60FM
D12	8000-00038-009	Diode, 1N60FM
D13	8000-00038-008	Diode, WG713
D14	8000-00011-166	Diode, 1S2688
D15	8000-00038-009	Diode, 1N60FM
D16	8000-00038-009	Diode, 1N60FM
D17	8000-00004-060	Diode, 1N34A
D18	8000-00011-045	Diode, 1S1211
D19	8000-00030-010	Diode, 1N4002
D20	8000-00011-043	Diode, BZ090
D21	8000-00038-008	Diode, WG713
D22	8000-00030-010	Diode, 1N4002
D23	8000-00038-008	Diode, WG713
D24	8000-00038-008	Diode, WG713
D25	8000-00038-008	Diode, WG713
D26	8000-00038-010	Diode, MV201
D27	8000-00004-239	Diode, 1S331
D28	8000-00042-007	Diode, 1N4448
D29	8000-00042-007	Diode, 1N4448
D30	8000-00004-060	Diode, 1N34A
D31	8000-00004-060	Diode, 1N34A
D32	8000-00004-060	Diode, 1N34A
D901	8000-00038-009	Diode, 1N60FM
D902	8000-00038-009	Diode, 1N60FM
FIL-1	8000-00004-139	Ceramic Filter, LFB-6, 455 KHz
IC1	8000-00038-003	Integrated Circuit, F9316PC
IC2	8000-00038-003	Integrated Circuit, F9316PC
IC3	8000-00038-003	Integrated Circuit, F9316PC
IC4	8000-00038-005	Integrated Circuit, 74H22/9H22
IC5	8000-00038-006	Integrated Circuit, 7493/9393
IC6	8000-00038-006	Integrated Circuit, 7493/9393
IC7	8000-00038-007	Integrated Circuit, F7474PC
IC8	8000-00038-004	Integrated Circuit, 7400/9N00
IC9	8000-00038-002	Integrated Circuit, MC4044P
IC10	8000-00042-008	Integrated Circuit, M53200P
IC11	8000-00042-008	Integrated Circuit, M53200P
IC12	8000-00042-008	Integrated Circuit, M53393P
IC13	8000-00042-011	Integrated Circuit, M53393P
IC14	8000-00042-008	Integrated Circuit, M53200P
IC15	8000-00042-008	Integrated Circuit, M53200P
IC16	8000-00042-012	Integrated Circuit, M54730P
IC17	8000-00042-010	Integrated Circuit, M53385P
IC18	8000-00042-009	Integrated Circuit, M53210P
J1	8000-00004-069	Connector, Ant., SO-239
J2	8000-00030-021	Jack, External Speaker
J3	8000-00030-021	Jack, PA

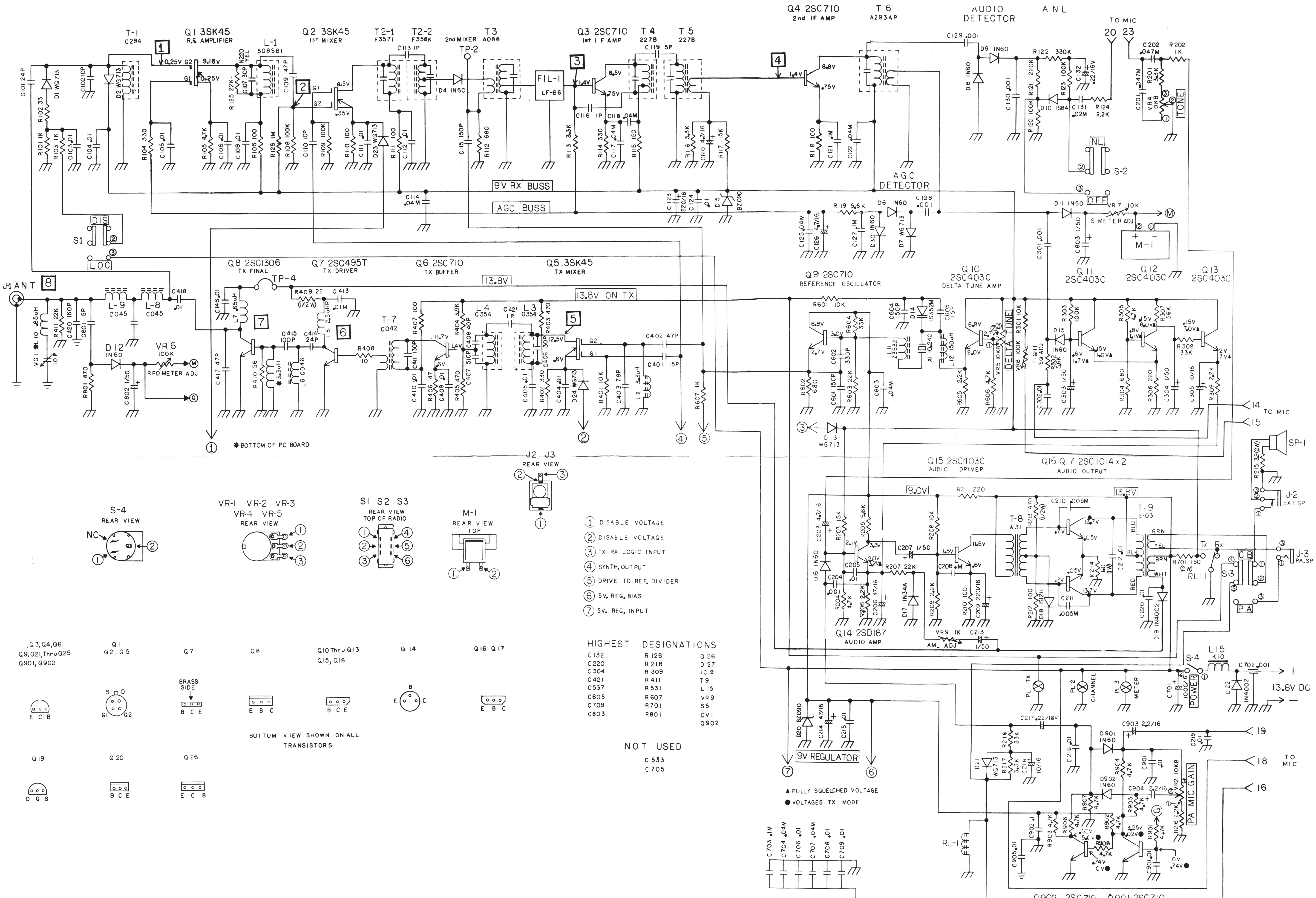
SYMBOL #	PART #	DESCRIPTION
L1	8000-00038-016	Coil, 508SB1
L2	Not Used	
L3	8000-00038-017	Coil, C354N
L4	8000-00038-017	Coil, C354N
L5	8000-00030-011	Choke Coil, RF, 2.5μh
L6	8000-00004-078	Coil, C046ZD
L7	8000-00004-055	Choke HF, 0.65μh
L8	8000-00004-077	Coil, C045ZD
L9	8000-00004-077	Coil, C045ZD
L10	8000-00004-059	Choke Coil, 0.85μh
L11	8000-00038-022	Coil, Z353ZZ
L12	8000-00004-057	Choke Coil, 150μh
L13	8000-00038-017	Coil, C354N
L14	8000-00038-023	Coil, Z355N
L15	8000-00030-012	Transformer, K-10
M1	8000-00030-029	Meter, A-36
PL1	8000-00004-142	Lamp, 16V, 40ma
PL3	8000-00011-056	Lamp, 12V, 70ma
Q1	8000-00042-013	Transistor, 3SK45B
Q2	8000-00011-053	Transistor, 3SK45B
Q3	8000-00011-047	Transistor, 2SC710C
Q4	8000-00011-047	Transistor, 2SC710C
Q5	8000-00011-053	Transistor, 3SK45B
Q6	8000-00011-047	Transistor, 2SC710C
Q7	8000-00004-089	Transistor, 2SC495T
Q8	8000-00038-001	Transistor, 2SC1306
Q9	8000-00011-047	Transistor, 2SC710C
Q10	8000-00030-007	Transistor, 2SC403C
Q11	8000-00030-007	Transistor, 2SC403C
Q12	8000-00030-007	Transistor, 2SC403C
Q13	8000-00030-007	Transistor, 2SC403C
Q14	8000-00030-009	Transistor, 2SD187R or Y
Q15	8000-00030-007	Transistor, 2SC403C
Q16	8000-00004-087	Transistor, 2SC1014C1
Q17	8000-00004-087	Transistor, 2SC1014C1
Q18	8000-00030-007	Transistor, 2SC403C
Q19	8000-00010-017	Transistor, 2SK30GR
Q20	8000-00011-049	Transistor, 2SC458LGC
Q21	8000-00011-047	Transistor, 2SC710C
Q22	8000-00011-047	Transistor, 2SC710C
Q23	8000-00011-047	Transistor, 2SC710C
Q24	8000-00011-047	Transistor, 2SC710C
Q25	8000-00011-047	Transistor, 2SC710C
Q26	8000-00011-050	Transistor, 2SC1061C
Q27	8000-00011-047	Transistor, 2SC710C
Q901	8000-00011-047	Transistor, 2SC710C
Q902	8000-00011-047	Transistor, 2SC710C
R214	8000-00042-001	Resistor, Fixed, 0.5Ω, 1 watt, Oxide Film
R532	8000-00042-004	Resistor, Fixed, 3.9Ω, 5 watt, Enamel

SYMBOL #	PART #	DESCRIPTION
RL1	8000-00030-022	Relay, HTC-12VDC
S1	8000-00038-032	Switch, Slide, 2PDT
S2	8000-00038-032	Switch, Slide
S3	8000-00038-032	Switch, Slide
S4	Part of VR-1	
SP1	8000-00038-036	Speaker, 8Ω
T1	8000-00038-018	Transformer, C294DD
T2-1	8000-00038-019	Transformer, F3571
T2-2	8000-00038-020	Transformer, F001AS
T3	8000-00030-018	Transformer, A088AT
T4	8000-00012-034	Transformer, EIA227B
T5	8000-00012-034	Transformer, EIA227B
T6	8000-00038-021	Transformer, A293AP
T7	8000-00030-016	Transformer, C042DD
T8	8000-00030-019	Transformer, A-31
T9	8000-00012-037	Transformer, E-03
VR1	Part of Control/Micro Switch Assembly	
VR2	8000-00042-003	Res., Var., 10K x 10KΩ, w/sw
VR3	Part of Control/Micro Switch Assembly	
VR4	8000-00030-002	Res., Var., 10KΩ
VR5	8000-00030-002	Res., Var., 10KΩ
VR6	8000-00004-094	Res., Var., 100KΩ
VR7	8000-00004-097	Res., Var., 10KΩ
VR8	8000-00004-094	Res., Var., 100KΩ
VR9	8000-00011-082	Res., Var., 1KΩ
X1	8000-00038-011	Crystal, HC25U, 10.240 MHz
	8000-00004-151	Fuse Holder
	8000-00030-023	Feed Through Bracket
	8000-00030-031	Clamper f/cord
	8000-00038-024	Heat Sink, C1678
	8000-00038-028	Mounting Bracket
	8000-00038-034	PL Assembly
	8000-00038-035	Knob delta tune
	8000-00038-038	Rubber f/meter
	8000-00038-039	Grommet
	8000-00038-042	Clamp, f/speaker
	8000-00042-016	Terminal Plate, 3P large
	8000-00042-017	Connector with wire, 24P
	8000-00042-018	PCB for plastic hinge
	8000-00042-019	Mounting for cord stopper
	8000-00042-020	Mounting for VR
	8000-00042-021	Bezel, Front
	8000-00042-022	Panel, Front
	8000-00042-023	Plate, FCC name
	8000-00042-024	Cabinet
	8000-00042-025	Microphone

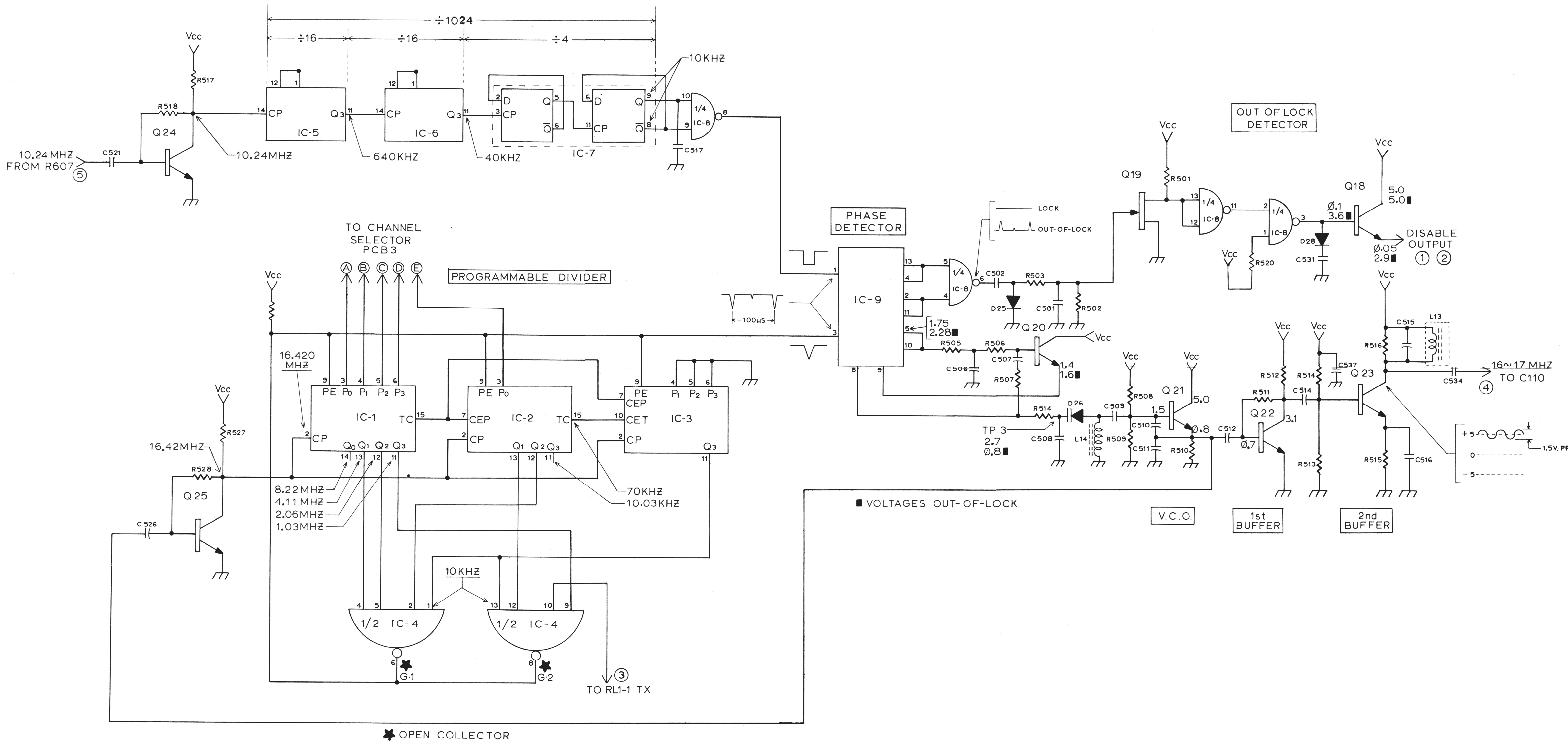
SYMBOL #	PART #	DESCRIPTION
	8000-00042-026	Styrofoam
	8000-00042-028	Heat Sink Plate
	8000-00042-029	Bushing, Rubber, 13 inch
	8000-00042-030	Mounting for meter
	8000-00042-031	Rivet, (black) NY
	8000-00042-032	Board, PA Gain P.C.
	8000-00042-033	Board, P.C.
	8000-00009-026	Fuse 3A

TOUCH-COM MICROPHONE
PART LIST

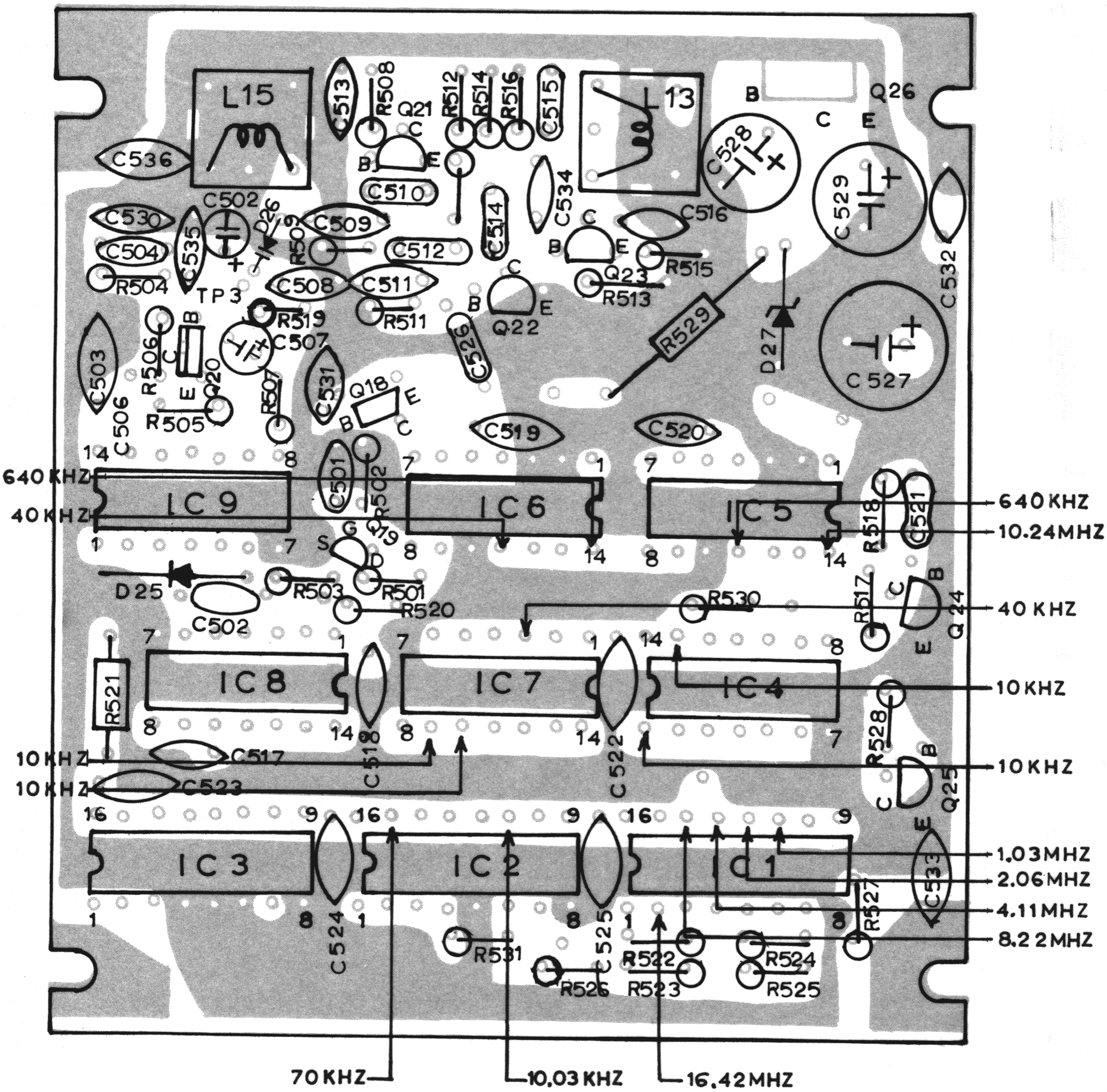
	8000-00042-034	Microphone Case, Rear w/hanger
	8000-00042-035	Microphone Switch
	8000-00042-036	Control/Micro Switch Assembly
	8000-00042-037	Amplifier, Complete
	8000-00042-038	Element Cushion
	8000-00042-039	Element w/cover
	8000-00042-040	Element Dust Cover
	8000-00042-041	Element Screen
	8000-00042-042	Microphone Case, Front
	8000-00042-043	Push to Talk Button
	8000-00042-044	Switch Knob w/spring (DN)
	8000-00042-045	Switch Knob w/spring (UP)
	8000-00042-046	Case Screw
	8000-00042-047	Screw
	8000-00042-048	Coiled Cord
	8000-00042-049	Wire
	8000-00042-050	Tube



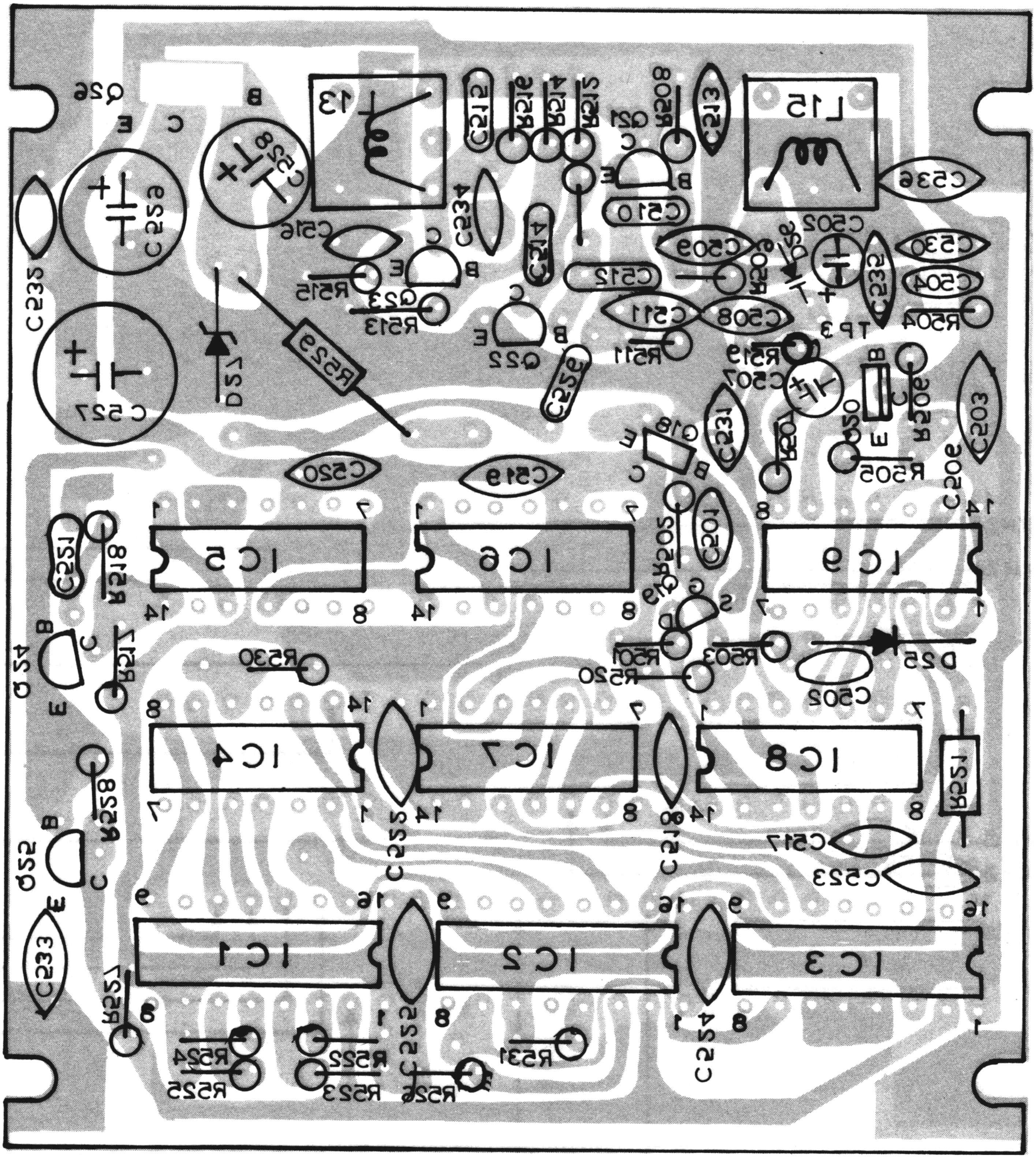
T-1 C294
Q1 3SK45 R.F. AMPLIFIER
L-1 508SB1
Q2 3SK45 1st MIXER
T2-1 F357I
T2-2 F358K
2nd MIXER TP-2
T3 A088
FIL-1 LF-B6
Q3 2SC710 1st I F AMP
T4 227B
T5 227B
Q4 2SC710 2nd IF AMP
T6 A293AP
AUDIO DETECTOR
ANL
TO MIC
TONE
NL
S-2
OFF
9V RX BUSS
AGC BUSS
AGC DETECTOR
S METER ADJ
M-1
DIS
S1
LOC
J1 ANT
Q8 2SC1306 TX FINAL
TP-4
Q7 2SC495T TX DRIVER
Q6 2SC710 TX BUFFER
Q5 3SK45 TX MIXER
13.8V
13.8V ON TX
Q9 2SC710 REFERENCE OSCILLATOR
Q10 2SC403C DELTA TUNE AMP
Q11 2SC403C
Q12 2SC403C
Q13 2SC403C
DELTA TUNE
TIGHT SQ ADJ
VR6 100K RF0 METER ADJ
* BOTTOM OF PC BOARD
J2 J3 REAR VIEW
S-4 REAR VIEW
VR-1 VR-2 VR-3 VR-4 VR-5 REAR VIEW
S1 S2 S3 REAR VIEW TOP OF RADIO
M-1 REAR VIEW TOP
1 DISABLE VOLTAGE
2 DISABLE VOLTAGE
3 TX RX LOGIC INPUT
4 SYNTH. OUTPUT
5 DRIVE TO REF. DIVIDER
6 5V. REG. BIAS
7 5V. REG. INPUT
HIGHEST DESIGNATIONS
C132 R126 Q26
C220 R218 D27
C304 R309 IC9
C421 R411 T9
C537 R531 L15
C605 R607 VR9
C709 R701 S5
C803 R801 CV1
Q902
NOT USED
C533
C705
Q3, Q4, Q6 Q9, Q21, Thru Q25 Q901, Q902
Q1 Q2, Q5
Q7
Q8
Q10 Thru Q13 Q15, Q18
Q14
Q16 Q17
BRASS SIDE
BOTTOM VIEW SHOWN ON ALL TRANSISTORS
Q19
Q20
Q26
Q15 2SC403C AUDIO DRIVER
Q16 Q17 2SC1014 x 2 AUDIO OUTPUT
9.0V
13.8V
T-8 A31
T-9 E-03
Q14 2SD187 AUDIO AMP
AM. ADJ
SP-1
J-2 EXT. SP
J-3 PA. SP
CB
PA
S-3
RL1-1
S-4
L15 K10
13.8V DC
POWER
CHANNEL
METER
9V REGULATOR
▲ FULLY SQUELCHED VOLTAGE
● VOLTAGES TX MODE
PA MIC GAIN
RL-1
Q902 2SC710 Q901 2SC710



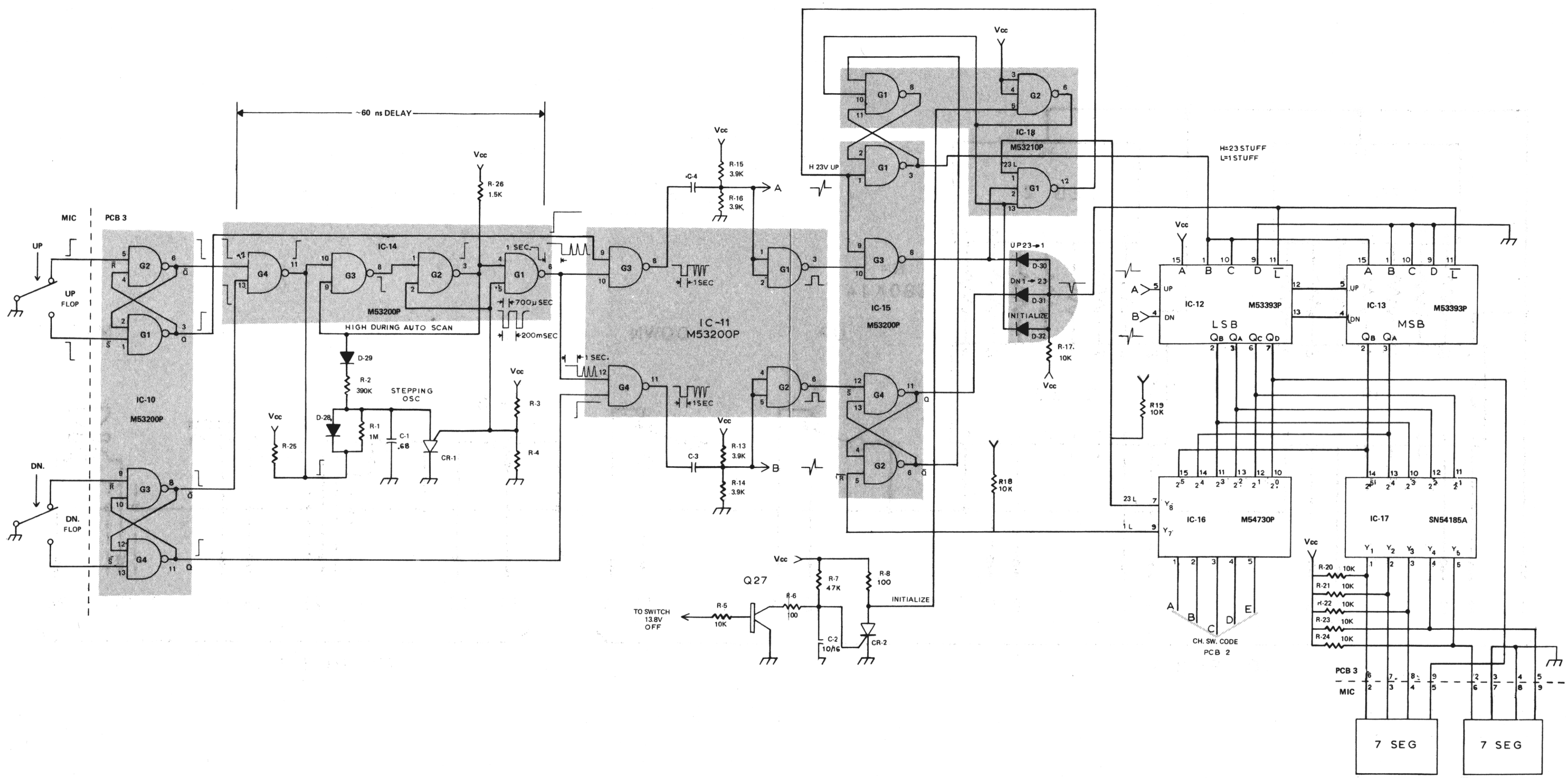
÷1024
÷16
÷16
÷4
Vcc
R517
R518
Q24
10.24 MHZ
FROM R607 ⑤
C521
10.24MHZ
IC-5
IC-6
IC-7
640KHZ
40KHZ
10KHZ
1/4 IC-8
C517
PHASE
DETECTOR
IC-9
100μS
LOCK
OUT-OF-LOCK
OUT OF LOCK
DETECTOR
Q19
R501
Q18
5.0
5.0■
Ø.1
3.6■
Ø.05
2.9■
DISABLE
OUTPUT
① ②
D28
C531
R520
C502
R503
D25
C501
R502
Q 20
1.75
2.28■
R505
R506
C506
C507
R507
1.4
1.6■
TO CHANNEL
SELECTOR
PCB3
PROGRAMMABLE DIVIDER
16.420
MHZ
IC-1
IC-2
IC-3
8.22MHZ
4.11MHZ
2.06MHZ
1.03MHZ
70KHZ
10.03KHZ
16.42MHZ
R527
R528
Q25
C 526
10KHZ
1/2 IC-4
1/2 IC-4
G-1
G-2
TO RL1-1 TX
OPEN COLLECTOR
■ VOLTAGES OUT-OF-LOCK
TP 3
2.7
Ø.8■
R514
D26
C509
C508
L14
R509
R508
C510
C511
Q 21
1.5
5.0
Ø.8
R510
C512
Q 22
Ø.7
3.1
R511
R512
R513
C514
R514
C537
Q 23
R516
C515
L13
C534
16~17 MHZ
TO C110
④
R515
C516
+5
0
−5
1.5V. PP
V.C.O.
1st
BUFFER
2nd
BUFFER



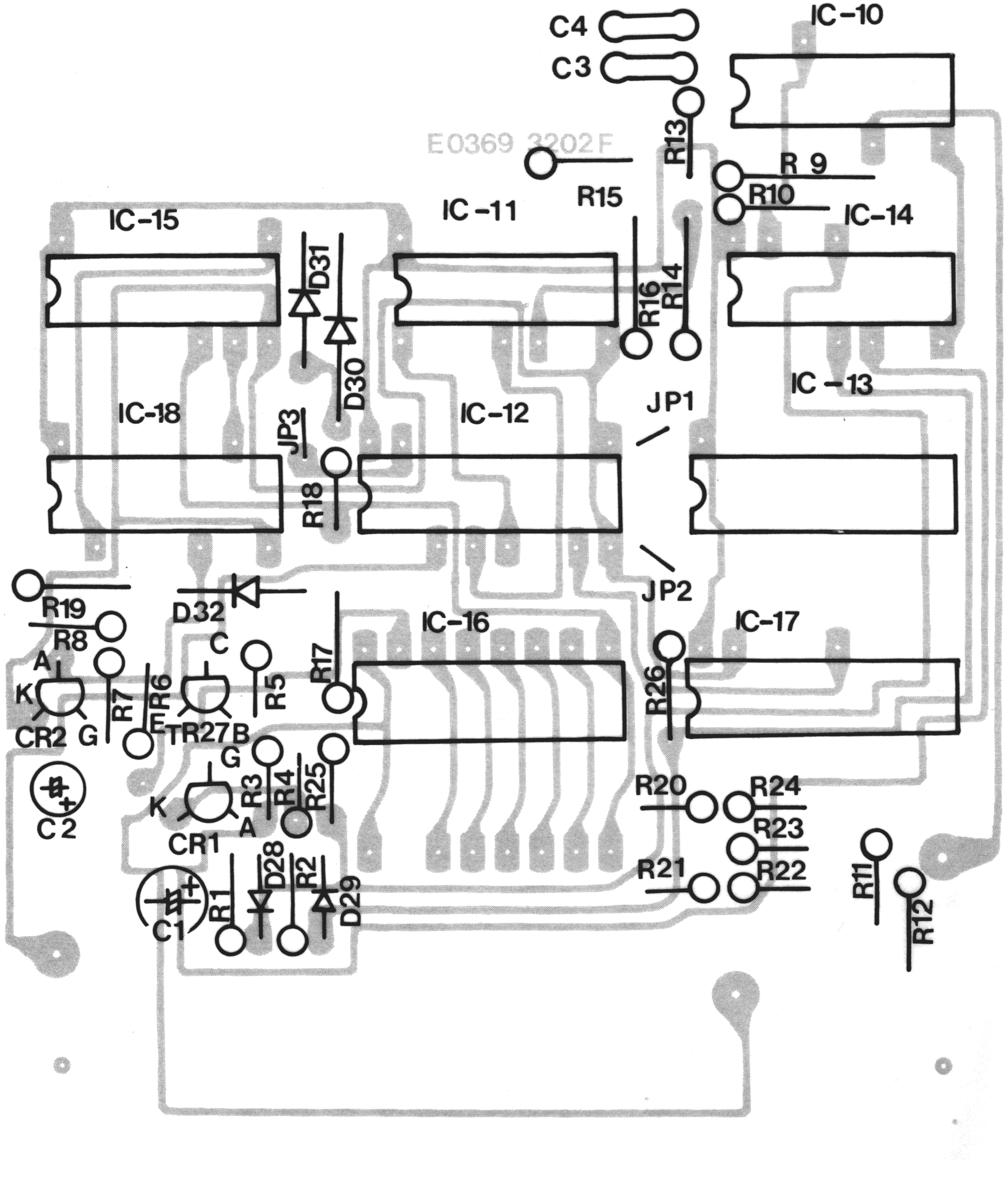
L15
L13
Q26
Q21
Q22
Q23
Q18
Q19
Q20
Q24
Q25
C536
C530
C504
C502
C535
C509
C510
C512
C508
C511
C513
C515
C514
C534
C516
C528
C529
C532
C527
C503
C506
C507
C531
C526
C519
C520
C501
C521
C517
C523
C518
C522
C524
C525
C533
R504
R505
R506
R507
R508
R509
R511
R512
R513
R514
R515
R516
R517
R518
R519
R501
R502
R503
R520
R521
R522
R523
R524
R525
R526
R527
R528
R529
R530
R531
D25
D26
D27
TP3
IC9
IC6
IC5
IC8
IC7
IC4
IC3
IC2
IC1
640KHZ
40KHZ
640KHZ
10.24MHZ
40KHZ
10KHZ
10KHZ
10KHZ
10KHZ
1.03MHZ
2.06MHZ
4.11MHZ
8.22MHZ
70KHZ
10.03KHZ
16.42MHZ



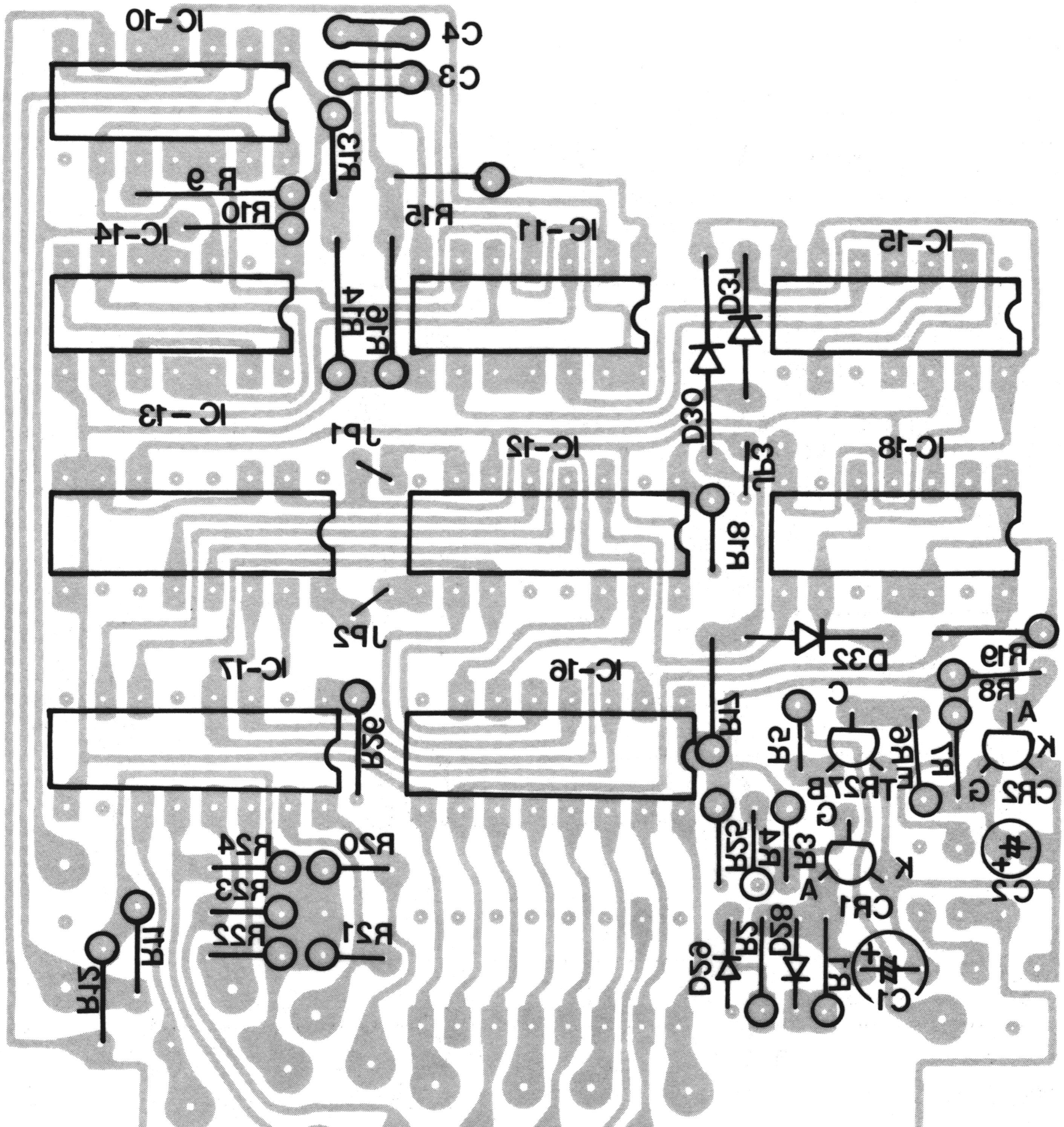
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
L15
D25
D27
C527
C529
C536
C502
R529

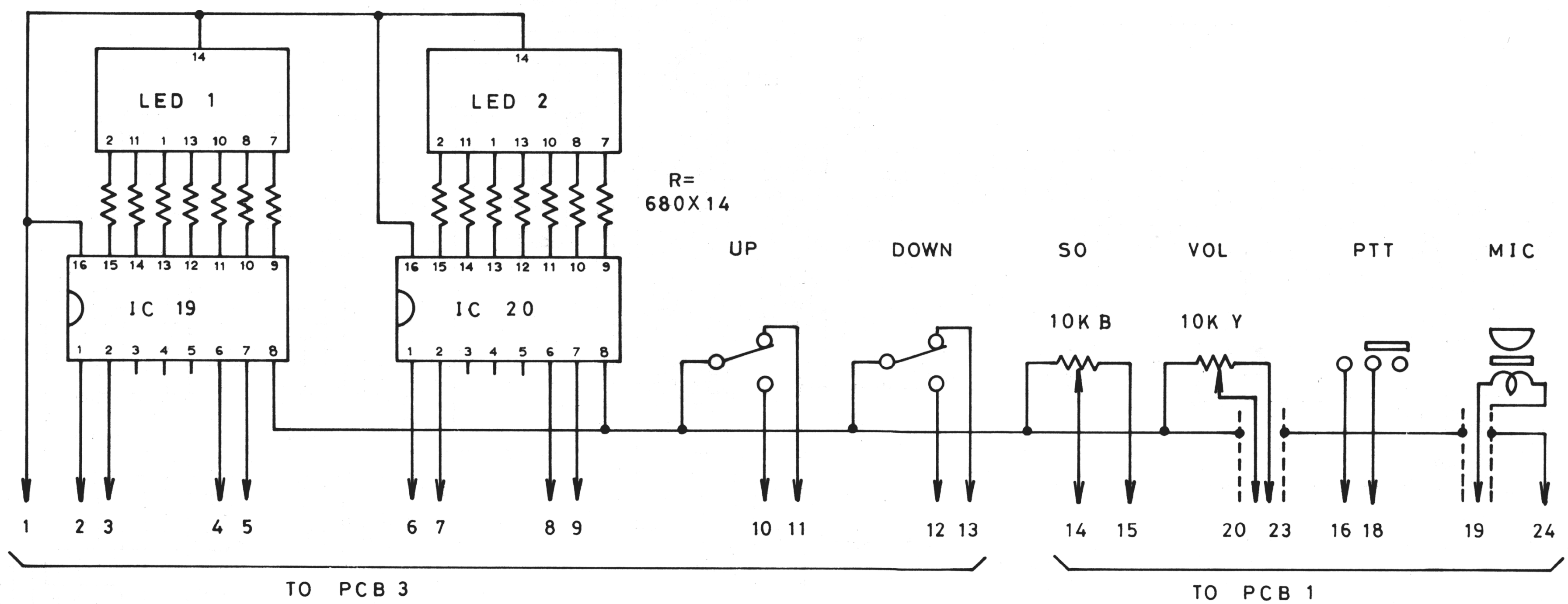


SBE-32CB CHANNEL SELECTOR
SCHEMATIC DIAGRAM



C4
C3
IC-10
E0369 3202F
R13
R 9
R10
R15
IC-15
IC -11
IC-14
D31
R16
R14
D30
IC-18
IC-12
JP1
IC -13
JP3
R18
JP2
R19
D32
IC-16
IC-17
R8
C
R17
A
K
R7
R6
R5
R26
CR2
G
E
TR27
B
G
R20
R24
R3
R4
R25
C2
K
A
R23
CR1
R21
R22
R11
R12
D28
R2
R1
D29
C1


IC-10
C4
C3
R13
R 9
R10
IC-14
R15
IC-11
IC-15
D31
R14
R16
D30
IC-13
JP1
IC-12
IC-18
JP3
R18
JP2
D32
R19
IC-17
IC-16
R17
R8
C
A
R26
R5
R6
R7
K
TR27B
G
CR2
R25
R4
R3
G
R24
R20
K
C2
R23
A
CR1
R22
R21
R11
R12
D29
R2
D28
R1
C1
E0369 3201F



LED 1
LED 2
14
2 11 1 13 10 8 7
R=
680X14
16 15 14 13 12 11 10 9
IC 19
IC 20
1 2 3 4 5 6 7 8
UP
DOWN
SO
VOL
PTT
MIC
10K B
10K Y
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 20 23 16 18 19 24
TO PCB 3
TO PCB 1