SBE Brute Service Manual

BRUTE

MODEL SBE-34CB

SERVICE MANUAL

SBE®

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ILLUSTRATIONS

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

Compliance	F.C.C. Type Accepted (Part 95, Class D)
Channels	23
Frequency Range	(26.965 - 27.255) MHz
Frequency Control	Crystals, Synthesized
Frequency Tolerance	±0.003%
Operating Temperature Range	-20°C to + 50°C
Humidity	95%
Input Voltage	(11.7 - 15.9) VDC positive or negative ground
Microphone	Dynamic
Size	2½"H (60mm), 6¾"W (170mm), 9-3/8"D (240mm)
Weight	2.2 lbs., 1.0 Kg.
PA Output	2 watts into an external 8Ω speaker
Power Consumption	13.8 VDC Receive (squelched) 0.2 amps Receive (2 watts audio) 0.35 amps Transmit (95% modulation) 1.4 amps
Fuse	2 amp fast blow (Type 3AG or A.G.C.)

2.2 RECEIVER

Sensitivity	0.7 uV for 10 db S+N/N ratio
Selectivity	6 db @ ±5 KHz, 40 db @ ±20 KHz, 50 db @ ±40 KHz
IF Frequency	455 KHz
AGC Response	Less than 10 db for 10 - 100,000 uV
Squelch Threshold	Less than 0.7 uV
Audio Power Output	2 watts @ 10% distortion

External Speaker	(Not Supplied) 4 or 8Ω. Disables internal speaker when connected.
Squelch Range	200 uV (Minimum)

2.3 TRANSMITTER

Power Output	4 watts (Maximum)
Modulation	95 - 100%
Modulator Response	300 - 2500 Hz
Output Impedance	50Ω, unbalanced
Emission	6A3

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-34CB 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 INTRODUCTION

The SBE-34CB is an AM transceiver with a single-conversion receiver using an intermediate frequency of 455 KHz.

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

With the PA/CB switch (S3) in CB, the unit will operate as a Citizen Band transceiver.

TRANSMIT MODE is initiated by pressing the push-to-talk switch which:

disables the RF AMP (Q1 and Q2), the IF AMP (Q4), and the first stage of audio (Q5),

disables the CB SPEAKER by opening its ground return,

energizes PL2 – the red transmit indicator lamp,

forward biases D9 – the transmitter crystal switching diode,

enables the MIC AMP by grounding the emitter circuit of Q11 through D12,

biases D1 to protect Q1 – the 1st RF AMP.

RECEIVE MODE is initiated by releasing the push-to-talk switch which:

enables the RF AMP (Q1 and Q2), the IF AMP (Q4), and the first stage of audio (Q5),

enables the CB SPEAKER by closing its ground return,

enables the RF AMP (Q1 and Q2), the IF AMP (Q4), and the first stage of audio (Q5),

forward biases D10 – the receiver crystal switching diode,

disables the MIC AMP by lifting the emitter circuit of Q11.

PA MODE is initiated by placing the PA/CB switch (S3) in PA which:

disables the transmitter RF,

disables the CB SPEAKER,

enables the PA speaker jack, J3.

The push-to-talk switch then enables the MIC AMP.

4.2 RECEIVER

GENERAL

In the 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 mixer – where it is mixed with an injection signal 455 KHz above the receive channel frequency. The ceramic filter F1 selects the 455 KHz converted signal to be fed to the 1st and 2nd IF amplifiers Q3 and Q4. The amplified IF signal is then detected by D3 which also develops the AGC voltage. After passing through the automatic noise limiter, which will be discussed separately, the detected audio signal is applied across potentiometer VR1 – the volume control. The audio signal

developed on the VR1 wiper is then fed to audio amplifier stage Q5 which then feeds Q12. The output of Q12 is transformer coupled to push-pull speaker driver amplifier Q13 and Q14.

AUTOMATIC GAIN CONTROL CIRCUIT

The AGC (Automatic Gain Control) on the SBE-34CB reduces the gain of the RF and IF amplifiers in response to a strong signal by lowering their bias voltage. The rectified output of D3 is filtered by R20 and C22 to produce the AGC voltage which is then fed to the bases of Q1 by R4, Q2 by R7, and Q3 by R12.

AUTOMATIC NOISE LIMITER CIRCUIT

The ANL circuit prevents impulse noise, such as ignition noise, from being amplified. The audio output voltage from the detector diode D3 is halved by the voltage divider R22 and R23 and fed to the anode of D4 – the ANL diode. The audio output from D3 is also fed through R24 to C25 where it is filtered and then through R25 to the cathode of D4. Since the audio signal is negative, the signal at the cathode of D4 is normally more negative than the anode and the diode is forward biased providing a low impedance path for the audio to the first audio stage, Q5. When a noise pulse appears in the output of the detector, the time constant of R24 and C25 prevents the cathode of D4 from responding as fast as the anode. The anode of D4 is thus driven more negative than the cathode causing D4 to become backed biased. D4 then becomes a high impedance that blocks the noise.

SQUELCH CIRCUIT

The squelch circuit turns the audio off when the received signal is less than the threshold level as determined by the squelch control – VR2. If Q6 is off, R36, R34 and R27 form a voltage divider network that provides the proper forward bias to the base of Q5 permitting it to amplify the audio signal. Raising the wiper on VR2 tends to forward bias the base of Q6 which turns Q6 on. When Q6 is on, the bias is removed from the base of Q5 – the 1st audio stage – thus preventing amplification of the audio signal. As the received signal becomes stronger, the AGC voltage lowers the bias on the base of Q3 thus lowering its emitter voltage. This emitter voltage feeds the base of Q6 through R35. Lowering the base voltage on Q6 turns it off permitting Q5 to amplify audio. Thus raising the wiper on VR2 increases the threshold level a signal must overcome to turn Q6 off and permit Q5 to amplify audio.

4.3 TRANSMITTER

GENERAL

In transmit mode, the outputs of oscillators Q7 and Q9 are mixed in the TX MIXER Q10. The output of Q10 is then fed through BAND PASS FILTER L10, L11, and L12 (26.965 - 27.255 MHz) to the TX BUFFER Q16. The output of the BUFFER feeds the DRIVER Q17 which in turn feeds the RF POWER AMP Q18. The output of the RF POWER AMP is then fed through a low pass filter, L17, L18 and L19, and a second harmonic trap, C9 and L20, to the antenna. Modulation is accomplished by driving the collector of the RF POWER AMP Q18 through L16 and the collector of the TX DRIVER Q17 through R91 and L14 by the AUDIO OUTPUT AMP (Q13 and Q14).

OVERMODULATION CONTROL CIRCUIT

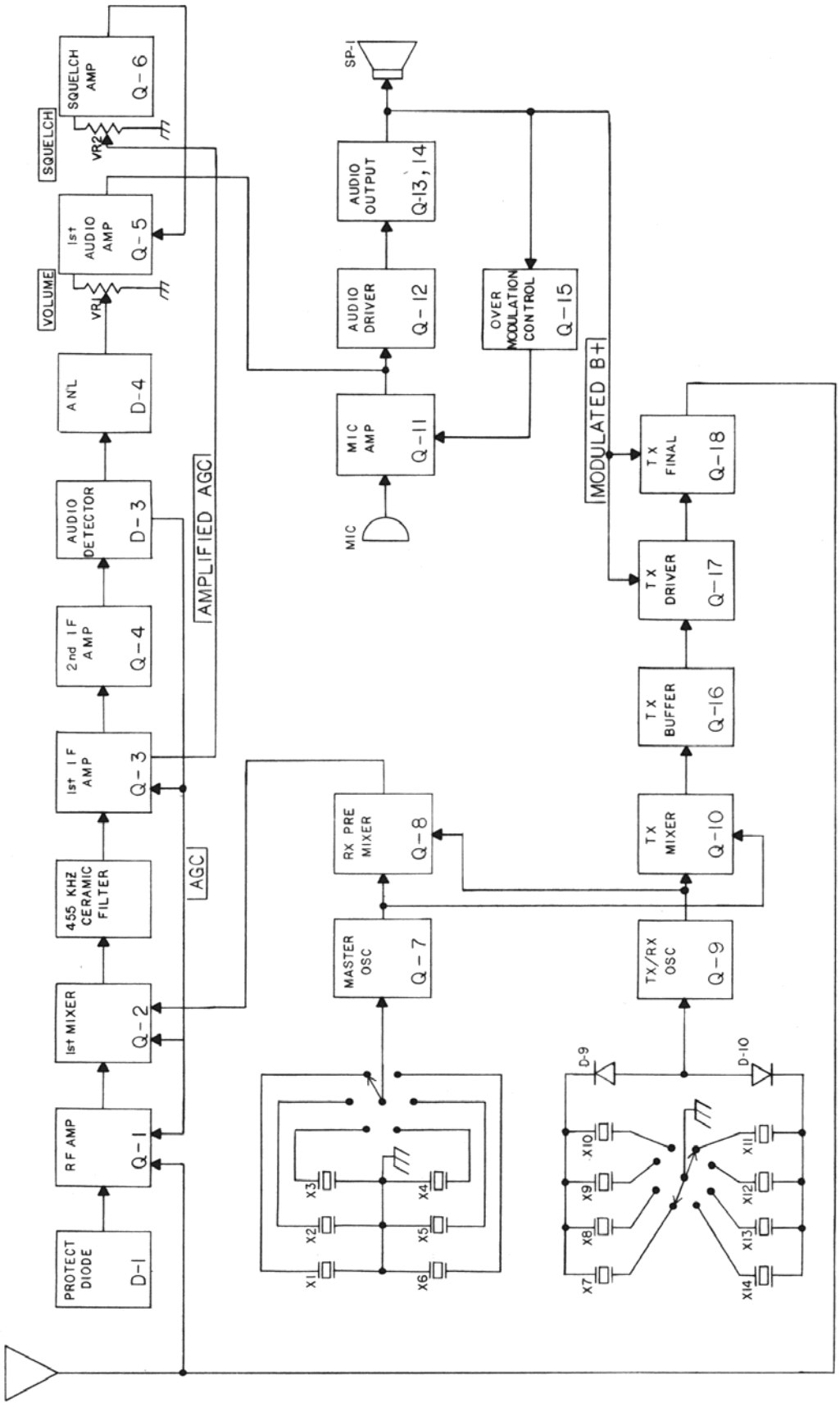
The OMC regulates the gain of the audio amplifier so as to accommodate a wide range of voice levels. The audio signal is fed from T2, the secondary of the audio output amplifier, to D11 where it is rectified; it is then filtered by R81 and C71 and fed to the base of Q15 – the OMC transistor. As the sound level

into the MIC increases, Q15 will begin conducting thus clamping the bottom of C55 to ground and reducing the signal level into Q11 — the MIC AMP.

FREQUENCY MIXING SCHEME

Channel Selector switch S1 selects one of six crystals (X1 - X6) for the master oscillator Q7 and one of four transmit (X7 - X10) or receive (X11 - X14) crystals for the transmit/receive oscillator Q9 (See Table 5-3). In receive mode, D9 is backed biased disconnecting any transmit crystals from the oscillator Q9; D10 is forward biased connecting the particular receive crystal selected by S1-b and -c. In transmit mode, the condition of the diodes is reversed and a particular transmit crystal is selected by S1-b and -c. The receiver injection signal is synthesized by mixing the output of Q7, the master oscillator, and Q9, the transmit/receive oscillator, in the RX PRE MIX Q8. Likewise, the transmit frequency is synthesized by mixing the output of Q7 and Q9 in the TX MIX Q10.

FIG. 4-1 SBE-34CB TRANSCEIVER BLOCK DIAGRAM



SECTION 5

SERVICING

5.1 INTRODUCTION

Read this section carefully before attempting any repair of the SBE-34CB. Refer to the circuit description, block and schematic diagrams. The transistor case diagrams are shown on the schematic diagram. Refer to these diagrams before checking transistors. Component layout and location 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 (5-1), PERFORMANCE VERIFICATION PROCEDURE. Figures (5-5, -6), 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 (5-2) lists RECOMMENDED TEST INSTRUMENTS. Tables (5-7, -8) show the proper TRANSMITTER ALIGNMENT PROCEDURE and RECEIVER ALIGNMENT PROCEDURE respectively. Figure (5-9), 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 from various points in the SBE-34CB during normal operation. Figure (5-11) shows RF amplification through a properly aligned transmitter. Figure (5-12) shows 50%, 100% and overmodulation respectively. Notice that the waveform at the collector of Q10 – the TX MIXER – contains several frequency components. Also notice that the waveform at the collector of Q18 – the TX FINAL – is unsymmetrical (Figure 5-12). This is proper since the TX FINAL operates class C for greater efficiency. Figure (5-12) shows how the output should look at the dummy load.

VOLTAGE MEASUREMENTS are shown on the schematic diagram for normal operation. RECEIVER INJECTION VOLTAGES are given in Table (5-10). 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 2 VAC of audio across the speaker or 8Ω load plugged into the speaker jack, EXT SP.

AGC VOLTAGES versus RF INPUT LEVEL are shown in Table (5-4). This table should be consulted before any adjustments are made on the squelch circuit since squelch is a function of AGC.

5.3 TROUBLESHOOTING

Troubleshooting the SBE-34CB transceiver is not essentially different than troubleshooting any other electronic device. Be a detective; suspect everything and everyone. Carefully inspect the unit for evidence of overheated components, cold solder joints, or tampering. Understand thoroughly the circuit description and block diagram. Try to start big and isolate the problem. Devise tests that will divide the transceiver in two and isolate the trouble to a particular half. Continue to divide into two parts until the trouble is located. For example, it is determined that a problem exists in the particular transceiver. The unit is divided into:

TRANSMITTER – RECEIVER.

Suppose that the transmitter puts out properly modulated carrier, but the receiver will not respond to a modulated RF signal at the proper frequency fed into the antenna jack. Since the transmitter modulates, it can be assumed that all of the audio amplifier except Q5 is good. After checking the TX/RX switch and receiver B+, the receiver is then divided into:

TABLE 5-1 PERFORMANCE VERIFICATION PROCEDURE

TRANSMITTER

INITIAL SET-UP
Connect the SBE-34CB to a 13.8 VDC supply. Connect a wattmeter and dummy load to the antenna jack.
STEP 1 Key the transmitter and observe that the transmit lamp is lit and that the output is at least 3 watts.
STEP 2 Whistle into microphone with transmitter keyed. Check for 90-100% modulation.
STEP 3 Connect counter to dummy load and check transmit frequencies on channels 1, 2, 3, 4, 8, 12, 16, and 20. (See Table 5-3.)

RECEIVER

INITIAL SET-UP
Connect SBE-34CB to 13.8 VDC supply. Connect RF signal generator to the antenna jack and set to 27.085 MHz 30% - 1 KHz modulation. Set the unit to channel 11; switch the PA/CB switch to CB. Turn the volume control full clockwise and the squelch control full counterclockwise. Connect 8Ω load to external speaker jack, EXT SP, and connect AC VTVM to 8Ω load. (See Figure 5-6.)
STEP 1 Adjust signal generator for 0.7 microvolts output. Verify that at least 4 VAC appear across the 8Ω load.
STEP 2 Increase signal generator output to 200 microvolts. Rotate squelch knob full clockwise. Receiver should squelch.
STEP 3 Set PA/CB switch to PA. Connect 8Ω load and AC VTVM to PA jack. Whistle into microphone with push-to-talk switch pressed. Check for a least 4 VAC audio.