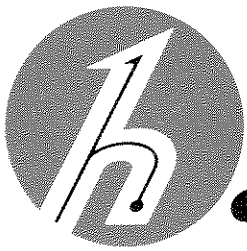
Bow



Hallicrafters

COMMAND LINE

INSTALLATION AND SERVICE INSTRUCTIONS

TWO-WAY FM LAND-MOBILE RADIO TRANSMITTER/RECEIVER

MODELS

CSB-30-2 AND CSM-30-2

WARRANTY

"This product is warranted to be free from defective material or parts, and it is agreed to furnish a new part in exchange for any part of this unit which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to the authorized radio dealer or wholesaler from whom purchased, intact, for examination with all transportation charges prepaid, within one year from the date of sale to original purchaser and provided that such examination discloses that it is thus defective. Warranty on tubes, pilot lights, transistors, and silicon diodes is effective for a period of 90 days.

This warranty does not extend to any radio products which have been subjected to misuse, neglect, accident, improper installation, or to use in violation of instructions furnished by us, nor does it extend to units which have been repaired or altered outside of our authorized facilities, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.

This warranty is in lieu of other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products."

the hallicrafters co.

156-001623

INSTALLATION AND SERVICE INSTRUCTIONS FOR COMMAND LINE FM TWO-WAY RADIO TRANSMITTER/RECEIVER

●

MODELS CSB-30-2 AND CSM-30-2 (BASE AND MOBILE)

Manufactured by

hallicrafters

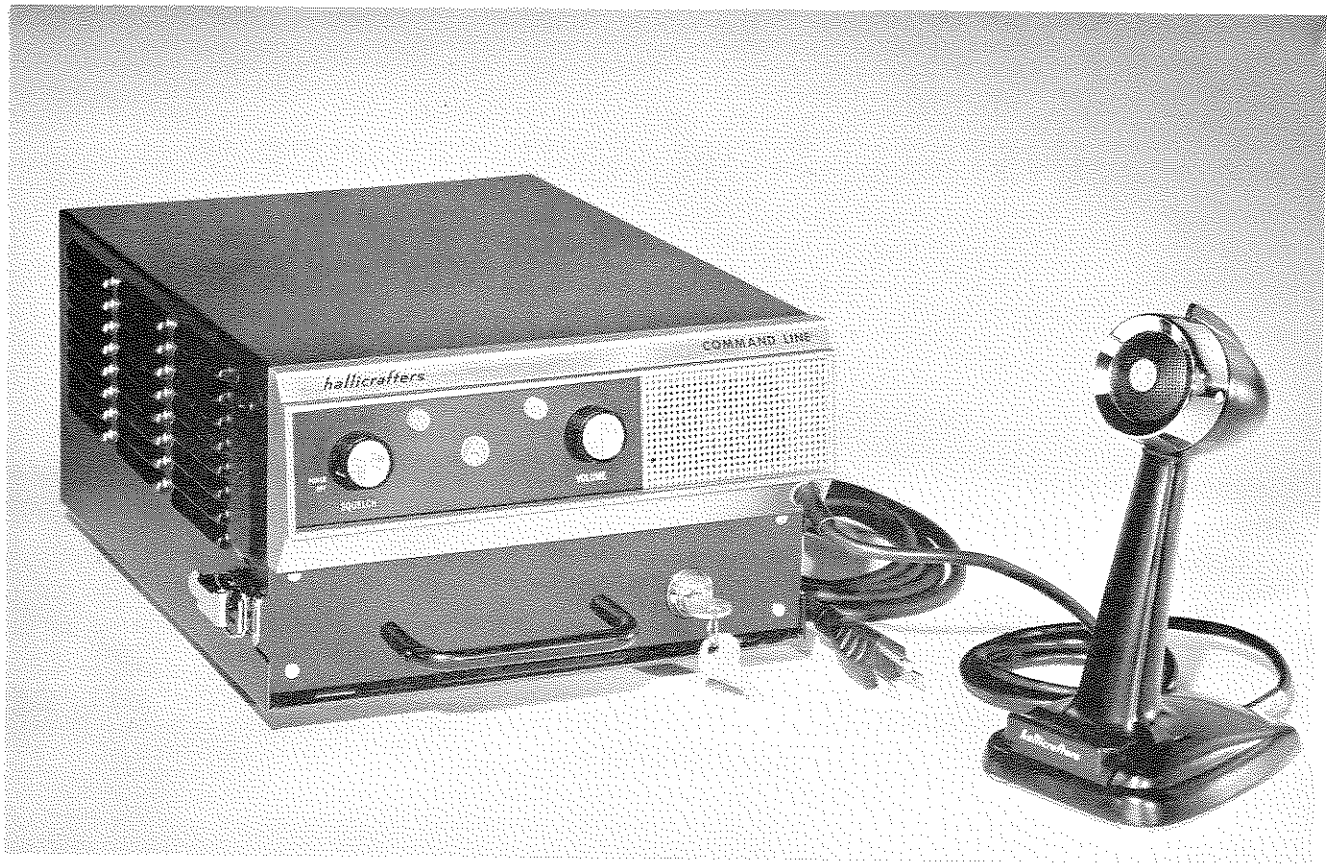
5th AND KOSTNER AVES.

CHICAGO 24, ILL.

U.S.A.

094-903445C
1166

Printed in U.S.A.



Hallicrafters' Model CSB-30-2 (LAAD) Base-Station Transmitter/Receiver.

156-002311

Hallicrafters' Model CSM-30-2 (FAAC and FAAT) Mobile Transmitter/Receiver.

156-002310

SECTION I

GENERAL DESCRIPTION

The Hallicrafters' Models CSM-30-2 and CSB-30-2 are crystal-controlled, two-way radio transmitter/receivers designed for narrow-band FM service (16F3 emission) in the 148 to 174 MC range. The units are similar in appearance and construction, differences being only in the power supplies. The CSB-30-2 has an AC operated supply (117 volts, 60 cycle) for base-station use while the CSM-30-2 has a DC supply (12 volts only) for mobile applications.

Various features and control options are available, including: 1) dual-frequency operation, 2) continuous tone-controlled squelch system (EIA RS-220); 3) microphone (carbon or transistorized dynamic) and 4) mounting configuration (one or two piece mount). All of these options are available as standard factory equipment or may be added by means of modification kits at any future date.

The mechanical design features rugged, military-type construction throughout. Installation flexibility is achieved by means of a removable control assembly. This assembly, which includes all necessary controls for operation of the unit, is an integral part of the transmitter/receiver for single-unit installations and cable-connected (up to 25 feet) for extended local-control applications (i.e., trunk-mounted mobile or semi-remote base). Conversion from one type of installation to another can be accomplished at any time by utilizing accessory parts kits available for this purpose.

Also available, as an option, is a miniaturized control head for remote-mount installations where operating-position space is at a premium. Designated the C-2102 Control Head, it is capable of all of the control functions and options of its larger counterpart; however, it requires the use of an external speaker (normally used with the C-3401 Speaker).

The main-unit cabinet includes a key lock which prevents access to the chassis frequency-determining elements by unauthorized personnel. In addition to the lock, the chassis is secured in the cabinet by two side-snap fasteners. No tools are required for chassis removal.

All alignment and test points are readily accessible on the top of the chassis for easy service and maintenance.

Efficient heat conduction and radiation out of the cabinet have been emphasized throughout the mechanical design. Extruded aluminum rails on either side of the chassis underside provide intimate heat transfer contact with the cabinet which then serves as a heat dissipator. To further reduce the adverse effects of heat, the cabinet is provided with louvers, strategically placed to maintain a high degree of convection cooling.

Circuit design and construction employ the latest up-to-date techniques to provide the ultimate in performance and long-term reliability. A receiver selectivity factor of better than 2 to 1 is obtained by use of a full eight-section crystal-lattice filter. This filter, boasting an ultimate attenuation of better than 100 DB, eliminates interference from strong adjacent-channel stations and insures maximum on-channel performance. The transmitter output stage employs a type 8150 tube which, being developed especially for two-way service, provides more useful power output than any other tube in its power class.

The models CSM-30-2 and CSB-30-2 are approved for use under parts 10, 11, 16 and 21 of the FCC Rules and Regulations.

SECTION II
SPECIFICATIONS

MECHANICAL SPECIFICATIONS AND FEATURES

CABINET

Aluminum; dull-black, baked-enamel finish.

CONSTRUCTION (Except Cabinet)

Aluminum; iridite finish.

OVERALL SIZE (HWD)

6 by 10-5/8 by 14 inches.

NET WEIGHT

CSB-30-2 (Base)

23 pounds.

CSM-30-2 (Mobile)

14 pounds.

POWER SUPPLY

CSB-30-2

Self-contained; silicon rectifiers.

CSM-30-2

Self-contained; dual transistors with silicon rectifiers.

INSTALLATION

CSB-30-2

Single unit or extended local (control head only on operating desk).

CSM-30-2

Under dash or trunk mount.

CONTROL HEAD

Plug-in, removable. May be connected with cable providing extended-local control (up to 25 feet). Optional miniaturized control head with separate speaker for close-space applications.

SPEAKER

Part of standard control head or separate four-inch PM with miniaturized control head.

MICROPHONE (Mobile)

Handheld carbon standard. Transistorized dynamic, optional extra.

MICROPHONE (Base)

Transistorized dynamic, desk stand, standard.

CONTROLS

Power on/off-squelch.
Volume.
Power on indicator lamp.
Transmit indicator lamp.
Channel selector, 1-2 (optional extra).

ANTENNA CONNECTOR

Screw type (SO-239).

ELECTRICAL SPECIFICATIONS AND PERFORMANCE

General (Receiver and Transmitter):

FREQUENCY RANGE

148 to 174 MC.

FREQUENCY STABILITY

±0.0005%, oven controlled.

AMBIENT TEMPERATURE RANGE

-30°C to +60°C (exterior of case).

VIBRATION

Meets mobile requirements of CD I-100.

INPUT VOLTAGE

CSB-30-2 (Base)

117 volts AC, 50/60 CPS.

CSM-30-2 (Mobile)

12 volts DC nominal (13.6 volts EIA Standard).

OVERALL SYSTEM AUDIO RESPONSE

Within +2 to -6 DB from 300 to 3000 CPS (EIA Standard for wire line connection) referenced at 1000 CPS.

Receiver:

SENSITIVITY

Less than 0.5 μV for 20 DB quieting.

SQUELCH SENSITIVITY

0.25 μV or less.

CRYSTAL

Third-overtone, series-resonant, similar to MIL Type CR-32/U.

CONVERSION SYSTEM

Dual; 10.7 MC and 1.65 MC.

SECOND CONVERSION OSCILLATOR

Crystal controlled.

SELECTIVE ELEMENT

Eight-section crystal-lattice filter at 10.7 MC.

SELECTIVITY

2 x down (-6 DB)

±7.5 KC.

1000 x down (-60 DB)

±13.5 KC.

100,000 x down (-100 DB)

±15 KC.

OSCILLATOR RADIATION

Within limits established by FCC Rules and Regulations, Part 15, Sub-Part C.

AUDIO POWER OUTPUT

1.5 watts at less than 10% distortion.

AUDIO OUTPUT IMPEDANCE

3.2 and 500 ohms.

AUDIO FREQUENCY RESPONSE

Within +1 to -3 DB of a standard 6 DB/octave de-emphasis curve from 300 to 3000 CPS referenced at 1000 CPS (EIA Standard).

DUTY CYCLE

Continuous.

TUBE COMPLEMENT

Cascode RF Amplifier	6ES8
Receiver Crystal Oscillator	(1/2)12AT7
First Mixer/Oscillator Multiplier	6BL8
First IF Amplifier	6BH6
Second Mixer/Oscillator	6BL8
First Low IF Amplifier-Limiter	6BH6
Second Low IF Amplifier-Limiter	6BH6
Gated Beam Discriminator-Limiter	6BN6
Squelch Noise/DC Amplifier	12AT7
First Audio/Output	6GW8

POWER DRAIN

CSB-30-2 (at 117 VAC)

78 watts +6 watts internal oven.

CSM-30-2 (at 12 VDC)

6.5 amperes +0.5 ampere internal oven.

SPURIOUS RESPONSE ATTENUATION

-85 DB.

Transmitter:

RF POWER OUTPUT

30 watts.

ANTENNA OUTPUT IMPEDANCE

52 ohms.

CRYSTAL

Fundamental frequency type, similar to MIL Type CR-27/U.

MULTIPLICATION ORDER

2 x 2 x 3 = 12.

SPURIOUS EMISSIONS

Attenuated in excess of EIA Standards.

MODULATION

Crystal-controlled FM (phase) type F3.

MODULATION DEVIATION

±5 KC (16F3 emission).

MODULATION CHARACTERISTIC

Within +1 to -3 DB of a standard 6 DB/octave pre-emphasis curve from 300 to 3000 CPS referenced at 1000 CPS (EIA Standard).

DEVIATION LIMITER

Automatic; prevents deviation beyond set amount.

MICROPHONE INPUT IMPEDANCE

125 ohms.

TUBE COMPLEMENT

Microphone Amplifier Automatic Deviation Control	6BN8
Transmitter Crystal Oscillator	(1/2)12AT7
Buffer Amplifier/Phase Modulator	6BL8
Buffer Amplifier/First Multiplier	6AW8A
Second Multiplier	12DQ7
Third Multiplier	6360
Output Power Amplifier	8150

POWER DRAIN

CSB-30-2 (at 117 VAC)

143 watts +6 watts internal oven.

CSM-30-2 (at 12 VDC)

11.9 amperes +0.5 ampere internal oven.

DUTY CYCLE

Intermittent (EIA).

SECTION III

INSTALLATION

3-1. UNPACKING

After unpacking the equipment, it should be carefully inspected for any possible damage which may have occurred during transit. Should any sign of damage be apparent, immediately file a claim with the carrier stating the extent of damage. Carefully check all shipping labels and tags for any special instructions before removing or destroying them.

3-2. PRELIMINARY TEST

Prior to installing the equipment, it should be bench tested to insure it to be in proper operating condition. The equipment has been completely aligned to frequency and tested at the factory before shipment so no performance deficiency should exist. If operational difficulties are experienced, refer to the maintenance section of this manual to identify and cure the cause of trouble.

IMPORTANT NOTE

According to FCC Rules and Regulations: only persons holding radio-telephone operator licenses (second class or higher) or persons working under their direct supervision are authorized to perform adjustments or tests coincident with the installation, servicing, or maintenance of a radio station, which may affect the proper operation of the equipment as set forth in the Rules and Regulations governing the class of service for which the equipment is licensed.

3-3. MOBILE INSTALLATIONS (CSM-30-2)

The following instructions outline the basic steps required to install the equipment in a vehicle in both under-dash and trunk-mount configurations.

Installation requirements will vary greatly depending on space available, operator preference, service accessibility, etc., and it is somewhat up to the discretion and ingenuity of the installer to plan the best possible installation in a particular case. A few moments spent in planning the installation, prior to its commencement, will pay dividends later on in terms of performance and ease of maintenance.

Points to remember when planning the installation are:

1 - Mount the unit so that it is in as protected an environment as possible. Avoid mounting it in a position where it might be subjected to water damage or in direct exposure to dust or dirt. Select a mounting that will provide adequate ventilation around the cabinet and will allow free air circulation through the louvers and transistor heat sink.

2 - Mount under-dash components for convenient access by the operator. Very often holes exist on the under side of the dashboard for vehicle accessories and these may sometimes be conveniently used for purposes of mounting the radio equipment.

3 - Use extreme care when drilling holes so as not to puncture the vehicle's fuel tank or damage electrical wires, hydraulic lines, etc.

4 - Route control cables, power cables, and antenna leads in protected places, out of the way of the operator's feet or possible heavy objects which may cause abrasion and subsequent failure.

3-3-1. DC UNIT FRONT-MOUNT INSTALLATION
(one-piece unit, control head attached, CSM-30-2 FAAC, refer to figure 1)

The unit is mounted by securing the trunion handle to the underside of the dashboard in a position providing operator accessibility to the front panel controls. Additional brackets may be

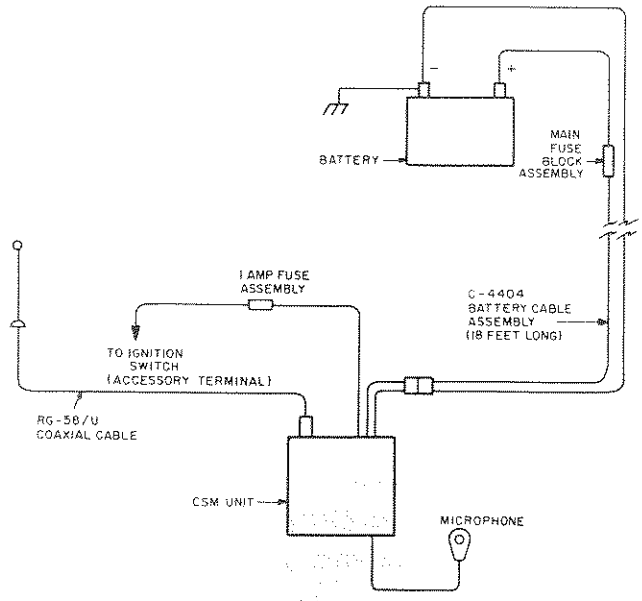


Figure 1. Front Mount Mobile Installation. 156-002602

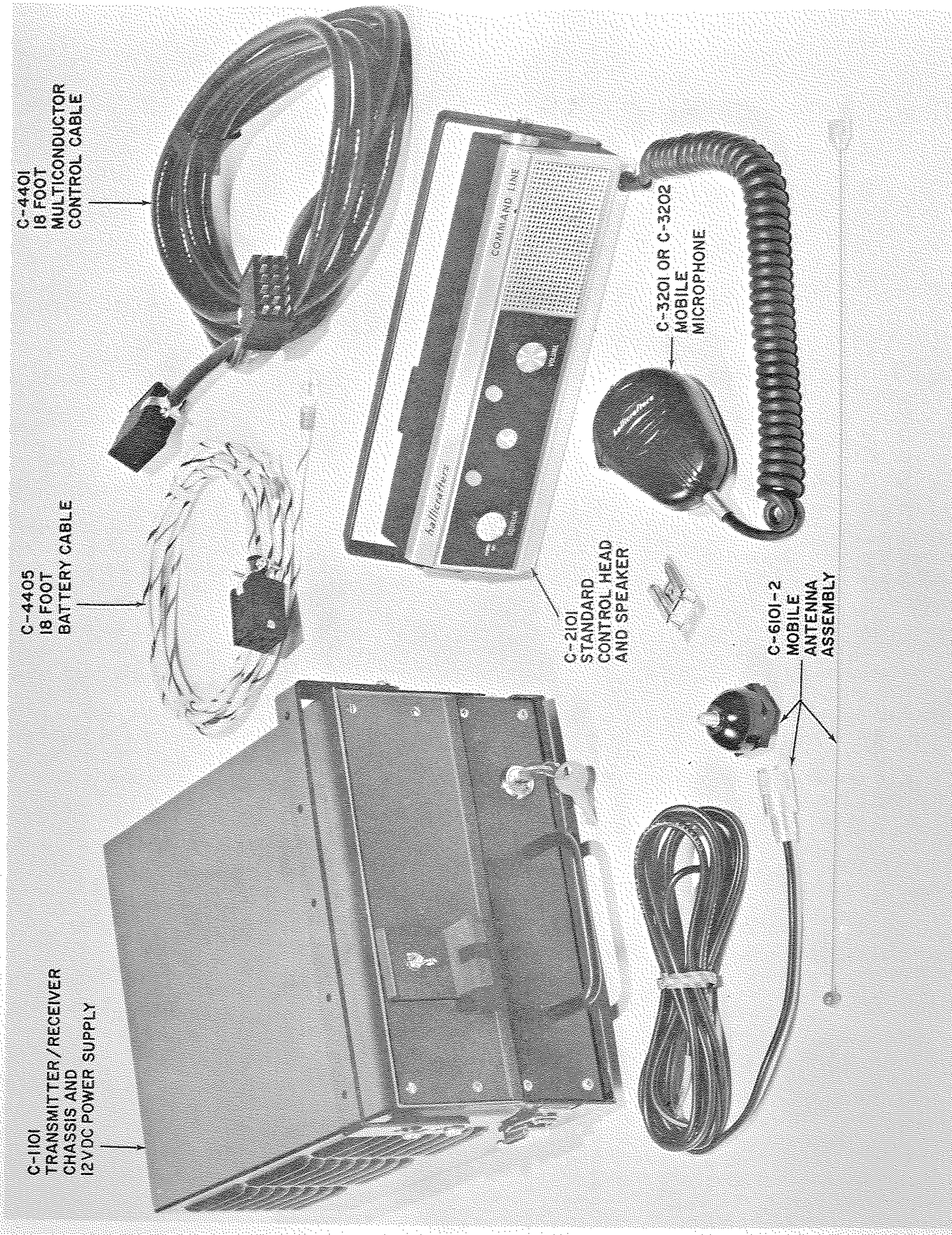


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Figure 2. Hallicrafters Model CSM-30-2 (TAAC and TAAT) Mobile Transmitter/Receiver.

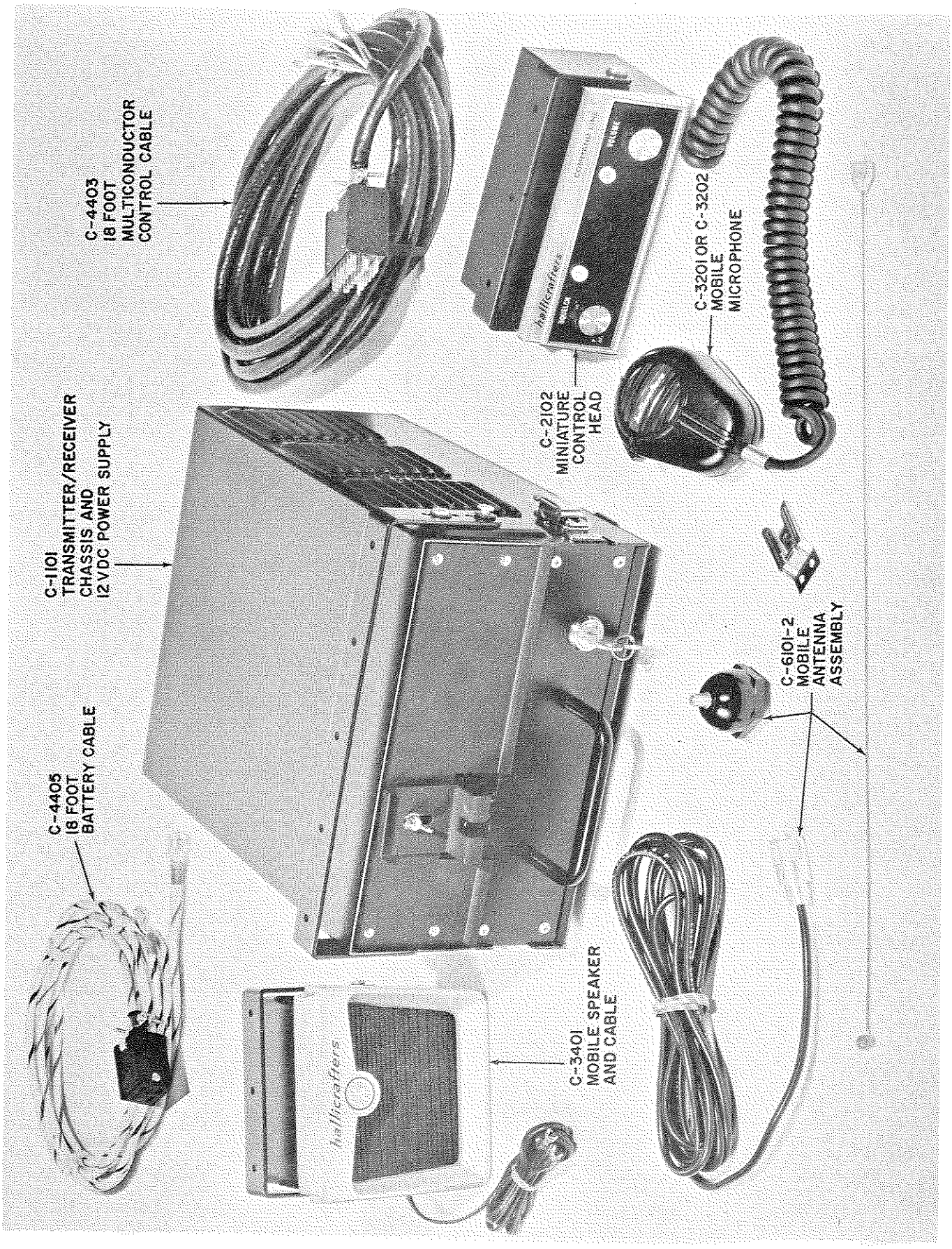

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Figure 3. Hallicrafters Model CSM-30-2 (TABC and TABT) Mobile Transmitter/Receiver.

necessary in order to fasten the unit securely in place. These may be made of perforated iron strapping, available from most local hardware stores, bent to suit the application.

The microphone holder should be mounted with self-tapping screws on the dashboard as near the operator as possible.

The relay switch line (fused NO. 20 AWG black lead coming out of the rear of the unit) should be connected to the accessory terminal of the vehicle's ignition switch. This provides the facility of turning off the radio equipment when the ignition key is removed.

3-3-2. DC UNIT TRUNK-MOUNT INSTALLATION (Separate control head units, CSM-30-2 TAAC and TABC)

The components shown in figures 2 and 3 in combination with the installation drawings, figures 4 and 5, show the various trunk-mount configurations possible with the CSM-30-2 equipment.

The transmitter/receiver chassis should be removed from its cabinet and the cabinet fastened to the mounting surface by means of self-tapping screws or bolts through each of the four bottom feet. In some installations, it may be advantageous to first attach the transmitter/receiver unit cabinet to a plywood board, slightly larger than the unit, and subsequently fasten the board to the mounting surface. This will provide a good flat mounting surface for the unit.

The control head should be mounted under the dashboard in a position convenient to the operator.

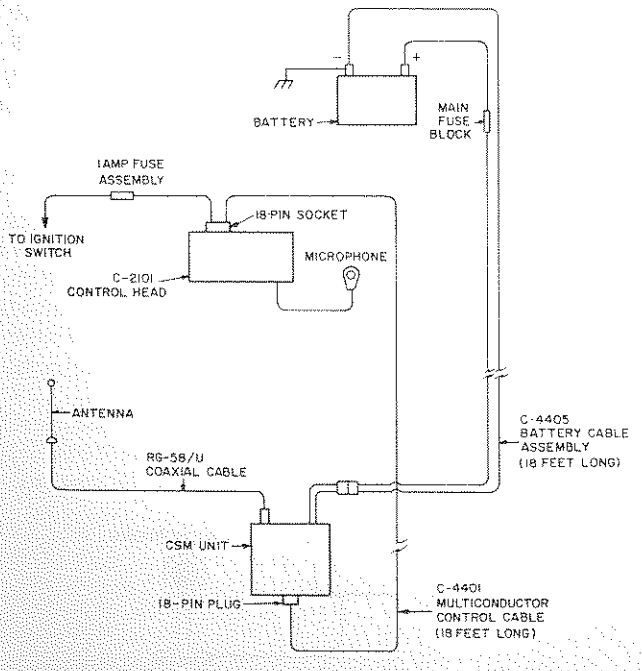

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Figure 4. Trunk-Mount Installation, Using One-Piece Control Head.

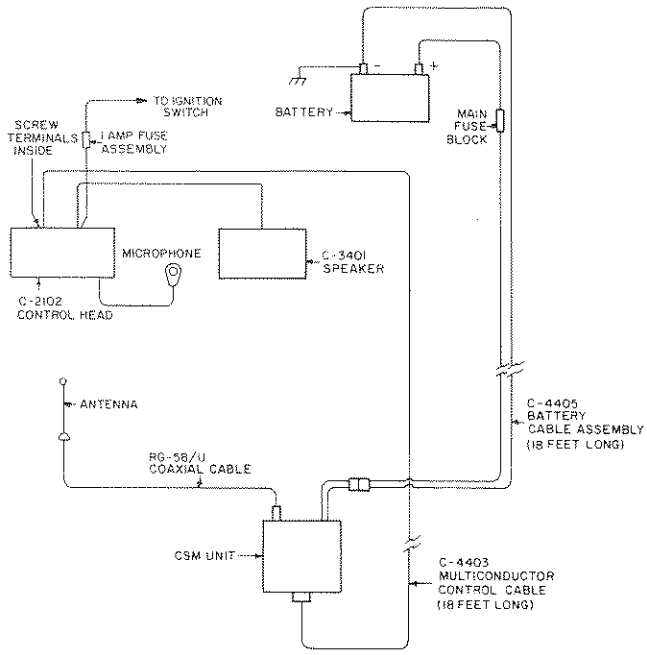

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Figure 5. Trunk-Mount Installation, Using Two-Piece Control Head.

The separate speaker assembly, when used (as with the C-2102 control head), may be mounted as space permits.

Connect the control cable between the control head and main unit. Connect the relay switch line (fused NO. 20 AWG black lead coming out of the control head end of the cable) to the accessory terminal of the vehicle's ignition switch. This provides the facility of turning off the radio equipment when the ignition key is removed.

3-3-3. BATTERY LEADS (mobile installations)

The battery leads should be run from the main chassis to the battery by as direct a means as is possible. Generally, there are holes in the firewall which will permit access to the battery in the engine compartment. Route the leads neatly to the battery, taping or clamping as required, to prevent them from coming in contact with the hot engine or becoming frayed on sharp metal corners. The ends of the leads should be attached to the battery connectors as shown in figures 1, 4, and 5 and tightened with a wrench.

IMPORTANT NOTE

The CSM-30-2 is designed for conventional negative ground 12-volt systems only. Be sure of polarity and voltage before connecting battery leads. The red lead should be connected to the positive, ungrounded terminal through a fuse block. The black lead should be connected directly to the negative, grounded terminal. Unless this is observed, damage to the vehicle or radio equipment may result.

For connection to other DC systems, ask your Hallicrafters' representative for assistance, outlining particulars of the required installation.

3-3-4. MOBILE ANTENNA INSTALLATION

Supplied as standard equipment with the CSM-30-2 is a quarter-wave vertical-whip antenna (C-6101). This antenna should be installed according to instructions included with it.

It is desirable to mount the antenna at or near the center of the vehicle's metal roof, as the roof, acting as a ground plane, will insure uniform performance in all directions.

On convertibles or other vehicles where a roof-top installation is impossible, the antenna may be mounted on the rear deck or trunk lid; however, with a probable decrease in overall performance. In these instances, the installation of a gain antenna is highly recommended. This type of antenna will generally outperform the standard roof-top, quarter-wave antenna and is a means by which even roof-top installations may be improved to give increased range or denser coverage.

3-3-5. MOBILE NOISE SUPPRESSION

The built-in noise suppression characteristics of the CSM-30-2 equipment make special precautions against noise sources in the vehicle normally unnecessary. If ignition noise is noticed after the installation, however, check for proper alignment and accurate netting to the base-station transmitter. If ignition noise is still present, perform the following checks on the vehicle.

1. Check distributor points, capacitor, and rotor and all the spark plugs. Replace worn plugs and any other obviously defective parts. Reset spark plug gaps to the correct spacing.

2. Using a DC continuity checker, check for a low-resistance DC path between the spark-plug terminal and the inside contact of the distributor cap. Replace all loose terminals.

3. If ignition noise is not yet eliminated, continue the following procedure step-by-step.

   a. Install a standard automobile radio distributor suppressor in the center lead from the ignition coil to the distributor.

   b. Install resistor-type spark plugs. Be sure to use the correct type plug set to the recommended gap.

   c. Connect a 0.1 to 0.5 μF coaxial feed-through capacitor in series with the primary lead to the distributor. The capacitor used should have a 50-volt, five-ampere minimum rating.

   d. Install resistor-type ignition leads.

   e. Install bonding straps across the rubber engine-support shock mounts between the engine and the vehicle frame.

Hallicrafters has available a mobile noise suppression kit, Model HA-3, which is suitable to this application. For generator noise suppression refer to the instructions with the HA-3 or other applicable noise suppression kits.

3-4. BASE STATION INSTALLATIONS (CSB-30-2)

The CSB-30-2 equipment is intended for base-station installations where a source of 117-volt 60-cycle power is available.

IMPORTANT NOTE

Your power outlet must furnish AC (alternating current). If in doubt about your power source, contact your local power company prior to inserting the power cord in a power outlet. Plugging the cord into the wrong power source may cause extensive damage to the unit, requiring costly repairs.

Models CSB-30-2L and CSB-30-2E are supplied with the installation materials necessary for local and extended local control installations respectively. When installing base-station equipment, care should be exercised to observe the National Electrical Code and local wiring codes.

3-4-1. LOCAL CONTROL INSTALLATION (CSB-30-2 LAAD)

The equipment should be installed as shown in figure 6. The CSB-30-2 unit may be placed in any location permitting free air circulation through the ventilation openings in the cabinet. Excessively warm locations such as those adjacent to radiators and heating units should be avoided.

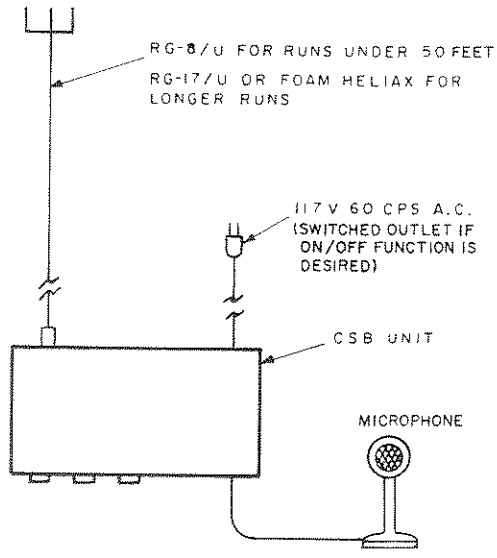


Figure 6. Local Control Base Station Installation.

3-4-2. EXTENDED LOCAL CONTROL INSTALLATION (CSB-30-2 EAAD)

The equipment should be installed as shown in figure 7, observing the same precautions for locating the unit as described under LOCAL CONTROL INSTALLATION. A 25-foot control cable, Model C-4402, is provided for interconnecting the transmitter/receiver chassis and the control head. (Longer cable lengths are available on special order for specific applications.)

On extended local control units, the control unit power turn-off function is inoperative and the equipment will turn on as soon as the power cord is plugged in and will remain on until the power cord is removed.

3-4-3. BASE STATION ANTENNA INSTALLATION

There are various types of antennas suitable for use with the CSB-30-2 equipment. The selection will depend on the specific application and requirements of the system.

In all but the most simple systems, a gain antenna is recommended. Although the initial cost is somewhat higher than a conventional ground plane antenna, the advantages realized in terms of increased range and denser coverage make the gain antenna a sound investment, particularly since it may be considered a nonrecurring cost.

In locating the antenna, take advantage of existing structures (tall buildings, water towers, etc.) wherever possible, thereby reducing the cost of installing a mast or tower of similar height.

If in doubt about the specific antenna to be used in a particular installation, contact The Hallicrafters Company directly. An experienced representative will assist you in selecting the most suitable antenna for your application.

3-5. CRYSTAL INFORMATION

After the installation is completed, crystals should be installed in the appropriate sockets in the crystal oven. Crystal position marking will be found on the inside of the oven when the cover is removed. The crystals are to be inserted in their appropriate positions (T, transmit; R, receive).

Crystals may be ordered from The Hallicrafters Co. Service Department, 5th and Kostner Avenues, Chicago 24, Illinois. Transmitting crystals should

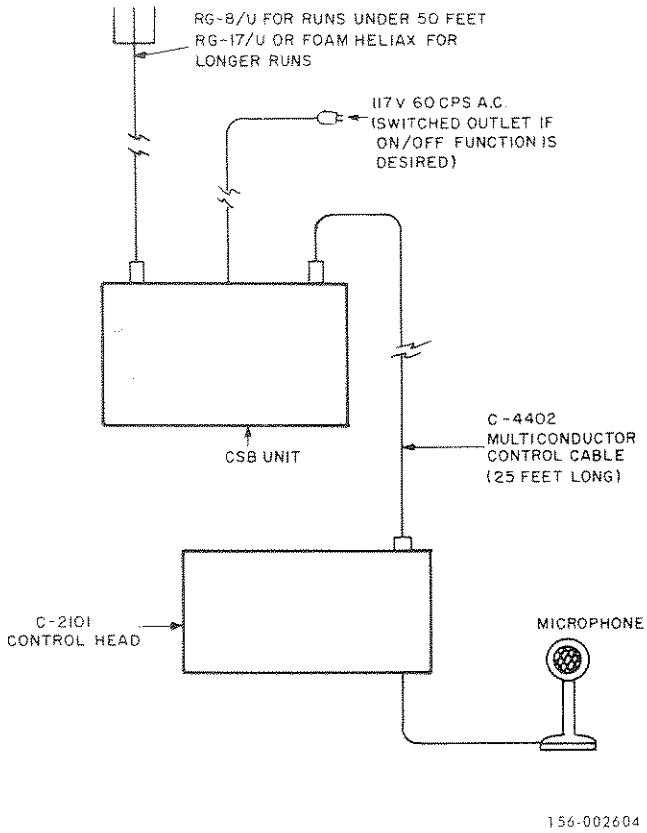


Figure 7. Extended Local Control Base Station Installation.

be ordered under part number 019-002949, and receiving crystals should be ordered under part number 019-002950. Be sure to specify operating frequencies when ordering crystals.

If crystals are obtained from sources other than The Hallicrafters Co., specify:

for the transmitter,

Crystal type:	MIL CR-27/U
Oven temperature:	75°C
Load capacity:	32 $\mu\mu$F
Frequency:	$\frac{\text{Channel frequency}}{12}$

for the receiver,

Crystal type:	MIL CR-32/U
Oven temperature:	75°C
Resonance:	Series
Frequency:	$\frac{\text{Channel frequency - 10.7 MC}}{3}$

SECTION IV
THEORY OF OPERATION

4-1. GENERAL

Hallicrafters Models CSB-30-2 and CSM-30-2 Transmitter/Receivers utilize similar circuitry, differences being only in the power supplies. The CSB-30-2 equipment has an AC supply for base-station use while the CSM-30-2 equipment contains a DC supply for mobile operation. Refer to figures 8 and 9 for block diagrams of the receiver and transmitter sections and to the back of this manual for the appropriate schematic diagrams of the CSB/CSM-30-2 equipment.

4-2. RECEIVER

The receiver section of the CSB/CSM-30-2 consists of nine tubes (plus squelch) functioning in a crystal-controlled, dual-conversion superheterodyne circuit. Dual-purpose tubes and semiconductors are used discriminately to provide the equivalent of sixteen tube functions.

4-2-1. RF AMPLIFIER

The input from the antenna relay, K1, is applied to the primary of the antenna coil, T5, and coupled to the grid (pin 2) of V7, 6ES8 dual triode, connected as a low-noise, series-fed, neutralized cascode RF amplifier. A series-tuned RF trap, L19, in the plate circuit of the first triode section is adjusted to 21.4 MC below the operating frequency. This adjustment provides maximum attenuation of the image frequency. The plate circuit of RF amplifier V7 consists of interstage filter network, FL3. Three critically-coupled coils are used in this filter to provide maximum suppression of spurious responses. The output of FL3 is coupled to the grid (pin 9) of the receiver first mixer, V8A.

4-2-2. RECEIVER OSCILLATOR

The receiver oscillator circuit, V1B (1/2 12AT7), is a modified Pierce type oscillator employing a phase-inverting inductance to operate CR-32/U overtone crystals at their natural series resonant frequency. The crystal, Y3, is housed in a standard plug-in oven which maintains a constant crystal temperature of 75° ±2°C. Small changes in receiver oscillator frequency can be made by adjustment of coil, L18. This adjustment is used to zero (net) the receiver to the exact channel frequency. RF output from the oscillator is coupled from the cathode (pin 3) of V1B, through C79, to the grid (pin 2) of the oscillator multiplier, V8B.

4-2-3. OSCILLATOR MULTIPLIER

Tube V8B (1/2 6BL8) is connected as a conventional multiplier with its plate circuit (L14 and C75) tuned to the third harmonic of the crystal frequency. The multiplied frequency is coupled to the grid (pin 9) of the receiver first mixer, V8A, through C78.

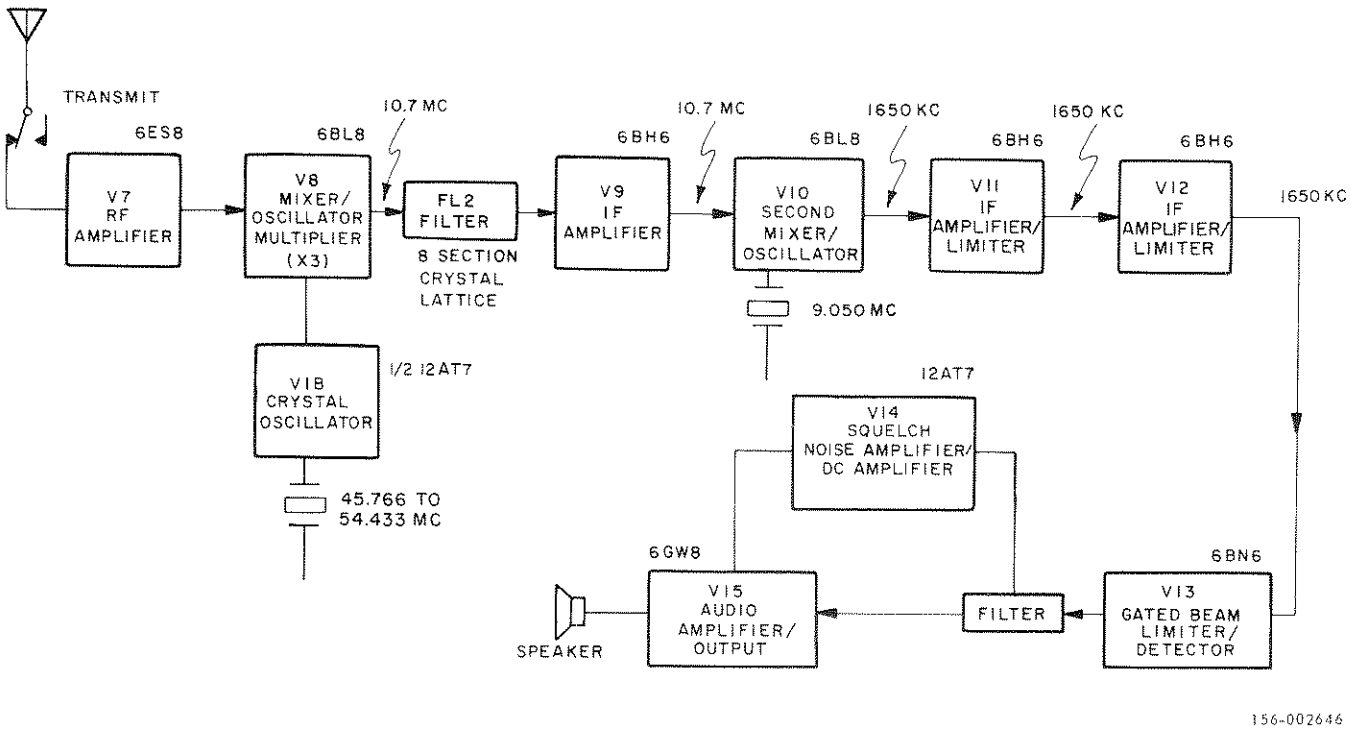


Figure 8. Receiver Block Diagram.

4-2-4. RECEIVER FIRST MIXER

RF signals from the interstage filter, FL3, and from the receiver oscillator multiplier, V8B, are applied to the grid (pin 9) of the receiver first mixer, V8A. These signals are mixed and produce a difference frequency of 10.7 MC. The 10.7-MC output from V8A is fed into an eight-section, crystal-lattice filter through an impedance matching network (L13, C71, and C70).

4-2-5. CRYSTAL LATTICE FILTER

The crystal-lattice filter establishes the overall selectivity characteristic of the receiver. The filter components are housed in a hermetically-sealed enclosure which guarantees their stability and reliable performance. No attempt should be made to service this filter. The output from the crystal-lattice filter is coupled through an impedance matching network (L12, C68, and C69) and coupling capacitor C67 to the grid (pin 1) of the first IF amplifier, V9.

4-2-6. RECEIVER FIRST IF AMPLIFIER

Tube V9, a type 6BH6 pentode, is used as a conventional IF amplifier at 10.7 MC. The amplified 10.7-MC signal from the plate (pin 5) of this tube is coupled through IF transformer, T4, and coupling capacitor, C63, to the grid (pin 2) of the receiver second mixer, V10A.

4-2-7. RECEIVER SECOND CONVERSION OSCILLATOR

The receiver second conversion oscillator, V10B, is a triode operated as a Pierce type oscillator which requires no adjustment. The circuit uses a standard CR-18/U crystal on 9.050 MC. A frequency of 9.050 MC is used in this circuit because that frequency is 1.650 MC below the first IF frequency thus producing a second IF frequency. The crystal output is coupled through capacitor C60 to the grid (pin 2) of the receiver second mixer, V10A.

4-2-8. RECEIVER SECOND MIXER

The 10.7-MC IF signal from V9 and the 9.050-MC oscillator signal from V10B are applied to the grid (pin 2) of the receiver second mixer, V10A. These signals are mixed and produce a difference frequency of 1650 KC (1.650 MC). The 1650-KC output from V10A is applied through the IF transformer, T3, and coupling capacitor, C89, to the grid (pin 1) of the first 1650-KC IF amplifier/limiter, V11.

4-2-9. FIRST 1650-KC IF AMPLIFIER/LIMITER

The type 6BH6 pentode used in this stage operates as a conventional IF amplifier in the presence of weak signals and, with signals in excess of a few microvolts, as a limiter. Limiter voltage developed across resistor, R61, is filtered and applied to the grid (pin 2) of the receiver RF amplifier, V7B, to prevent front-end overload on strong signals. The amplified/limited signal output is coupled through transformer T6 and capacitor C93 to the grid (pin 1) of the second 1650-KC IF amplifier/limiter, V12.

4-2-10. SECOND 1650-KC IF AMPLIFIER/LIMITER

Tube V12, normally operated with low plate and screen voltage applied, functions as a limiter under all signal conditions. The gain preceding this stage is sufficient to produce limiter action even on thermal noise. The developed limiter voltage can be measured at test point E. The output from V12 is coupled to the grid (pin 2) of the detector, V13, through transformer, T7.

4-2-11. GATED BEAM LIMITER/DETECTOR

Tube V13, a gated-beam type 6BN6, functions primarily as a discriminator. It also provides a limiting action which is particularly effective in the removal of fast transient noise pulses (ignition noise) that would otherwise degrade signal quality. These noise pulses cannot fully be removed by the preceding stages because of the limitations imposed by circuit time constants.

Limiter voltage is developed across resistor R68 and can be measured at test point F. It should be noted that this voltage will be approximately 0.8 to 1.0 volt and should change only very slightly with increasing signals. A large variation at this point is an indication of difficulty in the preceding stages.

Proper discriminator action is achieved by adjustment of the quadrature coil, L21. Output of the discriminator is developed as a function of phase differences between the signal grid (pin 2) and the quadrature grid (pin 6) across resistor R71. Output is coupled through an RF filter/de-emphasis network to the noise amplifier and audio amplifier.

4-2-12. SQUELCH CIRCUIT

The squelch circuit consists of V14, a 12AT7 dual-triode with one section functioning as a noise amplifier and the other as a control amplifier. A high-frequency bandpass filter, preceding the grid of V14A, accepts noise only from the discriminator. This noise is amplified to a high level by V14A and is then rectified by the squelch noise rectifier, CR1.

Rectifier CR1 is connected so as to produce positive voltage. This positive voltage, applied to the grid of the DC amplifier, V14B, provides control action. With no signal applied (large volume of noise present), the positive control voltage will be at a high level.

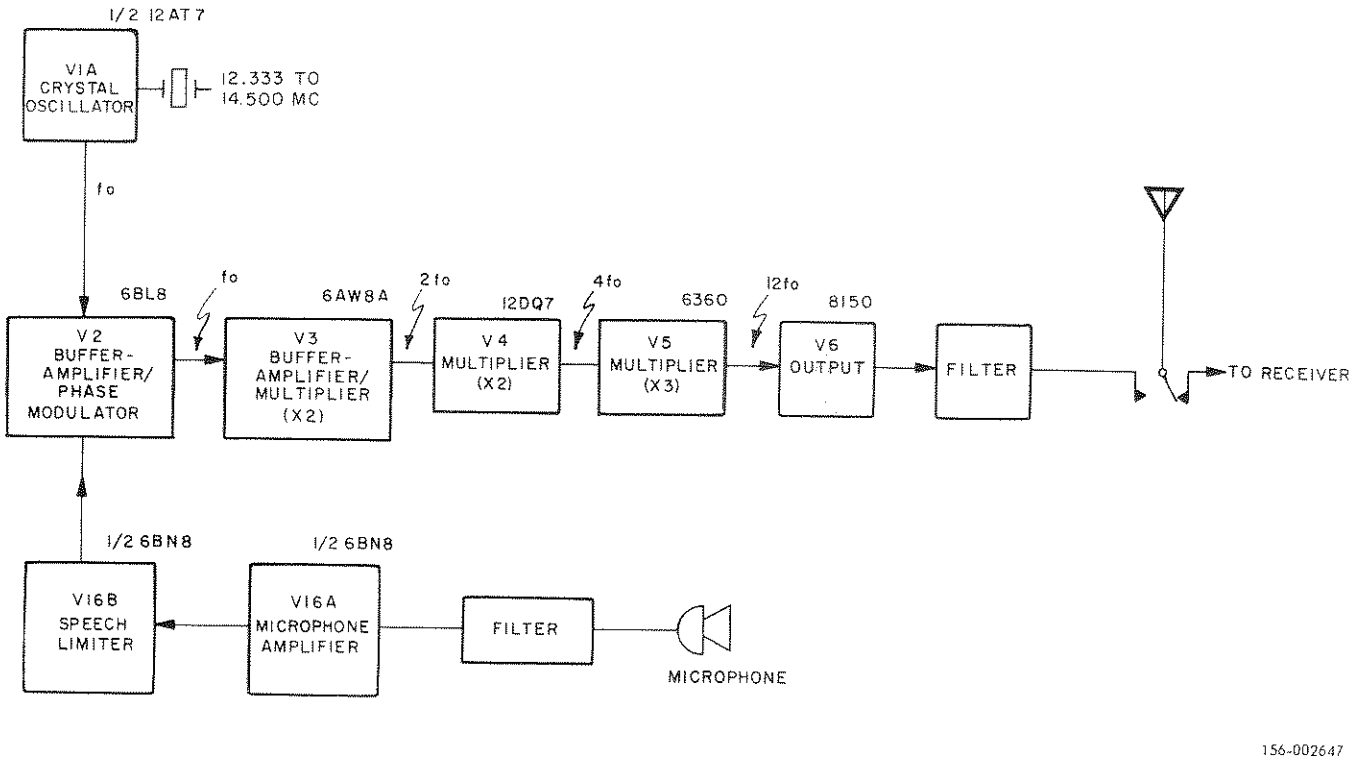


Figure 9. Transmitter Block Diagram.

The squelch control should be so adjusted that, with this level of positive grid voltage, V14B conducts to the point where the voltage drop across its plate load resistor is sufficient to cut off the DC controlled first audio amplifier, V15A, whose grid is returned through the plate load.

4-2-13. AUDIO AMPLIFIER/OUTPUT

Tube V15 is a type 6GW8 triode-pentode. The input from the discriminator/squelch circuitry is applied to the grid (pin 1) of the triode amplifier, V15A. The amplified output from V15A is coupled through capacitor C114 to the grid (pin 8) of the output tube V15B. V15B amplifies the audio signal which is then transformer coupled, through the audio output transformer, to the speaker.

4-3. TRANSMITTER

The transmitter section of the CSB/CSM-30-2 consists of six tubes functioning in a crystal-controlled, phase-modulated type circuit with a 30-watt, single-ended output operating class C. The discriminate use of dual-purpose tubes provides the equivalent of nine tube functons.

4-3-1. MICROPHONE AMPLIFIER

The audio input from the microphone is applied through coupling capacitor C49, and through a filter network, R30 and C50, to the grid (pin 8) of the microphone amplifier triode, V16A. The amplified output from V16A is coupled to the cathode (pin 3) of the speech limiter, V16B, through capacitor C53.

4-3-2. SPEECH LIMITER

The audio signal applied to tube V16B is affected by the limiting action of the two diode sections of this tube and the clipped output is applied through capacitor C54, the deviation adjust potentiometer R37, and resistors R38 and R8 to the grid (pin 9) of the transmitter phase modulator, V2B.

NOTE

Potentiometer R37 is not an audio gain control. Its function is only to set the maximum deviation limit. Therefore, R37 should be adjusted only when there is sufficient audio signal present to produce clipping action by V16B.

4-3-3. CRYSTAL OSCILLATOR AND FIRST BUFFER AMPLIFIER

The transmitter oscillator, V1A, is a Colpitts type oscillator using a fundamental frequency type CR-27/U crystal. The exact frequency is determined by the adjustment of trimmer, C1. The oscillator output is coupled through capacitor, C5, to the grid (pin 2) of the transmitter first buffer amplifier. The action of V2A isolates and amplifies the oscillator signal and applies this signal through capacitor C9 to the grid (pin 9) of the transmitter phase modulator.

4-3-4. PHASE MODULATOR AND BUFFER AMPLIFIER

RF signals from the oscillator circuit and audio signals from the microphone circuit are applied to the grid (pin 9) of the transmitter phase modulator (V2B). This tube varies the phase of the oscillator signal at the rate of the audio input applied. The phase modulated output of V2B is coupled through capacitor C13 to the grid (pin 2) of the transmitter buffer amplifier, V3A. Tube V3A isolates and amplifies the signal which is then applied to the grid (pin 7) of the transmitter first multiplier, V3B, through capacitor C17. Coil L2 in the plate circuit of V3A is tuned to the exact oscillator frequency.

4-3-5. FIRST MULTIPLIER

Tube, V3B, is a conventional pentode doubler circuit with the plate tank coil, L3, tuned to exactly twice the oscillator frequency. The output from V3B is coupled through C22 to the grid (pin 2) of the transmitter second multiplier, V4.

4-3-6. SECOND MULTIPLIER

Tube, V4, is a conventional pentode doubler circuit with the plate trimmer tuned to exactly four times the oscillator frequency. The output from V4 is transformer coupled through T1 to the grids (pins 1 and 3) of the transmitter third multiplier, V5.

4-3-7. THIRD MULTIPLIER

Tube, V5, is a dual tetrode type 6360 tube performing as a frequency tripler circuit. The input trimmers (C28) are tuned to four times the oscillator frequency while the trimmers in the plate circuits are adjusted to 12 times the oscillator frequency, which is the channel frequency of operation. The outputs of V5 are transformer coupled through T2 to the grid (pin 10) of the transmitter power amplifier, V6.

4-3-8. POWER AMPLIFIER

The type 8150 power pentode, V6, amplifies the signal to a level suitable for application to the antenna. Trimmer C35 in the grid circuit and coils L8A and L8B and trimmers C40 and C41 in the plate circuit are tuned to the exact channel frequency. The output from V6 is coupled through L8A and L8B, filtered through L9, L10, and L11 and applied through the antenna relay K1 to the antenna for transmission to other stations in the system.

SECTION V

MAINTENANCE AND ALIGNMENT

5-1. GENERAL

Instructions outlined in this section are directed mainly to servicemen familiar with industrial communications radios. This section contains information on preventive and corrective maintenance.

Preventive maintenance differs from corrective maintenance in that its objective is to prevent troubles from occurring. Preventive maintenance consists of work performed to keep equipment in good working order and reduce breakdowns and interruptions in service. Corrective maintenance is required when a malfunction of the equipment becomes apparent and an electrical or mechanical adjustment and/or replacement of components is necessary.

NOTE

Provisions have been made to key the transmitter "ON" from the inside of the chassis when performing maintenance and alignment on trunk mounted and remotely located equipments. To accomplish this short pins 9 and 12 of connector J1 together with a screwdriver or other metal object.

5-2. PREVENTIVE MAINTENANCE

Periodic checks should be performed by qualified servicemen to minimize equipment failure and maintain continuity of service. The following procedures should be of aid in checking the CSM/CSB-30-2 equipment for items which could result in either equipment breakdown or shortening the time of its useful service:

A. Remove all dirt, corrosion, and moisture from sockets, plugs, and case.

B. Examine all plugs and sockets for firm seating and positive contact.

C. Remove dust covers and examine all components, such as capacitors, resistors, tubes, diodes, and transistors, for outward signs of damage.

D. Inspect internal flexible wiring for signs of breaks, improper dress, and burned or frayed insulation.

5-3. CORRECTIVE MAINTENANCE

When the CSM/CSB-30-2 equipment fails to operate properly, the trouble may be corrected by mechanical or electrical adjustment or, if necessary, by replacement of one or more defective components. When a malfunction occurs in the CSM/CSB-30-2 Transmitter/Receiver, the normal procedure is to identify the trouble and localize the source to a particular stage or component by means of the Signal Strength Chart, Trouble Shooting Chart, and Schematic Diagrams appearing in the back of this manual.

5-3-1. SIGNAL STRENGTH CHART

Table 1 lists the signal strength required for 20 DB receiver quieting with a normal signal. Signal is to be injected from a 50-ohm (terminated) output from a Marconi Model 1066B or equivalent signal generator through an appropriate coupling capacitor.

TABLE 1. RECEIVER SIGNAL STRENGTH CHART

Injected Signal Frequency	Signal Injected at	Maximum Required Signal
1650 KC through a 0.01 μF capacitor	V12 - pin 1	10 Millivolts
	V11 - pin 1	100 Microvolts
10.700 MC through 0.002 μF capacitor	V9 - pin 1	5 Microvolts
	V8 - pin 1	5 Microvolts
Channel Frequency through a 4.7 $\mu\mu$F capacitor	V8 - pin 9	5 Microvolts
	V7 - pin 6	15 Microvolts
	V7 - pin 2	2 Microvolts
Channel Frequency Directly from Generator (not terminated)	Antenna Receptacle	0.5 Microvolt

5-3-2. TROUBLE SHOOTING CHART

Table 2 lists the most common troubles which occur in this type of equipment, their causes and remedies. The table is broken down into receiver, transmitter, and power supply problems to help isolate the malfunction.

TABLE 2. TROUBLE SHOOTING CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
RECEIVER		
Inoperative	(A) Audio Section: Tubes V13, V15 and/or associated circuitry defective. (B) IF Section: Tubes V12, V11, V10, V9, V8 and/or associated circuitry defective. (C) RF Section: Tubes V1B, V7 and/or associated circuitry defective.	Identify defective stage by voltage, resistance, and gain measurements (table 1). Locate and replace defective component.
Squelch Inoperative	Tube V14 and/or associated circuitry defective	Locate and replace defective component.
Low Sensitivity	(A) Defective tube in RF, IF, or audio section.	Identify defective stage by voltage, resistance, and gain measurements (table 1). Locate and replace defective component.
	(B) Receiver misaligned.	Realign receiver per paragraph 5-4.
	(C) Defective antenna, antenna cable, or relay K1.	Locate and replace defective component.
Audio Distorted	(A) Tube V15 and/or associated circuitry defective.	Locate and replace defective component.
	(B) Receiver misaligned.	Realign receiver per paragraph 5-4.
	(C) Defective or mis-adjusted channel crystal, Y3.	Re-net to frequency or replace crystal if necessary.
TRANSMITTER		
No RF Output	(A) Tubes V1 through V6 and/or associated circuitry defective. (B) Defective relay, K1. (C) Defective channel crystal, Y1.	Following the alignment procedure (paragraph 5-5), identify defective stage; locate and replace defective component.
Low RF Output	(A) Defective or weak tube V1 through V6.	Following the alignment procedure (paragraph 5-5), identify defective stage; locate and replace defective component.
	(B) Transmitter misaligned.	Realign transmitter per paragraph 5-5.
	(C) Defective Tune-Operate switch, S1.	Check and replace switch as necessary.
	(D) Low B+ voltage.	Check power supply.
Modulation Deviation Low	(A) Tube V16 defective. (B) Microphone defective.	Locate and replace defective component.
	(C) Deviation control, R37, mis-adjusted.	Readjust control per paragraph 5-5-4.

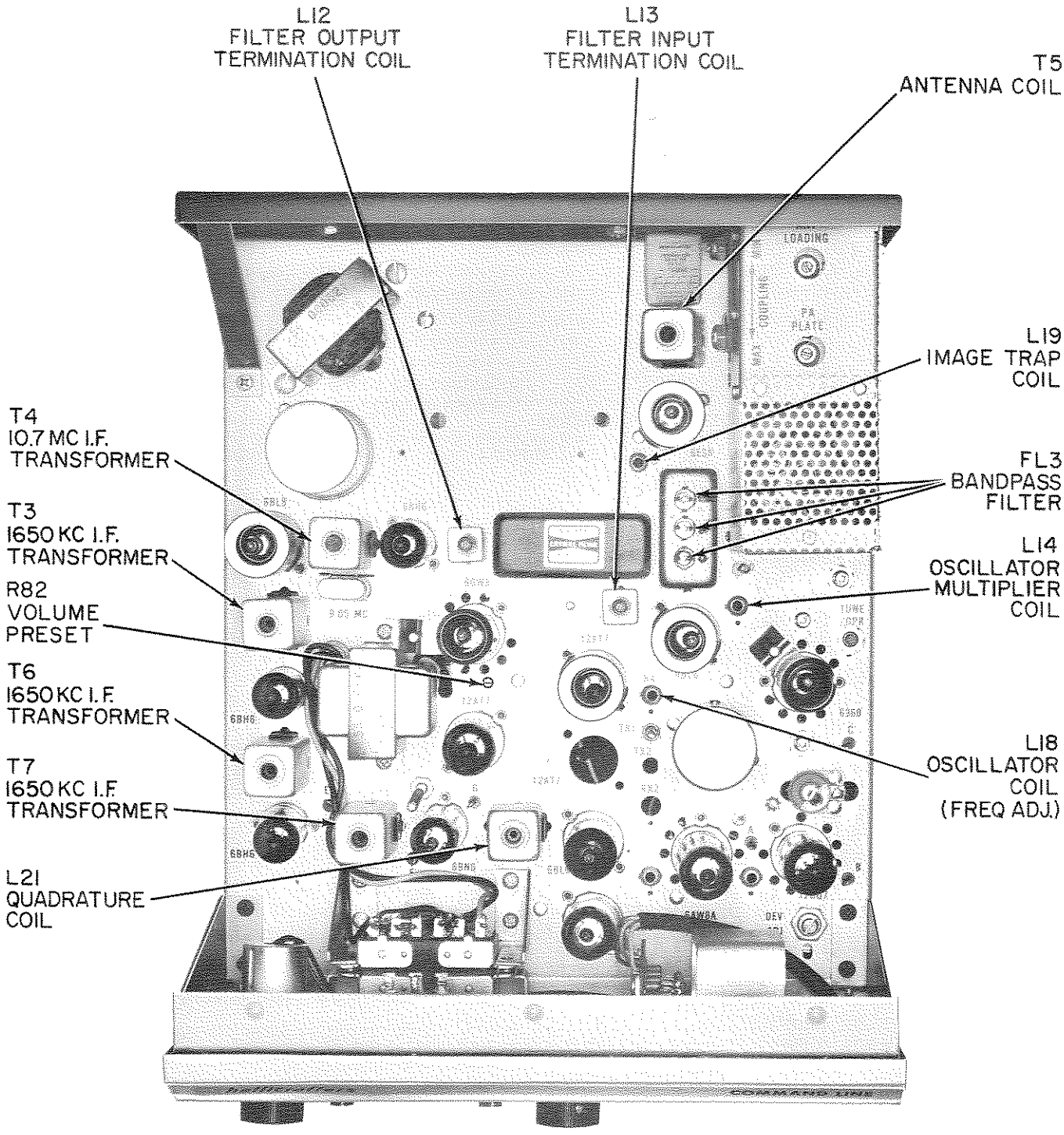


Figure 10. Top View of Chassis, Showing Receiver Alignment Points.

TABLE 2. TROUBLE SHOOTING CHART (CONT)

SYMPTOM	PROBABLE CAUSE	REMEDY
Modulation Distorted	(A) Transmitter misaligned.	Realign transmitter per paragraph 5-5.
	(B) Defective or mis-adjusted channel crystal, Y1.	Re-net to frequency or replace crystal if necessary.
POWER SUPPLY Inoperative (AC or DC units)	(A) Defective fuse(s). (B) Defective ON/OFF switch. (C) Defective power transformer.	Locate and replace defective component.
Blows Fuses (DC units)	(A) Transistor Q301, Q302 defective. (B) Silicon diodes CR301, 302 shorted. (C) Power transformer T301 defective. (D) B+ shorted.	Locate and replace defective component.
Blows Fuses (AC units)	(A) Silicon diodes CR401 through CR406 shorted. (B) Transformer T401 defective. (C) B+ shorted.	Locate and replace defective component.
Low B+ Voltage (AC or DC units)	(A) Shorted tube or B+ bypass capacitor. (B) Defective diodes in power supply. (C) Defective power supply filter capacitor.	Locate and replace defective component.

5-4. RECEIVER ALIGNMENT

Complete alignment of the receiver requires the use of RF signals at 1650 KC, 10.700 MC, and the desired operating frequency. Normally, complete alignment will not be required unless a major component has been replaced. In most cases only RF alignment and netting to the system frequency will be required, in which instances proceed directly with paragraph 5-4-7.

5-4-1. EQUIPMENT REQUIRED

1. FM Signal Generator; Boonton Type 202E, Marconi Model 1066B, or equivalent.
2. Multimeter; Simpson Model 260 or equivalent.
3. Frequency Standard capable of better than 0.0002% accuracy on the desired channel; Gertsch Model FM-7, Bailey Model 700 "Zero-Beat" or equivalent.
4. LF Signal Generator; Hewlett-Packard 606A, Measurements Model 65B, or equivalent.

5-4-2. 1650 KC IF ALIGNMENT

The second IF frequency is approximately 1650 KC, the exact frequency being determined by the first IF frequency minus the second oscillator crystal frequency. Best alignment can be obtained by injecting an unmodulated 10.7-MC signal at the 10.7-MC IF amplifier grid (V9, pin 1) and then aligning the 1650-KC IF stages. This method will account for slight variations in second conversion oscillator frequency and, for this reason, is preferred over using a signal at 1650 KC.

To align the second IF by this method, place the multimeter on the 2.5-volt DC range and connect the positive lead to ground and the negative lead to test point F. Short test point G to ground with

a small lead to disable the gated-beam discriminator. Adjust the generator output to produce a reading of approximately -0.5 to -1.5 volts, making certain that the stages are not saturating or limiting. If a reading cannot be obtained, it will be necessary to set the signal generator to 1650 KC and rough align the 1650-KC IF transformers. Connect the generator output to the grid of the second mixer (V10A, pin 2), if required.

Peak the top and bottom cores of T3, reducing the generator output as required to keep the meter reading below the saturation level. Peak the top and bottom cores of T6 and T7. Repeat adjustment of T3, T6, and T7 until no further increase in meter reading is obtained. Remove the short from test point G and adjust the quadrature coil (L21) for a very slight dip in the meter reading at test point F. The quadrature coil dip is quite small and it may be preferred to make this adjustment for maximum speaker audio output with a modulated FM input signal on the channel frequency. This completes the alignment of the 1650-KC IF.

5-4-3. 10.7-MC IF ALIGNMENT AND CRYSTAL FILTER ADJUSTMENT

Set the signal generator at 10.700 MC and connect the output to pin 1 of the first IF amplifier (V9). The test meter should be connected to test point F and test point G should be shorted to ground. Peak the top and bottom cores of T4. Remove the generator output from V9 and connect it to the first mixer grid (V8A, pin 9). Peak the terminating coils (L12 and L13) at the output and input of the crystal filter. After the coils have been peaked, slowly tune the generator over approximately a ±7-KC range and observe the test meter reading. If large dips or valleys occur in this range, adjust the terminating coils until minimum variation in the passband, commensurate with best output, is obtained. This completes the 10.7-MC IF alignment.

5-4-4. HIGH FREQUENCY OSCILLATOR ADJUSTMENT

This oscillator (V1B) is crystal controlled on 45 to 55 MC depending on the exact channel frequency. The oscillator frequency is multiplied by V8B to produce the channel frequency minus the 10.7-MC first IF frequency. For crystal information, refer to paragraph 3-5. The exact receiver operating frequency, using a particular crystal, can be determined by the following formula:

Receiver Operating Frequency = (Crystal Frequency x 3) - 10.7

Preliminary Adjustment. - This adjustment will be required only in cases of complete frequency change or replacement of major oscillator components.

Connect the FM signal generator, tuned at or near the carrier frequency (unmodulated), to the antenna input connector. Connect the test meter to test point F and ground test point G with a short lead.

Adjust the generator output for a meter reading between -0.5 and -1.5 volts. Insure that the IF stages are not limiting by increasing and decreasing the generator output slightly and observing a proportionate meter reading change.

Adjust the receiver oscillator frequency warping coil (L18) for maximum meter reading. Peak coil L14 in the tripler plate circuit.

Netting. - In order that the receiver frequency exactly coincide with the system channel frequency, the receiver oscillator must be adjusted so as to "net" the receiver on frequency. Inasmuch as the receiver selectivity is symmetrical, centered on 10.7 MC by virtue of the crystal-lattice filter, it is absolutely essential that the high frequency oscillator be set so as to produce this 10.7 MC IF signal exactly when heterodyned with the incoming channel signal. This can be accomplished by the following procedure.

Inject an unmodulated 10.7-MC signal (exactly on frequency) from the signal generator to the receiver first mixer (V8). This can be accomplished by wrapping a two or three turn link of hookup wire, connected to the generator output lead, around the tube with its shield removed.

A signal source, known to be on the desired channel frequency, either an accurately adjusted signal generator or a signal from the system control transmitter, should be connected to the receiver antenna input.

The oscillator frequency warping coil (L18) should be adjusted for zero beat with the 10.7-MC injected signal. Zero beat will be heard in the receiver speaker (volume control set at about mid range).

5-4-5. RF ALIGNMENT

Connect signal generator and test meter as specified for High Frequency Oscillator Adjustment, paragraph 5-4-4.

Peak core of antenna coil (T5) for maximum meter reading. Preadjust the three cores of FL3 fully counterclockwise (tuning studs full out). Adjust the signal generator for a meter reading of approximately -1.0 volt. Adjust first, second and third cores of FL3 in turn (first core is towards rear of chassis) for maximum meter indication, decreasing generator input to maintain less than a -1.5-volt reading. Repeat adjustments of FL3 until no further increase can be obtained.

5-4-6. IMAGE TRAP ADJUSTMENT

Connect FM signal generator to the antenna input. Tune the generator to the receiver image frequency (channel frequency minus 21.4 MC, unmodulated). Connect the test meter to test point E (or test point F with test point G shorted to ground). Adjust generator output to obtain a meter indication that is not being limited. Adjust the image trap coil (L19) for minimum indication on the meter (maximum rejection). Increase signal generator output only as required to observe a good null.

5-4-7. PERIODIC RECEIVER FREQUENCY CHECK

In the performance of normal periodic maintenance checks, complete alignment will not be necessary. The following procedure is to be performed in order to peak the receiver on the correct frequency.

Connect the FM signal generator to the antenna input and set it to the exact operating frequency. Connect the test meter to test point F and short test point G to ground with a short length of wire. Adjust the signal generator output for a meter reading between -0.5 and -1.5 volts with no limiting.

Repeak the following coils and transformers in the order shown: L18, L14, all three cores of FL3, L13, L12, top and bottom of T4, T3, T6, and T7. (This may also be accomplished using a weak signal from a transmitter in the system.)

Remove the short from test point G. Modulate the signal generator with a 100-CPS tone at 3.3 KC deviation and adjust the quadrature coil (L21) for maximum output at the speaker (if a transmitter is used, modulate with voice). The receiver sensitivity should be about 0.5 microvolt for 20-DB quieting with a squelch threshold opening of approximately 0.20 microvolt if the receiver is properly aligned.

5-4-8. VOLUME PRESET ADJUSTMENT

The Volume Preset control (R82) is preset at the factory, but may be re-adjusted if desired. Connect an indicating type wattmeter/load across the speaker. With no signal applied, set the VOLUME control to maximum and adjust the Volume Preset control for one watt of noise at the speaker.

5-5. TRANSMITTER ALIGNMENT

IMPORTANT NOTE

According to FCC Rules and Regulations: Only persons holding radiotelephone operator licenses (second class or higher) or persons working under their direct supervision are authorized to perform adjustments or tests coincident with the installation, servicing, or maintenance of a radio station, which may affect the proper operation of the equipment as set forth in the Rules and Regulations governing the class of service for which the equipment is licensed.

5-5-1. EQUIPMENT REQUIRED

1. Frequency standard capable of better than 0.0002% accuracy on the desired channel; Gertsch Model FM-7, Bailey Model 700 "Zero-Beat" or equivalent.
2. Deviation meter; Marconi Model TF-791D or equivalent.
3. Wattmeter/Load; Bird Model 612 or equivalent.
4. Multimeter; Simpson Model 260 or equivalent.

5-5-2. RF ALIGNMENT

Connect the indicating type wattmeter/load to the antenna output, using a minimum length of RG-8/U coaxial cable. Turn the equipment ON and leave it in the STANDBY for a minimum of 15 minutes to permit the oven and crystal to stabilize. Pull the Operate-Tune switch up to the Tune position. This reduces the screen voltage on the RF output tube to prevent its becoming damaged because of low drive during alignment.

Key the transmitter ON with the microphone switch. Connect the positive lead from the test meter to ground and the negative lead to test point A. Adjust the buffer plate circuit coil (L2) for maximum reading (-14 volts approximately). It may be necessary to adjust the crystal trimmer capacitor (C1) slightly to obtain a reading.

Connect the test meter to test point B and peak the first doubler coil (L3) for maximum indication on the meter (approximately -35 volts).

Connect the test meter to test point C. Adjust the second doubler plate tank and tripler grid timmers (C25 and C28) for maximum. This reading should be between -45 and -125 volts. Adjust trimmers C25 and C28 alternately, a little at a time, as there is some interaction caused by slight intentional overcoupling.

Connect the test meter to test point D and adjust the tripler plate and final grid trimmers (C32 and C35) for maximum. This reading should be between -40 and -55 volts. At this point there should be some indication of power output on the wattmeter (1 to 2 watts minimum).

If there is no indication of output on the wattmeter/load or if the indication is less than one watt, adjust the plate tuning capacitor (C40), loading capacitor (C41), and output link coupling assembly (side of final amplifier cage) to peak the output reading on the wattmeter.

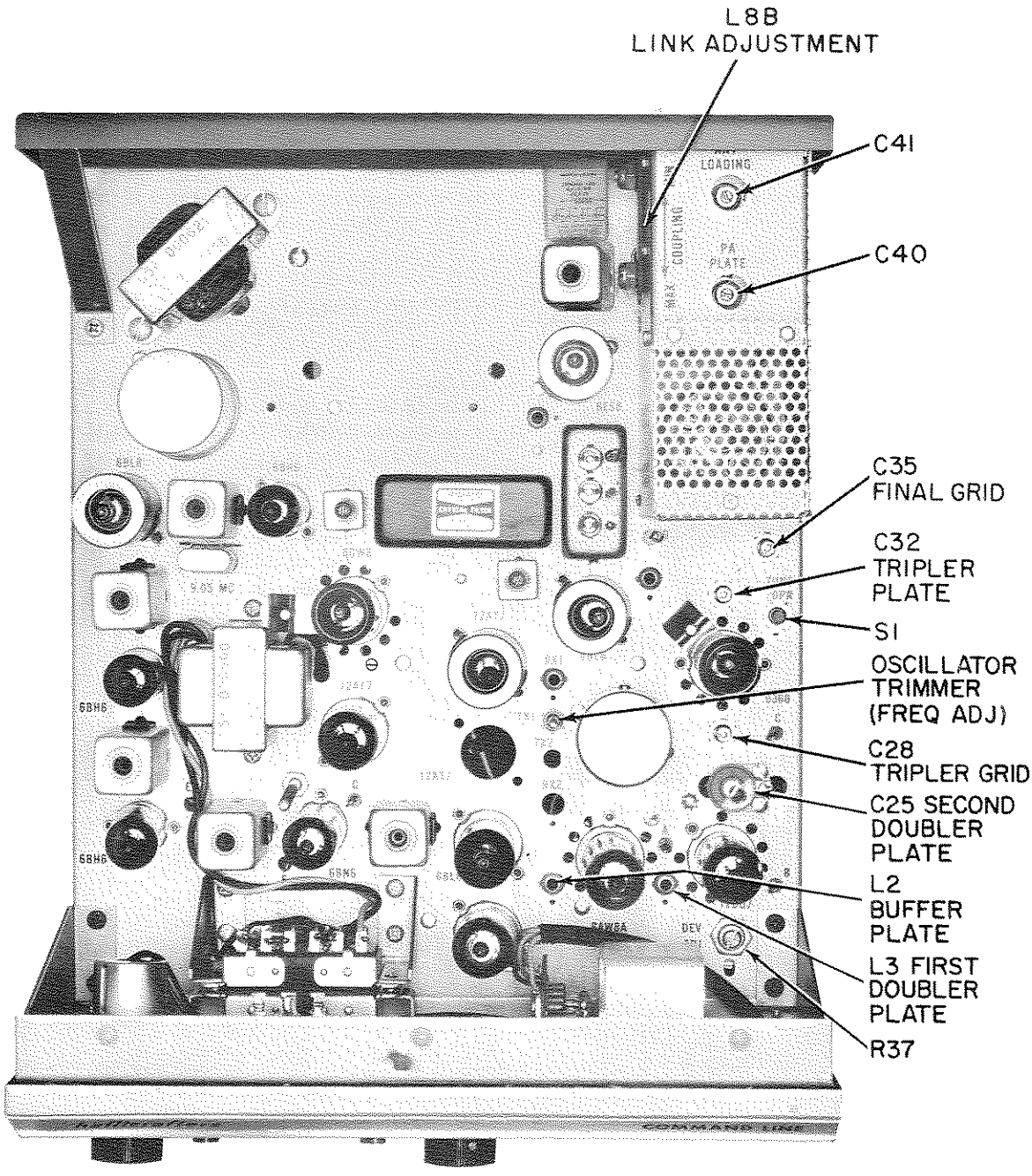


Figure 11. Top View of Chassis, Showing Transmitter Alignment Points.

Release the microphone key and push the Operate-Tune switch in to the Operate position (down). Key the transmitter and retune the plate tank trimmer (C40) for maximum indicated output on the wattmeter. Adjust the output coupling capacitor (C41) and the output link coupling to produce maximum output indication on the wattmeter/load.

IMPORTANT NOTE

Interaction between these three adjustments is normal and they must be adjusted alternately, a little at a time, to obtain maximum power output.

5-5-3. FREQUENCY CALIBRATION

The fundamental crystal frequency of the transmitter is between 12 and 15 MC depending on channel frequency. This frequency is multiplied in subsequent stages (2 times 2 times 3) to produce the output frequency. The output frequency should be measured by comparison to a secondary frequency standard with better than 0.0002% accuracy. It will be noted that the transmitting frequency varies approximately 200 CPS because of normal oven cycling. The operating frequency should be set with trimmer capacitor, C1, so as to center this variation exactly on the channel frequency indicated by the standard. For detailed information, refer to paragraph 3-5.

5-5-4. FREQUENCY DEVIATION

In order to check carrier deviation, sample the output at the load with a pickup loop connected to the deviation meter. Speak into the microphone in a loud voice and note the deviation. This should indicate not more than ±5 KC. Adjust the deviation control (R37), if necessary, to maintain the deviation within the ±5 KC limits.

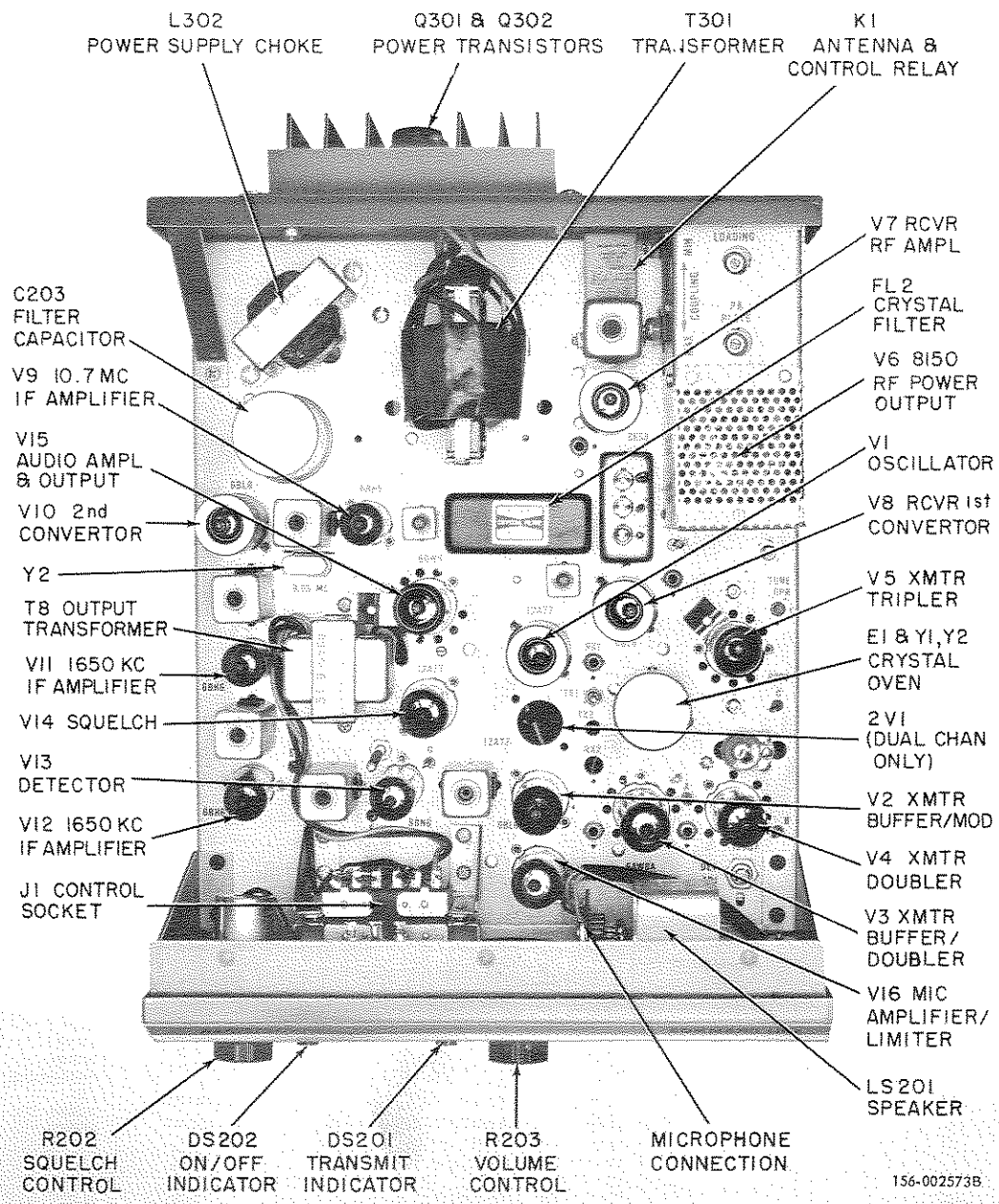
MODEL C-1101

12-VOLT DC

TRANSMITTER/RECEIVER CHASSIS

Hallicrafters' Model C-1101 is a 16-tube transmitter/receiver chassis designed for operation in the 148 to 174 MC range. The chassis includes a self-contained transistorized power supply which operates from a 12-volt negative-ground DC source. This transmitter/receiver chassis is used in the Model CSM-30-2 Two-Way FM Land-Mobile Radio equipment.

Detailed information regarding overall performance may be found in the Specifications section of the handbook on the CSM-30-2 equipment.



Model C-1101 Transmitter/Receiver Chassis

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, ±10%, 1/2 WATT.
   ALL CAPACITORS ARE IN UF (SEE PARTS LIST FOR VOLTAGE RATINGS)
2. S-SINGLE CHANNEL OPERATION
   DR-TWO CHANNEL RECEIVE
   DT-TWO CHANNEL TRANSMIT
   DTR-TWO CHANNEL TRANSMIT AND RECEIVE
3. C87, 3.3 UUF, NOT USED ON SOME UNITS.
4. ON TRUNK MOUNT UNITS, IGNITION SWITCH LINE COMES OUT OF CONTROL UNIT.
5. ALL VOLTAGES MEASURED WITH EIA STANDARD INPUT OF 13.6 VOLTS.
* VOLTAGE VARIES WITH SIGNAL STRENGTH AND SQUELCH CONTROL SETTING.

C-2101 CONTROL HEAD

C-1101 MAIN CHASSIS

CONTROL HEAD (C-2101)

MALE FEMALE

3.2Δ OUTPUT

500Δ OUTPUT

TRANSMIT INDICATOR

ON/OFF INDICATOR

CHANNEL 1

CHANNEL 2

PTT

SQUELCH SW

MICROPHONE INPUT

DUAL CHANNEL UNITS ONLY

MK20I MICROPHONE

TO IGNITION SWITCH SEE NOTE 4

TO BATTERY

BREAK FOR DTR & DT

DTR & DT UNITS ONLY

SEE NOTE 3

CHAN 1R

CHAN 2R

DTR & DR UNITS ONLY

SQUELCH

3.2 A. OUTPUT

500 Δ OUTPUT

+450V

+265V

089-00336C

PARTS LIST

Schematic Symbol	Description	Hallicrafters Part Number
	CAPACITORS	
C1	Variable, Trimmer, 1 $\mu\mu$F to 8 $\mu\mu$F, 500V (Piston type)	044-000586
C2,15	16 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131160
C3,69	68 $\mu\mu$F, 2%, 300V, Plastic Mica	481-161680
C4,53, 56,59,91, 92,95,101, 102,111,112,131,132	0.005 μF, 20%, 500V, Ceramic Disc	047-000442
C5, 17,52,79, 99,103	100 $\mu\mu$F, 2%, 300V, Plastic Mica	481-161101
C6,7,10, 14,16,18, 20,21,23, 24,26,27,34,37,39,48,57,61,64,65,66,72,73, 74,76,77,81,82,84,90,94,98,114,118,119,120, 121,122,125,126,127,128,129,130,133,134, 135,136,137,138,139,141	0.001 μF, 20%, 500V, Ceramic Disc	047-001671
C8,13,38,60	10 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131100
C9,29	4.7 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131047
C11,55, 96,107	470 $\mu\mu$F, 20%, 300V, Plastic Mica	481-161471
C12	25 μF -10+100%, 25V, Electrolytic	045-001000
C19,68	22 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151220
C22,63,67	50 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151500
C25	Variable, Trimmer, 2.5 $\mu\mu$F to 13 $\mu\mu$F, 500V	044-000415
C28,32	Variable, Trimmer, 2.7 $\mu\mu$F to 10.8 $\mu\mu$F	048-000539
C30,31	1.5 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131015
C35	Variable, Trimmer, 2.6 $\mu\mu$F to 13 $\mu\mu$F	048-000490
C36,83	5 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131050
C40,41	Variable, Trimmer, 3.8 $\mu\mu$F to 10.8 $\mu\mu$F	048-000540
C42	22 $\mu\mu$F, 10%, 500V, Ceramic Feed-Through	047-001733
C43,46	7 $\mu\mu$F, 2%, 500V, Plastic Mica	482-131070
C44,45	22 $\mu\mu$F, 10%, 500V, Ceramic Feed-Through (Button type)	047-001734
C47	7 $\mu\mu$F, $\pm$1 $\mu\mu$F, 500V, Mica Stand-Off (Button type)	047-001730
C49	0.1 μF, 10%, 200V, Paper Tubular	046-001294-004
C50	1200 $\mu\mu$F, 2%, 300V, Plastic Mica	481-261122
C51,54, 97,106, 108,110, 116,117,123,124,140,303	0.01 μF, 20%, 500V, Ceramic Disc	047-000354
C58	36 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151360
C62	105 $\mu\mu$F, 2%, 300V, Plastic Mica	493-121050-324
C70,89, 93	47 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151470
C71	43 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151430
C75,78	2.2 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131022
C80,87	3.3 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131033
C85,104, 105	270 $\mu\mu$F, 2%, 300V, Plastic Mica	481-161271
C88	0.002 μF, 20%, 500V, Ceramic Disc	047-000395
C109	0.0022 μF, 10%, 200V, Paper Tubular	046-001273-004
C113	5 μF -10+100%, 150V, Electrolytic	045-001002
C115	0.005 μF, GMV, 1000V, Ceramic Disc	047-100485
C301,306, 307	10 μF +75-10%, 350V, Electrolytic	045-000415
C302A,B, C and D	40 μF, 350V; 40 μF, 350V; 10 μF, 350V; 100 μF, 25V, Electrolytic	045-001003
C304	250 μF, 25V, Electrolytic	045-100618
C305	0.1 μF, +80-20%, 50V, Ceramic Disc	047-001146
C308	0.02 μF, 1000V, Ceramic Disc	047-001528
C86	1.8 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131018

Schematic Symbol	Description	Hallicrafters Part Number
	*RESISTORS	
R1,3,8, 10,25,31, 42,61,63,65,73,74	100K Ohm	451-252104
R2,9,75, 80	2200 Ohm	451-252222
R4,11,47, 54,69	220 Ohm	451-252221
R5	15K Ohm	451-252153
R6,32,48, 59,67,70	47K Ohm	451-252473
R7	12K Ohm	451-252123
R12,16,20, 53,64	1 Megohm	451-252105
R13,49,51	220K Ohm	451-252224
R14,17,45	22K Ohm	451-252223
R15	1000 Ohm	451-252102
R18	100 Ohm	451-252101
R19	15K Ohm,1 watt	451-352153
R21,40	68K Ohm	451-252683
R22,72	10K Ohm, 1 watt	451-352103
R23	27K Ohm, 1 watt	451-352273
R24	1800 Ohm, 1 watt	451-352182
R26,27	150K Ohm	451-252154
R28	27K Ohm, 2 watt	451-652273
R29	3900 Ohm, 1 watt	451-352392
R30	270K Ohm	451-252274
R33	470 Ohm	451-252471
R34,78	3.3 Megohm	451-252335
R35,36,38, 89	680K Ohm	451-252684
R37	Variable, 500K Ohm, 30%, 1/4 watt, Deviation adjust	025-002142
R39,41,44, 50,52,68	1500 Ohm	451-252152
R43,58	10K Ohm	451-252103
R46	120K Ohm	451-252124
R55,62,79, 81	470K Ohm	451-252474
R56	82K Ohm	451-252823
R57,71,76, 77,88	330K Ohm	451-252334
R60	330 Ohm	451-252331
R66	1000 Ohm, 1 watt	451-352102
R66	1000 Ohm, 1 watt	451-352102
R84	8.2 Megohm	451-252825
R85	180K Ohm	451-252184
R86	100K Ohm, 1 watt	451-352104
R87	22K Ohm, 1 watt	451-352223
R91	6800 Ohm, 2 watt	451-652682
R92	10 Ohm	451-252100
R93	12 Megohm	451-252126
R301	270 Ohm, 2 watt	451-652271
R302,303	10 Ohm, 5 watt, Wire Wound	445-012100
R304	25 Ohm, 10 watt, Wire Wound	445-032250
R305	10 Ohm, 5%, 1 watt	451-351100
R306,307	100K Ohm, 2 watt	451-652104
R82	Variable, 1 Megohm, 30%, 1/5 Watt, Volume Preset	025-002067

*All RESISTORS are carbon type, 10%, 1/2 watt unless otherwise stated.

	COILS AND TRANSFORMERS	
L1	Coil, 100 μH, RF Choke	053-000644
L2	Coil, Transmitter Amplifier	051-003660
L3,18	Coil, Transmitter 1st Doubler and Receiver Oscillator	051-003661
L4	Coil, 250 μH, RF Choke	053-100348
L5	Coil, 1 μH, RF Choke	053-000654
L6	Coil, 2.7 μH, RF Choke	053-000670
L7	Coil, 1.8 μH, RF Choke	053-000489
L8A	Coil, Final Tank	051-003668
L8B	Coil, Link	051-003667
L9,11	Coil, Lo-Pass Input and Output	051-003657
L10	Coil, Lo-Pass	051-003664
L12,13	Coil, Termination 10.7 MC	051-003656
L14	Coil, Receiver Injection	051-003659
L15,20,22, 23	Coil, RF Choke, Bead Shielding	077-002960
L16	Coil, 3.3 μH, RF Choke	053-000611
L17	Coil, RF Neutralizer	051-003669
L19	Coil, Image Trap	050-001625
L21	Coil, Quadrature	050-000935
L301	Reactor, Hash, 40 μH	050-000998
L302	Reactor, Filter, 1H	056-000621
T1	Transformer, Transmitter 2nd Doubler	051-003662

Schematic Symbol	Description	Hallicrafters Part Number
	COILS AND TRANSFORMERS (CONT)	
T2	Transformer, Transmitter Tripler	051-003663
T3,6,7	Transformer, IF, 1650 KC	050-000934
T4	Transformer, IF, 10.7 MC	050-000933
T5	Transformer, Antenna	051-003655
T8	Transformer, Audio Output	055-000500
T301	Transformer, Power	050-001368
	**ELECTRON TUBES AND DIODES	
V1,14	Tube, Type 12AT7	090-900034
V2,8,10	Tube, Type 6BL8	090-901431
V3	Tube, Type 6AW8A	090-901103
V4	Tube, Type 12DQ7	090-001528
V5	Tube, Type 6360	090-901253
V6	Tube, Type 8150	090-001534
V7	Tube, Type 6ES8	090-001529
V9,11,12	Tube, Type 6BH6	090-900821
V13	Tube, Type 6BN6	090-900826
V15	Tube, Type 6GW8	090-001502
V16	Tube, Type 6BN8	090-001465
CR1	Diode, Type HB-6	019-003065
CR301, 302	Diode, Silicon, Rectifier, Type 1N3195	019-002770

**See Section II, Page 3 for Tube Functions.

	SOCKETS	
XQ301, 302	Socket, Transistor	006-000922
XV1,2,7,8	Socket, Tube, 9 pin w/shield base	006-000395
XV3,4,5, 10,14,15, 16	Socket, Tube, 9 pin w/o shield base	006-000913
XV6	Socket, Tube, 12 pin	006-001082
XV9,11, 12,13	Socket, Tube, 7 pin	006-001048
XY1,3	Socket, Octal	006-000948
XY2	Socket, Crystal	006-100320
	MISCELLANEOUS	
FL3	Band Pass Filter Assembly	150-006267
	Cabinet Assembly, Riveted	150-006287
	Catch, Spring Tension and Strike	030-000869
J1	Connector, 18 pin Control Cable	010-002767
J2	Connector, Antenna	010-100056
P301	Connector, Input Power, Plug (Inc. Hardware)	010-002693
	Cover, Dust, Rear	066-003973
	Cover, Lo-Pass	066-003731
Y1	Crystal, Transmitting, 12-15 MC	019-002949
Y2	Crystal, 2nd Converter, 9.050 MC	019-002948
Y3	Crystal, Receiving, 49-55 MC	019-002950
FL1	Filter, Low-Pass	049-000251
FL2	Filter, Crystal, 10.7 MC	049-000230
F301	Fuse, Cartridge, 1/2 amp, 125V, slow-blow	039-100414
F302	Fuse, Cartridge, 15 amp, 32V	039-000707
	Fuse, Cart. 20 amp. 250V(C-4101)	039-000748
	Fuse Block (C-4101)	006-001121
XF301, 302	Fuseholder (Inc. Hardware)	006-000451
	Grommet, Rubber (1 inch by 1/2 inch dia.)	016-002381
	Handle, Chassis Removal	030-100584
	Handle, Unit Mounting (Front mount units only) (C-4103)	030-000889
	Heat Sink, Rear Panel	067-011149
	Insulator, Mica, to be used with Transistor Socket	008-005634
	Iron Core (FL3)	003-007727
	Iron Core (L2,L3,L14,L18)	003-007725
	Iron Core (L19)	003-203388
E1	Oven, Crystal	021-000672
	Panel Assembly, Blank	150-006934
	Panel, Rear	068-001374
	Power Cable (18 FT)	087-007878
	Power Cable (8 FT)	087-008006
K1	Relay, Armature (4PDT)	021-000667
K301	Relay, Contactor, 60 amp, 28V	021-000671
	Shield, Tube (V1,2,7,8)	069-201190
	Socket, Tube, Rear (Accessory)	006-200707
S1	Switch, Pushbutton, Tune Operate	060-002661
Q301,302	Transistor, Type 2N1554	112-000107

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, ±10%, 1/2 WATT.
   ALL CAPACITORS ARE IN UF (SEE PARTS LIST FOR VOLTAGE RATINGS)
2. S-SINGLE CHANNEL OPERATION
   OR-TWO CHANNEL RECEIVE
   DS-TWO CHANNEL TRANSMIT
   DTR-TWO CHANNEL TRANSMIT AND RECEIVE
3. C87, 3.3 UUF, NOT USED ON SOME UNITS
4. ALT. VOLTAGES MEASURED WITH EIA STANDARD INPUT OF 13.6 VOLTS.
*. VOLTAGE VARIES WITH SIGNAL STRENGTH AND SQUELCH CONTROL SETTING.

C-2101 CONTROL HEAD

C-1102 MAIN CHASSIS

CONTROL HEAD (C-2101)

R201 3 5W

R202 20,5W,20% VOLUME

LS201

DS201 TRANSMIT WHITE

DS202 ON/OFF AMBER

S202 CHANNEL / CHANNEL 1 / CHANNEL 2 / DUAL CHANNEL UNITS ONLY

R203 20K 30% SQUELCH

S201 ON/OFF

MK201 MICROPHONE PTT SW

MALE / FEMALE

3.2Ω OUTPUT

TRANSMIT INDICATOR

R26 150K

C49 0.001

500Ω OUTPUT

ON/OFF INDICATOR R27, 150K

CHANNEL 1

CHANNEL 2

PTT

SQUELCH SW

MICROPHONE INPUT

P201 / J1

T+200V

V1A TRANSMITTER OSCILLATOR (CHANNEL 1) 1/2-12AT7

V2A TRANSMITTER FIRST BUFFER AMPLIFIER 1/2-6BL8

V2B TRANSMITTER PHASE MODULATOR 1/2-6BL8

V3A TRANSMITTER BUFFER AMPLIFIER 1/2-6AM8A

V3B TRANSMITTER FIRST MULTIPLIER (X2) 12.5 TO 14.5MC 1/2-6AM8A

V4 TRANSMITTER SECOND MULTIPLIER (X2) 12007

V5 TRANSMITTER THIRD MULTIPLIER (X3) 6360

V6 TRANSMITTER POWER AMPLIFIER B150

24.6 TO 29MC

148 TO 174MC

Y1 6 OR 5.5 7 ON DTR & DT

BREAK FOR DTR & DT

TRANSMITTER OSCILLATOR (CHANNEL 2)

2V1A 1/2-12AT7

DTR & DT UNITS ONLY

PTT

T+420V

T+200V

R+475V

R+225V

S1 TUNE/OPERATE

J2

K1 PTT(GND) 12V

SEE NOTE 3

V7A RECEIVER RF AMPLIFIER 1/2-6ES8

V7B 1/2-6ES8

V8A RECEIVER FIRST MIXER 1/2-6BL8

V8B RECEIVER OSCILLATOR MULTIPLIER 1/2-6BL8

V9 RECEIVER FIRST IF AMPLIFIER 6BH6

V10A RECEIVER SECOND MIXER 1/2-6BL8

V10B RECEIVER SECOND CONVERSION OSCILLATOR 1/2-6BL8

V11 IF AMPLIFIER 6BH6

V12 IF AMPLIFIER 6BH6

V13 DETECTOR 6BH6

V14A SQUELCH/NOISE AMPLIFIER 1/2-12AT7

V14B SQUELCH DC AMPLIFIER 1/2-12AT7

V15A AF AMPLIFIER 1/2-6GW8

V15B AUDIO OUTPUT 1/2-6GW8

V16 6BH6

V1 12AT7

V2 6BL8

V3 6AM8

V4 12007

V5 6360

V6 B150

V7 8E58

V8 6BL8

V9 6BH6

V10 6BL8

V11 6BH6

V12 6BH6

V13 6BH6

V14 12AT7

V15 6GW8

V16 6BH6

2V1 12AT7

T1 .85MC

T2 148 TO 174MC

T3 148 TO 174MC

T4 10.7MC

T5 .85MC

T6 1.65MC

T7 1.65MC

T8 500Ω YELLOW 3.2Ω RED BLACK GREEN BLUE

FL1

FL2 10.7MC FILTER

FL3

L20

L21 QUADRATURE

Y2 9.050MC

E1 CRYSTAL OVEN

RECEIVER OSCILLATOR (CHANNEL 1)

RECEIVER OSCILLATOR (CHANNEL 2)

BREAK FOR DTR & DR

DTR & DR UNITS ONLY

CHAN 1R

CHAN 2R

R+225V

R+475V

+225V

+12.6VDC

12.6VAC

SQUELCH

3.2Ω OUTPUT

500Ω OUTPUT

T+420V

T+200V

PTT

T401

CR401 IN3195

CR402 IN3195

CR403 IN3195

CR404 IN3195

CR405 IN3195

CR406E IN3195

CR407 2E4

F401 2 AMP

F402 1/2 AMP

P401

117VAC 60~

12.6 VAC

L401 1H

R401 25 10W

R402 10 2W

R403 10

R404 100K 2W

R405 100K 2W

R406 10 1W 5% (T +420V) (R +475V)

C401 0.01

C402 0.01

C403 40

C404 40

C405A 40

C405B 40

C406A 40

C406B 40

C4060 100

089-00336-TC

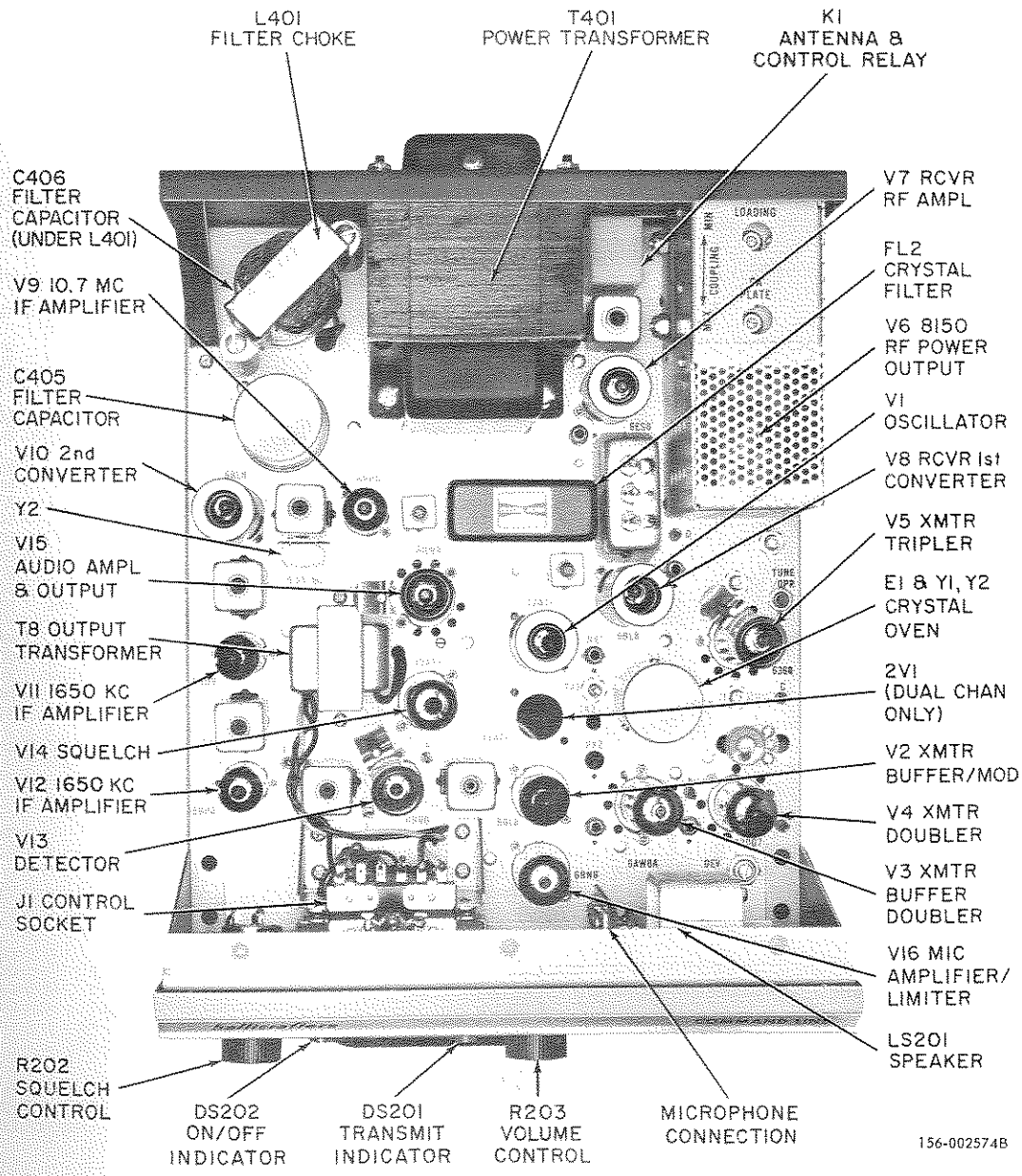
MODEL C-1102

117-VOLT AC

TRANSMITTER/RECEIVER CHASSIS

Hallicrafters' Model C-1102 is a 16-tube transmitter/receiver chassis designed for operation in the 148 to 174 MC range. The chassis includes a self-contained power supply which operates from a 117-Volt, 50/60-cycle AC source. This transmitter/receiver chassis is used in the Model CSB-30-2 Two-Way FM Land-Mobile Radio equipment.

Detailed information regarding overall performance may be found in the Specifications section of the handbook on the CSB-30-2 equipment.



Model C-1102 Transmitter/Receiver Chassis.

PARTS LIST

Schematic Symbol	Description	Hallicrafters Part Number
	CAPACITORS	
C1	Variable, Trimmer, 1 $\mu\mu$F to 8 $\mu\mu$F, 500V (Piston type)	044-000586
C2 15	16 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131160
C3,69	68 $\mu\mu$F, 2%, 300V, Plastic Mica	481-161680
C4,53,56, 59,91,92, 95,101,102, 111,112,131,132	0.005 μF, 20%, 500V, Ceramic Disc	047-000442
C5,17, 52,79,99, 103	100 $\mu\mu$F, 2%, 300V, Plastic Mica	481-161101
C6,7,10, 14,16,18, 20,21,23, 24,26,27,34,37,39,48,57,61,64,65,66,72,73, 74,76,77,81,82,84,90,94,98,114,118,119, 120,121,122,125,126,127,128,129,130,133, 134,135,136,137,138,139,141	0.001 μF, 20%, 500V, Ceramic Disc	047-001671
C8,13,38,60	10 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131100
C9,29	4.7 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131047
C11,55, 96,107	470 $\mu\mu$F, 20%, 300V, Plastic Mica	481-161471
C12	25 μF-10+100%, 25V, Electrolytic	045-001000
C19,68	22 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151220
C22,63,67	50 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151500
C25	Variable, Trimmer, 2.5 $\mu\mu$F to 13 $\mu\mu$F, 500V	044-000415
C28,32	Variable, Trimmer, 2.7 $\mu\mu$F to 10.8 $\mu\mu$F	048-000539
C30,31	1.5 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131015
C35	Variable, Trimmer 2.6 $\mu\mu$F to 13 $\mu\mu$F	048-000490
C36,83	5 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131050
C40,41	Variable, Trimmer 3.8 $\mu\mu$F to 10.8 $\mu\mu$F	048-000540
C42	22 $\mu\mu$F, 10%, 500V, Ceramic Feed-Through	047-001733
C43,46	7 $\mu\mu$F, 2%, 500V, Plastic Mica	482-131070
C44,45	22 $\mu\mu$F, 10%, 500V, Ceramic Feed-Through (Button type)	047-001734
C47	7 $\mu\mu$F, ±1 $\mu\mu$F, 500V Mica Stand-Off (Button type)	047-001730
C49	0.1 μF, 10%, 200V, Paper Tubular	046-001294-004
C50	1200 $\mu\mu$F, 2%, 300V, Plastic Mica	481-261122
C51,54, 97,106, 108,110, 116,117,123,124,140	0.01 μF, 20%, 500V, Ceramic Disc	047-000354
C58	36 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151360
C62	105 $\mu\mu$F, 2%, 300V, Plastic Mica	493-121050-324
C70,89, 93	47 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151470
C71	43 $\mu\mu$F, 2%, 300V, Plastic Mica	481-151430
C75,78	2.2 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131022
C80,87	3.3 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131033
C85,104, 105	270 $\mu\mu$F, 2%, 300V, Plastic Mica	481-161271
C88	0.002 μF, 20%, 500V, Ceramic Disc	047-000395
C109	0.0022 μF, 10%, 200V, Paper Tubular	046-001273-004
C113	5 μF,-10+100%, 150V Electrolytic	045-001002
C115	0.005 μF, GMV, 1000V, Ceramic Disc	047-100485
C401,402	0.01 μF, 1400V, Ceramic Disc	047-200752
C403,404	40 μF, 350V, Electrolytic	045-001026
C405A and B	40 μF, 350V; 40 μF, 350V	045-001027
C406A,B, C and D	40 μF, 350V; 40 μF, 350V; 10 μF, 350 V; 100 μF, 25V, Electrolytic	045-001003
C86	1.8 $\mu\mu$F, 2%, 300V, Plastic Mica	481-131018

Schematic Symbol	Description	Hallicrafters Part Number
	*RESISTORS	
R1,3,8, 10,25,31, 42,61,63,65,73,74	100K Ohm	451-252104
R2,9,75, 80	2200 Ohm	451-252222
R4,11,47, 54,69	220 Ohm	451-252221
R5	15K Ohm	451-252153
R6,32,48, 59,67,70	47K Ohm	451-252473
R7	12K Ohm	451-252123
R12,16,20, 53,64	1 Megohm	451-252105
R13,49,51	220K Ohm	451-252224
R14,17,45	22K Ohm	451-252223
R15	1000 Ohm	451-252102
R18	100 Ohm	451-252101
R19	15K Ohm,1 watt	451-352153
R21,40	68K Ohm	451-252683
R22,72	10K Ohm, 1 watt	451-352103
R23	27K Ohm, 1 watt	451-352273
R24	1800 Ohm, 1 watt	451-352182
R26,27,83	150K Ohm	451-252154
R28	27K Ohm, 2 watt	451-652273
R29	3900 Ohm, 1 watt	451-352392
R30	270K Ohm	451-252274
R33	470 Ohm	451-252471
R34,78	3.3 Megohm	451-252335
R35,36,38, 82,89	680K Ohm	451-252684
R37	Variable, 500K Ohm, 30%, 1/4 watt, Deviation adjust	025-002142
R39,41,44, 50,52,68	1500 Ohm	451-252152
R43,58	10K Ohm	451-252103
R46	120K Ohm	451-252124
R55,62,79, 81	470K Ohm	451-252474
R56	82K Ohm	451-252823
R57,71,76, 77,88	330K Ohm	451-252334
R60	330 Ohm	451-252331
R66	1000 Ohm, 1 watt	451-352102
R84	8.2 Megohm	451-252825
R85	180K Ohm	451-252184
R86	100K Ohm, 1 watt	451-352104
R87	22K Ohm, 1 watt	451-352223
R90	220 Ohm, 1 watt	451-352221
R91	6800 Ohm, 2 watt	451-652682
R92,403	10 Ohm	451-252100
R93	12 Megohm	451-252125
R401	25 Ohm, 10 watt, Wire Wound	445-032250
R402	10 Ohm, 2 watt	451-652100
R404,405	100K Ohm, 2 watt	451-652104
R405	10 Ohm, 5%, 1 watt	451-351100
R82	Variable, 1 Megohm, 30%, 1/5 Watt, Volume Preset	025-002067

* All RESISTORS are carbon type, 10%, 1/2 watt unless otherwise stated.

	COILS AND TRANSFORMERS	
L1	Coil, 100 μH, RF Choke	053-000644
L2	Coil, Transmitter Amplifier	051-003680
L3,18	Coil, Transmitter 1st Doubler and Receiver Oscillator	051-003681
L4	Coil, 250 μH, RF Choke	053-100348
L5	Coil, 1 μH, RF Choke	053-000654
L6	Coil, 2.7 μH, RF Choke	053-000670
L7	Coil, 1.8 μH, RF Choke	053-000489
L8A	Coil, Final Tank	051-003668
L8B	Coil, Link	051-003667
L9,11	Coil, Lo-Pass Input and Output	051-003657
L10	Coil, Lo-Pass	051-003664
L12,13	Coil, Termination, 10.7 MC	051-003656
L14	Coil, Receiver Injection	051-003659
L15,20,22, 23	Coil, RF Choke, Bead Shielding	077-002960
L16	Coil, 3.3 μH, RF Choke	053-000611
L17	Coil, RF Neutralizer	051-003669
L19	Coil, Image Trap	050-001625

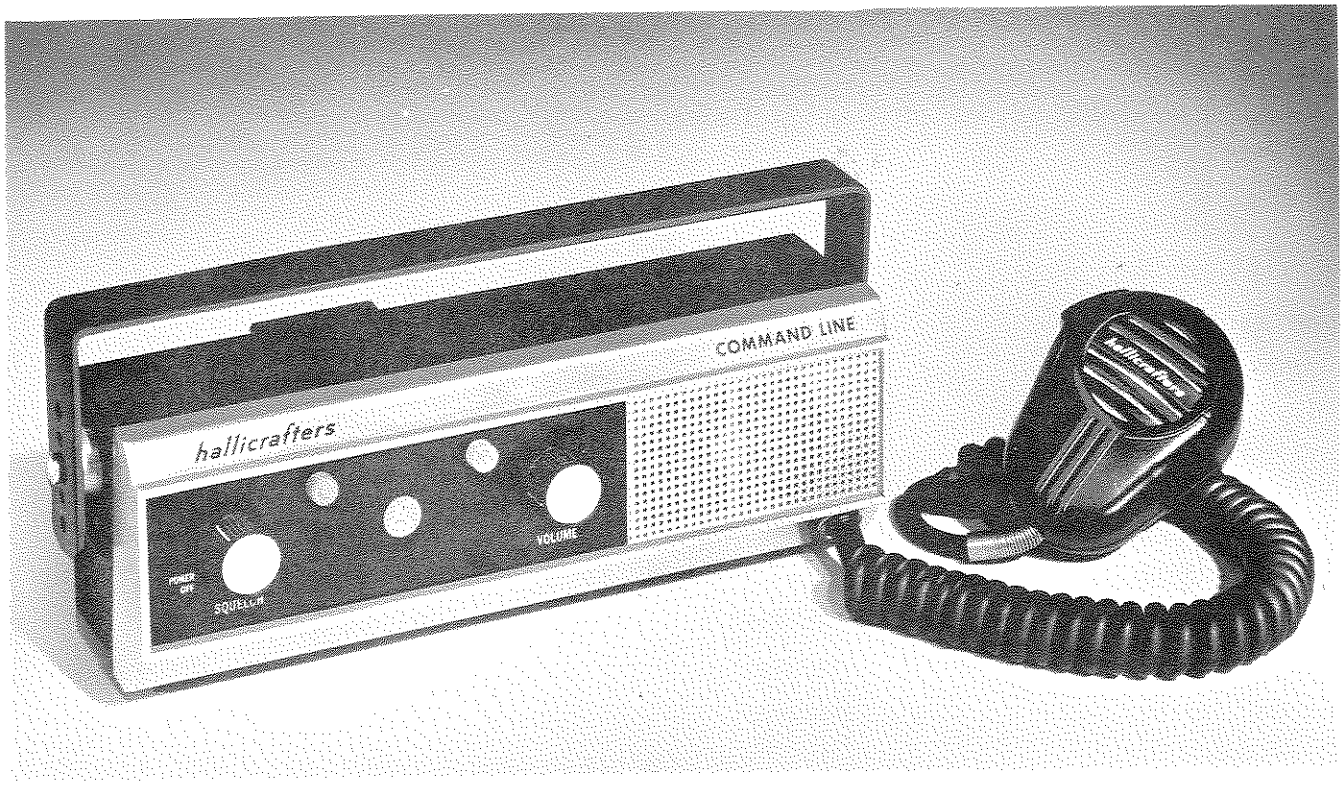
Schematic Symbol	Description	Hallicrafters Part Number
	COILS AND TRANSFORMERS (CONT)	
L21	Coil, Quadrature	050-000935
L401	Reactor, Filter, 1 H	056-000621
T1	Transformer, Transmitter 2nd Doubler	051-003662
T2	Transformer, Transmitter Tripler	051-003663
T3,6,7	Transformer, IF, 1650 KC	050-000934
T4	Transformer, IF, 10.7 MC	050-000933
T5	Transformer, Antenna	051-003655
T8	Transformer, Audio Output	055-000500
T401	Transformer, Power	052-001044
	**ELECTRON TUBES AND DIODES	
V1,14	Tube, Type 12AT7	090-900034
V2,8,10	Tube, Type 6BL8	090-901431
V3	Tube, Type 6AW8A	090-901103
V4	Tube, Type 12DQ7	090-001528
V5	Tube, Type 6360	090-901253
V6	Tube, Type 8150	090-001534
V7	Tube, Type 6ES8	090-001529
V9,11,12	Tube, Type 6BH6	090-900821
V13	Tube, Type 6BN6	090-900826
V15	Tube, Type 6GW8	090-001502
V16	Tube, Type 6BN8	090-001465
CR1	Diode, Type HB-6	019-003065
CR401,402, 403,404, 405,406	Diode, Silicon, Rectifier, Type 1N3195	019-002770
CR407	Diode, Silicon, Rectifier, Type 2E4	027-000283

** See Section II, Page 3 for Tube Functions

	SOCKETS	
XV1,2,7,8	Socket, Tube, 9 pin w/shield base	006-000395
XV3,4,5, 10,14,15, 16	Socket, Tube, 9 pin w/o shield base	006-000913
XV6	Socket, Tube, 12 pin	006-001082
XV9,11, 12,13	Socket, Tube, 7 pin	006-001048
XY1,3	Socket, Octal	006-000948
XY2	Socket, Crystal	006-100320
	MISCELLANEOUS	
FL3	Band Pass Filter Assembly	150-006267
	Cabinet Assembly, Riveted	150-006287
	Catch, Spring Tension and Strike	030-000869
J1	Connector, 18 pin Control Cable	010-002767
J2	Connector, Antenna	010-100056
P401	Connector, Line Cord, Three Conductor	087-106173
	Cover, Low-Pass	066-003731
Y1	Crystal, Transmitting, 12-15 MC	019-002949
Y2	Crystal, 2nd Converter, 9.050 MC	019-002948
Y3	Crystal, Receiving, 49-55 MC	019-002950
FL1	Filter, Low-Pass	049-000251
FL2	Filter, Crystal, 10.7 MC	049-000230
F401	Fuse, Cartridge, 2 amp, 125V, slow blow	039-100428
F402	Fuse, Cartridge, 1/2 amp, 125V, slow-blow	039-100414
XF401, 402	Fuseholder (Inc. Hardware)	006-000451
	Handle, Chassis Removal	030-100584
	Iron Core (FL3)	003-007727
	Iron Core (L2,L3,L14,L18)	003-007725
	Iron Core (L19)	003-203388
E1	Oven, Crystal	021-000672
	Panel Assembly, Blank	150-006934
	Panel, Rear	068-001374
K1	Relay, Armature (4PDT)	021-000667
	Shield, Tube (V1,2,7,8)	069-201190
	Socket, Tube, Rear (Accessory)	006-200707
S1	Switch, Pushbutton, Tune Operate	060-002661

MODEL C-2101

STANDARD CONTROL HEAD



156-002852

Hallicrafters' Model C-2101 Standard Control Head has been designed for use with two-way industrial radio equipment. This control head contains all the switching and control circuitry necessary for operation of a radio transmitter/receiver plus a 3-inch, 3.2-ohm permanent-magnet type speaker.

All connections are made to a rear-mounted, 18-pin Jones type plug. Connections are made as shown in the schematic diagram. The position of this plug and the physical design of the C-2101 control head permit it to be permanently attached to the front of a transmitter/receiver for local base-station and under-dash mobile configurations. The control head may also be encased and interconnected through a cable for remote base-station and trunk-mounted mobile configurations.

The following controls and indicators are located on the front panel of the C-2101 Control Head:

ON/OFF-SQUELCH: In the extreme counterclockwise position (OFF) power is removed from the equipment by breaking contact with the primary power source. As the control is rotated clockwise, power is applied to the equipment. Further clockwise rotation activates the squelch circuitry. The SQUELCH should be set to the point that just quiets the speaker noise under no signal conditions.

VOLUME: The VOLUME control adjusts the level of sound in the speaker and should be set to a point suitable to the operator.

ON-OFF INDICATOR: As soon as power is applied to the equipment, the amber lamp becomes illuminated.

TRANSMIT INDICATOR: When the equipment is on, if the push-to-talk switch on the microphone is depressed, the white lamp will illuminate showing that the equipment is in the transmit mode of operation.

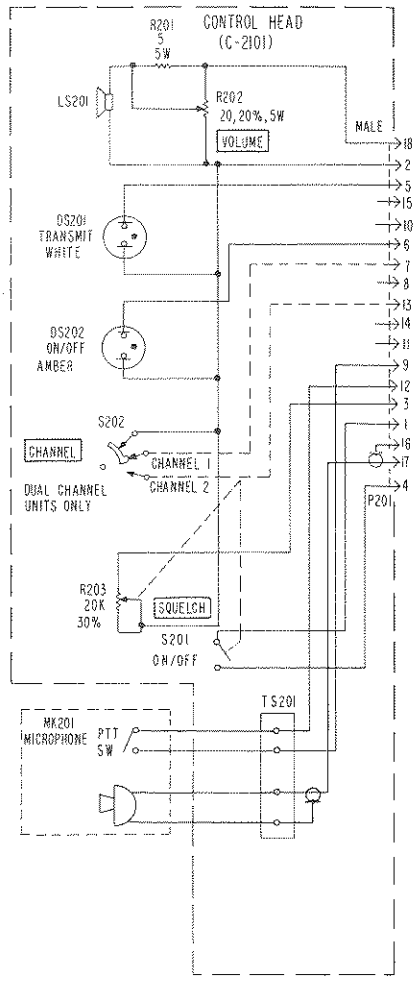
The C-2101 Control Head is so constructed that it can be modified for dual-channel and/or tone controlled squelch operation with a minimum of expended effort.

PARTS LIST

Schematic Symbol	Description	Hallicrafters Part Number
P201	Connector, 18 pin Control Cable	010-002766
	Cover, Rear (Remote units only)	066-003987
	Flex Relief, Microphone Cable	016-002381
	Handle, (DC units only)	030-000889
	Knob	015-001561
DS201	Lamp, Neon (White)	039-000728
DS202	Lamp, Neon (Amber)	039-000729
	Medallion, Hallicrafters Logo	007-000850
MK201	*Microphone, Carbon (C-3201C)	081-000114
MK201	*Microphone, Ceramic (C-3201S)	085-000238
MK201	*Microphone, Transistorized (C-3201T)	081-000115
	Panel Assembly, Control Mounting	150-006282
	Panel Assembly, Front	150-006279
	Panel, Escutcheon	068-001449
	Panel, Inlay, Single Channel	007-000847
	Panel, Inlay, Speaker Panel	007-000851
R201	Resistor, Wire Wound, 50 Ohm, 10%, 5 watt	024-001328-01
R202	Resistor, Variable, 20 Ohm, 20%, 5 watt VOLUME	025-002141
R203	Resistor, Variable, 20K Ohm, 20%, 1/2 watt SQUELCH	025-002230
LS201	Speaker, 3-inch, PM, 3.2-ohm	085-000224
S201	Switch, POWER-ON/OFF	P/O R203

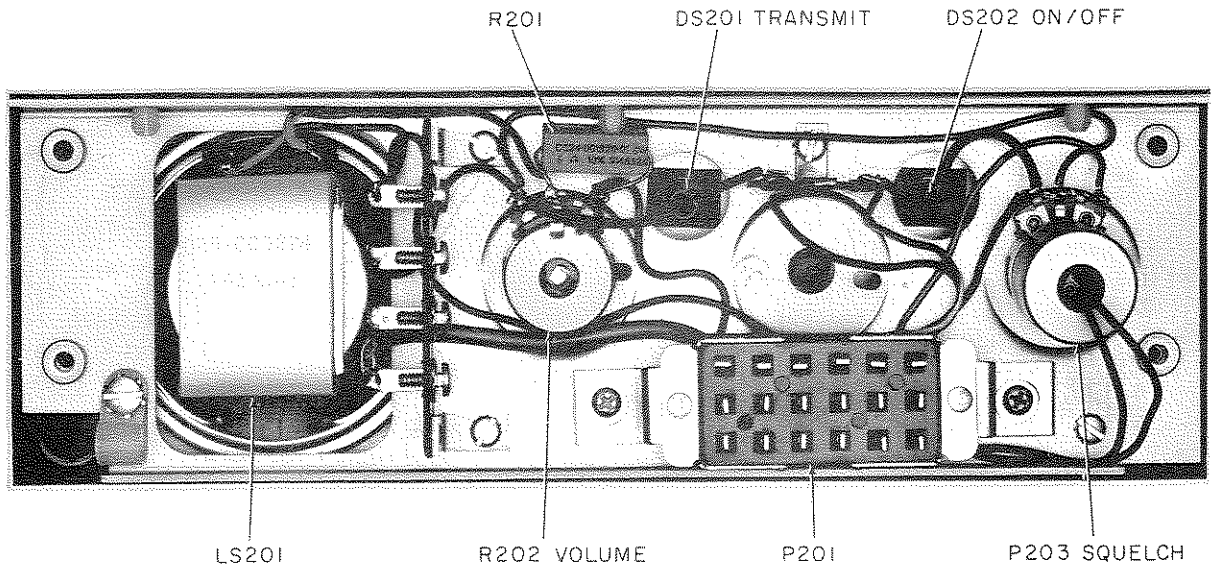
* Any of these microphones and others with appropriate connections may be used with the C-2101 Control Head.

SCHEMATIC DIAGRAM



155-000074

INTERNAL VIEW



156-002941

MODEL C-2102
MINIATURE CONTROL HEAD

155-002814

DESCRIPTION

Hallicrafters' Model C-2102 Miniature Control Head has been designed for use with mobile two-way industrial radio equipment. This control head contains all the switching and control circuitry necessary for operation of a radio transmitter/receiver. The C-2102 requires the use of a separate speaker, such as the Model C-3401. All connections to the control head are made to an internally mounted 20-pin screw-type terminal strip. Connections are made as shown in the schematic diagram.

CONTROLS AND INDICATORS

The following controls and indicators are located on the front panel of the C-2102 Control Head:

ON/OFF-SQUELCH: In the extreme counterclockwise position (OFF) power is removed from the equipment by breaking contact with the primary power source. As the control is rotated clockwise, power is applied to the equipment. Further clockwise rotation activates the squelch circuitry. The SQUELCH should be set to the point that just quiets the speaker noise under no signal conditions.

VOLUME: The VOLUME control adjusts the level of sound in the speaker and should be set to a point suitable to the operator.

ON-OFF INDICATOR: As soon as power is applied to the equipment, the amber lamp becomes illuminated.

TRANSMIT INDICATOR: When the equipment is on, if the push-to-talk switch on the microphone is depressed, the white lamp will illuminate showing that the equipment is in the transmit mode of operation.

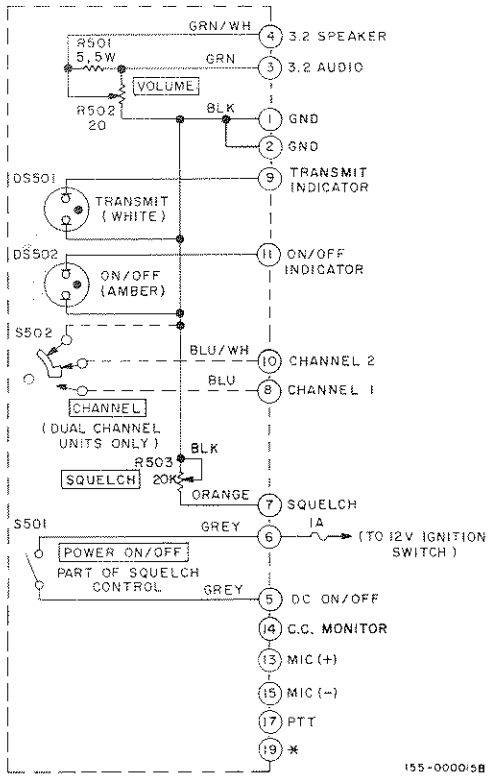
ACCESSORIES

The C-2102 Control Head is so constructed that it can be modified for dual-channel and/or tone controlled squelch operation with a minimum of expended effort.

PARTS LIST

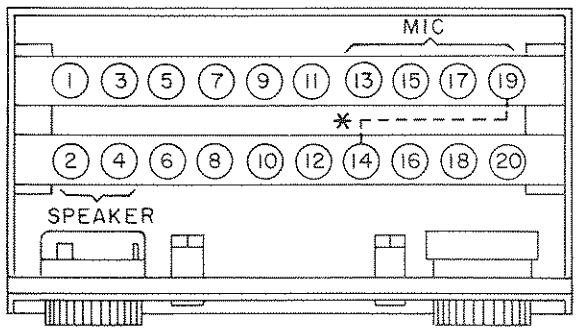
Schematic Symbol	Description	Hallicrafters Part Number
	Cover	066-004088
	Flex Relief, Microphone Cable	016-002381
	Grommet, Rubber	016-100002
	Handle, Unit Mounting	030-000910
	Holder, Microphone	076-003277
	Knob	015-001561
DS502	Lamp, Neon (Amber)	039-000742
DS501	Lamp, Neon (White)	039-000743
	Panel, Front	068-001478
	Panel Inlay	007-000878
R502	Resistor, Variable, 20 Ohm, 20%, 5 watt VOLUME	025-002285
R503	Resistor, Variable, 20K Ohm, 1/3 watt SQUELCH	025-002284
R501	Resistor, Wire Wound, 5 Ohm, 10%, 5 watt	024-001328-01
S501	Part of R503	

SCHEMATIC DIAGRAM



*Using C-3201C, T, or S microphones: Pin 19 is microphone PTT return lead. Using C-3201CA or TA microphones (for Command Call monitor with hang-up button): Jumper wire between pin 14 (C.C. Monitor) and pin 19 (microphone hang-up button) must be installed.

INTERNAL VIEW



156-001678

MODEL C-3201C

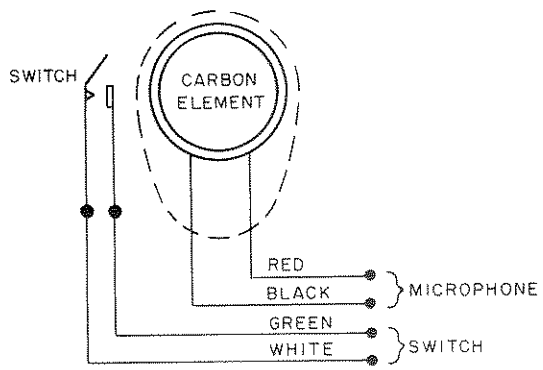
MOBILE HAND-HELD

CARBON MICROPHONE

Hallicrafters' Model C-3201C is a carbon-type hand microphone designed for use with two-way industrial radio equipment. The microphone is made of black high-impact plastic (cycolac) with a push-to-talk switch on the upper left side. The attached cable can be extended to approximately five feet.

156-002321

SCHEMATIC DIAGRAM



156-002947

MODEL C-3201T

MOBILE HAND-HELD

TRANSISTORIZED MICROPHONE

Hallicrafters' Model C-3201T is a controlled magnetic hand microphone designed for use with two-way industrial radio equipment. This microphone contains a transistor amplifier to increase the output to a higher level and improve speech intelligibility. The microphone is made of black high-impact plastic (cycolac) with a push-to-talk switch on the upper left side. The attached cable can be extended to approximately five feet.

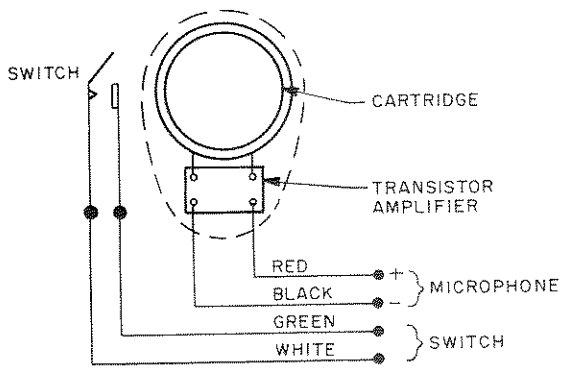
The DC voltage necessary for operation of the transistor amplifier should be supplied by the microphone input circuit of the associated transmitter. This voltage is the same as that required to operate a standard carbon microphone. The Model C-3201T is directly interchangeable with carbon microphone equipped units.

IMPORTANT

Be certain of polarity when interconnecting the microphone and its associated transmitter. The red microphone lead must be connected to a positive voltage source not to exceed 24 volts or permanent damage to the transistor will result.

156-002321

SCHEMATIC DIAGRAM



156-002948

MODEL C-3202TA

TRANSISTORIZED

DESK-STAND MICROPHONE

Hallicrafters' Model C-3202TA (Part No. 085-000236) is a dynamic-type desk-stand microphone designed for use with two-way industrial radio equipment. The microphone includes an integral transistor amplifier that raises the output of the element to a level suitable to modulate the transmitter. The microphone is made of black-finished, die-cast metal with chrome trim and includes approximately four feet of cable.

The microphone is provided with a lever on the right side of the base, to provide a monitoring control for use with tone-squelch equipped units. On these units, with the lever in the rear position, the receiver is under tone-squelch control. Prior to transmitting, the monitor lever should be moved forward, thereby disabling the tone-squelch unit. Alternately, in that the monitor lever is mechanically coupled to the touch bar, depressing the touch bar half way down will automatically cause the monitor lever to move forward.

Using this microphone, the associated transmitter/receiver is controlled as follows:

Depress the touch bar all the way to transmit, release to receive.

On tone squelch equipped units:

Momentarily depress the touch bar on the front of the microphone. This automatically moves the monitor lever forward, permitting the channel to be monitored.

Upon completion of your communication, move the monitor lever back to the rear position to return the equipment to the tone-squelch mode.

The aforementioned instructions apply to tone-squelch equipped units. On units without tone squelch, the monitor lever may be left in the forward position.

NOTE

The side lever provides the tone monitor function only. It does not provide a transmit "on" lock.

156-002822

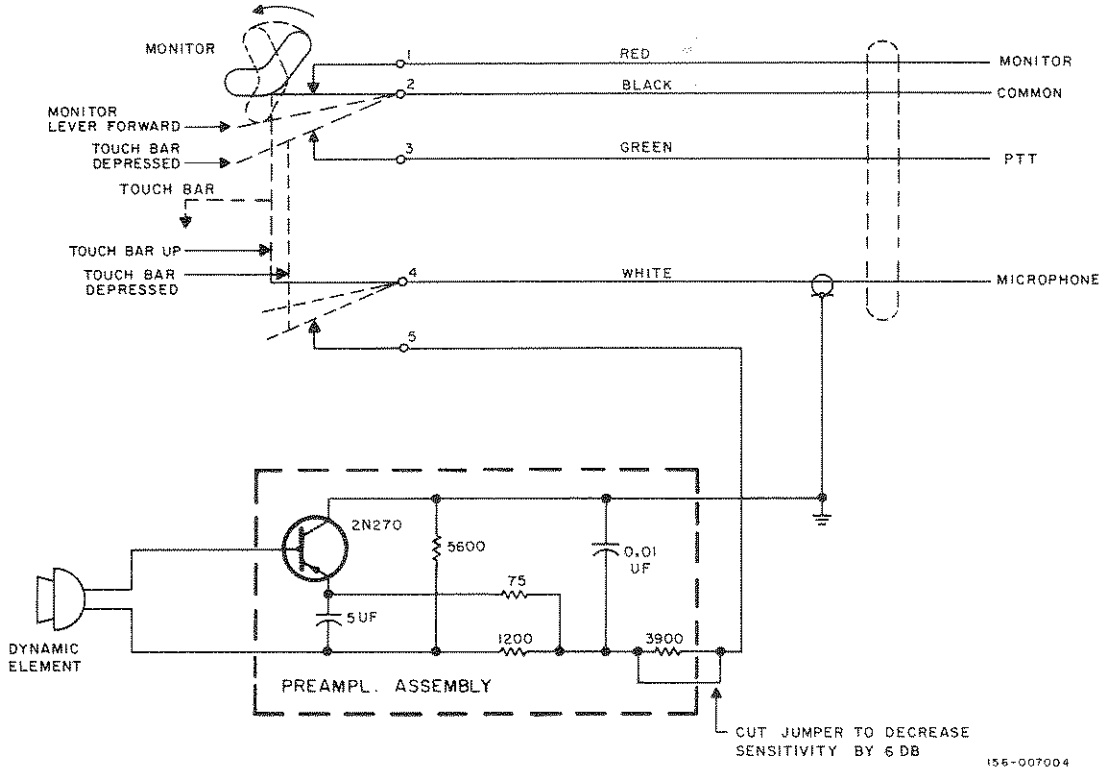
The microphone as supplied has an output that is essentially 6 DB above that normally obtained with a conventional carbon-type microphone. This permits the operator to speak in a normal voice at a comfortable distance (one to two feet).

It may be found in some installations with high ambient background noise that the sensitivity of the microphone is excessive. In these instances, the output level of the microphone may be reduced by clipping the jumper provided for this purpose (small green loop of wire coming out from one end of the transistor amplifier located in the microphone base).

The DC voltage necessary for operation of the transistor amplifier should be supplied by the microphone input circuit of the associated transmitter. This voltage is the same as that required to operate a standard carbon microphone. The Model C-3202TA is directly interchangeable with carbon microphone equipped units.

IMPORTANT

Be certain of polarity when interconnecting the microphone and its associated transmitter. The white microphone lead must be connected to a positive voltage source not to exceed 24 volts or permanent damage to the transistor will result.



SCHEMATIC DIAGRAM

MODEL C-3401
SPEAKER

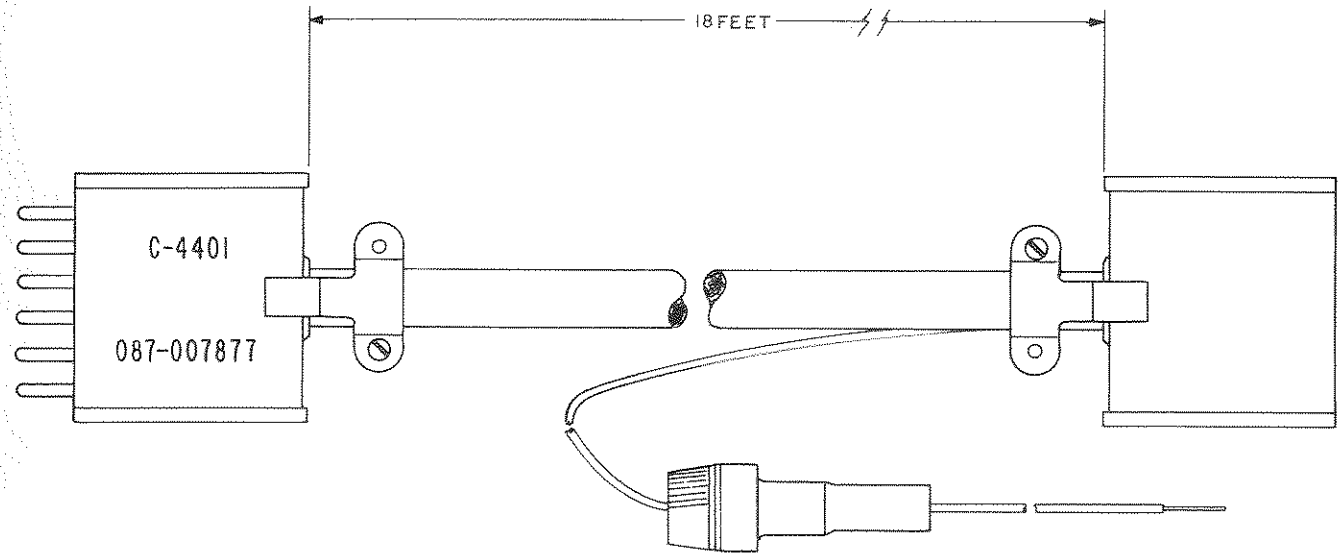
Hallicrafters' Model C-3401 Speaker is an enclosed unit with mounting trunion and cable designed for use with two-way industrial radio equipment. The C-3401 uses a 3.2-ohm, 4-inch permanent magnet speaker with a water-resistant cone. This unit is particularly suited for mobile applications, and is customarily used with the C-2102 Control Head in conjunction with Command Line transmitter/receivers. The speaker is housed in a die-cast metal case built to withstand the rough usage encountered in mobile installations.

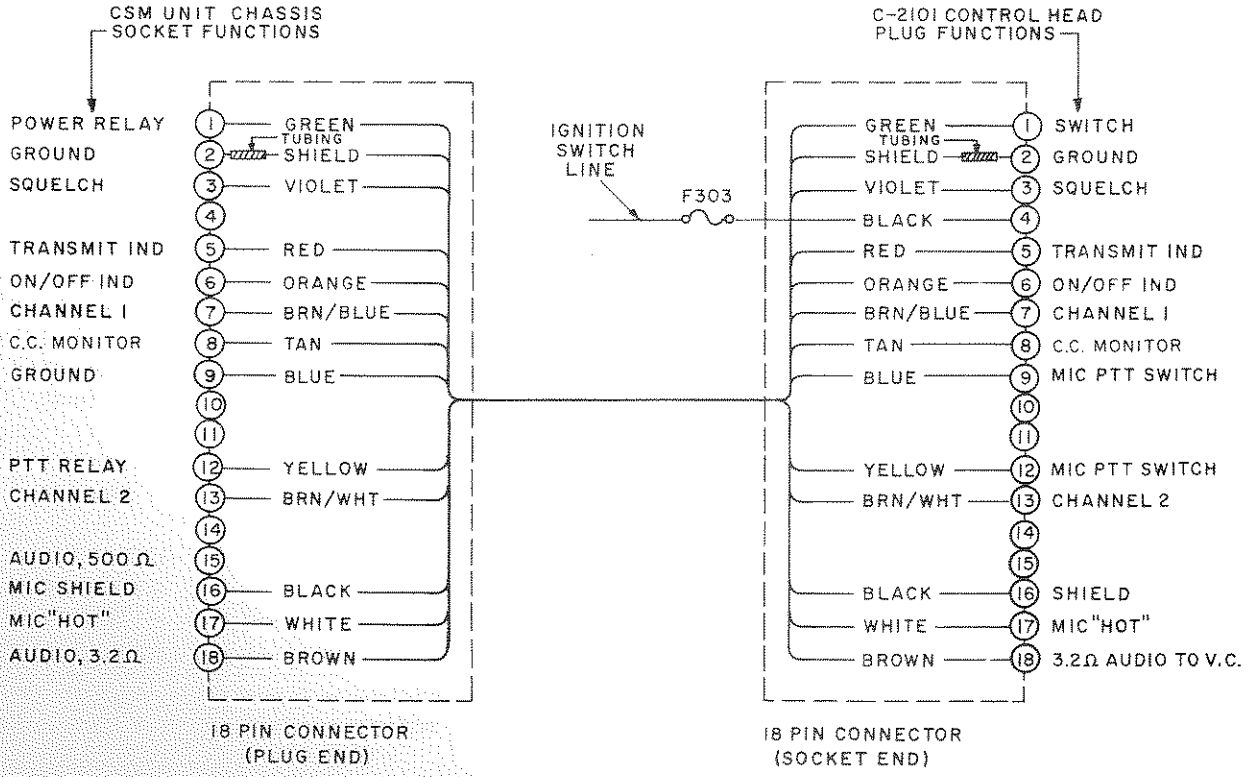
156-002853

PARTS LIST

DESCRIPTION	PART NUMBER
Cable, Two-Wire	087-101759
Escutcheon	007-000873
Grommet, Housing Foot	016-200980
Handle, Trunion	030-000897
Housing	066-004064
Medallion, Hallicrafters "H"	007-000850
Screw, Machine, NO. 10-32 x 1/2 inch (Handle)	407-065313-008
Speaker	085-000237
Speaker Grill	007-000874
Strain Relief (Cable)	076-100397
Washer, Fiber (Handle)	004-002674

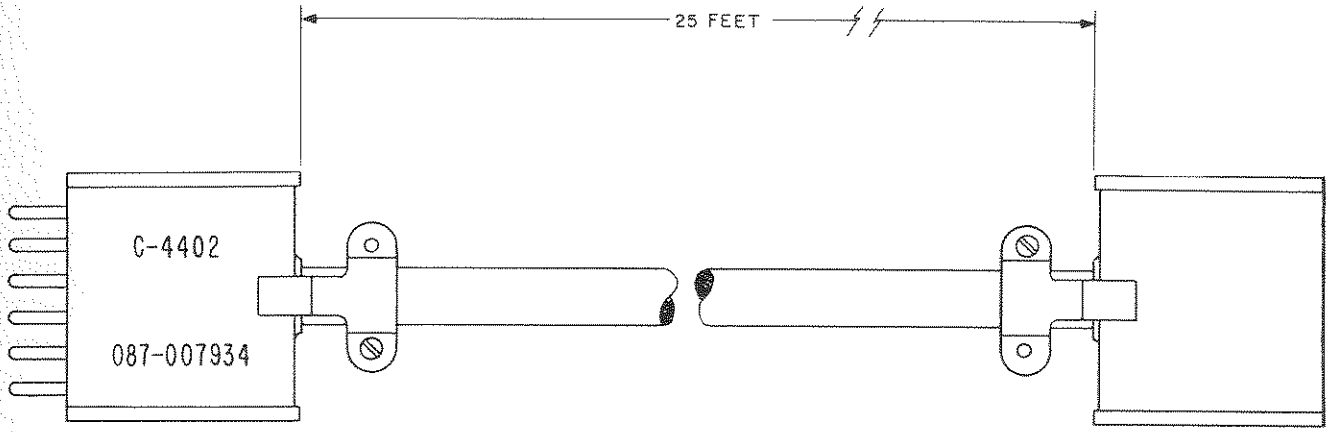
MODEL C-4401
18-FOOT CONTROL CABLE ASSEMBLY
(MODEL C-2101 CONTROL HEAD TO TRUNK MOUNTED UNIT)

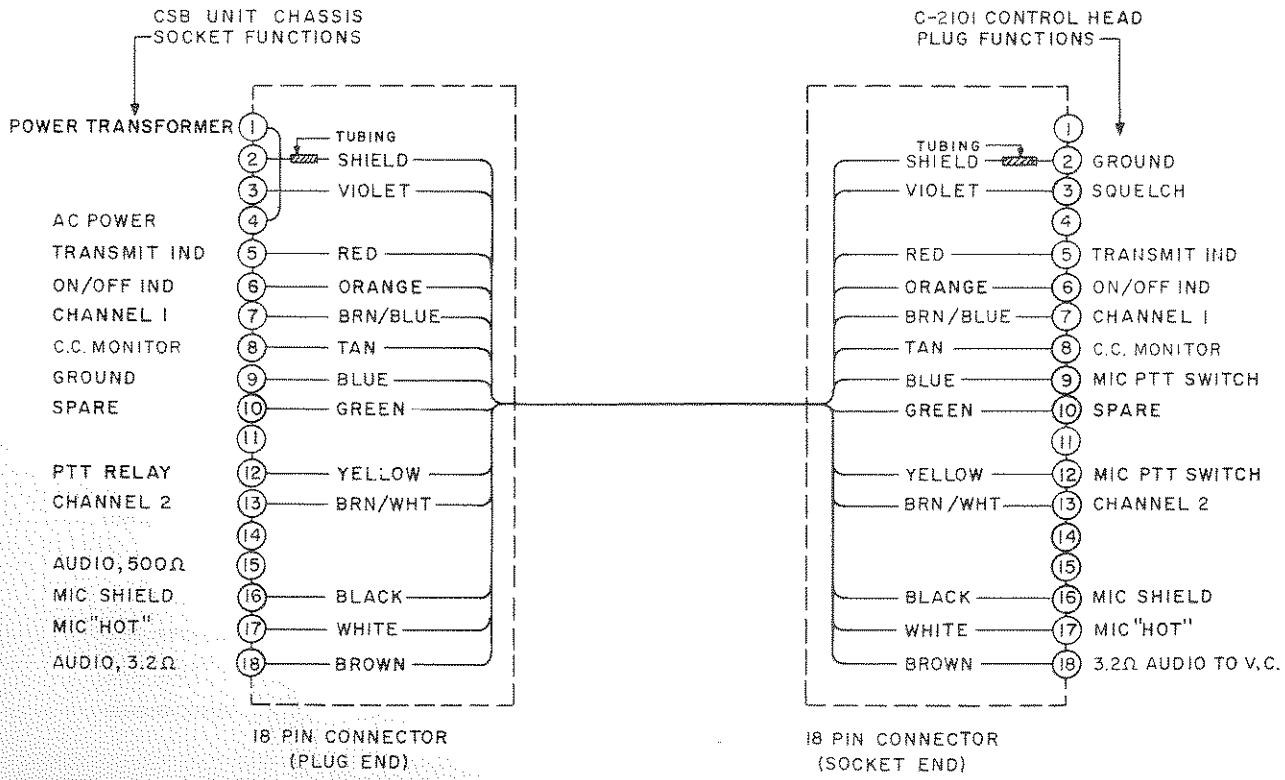




156-0024868

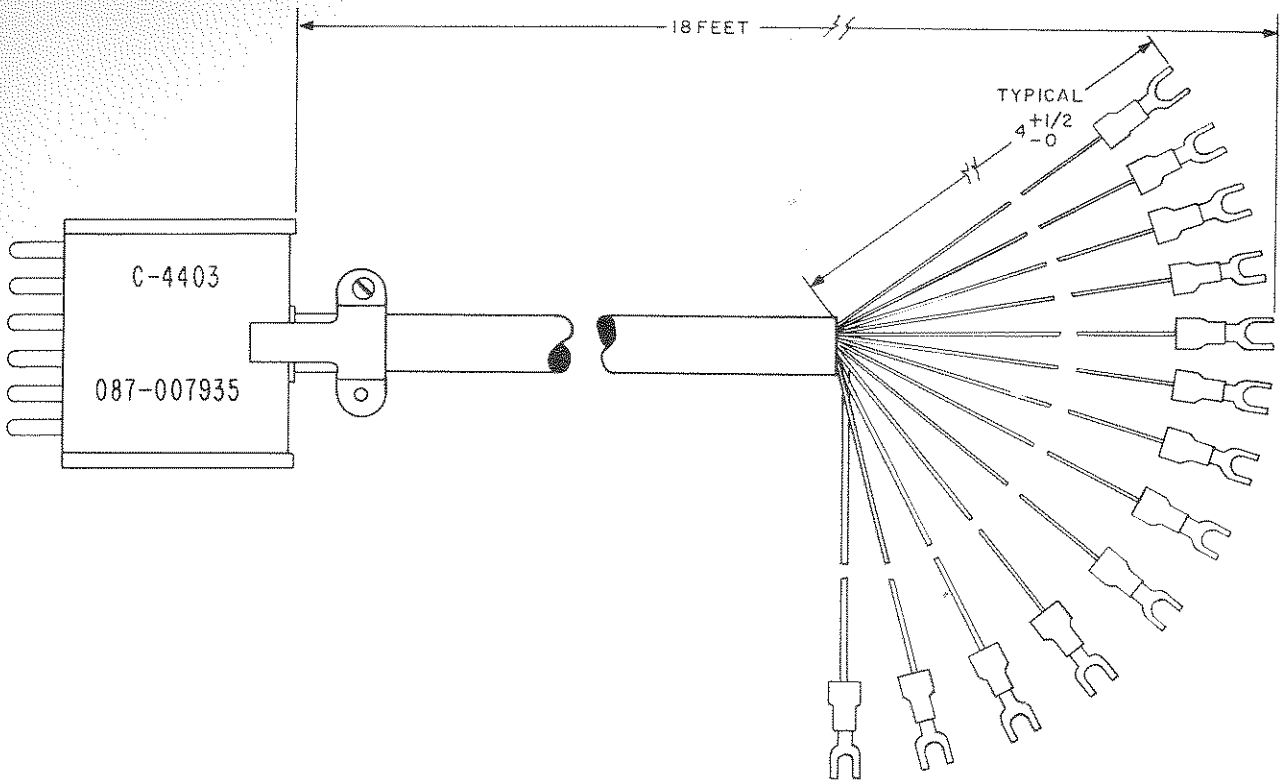
MODEL C-4402
25-FOOT CABLE ASSEMBLY
(MODEL C-2101 CONTROL HEAD TO REMOTE BASE STATION UNIT)





156-0024888

MODEL C-4403
18-FOOT CONTROL CABLE ASSEMBLY
(MODEL C-2102 MINIATURE CONTROL HEAD TO TRUNK MOUNTED UNIT)



CSM UNIT CHASSIS SOCKET FUNCTIONS			C-2102 CONTROL HEAD TERM. STRIP NUMBERING & FUNCTIONS
POWER RELAY	1	GREEN	GREEN — 5 SWITCH
GROUND	2	TUBING SHIELD	TUBING SHIELD — 1 GROUND
SQUELCH	3	VIOLET	VIOLET — 7 SQUELCH
	4		BLUE — 19 MIC PTT SW
TRANSMIT IND.	5	RED	RED — 9 TRANSMIT IND.
ON/OFF IND.	6	ORANGE	ORANGE — 11 ON/OFF IND.
CHANNEL 1	7	BRN/BLUE	BRN/BLUE — 8 CHANNEL 1
C.C. MONITOR	8	TAN	TAN — 14 C.C. MONITOR
GROUND	9	BLUE	
	10		
	11		
PTT RELAY	12	YELLOW	YELLOW — 17 MIC PTT SW
CHANNEL 2	13	BRN/WHT	BRN/WHT — 10 CHANNEL 2
	14		
AUDIO, 500 Ω	15		
MIC SHIELD	16	BLACK	BLACK — 15 MIC SHIELD
MIC "HOT"	17	WHITE	WHITE — 13 MIC "HOT"
AUDIO, 3.2 Ω	18	BROWN	BROWN — 3 3.2Ω AUDIO TO V.C.

18 PIN CONNECTOR (PLUG END)