Chapter 3
SINCGARS

3-1. System Description

a. SINCGARS radio systems are modular component sets. The individual components are totally interchangeable from one radio set to the next. SINCGARS radio set configurations provide identical, or in most cases, improved capabilities when compared to the AN/VRC-12 series radio sets they replace. Additionally, modular design lessens the burden on the logistics system to provide repair parts.

The primary component of SINCGARS is the receiver/transmitter (RT). There are two ground unit versions (RT-1523 integrated COMSEC (ICOM) and RT-1439 non-ICOM) and three avionic versions (RT-1476/1477/1478). All avionic models require external COMSEC devices.

(1) Either the RT-1523 (Figure 3-1) or the RT-1439 (Figure 3-2) is common to all ground-based sets. The main difference between radios is the device used to provide secure communication. The RT-1523 has internal COMSEC circuits (origin of the ICOM designation), and the RT-1439 uses the VINSON secure device. The secure devices are compatible if the same cryptonet variable is used in the ICOM radio and the VINSON device. The ground versions are equipped with a whisper mode for noise restriction during patrolling or while in defensive positions. The operator whispers into the handset and is heard at the receiver in a normal voice.

(2) The airborne versions differ in installation packages and requirements for data capable terminals. Airborne and ground versions are interoperable in FH and single-channel operations. In this chapter, the term SINCGARS pertains to ground and airborne versions. Exceptions will be noted as such.

c. SINCGARS operates in either the single-channel or FH mode. It is compatible with all current US and allied VHF radios in the single-channel mode on 50 kHz channels. Currently, in the FH mode, SINCGARS is only compatible with other Air Force, Marine, or Navy SINCGARS radios. SINCGARS stores eight single-channel frequencies and six separate hopsets. The cue and manual frequencies are included in the eight single-channel frequencies.

(1) Radio systems using special encoding techniques must provide outside network access through some hailing method. The cue frequency provides hailing ability to the SINCGARS radio. An individual outside the

network contacts the net control station (NCS) on the cue frequency. The SINCGARS radio in active FH mode gives audible and visual signals to the operator that an external subscriber wants to communicate with the FH network. The SINCGARS NCS operator must change to the cue frequency to communicate with the outside radio system.

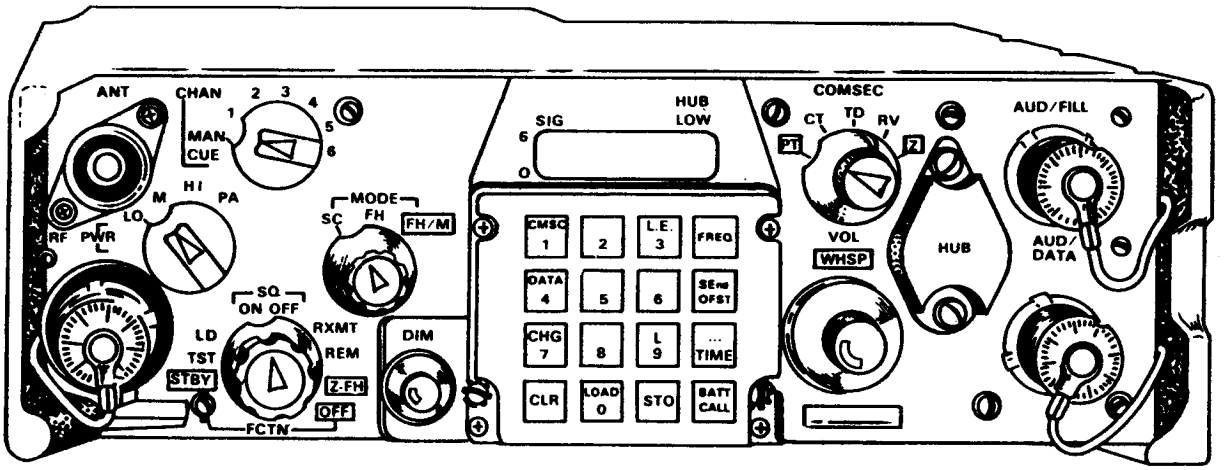

Figure 3-1. ICOM radio RT-1523.

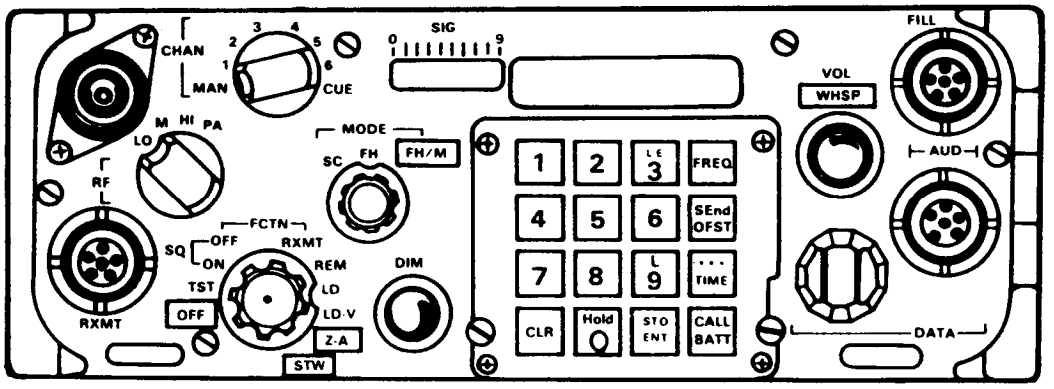

Figure 3-2. Non-ICOM radio RT-1439.

(2) The network uses the manual frequency for initial network activation. The manual frequency provides a common frequency for all members of the network to verify the equipment is operational before transferring to the FH mode. During initial net activation, all operators in the net tune to the manual frequency. After communications are established, the net switches to the FH mode and the NCS transfers the hopping variables to the out stations.

d. SINCGARS directly accepts either analog (voice or frequency shift key) or digital input signals. SINCGARS processes the incoming signal into a digital data stream operating at 16,000 bits per second (bps). Digital data input at that speed can be input directly. If a slower rate is needed, the radio is equipped with a data rate adapter (DRA). The slower speed is desirable since the radio provides error correction for speeds from 75 to 4,800 bps. The correction is made by repeating each character an odd number of times and deciding on a majority count.

e. An advantage of SINCGARS over current radios is the ability to control output power. The RT alone has three power settings that vary transmission range from 300 meters (990 feet) to 8 kilometers (5 miles). Adding a power amplifier (one of the modular components) increases the range to 35 kilometers (22 miles) or line of sight (LOS). The variable output power level allows users to lessen the signature given off by the radio set. Using lower power is particularly important at major CPs that operate in multiple networks. The ultimate goal is reducing the electronic signature at the CP. he NCS should ensure that all members of the network operate on the minimum power necessary to maintain reliable communications.

f. Operators of previous generation radios could not identify faulty equipment without a repairman and test equipment. SINCGARS has built-in test (BIT) functions that tell the operator the RT is malfunctioning. It also identifies the faulty circuits for the repairman.

3-2. Components

a. A few components make up the basic radio sets. This simplifies the radio's installation, tailoring capabilities for specific missions, and the maintenance support system. The RT discussed above is the main component of all radio sets. The components described below are combined in various quantities to build the specific radio required. Figure 3-3 shows the components and their relationship to each other in system configuration.

(1) Vehicular mount MT-6352 is common to all vehicular sets. The mount fits into the same drilled hole footprint as the previous AN/VRC-12 series radios. It provides a secure mounting location in the vehicle to prevent damage to equipment from shock and movement. The vehicular mount is issued as part of the installation kit, and like previous radio mounts, it has connection points for power and auxiliary equipment. The connectors are on the top of the mount for easy access when changing cables or configurations.

(2) Mounting adapter AM-7239 converts the vehicle power supply to the various operating voltages for radio and amplifier operation. The adapter provides surge protection for the radio if the vehicle is started when the radio is on. The adapter interfaces the vehicle intercom system and provides amplified output to power an external speaker. The adapter can house two RTs and one power amplifier in the same space that a single AN/VRC-12 radio previously occupied.

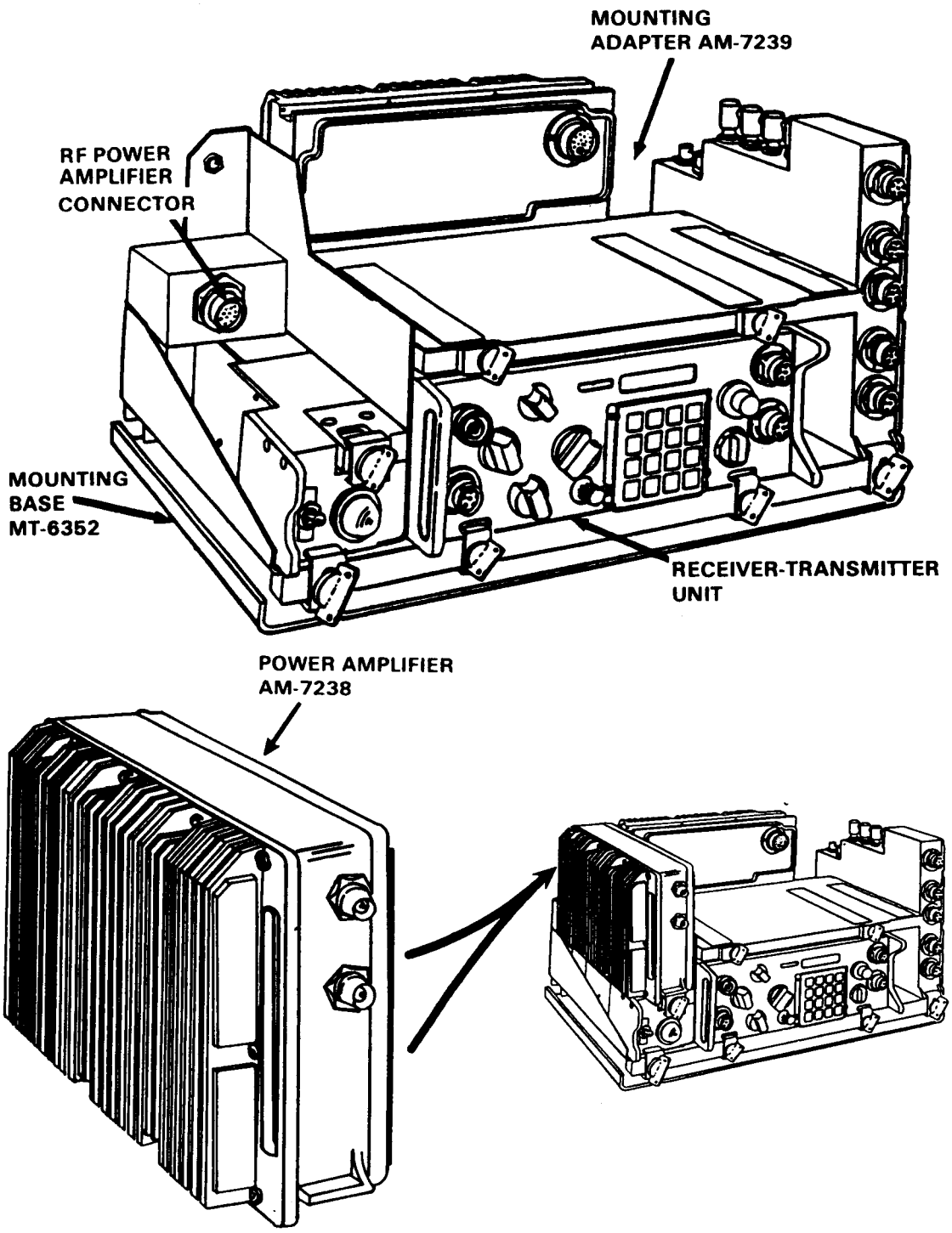

Figure 3-3. Radio set components.

(3) Power amplifier AM-7238 provides up to 50 watts output power from the radio in vehicle mounts. A single amplifier mounts in the mounting adapter to the side of the radio. If the set requires two high-power radios, a separate mount is used for the second amplifier. Due to internal circuits, the adapter mounted amplifier can only be used with the radio installed in the lower housing.

(4) SINCGARS uses broadband antennas that do not have to be changed with changing frequency (for example, OE-254 ground-plane or AS-3900 vehicular whip antennas). The output frequency can change over a wide range between hops due to the FH nature of SINCGARS. Therefore, conventional antennas with narrow bands of operation (for example, RC-292 ground-plane antenna) cannot be used.

(5) Voice input must be through the H-250 handset. Output is obtained through either the handset or the LS-671 auxiliary speaker. The LS-454 speaker can be used with the AN/VRC-12 and the SINCGARS family of radios.

b. *Common components* are the key to tailoring radio sets for specific missions. The components included in the radio set determine its capabilities. The number of RTs and amplifiers, an installation kit, and a backpack component determine the model. The RT is the basic building block for all radio configurations. The versions consist of a manpack (AN/PRC-119), six ground versions (AN/VRC-87 through AN/VRC-92), and three airborne versions (RT-1476/1477/1478).

(1) Manpack radio AN/PRC-119. The manpack radio (Figure 3-4) replaces the AN/PRC-77 and ANIPRC-25. It consists of one RT, a battery box, a handset, a manpack antenna, and an all-purpose lightweight individual carrying equipment (ALICE) pack. The non-ICOM radio must be used with VINSON to provide secure communications.

(2) Ground versions.

(a) Vehicular short-range radio AN/VRC-87. The AN/VRC-87 (Figure 3-5) is the base vehicular radio set. It consists of one RT, a radio mount, a mounting adapter, a vehicular antenna, and associated handsets and cabling. The A.N/VRC-87 replaces the AN/GRC-53 and AN/GRC-64.

(b) Dismountable short-range radio AN/VRC-88. The AN/VRC-88 adds the components needed to operate as a manpack radio (battery box, manpack antenna, and ALICE pack); otherwise, it is identical to the AN/VRC-87. The AN/VRC-88 replaces the A.N/GRC-125 and AN/GRC-160.

(c) Vehicular long-range/short-range radio AN/VRC-89. The AN/VRC-89 (Figure 3-6) is built from the AN/VRC-87 by adding another RT and a power amplifier. The AN/VRC-89 replaces the AN/VRC-12 and AN/VRC-47 which have a single RT and an auxiliary receiver. The additional RT replaces the auxiliary receiver in the previous versions. The RT provides increased capabilities over a receiver alone.

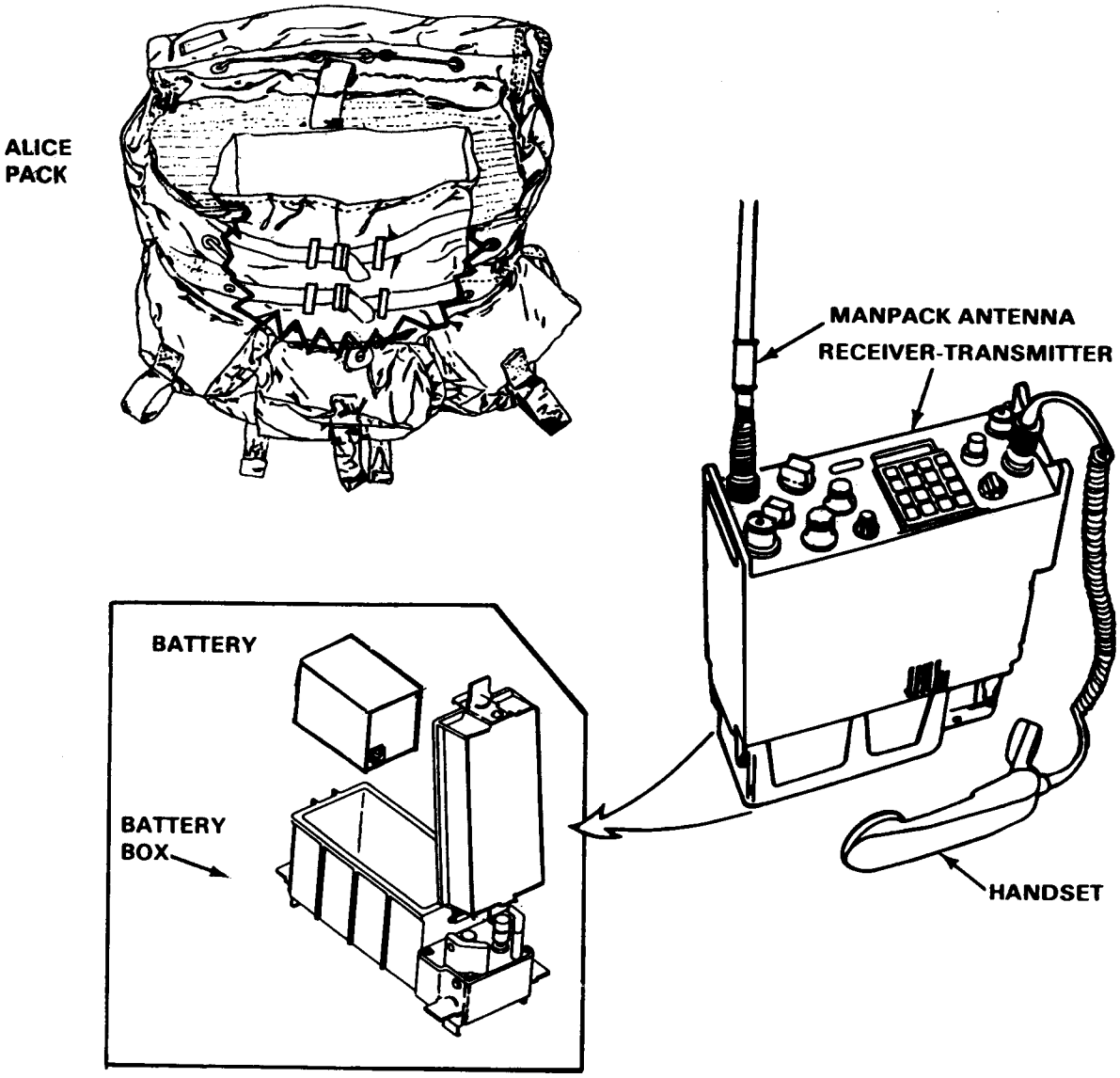

Figure 3-4. Manpack radio AN/PRC-119.

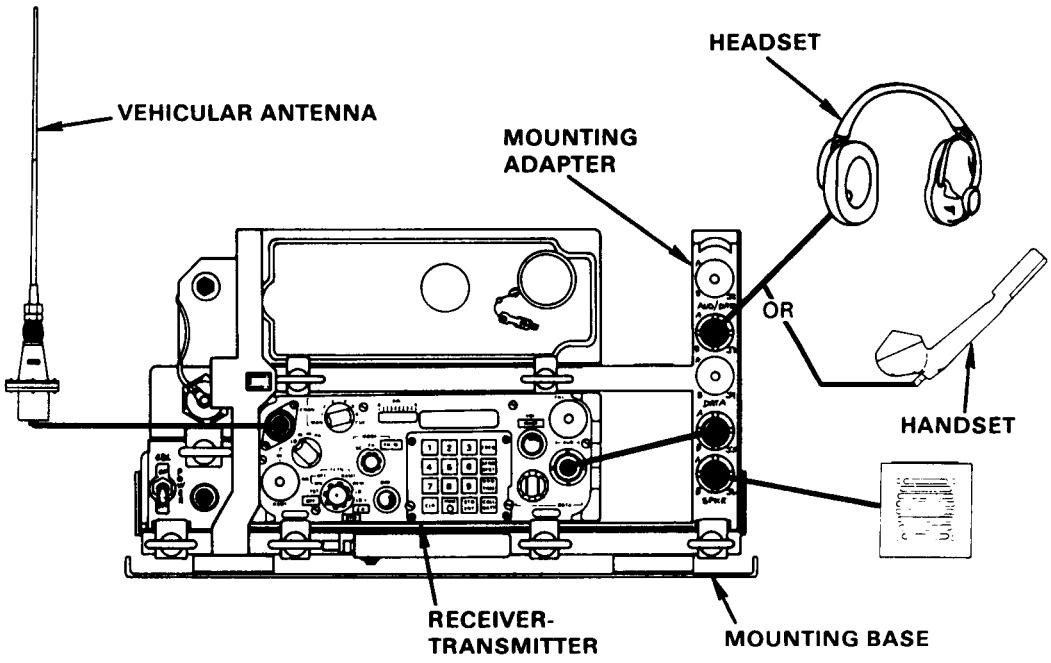

Figure 3-5. Vehicular short-range radio AN/VRC-87.

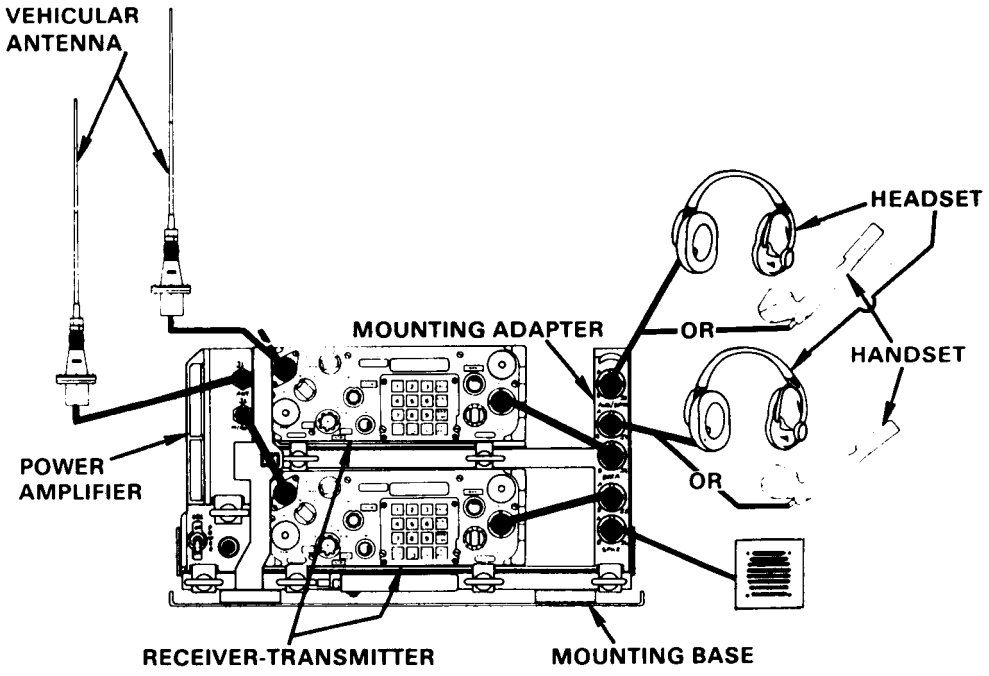

Figure 3-6. Vehicular long-range/short-range radio AN/VRC-89.

(d) Vehicular long-range radio AN/VRC-90. The AN/VRC-90 (Figure 3-7) is an AN/VRC-87 with a power amplifier added for long-range capability. It replaces the AN/VRC-43 and AN/VRC-46.

(e) Vehicular short-range/long-range dismountable radio AN/VRC-91. The AN/VRC-91 adds the components needed to operate as a manpack radio; otherwise, it is identical to the AN/VRC-89. It does not replace any similar single radio set. The closest configuration would be a combination of a manpack (AN/PRC-77) radio and a vehicular radio (AN/VRC-43 or AN/VRC-46) kept in the same vehicle.

(f) Vehicular dual long-range/retransmission radio AN/VRC-92. The AN/VRC-92 (Figure 3-8) adds a second power amplifier to the AN/VRC-89 to provide high-power capability for both radios in the mount. The second amplifier has its own mount (MT-6353/VRC) and obtains its power from cable connected to one of the auxiliary power outputs from the radio mount. In the mounting adapter, the comounted amplifier can only be used with the lower radio, and the separate amplifier can only be used with the upper radio. The AN/VRC-92 replaces the AN/VRC-45 and AN/VRC-49.

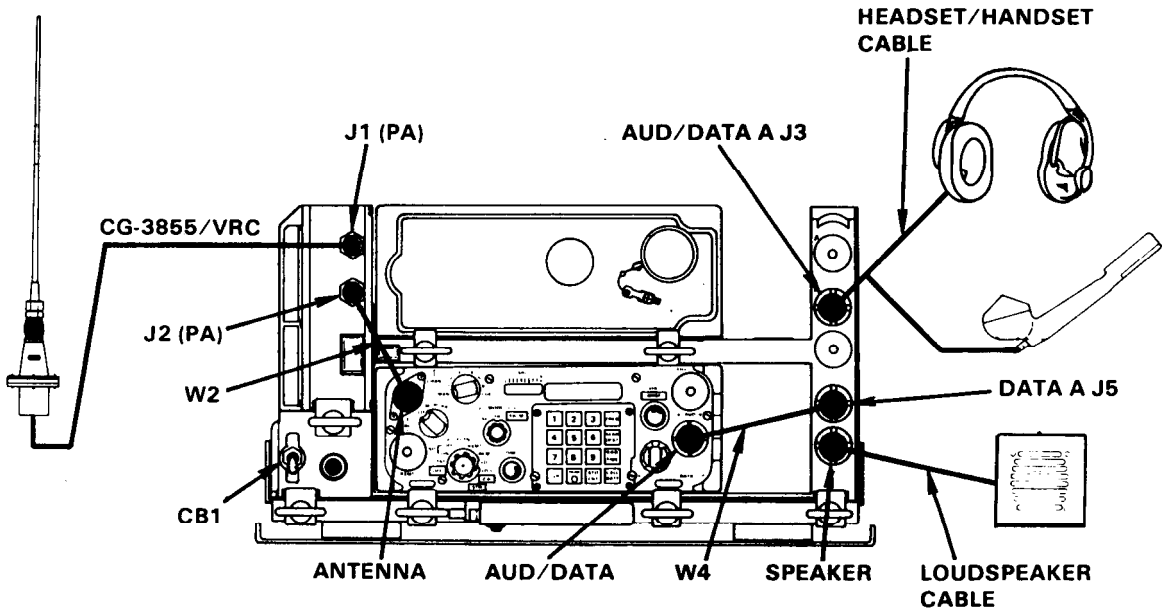

Figure 3-7. Vehicular long-range radio AN/VRC-90.

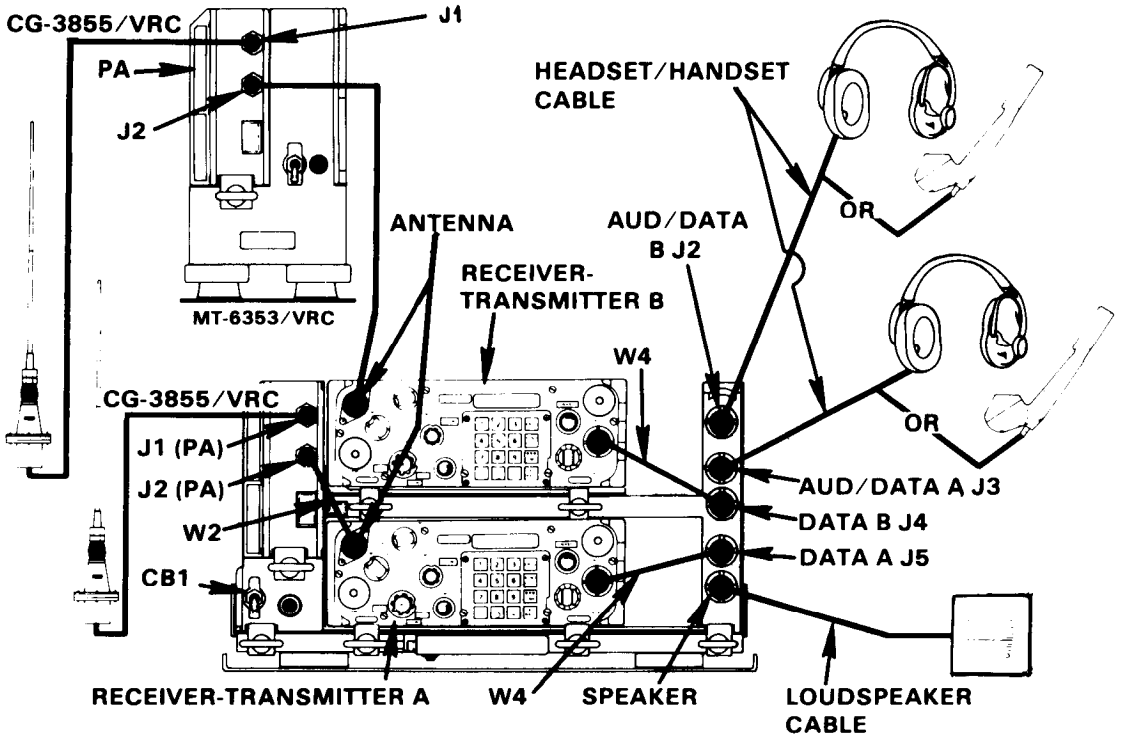

Figure 3-8. Vehicular dual long-range/retransmission radio AN/VRC-92.

(3) Airborne versions. The airborne and ground versions are interoperable. They appear physically different to the ground models and to each other. The only change in the airborne models is the face plate that is attached to the different configurations. The RT is identical in all three models, but the add-on modules change the capabilities of the base RT.

(a) The RT-1476/ARC-201 (Figure 3-9) is the basic version of the three. All three versions operate in both the single-channel and FH modes. There are no provisions for remoting the radio or allowing data input.

(b) The RT-1477/ARC-201 provides a remote capability for installations where the radio must be located away from the pilot's cockpit. It has a separate radio and remote control panel (Figure 3-10) so the pilot can remotely control the radio from his position in the aircraft. The RT-1476/1477 has retransmission capabilities.

(c) The RT-1478/ARC-201 (Figure 3-11) is equipped with a DRA for 600 and 1,200 baud data rates. The DRA processes the input signal in the same format as the ground radio in the AD2 mode of operation for use with TACFIRE data terminals. Therefore, it will only communicate with other SINCGARS radios and not with AN/VRC-12 series radios connected to TACFIRE terminals. The RT-1478 is a low density piece of equipment and is the only airborne version that accepts data.

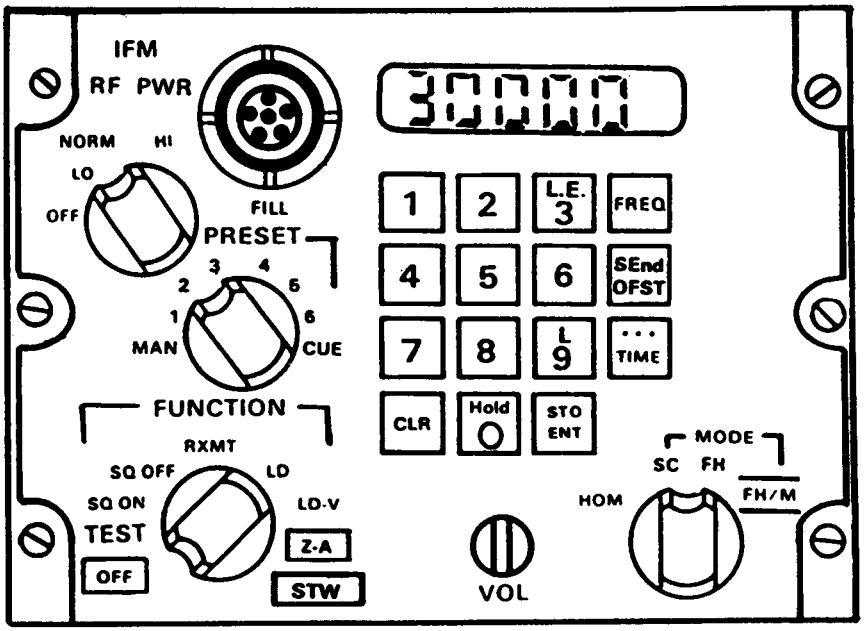

Figure 3-9. RT-1476/ARC-201.

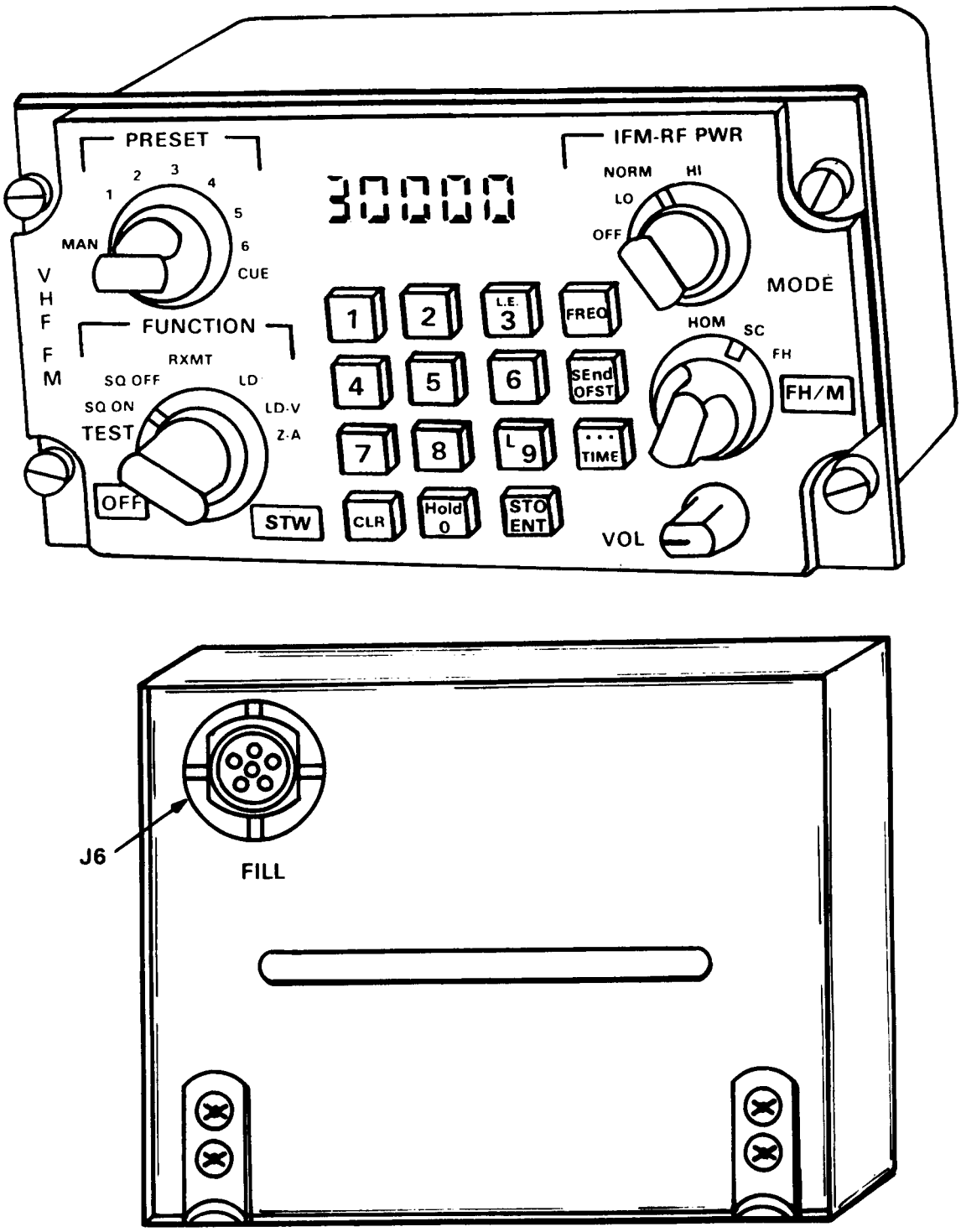

Figure 3-10. RT-1477/ARC-201 with remote control panel.

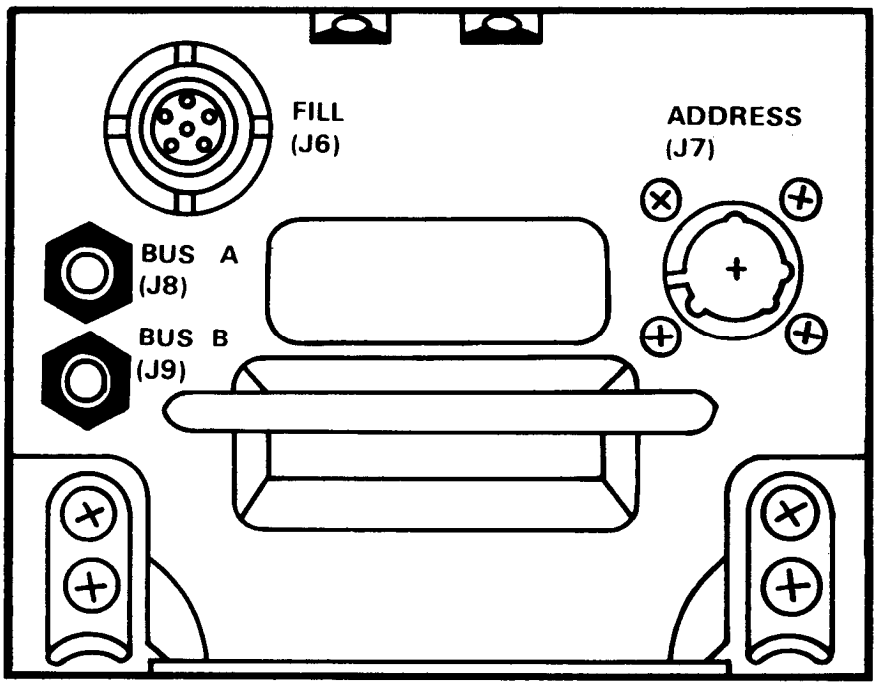

Figure 3-11. RT-1478/ARC-201.

3-3. Ancillary Equipment

a. There are two main categories of ancillary equipment associated with SINCGARS: remote control devices and data fill/variable storage transfer devices. Other devices that generate signals passed over SINCGARS radios, such as data terminals, are classified as input/output devices.

b. The two primary remote control systems are further divided into intravehicular remotes and external remotes. The intravehicular remote control unit (IVRCU) C-11291 is the remote for intravehicular radio control. The SINCGARS remote control unit (SRCU) and AN/GRA-39 are used to remote radios off the main site location.

(1) The IVRCU C-11291 (Figure 3-12) can control up to three separate radio sets in armored vehicles. The IVRCU can be used with either the ICOM or non-ICOM radio. It controls all functions of the three radios from a single station. The monitors can also be connected in parallel so two different operators, such as the vehicle commander and driver, can control the radios from their respective positions in the vehicle. The radio function switch must be set in the remote (REM) operating position for the external control monitor to function correctly. Like the radio, the monitor has BIT functions displayed through the monitor control panel.

(2) The SRCU (Figure 3-13) provides securable remoting of a single radio up to 4 kilometers (2.4 miles). The advantage of the SRCU over previous remotes is its ability to secure the wire line between the radio and the terminal set. The SRCU controls all radio functions including power output, channel selection, and radio keying. The remote also provides an intercom function from the radio to the terminal unit and vice versa.

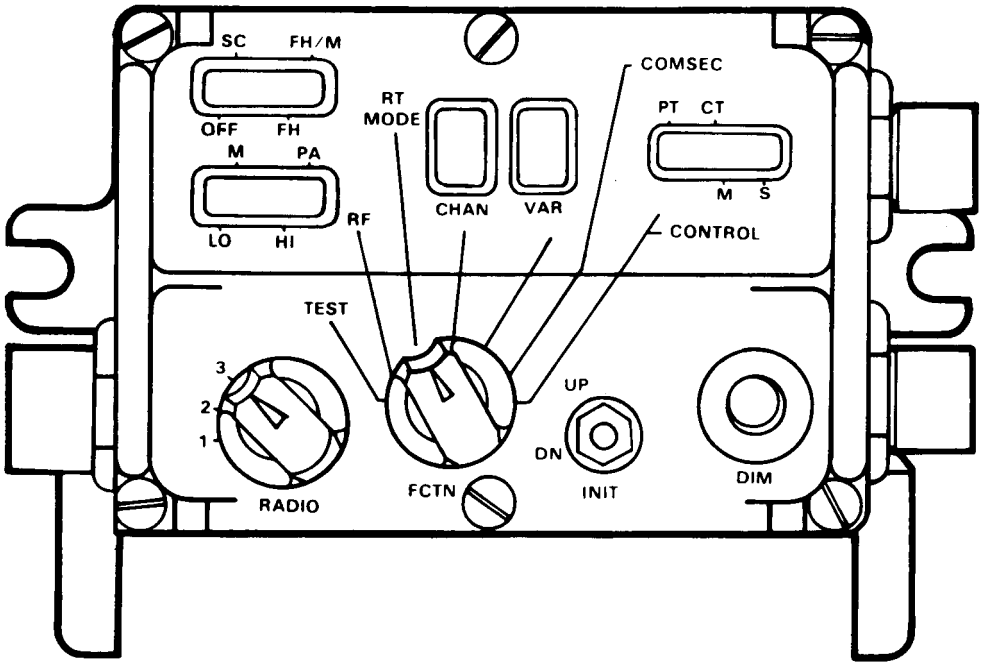

Figure 3-12. IVRCU-C11291.

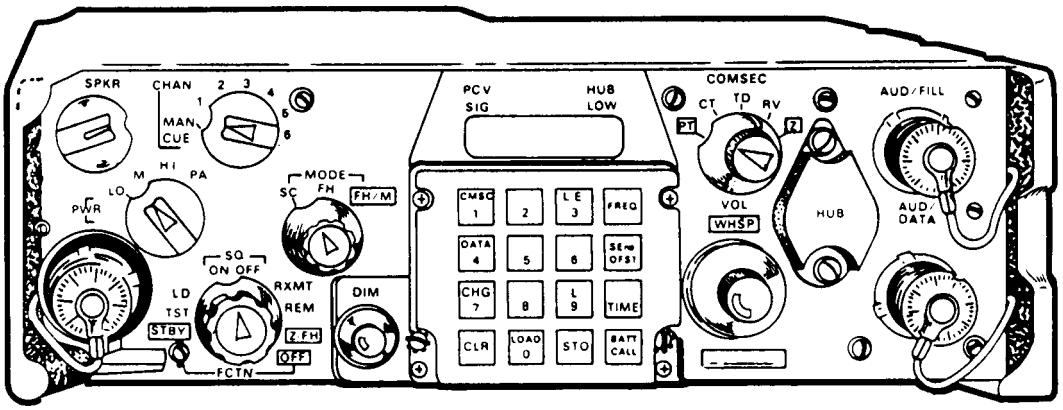

Figure 3-13. SRCU.

(3) The AN/GRA-39 (Figure 3-14), previously used to remote single-channel radios, is compatible with the ICOM and the non-ICOM radios. It controls only remote keying of the radio from the terminal set. The operator must set the other functions at the radio location.

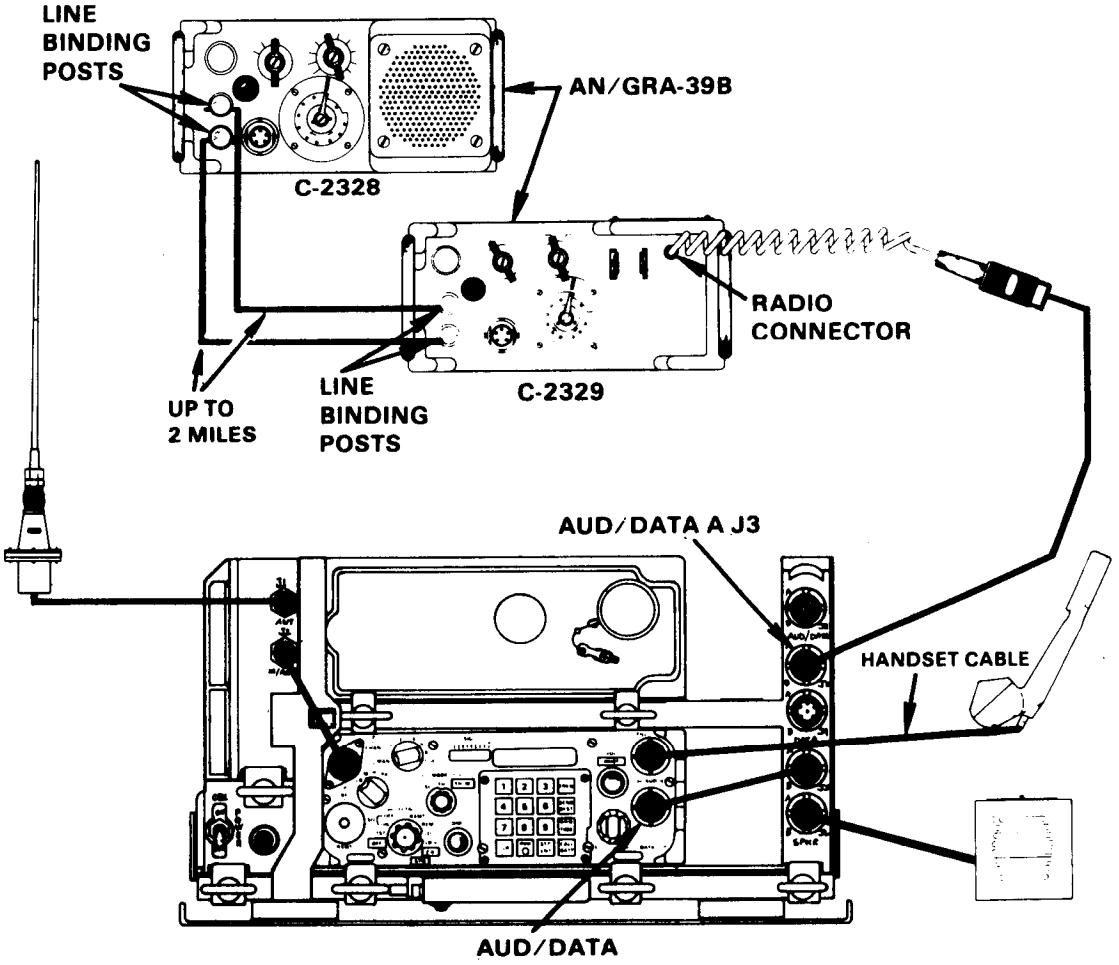

Figure 3-14. AN/GRA-39 with SINCGARS.

c. The data fill devices provide a means to transfer the required variables for the FH mode from unit to unit and to enter the variables into the radio.

(1) The MX-10579 (Figure 3-15) is used with the non-ICOM radio only. The MX-10579 holds up to 13 hopsets and two transmission security keys (TSKs) variables. It can be filled one location at a time or bulk loaded with a complete fill. The MK-18290 is used with the ICOM or the non-ICOM. The MX-18290 holds 13 hopsets and 6 TSK variables.

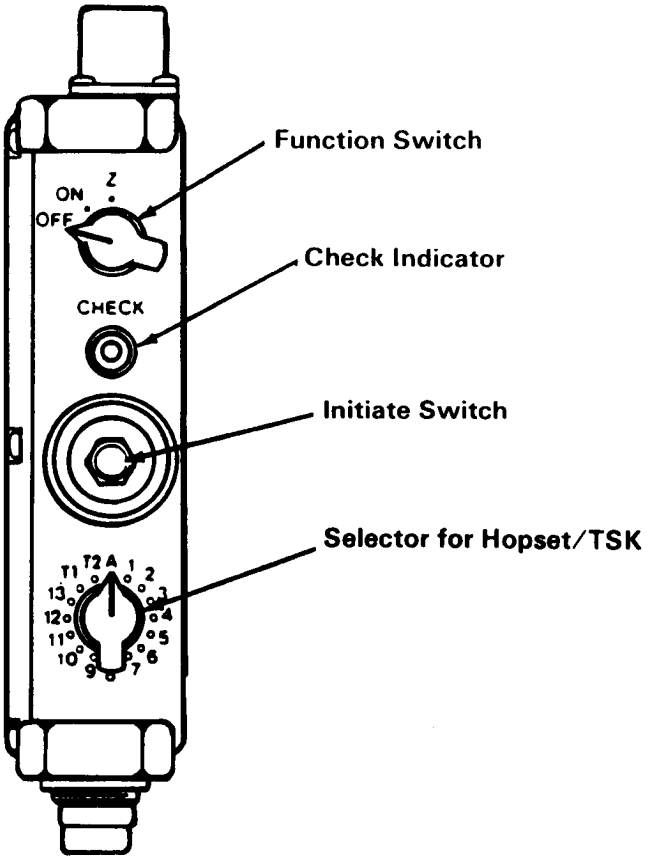

Figure 3-15. ECCM fill device MX-10579.

(2) The electronic notebook (EN) AN/CYZ-7A (Figure 3-16) is a small hand-held data memory device similar to a small calculator. It can be loaded with complete or partial SOI and the FH variables for operation of SINCGARS. It provides the operator with an automated search method to locate call signs and frequencies for use in any number of networks. The EN replaces the paper SOI for use in the field.

(3) Currently, an operator requires two fill devices to put a secure FH radio into a network. One device loads the radio and the second loads the secure device (VINSON or ICOM). The National Security Agency (NSA) is developing a single device to hold all the required variables and the SOI contained in the EN. Until the device is fielded, the operator must carry both devices.

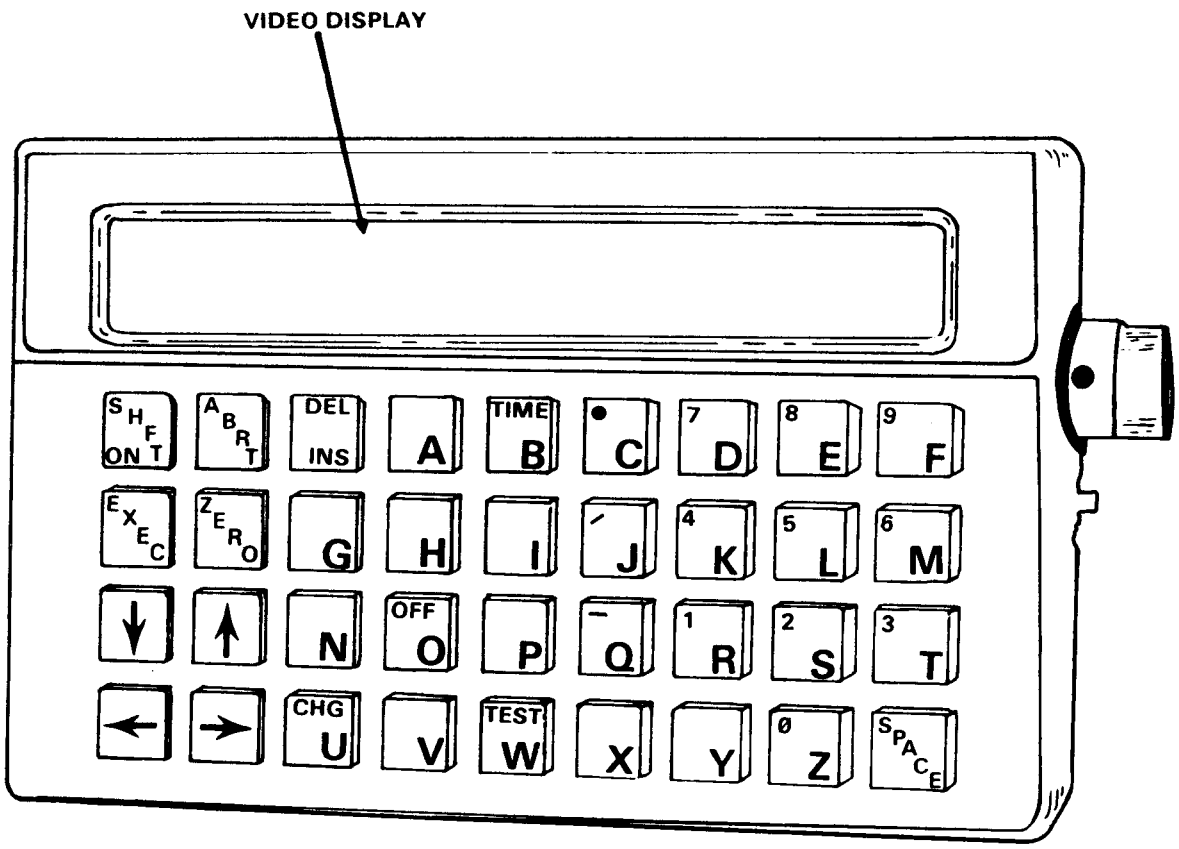

Figure 3-16. EN AN/CYZ-7A.