

**United States Army Aviation Logistics School
Fort Eustis, Virginia**

APRIL, 1994



THIS DOCUMENT HAS BEEN REVIEWED FOR OPSEC CONSIDERATIONS

STUDENT HANDOUT

AVIONICS

071-640-04

The proponent for this SH is USAALS

TERMINAL LEARNING OBJECTIVE:

At the completion of this lesson the student will:

ACTION: Verify avionics equipment operation.

CONDITIONS: Given an AH-64A helicopter, applicable technical manuals, and a requirement to verify avionics equipment operation.

STANDARDS: Verify avionics equipment operation in accordance with TM 1-1520-238-T series manuals, TM 11-1520-238-23 series manuals, TM 55-1520-238-10, TM 55-1520-238-23 series manuals, TM 55-1520-238-CL, and TM 55-1520-238-MTF.

SAFETY REQUIREMENTS: In addition to specific safety requirements of this lesson plan, aviation shop and flight line safety standards established in the technical manuals will be reinforced.

RISK ASSESSMENT LEVEL: Low

WARNING

ELECTROMAGNETIC RADIATION

DO NOT STAND IN THE DIRECT PATH OF AN ANTENNA WHEN THE APPLICABLE SYSTEM POWER IS ON.

! Microwave radiation produces electrical and magnetic forces, and generates heat in the human body, with potentially dangerous effects. Microwave radiation may cause nausea. If you feel the slightest warming effect or nausea while near an antenna, **MOVE AWAY QUICKLY.**

Location of antennas emitting microwave radiation on this helicopter are:

- The VHF AM-FM antenna on the aft surface of the vertical stabilizer.
- The VHF AM-FM blade antenna on the bottom center fuselage directly forward of the Doppler fairing.
- The UHF AM/lower IFF antenna on the bottom center fuselage directly aft of the Doppler fairing.
- The upper IFF antenna on top of the fuselage area aft of the canopy.

071-640-04

NOTES

- The radar jammer transmit antenna on top of the fuselage nose forward of the CPG station.
- ! Before replacing any of the above antennas, remove electrical power from the system and tag the circuit breaker and/or the external power connector to prevent injury to personnel.
- ! During operational check of the radar warning set, an active ground radar is used. Use care when activating and using the ground radar to avoid exposure to the antenna microwave radiation.
- ! Do not continuously look at the infrared countermeasures transmitter, located behind the main rotor mast, during operation or for a period of over 1 minute at a distance of less than 3 feet. Skin exposure to infrared radiation for longer than 10 seconds at a distance less than 4 inches shall be avoided.

WARNING

ELECTRICAL POWER

Electrical power operating or maintenance procedures, practices or conditions, which, if not strictly observed, could result in injury or death to personnel. These WARNINGS must be strictly obeyed by all personnel.

ENVIRONMENTAL CONSIDERATIONS: None

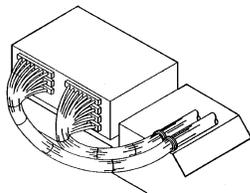
EVALUATION: This lesson will be evaluated during Practical Written Evaluation 9C7-515-04.



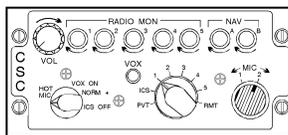
INTERCOMMUNICATIONS SYSTEM



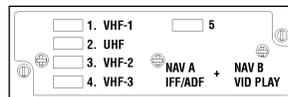
CYCLIC CONTROL
STICK GRIPS



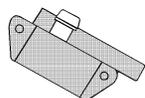
AUDIO JUNCTION BOX



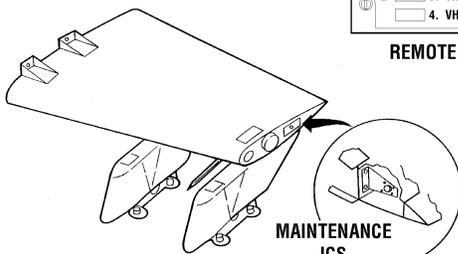
COMMUNICATIONS SYSTEM
CONTROL PANEL



REMOTE INDICATOR PANEL



TRANSMIT
FOOT SWITCHES



MAINTENANCE
ICS
RECEPTACLE

83-2247A

NOTES

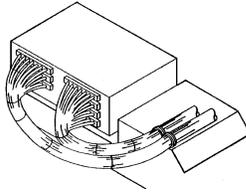
- A. Intercommunications System - the intercommunications system (ICS) provides the main control of all flight crewmember, ground crew communications, and radio communications.
1. Internal intercommunications
 - a. Provides the pilot and CPG crewstations with communication capability with each other ICS system.
 - (1) Both stations have microphone and headphone connections.
 - (2) Both stations have cyclic RADIO and ICS push-to-talk switches.
 - (3) The pilot station has a RADIO foot switch.
 - (4) The CPG station has a RADIO and ICS foot switch.
 - b. The transparent barrier/blast shield has a message pass-through area where items can be passed from one crewstation to another.
 2. External intercommunications
 - a. Provides the crewstations with communication capability with the external ICS system.
 - (1) Both wings have a jack station for use by ground personnel.
 - (2) The left wing audio is controlled by the CPG audio system.
 - (3) The right wing audio is controlled by the pilot audio system.
 - (4) The wing stations are disconnected electronically in-flight, for TEMPEST and system combat survivability reasons.
 3. The ICS provides selection, amplification, and isolation of RECEIVER AUDIO.
 - a. Communication radios
 - b. Navigation radios
 - c. Aircraft survivability equipment (ASE)
 4. The ICS also provides selection, amplification, and isolation of TRANSMITTER AUDIO for the communication radios in both crewstations.
 5. The ICS permits the pilot to change transmitter selection by use of a remote switch on the cyclic grip.



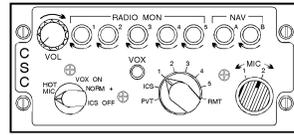
INTERCOMMUNICATIONS SYSTEM



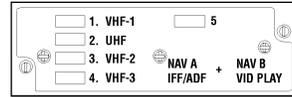
**CYCLIC CONTROL
STICK GRIPS**



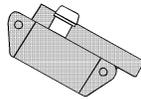
AUDIO JUNCTION BOX



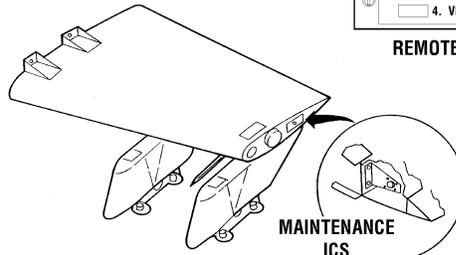
**COMMUNICATIONS SYSTEM
CONTROL PANEL**



REMOTE INDICATOR PANEL



**TRANSMIT
FOOT SWITCHES**



**MAINTENANCE
ICS
RECEPTACLE**

83-2247A

NOTES

6. There are provisions for secure voice communications.
 - a. They are not controllable from the ICS system but interface through it by virtue of an "as needed" hardware installation.
 - b. The ICS system is wired throughout with TEMPEST wiring to minimize radiated unsecure voice audio.

B. Features

1. The ICS system does not have an ON-OFF switch. When power is applied to the emergency bus, the ICS is powered and ready for use.
2. The ICS incorporates mostly government furnished equipment (GFE) as line replaceable units (LRUs) for commonality and ease of maintenance.

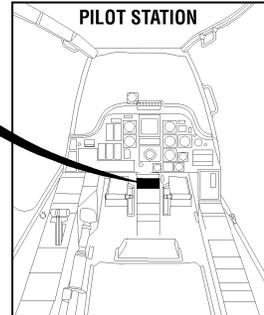
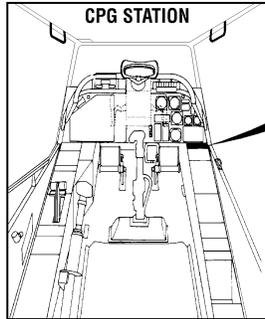
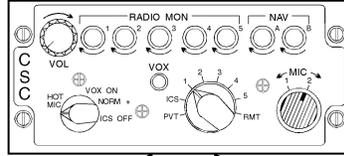
C. Major components

1. Communication system control (CSC) Panel (both crewstations)
2. Audio junction box (AJB)
3. Remote indicator panel (pilot station only)
4. Cyclic control stick grips (ICS/RADIO push-to-talk key switch)
5. Transmit foot switches (used as alternate ICS/RADIO push-to-talk key switches, dependent on the crewstation)
6. Maintenance ICS receptacle (one at each wing tip)



CSC PANEL C-11746(V)4/ARC

COMMUNICATIONS SYSTEM CONTROL PANEL



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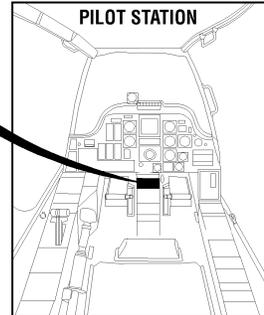
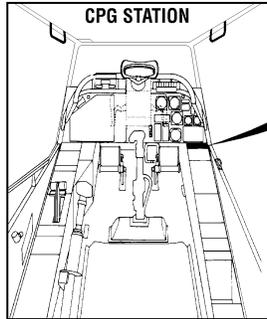
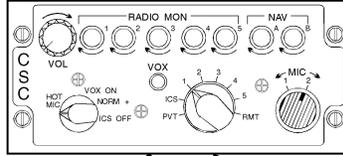
NOTES

- D. Component purpose, location, description, and operation
1. Communication System Control (CSC) Panel
 - a. The purpose of the CSC panel is to control all audio transmit and receive signals for the respective crew station.
 - b. Location of the CSC panels
 - (1) The CSC Panel in the pilot's station is located in the center console.
 - (2) The CSC Panel in the CPG's station is located forward on the right-hand console.
 - c. Description of the CSC panels
 - (1) The CSC Panels are identical and interchangeable.
 - (2) The CSC Panel switches are divided into two groups.
 - (a) The control panel switches located in top half of the control panel are the controls for the radio receivers.
 - (b) The bottom half of the control contains the transmitter control switches.
 - d. CSC operation
 - (1) Receiver control group
 - (a) VOL potentiometer - master volume control for the ICS volume level and all RADIO MON switches/potentiometers.
 - (b) RADIO MON switches/potentiometers - all RADIO MON switches are push ON, pull OFF switches/potentiometers. They rotate left to decrease and right to increase volume.
 - 1) RADIO MON 1 - provides ON/OFF and volume control for the No. 1 (Pilot's) VHF receiver.
 - 2) RADIO MON 2 - provides ON/OFF and volume control for the UHF receiver.
 - 3) RADIO MON 3 - provides ON/OFF and volume control for the No. 2 (CPG's) VHF receiver.
 - 4) RADIO MON 4 - growth potential
 - 5) RADIO MON 5 - spare



CSC PANEL C-11746(V)4/ARC

COMMUNICATIONS SYSTEM CONTROL PANEL



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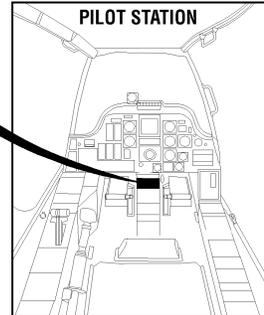
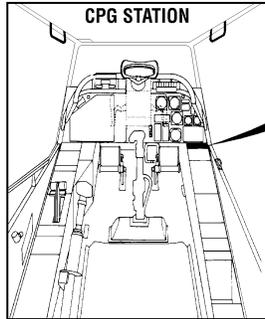
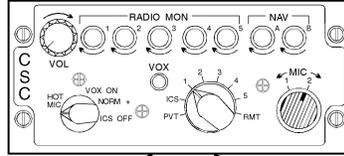
- (c) NAV switches - both NAV switches are push ON, pull OFF switch/potentiometers.
 - 1) NAV A - provides ON/OFF and volume control for ADF (ARN-89) and IFF (APX-100) audio.
 - 2) NAV B - provides ON/OFF and volume control for video recorder audio playback.

- (2) Transmitter group
 - (a) HOT MIC/VOX ON/NORM/ICS OFF rotary selector switch
 - 1) A 4-position rotary switch that provides control of the internal microphone amplifier.
 - 2) Switch positions
 - a) HOT MIKE position - allows interphone transmit functions at all times.
 - b) VOX ON position
 - c) Allows the use of the voice operated transmit function in ICS only. The "X" in the acronym VOX is from the standard communication abbreviation XMIT, which stands for transmit.
 - d) Radio transmit still requires the use of the ICS/RADIO key switch on the cyclic stick grips, or the transmit foot switches in each crewstation.
 - e) NORM position - allows interphone transmit functions only when ICS transmit switch is pressed.
 - f) ICS OFF position - disables microphone amplifier.



CSC PANEL C-11746(V)4/ARC

COMMUNICATIONS SYSTEM CONTROL PANEL



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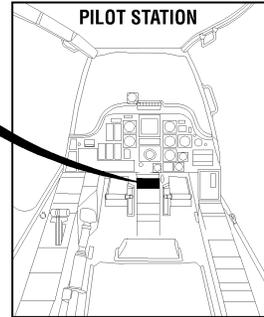
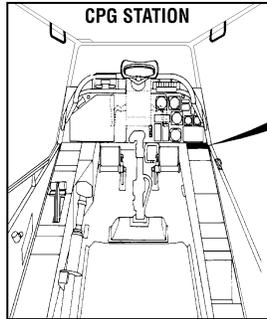
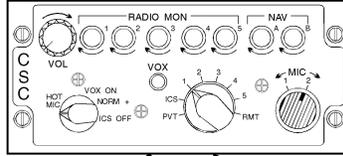
NOTES

- (b) Transmit select switch rotary switch
 - 1) An 8-position rotary switch that selects the system that is keyed by the cyclic stick Cyclic control stick grip ICS/RADIO push-to-talk key switch or the foot transmit switch in each crewstation.
 - 2) Switch positions
 - a) PVT - not used on the AH-64A
 - b) ICS position - allows intercommunication
 - c) Position No. 1 - allows transmission on the No. 1 VHF radio
 - d) Position No. 2 - allows transmission on the UHF radio
 - e) Position No. 3 - allows transmission on the No. 2 VHF radio
 - f) Position No. 4 - growth potential
 - g) Position No. 5 - growth potential
 - h) RMT
 - 1) Enables remote transmit select switch (RTSS) operation on the pilot cyclic stick grip.
 - 2) The RMT function is not available in the CPG's station.
- (c) MIC select switch
 - 1) MIC 1 - used with dynamic microphones
 - 2) MIC 2 - used with TEMPEST or carbon microphones
- (d) VOX potentiometer - provides control for voice threshold level at which the VOX circuitry will key the microphone for ICS communication.



CSC PANEL C-11746(V)4/ARC

COMMUNICATIONS SYSTEM CONTROL PANEL



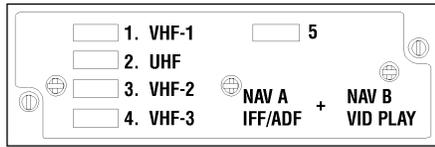
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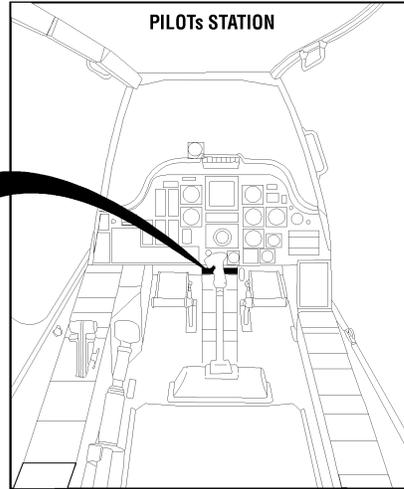
- (3) Flight critical and mission essential warning audio are hardwired into the CSC control panel. There are no audio level adjustments that can be made ON THE CREWSTATION CSC'S to change or eliminate the warning audio. The following audios are hardwired.
- (a) Stabilator control system automatic mode operation failure warning
 - (b) Engine out warning
 - (c) Low rotor RPM warning
 - (d) Radar warning



REMOTE INDICATOR PANEL



REMOTE INDICATOR PANEL



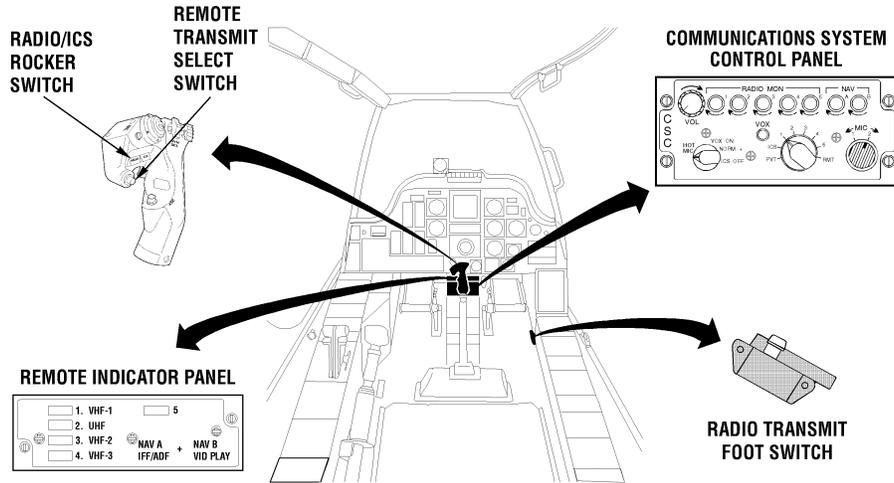
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NOTES

2. Remote indicator panel
 - a. The remote indicator panel provides the pilot with a visual indication of the radio that has been selected to transmit using the RTSS function.
 - b. Located on the center console in the pilot's station, above the CSC Panel.
 - c. The remote indicator panel contains five light emitting diodes that illuminate to show the communication radio that the pilot has selected when using the RMT function of the CSC.
 - (1) VHF-1
 - (2) UHF
 - (3) VHF-2
 - (4) VHF-3 (if installed)
 - (5) Spare



PILOT ICS COMPONENT LOCATIONS



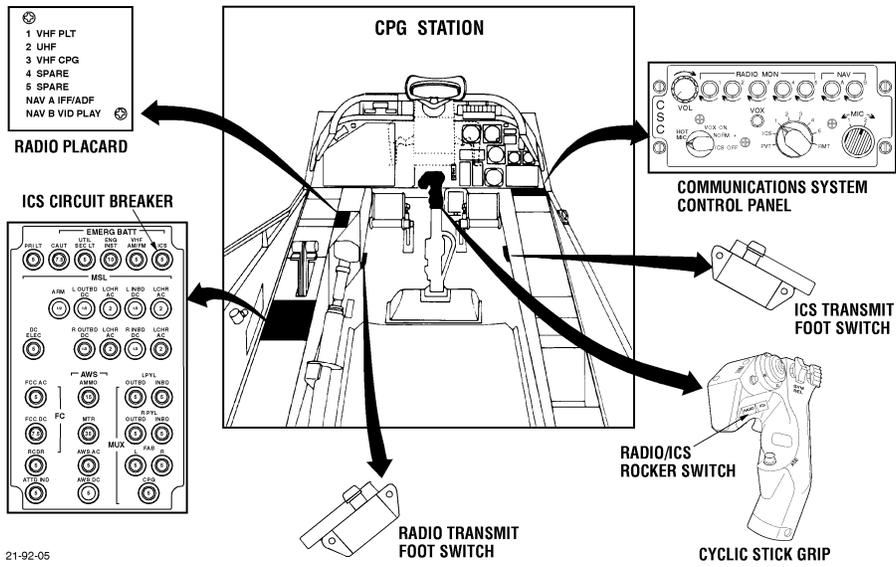
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NOTES

- d. Operation of the RTSS
- (1) The transmit select switch on the pilot's CSC panel must be in the RMT position to enable the remote transmit select function.
 - (2) When the pilot presses the remote transmit select switch (RTSS) on the cyclic grip:
 - (a) The next radio in sequence is selected for transmission by the electronic circuitry in the remote indicator panel.
 - (b) The appropriate light emitting diode indicates which radio has been selected.
 - (c) Each time the RTSS switch is pressed, the next radio in sequence is selected for transmission and the appropriate indicator lights.
 - (3) The pilot can use either the radio transmit foot switch or the RADIO/ICS rocker switch to transmit on the selected radio.



CPG ICS COMPONENT LOCATIONS

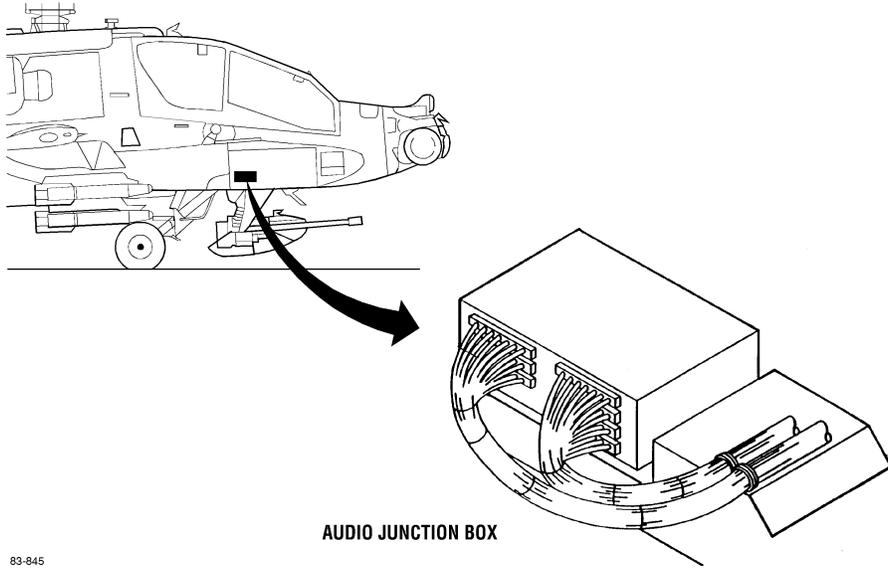


NOTES

- (4) Operation of the CPG's CSC panel is identical to the pilot's except the CPG has no remote transmit select switch capability. The CPG has an ICS transmit foot switch, a radio transmit foot switch, and the RADIO/ICS rocker switch.



AUDIO JUNCTION BOX



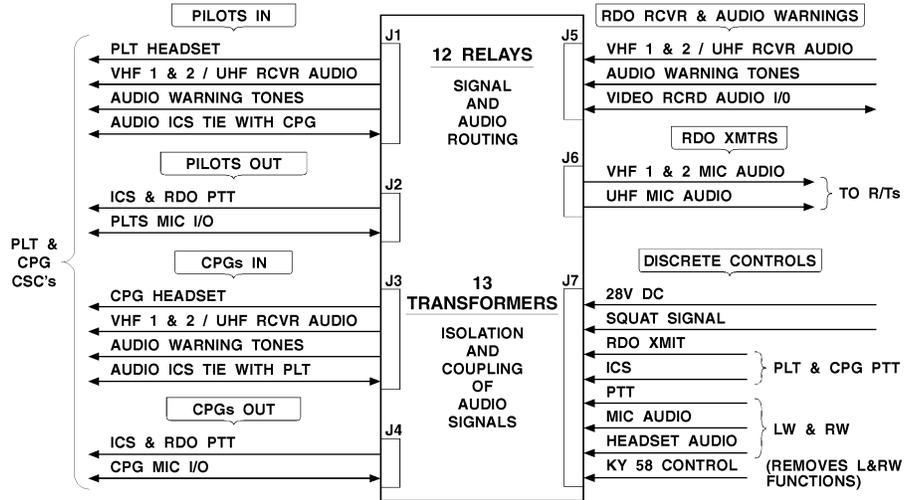
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NOTES

3. Audio Junction Box (AJB)
 - a. The AJB is the central signal routing and isolation unit for the AH-64A communications systems. The isolation aspect serves two purposes.
 - (1) The systems are isolated electronically to prevent the communication signals from interacting and creating operating problems.
 - (2) The electronic isolation minimizes any localized combat damage from disabling all communications.
 - b. Located in the right-hand forward avionics bay.
 - c. The AJB houses seven Raychem connectors on the front face, thirteen audio transformers, and twelve relays.



AUDIO JUNCTION BOX CONNECTORS



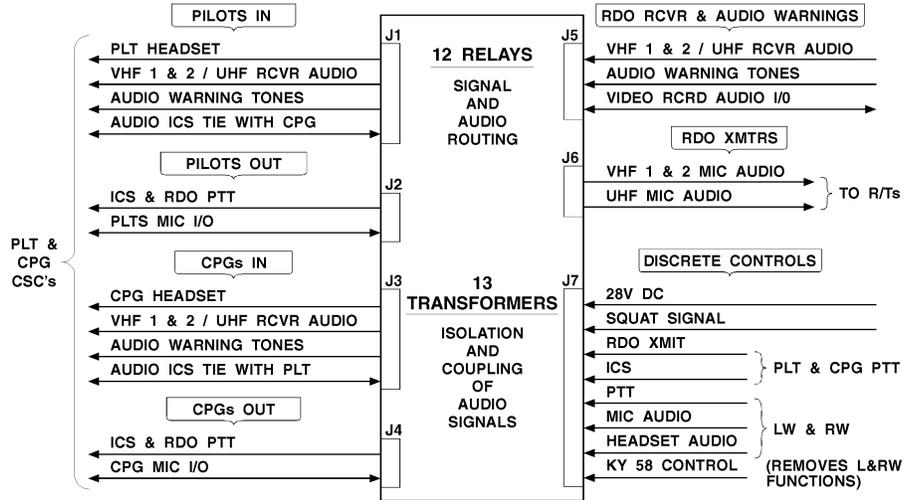
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NOTES

- (1) J1 PLT ICS RCVR - provides audio output connection to the pilot's CSC panel for all audio listed for J5 and the ICS tie between pilot's and CPG's CSC panels.
- (2) J2 PLT XMTR ICS - provides interconnect for all transmissions from the pilot's station.
- (3) J3 CPG ICS RCVR - provides audio output connection to the CPG's CSC panel for all audio listed for J5 and the ICS tie between the CPG's and pilot's CSC panels.
- (4) J4 CPG XMTR ICS - provides interconnect for all transmissions (ICS and radio) from the CPG station.
- (5) J5 RADIO RCVR WARNING - provides connection for audio from the following.
 - (a) No. 1 (pilot's) VHF receiver
 - (b) KY-28 receiver
 - (c) UHF receiver
 - (d) No. 2 (CPG) VHF receiver
 - (e) ADF receiver
 - (f) Video audio record
 - (g) Video recorder audio playback
 - (h) IFF failure warning
 - (i) Engine out warning
 - (j) Stabilator fail warning
 - (k) Radar warning
- (6) J6 RADIO XMTR - provides output signals to the No. 1 and No. 2 VHF radios, the UHF radio, and the KY-28 (if installed).
- (7) J7 DISCRETES - provides all discrete inputs.
- (8) Relays - there are 12 relays that are controlled by discrete inputs from J7. These relays are used to control the routing of signals and audio.



AUDIO JUNCTION BOX CONNECTORS



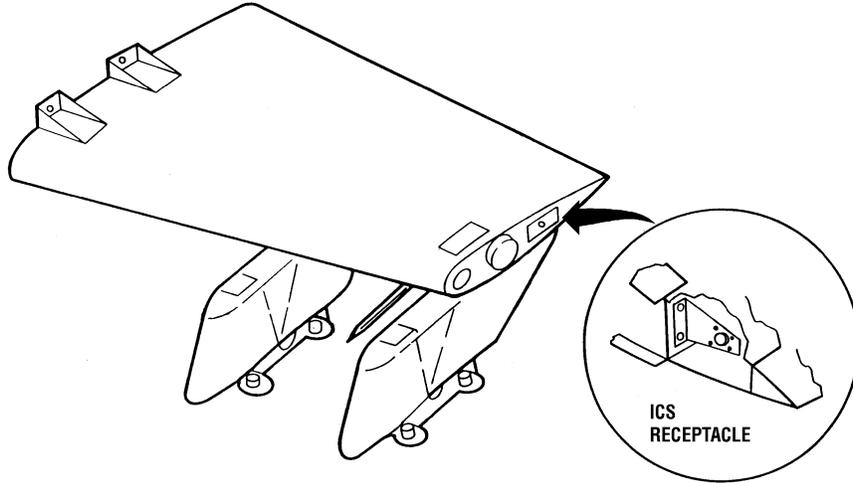
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NOTES

- (9) Transformers - 13 transformers are used to couple the various audios to and from other subsystems to the ICS. These transformers also provide isolation and impedance matching.



MAINTENANCE ICS RECEPTACLE



83-1514

NOTES

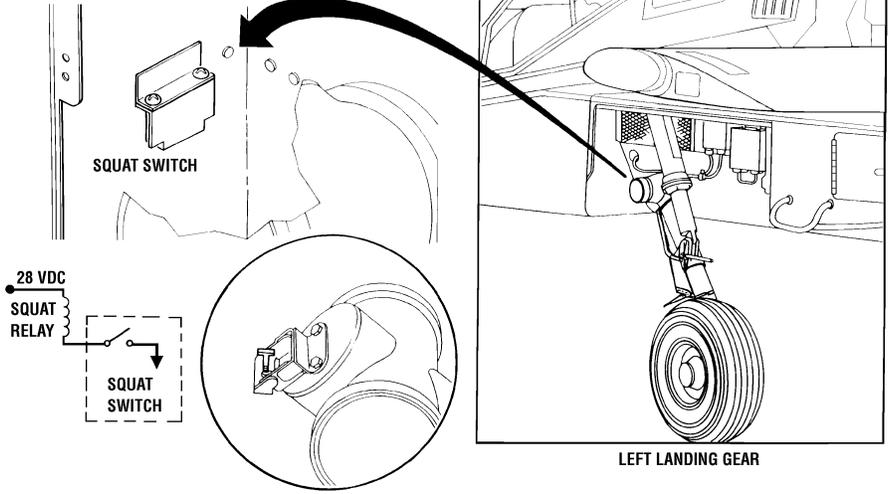
E. Interface components

1. Maintenance ICS receptacles

- a. Provide interface connections for maintenance personnel to communicate with the pilot and CPG crew stations during ground operations.
- b. A single ICS receptacle is mounted on each wing tip near the trailing edge, behind an access door.
- c. The maintenance ICS receptacle is a quick-disconnect type receptacle.
- d. Operation
 - (1) Squat switch must be open (aircraft on ground)
 - (2) The left maintenance receptacle parallels the CPG's CSC panel and the right receptacle parallels the pilot's CSC panel. This is accomplished by wiring in the AJB.
 - (3) Maintenance personnel must use the PTT switch to transmit even with HOT MIC selected on the crewstation CSC.
 - (a) Crewstation CSC VOL potentiometers control the respective maintenance ICS headset audio level.
 - 1) Crew members must coordinate with maintenance personnel utilizing the maintenance ICS feature.
 - 2) The respective crewstation CSC VOL potentiometers must be set high enough for maintenance personnel to communicate effectively, especially when the helicopter APU, engines, and rotors are operating.
 - (4) Operation of the KY-58 crypto-voice unit in the cipher mode prevents the maintenance ICS stations and crewstations from communicating with each other.



SQUAT SWITCH



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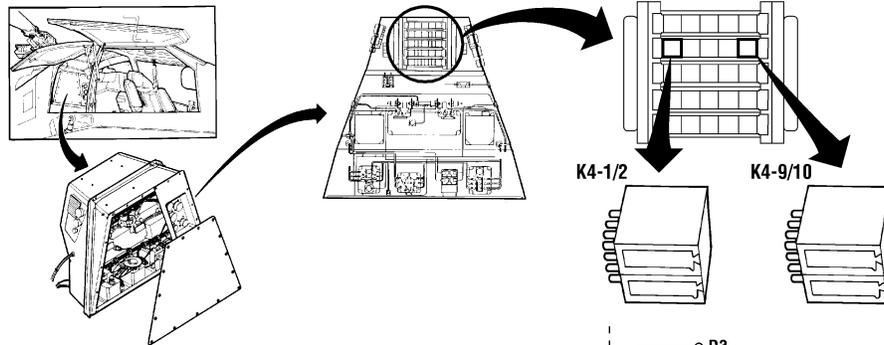
NOTES

2. Squat switch

- a. The squat switch provides a ground for the squat relay when the helicopter is in the air.
- b. Located on the left main landing gear.
- c. The squat switch is a solid state magnetic switch.
- d. Operation
 - (1) When the aircraft is on the ground, the switch is open and the ground is removed from the return side of the squat relay.
 - (2) When the aircraft is in the air, the switch is closed and a ground is supplied to the return side of the squat relay coil.



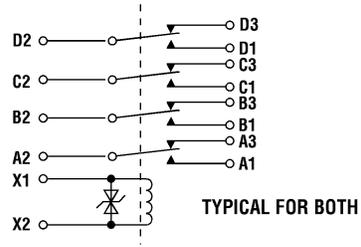
SQUAT RELAYS (K4-1/2 AND K4-9/10)



- K4-1/2** {
 - AC ELECTRICAL (GCU)
 - DASE
 - EXT STORES
 - CPG FCP

- K4-9/10** {
 - IFF KIT-1A
 - ICS WINGS
 - AWS TCB
 - TADS/PNVS ANTI-ICE

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83-1449



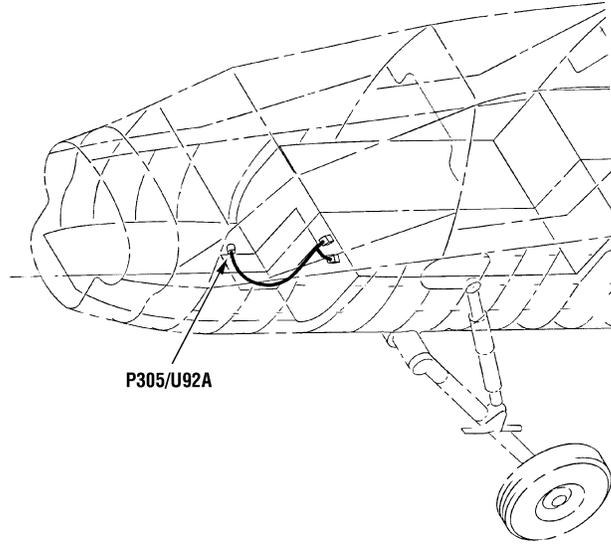
NOTES

3. Squat relay (K4-9/10)
 - a. Disconnects the maintenance receptacles from the ICS system when the helicopter is in flight.
 - b. The squat relay is located in the electrical power distribution center behind the pilot's seat.
 - c. The squat relay is a small (1 by 1 by 1 inch) plug-in type, solid-state LRU.
 - d. Power is supplied from the emergency dc bus via the IFF circuit breaker.
 - (1) When the aircraft is on the ground, the squat switch is open and the squat relay is de-energized.
 - (2) The squat relay provides a ground (when de-energized) to two relays in the AJB. When the two relays in the AJB are energized, the maintenance receptacles are connected to the ICS system.

4. ICS circuit breakers
 - a. Used to provide circuit protection for the ICS system.
 - b. Pilot's ICS circuit breaker is mounted on the center overhead circuit breaker panel.
 - c. CPG's ICS circuit breaker is mounted on the No. 1 CB panel in the left-hand console.
 - d. The ICS circuit breakers receive 28 VDC from the emergency dc bus and are rated at 5 amperes each.



WIRE HARNESS W219



83-1900

NOTES

5. Wiring harnesses

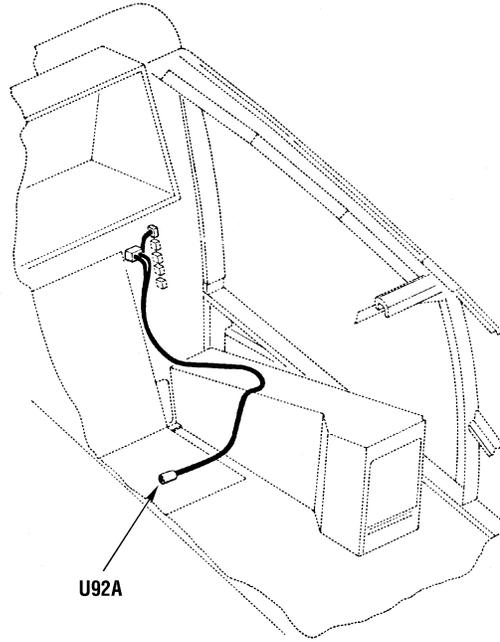
The following wiring harnesses interconnect the ICS and communication equipment.

- a. Wire harness 219 connects the CPG microphone adapter to the terminal block.

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**WIRE
HARNESS
W220**



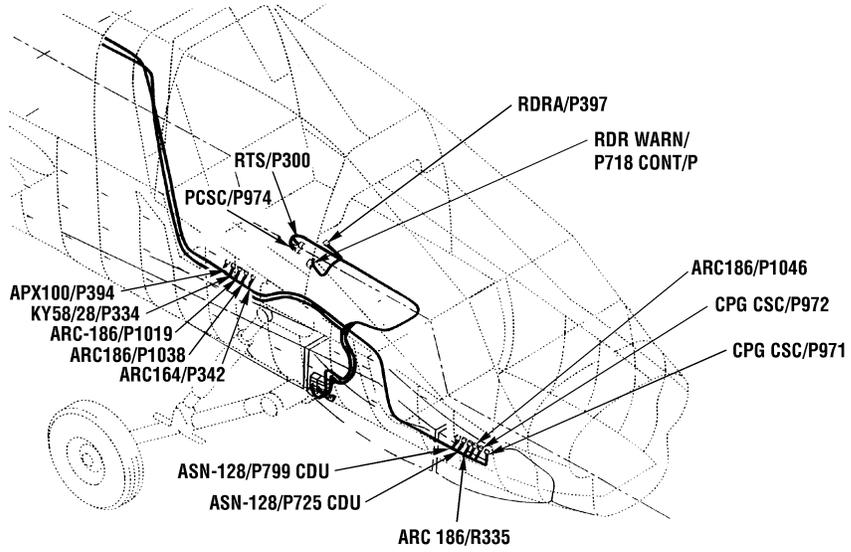
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NOTES

- b. Wire harness 220 connects the pilot microphone adapter to the terminal block.



HARNESS W266 (FORWARD)



21-92-03

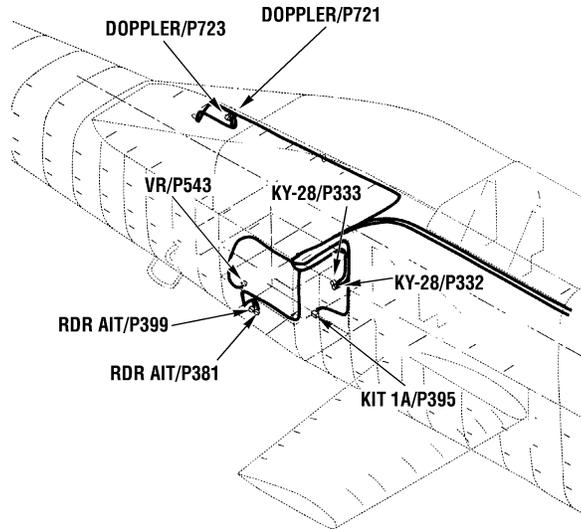
NOTES

c. Wire W266

- (1) Wire harness W266 is the main ICS harness. It connects a majority of the system audio signals through the audio junction box to the ICS.



HARNESS W266 (AFT)



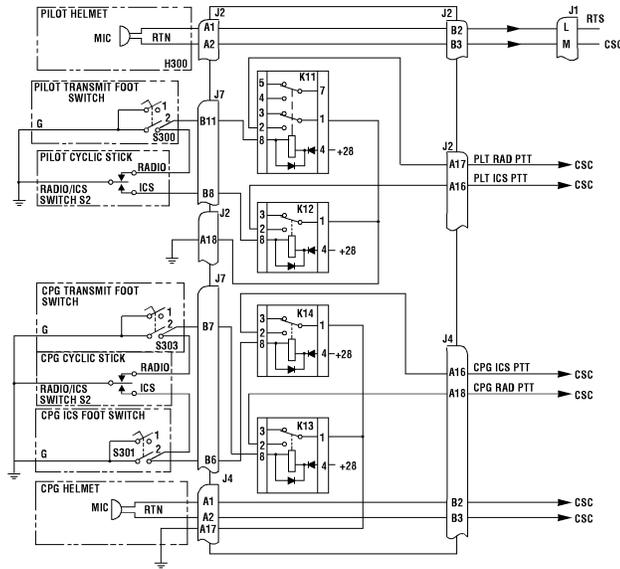
83-1905

NOTES

- (2) This harness connects equipment in the CPG/Pilot stations and aft avionics bay to the ICS.



PILOT AND CPG ICS OPERATION 1



21-91-11

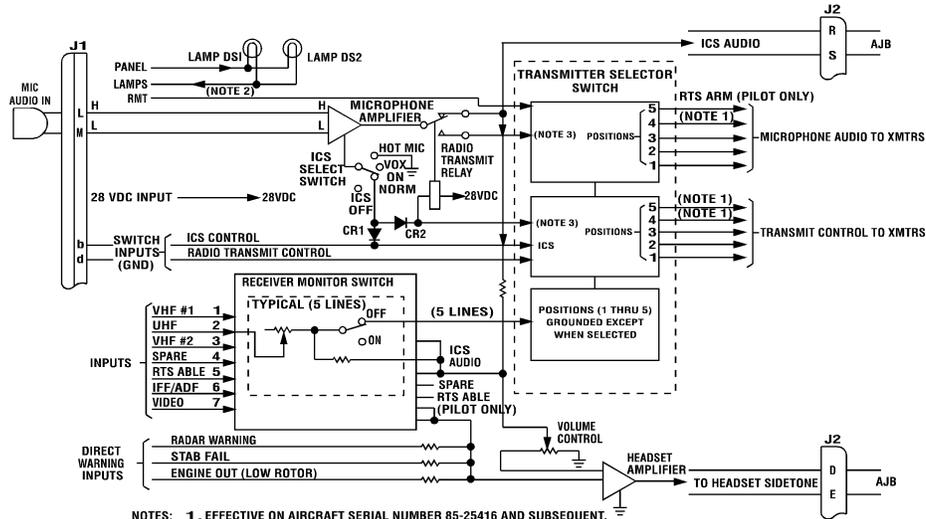
NOTES

F. Pilot and CPG ICS operation

1. Pressing the pilot's cyclic stick ICS rocker energizes K12 in the AJB. A ground is applied through the energized contacts of K12 to J2-A16 of the AJB. This ground is applied to the pilot CSC where it is used to turn on the microphone amplifier.
2. Pressing the pilot transmit foot switch or the cyclic stick radio switch energizes K11 in the AJB. A ground is applied through the energized contacts of K11 to the pilot's CSC where it is used to turn on the microphone amplifier, and enable ICS operation if the transmitter select switch is in ICS, or to enable radio transmission if a radio is selected.
3. Microphone audio is applied through the AJB to the CSC through the RTSS.



PILOT AND CPG ICS OPERATION 2



- NOTES: 1. EFFECTIVE ON AIRCRAFT SERIAL NUMBER 85-25416 AND SUBSEQUENT. SPARE ON AIRCRAFT SERIAL NUMBER 83-23787 THROUGH 85-25415.
 2. EFFECTIVE ON AIRCRAFT SERIAL NUMBER 85-25416 AND SUBSEQUENT.
 3. EFFECTIVE ON AIRCRAFT SERIAL NUMBER 85-25416 AND SUBSEQUENT. ONLY 1-3 POSITIONS ON AIRCRAFT SERIAL NUMBER 83-23787 THROUGH 85-25415.

21-94-135
89-21-02

NOTES

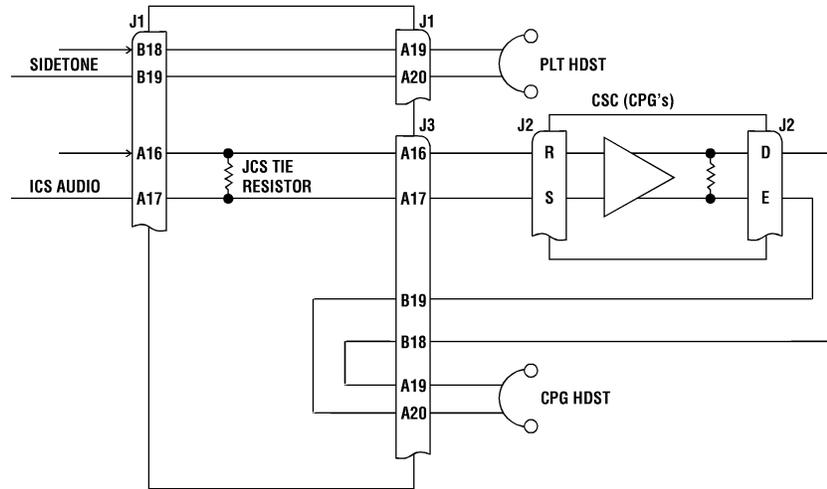
4. The microphone audio is input through J1-L&M to the microphone amplifier in the pilot's CSC.
5. The microphone amplifier is activated by:
 - a. Closing the pilot cyclic ICS switch - the ICS control signal operates the amplifier if the ICS select switch is in the norm position.

- or -
 - b. Closing the pilot cyclic RADIO transmit switch or the pilot radio transmit foot switch if the transmitter select switch is in ICS.

- or -
 - c. Setting the ICS select switch to HOT MIC - causes the microphone amp to stay on.
6. The amplified microphone audio is sent to the radio transmit relay.
7. If the ICS has been keyed, the radio transmit relay is de-energized and the amplified audio is sent to two places as ICS audio.
 - a. Out of the CSC on J2-R&S to the AJB and on TO THE CPG'S HEADSET AS ICS AUDIO.
 - b. Through the master volume control to the headset amplifier where it is amplified again and applied out of the CSC on J2-D&E to the AJB where it is applied TO THE PILOT'S HEADSETS AS SIDETONE.
8. If the RADIO has been keyed, the transmit relay is energized, the audio is applied to the transmitter select switch, for application to the selected radio as pilot's mic audio and transmitted out.



PILOT AND CPG ICS OPERATION 3



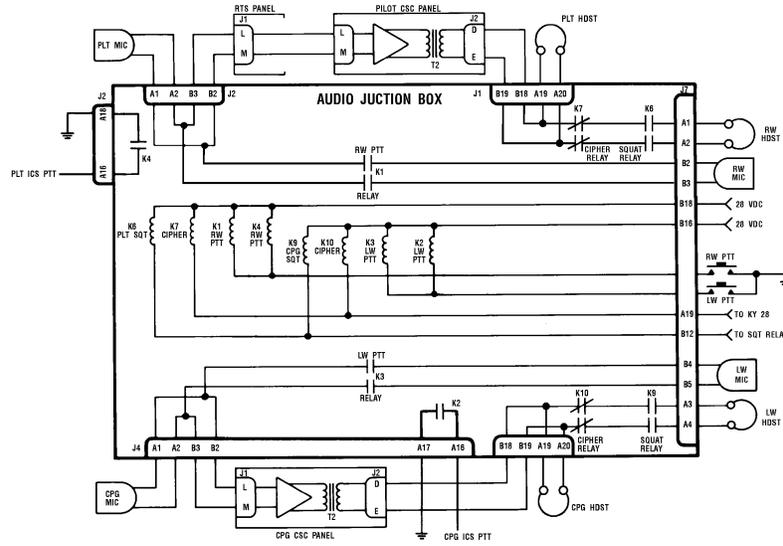
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89-21-03

NOTES

9. ICS audio is applied through the AJB to the CPG's CSC where it is amplified in the headset amplifier. It is then applied back through the AJB to the CPG's headset.
10. Sidetone is applied through the AJB to the pilot's headset.
11. CPG ICS operation is the same as pilot's ICS operation with the exception that there is not an RTSS in the CPG station.



MAINTENANCE ICS OPERATION



21-94-39

NOTES

G. Maintenance ICS operation

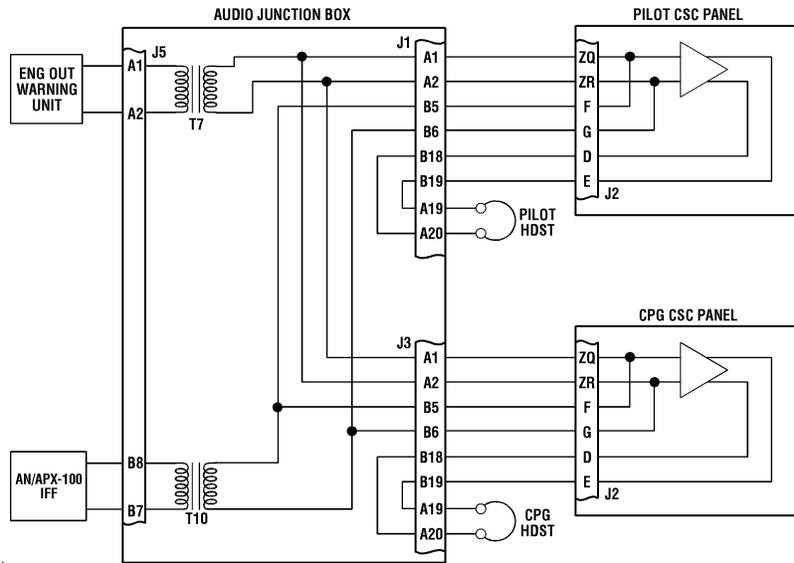
1. The right wing ICS maintenance receptacle is paralleled with the pilot's ICS and the left wing receptacle is paralleled with the CPG's ICS. ICS audio from any station can be heard by all stations. The helicopter must be on the ground to enable the wing ICS stations. When the helicopter is on the ground and power is applied, relays K6 and K9 are energized and the normally open contacts are closed.
2. When the right wing ICS push-to-talk (PTT) switch is pressed, relays K1 and K4 energize and the normally open contacts close. Audio from the RW microphone is applied through pins B2 and B3 of J7 and the closed contacts of relay K1.
3. The audio signal exits the AJB through pins B2 and B3 of J2.
4. Routing through the CSC is the same as normal ICS operation with the exception that K4 in the AJB now supplies the ground to turn on the microphone amplifier.
5. The RW headset is paralleled with the pilot's headset at J1 (pins B18-B19/A19-A20) of the AJB. Any plain voice audio the pilot receives can be heard by the RW ICS station.
6. The LW headset is paralleled with the CPG's headset at J3 (pins A19-A20/B18-B19) of the AJB. Any plain voice audio the CPG receives can be heard by the LW ICS station.
7. LW ICS operation is similar to RW ICS operation.

H. ICS warning signals operation

1. All warning signals are generated by the system being monitored and are applied to the AJB through J5.
 - a. Engine out warning
 - b. Stabilator warning
 - c. Radar warning
 - d. IFF warning



ICS WARNING SIGNALS



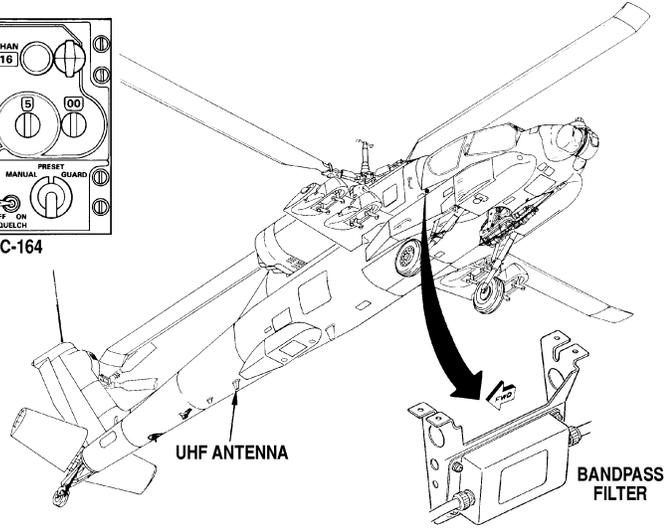
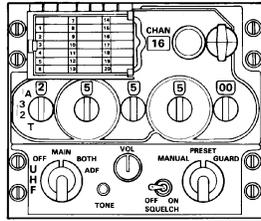
21-92-04

NOTES

2. When the engine out warning unit senses an engine failure, a signal is applied J5, pins A1 and A2.
 - a. The signal is applied to the primary of T7 (Turns ratio 1:7.3) and exits the AJB at pins A1 and A2 of J1 and at pins A1 and A2 of J3.
 - b. The signal from J1 is applied to the pilot's CSC panel at ZQ and ZR of J2.
 - c. The signal is amplified and sent to the pilot's headset via the AJB.
 - d. The signal from J3 is applied to the CPG's CSC panel at ZQ and ZR of J2.
 - e. The signal is amplified and sent to the CPG's headset via the AJB.
3. Operation of all warning signals is the same. The volume of the warning signals cannot be adjusted.



UHF MAJOR COMPONENTS



21-92-79

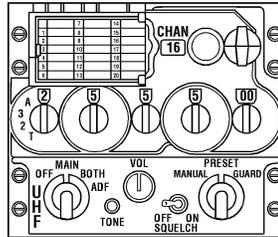
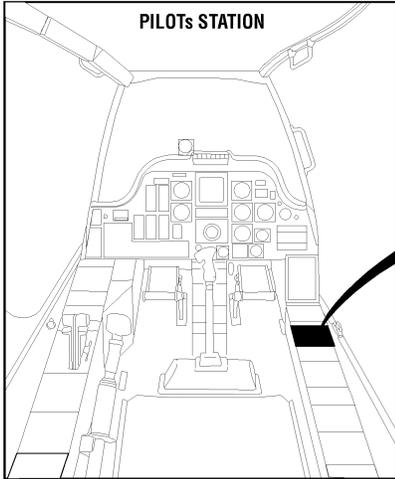
NOTES

A. UHF radio system

1. The purpose of the AN/ARC-164 ultra high frequency (UHF) radio system is to provide air-to-air and air-to-ground line-of-sight voice communications in the UHF band.
2. The UHF receiver/transmitter is a pilot-controlled LRU with all operator usable controls on the front panel.
3. Major components
 - a. RT-1167/ARC-164
 - b. Bandpass filter (FL-313)
 - c. UHF antenna (AT-741/A)



RT-1167C/ARC-164 LOCATION



RT-1167/ARC-164

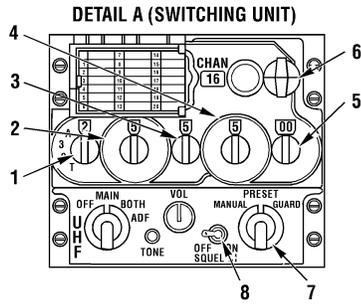
86-102A

NOTES

- B. Component purpose, location, description, and operation
1. The RT-1167/ARC-164 provides two-way AM wide or narrowband voice communication on any one of 7000 frequencies. The single UHF R/T unit is located in the pilot's right-hand console.
 - a. Frequency range is 225.000 to 399.975 MHZ in 25 KHZ steps with constant monitoring of the guard/emergency frequency of 243.000 MHZ.
 - b. Transmit power is a nominal 10 watts in wide or narrowband operation.



RT-1167C/ARC-164 FRONT PANEL (1)



1. MANUAL FREQUENCY SELECTOR SWITCH - 100S DIGITS
2. MANUAL FREQUENCY SELECTOR SWITCH - 10S DIGITS
3. MANUAL FREQUENCY SELECTOR SWITCH - UNITS DIGITS
4. MANUAL FREQUENCY SELECTOR SWITCH - TENTHS DIGITS
5. MANUAL FREQUENCY SELECTOR SWITCH - HUNDREDTHS AND THOUSANDTHS DIGITS
6. PRESET CHANNEL SELECTOR SWITCH
7. MANUAL - PRESET - GUARD SELECTOR SWITCH
8. SQUELCH ON - OFF SWITCH

86-103A

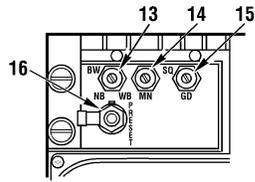
NOTES

c. RT-1167C/ARC-164 Front Panel

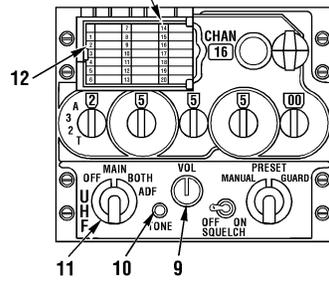
- (1) Manual frequency select switches provide the pilot with a means to manually select any of the 7000 frequencies by using combinations of the manual selector switches.
 - (a) Manual frequency select switch - 100's digits.
 - (b) Manual frequency select switch - 10's digits.
 - (c) Manual frequency select switch - units digits.
 - (d) Manual frequency select switch - tenths digits.
 - (e) Manual frequency select switch - hundredths and thousandths digits.
- (2) Preset channel selector switch is a rotary switch used to select one of 20 preset channels.
- (3) MANUAL-PRESET-GUARD selector switch selects the method of frequency selection.
 - (a) MANUAL - allows selection of any of 7000 frequencies using the five frequency selector switches.
 - (b) PRESET - allows use of the preset channel selector switch to select any one of 20 preset channels as indicated on the CHAN indicator.
 - (c) GUARD - the main receiver and transmitter are automatically tuned to the guard frequency. Selecting GUARD blocks out any frequency set either manually or preset.
- (4) SQUELCH ON-OFF switch - turns the auto squelch of the main receiver on or off.



RT-1167C/ARC-164 FRONT PANEL (2)



DETAIL A (SWITCHING UNIT)



- 9. VOLUME CONTROL
- 10. TONE SWITCH
- 11. MODE SELECTOR SWITCH
- 12. SNAP ON COVER
- 13. BANDWIDTH SELECTOR
- 14. SQUELCH - MAIN CONTROL
- 15. SQUELCH - GUARD CONTROL
- 16. PRESET SWITCH

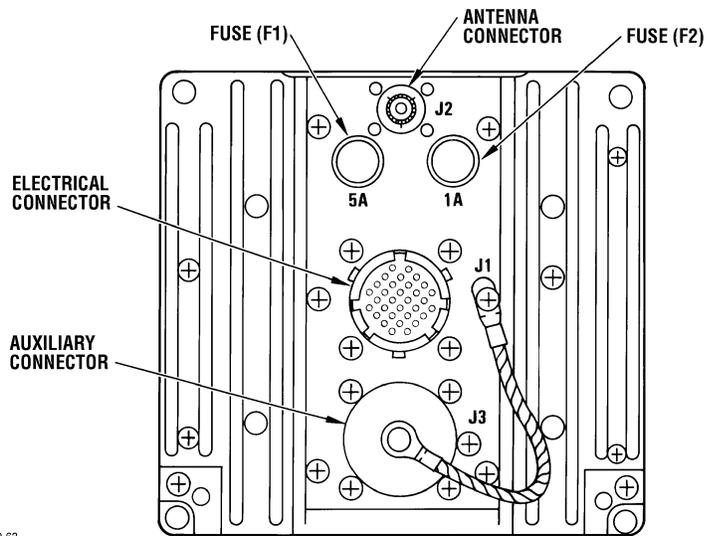
86-104A

NOTES

- (5) VOL control - controls the receiver audio output level
- (6) TONE switch - enables transmission and headset monitoring of a 1020 Hz tone on selected frequency for maintenance checks.
- (7) MODE SELECTOR switch
 - (a) OFF - turns power off
 - (b) MAIN - enables the transceiver
 - (c) BOTH - enables transceiver and guard receiver
 - (d) ADF - not operational on the AH-64A
- (8) Snap-on cover - covers the following switches
 - (a) Bandwidth select switch - selects wideband or narrow band operation. Wideband (WB) is used for AH-64A applications.
 - (b) Main squelch adjust - not adjustable at the unit level
 - (c) Guard squelch adjust - not adjustable at the unit level
 - (d) Preset switch - used to load any of the 7000 frequency into any of the 20 preset channels. To load a preset frequency:
 - 1) Select the frequency to be loaded using the manual frequency selector switches.
 - 2) Set MANUAL-PRESET-GUARD select switch to PRESET.
 - 3) Turn preset CHAN selector switch to desired channel number.
 - 4) Press and release PRESET switch. Preset frequency is now loaded into memory.



RT-1167/ARC-164 BACK PANEL



21-92-63

NOTES

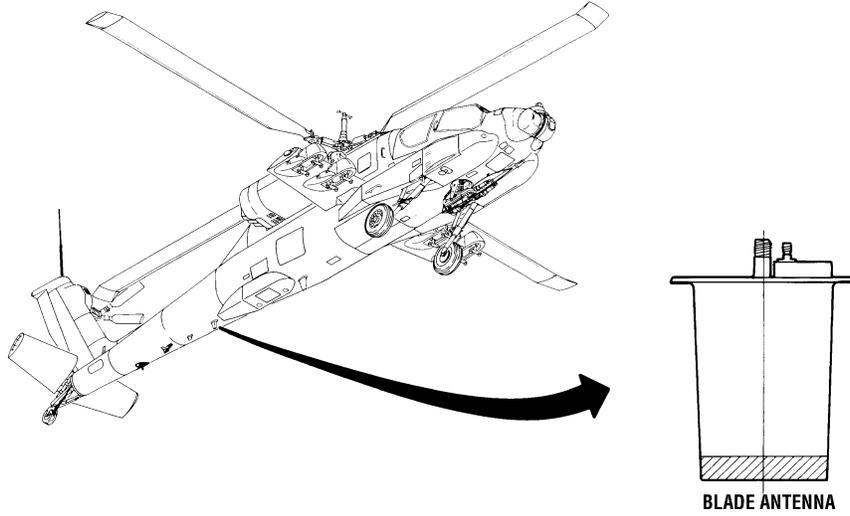
- d. RT-1167/ARC-164 back panel
 - (1) Connector J1 - electrical connector
 - (2) Connector J3 - auxiliary connector
 - (3) Connector J2 - antenna connector
 - (4) Fuse F1
 - (5) Fuse F2 - not used on the AH-64A

C. Interface components

- 1. Bandpass filter (FL-313)
 - a. The (FL-313) bandpass filter allows UHF radio signals to pass while rejecting IFF signals that are transmitted from the same antenna.
 - b. The bandpass filter is located inside the pilot's right-hand console.



UHF ANTENNA



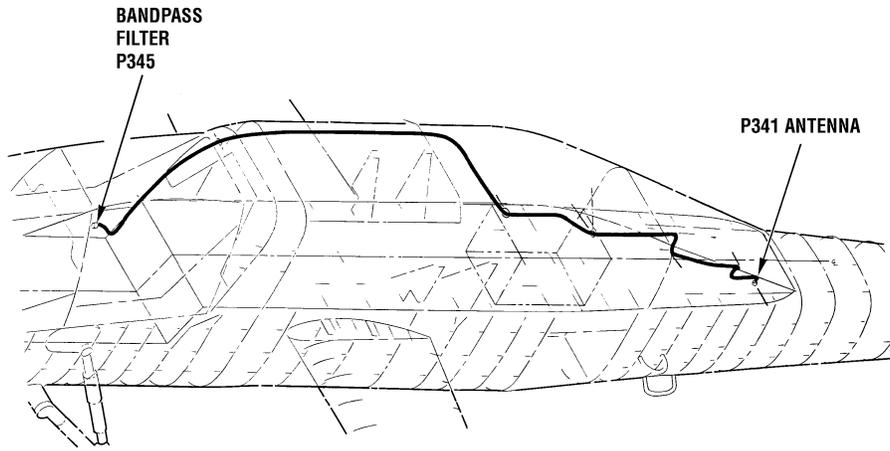
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NOTES

2. UHF antenna
 - a. The purpose of the UHF antenna is to allow UHF transmission and reception.
 - b. The antenna is mounted on the bottom center fuselage, directly behind the ADF fairing.
 - c. The UHF antenna is a blade/fin antenna with two connectors. One connector provides the UHF with transmission and reception; the other is connected to the IFF transponder lower antenna jack.



WIRE HARNESS W212



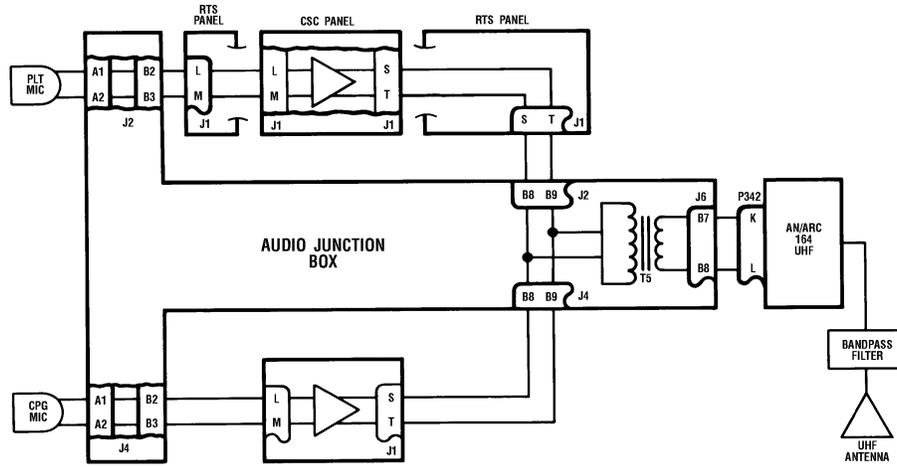
83-1902A

NOTES

3. Wire harness W212
 - a. The purpose of the W212 wire harness is to connect the UHF radio to the UHF antenna.
 - b. Wire harness W212 begins in the pilot's right-hand console and terminates at the UHF antenna.
 - c. W212 is a coax cable with two connectors.
 - (1) P341 connects to the UHF receiver/transmitter.
 - (2) P345 connects to the UHF antenna.



UHF AUDIO INTERFACE TRANSMIT OPERATION



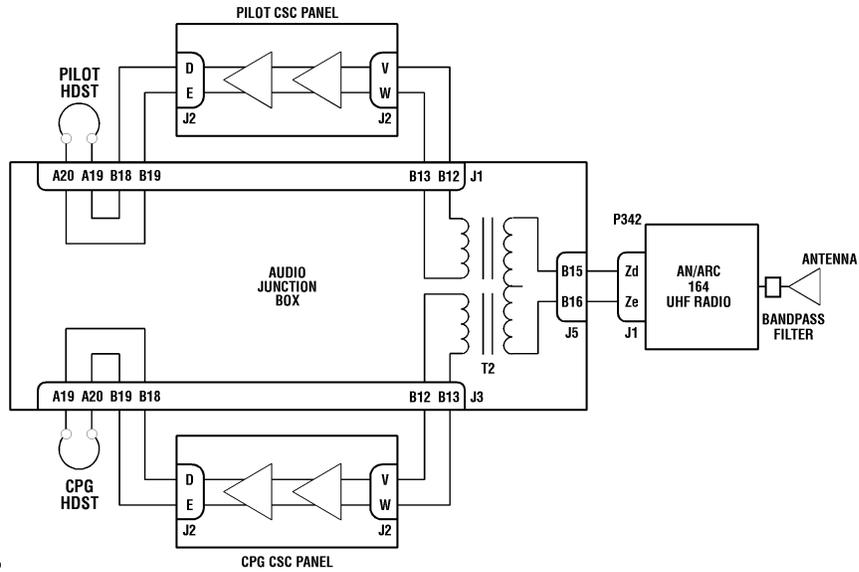
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NOTES

- D. UHF audio interface - transmit operation
1. For UHF transmission from the pilot's station, the pilot's CSC transmit select switch must be in position 2 or RMT. RMT enables the RTSS.
 - a. When the pilot presses the RADIO PTT switch and speaks into the microphone, an audio signal is developed by the microphone and is applied to the pilot's CSC panel via the RTSS panel.
 - b. The CSC panel amplifies the signal and applies the signal back through the RTSS panel.
 - c. The RTSS panel applies the signal to the AJB where it is applied to the primary of audio transformer T5.
 - d. A signal is induced into the secondary of T5 and sent to the UHF R/T unit to modulate the RF carrier for UHF emission by the antenna.
 2. For the CPG to transmit on the UHF, the CPG CSC panel transmit select switch must be in position 2.
 - a. When the CPG presses the RADIO PTT switch and speaks into the microphone, an audio signal is developed by the microphone and sent to the CPG's CSC panel via the AJB.
 - b. The CSC panel amplifies the signal and applies it back to the AJB to the primary of audio transformer T5.
 - c. The output of the secondary is applied to the UHF R/T unit to modulate the RF carrier for UHF emission by the antenna, via the bandpass filter.



UHF AUDIO INTERFACE- RECEIVE OPERATION



21-94-129
21-91-12

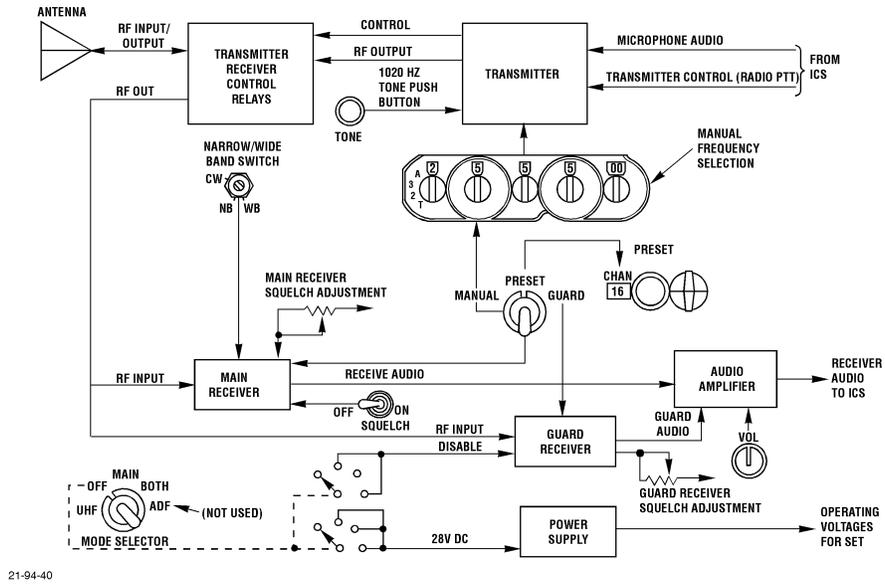
NOTES

E. UHF audio interface - receive operation

1. The UHF antenna receives the RF signal and applies it to the R/T unit via the bandpass filter.
2. The R/T processes the RF signal and converts it to an audio signal.
3. The audio signal is applied to the primary of audio transformer T2.
4. One secondary of T2 is applied to the pilot's CSC panel and one secondary of T2 is applied to the CPG's CSC panel.
5. The CSC panels amplify the signals, and applies them to the respective headsets via the AJB.



UHF-AM BLOCK DIAGRAM



21-94-40

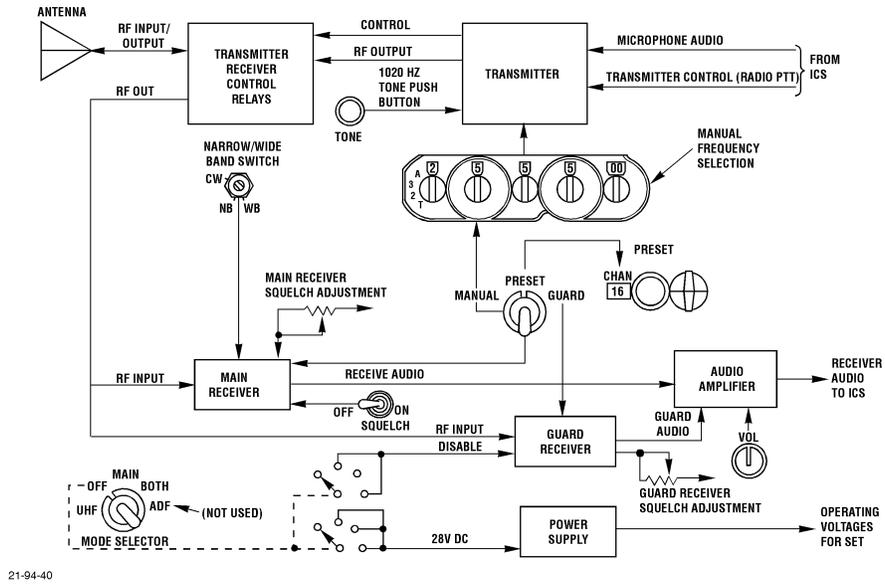
NOTES

F. UHF transceiver operation

1. UHF R/T components
 - a. Power supply
 - b. Transmitter/receiver control relays
 - c. Manual frequency selection switches
 - d. Preset frequency selection switch transmitter
 - e. Main receiver - processes all frequencies as selected manually or preset.
 - f. Guard receiver - processes only the 243.00 MHZ guard frequency.
 - g. Audio amplifier
2. When the MODE SELECTOR switch is placed to the MAIN position, the transmitter and main receiver are enabled and the guard receiver is disabled.
3. When the MODE SELECTOR switch is placed to the BOTH position the transmitter and both receivers, (MAIN and GUARD) are enabled.
4. The transmitter and main receiver are simultaneously tuned to the same frequency by the manual or preset frequency switches.
 - a. The transmitter is tuned by the frequency select knob when the MANUAL/PRESET/GUARD switch is in MANUAL.
 - b. When the switch is in PRESET, the transmitter and main receiver are tuned to the frequency loaded into the channel shown in the CHAN indicator.
 - c. When the GUARD position is selected, the transmitter and main receiver are tuned to the guard frequency (243.00 MHZ), and the guard receiver is disabled.
5. There are two basic modes of operation.
 - a. UHF receive mode operation
 - (1) The RF signal is applied from the antenna to the radio set via the bandpass filter.
 - (2) The incoming signal is applied through the receiver control relays to the MAIN and GUARD receivers.



UHF-AM BLOCK DIAGRAM



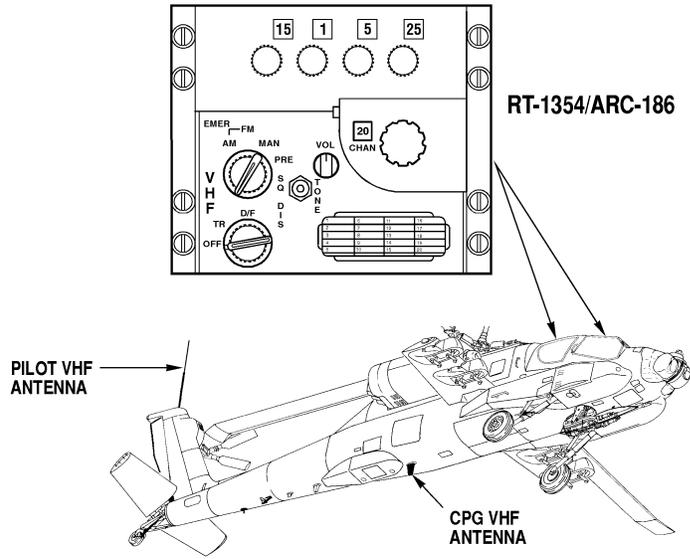
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NOTES

- (a) If the MODE SELECTOR is in BOTH and the incoming RF is 243.00 MHZ, the GUARD receiver processes the RF, convert it to an audio signal, and send it to the audio amplifier. The audio amplifier output is sent to the headsets via the ICS system.
 - (b) If the RF frequency is not 243.00 MHZ, the GUARD receiver does not process the signal.
 - (c) The MAIN receiver processes the RF signal; converts it into an audio signal and supplies the audio signal to the audio amplifier.
- (3) The audio amplifier output is connected to the headsets through the ICS system.
- (a) The VOL controls the output of the audio amplifier.
 - (b) If the VOL control is set to the minimum volume level position, NO UHF AUDIO CAN BE HEARD IN EITHER COCKPIT, REGARDLESS OF THE POSITION OF THE #2 AUDIO SWITCH/VOLUME CONTROL on either CSC.
- b. UHF transmit mode operation
- (1) Either crew member can transmit on the UHF radio by selecting position 2 on the CSC panel transmit select switch in the respective crewstation.
 - (2) When the PTT switch is pressed, a transmitter control ground is applied to the transmitter in the UHF radio set, via the CSC panel and AJB.
 - (3) The transmitter control ground energizes the transmitter control relays.
 - (4) Audio from the microphones is then applied to the transmitter section of the UHF via the ICS.
 - (5) The UHF radio amplitude modulates the transmit frequency, applies it through the transmit control relay, through the bandpass filter, and to the antenna.
 - (6) A modulated 1020 Hz tone can be generated by the tone pushbutton switch to check the radio set.



VHF AM/FM SYSTEM COMPONENTS



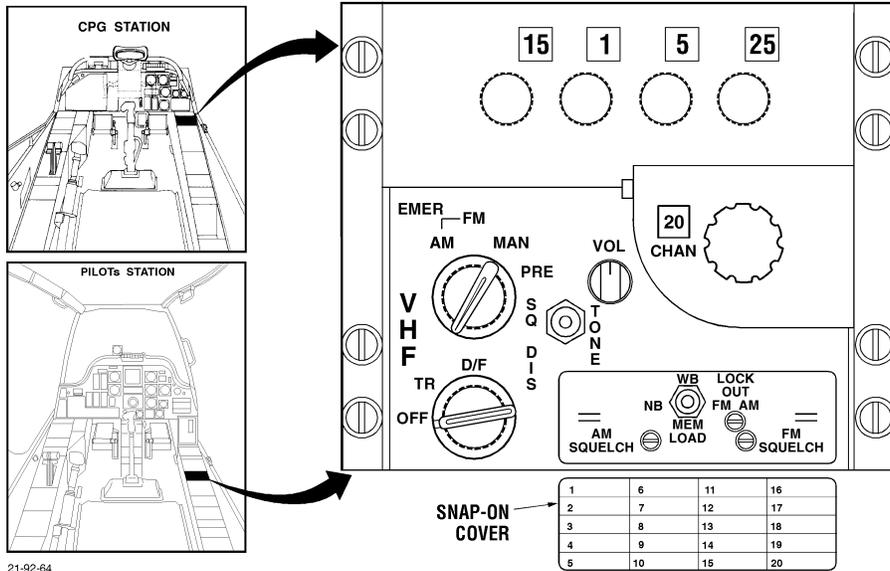
21-94-41
21-92-51

NOTES

- A. VHF AM/FM system
 - 1. The AN/ARC-186 very high frequency (VHF) radio system provides air-to-air and air-to-ground AM and FM communication in the VHF and FM bands.
 - 2. Features of the VHF radio
 - a. All operator useable controls are located on the front panel.
 - b. The VHF receiver/transmitters are located in pilot and CPG crewstations.
 - c. The pilot VHF has provision for use with a KY-58 secure voice unit.
 - 3. Major components
 - a. Two RT-1354/ARC-186 transceivers
 - b. CM-492 signal data comparator (first 11 aircraft only)
 - c. CPG VHF antenna
 - d. Pilot VHF antenna



VHF RT-1354/ARC-186 NO. 1 AND NO. 2



21-92-64

NOTES

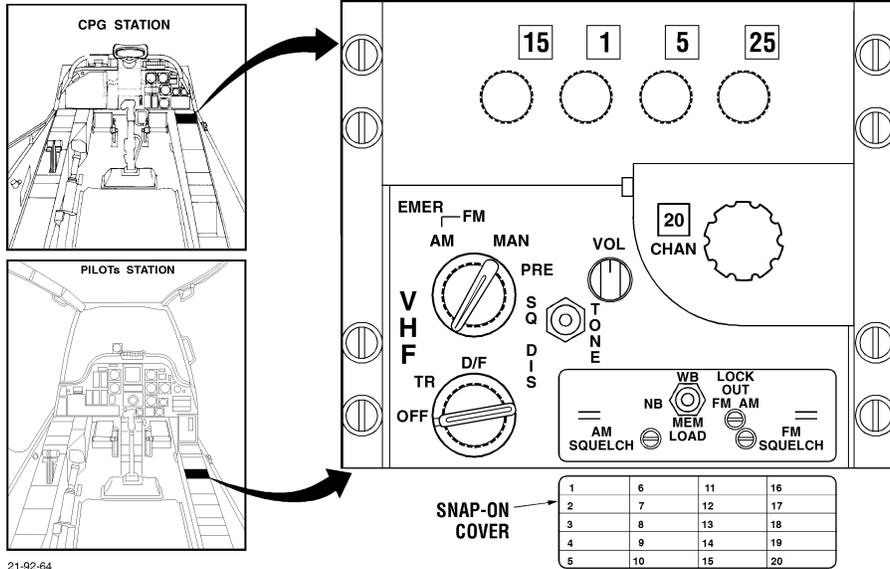
B. Component purpose, location, description, and operation

1. VHF RT-1354/ARC-186

- a. The VHF RT-1354/ARC-186 radio set provides VHF AM and FM clear voice communication.
- b. The No. 1 (Pilot's) VHF is located in the right-hand console in the pilot's crew station.
- c. The No. 2 (CPG's) VHF is located in the right-hand console in the CPG's station.
- d. Front panel provides ON/OFF and tuning controls.
 - (1) Frequency range is 116.000 to 151.975 MHZ in the AM mode and 30.000 to 87.975 MHZ in the FM mode.
 - (2) Frequency selection is in 25 KHZ steps.
- e. Transmit power is 16 watts in the AM mode and 10 watts in the FM mode.
- f. Operation
 - (1) Mode select switch
 - (a) OFF position - disables R/T
 - (b) TR position - enables transmit receive modes
 - (c) DF position - not used on the AH-64A
 - (2) Frequency control switch
 - (a) EMER AM/FM - selects a pre-stored guard channel of 121.500 MHZ (AM) or 40.500 MHZ (FM).
 - (b) MAN position - enables manual frequency selection
 - (c) PRE position - enables preset channel selection
 - (3) SQ DIS/TONE switch
 - (a) SQ DIS position - disables squelch
 - (b) TONE position - transmits 1000 Hz tone for test
 - (4) VOL control - clockwise rotation increases receiver audio output level



VHF RT-1354/ARC-186 NO. 1 AND NO. 2



21-92-64

NOTES

- (5) AM SQUELCH switch (under snap-on cover)
 - (a) Screwdriver adjustable potentiometer
 - (b) Squelch is overridden at maximum CCW position
 - (c) Clockwise rotation increases input signal required to open the squelch

- (6) BANDWIDTH/MEMORY LOAD switch (under snap-on cover)
 - (a) NB position - enables narrowband selectivity.
 - (b) WB position - enables wide band selectivity in the FM band. WB is used for AH-64A applications.
 - (c) MEM LOAD - momentary position allows manually selected frequency to be loaded into selected preset channel memory.

- (7) LOCKOUT switch (under snap-on cover)
 - (a) Selects the AM or FM frequency band to be locked out.
 - (b) Set to the center position to receive both AM and FM bands.

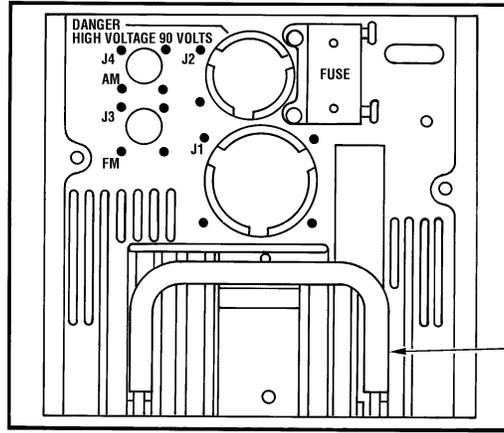
- (8) CHAN switch
 - (a) Selects preset channel from 1 to 20.
 - (b) Any combination of AM and FM frequencies may be preset.

- (9) CHAN indicator - indicates selected preset channel.

- (10) Channel select knobs and indicators - rotary switches used to select R/T frequencies. Frequency selected is read on the indicators.



RT-1354/ARC-186 BACK PANEL



FOLD AWAY
CARRYING HANDLE

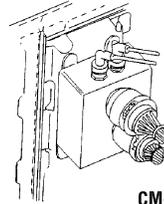
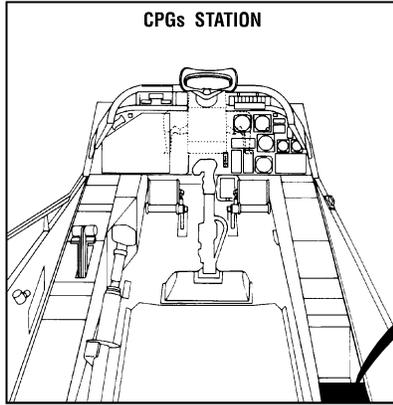
83-940A

NOTES

- (11) Rear panel
 - (a) Fuse F-1 - located under the fuse cover
 - (b) J-1 & J-2 - electrical connectors
 - (c) J-3 - FM antenna connector
 - 1) Used for both AM and FM operation
 - 2) Programmed by a jumper between pins A and G on P-1046 (connects to J-2)
 - (d) J-4 - not used on the AH-64A (AM antenna connector)



CM-492 SIGNAL DATA COMPARATOR



CM-492

21-94-42

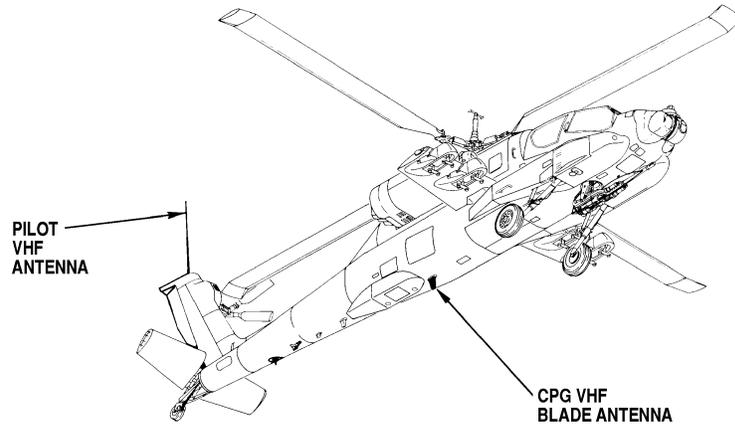
NOTES

C. Interface components

1. CM-492 signal data comparator
 - a. Provides coupling of the antenna coax for normal VHF No. 1 and FM operation on the first 11 aircraft.
 - b. Located inside the CPG's right-hand console, in front of the map storage compartment.
 - c. Originally installed to filter direction information from the FM homing antennas for DF operation. FM homing capability has been deleted from all aircraft.



VHF – AM/FM ANTENNAS



21-92-49

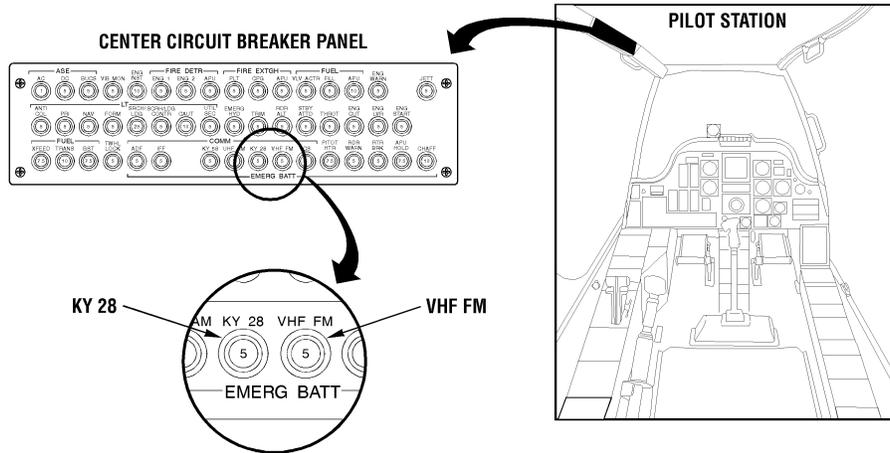
NOTES

2. VHF AM/FM antennas

- a. The pilot's (No. 1) VHF-AM/FM antenna is an integral part of the vertical stabilizer trailing edge.
 - (1) Helicopters with MWO 9-1090-208-50-37, NOE VHF communication improvement, utilize a whip antenna mounted on top of the vertical stabilizer instead of the trailing edge antenna. The trailing edge antenna remains on the helicopter for aerodynamic considerations.
- b. The CPG's (No. 2) VHF-AM/FM blade antenna is mounted on the bottom center fuselage, directly forward of the doppler fairing.



PILOT VHF CIRCUIT BREAKERS



83-946

NOTES

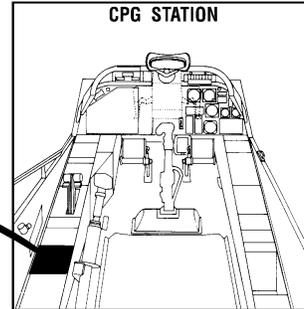
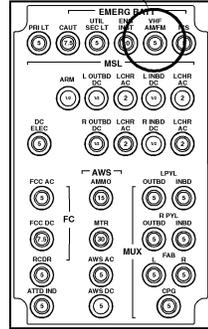
3. Circuit protection

a. Used to provide circuit protection for the VHF system.

(1) The VHF (No. 1) and KY-28 circuit breakers are mounted in the pilot's center overhead circuit breaker panel.



CPG VHF CIRCUIT BREAKER



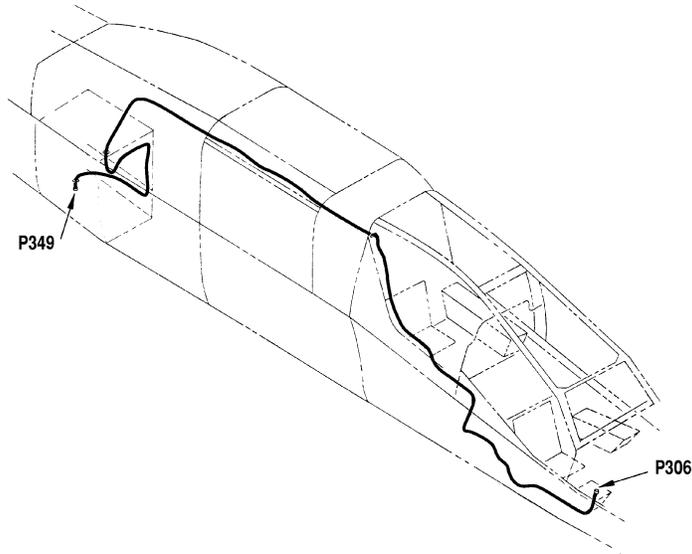
83-948

NOTES

- (2) The No. 2 VHF circuit breaker is located on the CPG's No. 1 circuit breaker panel.
- b. All of the VHF circuit breakers are rated at 28 VDC, 5 amps.



WIRE HARNESS W230



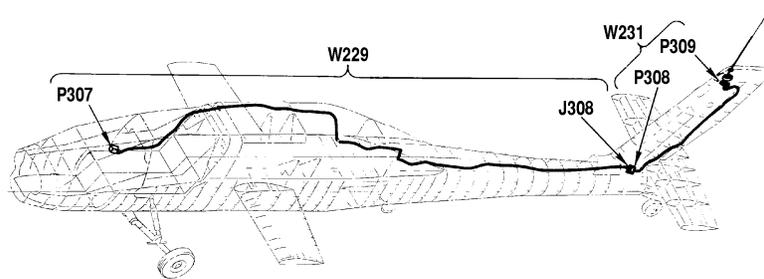
21-92-54

NOTES

4. Wire harness W230
 - a. Used to connect the CPG's R/T to the lower VHF antenna.
 - b. Wire harness W230 begins in the CPG station and terminates at the lower antenna.
 - c. W230 is a coax cable with two connectors.
 - (1) Connector P306/P336/P337 connects to the VHF R/T unit.
 - (2) Connector P348/P349 connects to the lower (No. 2) antenna.



WIRE HARNESS W229 AND W231



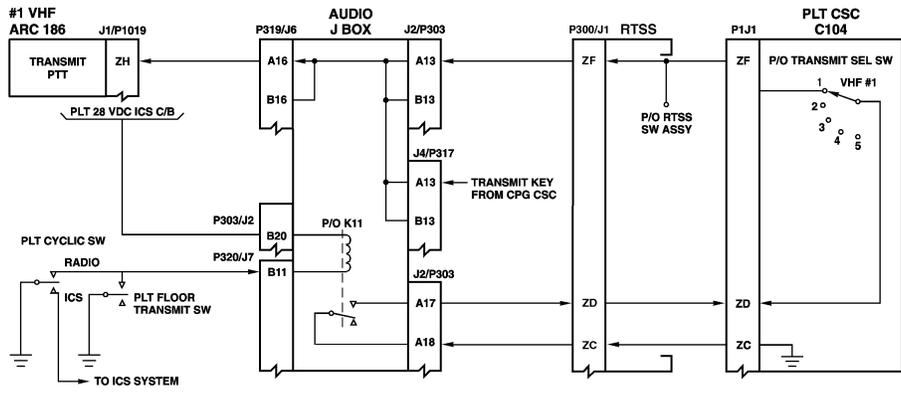
21-92-52

NOTES

5. Wire harness W229 and W231
 - a. Used to connect the No. 1 VHF R/T to the No. 1 VHF antenna.
 - b. Wire harness W229 begins in the pilot's right-hand console and terminates at the No. 1 VHF antenna.
 - c. Wire harnesses W229 and W231 are coax cables with two connectors each.
 - (1) Connector P307/P314/P318 connects to the pilot's VHF radio.
 - (2) Connector P309/P329/P330 connects to the No. 1 VHF antenna.



VHF AM/FM NO.1 KEYLINE INTERCONNECT



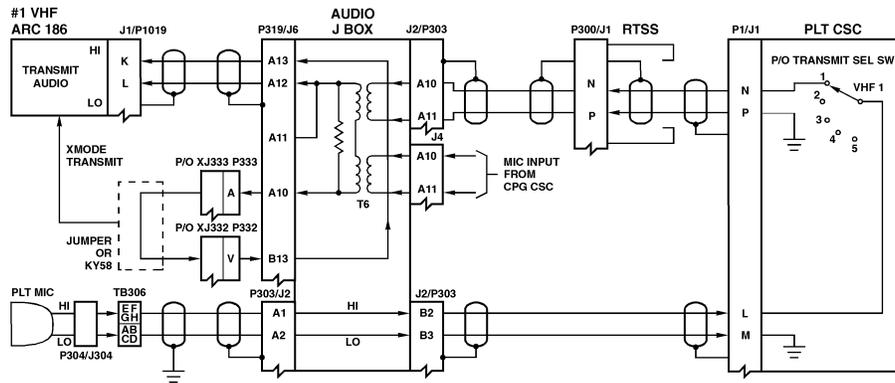
21-94-43

NOTES

6. VHF AM/FM No. 1 pilot crew station keyline interconnect (CPG circuit similar)
 - a. From the pilot cyclic RADIO or floor XMIT switches.
 - b. Through the AJB via K-11.
 - c. Through the RTSS panel.
 - d. Through the PLT CSC via the TRANSMIT SELECTOR SWITCH.
 - e. Through the RTSS.
 - f. Through the AJB.
 - g. To the XMIT PTT input of the VHF AM/FM No. 1.



VHF AM/FM NO.1 MICROPHONE AUDIO INTERCONNECT



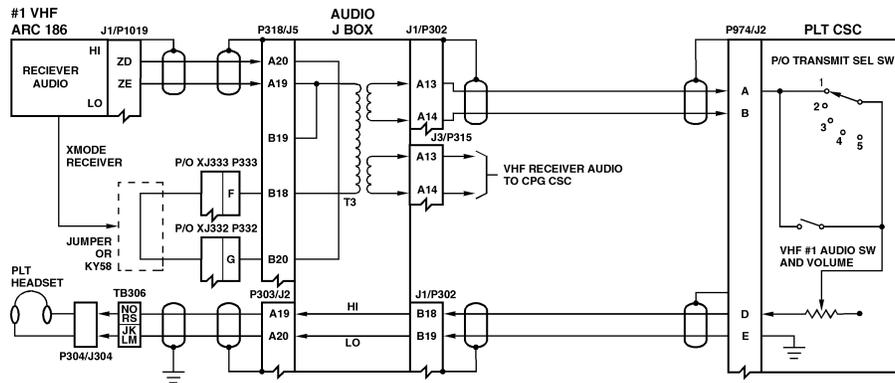
21-94-44

NOTES

7. VHF AM/FM No. 1 pilot crew station microphone interconnect (CPG circuit similar)
 - a. From the helmet mounted pilot microphone.
 - b. Through TB-306 behind the pilot seat.
 - c. Through the AJB.
 - d. Through the PLT CSC via the TRANSMIT SELECTOR SWITCH.
 - e. Through the RTSS.
 - f. Through the AJB via:
 - (1) The Input to the primary of T6.
 - (2) Output through the lower end of T6 secondary.
 - g. Out through J6 pin A10 to P-333 pin A.
 - h. Through the jumper XJ-333/332 or the KY-58 (if installed) to P-332 pin V.
 - i. Back to the AJB J6 pin B13.
 - j. Through the AJB to J6 pin A13.
 - k. To the XMIT PTT input of the VHF AM/FM No. 1.



VHF AM/FM NO.1 RECEIVER AUDIO INTERCONNECT



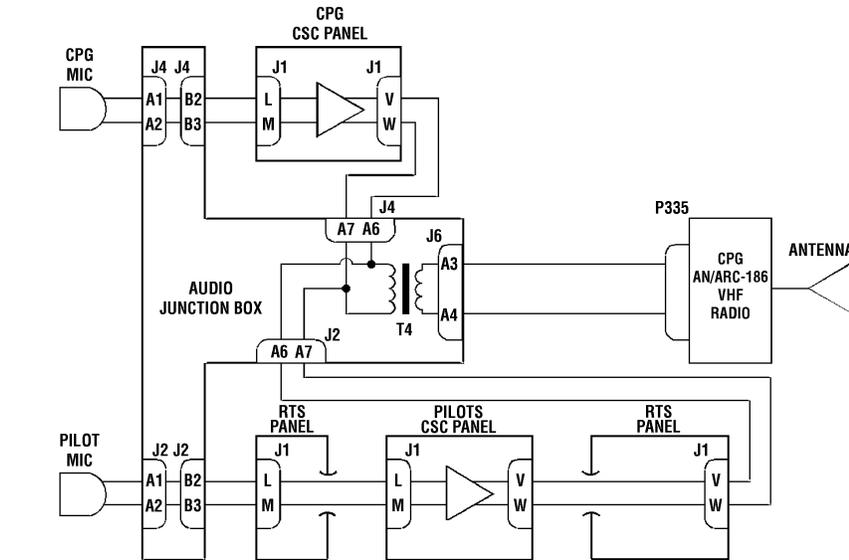
21-94-45

NOTES

8. VHF AM/FM No. 1 pilot crew station receiver interconnect (CPG circuit similar)
 - a. From the RCVR AUD output of the VHF AM/FM No. 1 to the AJB to J5 pin A20.
 - b. Through the AJB to J5 pin B20.
 - c. Out to the jumper XJ-333/332 or the KY-58 (if installed) to P-332 pin G.
 - d. Through the jumper to P-333 pin F.
 - e. Out to J5 pin B18.
 - f. Through the AJB via:
 - (1) The input to the primary of T3.
 - (2) Output through the upper secondary of T3.
 - g. Through the PLT CSC via the TRANSMIT SELECTOR SWITCH.
 - h. Through the AJB.
 - i. Through TB-306 behind the pilot seat.
 - j. To the helmet mounted pilot headset.



NO. 2 VHF AUDIO INTERFACE TRANSMIT OPERATION



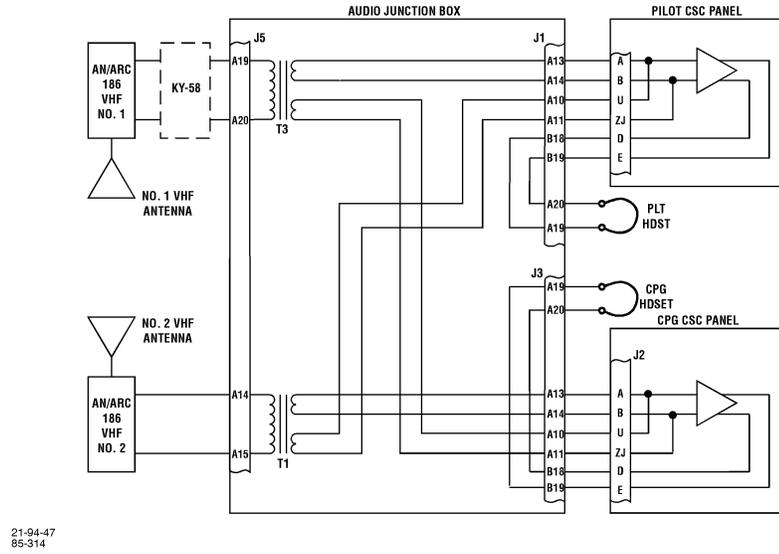
21-94-46
85-315A

NOTES

- D. VHF audio interface transmit operation - either crew member can transmit on either VHF radio by placing the TRANSMIT SELECT SWITCH on the respective CSC panel to position No. 1 to transmit on the No. 1 VHF, or position No. 3 to transmit on the No. 2 VHF.
1. Pilot transmit audio
 - a. The pilot must select position No. 3 on the CSC panel transmit select switch or place the transmit select switch to RMT and use the RTSS switch to select CPG VHF as indicated on the RTSS panel.
 - b. Transmit side tone is generated by the VHF and sent back to the headsets via the same path as receiver audio.
 - c. When the pilot presses the PTT switch and speaks into the microphone, an audio signal is developed and sent through the RTSS panel to the pilot's CSC panel.
 - d. The CSC panel amplifies the signal and applies it back through the RTSS panel to J2 of the AJB.
 - e. The signal is applied from J2 to the primary winding of T4.
 - f. The signal is induced into the secondary winding and is sent to the CPG's VHF radio.
 - g. The VHF radio processes the audio signal and converts it to an modulated RF signal.
 - h. The modulated RF signal is radiated out through the antenna.
 2. CPG transmit audio
 - a. When the CPG presses either radio PTT switch and speaks into the microphone, an audio signal is generated and coupled through the AJB to the CPG CSC panel.
 - b. The signal is amplified by the CSC panel and applied back to the AJB to the primary of audio transformer T4.
 - c. The secondary of T4 supplies the audio signal to the VHF transmitter.
 - d. The transmitter processes the audio signal and converts it to an RF signal.
 - e. The RF signal is radiated out through the antenna.



VHF AUDIO INTERFACE RECEIVE OPERATION



NOTES

E. VHF audio interface - receive operation

1. Receive operation of the No. 1 VHF

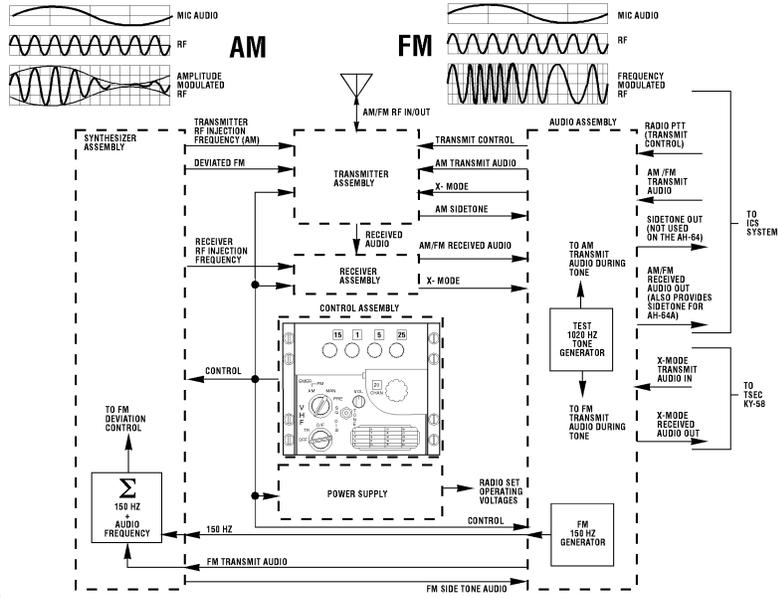
- a. The RF signal is applied from the antenna directly to the radio set. (For the first 11 aircraft, the RF signal is applied through the signal data comparator).
- b. The radio set processes the RF signal and converts it to audio.
- c. The audio signal is sent to the audio junction box, where it is applied to the primary of audio transformer T3.
- d. The audio signal is induced into the two secondary windings.
- e. One set of windings couple the signal to the pilot's CSC panel. The CSC provides amplification and volume control, and applies the signal back to the AJB where it is jumpered to the pilot's headset.
- f. The other set of secondary windings couple the audio signal to the CPG's CSC panel. The CSC panel provides amplification and volume control, and applies the signal back to the AJB where it is jumpered to the CPG's headset.

2. Receiver operation for the No. 2 VHF

No. 2 VHF receive operation is identical to No. 1 except audio transformer T1 is used. Both crew members can monitor both VHF radios by placing monitor switch/potentiometers 1 and 3 to the ON position and adjusting the volume.



VHF AM-FM BLOCK DIAGRAM



21-94-48

NOTES

F. VHF transceiver operation

1. VHF R/T components

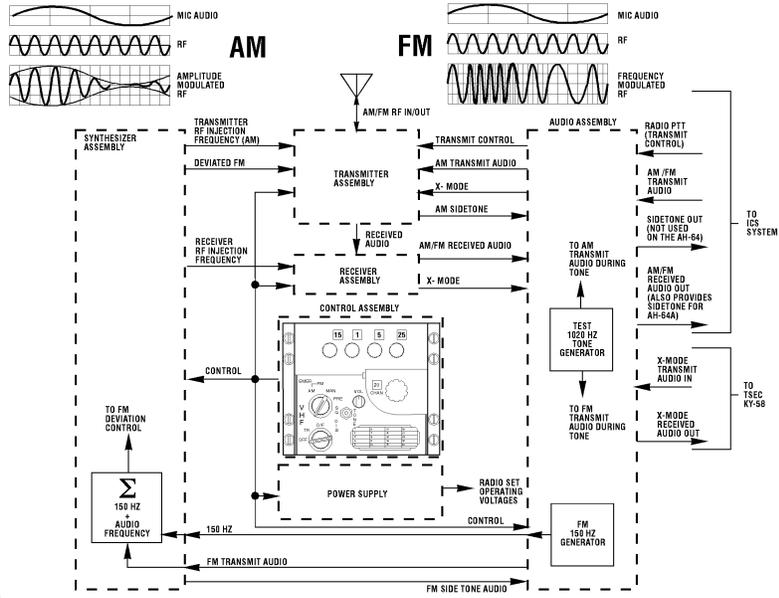
- a. Power supply
- b. Transmitter assembly
- c. Control assembly
- d. Receiver assembly
- e. Audio assembly

2. Power up

- a. The control assembly provides control signals to individual components within the unit. The signals contain information for mode, frequency, and switch positions.
- b. When the MODE SELECTOR switch is placed to the TR position (DF is not used on the AH-64A) and the FREQ CONT SWITCH is placed in the MAN position, the transmitter and receiver are enabled.
 - (1) The transmitter and receiver are simultaneously tuned to the same frequency by the MANUAL FREQ SELECTORS or the PRESET FREQ selector.
 - (2) The transmitter is tuned by the MANUAL FREQ SELECTORS to the frequency shown in the MANUAL FREQUENCY INDICATORS when the MODE SELECTOR is in MANUAL.
- c. When the MODE SELECTOR is in PRESET, the transmitter and main receiver are tuned to the frequency selected by PRESET CHAN SELECTOR. The individual channels have been loaded previously by using the MEM LOAD switch under the guarded cover.
- d. AM and FM modes are selected automatically by the radio.
 - (1) The radio is in the AM mode for frequencies ABOVE 100 MHZ.
 - (2) The radio is in the FM mode for frequencies BELOW 100 MHZ.
- e. When the EMER AM or FM position on the MODE SELECTOR switch is selected, the transmitter and receiver are tuned to the AM or FM guard frequency.
 - (1) AM guard is 121.50 MHZ.
 - (2) FM guard is 40.50 MHZ.



VHF AM-FM BLOCK DIAGRAM



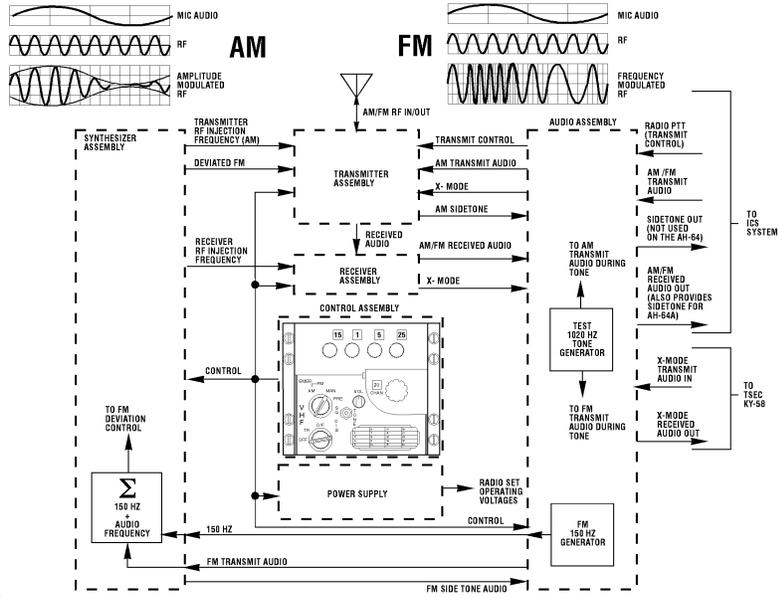
21-94-48

NOTES

3. There are two basic modes of operation; receive and transmit.
 - a. VHF receive mode operation
 - (1) The synthesizer assembly injects the proper RF frequency to the transmitter assembly, as determined by the control assembly MODE and frequency select switches.
 - (2) An RF signal is applied from the antenna to the radio set FM antenna jack (a jumper in the wire harness allows AM and FM signals to be applied to the receiver through the FM antenna jack).
 - (3) The incoming signal is applied to the receiver through the transmitter assembly.
 - (a) The receiver input is connected to the FM antenna jack.
 - (b) The transmitter output is inactive and is disconnected from the FM antenna jack.
 - (4) The receiver processes the RF signal.
 - (a) It checks to see that it matches the selected frequency. If it does match the signal it is allowed through. If not, the signal does not pass through.
 - (b) It checks to see if the signal is strong enough when compared to the receiver squelch setting (if the SQ/DIS is not selected).
 - (c) It converts the RF signal by removing the RF portion and leaving the audio.
 - (d) It applies the audio to the audio assembly.
 - (5) The audio assembly amplifies the audio signal and provides an audio output to the headsets.
 - (a) The VOL control allows for control of the audio amplifier output.
 - (b) If the VOL control is set to the minimum volume level position, NO VHF AUDIO CAN BE HEARD IN EITHER COCKPIT, REGARDLESS OF THE POSITION OF THE #1 AUDIO SWITCH/VOLUME CONTROL on either CSC (#3 if the CPG's VHF is being used).



VHF AM-FM BLOCK DIAGRAM



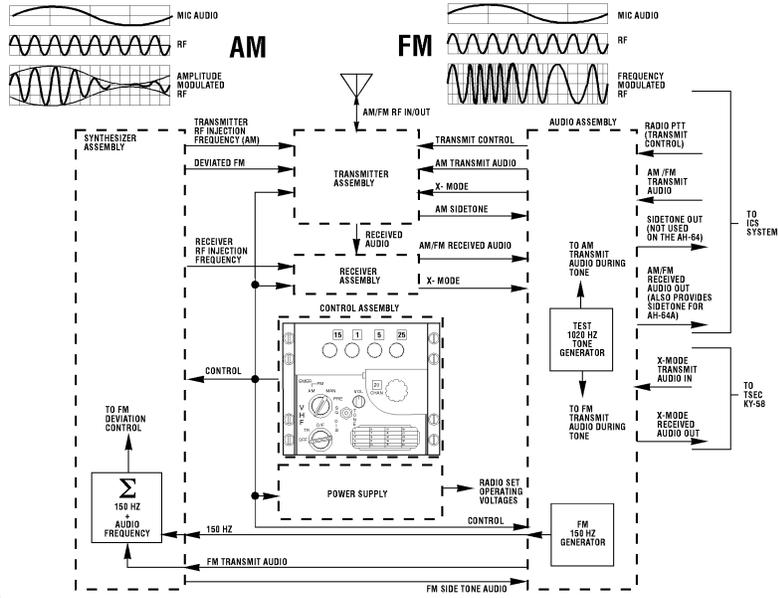
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NOTES

- (c) Either crewmember can monitor the receiver audio of the VHF radios by selecting position 1 (PLT VHF) or 3 (CPG VHF) on the CSC panel transmit select switch or by selecting the respective receiver audio control on the CSC.
- b. VHF transmit mode operation
- (1) Either crew member can transmit on the VHF radios by selecting position 1 (PLT VHF) or 3 (CPG VHF) on the CSC panel transmit select switch (or through the RTSS for the pilot) in the respective crewstation.
 - (2) When the PTT switch is pressed, a transmitter control ground is applied, via the CSC panel and AJB, to the audio assembly in the VHF radio set.
 - (3) The transmitter control ground energizes the transmitter.
 - (a) AM transmit
 - 1) The receiver input is disconnected from the FM antenna jack.
 - 2) The transmitter output is connected to the FM antenna jack.
 - 3) The synthesizer assembly injects the proper RF frequency to the transmitter assembly, as determined by the control assembly MODE and frequency select switches.
 - 4) Audio from the microphone is then applied to the transmitter assembly.
 - 5) The mic audio amplitude modulates (AM) the injected transmitter RF frequency.
 - 6) A portion of the AM transmitter frequency is processed to remove the RF and is applied to the audio assembly for use as sidetone.
 - a) The mic audio level is controlled by the VOL control and becomes AM sidetone audio.
 - b) The controlled AM side tone audio level is applied to the headsets via the AJB and CSC's.



VHF AM-FM BLOCK DIAGRAM



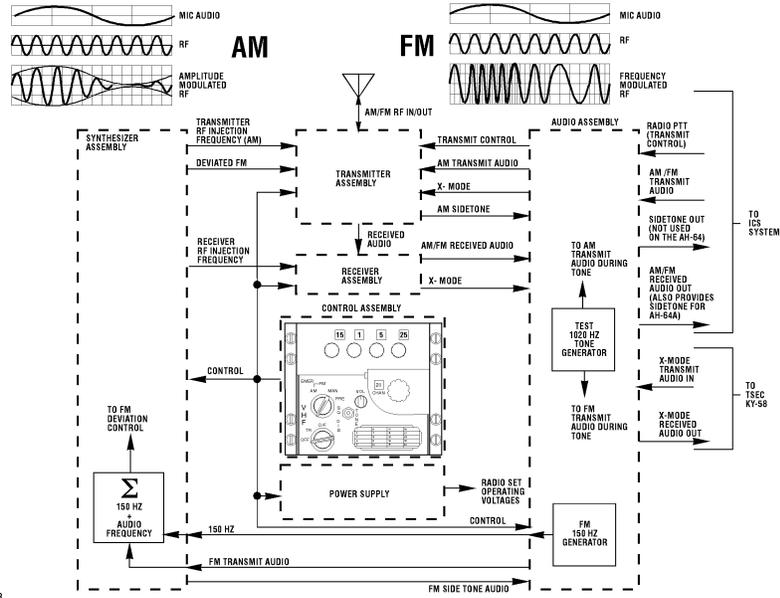
21-94-48

NOTES

- 7) The AM RF injection frequency is increased in power level.
 - 8) The power amplified AM transmitter frequency is applied to the antenna through the FM antenna jack. The transmitter RF signal is applied to the antenna through the radio set FM antenna jack (a jumper in the wire harness allows AM and FM signals to be applied to the antenna through the FM antenna jack).
 - 9) The AM transmitter frequency is radiated as RF energy from the antenna.
- (b) FM transmit
- 1) The receiver input is disconnected from the FM antenna jack.
 - 2) The transmitter output is connected to the FM antenna jack.
 - 3) Audio from the microphone is then applied to the synthesizer assembly.
 - 4) A portion of the mic audio is used as sidetone.
 - a) The mic audio level is controlled by the VOL control and becomes FM sidetone audio.
 - b) The controlled FM side tone audio level is applied to the headsets via the AJB and CSC's.
 - 5) A 150 HZ tone is also applied to the synthesizer assembly.
 - 6) The mic audio and 150 HZ tone are summed together in the synthesizer.
 - 7) The synthesizer RF injection frequency is determined by the control assembly MODE and frequency select switches.
 - 8) The summed frequency is used to deviate the RF injection frequency to create a deviated or FM radio frequency.



VHF AM-FM BLOCK DIAGRAM

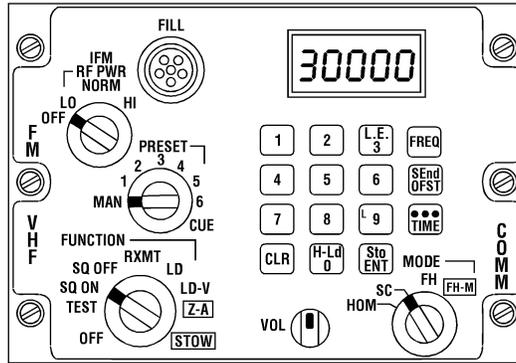


NOTES

- 9) The deviated or FM radio frequency is applied to the transmitter assembly.
 - 10) The frequency modulated (FM) RF injection frequency is applied to the transmitter assembly where the power level is increased.
 - 11) The power amplified FM RF transmitter frequency is applied to the antenna through the FM antenna jack. The transmitter RF signal is applied to the antenna through the radio set FM antenna jack (a jumper in the wire harness allows AM and FM signals to be applied to the antenna through the FM antenna jack).
 - 12) The power amplified FM RF transmitter frequency is radiated from the antenna.
- (c) A modulated 1020 Hz tone can be generated by the audio assembly as controlled by the TONE position of the SQ/DIS switch. This feature causes the radio to transmit and uses the 1020 HZ tone to modulate the AM or FM RF output instead of using the microphone input. This feature tests the ability of the radio to transmit and also tests the sidetone operation.



SINGARS AN/ARC-201 (V) VHF - FM



21-94-49

NOTES

A. VHF FM System

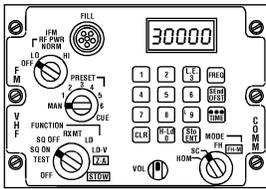
1. The AN/ARC-201 (V) SINCGARS very high frequency (VHF) radio system replaces the pilot crewstation AN/ARC-186 (V) AM/FM transceiver with an FM ONLY TRANSCEIVER and provides air-to-air and air-to-ground FM communication in the VHF FM bands.
2. Features of the SINCGARS VHF FM radio
 - a. Employs frequency hopping as an electronic counter measure to current battlefield jamming techniques.
 - b. 12 preset channels
 - (1) Six single channels
 - (2) Six frequency hopping channels
 - c. Two modes are available for filling the frequency hopping data.
 - (1) LOCAL FILL mode uses the MX-10579 ECCM fill device.
 - (2) ECCM REMOTE FILL (ERF) data is transmitted by the net control station (NCS).
 - d. Uses the standard NATO compatible 25 KHZ frequency spacing.
 - e. FM frequency coverage extended to 88 MHZ (30-87.975 MHZ).
 - f. Transmitter output power is 10 watts.
 - g. The SINCGARS VHF transceiver is located in the pilot crewstation.
 - h. All operator useable controls are on the front panel.
 - i. The SINCGARS VHF is compatible with the KY-58 secure voice unit.



SINGARS VHF-FM SYSTEM COMPONENTS

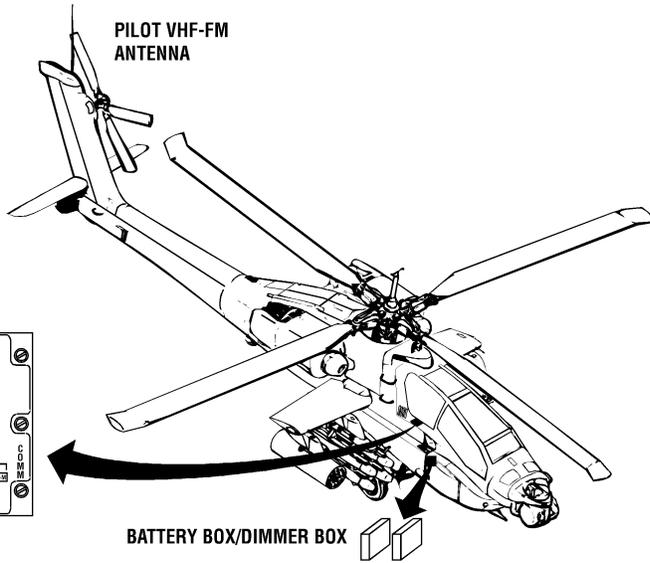


**MX-10579
ECCM
FILL
DEVICE**



AN/ARC-201 (V)

21-94-50

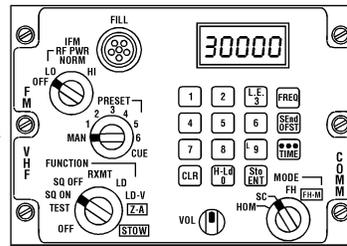
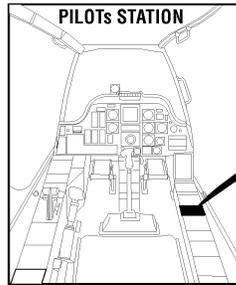
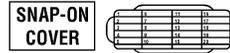
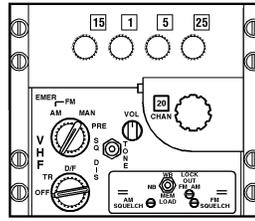
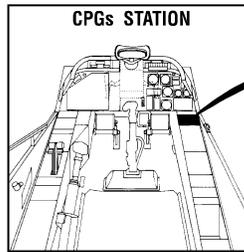


NOTES

3. SINGARS VHF FM system major components
 - a. RT-1476/ARC-201 (V) transceiver (pilots)
 - b. CY-8515/ARC-201 battery box
 - c. 90197098-501 dimmer control assembly
 - d. Pilot VHF antenna
 - e. MX-10579 ECCM fill device (associated equipment)



PILOT SINGARS RT-1476/ARC-201 FM AND CPG RT-1354/ARC-186 AM-FM



21-94-51

NOTES

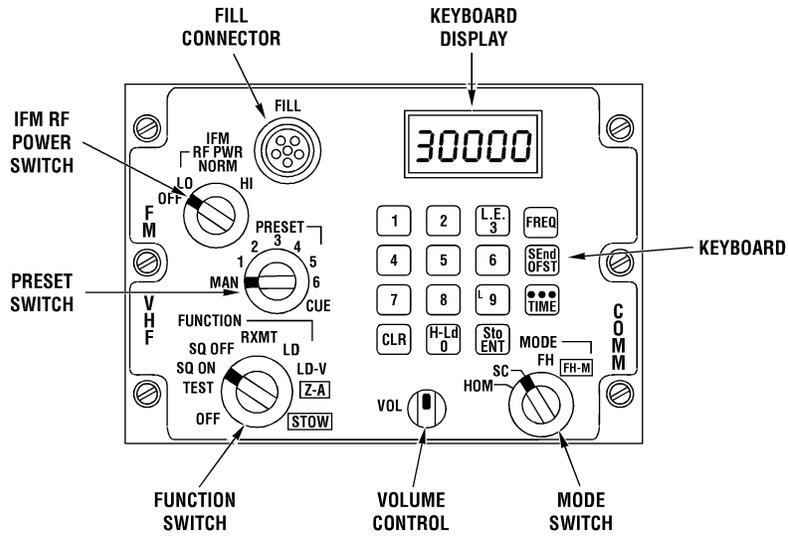
B. Component purpose, location, description, and operation

1. SINGARS VHF RT-1476/ARC-201 (V)

- a. The SINGARS VHF RT-1476/ARC-201 (V) radio set provides VHF FM ONLY, clear voice communication with a selectable frequency hopping feature.
- b. The SINGARS VHF is designated the No. 1 radio and replaces the AN/ARC-186 located in the pilot's crew station right-hand console.
- c. The CPG crewstation retains the AN/ARC-186 VHF AM/FM transceiver.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



21-94-52

NOTES

d. SINCGARS VHF FM transceiver description

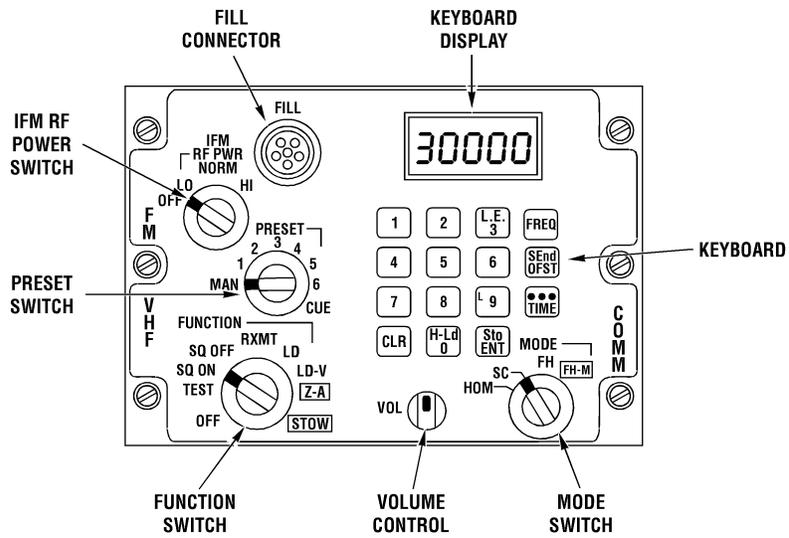
- (1) SINCGARS VHF-FM front panel controls
 - (a) FUNCTION selector
 - (b) MODE control
 - (c) PRESET switch
 - (d) Keyboard and display
 - (e) Volume control
 - (f) FILL connector
 - (g) IFM RF POWER switch

e. Front panel operation

- (1) FUNCTION selector switch - used to select the basic operational condition of the RT.
 - (a) OFF position
 - 1) All primary power is removed from the RT.
 - 2) The memory holding battery is connected to the memory circuit, providing the short term (between mission or overnight) retention of the Frequency Hopping (FH) parameters.
 - (b) TEST position
 - 1) The major components of the radio are examined to verify their operation.
 - a) The RT and ECCM module are both tested under microprocessor control.
 - b) The results of the self test are presented on the front panel displays.
 - 2) The presence of the of the ECCM module is also presented on the front panel displays.
 - (c) SQ ON position
 - 1) All primary power is applied and operation is by normal, locally controlled actions.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



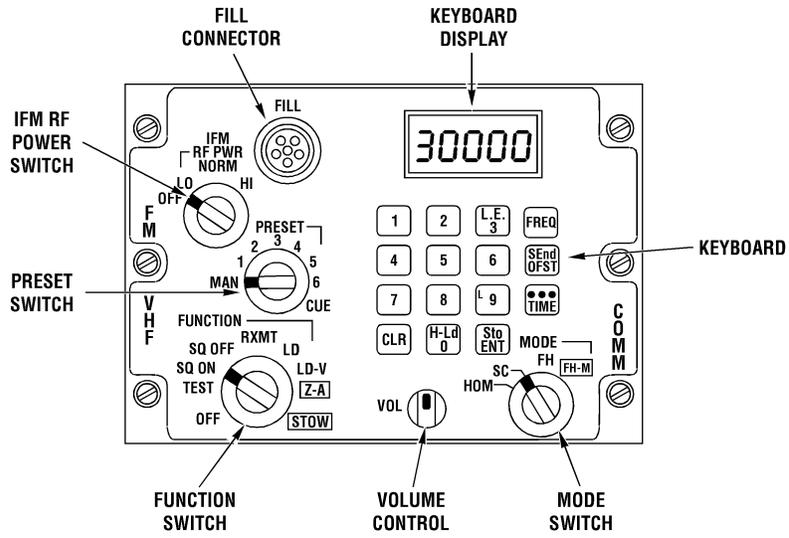
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NOTES

- 2) The squelch is enabled.
 - 3) The RT operation is controlled by the front panel selectors.
 - 4) Operation can be single channel or frequency hopping.
- (d) SQ OFF (squelch off) position
- 1) Disables the squelch circuits.
 - 2) Allows communication to be carried out at very low received signal levels.
- (e) RXMT (retransmit) position
- 1) Requires the installation of two SINCGARS radios in the helicopter, interconnected by a retransmit harness.
 - 2) One radio is used for receive and the other for transmit.
 - 3) The radios frequencies are set at least 10 MHZ apart.
 - 4) This feature is not used in the AH-64A because only one SINCGARS radio is installed.
- (f) LD (load) position
- 1) Permits loading of preset frequencies via the keyboard, PRESET switch in one of the preset positions.
 - 2) Permits loading of ECCM net parameters and lockout channels.
 - a) ECCM module must be installed in the RT.
 - b) Connect fill device to FILL connector.
 - c) Press the keyboard "H!LD" button once.
 - 3) Also permits loading of time.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



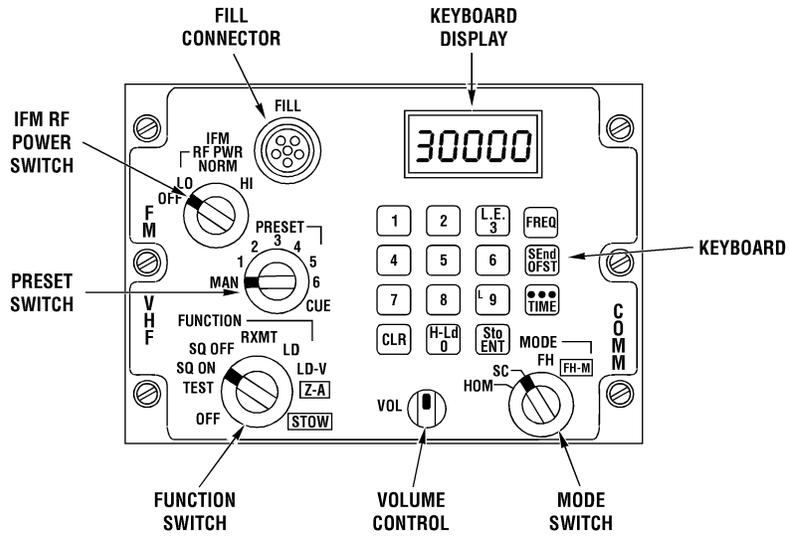
21-94-52

NOTES

- (g) LD-V position
 - 1) Permits loading of the mandatory TRANSEC frequency hopping variable.
 - a) All radios in the same net must contain the same variable.
 - b) ECCM module must be installed in the RT.
 - c) Connect fill device to FILL connector.
 - d) Press the keyboard "H!LD" button once.
- (h) Z-A (zero all) position
 - 1) Guarded position of the function switch, requires a pull and turn action to operate.
 - 2) Transmitter keying is inhibited.
 - 3) Zeros the ECCM variables.
 - 4) Tests and displays the results of the non-volatile RAM in the
 - a) ECCM module
 - b) Control module
 - 5) NOT an operational position but is used to clear the TRANSEC variable to avoid a security compromise.
- (i) STOW position
 - 1) Guarded position of the function switch, requires a pull and turn action to operate.
 - 2) Removes ALL power from the RT circuits.
 - a) ALL holding battery circuits
 - b) ALL functional circuits
 - c) ALL non-volatile memory circuits



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



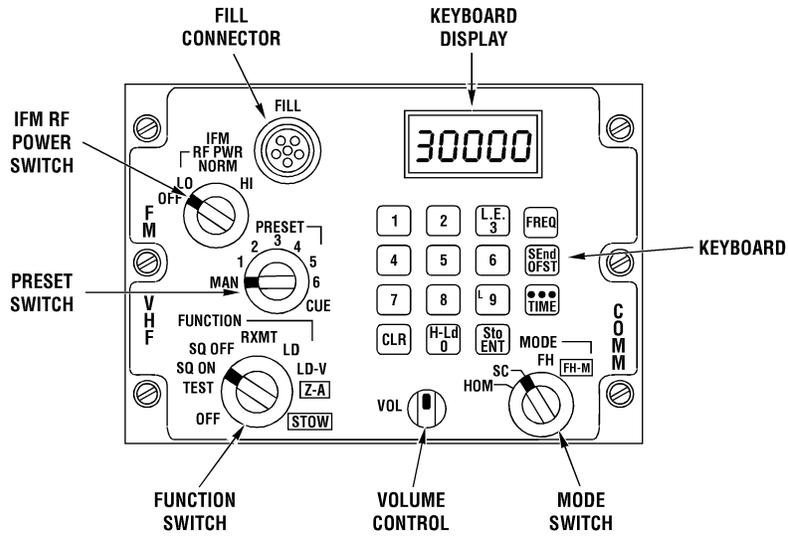
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NOTES

- 3) The normal use of this position provides complete disable of all radio circuits during extended periods of inactivity such as storage.
- (2) MODE control switch provides selection of the RT mode of operation.
- (a) HOM position
 - 1) Not used on AH-64A.
 - (b) SC (single channel) position
 - 1) Selects single channel mode of operation.
 - 2) Manual frequencies are selected by:
 - a) Placing the PRESET switch in MAN.
 - b) Select the frequency via keyboard/display.
 - c) Offsets may be applied.
 - 3) PRESET frequencies are selected by:
 - a) Placing the PRESET switch in 1-6 or CUE.
 - b) Offsets may be applied.
 - (c) FH (frequency hopping) position
 - 1) Selects frequency hopping mode of operation.
 - 2) Frequency hopping net parameters are selected by:
 - a) Placing the PRESET switch in 1-6.
 - b) MAN and CUE are invalid during FH operation.
 - c) In MAN the display shows "COLD".
 - d) In CUE the display shows the frequency as though in SC.
 - 3) The FUNCTION switch must be in an operational position.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



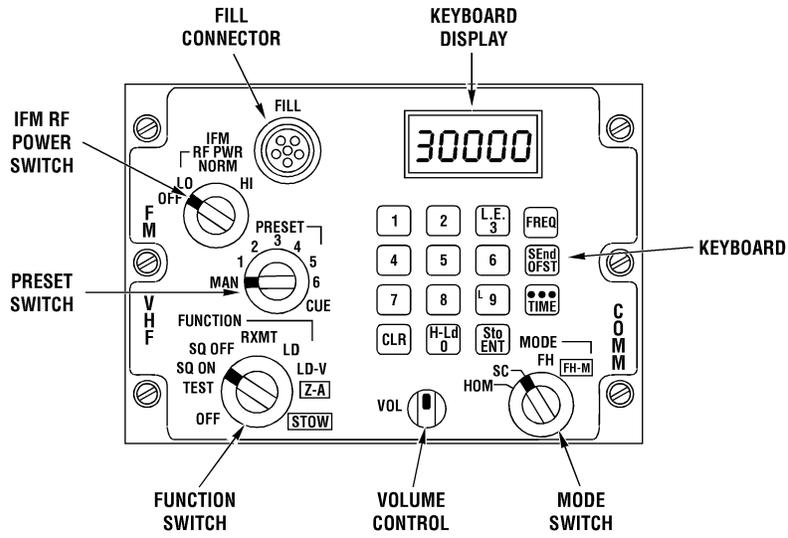
21-94-52

NOTES

- a) ON
 - b) SQ OFF
 - c) RXMT
 - d) LD
 - e) LD-V
- (d) FH-M (frequency hopping-master)
- 1) Guarded position of the function switch, requires a pull and turn action to operate.
 - 2) Identical to FH (frequency hopping) except that one radio in the net is designated as the "MASTER".
 - a) The operation of FH nets are time dependent and the accuracy of time as registered in each unit is of significant importance.
 - b) The system allows for considerable misalignment of time between units; however, a relative standard is required to prevent time creepage during normal communication.
 - c) The time differences are accommodated in the other units in the net and not the master.
- (3) PRESET switch is used to select MANUAL operation, PRESET operation (one of six frequencies) or CUE operation.
- (a) Is used to select specific, predetermined operating conditions within the RT.
 - (b) SC mode
 - 1) MAN position
 - a) Frequencies are selectable via the keyboard/display.
 - b) Any frequency within the band may be selected in 25 KHZ increments.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



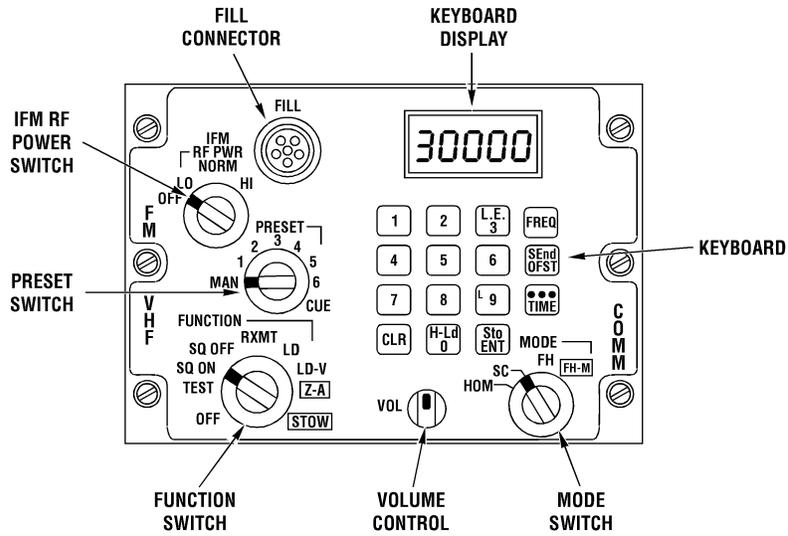
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NOTES

- c) Offsets of " 5 or " 10 KHZ may be applied to any selected frequency.
 - d) Offsets are retained until a new frequency is selected or until offsets are canceled.
 - 2) Positions 1-6
 - a) PRESET frequencies are selectable by rotating the PRESET switch to positions 1-6.
 - b) Previously stored frequency for a given position is indicated on the display.
 - c) If no frequency is stored, or the channel has been zeroed, the display reads "FILL" and the position number (1-6).
 - d) Offsets of " 5 or " 10 KHZ may be applied to any PRESET frequency.
 - e) Offsets are retained until a new frequency is selected or until offsets are canceled.
- (c) FH or FH-M modes
 - 1) Frequency hopping nets are selected by rotating the PRESET switch to positions 1-6.
- (d) CUE position
 - 1) Special signaling channel used by a non-ECCM radio to signal, or "CUE" an ECCM radio within a net that contact is being attempted.
 - a) CUE position is selected on the non-ECCM radio and the transmitter is keyed for a minimum of four seconds.
 - b) The ECCM radio receives the CUE signal and provides a 2 second audible tone and a seven second visual signal on the display (displays "CUE ") each time the non-ECCM radio is keyed.
 - c) The ECCM radio is then switched to SC CUE or some other pre-determined frequency to establish contact with the non-ECCM radio.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



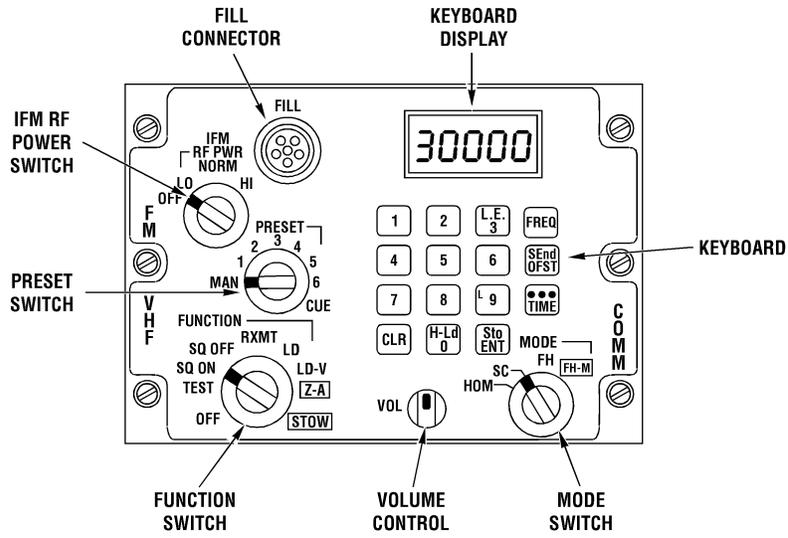
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NOTES

- (4) Keyboard and display
- (a) Display
- 1) 5 digit, 7 segment LCD readout
 - 2) Dimmable from full sunlight readable to NVG, low level, compatible.
 - 3) Is on continuously and generally operates in relation to keyboard inputs, the exceptions are:
 - a) FUNCTION selector in an operating mode, MODE switch in SC causes the frequency stored at a particular location of the PRESET switch to be displayed.
 - b) Depressing the frequency button on the keyboard displays the current operating frequency or hopset number.
- (b) Keyboard
- 1) Is a 15 button array of pressure switches arranged in a 4 X 4 matrix.
 - a) 2 command buttons (CLR and Sto/ENT)
 - b) 10 numeric buttons (0/H!LD thru 9)
 - c) 3 special function buttons (FREQ, SEnd/OFST and TIME)
 - 2) Is used to insert or cause data to be displayed depending on the key-switch actuated and the position of the FUNCTION and MODE switches.
- (c) CLR (command button)
- 1) Zeroizes the display.
 - 2) Must be pressed to remove old data before entering new data during LD or changing frequencies during MANUAL operation.
 - 3) Also used to clear partial or erroneous entries.
 - 4) Does not change operation of the RT, it only erases the display.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



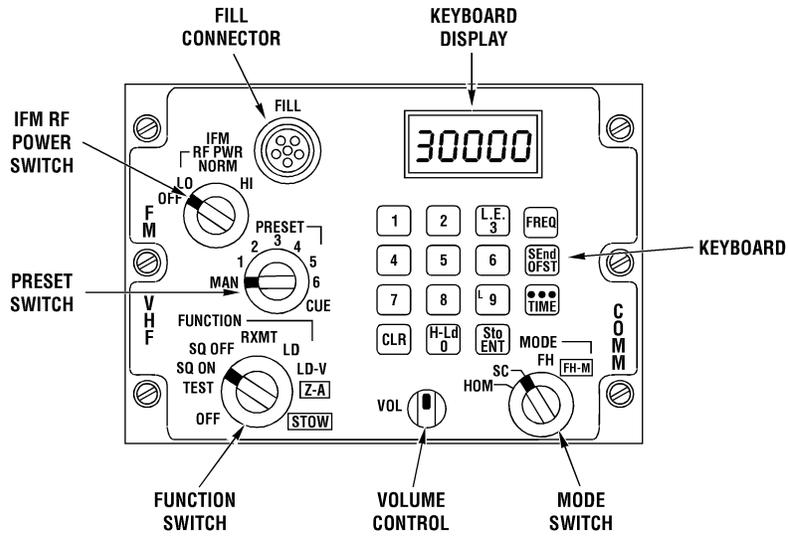
21-94-52

NOTES

- (d) Sto/ENT (command button)
- 1) ENT
 - a) Is used to initiate entry of all data selected by using the keyboard.
 - b) IN ALL CASES ONLY VALID COMPLETE ENTRIES enable the Sto/ENT button to have an effect and enter the data.
 - c) Acceptance of new data is signaled by a momentary blink of the display when the ENT button is pressed.
 - 2) Sto (FH or FH-M)
 - a) Stores a received Hopset or Lockset that is temporarily stored in Holding Memory.
 - b) Selection of PRESET 1-6 is necessary.
- (e) Numeric buttons 1-9 functions
- 1) Used to key in:
 - a) Frequency
 - b) Frequency offsets
 - c) Time
 - 2) The CLR button is used to clear the display.
 - a) New data can now be registered.
 - b) Operation of the RT is not altered.
 - 3) Operation of the RT is not altered until complete, valid data is registered on the readout and the keyboard ENT button is pressed.
 - a) Acceptance of new data is signaled by a momentary blink of the display when the ENT button is pressed.
 - b) Once this occurs, the RT acts upon the entry.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



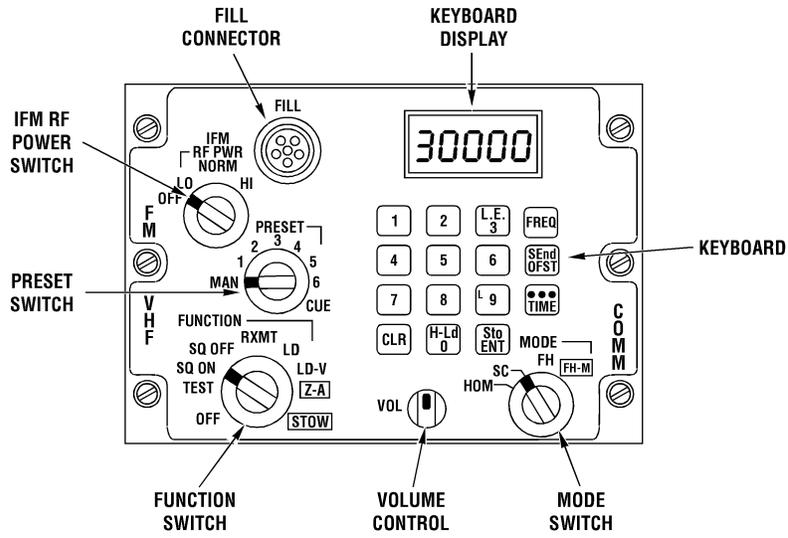
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NOTES

- (f) Numeric button 0/H!LD functions
- 1) Used to enter in zeros in the same manner as buttons 1-9.
 - 2) Second action (H!LD) initiates transfer of ECCM parameters.
- (g) FREQ (special function button - SC operation)
- 1) Displays the current MANUAL or PRESET operating frequency.
 - 2) Also used in loading PRESET frequencies.
 - a) FUNCTION switch must be in LD
 - b) CLR, NUMERIC and ENT buttons
 - 3) If the frequencies (MANUAL or PRESET) have been zeroized (ZA on the FUNCTION selector):
 - a) FILL is displayed
 - b) The preset number (1-6) is also displayed when frequency is pressed and until valid frequencies are entered.
- (h) SEnd/OFST (special function button)
- 1) Used to modify a single channel operating frequency by " 5 or " 10 KHZ.
 - 2) MODE switch MUST be in the SC position.
 - 3) FUNCTION switch can be in any position.
 - 4) Pressing OFST displays the current valid offset applied to the selected single channel frequency.
 - 5) The offsets applied to the basic frequency are displayed in the two right hand digits of the display.
 - a) A minus (-) sign in the center digit position indicates a negative offset.
 - b) Positive offsets are indicated by NO prefix.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



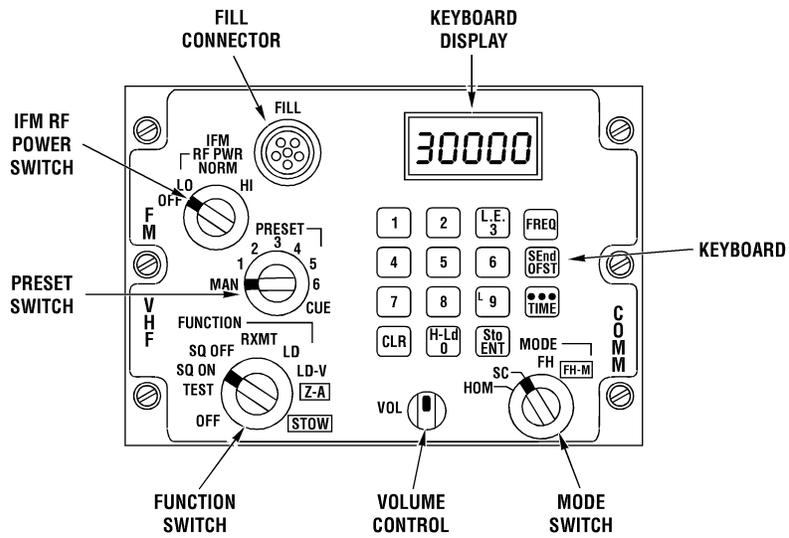
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NOTES

- 6) To apply an offset:
 - a) Press OFST.
 - b) Press CLR.
 - c) If a negative offset is desired, press OFST again.
 - d) To enter a 5 KHZ offset, press 0 and 5 on the keyboard.
 - e) To enter a 10 KHZ offset, press 1 and 0 on the keyboard.
 - f) Press ENT once the valid offset is displayed.
 - 7) The second action (SEnd) of the button initiates an ERF transmission if a hopset or lockset is in the holding memory and the MODE switch is in the FH-M position.
- (i) TIME (special function button)
- 1) The time button is used to display or change the time setting within each RT.
 - 2) There are three separate display fields.
 - a) Days (0-99)
 - b) Hours and minutes (0-23 hours, 0-59 minutes)
 - c) Seconds (0-59)
 - 3) To display time:
 - a) Press TIME, the days are displayed in the left two digits.
 - b) Pressing TIME again changes the field to Hours and Minutes (hours on the left, center digit off, minutes on the right).
 - c) Pressing TIME again changes the field to minutes and seconds (minutes on the left, center digit off, seconds on the right), the seconds will be running.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



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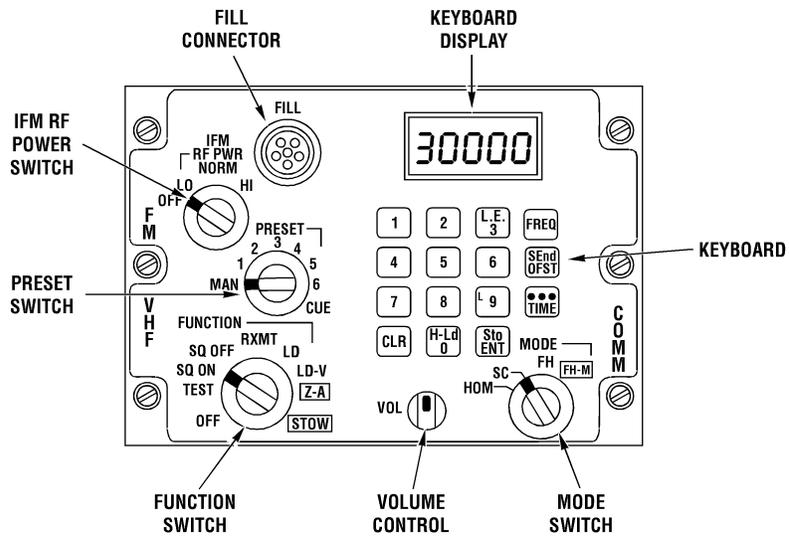
NOTES

- 4) To set or reset TIME:
 - a) FUNCTION must be in LD position (MODE and PRESET may be in any position).
 - b) CLR is pressed.
 - c) The display stops running, displaying entry information only.
 - d) The internal clock continues to run.
 - e) Press TIME the required number of times to display the days, hours-minutes.
 - f) Press CLR (the day display digits are removed, the hours-minutes appear with underlines where numbers were present).
 - g) Use the keyboard to place the desired TIME parameter into the display.
 - h) When the parameter is displayed it is registered, visible but not running.
 - i) When all the desired parameters are valid and correct, press ENT to start the display running (the display blinks momentarily, indicating that the entry is accepted and the seconds start running from zero).
 - j) The minutes and seconds parameter field can be called up on the display in this procedure but cannot be changed. Minutes are changed under the hours-minutes parameter field and seconds automatically are reset and start from zero when ENT is pressed.

- (5) VOL control
 - (a) The VOL control allows for control of the audio amplifier output.
 - (b) If the VOL control is set to the minimum volume level position, NO SINGARS AUDIO CAN BE HEARD IN EITHER COCKPIT, REGARDLESS OF THE POSITION OF THE #1 AUDIO SWITCH/VOLUME CONTROL on either CSC.



RT-1476/ARC-201 (V) VHF-FM FRONT PANEL



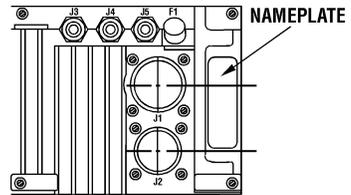
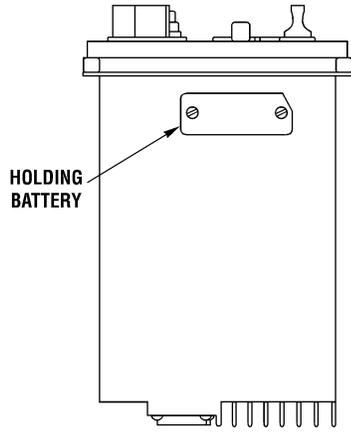
21-94-52

NOTES

- (c) Either crewmember can monitor the SINCGARS receiver audio by selecting position 1 (PLT VHF) on the CSC panel transmit select switch or by selecting the No. 1 receiver audio control on the respective CSC.
 - (d) Clockwise rotation increases volume.
- (6) FILL connector
- (a) Is used to fill ECCM parameters from an external fill device.
 - (b) Entry or parameters are initiated by the HILD button on the keyboard with the FUNCTION switch in the LD or LD-V positions.
- (7) IFM RF POWER switch
- (a) Allows one of three RF power levels to be selected for the SINCGARS radio WHEN USED WITH the IFM AM-7189/A RF power amplifier.
 - 1) OFF (bypass) - uses the standard 10 watt output from the radio directly.
 - 2) LO (low power) - 2.5 watts.
 - 3) NORM (normal power) - 10 watts.
 - 4) HI (high power) - 40 watts.
 - (b) The OFF position is the normal operating position for the AH-64A, as no IFM AM-7189/A RF power amplifier is used.



RT-1476/ARC-201(V) VHF-FM HOLDING BATTERY AND BACK PANEL



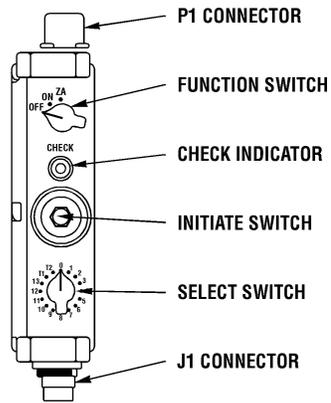
21-94-53

NOTES

- f. RT-1476/ARC-201 (V) VHF-FM holding battery and back panel
- (1) The internal holding battery is not used on the AH-64A.
 - (2) An external holding battery is provided for AH-64A installations.
 - (3) Back panel provides the following SINCGARS VHF-FM interface functions.
 - (a) J1 is the system connector and interfaces the SINCGARS VHF-FM with the helicopter. J1 provides the following connections.
 - 1) 28 VDC emergency bus for operating power
 - 2) 28 VDC return and chassis ground
 - 3) External holding battery
 - 4) 115 VAC dimmer control assembly
 - 5) Helicopter audio system
 - 6) TSEC-KY-58 interface
 - 7) RXMT interface to a second ARC-201 (not used on the AH-64A)
 - (b) J2 is the ancillary connector and is used to interface the AN/ARC-201 (V) to an external RF power amplifier and data communications device. Neither are used on the AH-64A).
 - (c) J3 is the RF connection for the pilot VHF communication antenna.
 - (d) J4 and J5 are for right and left homing antennas (not used on the AH-64A).
 - (e) F1 is a replaceable fuse for primary input power protection.



MX-10579 ECCM FILL DEVICE



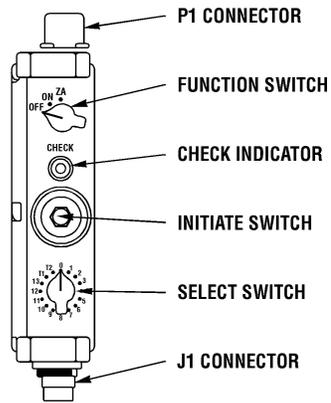
21-94-54

NOTES

2. MX-10579 ECCM fill device
 - a. Used to fill the RT-1476/ARC-201 (V) VHF-FM with ECCM data.
 - (1) TRANSEC variable
 - (2) Hopset
 - (3) Lockset
 - b. MX-10579 ECCM fill device component description and operation
 - (1) J1 connector connects to a tape reader or another fill device in order to load data.
 - (2) FUNCTION switch
 - (a) ON and OFF turns the MX-10579 ECCM Fill Device on and off.
 - (b) ZA zeroizes all when the SELECT switch is in the "A" position and the INITIATE switch is pressed.
 - (c) ZA zeroizes the respective fill position (1-13, T1 and T2) when the SELECT switch is in the "A" position and the INITIATE switch is pressed.
 - (3) INITIATE switch
 - (a) Zeroizes the fill device.
 - (b) Requests data during the loading of the fill device.
 - (c) Check if a SELECT switch position has data in it.
 - (4) SELECT switch
 - (a) Selects which hopset, lockset, or TRANSEC variable is:
 - 1) Stored
 - 2) Transferred
 - 3) Zeroized
 - (b) The "A" position is used to transfer all data from one fill device to another or zeroize all data.



MX-10579 ECCM FILL DEVICE



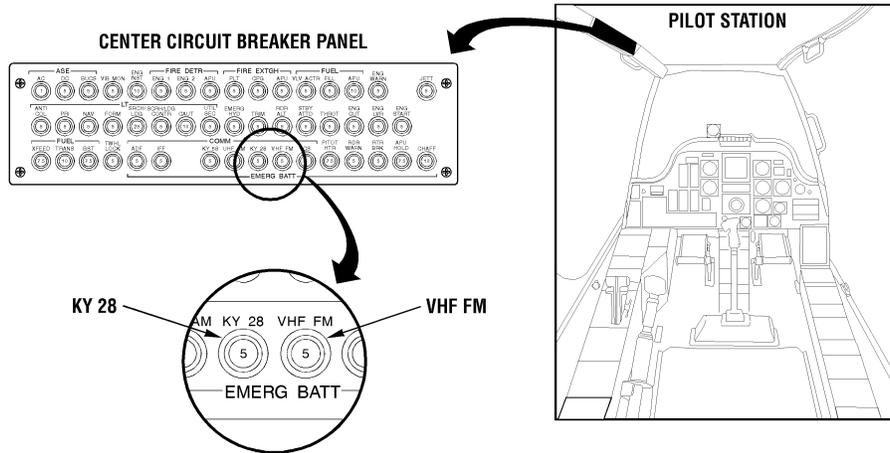
21-94-54

NOTES

- (c) Positions 1-13 are for hopsets and locksets.
 - (d) Positions T1 and T2 are for TRANSEC variables.
- (5) CHECK indicator blinks when:
- (a) Data is transferred OUT to an RT.
 - (b) Data is transferred IN from a tape reader to MX-10579 ECCM fill device.
 - (c) The FUNCTION switch is OFF.
 - (d) SELECT switch positions (1-13, T1 and T2) contain data and the INITIATE switch is pressed.
- (6) P1 connector connects to the RT-1476/ARC-201 (V) VHF-FM FILL connector via a jumper harness.



PILOT VHF CIRCUIT BREAKERS



83-946

NOTES

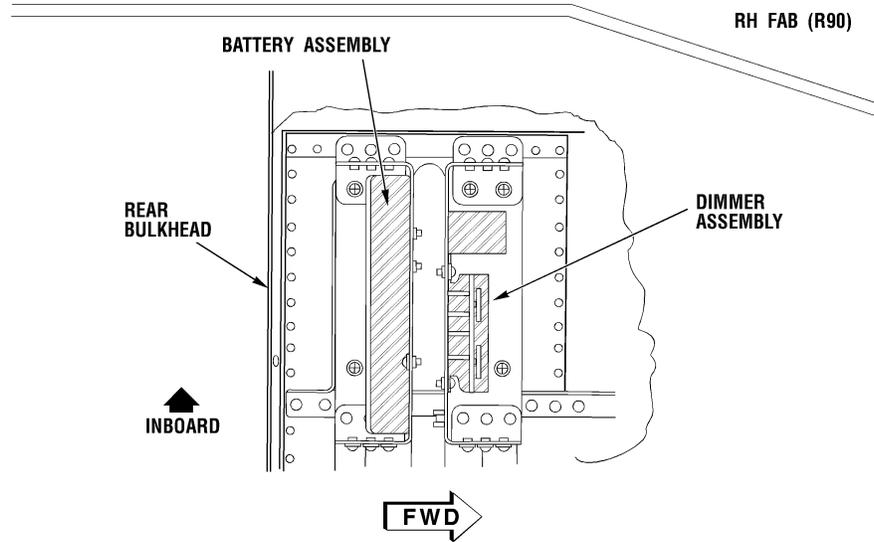
A. Interface components

1. Circuit protection

- a. Used to provide circuit protection for the pilot VHF-FM system.
- b. The VHF (No. 1) circuit breaker is mounted in the pilot's center overhead circuit breaker panel and is rated at 28 VDC, 5 amps.



SINGARS BATTERY ASSEMBLY AND DIMMER ASSEMBLY



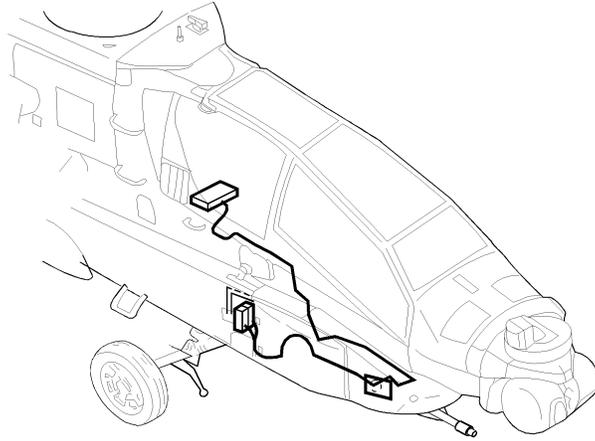
21-94-55

NOTES

2. CY-8515/ARC-201 battery box
 - a. Contains five "C" size batteries.
 - b. Provides holding power for the RT-1476/ARC-201 (V).
 - (1) ECCM memory
 - (2) RT presets
 - (3) Time
 - c. Located in the upper, aft portion of the RH FAB (R90).
3. 90197098-501 dimmer control assembly
 - a. Consists of a voltage reducer assembly and a 28 VDC to 115 VAC converter.
 - b. Converts the 0 - 28 VDC dimmer input from the helicopter interior lighting system to a variable 115 VAC dimmer voltage that is compatible with the RT-1476/ARC-201 (V).
 - c. Located in the upper, aft portion of the RH FAB (R90).



SINGGARS 2290110-501 WIRE HARNESS



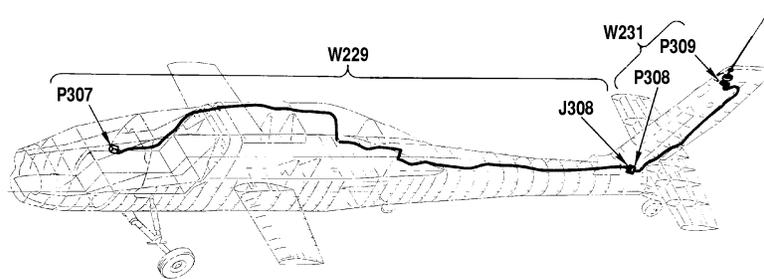
21-94-56

NOTES

4. SINGARS wire harness
 - a. Used to connect the R/T to the holding battery and the dimmer control assembly.
 - b. Wire harness W172 begins in the pilot crewstation RH console.
 - c. Runs forward to the front of the CPG crewstation RH console.
 - d. Enters the forward end of the RH FAB (R-90) and is routed aft.
 - e. Continues to the rear bulkhead area of the RH FAB and connects to the holding battery and the dimmer control assembly.



WIRE HARNESS W229 AND W231



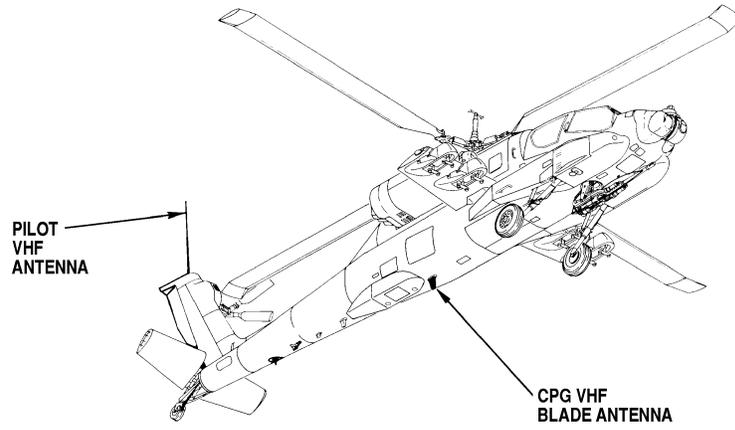
21-92-52

NOTES

5. Wire harness W229 and W231
 - a. Used to connect the No. 1 VHF-FM R/T to the No. 1 VHF antenna.
 - b. Wire harness W229 begins in the pilot's right-hand console and terminates at the No. 1 VHF antenna.
 - c. Wire harnesses W229 and W231 are coax cables with two connectors each.
 - (1) Connector P307/P314/P318 connects to the pilot's VHF radio.
 - (2) Connector P309/P329/P330 connects to the No. 1 VHF antenna.



VHF – AM/FM ANTENNAS



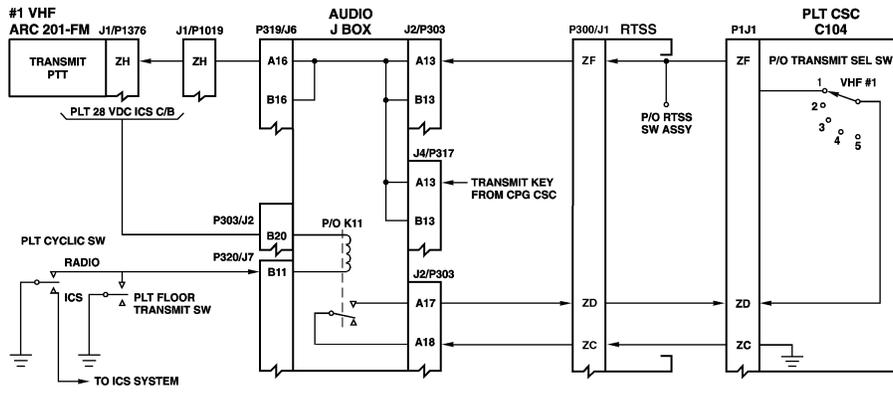
21-92-49

NOTES

6. The pilot's (No. 1) VHF-AM/FM antenna
 - a. Used by the SINCGARS RT-1476/ARC-201 (V) VHF-FM transceiver.
 - b. An integral part of the vertical stabilizer trailing edge.
 - c. Helicopters with MWO 9-1090-208-50-37, NOE VHF communication improvement, utilize a whip antenna mounted on top of the vertical stabilizer instead of the trailing edge antenna. The trailing edge antenna remains on the helicopter for aerodynamic considerations.



VHF AM/FM NO.1 KEYLINE INTERCONNECT



21-94-57

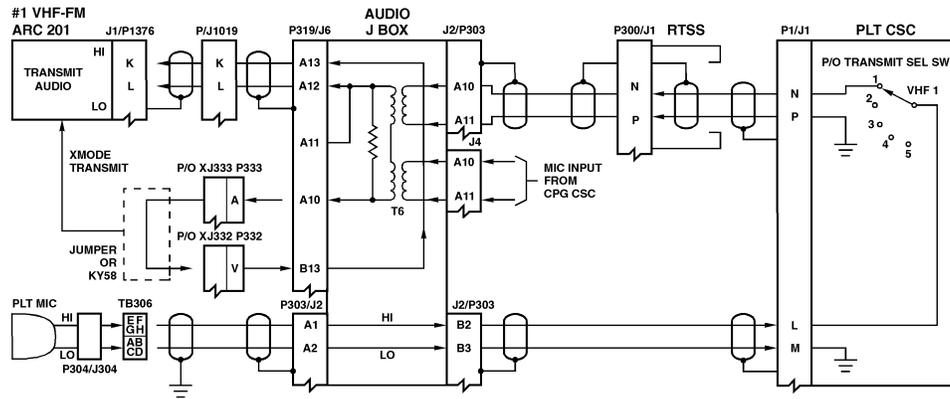
NOTES

B. SINGARS AN/ARC-201 (V) Operation

1. VHF FM No. 1 pilot crew station keyline interconnect (CPG circuit similar)
 - a. From the pilot cyclic RADIO or floor XMIT switches.
 - b. Through the AJB via K-11.
 - c. Through the RTSS panel.
 - d. Through the PLT CSC via the TRANSMIT SELECTOR SWITCH.
 - e. Through the RTSS.
 - f. Through the AJB.
 - g. Through the interface connector P/J 1019.
 - h. To the XMIT PTT input of the VHF FM No. 1.



VHF AM/FM NO.1 MICROPHONE AUDIO INTERCONNECT



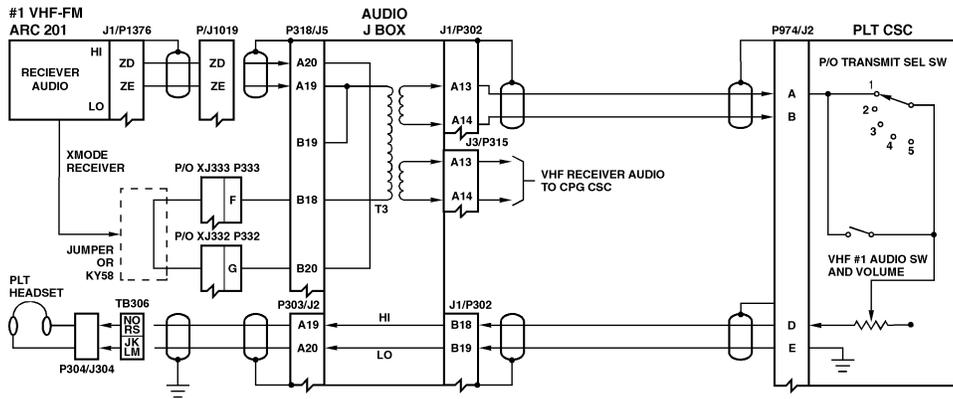
21-94-58

NOTES

2. VHF FM No. 1 pilot crew station microphone interconnect (CPG circuit similar)
 - a. From the helmet mounted pilot microphone.
 - b. Through TB-306 behind the pilot seat.
 - c. Through the AJB.
 - d. Through the PLT CSC via the TRANSMIT SELECTOR SWITCH.
 - e. Through the RTSS.
 - f. Through the AJB via:
 - (1) Input to the primary of T6.
 - (2) Output through the lower end of T6 secondary.
 - g. Out through J6 pin A10 to P-333 pin A.
 - h. Through the jumper XJ-333/332 or the KY-58 (if installed) to P-332 pin V.
 - i. Back to the AJB J6 pin B13.
 - j. Through the AJB to J6 pin A13.
 - k. Through the interface connector P/J 1019.
 - l. To the XMIT PTT input of the VHF FM No. 1.



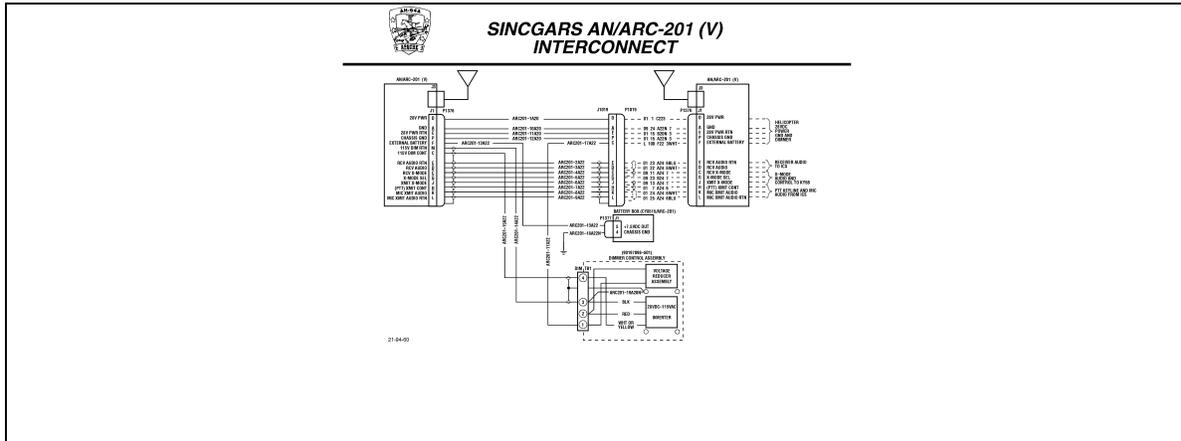
VHF AM/FM NO.1 RECEIVER AUDIO INTERCONNECT



21-94-59

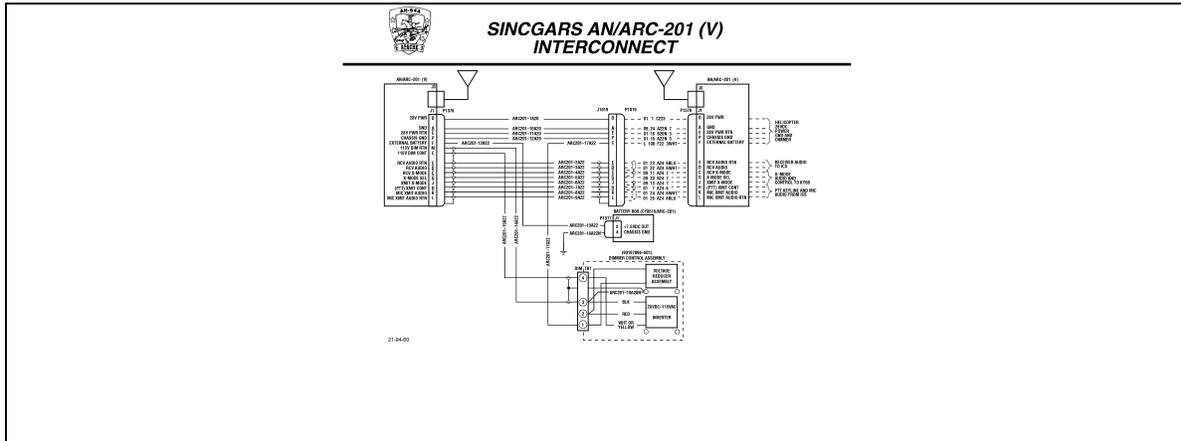
NOTES

3. VHF FM No. 1 pilot crew station receiver interconnect (CPG circuit similar)
 - a. From the RCVR AUD output of the VHF FM No. 1 to the interface connector P/J 1019.
 - b. To the AJB to J5 pin A20.
 - c. Through the AJB to J5 pin B20.
 - d. Out to the jumper XJ-333/332 or the KY-58 (if installed) to P-332 pin G.
 - e. Through the jumper to P-333 pin F.
 - f. Out to J5 pin B18.
 - g. Through the AJB via:
 - (1) Input to the primary of T3.
 - (2) Output through the upper secondary of T3.
 - h. Through the PLT CSC via the TRANSMIT SELECTOR SWITCH.
 - i. Through the AJB.
 - j. Through TB-306 behind the pilot seat.
 - k. To the helmet mounted pilot headset.



NOTES

4. The interconnection of the AN/ARC-201 (V) is separated into the following basic areas.
 - a. Helicopter
 - (1) 28 VDC power
 - (2) Grounds
 - (3) Dimmer
 - b. Battery box
 - (1) 7.5 VDC
 - (2) Chassis ground
 - c. ICS
 - (1) Transmit control and audio
 - (2) Receive audio
 - d. KY-58
 - (1) X-mode select
 - (2) X-mode transmit and receive audio
5. The AN/ARC-201 (V) receives the following inputs from the helicopter.
 - a. 28 VDC power from the DC emergency bus is applied to the radio, via P/J1019, as the primary operating voltage.
 - b. Ground, via P/J1019.
 - (1) 28 VDC RTN is the ground path for the primary operating circuits within the radio.
 - (2) GND is the ground path for the modules within the radio.
 - (3) CHASSIS GND is the ground path for the radio chassis.
 - c. Dimmer
 - (1) Adjustable 0-28 VDC from the RCSL dimmer control is provided to the dimmer control assembly voltage reducer assembly, via P/J1019.
 - (a) The voltage reducer assembly provides a variable output to the dimmer control assembly inverter.



NOTES

- (b) The 28 VDC-to-115 VAC inverter converts the variable output from the voltage reducer assembly into a variable AC voltage output.
 - (c) Variable AC voltage output is applied to the radio to control the 115 VAC dimmer lights in the front panel.
- d. Battery box
 - (1) 7.5 VDC from the positive battery output is applied to the radio as the holding voltage for the memory circuits.
 - (2) Chassis ground is connected to helicopter ground to complete the ground path for the battery circuit.
- e. ICS
 - (1) Provides transmit control and microphone audio from the pilot and CPG CSC's and the AJB, via P/J1019.
 - (2) Provides receiver audio to the AJB, pilot and CPG CSC's, via P/J1019.
- f. KY-58
 - (1) Provides X-mode select from the TSEC/KY-58 secure voice system to enable the RT to function during cipher voice operations.
 - (2) X-mode transmit and receive audios are interfaced with the RT from the KY-58 secure voice unit for signal processing during cipher voice operations.



PREMISSION CHECKOUT SELF - TEST

Power-up Test

Listen to intercom audio. A beep at power-up is normal.

RT Self-Test Using TEST Position of FUNCTION Switch.

- - - - -

Displayed for about
3 seconds. Signals
beginning of self-test.

E - - - -

Displayed for about
2 seconds. Indicates ECCM
module present in rt.

88888

Displayed for about
7 seconds. Tests all
segments of display.

Good

End of cycle. Rt has passed
self-test.

21-94-61

NOTES

- C. The premission checkout procedures determine the operational status of the radio by:
1. Using the self test which consists of:
 - a. Power up test
 - b. RT self test
 2. Verifying that the radio is loaded with proper fill information.
 3. Verifying communications ability in the SC and FH modes of operation.
- D. Self test
1. Power up test
 - a. Initial conditions
 - (1) MODE switch - any position
 - (2) PRESET switch - any position
 - (3) IFM RF power switch - OFF
 - (4) VOL - maximum clockwise
 - b. FUNCTION switch - TEST
 - (1) A beep should be heard in the headset.
 2. RT self test
 - a. The display should follow the correct sequence and readout
 - (1) All dashes for 3 seconds.
 - (2) E and dash for 2 seconds, indicates the presence of the ECCM module.
 - (3) All "8's" for about 7 seconds, display test.
 - (4) Good indicates the end of test, RT passed.
 - b. Sidetone
 - (1) Ensure VOL is set maximum clockwise.
 - (2) Press the cyclic RADIO or foot transmit switches.
 - (3) Talk into mic and verify proper sidetone.



PREMISSION CHECKOUT FAILURE INDICATIONS

Failures in the automatic tests will be indicated by the word FAIL followed by a number to indicate the failed component.

The control panel tests its own internal circuitry and the interface to the RT before commanding the RT test.

FAILURE INDICATIONS:

F A I L 7

Indicates failures of the interface to the RT

F A I L 8

Indicates internal failure of the control panel

F A I L 1

Indicates failure of the RT

F A I L 3

Indicates failure of the ECCM module

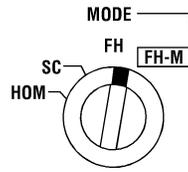
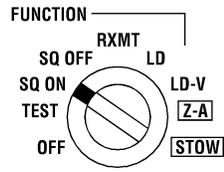
21-94-82

NOTES

- c. If the RT fails the self test, one of the following indications will be present on the display
- (1) FAIL7 - indicates failure of RT interface.
 - (2) FAIL8 - indicates failure of the control panel.
 - (3) FAIL1 - indicates failure of the RT.
 - (4) FAIL3 - indicates failure of the ECCM module.
 - (5) Corrective maintenance action must be taken if any of these failures are present at the completion of self test.



FILL INFORMATION CHECK



F I L L t

F I L L n

n IS CHANNEL NUMBER

L 7

L 8

L 7 L 8

21-94-83

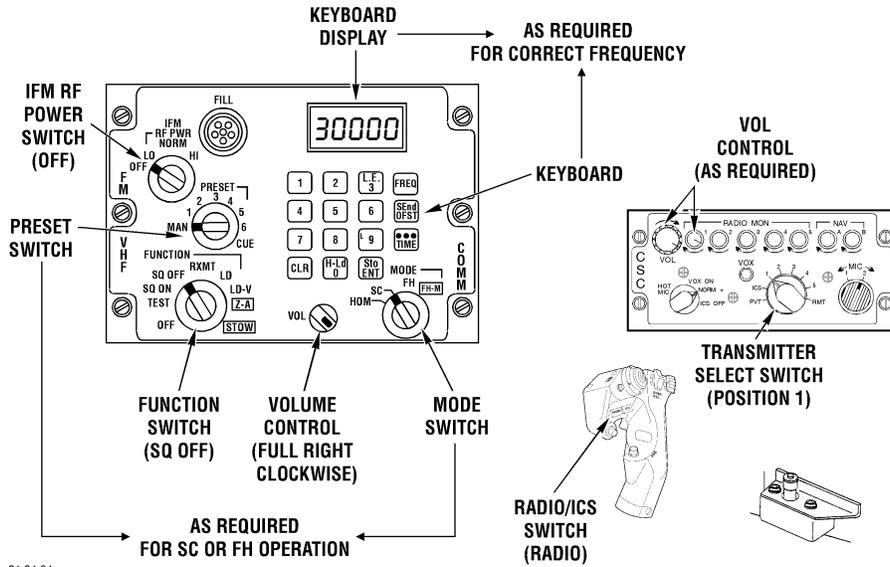
NOTES

E. Fill information check

1. This test must be performed if the radio set is to be used for FH communication.
 - a. FUNCTION - SQ ON
 - b. MODE - FH (If "FILLE" is displayed the TRANSEC variable needs to be loaded.)
 - c. Set the PRESET switch to the operating channels. (If "FILLN" is displayed the hopset needs to be loaded.)
 - d. If "L7 or L8" or other combinations are displayed, the lockset(s) needs to be loaded.



COMMUNICATION CHECK



21-94-64

NOTES

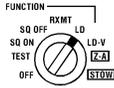
F. Communication check

1. FUNCTION switch - SQ OFF
2. VOL - maximum clockwise
3. IFM RF power switch - OFF
4. MODE switch - SC or FH
5. PRESET switch - MAN or desired channel (1-6)
6. Press the cyclic RADIO or foot transmit switches.
7. Talk into mic and verify proper sidetone.
8. Using correct frequency or hopset contact a local station and receive an acknowledgement of adequate transmission.



SINGLE CHANNEL OPERATION LOADING/CLEARING A FREQUENCY

(1) Obtain authorized operating frequency. Then set switches as shown.



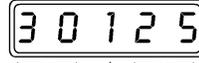
FUNCTION - LD



MODE - SC



PRESET - WHERE NEEDED



30 THROUGH 87

0 THROUGH 9

00, 25, 50,
OR 75

NOTE

The MAN channel can be loaded with FUNCTION switch at LD, LD-V, SQ ON, SQ OFF, or RXMT.

S
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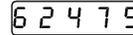
(1) Loading Frequency

- | | | |
|-----------------------------------|--|--------------------------|
| | <u>MAN</u> | <u>1 to 6 and CUE</u> |
| (a) Set switches: | FUNCTION - LD* | FUNCTION - LD |
| | PRESET - MAN | PRESET - Desired Channel |
| | MODE - SC | MODE - SC |
| (b) Load/store frequency: | Press FREQ, CLR, numbers for frequency, Sto/ENT. | |
| (c) Set or verify FUNCTION switch | at normal operating position. | |

(2) Clearing Frequency

- | | | | |
|-----------------------------------|-----------------------------------|------------|---|
| (a) Set switches: | FUNCTION - LD* | MODE - SC, | PRESET - Position where frequency is located. |
| (b) Clear frequency: | Press FREQ, CLR, H-Ld/0, Sto/ENT. | | |
| (c) Set or verify FUNCTION switch | at normal operating position. | | |

*MAN channel can be loaded/cleared with FUNCTION switch at LD, LD-V, SQ ON, SQ OFF, or RXMT.



FREQ PRESSED



CLR PRESSED



NUMBERS PRESSED

21-94-65

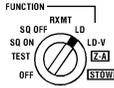
NOTES

9. Before communicating in the SC mode, the RT must be loaded with one or more frequencies, either MANUAL or PRESET.
10. When entering information on the keyboard, the display shows what has been done or what is required next.
11. MANUAL frequency loading
 - a. FUNCTION switch - LD
 - b. MODE switch - SC
 - c. PRESET switch - MAN
 - d. To load/store MAN frequency, press:
 - (1) FREQ
 - (2) CLR
 - (3) Keyboard numbers for the desired frequency
 - (4) Sto/ENT
 - e. FUNCTION switch - normal operating position
12. PRESET frequency loading
 - a. FUNCTION switch - LD
 - b. MODE switch - SC
 - c. PRESET switch - to the desired channel (1-6)
 - d. To load/store PRESET frequency, press:
 - (1) FREQ
 - (2) CLR
 - (3) Keyboard numbers for the desired frequency
 - (4) Sto/ENT
 - e. FUNCTION switch - normal operating position



SINGLE CHANNEL OPERATION LOADING/CLEARING A FREQUENCY

(1) Obtain authorized operating frequency. Then set switches as shown.



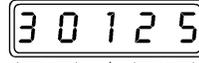
FUNCTION - LD



MODE - SC



PRESET - WHERE NEEDED



30 THROUGH 87

0 THROUGH 9

00, 25, 50,
OR 75

NOTE

The MAN channel can be loaded with FUNCTION switch at LD, LD-V, SQ ON, SQ OFF, or RXMT.

SUMMARY

(1) Loading Frequency

<u>MAN</u>	<u>1 to 6 and CUE</u>
(a) Set switches: FUNCTION - LD*	FUNCTION - LD
PRESET - MAN	PRESET - Desired Channel
MODE - SC	MODE - SC

(b) Load/store frequency: Press FREQ, CLR, numbers for frequency, Sto/ENT.

(c) Set or verify FUNCTION switch at normal operating position.

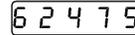
(2) Clearing Frequency

(a) Set switches: FUNCTION - LD*, MODE - SC, PRESET - Position where frequency is located.

(b) Clear frequency: Press FREQ, CLR, H-Ld/0, Sto/ENT.

(c) Set or verify FUNCTION switch at normal operating position.

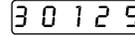
*MAN channel can be loaded/cleared with FUNCTION switch at LD, LD-V, SQ ON, SQ OFF, or RXMT.



FREQ PRESSED



CLR PRESSED



NUMBERS PRESSED

21-94-65

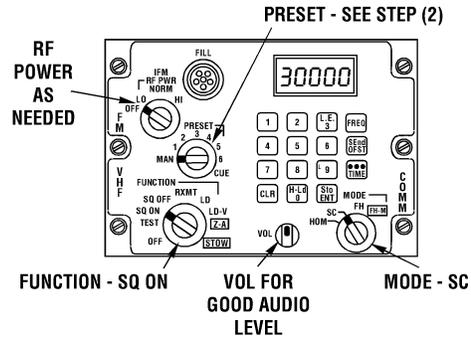
NOTES

13. MANUAL/PRESET frequency clearing
 - a. FUNCTION switch - LD
 - b. MODE switch - SC
 - c. PRESET switch - MAN or to desired PRESET channel (1-6)
 - d. To clear MAN frequency, press:
 - (1) FREQ
 - (2) CLR
 - (3) H-LD/0
 - (4) Sto/ENT
 - e. FUNCTION switch - normal operating position



COMMUNICATING IN THE SC MODE

- (1) Set switches and controls as shown.



- (2) Set PRESET switch to position of assigned frequency. Display will show frequency. (If display times out, FREQ button will cause frequency to be shown again.)
- (3) Key transmitter. Press push-to-talk switch.
- (4) Contact required station. Listen for sidetone when you talk into mic. Adjust VOL control for comfortable level.

21-94-66

NOTES

G. Communicating in the SC mode

1. FUNCTION switch - SQ ON
2. MODE switch - SC
3. PRESET switch - MAN or desired Channel (1-6)
4. IFM RF power switch - OFF
5. Press the cyclic RADIO of foot transmit switches.
6. Talk into mic and verify proper sidetone.
7. Using correct frequency, contact a local station and receive an acknowledgement of adequate transmission.



CLEARING A FH SET

INITIAL CONDITIONS

Set switches: FUNCTION - LD; MODE - FH (NCS - **FH-M**)
 Be sure display is blank before clearing a Lockset or Hopset.

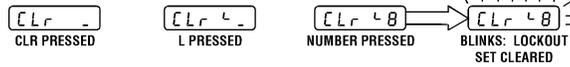
CLEARING A HOPSET

Press CLR, followed by number (1-6) of channel to be cleared.
 The display will change as shown and a beep will be heard when the display blinks.



CLEARING A LOCKSET EXAMPLE: HL875 LOCKSET NUMBER

Press CLR, followed by L/9. Then press number (1-8) of left digit of lockout set number. The display will change as shown, and a beep will be heard when the display blinks.



21-94-67

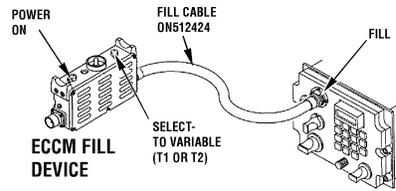
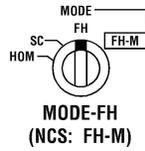
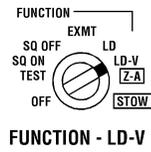
If more hopsets or lockout sets need to be cleared, repeat the respective steps, then reset RT switches to normal positions.

NOTES

- H. Clearing a single FH (lockset and hopset) set
1. This procedure allows a single FH lockset to be cleared from the RT (example - lockset number HL875).
 - a. FUNCTION switch - LD
 - b. MODE switch - FH (NCS FH-M)
 - c. Press CLR and the L/9 key
 - d. Press the number (1-8) of the left digit of the lockset number in the channel to be cleared (example - lockset number HL875).
 - e. The display indicates the clear function and the lockset number to be cleared.
 - f. A beep is heard and the display blinks to advise that the channel is cleared.
 2. This procedure allows a single FH hopset to be cleared from the RT.
 - a. FUNCTION switch - LD
 - b. MODE switch - FH (NCS FH-M)
 - c. Press CLR and the number of the channel to be cleared.
 - d. The display indicates the clear function and the channel to be cleared.
 - e. A beep is heard and the display blinks to advise that the channel is cleared.
 3. Repeat the above steps if more lockset or hopsets are to be cleared.



LOADING TRANSEC VARIABLE

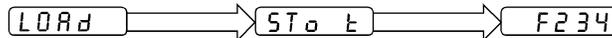


Loading TRANSEC Variable

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- (1) Clear RT memories (Do ONLY if all required FH data is to be loaded.) Set RT FUNCTION - **Z-A**. The display must show "Good".
- (2) Test RT. Set FUNCTION switch to TEST. At end of test, the display must show "Good".
- (3) Set switches. FUNCTION - LD-V; MODE - FH; PRESET - any position except CUE; fill device power ON; select switch to T1 or T2.
- (4) Load and Store variable: Press keyboard H-Ld/0.

BEEP



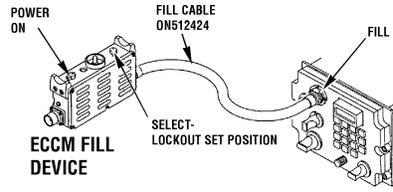
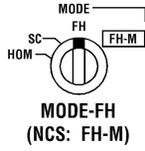
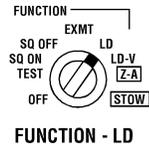
21-94-88

NOTES

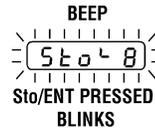
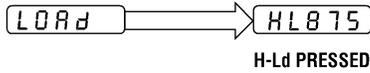
- I. Loading TRANSEC variable - the TRANSEC variable is electronic control data required in the RT for FH operation and is loaded by AVUM personnel. Only one TRANSEC variable is required by the RT and must be in the permanent memory (PM). All radios in the same net MUST contain the same TRANSEC variable. Proceed as follows.
- a. Clear memories as required.
 - b. TEST RT
 - c. FUNCTION switch - LD-V
 - d. MODE switch - FH (NCS FH-M)
 - e. PRESET switch - any position except CUE
 - f. MX-10579 ECCM fill device
 - (1) Connect
 - (2) Power ON
 - (3) SELECT switch to T1 or T2
 - g. Press H-Ld/0
 - h. The display indicates LOAd, then "Sto t" and a beep is heard.
 - i. A hopset number or "FILLn" is displayed next.
 - (1) The hopset number indicates the RT is ready for use.
 - (2) If "FILLn" is displayed load a hopset or select another channel.
 - (3) A bad fill sounds an alarm and the display indicates "bad".
 - j. MX-10579 ECCM fill device
 - (1) Power OFF
 - (2) Disconnect
 - k. FUNCTION switch - normal operating position as required.



LOADING LOCKOUT SET



S U M M A R Y	Loading Lockout Set	
	(1)	Set switches: FUNCTION-LD, MODE-FH (NCS; FH-M), PRESET-any position except CUE; ECCM fill device to RT FILL; fill device power ON, select switch to required lockout set.
	(2)	Load lockout set: Press H-Ld/0.
	(3)	Store lockout set: Press Sto/ENT.



21-94-89

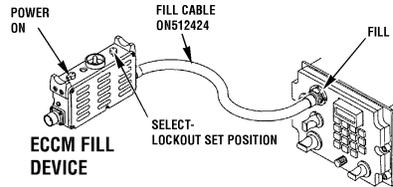
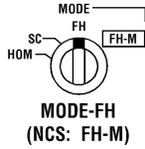
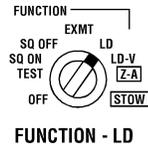
NOTES

J. Loading lockout set (lockset)

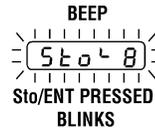
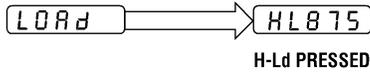
1. The lockout set, or lockset, is data which prevents transmission and reception on particular frequencies. It is used for FH by all RT's using the hopset which needs the lockset. Lockset data may not be required by some hopsets. Check the CEOI for lockset(s) required. It can be loaded from the net control station (NCS) during ERF or by the MX-10579 ECCM fill device.
2. To see if locksets have already been loaded, set:
 - a. FUNCTION switch - SQ ON
 - b. MODE switch - FH (or FH-M for the NCS)
 - c. PRESET switch - desired channel (1-6)
 - d. Press FREQ several times to display the lockset numbers.
3. Loading lockset
 - a. FUNCTION switch - LD
 - b. MODE switch - FH (NCS FH-M)
 - c. PRESET switch - any position except CUE
 - d. MX-10579 ECCM fill device
 - (1) Connect
 - (2) Power ON
 - (3) SELECT switch to required lockset channel 1-12
 - e. Press H-Ld/0
 - f. The display indicates LOAd, then the lockset number (example - lockset number HL875).
 - g. Press Sto/ENT
 - h. The display blinks and Sto8 is displayed, 8 is the first number of the lockset and a beep is heard.



LOADING LOCKOUT SET



S U M M A R Y	Loading Lockout Set	
	(1)	Set switches: FUNCTION-LD, MODE-FH (NCS; FH-M), PRESET-any position except CUE; ECCM fill device to RT FILL; fill device power ON, select switch to required lockout set.
	(2)	Load lockout set: Press H-Ld/0.
	(3)	Store lockout set: Press Sto/ENT.



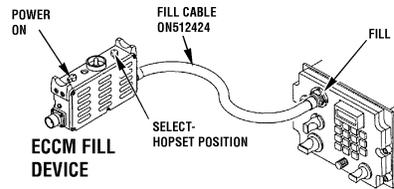
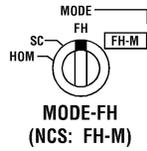
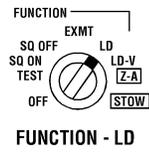
21-94-89

NOTES

- i. MX-10579 ECCM fill device
 - (1) Power OFF
 - (2) Disconnect
- j. FUNCTION switch - normal operating position as required



LOADING HOPSET



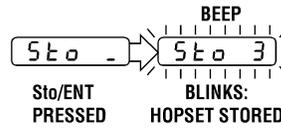
Loading Hopset

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Y

(1) Set switches: FUNCTION-LD, MODE-FH (NCS; FH-M), PRESET-any position except CUE; ECCM fill device to RT FILL; fill device power ON, select switch to required hopset.

(2) Load hopset: Press H-Ld/0.

(3) Store hopset: Press Sto/ENT followed by channel number (1-6).



21-94-70

NOTES

K. Loading hopset

1. The hopset is data that determines which frequencies are used by the RT during FH. It is used for FH by all RT's using the hopset which needs the lockset. Lockset data may not be required by some hopsets. Check the CEOI for lockset(s) required. It can be loaded from the net control station (NCS) during ERF or by the MX-10579 ECCM fill device.
2. Channels with hopset already in them must be cleared prior to loading a new hopset.
3. Loading hopset
 - a. FUNCTION switch - LD
 - b. MODE switch - FH (NCS FH-M)
 - c. PRESET switch - any position except CUE
 - d. MX-10579 ECCM fill device
 - (1) Connect
 - (2) Power ON
 - (3) SELECT switch to required Hopset channel 1-12
 - e. Press H-Ld/0
 - f. The display indicates LOAd, then the hopset number (example - lockset number HF234).
 - g. Press Sto/ENT FOLLOWED BY THE CHANNEL NUMBER (1-6).
 - (1) The display indicates that the Sto function is selected and a channel number is needed.
 - (2) The display blinks, "Sto 3" is displayed, and a beep is heard.
 - h. MX-10579 ECCM fill device
 - (1) Power OFF
 - (2) Disconnect
 - i. FUNCTION switch - normal operating position as required.



SETTING TOD

Setting TOD

**S
U
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Y**

- (1) Set switch: FUNCTION - LD.
- (2) Load/store days: Press · · · /TIME, CLR, day numbers, sto/ENT.
- (3) Load/store hours, minutes: Press · · · /TIME, CLR, hour numbers, minute numbers, Sto/ENT.

21-94-71

NOTES

L. Setting TOD

1. The correct time of day (TOD) is needed by all RT's in a net to synchronize FH communications. It can be loaded from the net control station (NCS) during ERF or by the RT keyboard.
2. The NCS is the time keeper for the net clocks. Usually net members should not load the TOD unless preparing for a full load opening.
 - a. All RT TOD's must be within " 4 seconds.
 - b. If the RT is zeroized (Z-A), all time parameters (days, hours, minutes) must be set manually or received from the NCS.
 - c. The TOD clock stops running if the RT FUNCTION switch has been OFF for 24 hours or more.
 - d. TOD can be checked by pressing keyboard .../TIME three times and watching the display.
3. FUNCTION switch - LD
4. Load/store days
 - a. Press .../TIME
 - b. CLR
 - c. Day numbers
 - d. Sto/ENT
5. Load/store hours and minutes
 - a. Press .../TIME
 - b. CLR
 - c. Hour numbers
 - d. Minute numbers
 - e. Sto/ENT



LOADING CUE FREQUENCY

Check the CEOI for the authorized cue frequency. It is loaded into the CUE channel of FH net rt and is loaded like any preset single channel frequency. A summary of the procedure is given here.

Loading Cue Frequency

S U M M A R Y

- (1) Set switches: FUNCTION - LD; PRESET - CUE; MODE - SC*.
- (2) Load/store cue frequency: Press FREQ, CLR, frequency numbers, Sto/ENT.

*MODE can be at SC, FH or FH-M to load Cue channel.

21-94-72

NOTES

M. Loading cue frequency

1. Cue is used when it is necessary to contact a different FH radio net. It can be used if the operator missed the primary net's opening and needs an ERF. It can also be used to request entry into an alternate net. To cue an FH radio net the cue frequency must be loaded into the CUE channel of the net radio.
 - a. FUNCTION switch - LD
 - b. MODE switch - SC
 - c. PRESET switch - CUE
2. To cue the radio net
 - a. Key transmitter for 4 seconds.
 - b. Un-key the transmitter and wait at least 15 seconds for a reply (repeat these steps several times as necessary).



COLD START OPENING

Communicating in FH mode. Net members must listen closely to the NCS and do only what the NCS directs.

Cold Start Opening

- (1) NCS + MBR. Set switches: FUNCTION - LD; Mode - FH (NCS: **FH-M**); PRESET - MAN.
- (2) NCS. Contact Members. Confirm communication and have members stand by.
- (3) NCS. Retrieve required set. For lockout set, press H-Ld/0, L/9, and number (first digit of lockout set number). For hopset, press H-Ld/0, and channel number.
- (4) NCS. Transmit ERF. Press SEnd/OFST. Confirm member's reception of ERF and have members store it.
- (5) MBR. Store ERF. For lockout set, press Sto/ENT. For hopset, press Sto/ENT, then the channel number.
- (6) NCS. Contact members. Have them set PRESET to where hopset was stored. Then set NCS PRESET switch to hopset channel.
- (7) MBR. On command, set PRESET switch to where hopset was stored.
- (8) NCS. Contact members. Confirm communication on hopset(s). Repeat steps (3) thru (5) for additional hopset ERF.
- (9) NCS + MBR. Set FUNCTION switch to normal operation position.

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21-94-73

NOTES

- N. Cold start opening is the method that should usually be used to open the net.
1. NCS general loading
 - a. Only one set (lockset or hopset) at a time can be in holding memory.
 - (1) A retrieved set does not have to be stored back into permanent memory.
 - (2) To clear the display of a set in holding, retrieve another set or move the FUNCTION switch from LD.
 - b. If display reads TOD the "time of day" must be loaded before trying to ERF.
 - c. Allow enough time between steps for members to do the required actions.
 - d. The MAN channel is the net's communication channel during cold start, be sure members know to return to MAN if contact is lost.
 2. Cold Start Opening Requires that the NCS do the following local fill procedures in the listed order.
 - a. TRANSEC variable
 - b. Lockset
 - c. Hopset
 - d. Time of day (TOD)
 - e. CUE frequency
 - f. MAN frequency
 3. Net member general loading
 - a. If display reads "L7", "L8", or "L7 L8" you are missing mandatory Lockset(s).
 - (1) Contact NCS and request Lockset(s). Only one set (lockset or hopset) at a time can be in holding memory.
 - (2) Lockset must be received before hopset(s).
 - b. If lockset or hopset is in your holding memory an ERF cannot be received.
 - (1) This would happen if another member had to have an ERF repeated.
 - (2) Clear holding memory by storing or moving FUNCTION switch from LD.



COLD START OPENING

Communicating in FH mode. Net members must listen closely to the NCS and do only what the NCS directs.

S U M M A R Y

Cold Start Opening

- (1) NCS + MBR. Set switches: FUNCTION - LD; Mode - FH (NCS: FH-M); PRESET - MAN.
- (2) NCS. Contact Members. Confirm communication and have members stand by.
- (3) NCS. Retrieve required set. For lockout set, press H-Ld/0, L/9, and number (first digit of lockout set number). For hopset, press H-Ld/0, and channel number.
- (4) NCS. Transmit ERF. Press SEnd/OFST. Confirm member's reception of ERF and have members store it.
- (5) MBR. Store ERF. For lockout set, press Sto/ENT. For hopset, press Sto/ENT, then the channel number.
- (6) NCS. Contact members. Have them set PRESET to where hopset was stored. Then set NCS PRESET switch to hopset channel.
- (7) MBR. On command, set PRESET switch to where hopset was stored.
- (8) NCS. Contact members. Confirm communication on hopset(s). Repeat steps (3) thru (5) for additional hopset ERF.
- (9) NCS + MBR. Set FUNCTION switch to normal operation position.

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NOTES

4. Cold start opening requires that all the net members do the following local fill procedures in the listed order.
 - a. TRANSEC variable (same as NCS)
 - b. MAN frequency (same as NCS)
 - c. Locksets, hopsets, and TOD are not required for a cold start.

5. Cold start opening procedures
 - a. NCS + member
 - (1) FUNCTION switch - LD
 - (2) MODE switch - FH (NCS FH-M)
 - (3) PRESET switch - MAN
 - b. NCS
 - (1) Contact members
 - (2) Confirm communication and have members stand by.
 - c. NCS - Retrieve required set
 - (1) For Lockset, press H-Ld/0, L,9 and number (first digit of Lockset number).
 - (2) For Hopset, press H-Ld/0, L,9 and channel number.
 - d. NCS - transmit ERF
 - (1) Press SEnd/OFST
 - (2) Confirm member's reception of ERF and have them store it.
 - e. MBR - store ERF
 - (1) For Lockset, press Sto/ENT
 - (2) For Hopset, press Sto/ENT and channel number.
 - f. NCS
 - (1) Contact members



COLD START OPENING

Communicating in FH mode. Net members must listen closely to the NCS and do only what the NCS directs.

S U M M A R Y

Cold Start Opening

- (1) NCS + MBR. Set switches: FUNCTION - LD; Mode - FH (NCS: FH-M); PRESET - MAN.
- (2) NCS. Contact Members. Confirm communication and have members stand by.
- (3) NCS. Retrieve required set. For lockout set, press H-Ld/0, L/9, and number (first digit of lockout set number). For hopset, press H-Ld/0, and channel number.
- (4) NCS. Transmit ERF. Press SEnd/OFST. Confirm member's reception of ERF and have members store it.
- (5) MBR. Store ERF. For lockout set, press Sto/ENT. For hopset, press Sto/ENT, then the channel number.
- (6) NCS. Contact members. Have them set PRESET to where hopset was stored. Then set NCS PRESET switch to hopset channel.
- (7) MBR. On command, set PRESET switch to where hopset was stored.
- (8) NCS. Contact members. Confirm communication on hopset(s). Repeat steps (3) thru (5) for additional hopset ERF.
- (9) NCS + MBR. Set FUNCTION switch to normal operation position.

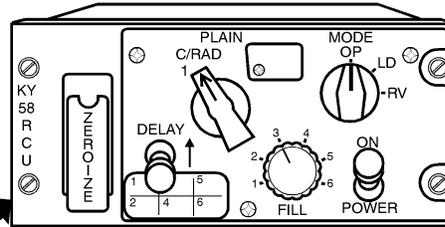
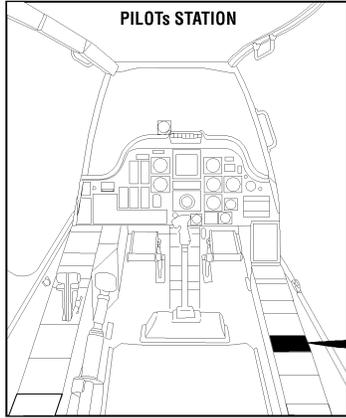
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NOTES

- (2) Have them set PRESET, switch to the number (1-6) where the Hopset was stored.
 - (3) Then set NCS PRESET, switch to the number (1-6) where the Hopset was stored.
- g. MBR - on command, set PRESET to the number (1-6) where the hopset was stored.
- h. NCS
- (1) Contact members
 - (2) Confirm communication on Hopset(s).
 - (3) Repeat steps c, d, and e for each additional Hopset.
- i. NCS + MBR - set function switch to normal operating position



TSEC/KY-58 REMOTE CONTROL UNIT



Z-AHP, REMOTE CONTROL UNIT (RCU)

21-94-74
21-90-07-1A

NOTES