SECTION IV

AUXILIARY EQUIPMENT

TABLE OF CONTENTS

HEATING AND VENTILATION SYSTEM

The heating and ventilation system consists of two subsystems providing selected use of heated or unheated air from separate sources. The Y-valve located at the upper defroster nozzles permits either system to be used for directing air to the windshield as the dominating pressure dictates the free floating flapper valves' position.

HEATING SYSTEM

The cabin heating-defrosting system uses bleed air from the engines' compressors as a heat source; provides air to outlets on both door posts, on both sides of the pedestal, in lower forward window areas, and to nozzles at both windshields as selected by the pilot. The system is controlled by heater switches on the overhead console (figure 4-1), a temperature selecting dial on the right hand door post, and a heat-defrost control lever located on the right-hand side of the pedestal.

HEATING SYSTEM OPERATION

Bleed air shutoff valves and the solenoid on the mixing valve are actuated from the 28V DC essential bus when heater switch is placed ON (figure 4-1, sheet 2). The bleed air shut-off valves are spring-loaded closed, electrically-controlled, and require bleed air pressure to open. When engines are operating to apply bleed air pressure, the shutoff valves will open and bleed air will enter the variable control mixing valve. The bleed air nozzle acts as a jet pump through the valve venturi, drawing in ambient air to control mixed air flow and temperature. In normal heating position, heated air flows to outlets on each door post, each side of the pedestal right-hand lower windshield defrost nozzles and an outlet provided for the forward lower left hand area. In defrosting of windshields, the outlet valve is manually activated by the heat-defrost lever to allow air flow to windshield nozzles (figure 4-1). Placing the defrost control lever, located on the right-hand side of the pedestal, to full forward position provides maximum defrost. This lever actuates a flapper valve and a snap switch to provide all heat to the windshield which mechanically closes off the pedestal outlets and electrically closes the door post outlets. The pressure in the duct system from the heater actuates the free-floating flapper Y-valve, at the lower end of the defrost nozzles, which directs the heated air to the windshield. Circuit protection is provided by circuit breaker CABIN HEATER.

NOTE

Loss of either engine closes the bleed air solenoid valves and heating system is inoperative.

CAUTION

The bleed air heater should be in the OFF position during flight conditions requiring maximum engine power available. Do not use bleed air during Engine Restart During Flight.

VENTILATING SYSTEM

The ventilation-defogging system uses ram air from two intake grills (figure 4-1) on the cabin nose. Two blowers (figure 4-1) on the cabin nose. Two blowers (figure 4-1, sheet 2) deliver air to windshield nozzles and outlets on each side of the instrument panel. Air intake is controlled by an actuating cable knob (figure 4-1). All of the ventilation air can be used for windshield defogging if desired, by mechanically closing the outlets located on each side of the instrument panel. The pressure in the duct system from either ram air or blower will actuate the free-floating valves, located at the lower end of the defrost nozzles, to direct this air to the windshield. The blowers are controlled by the overhead panel switch through the 28V DC essential bus and protected by circuit breaker VENT BLWR.

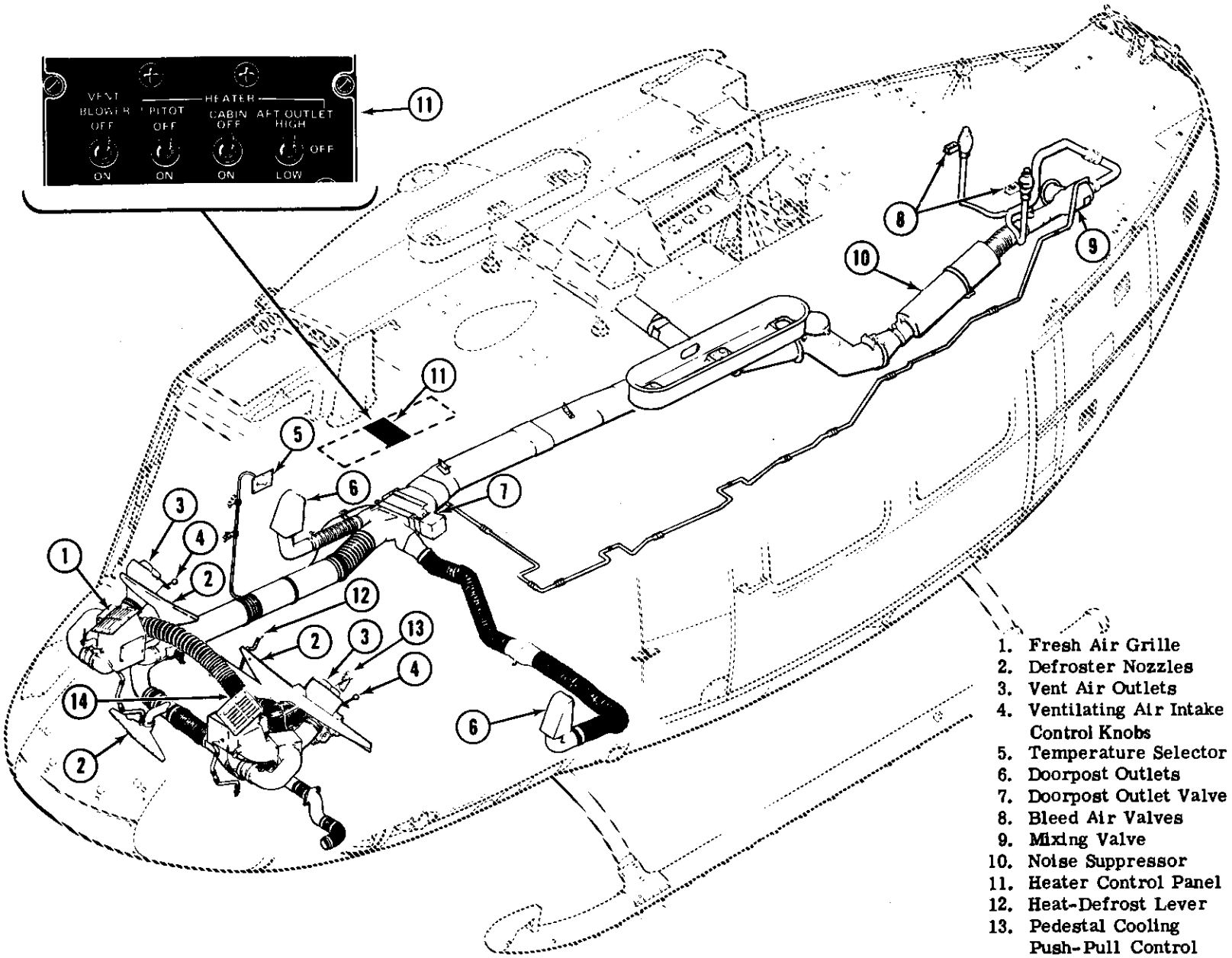


Figure 4-1. Heating and ventilation system (Sheet 1 of 2)

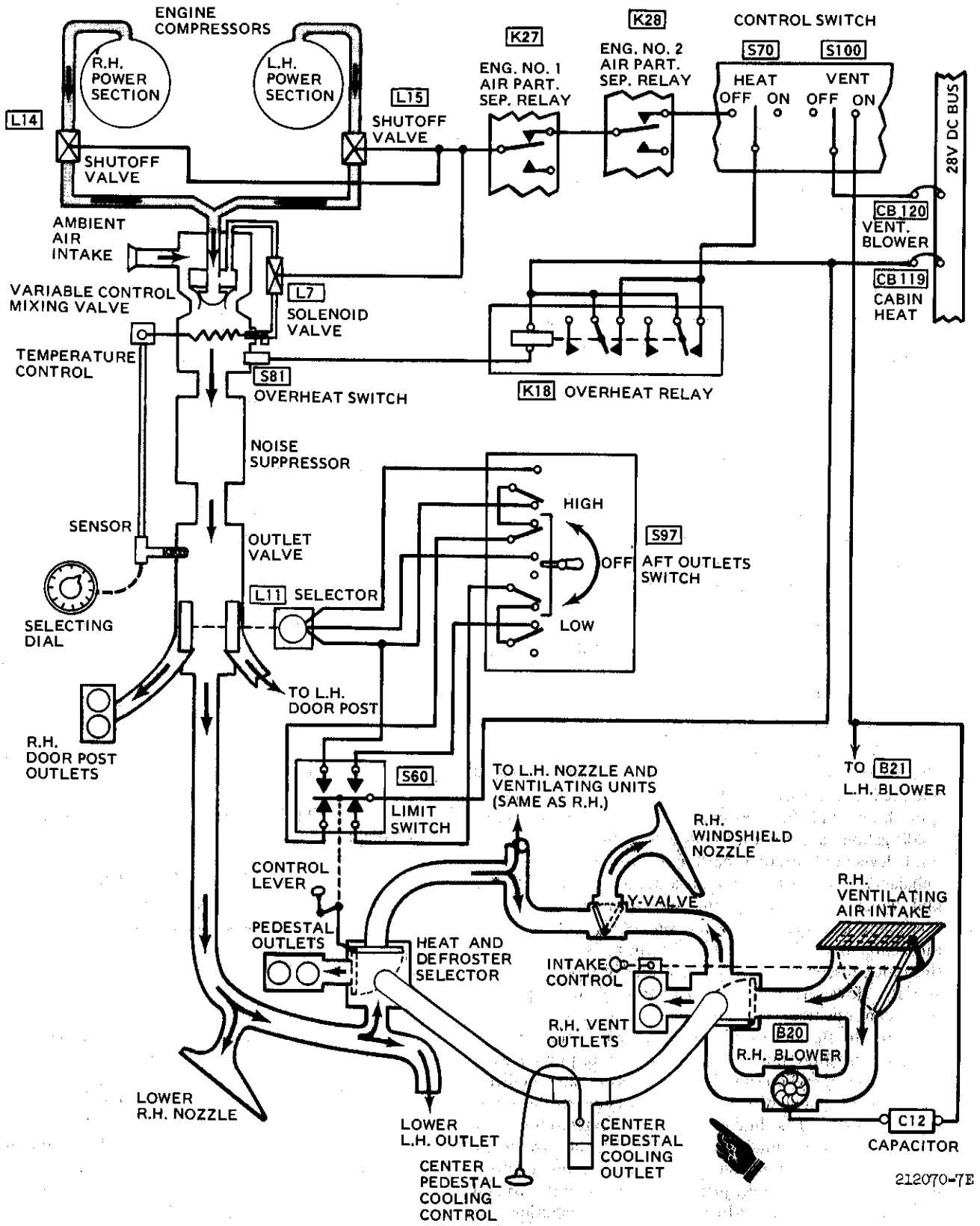


Figure 4-1. Heating and ventilation system (Sheet 2 of 2)

VENTILATING SYSTEM OPERATION

Ram air is admitted by pulling the manual (intake) control knob. When desired, both blowers are started by placing VENT BLOWER switch to ON and unheated air is delivered through vent outlets and windshield nozzles. Cargo compartment upper ram air vents may be opened to provide ram air in the cargo compartment (figure 4-1). Flex hoses connected to the right and left side check valves carry ram air into the forward opening of the pedestal console. This provides supplemental ventilation for cooling transistorized avionics equipment. A shut-off valve is actuated by a push-pull control knob mounted on the left side of the console at the bottom edge of the instrument panel (figure 4-1). This control must be closed (in) when operating heater, and open (out) during operation in temperatures above 19° C (65° F). Blower assist is recommended when OAT exceeds 29.5° C (85° F).

PITOT HEATER

The pitot tube heater prevents the pitot tube from icing over. The electrical circuit includes a heating element, control switch and PITOT HTR circuit breaker. The heating element is in the pitot tube which is mounted externally in the center, forward portion of the cabin roof (figure 1-2). The heating element utilizes 28V DC (figure 1-17) and is energized manually by the PITOT HEATER switch (figure 1-18) in the ON position.

AERIAL SPRAY SYSTEM 3090-3

The 3090-3 aerial spray system is self-contained, windmill operated and consists of the tank and tank structure, the spray boom and the valve controls. The fiberglass tank has a 200 gallon capacity with markings on the side to indicate fluid level and internal baffling to preclude a lateral c.g. imbalance. The system contains a pump, driven by a windmill which is turned by the slipstream of the aircraft. The pump is located on the left side of the aircraft, aft of the center door post. The tank is normally filled through the quick disconnect filler located on the right side of the aircraft. However, it can be filled through the top at the filler cap opening. The spray boom extends 3 1/2 feet from tip to tip and has 56 openings which may be configured with spray nozzles of various sizes or plugs depending on the spray coverage required. The valve controls, located on a panel which folds down between the pilots' seats, consist of a brake to halt the operation of the windmill pump manually, a valve to open the flow to the boom, and a system pressure gauge. In addition, a valve is installed under the tank, just to the left of center to control the flow of fluid when the pump is operating with the flow valve turned off. In the clockwise position, fluid passing through the pump is returned to the tank before passing through the pump again. In the counterclockwise position, fluid is recirculated immediately to the pump.

WARNING

Many of the agents used in the spray system are toxic and caustic. Prior to spray system missions, crew members should familiarize themselves with individual agent properties and special procedures to be followed in the event of crew member or aircraft contamination.

For detailed loading and maintenance information, refer to Army Technical Manual 5-3740-210-2.

NOTE

The spray tank is limited to 195 gallons of fluid.

Preflight Checkout

1. Check five low pressure hoses and three high pressure hoses for security.
2. Check deck fittings for security.
3. Check all pump attachment fasteners.
4. Check tank for damage, leads and alignment.
5. Check booms, boom struts and cables for wear, damage, proper tension and security.
6. Check pump fasteners for security.
7. Check pump fan blades for proper setting (as per flight plan).

CAUTION

Fan blades should be adjusted gradually in a clockwise direction and stopped at the exact setting. If the desired setting is overshot, return blades to maximum counterclockwise setting and then repeat clockwise adjustment.

8. Check fan brake in locked and unlocked positions.

NOTE

Fan should spin freely by hand when unlocked.

9. Listen to pump bearings when fan is handspun to ascertain freedom from friction.

10. Check manually operated bypass valve in proper position according to flight plan.

11. Install and arrange nozzles, orifices and cores on booms.

12. Check for proper operation of manual control valve by actuating valve lever. If inoperative, check for binding in the fittings at the end of the push-pull rod.

Inflight Checkout

CAUTION

- Special care must be taken while taxiing to preclude boom contact with the ground.
- In the event of fan blade damage, leakage, or inability to turn off the flow with the flow valve, engage the pump brake. If boom vibrates or misaligns in flight, land and adjust the tension on the cables. Airspeed should be decreased if vibration is excessive.

1. Subject to flight plan, manual fan brake may be released immediately after takeoff to permit pre-agitation and/or heating of fluid.

CAUTION

Do not run pump dry in actual operation.

2. When planned altitude and speed have been attained and aircraft has reached the designated test or operational area, inflight checkout may proceed.

3. If brake has not been previously released, release at this point. Open valve and visually check nozzles for spray.

4. Observe pressure gauge for proper reading (as per flight plan), observe nozzles for proper operation and flow and check for system leaks.

5. After approximately 30 seconds, close valve and check for leaks.

6. Repeat steps 3 through 5.

7. Apply pump brake or allow to run as per flight plan.

Inflight Operation

NOTE

Spraying operations should be aligned as much as possible to parallel the wind to obtain the most consistent swaths. Turning while spraying should be avoided if possible to avoid the possibility of spray contacting the boom.

1. Release pump brake, if engaged.

2. At desired point, move valve control lever to open position.

3. Conduct spray operation as per plan and prepare inflight portion of system log.

4. At completion of swath, operation or mission, move valve control lever to closed position.

5. Apply pump brake at completion of mission.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

Figure 4-2 lists equipment installed, and their primary characteristics. Antennas are shown in figure 4-3.

AUDIO CONTROL PANELS C6533/ARC

The C6533/ARC communication control provides an intercommunication capability between the crewmember stations. It provides a means by which the crewmembers may select any one of four receiver-transmitters for voice communications. Additional audio circuits may also be monitored. The operator may select seven receiver circuits to monitor. Also, two direct audio inputs are utilized for continuous monitoring at all audio control panels (IFF MODE 4 and MARKER BEACON). A third direct audio input is connected to the four stations in the cargo compartment which provides continuous monitoring of the audio control panel circuit at the four stations. Keying of intercom or selected transmitter is provided through trigger-type microphone switches (figure 1-10) on the cyclic sticks. Depressing the trigger switch to the first detent, permits interphone communication. Depressing the switch to the second detent permits radio transmission. The pilot and copilot have each been provided with a foot switch located on the floor adjacent to the pedestal. The foot switch may be used to transmit, and may also be used for intercom if the selector switch is in the applicable radio or ICS position. The crewmembers are provided with a hot mike switch for intercom.

COMMUNICATION AND NAVIGATION EQUIPMENT

FACILITY	NOMENCLATURE	USE	RANGE	LOCATION OF CONTROLS
Audio Control Panel	C-6533/ARC	Interphone for pilot and crew, Integrates all communication equipment		Pedestal and crewmember stations
VHF-FM Communications	Radio Set AN/ARC-114	Two-way Voice Communications in frequency range of 30.00 to 75.95 MHz	Line of Sight	Pedestal
Voice Security Unit	TSEC/KY-28	Audio processing encoder and decoder		Pedestal
VHF-AM Communications	Radio Set AN/ARC-115	Two-way Voice Communication in the frequency range of 116.000 to 149.975 MHz	Line of sight	Pedestal
UHF-AM Communications	Radio Set AN/ARC-164	Two-way Voice Communication in the frequency range of 225.00 to 399.975 MHz	Line of sight	Pedestal
Automatic Direction Finding	Direction Finder Set AN/ARN-89	Automatic direction finding and homing in the frequency range of 100 to 3000 KHz	150 to 200 miles average depending on terrain interference	Instrument Panel and Pedestal
Magnetic heading Indications	Gyromagnetic Compass AN/ ASN-43	Navigational Aid provides heading information (Slaved and Free Gyro)		Instrument Panel and Pedestal
Identification	Transponder Set AN/APX-72	Transmits a coded reply to IFF radar interrogator system	Line of sight	Pedestal
HF SSB/AM Communications	HF Set AN/ARC-102	Two-way voice communications in the frequency range of 2.0 to 29.999 MHz	Up to 200 miles	Pedestal
Loudhailer System		One-way voice communications	10 to 1500 feet altitude	Pedestal

Figure 4-2. Communication and navigation equipment (Sheet 1 of 2)

COMMUNICATION AND NAVIGATION EQUIPMENT (CONTINUED)

FACILITY	NOMENCLATURE	USE	RANGE	LOCATION OF CONTROLS
UHF Direction Finding	UHF-AM, AN/ARA-50	Airborne direction finding and navigation aid from 225.00 to to 399.95 MHz range	Line of sight	Pedestal
TACAN	TACAN-AN/ARN-118	Provides air navigation and distance measuring	Line of Sight 390 NM surface 200 NM airborne	Pedestal
VHF Navigation (VOR, Localizer)	VOR Set-AN/ARN-82	VHF Navigational aid and VHF audio reception in frequency range of 108.00 to 126.95 MHz	Line of Sight	Pedestal
Tracking and terrain clearance	Radar Altimeter AN/ARN-171(v)	Terrain clearance in feet from 0 to 5000 feet vertical	0 to 5000 feet	Instrument panel
Marker Beacon Reception	Marker Beacon R-1041/ARN or Marker Beacon Receiver 51Z-4	Navigational Aid Navigational Aid	Vertical 50,000 feet Vertical 45,000 feet	Instrument Panel Instrument Panel

Figure 4-2. Communication and navigation equipment (Sheet 2 of 2)

Rotary Selector Switch

The transmitter (rotary) selector switch has six positions, five of which are utilized at each interphone station. Position marked ICS permits audio intercommunications between two or more crewmembers. Position: VHF-FM, 2, UHF-AM, 3, VHF-AM, 4, HF, and 5, loudhailer system if installed. Position 5, loudhailer system, is operated from the pilot's, copilot's and crewmember station 3 positions.

Monitor Switches

Monitor switches at the top of the control panel allow selected monitoring of all communication equipment. These switches are ON when they are pushed forward. Six of the seven monitor (mixing) switches are connected at each aft crewmember interphone stations. All seven switches are connected to the pilot and copilot stations. Switch 1 in the ON position utilizes the VHF-FM, 2 utilizes the UHF-AM, 3, VHF-AM, 4, HF (SSB). Switch 5 must be in the ON position to monitor all Stations and ICS. AUX switch monitors VOR, NAV switch monitors ADF and TACAN.

Volume Control Knob

A volume control knob (figure 4-4) adjusts headset listening level. The maximum obtainable level for any monitored radio equipment depends on the volume control setting of the equipment being monitored.

Hot Mike Switch

A hot mike toggle switch (figure 4-4), when in HOT MIKE position, permits hand-free intercom communication.

Normal Operation

1. All INTERCOMM circuit breakers – IN.
2. Monitor switches – as desired.
3. Volume – adjust the VOL control for a comfortable level at the head set.
4. TRANSMITTER SELECTOR – Set to position desired.

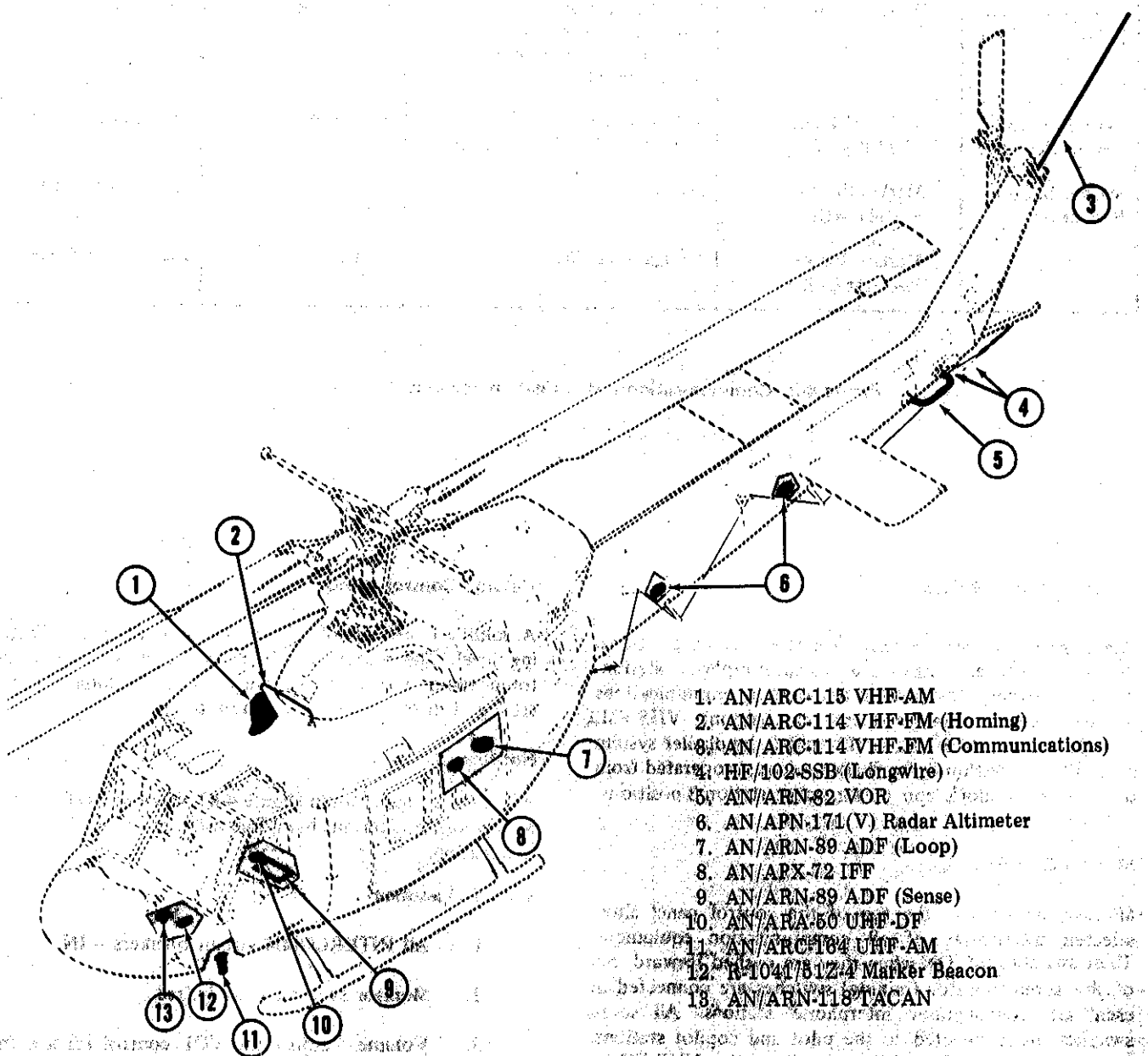
NOTE

Depressing the cyclic switch to the second detent, or the foot switch, keys the selected transmitter or ICS.

5. HOT MIKE – OFF when hot microphone operation is not required.

GUNNER INTERCOMMUNICATION SYSTEM

Interphone keying for the XM-93 and XM-94 armament subsystems, if installed, provide the door gunners interphone keying capability without removing their hands from the grip handles while firing. The system consists of airframe mountings hardware, interconnecting wiring, plugs, and two grip handle push-to-talk spring return switches. The



1. AN/ARC-115 VHF-AM
2. AN/ARC-114 VHF-FM (Homing)
3. AN/ARC-114 VHF-FM (Communications)
4. HF/102-SSB (Longwire)
5. AN/ARN-82 VOR
6. AN/APN-171(V) Radar Altimeter
7. AN/ARN-89 ADF (Loop)
8. AN/APX-72 IFF
9. AN/ARN-89 ADF (Sense)
10. AN/ARA-50 UHF-DF
11. AN/ARC-164 UHF-AM
12. R-1041/512-4 Marker Beacon
13. AN/ARN-118 TACAN

Figure 4-3. Antenna Installation

system is wired parallel with the ICS Keying switches in the respective (gunner) roof mounted ICS stations and associated mic-headset and keying switches. Each side gunner is provided with a push-to-talk switch mounted in the left gun handle grip which allows communication without removing either hand from the gun grips.

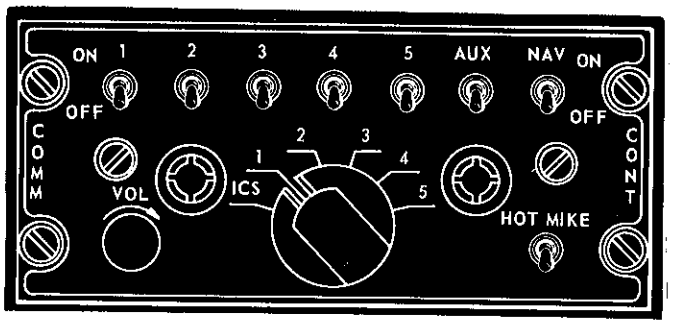


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Figure 4-4. Audio distribution control panel C-6533/ARN

HF RECEIVER - TRANSMITTER – AN/ARC-102

Hf Receiver - transmitter (figure 4-5) is a lightweight airborne radio set. It provides transmission and reception of amplitude – modulated, single-side-band, and continuous-wave signals within the high frequency range of 2.000 to 29.999 MHz on any of its 28,000 channels.

The HF set is used for air-to-air and air-to-ground two-way communications. The operating range of the HF set varies according to the terrain, atmospheric conditions, and the altitude of the aircraft.

The HF set consists of a receiver-transmitter and power supply installed in the aft right-hand avionics compartment; an antenna coupler and impedance matching network; a long wire type antenna installed on each side of the tail boom; remote control panel installed in the pedestal; and interconnecting cable assemblies.

The receiver-transmitter is composed of eleven plug-in modules, which includes an interchangeable internal power supply. The complete unit is contained in a metal case. The receiver-transmitter is controlled from the control panel installed in the pedestal. Primary power to operate the receiver-transmitter is supplied from the helicopter 28-volt DC power supply through the HF power supply.

The HF antenna coupler automatically matches the impedance of the long wire antenna to the frequency selected on the remote control unit. Power to operate the antenna coupler is supplied from the HF coupler circuit breaker.

HF Radio Control Panel

The HF control panel (see figure 4-5) is marked HF. It provides remote control of the HF Radio Set. The operating controls and their functions are as follows:

Control	Function
Mode selector knob	Turns the radio set on or off and selects the mode of operation.

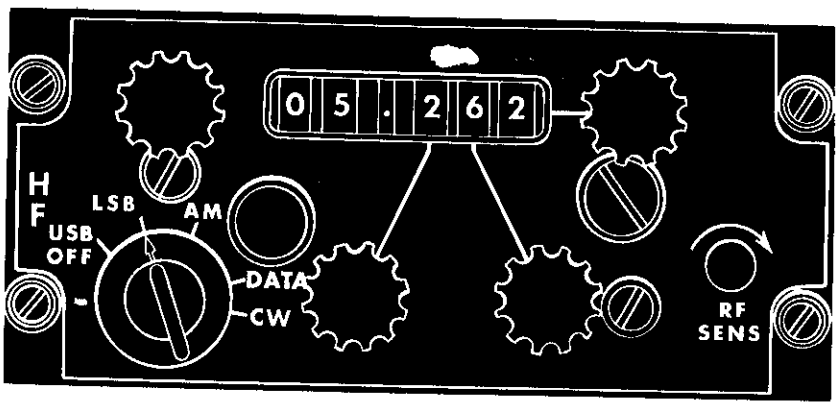

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Figure 4-5. AN/ARC 102 Control panel

Position	Action
OFF-------	Turns the radio set off
USB-------	Selects the upper-sideband mode of operation.
LSB-------	Selects the lower-sideband mode of operation.
AM-------	Selects the amplitude modulated mode of operation.
DATA-------	Permits use of auxiliary data equipment.
CW-------	Selects continuous wave mode of operation.
Frequency select	Select the frequency to which the radio set is to be tuned.

Knob	Action
Megahertz select knob	Selects a megahertz point from 2 to 29, in 1 MHz steps.
One hundred kilohertz select knob	Selects hundred kilohertz point from 0-9, in 0.1 MHz steps.
Ten kilohertz select knob	Selects a ten kilohertz point from 0-9, in 0.01-MHz steps.
One kilohertz select knob	Selects a one kilohertz point from 0-9, in 0.001-MHz steps.
RF SENS knob	Adjusts the volume in the headsets.
Frequency indicator	Indicates the frequency to which the radio set is tuned.

Mode Selector Switch

Depending on the mode of transmission desired, set the mode selector to USB, LSB, or AM. Refer to the voice communication frequency chart (usually located adjacent to the control panel) and set the proper frequency with the frequency select knobs.

HF — Operation

The operating procedure for the HF Radio Set is presented in the following steps:

WARNING

When ground testing ARC-102 equipment, be sure that personnel are clear of antenna. Serious burns can result if body contact is made with the antenna during transmission.

1. Check that HF circuit breakers are in.

2. Position the function selector switch to the desired mode of operation.

3. Rotate the frequency control knob to select the desired frequency.

4. To monitor the HF receiver, turn on monitor switch No. 4.

5. Adjust RF SENS control and volume controls on HF control panel and volume control on audio control panel to a comfortable level.

6. Select position No. 4 on transmitter selector switch.

7. To tune the transmitter, depress the microphone switch momentarily and release. When the side tone ceases, the transmitter is tuned and ready for operation.

8. Depress foot switch or cyclic stick trigger switch to transmit.

9. To turn the HF radio set off, rotate the function selector switch to OFF position.

VHF-FM-AN/ARC-114

The ARC-114 provides two-way frequency modulated (FM) narrow band voice communications and homing capability in the frequency range of 30.00 to 75.95 MHz on 920 channels for a distance range limited to line of sight. Transmission and reception are on the same frequency. A separate guard receiver is included in the radio set to monitor the 40.50 MHz FM distress frequency. The FM antenna is used with the transmitter and guard receiver, and either the FM antenna or the homing antenna are used with the main receiver. Secure communications are possible when the secure-voice encoder/decoder is used with the FM

facility. The homing function of the FM supplies inputs to the course indicators to provide visual steering indication for homing on a received signal. Warning flags are provided in the course indicators to inform the pilot and copilot of an adequate homing signal. It has the additional capability for retransmission of voice, CW or X-mode communications when a second set is installed in the aircraft; however, since the second VHF-FM set is not installed this capability is not utilized. The radio set is marked VHF FM COMM and is mounted on the pedestal (figure 1-12). Primary power is supplied by 28V DC and protected by circuit breaker VHF-FM.

VHF – FM Control Panel

The FM radio transmitter and receiver operate on the same frequency and are simultaneously tuned by frequency selector knobs on the front panel. When the function selector switch is in the T/R GUARD position a fixed-tuned guard receiver is energized to provide constant monitoring of the FM distress frequency regardless of the radio frequency setting. During normal communications, the aircraft VHF/FM antenna is used for transmission and reception. The audio signal level is adjusted by the volume control on the panel and is then applied to the impedance matching network through the secure voice encoder/decoder when installed. The impedance matching network loads and distributes the receiver audio signal to the audio control panels for selection. When the appropriate switch selection is made, the audio is amplified in the audio control panel. The audio level is further adjusted by the audio control panel volume AUDIO control (figure 4-6). Selected audio is fed to the operator's (pilot's, copilot's or crew's) headset.

Control	Function
FUNCTION Selector	
OFF position	Power off.
TR position	Receiver-On; Transmitter – standby
TR GUARD position	Receiver – On; Transmitter – standby; guard receiver – ON.

NOTE

Reception on guard frequency is unaffected by frequencies selected for normal communications.

HOMING	Activates the homing mode and display on course indicator. May also be used to receive normal voice communications.
RETRAN	Activates the retransmission mode when second FM set is installed in the aircraft. May be used also for normal voice communications.
FREQUENCY Selectors	
Left Selector	Selects first two digits of desired frequency.
Right Selector	Selects third and fourth digits of desired frequency.
RCVR TEST Button	When pressed, audible signal indicates proper receiver performance.
SQUELCH	Squelch control adjusted by maintenance personnel only.
AUDIO	Adjusts receiver volume.

VHF-FM – Operation

The FM receiver audio output signal is connected to "Monitor No. 1" input circuit of the audio control panels. The microphone keying and transmitter audio input signals are connected to Selector Switch position No. 1 of the audio control panels (figure 4-4).

1. VHF-FM XCVR circuit breakers – IN.
2. TRANSMIT/RECEIVE.
   a. Function selector – T/R or T/R Guard
   b. Frequency – Select.
   c. RVCR TEST – Press to test.
   d. AUDIO – Adjust.
      (1) Transmitter selector switch - Number 1 position.
      (2) Monitor Switch No. 1 – ON.
      (3) Microphone switch – Press.
3. FM HOMING.
   a. Function selector – HOMING.

b. Frequency controls – Adjust to frequency of desired homing station.

c. AUDIO – Adjust.

d. Course Deviation Indicator – Observe. If sufficient signal strength is indicated (flags out of view) note the position of the Course Deviation Indicator (CDI).

e. Fly the helicopter toward the homing station by heading in the direction that causes the CDI to position itself in the center of the indicator scale. To ensure that the helicopter is not heading away from the homing station, change the heading slightly and note that the CDI deflects in the direction opposite that of the turn.

f. Observe the GLIDE SLOPE INDICATOR (GSI). When approaching the FM station the GSI deflects downward.

4. RETRAN – NOT USED.

5. STOPPING PROCEDURE.

Function Selector – OFF.

COURSE INDICATOR – ID-387/ARN

The course indicator (figure 4-7) is used in conjunction with the following equipment: VHF-FM, Gyromagnetic Compass, VOR and TACAN. Individual, detailed functions of the indicator are covered with the respective sets listed above.

Course Indicator – Operation

1. Course Deviation Indicator (CDI) indicates any of the following:

a. VOR course deviation from selected VOR radial or localizer path when system is energized and VOR/TACAN switch is in VOR position.

b. TACAN course deviation from selected TACAN radial when system is energized and VOR/TACAN switch is in TACAN position.

c. VHF-FM homing is energized when VHF-FM function selector switch is in HOME position. (Overrides a. and b. for both pilot's and copilot's indicators.)

2. The Glide Slope Indicator (station approach indicator) is connected only when the VHF-FM is utilized in HOMING mode and indicates increasing signal strength by movement downward.

3. Heading Pointer displays Gyromagnetic Compass heading information and displays heading in relation to course selected with the SET knob and shown in the course selector window.

4. Aircraft with R-1041/ARN Marker Beacon installed, the marker beacon light will illuminate when the marker beacon switch is on and a marker beacon signal received.

5. Warning Flags.

a. Course warning (OFF) flag will disappear when a reliable TACAN, VOR or VHF-FM homing signal is being received.

b. Course warning flag and a glide slope off flag will disappear when a reliable VHF-FM homing signal is received.

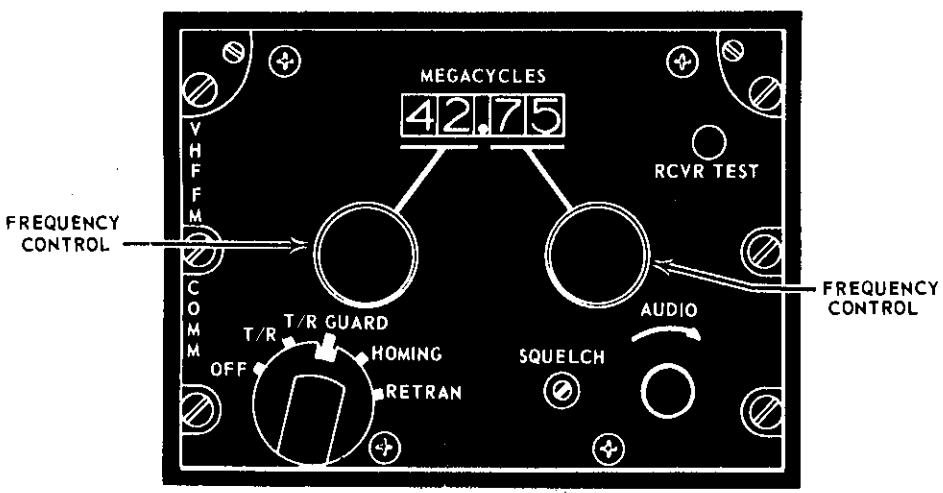

Figure 4-6. VHF-FM-AN/ARC-114 Control panel

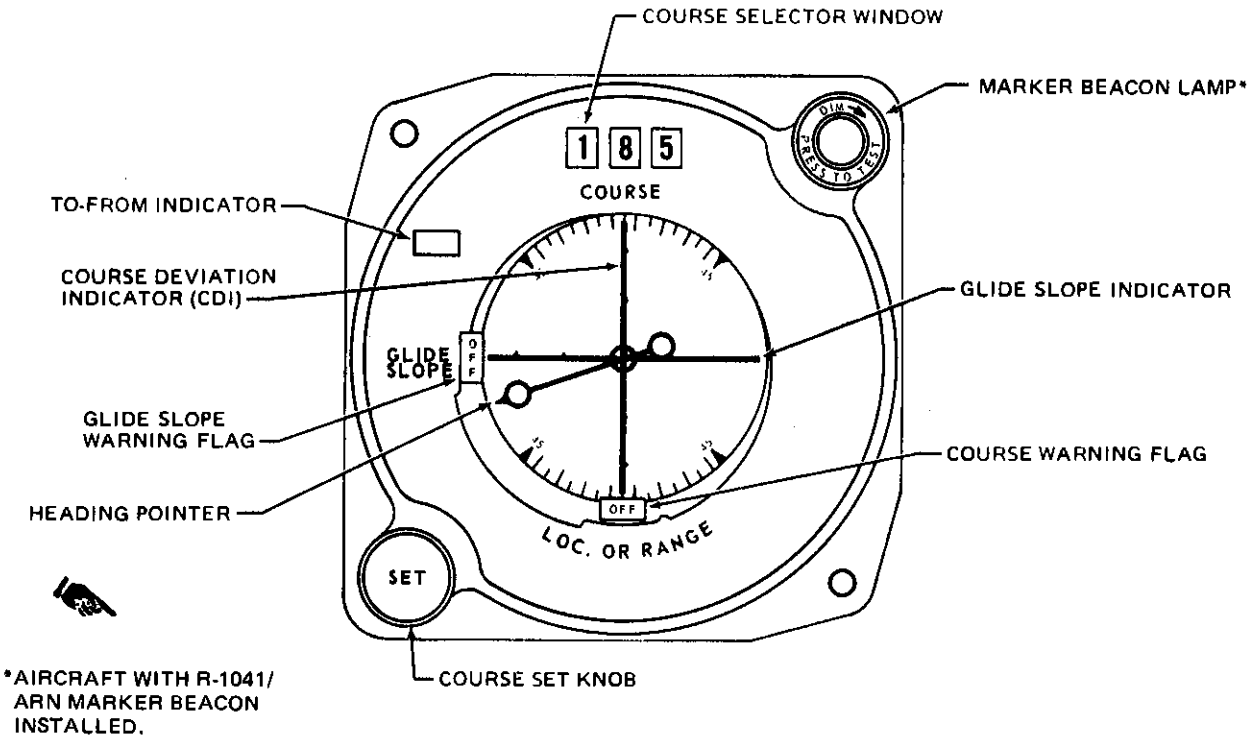

Figure 4-7. ID-387/ARN Course indicator

6. Course selector window depicts the heading selected by the SET knob. The heading pointer indication relates to the course shown in the course selector window.

7. To-From indicator depicts the aircraft's position in relation to the selected VOR or TACAN ground station depending on the heading selected in the course selector window.

TSEC/KY-28 SECURITY SET

Voice security unit TSEC/KY-28 is a classified audio processing device that accepts voice communications from the aircraft communications system, encodes the audio, and delivers it to the FM radio set for transmission. It decodes information received by the FM radio set and delivers decoded voice through the communications system to the headset. The control indicator panel is shown in figure 4-8. Power is supplied by the 28V DC essential bus and protected by circuit breaker VOICE SECURITY.

Security Set Operation

1. Control indicator POWER ON switch ON Figure 4-8).

CAUTION

The POWER ON switch must be in the ON position, regardless of the mode of operation, whenever the control indicator C-8157/ARC is installed in the aircraft.

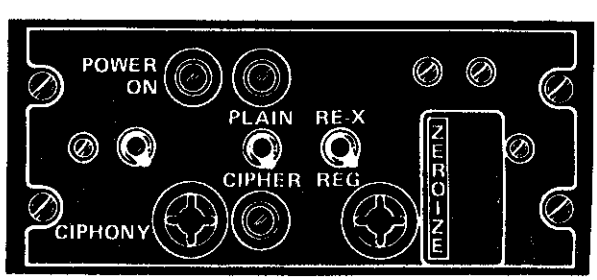

Figure 4-8. Control indicator C-8157/ARC

2. VHF-FM set – POWER ON.

NOTE

When power is initially applied, an automatic alarm procedure is initiated. A constant tone is heard in the headset and, after approximately 2 seconds, the constant tone will change to an interrupted tone.

3. To clear the interrupted tone, depress and release the microphone switch and the interrupted tone will no longer be heard. The circuit will be in a standby condition ready for either transmission or reception.

NOTE

No traffic will be passed if the interrupted tone is still heard after depressing and releasing the microphone switch.

4. Set control unit for desired type of operation (Plain mode or Cipher mode).

5. Plain Mode (figure 4-8)

a. Control Indicator POWER ON switch – ON

b. PLAIN – CIPHER switch – PLAIN (indicated by red light)

c. RE-X-REG switch – REG; except when operating with retransmission units, at which time switch will be placed in RE-X position.

d. Press the microphone switch to transmit; release for reception.

6. Cipher Mode (figure 4-8)

a. PLAIN-CIPHER switch – CIPHER (indicated by green light). Cipher lights are also located adjacent to each crew members ICS control panel.

b. RE-X-REG switch – REG; except when operating with retransmission units, at which time the switch will be placed in RE-X position.

c. To transmit, press the microphone switch. DO NOT TALK: In approximately 1/2 second, a beep will be heard. This indicates the receiving station is now capable of receiving your message. Transmission can now commence.

NOTE

Only one TSEC/KY-28 can transmit on a given frequency. Always listen before attempting to transmit to assure that no one else is transmitting.

d. When transmission is completed, release the microphone switch. This will return equipment to standby condition.

e. To receive, it is necessary for another station to send you a signal first. Upon receipt of a signal, the cipher equipment will be automatically switched to the receive condition, which will be indicated by a short "beep" heard in the headset. Reception will then be possible. Upon loss of the signal, the cipher equipment will be automatically returned to standby condition.

f. To clear the code place ZEROIZE switch in the UP position to clear the code from the TSEC/KY-28 (lift the cover to throw switch).

VHF-AM-AN/ARC-115

The ARC-115 provides two-way VHF amplitude modulated (AM) narrow band voice communications within the frequency range of 116.00 to 149.975 MHz on 1360 channels for a distance range of approximately 50 miles, line of sight. A separate guard receiver is included in the facility to monitor the 121.500 MHz VHF distress frequency. The receivers are disabled during transmitter operation. The radio set is marked VHF AM COMM and is mounted on the left side of the pedestal (figure 1-12.) Power is supplied by the 28V DC essential bus and protected by circuit breaker VHF AM, XCVR.

VHF-AM Radio Control Panel

The VHF command radio transmitter and main receiver operate on the same frequency and are simultaneously tuned by frequency selector knobs on the panel (figure 4-9). When the function selector switch is in the T/R GUARD position the fixed-tuned guard receiver is energized to provide constant monitoring of the VHF distress frequency regardless of the main radio frequency setting. The aircraft VHF antenna is used for transmission and reception. The audio signal level is adjusted by the volume control on the panel. When the appropriate switch selection is made, the audio signal is amplified in the audio control panel. The audio signal level is further adjusted by the audio control panel AUDIO control. When the appropriate selector switch setting is made, and the microphone switch is depressed, the microphone output is amplified in the audio control panel and applied to the VHF command transmitter. Sidetone audio is routed back to the headsets in the same way as receiver audio above.

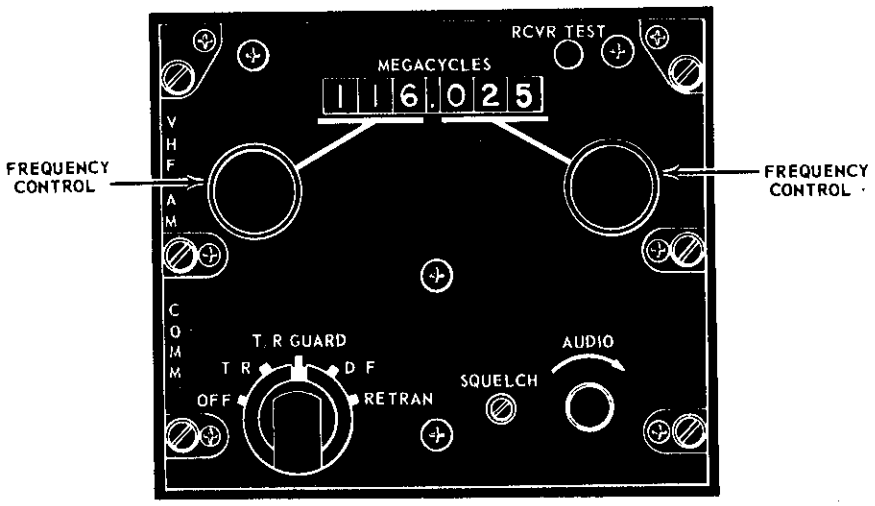

Figure 4-9. VHF-FM-AM-AN/ARC-115 Control panel

Control	Function
FUNCTION Selector	
OFF position	Power off.
TR position	Receiver-On; Transmitter – standby.
TR Guard position	Receiver-On; Transmitter – standby; guard receiver-ON.

NOTE

Reception on guard frequency is unaffected by frequencies selected for normal communications.

DF	Not used.
RETRAN	Not used.
FREQUENCY Selector	
Left selector	Selects first three digits of desired frequency.
Right selector	Selects last digits of desired frequency.
RCVR TEST	When pressed, audible signal indicates proper receiver performance.
SQUELCH	Squelch control adjusted by maintenance personnel only.
AUDIO	Adjusts receiver audio volume.

VHF – Operation

The VHF receiver's audio output signal is connected to Monitor No. 3 input circuit of the audio control panels. The microphone keying and transmitter audio input signals are connected to transmitter selector switch position No. 3 of the audio control panels.

1. VHF-AM XCVR circuit breaker – IN.
2. TRANSMIT/RECEIVE.
   a. Function selector – T/R or T/R GUARD
   b. Frequency – Select.
   c. RCVR TEST – Press to test.
   d. AUDIO – Adjust.
   e. Transmit.
      (1) Transmitter selector – Number 3 position.

(2) Monitor switch No. 3 – ON.

(3) Microphone switch – PRESS for transmitting, RELEASE for reception.

3. STOPPING PROCEDURE.

Function Selector – OFF.

UHF COMMAND RADIO AN/ARC-164(V)

The UHF command radio provides voice transmission and reception in the frequency range of 225.000 to 399.975 megahertz, with 7000 frequencies available in steps of 0.025 megahertz. Receiver and transmitter tuning is accomplished automatically after a frequency change. A main receiver and a guard receiver are used in the system. The main receiver tunes to any selected frequency; the guard receiver remains tuned to a guard frequency. In addition, the UHF radio set is capable of automatic direction finder (ADF) reception. Electrical power for the UHF radio is supplied from the 28V DC essential bus and is protected by a circuit breaker located on the overhead circuit breaker panel.

UHF Command Radio Controls

COMMAND CONTROL PANEL. (See figure 4-10.) The three-position (MANUAL, PRESET, GUARD) frequency mode selector switch, located on the right side of the control panel, is used to select the type of frequency control desired. With the switch positioned to PRESET, the preset channel selector knob, located at the top right of the control panel, can be used to select any one of 20 preset frequencies. The preset channel selected is displayed on the chan readout indicator to the left of the preset channel selector knob. When the frequency mode selector switch is positioned to MANUAL, the five manual selector knobs, located across the top of the control panel, can be used to select any one of 7000 frequencies in the operating range. The manual selector knobs control the digits making up the desired frequency. Each of the digits appears in a window above the associated knob. When the selector switch is positioned to GUARD, reception and transmission are on the guard frequency.

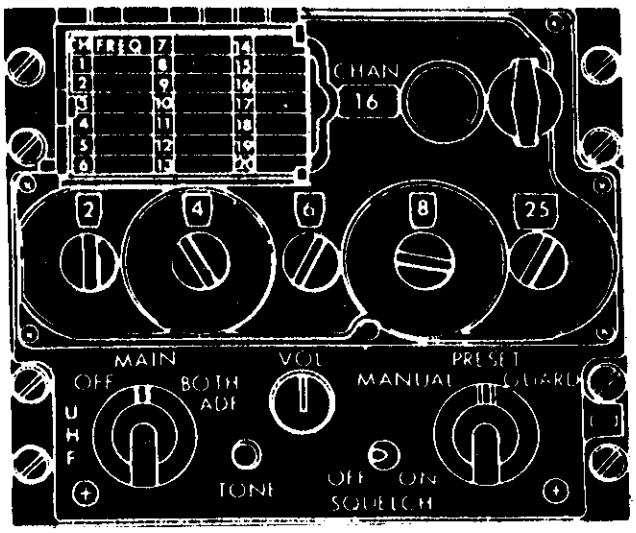

Figure 4-10. UHF Command Radio Control Panel, AN/ARC-164(V)

* Fig Added
SEE Sup Is-93 NOTE

The GUARD position of the frequency mode selector switch should not be used except in actual emergencies.

The four-position (OFF, MAIN, BOTH, ADF) function selector switch on the left side of the control panel turns the radio set on and determines whether the main or the guard receiver is being used in conjunction with the transmitter. When the switch is positioned to MAIN, the main receiver and the transmitter are ready for use, and the guard receiver is inoperative. If the function selector switch is at MAIN and the frequency mode selector switch is at GUARD, the main receiver and the transmitter will be ready for use on the guard frequency. With the function selector switch positioned to BOTH, the main receiver, guard receiver, and the transmitter are all ready for use; the main receiver and transmitter are ready for use on the selected frequency and the guard receiver monitors the guard frequency.

When the function selector switch is positioned to ADF, the guard receiver is disabled and the main receiver is switched to the UHF direction finder antenna. When the switch is in this position, the transmitter will tune to the manual, preset, or guard frequency, depending on the position of the frequency mode selector switch, but the switching arrangement within the command control panel is such that no transmissions can be made. When the function selector switch is in any position other than ADF or OFF, the tone button at the bottom of the control panel can be used to transmit a continuous wave tone modulated at 1,020 Hz. Pressing the tone button energizes the transmitter and an audio oscillator. A volume control knob, located at the bottom center of the control panel, is used to adjust the level of the audio signal.

The two-position (OFF, ON) squelch switch enables (ON position) or disables (OFF position) the main and the guard receiver squelch.

Normal Operation of the UHF Command Radio.

To put the radio into operation, proceed as follows:

1. Place the function selector switch to any position except ADF or OFF; allow one minute for warmup.

2. Select a channel, using the preset channel selector knob or the manual selector knobs.

3. To receive, actuate the respective UHF monitor switch to the intercommunication system control panel.

4. To transmit, place the selector on the intercommunication system control panel to UHF.

To turn the UHF command radio system off, place the function selector switch to OFF.

Emergency Operation of the UHF Command Radio.

NOTE

When operating a UHF command radio under emergency conditions, set the frequency mode selector switch to GUARD and the function selector switch to MAIN. Do not use the BOTH position, since the noise from the two receivers may make the incoming signal unintelligible.

If the equipment fails in some particular function, the remaining workable functions may satisfy minimum requirements for operation. If transmission on a preset channel is not possible, an attempt may be made to use a manually selected channel or the guard frequency. If reception fails on a selected channel, reception on the guard frequency may be tried.

BEARING DISTANCE HEADING INDICATOR

The BDHI (Bearing Distance Heading Indicator) is used in conjunction with the following equipment: ADF, VOR, Gyromagnetic Compass, TACAN and UHF-DF (5 and 46, figure 1-11). Individual detailed functions of the indicator are covered with the respective sets listed above.

BDHI—Operation

1. Pointer No. 1 (figure 4-11) indicates magnetic bearing of either ADF or UHF-DF. The UHF-DF signal overrides the ADF signal when both are energized.

2. Pointer No. 2 indicates magnetic bearing of either TACAN or VOR according to the position of the respective pilot's or copilot's VOR/TACAN toggle switch (figure 4-15).

3. Top Index indicates gyromagnetic compass heading read out in both MAG and DG modes (figure 4-12). Synchronization of indicator heading dial is accomplished by the synchronization knob on the controller (figure 4-12) located on the pedestal (figure 1-12).

4. Range Indicator (figure 4-11) indicates distance to the TACAN station. An OFF flag is visible when the circuit is de-energized or receiving an unreliable signal.

* See Sup IS-93

UHF DIRECTION FINDER SYSTEM AN/ARA-50

Direction Finder Group is a lightweight airborne direction finding system operated in the UHF range. The equipment is used with the existing UHF receiver-transmitter. With this direction finder group, bearings may be taken from the aircraft to any transmitter operating in the 225.0-to 399.95 megahertz range. The UHF-DF may be used for course navigation, search and rescue operations, or for determining the relative azimuths of other aircraft. The UHF DF set is powered by 28V DC, 115V AC 400 Hz and 26V AC 400 Hz and is protected by circuit breakers NAV UHF-DF, NAV UHF-DF, and BDHI pointer 1. The navigational information from the UHF direction finder system is presented on No. 1 pointer of both BDHI's. Automatic switching circuit is provided whereby UHF-DF navigational information overrides ADF information when D/F function is selected on the UHF control panel.

UHF-DF—Operation.

1. UHF Function Selector Switch—D/F position.

2. UHF-DF Range Select Switch—As required.

NOTE

At short distances to the stations, there may be less bearing pointer oscillation if the range select switch is positioned to SHORT. With the range select positioned to LONG, a RF amplifier is placed in the circuit which increases the range.

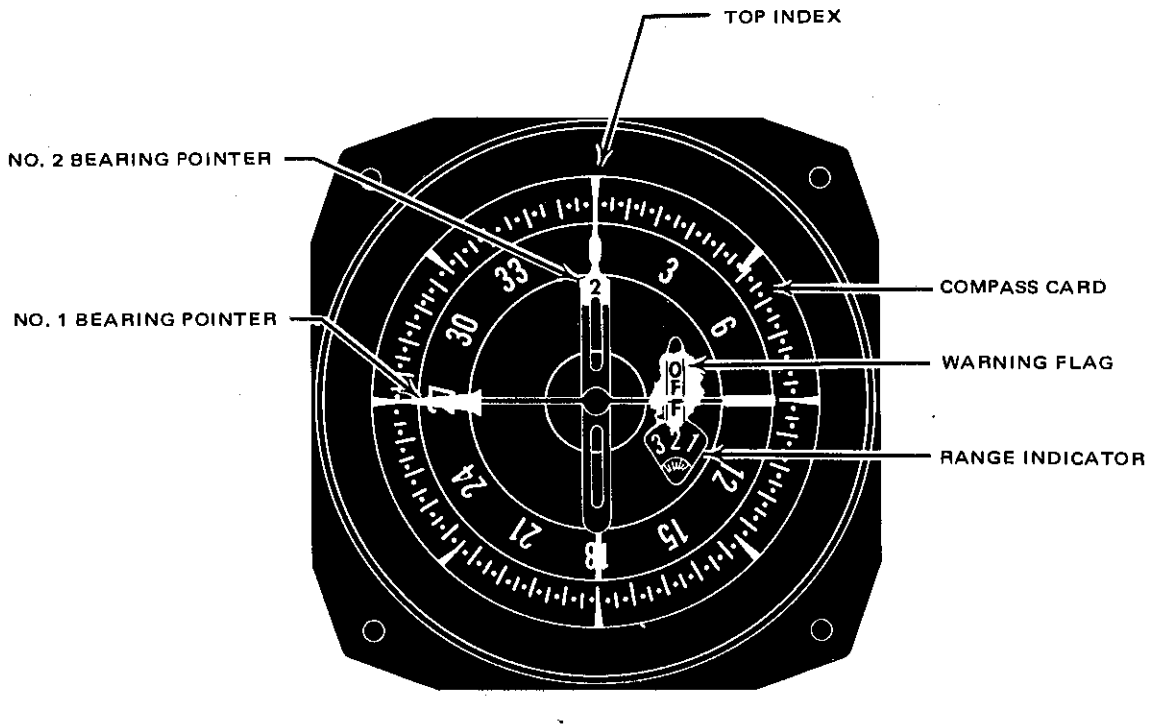

Figure 4-11. Bearing distance heading indicator

3. The station or aircraft to which a bearing is desired must transmit to obtain a bearing. While the station or aircraft is transmitting, select the DF position with the UHF Function Selector Switch and read the magnetic bearing under the No. 1 bearing pointer on the pilot's or co-pilot's BDHI.

UHF-DF Range Select Switch

The UHF-DF Range Select Switch is located on the lower portion of the pilot's instrument panel (figure 1-11) and is used in conjunction with the UHF-DF system. Refer to TACAN-VOR panel (figure 4-15).

GYROMAGNETIC COMPASS AN/ASN-43

The gyromagnetic compass set provides a visual indication of the aircraft magnetic heading on the BDHI compass card (figure 4-11). Two modes of operation, magnetic and directional gyro, are available. The normal mode (figure 4-12) is the slaved mode, in which the directional gyro is slaved to the earth's magnetic meridian by the flux valve of the compass. The directional gyro mode is used in latitudes where magnetic heading information is unreliable. The gyro compass system is powered by 115V AC and 26V AC 400 Hz and is protected by circuit breakers GYRO CMPS, GYRO CMPS, CMPS SERVO AMPL, and CMPS IND located on the circuit breaker panel (figure 1-18).

Compass Heading Synchronization

Heading synchronization is accomplished by proper use of the synchronization knob (figure 4-12) on the compass controller. By observing the indication of the annunciator on the controller, the dot (•) or cross (+) will indicate

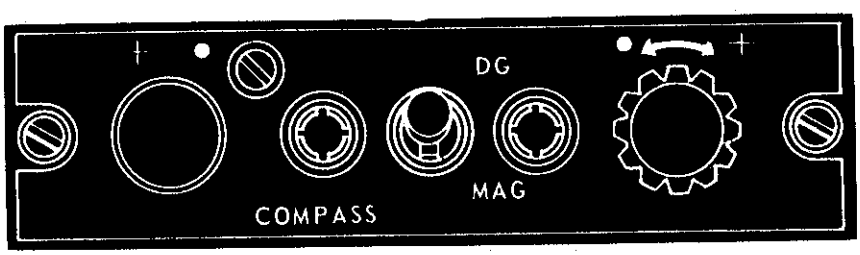

Figure 4-12. Gyromagnetic compass controller – AN/ASN-43

the direction that the synchronizing knob should be turned to give immediate and accurate synchronization of the compass card (figure 4-11).

Gyro Compass—Operation

1. BATTERY switch – ON (OFF for APU).

2. Circuit breakers – IN.

3. DG/MAG switch – as desired; DG operation is recommended when flying in latitudes greater than 70°.

4. In MAG mode Gyro Compass System will remain synchronized during normal flight maneuvers. In normal operation, the annunciator will oscillate slightly about center position; however, during certain aircraft maneuvers, compass system may become unsynchronized, as seen by the annunciator moving off center. The slaving circuits in compass system will slave slowly to remove errors and synchronize the system. If fast slaving is desired, turn the synchronizing knob (figure 4-12) in the direction indicated by the annunciator until the annunciator is centered again.

5. When operating in the DG mode, the annunciator becomes inoperative and the gyro is unslaved periodically update the heading to a known heading reference by rotating the synchronizing knob.

6. STOPPING PROCEDURE.

Circuit Breakers – OUT.

VOR SET-AN/ARN-82

Radio Receiving Set AN/ARN-82 receives very high-frequency omni range (VOR) signals and localizer signals in the frequency range of 108.00 to 117.95 MHz from a ground transmitter. The signals are demodulated and used to drive course deviation indicators and bearing pointers. Audio signals may also be received in the communications band from 118.00 to 126.95 MHz. The combination of the localizer capability and a glide slope receiver make up an instrument landing system (ILS).

NOTE

A glide slope receiver has not been installed in this aircraft.

VOR—Description

The VOR Set is powered by 28V DC, 26V AC 400 Hz, and protected by circuit breakers NAV-OMNI and BDHI Pointer No. 2.

NOTE

With both VOR/TACAN selector switches in the VOR position bearing information is presented on No. 2 pointer of both BDHI's and the course deviation information is presented on both course indicators. (See figures 4-7 and 4-11).

Control	Function
VOL Control	Controls receiver audio volume
Power switch	Turns primary power to the radio set ON or OFF and allows for test of accuracy of Course Deviation Indicator in the TEST position.
Megahertz selector	This is the control knob on the left side. It is used to selec the megahertz of the desired frequency.
Kilohertz selector	Used to select the kilohertz of the desired frequency

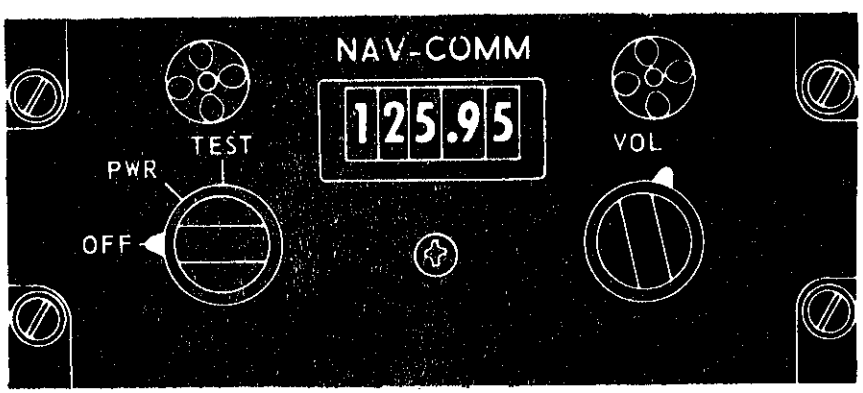

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Figure 4-13. VOR-AN/ARN-82 Control panel

VOR – Operation

For proper operation of pointer NO. 2 of BDHI's, the AN/ASN-43 system must be energized; therefore CMPS SERVO AMPL, CMPS IND and both GYRO CMPS circuit breakers must be in for the VOR system to function properly. When the switch is in the TEST position and energized, the VOR test circuit in the radio receiver disables the receiver squelch circuit. A course warning flag indicates when, either the localizer or VOR is selected, the signal is too weak for reliable operation, or when a malfunction develops in the receiver.

1. TACAN/VOR selector switch – VOR.
2. Battery switch – ON (OFF for APU).
3. NAV-OMNI, BDHI POINTER No. 2 and respective ICS circuit breakers – IN.
4. Power switch – PWR.
5. Frequency – Select.
6. AUX switch on audio control panel – ON.
7. Volume – Adjust.
8. Identify station.
9. STOPPING PROCEDURE

   Power switch – OFF

VOR – Operational Check

With the power switch in the TEST position and 180° set in the course selector window, the CDI should center and TO should show in the To - From Indicator. A noise in the headset that stops when the power switch is returned to PWR indicates that the squelch circuit is working properly.

TACAN AN/ARN-118V

The TACAN Navigation Set AN/ARN-118(V) is a polar coordinate navigation system that is used to determine the relative bearing and slant-range distance to a selected TACAN station. The selected TACAN station can be a ground, shipboard, or airborne station. The ground and shipboard TACAN stations are considered surface beacons. An airborne station only supplies slant-range distance information unless the aircraft is specially equipped with a bearing transmitter and rotating antenna. TACAN Navigation Set AN/ARN-118(V) is not capable of transmitting bearing information but does supply slant-range distance replies when interrogated. The TACAN Navigation Set has provisions for 126 X channels and 126 Y channels. The Y channels differ from the X channels in pulse spacing. The maximum operating range of the TACAN Navigation Set is 390 NMI when the selected TACAN station is a surface beacon and 200 NMI when the selected TACAN station is an airborne beacon.

NOTE

The Y channels were developed to alleviate congestion of the X channels but have not yet been implemented in AF ground stations. Use of Y channels is encouraged in air-to-air modes.

The AN/ARN-118 TACAN navigation system is capable of providing a continuous indication of the bearing and distance of the aircraft from any selected TACAN surface beacon located within a line-of-sight distance up to 390 nautical miles. Bearing information is determined by the measurement of the phase difference between a reference bearing signal and a variable signal, both transmitted by the surface beacon. TACAN information is presented on the Bearing Indicators Number 2 pointer, Distance Indicators and Course Indicators unless VOR is selected. The TACAN system is powered by 28 volts dc power and 115 volts ac power. Circuit breakers are located on overhead dc circuit breaker panel and ac circuit breaker panel.

Controls for the TACAN systems are located on the TACAN control panel (figure 4-14) on the pedestal console. A five-position (OFF, REC, T/R, A/A REC, A/A T/R) function switch selects the mode of operation. With the function switch in the REC position, only bearing information is received, with the switch in T/R position, both bearing and range data are received. The A/A REC and A/A T/R positions of the switch are the same as the REC and T/R positions, except that the TACAN system is transmitting and receiving signals to and from a suitably equipped cooperating aircraft rather than a ground station.

NOTE

The TACAN system can receive both distance and bearing information from other suitably equipped aircraft but can only transmit distance information.

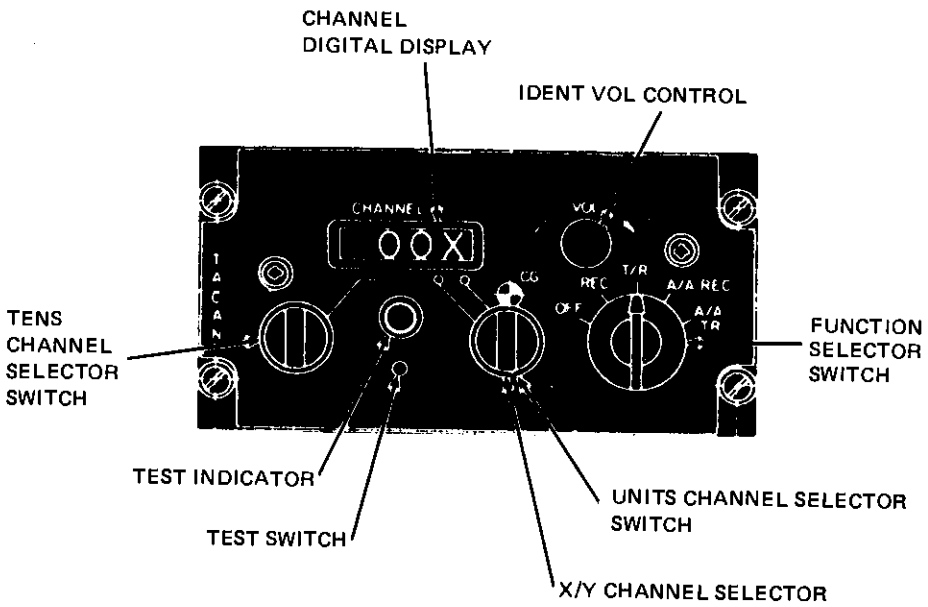

Figure 4-14. TACAN Control Panel (AN/ARN-118V)

CAUTION

The channel select switch contains a built-in stop to prevent rotation past the nine (9) position on the units (one's) digit setting. Do not attempt to override the stop. Reverse direction when the stop is reached.

The channel selector tunes the equipment to any of 126 frequency channels. The volume control knob varies the volume of the audio signals received from the surface beacon and heard through the intercommunication system when the appropriate monitor button is pulled out. The manual self-test provides a test of the complete TACAN system except for the antennas.

Manual Self-Test of TACAN System

To initiate self-test, select a course of 180 degrees, place the function switch in the T/R position, and allow 90 seconds for warmup. Depress the test button and observe that the indicator illuminates for about one second; and that for about seven seconds, the DME flags come into view and the bearing pointers indicate 270 degrees. For the next fifteen seconds, the flags go out of view, the DME's indicate 000.0 ($\pm$ 0.5), the bearing pointers indicate 180 ($\pm$ 3) degrees, the course deviation bar centers to within $\pm$ 1/2 dot, and the TO-FROM arrow indicates TO. When the self-test is complete, all indicators return to indications displayed prior to initiation of self-test. A failure is recorded on the indicator light if the light stays on during the test; however, the test can be performed again in the REC mode. If the indicator light does not come on in the REC mode, the malfunction is isolated to the transmitter section and the bearing information is valid.

CAUTION

Bearing and/or distance indications may still be present when the TEST lamp is on. Such indications could be either partially usable on grossly inaccurate. They should be cross-checked, using every available means. Be prepared for the possibility of TACAN equipment failure if the TEST lamp illuminates.

Automatic Self-Test of TACAN System

An automatic self-test occurs when the receiver signal becomes unreliable or the signal is lost, to insure that the TACAN system is operating properly. The results of the automatic self-test are the same as for the manual self-test, except that the DME flags and NAV flags remain in view.

Air-to-Air Modes

A/A T/R MODE

In the A/A T/R mode, the AN/ARN-118(V) interrogates a cooperating aircraft and receives slant range distance information. If the cooperating aircraft has bearing transmitting capabilities, bearing information is also received. Up to five aircraft can receive slant range from one cooperating aircraft at one time.

A/A REC MODE

In the A/A REC mode, only bearing can be received; however, the cooperating aircraft must have bearing transmitting capabilities.

NOTE

In Air-to-Air modes, the receiving aircraft must select a channel 63 channels above or below the cooperating aircraft channel. Use of Y channels is recommended to prevent possible DME interference. Also to prevent interference from IFF or transponder signals, select Y channels or select X channels between 11 and 58 and 74 to 121.

Normal Operation of the TACAN System

1. TACAN Circuit Breakers – In

2. Place the TACAN/VOR switch in TACAN position.

3. Place the function switch to desired position. Allow a 90-second warmup period.

4. Turn the channel selector knobs to the desired channel.

5. Check station identification through interphone and set volume on the TACAN volume control.

6. To turn TACAN system off, place the function switch in the OFF position.

TACAN-VOR PANEL

The NAV EQUIPMENT SELECTOR PANEL (figure 4-15) located on the instrument panel, contains the following switches: UHF/DF RANGE, CODE HOLD, MARKER BEACON SENSING, and TACAN-VOR.

UHF-DF Range Switch

The UHF-DF RANGE LONG-SHORT switch is used in conjunction with the AN/ARA-50 Direction Finder Group and the RF Amplifier. When the switch is placed in the LONG position, the RF Amplifier is placed into the circuit which increases the effective operating range of the UHF Direction Finder. With the UHF-DF RANGE LONG-SHORT switch in the SHORT position, the RF Amplifier is not in the circuit and the UHF Direction Finder operates in a normal manner.

Code Hold Switch

The CODE HOLD ON-OFF switch is used in conjunction with the MODE 4 CODE-HOLD switch on the Transponder

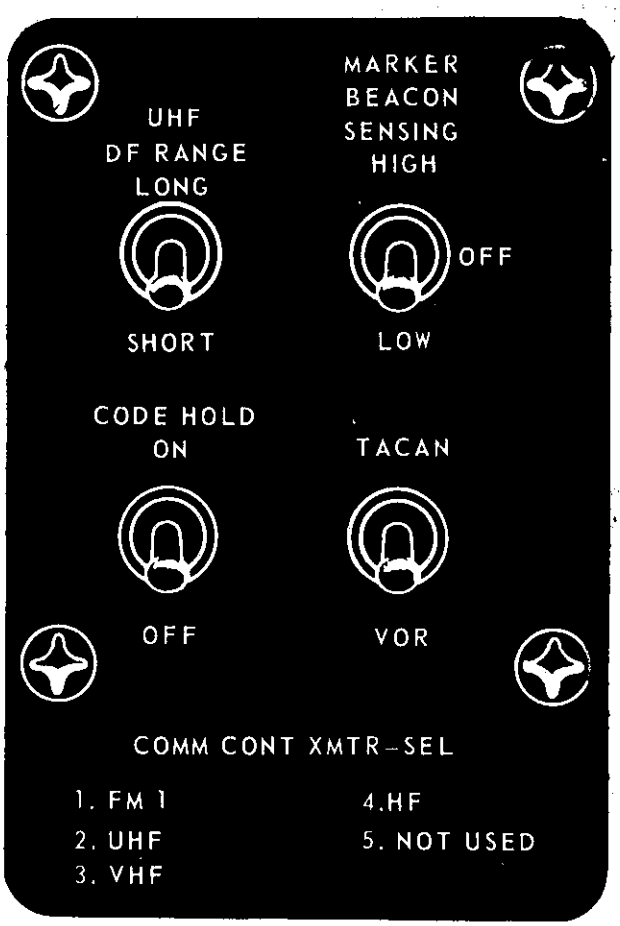

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Figure 4-15. NAV equipment selector panel.

Set Control. The MODE 4 switch is a guarded toggle switch. Function of the switch is to arm the code hold function of the Computer on the ground to prevent loss of code when electrical power is turned off. In flight, the function is to dis-arm the code hold function of the Computer and prevent holding code when electrical power is turned off or lost.

Code Hold Switch Operation

1. Arming of Code Hold Function.

a. Upon landing the aircraft, place the CODE HOLD ON-OFF switch in the ON position. At this time the IFF CODE HOLD caution light located on the caution panel should illuminate.

b. Momentarily hold the MODE 4 CODE switch on the Transponder Set Control to the HOLD position. This completes the operation for "holding" the MODE 4 information.

2. To dis-arm the code hold function, place the CODE HOLD ON-OFF switch to the OFF position.

3. Zeroing (removing of code) can be accomplished at any time with electrical power turned on, by placing the MODE 4 CODE switch on the APX control to the ZERO position.

NOTE

The IFF CODE HOLD caution light requires an external ground to illuminate. When the CODE HOLD ON-OFF switch is in the ON position the IFF CODE HOLD caution light will illuminate. However, by placing the IFF CODE HOLD ON-OFF switch to ON will not prevent the Computer from dumping the MODE 4 code information when aircraft electrical power is removed. The computer will hold the MODE 4 code information only when the IFF CODE HOLD ON-OFF switch is in the ON position and the APX transponder control MODE 4 CODE switch is then momentarily held in the HOLD position.

Marker Beacon Sensing Switch

The MARKER BEACON SENSING HIGH-OFF-LOW switch is used to turn the marker beacon receiver on, off, and for increasing or decreasing sensitivity of the marker beacon receiver. The up position marked HIGH increases the sensitivity for flying high altitudes and the down position marked LOW decreases the sensitivity for flying low altitudes. The center position is marked OFF, and the marker beacon receiver is off when the switch is in this position. The marker beacon lamps on both course indicators/or instrument panel are connected in parallel to the marker beacon receiver output. In order to check the lamp indicators for a bulb filament test, the HIGH-OFF-LOW switch must first be placed in either HIGH or LOW position. Then the push-to-test check may be made.

NOTE

Aircraft not modified by T.O. 1H-1(U)N-591 do not have a marker beacon audio volume control. The audio will be adjusted to a level that is compatible with the audio levels of the other systems furnishing audio to the Audio Distribution Control Panel. However, if a change in marker beacon audio level is desired during flight, it can only be accomplished by changing the Audio Distribution Control Panel volume control. When the R-1041A/ARN Marker Beacon Receiver is accessible, a volume control locater on the front of the receiver may be adjusted to obtain the desired marker beacon audio level.

TACAN-VOR Switch

The pilot's TACAN-VOR switch is located between the clock and the CODE HOLD ON-OFF switch. The copilot's TACAN-VOR switch is located between the BDHI and the Vertical Velocity Indicator. The up position selects TACAN and the down position selects VOR for both the pilot's and copilot's switches. The bearing outputs of both the TACAN and VOR are presented on both pilot's and copilot's Course Deviation Indicators and both Bearing-Distance-Heading Indicators (BDHI's), depending on the selection made on the pilot's and copilot's TACAN-VOR switches. The results of the different selections made by the pilot and copilot are presented as follows:

1. Pilot's TACAN-VOR switch to TACAN, Co-pilot's switch to TACAN:

BDHI Indications:

a. Pointer No. 2 of both BDHI's indicates TACAN magnetic bearing.

b. Distance indicators of both BDHI's are connected to the TACAN at all times and will indicate distance to the selected TACAN ground station whenever the TACAN is turned on.

Course Indicator Indications:

a. The CDI'S of both indicators indicate course deviation from the course selected by the pilot's ID-387/ARN SET knob.

b. The vertical OFF flags (bearing alarm) titled "LOC. OR RANGE" (at bottom of indicator) are connected in parallel to the TACAN system. The TO-FROM indicators of both Course Indicators are connected in parallel to the TACAN system.

c. The copilot's SET knob is not used with this selection of the two TACAN-VOR switches.

2. Pilot's TACAN-VOR switch to VOR, Copilot's switch to TACAN:

BDHI Indications:

a. Pointer No. 2 of pilot's BDHI indications VOR magnetic bearing. Pointer No. 2 of copilot's BDHI indicates TACAN magnetic bearing.

b. Both pilot's and copilot's distance dials indicate the distance to the selected TACAN ground station.

Course Indicator Indications:

a. The pilot's course indicator is connected to the VOR system, and the copilot's course indicator is connected to the TACAN system. The pilot's SET knob selects the desired radial to the VOR station, and the copilot's SET knob selects the desired radial to the TACAN station.

b. The pilot's vertical (bearing alarm) OFF flag indicates whether or not the received VOR signal is acceptable. The copilot's vertical (bearing alarm) OFF flag indicates whether or not the received TACAN signal is acceptable. The pilot's TO-FROM indicator is connected to the VOR system, and copilot's TO-FROM indicator is connected to the TACAN system.

3. Pilot's TACAN-VOR switch to VOR, Copilot's switch to VOR:

BDHI Indications:

a. Pointer No. 2 of both pilot's and co-pilot's the BDHI's indicate VOR magnetic bearing.

b. Even though both the pilot's and co-pilot's TACAN-VOR switches are in the VOR position, the range indicator will display the distance to the selected ground station whenever the TACAN system is turned on.

Course Indicator Indications:

a. The CDI's of both indicators indicate course deviation from the course selected by the pilot's ID-387/ARN SET knob.

b. The vertical OFF flags and the TO-FROM indicators on both indicators are connected to the VOR system.

c. The copilot's SET knob is not used with this selection of the two TACAN-VOR switches.

4. Pilot's TACAN-VOR switch to TACAN, Co-pilot's switch to VOR:

BDHI Indications:

a. Pointer No. 2 of pilot's BDHI indicates TACAN magnetic bearing. Pointer No. 2 of copilot's BDHI indicates VOR magnetic bearing.

b. Both pilot's and copilot's distance dials indicate the distance to the selected TACAN ground station.

Course Indicator Indications:

a. The pilot's course indicator is connected to the TACAN system, and the copilot's course indicator is connected to the VOR system. The pilot's SET knob selects the desired radial to the TACAN station, and the copilot's SET knob selects the desired radial to the VOR station.

b. The pilot's vertical OFF flag and the TO-FROM indicator are connected to the TACAN system, and the copilot's vertical OFF flag and the TO-FROM indicator are connected to the VOR system.

AUTOMATIC DIRECTION FINDING SYSTEM – AN/ARN-89

The ADF (figure 4-16) provides the pilot and copilot with visual indications of the relative bearing to the station being received. The ADF radio-bearing indications can be used for homing and obtaining a fix. The information is displayed on the BDHI No. 1 pointer. The ADF receiver has one continuous-tuning frequency range of 100 to 3,000 kHz. Three modes of operation allow the ADF to

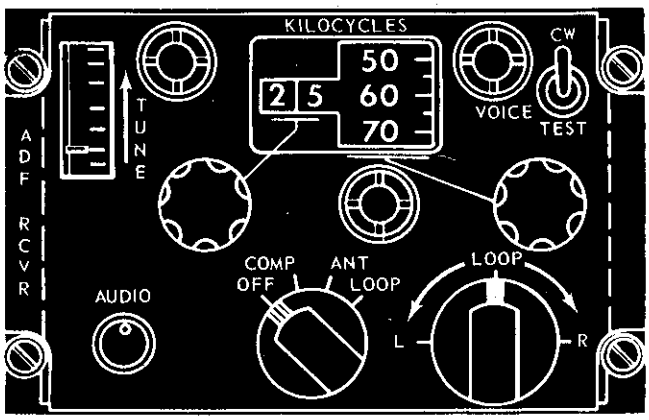


Figure 4-16. ADF Control panel

function as an automatic direction finder, a manual direction finder, or as an AM receiver. A beat frequency oscillator is included to provide an audible indication of unmodulated carrier signals. The ADF set is powered by 28V DC and protected by circuit breakers NAV-LF ADF. The ADF set and BDHI Pointer No. 1 is powered by 26V AC 400 Hz and protected by circuit breaker BDHI Pointer 1.

NOTE

The ADF receiver's audio output signal is connected to the NAV Monitor input circuit of the audio control panel.

Control	Function
AUDIO	Adjusts receiver volume.
FUNCTION Selector	
OFF position	Power off.
COMP position	ADF operation as an automatic direction finder.
ANT position	Receiver provides aural information only.
LOOP position	ADF operation as a manual direction finder using the loop antenna only.
LOOP switch	Manual positioning of loop antenna when ADF is operating in manual direction finding mode.
TUNE meter	Up deflection of the needle indicates most accurate turning of the receiver.
FREQUENCY Selector	
Left Selector	Selects first two digits of desired frequency.
Right Selector	Selects third and fourth digits of desired frequency.
CW VOICE TEST Switch	
CW position	Provides tone that may be used for identification, tuning, or CW station.
VOICE position	Permits normal aural reception.
TEST position	Rotates No. 1 pointer to provide a check of pointer accuracy with function selector in the COMP position, Inoperative in LOOP and ANT positions. The switch is spring loaded away from TEST position.

ADF-Operation

NOTE

The ADF bearing information is presented on No. 1 pointer of both BDHI's.

1. NAV switch on audio control panel - ON.

2. ADF Function

   a. Function selector – ANT

   b. Frequency – Select

   c. Voice for modulated beacon; CW for unmodulated (or CW beacon)

   d. AUDIO – Adjust

   e. Tune for max tune needle deflection, and "zero beat" tone, simultaneously when using unmodulated beacon. On modulated beacons tune for max. needle deflection – there will be no "zero beat" tone.

   f. Function selector – COMP.

3. In the event the ADF function is inoperative, use the following procedures for manual direction finding:

   a. Function selector - Loop.

   b. Voice CW switch - CW.

   c. Rotate loop for maximum reception and retune.

   d. Rotate loop to zero tone (null) and adjust volume for a 5 to 8 degree null width.

e. Check for ambiguity - The No. 1 bearing pointer will either read the magnetic bearing to the station or be 180 degrees out.

4. STOPPING PROCEDURE

Function Selector - OFF.

RADAR ALTIMETER SYSTEM – AN/APN-171 (V).

The electronic radar altimeter set (figure 4-17) is powered by 28V DC and 115V AC 400 Hz, and protected by three circuit breakers marked RADAR ALT.

Radar Altimeter – Description

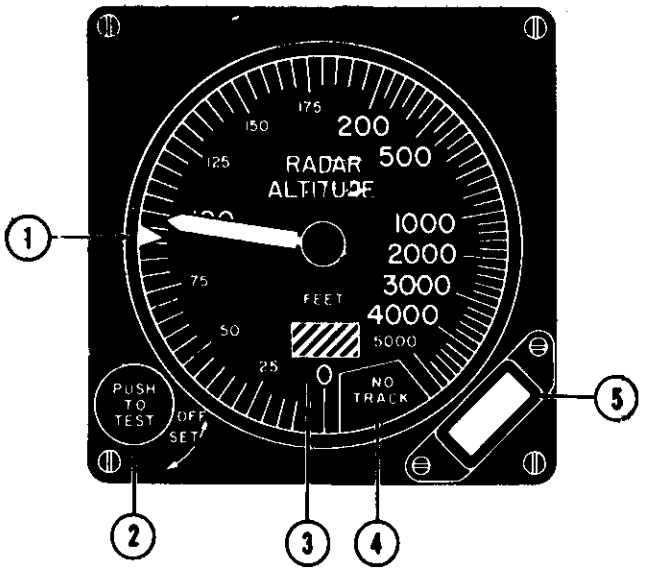
The radar altimeter is an electronic low-level altitude indicating system which provides the following features:

1. The radar altimeters (ID-1345/APN-171 (V) height indicators) provide precise altitude indications from 0 to 5000 feet. The indicators contain a power ON-OFF, PUSH TO TEST and low altitude WARN SET index controls.

2. The system includes a manually set, low-level warning lamp to warn that a predetermined low altitude limit has been reached. (When lit, a yellow background with the word "LOW" in black is illuminated.

3. The radar altimeters provide a black and yellow striped flag indication in the indicator window when loss of altitude sensing occurs. The flag also appears in the indicator window when loss of the power occurs.

4. A knob, in the lower left-hand corner of each radar altimeter, controls the power applied to the electronic altimeter set and rotates the altitude limit index when the control is rotated. When this control is pressed, it switches the system into the self-test mode of operation. The self-test mode of operation provides a visual indication of 100± 15 feet on the indicator if the system is operating properly. If the system is operating normally, i.e. no malfunctions, the OFF flag will be hidden. The altitude limit index sets the altitude at which the low altitude limit switch actuates.



1. Low Altitude Bug
2. Low Altitude Set
3. Power Off No Track Flag
4. No Track Mask
5. Low Altitude Warning

Figure 4-17. Radar altimeter – AN/APN-171(V)

Radar Altimeter – Operation

WARNING

This system indicates altitude directly below the aircraft. In a bank, the actual altitude will be lower than indicated.

NOTE

Allow five minutes for warmup.

1. RADAR ALT circuit breakers (figure 1-18) – IN.

2. Indicator control knob (figure 4-17) – Rotate clockwise from OFF.

3. Select desired low altitude warn index by rotating control knob until indicator index pointer reaches desired ground clearance setting.

4. Test system by depressing control knob. When knob is depressed, a reading of 100 plus or minus 15 feet will be indicated if the system is functioning properly. Releasing the push to test knob restores the system to normal operation.

MARKER BEACON RECEIVER – R-1041/ARN

The marker beacon receiver set provides the pilot and copilot with visual and aural indications for determining the position of the helicopter in relation to a 75 MHz marker beacon transmitting station. When the helicopter is within the radiated field of the marker beacon transmitting station, the MARKER BEACON indicator lamp (figure 4-7) illuminates, and an aural tone is heard in the headset. The outer marker tone is a low tone 400 Hz. The middle marker tone is 1300Hz high tone. The audio signal is strongest directly over the transmitting station and diminishes in strength as the helicopter passes through the signal cone.

Marker Beacon Receiver (R-1041/ARN) – Description

The marker beacon receiver (figure 4-7) includes a HIGH/LOW sensing switch (figure 4-15) and the audio signal is controlled by the VOL control on the audio control panel (figure 4-4). The marker beacon light has a press-to-test feature incorporated on the light. (Refer to TACAN-VOR PANEL, Section IV.) The HIGH/LOW switch on the TACAN/VOR switch panel (figure 4-15) turns the marker beacon ON or OFF and selects the sensitivity. When the switch is set to LOW, receiver sensitivity is reduced, and the marker beacon reacts to nearby transmitting stations only. The M/B RECEIVER is powered by 28V DC essential bus and protected by circuit breaker MARKER BEACON.

MARKER BEACON RECEIVER 51Z-4

The marker beacon receiver set provides the pilot and co-pilot with visual and aural indications for determining the position of the helicopter in relation to a 75 MHz marker beacon transmitting station. Visual identification is provided by one of three colored indicator lamps; blue for ILS outer markers; amber for ILS middle markers; white for airways, fan, or Z markers. Aural identification is provided by one of three audio tones in the headset. The outer marker tone is a low tone 400 Hz. The middle marker tone is a 1300 Hz tone. The airways, fan, or Z marker tone is 3000 Hz. The audio signal is strongest directly over the transmitting station and diminishes in strength as the helicopter passes through the signal cone.

Marker Beacon Receiver (51Z-4) - Description

The marker beacon receiver includes a HIGH-OFF-LOW sensing switch on the TACAN-VOR selector panel (figure 4-15), a VOL control on the audio distribution control panel (figure 4-4), six visual indicators with press-to-test and dimmer features on the instrument panel, 51Z-4 Marker Beacon Receiver, 390R-1 Shockmount, and AT-640( )/ARN antenna. The HIGH-OFF-LOW switch turns the marker beacon ON or OFF and selects the sensitivity. The VOL control on the audio control panel controls the audio signal output of the marker beacon receiver. The visual indicators provide visual indication of reception of marker beacon signal. The marker beacon receiver is powered by the 28V DC essential bus and protected by a 5-ampere circuit breaker labeled MARKER BEACON in the overhead circuit breaker panel.

Marker Beacon Receiver – Operation

1. Battery switch – ON (OFF for APU).
2. MARKER BEACON and respective INTER COMM circuit breakers – IN.
3. HIGH/LOW SENSING switch (figure 4-15) – As desired.
4. Volume control on audio control panel – Adjust.
5. STOPPING PROCEDURE

   HIGH/LOW/OFF sensing switch – OFF.

IFF RADAR IDENTIFICATION SET – AN/APX-72

The AN/APX-72 IFF basic equipment enables the helicopter to identify itself automatically when properly challenged by friendly surface and airborne radar equipment. Basic equipment consists of the receiver-transmitter, antenna and control panel (figure 4-18) which enables the set to operate in modes 1, 2, and 3/A. When Computer KIT-1A/TSEC (Classified) is installed mode 4 is operational. When Altimeter-Encoder AAU-21/A is installed, the altitude of the helicopter can be transmitted in mode C to an interrogating station. Test Set, TS-1843/APX is an inflight test set that is used to indicate either satisfactory or unsatisfactory performance of the over all

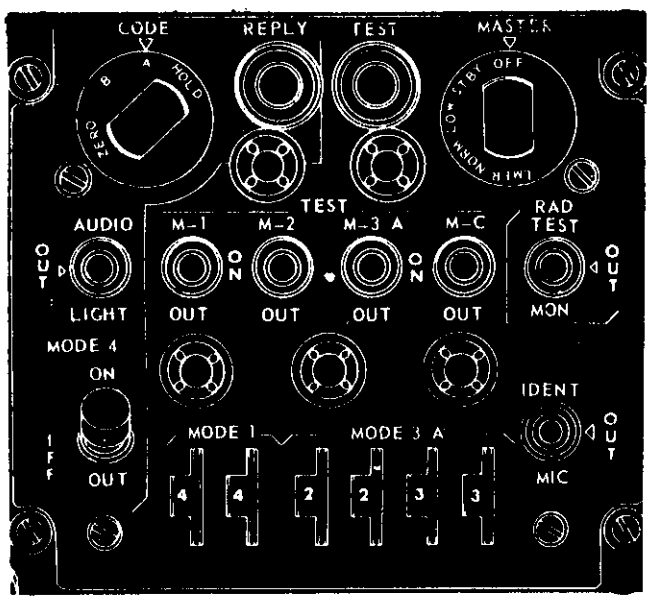
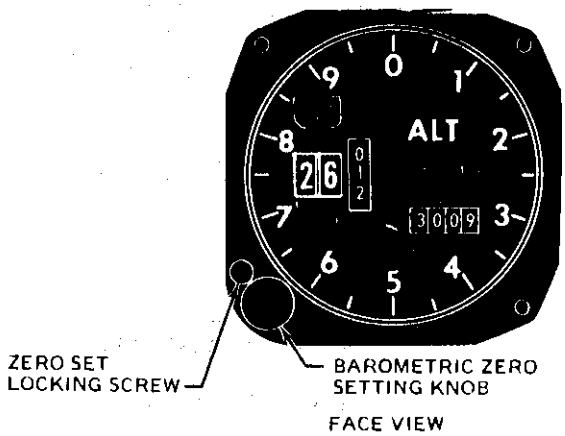


Figure 4-18. Transponder APX-72 control panel



AAU-21A ALTIMETER-ENCODER

Figure 4-19. Altimeter encoder – AAU-21A

transponder system on a go-no-go basis. RT-859/APX-72 transceiver and TS-1843/APX test set is powered by the 28V DC essential bus and protected by circuit breakers IFF XCVR and IFF TEST SET. KIT-1A/TSEC computer is powered by the 115V AC essential bus and protected by circuit breaker IFF CMPTR.

IFF Control Panel

The IFF control panel (figure 4-18) located on the pedestal, contains the switches and controls for applying power and selecting the mode of operation of the transponder equipment. The switches, controls and their function are as follows:

Master Switch. The master switch is a 5-position rotorary switch. It is used to select the following operating conditions:

OFF – No electrical power is applied to the set; the set is not operating.

STBY – Primary power is applied to the set. The tubes are warmed and ready for immediate operation; however, the set cannot be used to receiver or transmit.

LOW – The receiver operates at a reduced sensitivity and replies are transmitted only in response to nearby sources of interrogation signals.

NORM – The receiver portion of the transponder is operating at full sensitivity. Transmitter power to the transponder is the same for both LOW and NORM position.

EMER – Causes automatic transmission of emergency reply signals.

IDENT – MIC switch. Enables IDENT reply operation.

IDENT position – When momentarily actuated (switch has spring-loaded return) initiates IDENT reply operation of approximately 30 seconds.

MIC position – allows the pilot to initiate code reception through UHF-AM set by pressing the microphone switch.
OUT position – Disables any IDENT reply from the transponder system.
M-1 switch – Enables the transponder set to reply to Mode 1 interrogations when in the ON position. Enables the Test Set TS-1843/APX (when installed) to locally interrogate the transponder while also enabling the transponder to reply when held in the test position. The test set will then also measure the characteristics of the reply and illuminate the TEST light when the reply is satisfactory.
M-2 switch – Enables the transponder set to reply to Mode 2 interrogations when in the ON position. Disables the reply to Mode 2 interrogation in the OUT position. Enables the Test Set TS-1843/APX, (when installed) to locally interrogate the transponder while also enabling the transponder to reply when held in the test position. The test set will then also measure the characteristics of the reply and illuminate the TEST light when the reply is satisfactory.
M-3/A switch – Enables the transponder set to reply to Mode 3/A interrogations when in the ON position. Enables the Test Set TS-1843/APX (when installed) to locally interrogate the transponder while also enabling the transponder to reply when held in the TEST position. The test set will then also measure the characteristics of the reply and illuminate the TEST light when the reply is satisfactory.
M-C. Enables the transponder set to reply to Mode C interrogations when in the ON position. Disables the reply to Mode C interrogations in the OUT position. Enables the Test Set TS-1843/APX (when installed) to locally interrogate the transponder while also enabling the transponder to reply when held in the TEST position. The test set will then also measure the characteristics of the reply and illuminate the TEST light when the reply is satisfactory.
TEST light – Illuminates when the transponder responds properly to a Mode 1, 2, 3/A, or C test.
MODE 1 code select switches – Selects and indicates the Mode 1 two-digit reply code number.
Mode 3/A code select switches – Selects and indicates the M3/A four-digit reply code number.
MODE 4 ON-OUT switch – Enables the transponder to decode Mode 4 interrogations when in the ON position. Disables a Mode 4 decode when in the OUT position.
CODE control – Functions of this control are operationally classified.

MODE 4 AUDIO – LIGHT switch – In the AUDIO position, permits aural and reply light monitoring of valid Mode 4 interrogations and replies. (Refer to TACAN-VOR PANEL, Section IV for HOLD and ZERO positions.) In LIGHT position, enables only REPLY light monitoring.
REPLY light – Indicates presence of Mode 4 replies.
RAD TEST-MON – Three position toggle switch. Positions labeled RAD TEST, OUT and MON. In the RAD TEST (upper) position, switch is spring-loaded to return to the OUT (center) position.
RAD TEST position – Enables an appropriately equipped transponder to reply to TEST mode interrogations from an AN/APM-123(V)-1 or similar equipment. Other functions in this switch position are classified.
MON position – Enables the monitor circuits of Test Set TS-1843/APX. The TEST light will come on whenever replies are transmitted in any SIF mode.
OUT position – RAD TEST and MON self-test features of the system are de-energized.

NOTE

It is possible for the indicating lights to be dimmed for use under conditions of low ambient light to the point where their indications may not be visible in normal ambient light level. For this reason it is important that the Preflight check and other routine checks include resetting the level of indicating light intensity at the same time the lights are checked by the Press-to-Test method.

Operating Procedure.

1. IFF circuit breakers – CHECK IN.
2. MASTER control – Low or NORM as required.
3. M-1, M-2, M-3/A, M-C and MODE 4 switches – ON – unless operational requirements indicate that only specific modes will be used, then all other mode switches will be OUT.
4. Desired code – Set.
5. AUDIO-LIGHT switch – LIGHT.
6. IDENT-MIC switch – OUT.
7. RAD TEST-MON switch – OUT.
8. STOPPING PROCEDURE
   Master Switch – OFF.

Identification of Position (I/D) Operation

Momentarily hold IDENT-MIC switch in the IDENT position, transponder set will transmit position identifying (I/P) signals to all interrogating stations on mode 1, 2, and 3/A, for 30 seconds. Transmission of the (I/P) signal does not occur in these modes if the mode enable switches are in the OUT position. MIC position allows remote use of the microphone switches in lieu of the manually operated IDENT switch on the IFF control panel.

Emergency Operation

During an aircraft emergency or distress condition the transponder set may use specifically coded emergency signals on modes 1, 2, and 3/A to all interrogating stations. For emergency operation set the MASTER control as follows: Pull the MASTER control knob outward and rotate to the EMER position. Let the MASTER control remain in the EMER position for the duration of the emergency and return to the NORM, LOW or OFF position as required. When emergency position is selected mode 3A code 7700 is automatically broadcast.

Monitoring Operation

Valid mode 4 interrogations and replies can be monitored either aurally or visually by placement of the AUDIO-LIGHT switch on the transponder control panel in AUDIO position. Place the AUDIO-LIGHT switch in AUDIO. Mode 4 interrogating and reply pulses will be audible in the pilot's headset and visible on the REPLY light. Place the AUDIO-LIGHT switch in LIGHT. Identification of mode 4 interrogating and reply pulses will be visible on the REPLY light.

IFF Caution Light

The IFF caution light signifies that the Mode 4 function of the IFF transponder is inoperative. This caution segment is illuminated by a positive 28V DC signal, which is present in the event Mode 4 code is lost, the KIT-1A/TSEC computer malfunctions, or the transponder malfunctions.

IFF Code Hold Caution Light

The IFF CODE HOLD caution light requires an external ground to illuminate. When the CODE HOLD ON/OFF switch is in the ON position, the IFF CODE HOLD caution light will illuminate. However, by placing the IFF CODE HOLD ON/OFF switch to ON will not prevent the computer from dumping the MODE 4 code information when aircraft electrical power is removed. The computer will hold the MODE 4 code information only when the IFF CODE HOLD ON/OFF switch is in the ON position and the C-6280(P)/APX transponder control MODE 4 switch is then momentarily held in the HOLD position.

Alt Encoder Caution Light

The ALT ENCODER caution light requires an external ground to illuminate. In the event the 115V AC power is interrupted or a malfunction in the rectifier circuit develops, the altimeter encoder supplies an external ground for the ALT ENCODER caution light via an interlock relay.

LOUDHAILER SYSTEM

The loudhailer system, if installed, provides 1-way voice communication from the pilot, copilot, or crewmember station 3 position to personnel on the ground when the helicopter is hovering or cruising at altitudes from approximately 10 to 1500 feet. The system contains two loudspeakers connected in parallel, a 250-watt audio amplifier, and a loudhailer control panel. The two loudspeakers are mounted on the battery compartment cover and point down at approximately 45 degrees. The audio amplifier (figure 4-20) is mounted in the battery compartment, and the loudhailer control panel (figure 4-21) is mounted in the pedestal. The system receives power from the 28-volt dc nonessential bus and is protected by a 15-ampere circuit breaker, marked LOUDHAILER, located on the overhead circuit breaker panel.

Loudhailer System Controls

The loudhailer system controls consist of controls on the loudhailer control panel and the audio amplifier. The loudhailer control panel contains a power switch, marked OFF and ON, a volume control, marked LOUDHAILER with an INC arrow going clockwise, and a panel light. The audio amplifier contains a power switch, marked POWER ON, a POWER PUSH TO TEST indicator light, a volume control, marked GAIN, with center OFF and four positions clockwise and counterclockwise, MIC and RECORDER input jacks, a MONITOR output jack, and a power input and audio output jack. The GAIN control is rotated through four numbered positions clockwise to control the volume of live transmissions.

Loudhailer System Operation

To transmit on the loudhailer system from the pilot, copilot, or crewmember station 3 position, perform the following:

WARNING

Do not turn the microphone volume control to the full-on position during ground operation. Serious injury to ears of personnel could result. Severe audio feedback and rumble may occur while on the ground, which could result in damage to the equipment.

1. After takeoff, on the loudhailer control panel, set the power switch to the ON position and set the volume control as desired.

2. From the pilot, copilot, and/or crewmember station 3 position, place the transmitter rotary selector switch on interphone panel C-6533/ARC to position 5.

3. Press the microphone trigger switch (cyclic stick grip for pilot and copilot and hoist control for crewmember station 3) to the radio position and speak into the microphone. The pilot and copilot may use the foot switch instead of the cyclic stick grip. The volume may be controlled as desired at the loudhailer control panel.

4. To turn off the loudhailer system, set the power switch on the loudhailer control panel to OFF.

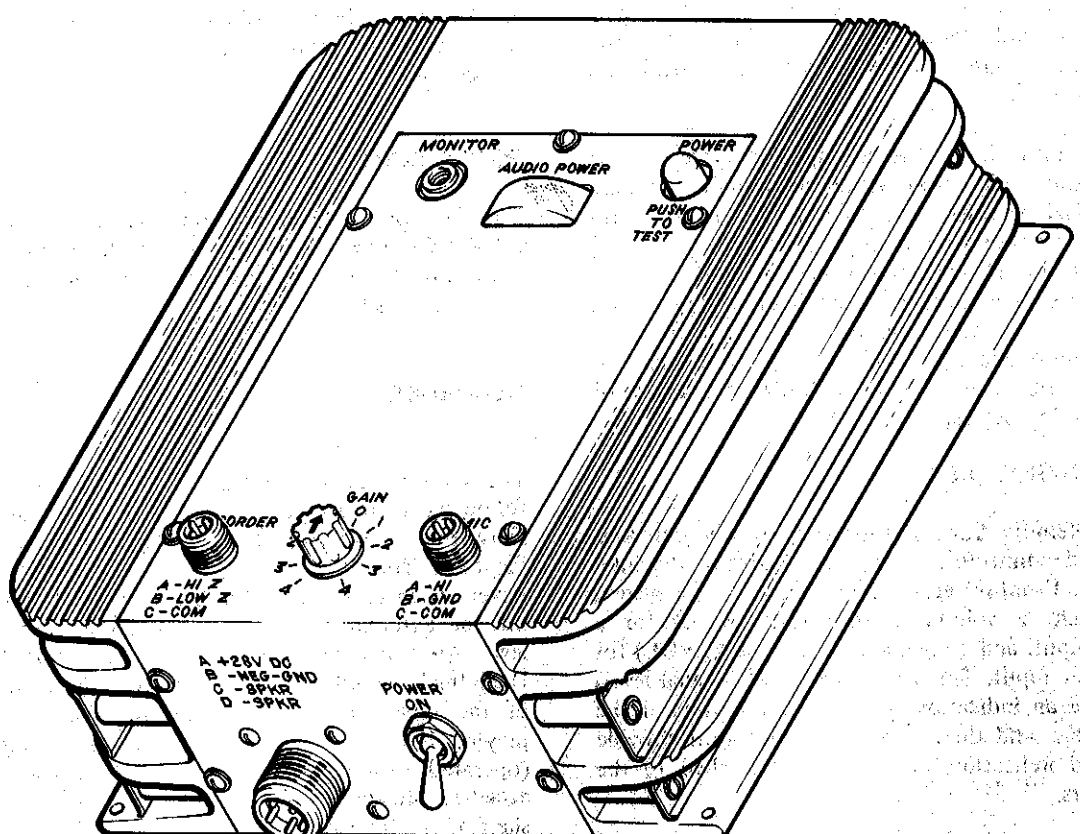


Figure 4-20. Loudhailer audio amplifier

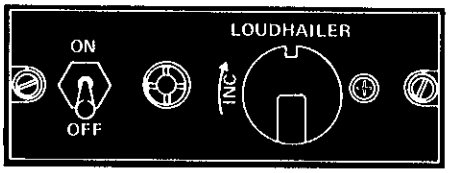


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Figure 4-21. Loudhailer control panel

LOUDSPEAKER SYSTEM

The portable system is self-contained, and is mounted in a box type frame which may be attached on the left-hand side of the cabin floor just aft of the center door post. The frame is secured to floor receptacles by five self-contained quick disconnects. Electrical power, 28V DC non-essential, is supplied to the loudspeaker system when the self-contained flex cable is engaged with the power receptacle located on the left center door post near floor level. When the loudspeaker system is in correct position, the speaker faces outboard, amplifiers and controls are inboard (figure 4-22).

The primary purpose of the loudspeaker system is to broadcast normal voice from either microphone or tape recorder through transistorized preamplifier, remote control unit, distribution panel, high power transistorized amplifiers and out the high power speaker cluster. Sound emanating from the speaker at its highest undistorted level will penetrate, when the helicopter is airborne, a distance of approximately 2 miles in a vertical angle of approximately 90 degrees and a horizontal angle of approximately 45 degrees.

REMOTE CONTROL UNIT

The RMC-3 Remote Control Unit contains the controls, indicators, and connectors necessary to control the integrated system. Front-panel controls consist of the system POWER switch, a volume control (MIC VOL) for a microphone input, and a volume control (TAPE VOL) for a tape recorder input. Three front-panel VU (signal level) meters provide an indication of the power output of the three Amplifiers, and three front-panel indicators provide an illuminated indication when power is applied to the three amplifiers.

DISTRIBUTION PANEL

The Distribution Panel provides the connectors and switching circuitry to electrically couple the system together.

AMPLIFIER SYSTEM

The amplifier system contains three MA-600 amplifiers. Each amplifier is completely transistorized and is capable of providing 600 watts of audio output power. The front-panel also contains fuses for overload protection. The three 600 watt transistor amplifiers are located in the aft, inboard corner of the loudspeaker system's rack.

SPEAKER ASSEMBLY

The speaker assembly, mounted in a retracting cradle (figure 4-22), consists of 24 speakers mounted to the central manifold of the speaker horn. The speaker "hook up" terminal board is mounted on the bottom side of the horn, and serves as electrical coupling point for respective amplifier outputs and drivers.

SPEAKER RETRACT HANDLE

The speaker retract handle, located above the top shelf of the rack, is provided for the operator to grip and tilt the speaker assembly to different tilt angles from horizontal position (0 degrees) to 15 degrees, 30 degrees or 45 degrees down.

POWER CORD

The flex power cord and plug serves to couple power (28V DC) from the power receptacle in the left center door post to the loudspeaker system on the right hand side of the rack.

RECORDER

The recorder is a dual track, four speed unit with the following controls: Rewind Button, Play Button, Fast Forward Button, Stop Button, Playback Volume Control, Playback Tone Control, Speed Tuning Control, Record Lever, Microphone Selector Switch (for selecting built-in mic or external mic), Record Volume Control, Record level Auto/Manual Selector, and Tape Speed Selector. Dual track recordings may be played by playing one side of the tape, then manually turning the tape over and playing the other side of the tape. The tape recorder (operated from 12V DC supplied by control panel via attached stowed cord and plug) is attached to the top shelf of the loudspeaker system rack.

OPERATING PROCEDURES (Using Tape Recorder)

1. Check that all audio and tape recorder power switches are in OFF positions and LOUDSPKR SYS circuit breaker – IN.