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C-12-114-0G0/MF-000

DESCRIPTION AND MAINTENANCE INSTRUCTIONS

CT114 TUTOR

TELECOMMUNICATIONS

(ENGLISH)

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LIST OF EFFECTIVE PAGES

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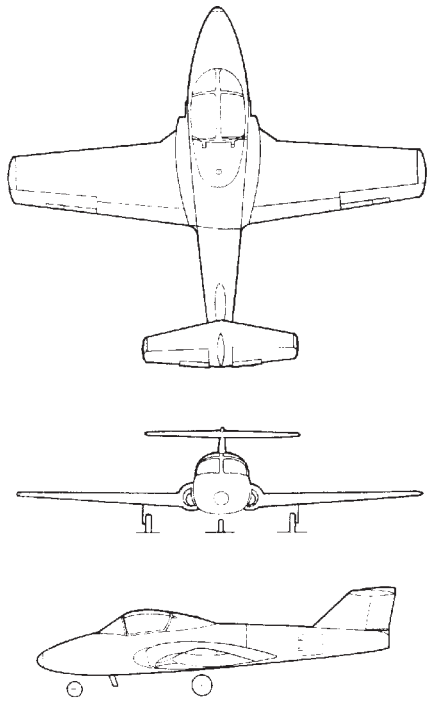

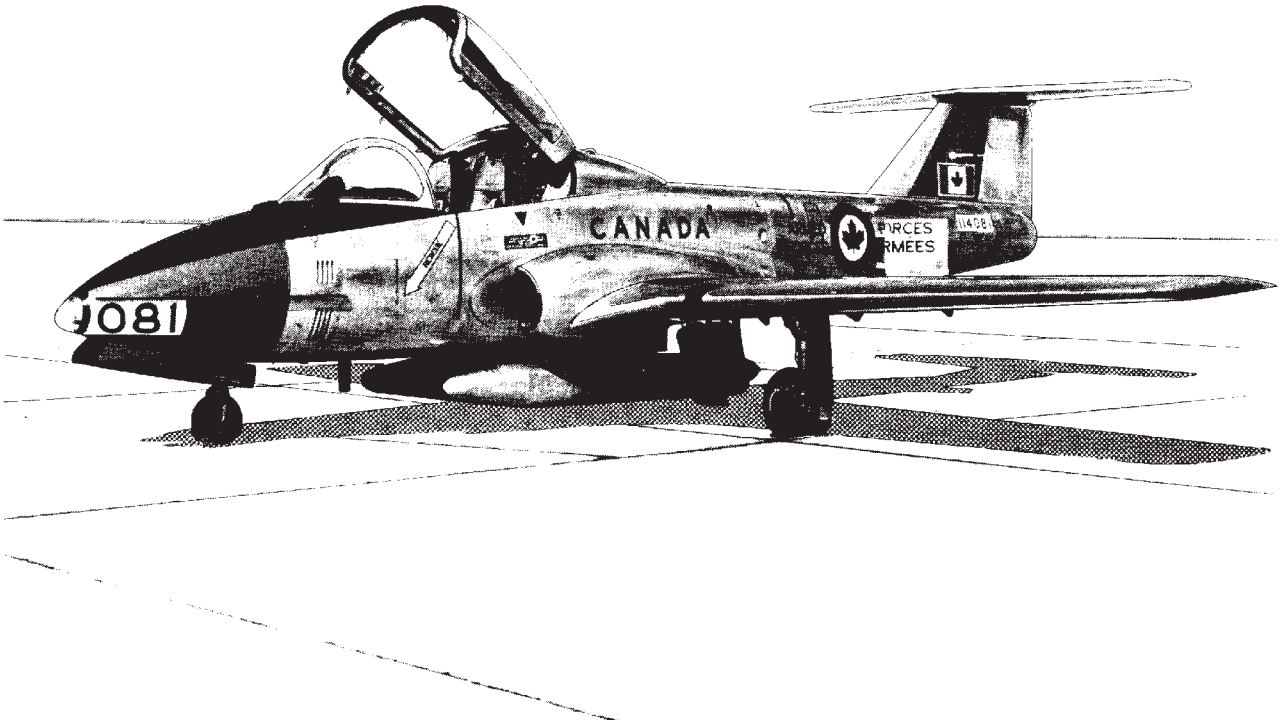

Frontispiece

PART 1
GENERAL INFORMATION

Part 1 of this publication has been deleted and the data formerly included has been consolidated in C-12-114-000/ MF-000. When reference to Part 1 is made in this CFTO, refer to C-12-114- 000/MF-000.

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PART 2

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SECTION 2 - UHF SYSTEM

PART 2

LIST OF ILLUSTRATIONS

COMMUNICATION SYSTEMS

PART 2 – SECTION 1

INTERCOM

INTERCOM

GENERAL

1. The AN/AIC-502 intercom system provides hot mike intercommunication between the two pilots , microphone and listening facilities for communication and navigation radio, and monitoring of landing gear warning signals. The intercom has a C-5140/AIC-502 modified dual control panel and two AM-5186/AIC-502 amplifiers, one each for the student (left) and instructor (right). For the intercom block diagram, see Figure 2-1 0. For the audio and microphone circuits, see Figure 2-2.

COMPONENT

2. A list of system components follows. For further details, refer to the wiring diagram in C-12-114-000/ DW-000.

COMPONENT	LOCATION
Amplifiers (2) - AM- 5186/AIC-502	Forward of instrument panel
Dual control panel - C- 5140/AIC-502	Centre control console
UHF main/emergency relay	Centre control console
Circuit-breaker	Centre control console extension
Instructors PTT switch	Instructors throttle
Mute switch	RH console
Mute switch	Instructors control column
Mute switch	Students control column
Students PTT switch	Students throttle

DESCRIPTION

3. The intercom system includes two AM-5186/AIC-502 transistor amplifiers and one dual control panel (see Figure 2-3). Power for the system is supplied through a 28-volt d.c. circuit-breaker. A four-wire cable for the RH pilots headset is terminated by a headset connector at one end and connected to the mic input of the LH pilots amplifier at the other end. A similar cable for the LH pilots headset is connected to the LH pilots amplifier.

4. Associated with the intercom circuit are two press-to-talk (PTT) switches and three mute switches. When either the RH pilots or LH pilots PTT switch is pressed, the output of the appropriate microphone amplifier is transferred from the interphone to the UHF channel (main or emergency). A mute switch is provided on each stick grip (control column) and on the RH console to cut out the receiving audio and sidetone of communication and navigation radio systems.

5. The intercom control panel has six separate volume controls: one for each pilot controlling separately the audio listening levels of interphone, UHF, and VOR-Tacan. The signal heard through the VOR-Tacan circuit depends on selection of VOR/ILS or TACAN on the VOR/ILS - TACAN SEL switch on the miscellaneous controls and marker panel (near the centre of the instrument panel). For the control circuits of this switch refer to the VOR-ILS-Marker Receiver system in Part 3A, following. The receiving and sidetone audio levels of radio systems are also adjusted by the volume controls of the radio control units.

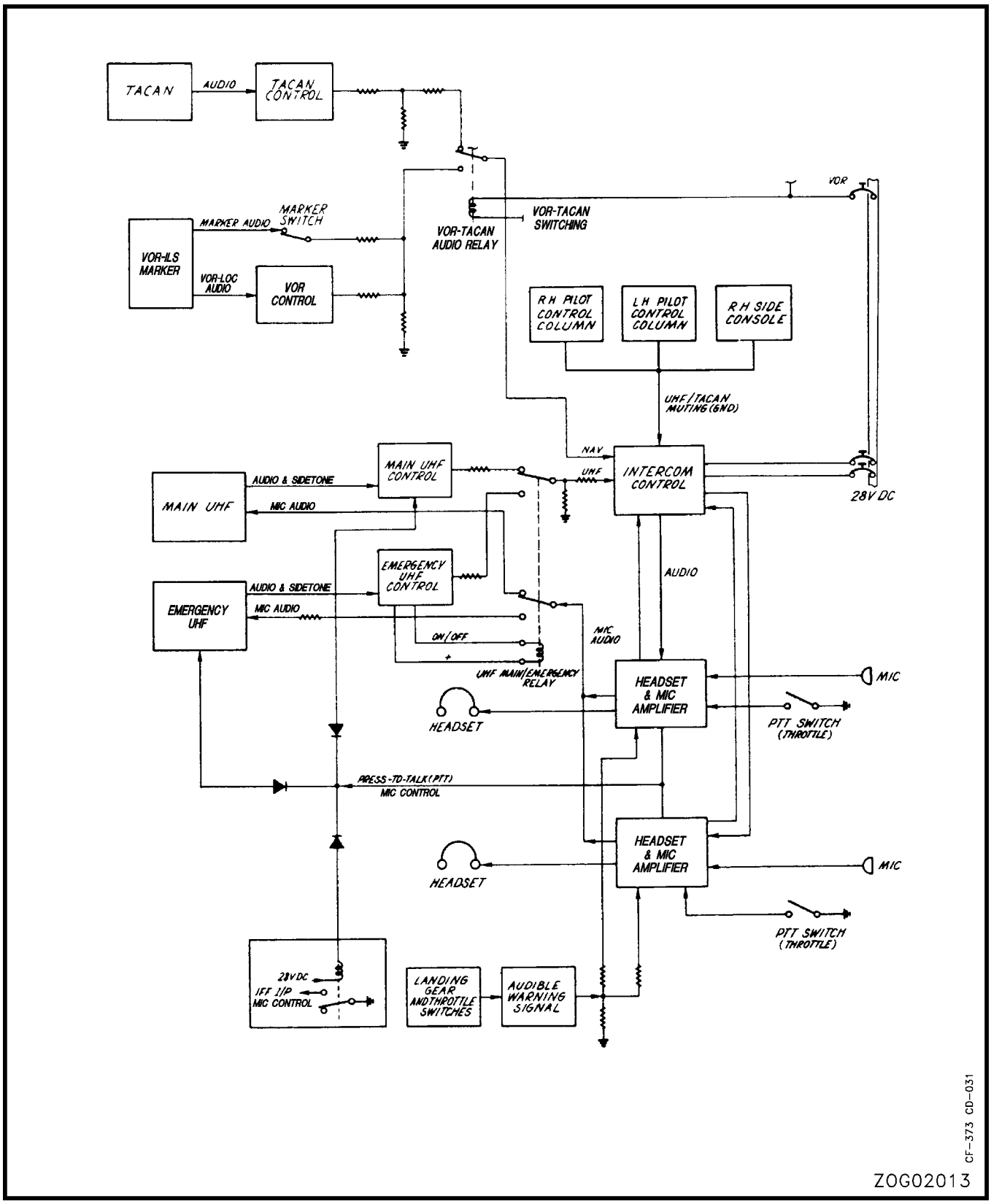


Figure 2-1 Intercom System – Block Diagram

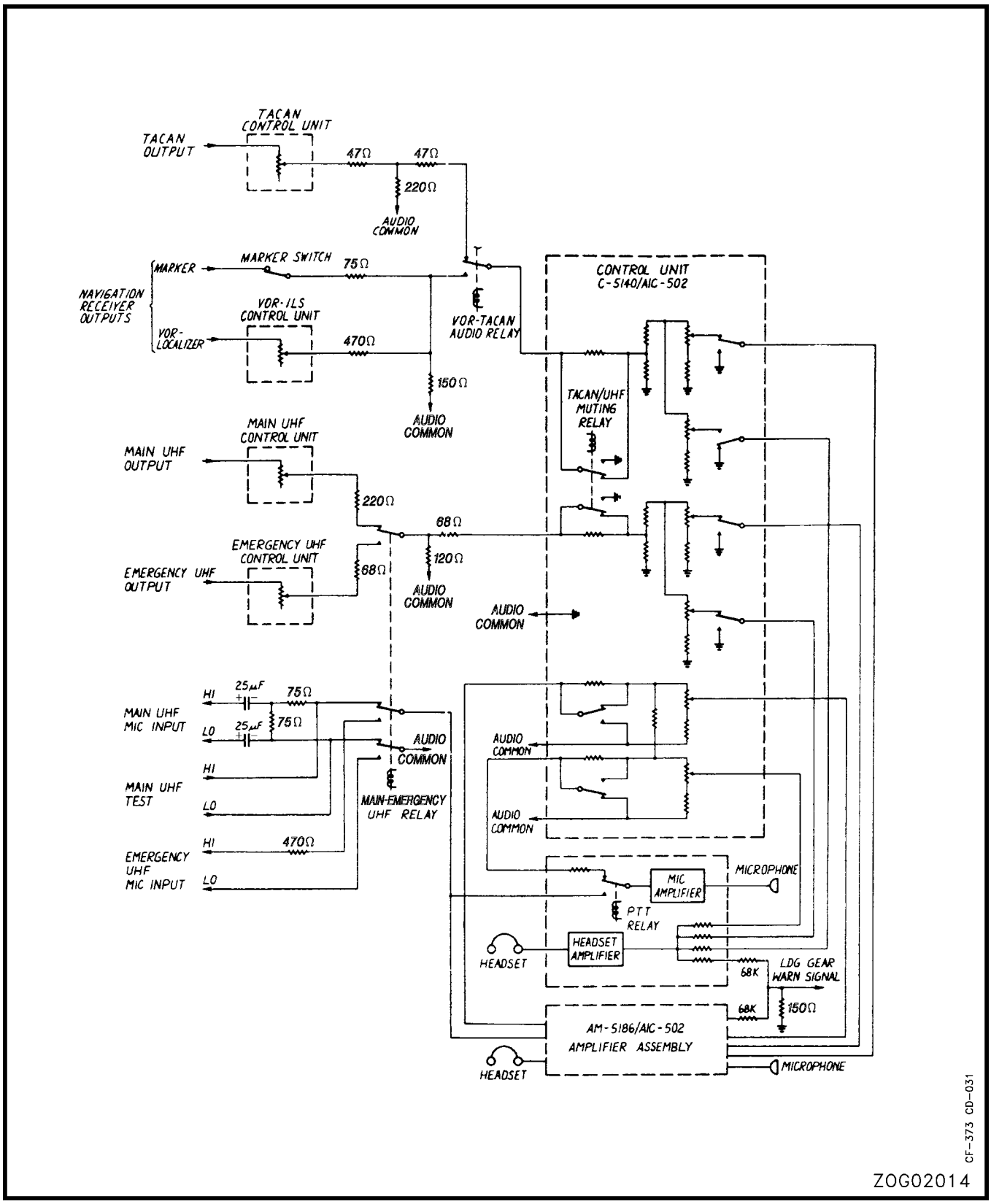


Figure 2-2 Intercom – Audio and Microphone Circuits

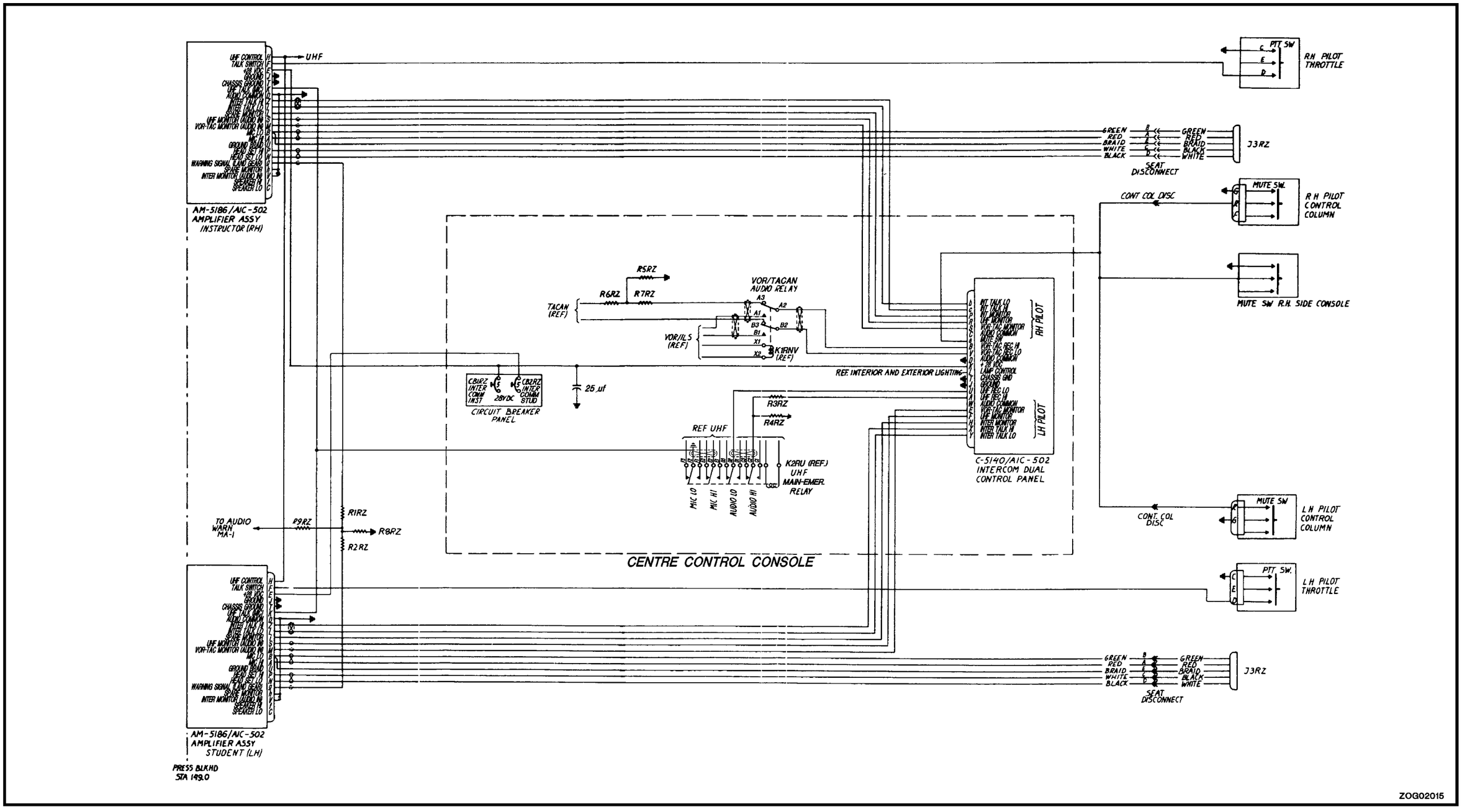


Figure 2-3 Intercom System – Electrical Schematic

6. A landing gear audible warning is provided by a tone through the intercom system to the pilots headsets when the landing gear is in any position other than down and locked and when the power lever is retarded below the minimum cruising power position. The interrupted audible landing gear warning signal from the MA-1 is attenuated and fed to both pilots amplifiers. For details on the landing gear, refer to C-12-114-0A0/MF-000.

REMOVAL AND INSTALLATION OF INTERCOM AMPLIFIERS

7. The two amplifiers are located on a shelf behind the left side of the instrument panel. Access to the amplifiers is gained by removing the canvas cover below the windshield. Each amplifier is housed in a case fitted with a cover, the amplifier being assembled on the cover. The case is secured to the shelf by four bolts and is slotted to receive the plug assembly.

8. Before removing the amplifier, ensure that there is no power on the aircraft. To remove the amplifier from its case, remove lockwire and disconnect the plug. Release two camlock fasteners and lift the cover clear of its case, leaving the case attached to the shelf.

9. To install the amplifier, insert amplifier in the case (attached to the shelf), secure fasteners, connect plug, and lockwire.

REMOVAL AND INSTALLATION OF UHF MAIN EMERGENCY RELAY

10. For removal and installation of the UHF main emergency relay (K2RU), refer to Section 2, following.

FUNCTIONAL CHECK

CAUTION

Prior to carrying out a functional check on the intercom system, raise and lower seats to maximum limits ensuring that the mic/tel cable remains connected and is secured at both ends. Ensure mic/tel cable does not foul in the ejection seat mechanism during the vertical travel.

11. Carry out a check of the intercom system as follows. Two microphone-headsets (Item 73, Figure 1-5) are required for this procedure.

NOTE

No transmission should be heard when intercom circuit- breakers are pulled out. If faint transmission is detected, carry out a check of the intercom amplifier circuit-breakers as per Paragraph 12, following.

a. Energize cockpit No. 2 essential d.c. bus, cockpit non- essential d.c. bus, and No. 2 inverter (see Figure 1-1).

b. Ensure that circuit-breaker CB1RZ and CB2RZ are pushed in and select the power switch on intercom control panel on centre control console to ON.

c. Attach headsets to their respective connectors on the ends of the microphone headset cables hanging from the left side of both seats and ensure that muting switches (3) are not depressed.

d. Set both pilots audio level controls on intercom control panel on centre control console to one half of full rotation. At this position, the audio level control give the best results.

e. Select both pilots hot mic, UHF, and Tacan switches (six switches) to ON. These switches are located on the intercom dual control panel on the centre control console.

f. Speak normally into the RH side microphone and check that the audio is satisfactory. Adjust the RH side audio level control on intercom control panel to provide a satisfactory audio level.

g. Repeat (f), preceding, for the LH side station.

h. Speak into the RH side microphone while listening on the LH side phones. Check for clarity and volume.

j. Speak into the LH side microphone while listening on the RH side phones. Check for clarity and volume.

k. To test the UHF function, select a suitable frequency on the UHF and establish communication with the ground station by pressing the instructors or students PTT switch (refer to UHF functional check in Section 2, following).

CAUTION

Before pressing the PTT switch, ensure that there are no other transmissions on the channel selected.

m. When carrying out a VOR or Tacan functional test, listen for the station identity tone (refer to the VOR or Tacan functional check in Part 3 or Part 3A, following).

n. When carrying out a landing gear test, check the landing gear warning signal (refer to the landing gear check in C-12-114-0A0/MF- 000).

NOTE

The landing gear warning tone is heard through the intercom system when the landing gear is in any position other than down and locked, and the power lever is retarded below the minimum cruising power position.

p. Switch off power and disconnect the d.c. ground power unit.

INTERCOM AMPLIFIER CIRCUIT-BREAKER CHECK

12. Procedure:

a. Ensure that UHF is tuned to a frequency not in use or connect a dummy load to UHF output.

b. Ensure that circuit-breakers CB1RZ and CB2RZ are pulled out.

c. Place power switch on intercom control panel to ON.

d. Place emergency UHF switch to OFF.

e. Place UHF control to T/R and set UHF volume control to mid position.

f. Pull UHF control button to ON position and set to mid position on intercom control panel.

g. Connect ground power, place master switch to GP and switch on No. 1 and No. 2 inverters.

h. Push in circuit-breaker CB1RZ (instructors amplifier) and, with UHF operating, speak into instructors microphone.

j. Check that sidetone is heard in instructors headset and no sound is present in students headset.

k. Pull out circuit-breaker CB1RZ (instructors amplifier) and push in CB2RZ (students amplifier) and, with UHF operating, speak into students microphone.

m. Check that sidetone is heard in students headset and no sound is present in instructors headset.

n. Return all switches to OFF or normal position and remove ground power from aircraft.

PART 2 – SECTION 2

UHF SYSTEM

UHF SYSTEM

DESCRIPTION

1. The UHF system is a radio communication facility providing voice transmission and reception in the frequency range of 225 to 400mc. The system consists of two transceiver radio sets, an AN/ARC-552 main UHF radio, and an AN/ARC-504 emergency UHF radio. Transmission and reception are on the same frequency and one antenna is shared by the two transceivers. The control panels allow either instructor or student to control the UHF system. Rapid test facilities are provided for both radio sets. For a block diagram of the UHF system, see Figure 2-4 and for a schematic, see Figure 2-5.

SYSTEM COMPONENTS

2. A list of system components follows. For further details, refer to C-12-114-000/DW-000.

COMPONENT	DESIGNATION	LOCATION
UHF main transceiver	RT-5011/ARC-552	Equipment - Nose section
UHF main control	C-5067/ARC-552	Centre console
Rotary channel selector	C-5063/ARC-552	Instrument panel
Remote channelling unit	C-5069/ARC-552	LH canopy sill (sta 206)
UHF command indicator		Instrument panel - Students side
Directional coupler	CU-5038A/ARC-552A	Bulkhead, sta 110
Main UHF rapid test facility		Bulkhead, sta 110
UHF antenna	AT-256A/ARC	Bottom of fuselage sta 166.5
UHF emergency transceiver	RT-5014/ARC-504	Equipment - Nose section
UHF auxiliary control	41A-72030	Centre console
Coaxial relay	28-73008	Bulkhead, sta 110
Emergency UHF rapid test facility	41A-71040-2	Bulkhead, sta 110

POWER

3. Power requirements for the UHF system are 115-volt three-phase a.c. and 28-volts d.c. The three-phase supply for the main UHF is fed through three circuit-breakers, CB3RU, C4RU, C5RU and the 28- volt d.c. supply is fed from circuit-breaker CB2RU. The emergency UHF requires only d.c. power which is fed through circuit-breaker CB1RU. All these circuit-breakers are on the centre console circuit-breaker panel. The main UHF is automatically switched off if either the aircraft single-phase or three-phase supply should fail.

COOLING

4. Cooling for the UHF and the other equipment in the nose area is provided by outlet air from the cabin pressure regulator and relief

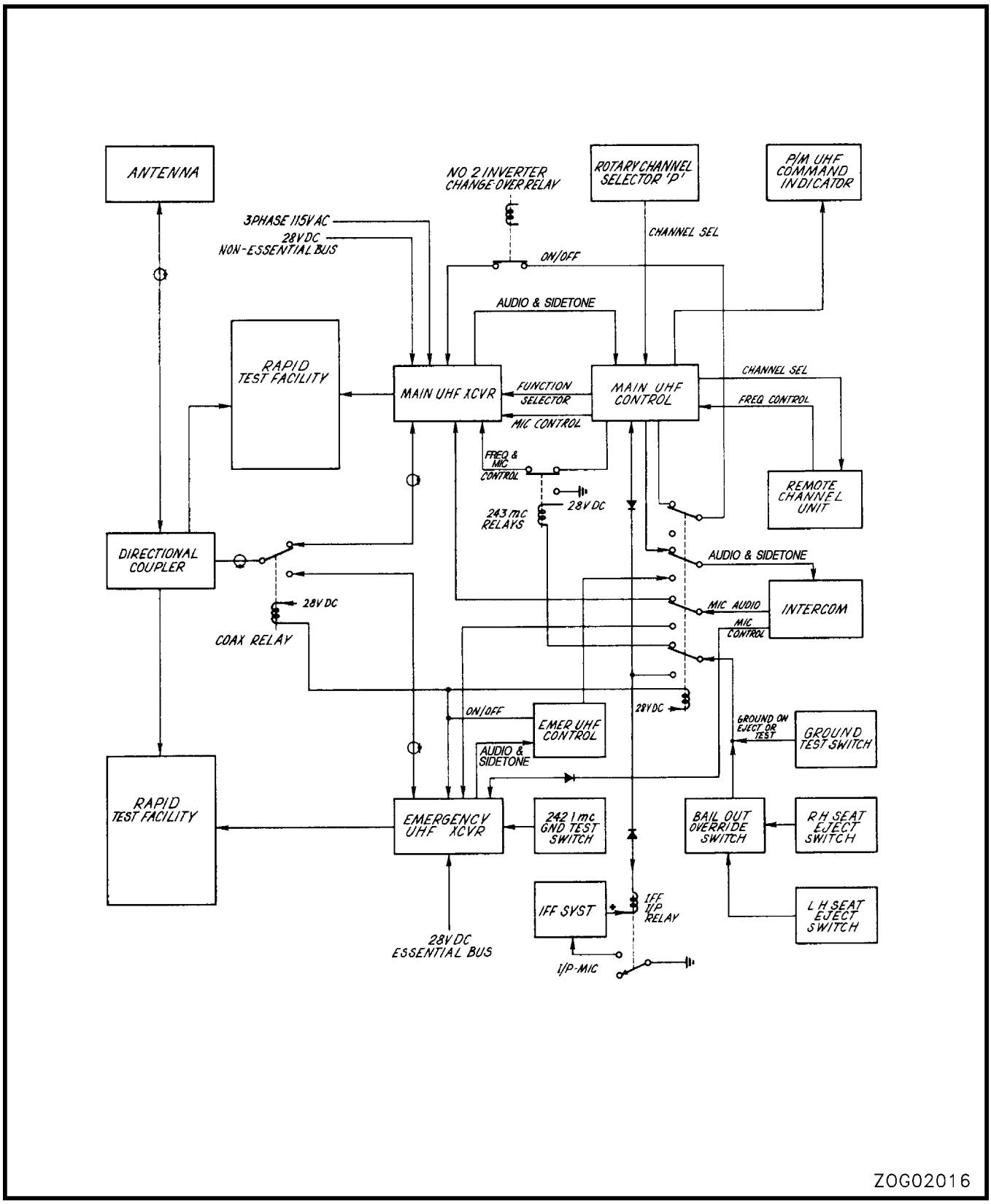
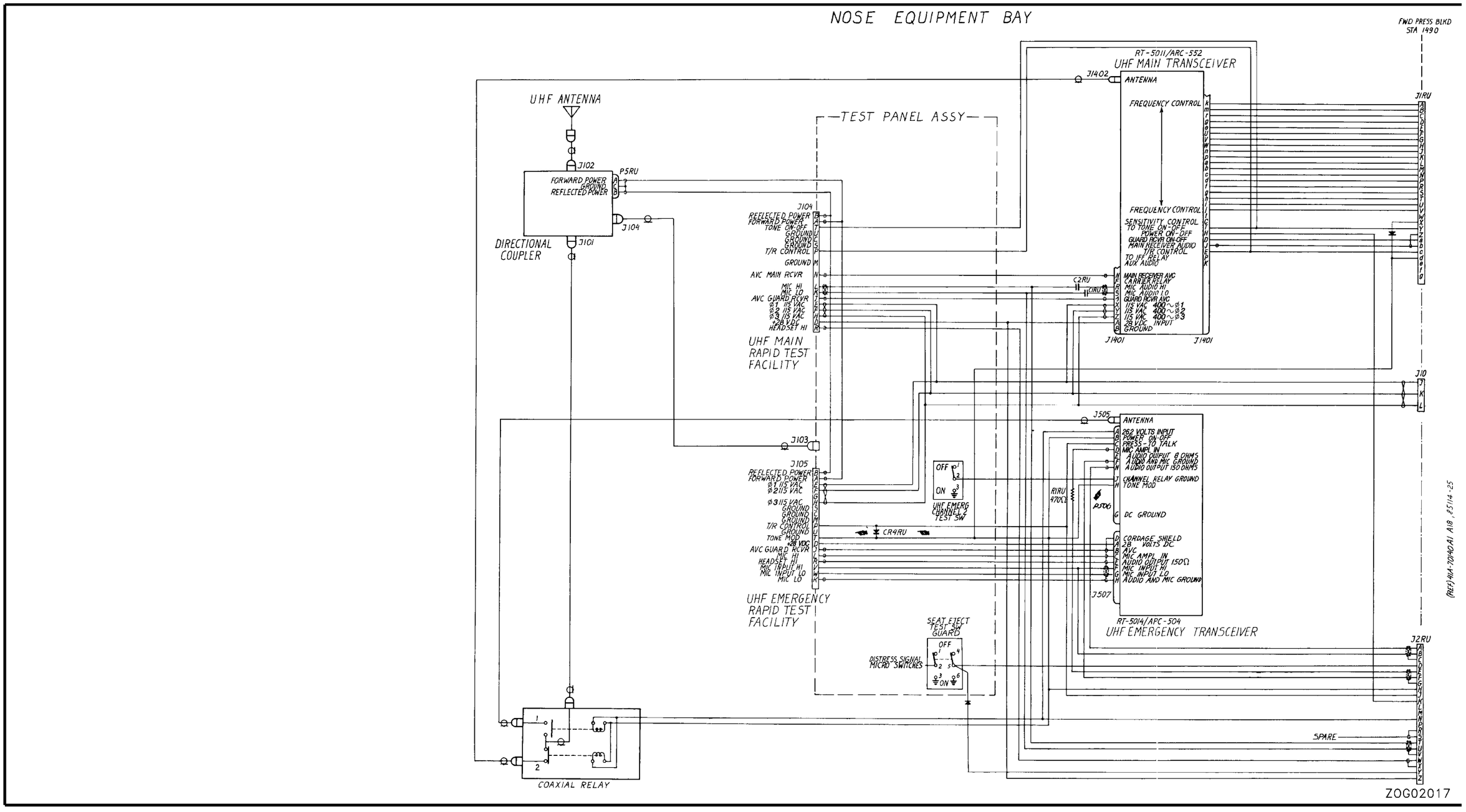


Figure 2-4 (Issue 1) UHF System Block Diagram



UHF Radio – AN/ARC-552 – Electrical Schematic Figure 2-5 (Sheet 1 of 2)

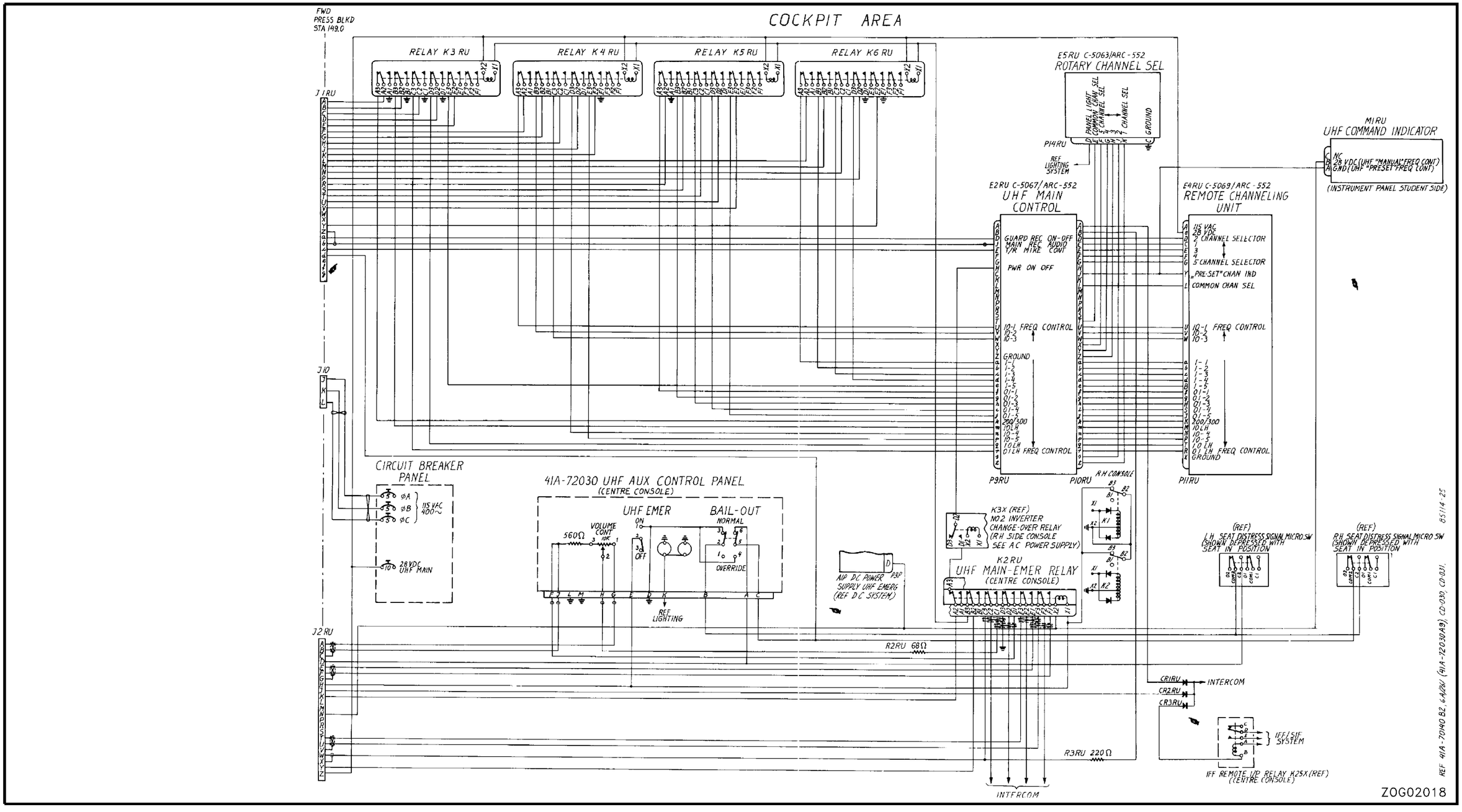


Figure 2-5 (Sheed 2 of 2) UHF Radio – AN/ARC-552 – Electrical Schematic

valve. The air is circulated throughout the area and exhausted overboard through louvers in the aircraft skin. For further details on the cooling system for the nose compartment, refer to C-12-114-0C0/MF-000.

5. A cooling flow is now available when the engine is stopped and this may place a restriction on UHF operation on the ground, depending on the ambient temperature. Ground testing of the UHF system should be carried out with the nose panels open. If the ambient temperature exceeds 95°F, the UHF should be operated on an intermittent basis.

NOTE

Intermittent operation for the UHF is defined as 2 minutes transmit and 13 minutes receive, in a 30-minute period, followed by 15 minutes receive.

MAIN UHF

DESCRIPTION

6. The main UHF system has a remotely controlled transceiver designed for AM radio-telephone communication and providing simultaneous monitoring on the guard channel. There are 1750 channels available in steps of one-tenth megacycle. Any one of the 1750 channels can be selected manually and any 24 (including guard channel) may be selected remotely by means of the C-5063/ARC-552 rotary channel selector and the C-5069/ARC-552 remote channelling unit. A UHF command indicator is also provided to indicate either preset or manual frequency control.

7. If an emergency condition occurs, necessitating the ejection of one seat or the bail-out of both pilots, the EUHF transceiver will automatically transmit a 400-cycle modulated signal at the emergency carrier frequency of 243mc. A bail-out override switch on the UHF auxiliary control panel is provided to allow the remaining pilot to override the automatic distress signal microswitch. However, on ejection of the remaining pilot, the EUHF automatically transmits the emergency signal regardless of the override position of the bail-out switch.

MAIN TRANSCEIVER

8. The RT-5011/ARC-552 main transceiver consists of one transmitter and two receivers. The transmitter and main receiver use the same frequency determining system, since they operate on the same frequency. The guard receiver is independently tunable over a frequency range of 238 to 248 mc, the normally assigned guard frequency being 243 mc. Either the main or both receivers may be used at one time, and the audio outputs of the two receivers are combined in a common audio channel. For further details on the AN/ARC-552 transceiver, refer to C-50-122-000/MF-000.

MAIN CONTROL UNIT

9. The C-5067/ARC-552 control unit offers full control of the RT- 5011/ARC-552 main transceiver. The front panel of the control unit has a preset-manual switch, a volume control, a function selector switch (OFF, T/R, T/R + G, ADF), and four frequency controls (hundreds, tens, units, tenths). The frequency selected is indicated by digits appearing at the windows above the frequency controls. Panel lighting is provided by four lamps. Electrical connection is made through two connectors at the rear of the unit. For further details on the C-5067/ARC-552 control unit, refer to C-50-121-000/MF-000.

ROTARY CHANNEL SELECTOR

10. The C-5063/ARC-552 channel selector is a rotary switch which permits the operator to select any one of 24 (including guard channel) frequencies that have been preset on the C-5069/ARC-552 remote channelling unit. Panel lighting is provided and electrical connection is through a connector at the rear of the unit. The rotary channel selector is located on the student's side of the instrument panel. For further details on the C-5063/ARC-552 selector, refer to C-50-121-000/MF-000.

REMOTE CHANNELLING UNIT

11. The C-5069/ARC-552 remote channelling unit is a remote control unit that is used for presetting 24 (including guard channel) frequencies, any on e of which can be selected by the C-5063/ARC- 552 rotary channel selector.

12. The remote channelling unit consists of a motor-driven drum having small slots running along the drum. Each slot in the drum contains seven pins, spaced across the length of the drum, which may be moved into desired positions to select frequency for channels 1 to 24, including guard channel. The removable dust cover contains a hinged panel on which are mounted a frequency chart and the presetting tool tuned for adjusting the frequency selector pins. The panel is opened to allow access to the frequency selector pins. Electrical connections are made through two connectors at the rear of the unit. For further information on the c-5069/ARC-552 remote channelling unit, refer to C-50-121-000/MF-000.

UHF COMMAND INDICATOR

13. The UHF command indicator is used to indicated either preset or manual frequency control. The indicator is located on the students side of the instrument panel.

RAPID TEST FACILITY

14. The main UHF rapid test facility consists of a receptacle that is connected in circuit with power and transceiver functions. This receptacle, located at the bulkhead station 110, is provided for connecting a TS5030/ ARM503 UHF test set.

UHF ANTENNA

15. The AT-256A/ARC-552 UHF antenna is a quarter-wave stub antenna designed to operate within the UHF frequency band. Connection to the antenna is through a CU-5038/ARC-552A directional coupler.

DIRECTIONAL COUPLER

16. The CU-5038/ARC-552A directional coupler is connected between the coaxial relay and the antenna and is connected to the rapid test facility for measurement of forward and reflected power.

COAXIAL RELAY

17. The coaxial relay connects the output of the main and emergency transceivers to the antenna via the directional coupler. The coaxial relay normally connects the main transceiver to the antenna but, when the emergency transceiver is switched on, the coaxial relay disconnects the main transceiver from the antenna and connects the emergency transceiver.

BLOCKING DIODES

18. Diodes CR1RU, CR2RU, and CR3RU are installed in the centre console to prevent sneak grounds from producing false circuit conditions that may cause operation of the IFF remote I/P relay (see Figure 2-5).

EMERGENCY UHF

GENERAL

19. The RT-5014/ARC-504 emergency UHF radio is controlled by the 41A-72030 control panel. It operates on 243.0 mc and is used as a stand-by for the main UHF in the emergency mode. A ground test switch (nose section) permits test transmissions to be made on 242.1 mc instead of 243 mc to eliminate system checks on the distress frequency. The emergency UHF is on stand-by under normal conditions, and is put into operation manually where the main UHF is unserviceable or automatically when there is loss of generator power . The emergency UHF transmitter will transmit a continuous tone on the distress

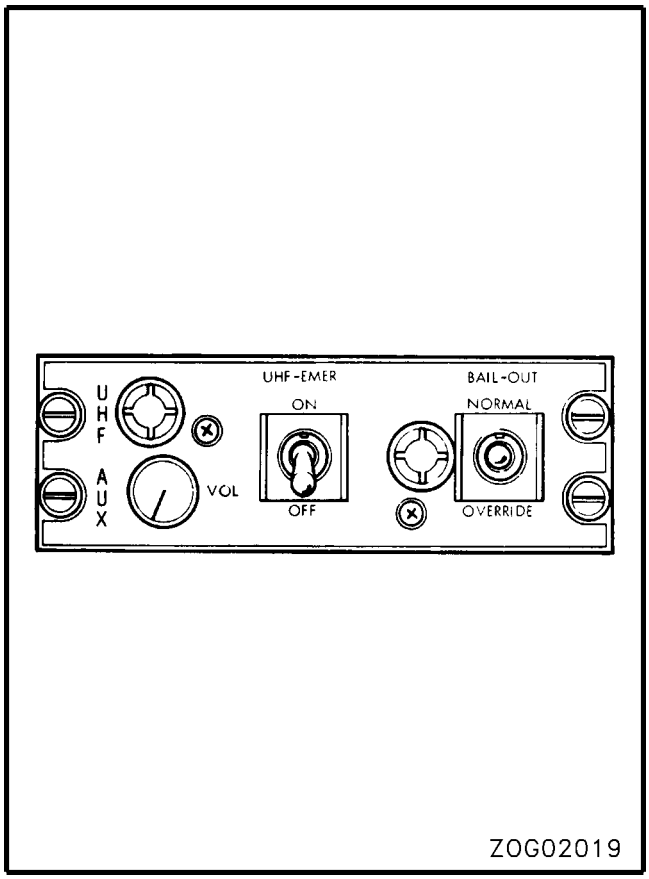


Figure 2-6 UHF Auxiliary Control Panel

signal frequency automatically should seat ejection occur. The emergency UHF performs the same functions as the main UHF in the emergency mode. For information on the emergency transceiver, refer to C-50-121-000/MF-000.

AUXILIARY CONTROL PANEL
(See Figure 2-6)

20. The 41A-72030 auxiliary control provides control of the emergency radio. On the front panel is a volume control, a UHF and emergency on-off switch, a bail-out normal-override switch, and two panel lights. The bail-out switch allows a remaining pilot to override the UHF and IFF emergency mode energized by the automatic distress signal microswitch. For an internal schematic of the 41A- 72030 auxiliary control panel, see Figure 2-5.

RAPID TEST FACILITY

21. The emergency UHF rapid test facility is a receptacle (bulkhead, station 110) connected to power and transceiver functions. This receptacle is for connecting a TS5030/ARM503 UHF test set for testing the system.

RELAY OPERATION
(See Figure 2-5)

22. When the emergency transceiver is manually switched on or any power failure occurs or a bail-out is initiated, the UHF main- emergency relay (K2RU) is energized. This relay connects the intercom to the emergency UHF. The coaxial relay is also energized and connects the emergency UHF to the antenna and disconnects the main UHF from the antenna.

23. DELETED

24. DELETED

a. DELETED

b. DELETED

c. DELETED

d. DELETED

REFERENCES

25. For further information on the RT-5011/ARC-552 UHF radio, refer to C-50-121-000/MF-000. For further information on the RT- 5014/ARC504 emergency UHF radio, refer to C-50-121-000/MF-000. For the system wiring diagram, refer to C-12-114-000/DW-000.

REMOVAL AND INSTALLATION OF MAIN TRANSCEIVER

26. The RT-5011/ARC-552 UHF transceiver is located on a mounting tray in the nose equipment section. The unit is secured by two wing-nut fasteners attached to the mounting tray. Cable connections to the unit are on the front panel. Ensure that there is no power on the aircraft. Remove the transceiver as follows:

a. Disconnect the coaxial lead and harness connection from the transceiver.

b. Remove lockwire from the wing-nut fasteners and unscrew wing- nuts sufficiently to release unit.

c. Carefully slide out unit and remove.

27. Installation is the reverse of the removal procedure. Ensure that the unit is lockwired.

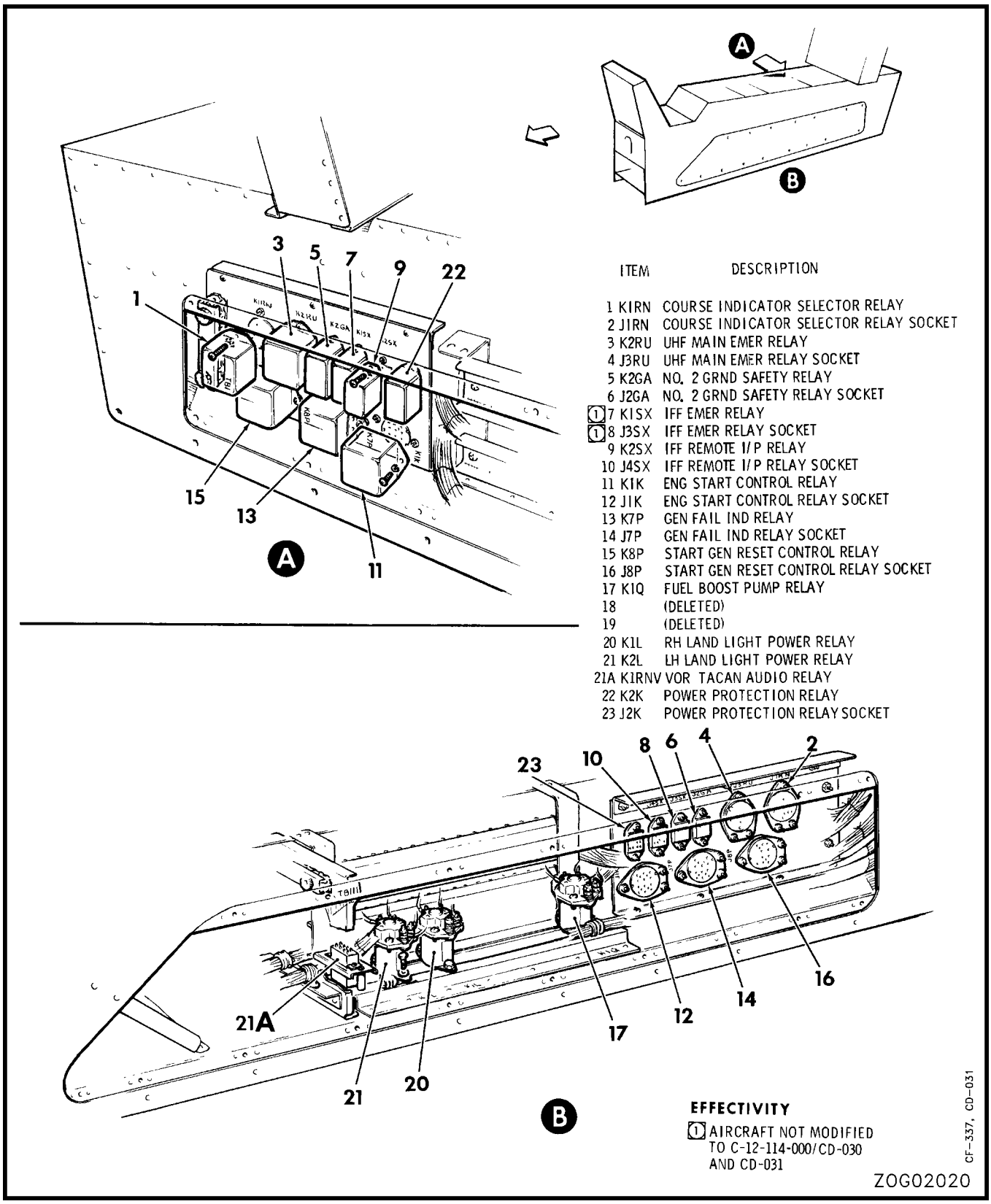


Figure 2-7 Removal and Installation of Centre Console Relays

REMOVAL AND INSTALLATION OF EMERGENCY TRANSCEIVER

28. The RT-5014?ARC-504 emergency transceiver is attached to a mounting plate and located on the shelf at the rear of the nose equipment section. The mounting plate is secured by two slide clips.

29. Ensure that there is no power on the aircraft. Remove the transceiver as follows:

a. Disconnect two harness plugs and one coaxial lead from the front panel.

b. Remove lockwire from pinch clips, release the clips, and carefully lift out unit and remove.

30. Installation in the reverse of the removal procedure. Ensure that the mounting clips are lockwired.

REMOVAL AND INSTALLATION OF RELAYS

31. The UHF main-emergency relay (K2RU) and the IFF remote I/P relay (K2SX) are located in the centre control console. These relays are mounted on a panel inside the condole at the rear, immediately below the circuit-breaker panel. The relays are of the plug-in type and are secured by screws. Access to the relays is from the RH side, access to the relay socket and harness is from the LH side of the console, with the seats removed. For relay location, see Figure 2-7.

32. To remove relays K2RU and K2SX from the centre control console, proceed as follows:

CAUTION

Before removing seat, ensure that power is disconnected from the aircraft and the EUHF, UHF and IFF circuit-breakers are pulled out.

a. Remove the RH seat (refer to C-12-114-0A0/MF-000).

b. Remove the RH side panel of the centre console by removing 17 screws.

c. Locate relays K2RU and K2SX. Remove securing screws and remove relays.

33. Installation is the reverse of the removal procedure.

34. To remove the UHF normal-emergency relays (K3RU, K4RU, K5RU, K6RU) in the left hand console, proceed as follows:

CAUTION

Before removing seat, ensure that power is disconnected from the aircraft and the EUHF, UHF and IFF circuit-breakers are pulled out.

a. Remove the LH seat (refer to C-12-114-0A0/MF-000).

b. Locate the rear side panel directly below the manually operated canopy handle on the LH condole. Remove six screws and remove panel.

c. Locate the relays and remove relay holding screws. Remove relays.

d. If it is necessary to examine the relay sockets and harness, slacken off four screws and remove relay panel.

35. Installation is the reverse of the removal procedure.

REMOVAL AND INSTALLATION OF REMOTE CHANNELLING UNIT

36. The C-5069/ARC-552 remote channelling unit is located below the canopy sill at station 206. To remove the unit, disconnect the plug and unfasten the upholstery as necessary. Release slide fasteners and lift out control. Installation is the reverse of removal.

FUNCTIONAL TEST - MAIN UHF SYSTEM

TEST EQUIPMENT

37. The following test equipment is required:

a. Portable UHF test set (Item 66, Figure 1-5).

b. Microphone-headset (Item 73, Figure 1-5).

c. RF wattmeter (Item 78, Figure 1-5).

d. Coax cable (make from 12 feet of RG-58A/U and 2 Cannon connectors DIC-2210 or equivalent).

e. DELETED

PRELIMINARY

38. Carry out the following preliminary checks:

CAUTION

The nose access panels should be open when testing the UHF on the ground. Do not transmit without a load on the transceiver RF output connector.

a. Energize cockpit No. 2 essential d.c. bus, cockpit non- essential d.c. bus, and No. 2 inverter (see Figure 1-1).

b. Connect the test set to J103 and J104.

c. Ensure that the following circuit-breakers are pushed in:

(1) No. 1 Inverter Control.

(2) Inverter Failure.

(3) UHF Main.

(4) UHF (3).

(5) Generator Fail.

(6) Intercom.

(7) Console Lights.

(8) Instrument Panel Lights.

d. Select No. 1 and No. 2 inverter control switches to ON.

e. Select the OFF-T/R switch (radio control panel) to T/R.

f. Set the instrument panel light dimmer and the console and circuit-breaker panel lights dimmer on the centre console to BRIGHT.

TEST SET

39. Connect coax cable between RF-OUT on test set and the UHF connector J103 on the aircraft test panel.

a. Set the function switch to ZERO and adjust the meter zero control for a zero indication on the meter.

NOTE

The meter zero control should be adjusted with the test set in the horizontal position all further measurements should be taken with the test set in this position. Zero indication should be checked at intervals throughout the test procedure.

b. Set the function switch to 27.5V. The meter should read 180 to 187 microamperes (27 to 28 volts).

c. Set the function switch to PH1, PH2, and PH3 in turn. In each position, the meter reading should be between 150 and 156 microamperes (112 to 117.5 volts).

MAIN RECEIVER AVC

40. Check the AVC voltage as follows:

a. Select the PRE-MAN switch on UHF main control unit to MAN and set the manual frequency switches for 304.7 mc.

b. Check that an M appears in the UHF command indicator window.

c. Turn the test set function switch to AVC. The meter should read from 13 to 100 microamperes with no signal input.

NOTE

The AVC voltage will increase with an increase in signal input.

GUARD RECEIVER AVC

41. Select the T/R switch on UHF main control panel to T/R + G. Turn the test set function selector to AVC GD (AVC guard). The meter should read from 33 to 200 microamperes with no signal input.

MAIN RECEIVER SENSITIVITY

42. Carry out a receiver sensitivity check as follows:

a. Select the T/R-OFF switch on UHF main control panel to T/R, select the test set function switch to AVC and the TRANS PWR switch to FWD.

b. Adjust test set tuning dial to 304.7 mc (main receiver frequency) by tuning for a

maximum AVC indication on test set meter. Adjust attenuator to 5 microvolts.

c. Select the function switch to RF SET and adjust RF SET control for a reading of 70 microamperes at the RF mark.

d. Repeat (b) and (c), preceding, as necessary.

e. Select the function switch to AUDIO and modulate the signal by placing the RF MOD switch to ON.

f. With the volume control on UHF main control panel, adjust the audio level to 150 microamperes (0 db) on the test set meter.

g. Place the RF MOD switch to OFF and note the level on the test set meter. This reading should be 33 microamperes or less, which indicates a S + N/N ratio of 8db or more.

NOTE

The meter reading will drop, hesitate for a moment, and then drop to zero. The reading desired is at the point where the needle hesitates.

GUARD RECEIVER SIGNAL - NOISE RATIO

43. Carry out a receiver sensitivity check as follows:

a. Select the function switch on the radio control panel to T/R + G. Select the test set function switch to AVC-GD.

b. DELETED

c. Repeat Paragraph 42(b) to (f) inclusive, preceding, using a frequency of 243.0 mc.

d. Select the RF MOD switch to OFF and note the level on the test set meter. This reading should be 53 microamperes or less, which indicates a S + N/N ratio of 6db or more.

TRANSMITTER POWER OUTPUT

44. Carry out a transmitter power output check as follows:

a. Select the function switch on radio control panel to T/R.

b. Select the PRE/MAN switch to MAN. Manually select a frequency of 240 mc.

c. Select the test set function switch to TRANS PWR.

d. Select the TRANS PWR switch to FORWARD.

e. Select the TRANS/TONE switch on test set to TRANS. The reading on the test set meter should be at least 129 microamperes. Refer to the graph supplied with the test set for conversion of microamperes to watts.

f. Select the TRANS PWR switch to REFL (reflected) and note the meter reading in microamperes. Refer to the graph supplied with the test set for conversion of microamperes to RF reflected power in watts.

g. Determine from the forward and reflected power that the SWR is less than 2.5 : 1.

h. Repeat (b) to (g) inclusive, preceding, for the following frequencies:

(1) 250.0 mc.

(2) 270.0 mc.

(3) 290.0 mc.

(4) 300.0 mc.

(5) 310.0 mc.

(6) 320.0 mc.

TRANSMITTER MODULATION

45. Carry out a transmitter percentage modulation check as follows:

a. Manually select a frequency of 304.7 mc on the radio control panel.

b. Select the test set function switch to TRANS PWR.

c. Select the TRANS MOD switch to DIRECT.

d. Select the TRANS PWR switch to CAL.

e. Hold the TRANS TONE switch to TRANS and adjust the meter reading to % CAL with the % MOD CAL control.

f. Select the function switch to % MOD. Hold the TRANS TONE switch to TRANS. The meter should read from 150 to 200 microamperes (80% to 100% modulation).

NOTE

The headset must be disconnected for this check.

SIDETONE LEVEL

46. Carry out a sidetone level check as follows:

a. On the test set, turn function switch to AUDIO. Place RF MOD switch to ON and adjust volume control on radio control panel for a meter reading of 50 microamperes.

b. Place test set function switch to SIDETONE and turn RF MOD to OFF.

c. Place TRANS TONE switch to TRANS and module transmitter by placing TRANS MOD switch to DIRECT. The meter reading should be between 100 to 150 microamperes.

d. Place function switch on radio control panel to OFF and disconnect test set.

dA. Switch T/R control OFF. Disconnect RF wattmeter and dummy load. Connect aircraft coaxial antenna cable to transceiver.

EMERGENCY EJECT

47. DELETED

a. DELETED

b. DELETED

c. DELETED

d. DELETED

e. DELETED

f. DELETED

g. DELETED

h. DELETED

j. DELETED

k. DELETED

m. DELETED

n. DELETED

p. DELETED

q. DELETED

r. DELETED

s. DELETED

t. DELETED

u. DELETED

v. DELETED

FUNCTIONAL TEST EUHF/IFF BAILOUT CIRCUIT

47A. Carry out an EUHF/IFF bailout circuit check as follows:

a. Connect a termaline wattmeter to J102 of the directional coupler CU-5038/ARC-552 and an IFF ramp test set to J2 ANT of the RT862(A)/APX77.

b. Apply ground power to aircraft and engage inverter No. 1. After approximately 30 seconds, energize and hold the spring loaded SEAT EJECT TEST switch located on the UHF test panel in the right hand nose compartment.

c. Check to see that a minimum of 2.2 watts RF power is indicated on the wattmeter and 400 Hz audio tone is present with the intercom UHF switch on. Ensure that after 20 seconds the OFF ramp tester indicates 7700 mode 3 reading.

CAUTION

With the SEAT EJECT TEST switch energized the IFF will radiate an emergency signal even with the IFF control master switch off. Do not energize SEAT EJECT TEST switch without the ramp test set connected.

d. Release SEAT EJECT TEST switch to the OFF position. Remove the wattmeter and IFF ramp tester and reconnect the antenna coax cables.

NOTE

The BAILOUT OVERRIDE switch on the UHF AUX panel does not work for this test.

CAUTION

Before proceeding to the following test contact local Air Traffic Control (ATC) for authorization to transmit on 243 Mhz.

e. Carry out functional check of EUHF by contacting ATC on 243 Mhz. Ensure that both Tx and Rx signals are clear and strong.

f. Turn off inverter No. 1, turn off aircraft power and remove ground power.

SNEAK CIRCUIT CHECK

48. Carry out the following check:

a. Ensure that the following circuit-breakers are pushed in:

(1) IFF (2) (centre console).

(2) DELETED

(3) UHF Emergency (centre console).

b. Select the IFF function switch to NORM.

c. Push in both I/C controls on the intercom dual control panel and ensure that the UHF control is set at mid position and is pulled out.

d. Without depressing the push-to-talk switch speak into the microphone and listen in headset to ensure that there is no sidetone.

e. Select the UHF emergency switch (auxiliary control panel) to ON. Repeat (d), preceding.

f. Select the main UHF control to OFF.

g. DELETED

OPERATIONAL CHECK

49. Carry out an operational check as follows:

CAUTION

Before communicating with the ground station, ensure that there are no other transmissions on the channel selected.

a. Select the PRE/MAN switch to PRE. Select a suitable channel.

b. Select T/R-OFF switch to T/R. Allow a warm-up period and connect a microphone headset to the pilots jack.

c. Depress the mic button on the pilots power lever and establish communication with the ground station.

d. Select T/R + G and repeat (c), preceding.

e. Select the PRE/MAN switch to MAN. Manually select the chosen frequency on the radio control panel and repeat (c), preceding.

AUXILIARY CONTROL PANEL CHECK

50. Visually inspect the control panel for damage and ensure that all controls are free to move normally. Remove panel and disconnect the connector and plug. Using an ohmmeter, carry out a continuity and resistance check from the control panel connector as follows:

Bail-out Override

51. Carry out a bail-out override continuity check as follows:

a. On auxiliary control panel, place the bail-out override switch to NORMAL.

b. Place the multimeter function switch to D.C. and the range switch to RX1.

c. Connect the multimeter to pins A and C on the connector. The meter should read infinity.

d. Place the bail-out override switch to OVERRIDE. The meter should read zero.

e. Disconnect the ohmmeter lead from pin A and connect to pin D.

f. Place the bail-out override switch to NORMAL. The meter should read zero.

g. Disconnect the ohmmeter lead from pin C and connect to pin B. The meter should read infinity.

h. Place the bail-out override switch to OVERRIDE. The meter should read zero.

Volume Control

52. Carry out a volume control continuity check as follows:

a. Disconnect ohmmeter leads from B and D on connector and connect to pins G and H.

b. Place the range switch on multimeter to the RX100 scale.

c. Turn the VOL control on the auxiliary control panel maximum clockwise. The meter should read zero ohms.

d. Slowly turn the VOL control counterclockwise. The meter should indicate a smooth increase in resistance.

e. With the VOL control in the fully counterclockwise position, the meter should read between 9000 ohms and 11,000 ohms.

f. Remove the meter lead from pin G and connect to pin F. The meter should read between 500 ohms and 620 ohms.

g. Turn the VOL control slowly clockwise. The meter should indicated a smooth increase in resistance.

h. With the VOL control in the fully clockwise position, the meter should read between 9,500 ohms and 11,620 ohms.

j. Remove the meter lead from pin F and connect to pin J. Rotate VOL control fully counterclockwise and repeat (g) and (h), preceding.

k. Remove the meter lead from pin H and connect to pin G. The meter should read between 9,500 ohms and 11,620 ohms.

m. Remove both meter leads from pins G and J on connector.

n. With meter switch selected to highest range, connect one lead to test point M and connect the other lead in succession to test points F, G, H and J. Readings should be infinity.

UHF Emergency On-off

53. Carry out a UHF emergency on-off check as follows:

a. On auxiliary control panel, place the UHF EMER ON-OFF switch to off and connect the meter leads to pins D and E of the connector.

b. With the meter switch on highest range, reading should be infinity.

c. On auxiliary control panel, place UHF EMER ON-OFF switch to ON. The meter should read zero.

d. Repeat (a) to (c) inclusive, preceding, several times to ensure that a malfunction of the switch does not occur when switching from ON to OFF and vice versa.

Pilot Light

54. Check that the lamps used are number 327 and that lights and shields are clear and not tinted. Carry out a pilot light continuity check as follows:

a. Remove both pilot lamps from their holders and connect the multimeter leads to pin K of connector and the chassis of UHF auxiliary control panel. The meter should indicate infinity.

b. Replace one lamp in either of the holders. The meter should indicate zero ohms.

c. Remove lamp from holder and place other lamp in other holder. The meter should indicate zero ohms.

d. If the meter does not indicate zero ohms, check the continuity of the lamp to ensure it is not an open circuit.

e. Replace both lamps in their holders.

FUNCTIONAL TEST - EMERGENCY UHF SYSTEM

TEST EQUIPMENT

55. The following test equipment is required:

a. Portable UHF test set (Item 66, Figure 1-5).

b. Microphone-headset (Item 73, Figure 1-5).

c. RF wattmeter (Item 78, Figure 1-5).

d. Adapter cable for microphone-headset.

e. Adapter, IPC 83100.

f. Seat microswitch clamps (2).

PRELIMINARY

56. Procedure:

a. Energize cockpit No. 2 essential d.c. bus, cockpit non- essential d.c. bus, and No. 1 and No. 2 inverters (see Figure 1-1).

b. Connect UHF test set to UHF emergency rapid-test facility J-103 and J-105 on test panel in nose equipment bay.

c. Ensure that the following circuit-breakers are pushed in.

(1)	CB1RU	UHF EMERG
(2)	CB1RU	(115-volt phase A)
(3)	CB1RU	(115-volt phase B)
(4)	CB1RU	(115-volt phase C)
(5)	CB1RU	INTERCOM (28-volt d.c.)

d. Select intercom ON-OFF switch and emergency UHF ON-OFF switch, on UHF auxiliary control panel, to ON.

TEST SET

57. Switch on test set and allow a warm-up period.

a. Set function switch to zero and adjust meter zero control for a zero indication on meter.

b. Set function switch to 27.5. The meter should read 172 to 193 microamperes (26.2 to 29 volts).

c. Set function switch to PH1, PH2, and PH3 in turn. In each position, the meter reading should read between 143 and 161 microamperes (108 and 121 volts).

EMERGENCY RECEIVER AVC

58. Select function switch to AVC GD. The meter should read not less that 35 microamperes (0.8 volts d.c.).

NOTE

The meter reading is the residual AVC voltage obtained when the signal generator is not tuned to the UHF receiver. The AVC voltage increases as the test set is tuned and as the signal is increased with the step attenuator.

RECEIVER SIGNAL-NOISE RATIO

59. On the test set, select the transfer power switch to FWD and the function switch to RF SET. With the attenuator switch at -40db, adjust the RF SET knob until the meter reads opposite the RF indication.

a. Tune the test set oscillator to the guard frequency by selecting the test set function switch to AVC GD and adjusting the megacycle dial for maximum meter reading.

b. Select the test set function switch to RF SET and readjust the meter to the RF level.

c. Adjust the output attenuator to -50db and repeat (a) and (b), preceding.

d. Select the function switch to AUDIO and switch RF MOD to ON (the modulation has been readjusted to 30% at 400 cycles).

e. Listen for a clear 400-cycle tone in the headset.

f. Select the RF MOD switch to OFF and check that the noise level in the headset is decidedly less than the level of the 400-cycle tone.

TRANSMITTER SWR CHECK

60. Carry out a standing wave ratio (SWR) and output power check as follows:

a. Select the TEST CHANNEL switch in nose equipment bay to TEST and fasten it in that position.

b. Select the test set function switch to TRANS PWR. Select the TRANS PWR switch to FWD. Select the RF MOD switch to OFF.

c. Operate the PTT switch on the instructors power lever. The meter should read at least 50 microamperes. Refer to graph supplied with test set for conversion of microamperes forward-power to watts.

d. Select the TRANS PWR switch to REF and note the meter reading in microamperes. Refer to graph supplied with test set for conversion of microamperes to RF reflected power in watts.

e. Determine from the forward and reflected powers that the SWR is less that 2.5:1 by referring to the graph of forward-reflected power supplied with the test set.

PERCENTAGE MODULATION

61. Carry out percentage modulation check as follows:

a. Select the TRANS MOD switch to INTERPHONE.

b. Select the TRANS PWR switch to CAL.

c. Select the test set function switch to TRANS PWR.

d. Operate the PTT switch on the left-hand power lever and adjust the meter reading to 50 microamperes by means of the % MOD CAL control.

e. Select the function switch to % MOD and, holding the PTT switch to ON, note the meter reading in microamperes.

NOTE

The headset must be disconnected for this check.

f. Multiply the meter reading by two. Determine the percentage modulation from the graph (microamperes-% modulation) supplied with the test set. Check that the percentage of modulation is between 65% and 100%.

SIDETONE LEVEL

62. The sidetone level is measured at the audio output of the receiver. Carry out a sidetone check as follows:

a. Select the function switch to SIDETONE.

b. Select the TRANS MOD switch to INTERPHONE

c. Hold down the PTT switch and listen for an adequate level of 400-cycle tone from the headset.

NOTE

Hold down the PTT switch and select the UHF I/C VOL to mid position and check for smooth operation of volume control on the UHF AUX control panel. Leave the control VOL/UHF AUX set to a comfortable listening level.

CHANNEL 1 (243.0 mc/s)

63. The following check is carried out using a dummy load (RF wattmeter).

a. Select emergency UHF ON-OFF switch to OFF and release test channel switch.

b. Disconnect coaxial lead from AT-265A/ARC UHF antenna and connect RF wattmeter with disconnect coaxial lead.

c. Select emergency UHF ON-OFF switch to ON. Key transmitter and check that RF wattmeter indicates at least 2.2 watts.

NOTE

To check that the tubes have been heated with the ON-OFF switch in OFF position, the transmitter must be keyed immediately.

BAIL-OUT TONE CHECK

63A. Procedure:

a. Using headset, check that, when seat eject test switch in nose compartment is placed in TEST position and bail-out switch on UHF auxiliary panel is in NORMAL position, the transceiver immediately transmits a carrier modulated signal at 400 cycles.

b. Remove either seat, place seat eject test switch to NORMAL and check that the transceiver immediately transmits a carrier signal modulated at 400 cycles.

c. Place bail-out switch on auxiliary panel to OVERRIDE and note that the transmission ceases immediately.

d. With bail-out switch still in OVERRIDE position, remove second seat and note that the transceiver again transmits a carrier modulated by 400 cycles.

dA. Replace seats and return bail-out switch to NORMAL.

TRANSMIT ISOLATION DIODE CHECK

63B. Press PTT switch several times and check with headset and wattmeter that the Emergency UHF immediately transmits an unmodulated carrier.

AUTOMATIC SELECTION FEATURE

63C. The following tests are to ensure that the EUHF is selected incase of a power failure of bail-out:

a. Switch EUHF OFF and check that when PTT switch is pressed, there is no transmission.

b. Switch No. 1 inverter OFF. Check that, when PTT switch is pressed, an unmodulated carrier is transmitted. Switch No. 1 inverter ON.

c. Place seat eject test switch in nose compartment to TEST and check that a carrier modulated of 400 cycles is transmitted immediately. Return test switch to OFF.

TRU CHECK

63D. Procedure:

a. Remove dummy load and reconnect coaxial lead. Switch EUHF ON.

aA. Check with UHF ground station and sidetone that the RF carrier is not modulated by abnormal ripple or hum.

b. Switch off the No. 1 inverter switch and ensure that the Emergency UHF continues to operate.

c. Switch on the No. 1 inverter switch. Switch off the No. 2 inverter switch and ensure that the Emergency UHF continues to operate.

d. Switch off the No. 1 inverter switch and check that the Emergency UHF does not operate.

OPERATIONAL CHECK

63E. Procedure:

a. Establish two-way communication with ground station.

b. Check that the general performance of the equipment is acceptable to the aircraft and the ground station.

c. Switch off all equipment.

d. DELETED

s. Disconnect and remove all equipment used during the test.

FUNCTIONAL TEST - EJECTION SEAT DISTRESS SIGNAL MICROSWITCHES

EJECTION SEAT DISTRESS SIGNAL MICROSWITCHES

64. Carry out the following check whenever the seats are removed and reinstalled. An ohmmeter is required for this check. The readings listed are obtained using a Stark Model 460 multimeter on the OHMS x 10 scale with the +VE lead of the ohmmeter to ground.

a. Ensure that the IFF and UHF systems are switched off and ensure that the main UHF 28-volt d.c. circuit-breaker (CB2RU) is pulled out and the RT5014/ARC504 is disconnected.

b. Select the normal-override switch on the auxiliary control panel to the override position. Connect the ohmmeter between TB101- 7 (nose equipment section) and ground. With both seats out, the ohmmeter should read approximately 50 ohms.

CAUTION

When installing seats, ensure that the microswitch clamp, or protective cap if used, is removed.

c. DELETED

d. DELETED

e. DELETED

f. Move meter lead from TB101-7 to TB104-4. Reading should be zero ohms.

g. Install one seat (refer to C-12-114-0A0/MF-000). The meter should read infinity.

h. Move meter lead from TB104-4 to TB101-7. Reading should be infinity.

j. Select normal/override switch to NORMAL. The meter should read approximately 50 ohms.

k. Move meter lead from TB101-7 to TB104-4. Reading should be zero ohms.

m. Install second seat. The meter should read infinity.

n. Move meter lead from TB104-4 to TB101-7. Reading should be infinity.

p. Reconnect RT5014/ARC504.

NOTE

If the readings in (b) and (j), preceding, are approximately 40 ohms against 50 ohms, and the readings in (h) and (n), preceding, are approximately 60 ohms against infinity, the system is probably serviceable but the preset on the UHF is on a different channel than the memory drum. Applying power, switching the main UHF on and presetting will correct the readings.

PART 2A

TABLE OF CONTENTS

COMMUNICATION SYSTEMS

SECTION 1 – INTERCOM

SECTION 2 – UHF SYSTEM

SECTION 3 – VHF SYSTEM

PART 2A

LIST OF ILLUSTRATIONS

COMMUNICATION SYSTEMS

PART 2A

COMMUNICATION SYSTEMS

(This part provides descriptive maintenance instructions, and electronic wiring data of the Intercom, UHF and VHF systems for the CT114 aircraft modified in accordance with C-12-114-000/CF-459 or CF-461, CF-462, CF-463, CF-464 and CF-507. Aircraft not modified in accordance with CF-507 are refered to as ex-Snowbird.)

SECTION 1

INTERCOM

GENERAL DESCRIPTION

1. The 5071-1-1/AIC-504 intercom panel or Audio Selector Panel (ASP) is designed for use in training applications. All electronics and controls are duplicated within the panel. Total system separation is maintained using dual amplifiers and power supplies.

2. The ASP is located on the centre console between the RH and LH seats. The panel is secured by four standard Dzus fasteners. The panel is connected to the interphone system via a circular connector located on the rear of the panel. All controls for the RH and LH seats are located on the front of the panel. An edge-lit panel illuminates volume control knobs and switch placards. Power for switch lighting is supplied by 28-volt dc aircraft power. No provision is made for variable lighting.

3. Inside the ASP are two Printed Circuit Board (PCB) assemblies, Part Nos 5071-30-2 and 5071-30-3. The 5071-30-2 board is utilized by the LH controls, and the 5071-30-3 by the RH controls. The boards are identical, with the exception of four additional resistors (R33, R35, R36 and R39) on the 5071-30-2, to reduce bleed-through.

CONTROLS

4. The audio selector panel controls are illustrated in Figure 2A-1. These controls allow selection and volume control of incoming audio signals. Pulling out the control knobs (INT, UHF, VHF and NAV) selects the associated audio signal. Rotating the control knob clockwise (CW) increases volume; rotating counter-clockwise (CCW) decreases volume.

5. The VHF/UHF toggle switches are two-position switches which enable each operator to transmit on the desired radio. Selected radios shall be keyed with external Press-To-Talk (PTT) switches. For the intercom system electrical schematic, see Figure 2A-3.

COMPONENT LOCATIONS

6. For location of intercom system main components, see Figure 2A-2.

OPERATION

INTERCOM

7. With RH INT switch pulled out, hot mic interphone and sidetone are provided. LH seat headset volume is controlled using the LH INT volume control knob.

8. With LH INT switch pulled out, hot mic interphone and sidetone are provided. RH seat headset volume is controlled using the RH INT volume control knob.

TRANSCEIVER

9. Transceiver sidetone is obtained on the normal receiver input channel. Pull out the received input switch to receive transmit sidetone. Adjust the volume using the receiver volume control.

RECEIVED AUDIO

10. Pull out receiver switch and adjust volume level using associated receiver volume control.

UHF OR VHF TRANSMIT

11. Select desired transmitter using either VHF/UHF toggle switches (mic select switch) on the ASP. Activate the Press-To-Talk (PTT) switch located on the throttles. When transmitting, the INT switch of the transmitting operator is overridden. Sidetone for the selected channel is obtained from the selected receiver; enabling the other operator to hear the transmission.

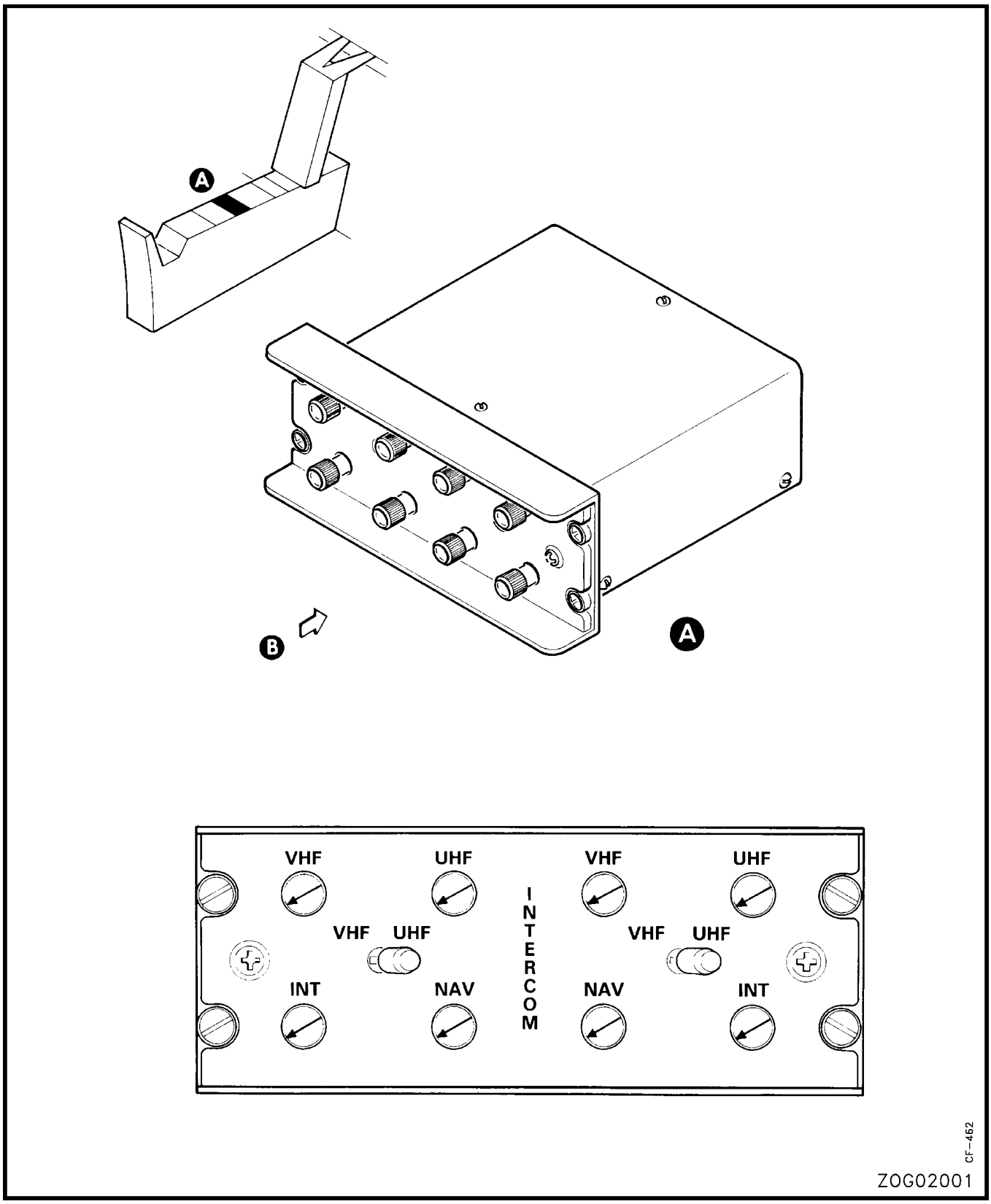
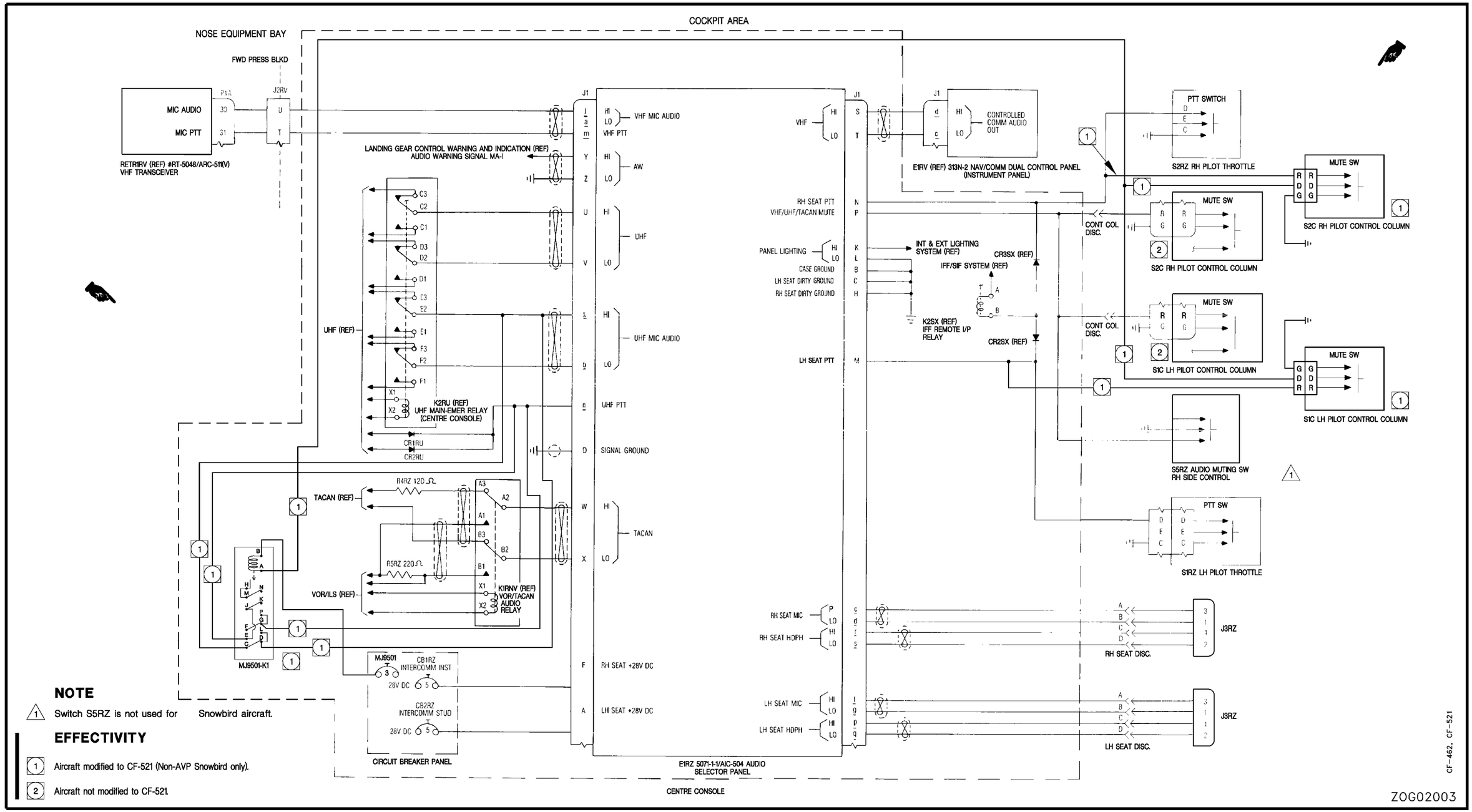


Figure 2A-1 AIC-504 Audio Selector Panel

Component	Locations
5071-1-1/AIC-504 Audio selector panel (E1RZ)	Centre console
Circuit-breaker (CB1RZ) (RH SEAT)	Centre console extension
Circuit-breaker (CB2RZ) (LH SEAT)	Centre console extension
Student PTT switch (S1RZ)	LH seat throttle
Instructor PTT switch (S2RZ)	RH seat throttle
AUDIO MUTING switch (S5RZ)	RH console
Component	Locations
Mute switch (S1C)	LH pilot control column
Mute switch (S2C)	RH pilot control column
LH mic and headset connector (J3RZ)	LH seat
RH mic and headset connector (J3RZ)	RH seat

Figure 2A-2 Intercom System – Component Locations



NOTE

1. Switch S5RZ is not used for Snowbird aircraft.

EFFECTIVITY

1. Aircraft modified to CF-521 (Non-AVP Snowbird only).
2. Aircraft not modified to CF-521.

Intercom System – Electrical Schematic Figure 2A-3

UHF/VHF/NAV MUTING

12. Depress AUDIO MUTING (UHF/VHF/NAV mute) switch on the RH console to activate the UHF/VHF/NAV mute line. This disables reception of all incoming received audio for either the LH or RH seats.

COCKPIT SPEAKER AND VOICE RECORDER

13. No provisions are made for interface with a cockpit speaker or voice recorder.

POWER SUPPLY AND LIGHTING

14. ASP power comes from the aircraft 28-volt dc power supply. Power is routed to pins A and F of the rear connector J1 through two, INTERCOMM INST and INTERCOMM STUD circuit-breakers, located on the centre console extension.

15. Edge-lit lighting voltage is supplied by aircraft 28-volt dc power supply. The voltage is routed through pins K and L of the rear connector J1 to eight edge-lit lamps soldered to the edge-lit PCB.

RECEIVER INPUTS

16. Audio from all receivers (VHF/UHF/NAV) is routed into the ASP through connector J1 (pins S, V and W) to the PCB and back to the volume controls. With the knobs pulled out, audio is routed to PCB radio inputs at VHF, UHF and NAV. From here, signals are amplified and sent to headphone amplifiers AR2 and AR4. During VHF/UHF/NAV muting, receiver audio is prevented from reaching headsets.

AURAL WARNING

17. Aural warning signals are routed through connector J1 (pin Y) to the PCB. They are then routed to headphone amplifiers AR2 and AR4.

FUNCTIONAL TEST

EQUIPMENT

18. The following equipment is required:

a. H-157/AIC headset or equivalent.

b. M-87/AIC microphone or equivalent.

INTERCOM SYSTEM

19. Proceed as follows:

NOTE

No transmissions shall be made on 121.5 MHz or 243 MHz at any time.

a. Connect ground power to the aircraft and set dc MASTER switch to GRD PWR.

b. Ensure that INTERCOMM INST and INTERCOMM STUD circuit-breakers are closed.

c. Attach headsets to their respective connectors (J3RZ) on the ends of the microphone headset cables hanging from the LH side of both seats and ensure that muting switches are not depressed.

d. Set both the instructor and student audio level controls (INT, UHF, VHF and NAV) on the ASP, located on the centre console, to one half of full CW rotation. Set all controls to on (pulled out).

e. Speak normally into the RH side microphone and check that the audio level is satisfactory. Adjust the RH side audio level on the ASP to provide a satisfactory audio level.

f. Repeat Step e for LH side.

g. Speak into the RH side microphone while listening with the LH side headset. Check for clarity and volume.

h. Repeat Step g for LH side while listening with the RH side headset.

j. Open INTERCOMM STUD circuit-breaker and verify that the LH side is disabled while the RH side remains operational. Close INTERCOMM STUD circuit-breaker and open INTERCOMM INST circuit-breaker. Verify that LH side is now operational while the RH side is disabled. Close the INTERCOMM INST circuit-breaker.

k. Test the UHF function by selecting a suitable frequency on the UHF and establishing communication with the ground station, by pressing the RH or LH seat PTT switch (refer to UHF system testing, Section 2).

m. Test the VHF function by selecting a suitable frequency on the VHF and establishing communication with the ground station, by pressing the RH or LH seat PTT switch (refer to VHF system testing, Section 3).

n. Test the NAV function by carrying out the appropriate functional tests of both the VOR/ILS/MKR and TACAN (refer to Part 3A, Sections 1 and 2). Listen to the marker tones, the VOR 1020-Hz tone, and the VOR and TACAN identity tones.

p. Set dc MASTER switch to OFF and remove ground power from the aircraft.

AURAL WARNING ADJUSTMENT

20. Aural warnings shall be adjusted on initial installation of ASP by carrying out the following procedure:

a. Remove ASP cover and locate R37; a small potentiometer on RH and LH channel amps. This adjusts the aural warning.

b. Install ASP and apply aircraft power. Set INT volume controls at normal levels, press master warning annunciator panel TEST switch and adjust R37 on each channel for comfortable aural warning audio level for LH and RH seat positions.

c. Disconnect power from aircraft and remove ASP. Install cover and reinstall ASP.

d. Apply power to confirm acceptable aural warning levels.

e. Disconnect aircraft power.

SECTION 2
UHF SYSTEM

GENERAL DESCRIPTION

1. The UHF radio system uses an AN/ARC-164 receiver-transmitter to provide air-to-ground and air-to-air short-range voice communication. The system operates over the frequency range of 225.000 to 399.975 MHz on channels spaced at 25 kHz intervals. For the UHF system electrical schematic, see Figures 2A-6 and 2A-7 (ex-Snowbird aircraft).

2. The system comprises the following main components (see Figure 2A-4):

a. An RT-5078/ARC-164 transceiver, mounted on the MT-4838/ARC-164 shockmount tray, located in the nose compartment.

b. A C5367(V)2/ARC-164 radio set control unit mounted on the centre console.

c. An ID-1961B/ARC-164 frequency channel indicator mounted on the LH side of the LH instrument panel.

NOTE

For Snowbird aircraft, the frequency channel indicator is mounted on the top centre of the LH instrument panel.

d. A preset frequency read switch (S4RU) mounted on the LH side of the instrument panel.

e. A UHF AT-256A/ARC antenna installed on the lower fuselage at FS 166.5.

COMPONENT LOCATIONS

3. For location of UHF and EUHF (ex-Snowbird aircraft) systems main components, see Figure 2A-5.

COMPONENT DESCRIPTION

C5367(V)2/ARC-164 UHF RADIO SET CONTROL UNIT

4. The UHF radio set control unit is mounted on the centre console. Communication control is accomplished from either seat. The controls operate as follows:

a. The MANUAL/PRESET/GUARD switch has MANUAL, PRESET and GUARD positions. It selects the mode of frequency selection.

b. The preset channel selector switch selects one of 20 preset channels.

c. The five manual frequency selector switches select the operating frequency as follows (switches are listed in left-to-right order):

(1) Selects 100s digit (2 to 3).

(2) Selects 10s digit (0 through 9).

(3) Selects units digit (0 through 9).

(4) Selects 10ths digit (0 through 9).

(5) Selects 100ths and 1000ths digits (00, 25, 50, or 75).

d. The SQUELCH OFF/ON switch controls the main receiver squelch.

e. The VOL control adjusts the main receiver audio level.

f. The TONE switch controls the transmission of the 1020-Hz tone on the selected frequency.

g. The UHF function selector switch selects the operating mode as follows:

(1) OFF shuts off the equipment.

(2) MAIN activates the main receiver and the transmitter.

(3) BOTH activates the main receiver, the transmitter and the guard receiver.

(4) ADF activates the ADF and the main receiver.

h. The following controls and adjustments are located behind the FREQ CHAN subpanel on the radio set control unit:

(1) The BW switch selects wide band or narrow band selectivity of the main receiver.

(2) The PRESET switch stores a selected frequency in a selected preset channel.

(3) The SQUELCH MN control on the control box is not active. If it is necessary to adjust the receiver SQUELCH, adjust SQUELCH MN on RT5078 by rotating the adjustment fully counter-clockwise. Set OFF/MAIN/BOTH/ADF switch to MAIN and set SQUELCH switch to ON. Rotate adjustment clockwise until receiver noise is quieted completely.

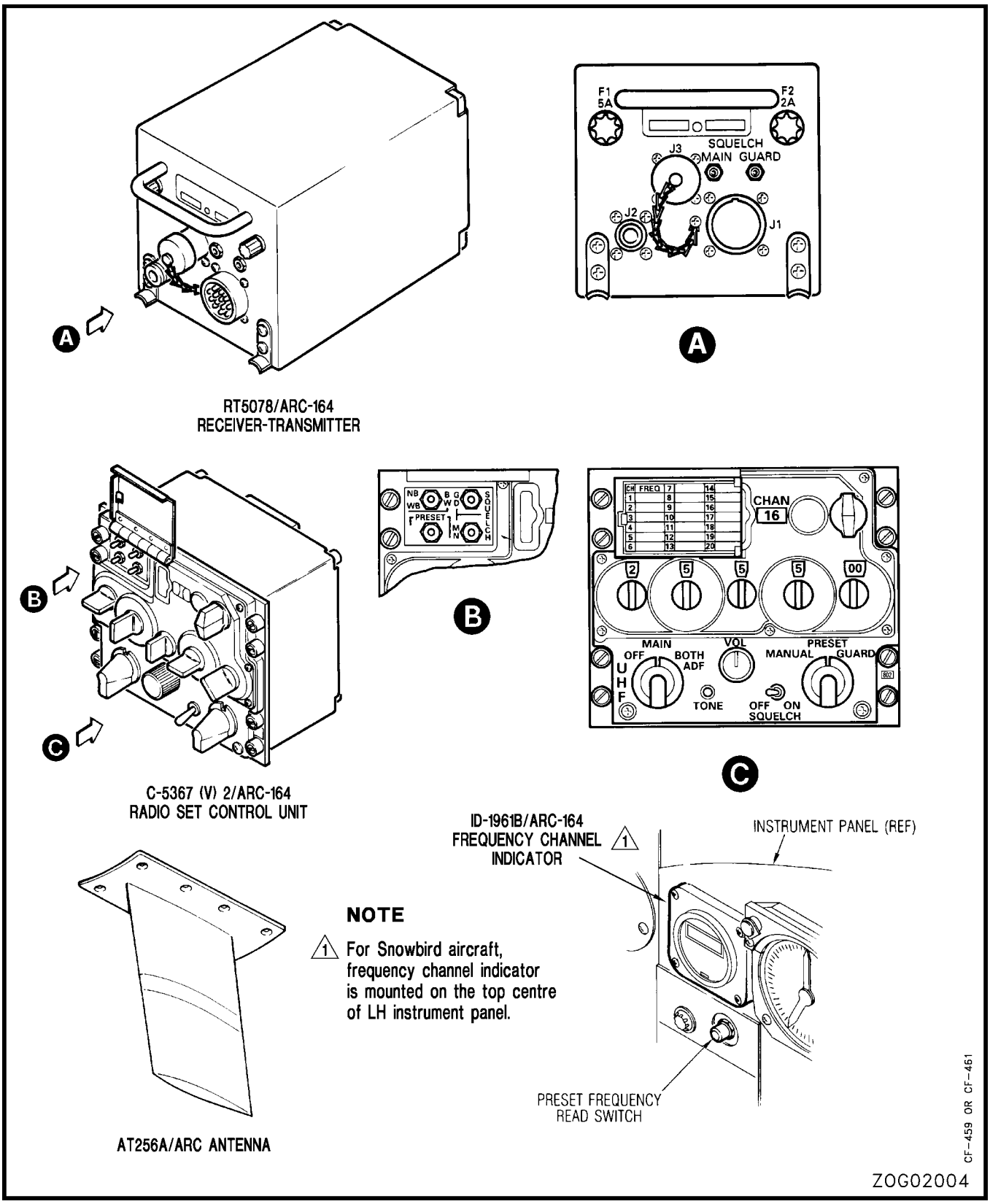


Figure 2A-4 AN/ARC-164 UHF Radio System – Main Components

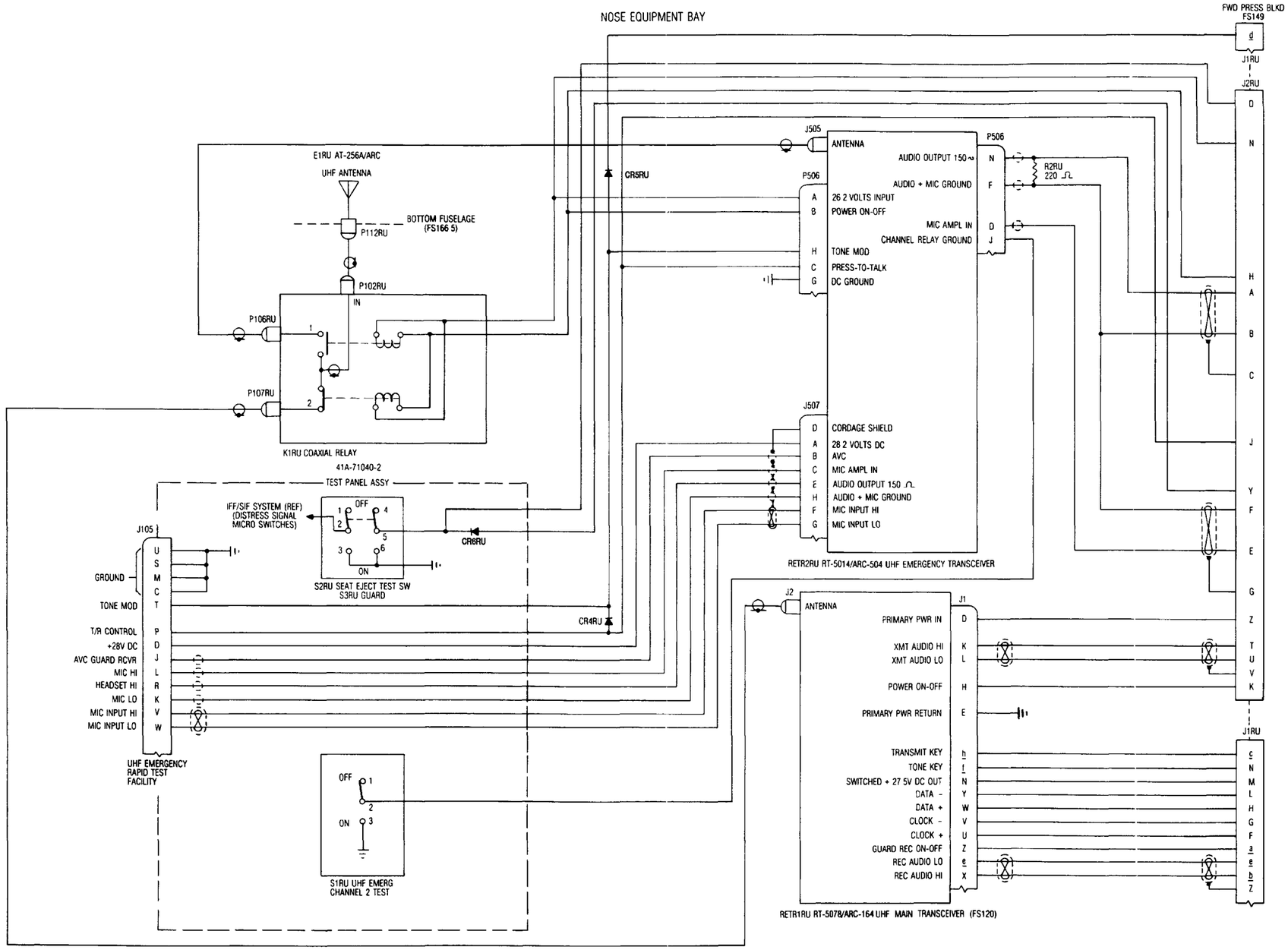
Component	Locations
UHF emergency rapid test facility *	Bulkhead, FS 110
Coaxial relay (K1RU) *	Bulkhead, FS 110
Resistor (R2RU) *	Bulkhead, FS 110
RT5078/ARC-164 UHF main transceiver (RETR1RU)	Nose compartment, FS 120
RT5014/ARC-504 UHF emergency transceiver *	Nose compartment
AT-256A/ARC UHF antenna (E1RU)	Bottom fuselage, FS 166.5 Bottom fuselage, FS 190.0 **
ID-1961B/ARC-164 frequency channel indicator (M1RU)	Instrument panel, LH side Top centre of LH instrument panel ***
Preset frequency read switch (S4RU)	Instrument panel, RH side
Component	Locations
C5367(V)2/ARC-164 radio set control unit (E2RU)	Centre console
UHF auxiliary control panel (E3RU)	Centre console
UHF main emergency relay (K2RU)	Centre console
Circuit-breaker (CB1RU) *	Centre console extension
Circuit-breaker (CB2RU)	Centre console extension

* On Ex-Snowbird aircraft only.

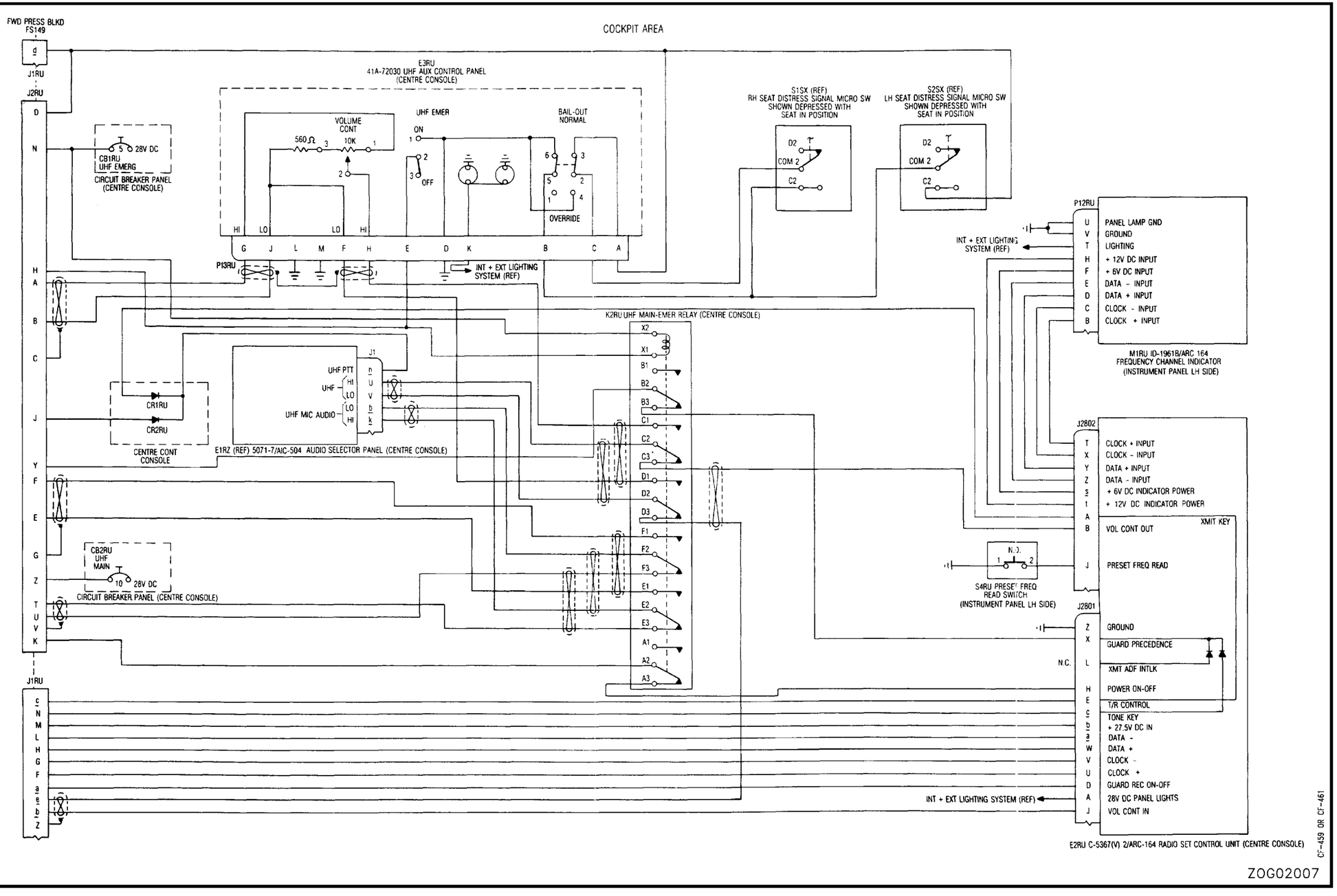
** On ADF equipped Snowbird aircraft.

*** On Snowbird aircraft only.

Figure 2A-5 AN/ARC-164 UHF Radio System – Component Locations



AN/ARC-164 UHF Radio System – Electrical Schematic (ex-Snowbird aircraft) (Sheet 1 of 2) Figure 2A-6



AN/ARC-164 UHF Radio System – Electrical Schematic (ex-Snowbird aircraft) (Sheet 2 of 2) Figure 2A-6

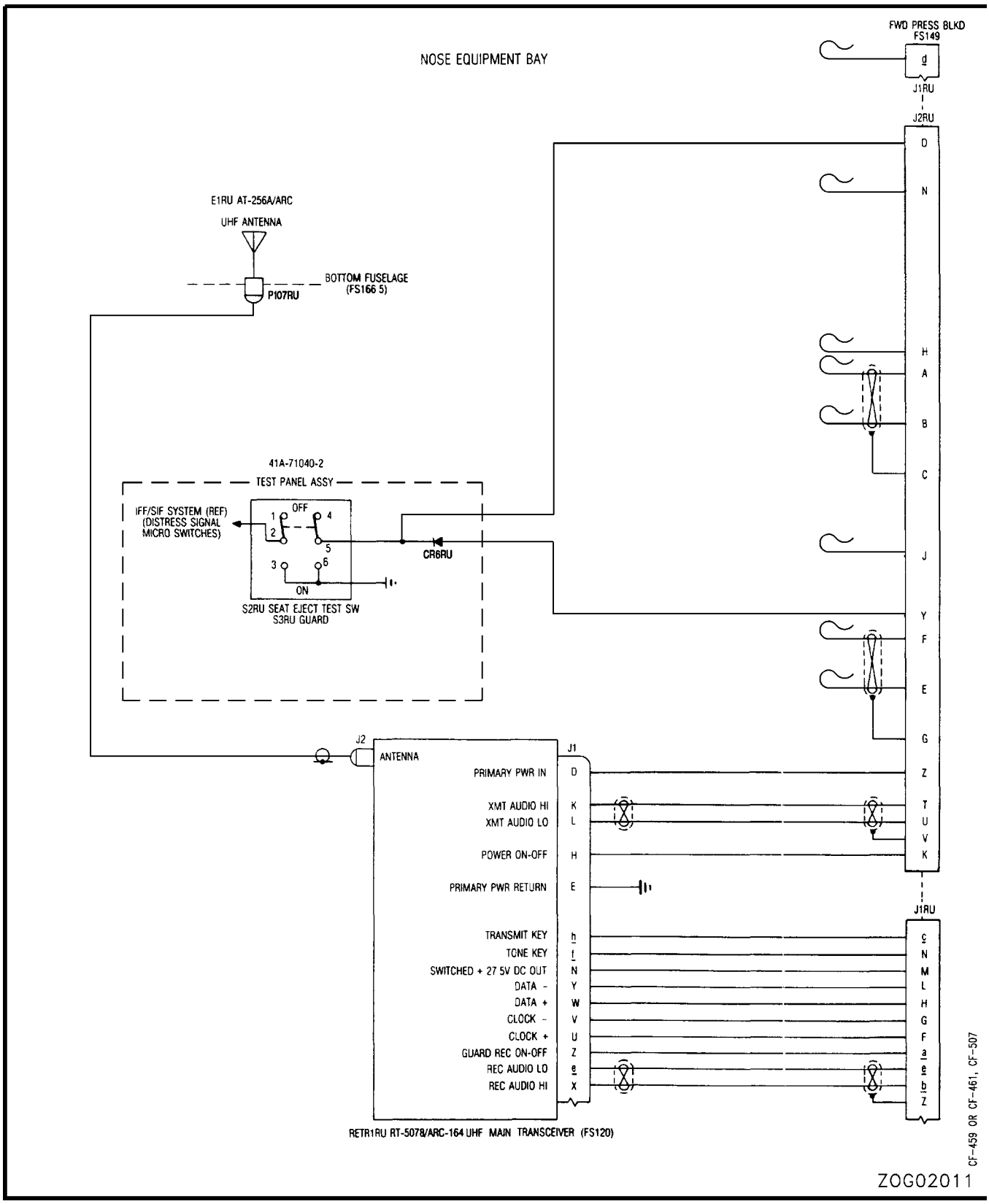
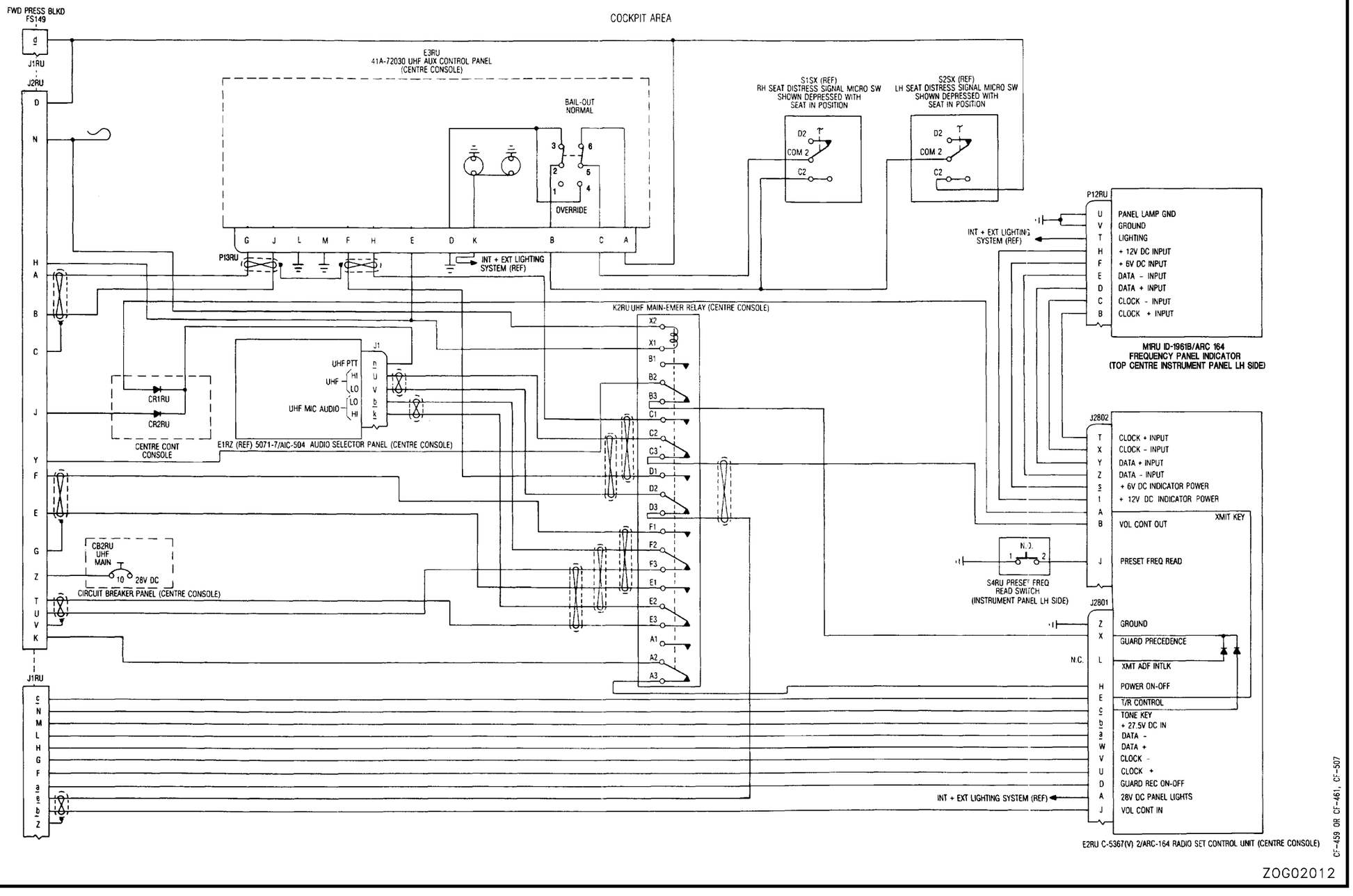


Figure 2A-7 (Sheet 1 of 2) AN/ARC-164 UHF Radio System – Electrical Schematic (Snowbird aircraft)



AN/ARC-164 UHF Radio System – Electrical Schematic (Snowbird aircraft) (Sheet 2 of 2) Figure 2A-7

(4) The SQUELCH GD control on the control box is not active. If it is necessary to adjust the receiver SQUELCH, adjust SQUELCH GD on RT5078 by rotating the adjustment fully counter-clockwise. Set OFF/MAIN/BOTH/ ADF switch to BOTH and set SQUELCH switch to ON. Rotate adjustment clockwise until receiver noise is quieted completely.

RT-5078/ARC-164 RECEIVER-TRANSMITTER

5. The solid state UHF receiver-transmitter operates over the frequency range of 225.000 to 399.975 MHz in 25 kHz increments as selected from the associated radio set control unit. Functionally, the receiver-transmitter consists of five electronic assemblies: a 10-watt carrier transmitter, a main receiver, a 243.0-MHz guard receiver, a synthesizer, and a data converter. The synthesizer assembly consists of a 7000-channel frequency synthesizer and tuning voltage generator for receiver tuning. The data converter assembly provides interfacing between the receiver-transmitter and the control units. The receiver-transmitter is a self-contained unit, with internal protection provided by two fuses on the front panel.

ID-1961B/ARC-164 FREQUENCY CHANNEL INDICATOR

6. The frequency channel indicator is mounted on the LH side, or top centre (Snowbird aircraft) of the LH instrument panel. The indicator provides a six-digit readout of the manually-selected channel frequency; a two-digit readout of a selected preset channel number; or a single-digit (G) guard channel indicator. Input serial data and dc operating power are provided to the frequency indicator from the C5367(V)2/ARC-164 radio set control unit.

PRESET FREQUENCY READ SWITCH

7. The preset frequency read switch (S4RU) is mounted on the LH side of the instrument panel, below the frequency channel indicator. Once depressed, the switch provides a ground, with the MANUAL/PRESET/ GUARD switch set to PRESET, to the UHF radio set control unit. This ground activates the UHF radio set control unit to indicate the chosen preset frequency on the frequency channel indicator.

EMERGENCY UHF ANTENNA SWITCHING (EX-SNOWBIRD AIRCRAFT)

8. The AT-256A/ARC UHF antenna is connected to the RT- 5078/ARC-164 transceiver through the coaxial relay (K1RU) located on the bulkhead, at FS 110.

COAXIAL RELAY (EX-SNOWBIRD AIRCRAFT)

9. The coaxial relay (K1RU) connects the output of the main and emergency transceivers to the antenna. The coaxial relay normally connects the main transceiver to the antenna; however, when the emergency transceiver is activated, the coaxial relay disconnects the main transceiver from the antenna and connects the emergency transceiver.

PILOT MICROPHONE SWITCH

10. Each pilots' microphone Press-To-Talk (PTT) switch is located on the throttle lever grip. Holding the microphone button depressed allows transmission from the radio communication set.

MUTE SWITCH

11. Radio muting is accomplished by operating either the AUDIO MUTING switch on the RH console or the mute switches on the instructor and student control columns.

UHF RADIO POWER

12. The UHF radio system operates on 28-volt dc power, which is supplied through a 10-ampere, UHF MAIN circuit-breaker, located on the centre console circuit-breaker panel.

EUHF RADIO POWER (EX-SNOWBIRD AIRCRAFT)

13. The EUHF radio system operates on 28-volts dc power, which is supplied through a 5-ampere circuit-breaker, UHF EMERG, located on the centre console circuit-breaker panel.

OPERATION

GENERAL

14. The AN/ARC-164 UHF radio system operates in conjunction with the interphone system to provide air-to-ground and air-to-air short-range voice communication. The radio is activated from either the LH or RH seat.

15. Operation of the UHF radio is controlled from the C5367(V)2/ARC-164 radio set control unit, located on the centre console. The radio is activated by setting the OFF/MAIN/BOTH/ADF switch, on the control unit, to the MAIN or BOTH position. In the BOTH position, the guard receiver is also activated.

16. The main receiver and transmitter are tuned to the guard frequency and the guard receiver is de-activated by setting the control unit MANUAL/PRESET/GUARD switch to the GUARD position.

17. The operating frequency within the 225.000 to 399.975 MHz frequency band may be selected manually by setting the control unit MANUAL/PRESET/ GUARD switch to MANUAL and using the five frequency selector controls. Any one of 20 preset frequencies may be selected by means of the preset channel selector switch when the MANUAL/PRESET/GUARD switch is in the PRESET position.

18. The volume of the receiver audio output is adjusted by means of the VOL control on the control unit. The control unit SQUELCH switch allows the receiver squelch to be de-activated to receive low level signals, or to check the receiver noise during maintenance.

TRANSMITTER

19. The transmitter assembly consists of three subassemblies: the modulator, the RF power amplifier and the power supply. The modulator subassembly contains a modulator, an audio amplifier and mixer, a T/R switch driver and a 1020-Hz tone generator. The power amplifier subassembly contains a power amplifier, a driver amplifier, a power output sampler and a T/R switch.

20. The power supply subassembly operates from 28-volts dc and generates the voltages required by the receiver-transmitter.

21. When the PTT switch on the engine throttle is depressed, microphone audio is supplied from the control unit to the modulator assembly, along with the keying voltage needed to operate the T/R switch driver. The switch driver in turn activates the T/R switch in the RF power amplifier. The modulated RF signal from the modulator is supplied to the power amplifier via the driver amplifier, and the power amplifier output is supplied to the antenna via the T/R switch. The transmitter output is sampled and supplied back to the modulator subassembly for power and modulation control and for the generation of sidetone.

22. The frequency of the transmitted signal is determined by the RF injection frequency supplied to the modulator from the synthesizer assembly. The modulator subassembly contains a 1020-Hz tone generator. To transmit this tone on any selected frequency, the tone generator is activated by means of the TONE switch on the control unit.

MAIN RECEIVER

23. The main receiver is a double-super-heterodyne type. The injection frequency for the first mixer is obtained from the synthesizer assembly, and the injection frequency for the second mixer is obtained from a crystal-controlled local oscillator. The first IF is 70 MHz and the second is 30.112 MHz. The RF amplifier contains varactor diodes which tune the receiver operating frequency by means of a tuning voltage generated in the synthesizer assembly.

24. Received signals are supplied from the antenna to the receiver RF amplifier via the T/R switch in the transmitter assembly, and the guard receiver assembly. Receiver gain is controlled by the AGC voltages applied to the RF amplifier and the first IF amplifier. The AGC voltages are derived from the receiver audio output, as is the squelch control voltage. Squelch, which is amplified, may be de-activated by means of the SQUELCH switch on the control unit. The squelch circuit shop adjustment potentiometer is located on the data converter assembly. The receiver audio output is supplied to the guard receiver assembly, where, after power amplification, it is transformer-coupled into the interphone system.

GUARD RECEIVER

25. The guard receiver is a super-heterodyne receiver operating on the UHF emergency frequency of 243.000 MHz. The injection frequency for the mixer is obtained from a crystal- controlled local oscillator. The intermediate frequency is 30.112 MHz. By changing crystals and re-aligning, the receiver may be operated on any frequency between 238.00 and 248.00 MHz. Received signals are supplied from the antenna to the receiver RF amplifier via the T/R switch in the transmitter assembly. Receiver gain is controlled by AGC voltages applied to the RF amplifier and the first IF amplifier. The AGC voltages are derived from the receiver output, as is the squelch control voltage. Squelch is applied to the audio amplifier. The audio power amplifier amplifies the received guard frequency signals, the audio output of the main receiver and the sidetone signals from the transmitter. The power amplifier output is transformer-coupled into the interphone system. The squelch circuit shop adjustment potentiometer is located on the data converter assembly.

SYNTHESIZER

26. The synthesizer consists of a 7000-channel frequency synthesizer and a tuning voltage generator. The synthesizer generates both the on-channel transmitter

injection signal and the main receiver first local oscillator signal. The synthesizer uses a temperature-compensated crystal-controlled oscillator. The output of the oscillator is used as a reference for synthesizing, by phase-locked techniques, any one of 7000 frequencies spaced 25 kHz apart between 225.000 MHz and 399.975 MHz for transmit, or between 295.000 MHz and 459.975 MHz for receive. The tuning voltage is used to tune the varactor diodes in the main receiver RF amplifier.

27. The synthesizer assembly consists of a digital subassembly, an analog subassembly, and a digital-to-analog subassembly. The three subassemblies are interrelated. The synthesizer output frequencies are generated by three Voltage-Controlled Oscillators (VCO). One VCO generates transmitter low-band injection frequencies. The second VCO generates transmitter high-band injection frequencies and receiver low-band local oscillator signals. The third VCO generates receiver high-band local oscillator signals. Selection of the appropriate VCO is determined by the receive/transmit information and the high-band/low-band frequency information received from the data converter assembly. Lock-out control logic is provided to prevent the generation of transmitter frequencies below 225.000 MHz and receiver local oscillator frequencies below 295.000 MHz. This disables both the receiver and transmitter below the on-channel frequencies of 225.000 MHz.

DATA CONVERTER

28. The data converter assembly consists of a series-to-parallel data converter subassembly and a 28-volt switch subassembly. The assembly also contains main receiver and guard receiver squelch circuit adjustment potentiometers. The data converter consists of a shift-register circuit, a flip-flop latching circuit, and controlling logic circuits, which accept data and clock signal inputs from the control panel memory. These inputs are processed to produce a frequency control signal and a wide-band/narrow-band IF signal.

29. The 28-volt switch subassembly operates from the aircraft 28-volt dc supply. It receives inputs from: the control unit OFF/MAIN/BOTH/ADF SWITCH, the PTT switch, and the TONE switch. The outputs the subassembly provides are: a power on-off switching circuit to the transmitter power supply, a transmit key (circuit) to the transmitter modulator, and a key (circuit) to activate the 1020-Hz oscillator in the modulator subassembly.

CONTROL UNIT

30. The control unit consists of a switching assembly and a control adapter assembly. The switching assembly contains a memory subassembly, an interface subassembly, and all the switches used for controlling the radio operating modes. The control adapter assembly generates dc supplies for the control unit and the external frequency channel indicator.

31. The memory subassembly contains circuits to allow the presetting of 20 operating channels. The frequencies of the preset channels are manually annotated on the CHANNEL/FREQUENCY subpanel on the front of the control unit. Any one of the preset channels may be selected by means of the preset channel selector switch. The memory subassembly also converts parallel frequency control data to serial data for use in the receiver-transmitter.

32. The controls on the switching assembly are used to perform the following functions:

a. To activate the equipment power on/off.

b. To adjust the receiver volume.

c. To activate and to de-activate the receiver squelch.

d. To select one of 20 preset channels.

e. To select one of 7000 channels.

f. To select the operating mode.

g. To select the frequency selection mode.

h. To activate transmission of the 1020-Hz tone on the selected frequency.

j. To select narrow and/or wide band receiver operation.

33. The control adapter assembly produces, from a 28-volt dc input, dc power which supplies the control unit and the external frequency channel indicator.

FREQUENCY CHANNEL INDICATOR

34. The ID-1961B/ARC-164 frequency channel indicator is made up of four component board assemblies. It contains the logic circuits and the indicators to provide the following:

a. A six-digit readout of a manually-selected frequency.

b. A two-digit readout of a selected preset channel number.

c. A single-digit (G) guard channel indicator.

35. Input signal data and dc operating power are provided by the control unit.

FUNCTIONAL TEST

EQUIPMENT

36. The following equipment is required:

a. A H-157/AIC headset or equivalent.

b. A M-87/AIC microphone or equivalent.

UHF SYSTEM

37. For the functional test of the AN/ARC-164 UHF main communications transceiver and the AN/ARC-504 UHF emergency communications transceiver (ex-Snowbird aircraft), proceed as follows:

a. Connect headsets to both LH and RH seat intercom connectors (J3RZ), and set intercom controls to mid-range.

b. Set audio level on UHF radio set control panel and UHF auxiliary control panel to mid-range, and set transceiver to 225.000 MHz.

c. Set the VHF/UHF toggle switch on the audio selector panel to UHF and ensure that the following circuit-breakers, located on the centre console extension, are opened:

(1) UHF MAIN.

(2) UHF EMERG (ex-Snowbird aircraft).

(3) INTERCOMM INST.

(4) INTERCOMM STUD.

d. Connect ground power to aircraft and set dc MASTER switch to GRD PWR.

e. Close INTERCOMM STUD circuit-breaker and listen for any abnormal noise level.

f. Close INTERCOMM INST circuit-breaker and listen for any abnormal noise level.

g. Verify full communications capability between LH and RH seats.

h. Close UHF MAIN and UHF EMERG (ex-Snowbird aircraft) circuit-breakers, turn the AN/ARC-164 UHF radio set control unit and the AN/ARC-504 EUHF auxiliary control panel (ex-Snowbird aircraft) on, and verify the following:

(1) No significant increase in noise level is heard over the intercom system.

(2) The AN/ARC-504 EUHF is not in transmit mode (ex-Snowbird aircraft).

(3) The main UHF is not operating.

j. Turn the AN/ARC-504 EUHF auxiliary control panel off (ex-Snowbird aircraft).

k. Depress either PTT switch and confirm that the AN/ARC-164 UHF main transceiver goes into transmit mode. Verify that the remote frequency channel indicator reads 225.000 MHz.

m. Set the AN/ARC-164 UHF radio set control unit to 399.975 MHz, depress the PTT switch and verify that the system transmits on 399.975 MHz.

n. Reset the control unit to 260.000 MHz. Depress the PTT switch and verify that the system transmits on 260.000 MHz.

p. Select tower frequency and contact tower. Verify the channel and frequency in operation. Confirm clarity of communications between the LH and RH seats and the tower operator.

q. Set dc MASTER switch to OFF and disconnect ground power from the aircraft.

EUHF/IFF BAILOUT CIRCUITS

38. The following equipment is required:

a. A 50-ohm, 50 watt dummy load wattmeter.

b. A H-157/AIC headset or equivalent.

c. IFF ramp test set.

NOTE

Tests will be conducted in the following procedure. No transmissions shall be made on 243.000 MHz at any time that the UHF antenna is connected.

39. Proceed as follows:

a. Disconnect RF cable (RU700A) from antenna or, coaxial relay (K1RU) at FS 110 (ex-Snowbird aircraft) and connect the dummy load wattmeter.

b. Connect IFF ramp test set to J2 of the RT-862/APX-77 transponder.

c. Connect headsets to both LH and RH seat intercom connectors (J3RZ) and set intercom controls to mid-range.

d. Connect ground power to the aircraft and set dc MASTER switch to GRD PWR.

e. Close UHF MAIN and UHF EMERG (ex-Snowbird aircraft) circuit-breakers and turn on the AN/ARC-164 UHF radio set control unit.

f. Set the AN/ARC-164 UHF radio set control unit MANUAL/PRESET/GUARD switch to GUARD, depress the PTT switch and verify the following:

(1) The system transmits on 243.000 MHz.

(2) The frequency channel indicator displays the letter G.

(3) The wattmeter reads approximately 7.5 watts.

g. Release the PTT switch. Open the guard (S3RU) and set the seat eject test switch (S2RU), located on the RH side, to on. Verify that the AN/ARC-164 UHF main transceiver transmits on 243.000 MHz and that the carrier is modulated with the bail-out tone.

h. Repeat Step f with the MANUAL/PRESET/GUARD switch set to MANUAL, and then to PRESET. Verify that the frequency channel indicator indicates 243.000 MHz, regardless of the settings of the frequency selector and preset channel selector switches. Set seat eject test switch (S2RU) to off.

j. Set the AN/ARC-164 UHF radio set control unit to 260.000 MHz.

k. Set UHF-EMERG switch, on AN/ARC-504 auxiliary control panel, to ON (ex-Snowbird aircraft).

m. Set the seat eject test switch (S2RU) to on. Verify that the AN/ARC-504 emergency transceiver transmits on 243.000 MHz and that the carrier is modulated with the bail-out tone (ex-Snowbird aircraft).

n. Ensure that the IFF ramp test set indicates 7700 (mode 3/A) and that the wattmeter reads 3 to 5 watts.

p. Open the UHF EMERG circuit-breaker (ex-Snowbird aircraft), ensure that the AN/ARC-164 UHF radio set control unit is turned on.

q. Release PTT switch, turn off AN/ARC-164 UHF radio set control unit and, AN/ARC-504 EUHF auxiliary control panel (ex-Snowbird aircraft).

r. Set dc MASTER switch to OFF and disconnect ground power from the aircraft.

s. Remove test equipment and reconnect RF cable (RU700A) to antenna or, coaxial relay (K1RU) (ex-Snowbird aircraft).

RECEIVER SQUELCH ADJUSTMENT

40. Receiver squelch adjustment is accomplished with the system in operation. Proceed as follows:

a. Connect ground power to the aircraft and set dc MASTER switch to GRD PWR.

b. Gain access to the receiver/transmitter main (MN) and guard (GD) squelch screwdriver adjustments.

c. Rotate the main squelch adjustment to its extreme counter-clockwise position.

d. Set the OFF/MAIN/BOTH/ADF switch to MAIN and set the SQUELCH switch to ON.

e. Select a frequency that is used extensively.

f. Use a test headset and wait for a period when no signals are being received. Rotate the main squelch adjustment slowly clockwise until the receiver noise is just quieted completely.

g. Check other frequencies (while no signals are being received). If noise is heard, turn the squelch adjustment further clockwise until noise stops.

h. Turn the OFF/MAIN/BOTH/ADF switch to the BOTH position.

j. SELECT the guard frequency and repeat Steps f and g using the guard squelch adjustment.

k. Set dc MASTER switch to OFF and disconnect ground power from the aircraft.

SECTION 3

VHF SYSTEM

GENERAL DESCRIPTION

1. The VHF radio system uses an AN/ARC-511 receiver-transmitter to provide air-to-ground and air-to-air voice communication. The system operates over a frequency range of 116.000 to 151.975 MHz on channels spaced at 25 kHz intervals. For the VHF system electrical schematic , see Figure 2A-10.

2. The system comprises the following components (see Figure 2A-8):

a. An RT-5048/ARC-511 transceiver, mounted on the M/F 390R-20 shockmount tray, located in the nose compartment.

b. A 313N-2/ARC-511 NAV/COMM dual control unit mounted on the centre lower area of the instrument panel (refer to C-12-114-0E0/MF-000).

c. A VHF ARC-511 antenna installed aft of the canopy, dorsal centreline at FS 235.

COMPONENT LOCATIONS

3. For location of VHF system main components, see Figure 2A-9.

COMPONENT DESCRIPTION

313N-2 NAV/COMM DUAL CONTROL UNIT

4. **General.** The 313N-2 NAV/COMM dual control unit provides frequency control of airborne VHF communications equipment, VHF navigation receivers and glide slope receivers.

5. Designed for panel mounting on the aircraft instrument panel, the 313N-2 has four quick-release fasteners at the corners of the front panel. The 0.064-inch thick aluminum front panel of the unit has a black Plexiglas overlay which is edge-lit so that only the panel markings are illuminated. Behind the front panel, the 313N-2 is enclosed in a one-piece aluminum dust cover which may be removed from behind. All electrical connections are made through two rear-mounted connectors (P1ARV and P1BRV).

6. **VHF Frequency Controls.** The 313N-2 NAV/COMM dual control unit has two separate sets of VHF frequency controls placarded on the front panel (see Figure 2A-8) as COMM and NAV. The communication controls adjust the frequency of the VHF communications equipment and the navigation controls adjust the frequency of the VHF navigation receiver and the glide slope receiver.

7. **Frequency Selector Knobs.** Each set of VHF frequency controls contain two frequency selector knobs, for COMM and NAV. The LH COMM and NAV knobs adjust the frequency in 1.0 MHz steps. The RH COMM knob adjusts the communication frequency in 0.025 MHz steps. The RH NAV knob adjusts the navigation frequency in 0.05 MHz steps. This model of the 313N-2 can be used only in military applications having 100 kHz channel spacing. The internal switching circuits will not utilize the 50 kHz channel spacing feature. All the frequency selector knobs are rotated clockwise for an increase in frequency.

8. **Power and Gain Controls.** Mounted concentrically on the LH COMM and NAV frequency selector knobs are OFF-PWR switches. These OFF-PWR switches control power to their respective equipment. Also, the LH COMM frequency selector knob has a TEST position which disables the squelch circuit in the communications receiver. This increases background noise to the headsets connected to monitor VHF audio output. A VOL (volume) control, which adjusts the communication and navigation audio levels is mounted concentrically on the RH COMM and NAV frequency selector knobs.

9. **NAV TEST Toggle Switch.** Mounted in the upper centre of the front panel is a three-position NAV TEST toggle switch used to test the VOR/LOC system. With the navigation receiver tuned to a localizer frequency, setting the switch to the UP/L position causes the vertical (on course) needle to deflect left and the glide slope pointer to deflect upward on the course indicator. Setting the switch to the DN/R position causes the vertical needle to deflect right and the glide slope pointer to deflect downward. With the navigation receiver tuned to a VOR frequency, setting the NAV TEST toggle switch to the VOR (down) position provides an airborne duplication of a ground VOR test station. The RMI indicates 180 degrees, and with the SET knob set to 180, the vertical needle centres, and the TO-FROM flag indicates TO.

10. **Digital Counter Dials.** The selected frequency is indicated on digital counter dials. These digital counter dials have 3/8-inch back-lit numerals and are mounted behind two windows in the front panel.

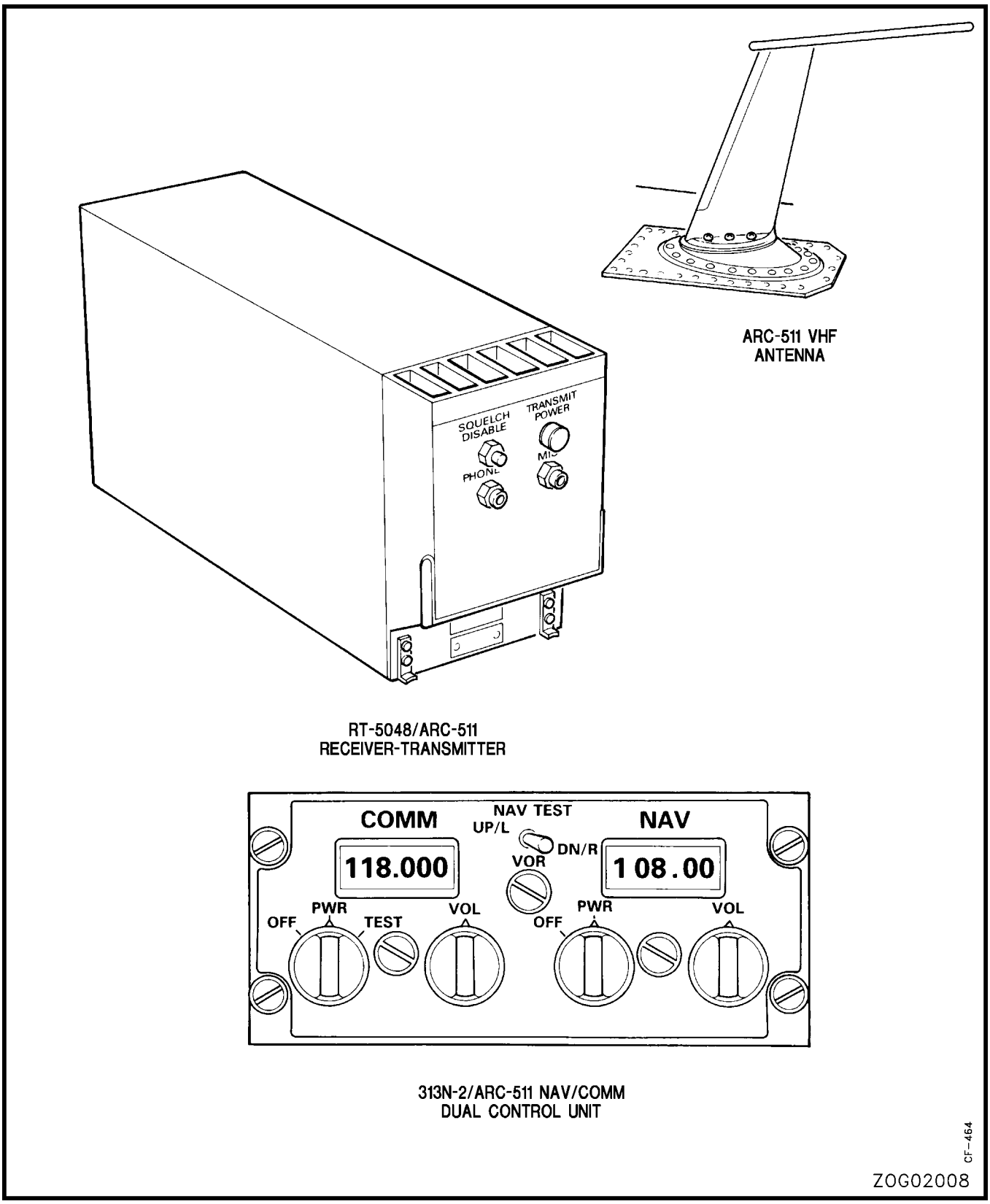


Figure 2A-8 AN/ARC-511 VHF Radio System – Main Components

Component	Locations
RT-5048/ARC-511 VHF transceiver (RETR1RV)	Nose compartment
313N-2/ARC-511 NAV/COMM dual control unit (E1RV)	Instrument panel, centre lower area
ARC-511 VHF antenna	Dorsal centreline, FS 235
Circuit-breaker (CB1RV)	Centre console extension

Figure 2A-9 AN/ARC-511 VHF Radio System – Component Locations

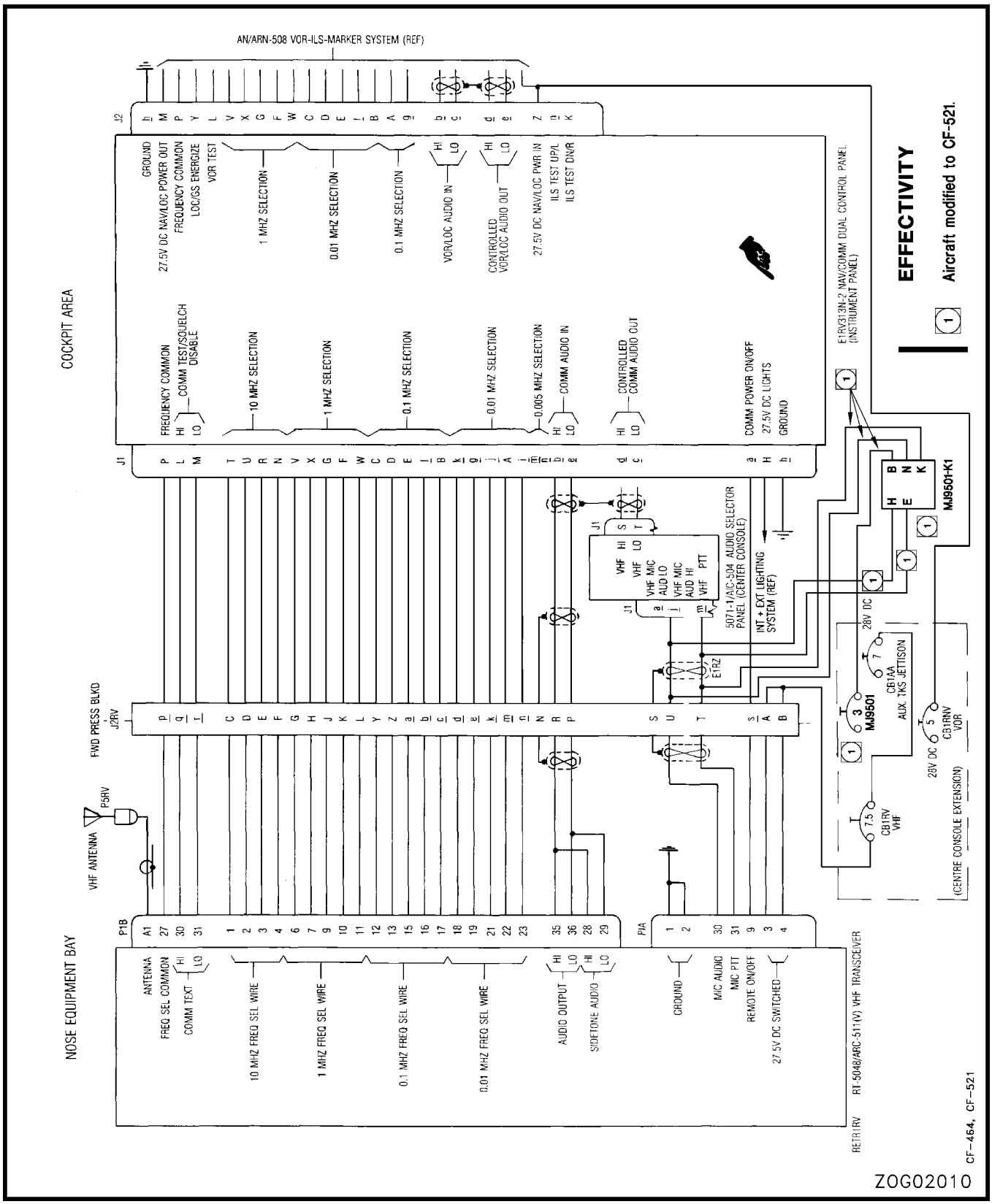


Figure 2A-10 AN/ARC-511 VHF Radio System – Electrical Schematic

RT-5048/ARC-511 VHF RECEIVER-TRANSMITTER

11. The modular-constructed, solid-state VHF receiver-transmitter operates over the frequency range of 116.000 to 151.975 MHz in 25 kHz increments, as selected from the associated 313N-2/ARC-511 NAV/COMM dual control unit. The receiver-transmitter consists of a main frame chassis with a cast aluminum front panel heat sink and five electronic assemblies: a synthesizer, a receiver, a power supply, a transmitter, and a modulator power amplifier.

12. A TRANSMIT POWER indicator, a SQUELCH DISABLE push-button, PHONE and MIC jacks are mounted on the front panel.

13. The receiver-transmitter plugs into two electrical connectors on the shockmounted holding tray. Care shall be taken when installing and/or removing the receiver-transmitter, to prevent the connector pins from being damaged or bent.

VHF ANTENNA

14. The antenna is mounted on the fuselage, aft of the canopy at FS 235. The antenna is connected to the transceiver coaxial insert connector (P1BRV) via a coaxial connector (P5RV), located underneath the antenna.

VHF RADIO POWER

15. The VHF radio system operates on 28-volt dc power, supplied through the 7.5-ampere VHF circuit-breaker located on the centre console extension circuit-breaker panel. Lighting power is supplied through the INST. PNL. LTS circuit-breaker.

OPERATION

GENERAL

16. The VHF radio system operates in conjunction with the intercom system to provide air-to-air and air-to-ground voice communication.

17. The operating frequency lies within the 116.00 to 151.995 MHz frequency range and is manually selected from the frequency selector knobs on the 313N2/ARC-511 NAV/COMM dual control unit. Each frequency selection is shown on the digital counter dials and is fed to the receiver-transmitter synthesizer.

TRANSMIT MODE

18. The VHF radio system goes into the transmit mode when: the power is turned on; the operating frequency is selected; and the PTT switch on the pilot's throttle is depressed and held to ground the keyline. The keyline ground generated by the PTT switch is routed through the intercom control panel to the receiver-transmitter and provides the following:

a. Transmitter excitation from the frequency synthesizer: applies power to the transmitter amplifiers; activates the modulator; connects the transmitter to the antenna through the T/R switch; and defeats the receiver squelch so that the audio amplifier may be used for sidetone amplification.

b. The audio output from the microphone is fed through the intercom control panel to the receiver-transmitter into the modulator and is applied to the RF power amplifier.

c. The modulated RF output of the power amplifier is routed through the T/R switch to the antenna. On the receiver-transmitter front panel, the TRANSMIT POWER indicator illuminates when the output power exceeds 10 watts. The sidetone audio output from the RF power amplifier is fed back to the receiver audio amplifier and is supplied through the intercom control panel to the pilot's headset. On completing the transmission, the PTT switch is released and the keyline ground is removed. The receiver-transmitter reverts to its initial condition.

RECEIVER MODE

19. The VHF radio system goes into receive mode when power is turned on and the operating frequency is selected. If operating frequency is within the range of the low-band preselector (116.000 to 135.975 MHz), the frequency synthesizer supplies a dc tuning voltage to the preselector and an RF injection signal to the mixer to tune the receiver assembly. If the selected frequency is not within the low-band preselector range, the frequency synthesizer also generates a high-band control signal to switch to the high-band preselector (136.000 to 151.975 MHz frequency range).

20. The RF signal from the VHF antenna is connected through the T/R switch to the preselector and then to the mixer, where it is mixed with the RF injection signal to produce a 20-MHz difference frequency. The 20 MHz frequency is amplified, Automated-Gain-Controlled (AGC), and detected in the IF stages of the receiver as follows:

a. The detected audio is amplitude- and bandpass-limited and then supplied to the audio output amplifier. The squelch circuits disable the output amplifier if the correct signal-to-noise or carrier level is not present.

b. The receiver audio amplifier output is routed through the interphone to both cockpit headsets. On the receiver-transmitter front panel, depressing the SQUELCH DISABLE pushbutton allows receiver noise to be monitored over the headsets to check serviceability or to receive low-level signals.

FUNCTIONAL TEST

EQUIPMENT

21. The following equipment is required:

a. H-157/AIC headset or equivalent.

b. M-87/AIC microphone or equivalent.

VHF SYSTEM

22. Proceed as follows:

a. Set audio level on 313N-2 VHF NAV/COMM dual control unit to mid-range and set transceiver to transmit at 118.000 MHz.

b. Set the VHF/UHF toggle switch, on the audio selector panel, to VHF and ensure that the following circuit-breakers on the centre console extension are opened:

(1) UHF MAIN.

(2) UHF EMERG (ex-Snowbird aircraft)

(3) INTERCOMM INST.

(4) INTERCOMM STUD.

(5) VHF.

c. Connect ground power to the aircraft and set dc MASTER switch to GRD PWR.

d. Close INTERCOMM STUD circuit-breaker and listen for an abnormal noise level.

e. Close INTERCOMM INST circuit-breaker and listen for any abnormal noise level.

f. Verify full communications capability between LH and RH seats.

g. Close VHF circuit-breaker, set the LH COMM frequency selector knob, on the 313N-2 NAV/COMM dual control unit, to PWR and verify the following:

(1) No significant increase in noise level is heard over the intercom system.

(2) Set the LH COMM frequency selector knob to TEST. There should be a sharp increase in the background noise as the squelch circuits are disabled.

h. Ensure that the following circuit-breakers, on the centre console extension, are closed:

(1) VOR.

(2) VOR-TAC SEL.

(3) VOR AC.

j. On the 313N-2 NAV/COMM dual control unit, set the LH NAV frequency selector knob to PWR and the NAV VOL control to mid- range.

k. Perform the self-test described in Part 3A, Section 1 by holding the NAV TEST toggle switch, on the 313N-2 NAV/COMM dual control unit, to the VOR position. Verify also that a 30-Hz tone is audible when the NAV TEST toggle switch is held at the VOR position.

m. Select a suitable low frequency and contact tower. Verify the channel and frequency in operation. Confirm clarity of communication between the LH and RH seats and the tower operator.

n. Select a suitable high frequency and repeat Step m.

p. Test the frequency control of the VOR-ILS receiver by carrying out self tests and functional tests described in Part 3A, Section 1.

q. Set dc MASTER switch to OFF and disconnect ground power from the aircraft.

PART 3
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NAVIGATION SYSTEMS

PART 3A – SECTION 1

AN/ARN-508 VOR/ILS/MARKER RECEIVER SYSTEM

VOR/ILS/MARKER SYSTEM

GENERAL

1. The AN/ARN-508 system uses a receiver unit that combines VOR- localizer, glide slope and marker receivers. For navigation the system indicates VOR course deviation on course indicators and VOR ground statio bearing on the distance radio magnetic indicators of the Tacan system. For landing approach it indicates localizer and glide slope deviation on the course indicators, and marker beacon signals on three indicator lamps on the miscellaneous controls and marker panel (on the centre instrument panel). Audio outputs are wired to the aircraft intercom.

SYSTEM COMPONENTS

GENERAL

2. A list of the system components and their locations follows. For the main components see Figure 3A-1, and for diagrams of location and wiring refer to C-12-114-000/DW-000.

COMPONENT	DESIGNATION	LOCATION
Navigation receiver	R-5069/ARN-508	Nose compartment
Control unit	C-5302/ARN-508	Centre instrument panel
Miscellaneous controls and marker panel		Centre instrument panel
VOR-Localizer antenna system, consisting of:	OE-5008/ARN-508	Vertical stabilizer
Antenna elements (2)	AS-5084/ARN-508	
Hybrid junction	CV-5116/ARN-508	
Glide slope antenna	AS-5071/ARN	Aircraft nose end
Marker antenna	AT-640A/ARN	Bottom fusealge, below cockpit
Course indicators (2) * (course deviation indicators)	MN-97HA-4/ARN	Left and right instrument panels
Distance radio magnetic indicators (2) (part of Tacan system)	ID-5040A/ARN	Left and right instrument panels
Rotary solenoid switch *		Nose compartment
Course indicator selector relay *		Centre contol console
VOR-Tacan audio relay *		Centre control console

* Components common to VOR and Tacan systems.

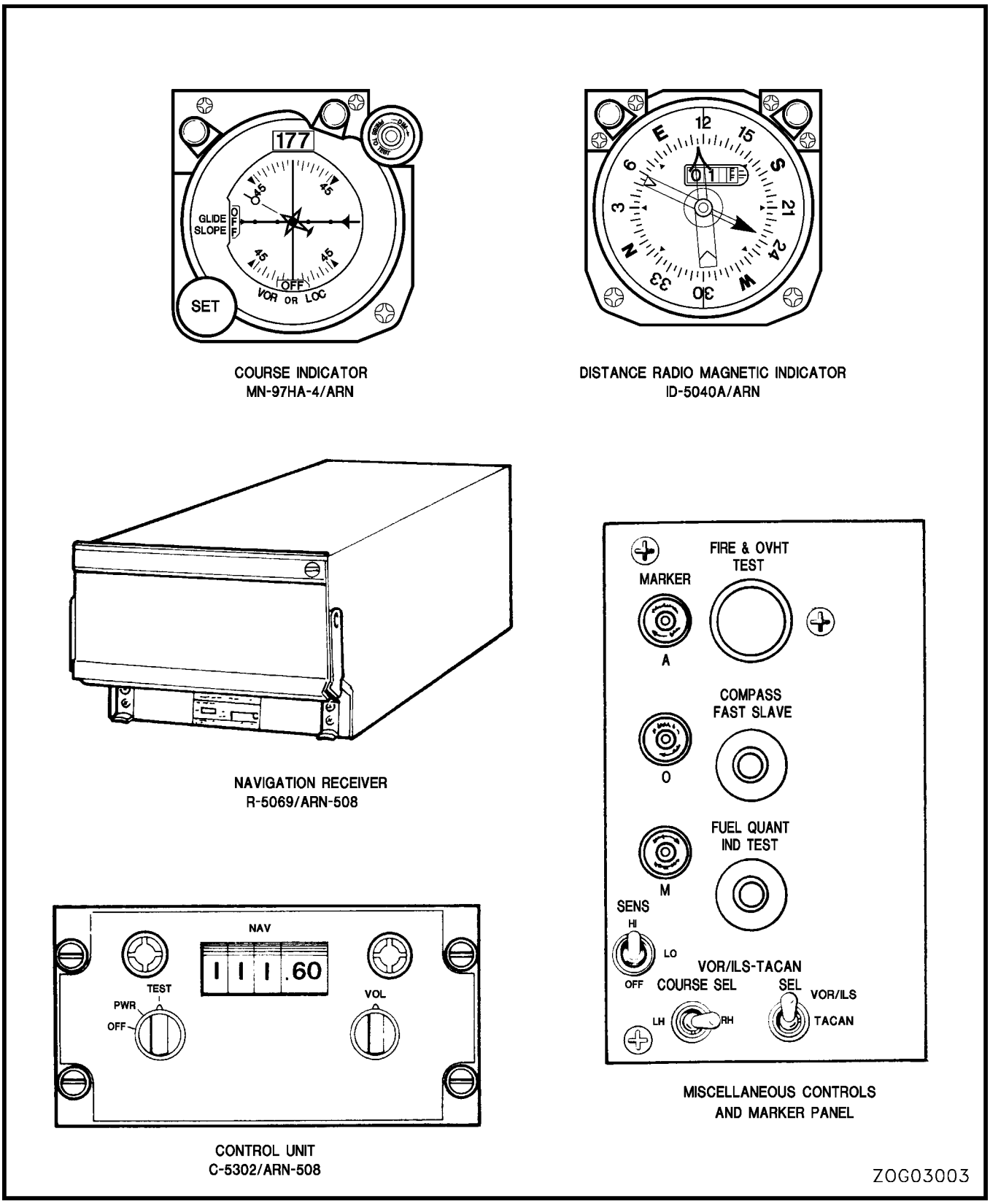


Figure 3A-1 VOR/ILS/Marker System Components

OPERATION OF SYSTEM

VOR OPERATION

3. VHF omnidirectional radio range (VOR) operation is activated when the system is switched on and the frequency of a VOR ground station is selected on the control unit. VOR frequencies are at even tenths of a megahertz in the range from 108.00 to 117.00 MHz. In this operation the direction between the ground station and the aircraft is determined by measuring the phase difference between a reference phase signal and a variable phase signal, which are two modulations in the ground station signal as received at the aircraft. Both modulations are synchronized with the ground station transmitting antenna, which rotates in azimuth at 30 revolutions per second. The carrier is amplitude-modulated with a 9960-Hz subcarrier that is frequency-modulated at 30 Hz with a deviation of 480 Hz. This frequency modulation is the reference phase signal; its phase angle is not affected by direction from the transmitting antenna to the aircraft. The variable phase signal is a 30-Hz amplitude modulation of the carrier, introduced at the aircraft antenna by rotation of the directional transmitting antenna at the ground station, and therefore having a phase angle that depends on the direction from the transmitting antenna to the aircraft. The receiver measures the phase difference between the two signals. A VOR radial (i.e., any line of bearing from the ground station) can be selected on the course indicator, which then displays left-right deviation signals for steering the aircraft onto the radial. The receiver also compares the reference-phase and variable-phase signals, and produces a synchro output indicating the geographic bearing of the ground station from the aircraft, for display on flight instruments. Radio communication of station identity signals is made on the same carrier as the phase reference signals.

ILS OPERATION

4. Instrument landing system (ILS) operation is selected by setting the frequency selector on the control unit to a localizer frequency, an odd tenth of a megahertz in the range from 108.10 to 111.90 MHz. The same receiver is used as in VOR operation. At the same time a glide slope section of the receiver is automatically switched on and tuned to its required frequency. Corresponding to each localizer frequency is a particular glide slope frequency in the range from 329.30 to 335.00 MHz (not shown on the frequency selector). The ILS ground station transmits two narrow beams on the localizer frequency, one on each side of the landing approach path and overlapping slightly in the centre, the left beam modulated with 90 Hz and the right beam with 150Hz. The station also transmits two narrow beams on the glide slope frequency, one above and one below the glide path and overlapping slightly on the path, the upper beam modulated with 90 Hz and the lower beam with 150 Hz. From the localizer radio signals the receiver produces lateral deviation signals, and from the glide slope radio signals it produces up-down deviation signals, to guide the pilot in landing. Both kinds of deviation signals are displayed on the course indicators.

MARKER OPERATION

5. Marker beacons transmitting on 75 MHz are located on airways and a t standard distances along the approaches to runways. In a landing approach, the aircraft flies over an airway marker beacon, an outer marker beacon and a middle marker beacon, in the order named, and in each beacon position an indicator light on the miscellaneous controls and marker panel comes on and an audio tone is applied to the intercom. The light colours and audio tones are: airways, white, 3000 Hz continuous; outer, blue, 400 Hz Morse-keyed in a steady series of alternating dots and dashes. The marker receiver sensitivity can be set high or low by means of the marker on-off switch on the miscellaneous controls and marker panel.

NAVIGATION RECEIVER

6. The circuits of the navigation receiver consist of a power supply built into the main chassis, and sis plug-in subassemblies: the glide slope receiver and instrumentation sub-assembly A1, marker beacon receiver A2, VOR-localizer receiver A4, VOR-localizer instrumentation board A6, automatic-manual VOR instrumentation board A7, and RMI driver A8.

a. VOR-Localizer Receiver: The VOR-localizer receiver A4 receives, detects and

amplifies either a VOR signal or a localizer signal, depending on the frequency selection made on the system control unit.

b. VOR-Localizer Instrumentation Board: The audio channel of the VOR-localizer instrumentation board A6 separates the audio communication signal from the composite VOR or localizer output of the receiver A4, and amplifies it for transmission through the aircraft intercom. When a VOR signal is received, the VOR instrumentation channel in the board A6 detects separately the 30- Hz variable-phase signal and the 9960-Hz subcarrier, and demodulates the 30-Hz reference signal from the subcarrier. It then filters both 30-Hz signals and converts the variable-phase signal to d.c. voltages proportional to the sine and cosine of the difference phase angle, for further processing in the automatic- manual instrumentation board. When a localizer signal is received, a detector and filter network in the board A6 produces localizer deviation signals from the output of the receiver board A4. This deviation signal and the VOR deviation signal from the automatic-manual instrumentation board A7 are d.c. voltages for operation of the lateral deviation bar movements in the course indicators. Both signals pass out through a switching circuit in the board A6. The board also includes a flag control circuit and an adjacent channel sensor. The flag control circuit causes display of the VOR- localizer OFF warning flag on the course indicator if the variable- phase or reference-phase signal is lost of if the combined signal are below 50% strength. To reduce the danger of mischanneling, the flag control circuit also displays the flag if the output of the adjacent channel sensor is too strong.

c. Automatic-Manual Instrumentation Board: The sine and cosine d.c. outputs of the VOR-localizer instrumentation board A6 are modulated by 26-volt 400-Hz aircraft power in the automatic-manual instrumentation board A7, to become a.c. signals. In the manual channel, these signals are passed out to a resolver in a course indicator, where the angle of the resolver (COURSE) is selected manually by means of the SET knob. The resolver adds the angle of the selected radial to the variable-phase angle of the signal so that the deviation output will be zero when the aircraft is on the radial.

d. RMI Driver: Automatic bearing information is generated in the RMI driver A8. The driver receives heading synchro information from the aircraft compass system and converts it to sine and cosine components, and receives also the sine and cosine outputs VOR- localizer instrumentation of board A6. It subtracts the magnetic heading from the VOR bearing to produce relative bearing, which it transmits as three-wire synchro information to the DRMIs of the Tacan system (using the narrow bearing pointers). The output of the RMI driver parks the DRMI pointers at 90° relative bearing when the VOR-localizer OFF flags on the course indicators are displayed or when a localizer channel is selected.

e. Glide Slope Receiving and Instrumentation Subassembly: When a localizer frequency is selected for the VOR-localizer receiver, the receiver in the glide slope receiving and instrumentation subassembly A1 is automatically tuned to a corresponding glide slope channel. This board amplifies and detects the signal, filters the 90-Hz and 150-Hz components, and converts them to d.c. deflection signals that are fed out to the glide slope pointer movements of the course indicators. A flag switching circuit in the board also receives the output of the filtering and differentiating network. The switching circuit de-energizes the glide slope flag movements of the course indicators if the signal is unreliable, causing the glide slope OFF flags to be displayed.

f. Marker Receiver Subassembly: When the aircraft flies over a marker beacon, the marker receiver subassembly A2 receives and amplifies the beacon signal, detects the audio from the signal and feeds it to the aircraft intercom. It also filters the audio output to determine its frequency and to drive the corresponding lamp switch which lights an indicator lamp on the miscellaneous controls and marker panel.

CONTROL UNIT

7. The contro unit bearing the identification NAV above the frequency indicating counter. It has 28-volt dial lighting varied by the instrument lights dimmer on the centre console. The control functions are as follows:

a. Function Switch: The function switch knob is concentric with the megahertz selector knob at lower left. It has three positions, OFF,

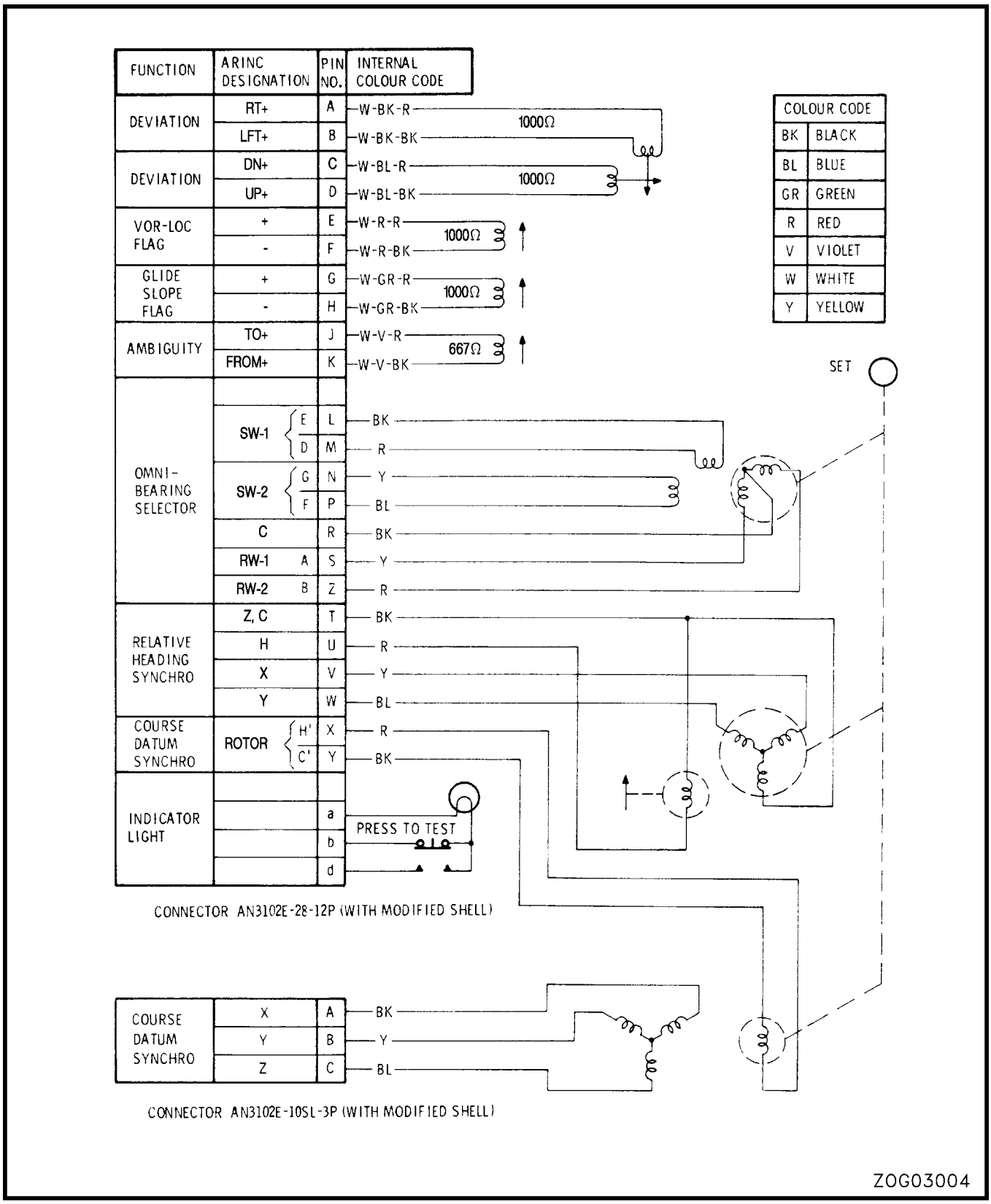


Figure 3A-2 MN-97HA-4/ARN Course Indicator – Schematic Diagram

PWR and TEST, respectively switching the navigation receiver unit off and on and actuating the self-test functions. (For self-test, refer to Paragraphs 20 to 24, following.)

b. Megahertz Selector: At lower left, changes the VOR-localizer receiving frequency in 1-MHz steps, frequency being indicated by the first three digits on the counter.

c. Kilohertz Selector: At lower right, changes the VOR-localizer receiving frequency in 50-KHz steps, frequency indicated by the last two digits on the counter. When a frequency is selected on the VOR-localizer receiver, a corresponding frequency is selected on the glide slope receiver, though not indicated on the control unit.

d. VOL Knob: At lower right concentric with kilohertz selector, adjusts the level of the VOR-localizer receiver audio output.

COURSE INDICATOR

8. Description:

a. Functions: The course indicator (also called course deviation indicator) indicates the heading of the aircraft with respect to a selected bearing, deviation of the aircraft position from a VOR or Tacan radial corresponding to the selected bearing, and lateral and vertical deviations of the aircraft from a path. It includes a resolver that applies the selected bearing information to the VOR or Tacan system, a relative heading synchro, an additional course datum synchro, and an indicator light. For a face view and schematic diagram of the instrument, see Figures 3A-1 and 3A-2, respectively.

b. Bearing Selection: VOR or Tacan bearing is selected on one course indicator to determine deviation and to-from indications on both course indicators (refer to indicator switching, Paragraphs 10 to 12, following). The top of the instrument (lubber line position) always represents a selected bearing. The bearing is selected by turning the SET (bearing selector) knob at the lower left corner of the instrument, and is indicated in degrees by a digital counter at the top. Coupled mechanically with the knob and counter are the omnibearing resolver, relative heading synchro, and course datum synchro.

c. Resolver: In the omnibearing resolver, the rotor angle is set by means of the bearing selector knob. This rotor has two sections 90° apart with a common terminal, and is excited by a reference phase signal from VOR or Tacan. The stator has two separated sections 90° apart, producing output voltages proportional in magnitude to the sine and cosine of the rotor angle. The VOR or Tacan equipment, by recombining these components in suitable phase relation, adds the rotor angle (selected bearing) to the original phase angle of the signal. (The resolver setting on one indicator determines deviation and to-from indications on both indicators).

d. Relative Heading Synchro: This synchro drives a pointer in the form of an aircraft with a small circle ahead of it. On each indicator the pointer indicates aircraft heading with respect to the bearing selected on that indicator. The synchro receives heading from the compass system, and the manual selection displaces the synchro stator so that the pointer indicates only the difference between aircraft heading and selected bearing. This difference is indicated on 45° left and right scales on the instrument face.

e. Course Datum Synchro: The course datum synchro is an ordinary synchro with rotor angle set by means of the bearing selector knob, suitable for applying the bearing selection to another external system. It is not used in the Tutor aircraft.

f. To-from Indication: D.C. voltages from VOR or Tacan actuate a flag movement that displays the word TO when the bearing of the ground station from the aircraft is within 90° of the reciprocal bearing. (The bearing selection on one indicator determines these indications on both indicators.)

g. Lateral Deviation: Lateral deviation signals from VOR, localizer or Tacan are d.c. voltages applied to a coil movement in the instrument, deflecting a vertical bar to left or right. The position of the bar represents the position of the VOR or Tacan radial (bearing line) or the localizer path with respect to the position of the aircraft. (The bearing selection on one indicator determines these indications on both indicators.)

h. Bearing Validity flag: A flag at the bottom of the instrument face, controlled by a d.c. voltage, displays the word OFF when the VOR, localizer or Tacan bearing signals are unreliable. This warning applies to the lateral deviation bars and, on the Tutor aircraft, to the VOR or Tacan bearing pointers on the distance radio magnetic indicators.

j. Vertical Deviation: Vertical deviation input signal are d.c. voltages applied to a coil movement in the instrument, actuating a horizontal bar. The bar, deflected above or below centre, indicates the position of a glide path with respect to that of the aircraft.

k. Glide Slope Validity flag: A flag at the left of the instrument face, controlled by a d.c. voltage, displays the word OFF when the glide slope deviation signal is unreliable or not in use.

m. Indicator Light: The indicator light in the upper right corner of the instrument is not wired to Tutor aircraft circuit. The light has press-to-test and built-in shutter dimming.

DISTANCE RADIO MAGNETIC INDICATOR (DRMI)

9. The distance radio magnetic indicator (DRMI) is part of the Tacan system. Two DRMIs are installed one each for the student and instructor. Each DRMI has two pointers actuated by relative bearing signals and indicating on a compass-driven card that converts the indications to compass bearings. On both DRMIs, the wide pointer indicates Tacan station bearing and the narrow pointer VOR station bearing. When either system is selected for course indicator display and produces an unreliable bearing signal, the VOR- localizer OFF flags are displayed on the course indicators.

VOR/ILS - TACAN SELECTION FOR COURSE INDICATORS

10. Selection of VOR/ILS or Tacan information for the course indicators is made on the two VOR/ILS - TACAN switches on the miscellaneous controls and marker panel. The SEL switch, with VOR/ILS and TACAN position, controls a rotary solenoid switch in the nose compartment, routing signal circuits from on system or the other to the course indicators. All these circuits go direct from the rotary solenoid switch to the indicators except the resolver circuit, for which the COURSE SEL switch selects one indicator according to its position LH or RH. This switch transfers the circuits by means of the course indicator selector relay in the centre console.

SOLENOID SWITCH AND RELAY CIRCUIT

11. For control circuits refer to Figure 3A-3. Power to operated the solenoid switch and the course indicator selector relay is obtained from the VOR/TAC/SEL circuit breaker on the cockpit No. 2 essential d.c. bus. The COURSE SEL switch energizes the relay in RH position to select the resolver circuits of the instructor's course indicator, and de-energizes it in LH position to select those of the student's course indicator. The SEL switch applies voltage alternately to two contacts of the solenoid switch to select VOR/ILS Tacan. The solenoid switch latches when energized, opening the control contact through which it has just been energized and closing the opposite control contact. Internal contacts in series with the solenoid also open during the latching action. An arc suppression diode is connected externally across the solenoid. The controlling circuit terminals are on receptacle J2 of the solenoid switch. In the circuits controlled by the switch, all common contacts are on receptacle J1, VOR/ILS position contacts on J2, and Tacan position contacts on J3. The circuits controlled by the rotary solenoid switch are shown schematically in Figures 3A-4 to 3A-6; those controlled by the course indicator selector relay are shown in Figure 3A-4.

INDICATOR SIGNAL CIRCUIT LOADING

12. Permanent resistor loads are connected across the deviation, to -from and off flag outputs of VOR/ILS receiver, and the rotary solenoid switch terminates all deviation and flag circuits in additional resistor loads when not connecting them to the indicators (see Figures 3A-5 and 3A-6). In connecting these circuits to the indicators, the switch parallels the indicators across each circuit except Tacan left-right deviation, to which it connects the indicators in series (see Figure 3A-5).

VOR-TACAN AUDIO RELAY

13. The VOR-Tacan audio relay is energized from the VOR system circuit-breaker on the cockpit No. 1 essential d.c. bus by the rotary solenoid switch in VOR/ILS position (see Figure 3A-3). When energized, the relay connects VOR, ILS or marker audio to the intercom; when de-energized it disconnects these and connects Tacan audio to the same intercom circuit.

MARKER SWITCHING AND INDICATION

14. The marker receiver section of the navigation receiver is controlled by the marker SENS switch on the miscellaneous controls and marker panel. The switch positions are OFF, LO for low sensitivity, and HI for high sensitivity of the marker receiver. On the same panel are the marker beacon indicator lights; A (airways), O (outer), and M (middle), in order from top to bottom. These lights have manual shutter dimming; the press-to-test terminals are not wired.

ANTENNAS

15. The glide slope and marker receiver antennas are horizontally polarized and have 52 ohms nominal impedance at the coaxial connector. The two VOR-localizer receiver antennas on the vertical stabilizer are matched to the 50-ohms coaxial line through a hybrid junction in the leading edge of the stabilizer.

REFERENCES

16. For further information on the AN/ARN-508 navigation system components refer to C-57-386-000/MF-000,

FUNCTIONAL TEST

EQUIPMENT REQUIRED

17. The following test equipment of equivalent is required:

Navigation test set NAV-401L

Intercom headset

POWER AND SIGNAL REQUIREMENTS

18. The VOR/ILS/marker system exchanges signal with the following system, which must be serviceable for the functional check of this system:

Compass system (refer to C-12-114-0E0/MF-000).

Intercom.

19. Power for the VOR/ILS/marker system is supplied through the following circuit breakers on the console circuit-breaker panel:

28-volt D.C.:

VOR VOR-TAC SEL

26-volt A.C.: VOR AC

SELF-TEST

20. Set controls as follows:

VOR/ILS - TACAN: SEL to VOR/ILS.

COURSE SEL to LH.

MARKER SENS to LO.

Control unit: Function switch to PWR. Frequency selectors to a localizer frequency (odd tenth of a megahertz)

21. Hold control unit function switch at TEST and check that:

a. Course deviation bars on both course indicators move approximately one dot to right, and VOR OR LOC OFF flag are out of view.

b. Glide slope bars move down approximately one dot, and GLIDE SLOPE warning flags are out of view.

c. All three MARKER lights are flashing at 30-Hz rate.

NOTE

The marker light press-to-test connections are not wired.

d. Narrow pointers of DRMIs indicate 90° on compass card.

22. Release function switch, and select a

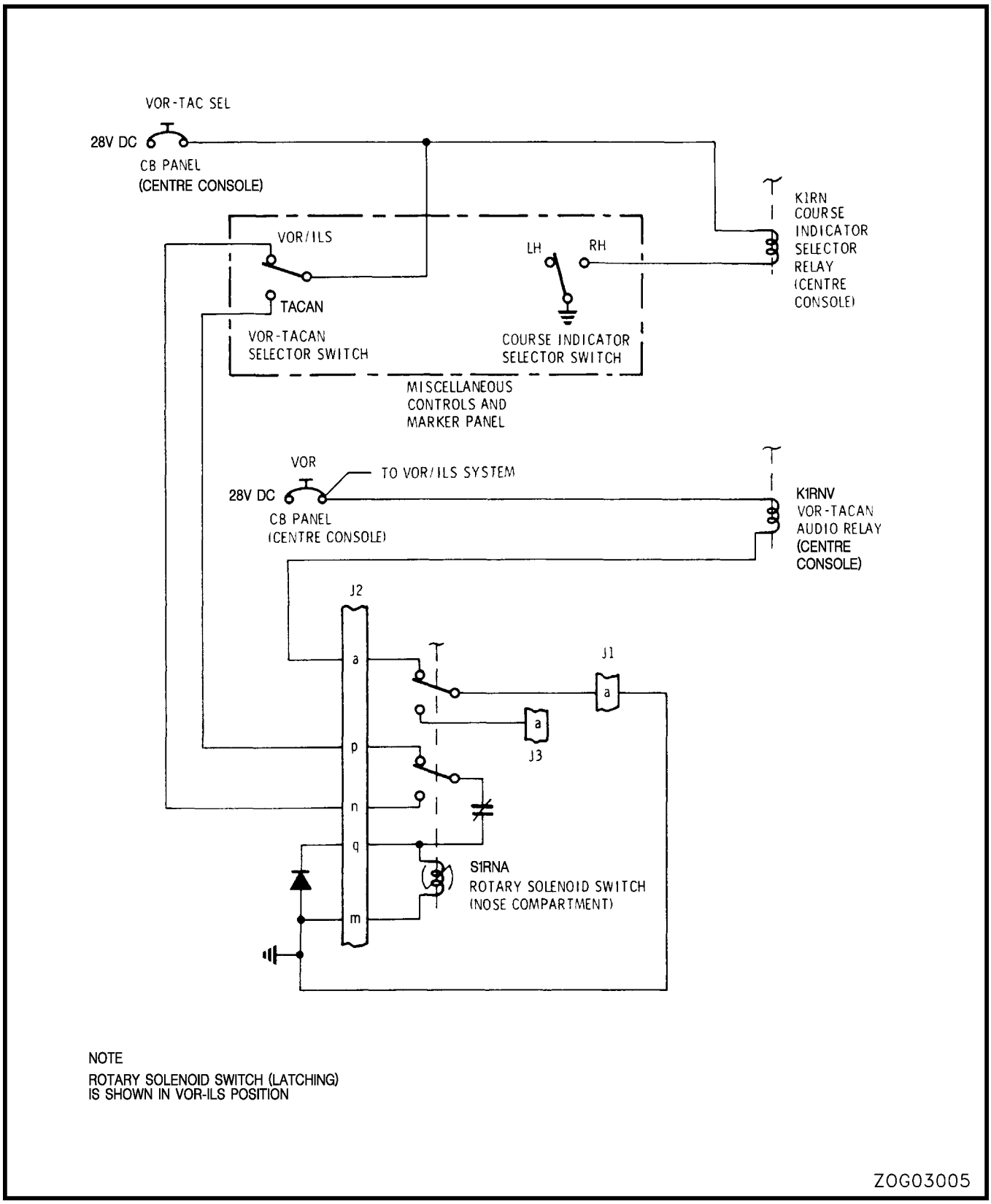
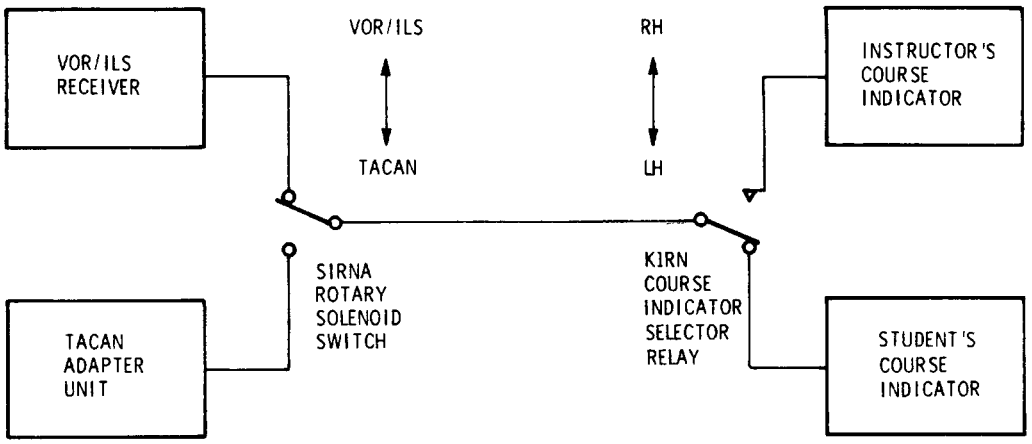


Figure 3A-3 Rotary Solenoid Switch and Relay Control Circuits



NOTE

THE CIRCUIT SHOWN IS IDENTICAL FOR EACH OF SIX RESOLVER TERMINAL FUNCTIONS. THE SWITCH AND RELAY SECTIONS USED ARE AS FOLLOWS:

FUNCTION		SIRNA SECTION	K1RN SECTION
STATOR SW-1	E	R	F
	D	b	A
STATOR SW-2	G	(GROUND)	(GROUND)
	F	c	B
ROTOR COMMON	C	N	D
ROTOR RW-1	A	L	C
ROTOR RW-2	B	M	E

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Figure 3A-4 Resolver Switching

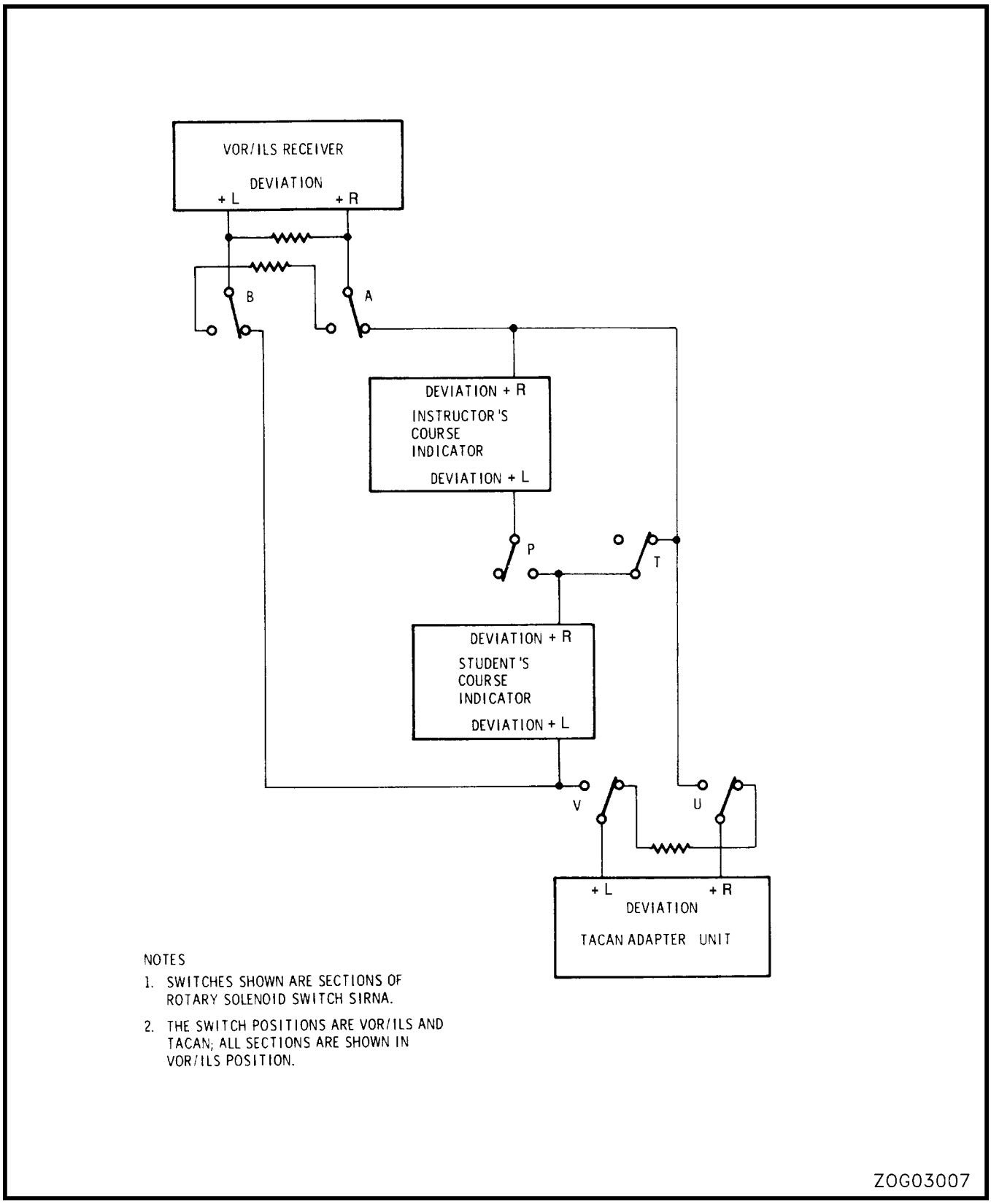
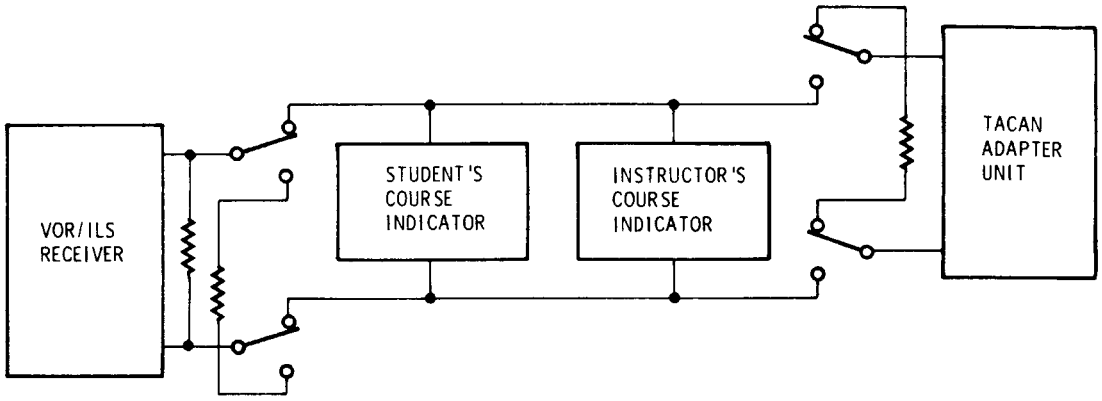
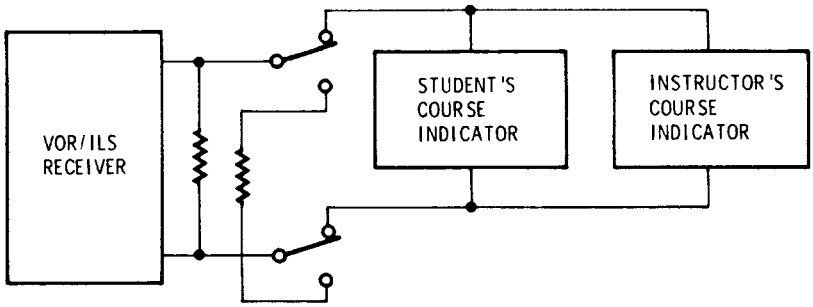


Figure 3A-5 Course Deviation Switching



VOR-LOC OFF FLAG OR TO-FROM FLAG



GLIDE SLOPE DEVIATION OR GLIDE SLOPE FLAG

NOTES

1. SWITCHES SHOWN ARE SECTIONS OF ROTARY SOLENOID SWITCH SIRNA.
2. THE POSITIONS ARE VOR/ILS AND TACAN: VOR/ILS POSITION SHOWN.
3. EACH CIRCUIT IS IDENTICAL FOR EACH OF TWO FUNCTIONS. THE SWITCH SECTIONS USED FOR EACH FUNCTION ARE AS FOLLOWS:

FUNCTION		SECTION OF SIRNA	
		SWITCHING VOR/ILS	SWITCHING TACAN
VOR OR LOC OFF FLAG RETRACTION	+	E	Y
	-	F	Z
TO-FROM FLAG	+ TO	J	W
	+ FROM	K	X (GROUND)
GLIDE SLOPE DEVIATION	+ UP	D	
	+ DOWN	C	
GLIDE SLOPE FLAG RETRACTION	+	G	
	-	H	

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Figure 3A-6 Switching of Flags and Glide Slope Deviation

VOR frequency (even tenth of a megahertz) on which usable signal is received by the aircraft. Hold function switch at TEST, and check that the narrow pointers on both DRMIs indicate 3° (±2°) on compass card.

23. On left instrument panel course indicator (student's) turn SET knob until COURSE read-out indicates 000 (±5). Holding function switch at TEST, check that:

a. Course deviation bar is centered, TO flag is displayed, and VOR OR LOC warning flag is out of view.

b. Glide slope bar is deflected downwards and GLIDE SLOPE warning flag is out of view.

c. All three MARKER lights are flashing at 30-Hz rate.

d. On release of function switch, narrow pointers of both DRMIs point 90° right of aircraft heading.

24. Display COURSE setting of student's course indicator, and select RH on COURSE SEL switch. Repeat procedures of Paragraphs 23 and 24, using right instrument panel (instructor's) course indicator for course selection at beginning or Paragraph 23.

PANEL LIGHTING

25. Adjust INSTRUMENT dimmer on lighting control panel near rear end of centre console, to check dimmer and to obtain desired lighting of navigation control unit dial.

SELECTION OF AREA FOR TESTS

26. The preferred area for the marker, glide slope, localizer and VOR tests that follow is outdoors at a distance form all large metallic objects. If the tests are performed in a hangar, some interference problems may be encountered, and large metallic objects near the aircraft may make satisfactory readings impossible.

MARKER TEST

27. Procedure:

a. Position NAV-401L test set between 10 and 15 feet from aircraft marker antenna, which is on centre-line of underside of aircraft. Connect test set antenna and extend it to full length. Note that any control name followed by an index number in the following procedures refer to Figure 3A-7, where the index number locates the control.

b. Set power switch (24) of test set to BAT, and allow 30 seconds for stabilization. If digital display counter is on, press counter mode switch (3) to switch it off.

NOTE

With a freshly charged battery, the test set can be used for one hour of continuous operation with the digital display off. To check battery charge, move MONITOR switch (29) to BAT, and check whether MONITOR meter (28) reads in white band (13% to 17%). When used on battery, the test set will turn itself off after 6 to 10 minutes' operation.

c. Select on test set:

MONITOR (29)	100%
Counter mode switch (3)	GEN
MODE (1)	MKR XTL
OUTPUT (8)	Highest level (approximately - 13 dbm, 10,000 uv)
MASTER MOD (23)	CAL

Tone selector switch (16) 400, 1300 and 3000 successively

NOTE

Do not use VAR positions of MODE switch when radiating signal.

d. Adjust TUNE knob (6) until tuning indicator lamp (6) is out and a maximum is obtained on MONITOR meter (28).

e. On intercom control, pull out both VOR-TAC volume controls and set to mid-range. Check that the other knobs are pushed in.

f. Connect headset to left intercom; check that the 400-Hz tone is heard and blue (0)

marker lamp alone is on.

NOTE

Large metallic objects near the aircraft may, by interference, prevent operation of the marker lights.

g. Set marker SENS switch to HI: check that the tone is louder and blue lamp brighter.

h. Set marker switch to OFF, and check that the light stays on but tone is not heard.

j. Set SENS to HI. Select 1300 on test set tone selector switch (16); check that a 1300-Hz tone is heard and the amber (M) marker lamp alone is on.

k. Select 3000 on tone selector switch (16); check that a 3000-Hz tone is heard and the white (A) marker lamp alone is on.

m. Transfer headset to right intercom and check that the 3000-Hz tone is heard. Set marker SENS to OFF; check that the tone ceases and light stays on.

GLIDE SLOPE TEST

28. Procedure:

a. Select on test set:

MONITOR (29)	100%
Counter mode switch (3)	GEN
MODE (1)	G/S XTL
OUTPUT (8)	Highest level (approximately - 60 dbm, 225 uv)
MASTER MOD (23)	CAL
G/S DDM (13)	Upper zero
LOC DDM (18)	Upper zero

NOTE

Do not place LOC DDM switch in any position other than 0 when using G/S DDM.

b. Adjust TUNE knob (6) until tuning indicator lamp (6) is out and a maximum is obtained on MONITOR meter (28).

c. Select frequency 108.10 on navigation control unit, and LH on VOR/ILS - TACAN SEL switch.

d. On both course indicators, check that the glide slope bar is centered, and GLIDE SLOPE warning flag out of view. VOR-localizer OFF flag may or may not disappear.

e. On G/S DDM (13) select positions in sequence given below and check indications on both indicators:

Position	Indication
Upper zero	Bar centered, flag out of view
.091 right	Bar one dot up
.175 right	Bar two dots up
.400 right	Full scale deflection up
.091 left	Bar one dot down
.175 left	Bar two dots down
.400 left	Full scale deflection down
90~	GLIDE SLOPE flag shows
150~	GLIDE SLOPE flag shows
Lower zero, with DDM variable (14) centered	Bar centered and flag out of view

f. With G/S/ DDM (13) at lower zero, rotate G/S DDM variable (14) from extreme left, clockwise to extreme right, and check that the bar moves smoothly from top to bottom on both indicators. Return both controls to top zero position.

LOCALIZER TEST

29. Procedure:

a. Select on test set:

MONITOR (29)	100%
counter mode switch (3)	GEN

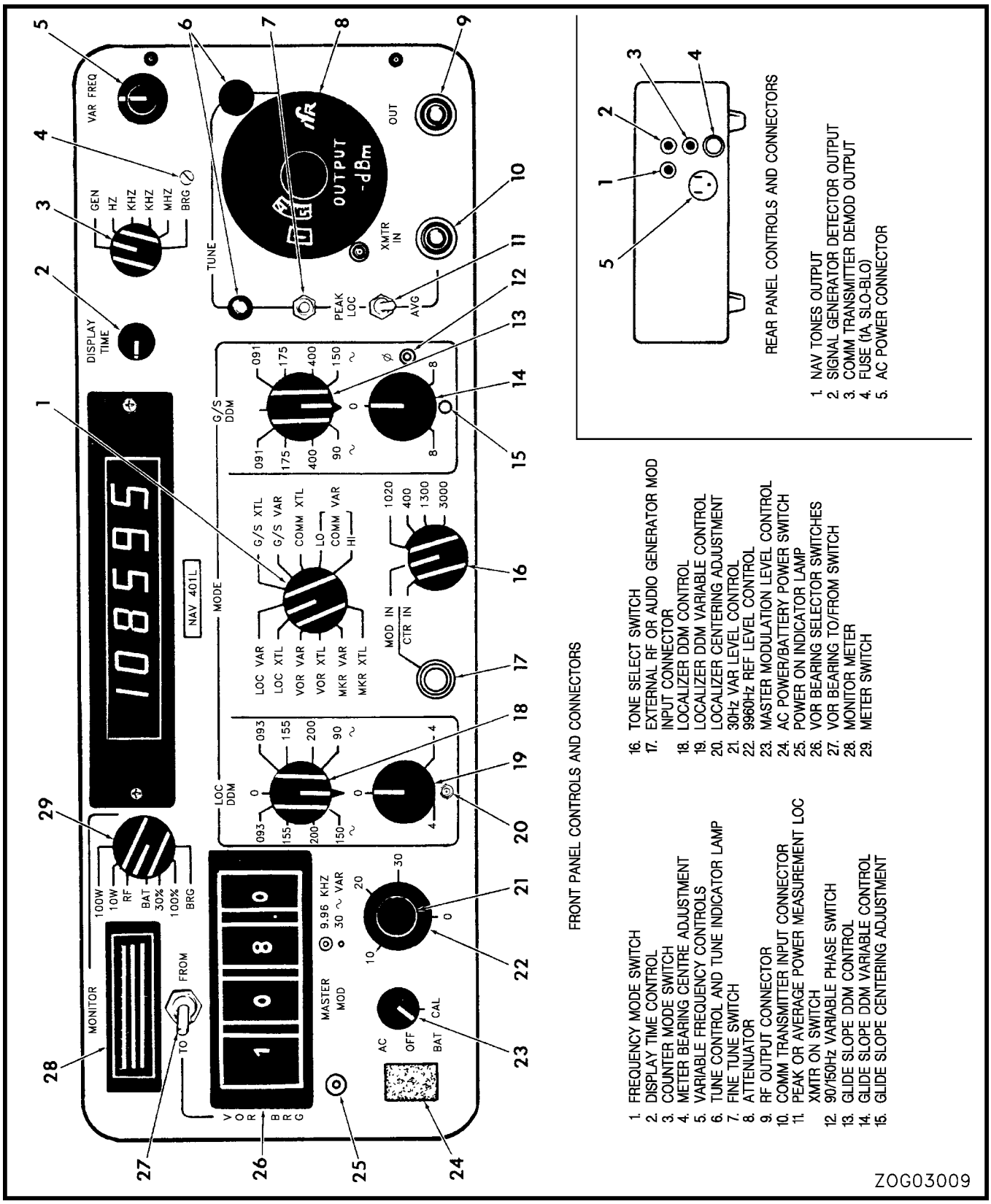


Figure 3A-7 NAV-401L Test Set

MODE (1)	LOC XTAL
MASTER MOD (23)	CAL
OUTPUT (8)	-29 dbm (1000 uv)

b. Adjust TUNE knob (6) until light goes out and a maximum is obtained on MONITOR meter (28).

c. Select frequency 108.10 on navigation control unit, and LH on VOR/ILS - TACAN COURSE SEL.

d. On both indicators, check that the course deviation bar is centered, VOR OR LOC OFF flag out of view, and GLIDE SLOPE flag in view.

e. On LOC DDM (18) select positions given below and check indications on both indicators:

Position	Indication
Upper zero	Bar centered, flag out of view
.093 right	Bar one dot right
.155 right	Bar two dots right
.200 right	Bar full scale deflection right
.093 left	Bar one dot left
.155 left	Bar two dots left
.200 left	Bar full scale deflection left
Lower zero	Bar centered, flag out of view

f. With LOC DDM (18) at lower zero, move LOC DDM variable (19) from extreme left, clockwise to extreme right, and check that the bar moves smoothly from left to right on both indicators. Return both controls to top zero position.

VOR TEST

30. Procedure:

a. Select on test set:

MONITOR (29)	BRG
Counter mode switch (3)	GEN
MODE (1)	VOR XTL
Tone select switch (16)	1020
9.96 KHZ (22)	30
30 VAR (21)	30
MASTER MOD (23)	CAL
OUTPUT (8)	-29 dbm (1000 uv)
TO - FROM (27)	TO
VOR BRG (26)	000.0

b. Adjust TUNE knob (6) until tuning lamp (6) is out and a maximum is obtained on MONITOR METER (28).

c. Select 108.00 on navigation control unit and 000.0 on VOR bearing selector switches (26); check that all four indicators indicate 000.0° and the TO flag is displayed on both course indicators. Check reception of 1020-Hz tone through intercom.

d. Select 030.0° on VOR bearing selector switches (26), and check that all four indicators read 030.0° with TO flag display on course indicators.

e. On test set TO-FROM switch (27) select FROM. Check that the course indicators read 30° (±1°) and FROM, and that the DRMIs indicate 210°.

f. Repeat (d) and (e) at all 30° intervals, selected on the bearing selector switches, checking that the course indicators agree with the bearing selection and DRMIs agree with the bearing and its reciprocal as required.

NOTE

Selections on the test set may be inaccurate above 350°.

g. Select local station on navigation control unit and check that the radial indication and received audio are correct.

NOTE

VAR positions of the MODE switch (1) may be used in trouble- shooting, for frequencies other than the accepted test frequencies, but when these positions are used the signal must be infected into the system through a coaxial cable.

PART 3A – SECTION 2

AN/ARN-504 (V) 3 TACAN SYSTEM

TACAN SYSTEM

GENERAL

1. The tactical air navigation (Tacan) system AN/ARN-504(V)3 indicates the bearing and slant range of a Tacan ground station, and can indicated the slant range of similarly equipped aircraft. Ground station bearing is determined, without using the transmitting section of the Tacan set, by decoding a series of amplitude-modulated pulse pairs received from the ground station. It is indicated in the from of station bearing on the distance radio magnetic indicators (DRMIs) and in the form of aircraft position deviation on the course indicators. Range to the ground station can be determined at the same time as bearing by activating the transmitting section of the Tacan set, and measuring the time interval between interrogation pulses transmitted from the aircraft and response pulses received from the ground station. It is indicated on the DRMIs. When ground station range and bearing are not being determined, range to other aircraft can be measured and indicated similarly to ground station range. The Tacan system operates on any of 126 channels within the frequency range of 962 to 1213 MHz, and has a maximum distance range of 207 nautical miles.

SYSTEM COMPONENTS

GENERAL

2. A list of the system components and their locations follows. For diagrams of location and wiring refer to C-12-114-000/DW-000.

COMPONENT	DESIGNATION	LOCATION
Receiver- Transmitter	RT-5036/ARN- 504(V)	Nose compartment
Adapter unit	MX-5163/ARN- 504(V)	Nose compartment
Mounting base	MT-5154/ARN- 504(V)	Nose compartment
Control unit	C-5287/ARN- 504(V)	Centre control console
Antenna	AT-741A/ARN	Bottom fuselage, station 212
RF test receptacle		Test panel in nose compartment
Course indicator (2)*	MN-97HA/ARN	Left and right instrument panel
Distance radio magnetic indicators (2)	ID -5040A/ARN	Left and right instrument panel
VOR/ILS - TACAN SEL switch *		Miscellaneous controls and marker panel (instrument panel)
Rotary solenoid switch *		Nose compartment
VOR-Tacan audio relay *		Centre control console
COURSE SEL LH/RH switch *		Miscellaneous controls and marker panel (instrument panel)

COMPONENT	DESIGNATION	LOCATION
Course indicator selector relay *		Centre control console (inner rear)
Coaxial filter		Rear mounting base

* Components common to VOR and Tacan systems.

COMPONENT DESCRIPTION

GENERAL

3. This description deals with external features affecting installation and interconnection of the components that constitute Tacan navigation set AN/ARN-504(V)3 (see Figure 3A-8). Functional description of these and other components is given under Operation of System.

RECEIVER-TRANSMITTER

4. The receiver-transmitter consists of 12 modules and other assemblies mounted on a chassis and enclosed in an RF-tight cover. It is mounted on the adapter unit, to which it connects through a multiple-pin connector at the rear. Direct connection to aircraft cables is made through coaxial receptacles on the receiver- transmitter front panel for the antenna signal, suppression input pulse, and suppression output pulse. A fuse for 115-volt a.c. internal circuits is installed on the front panel, together with a spare fuse. Also on the front panel are test equipment (AGE) connector protected by a cover plate, and the self-test status indicators for the receiver-transmitter, couplers and control unit.

ADAPTER UNIT

5. The adapter unit holds the receiver-transmitter unit, to which it connects through a multiple-pin receptacle when the receiver- transmitter is mounted. Two multiple-pin connectors at the rear of the adapter unit mate with connectors in the mounting base when the adapter unit is mounted in the base. The following items are parts of the adapter unit:

Range coupler module

Bearing coupler module

Cooling blower for receiver-transmitter

Antenna switch driver (output not used in Tutor aircraft)

Receiver-transmitter power application circuit

Power line filters

RFI suppression devices

Audio amplifier for beacon identity tone output

MOUNTING BASE

6. The mounting base is a shock mount on which the adapter unit is mounted, and which connects the adapter unit to aircraft wiring. When the mounting base is installed, two connectors on aircraft wiring harnesses are mounted in the back of the base, in such a position as to mate with adapter unit multiple-pin connectors when the unit is inserted in the base.

CONTROL UNIT

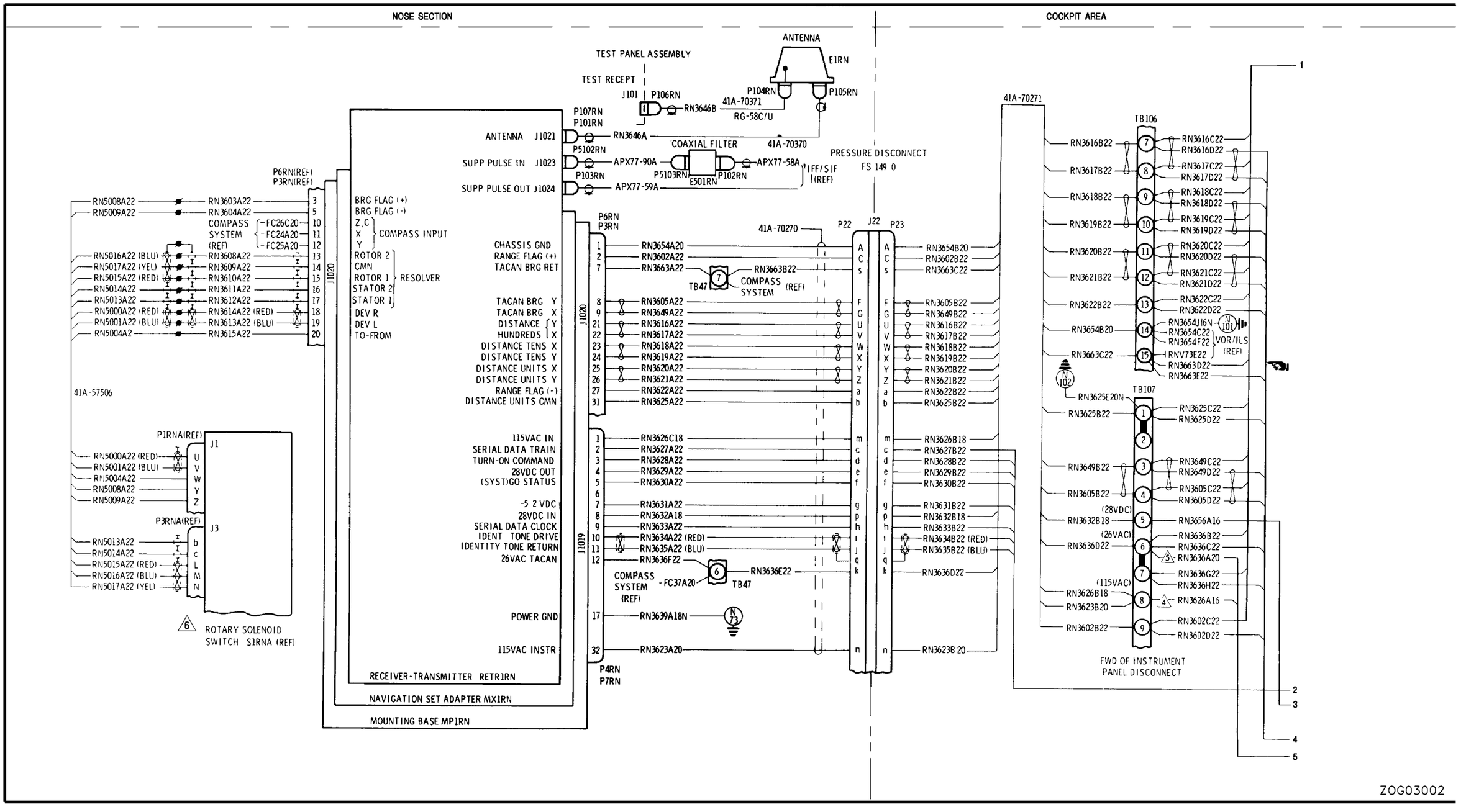
7. The control unit completes the set of four AN/ANR-504(V) components. Its installation features are not unusual.

OPERATION OF SYSTEM

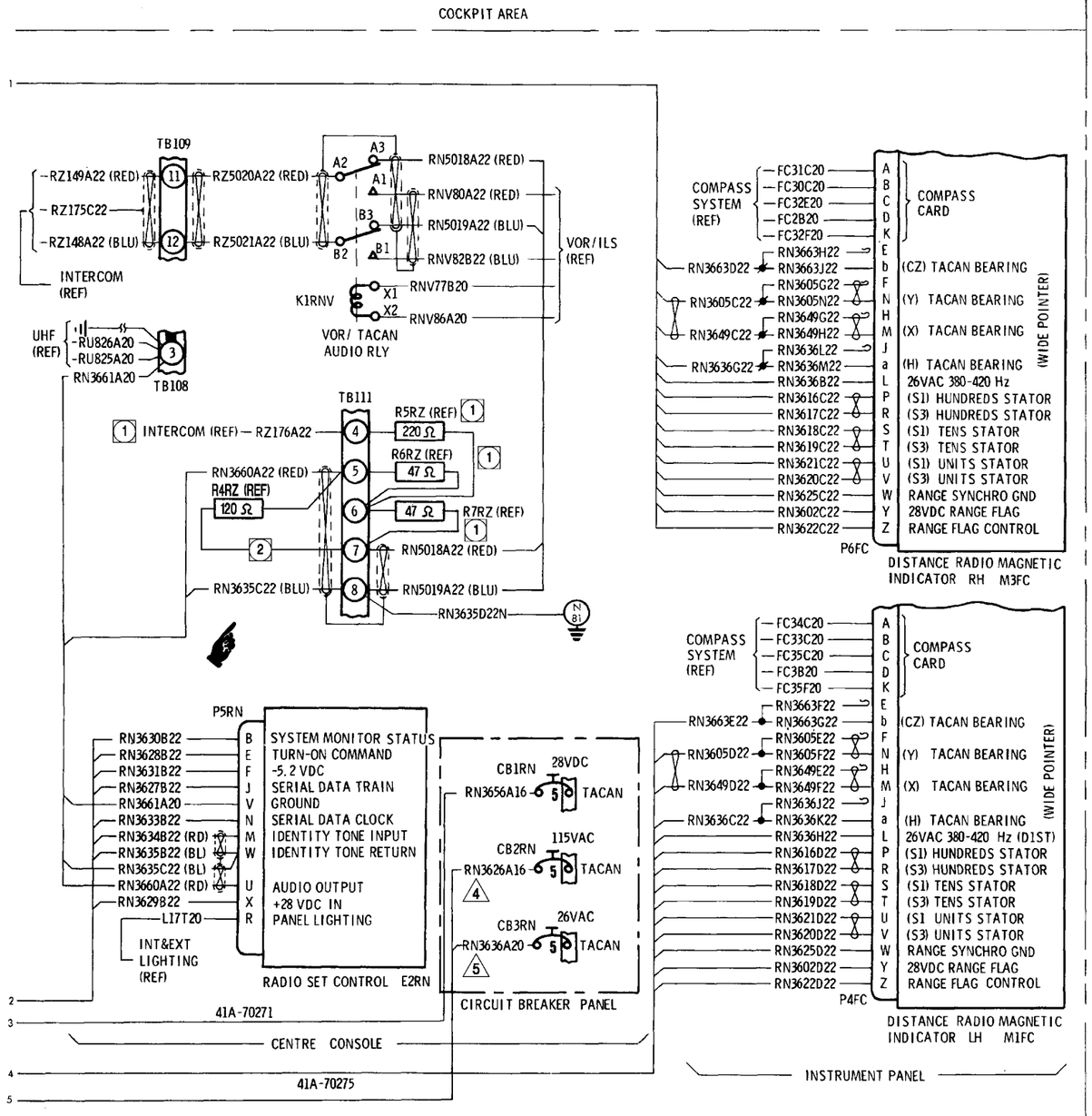
RECEIVER-TRANSMITTER

8. The receiver-transmitter receives and transmits pulsed RF signals and interprets the signals in terms of bearing, range, and ground station identity tone. The bearing and range outputs of the receiver-transmitter are digital, and are converted to synchro outputs in the bearing and range couplers of the adapter unit. The identity tone output is amplified in the adapter unit and routed to the aircraft intercom system.

9. Suppression pulses, or receiver blanking pulses, are fed from Tacan to the identifica-



AN/ARN-504 Tacan System – Diagram (Sheet 1 of 2) Figure 3A-7A



ITEM LIST					LOCATION	
ITEM NO	DESCRIPTION	PART NO OR SPEC	TYPE	MFG	FIG	CALL-OUT
CB1RN	CIRCUIT BREAKER	S1412-5	5A		3-2	36
CB2RN	CIRCUIT BREAKER	1500-059-5	5A	MECH PROD	3-2	36
CB3RN	CIRCUIT BREAKER	1500-059-5	5A	MECH PROD	3-2	36
E1RN	ANTENNA	2334	AT-741/A	TRANSCO PROD	3-2	23
E2RN	CONTROL UNIT		C-5287/ARN-504(V)		3-2	45
J101	RF RECEPTACLE		UG-492D/U		3-2	1
M1FC	DRMI - LH				2-2	77
MP1RN	MOUNTING BASE		MT-5154/ARN-504(V)		3-2	52
MX1RN	ADAPTER		MX-5163/ARN-504(V)		3-2	53
M3FC	DRMI - RH				2-2	77
P3RN	PLUG	DPA-32-33S		CANNON	3-2	53
P4FC	PLUG	PT06SE-18-32S		BENDIX	2-2	77
P4RN	PLUG	DPA-32-33S		CANNON	3-2	53
P5RN	PLUG	WP20SM		WINCHESTER	3-2	45
P6FC	PLUG	PT06SE-18-32S		BENDIX	2-2	77
P6RN	DPA 90° SHELL	20746-1		CANNON	3-2	53
P7RN	DPA 90° SHELL	20746-1		CANNON		53
P101RN	RF PLUG	KH-59-08	UG-59B/U	KINGS		52
P102RN	RF PLUG	31-352		AMPHENOL		52
P103RN	RF PLUG	31-352		AMPHENOL		52
P104RN	RF PLUG	KC-59-21	UG-88D/U	KINGS		23
P105RN	RF PLUG	KC-59-11	UG-1213/U	KINGS		23
P106RN	RF PLUG	KC-59-21	UG-88D/U	KINGS		1
P107RN	RF 90° ADAPTER		UG-212C/U			52
RETR1RN	RECEIVER-TRANSMITTER		RT-5036/ARN-504(V)			52
P5102RN	RF PLUG	31-352				52
P5103RN	RF PLUG	16925				52
E501RN	COAXIAL FILTER	SCHP51			3-2	52

NOTES

1 Coaxial cables per MIL-C-17 coded
Single conductor shielded cable per MIL-C-7078, type II, coded
Two conductor shielded cable per MIL-C-7078, type II twisted, coded
All other wire per MIL-W-5086, type II

2 For twisted pair, twist two MIL-W-5086, type II wires together to form 3/4 inch lay, coded

3 In harness 41A-57506, wire specifications are:
Shielded wire: MIL-C-27500-22( )BT
Unshielded wire: MIL-W-5086 type II

4 Wire M5086-1-16-9

5 Wire M5086-2-20-9

6 See C-12-114-000/DW-000, **Part 3, Figure 3-7** for the following TACAN system circuitry:
Course indicators
Course indicator selector relay
Course selector LH/RH switch
Rotary solenoid switch
VOR/ILS - TACAN selector switch

7 **See C-12-114-000/DW-000, Part 3, Figure 3-2 for location of items.**

EFFECTIVITY

1 **Aircraft not modified to CF-462.**

2 **Aircraft modified to CF-462.**

CF-373, CD-031, 41A-70170AB, 41A-7017281, 41A-70173A, CF-393 CD-030(C74F47081), 80114-01(CF-408), CF-412, CF-462

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Figure 3A-7A (Sheet 2 of 2) AN/ARN-504 Tacan System – Diagram

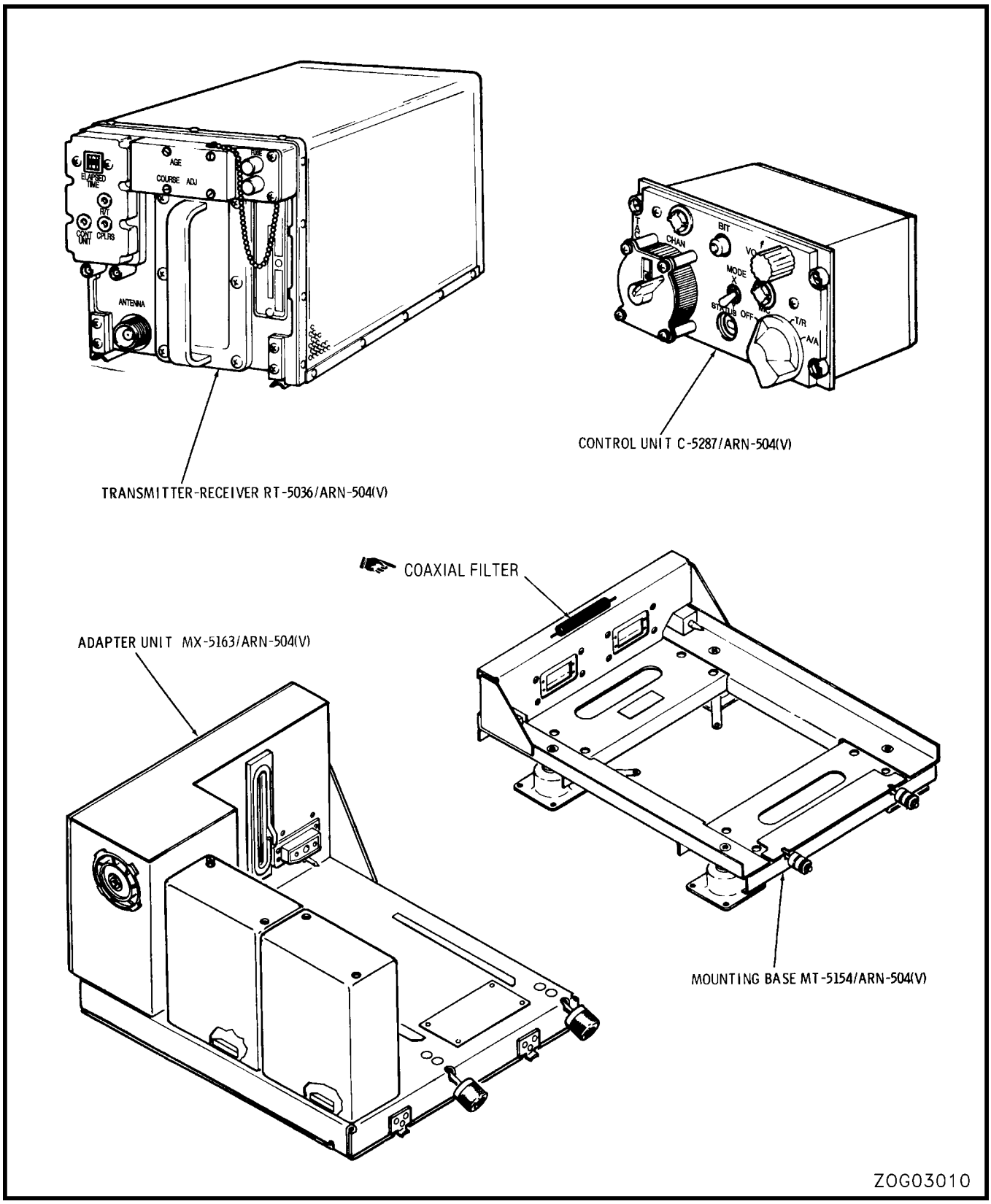


Figure 3A-8 Tacan Navigation Set AN/ARN-504 Components

tion radar and from the identification radar to Tacan. Each suppression pulse is synchronized with the transmitter output of its own system, and prevents the high RF power of that output from affecting the receiver of the other system.

COAXIAL FILTER

9A. A coaxial filter, clamp-mounted on the back top flange of the MT-5154 mounting base, is connected in series with the line bringing the suppression pulse from the IFF system. The filter removes a high-frequency ringing at the leading edge of the pulse which would trigger the Tacan self-test function.

BEARING COUPLER

10. The bearing coupler, in the adapter unit, converts the digital bearing output of the receiver-transmitter to shaft position. Mechanically coupled to the shaft are an output synchro for bearing indication and a resolver whose output is compared with that of a selected course resolver in a course indicator. The resulting output of the resolvers is applied to a phase detector in the bering coupler, which generates deviation and to-from signals fro the course indicators.

11. The bearing output synchro in the bearing coupler is a differential synchro which receives heading information from the signal repeater unit of the compass system. This heading is subtracted in the synchro from the Tacan bearing output, because the Tacan bearing is geographical and the DRMI pointers require relative bearing, 26-volt a.c. excitation to the heading output synchro of the signal repeater unit is supplied from Tacan.

RANGE COUPLER

12. The range coupler, in the adapter unit, converts the digital range output of the receiver-transmitter to three synchro outputs, to drive the three range dials of each DRMI.

CONTROL UNIT

13. Description:

a. Lighting: The unit has built-in edge lighting powered from the console lights dimmer on the centre console.

b. Channel Selector: Has concentric dials for tens and units, selecting 126 channels.

c. Function Selector Switch: Enables the pilot to select OFF and three modes of operation. In the REC mode, the Tacan receiver is energized and ground beacon radio bearing signals are converted to visual bearing displayed on the course indicators and DRMIs. In the T/R mode the Tacan transmitter and receiver are energized and both bearing and range information are displayed (range display added on the DRMIs). In A/A mode (air to air) the range to another aircraft is indicated on the DRMIs.

d. Volume Control Knob: Is used to adjust the audio level of the Morse code identification signal which is received from the selected ground beacon or other aircraft.

e. Mode Selector Switch: Selects X or Y operation of the range system, in which the replies from the ground station of other aircraft are on different sets of frequencies.

f. BIT Button and Status Window: Explained under self-test, Paragraph 22.

TACAN ANTENNA

14. One antenna is used for transmitting and receiving Tacan signals. A coaxial test receptacle in the nose compartment is used when carrying out functional checks.

COURSE INDICATOR, MAIN FUNCTIONS

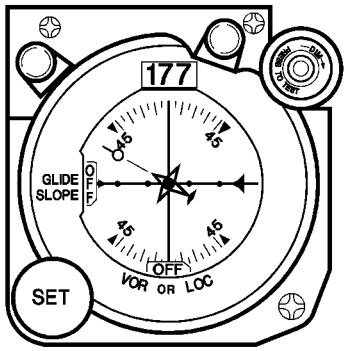
15. For the instruments used with Tacan see Figure 3A-9. Two course indicators are installed, one for the student and one for the instructor. When Tacan is selected for the course indicators, on the VOR/ILS - TACAN selector switch, Tacan information is applied to the indicators as follows:

a. On the course indicator selector switch, one of the two indicators is selected to determine the Tacan bearing reference. The COURSE readout at the top of this indicator is then set by means of the SET knob, to select a line of bearing on the Tacan ground station. This bearing is the reference for deviation

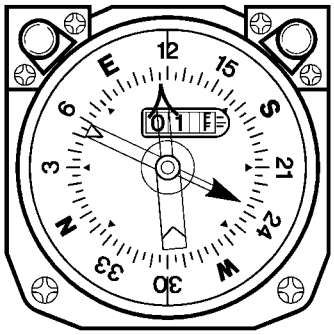
bar and to-from indications on both indicators, regardless of the setting of the other indicator.

b. On both indicators, a vertical bar is centered when the aircraft position is on the selected Tacan bearing line or on its reciprocal line. When the aircraft is off the line, the bar is deflected to left or right to indicated the position of the line with respect to the position of the aircraft.

c. On both indicator, a to-from flag on the instrument face displays the word TO when the bearing of the Tacan station from the air-



COURSE INDICATOR
MN-97HA-4/ARN



DRMI
ID-5040A/ARN

ZOG03011

Figure 3A-9 Tacan Instruments

craft is within 90° of the selected bearing, and the word FROM when the bearing of the Tacan station is within 90° of the reciprocal of the selected bearing.

d. On each indicator, a relative heading pointer indicates aircraft heading with respect to the bearing (COURSE) selected on the same indicator. It indicates on 45° left and right scales the difference between aircraft compass heading and this selected bearing.

BEARING VALIDITY SIGNAL

16. When Tacan is selected on the VOR/ILS - TACAN selected switch, VOR/ILS OFF flags on both course indicators are retracted from view by a bearing output validity signal from Tacan. Display of the flags will indicated that Tacan is off or its bearing outputs unreliable. This unreliability warning applies to the deviation bar and to-from flag on both course indicators, and to the wide bearing pointer on both DRMIs.

DISTANCE RADIO MAGNETIC INDICATOR (DRMI)

17. Two distance radio magnetic indicators (DRMIs) are installed, one for the student and one for the instructor. See Figure 3A-9. The DRMI receives aircraft magnetic heading from the compass system and indicates it on a rotating compass card against the fixed lubber line at the top of the instrument face. It indicates VOR ground statio bearing with a narrow pointer and Tacan ground station bearing with a wide pointer. These pointers receive relative bearing, which is converted to magnetic bearing by the compass card position.

18. The DRMIs also have digital range readouts in nautical miles, both DRMIs indicating Tacan range. In VOR operation the Tacan range indication is still present, provided that Tacan range is switched on. The range readouts are equipped with OFF warning flags that are retracted from view by a range validity signal from Tacan. The OFF flags, when displayed, indicated that Tacan range is switched off or the range signal unreliable.

VOR/ILS - TACAN SELECTION FOR COURSE INDICATORS

19. Selection of VOR/ILS or Tacan information for display on the course indicators is made by means of the two VOR/ILS - Tacan switches. (For full details, including diagrams, refer to the VOR/ILS system.) The two position SEL switch controls a rotary solenoid switch in the nose compartment routing signal circuits between VOR/ILS and the course indicators or between Tacan and the course indicators, depending on selection. All these circuits go to both course indicators except the bering resolver circuits, which go to one course indicator selected by the two-position COURSE SEL switch. This switch in LH or RH position selects, respectively, the student's or instructor's course indicator by means of the course indicator selector relay in the centre console. The selected course indicator determines the VOR or Tacan radial for navigation.

INDICATOR SIGNAL CIRCUIT LOADING

20. Permanent resistor loads are connected across all deviation and flag outputs of VOR/ILS, and the rotary solenoid switch terminates all VOL/ILS and Tacan deviation and flag outputs in additional resistor loads when not connecting them to the indicators. When connecting the indicators, the switch parallels them across each circuit except Tacan left-right deviation, which if feeds to the indicators in series.

VOR-TACAN AUDIO

21. When VOR/ILS is selected on the VOR/ILS - Tacan SEL switch, one section of the rotary solenoid switch energizes the VOR-Tacan audio relay with 28-volt dc from the VOR circuit breaker on the centre console circuit-breaker panel. When energized, the relay connects the VOR/ILS and marker audio outputs to an input of the intercom; when de-energized it substitutes Tacan audio for these at the same input of the intercom.

SYSTEM SELF-TEST

22. The BIT button (built-in test) on the control unit, when used, initiates a self-test sequence lasting 15 to 20 seconds. While the button is pressed, the word GO appears in the status indicator window on the control unit. When the button is released, the window is blank at first and then displays GO if the system is serviceable. The three status windows on the front of the receiver-

transmitter indicate the condition of the receiver-transmitter, the couplers and the control unit, respectively by showing a light colour to indicate a fault. The system self-test uses whatever channel has been selected, and will not test the range system unless T/R or A/A is selected on the control unit. The three fault indications on the receiver-transmitter latch on when made, and stay on until power is interrupted. They are reset every time the BIT sequence is initiated. A fault indication after switching off should be disregarded.

REFERENCES

23. For further information on Tacan navigation set AN/ARN-504(V)3, refer to C-57-364-000/MF-000. For the course indicators refer to the VOR/ILS system in this Part.

FUNCTIONAL TESTS

EQUIPMENT REQUIRED

24. The following test equipment or equivalent is required:

Tacan test set AN/ARM-511

Intercom headset

POWER AND SIGNAL REQUIREMENTS

25. The Tacan system exchanges signals with the following system, which must be serviceable for the functional check of Tacan:

Compass system (refer to C-12-114-0E0/MF-000).

Intercom

26. Power for Tacan is supplied as follows:

a. Circuit breakers on centre console circuit-breaker panel:

28-volt D.C.:	TACAN
	VOR-TAC SEL
	VOR
115-volt A.C.:	TACAN
26-volt A.C.:	TACAN

b. The receiver-transmitter unit is equipped with a 115-volt a.c. power fuse on the front panel.

PANEL LIGHTING

27. Check that the CONSOLE lighting dimmer on centre console varies properly the panel lighting of Tacan control unit.

SELF-TEST

28. Procedure:

a. Set control unit function switch to REC and allow 3 minutes' warm up.

b. Set channel selector to any channel other than local station, and check for the following indications on course indicators and DRMIs:

(1) Wide bearing pointers of DRMIs rotate continuously counter- clockwise.

(2) DRMI range readout shutters remain in view; range numeral counters do not spin behind shutters.

(3) On course indicators, VOR/ILS OFF flags are in view, and course deviation bar sweeps continuously from side to side.

(4) TO-FROM flags alternate smoothly between opposite positions.

c. Set function switch to T/R, and check that the range readout shutters remain in view and range numeral counters do not spin.

d. Press and release BIT button on control unit. The status window will display the word GO while button is held. On release of the button:

(1) Check that the word GO disappears, that it is displayed again after approximately 10 seconds, and that it disappears after approximately 10 seconds more. After release of the button, failure to display GO indicates a system fault.

(2) Check that the three status windows on front of receiver- transmitter remain dark. A light colour in a window indicates a fault in the corresponding unit. (CPLRS window represents the adapter unit.) These three fault

indications latch on when made, and remain on until the system is switched off.

e. Select course 000 on both course indicators, and check that the course deviation bar is centered. The centering and course width adjustments are under cover on front of receiver-transmitter. Adjust centering if necessary, then displace course selection 10° in each direction and use course width adjustment to place bar on second dot each way.

LOCAL BEACON CHECK

29. Procedure:

a. Select REC on control unit function selector. (Keep mode selector in X position.) Allow three minutes' warm up.

b. Select Tacan on VOR/ILS-TACAN SEL switch on miscellaneous controls and marker panel.

c. On control unit, select local Tacan beacon channel and, after warm-up, set function selector to T/R. Check that the range OFF flags on both DRMIs and VOR-ILS OFF flags on both course indicators are retracted from view.

d. Check that both DRMIs lock on the approximate bearing and range of beacon. (Bearing for Tacan is on wide pointer.)

e. Select LH on VOR/ILS-TACAN COURSE SEL switch.

f. Adjust SET knob on student's course indicator until left-right deviation bars of both course indicators are centered. Check that the COURSE readout of student's course indicator indicates bearing shown on DRMIs or its reciprocal, and that the to-from flag reads TO for DRMI bearing or FROM for reciprocal bearing.

g. Display COURSE readout selection 10° from bearing obtained in (f), and check that both deviation bars are displaced approximately two dots in opposite direction.

h. Leave student's COURSE selection with bar displaced. Select RH on VOR/ILS-TACAN COURSE SEL switch.

j. Using instructor's course indicator for course selection, repeat (f) and (g).

k. Using intercom and headset, monitor the beacon identity tone. Check that it is clear and is properly varied in loudness by volume control on Tacan control unit.

TACAN SYSTEM FUNCTIONAL CHECK

30. Procedure:

a. To perform the functional check, obtain the following items of test equipment:

(1) AN/ARM-511 (Model BD-2655) Tacan test set (refer to C-57-475- 000/MS-000).

(2) Intercom headset.

b. Select 115-volt a.c. operation on front panel of ARM-511 test set. Ensure that 0.5- and 2.0-amp fuses in test set are intact.

WARNING

Ensure that 115-volt, 50- to 400-Hz receptacle (ramp supply leads) are wired correctly for power cable assembly plug CX- 5234/ARM-511. Miswiring will damage test set (refer to C-57-475- 000/MS-000).

c. Connect ARM-511 test set to 115-volt, 50- to 400-Hz ramp supply.

CAUTION

Do not operate Tacan in T/R mode without suitable load connected to RF output of Tacan transceiver. The antenna line can be disconnected with the function switch in REC position, for connection of the ARM-511 test set.

d. Select Tacan on VOR/ILS-Tacan selector, and RH on course indicator selector.

e. Place Tacan control function switch to the REC position and allow 5 minutes for warm up.

f. Prior to installing AS-5120 antenna or connecting the CG-5096 calibrated RF cable assembly, perform the following:

NOTE

Do not operate SELF-TEST while connected to the Tacan receiver-transmitter.

(1) Set POWER switch to ON (power INPUT lamp comes on).

(2) Set control as follows:

TEST SET FUNCTION	SELF TEST
RF ATTENUATION	40 dB
O/P Level	CALIBRATED

(3) Check that A-A AIRCRAFT TRANSPONDER AND TX POWER LEVEL FAIL lamp come on (red). Set O/P level to HIGH and ensure that A-A AIRCRAFT TRANSPONDER and TX POWER LEVEL PASS lamp come on (green).

g. Radiated Tests - Perform radiated test as follows:

CAUTION

Do not use ARM-511 test set in the radiate mode for transmitted power or receiver sensitivity tests.

(1) Connect AS-5120 antenna to RF connector. Connecting antenna to RF socket depresses a flange in the antenna base actuating a switch which limits the test set operation to channel 18X. Ensure that CHANNEL switch is set to 18, mode switch is set to X and that channel 18 is selected on aircraft Tacan control panel for radiated tests.

NOTE

Position of ARM-511 test set antenna is vertical and at least 10 feet away from Tacan transceiver antenna.

(2) Set ARM-511 test set controls as follows:

TEST SET FUNCTION	BEARING/RANGE
BEARING	90°
RANGE n mi	5 n mi
DEVIATION SELECT	OFF
MODULATION	25% and NORMAL
PASS SELECT	TEST 1
RF ATTENUATION	0db
O/P LEVEL	HIGH
CHANNEL	18
MODE	X

(3) On Tacan control, set function switch to T/R and ensure that channel selector is set to 18.

(4) Check that aircraft Tacan locks on. Ensure that aircraft DRMI bearing pointer indication and range counter reading agree with the ARM-511 setting; bearing of 90° (± 2°) and range of 5 n mi (± 0.1).

h. Bearing Deviation - Perform bearing deviation test as follows:

NOTE

This check system tracking and proper operation of aircraft instruments.

(1) On ARM-511 test set, set DEVIATION SELECT switch to BEARING 15° MAX and slowly rotate DEVIATION control to vary DRMI bearing pointers between 75° and 105°.

(2) Observe that DRMI bearing pointers do not jump or stick and that the course indicator deviation bars follow correctly.

j. Range Deviation - Perform range deviation test as follows:

NOTE

This test check system tracking and proper operation of the aircraft range instruments.

(1) On ARM-511 test set, set DEVIATION SELECT control to RANGE 5 n mi MAX and rotate DEVIATION control to vary DRMI digital range readout between 0 n mi and 10 n mi.

NOTE

Do not use 0 n mi selection on RANGE n mi selector for this check.

(2) Observe that the digital range readouts on the DRMIs do not jump or stick.

NOTE

Rapid movement of the DEVIATION control may cause the Tacan transceiver to break lock.

k. Repeat checks in Paragraphs (h) and (j) for various combination of ARM-511 test set range and bearings. Range indication on DRMI are for 5 n mi (plm 0.1), 125 n mi (± 2) and 283 n mi (± 5). Bearing indications are for 90° (± 2°), 230° (± 2°) and 320° (± 2°).

m. CDI Course Centering and Width Adjustment - Perform CDI course and width adjustment as follows:

(1) Set controls on ARM-511 test set as detailed in Paragraph (g) (2).

(2) On CDI (RH) adjust SET (bearing selector) knob at lower left corner of instrument until digital counter window at top of CDI reads 90° (bearing reference is established on CDI selected with course indicator selector switch).

(3) If course deviation is not centered, adjust COURSE CENTRE adjustment on the front panel of the Tacan receiver-transmitter RT-5036 until bar is centered.

(4) Adjust SET knob on CDI until course deviation bar is centered over second dot, left or right of centre. The digital counter on CDI should read 100° or 80° (± 2°) respectively.

(5) If the course deviation is not within tolerance, adjust on front panel of Tacan receiver-transmitter until the deviation bar centres over the second dot.

NOTE

The above check is carried out using the LH or RH CDI. When performing checks ensure that the corresponding CDI operates correctly.

n. Identity Tone Check - Perform identity tone check as follows:

(1) Set function selector to REC on Tacan control and, on test set, press IDENTITY TONE button. Confirm that audio tone (Morse Code) is audible in headsets connected to intercom dual control panel on centre control console.

(2) Operate VOL control on Tacan control by listening to audio tone on LH and RH side phones.

p. Modulation Check - With aircraft Tacan locked on and the DRMIs and CDIs showing the selected range and bearing, select the following on the ARM-11 test set:

(1) MODULATION - 15 Hz/10% - Tacan remains locked on.

(2) MODULATION - 15 Hz/25% - Tacan remains locked on.

(3) Reselect MODULATION - NORMAL/25%

q. Air-to-Air Transponder Check - Perform air-to-air transponder check as follows:

(1) On Tacan control set function to A/A.

(2) On ARM-511 test set select TEST SET FUNCTION switch to SYSTEM and A/A AIRCRAFT TRANSPONDER switch to TEST 1 position.

(3) Observe that the PASS green lamp comes on and the DRMIs indicated selected range.

(4) Set TEST SET FUNCTION to interrogate.

(5) Verify that PASS green lamp comes on.

(6) Set TEST SET FUNCTION to TRANSPOND.

(7) Verify that DRMIs indicate selected range and PASS light is off.

r. Direct Connection Test (Pass/Fail) - The direct connection test method is the most accurate and complete test of the aircraft Tacan set that can be performed using the AN/ARM-511 test set. These tests must be carried out prior to declaring the Tacan set unserviceable. To carry out these checks proceed as follows:

CAUTION

To prevent damage to the Tacan receiver-transmitter, ensure that function switch on Tacan control panel s set to REC before disconnecting antenna from Tacan receiver-transmitter.

(1) Disconnect RF antenna cable from Tacan receiver-transmitter. Interconnect calibrated RF cable assembly CG-5096/ARM-511 (part of AN/ARM-511 test set) between test set and Tacan transceiver.

(2) Carry out tests detailed in Paragraphs (g) through (q), preceding, on channels 18, 47, 100 and 123.

s. Transmitted Power Test - Conduct Tacan transmitted power test as follows:

(1) On ARM-511 test set, set controls as follows:

TEST SET FUNCTION	POWER LEVEL
O/P LEVEL	HIGH
CHANNEL	18
RF ATTENUATION	51 (less 8 dB for CG-5096 RF cable attenuation)

(2) On Tacan control, set function switch to T/R and channel selector to 18.

(3) Check that on ARM-511 test set TX POWER LEVEL PASS lamp comes on.

(4) Repeat steps (1) through (3), preceding, for channels 47, 100 and 123 using ARM-511 test set and selecting the corresponding channel frequencies on Tacan control.

t. Tacan Receiver Sensitivity Test – Conduct Tacan receiver sensitivity test as follows:

(1) On test set, set controls as follows:

CHANNEL	18
TEST SET FUNCTION	BEARING/RANGE
O/P LEVEL	CALIBRATED
RF ATTENUATION	42 (less 8 dB for RF cable)

(2) On Tacan control, ensure that function switch is in T/R position, select channel 15 and, after 15 seconds, select channel 18.

(3) On DRMI indicators, check that Tacan is locked on and that the range counter readings and bearing pointer indications corresponding with range and bearing selected on the ARM-511 test set.

(4) Press PRESS/IDENTITY TONE button and confirm that audio tone is audible and intelligible in both LH and RH headsets.

u. Receiver AGC TEST – Perform receiver AGC test as follows:

(1) Set O/P LEVEL on test set to HIGH, then reselect to CALIBRATED.

(2) Observe on DRMI indicators that range and bearing remain unchanged during switching.

v. Transmitted Power Measurement – This test serves to measure the actual transmitted power of the aircraft Tacan system. For this measurement, the minimum acceptable transmitted power is 750 watts. Perform transmitted power measurement test as follows:

(1) The Tacan transceiver antenna connector is connected to the RF connector on test set by calibrated RF cable assembly CG-5096 (part of AN/ARM-511 test set).

(2) Set AN/ARM-511 test set controls as follows:

TEST SET FUNCTION	POWER LEVEL
O/P LEVEL	HIGH
CHANNEL	18
RF ATTENUATION	51 dB (less 8 dB CG-5096 cable loss)

(3) Refer to Figure 3A-10 to convert total attenuation to transmitted power expressed in dB and watts. Total attenuation for calculating actual transmitted power is derived from the addition of CG-5096 cable loss and ARM-511 RF ATTENUATION SETTING.

w. Receiver Sensitivity Measurement – This test measures the actual receiver sensitivity of the aircraft Tacan system. When performing this measurement, the minimum acceptable receiver sensitivity is -82 dBm.

(1) Connect CG-5096 cable assembly between Tacan transceiver antenna connector and ARM-511 test set RF connector as in Paragraph (v), preceding.

(2) Set ARM-511 test set controls as follows:

CHANNEL	18
TEST SET FUNCTION	BEARING/RANGE
O/P LEVEL	CALIBRATED
RF ATTENUATION	42 (less attenuation of calibrated cable)

(3) Slowly increase ATTENUATOR settings on ARM-511 test set until DRMI bearing or range indicator unlocks. The setting on the RF ATTENUATION control just prior to unlock corresponds to receiver sensitivity expressed in -dBm. Refer to Figure 3A-10 to convert receiver sensitivity to total attenuation.

(4) Calculate Rx sensitivity as follows:

-42 dBm (front panel output power, ATTENUATOR at 0 dB, CALIBRATED position)

-42 dBm (ATTENUATOR setting just prior to unlock)

-8 dBm (CG-5096 cable loss)

-92 dBm (total attenuation)

x. RF Cable Loss Measurement – Specifications require that the line loss in aircraft Tacan RF cables be less than 2 dB when first installed. With

time, attenuation in the RF cable increases, consequently a line loss of 4 dB or more on test confirms the cable to be unserviceable. If cabling is suspect, conduct RF cable loss measurement as follows:

(1) Connect calibrated RF cable assembly CG-5096 between Tacan transceiver antenna connector and test set RF connector.

(2) Measure transmitter power on channels 18, 47, 100 and 123 as detailed for channel 18 in Paragraph (w). Record and average the readings. Refer to Figure 3A-10 to convert results to transmitted power expressed in dB.

(3) Disconnect calibrated RF cable assembly from Tacan transceiver antenna connector and reconnect aircraft RF cable. Connect calibrated RF cable assembly between test set and test receptacle on test panel assembly.

(4) Measure RF cable loss by repeating steps of procedure in Paragraph (w) preceding, for channels 18, 47, 100 and 123. The difference in RF cable loss between this test and the measurement made when CG-5096 RF cable assembly is connected directly to the Tacan transceiver antenna connector should not exceed 3 dB.

y. Turn off power to Tacan and indicators and disengage associated circuit breakers. Disconnect power supply to aircraft and test equipment.

z. Remove test equipment and cables. Reconnect aircraft cable connections. Secure attaching hardware.

REMOVAL AND INSTALLATION

RECEIVER-TRANSMITTER AND ADAPTER UNIT

31. The receiver-transmitter is mounted in the adapter unit, and the adapter unit is mounted in the mounting base. No special instructions are required for removal of the first two units, except that it is convenient practice to remove them as one piece from the aircraft when repair or replacement of the adapter unit alone is required.

MOUNTING BASE

32. The following note applies to removal and installation of the mounting base.

a. Before removing mounting base, make sure that the two aircraft harness plug connectors are marked for attachment in the correct places in base on installation. These two connectors are mechanically but not electrically interchangeable.

b. To detach connectors, detach first the mounting plates from the base, then the connectors from the plates. Plates should remain with mounting base, being part of it.

c. To mount connectors when installing base, first detach the small mounting plates, then pass the connectors through the mounting holes in base from the back. If necessary, refer to Tacan wiring diagram in C-12-114-000/DW-000 to ensure that the connectors are not interchanged. The designations J1019 and J1020, marked on base, refer to receptacles on adapter unit that mate with these plugs.

d. After passing plugs through holes, attach them to the back of the mounting plates, then attach plates in their places on base. The plate mounting screws are designed to allow the connector assemblies play to align themselves with receptacles of adapter unit.

TX Power O/P Level at High			RX Sensitivity O/P Level at Calibrated	
Total Attenuation	**TX Power Watts**	**TX Power dBm**	**Total Attenuation**	**RX Sens dBm**
47	447	56.5	38	-80
48	562	57.5	39	-81
49	708	58.5	40	-82
49.25	750	58.75		
50	891	59.5	41	-83
51	1122	60.5		
52	1413	61.5		
53	1778	62.5		
54	2239	63.5	50	-92
55	2818	64.5	51	-93
56	3548	65.5	52	-94
57	4467	66.5	53	-95

Figure 3A-10 Conversion Tables

PART 4

IFF/SIF SYSTEM

PAGES 2 TO 12 DELETED

PART 5

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IFF SYSTEMS

PART 5

LIST OF ILLUSTRATIONS

IFF SYSTEM

PART 5

IFF SYSTEM

IDENTIFICATION RADAR

GENERAL

1. The AN/APX-77A IFF system (identification friend or foe) transmit coded RF pulses in response to coded pulses received from the interrogation radar of a ground station or another aircraft. Operation can be selected in four modes:

a. Mode 1 - Security identity

b. Mode 2 - Personal identity

c. Mode 3/A - Air traffic identity

d. Mode C - Altitude reporting

SYSTEM COMPONENTS

GENERAL

2. A list of the main components and their locations follows:

COMPONENT	DESIGNATION	LOCATION
Transponder (receiver- transmitter)	RT-8621( )/APX- 77	Nose compartment
Transponder test set	TS-1843B/APX	Nose compartment
Control unit (transponder set control)	C-6280(P)/APX	Centre console
Bailout relay		Nose compartment
Altitude computer-indicator (part of servoed altimeter system)		Instructor's instrument panel
Test receptacle (part of servoed altimeter system)		Right side console
Remote I/P relay		Centre console
Antenna	AT-741A/APX	Underside of right wing, station 191
RF test receptacle		Test panel, nose compartment
Seat ejection test switch		Test panel, nose compartment

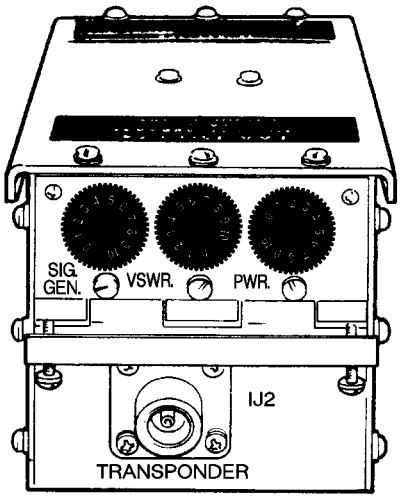
OPERATION OF SYSTEM

GENERAL

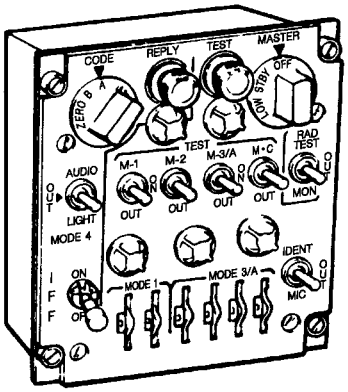
3. For the main components of the system see Figure 5-1. For diagrams of location and wiring see C-12-114-000/DW-000.

MODE OF INTERROGATION

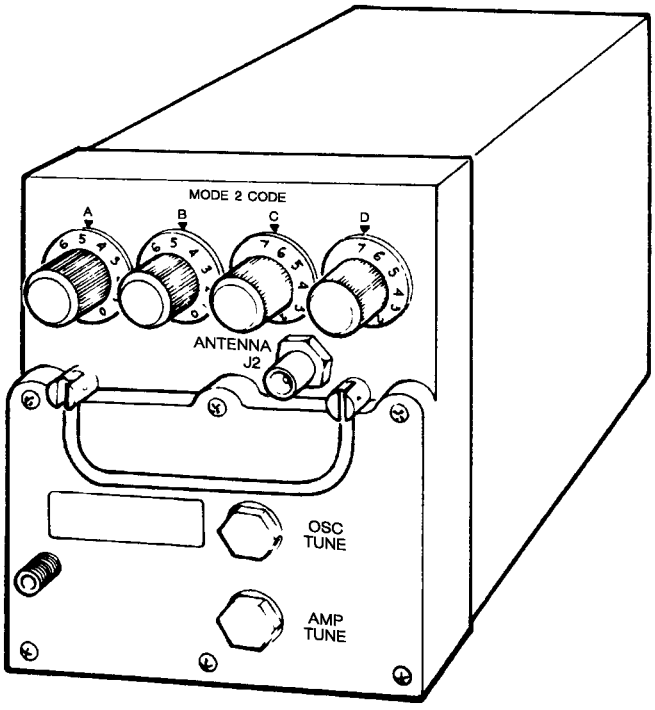
4. The IFF system can be pre-set to respond in various ways to several modes of interrogation. An interrogation is a com-



TEST SET TS-1843B/APX



CONTROL UNIT C-6280(P)/APX



TRANSPONDER RT-862A/APX-77

ZOG05001

Figure 5-1 IFF Main Components

bination or received RF pulses, the combination recurring at a repetition rate determined by the interrogating radar. The modes of interrogation are as follows, the pulse interval in microseconds (usec) being specified as between the leading edges of successive pulses:

a. Mode 1 - Two pulses at 3 usec.

b. Mode 2 - Two pulses at 5 usec.

c. Test mode - Two pulses at 6.5 usec.

d. Mode 3/A - Two pulses at 8 usec.

e. Mode C - Two pulses at 21 usec.

SIF REPLY PULSE SEQUENCE

5. Replies are coded to the SIF (selective identification feature) coding system. The normal SIF reply to a recognized interrogation is a train of transmitted RF pulses, each 0.45 usec wide, in which the first and last are the framing pulses, 20.3 usec apart at the leading edges. The framing pulses, which are always present in the train, identify it as SIF. Between the framing pulses are 13 positions, 1.45 usec apart, any of which can be occupied by an information pulse except the centre one, which remains vacant. The information pulses are designated by letter groups A, B, C and D and, within each group, by numbers 1, 2 and 4. Each pulse is recognized by its position in the reply, the sequence of positions being F1 (first framing pulse), C1, A1, C2, A2, C4, A4, X (vacant position), B1, D1, B2, D2, B4, D4, and F2 (second framing pulse).

REPLY CODE DESIGNATION

6. A particular SIF reply code is preselected on the controls as a sequence of digits. Each digit is the sum of the numbers assigned to the pulses present in one letter group, and the digits are read in alphabetical order of the groups. For example, code 6354 sets up a reply train that contains the 2 and 4 pulses of group A, the 1 and 2 pulses of group B, the 1 and 4 pulses of group C, and the 4 pulse of group D.

NORMAL REPLIES

7. The information pulses possible in a normal mode 1 reply are only the A and the B pulses, omitting B4. This provides 32 combinations, coded 00 to 73. In mode 2, 3/A and test, all 12 information pulse positions are used, providing 4096 combinations in each mode, coded 0000 to 7777. Mode C replies embody a hybrid reflected binary (gray) code, using all four groups. Whenever the D4 pulse is present in a mode C reply, an extra pulse is also present, 4.35 usec after the F2 pulse. Mode C reply coding is generated by an altitude encoder in the computer-indicator of the servoed altimeter system (refer to C-12-114-0E0/MF-000).

EMERGENCY REPLIES

8. In modes 1 and 2, an emergency reply to a single interrogation is a normal reply pulse train followed by three pairs of normally spaced framing pulses, with an interval of 4.35 usec from each F2 pulse to the next F1 pulse. In mode 3/A and test mode, the emergency reply is information code 7700, followed by three pairs of framing pulses as in modes 1 and 2. In mode C, emergency replies do not differ from normal replies.

I/P REPLIES

9. In mode 1, and I/P (identification of position) reply is two normal reply trains with an interval of 4.35 usec from the first F2 pulse to the second F1 pulse. In modes 2, 3/A and test, the I/P reply is one normal reply train with a single pulse following 4.35 usec after the F2 pulse. In mode C, I/P replies do not differ from normal replies.

TRANSPONDER

10. A preselected circuit in the transponder passes incoming 1030- MHz signals to the receiver and keeps the 1090-MHz transmitter output pulses from interfering with receiver performance. Low and normal sensitivity of the receiver can be selected on the control unit. The transponder also contains an automatic overload circuit that reduces sensitivity by blocking some of the interrogations when their recurrence frequency is excessive. The video output of the receiver is passed to the decoder, which identifies the mode of interrogation and triggers the reply coding circuits for that mode, and the video pulses generated in the reply coding circuits are used for modulating the transmitter. Reply coding for mode 2 is selected on four rotary switches on

the transponder, but the reply coding controls for modes 1 and 3/A are on the control unit.

CONTROL UNIT

11. The control unit contains all the operating controls, including the reply code selectors for modes 1 and 3/A. The MASTER switch has five positions. In OFF position it switches off the system, and in STBY position it switches on the receiver but not the transmitter. LOW and NORM positions switch the system into full operation with reduced and normal receiver sensitivity, respectively. EMER position causes emergency replies to be made to interrogations in modes 1, 2 and 3/A, regardless of the mode switch setting. To prevent accidental selection of OFF or EMERG, the master switch knob must be pulled out to make either of those selections.

12. The mode switches, M-1, M-2, M-3/A and M/C, each for the mode indicated, leave the mode switched off in OUT position, select normal operation of the mode in ON position, and select test operation of the mode in TEST position. The transponder also sends mode-1 replies to mode-1 interrogations when one or more of the other modes are selected. The mode switches are spring-loaded to return from TEST to ON. The test position function is described with the test set in Paragraph 13, following. The replay code selectors are two MODE 1 and four MODE 3/A digitally marked thumbwheels. A rotary switch and two toggle switches on the left of the control panel and a REPLY light near top centre are for mode 4 operation, not used at present. The I/P switch (IDENT-OUT-MIC) is used on request from the interrogating station. It is inactive in OUT position. When it is held in IDENT position, I/P replies are made to interrogation in modes 1, 2 and 3/A, and the responses continue in the same way fro 16 to 30 seconds after release of the switch. The MIC position of the switch transfers the I/P switching function to the microphone buttons (pressing the button initiates the I/P responses). The function of the RAD TEST - OUT - MON switch is described with the test set in Paragraph 13, following.

TEST SET

13. The test set in the system is operated by controls on the contro unit. When the MASTER switch is at NORMAL, the test switch at RAD TEST, and any mode switch held in TEST position, the test set interrogates the transponder in the selected mode with RF pulses at a predetermined level. It lights the TEST lamp on the control unit if the transponder satisfies the combined requirements of receiver frequency and sensitivity, reply pulse spacing and carrier frequency, and antenna circuit VSWR. With the test switch in MON position, the test set makes a similar check of the replies to external interrogation. Preset controls on the test set adjust the RF level of interrogation (SIG GEN), the threshold of acceptance for reply peak power (POWER), and the threshold of rejection for VSWR.

ANTENNA

14. The antenna serves for both reception and transmission. In addition to the main RF connector, it has a test receptacle, which is connected by coaxial cable to the RF test receptacle on the test panel in the nose compartment.

SUPPRESSION PULSE CABLES

15. Two coaxial cables carry suppression pulses (receiver blanking pulses) between IFF and TACAN. Each suppression pulse is synchronized with the transmitter output of its own system, and prevents the high RF power of that output from affecting the receiver of the other system.

BAILOUT RELAY

16. When either pilot's seat is ejected, the bailout relay switches the IFF to emergency operation. Power to energize the relay is supplied through the EMERG IFF circuit-breaker on the centre console circuit-breaker panel, and the relay is energized by grounding through either of the distress signal micro-switches on the ejection seat rails. In parallel with these switches is one section of the ejection test switch on the test panel in the nose compartment.

17. In a bailout, seven control lines connected to the transponder unit must be grounded, to switch the unit on and to select the required modes of operation. A blocking diode is connected to the bailout relay coil ground switching terminal, and when the relay is energized, all seven control lines are

grounded through the diode. Six of the seven are grounded through normally open contacts of the relay in series with the diode, and five of the six are at the same time disconnected from the control unit by opening of the normally closed contacts. The sixth line, mode 1 control, is permanently connected to the control unit. The seventh line, power relay control, is permanently connected to both the control unit and the diode. The diode prevents this line from energizing the bailout relay in normal operation.

REMOTE I/P RELAY

18. Power to energize the remote I/P relay is supplied through the EMERG IFF circuit-breaker on the centre console circuit-breaker panel, and the relay is energized by grounding through either of the intercom press-to-talk switches. When energized, the relay applies a ground to the remote I/P control terminal of the IFF control unit.

SERVOED ALTIMETER TEST RECEPTACLE

19. The digital output of the altitude computer-indicator (servoed altimeter system) is connected to the transponder through a test receptacle on the right side console. Continuity through the receptacle is made by the jumper wires of a shorting plug, which is inserted for normal operation and which can be removed for the insertion of a test circuit plug.

REFERENCES

20. For further information on units of the system, refer to the following Canadian Forces Technical Orders:

Transponder C-59-122-A00/MF-000

Control unit C-59-107-000/MS-000

Test set C-59-122-X02/MS-000

FUNCTIONAL TESTS

NOTE

For the EUHF/IFF bailout circuits functional test, see Part 2, Section 2, paragraph 47A.

TEST EQUIPMENT

21. The following test equipment is required:

a. Transponder ramp test set AN/APM-515 (T-43A).

b. Pressure-temperature test set TTU-205A.

PRIMARY POWER

22. Check that the following circuit-breakers on the centre console circuit-breaker panel are pushed in:

IFF

IFF TEST SET

EMERG IFF

CHECK WITH BUILT-IN TEST SET

23. Procedure:

a. On IFF control unit, set MASTER switch to NORM, test switch to RAD TEST, code selectors to any code, and all controls to OUT.

b. Set each one of the mode switches M-1, M-2, M-3/A and M-C, separately to TEST and return it to out. In each case check that the TEST lamp on control unit remains on while switch is in TEST position.

c. On IFF control unit, set test switch to MON.

d. On both IFF and test set, select the following mode 1 codes, and check that the TEST light on IFF control unit comes on every time the two code settings agree:

00	70
10	71
30	73

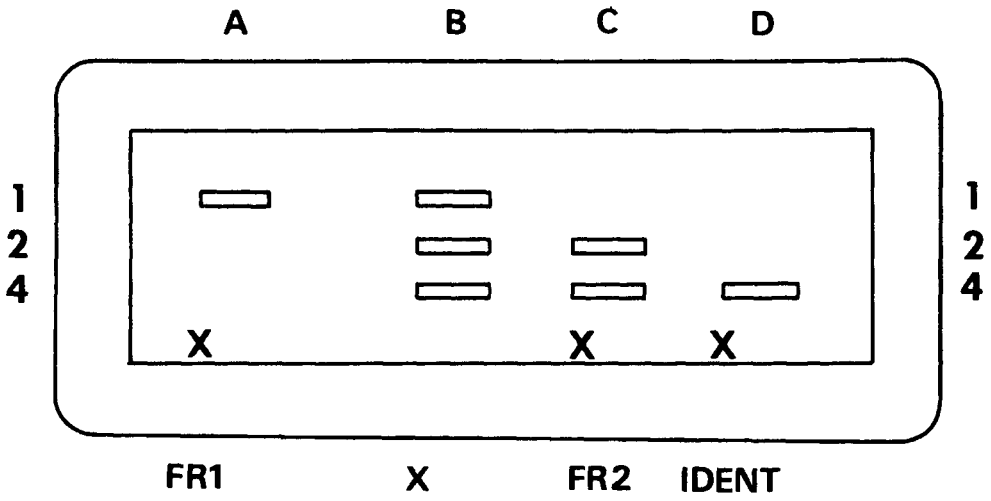
NOTE

The TEST light may go out momentarily at a slow, steady repetition rate while the test switch is in MON position. This does not indicated malfunction. Random flickering and light out indicated malfunction. Do not leave the switch in MON position for long periods when the position is not required.

CHECK OF MODES 1, 2 AND 3/A

24. Procedure:

a. Warm up IFF for at least one minute



DISPLAY OF 1764 CODE WITH FRAMING AND IDENTIFICATION PULSES

Z0G05002

Figure 5-2 Typical Display on AN/APM-515 Test Set

with function selector of control unit in STBY or LOW position. Set M-1 switch to ON, other mode switches to OUT, and function selector to NORM.

b. Set up AN/APM-515 test set outside aircraft in clear line of sight to aircraft IFF antenna. Connect test set antenna. Switch test set on, using test set battery or aircraft 115-volt a.c. (Test set can be operated while battery is charging.)

c. On test set, make the following control selections:

(1)	SENSITIVITY	Maximum clockwise
(2)	1090 MHz	Zero
(3)	SLS	OFF
(4)	MODE	1
(5)	READOUT	PILOT
(6)	DATA SOURCE	TRANSPONDER

d. Observe microammeter on test set to see whether IFF is replying to test set interrogation. (Erratic readings indicate uneven replies due to weak interrogating signal or obstruction between antennas.)

e. Set SLS switch on test set to ON, and check that the microammeter reading falls to zero. If meter still indicates a reply, adjust position of test set antenna to increase strength of interrogation.

f. Set SLS to OFF, and adjust SENSITIVITY for approximate quarter- scale reading on microammeter. Adjust 1090 MHz control for maximum meter deflection, and check frequency error on 1090 MHz dial. Maximum permissible error is ±3 MHz.

g. Set SENSITIVITY for full-scale deflection of meter and READOUT switch to PILOT. Check indication of framing pulses (FR1 and FR2) on test set readout. For typical readout pattern see Figure 5-2.

h. On IFF control unit, hold function switch momentarily in IDENT position, and check indication of IDENT pulse on test set readout, 30 seconds maximum. Repeat, using MIC position and microphone button.

CAUTION

Throughout the following steps, do not select any reply code beginning with 77. Such codes could activate a ground station alarm.

j. Select mode 1 reply code 00 on IFF control unit, then rotate each mode 1 code selector switch through its positions and check for the corresponding readouts on test set. (All reply pulses except B4 should be indicated.)

k. On IFF control, switch M-1 to OUT and M-2 to ON, and select mode 2 on test set.

m. Repeat (e), (g) and (j) for mode 2, using reply code selector switches on transponder. Start codes with 0000, and rotate switches through all positions.

n. On IFF control, switch M-2 to OUT and M-3/A to ON, and select mode 3/A on test set.

p. Repeat (e), (g) and (j) for mode 3/A, using mode 3/A reply code selector switches in IFF control unit. Start codes with 0000 and rotate switches through all positions.

IFF EMERGENCY CHECKS

25. Procedure:

CAUTION

This check radiates an emergency signal. It is made on Mode 3 only.

a. Notify GCA that this test is about to be made. GCA may or may not hear a 7700 alarm signal during the test.

b. With Modes 1 and 2 out and Mode 3/A selected, pull and rotate IFF control unit function switch to EMER momentarily. Check that the test set indicates reception of the 7700 emergency code. Return control to NORMAL.

c. Ensure that the emergency UHF radio is on channel 2. Initiate a bailout sequence, and check that the 7700 code is indicated on test set. Select override on EUHF control unit, and check that the bailout tone ceases but 7700 code continues.

d. Return EUHF control to normal (bailout off). Switch IFF off, select all modes out, and leave set switched off for 3 minutes.

e. Initiate bailout sequence, and check that the emergency code transmission is indicated on test set within 20 seconds.

MODE C CHECK

26. Procedure for Mode C uses the altitude computer-indicator for digital input to the IFF. (It does not check the altitude-measuring accuracy of the computer-indicator.) Continue as follows:

a. On IFF control unit, switch M-3/A to OUT and M-C to ON.

b. On test set, select mode C and set READOUT switch to ALTITUDE.

c. Attach pressure-temperature test set adapter to end of pitot- static boom and to pitot and static connection on test set. Maintain indication of 200 knots on airspeed indicators.

d. Adjust baroset knob on altitude computer-indicator for a counter reading of 29.92 in. Hg. Apply pressure altitudes and check that the APM-515 test set readout agrees with the computer- indicator dial at the following positions:

-300	4,800	20,200	39,900
1,000	10,400	23,200	49,600
2,300	18,100	29,500	62,900

e. If no more altitude readings are required (refer to Paragraph 27, following), disconnect pressure-temperature test set.

ENCODER CIRCUIT CHECK

27. A coding error can be due to failure in the encoding circuits of the computer-indicator or in the corresponding digital channels of the IFF. If trouble is suspected, the following procedure may be used to check the encoding circuits:

a. Apply pressure-temperature test set as in 26 (c), preceding.

b. On APM-515 test set, make the following selections:

MODE	C
READOUT	ALTITUDE
DATA SOURCE	ARINC

c. Using appropriate cable supplied, connect APM-515 test set to altitude test receptacle on right side console. Set POWER switch to INTLK.

d. Check that the baroset adjustment on computer-indicator is 29.92 in. Hg, and apply pressure altitudes to produce indications throughout the range shown in the table, Figure 5-3. At 500-foot ascending intervals throughout this range, check that the APM-515 test set readout agrees with the computer-indicator dial.

e. Repeat (d) for descending intervals displaced 250 feet (approximately) from the ascending measurements.

NOTE

Altitude coding can be checked, if desire, by setting READOUT switch on test set to PILOT and referring to the coding table, Figure 5-3.

f. Disconnect pressure-temperature test set.

Altitude	Reply code			
	A	B	C	D
–1 000	0	0	2	0
– 900	0	0	3	0
– 800	0	0	1	0
– 700	0	4	1	0
– 600	0	4	3	0
– 500	0	4	2	0
– 400	0	4	6	0
– 300	0	4	4	0
– 200	0	6	4	0
– 100	0	6	6	0
000	0	6	2	0
100	0	6	3	0
200	0	6	1	0
300	0	2	1	0
400	0	2	3	0
500	0	2	2	0
600	0	2	6	0
700	0	2	4	0
800	0	3	4	0
900	0	3	6	0
1 000	0	3	2	0
1 100	0	3	3	0
1 200	0	3	1	0
1 300	0	7	1	0
1 400	0	7	3	0
1 500	0	7	2	0
1 600	0	7	6	0
1 700	0	7	4	0
1 800	0	5	4	0
1 900	0	5	6	0
2 000	0	5	2	0
2 100	0	5	3	0
2 200	0	5	1	0
2 300	0	1	1	0
2 400	0	1	3	0
2 500	0	1	2	0
2 600	0	1	6	0
2 700	0	1	4	0
2 800	4	1	4	0
2 900	4	1	6	0
3 000	4	1	2	0
3 100	4	1	3	0
3 200	4	1	1	0
3 300	4	5	1	0
3 400	4	5	3	0
3 500	4	5	2	0
3 600	4	5	6	0
3 700	4	5	4	0
3 800	4	7	4	0
3 900	4	7	6	0

Altitude	Reply code			
	A	B	C	D
4 000	4	7	2	0
4 100	4	7	3	0
4 200	4	7	1	0
4 300	4	3	1	0
4 400	4	3	3	0
4 500	4	3	2	0
4 600	4	3	6	0
4 700	4	3	4	0
4 800	4	2	4	0
4 900	4	2	6	0
5 000	4	2	2	0
5 100	4	2	3	0
5 200	4	2	1	0
5 300	4	6	1	0
5 400	4	6	3	0
5 500	4	6	2	0
5 600	4	6	6	0
5 700	4	6	4	0
5 800	4	4	4	0
5 900	4	4	6	0
6 000	4	4	2	0
6 100	4	4	3	0
6 200	4	4	1	0
6 300	4	0	1	0
6 400	4	0	3	0
6 500	4	0	2	0
6 600	4	0	6	0
6 700	4	0	4	0
6 800	6	0	4	0
6 900	6	0	6	0
7 000	6	0	2	0
7 100	6	0	3	0
7 200	6	0	1	0
7 300	6	4	1	0
7 400	6	4	3	0
7 500	6	4	2	0
7 600	6	4	6	0
7 700	6	4	4	0
7 800	6	6	4	0
7 900	6	6	6	0
8 000	6	6	2	0
8 100	6	6	3	0
8 200	6	6	1	0
8 300	6	2	1	0
8 400	6	2	3	0
8 500	6	2	2	0
8 600	6	2	6	0
8 700	6	2	4	0
8 800	6	3	4	0
8 900	6	3	6	0

Figure 5-3 (Sheet 1 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
9 000	6	3	2	0
9 100	6	3	3	0
9 200	6	3	1	0
9 300	6	7	1	0
9 400	6	7	3	0
9 500	6	7	2	0
9 600	6	7	6	0
9 700	6	7	4	0
9 800	6	5	4	0
9 900	6	5	6	0
10 000	6	5	2	0
10 100	6	5	3	0
10 200	6	5	1	0
10 300	6	1	1	0
10 400	6	1	3	0
10 500	6	1	2	0
10 600	6	1	6	0
10 700	6	1	4	0
10 800	2	1	4	0
10 900	2	1	6	0
11 000	2	1	2	0
11 100	2	1	3	0
11 200	2	1	1	0
11 300	2	5	1	0
11 400	2	5	3	0
11 500	2	5	2	0
11 600	2	5	6	0
11 700	2	5	4	0
11 800	2	7	4	0
11 900	2	7	6	0
12 000	2	7	2	0
12 100	2	7	3	0
12 200	2	7	1	0
12 300	2	3	1	0
12 400	2	3	3	0
12 500	2	3	2	0
12 600	2	3	6	0
12 700	2	3	4	0
12 800	2	2	4	0
12 900	2	2	6	0
13 000	2	2	2	0
13 100	2	2	3	0
13 200	2	2	1	0
13 300	2	6	1	0
13 400	2	6	3	0
13 500	2	6	2	0
13 600	2	6	6	0
13 700	2	6	4	0
13 800	2	4	4	0
13 900	2	4	6	0

Altitude	Reply code			
	A	B	C	D
14 000	2	4	2	0
14 100	2	4	3	0
14 200	2	4	1	0
14 300	2	0	2	0
14 400	2	0	3	0
14 500	2	0	2	0
14 600	2	0	6	0
14 700	2	0	4	0
14 800	3	0	4	0
14 900	3	0	6	0
15 000	3	0	2	0
15 100	3	0	3	0
15 200	3	0	1	0
15 300	3	4	1	0
15 400	3	4	3	0
15 500	3	4	2	0
15 600	3	4	6	0
15 700	3	4	4	0
15 800	3	6	4	0
15 900	3	6	6	0
16 000	3	6	2	0
16 100	3	6	3	0
16 200	3	6	1	0
16 300	3	2	1	0
16 400	3	2	3	0
16 500	3	2	2	0
16 600	3	2	6	0
16 700	3	2	4	0
16 800	3	3	4	0
16 900	3	3	6	0
17 000	3	3	2	0
17 100	3	3	3	0
17 200	3	3	1	0
17 300	3	7	1	0
17 400	3	7	3	0
17 500	3	7	2	0
17 600	3	7	6	0
17 700	3	7	4	0
17 800	3	5	4	0
17 900	3	5	6	0
18 000	3	5	2	0
18 100	3	5	3	0
18 200	3	5	1	0
18 300	3	1	1	0
18 400	3	1	3	0
18 500	3	1	2	0
18 600	3	1	6	0
18 700	3	1	4	0
18 800	7	1	4	0
18 900	7	1	6	0

Figure 5-3 (Sheet 2 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
19 000	7	1	2	0
19 100	7	1	3	0
19 200	7	1	1	0
19 300	7	5	1	0
19 400	7	5	3	0
19 500	7	5	2	0
19 600	7	5	6	0
19 700	7	5	4	0
19 800	7	7	4	0
19 900	7	7	6	0
20 000	7	7	2	0
20 100	7	7	3	0
20 200	7	7	1	0
20 300	7	3	1	0
20 400	7	3	3	0
20 500	7	3	2	0
20 600	7	3	6	0
20 700	7	3	4	0
20 800	7	2	4	0
20 900	7	2	6	0
21 000	7	2	2	0
21 100	7	2	3	0
21 200	7	2	1	0
21 300	7	6	1	0
21 400	7	6	3	0
21 500	7	6	2	0
21 600	7	6	6	0
21 700	7	6	4	0
21 800	7	4	4	0
21 900	7	4	6	0
22 000	7	4	2	0
22 100	7	4	3	0
22 200	7	4	1	0
22 300	7	0	1	0
22 400	7	0	3	0
22 500	7	0	2	0
22 600	7	0	6	0
22 700	7	0	4	0
22 800	5	0	4	0
22 900	5	0	6	0
23 000	5	0	2	0
23 100	5	0	3	0
23 200	5	0	1	0
23 300	5	4	1	0
23 400	5	4	3	0
23 500	5	4	2	0
23 600	5	4	6	0
23 700	5	4	4	0
23 800	5	6	4	0
23 900	5	6	6	0

Altitude	Reply code			
	A	B	C	D
24 000	5	6	2	0
24 100	5	6	3	0
24 200	5	6	1	0
24 300	5	2	1	0
24 400	5	2	3	0
24 500	5	2	2	0
24 600	5	2	6	0
24 700	5	2	4	0
24 800	5	3	4	0
24 900	5	3	6	0
25 000	5	3	2	0
25 100	5	3	3	0
25 200	5	3	1	0
25 300	5	7	1	0
25 400	5	7	3	0
25 500	5	7	2	0
25 600	5	7	6	0
25 700	5	7	4	0
25 800	5	5	4	0
25 900	5	5	6	0
26 000	5	5	2	0
26 100	5	5	3	0
26 200	5	5	1	0
26 300	5	1	1	0
26 400	5	1	3	0
26 500	5	1	2	0
26 600	5	1	6	0
26 700	5	1	4	0
26 800	1	1	4	0
26 900	1	1	6	0
27 000	1	1	2	0
27 100	1	1	3	0
27 200	1	1	1	0
27 300	1	5	1	0
27 400	1	5	3	0
27 500	1	5	2	0
27 600	1	5	6	0
27 700	1	5	4	0
27 800	1	7	4	0
27 900	1	7	6	0
28 000	1	7	2	0
28 100	1	7	3	0
28 200	1	7	1	0
28 300	1	3	1	0
28 400	1	3	3	0
28 500	1	3	2	0
28 600	1	3	6	0
28 700	1	3	4	0
28 800	1	2	4	0
28 900	1	2	6	0

Figure 5-3 (Sheet 3 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
29 000	1	2	2	0
29 100	1	2	3	0
29 200	1	2	1	0
29 300	1	6	1	0
29 400	1	6	3	0
29 500	1	6	2	0
29 600	1	6	6	0
29 700	1	6	4	0
29 800	1	4	4	0
29 900	1	4	6	0
30 000	1	4	2	0
30 100	1	4	3	0
30 200	1	4	1	0
30 300	1	0	1	0
30 400	1	0	3	0
30 500	1	0	2	0
30 600	1	0	6	0
30 700	1	0	4	0
30 800	1	0	4	4
30 900	1	0	6	4
31 000	1	0	2	4
31 100	1	0	3	4
31 200	1	0	1	4
31 300	1	4	1	4
31 400	1	4	3	4
31 500	1	4	2	4
31 600	1	4	6	4
31 700	1	4	4	4
31 800	1	6	4	4
31 900	1	6	6	4
32 000	1	6	2	4
32 100	1	6	3	4
32 200	1	6	1	4
32 300	1	2	1	4
32 400	1	2	3	4
32 500	1	2	2	4
32 600	1	2	6	4
32 700	1	2	4	4
32 800	1	3	4	4
32 900	1	3	6	4
33 000	1	3	2	4
33 100	1	3	3	4
33 200	1	3	1	4
33 300	1	7	1	4
33 400	1	7	3	4
33 500	1	7	2	4
33 600	1	7	6	4
33 700	1	7	4	4
33 800	1	5	4	4

Altitude	Reply code			
	A	B	C	D
33 900	1	5	6	4
34 000	1	5	2	4
34 100	1	5	3	4
34 200	1	5	1	4
34 300	1	1	1	4
34 400	1	1	3	4
34 500	1	1	2	4
34 600	1	1	6	4
34 700	1	1	4	4
34 800	5	1	4	4
34 900	5	1	6	4
35 000	5	1	2	4
35 100	5	1	3	4
35 200	5	1	1	4
35 300	5	5	1	4
35 400	5	5	3	4
35 500	5	5	2	4
35 600	5	5	6	4
35 700	5	5	4	4
35 800	5	7	4	4
35 900	5	7	6	4
36 000	5	7	2	4
36 100	5	7	3	4
36 200	5	7	1	4
36 300	5	3	1	4
36 400	5	3	3	4
36 500	5	3	2	4
36 600	5	3	6	4
36 700	5	3	4	4
36 800	5	2	4	4
36 900	5	2	6	4
37 000	5	2	2	4
37 100	5	2	3	4
37 200	5	2	1	4
37 300	5	6	1	4
37 400	5	6	3	4
37 500	5	6	2	4
37 600	5	6	6	4
37 700	5	6	4	4
37 800	5	4	4	4
37 900	5	4	6	4
38 000	5	4	2	4
38 100	5	4	3	4
38 200	5	4	1	4
38 300	5	0	1	4
38 400	5	0	3	4
38 500	5	0	2	4
38 600	5	0	6	4
38 700	5	0	4	4

Figure 5-3 (Sheet 4 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
38 800	7	0	4	4
38 900	7	0	6	4
39 000	7	0	2	4
39 100	7	0	3	4
39 200	7	0	1	4
39 300	7	4	1	4
39 400	7	4	3	4
39 500	7	4	2	4
39 600	7	4	6	4
39 700	7	4	4	4
39 800	7	6	4	4
39 900	7	6	6	4
40 000	7	6	2	4
40 100	7	6	3	4
40 200	7	6	1	4
40 300	7	2	1	4
40 400	7	2	3	4
40 500	7	2	2	4
40 600	7	2	6	4
40 700	7	2	4	4
40 800	7	3	4	4
40 900	7	3	6	4
41 000	7	3	2	4
41 100	7	3	3	4
41 200	7	3	1	4
41 300	7	7	1	4
41 400	7	7	3	4
41 500	7	7	2	4
41 600	7	7	6	4
41 700	7	7	4	4
41 800	7	5	4	4
41 900	7	5	6	4
42 000	7	5	2	4
42 100	7	5	3	4
42 200	7	5	1	4
42 300	7	1	1	4
42 400	7	1	3	4
42 500	7	1	2	4
42 600	7	1	6	4
42 700	7	1	4	4
42 800	3	1	4	4
42 900	3	1	6	4
43 000	3	1	2	4
43 100	3	1	3	4
43 200	3	1	1	4
43 300	3	5	1	4
43 400	3	5	3	4
43 500	3	5	2	4
43 600	3	5	6	4

Altitude	Reply code			
	A	B	C	D
43 700	3	5	4	4
43 800	3	7	4	4
43 900	3	7	6	4
44 000	3	7	2	4
44 100	3	7	3	4
44 200	3	7	1	4
44 300	3	3	1	4
44 400	3	3	3	4
44 500	3	3	2	4
44 600	3	3	6	4
44 700	3	3	4	4
44 800	3	2	4	4
44 900	3	2	6	4
45 000	3	2	2	4
45 100	3	2	3	4
45 200	3	2	1	4
45 300	3	6	1	4
45 400	3	6	3	4
45 500	3	6	2	4
45 600	3	6	6	4
45 700	3	6	4	4
45 800	3	4	4	4
45 900	3	4	6	4
46 000	3	4	2	4
46 100	3	4	3	4
46 200	3	4	1	4
46 300	3	0	1	4
46 400	3	0	3	4
46 500	3	0	2	4
46 600	3	0	6	4
46 700	3	0	4	4
46 800	2	0	4	4
46 900	2	0	6	4
47 000	2	0	2	4
47 100	2	0	3	4
47 200	2	0	1	4
47 300	2	4	1	4
47 400	2	4	3	4
47 500	2	4	2	4
47 600	2	4	6	4
47 700	2	4	4	4
47 800	2	6	4	4
47 900	2	6	6	4
48 000	2	6	2	4
48 100	2	6	3	4
48 200	2	6	1	4
48 300	2	2	1	4
48 400	2	2	3	4
48 500	2	2	2	4

Figure 5-3 (Sheet 5 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
48 600	2	2	6	4
48 700	2	2	4	4
48 800	2	3	4	4
48 900	2	3	6	4
49 000	2	3	2	4
49 100	2	3	3	4
49 200	2	3	1	4
49 300	2	7	1	4
49 400	2	7	3	4
49 500	2	7	2	4
49 600	2	7	6	4

Altitude	Reply code			
	A	B	C	D
49 700	2	7	4	4
49 800	2	5	4	4
49 900	2	5	6	4
50 000	2	5	2	4
50 100	2	5	3	4
50 200	2	5	1	4
50 300	2	1	1	4
50 400	2	1	3	4
50 500	2	1	2	4
50 600	2	1	6	4
50 700	2	1	4	4

Figure 5-3 (Sheet 6 of 6) Altitude Reply Codes

PART 6

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UNDERWATER ACOUSTIC BEACON

PART 6

UNDERWATER ACOUSTIC BEACON

DESCRIPTION

GENERAL

1. The DK100 underwater acoustic beacon is a battery-powered device which radiates pulsed acoustic signals to facilitate location of ditched aircraft with underwater listening devices during search operations. Immersion of the aircraft in water activates a water-sensitive switch permitting the beacon to operate continuously for at least 30 days after crashing into water.

EQUIPMENT DESCRIPTION

2. The beacon is contained in a case 1.3 inches in diameter by 3.92 inches long, installed in an extruded aluminum (type N30A26) mount assembly. The mount is installed near the centre of the bulkhead, F.S.149, nose electronics compartment. Access to the beacon assembly is through the RH inverter access panel assembly.

OPERATION

3. The beacon is a battery-operated underwater acoustic pulse generator that is activated when the switch end of the beacon is immersed in water. The water switch, which is part of a low-current triggering circuit, closes on immersion in water to initiate normal pulsing of the beacon oscillator circuit. Output voltage from the oscillator circuit drives the piezo-ceramic transducer ring, producing 37.5-kHz pulses. The resultant mechanical motion is transmitted to the metal case of the beacon which in turn radiates it to the surrounding water. Acoustic pulses generated are of 10- millisecond nominal duration and occur once every second. The beacon can withstand depths to 20,000 feet, permitting detection of emitted acoustic signals in the range between 2000 and 4000 yards.

LOCATION

4. The beacon is installed in a position where there is the least risk of damage to it in a crash, and is installed with the water switch downwards, so that moisture will not accumulate on the switch. A resistance of a few thousand ohms across the contacts is low enough to switch the oscillator on.

REFERENCE

5. For further information on the beacon refer to C-57-701-000/MS-001.

SERVICING

6. Maintenance consists of regular checking to ensure the that the water switch is clean and dry, wiping the switch clean with solvent IAW C-12-114-000/NR-000, Part 6.

FUNCTIONAL CHECKS

7. An ultrasonic test set 42A12A is required to check the underwater acoustic beacon.

TEST

8. Procedure:

a. On test set, set INT-EXT switch to INT.

b. Set TUNING between 35 and 40 kHz. Turn GAIN clockwise and check for operation by jingling keys, coins or similar ultrasonic noise maker near microphone. (Clanging should be heard in loudspeaker.)

c. Temporarily short out water switch by means of metal braid or other flexible conductor, and tune test set for best audible signal.

d. Check that the pulse repetition rate is approximately one pulse per second. (A rapid or accelerating pulse rate can indicate end of battery life.)

e. Check that the frequency of the signal is approximately 37.5 kHz by tuning test set to zero beat and reading frequency on tuning scale.

NOTE

For accurate operation, the beacon needs to be in a large volume of water. Operation in air makes considerable difference to the frequency, pulse rate and signal strength because of mismatched acoustic loading.

REMOVAL AND INSTALLATION

REMOVAL

9. To remove the beacon, remove lockwire and three screws holding the securing plate, remove plate and withdraw beacon from mount.

INSTALLATION

10. Procedure:

    a. Insert beacon in mount with switch end down, and with markings and battery replacement date visible for reading.

    b. Install securing plate with the three screws and lock washers.

    c. Lockwire the three screws with 0.020-inch monel wire.

    d. Perform functional check.

PART 7

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DF-206A ADF SYSTEM

PART 7

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DF-206A ADF SYSTEM

PART 7

DF-206A ADF SYSTEM

DESCRIPTION AND OPERATION

INTRODUCTION

NOTE

For aircraft with Modification Leaflet C-12-114-000/CF-459 or CF-461, and, CF-462, CF-463 and CF-464 incorporated.

1. The DF-206A Automatic Direction Finder (ADF) supplies direction-finding signal to indicators on the right-hand (RH) and left-hand (LH) instrument panels. The system is a combination direction-finding and radio receiver system that uses broadcast and range stations within the frequency rang of 100 to 2199.5 kHz for navigational purposes. Figure 7-1 tabulates the system primary components, Figure 7-2 illustrates the component locations and Figure 7-4 is a schematic of the system.

Component	Part Number	Quantity
Control, DF-206A	622-6813-001	1
Receiver, DF-206A	622-6812-003	1
Antenna, DF-206A	622-6820-001	1
Mount, DF-206A	622-7210-002	1

Figure 7-1 Tabulation of DF-206A System Primary Components

GENERAL

2. The DF-206A ADF System receives frequencies from 100 to 2199.5 kHz. This range includes many standard commercial broadcast stations at 550 to 1610 kHz, Non-Directional Beacons (NBD) at 190 to 550 kHz, and Consolan stations at approximately 300 kHz. The directional characteristics of the loop antennas are used to determine the bearing to a selected ground station. The received signal strength is relative to the position of the antennas with respect to the transmitting ground station. The received signal are routed to the receiver and, depending on which mode is selected, the processed signals are presented on the RH and LH distance and radio magnetic indicators (DRMIs) and/or aurally.

MODES OF OPERATION

3. The DF-206A ADF system has two functional modes of operation. When the mode selector switch (AN/ANT/OFF) is set to ANT, the DF- 206A functions as an aural receiver and provides an aural output of received signals only. This aural signal is heard through the aircraft intercommunication system. When the mode selector switch is set to ADF, the system functions as an automatic direction- finder that provides relative bearing-to-the-station signals to the RH and LH DRMIs. In addition, when in ADF mode, an aural output of the received signal is provided through the aircraft intercommunication system. When the mode selector switch is set to OFF, power is removed from the system.

SYSTEM POWER SUPPLIES

4. The DF-206A ADF system is supplied with 28VDC from the essential DC bus through the 3-ampere ADF 28VDC circuit- breaker, and 26 VAC from the instrument bus through the 3-ampere ADF

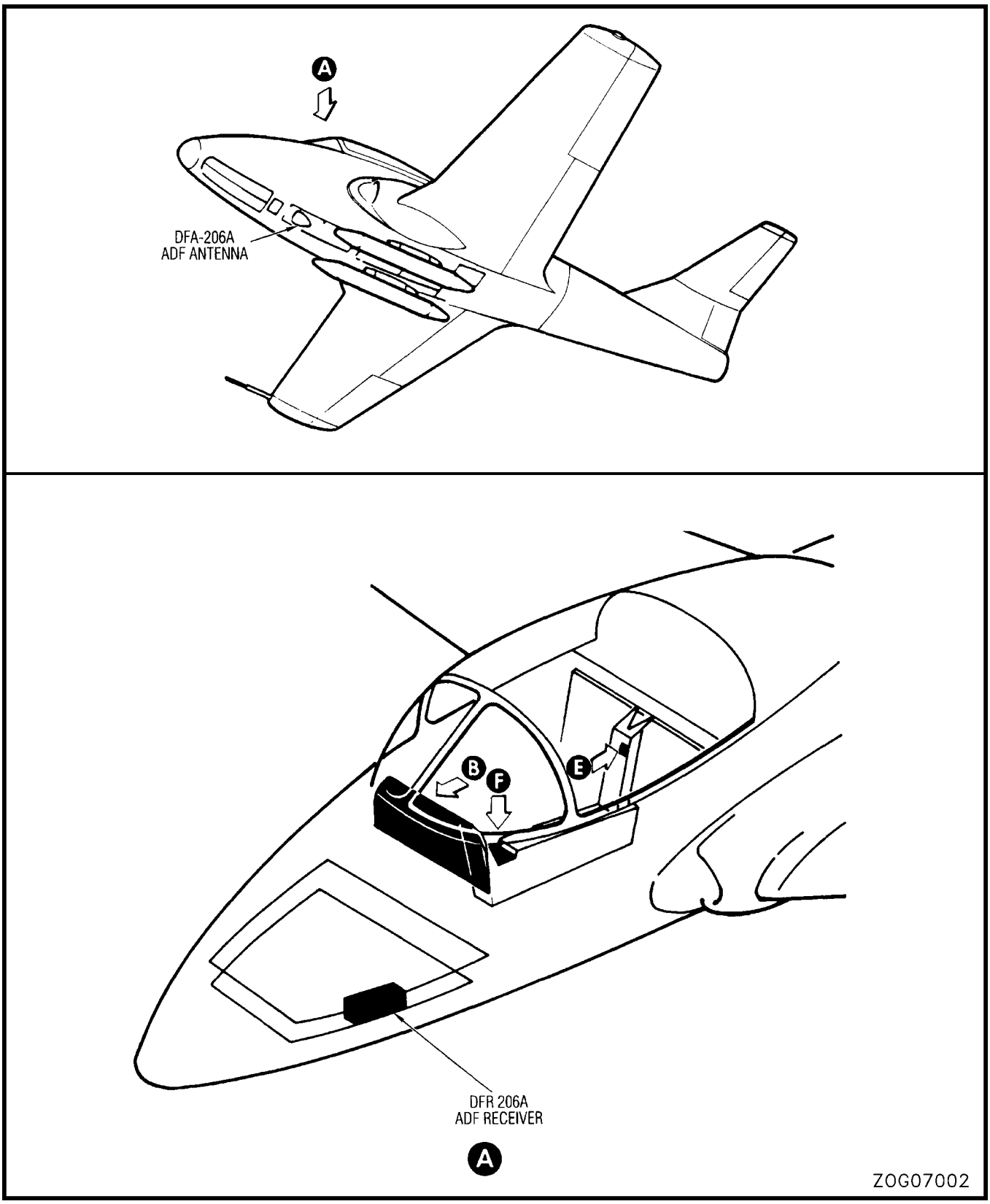

Figure 7-2 (Sheet 1 of 2) DF-206A ADF System Component Locations

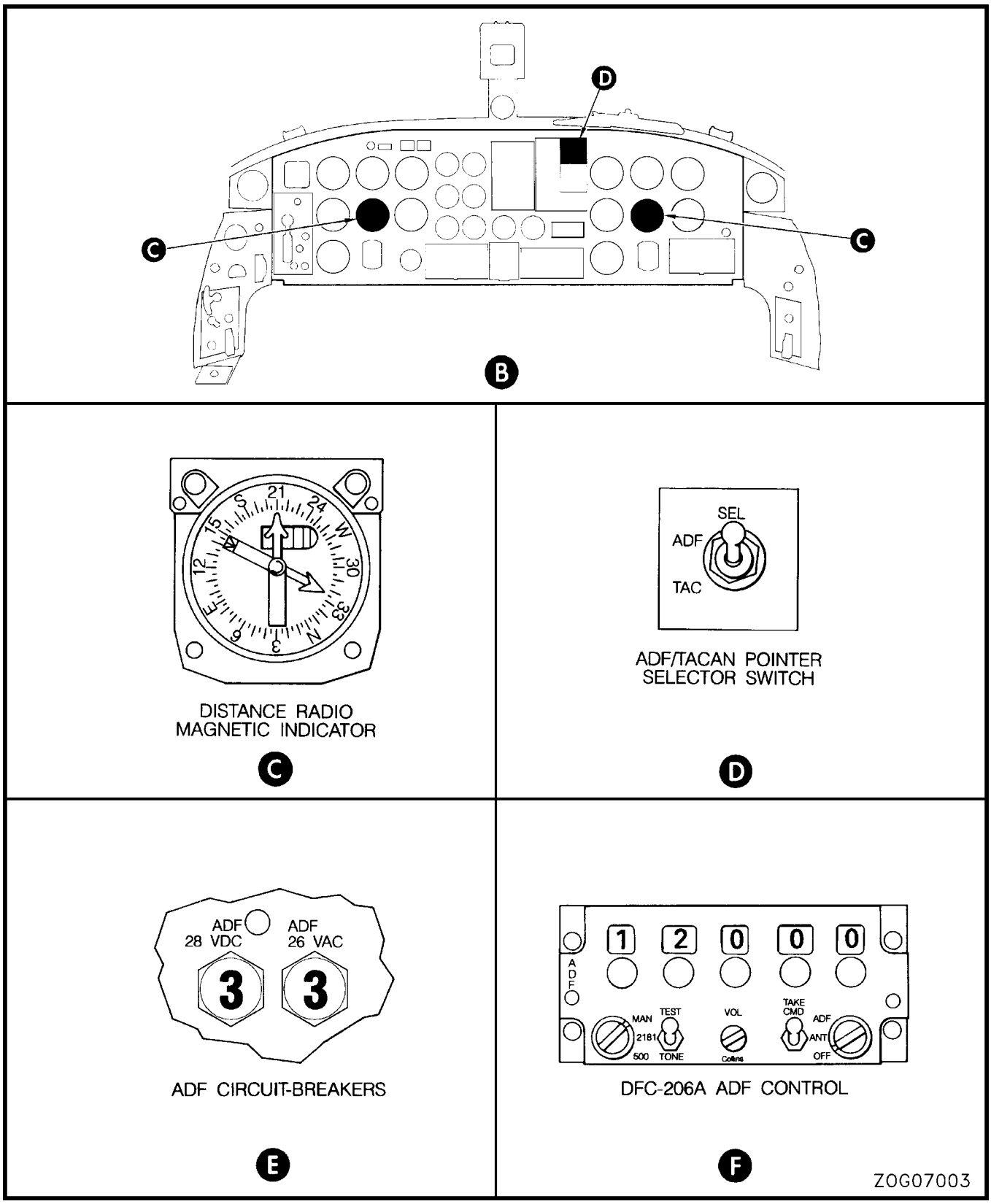

Figure 7-2 (Sheet 2 of 2) DF-206A ADF System Component Locations

26VAC circuit-breaker. Both circuit-breakers are mounted on the centre console circuit-breaker panel. System power is controlled by the DF-206A control.

DF-206A CONTROL

5. The DF-206A control is a panel-mounted unit that contains the switches and knobs necessary to operate the ADF system. The control front face is illustrated and the switch and knob functions are described in Figure 7-3. An electrical connector on the rear of the control connects the control to the ADF system.

DF-206A ANTENNA

6. The DF-206A antenna contains two loop antennas and one omnidirectional sense antenna. The two loop antennas are mounted 90 degrees apart. One loop antenna is oriented to receive maximum signal when the aircraft is headed directly towards or away from the ground transmitter. The second loop antenna receives maximum signal when the ground station is at 90 or 270 degrees to the aircraft's line of flight. The correct bearing angle is determined when the received signals from the loop antennas are combined with the signal received by the sense antenna. This combined signal is routed to the DF-206A receiver.

DF-206A RECEIVER

7. The DF-206A receiver accepts the combined loop and sense antenna signals and sends them via the DF-206A control to the aircraft intercommunication system. The combined signal is also compared with an internal 87-Hz signal to determine relative bearing. This relative bearing signal is converted to synchro signals to drive the RH and LH DRMI bearing pointers on selection at the control.

DISTANCE AND RADIO MAGNETIC INDICATORS

8. The processed signals from the DF-206A receiver may be presented on the RH and LH DRMIs when the control mode selector switch is set to ADF and the ADF/TAC bearing pointer selector switch is set to ADF. The ADF and the TACAN systems share the wide bearing pointer on both the RH and LH DRMIs; see Figures 7-2 and 7- 4. Setting the ADF/TAC SEL switch to ADF energizes relay K503 selecting the processed bearing signal from the DF-206A receiver to the wide pointers of the RH and LH DRMIs.

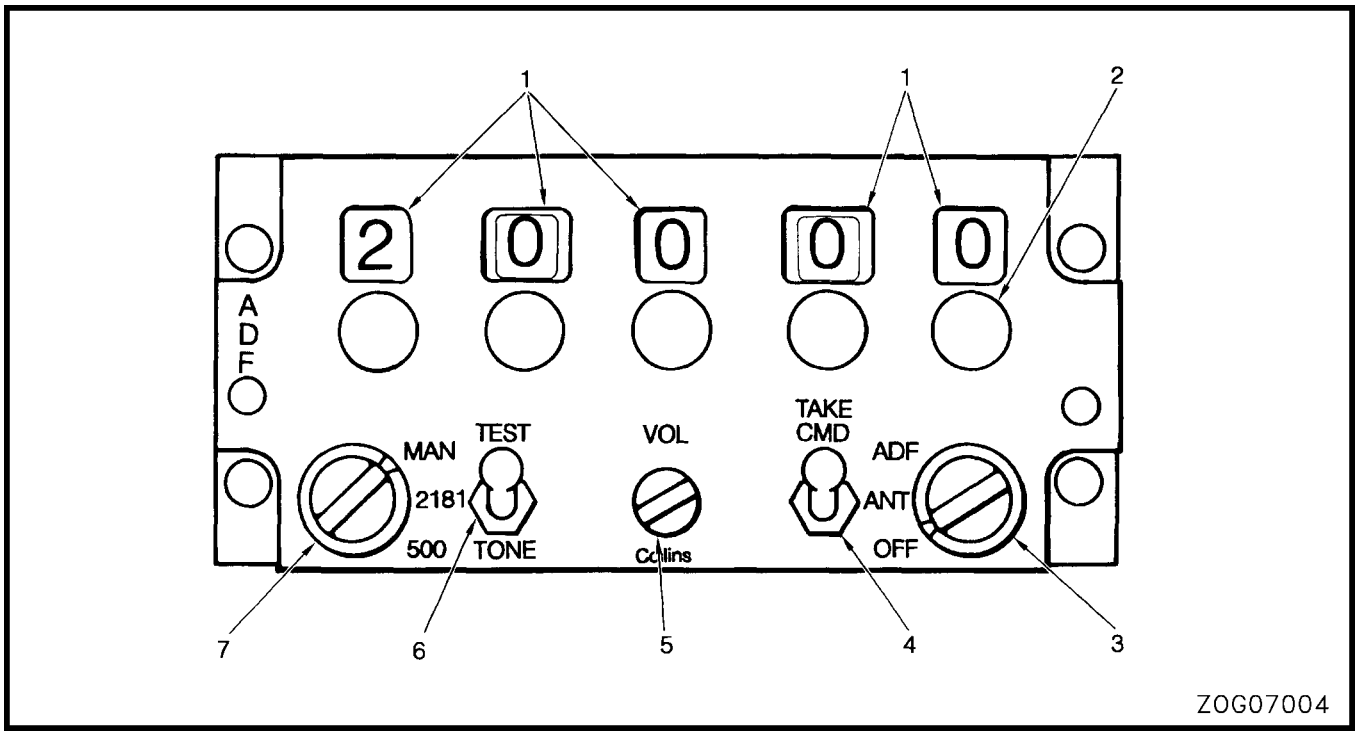

Figure 7-3 (Sheet 1 of 2) DF-206A Control Unit Switch Functions

Item	Description	Function
1	Frequency windows (5)	Show selected frequency in kHz and tenths of a kHz.
2	Frequency selection knobs (5)	Used to select the desired frequency when MAN is set on frequency mode selector switch.
3	System mode selector switch (ADF/ANT/OFF)	Selects the mode of system operation: ADF – Receive signals to DRMI and intercommunication system. ANT – Receives signals to intercommunication system only. OFF – System closes down.
4	TAKE CMD – take command switch	Not used in this installation.
5	VOL – Volume control	Controls received signal volume in 12 discrete steps.
6	TEST/TONE switch	Three setting, centre off switch: TEST – Momentary setting that selects the self-test. TONE – This setting selects a tone generator for continuous wave operation.
7	Frequency mode selector (MAN/2182/500)	Selects mode of frequency selection: MAN – Allows frequency selection with the frequency selection knobs. 2182 – Selects 2182 kHz as the operating frequency. 500 – Selects 500 kHz as the operating frequency.

Figure 7-3 (Sheet 2 of 2) DF-206A Control Unit Switch Functions

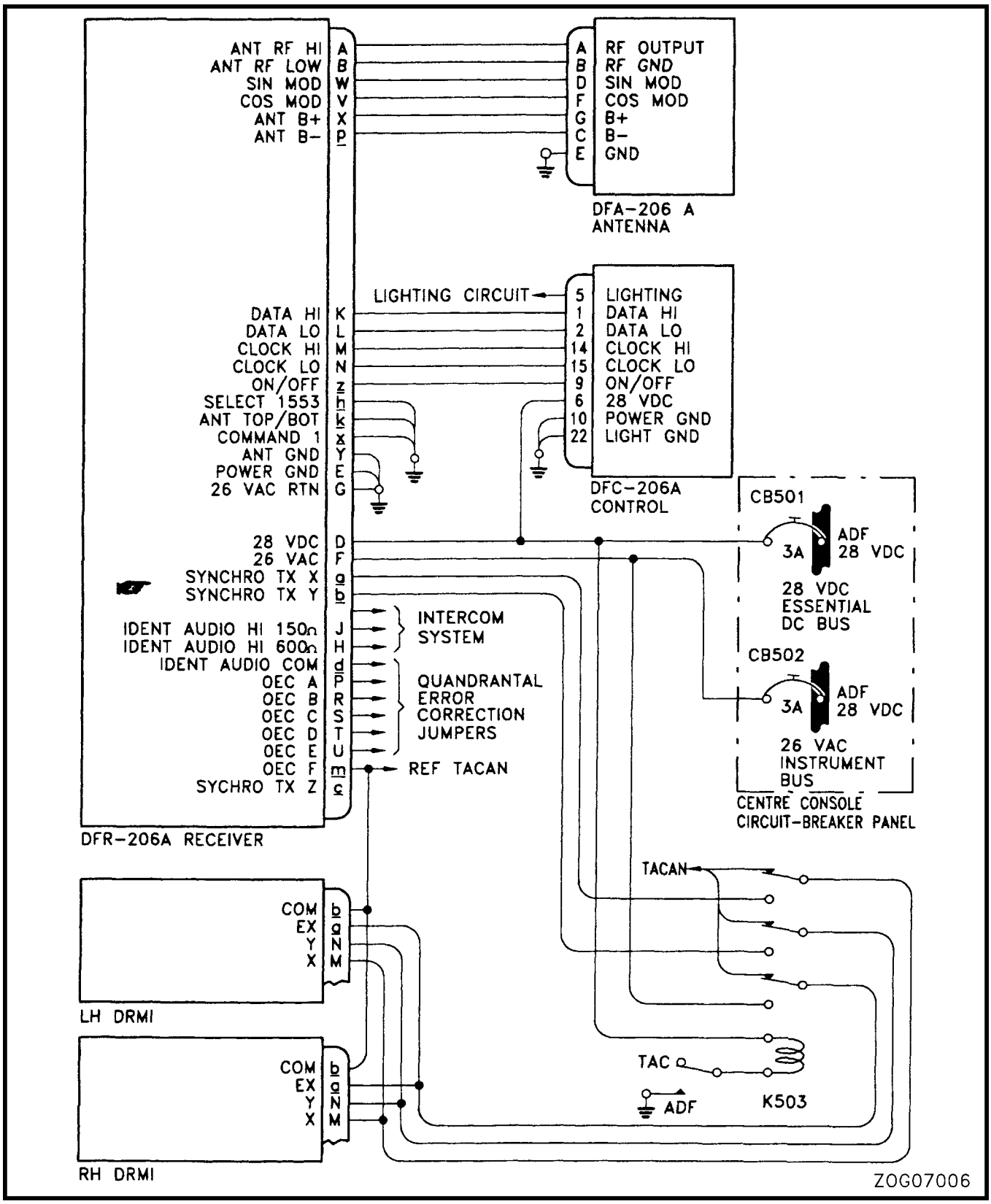

Figure 7-4 DF-206A ADF System - Schematic

OPERATIONAL CHECK-OUT

GENERAL

9. Before starting the operational check-out, ensure that the aircraft is positioned away from any structures or other aircraft. Furthermore, ensure that the intercommunication system is serviceable before starting the check-out.

OPERATIONAL CHECK-OUT PROCEDURE

10. Ensure that the ADF 28VDC and ADF 26 VAC circuit-breakers are closed, then perform an operational check-out of the DF-206A ADF system as follows:

a. Apply ground power to the aircraft.

b. Connect a head-set to the RH MIC/TEL socket.

c. Set the ADF/TAC SEL switch to ADF.

d. Set the ADF control MAN/2128/500 switch to MAN.

e. Set the ADF control ADF/ANT/OFF switch to ANT and ensure that the control panel lights illuminate when the INTERIOR LIGHTS - CONSOLE dimmer is rotated clockwise.

f. Pull out the RH NAV knob on the intercommunication system audio selector panel (ASP) and tune the ADF receiver to a convenient frequency in each of the following bands:

(1) 190 - 279.5 kHz;

(2) 280 - 399.5 kHz;

(3) 400 - 499.5 kHz;

(4) 500 - 599.5 kHz;

(5) 600 - 899.5 kHz;

(6) 900 - 1399.5 kHz; and

(7) 1400 - 1749.5 kHz.

NOTE

Ensure that an audio signal is received and heard through the head-set for each band selected. Adjust the VOL control on the DF-206A control unit to the desired level.

g. Set the ADF/ANT/OFF switch to ADF.

h. Tune the ADF receiver to several local NDBs, and ensure that the wide bearing pointer on the RH DRMI assumes a bearing relative to the location of each tuned station.

j. With the ADF receiver tuned to a station, note the indicated bearing pointer setting. Momentarily set the TEST/TONE switch on the ADF control to TEST and ensure that the wide bearing pointer advances 90 degrees from original position.

k. Release the TEST/TONE switch and ensure that the wide bearing pointer returns to the pre-test setting.

NOTE

The wide bearing pointer will ″park″ horizontally if there is no signal being received or the received signal is of poor quality.

m. Repeat the instructions of paragraphs 10b through 10k after connecting the head-set to the LH MIC/TEL socket, pulling out the LH NAV knob on the ASP, and monitoring the LH DRMI.

n. Set the ADF/ANT/OFF switch to OFF, push in both NAV knobs on the ASP and disconnect ground power.

REMOVAL AND INSTALLATION

GENERAL

11. This part describes the removal and installation of the major components of the DF-206A ADF system.

DF-206A CONTROL REMOVAL

WARNING

Ensure that all applicable circuit-breakers are open prior to removal or installation of any equipment.

12. Proceed as follows:

a. Loosen the four Dzus fasteners and carefully lift the control from the pedestal to gain access to the electrical connector.

b. Disconnect the electrical connector and remove the control.

DF-206A CONTROL INSTALLATION

WARNING

Ensure that all applicable circuit-breakers are open prior to removal or installation of any equipment.

13. Proceed as follows:

a. Reverse the procedure of paragraph 12.

b. Close the applicable circuit-breakers and perform an operational check-out of the system.

DF-206A ANTENNA REMOVAL

WARNING

Ensure that all applicable circuit-breakers are open prior to removal or installation of any equipment.

14. Proceed as follows:

a. Open the forward lower fuselage door and disconnect the antenna electrical connector.

b. While supporting the antenna, remove and retain the attaching hardware and antenna gasket, then carefully remove the antenna.

DF-206A ANTENNA INSTALLATION

WARNING

Ensure that all applicable circuit-breakers are open prior to removal or installation of any equipment.

15. Proceed as follows:

a. Prior to antenna installation, ensure that all old sealant is removed from the faying surfaces of the fuselage door and antenna.

WARNING

Aliphatic naphtha is flammable and toxic. Protection for skin, eye and respiratory tract is required.

b. Thoroughly clean the faying surfaces with a clean cloth moistened with specification TT-N-95 aliphatic naphtha until the surfaces are free from grease, oil or other foreign matter.

c. Using the hardware retained in paragraph 14b, secure the antenna and gasket to the forward lower fuselage door, then connect the electrical connector.

NOTE

Replace the antenna gasket only if it is damaged.

WARNING

PR1422-G-B2 sealant is flammable and toxic. Protection for skin, eye and respiratory tract is required.

d. Apply a bead of sealant (PR1422-G-B2) around the gasket and antenna to prevent the ingress of moisture.

e. Close the applicable circuit-breakers and perform an operational check-out of the system.

DF-206A RECEIVER REMOVAL

WARNING

Ensure that all applicable circuit-breakers are open prior to removal or installation of any equipment.

16. Proceed as follows:

a. Gain access to the receiver and disconnect the electrical connector.

b. Loosen the knurled knob at the front of the receiver mount, then pull the receiver forward to remove.

DF-206A RECEIVER INSTALLATION

WARNING

Ensure that all applicable circuit-breakers are open prior to removal or installation of any equipment.

17. Proceed as follows:

a. Reverse the procedure of paragraph 16 and ensure that the access panel is secure.

b. Close the applicable circuit-breakers and perform an operational check-out of the system.