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C-12-114-0G0/MF-001

DESCRIPTION AND MAINTENANCE INSTRUCTIONS

CT114 TUTOR

TELECOMMUNICATIONS

(ENGLISH)

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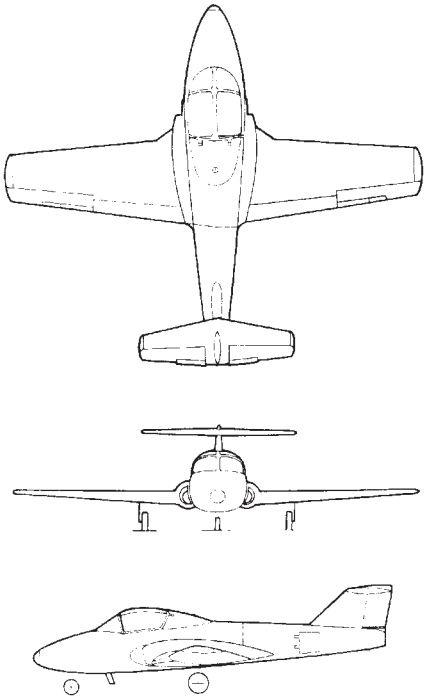
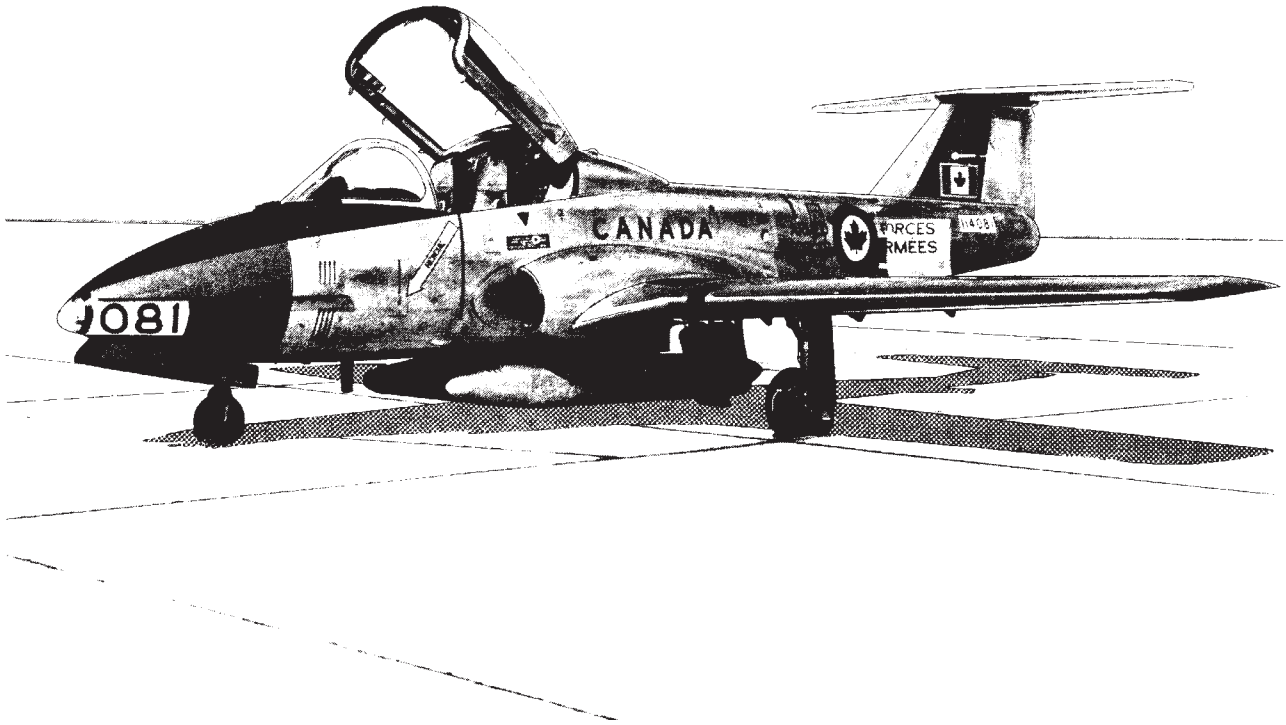


CT114 TUTOR



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PART 1

GENERAL INFORMATION

PURPOSE

This publication is one of a series providing descriptive and corrective maintenance instructions for CT114 (Tutor) rewire and Snowbird variant aircraft. For general information and preventive maintenance instructions, see C-12-114-000/MF-001. For a list of applicable publications, see C-12-114-000/AX-000.

NOTE

This publication contains information pertaining to the operation, maintenance and servicing of the telecommunications system used in CT114 Tutor aircraft rewired in accordance with C-12-114-000/CD-036. For information regarding a pre-rewired aircraft, refer to C-12-114-0G0/MF-000.

PART 2

COMMUNICATION SYSTEMS

SECTION 1

INTERCOM

GENERAL

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 Vdc 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 utilised 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 2-1-1. 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 2-1-4. If modification C-12-114-000/CF-525 is embodied, the VHF/UHF toggle switches on the intercom box function as indicated in Figure 2-1-3. For the intercom system interconnect diagram with modification C-12-114-000/CF-525 embodied, see Figure 2-1-5.

COMPONENT LOCATIONS

6. For location of intercom system main components, see Figure 2-1-2.

OPERATION

INTERCOM

7. With the 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 the 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 monitor 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 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. See Paragraph 5 for operation of the PTT switches if modification C-12-114-000/CF-525 is embodied.

UHF/VHF/NAV MUTING

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

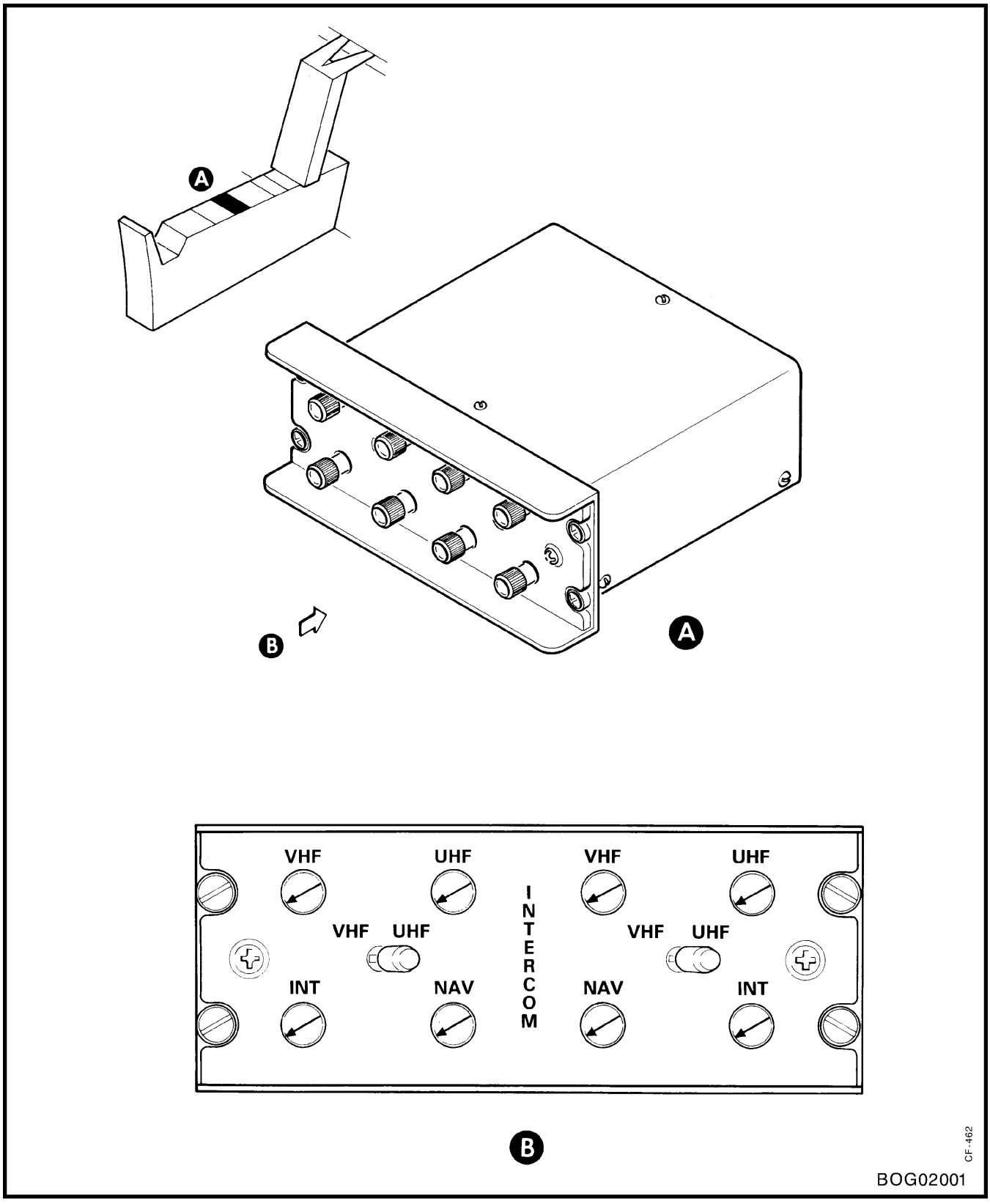


Figure 2-1-1 AIC-504 Audio Selector Panel

Component	Location
5071-1-1/AIC-504 Audio selector panel (E1RZ)	Centre control
Circuit-breaker (CB1RZ)	Circuit breaker panel
Circuit-breaker (CB2RZ)	Circuit breaker panel
LH PTT switch (S1RZ)	LH seat throttle or LH stick grip (CF-525)
RH PTT switch (S2RZ)	RH seat throttle or RH stick grip (CF-525)
AUDIO MUTING switch (S5RZ)	RH fascia panel
Mute switch (S1C)	LH stick grip (not if CF-525 embodied)
Mute switch (S2C)	RH stick grip (not if CF-525 embodied)
LH mic and headset connector (J3RZ)	LH seat
RH mic and headset connector (J3RZ)	RH seat

Figure 2-1-2 Component Locations

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 Vdc power supply. Power is routed to pins A and F of connector J1 through two circuit-breakers, INTERCOM LH and RH, on the circuit-breaker panel.

15. Edge-lit lighting voltage is supplied by the 28 Vdc bus. The power is routed through pins K and L of connector J1 to eight 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. From here, they are routed to headphone amplifiers AR2 and AR4.

REMOVAL AND INSTALLATION

AUDIO SELECTOR PANEL REMOVAL

WARNING

Ensure that all applicable circuit-breakers are open prior to removal or installation of any equipment.

18. Proceed as follows:

a. Loosen the four Dzus fasteners and carefully lift the audio selector panel from the centre console to gain access to the electrical connector.

b. Disconnect the electrical connector and remove the audio selector panel.

AUDIO SELECTOR PANEL INSTALLATION

WARNING

Ensure that all applicable circuit-breakers are open prior to removal or installation of any equipment.

19. Proceed as follows:

a. Reverse procedure of Paragraph 18.

b. Close the applicable circuit-breakers and perform an operational check-out of the system.

FUNCTIONAL TEST

EQUIPMENT

20. The following equipment is required:

a. H-157/AIC headset or equivalent.

b. M-87/AIC microphone or equivalent.

INTERCOM SYSTEM

21. 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 INTERCOMM RH and INTERCOMM LH 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 muting switches are not depressed.

d. Set both the RH and LH audio level controls (INT, UHF, VHF and NAV) on the ASP 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.

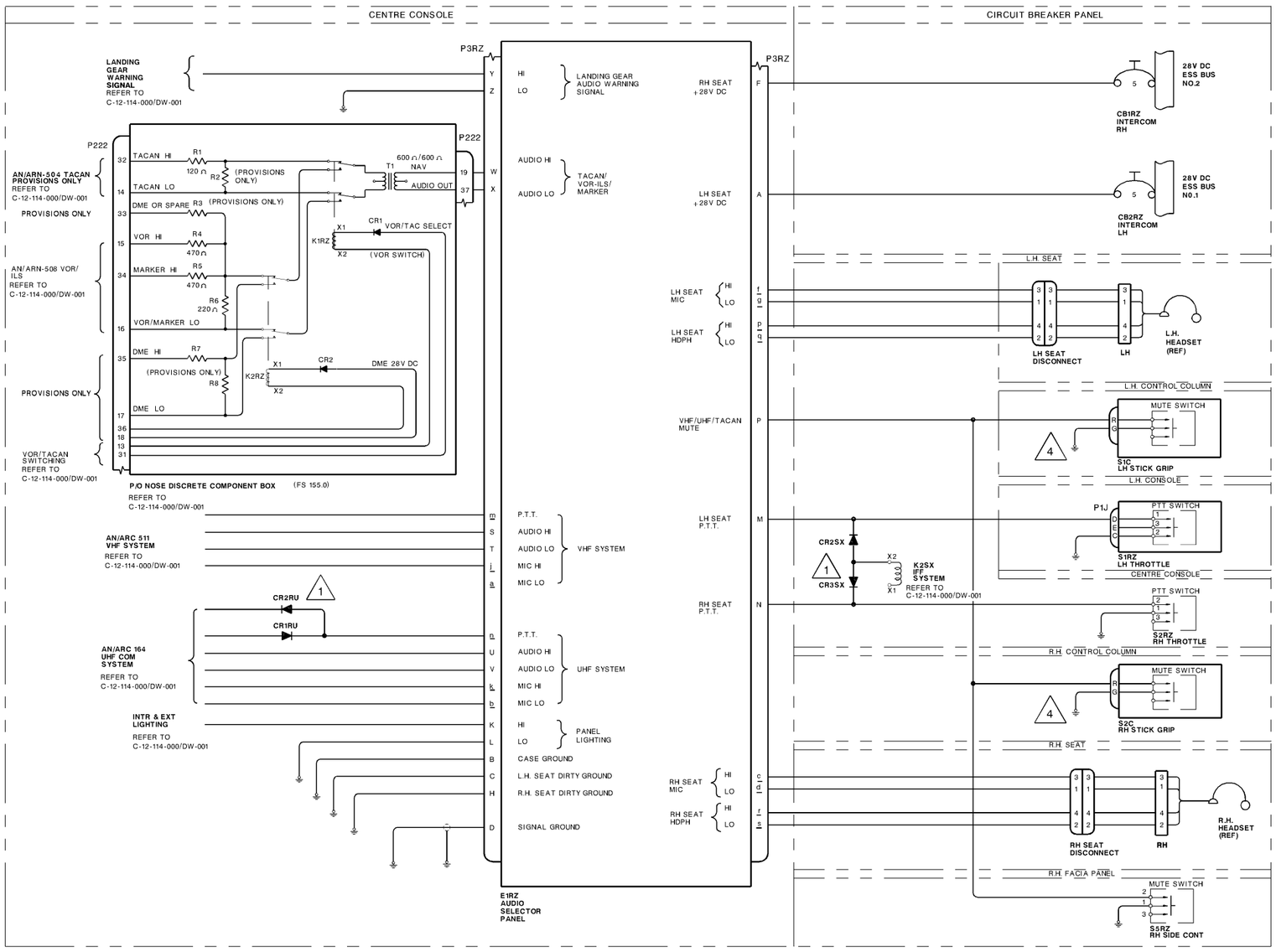
SWITCH	VHF/UHF (AIC)	VHF/MUTE PTT	THROTTLE PTT	RESULT
1.	VHF	PRESS ON		VHF XMIT
	VHF		PRESS ON	VHF XMIT
2.	UHF	PRESS ON		VHF XMIT
	UHF		PRESS ON	UHF XMIT

NOTES

1. If the AIC 504 VHF/UHF switch is left in the UHF position, the UHF transmit function is controlled by the PTT switches on the throttles, while the VHF transmit function is enabled by the stick grip mute switches.

2. In case of failure of relay K1RV in the centre console or power failure, the VHF transmit function will revert to the throttle PTT switches when the VHF is selected at the AIC 504 Intercom Control Panel.

Figure 2-1-3 Intercom Box VHF/UHF Toggle Switches – Selections



NOTES

1. LOCATED IN DISCRETE COMPONENT BOX A2 (FS 155).
2. REFER TO C-12-114-000/DW-001, INTERCOM SYSTEM.
3. REFER TO C-12-114-000/DW-001.
4. FOR MODIFICATION C-12-114-000/CF-525, SEE FIGURE 2-1-5, INTERCOM SYSTEM-INTERCONNECT DIAGRAM, VHF PRESS TO TALK SWITCHES (C-12-114-000/CF-525) - WIRING.

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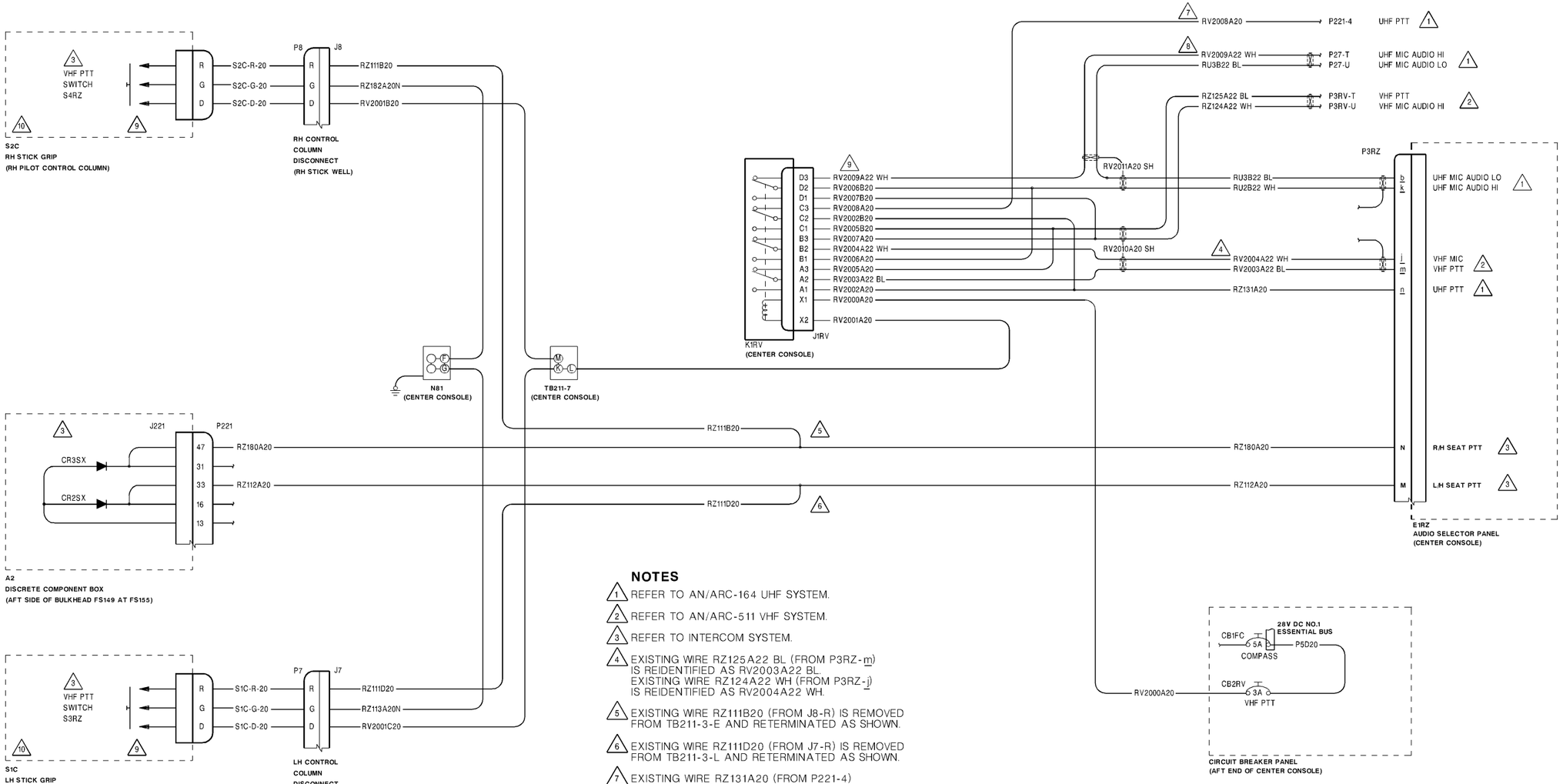
Intercom System – Electrical Schematic Figure 2-1-4



NOTES

1. REFER TO AN/ARC-164 UHF SYSTEM.
2. REFER TO AN/ARC-511 VHF SYSTEM.
3. REFER TO INTERCOM SYSTEM.
4. EXISTING WIRE RZ125A22 BL (FROM P3RZ-m) IS REIDENTIFIED AS RV2003A22 BL.
   EXISTING WIRE RZ124A22 WH (FROM P3RZ-j) IS REIDENTIFIED AS RV2004A22 WH.
5. EXISTING WIRE RZ111B20 (FROM J8-R) IS REMOVED FROM TB211-3-E AND RETERMINATED AS SHOWN.
6. EXISTING WIRE RZ111D20 (FROM J7-R) IS REMOVED FROM TB211-3-L AND RETERMINATED AS SHOWN.
7. EXISTING WIRE RZ131A20 (FROM P221-4) IS REIDENTIFIED AS RV2008A20.
8. EXISTING WIRE RU2B22 WH (FROM P27-T) IS REIDENTIFIED AS RV2009A22 WH.
9. FOR TERMINATING EXISTING WIRING TO RELAY K1RV AND FOR WIRING MODIFICATION TO S3RZ AND S4RZ VHF PTT SWITCHES, SEE C-12-114-000/CF-525.
10. PRIOR TO C-12-114-000/CF-525, S3RZ AND S4RZ VHF PTT SWITCHES WERE MUTING SWITCHES.

EFFECTIVITY

This page indicates CT114 aircraft modified to C-12-114-000/CF-525.

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Intercom System – Interconnect Diagram VHF Press to Talk Switches (C-12-114-000/CF-525) – Wiring Figure 2-1-5

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

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

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

j. 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 (see UHF system testing, Section 2).

k. 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 (see VHF system testing, Section 3).

l. Test the NAV function by carrying out the appropriate functional tests of both the TACAN and VOR/ILS (see Sections 4 and 5). Listen to the marker tones, the VOR 1020-Hz tone, and the VOR and TACAN identity tones.

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

AURAL WARNING ADJUSTMENT

22. 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. These adjust the aural warning levels.

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 re-install 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 RT-5078/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 Figure 2-2-3.

SYSTEM COMPONENTS

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

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

b. A C-5367/ARC-164(V) radio set control unit mounted on the centre console.

c. An ID-1961B/ARC-164(V) frequency channel indicator mounted on the centre of the instrument panel (see C-12-114-0E0/MF-001).

d. A preset frequency read switch (S4RU) mounted on the LH side of the instrument panel (see C-12-114-0E0/MF-001).

e. Two take control switches (S3RU), one mounted on the RH side of the instrument panel and one located on the remote channel selector (see C-12-114-0E0/MF-001).

f. A C5556/ARC-164 remote channel selector mounted on the LH side of the instrument panel (see C-12-114-0E0/MF-001).

g. A UHF AT-256A/ARC antenna installed on the lower fuselage at FS 166.5. A list of system components follows. For further details, see C-12-114-000/DW-001.

COMPONENT LOCATIONS

3. For location of UHF system main components, see Figure 2-2-1.

COMPONENT DESCRIPTION

C-5367/ARC-164(V) 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 selects the mode of frequency to be used.

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 digits (2 to 3).

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

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

(4) Selects 10ths digits (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-transmitter.

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

(4) ADF is not active.

Component	Location
RT-5078/ARC-164 UHF receiver-transmitter (RETR1RU)	Nose compartment, FS 120
AT-256A/ARC UHF antenna (E1RU)	Bottom fuselage, FS 166.5 Bottom fuselage, FS 190.0 *
ID-1961B/ARC-164(V) frequency channel indicator (E4RU)	Instrument panel, centre
Preset frequency read switch (S4RU)	Instrument panel, LH side
706643-802CF-004 or 706643-802CF-018 ARC-164 radio set control unit (E2RU)	Centre console
Remote channel selector (E3RU)	Instrument panel, LH side
Take control switch (S3RU)	RH – Instrument panel, RH side LH – Remote channel selector
Auxiliary override panel (E5RU)	Centre console extension
UHF select relay (K1RU)	Cockpit Discrete Component Box
UHF select relay No. 2 (K2RU)	Cockpit Discrete Component Box
Circuit-breaker (CB1RU)	Centre console extension

* On ADF equipped Snowbird aircraft antenna is located here

Figure 2-2-1 AN/ARC-164 UHF Radio – Component Locations

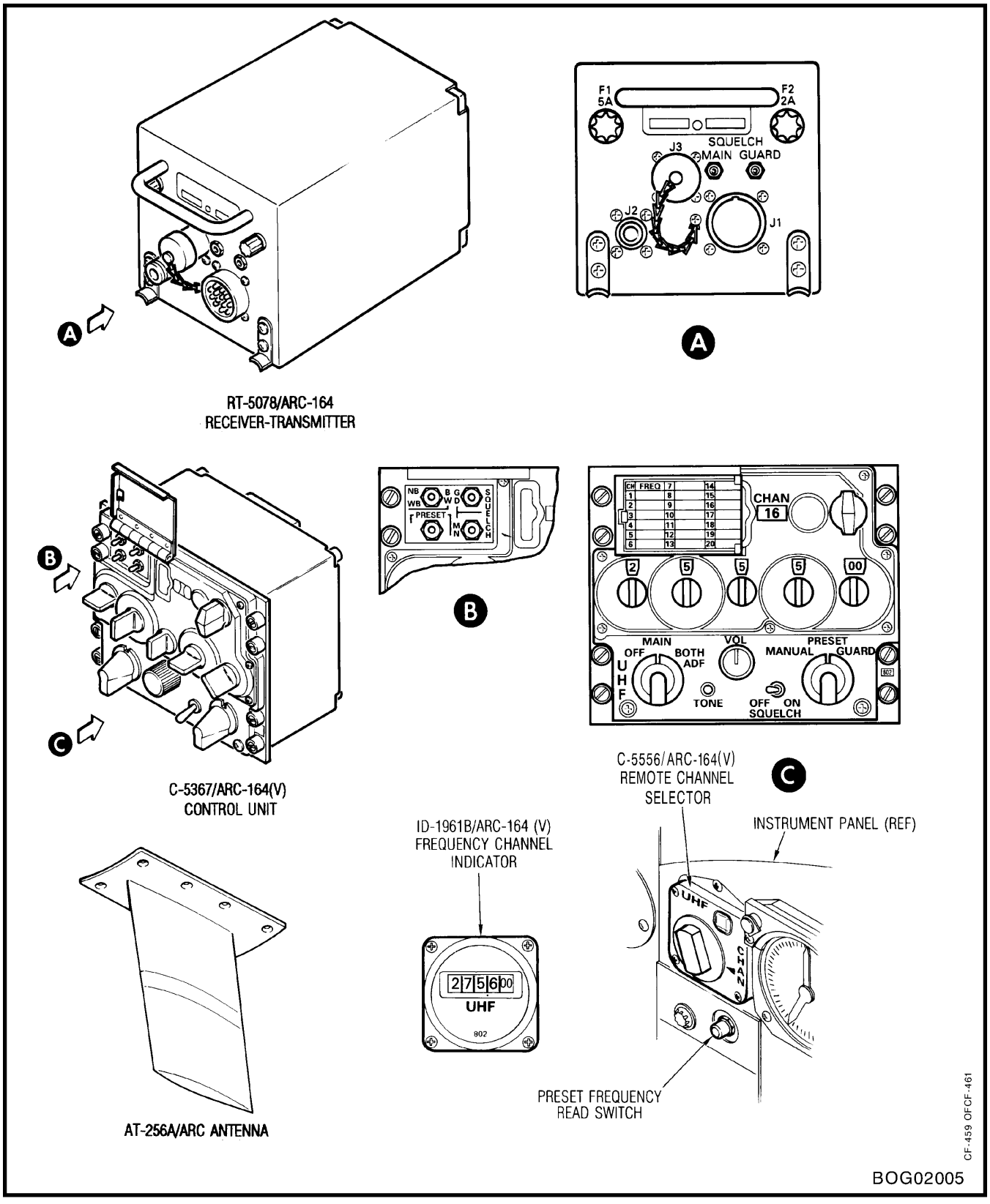


Figure 2-2-2 AN/ARC-164 UHF Radio – Main Components

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.

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 by two fuses on the front panel.

ID-1961B/ARC-164(V)
FREQUENCY CHANNEL INDICATOR

6. The frequency channel indicator is mounted in the centre of the instrument panel. The indicator provides a six-digit readout of the manually selected channel frequency, a two-digit read-out 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 radio set control unit.

NOTE

On Snowbird variant aircraft, the frequency channel indicator is located on top of the instrument panel (see C-12-114-0E0/MF-001).

REMOTE CHANNEL SELECTOR

7. The remote channel indicator is a rotary switch mounted on the LH side of the instrument panel which permits the operator to select any one of 20 (including guard channel) frequencies that have been preset on the radio-set control unit.

PRESET FREQUENCY READ SWITCH

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

TAKE CONTROL SWITCH

9. Two take control switches are installed on the UHF system: the RH switch is located on the RH instrument panel, above the artificial horizon, and the LH switch is located on the remote channel selector. When the MANUAL/PRESET/GUARD switch is set to MANUAL, control of the UHF system is always from the RH side. The MANUAL/PRESET/GUARD switch must be set to PRESET for the take control switches to work.

PILOT MICROPHONE SWITCH

10. Each pilot microphone press-to-talk (PTT) switch is located on the throttle lever grip or control column stick grip (see C-12-114-000/CF-525). 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 fascia panel or the mute switches on the RH and LH stick grip. If C-12-114-000/CF-525 is embodied, the RH and LH stick grip muting switches are used as VHF PTT switches.

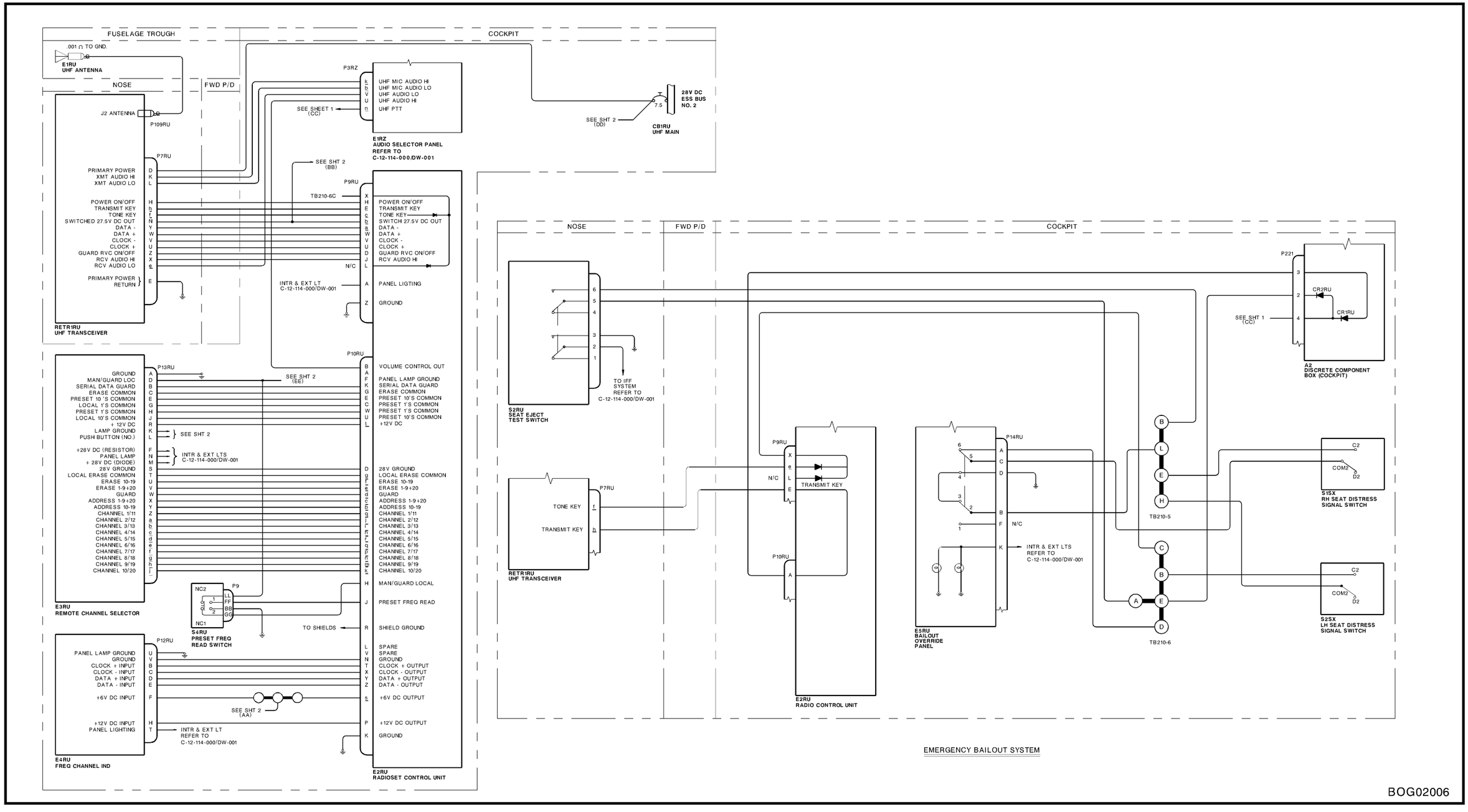
UHF RADIO POWER

12. The UHF radio system operates on 28 Vdc power, supplied through a 7.5-ampere UHF circuit-breaker on the circuit-breaker panel.

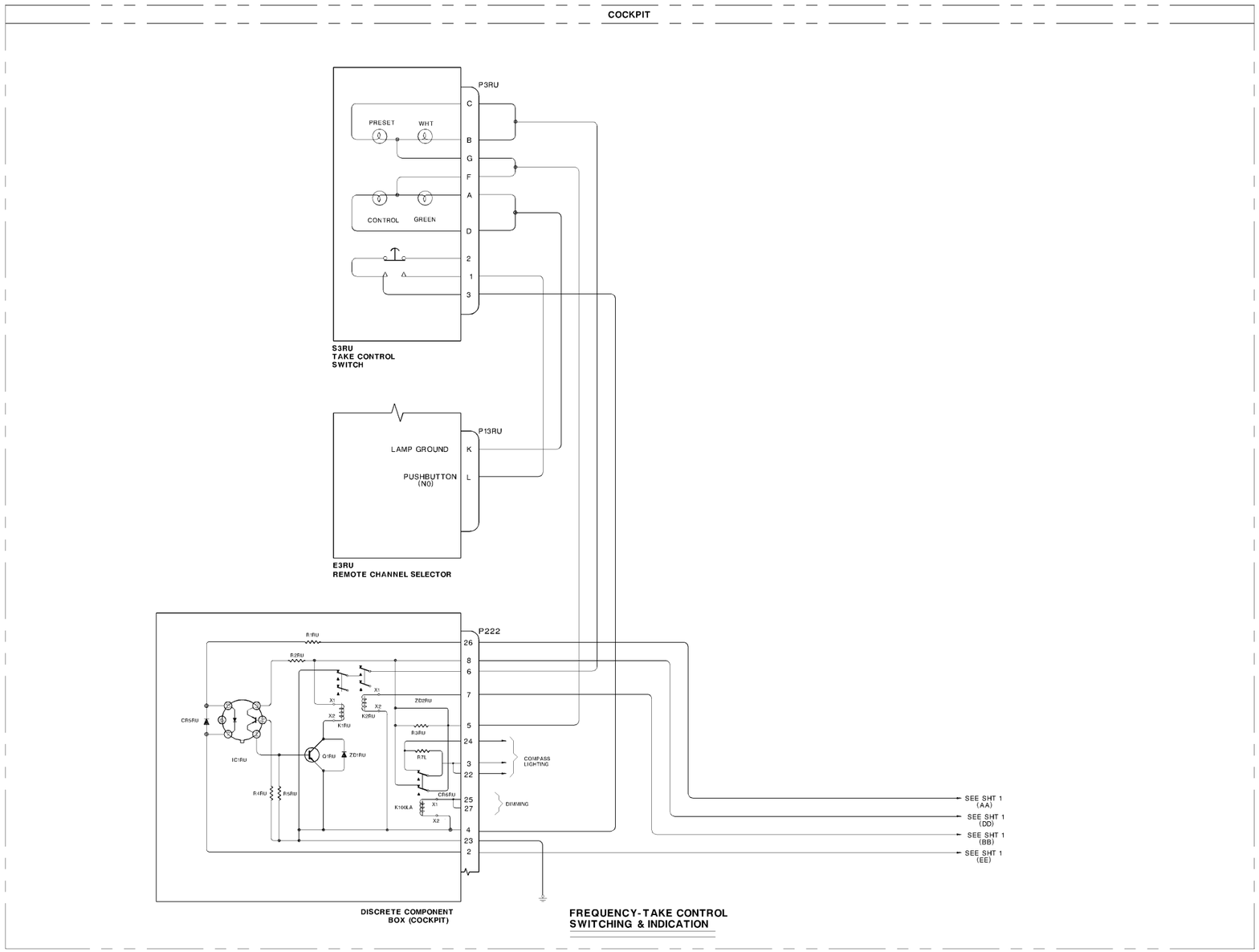
COOLING

13. Cooling for the UHF and the other equipment in the nose area is provided by outlet air from the cabin pressure regulator and relief valve. This 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, see C-12-114-0C0/MF-001.

14. A cooling flow is not available when the engine is stopped and this may place a restriction on UHF operation on the ground, depending on the ambient



UHF Radio AN/ARC-164 – Electrical Schematic (Sheet 1 of 2) Figure 2-2-3



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UHF Radio AN/ARC-164 – Electrical Schematic (Sheet 2 of 2) Figure 2-2-3

temperature. Ground testing of the UHF system should be carried out with the nose panels open. If the ambient temperature exceeds 35 degrees Celsius (95 degrees Farenheit), the UHF system should be operated on an intermittent basis.

NOTE

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

OPERATION

GENERAL

15. 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.

16. Operation of the UHF radio is controlled from the C-5367/ARC-164(V) 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.

17. The main receiver-transmitter is tuned to the guard frequency and the guard receiver is disabled by setting the control unit MANUAL/PRESET/GUARD switch to the GUARD position.

18. 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.

19. The volume of the receiver audio output is adjusted with the VOL control on the control unit. The control unit SQUELCH switch allows the receiver squelch to be deactivated to receive low level signals, or to check the receiver noise during maintenance.

TRANSMITTER

20. 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.

21. The power supply subassembly operates from 28 Vdc and generates the voltages required by the receiver-transmitter.

22. 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.

23. 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

24. 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.

25. Received signals are supplied from the antenna to the receiver RF amplifier via the T/R switch in the transmitter assembly, and to 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 deactivated with the SQUELCH switch on the control unit.The squelch circuit shop adjustment potentiometer is located on the data converter assembly. Cockpit adjustment of squelch is made at the control unit. 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

26. 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 realigning, 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

27. 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.

28. The synthesizer assembly consists of a digital sub-assembly, an analog sub-assembly, and a digital-to-analog sub-assembly. The three sub-assemblies 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

29. The data converter assembly consists of a series-to-parallel data converter sub-assembly 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.

30. The 28-volt switch sub-assembly operates from the aircraft 28 Vdc 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

31. The control unit consists of a switching assembly and a control adapter assembly. The switching assembly contains a memory sub-assembly, an interface sub-assembly, 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.

32. The memory sub-assembly contains circuits to allow the presetting of 20 operating channels. The frequencies of the preset channels are manually-annotatedon 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 or the remote channel selector. The memory sub-assembly also converts parallel frequency control data to serial data for use in the receiver-transmitter.

33. 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 deactivate 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.

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

34. The control adapter assembly produces, from a 28 Vdc input, dc power which supplies the control unit and the frequency channel indicator.

FREQUENCY CHANNEL INDICATOR

35. 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.

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

REMOVAL AND INSTALLATION OF RECEIVER-TRANSMITTER

37. The RT-5078/ARC-164 UHF receiver-transmitter is located on a mounting tray in the nose equipment section. The unit is secured by two fasteners attached to the mounting tray. Cable connections to the unit are located on the front. Ensure that there is no power on the aircraft. Remove the receiver-transmitter as follows:

a. Disconnect coaxial lead and harness connection from receiver-transmitter.

b. Remove lockwire from fasteners and unscrew sufficiently to release unit.

c. Carefully slide out unit and remove.

38. Installation is the reverse of the removal procedure. Ensure unit is lockwired.

FUNCTIONAL TEST

EQUIPMENT

39. The following equipment is required:

a. In-line watt meter (BIRD, model 43 or equivalent).

b. H-157/AIC headset or equivalent.

c. UHF monitor receiver.

d. Phillips PM6668 frequency counter, 500 MHz or equivalent.

e. Plug-in elements for the BIRD in-line watt meter (50C and 50D).

NOTE

Notify local air traffic control (ATC) that the following tests are about to be carried out. ATC may receive a transponder code 7700 signal and/or UHF transmissions on the emergency frequency (243 MHz) during these tests.

UHF SYSTEM

40. For the functional test of the AN/ARC-164 system, proceed as follows:

a. Disconnect UHF antenna and connect in-line watt meter as shown in Figure 2-2-4.

NOTES

1. Ensure that a plug-in element (50D) is installed in watt meter.

2. Ensure that the arrow on plug-in element is pointed towards UHF antenna.

b. Set DC master switch to GND PWR.

c. Set UHF frequency selector to an unused frequency between 312 and 313 MHz.

d. Momentarily key the transceiver and record output power on in-line watt meter.

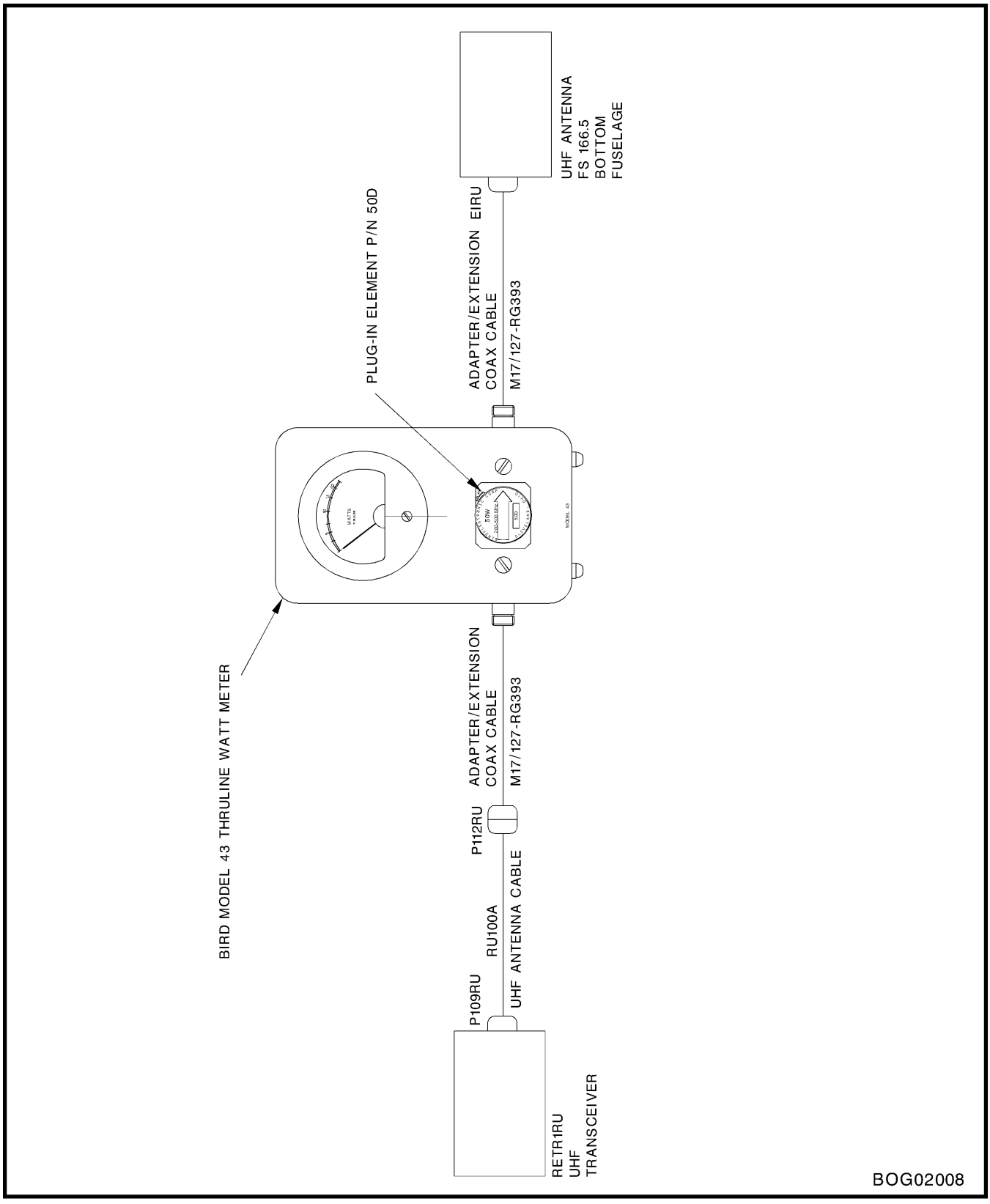


Figure 2-2-4 UHF Radio System Test Sets Attachment

e. Turn plug-in element around in watt meter so arrow is facing transceiver.

f. Momentarily key transceiver again and record output power on in-line watt meter.

g. Calculate the standing wave ratio (SWR) as follows:

$$\frac{(\text{output power in step d}) + (\text{output power in step f})}{(\text{output power in step d}) - (\text{output power in step f})}$$

Record result on appropriate UHF test data sheet. SWR shall be 2.5:1 or better.

h. Set DC master switch to OFF.

i. Disconnect test equipment from UHF antenna system and reconnect UHF antenna coaxial cable to UHF antenna.

j. Set DC master switch to GND power.

k. Set VHF/UHF toggle switch on audio selector panel to UHF and verify that no significant noise is heard over intercom system.

l. Preset all 20 channels of radio control unit using the following procedure:

(1) Place function switch in MAIN position.

(2) Place MANUAL/PRESET/GUARD switch in PRESET position.

(3) Use manual frequency selector switch to choose desired channel number.

(4) Turn preset channel selector switch to desired channel number.

(5) Press preset switch located under frequency chart.

m. Ensure that headsets are connected to both LH and RH intercom jacks and UHF intercom volume control is set to mid-range.

n. Set audio level on UHF radio control panel to mid-range and set UHF transceiver to 225.000 MHz. Verify that remote channel indicator displays a frequency of 225.000 MHz.

o. Press LH seat UHF take control button on preset frequency selector. Select guard channel G (left-most) on remote channel selector.

p. Verify that remote channel indicator displays G.

q. Press PRESET FREQUENCY READ switch and verify that remote channel indicator displays the frequency 243.000 MHz. If frequency is incorrect on guard channel, then remove defective control and route to second-line shop for corrective action.

r. Depress either PTT switch and verify that system transmits on the frequency 243.000 MHz.

s. Repeat Steps o through r for channels 1 through 20. The remote channel indicator should display channel number selected by remote channel selector. When PRESET FREQUENCY READ switch is pressed, channel indicator should display corresponding frequency of selected channel.

t. Repeat Steps o through r for guard channel G (right-most).

u. Ensure that TAKE CONTROL button is not pressed.

v. Set MANUAL/PRESET/GUARD switch to GUARD. Depress PTT switch and verify that system transmits on 243.000 MHz.

w. Set selector switch on UHF control panel to PRESET. Ensure that preset channel selected is not GUARD channel or 243.000 MHz. Set EJECTION TEST SWITCH (S2RU), located on RH side, to ON. Verify the following conditions:

(1) System transmits on 243.000 MHz.

(2) Carrier is modulated with bail-out tone.

x. Set MANUAL/PRESET/GUARD switch to MANUAL. Depress PTT switch and verify all conditions listed in Step s, regardless of setting of frequency selector on control unit.

y. Ensure that TAKE CONTROL push-button is pressed. Depress PTT switch and verify all conditions listed in Step s, regardless of channel selected on remote channel selector.

z. Contact tower on a suitable frequency. Verify that channel and frequency are in operation and confirm clarity of communications from both LH and RH seats

and tower. If modification C-12-114-000/CF-525 is embodied, the control column stick grip muting switches operate as VHF PTT switches. In this configuration the only muting switch is S5RU on RH facia panel. Press MUTE switch on LH control column and verify that UHF communication is cut out. Repeat this test using RH control column MUTE switch and MUTE switch (S5RZ) on RH facia panel.

aa. Select at least two more UHF frequencies and confirm operation as in Step x.

ab. Set DC master switch to OFF.

RECEIVER SQUELCH ADJUSTMENT

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

a. The SQUELCH MN control on the control box is not active.

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

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

d. If it is necessary to adjust the receiver squelch, adjust SQUELCH MN on the RT5078 by rotating the screwdriver adjustment fully counter-clockwise.

e. Set OFF/MAIN/BOTH/ADF switch to MAIN and SQUELCH switch to ON.

f. Select a frequency that is used extensively.

g. Use headset and wait for a period when no signals are being received. Rotate the screwdriver adjustment clockwise until the receiver noise is just quieted completely and continue for 1/8 turn beyond that point.

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

i. Set OFF/MAIN/BOTH/ADF switch to the BOTH position.

j. Select the guard frequency and repeat Step g using the guard squelch adjustment.

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

SECTION 3

VHF RADIO

GENERAL DESCRIPTION

1. The VHF radio system uses an RT-5048/ARC-511(V) 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 2-3-3.

2. The system comprises the following components, see Figure 2-3-1:

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

   b. A 522-2447-552 NAV/COMM dual control unit mounted on the centre lower area of the instrument panel (see C-12-114-0E0/MF-001).

   c. A 16-21B VHF antenna installed aft of the canopy dorsal centreline at FS 235.

COMPONENT LOCATIONS

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

COMPONENT DESCRIPTION

522-2447-552 NAV/COMM DUAL CONTROL UNIT

4. **General.** The 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 NAV/COM dual control unit has four quick-release fasteners at the corners of the front panel. The 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 control unit is enclosed in a one-piece aluminum dust cover which may be removed from behind. All electrical connections are made through a rear-mounted connector (P4RV).

6. **VHF Frequency Controls.** The NAV/COMM dual control unit has two separate sets of VHF frequency controls, placarded on the front panel (see Figure 2-3-1) 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. The internal switching circuits will not utilize the 50 kHz channel spacing feature, thus operating only on 100 kHz channel spacing.

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. 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. The VOL (volume) control adjusts the communication and navigation audio levels and 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 glideslope 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 glideslope 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.

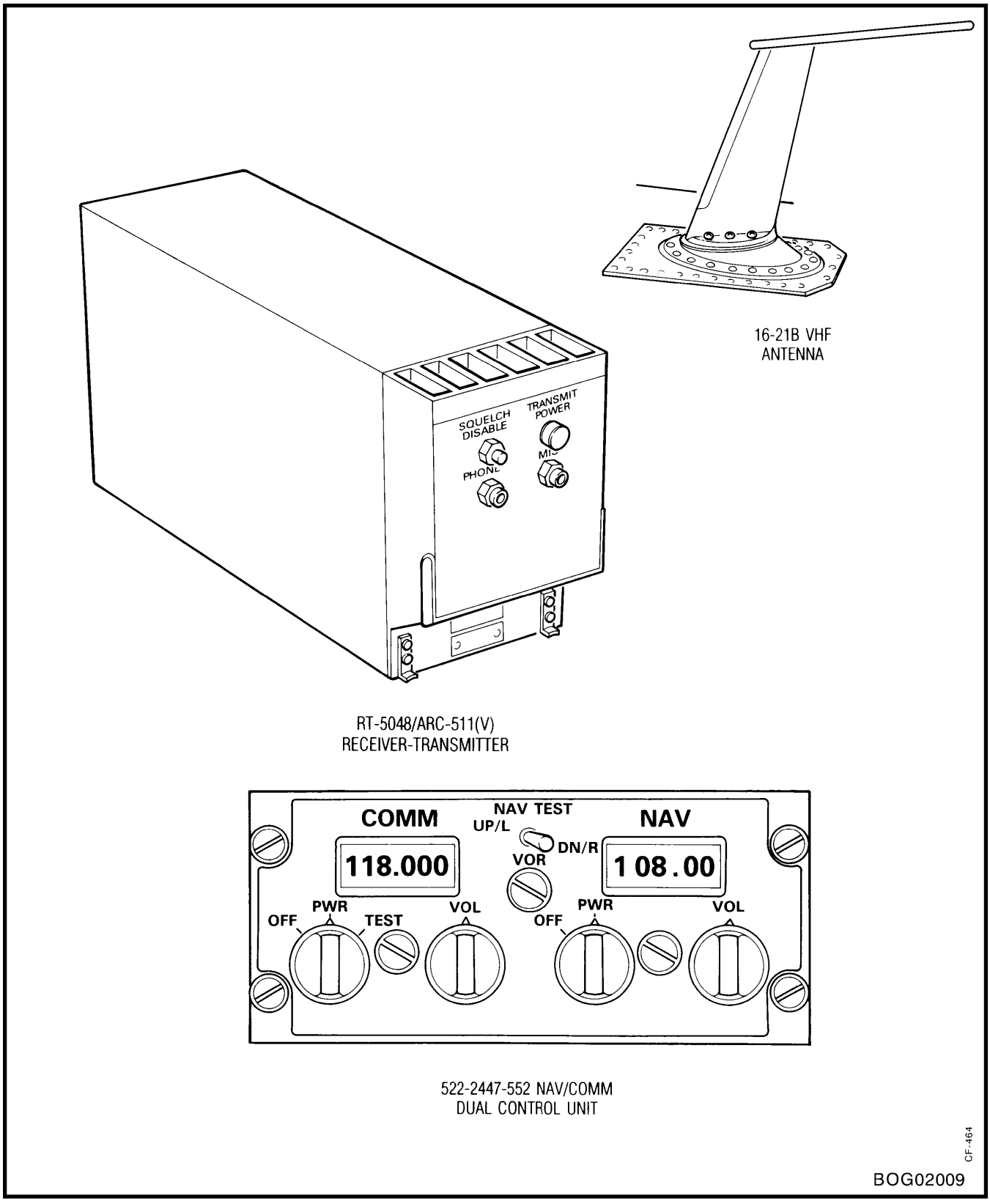


Figure 2-3-1 AN/ARC-511(V) VHF Radio – Main Components

Component	Location
RT-5048/ARC-511(V) VHF transceiver (RETR1RV)	Nose compartment
522-2447-552 NAV/COMM dual control unit (E1RV)	Instrument panel, centre lower area
16-21B VHF antenna	Dorsal centreline, FS 235
Circuit-breaker (CB1RV)	Circuit-breaker panel
Circuit-breaker (CB2RV)(VHF PTT)	Circuit-breaker panel if modification C-12-114-000/ CF-525 embodied

Figure 2-3-2 AN/ARC-511(V) VHF Radio – Component Locations

RT-5048/ARC-511(V) 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 522-2447-552 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 Vdc power, supplied through a 7.5-ampere circuit- breaker located on the 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 522-2447-552 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, or VHF PTT switch on control column stick grip (muting switch) if modification C-12-114-000/CF-525 embodied, 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:

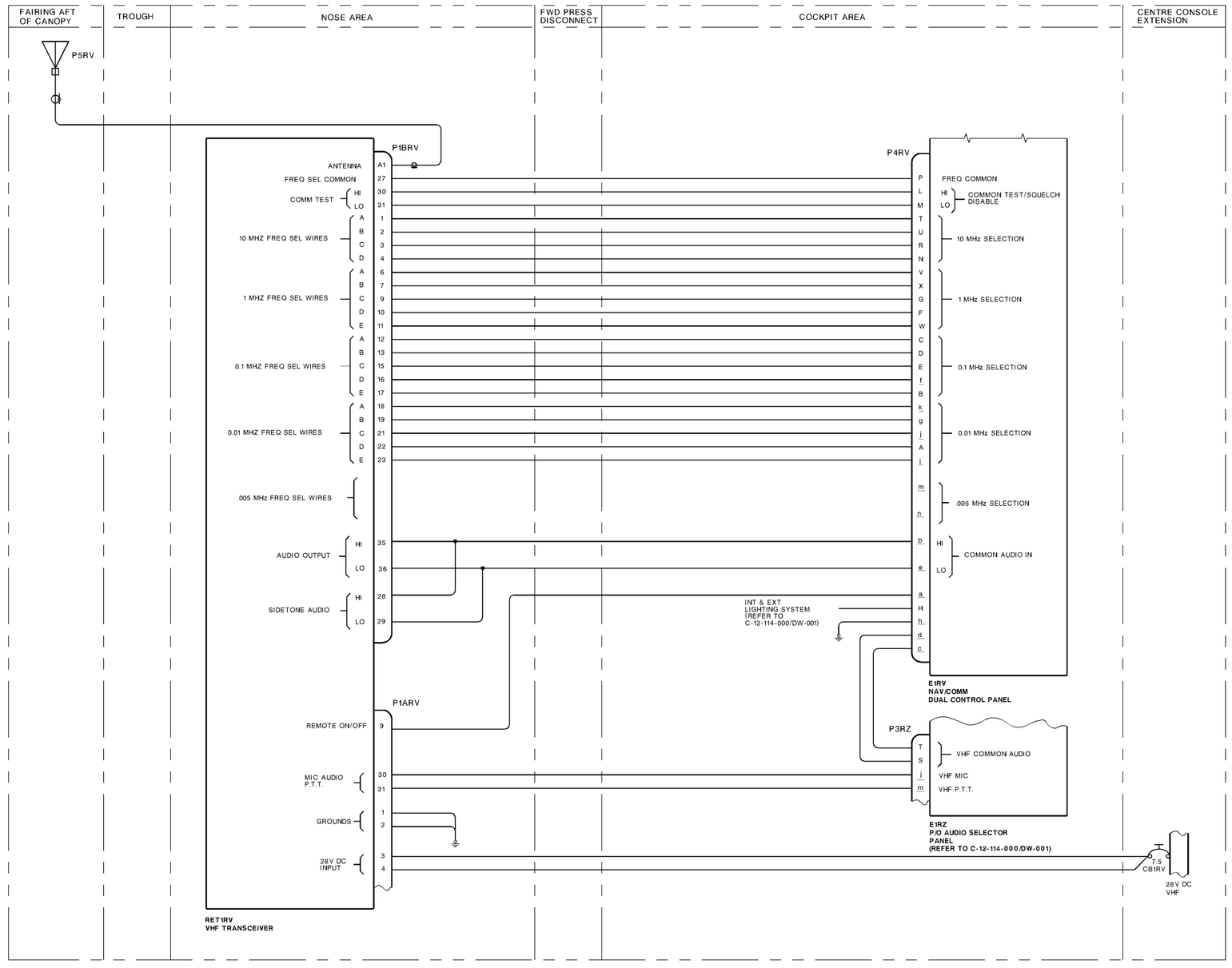
a. Transmitter excitation from the frequency synthesizer applies power to the transmitter amplifiers, activates the modulator, connects the transmitter to the antenna through the T/R switch and defeats the receiver squelch so that the audio amplifier may be used for sidetone amplification.

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.

19. 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 pilots 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

20. The VHF radio system goes into receiver 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).



NOTES

1. REFER TO C-12-114-000/DW-001, VHF AN/ARC 511.
2. IF C-12-114-000/CF-525 EMBODIED, SEE FIGURE 2-1-4.

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AN/ARC-511(V) VHF Radio – Electrical Schematic Figure 2-3-3

21. 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 push-button allows receiver noise to be monitored over the headsets to check serviceability or to receive low-level signals.

FUNCTIONAL TEST

EQUIPMENT

22. The following equipment is required:

a. H-157/AIC headset or equivalent.

b. VHF monitor receiver.

c. Plug-in elements for BIRD in-line watt meter (50C and 50D).

d. In-line watt meter (BIRD, model 43 or equivalent).

VHF SYSTEM

23. To perform a functional test of the VHF system, proceed as follows:

a. Set DC master switch to GND PWR and verify continuity of 28 Vdc power and grounds to correct termination points in VHF system.

b. Ensure that the following circuit-breakers on centre console are pushed in:

(1) VHF.

(2) UHF.

(3) INTERCOM RH.

(4) INTERCOM LH.

(5) VHF PTT (if modification C-12-114-000/CF-525 embodied).

c. Ensure that headsets are connected to LH and RH intercom jacks and VHF intercom volume control is set to mid-range.

d. Set communication volume control on dual NAV/COM control unit to mid-range; set communication frequency selector to 118.000 MHz.

e. Set VHF/UHF toggle switch on audio selector panel to VHF.

f. Position communication switch to TEST. There should be a sharp increase in background noise as squelch circuits are disabled.

g. Disconnect VHF antenna and connect in-line watt meter as shown in Figure 2-3-4.

NOTES

1. Ensure that a plug-in element (50C) (slug) is installed in watt meter.

2. Ensure that arrow on plug-in element is pointed toward VHF antenna.

h. Set DC master switch to GND PWR.

i. Set VHF frequency selector to an unused frequency between 127 and 128 MHz.

j. Momentarily key the transceiver and record output power on in-line watt meter.

k. Turn plug-in element around in watt meter so arrow is facing transceiver.

l. Momentarily key the transceiver again and record output power on in-line watt meter.

m. Calculate the standing wave ratio (SWR) as follows:

$$\frac{(\text{output power in Step j}) + (\text{output power in Step l})}{(\text{output power in Step j}) - (\text{output power in Step l})}$$

Record result on appropriate VHF test data sheet. SWR shall be 2.5:1 or better.

n. Set DC master switch to OFF.

o. Disconnect test equipment from VHF antenna system and reconnect VHF antenna coaxial cable to VHF antenna.

p. Set DC master switch to ON.

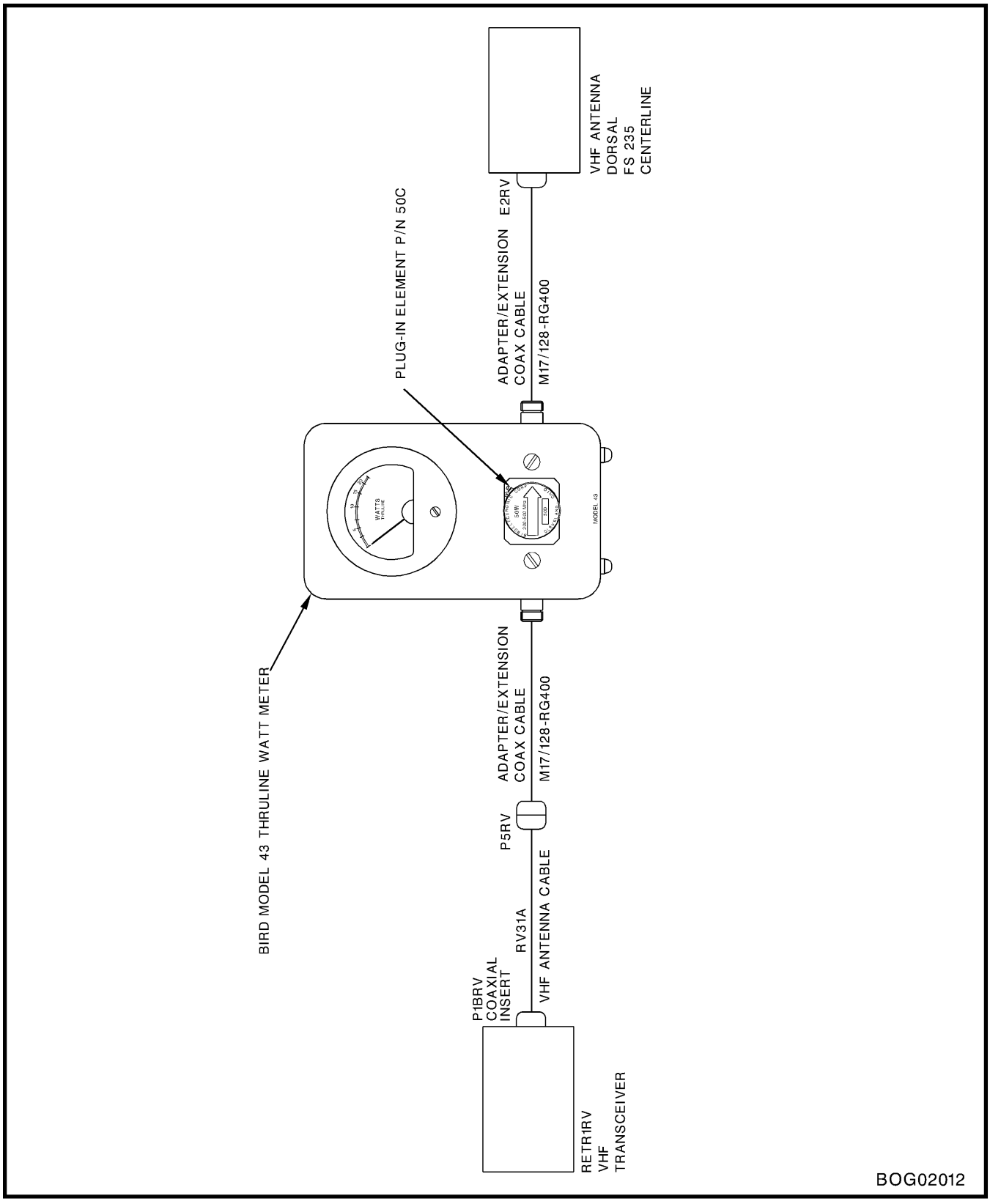


Figure 2-3-4 VHF Radio System Test Sets Attachment

q. Set communication switch to PWR. Contact tower on a suitable frequency. Verify that channel and frequency are in operation and confirm clarity of communications from both LH and RH seats and tower. If modification C-12-114-000/CF-525 is embodied, the control column stick grip muting switches operate as VHF PTT switches. In this configuration, the only muting switch is S5RU on RH facia panel. Press MUTE switch on LH control column and verify that VHF communication is cut out. Repeat this test using RH control column MUTE SWITCH and MUTE SWITCH (S5RU) on RH facia panel.

r. Select at least two more VHF frequencies and confirm operation as in Step q.

s. Set DC master switch to OFF.

SECTION 4

AN/ARN-504(V) 3 TACAN

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 indicate 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 form 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 NM.

SYSTEM COMPONENTS

GENERAL

2. For the location of the main components, see Figure 2-4-1. For the electrical schematic, see Figure 2-4-2.

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 2-4-3). 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. Connections for the antenna signal and the suppression input and output pulses are made through coaxial receptacles on the receiver-transmitter front panel. The following are also located on the front panel:

a. A test equipment (AGE) connector protected by a cover plate.

b. The self-test status indicators for the receiver-transmitter, couplers and control unit.

c. A fuse for 115 Vac internal circuits and a spare fuse.

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:

a. Range coupler module.

b. Bearing coupler module.

c. Cooling blower for receiver-transmitter.

d. Antenna switch driver (output not used in Tutor aircraft).

e. Receiver-transmitter power application circuit.

f. Power line filters.

g. RFI suppression devices.

h. Audio amplifier for beacon identity tone output.

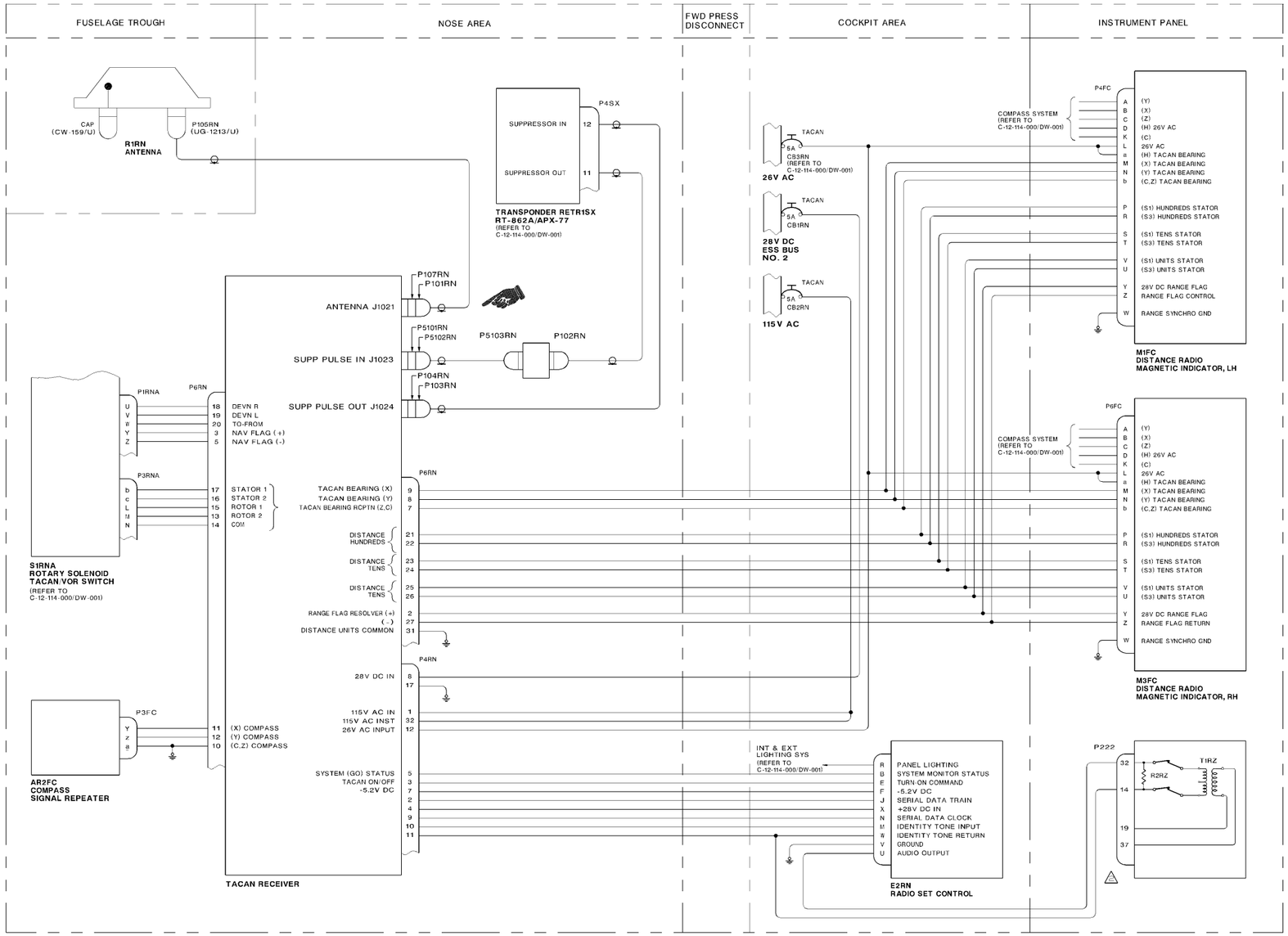
MOUNTING BASE

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.

Component	Location
RT-5036/ARN-504(V) receiver-transmitter	Nose compartment
MX-5163/ARN-504(V) adapter unit	Nose compartment
MT-5154/ARN-504(V) mounting base	Nose compartment
C-5287/ARN-504(V) control unit	Centre forward console
AT-741A/ARN antenna (R1RN)	Bottom fuselage, station 212
MN-97HA-4/ARN course indicators (2) *	Instrument panel, LH and RH side
ID-5040A/ARN distance radio magnetic indicators (2)	Instrument panel, LH and RH side
VOR/ILS-TACAN SEL switch *	Miscellaneous controls and marker panel (instrument panel)
Rotary solenoid switch (S1RNA) *	Nose compartment
VOR/TACAN audio relay *	Centre control console
COURSE SEL LH/RH switch *	Miscellaneous controls and marker panel (instrument panel)
Course indicator selector relay *	Centre console (inner rear)
Coaxial filter	Rear mounting base
Circuit-breaker (CB1RN)	Centre console extension
Circuit-breaker (CB2RN)	Centre console extension
Circuit-breaker (CB3RN)	Centre console extension
Circuit-breaker (CB1RNA) *	Centre console extension
Circuit-breaker (CB1RNV) *	Centre console extension

* Components common to VOR and TACAN systems.

Figure 2-4-1 AN/ARN-504 TACAN System – Component Locations



NOTE

1. REFER TO C-12-114-000/DW-001, TACAN AN/ARN-504

⚠1 REFER TO C-12-114-000/DW-001.

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AN/ARN-504 TACAN System – Electrical Schematic Figure 2-4-2

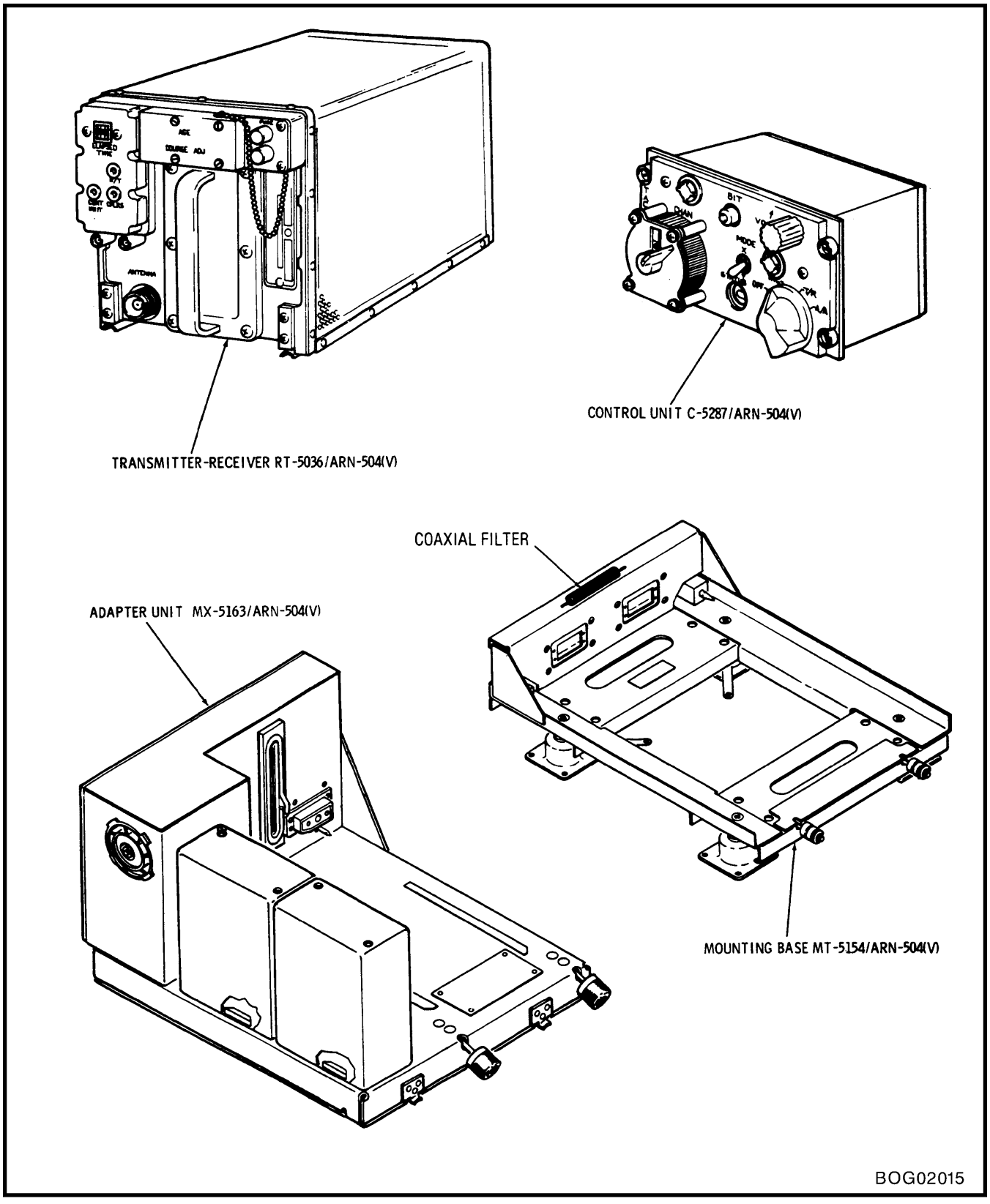


Figure 2-4-3 TACAN Navigation Set AN/ARN-504 Components

CONTROL UNIT

7. The control unit completes the set of four AN/ARN-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 identification 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

10. A coaxial filter, clamp-mounted on the back top flange of the MT-5154/ARN-504(V) mounting base, is connected in series with the suppression pulse line 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

11. 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 bearing coupler, which generates deviation and to-from signals for the course indicators.

12. 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. A 26 Vac excitation to the heading output synchro of the signal repeater unit is supplied from TACAN.

RANGE COUPLER

13. 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

14. Description:

a. **Lighting.** The unit has built-in edge lighting, controled by 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 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 or other aircraft are on different sets of frequencies.

f. **BIT Button and Status Window.** Explained under self-test, see Paragraph 23.

TACAN ANTENNA

15. One antenna is used for transmitting and receiving TACAN signals.

COURSE INDICATOR, MAIN FUNCTIONS

16. See Figure 2-4-4. Two course indicators are installed on the instrument panel. 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 adjusted with 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 indicate the position of the line with respect to the position of the aircraft.

c. On both indicators, a to-from flag on the instrument face displays the word TO when the bearing of the TACAN station from the aircraft is within 90 degrees of the selected bearing, and the word FROM when the bearing of the TACAN station is within 90 degrees 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 game indicator. It indicates on 45 degrees left and right scales the difference between aircraft compass heading and this selected bearing.

BEARING VALIDITY SIGNAL

17. When TACAN is selected on the VOR/ILS – TACAN selector 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 indicate 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)

18. Two distance radio magnetic indicators (DRMI) are installed on the instrument panel (see Figure 2-4-4). 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 station 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.

19. The DRMI's have digital range readouts in nautical miles, both DRMI 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, indicate that TACAN range is switched off or the range signal unreliable.

VOR/ILS – TACAN SELECTION FOR COURSE INDICATORS

20. Selection of VOR/ILS or TACAN information for display on the course indicators is made by means of the two VOR/ILS – TACAN switches (see Section 5 for VOR/ILS system). The two-position SEL switch controls a rotary solenoid switch in the nose compartment, routing signal circuits between VOR/ILS or TACAN and the course indicators. All these circuits go to both course indicators except the bearing resolver circuits, which go to one course indicator selected by the two-position COURSE SEL switch. This switch selects the LH or RH 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

21. Permanent resistor loads are connected across all deviation and flag outputs of VOR/ILS, and the rotary solenoid switch terminates all VOR/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 it feeds to the indicators in series.

VOR/TACAN AUDIO

22. 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 Vdc from the VOR circuit-breaker on the centre

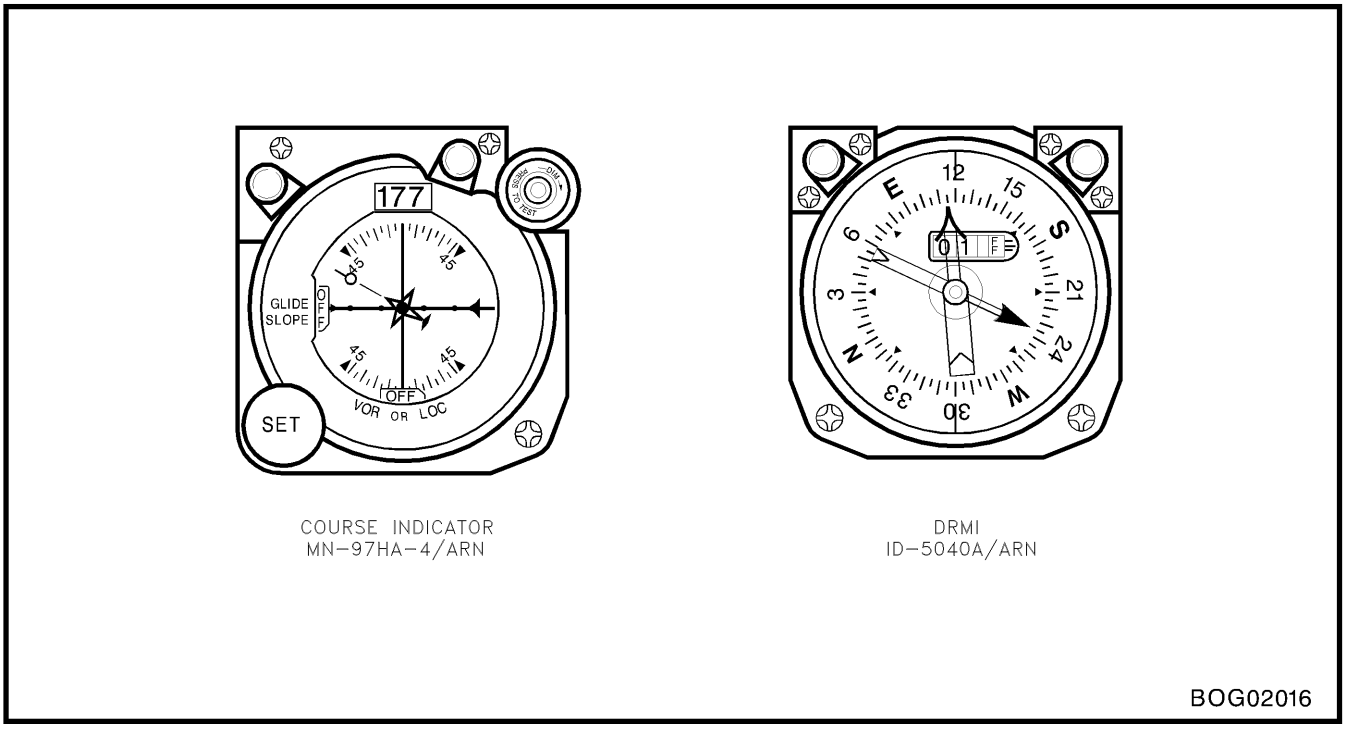


Figure 2-4-4 TACAN Instruments

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

23. The (built-in test) BIT button on the control unit initiates a 15 to 20 second self-test sequence. 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 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

24. For further information on TACAN navigation set AN/ARN-504(V) 3, see C-57-364-000/MF-000. See Section 5, VOR/ILS system, for information on the course indicators.

FUNCTIONAL TESTS

EQUIPMENT REQUIRED

25. The following test equipment or equivalent is required:

a. TACAN test set AN/ARM-511.

b. Intercom headset.

POWER AND SIGNAL REQUIREMENTS

26. The TACAN system exchanges signals with the following systems, which must be serviceable for the functional check of TACAN:

a. Compass system (see C-12-114-0E0/MF-001).

b. Intercom.

27. The receiver-transmitter unit is equipped with a 115 Vac power fuse on the front panel. Power for the TACAN is supplied by the following circuit-breakers on the circuit-breaker panel:

a. 28 Vdc – TACAN DC, VOR-TAC SEL and VOR.

b. 115 Vac – TACAN AC.

c. 26 Vac – TACAN AC.

PANEL LIGHTING

28. Check that the CONSOLE lighting dimmer on centre console varies the panel lighting of TACAN control unit.

SELF-TEST

29. Proceed as follows:

a. Set control unit function switch to REC and allow a 3-minute warm-up.

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

(1) Wide bearing pointers of DRMI 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 an additional 10 seconds. 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 centred. The centring and course width adjustments are under the front cover of the receiver-transmitter. Adjust centring if necessary, then displace course selection 10 degrees in each direction and use course width adjustment to place bar on second dot each way.

LOCAL BEACON CHECK

30. Proceed as follows:

a. Select REC on control unit function selector. (Keep mode selector in X position.) Allow a 3-minute 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 DRMI and VOR-ILS OFF flags on both course indicators are retracted from view.

d. Check that both DRMI lock on to 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 LH course indicator until left-right deviation bars of both course indicators are centred. Check that the COURSE readout of LH course indicator indicates bearing shown on DRMI or its reciprocal, and that the TO-FROM flag reads TO for DRMI bearing or FROM for reciprocal bearing.

g. Displace COURSE readout selection 10 degrees from bearing obtained in Step f, and check that both deviation bars are displaced approximately two dots in opposite direction.

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

i. Using RH course indicator for course selection, repeat Steps f and g.

j. Using intercom and headset, monitor the beacon identity tone. Check that it is clear and varies in loudness with the volume control on the TACAN control unit.

TACAN SYSTEM FUNCTIONAL CHECK

31. Obtain the following test equipment and proceed as follows:

a. AN/ARM-511 (Model BD-2655) TACAN test set (see C-57-475-000/MS-000).

b. Intercom headset.

c. Select 115 Vac operation on front panel of ARM-511 test set. Ensure that 0.5 and 2.0 ampere 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 (see C-57-475-000/MS-000).

d. Connect ARM-511 test set to 115 volts, 50 to 400 Hz ramp supply. 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.

e. Select TACAN on VOR/ILS-TACAN selector, and RH on course indicator selector.

f. Place TACAN control function switch to the REC position and allow 5 minutes for warm-up.

g. 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 illuminates).

(2) Set controls 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 lamps illuminate (red). Set O/P level to HIGH and ensure that A-A AIRCRAFT TRANSPONDER and TX POWER LEVEL PASS lamps illuminate (green).

h. **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 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 ft away from TACAN transceiver antenna.

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

TEST SET FUNCTION	–	BEARING/ RANGE
BEARING	–	90 degrees
RANGE NM	–	5 NM
DEVIATION SELECT	–	OFF
MODULATION	–	25 per cent and NORMAL
PASS SELECT	–	TEST 1
RF ATTENUATION	–	0 dB
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 settings; bearing of 90 ±2 degrees and range of 5 ±0.1 NM.

i. **Bearing Deviation.** Perform bearing deviation test as follows:

NOTE

This checks system tracking and proper operation of aircraft instruments.

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

(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 checks system tracking and proper operation of the aircraft range instruments.

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

NOTE

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

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

NOTE

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

k. Repeat checks in Steps i and j for various combination of ARM-511 test set range and bearings. Range indications on DRMI are for 5 ±0.1 NM, 125 ±2 NM and 283 ±5 NM. Bearing indications are for 90 ±2 degrees, 230 ±2 degrees and 320 ±2 degrees.

l. **CDI Course Centring and Width Adjustment.** Perform CDI course centring and width adjustment as follows:

(1) Set controls on ARM-511 test set as detailed in Step h(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 degrees (bearing reference is established on CDI selected with course indicator selector switch).

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

(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 degrees or 80 ±2 degrees 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.

m. **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 the LH and RH headsets.

n. **Modulation Check.** With aircraft TACAN locked on and the DRMIs and CDIs showing the selected range and bearing, select the following on the ARM-511 test set:

(1) MODULATION – 15 Hz/10 per cent.

(2) TACAN remains locked on.

(3) MODULATION – 15 Hz/25 per cent.

(4) TACAN remains locked on.

(5) Reselect MODULATION – NORMAL/ 25 per cent.

o. **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 TRANSPONSER switch to TEST 1 position.

(3) Observe that the PASS green lamp illuminates and the DRMIs indicate selected range.

(4) Set TEST SET FUNCTION to interrogate.

(5) Verify that PASS green lamp illuminates.

(6) Set TEST SET FUNCTION to TRANSPOND.

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

p. **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 is 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 Steps i through o, on channels 18, 47, 100 and 123.

q. **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 illuminates.

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

r. **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 correspond 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.

s. **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.

t. **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).

u. 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)

(1) See Figure 2-4-5 to convert total attenuation to transmitted power expressed in decibel 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.

v. **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 Step t.

(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. See Figure 2-4-5 to convert receiver sensitivity to total attenuation.

(4) Calculate Rx sensitivity as follows:

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

(b) 42 dBm (ATTENUATOR setting just prior to unlock)

(c) 8 dBm (CG-5096 cable loss)

(d) 92 dBm (total attenuation)

w. **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

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 2-4-5 Conversion Tables

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 transmitted power on channels 18, 47, 100 and 123 as detailed for channel 18 in Step u. Record and average the readings. See Figure 2-4-5 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 the procedure in Step u, 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.

x. Turn off power and disconnect ARM-511 test set.

y. Turn off power to TACAN and indicators and open 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

32. 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

33. The following 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, first detach the mounting plates from the base, then the connectors from the plates. The plates are part of the mounting base and should remain with it.

c. To mount connectors when installing base, first detach the small mounting plates, then pass the connectors through the mounting holes in the base. If necessary, refer to TACAN wiring diagram in C-12-114-000/DW-001 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 connectors.

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.

SECTION 5

AN/ARN-508 VOR/ILS/MARKER

VOR/ILS/MARKER SYSTEM

GENERAL

1. The AN/ARN-508 system uses a receiver unit that combines VOR-localizer, glideslope and marker receivers. For navigation the system indicates VOR course deviation on course indicators and VOR ground station bearing on the distance radio magnetic indicators of the TACAN system. For landing approach, it indicates localizer and glideslope 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. Figure 2-5-1 illustrates the system main components and Figure 2-5-2 list the components locations. For the electrical schematic, see Figure 2-5-3.

OPERATION OF SYSTEM

VOR OPERATION

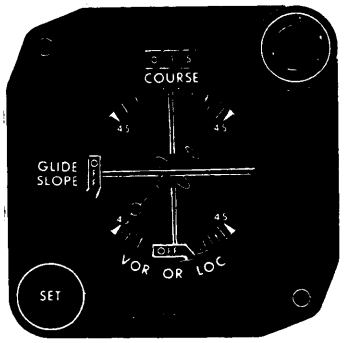
3. VHF omnidirectional radio range (VOR) operation is activated when the system is switched on and the frequency of a VOR ground station is selected on the control unit. VOR frequencies are at even tenths of a megahertz in the range from 108.00 to 117.00 MHz. In this operation the direction between the 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

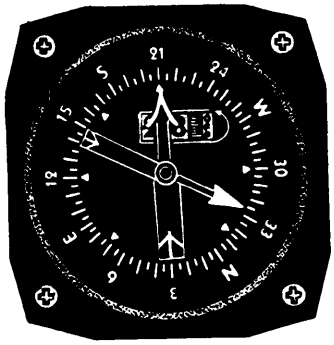
4. Instrument Landing System (ILS) operation is selected by setting the frequency selector on the control unit to a localizer frequency, an odd tenth of a megahertz in the range from 108.10 to 111.90 MHz. The same receiver is used as in VOR operation. At the same time a glideslope section of the receiver is automatically switched on and tuned to its required frequency. Corresponding to each localizer frequency is a particular glideslope 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 over lapping slightly in the centre, the left beam modulated with 90 Hz and the right beam with 150 Hz. The station also transmits two narrow beams on the glideslope 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 glideslope 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

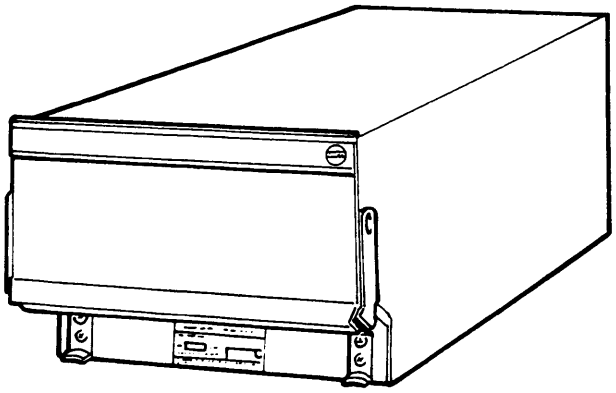
5. Marker beacons transmitting on 75 MHz are located on airways and at standard distances along the approaches to runways. In a landing approach, the aircraft flies over an airway marker beacon, an outer marker beacon and a middle marker beacon, in the order named, and in each beacon position an indicator 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 dashes at



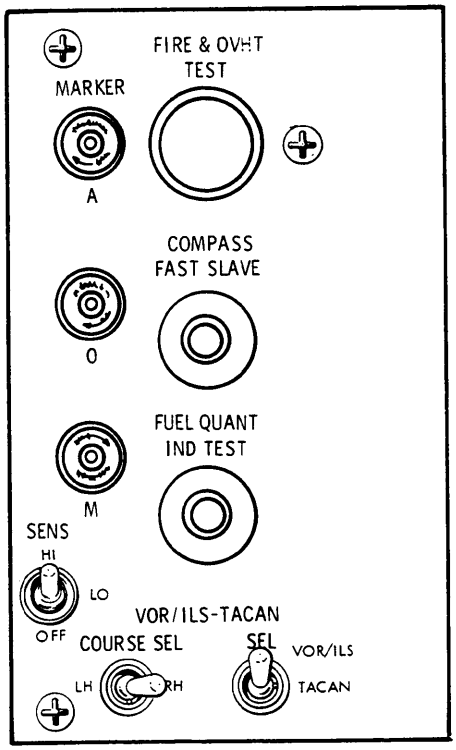
COURSE INDICATOR
MN-97HA-4/ARN



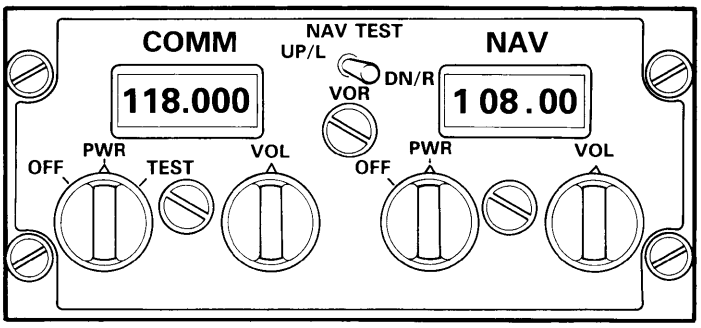
DISTANCE RADIO MAGNETIC INDICATOR
ID-5040A/ARN



NAVIGATION RECEIVER
R-5069/ARN-508



MISCELLANEOUS CONTROLS
AND MARKER PANEL



522-2447-552
DUAL CONTROL UNIT

BOG02018

Figure 2-5-1 AN/ARN-508 VOR/ILS/Marker System – Main Components

Component	Location
R-5069/ARN-508 navigation receiver	Nose compartment
C-5302/ARN-508 control unit	Centre instrument panel
Miscellaneous controls and marker panel	Centre instrument panel
OE-5008/ARN-508 VOR-localizer antenna system, consisting of:	Vertical stabilizer
AS-5084/ARN-508 antenna elements (2)	
CV-5116/ARN-508 or 776-7358-001 hybrid junction	
AS-5071/ARN 522-0688-013 glideslope antenna	Aircraft nose cone
AT-640A/ARN 522-0854-023 marker antenna	Bottom fuselage, below cockpit
MN-97HA-4/ARN course indicators (2) * (course deviation indicators)	Left and right instrument panels
ID-5040A/ARN distance radio magnetic indicators (2) (part of TACAN system)	Left and right instrument panels
Rotary solenoid switch *	Nose compartment
Course indicator selector relay *	Centre control console
VOR-TACAN audio relay *	Centre control console
Circuit-breaker (CB1RNA) *	Centre console extension
Circuit-breaker (CB1RNV) *	Centre console extension
Circuit-breaker (CB2RNV) *	Centre console extension

* Components common to VOR and TACAN systems.

Figure 2-5-2 AN/ARN-508 VOR/ILS/Marker System – Component Locations

the rate of 2 per second; middle, amber, 1300 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 six plug-in subassemblies: the glideslope 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.

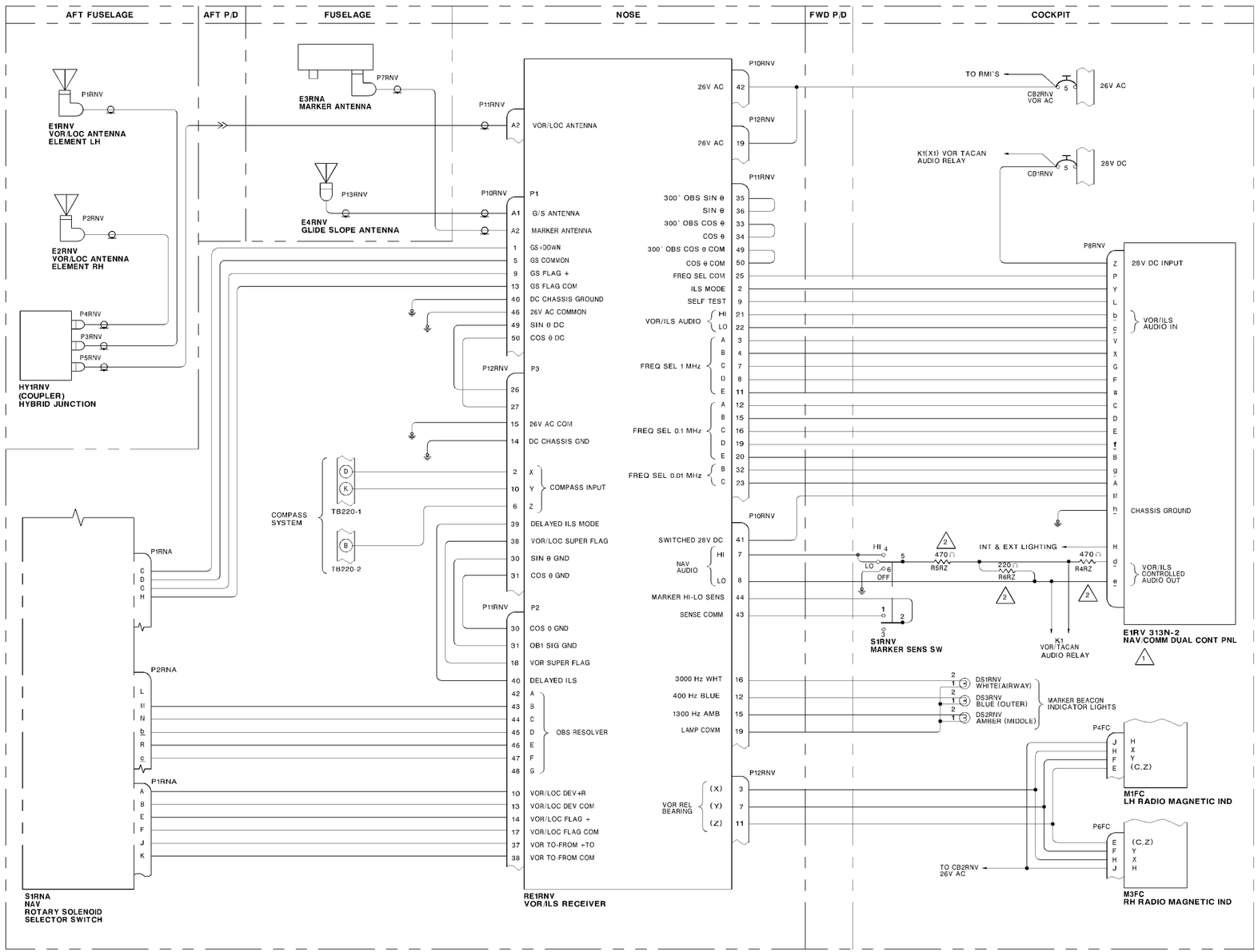
b. **VOR-Localizer Instrumentation Board.** The audio channel of the VOR-localizer instrumentation board A6 separates the audio communication signal from the composite VOR or localizer output of the receiver A4, and amplifies it for transmission through the aircraft intercom. When a VOR signal is received, 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 dc 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 dc 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 or if the combined signals are below 50 per cent 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 dc outputs of the VOR-localizer instrumentation board A6 are modulated by 26 Vac 400 Hz aircraft power in the automatic-manual instrumentation board A7 to be converted to ac signals. In the manual channel, these signals are fed 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 degrees relative bearing when the VOR-localizer OFF flags on the course indicators are displayed or when a localizer channel is selected.

e. **Glideslope Receiving and Instrumentation Subassembly.** When a localizer frequency is selected for the VOR-localizer receiver, the receiver in the glideslope receiving and instrumentation subassembly A1 is automatically tuned to a corresponding glideslope channel. This board amplifies and detects the signal, filters the 90 and 150 Hz components, and converts them to dc deflection signals that are fed out to the glideslope 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 glideslope flag movements of the course indicators if the signal is unreliable, causing the glideslope 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



NOTES :

1. NAV SIDE OF CONTROL PANEL SHOWN ONLY.
2. RESISTORS LOCATED IN COCKPIT DISCRETE COMPONENT BOX.

B0G02045

AN/ARN-508 VOR/ILS Navigation System – Schematic Figure 2-5-3

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 control unit bears the identification NAV above the frequency indicating counter. It has a 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 selector knob is concentric with the megahertz selector knob at lower left. It has two positions, OFF and PWR, respectively switching the navigation receiver unit off and on. (For self-test, see Paragraphs 20 to 26.)

b. **Megahertz Selector.** This selector changes the VOR-localizer receiving frequency in 1 MHz steps. The frequency is indicated by the first three digits on the counter.

c. **Kilohertz Selector.** This selector changes the VOR-localizer receiving frequency in 50 KHz steps. The frequency is 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 glideslope receiver, though not indicated on the control unit.

d. **VOL Knob.** The volume control is concentric with the kilohertz selector and 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 2-5-1 and 2-5-4, 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 (see indicator switching, Paragraphs 10 to 12). 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 degrees apart with a common terminal, and is excited by a reference-phase signal from VOR or TACAN. The stator has two separate sections 90 degrees 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 degrees 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.** Dc 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 degrees of the selected bearing, and the word FROM when the station bearing is within

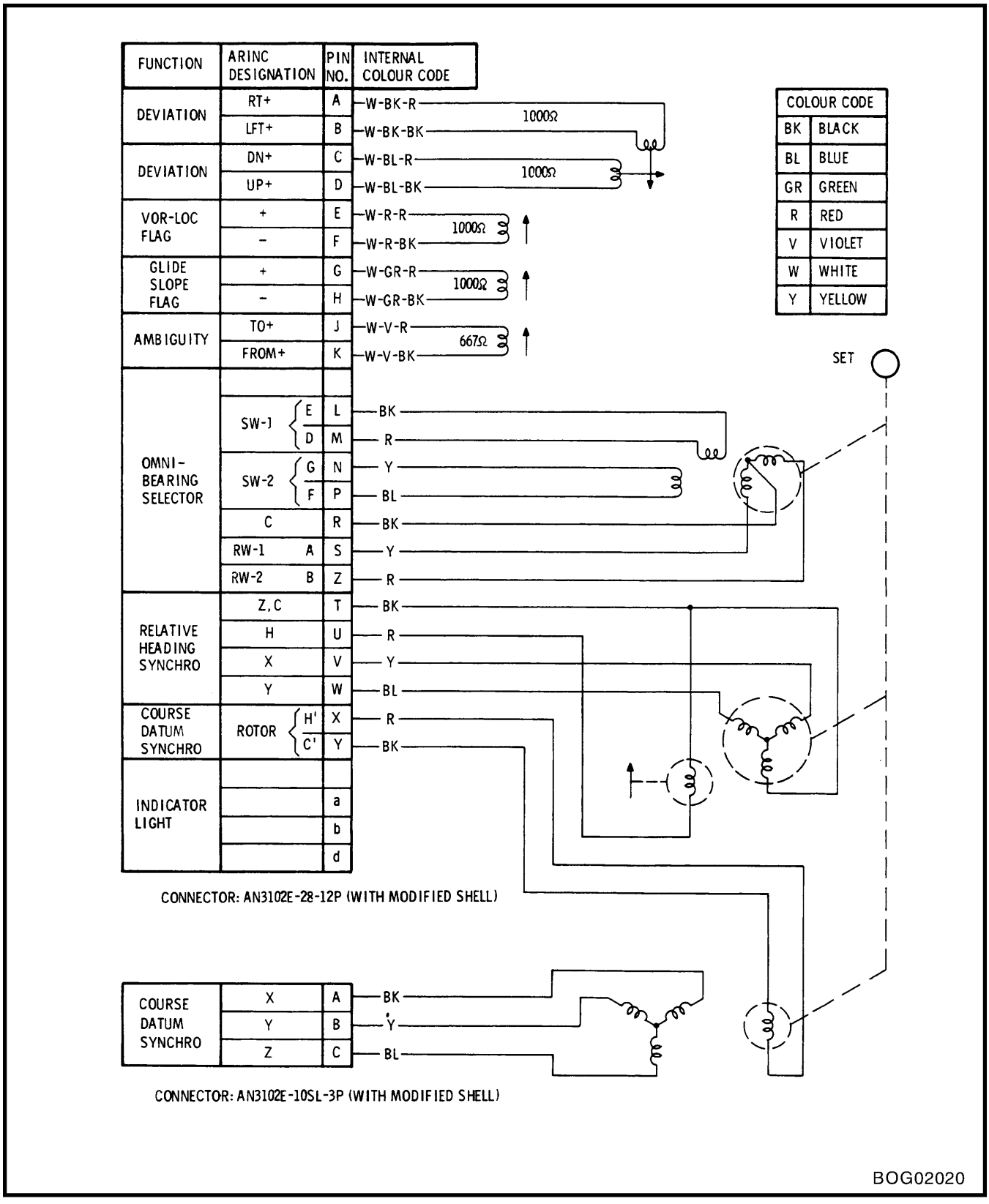


Figure 2-5-4 MN-97HA-4/ARN Course Indicator – Schematic Diagram

90 degrees 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 dc 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 dc 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.

i. **Vertical Deviation.** Vertical deviation input signals are dc 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.

j. **Glideslope Validity Flag.** A flag at the left of the instrument face, controlled by a dc voltage, displays the word OFF when the glideslope deviation signal is unreliable or not in use.

k. **Indicator Light.** The indicator light in the upper right corner of the instrument is not wired to Tutor aircraft circuits. 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 LH and RH side. 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 positions, controls a rotary solenoid switch in the nose compartment, routing signal circuits from one system or the other to the course indicators. All these circuits go direct from the rotary solenoid switch to the indicators except the resolver circuits, 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 LH console.

SOLENOID SWITCH AND RELAY CIRCUITS

11. For control circuits, see Figure 2-5-5. Power to operate the solenoid switch and the course indicator selector relay is obtained from the VOR-TAC SEL circuit-breaker on the cockpit No. 2 essential dc bus. The COURSE SEL switch energizes the relay in RH position to select the resolver circuits of the RH course indicator, and de-energizes it in LH position to select those of the LH course indicator. The SEL switch applies voltage alternately to two contacts of the solenoid switch to select VOR/ILS or 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 and by the course indicator selector relay are shown schematically in Figure 2-5-5.

INDICATOR SIGNAL CIRCUIT LOADING

12. Permanent resistor loads are connected across the deviation, TO-FROM and OFF flag outputs of the 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 Figure 2-5-5). 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 2-5-5).

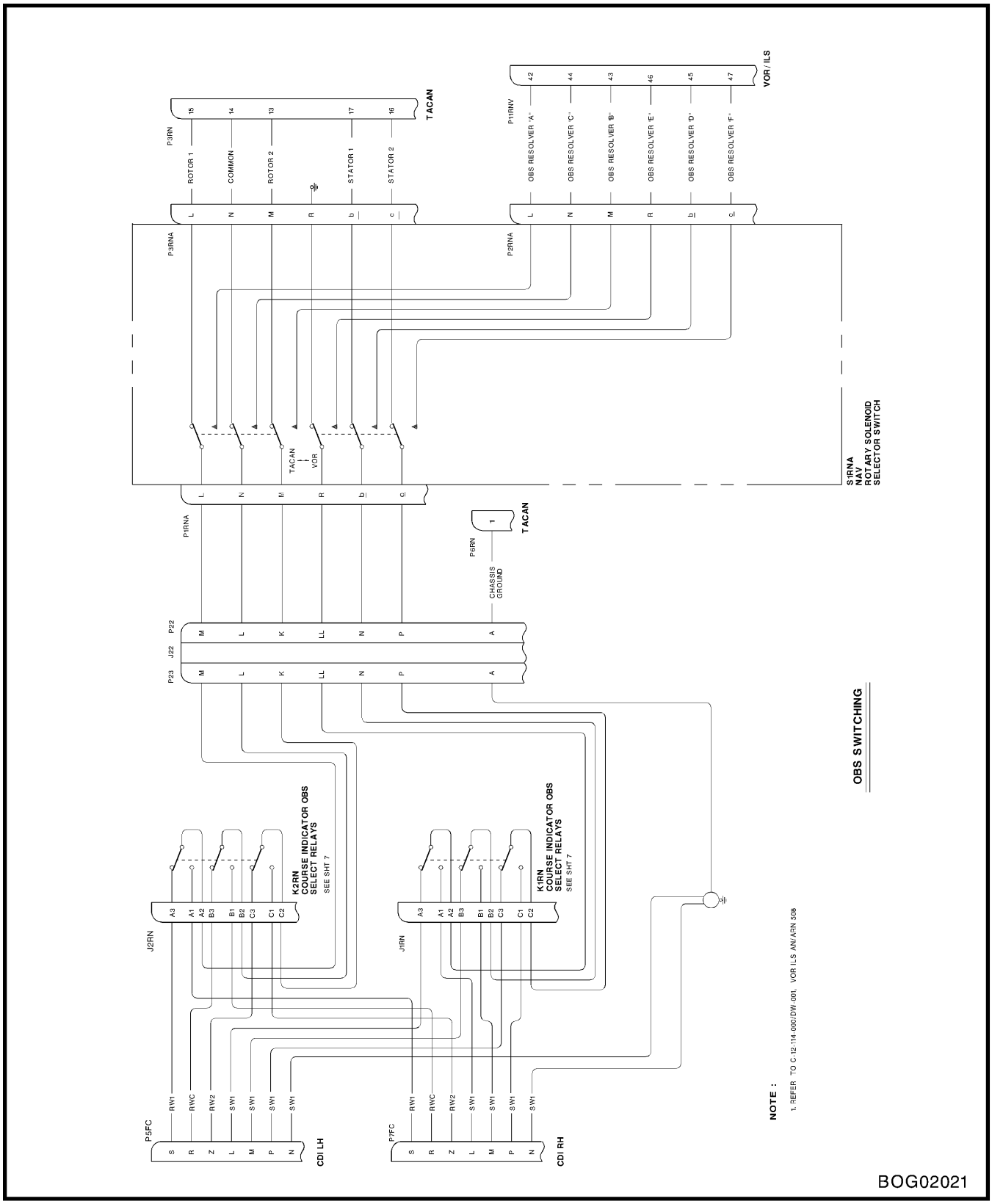


Figure 2-5-5 (Sheet 1 of 7) VOR/TACAN Switching – Electrical Schematic

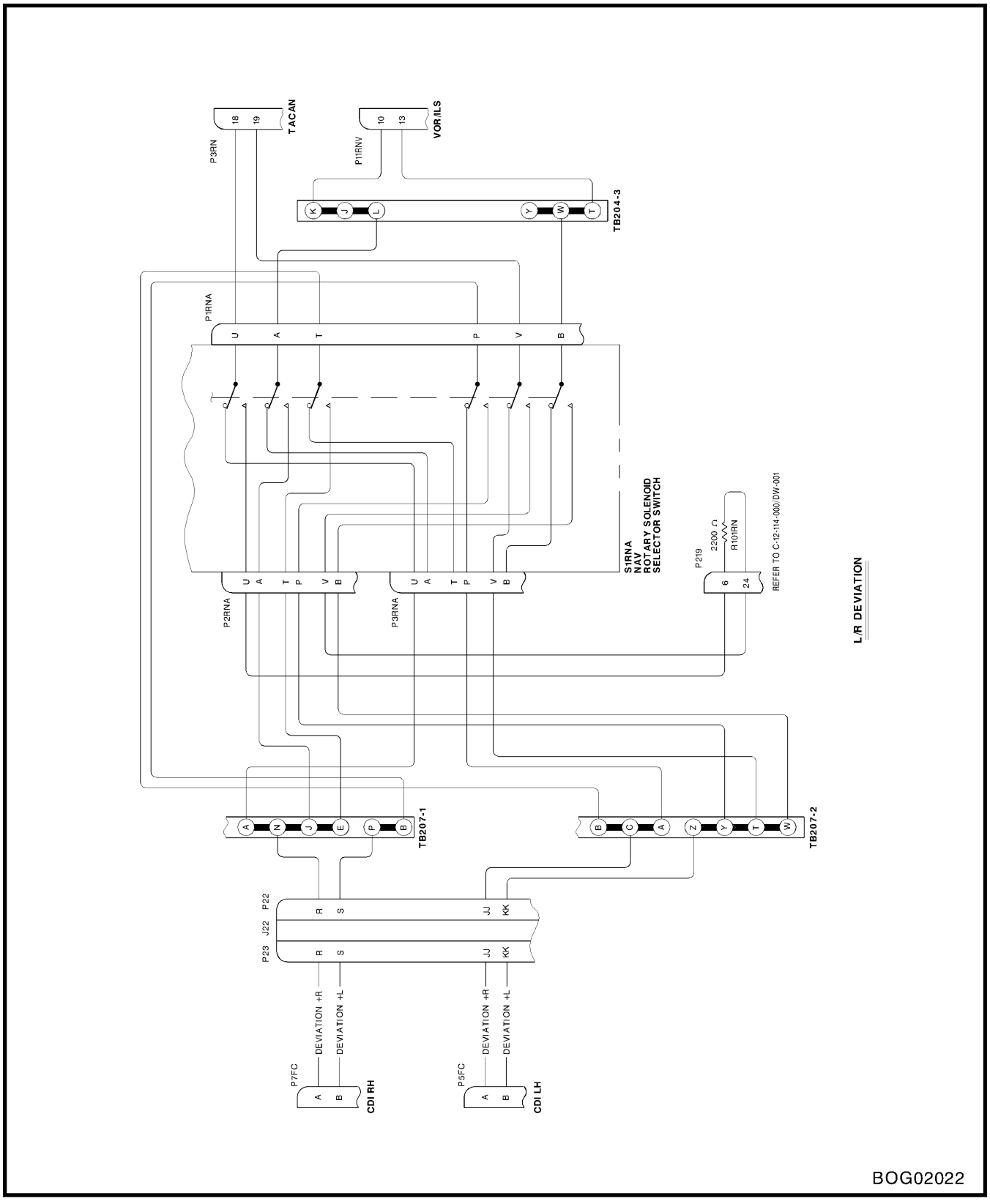


Figure 2-5-5 (Sheet 2 of 7) VOR/TACAN Switching – Electrical Schematic

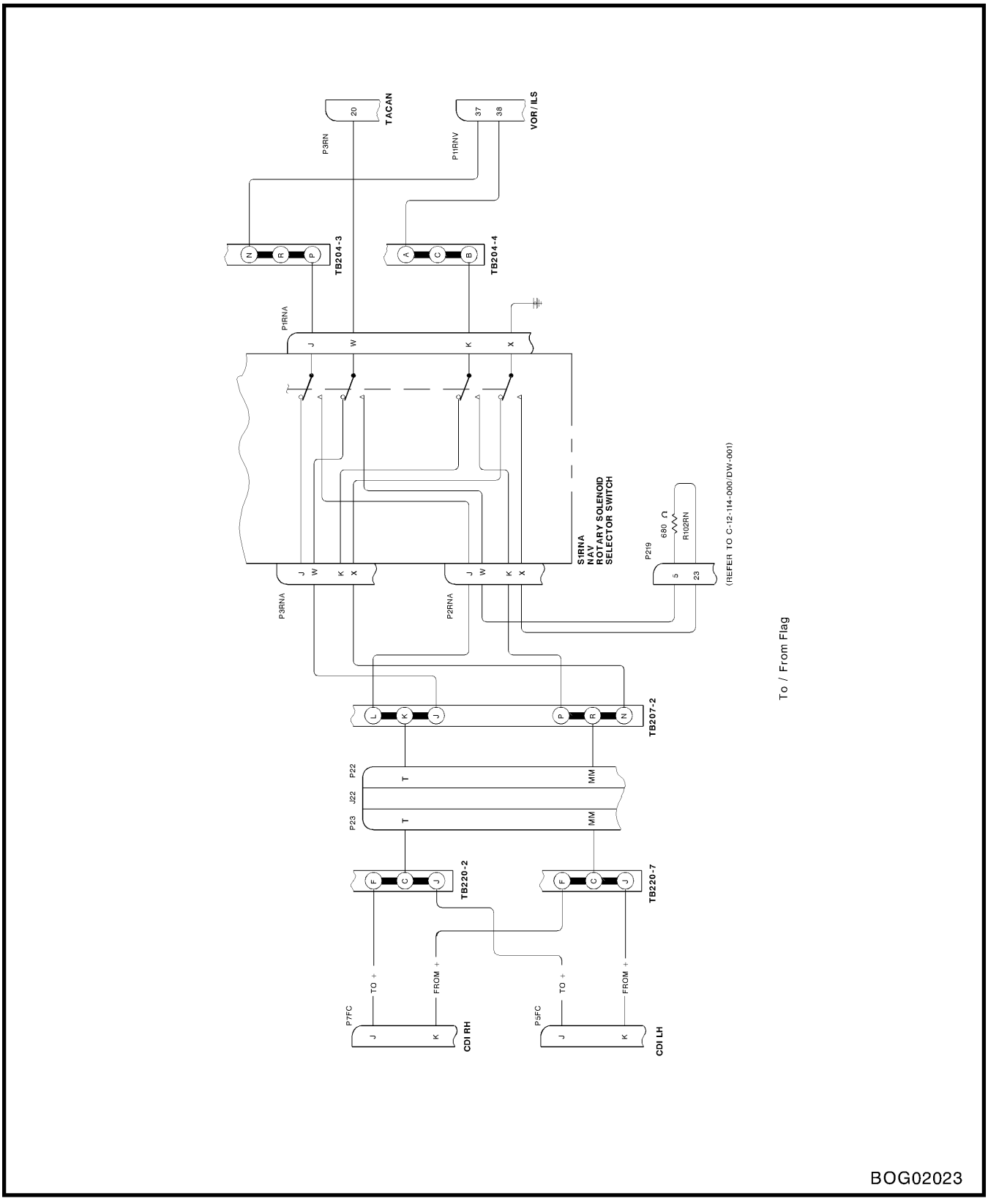


Figure 2-5-5 (Sheet 3 of 7) VOR/TACAN Switching – Electrical Schematic

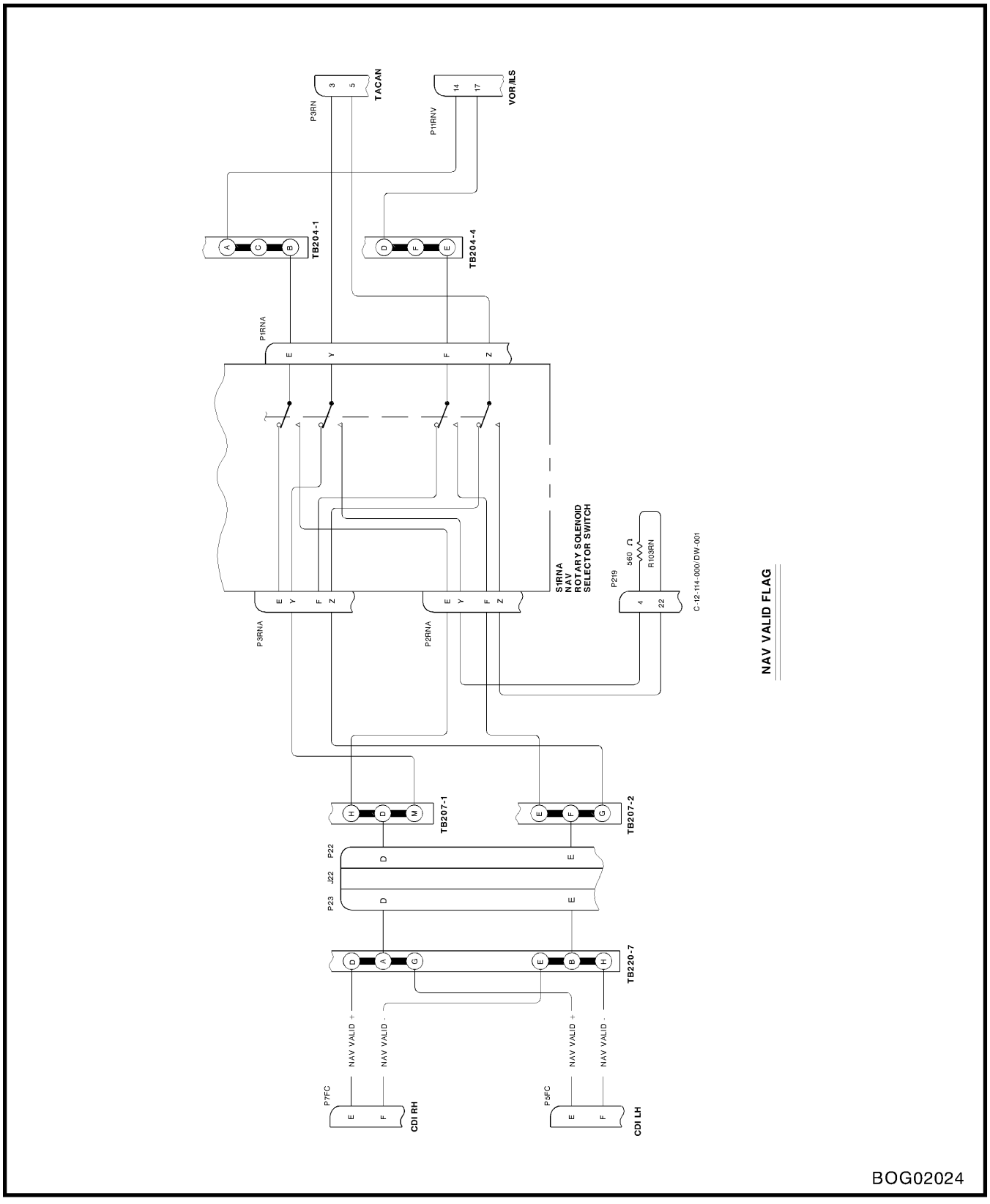


Figure 2-5-5 (Sheet 4 of 7) VOR/TACAN Switching – Electrical Schematic

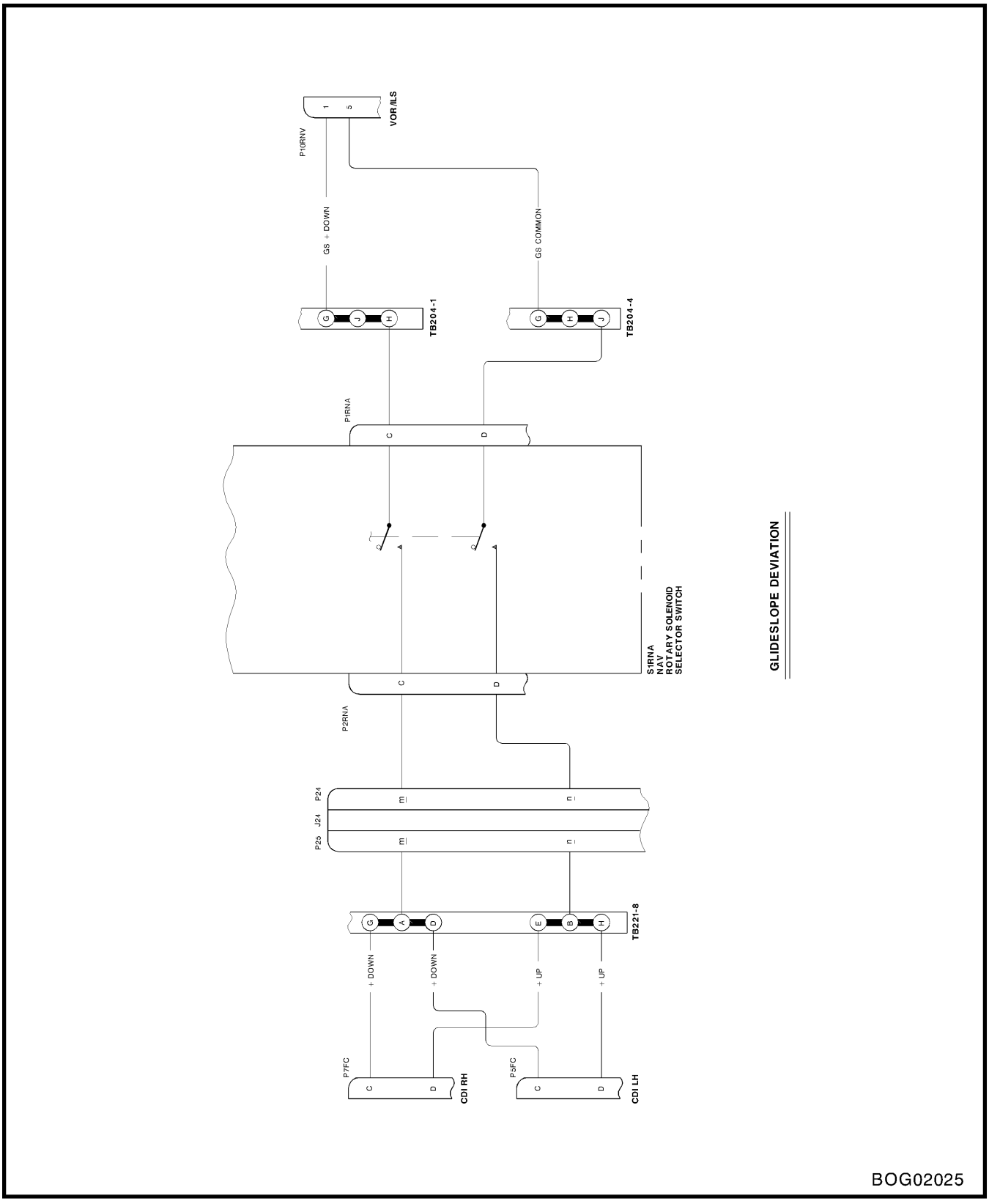


Figure 2-5-5 (Sheet 5 of 7) VOR/TACAN Switching – Electrical Schematic

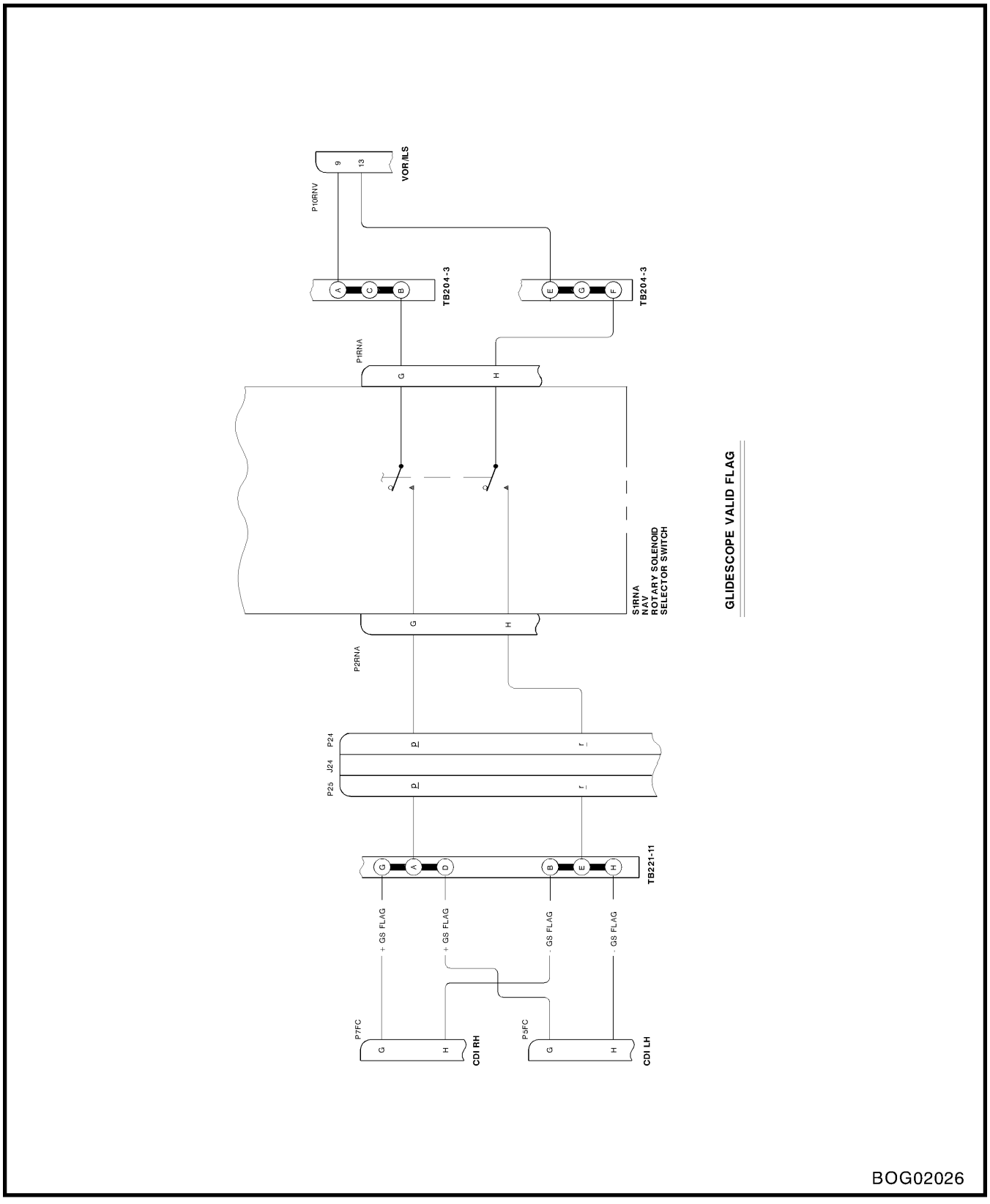
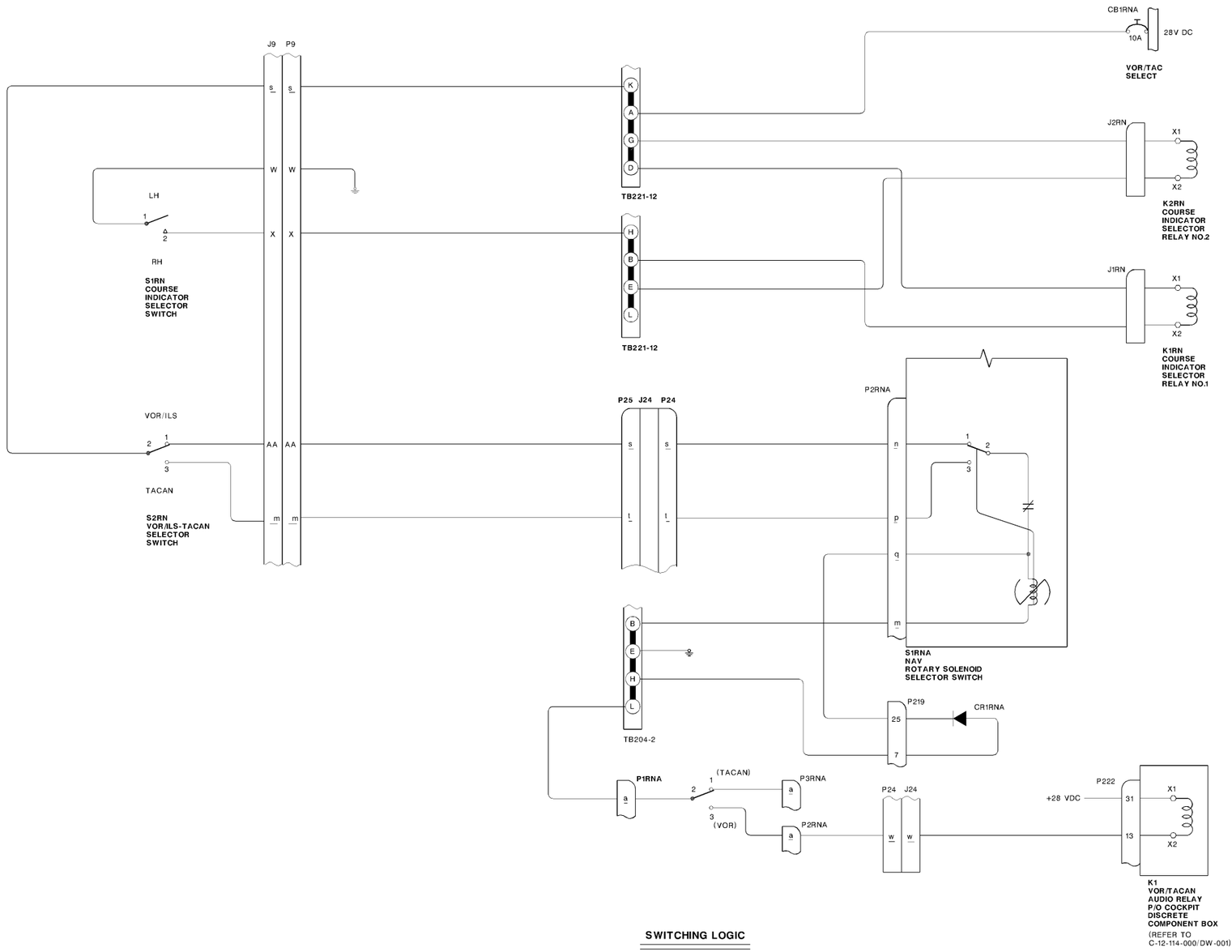


Figure 2-5-5 (Sheet 6 of 7) VOR/TACAN Switching – Electrical Schematic



(Sheet 7 of 7) VOR/TACAN Switching – Electrical Schematic Figure 2-5-5

VOR/TACAN AUDIO RELAY

13. The VOR/TACAN audio relay is energized from the VOR system circuit-breaker on the cockpit No. 1 essential dc bus by the rotary solenoid switch in VOR/ILS position (see Figure 2-5-5). 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 glideslope and marker receiver antennas are horizontally polarized and have 52 Ω nominal impedance at the coaxial connectors. The two VOR-localizer receiver antennas on the vertical stabilizer are matched to the 50 Ω 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, see C-57-386-000/MF-000.

FUNCTIONAL TESTS

EQUIPMENT REQUIRED

17. The following test equipment or equivalent is required:

a. Navigation test set NAV-401L.

b. Intercom headset.

POWER AND SIGNAL REQUIREMENTS

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

a. Compass system (see C-12-114-0E0/MF-001).

b. Intercom.

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

a. 28 VDC – VOR.

b. VOR-TAC SEL.

c. 26 VAC – 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 flags are out of view.

b. Glideslope bars move down approximately one dot, and GLIDESLOPE 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 degrees on compass card.

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

23. On left instrument panel course indicator (LH) turn SET knob until COURSE readout 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. Glideslope bar is deflected downwards and GLIDESLOPE 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 degrees right of aircraft heading.

24. Displace COURSE setting of LH course indicator, and select RH on COURSE SEL switch.

25. Hold NAV test switch at VOR; verify that a 30-Hz tone is audible in headset.

26. Repeat procedures of Paragraphs 23 through 25, using right instrument panel (RH) course indicator for course selection at beginning of Paragraph 23.

PANEL LIGHTING

27. 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.

NOTE

The marker, glideslope and localizer tests that follow may be performed indoors; however, interference problems may be encountered due to the proximity of large metallic objects near the aircraft. If satisfactory readings are not possible, these tests shall be performed outdoors at a distance from all large metallic objects.

MARKER TEST

28. Procedure:

a. Position NAV-401L test set between 10 and 15 feet from aircraft marker antenna, which is on centreline 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, see Figure 2-5-6, is 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 1 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 per cent). When used on battery, the test set will turn itself off after 6 to 10 minutes of operation.

c. Select on test set:

MONITOR (29)	–	100 per cent
Counter mode switch (3)	–	GEN
MODE (1)	–	MKR XTL
OUTPUT (8)	–	Highest level (approximately –13 dBm, 10 000 µV)
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) extinguishes and a maximum is obtained on MONITOR meter (28).

e. On intercom control, pull out NAV volume controls and set to mid-range. Ensure that the other knobs are pushed in.

f. Connect headset to left intercom. Select 400 on test set tone selector switch (16). Check that the 400-Hz tone is heard and only the blue marker lamp illuminates.

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 remains illuminated but tone is not heard.

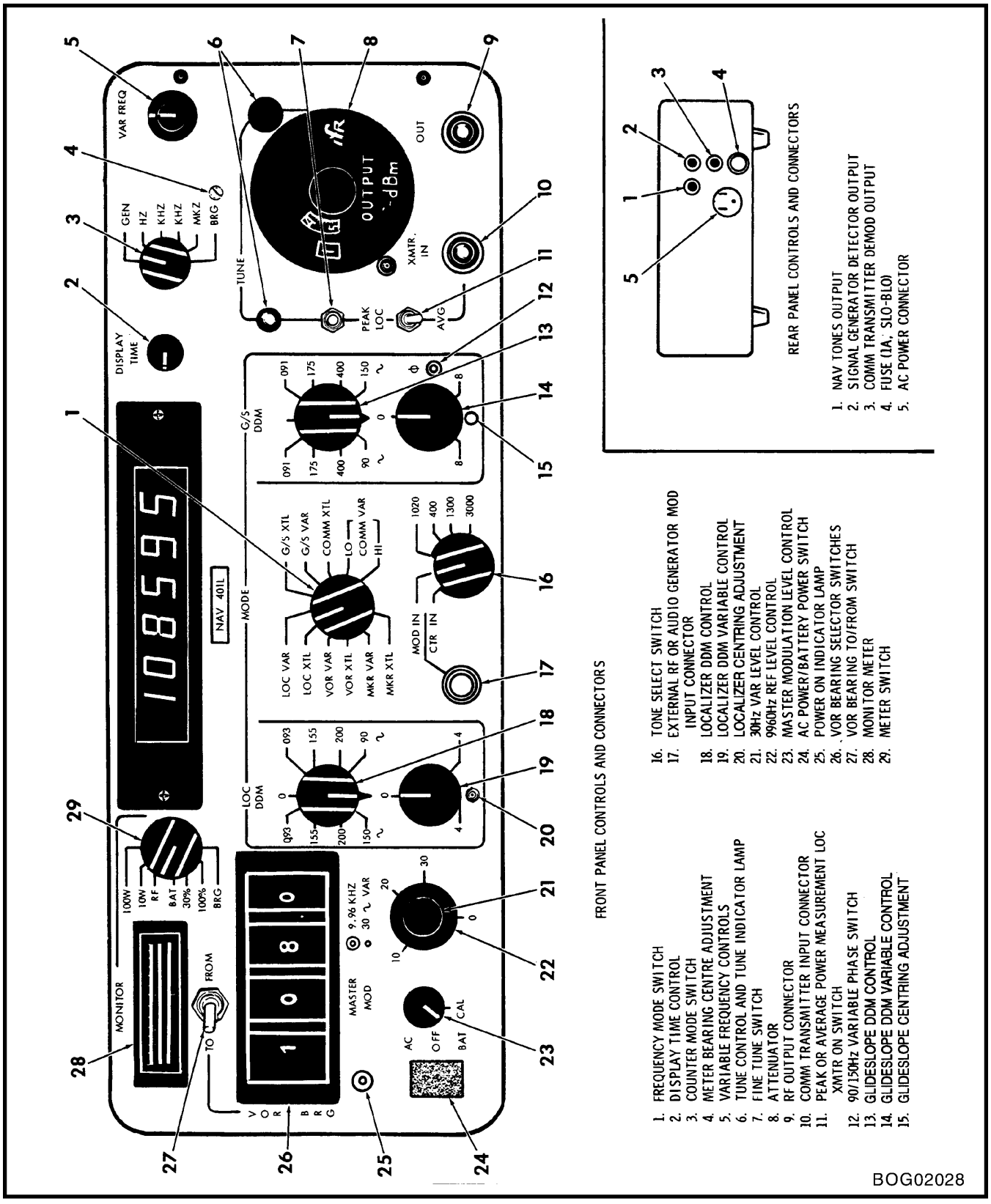


Figure 2-5-6 NAV-401L Test Set

i. 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.

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

k. 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 remains illuminated.

GLIDESLOPE TEST

29. Procedure:

a. Select on test set:

MONITOR (29)	–	100 per cent
Counter mode switch (3)	–	GEN
MODE (1)	–	G/S XTL
OUTPUT (8)	–	Highest level (approximately –60 dBm, 225 µV)
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) extinguishes 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 glideslope bar is centred, and GLIDESLOPE 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 centred, flag out of view
0.091 right	–	Bar one dot up
0.175 right	–	Bar two dots up
0.400 right	–	Full scale deflection up
0.091 left	–	Bar one dot down
0.175 left	–	Bar two dots down
0.400 left	–	Full scale deflection down
90 ~	–	GLIDESLOPE flag shows
150 ~	–	GLIDESLOPE flag shows
Lower zero with DDM variable (14) centered	–	Bar centred 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

30. Procedure:

a. Select on test set:

MONITOR (29)	–	100 per cent

Counter mode switch (3)	–	GEN
MODE (1)	–	LOC XTL
MASTER MOD (23)	–	CAL
OUTPUT (8)	–	-29 dBm (1000 µV)

b. Adjust TUNE knob (6) until light extinguishes 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 centred, VOR or LOC OFF flag out of view, and GLIDESLOPE flag in view.

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

Position		**Indication**
Upper zero	–	Bar centred, flag out of view
0.093 right	–	Bar one dot right
0.155 right	–	Bar two dots right
0.200 right	–	Bar full scale deflection right
0.093 left	–	Bar one dot left
0.155 left	–	Bar two dots left
0.200 left	–	Bar full scale deflection left
Lower zero	–	Bar centred, 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

31. 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 µV)
TO-FROM (27)	–	TO
VOR BRG (26)	–	000.0

b. Adjust TUNE knob (6) until tuning lamp (6) extinguishes 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 degrees and the TO flag is displayed on both course indicators. Check reception of 1020 Hz tone through intercom.

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

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

f. Repeat Steps d. and e. at all 30-degree 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 degrees.

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 troubleshooting, for frequencies other than the accepted test frequencies, but when these positions are used the signal must be injected into the system through a coaxial cable.

SECTION 6

DF-206A ADF SYSTEM

INTRODUCTION

NOTE

The DF-206A ADF system is installed only on selected Snowbird aircrafts.

1. The DF-206A Automatic Direction Finder (ADF) supplies direction-finding signals 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 range of 100 to 2199.5 kHz for navigational purposes. Figure 2-6-1 tabulates the system primary components, Figure 2-6-2 illustrates the component locations and Figure 2-6-4 is an electrical schematic of the system.

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 (NDB) at 190 to 550 kHz, and Consolan stations at approximately 300 kHz. The directional character istics 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 signals 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 (DRMI) and/or aurally.

MODES OF OPERATION

3. The DF-206A ADF system has two functional modes of operation. When the mode selector switch (ADF/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 DRMI. 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 a 28 Vdc from the essential dc bus through the 3 ampere ADF DC circuit-breaker, and a 26 Vac from the instrument bus through the 3 ampere ADF AC circuit-breaker. Both circuit-breakers are mounted on the centre console circuit-breaker panel. System power is controlled by the DFC-206A control.

DFC-206A CONTROL

5. The DFC-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 2-6-3. An electrical connector on the rear of the control connects the control to the ADF system.

DFA-206A ANTENNA

6. The DFA-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 DFR-206A receiver.

DFR-206A RECEIVER

7. The DFR-206A receiver accepts the combined loop and sense antenna signals and sends them via the DFC-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 RADIO MAGNETIC INDICATORS (DRMI)

8. The processed signals from the DFR-206A receiver may be presented on the RH and LH DRMI 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

Component	Part Number
Control, DFC-206A	622-6813-001
Receiver, DFR-206A	622-6812-003
Antenna, DFA-206A	622-6820-001
Mount, DF-206A	622-7210-002

Figure 2-6-1 Tabulation of DF-206A System Primary Components

the wide bearing pointer on both the RH and LH DRMI (see Figures 2-6-2 and 2-6-4). Setting the ADF/TAC SEL switch to ADF energizes relay K503 selecting the processed bearing signal from the DFR-206A receiver to the wide pointers of the RH and LH DRMI.

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 DC and ADF AC 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 headset to the RH MIC/TEL socket.

c. Set the ADF/TAC SEL switch to ADF.

d. Set the ADF control MAN/2182/500 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 to 279.5 kHz.

(2) 280 to 399.5 kHz.

(3) 400 to 499.5 kHz.

(4) 500 to 599.5 kHz.

(5) 600 to 899.5 kHz.

(6) 900 to 1399.5 kHz.

(7) 1400 to 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 DFC-206A control unit to the desired level.

g. Set the ADF/ANT/OFF switch to ADF.

h. Tune the ADF receiver to several local NDB, and ensure that the wide bearing pointer on the RH DRMI assumes a bearing relative to the location of each tuned station.

i. 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.

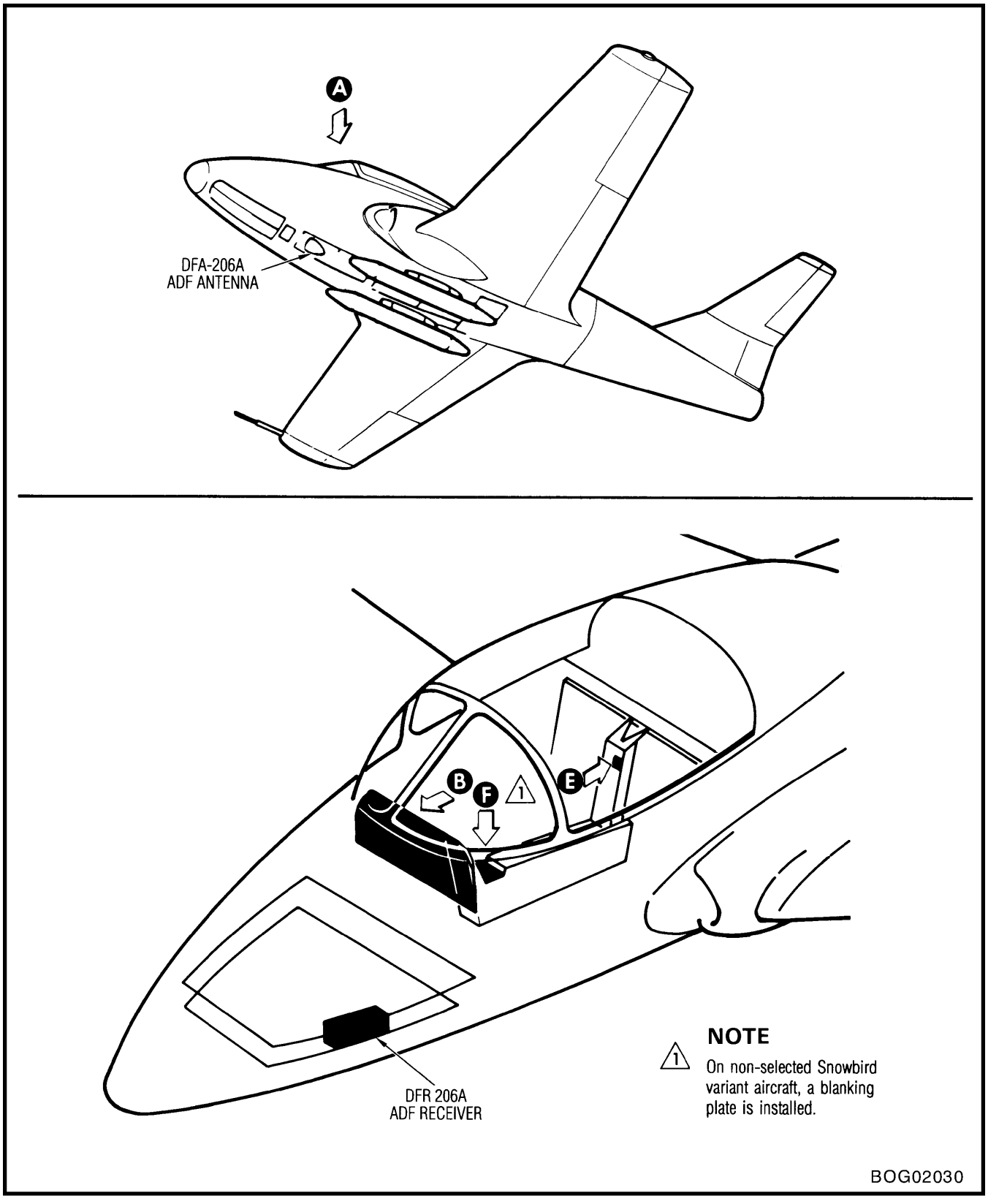


Figure 2-6-2 (Sheet 1 of 2) DF-206A ADF System – Component Locations

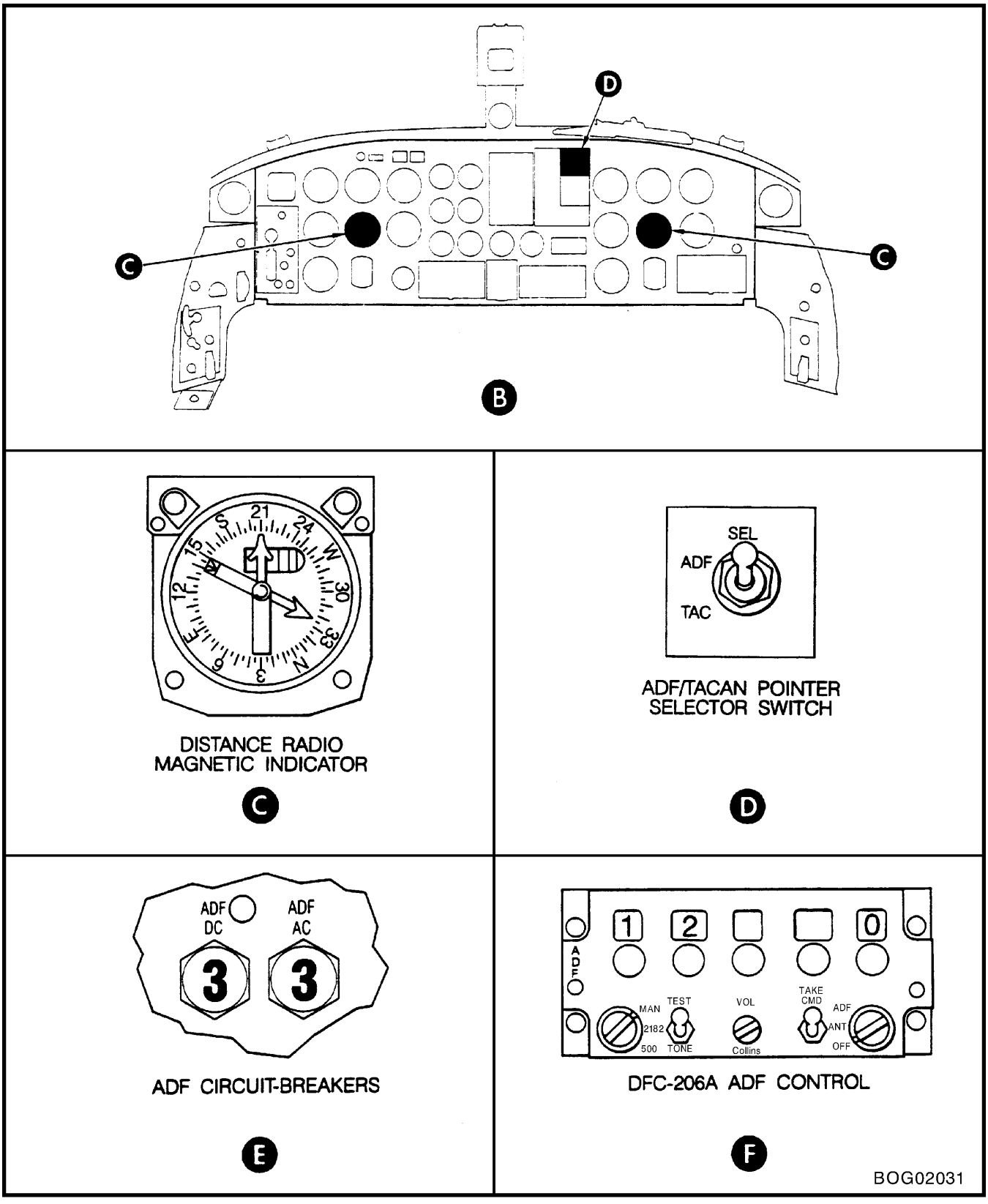


Figure 2-6-2 (Sheet 2 of 2) DF-206A ADF System – Component Locations

j. Release the TEST/TONE switch and ensure that the wide bearing pointer returns to the pretest setting.

NOTE

The wide bearing pointer will ″park″ horizontally if there is no signal received or the received signal is of poor quality.

k. Repeat the instructions of Paragraph 10, Steps b through j 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.

l. 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.

DFC-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.

DFC-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.

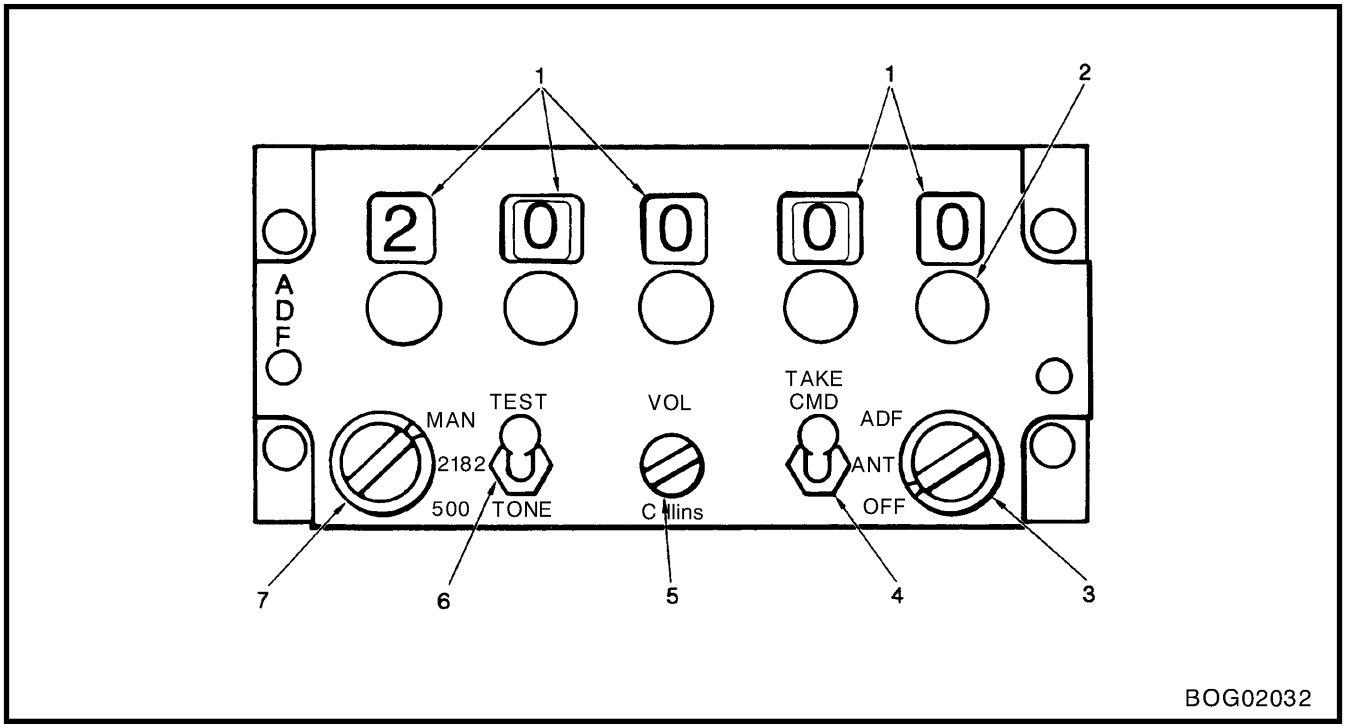


Figure 2-6-3 (Sheet 1 of 2) DFC-206A Control Unit Switch Functions

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 2-6-3 (Sheet 2 of 2) DFC-206A Control Unit Switch Functions

b. Close the applicable circuit-breakers and perform an operational check-out of the system.

DFA-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.

DFA-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 14, Step b, 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.

DFR-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 removed.

DFR-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 procedures 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.

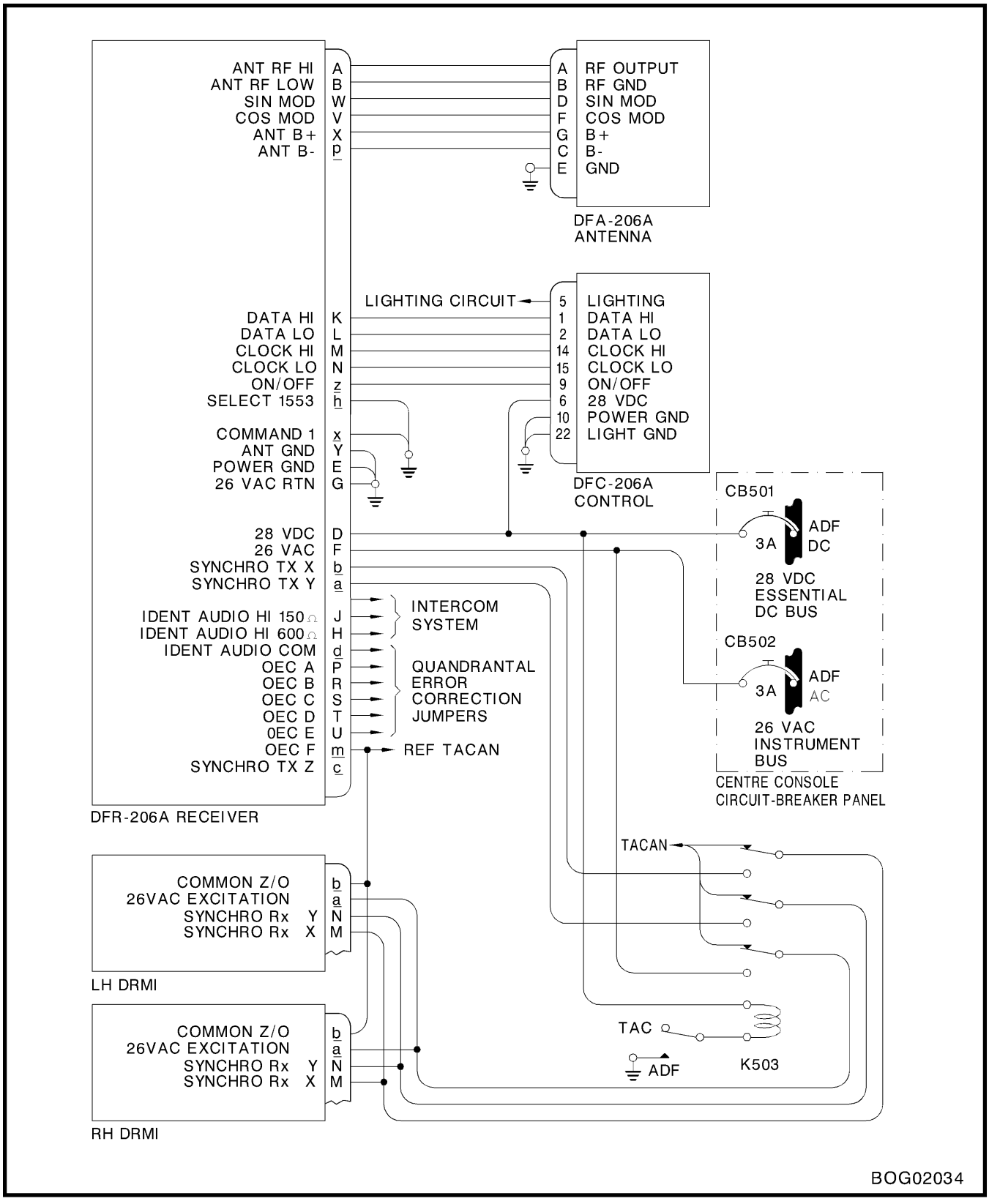


Figure 2-6-4 DF-206A ADF System – Electrical Schematic

SECTION 7

IFF SYSTEM

IDENTIFICATION RADAR

GENERAL

1. The AN/APX-77A IFF system (identification friend or foe) transmits 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. For a list of the main components and their locations, see Figure 2-7-1.

OPERATION OF SYSTEM

GENERAL

3. For the main components of the system, see Figure 2-7-2. For an electrical schematic of the system, see Figure 2-7-3.

MODES OF INTERROGATION

4. The IFF system can be preset to respond in various ways to several modes of interrogation. An interrogation is a combination of 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 (µsec) being specified as between the leading edges of successive pulses:

a. Mode 1 – Two pulses at 3 µsec.

b. Mode 2 – Two pulses at 5 µsec.

c. Test mode – Two pulses at 6.5 µsec.

d. Mode 3/A – Two pulses at 8 µsec.

e. Mode C – Two pulses at 21 µsec.

SIF REPLY PULSE SEQUENCE

5. Replies are coded to the selective identification feature (SIF) coding system. The normal SIF reply to a recognized interrogation is a train of transmitted RF pulses, each 0.45 µsec wide, in which the first and last are the framing pulses, 20.3 µsec 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 µsec 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

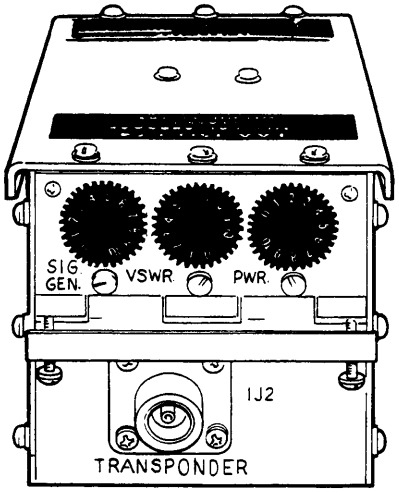
7. The information pulses possible in a normal mode 1 reply are only the A and the B pulses, omitting B4. This provides 32 combinations, coded 00 to 73. In modes 2, 3/A and test, all 12 information pulse positions are used, providing 4096 combinations in each mode, coded 0000 to 7777. Mode C replies 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 µsec after the F2 pulse. Mode C reply coding is generated by an altitude encoder in the computer-indicator of the servoed altimeter system (see C-12-114-0E0/MF-001).

EMERGENCY REPLIES

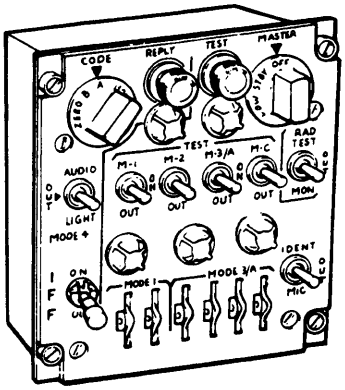
8. In modes 1 and 2, an emergency reply to a single interrogation is a normal reply pulse train followed by three pairs of normally spaced framing pulses, with an interval of 4035 µsec from each F2 pulse to the next Fl pulse. In mode 3/A and test mode,

Component	Location
RT-862/APX-77 transponder (receiver-transmitter)	Nose compartment
TS-1843B/APX transponder test set	Nose compartment
C-6280(P)/APX control unit (transponder set control)	Centre console
Bailout relay	Nose compartment
Altitude computer-indicator (part of servoed altimeter system)	Instrument panel, RH side
Test receptacle (part of servoed altimeter system)	RH side console
Remote I/P relay	Nose relay panel
AT-741A antenna	Underside of right wing, FS 191.5
Seat ejection test switch	Test panel, nose compartment
Circuit-breaker (CB1SX)	Centre console extension
Circuit-breaker (CB2SX)	Centre console extension
Circuit-breaker (CB3SX)	Centre console extension

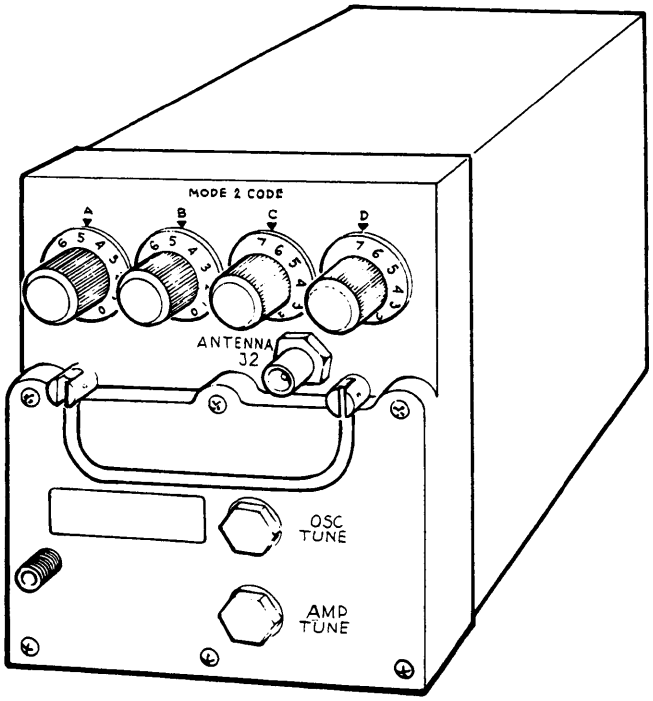
Figure 2-7-1 IFF System – Component Locations



TEST SET TS-1843B/APX



CONTROL UNIT C-6280(P)/APX



TRANSPONDER RT-862A/APX-77

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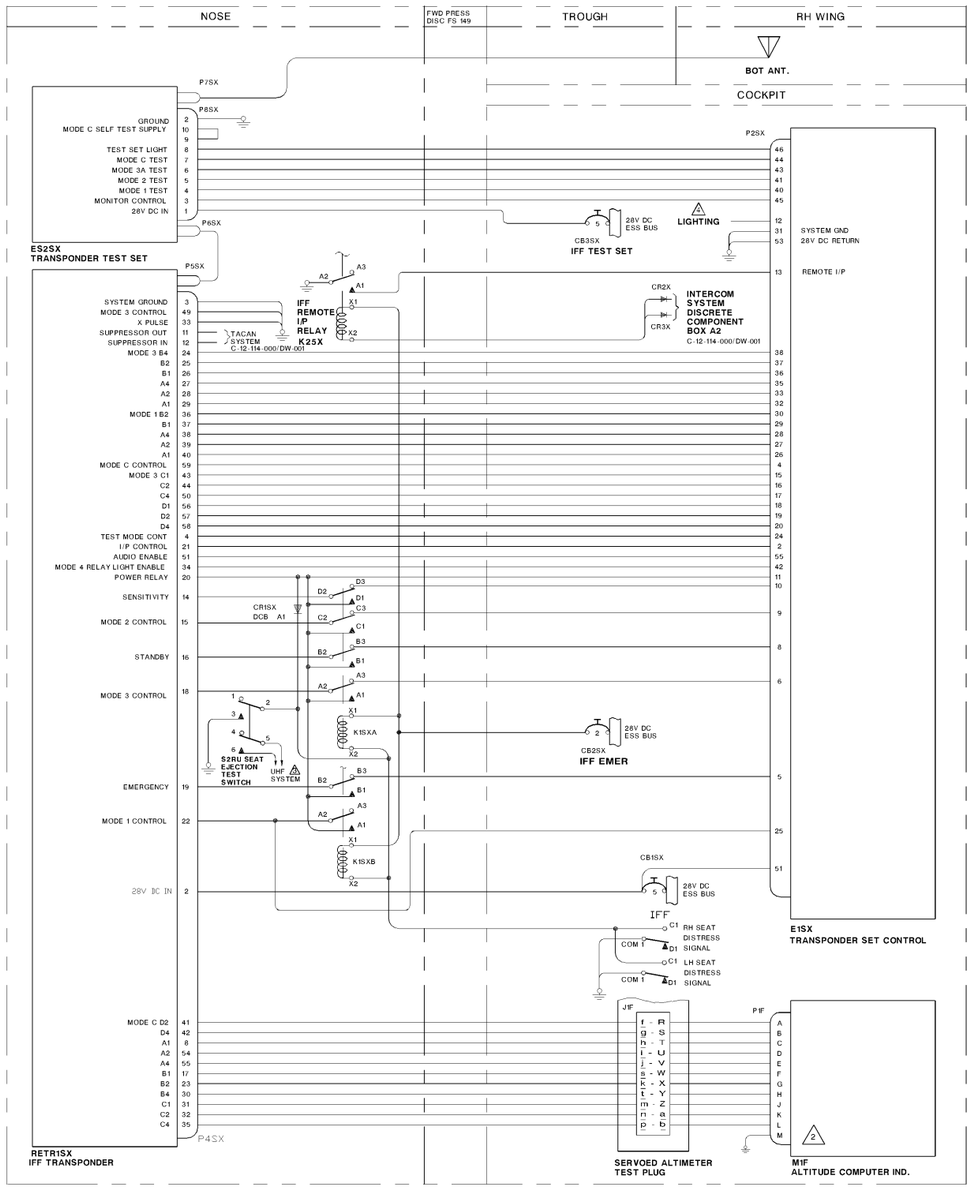
Figure 2-7-2 IFF System – Main Components



NOTE : 1. REFER TO C-12-114-000/DW-001, IFF AN/APX 77
2. REFER TO C-12-114-000/DW-001, SERVOED ALT SYSTEM SCHEMATIC
3. REFER TO C-12-114-000/DW-001.
4. REFER TO C-12-114-000/DW-001.

BOG02037

IFF System – Electrical Schematic Figure 2-7-3

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, an I/P (identification of position) reply is two normal reply trains with an interval of 4.35 µsec 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 µsec after the F2 pulse. In mode C, I/P replies do not differ from normal replies.

TRANSPONDER

10. A preselector 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 settings. To prevent accidental selection of OFF or EMER, the master switch knob must be pulled out to make either of those selections.

12. The mode switches, M-l, 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. The reply 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 for 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.

TEST SET

13. The test set in the system is operated by controls on the control 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.

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 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 circuit-breaker panel. The relay is energized by grounding through either of the

distress signal microswitches 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 lines are grounded through normally open contacts of the relay in series with the diode, and five of the six lines 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, 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:

a. Transponder – C-59-122-A00/MF-000

b. Control unit – C-59-107-000/MS-000

c. Test set – C-59-122-X02/MS-000

FUNCTIONAL TESTS

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. Apply ground power to the aircraft.

23. Set the dc MASTER switch to GRD PWR and ensure that the following circuit-breakers on the circuit-breaker panel are pushed in:

a. IFF, IFF TEST SET, and EMERG IFF.

CHECK WITH BUILT-IN TEST SET

24. Procedure:

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

b. Set and hold each one of the mode switches M-1, M-2, M-3/A and M-C separately to TEST and then release 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:

(1) 00 – 70

(2) 10 – 71

(3) 30 – 73

NOTE

The TEST light may extinguish momentarily at a slow, steady repetition rate while the test switch is in MON position. This does not indicate malfunction. Random flickering and light out indicate 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

25. Procedure:

a. Warm up IFF for at least 1 minute 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 Vac. (Test set can be operated while battery is charging.)

c. On test set, make the following controls elections:

(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 2-7-4.

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.

NOTE

Throughout the following steps, do not select any reply code beginning with 77. Such codes could activate a ground station alarm.

i. 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.)

j. On IFF control, switch M-1 to OUT and M-2 to ON, and select mode 2 on test set.

k. Repeat Steps e, g and i for mode 2, using reply code selector switches on transponder. Start codes with 0000, and rotate switches through all positions.

l. On IFF control, switch M-2 to OUT and M-3/A to ON, and select mode 3/A on test set.

m. Repeat Steps e, g and i 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

26. Procedure:

CAUTION

This check radiates an emergency signal. It is made in 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.

NOTE

Refer to aircraft operating instructions manual C-12-114-000/MB-001, Section 2, Paragraph 24(b). DO NOT TRANSMIT MAYDAY.

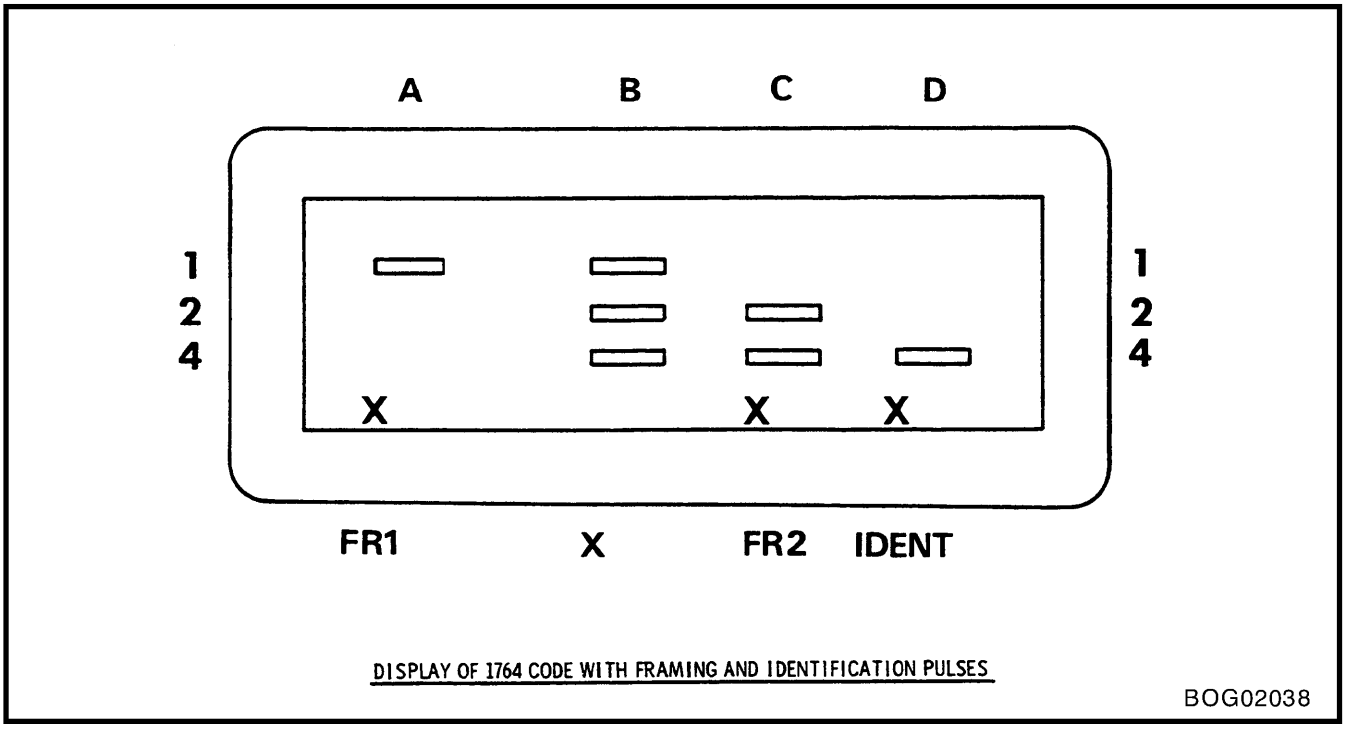


Figure 2-7-4 Typical Display on AN/APM-515 Test Set

c. Initiate a bailout sequence by selecting the ejection test switch to ON. Check that the 7700 code is indicated on test set. Select OVERRIDE on the auxiliary override panel, and check that the bailout tone ceases but 7700 code continues.

d. Select NORMAL on the bailout override panel (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

27. 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 kt on air-speed indicators.

d. Adjust baroset knob on altitude computer-indicator for a counter reading of 29.92 in. of 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 (see Paragraph 27), disconnect pressure-temperature test set.

ENCODER CIRCUIT CHECK

28. 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 Paragraph 27, Step 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. of Hg, and apply pressure altitudes to produce indications throughout the range shown in the table, Figure 2-7-5. At 500 ft ascending intervals throughout this range, check that the APM-515 test set readout agrees with the computer indicator dial.

e. Repeat Step d for descending intervals displaced 250 ft (approximately) from the ascending measurements.

NOTE

Altitude coding can be checked, if desired, by setting READOUT switch on test set to PILOT and referring to the coding table, see Figure 2-7-5.

f. Set the dc MASTER switch to OFF. Disconnect pressure-temperature test set. Disconnect ground power from aircraft.

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

Altitude	Reply code			
	A	B	C	D
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
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

Figure 2-7-5 (Sheet 1 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
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
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

Altitude	Reply code			
	A	B	C	D
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
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

Figure 2-7-5 (Sheet 2 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
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	5	4	0
18 900	7	5	6	0
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

Altitude	Reply code			
	A	B	C	D
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
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

Figure 2-7-5 (Sheet 3 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
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
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

Altitude	Reply code			
	A	B	C	D
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
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

Figure 2-7-5 (Sheet 4 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
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
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

Altitude	Reply code			
	A	B	C	D
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
43 700	3	5	4	4
43 800	3	7	4	4
43 900	3	7	6	4

Figure 2-7-5 (Sheet 5 of 6) Altitude Reply Codes

Altitude	Reply code			
	A	B	C	D
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

Altitude	Reply code			
	A	B	C	D
48 500	2	2	2	4
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
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 2-7-5 (Sheet 6 of 6) Altitude Reply Codes

SECTION 8

UNDERWATER ACOUSTIC BEACON

DESCRIPTION

GENERAL

1. The DK100 underwater acoustic beacon is a self-contained, battery-powered device that radiates pulsed acoustic signals to facilitate location of ditched aircraft. Immersion of the beacon in water activates a water-sensitive switch that permits continuous operation for 30 days.

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, FS 149, nose electronics compartment. Access to the beacon assembly is through the access panel located above the RH battery compartment.

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 piezoceramic 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 ms nominal duration and occur once every second. The beacon can withstand depths to 20 000 ft, permitting detection of emitted acoustic signals in the range between 2000 and 4000 yard.

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 regularly checking to ensure that the water switch is clean and dry, and wiping the switch clean in accordance with C-12-114-000/NE-000, Part 1, Section 3, Page 1-3-5-1.

FUNCTIONAL CHECKS

EQUIPMENT REQUIRED

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. Lock-wire the three screws with 0.020 in. monel wire.

d. Perform functional check.