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Introduction

Communications is a function of the Challenger 604 fully integrated avionics system and includes the following:

- Audio Integrating System
- VHF Communication System
- HF Communication System
- Radio Tuning System
- Cockpit Voice Recorder (CVR) System
- Flight Data Recorder (FDR) System
- Static Dischargers

Audio Integrating System

Description

The audio integrating system provides an interface between crew microphones, speakers, headphones, and the aircraft's radio, warning and recording systems. The audio integrating system also provides an interface between any or all flight crew and ground crew stations.

Components and Operation

The audio integrating system consists of the following components:

- two flight crew jack panels
- three ground crew interphone units (jacks)
- two speakers
- two audio control panels

Flight Crew Jack Panels

Two flight crew jack panels (Pilot and Copilot) are located in the flight compartment.

Ground Crew Interphone-Jack Units

The three ground crew interphone-jack units are installed in the following locations:

- nosewheel well
- main avionics bay
- aft equipment compartment

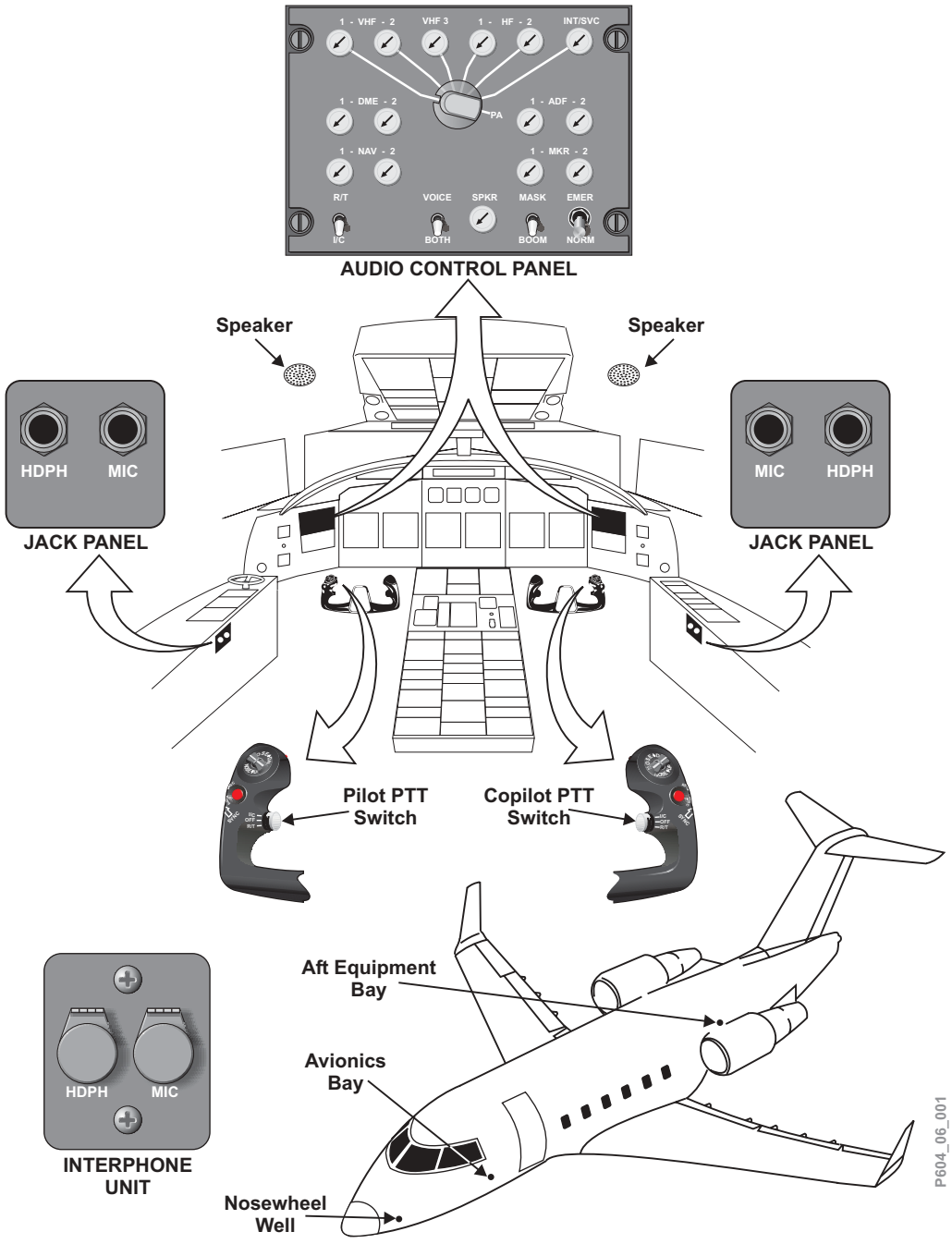
Each assembly is a metal-case sealed unit which has one microphone jack and one headphone jack. The microphone jacks in the nosewheel well and aft compartment are deactivated in flight by the WOW switch.

Speakers

Two independent speakers are mounted in the roof of the flight compartment for the pilot's and copilot's audio systems. The speakers allow audio monitoring without the use of headphones.

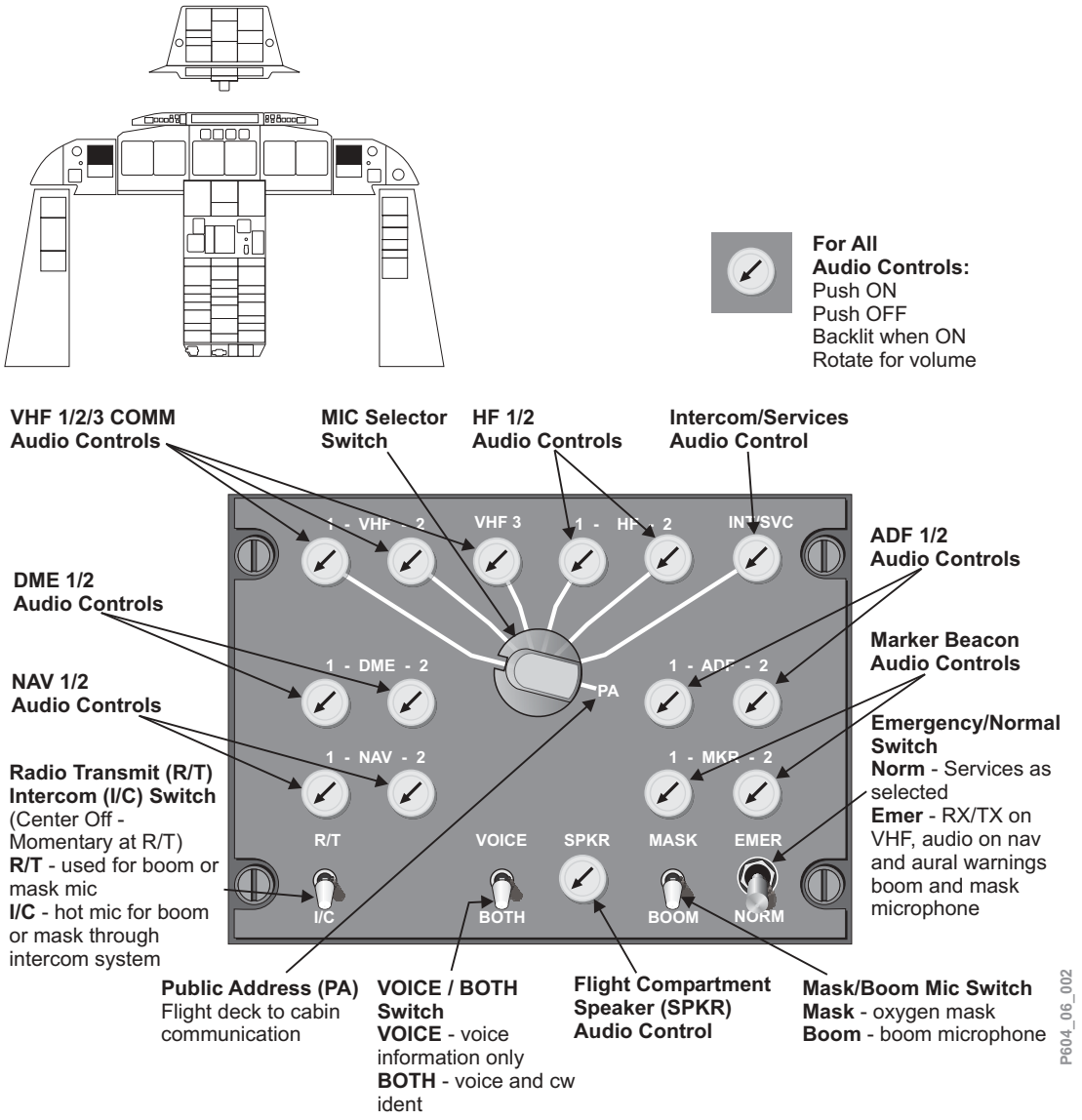
Controls and Indicators

The audio control panels provide controls for selecting and controlling receiver audio from the COM/NAV systems, and controls for connecting the microphone audio and keying to the HF/VHF systems.



Audio Integrating System Components

Figure 6-1



Audio Control Panel

Figure 6-2

VHF Communication System

Description

The VHF communication system consists of two very high frequency (VHF) transceivers (VHF 1 and VHF 2) which operate independently. The VHF transceivers provide amplitude modulated (AM) short-range voice communications in the frequency range of 118.00 to 151.975 MHz, selectable in increments of 25 KHz/ 8.33 KHz.

Components and Operation

The VHF communication system consists of the following components:

- two transceivers
- two antennas

Associated components:

- two radio tuning units (RTUs)
- two audio control panels
- one reversionary / inhibit panel
- integrated avionics processor system (IAPS)

Transceivers

Two VHF-422B transceivers contain the circuits required for transmission and reception of radio signals, and processing of audio signals.

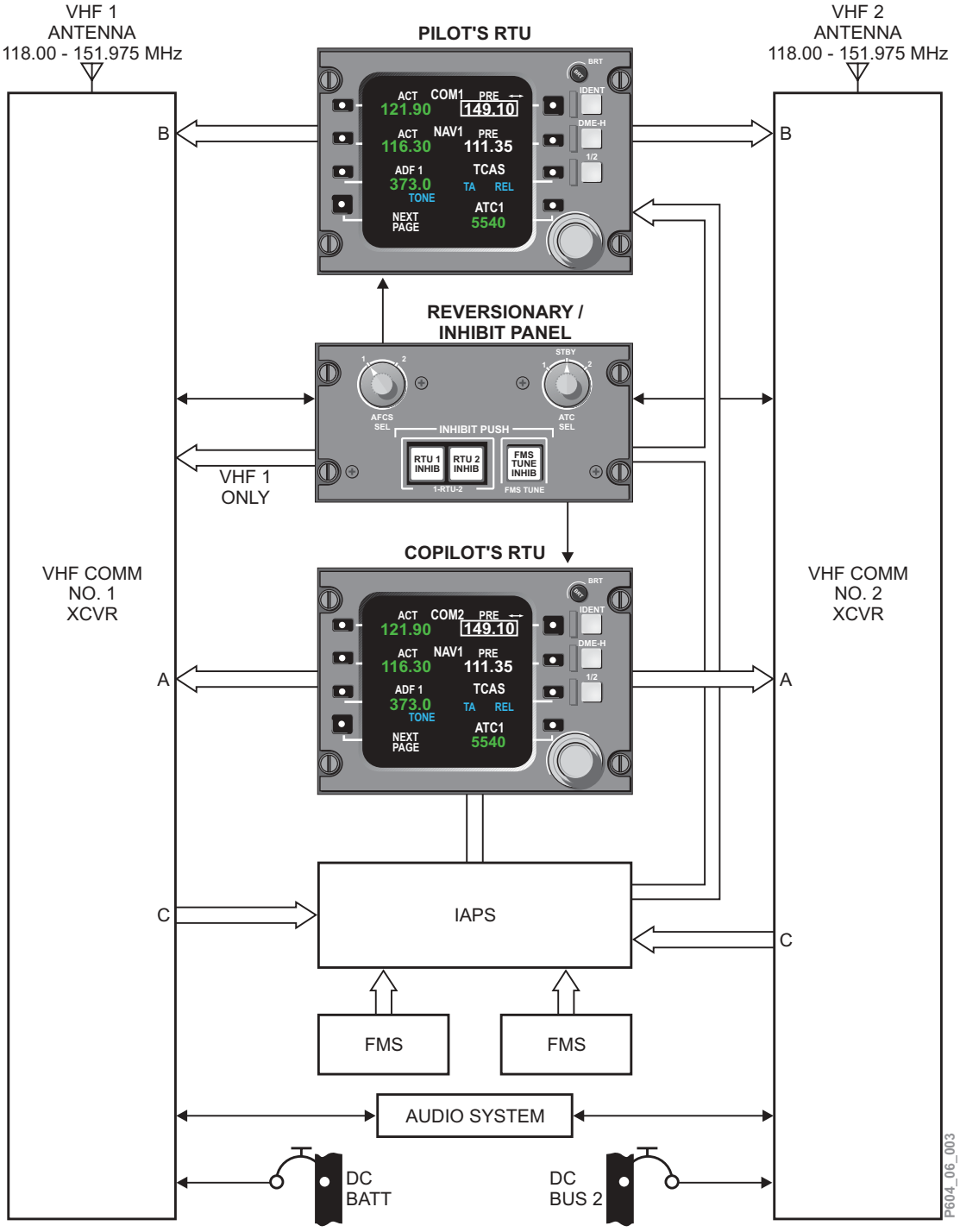
Antennas

There are two VHF antennas located as follows:

- VHF 1 antenna - upper side of the fuselage
- VHF 2 antenna - underside of the fuselage

Integrated Avionics Processor System

The integrated avionics processor system (IAPS) is a card cage assembly that physically houses some avionic line replaceable units (LRUs). The IAPS reads several avionic buses and distributes data to those LRUs requiring the information. Most avionics data is processed by this unit.



VHF Communication System - Block Diagram

Figure 6-3

Controls and Indicators

The VHF communication system controls and indicators are described in the following sections of this chapter:

- Audio control panel is described in the Audio Integrating System
- RTU and reversionary / inhibit panel are described in Radio Tuning System

The VHF transceiver is normally tuned by the on-side RTU. The VHF transceiver may also be tuned by the cross-side RTU or by the FMS. The VHF transceiver supplies an audio output to the audio system and a digital bus output to the IAPS. The data output contains the communication frequency which is echoed back to the RTUs.

HF Communication System

Description

The HF communication system consists of two high-frequency (HF) transceivers (HF 1 and HF 2) which operate independently.

Communication range on HF frequencies is longer (potentially global), but less reliable than on conventional VHF and UHF frequencies, and varies substantially with factors such as operating frequency, season, time of day, atmospheric noise, and solar activity.

Components and Operation

The HF communication system consists of the following components:

- two transceivers
- two couplers
- one antenna

Associated components:

- two radio tuning units (RTUs)
- two audio control panels
- one reversionary / inhibit panel
- one SELCAL decoder
- Integrated Avionics Processor System (IAPS)

Transceivers

The transceivers provide signal processing for transmission and reception. The unit consists of a control module, RF/IF module, frequency synthesizer, frequency standard, power supply/audio module and a power amplifier.

The transceivers provide amplitude modulated (AM) and single sideband (SSB) long-range voice communications in the frequency range of 2 to 30 MHz, selectable in increments of 100 Hz. Limited preset channel selection is also available and a SELCAL (selective calling) feature is incorporated.

The two HF transceivers are identical and independent. They may be operated simultaneously in receive mode but only one transceiver at a time can operate in transmit mode. In a dual HF system configuration, antenna coupler No. 1 and antenna coupler No. 2 exchange status (interlock) data to ensure that only one transceiver is connected to the antenna for the transmit mode. When one transceiver is keyed to transmit, the other transceiver is disconnected from the antenna and is unable to receive or transmit. Frequency and mode selection is covered in the RTU section.

Antenna Coupler

The antenna coupler matches the impedance of the transceivers to the antenna as different frequencies are selected and keyed.

Antenna

The antenna is an integral part of the leading edge of the vertical stabilizer. The antenna is connected to the antenna coupler units via an RF strap.

CAUTION

High voltages and currents are present in this area during transmissions.

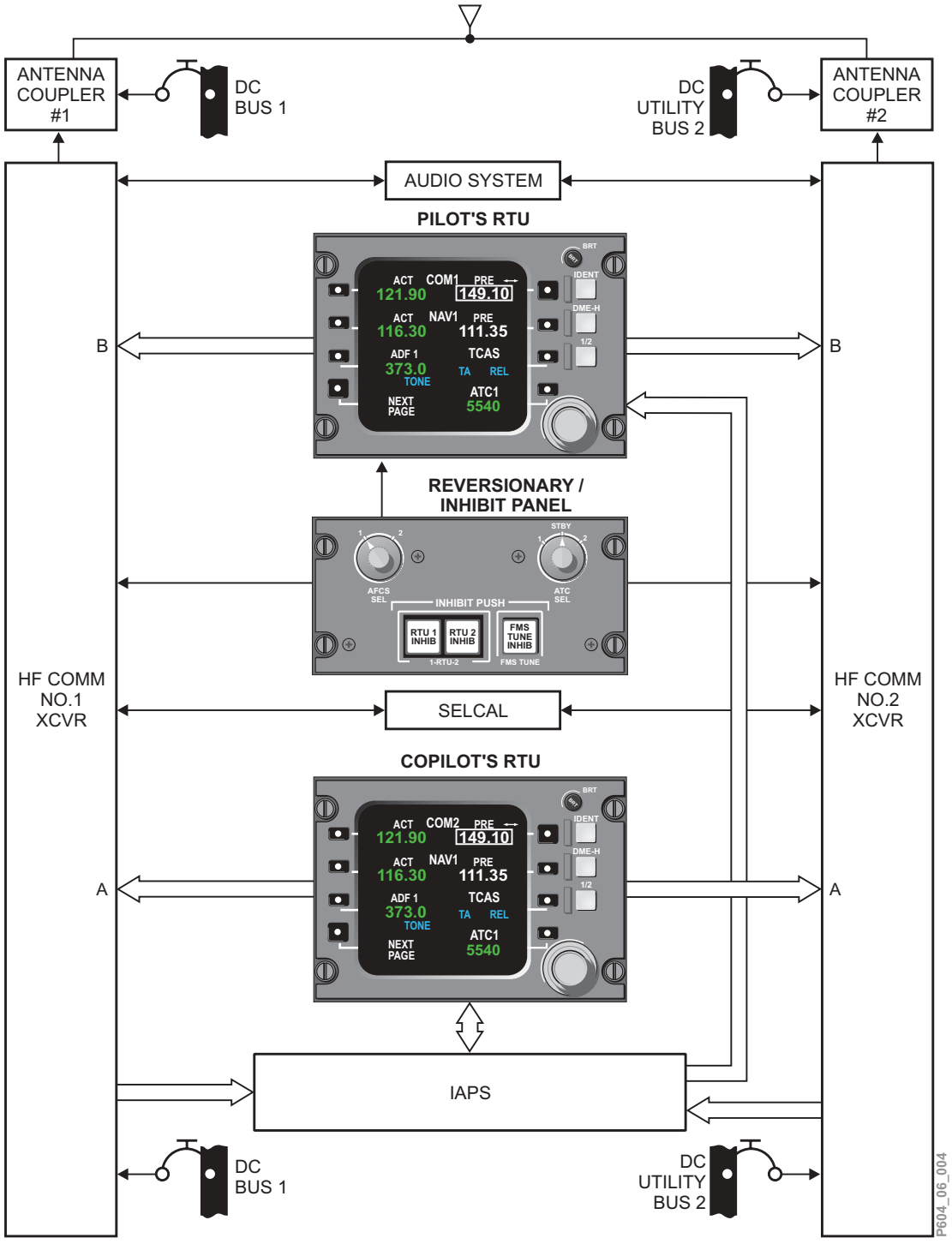
Selective Calling (SELCAL)

Both HF transceivers are coupled to a SELCAL system, which monitors the selected HF frequencies for the airplane's unique SELCAL code without requiring the crew to continuously monitor the HF audio. If the code is detected, an EICAS message and an audio alert are triggered to advise the flight crew that a ground station is calling. The EICAS message is reset when the appropriate HF transceiver is keyed to transmit.

Controls and Indicators

The HF communication system controls and indicators are described in the following sections of this chapter:

- Audio control panel is described in Audio Integrating System
- RTU and reversionary / inhibit panel are described in Radio Tuning System



HF Communication System - Block Diagram

Figure 6-4

Radio Tuning System

Description

The radio tuning system provides integrated control of airplane communication and navigation radio subsystems. It supports full cross-side and reversionary tuning, thus allowing single-point control of both on-side and cross-side radios from the pilot or copilot positions.

Components and Operation

The radio tuning system consists of the following components:

- two radio tuning units (RTUs)
- one reversionary / inhibit panel

For the Flight Management System (FMS) tuning of communications, refer to Chapter 17 Navigation Systems under the heading “TUNE PAGE” in the FMS section.

Controls and Indicators

Radio Tuning Unit (RTU)

Line Select Keys

The RTU has eight panel-mounted line select keys adjacent to the display, four on the left and four on the right of the display. Each key has a mechanical, momentary, nonlatching action. The functions performed by these keys vary with each display presented.

Dedicated Pushbuttons (IDENT, DME-H and 1/2)

There are three dedicated function pushbuttons on the RTU. These pushbuttons have mechanical, momentary, nonlatching actions, but may have latched functions implemented by system software.

Tune Knob Cluster

Two concentric knobs are used to tune frequencies (or select codes) for the RTU — both knobs are rate-aided. The functions controlled by the tuning/code knobs include:

- active frequency/code
- preset frequency/code
- numbered preset channels in the preset field only
- HF COM squelch/emission mode values

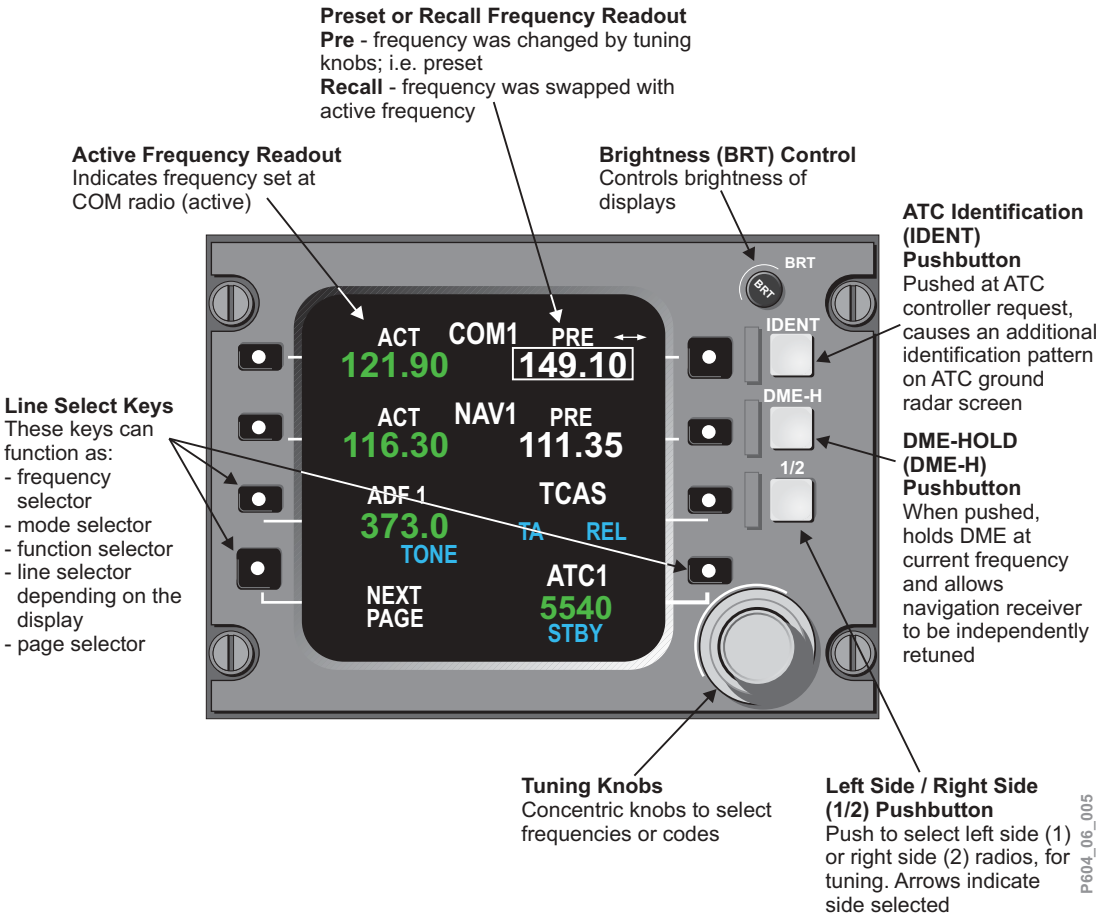
The function to be tuned is selected using the line select keys. A tuning window is displayed around the frequency/code to be tuned to confirm the selection.

Tuning Window

The tuning window is displayed as a rectangle around the frequency/code to be tuned or modified. The default position for the tuning window on the primary top level display is the VHF COM preset frequency.

NOTE

When no activity is detected from the line select keys or tuning/code knobs for 20 seconds, the display page reverts to the primary top level display and the tuning window is placed at the default position.



Radio Tuning Unit

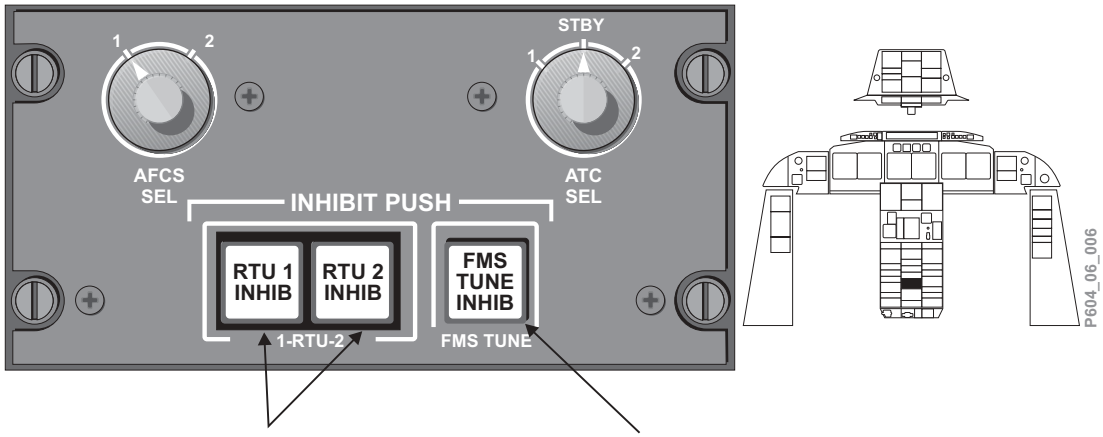
Figure 6-5

Active and Preset Frequencies/Codes

The preset frequency/code appears on the right side of the subdisplay. If the preset frequency/code has been tuned or otherwise modified, a PRE annunciator is displayed above it. If the active and preset frequencies/codes are swapped, a RECALL annunciator appears above the preset frequency/code. Additionally, if the tuning window surrounds the preset frequency/code, an arrow appears to the right of the PRE or RECALL annunciator to indicate that the next press of the associated line select key will cause the active and preset frequency/code to swap.

Reversionary/Inhibit Panel

The reversionary/inhibit panel allows selective deactivation of either or both RTUs, and/or inhibits the FMS from tuning the COM/NAV systems.



RTU 1 (2) INHIBIT Switch/Lights
RTU 1 - when pressed in (latched), light comes on, disables RTU 1 and enables direct cross-side tuning of off-side radios (RTU 2 controlling COM 1, NAV 1, etc.)
RTU 2 - when pressed in (latched), light comes on, disables RTU 2 and enables cross-side tuning of off-side radios (RTU 1 controlling COM 2, NAV 2).

FMS TUNE INHIB Switch/Light
When pressed in (latched), light comes on and prevents RTUs from being tuned by either FMS.

Reversionary/Inhibit Panel
Figure 6-6

Operation

The operation of the RTU is presented in a sequence that shows the top page followed by the hierarchy of the selected system.

Display Hierarchy

The RTU display is two-level tiered for the VHF COM/NAV, ADF, ATC and TCAS systems as follows:

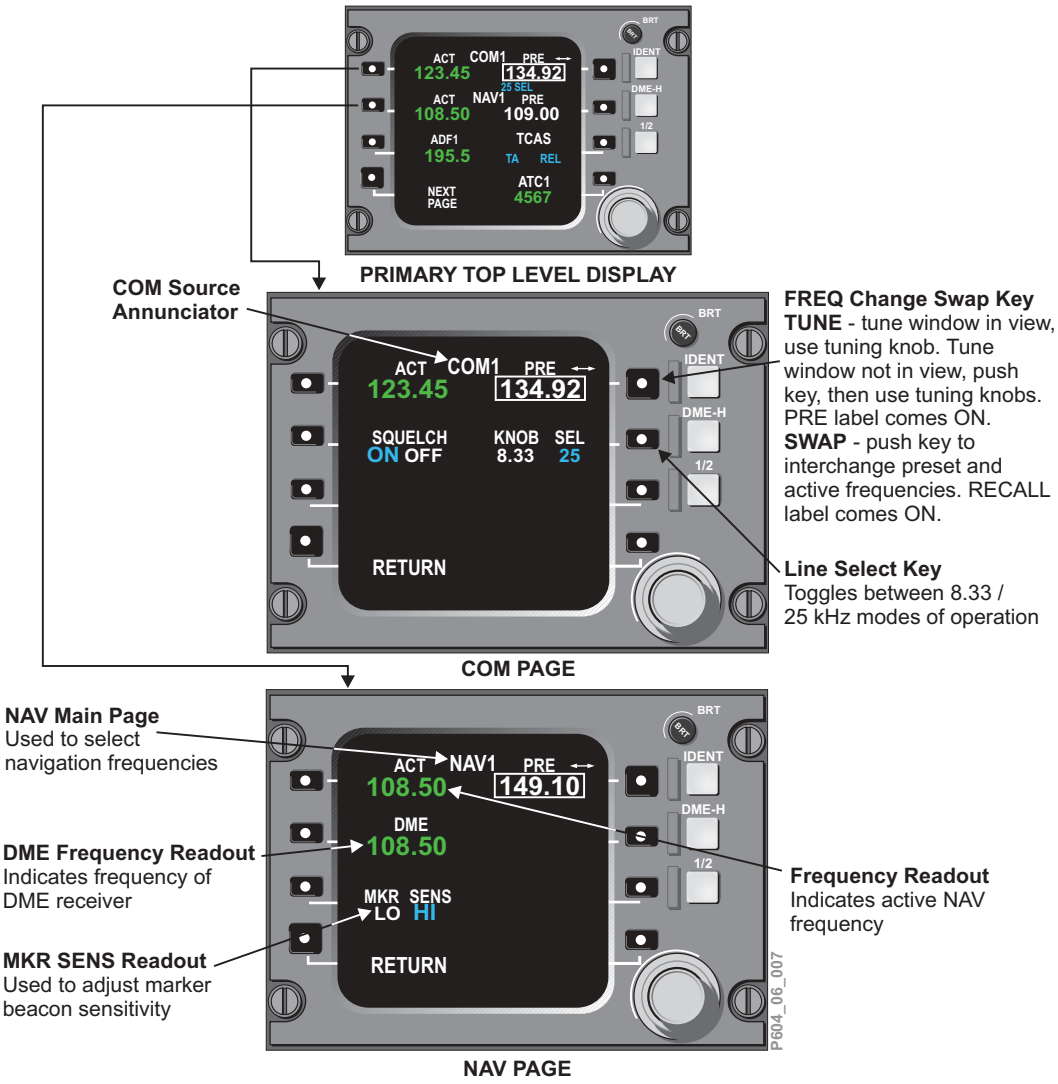
- primary top level display
- main display page

The RTU display is three-level tiered for the auxiliary VHF COM (3) transceiver as follows:

- primary top level display
- secondary top level display
- auxiliary VHF COM main

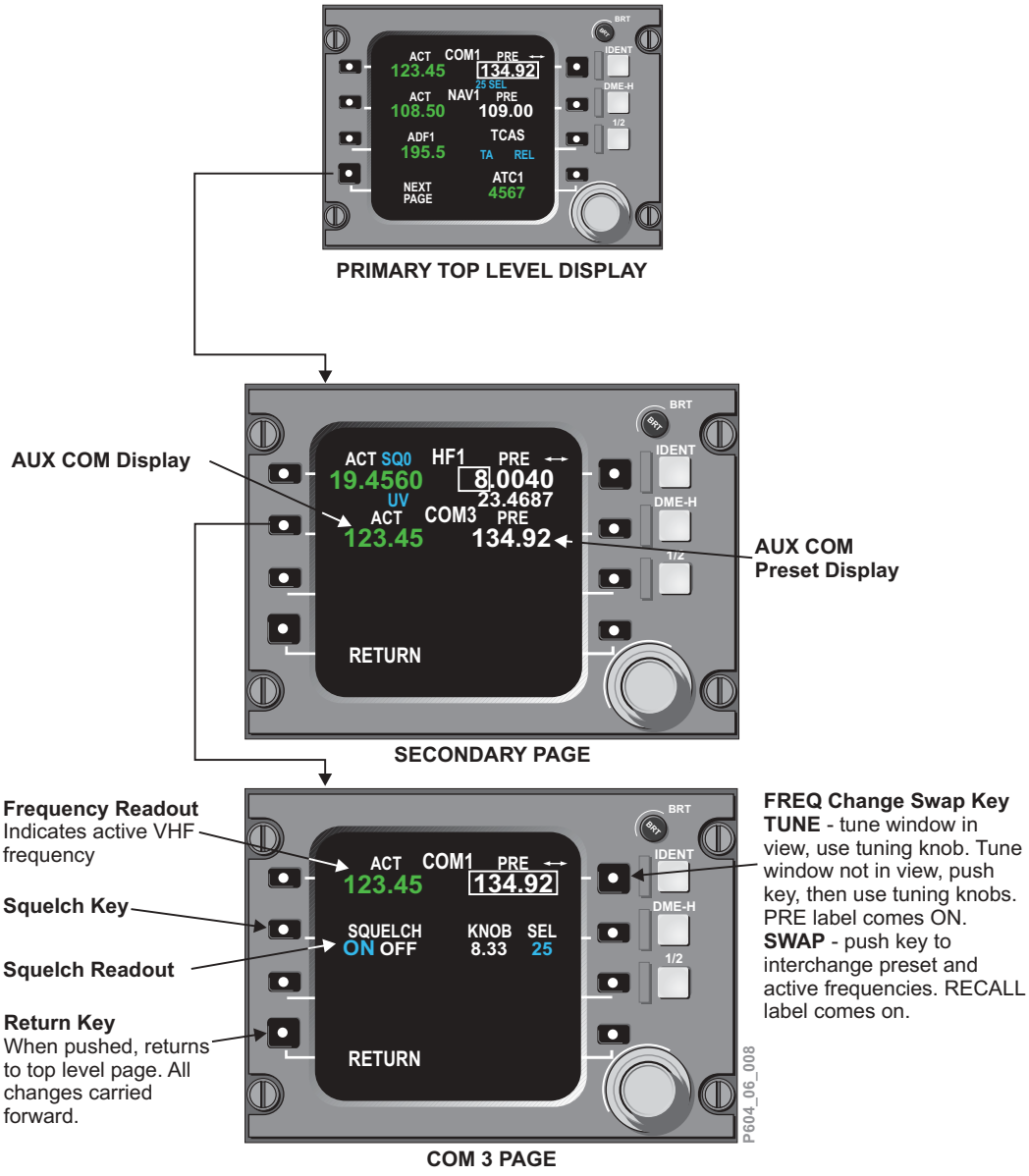
The RTU display is four-level tiered for the HF COM system as follows:

- primary top level display
- secondary top level display
- HF COM main
- number preset pages



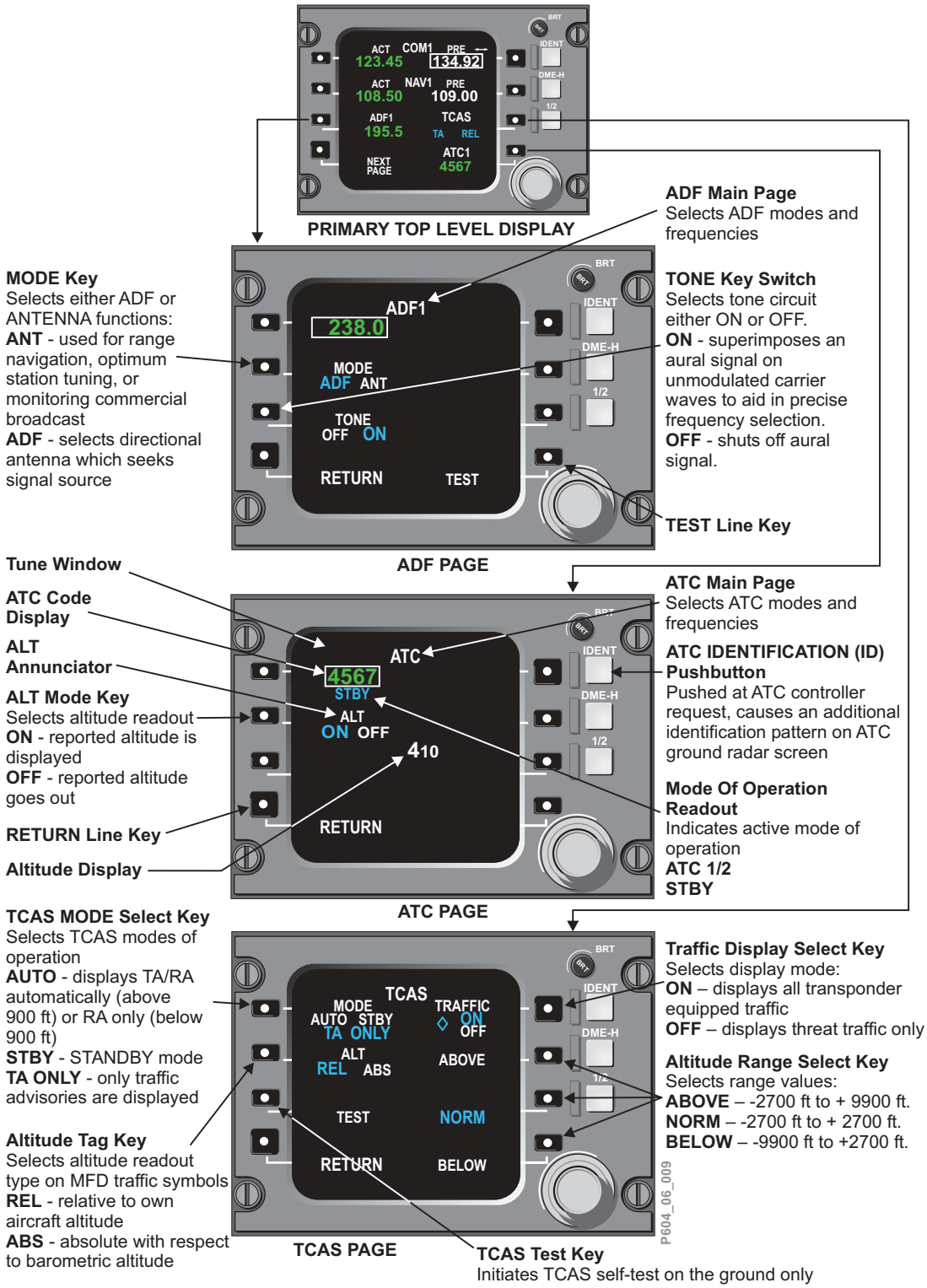
COM/NAV Selections

Figure 6-7



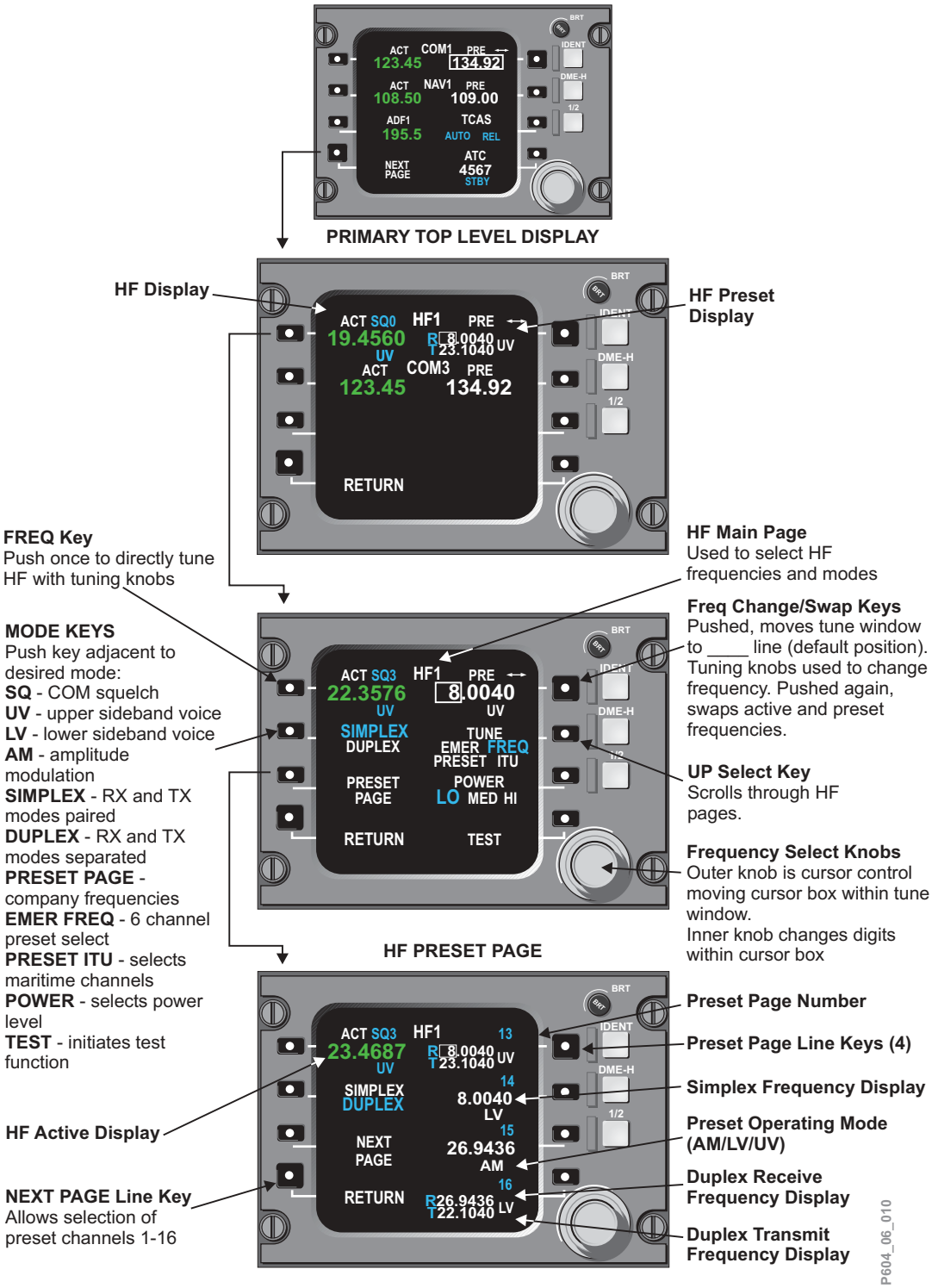
COM 3 Selections

Figure 6-8



ADF, ATC and TCAS Selections

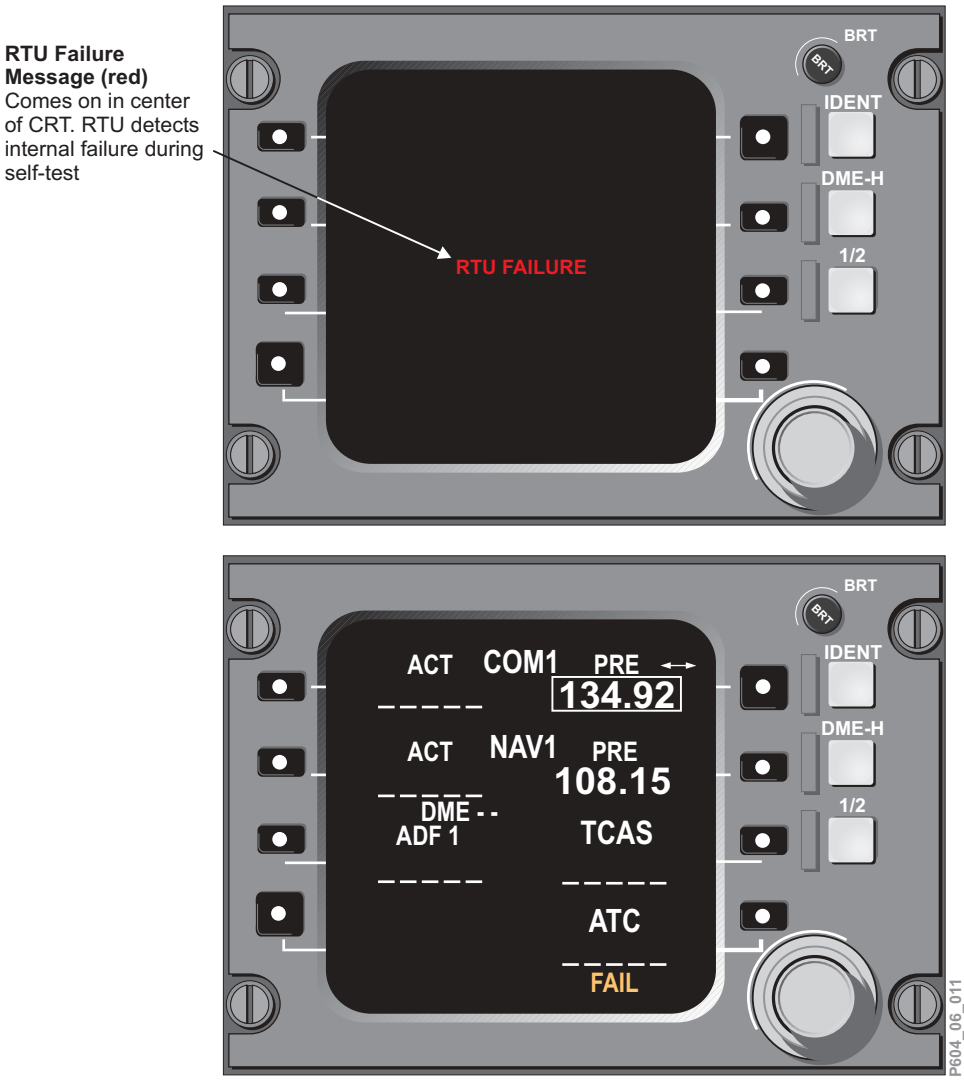
Figure 6-9



HF Selections

Figure 6-10

RTU Failure Indications



RTU and COM/NAV Failure Indications

Figure 6-11

Self-Test

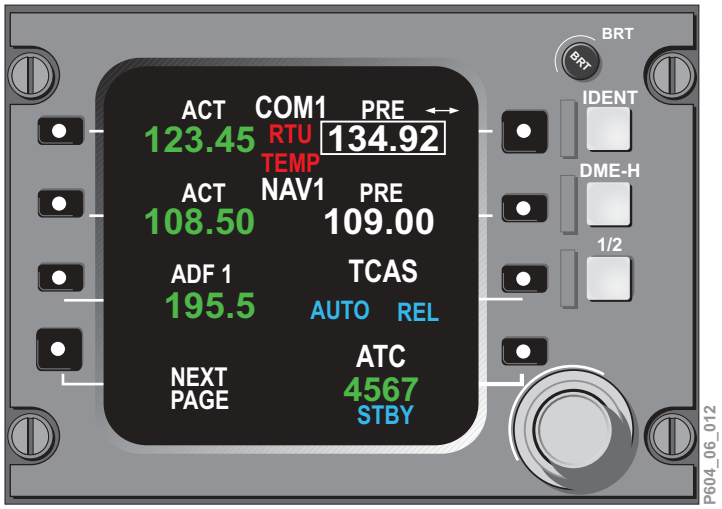
On power-up, the RTU performs a self-test. Should the RTU fail the self-test, the screen will go blank and an RTU FAILURE annunciator will appear in the center of the screen.

Overtemperature

The internal temperature is constantly monitored. If the temperature exceeds the internal threshold, the RTU TEMP annunciator is displayed.

Readout

When a value is selected, it is not displayed on the RTU unless it has been accepted by the addressed system or unit and returned to the RTU. If the echoed data does not match the new value selected within two seconds, the displayed data is replaced by dashes indicating that the selection has failed.



RTU TEMP Annunciation
Figure 6-12

Cockpit Voice Recorder System

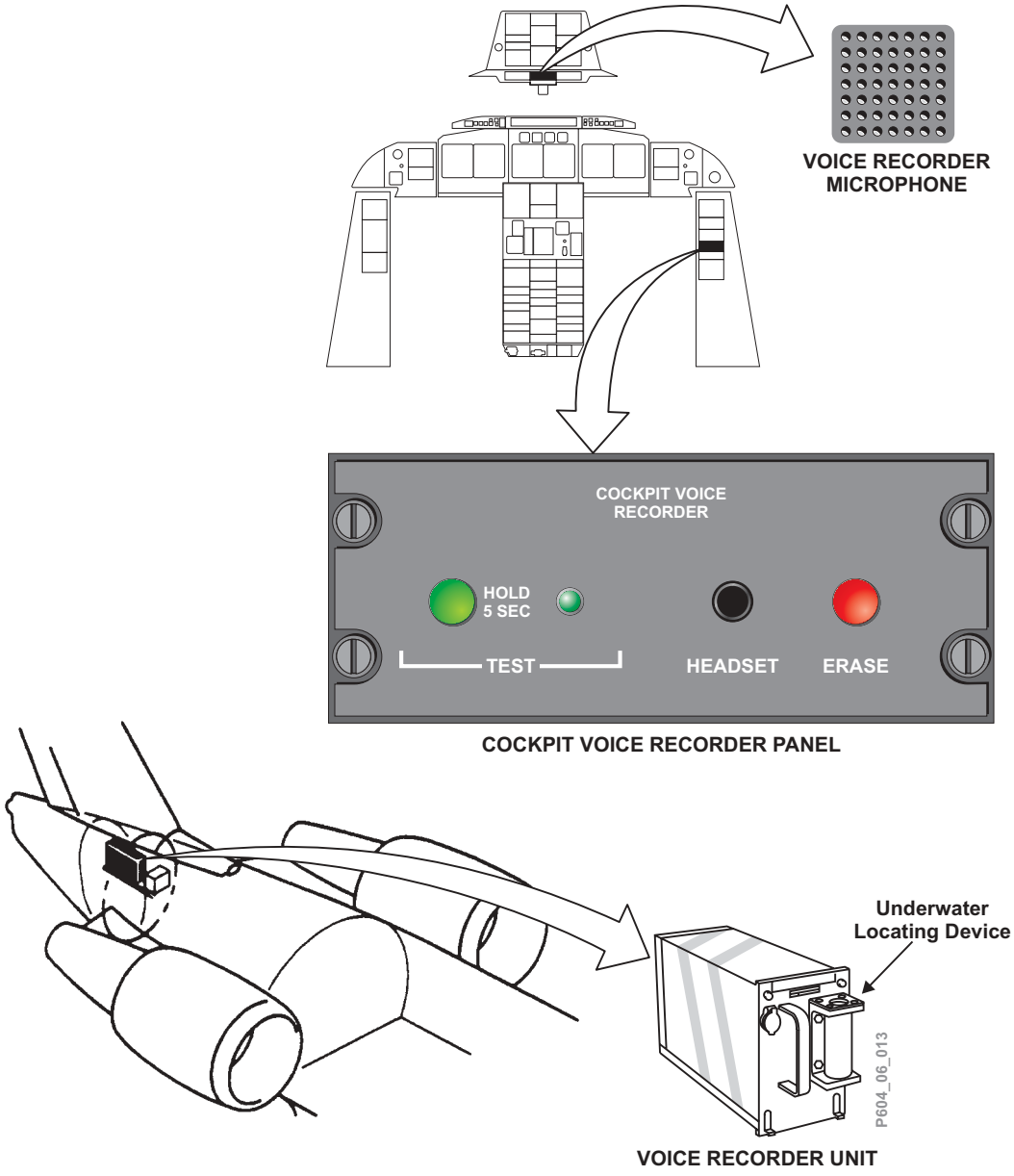
Description

The cockpit voice recorder (CVR) system is a high-fidelity recorder which records the flight crew conversations, radio communications and flight compartment sounds on three separate channels. A fourth channel is used for synchronization with the flight data recorder (FDR). The system operates in conjunction with the audio integrating system. The CVR consists of the following components:

- one recorder
- one CVR control unit
- one microphone

Recorder

The recorder is designed to continuously acquire and store, in a solid-state memory, audio data for a minimum of 30 minutes. The solid-state memory has no moving parts to ensure maximum reliability.



CVR System

Figure 6-13

CVR Control Unit

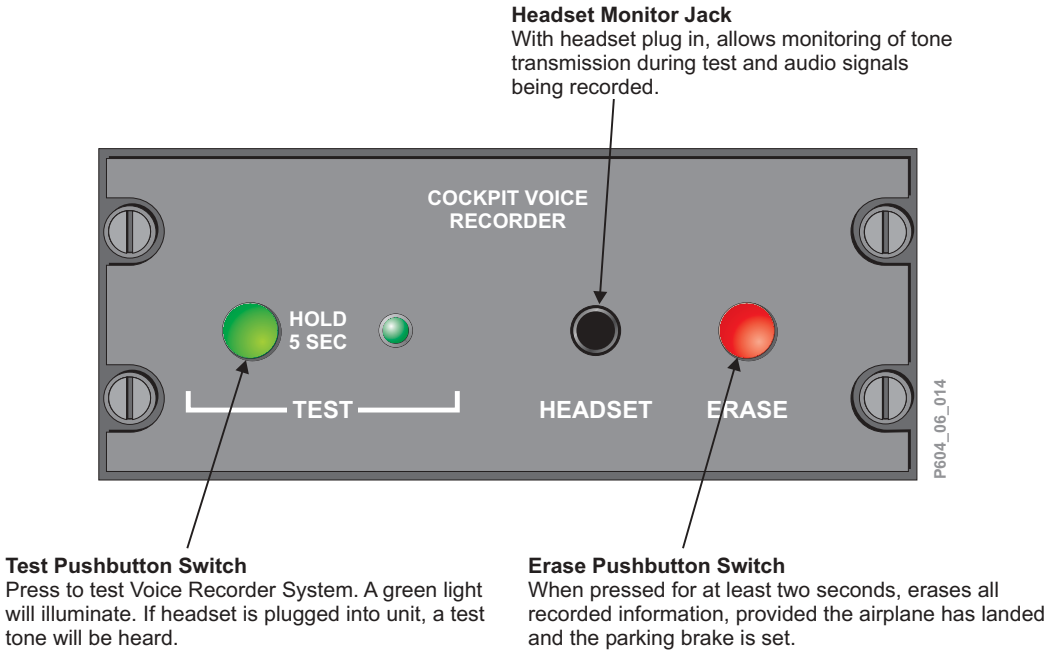
The CVR control unit contains a meter, an ERASE and a TEST Pushbutton, and a headset monitor jack.

Microphone

The remote area microphone is mounted on the overhead panel behind a grille. The microphone picks up flight compartment conversations and sounds, and feeds them into the recorder.

Controls and Indicators

For controls and indicators, refer to the CVR control unit section.



Cockpit Voice Recorder Panel

Figure 6-14

Operation

The CVR constantly records when power is supplied to the system. The only way to preserve specific recorded information is to pull the CVR circuit breaker or otherwise shut down the system.

Test

Incorporated into the CVR is a built-in-test-equipment (BITE) utility program which provides a go/no-go indication.

The self-test is initiated by pressing the TEST Pushbutton on the CVR control unit. This causes a test tone to be applied to each channel individually. The test tone is processed, stored in memory and read from memory. The tone is then checked for expected frequency and amplitude.

Visual indication of the test is provided on the test meter. The test meter provides an indicator signal which is the go/no-go display.

The phone jack permits monitoring of the actual recorded audio as well as the tone bursts during test.

Erase

The ERASE Pushbutton will bulk-erase the entire memory, provided that the parking brake is set and the WOW interlocks are closed. The bulk-erase Pushbutton must be held for more than two seconds for the bulk-erase to take place.

Flight Data Recorder System

Description

The flight data recorder (FDR) is a solid-state system that records airplane flight parameters for future retrieval and analysis.

The FDR puts a digital stream of data from the data concentrators into a solid-state memory module which has a capacity to retain 25 hours of data. When the memory module is full, the data is progressively overwritten by the most recent data being recorded.

Components and Operation

The FDR system consists of the following components:

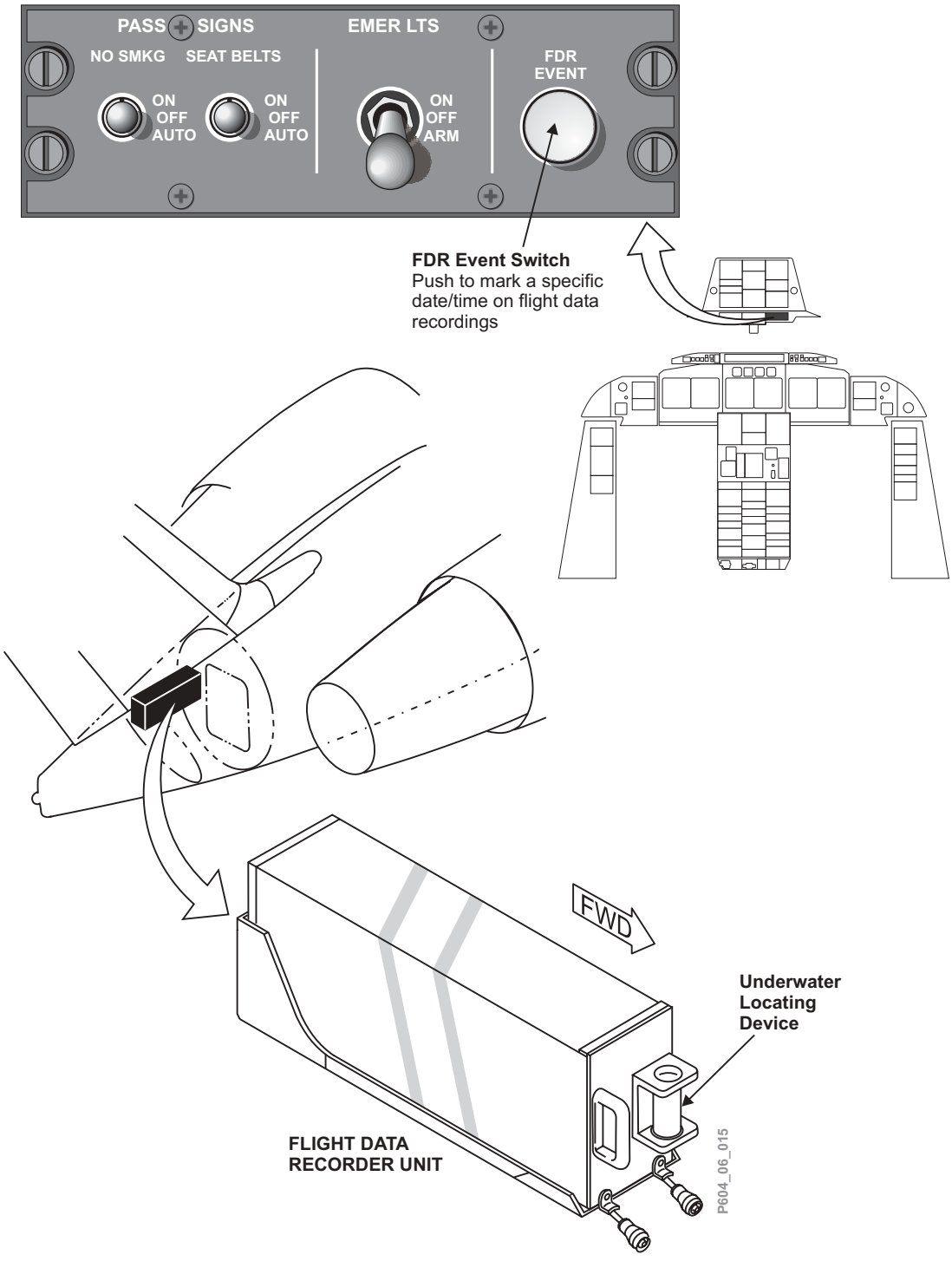
- one recorder
- one FDR EVENT switch

Recorder

The recorder solid-state memory has no moving parts. This ensures maximum reliability. Recorded data may also be retrieved (downloaded) for analysis purposes.

The FDR is automatically turned on when the right engine start switch is pushed. It then starts to record data from the data concentrator unit (DCU). This data is fed back to the originating DCU. If the DCU is unable to synchronize with the data returned from the FDR for longer than 8 seconds, the FDR FAIL status message will be displayed on the EICAS.

The FDR shuts down when power is removed from the system by pulling the FDR circuit breaker or by shutting down the aircraft.



Flight Data Recorder System

Figure 6-15

Controls and Indicators

FDR EVENT Switch

The FDR EVENT switch is located on the PASS SIGNS/EMER LTS/FDR EVENT panel. When pushed, the switch sends a signal to the data concentrators which place a marker in the recorder memory to facilitate data retrieval. An event marker can be added to the FDR any time the FDR is operating.

EICAS Messages

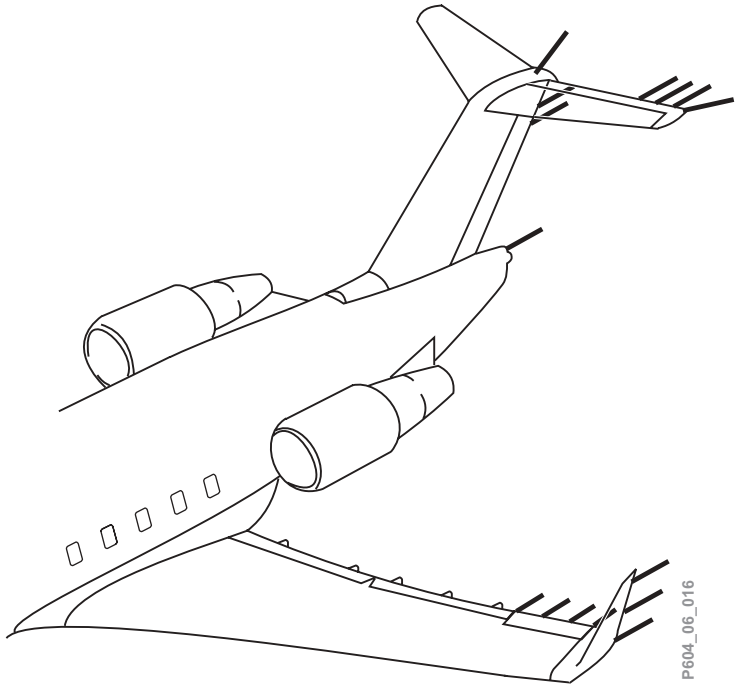
MESSAGE	MEANING	AURAL WARNING (IF ANY)
FDR EVENT	Confirm the flight data recorder has set a marker in response to activation of the button on the control panel.	
SELCAL HF 1/2	A call for this aircraft has been detected on the respective high-frequency radio. Message will be canceled when that radio is keyed to reply.	"SELCAL"
FDR FAIL	Indicates the flight data recorder is inoperative.	

EICAS Messages
Table 6-1

Static Dischargers

Description

The aircraft is equipped with a system of wicks on the aft-facing surfaces and horizontal stabilizer tips. Each wick consists of a base and a discharger. The 24 (26 as per SB 604-23-006) dischargers allow gradual bleed-off of static electrical charges from the airframe to prevent radio interference.



Static Dischargers Location
Figure 6-16