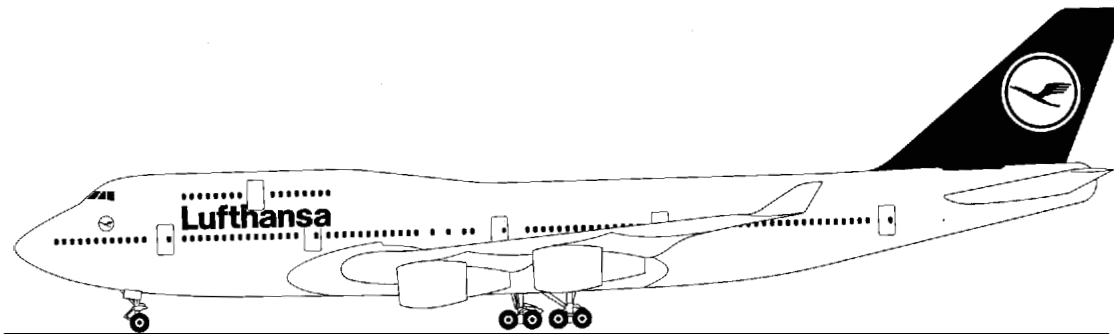




Lufthansa Technical Training

Training Manual B 747-400

ATA 23-71 VOICE RECORDER ATA Spec. 104 Level 3





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Lufthansa Technical Training GmbH

Lufthansa Base Frankfurt

D-60546 Frankfurt/Main

Tel. +49 69 / 696 41 78

Fax +49 69 / 696 63 84

Lufthansa Base Hamburg

Weg beim Jäger 193

D-22335 Hamburg

Tel. +49 40 / 5070 24 13

Fax +49 40 / 5070 47 46

CVR



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ATA 23-71 COCKPIT VOICE RECORDER

CVR



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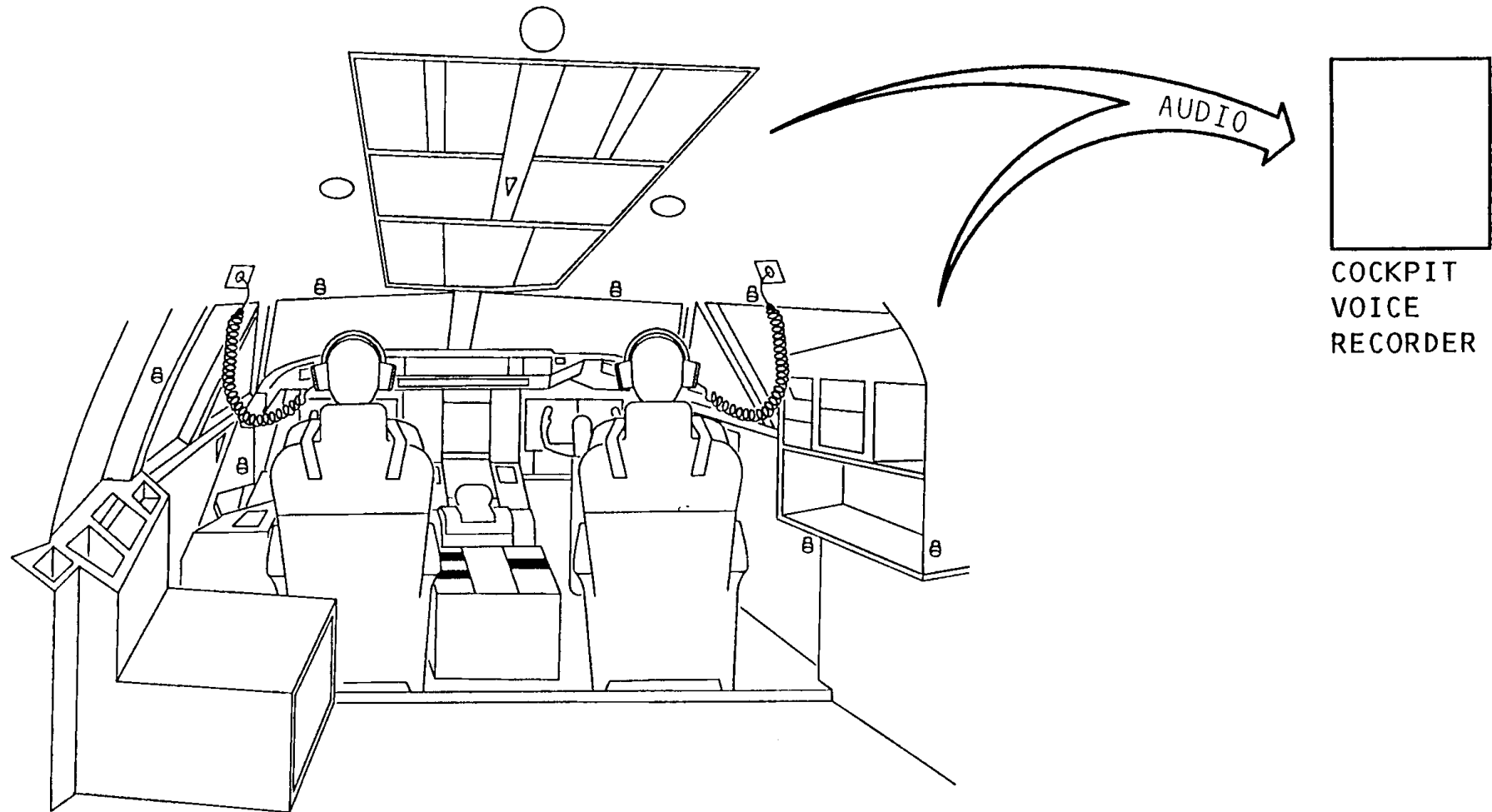
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VOICE RECORDER SYSTEM - INTRODUCTION

The voice recorder system continuously records the last 30 minutes of flight crew communications, conversations, and flight deck sounds such as aural warnings. The recorded audio can be useful in post-incident investigations.

**Figure 1 VOICE RECORDER SYSTEM - INTRODUCTION**



CVR

VOICE RECORDER SYSTEM

General

The cockpit voice recorder (CVR) receives audio from the:

- Audio management unit (AMU)
- CVR microphone.

The cockpit voice recorder panel connects the cockpit voice recorder microphone and the CVR.

Components

The voice recorder system has these components:

- Cockpit voice recorder microphone
- Cockpit voice recorder panel
- CVR.

The cockpit voice recorder microphone collects flight compartment sounds, such as voices and aural warnings. The audio goes through the cockpit voice recorder panel to the CVR.

The AMU sends these three channels of audio to the CVR:

- Captain
- First officer (FIO)
- First observer (F/OBS).

You monitor recorded audio with phone jacks at these locations:

- Cockpit voice recorder panel
- P37 nose wheel well

An erase switch on the cockpit voice recorder panel is disabled.

A test switch on the cockpit voice recorder pane starts a test of the voice recorder system. The cockpit voice recorder panel shows the results of the test.

An underwater locator beacon is on the front panel of the CVR. It operates underwater.

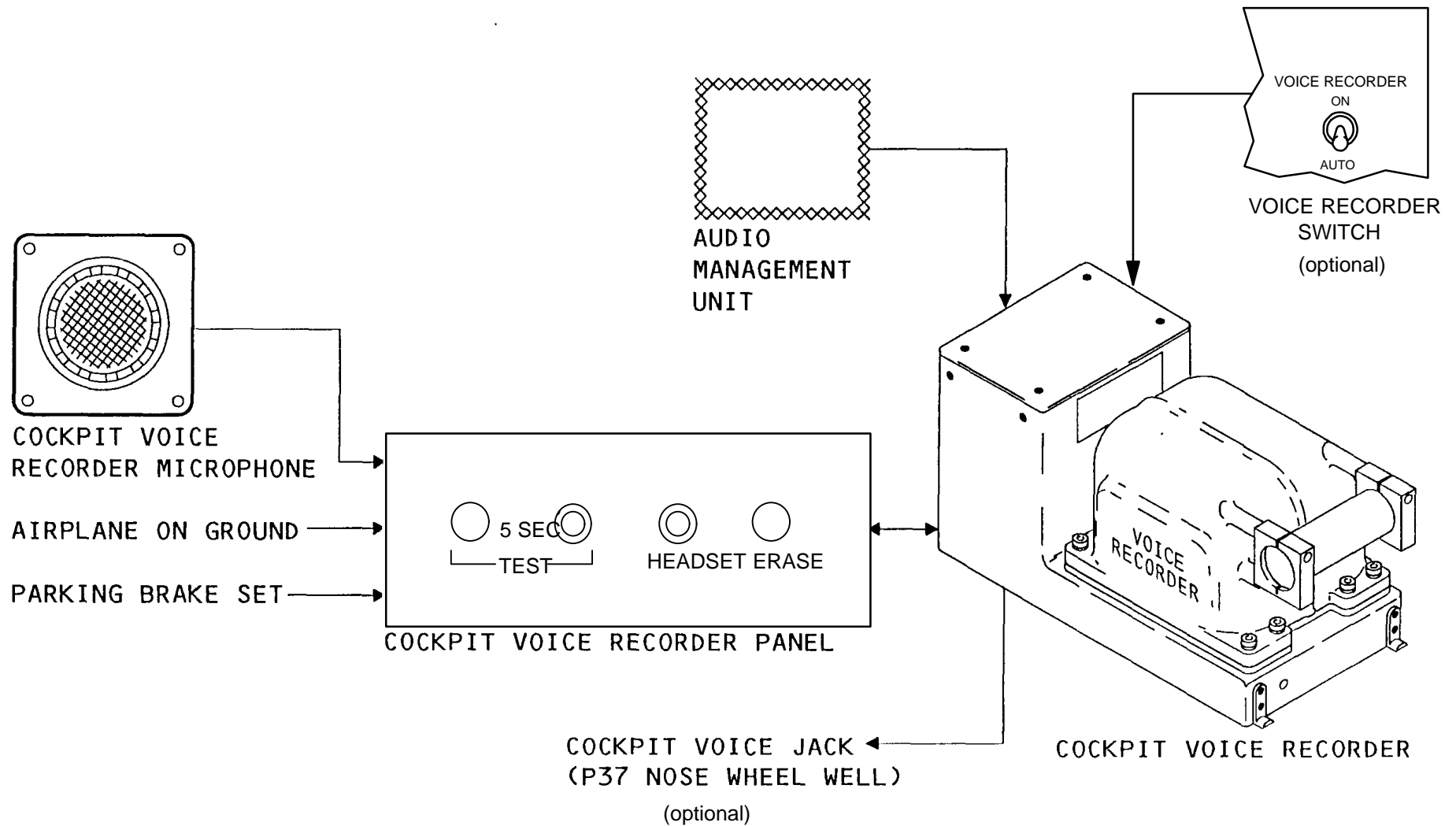


Figure 2 VOICE RECORDER SYSTEM (Digital)



CVR

VOICE RECORDER SYSTEM

General

The cockpit voice recorder (CVR) receives audio from the:

- Audio management unit (AMU)
- CVR microphone.

The cockpit voice recorder panel connects the cockpit voice recorder microphone and the CVR.

Components

The voice recorder system has these components:

- Cockpit voice recorder microphone
- Cockpit voice recorder panel
- CVR.

The cockpit voice recorder microphone collects flight compartment sounds, such as voices and aural warnings. The audio goes through the cockpit voice recorder panel to the CVR.

The AMU sends these three channels of audio to the CVR:

- Captain
- First officer (FIO)
- First observer (F/OBS).

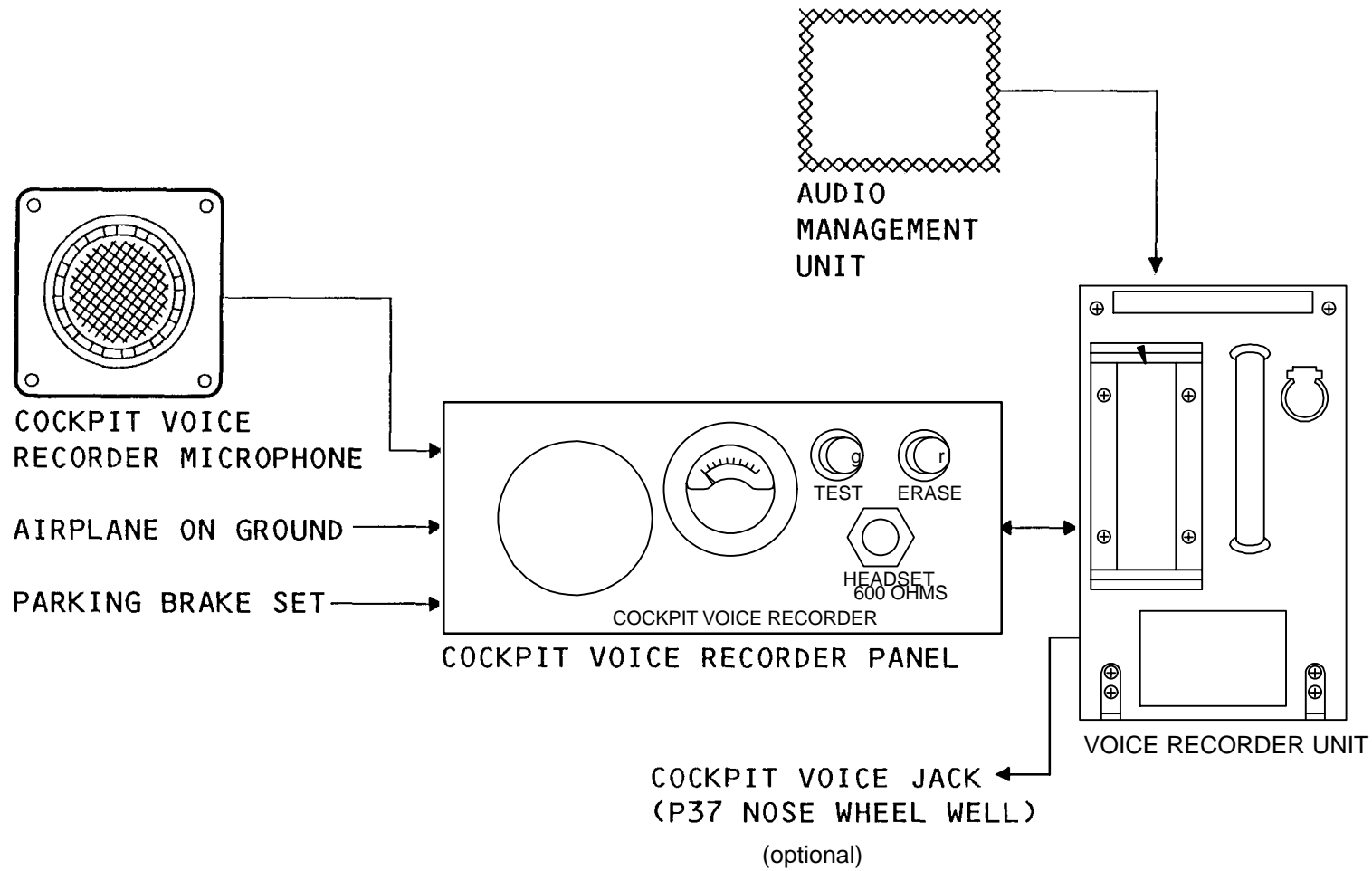
You monitor recorded audio with phone jacks at these locations:

- Cockpit voice recorder panel
- P37 nose wheel well (optional)

An erase switch on the cockpit voice recorder panel is disabled.

A test switch on the cockpit voice recorder pane starts a test of the voice recorder system. The cockpit voice recorder panel shows the results of the test.

An underwater locator beacon is on the front panel of the CVR. It operates underwater.

**Figure 3 VOICE RECORDER SYSTEM (analog)**



CVR

VOICE RECORDER SYSTEM

General

The cockpit voice recorder (CVR) receives audio from the audio management unit (AMU) and CVR microphone. The cockpit voice recorder panel connects the cockpit voice recorder microphone and the CVR.

Components

The voice recorder system has these components:

- Cockpit voice recorder microphone
- Cockpit voice recorder panel
- CVR.

The cockpit voice recorder microphone collects flight compartment sounds, such as voices and aural warnings. The audio goes through the cockpit voice recorder panel to the CVR.

The AMU sends these three channels of audio to the CVR:

- Captain
- First officer (F/O)
- First observer (F/OBS).

You monitor recorded audio with a phone jack on the cockpit voice recorder panel.

An erase switch on the cockpit voice recorder panel erases the recorded audio when the airplane is on the ground and the parking brake is Set. A test switch on the cockpit voice recorder panel starts a test of the voice recorder system. The cockpit voice recorder panel shows the results of the test.

An underwater locator beacon is on the front panel of the CVR. It operates underwater.

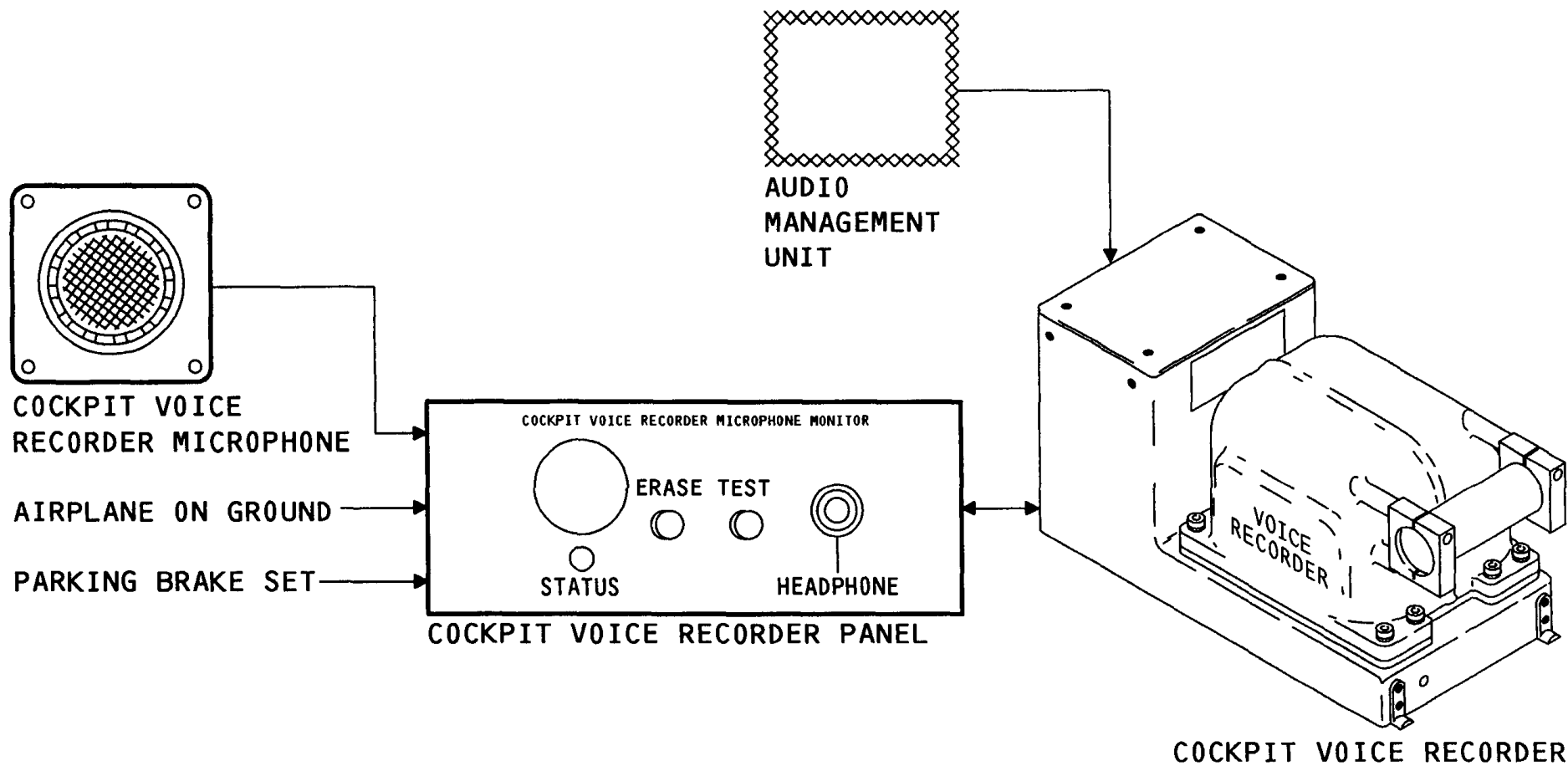


Figure 4 VOICE RECORDER SYSTEM (Digital)

CVR



COMPONENT LOCATIONS - FD, NOSE WHEEL WELL

The voice recorder system components in the flight deck are:

- Voice recorder control panel
- Voice recorder ON/AUTO switch (optional)
- Microphone monitor panel
- Circuit breaker

There is an optional voice recorder jack on the nose wheel well control panel (P37).

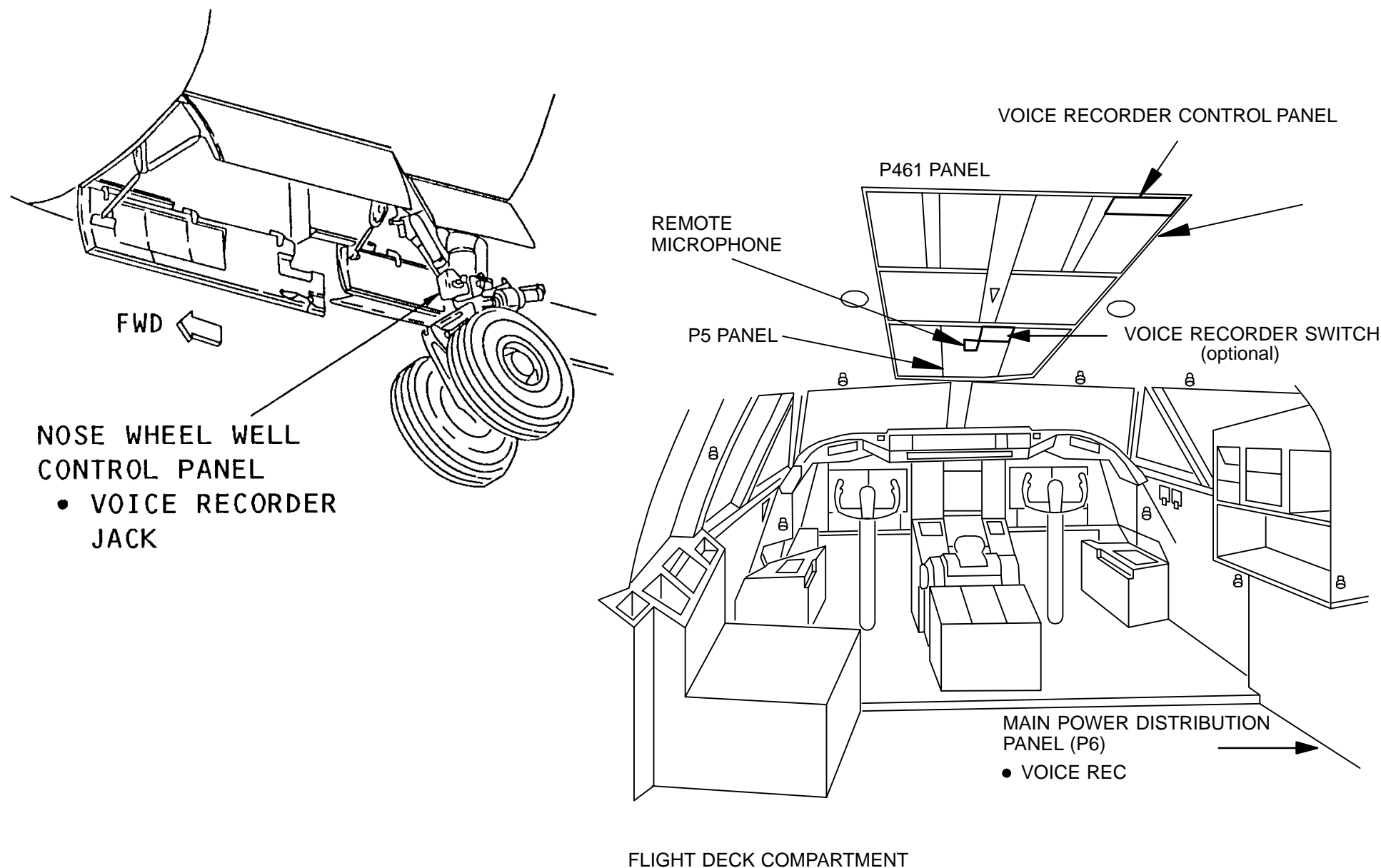


Figure 5 COMPONENT LOCATIONS - FD, NW

CVR



COMPONENT LOCATION - AFT EQUIPMENT CENTER

The cockpit voice recorder is in the aft equipment center (E8).

A ceiling access panel allows access to the E8 rack.

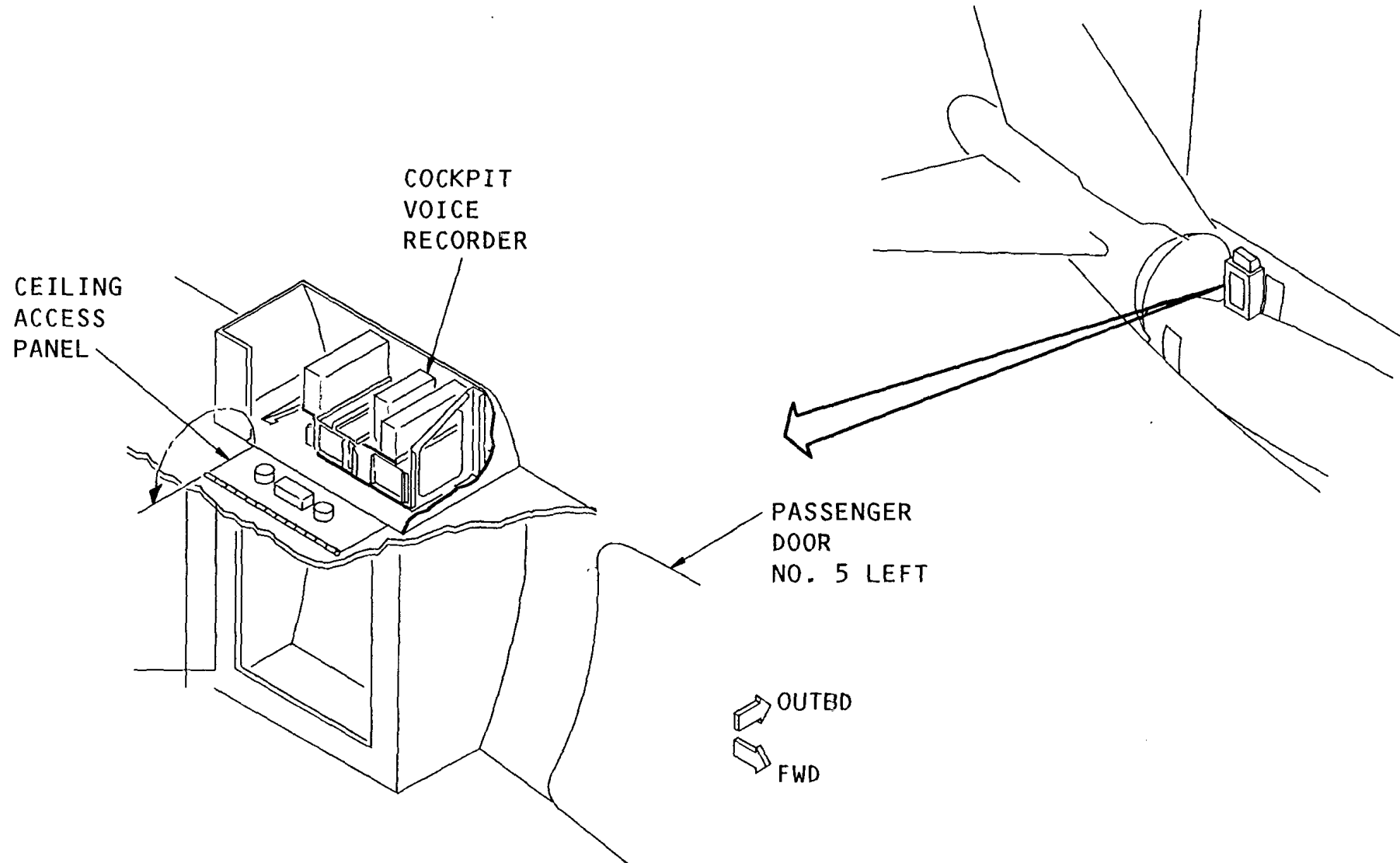


Figure 6 COMPONENT LOCATION - AFT EQUIP CTR



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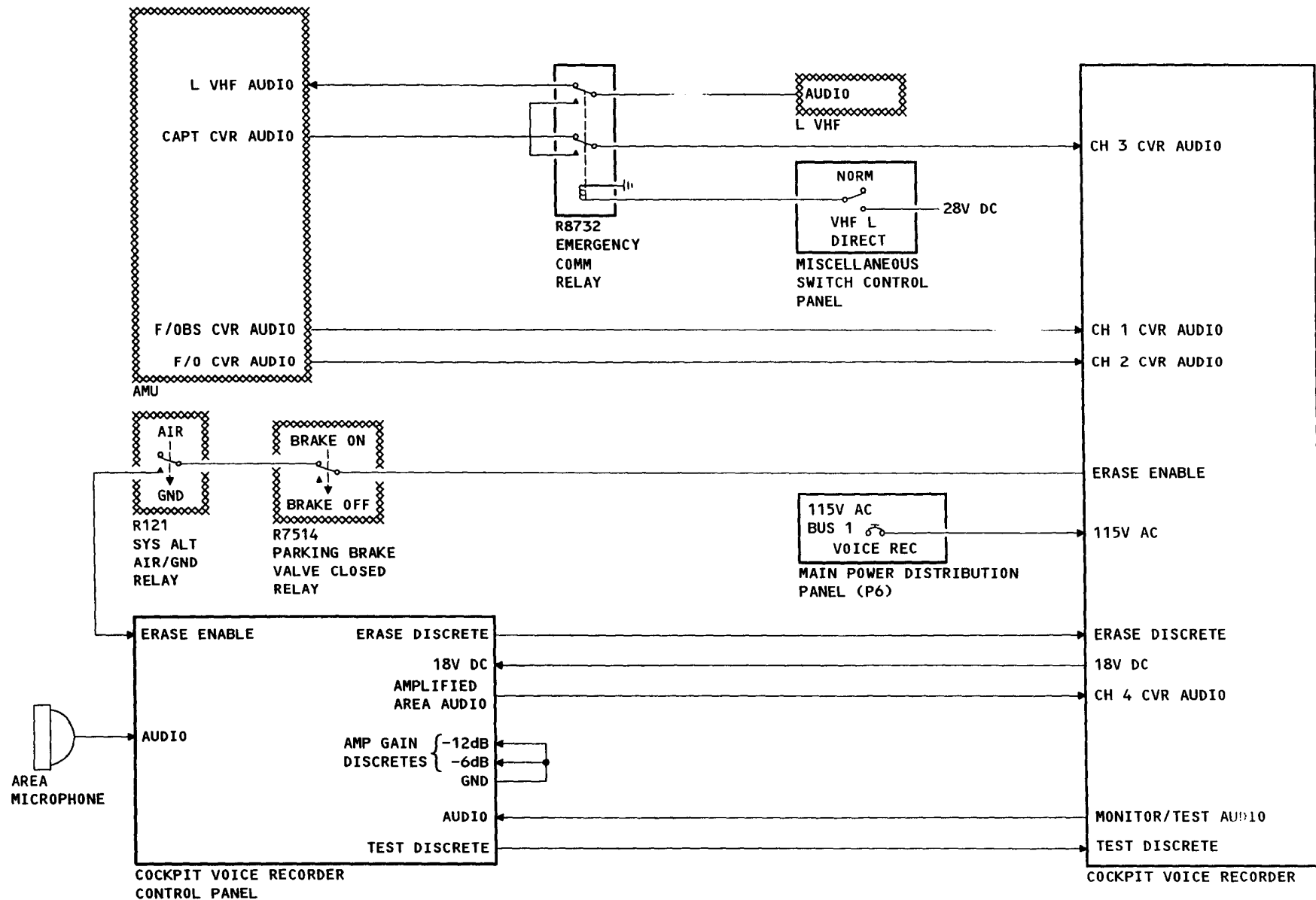


Figure 7 CVR – INTERFACE DIAGRAM



CVR

CONTROL PANEL INTERFACE

Power

The cockpit voice recorder (CVR) gets 115v ac from the voice recorder circuit breaker. The CVR supplies:

- 18v dc to the audio amplifier in the voice recorder control panel.
- An externally routed bias jumper.

Cockpit Voice Recorder

The CVR sends:

- Audio to the control panel and the nose wheel well control panel.
- Test output to the control panel. meter.

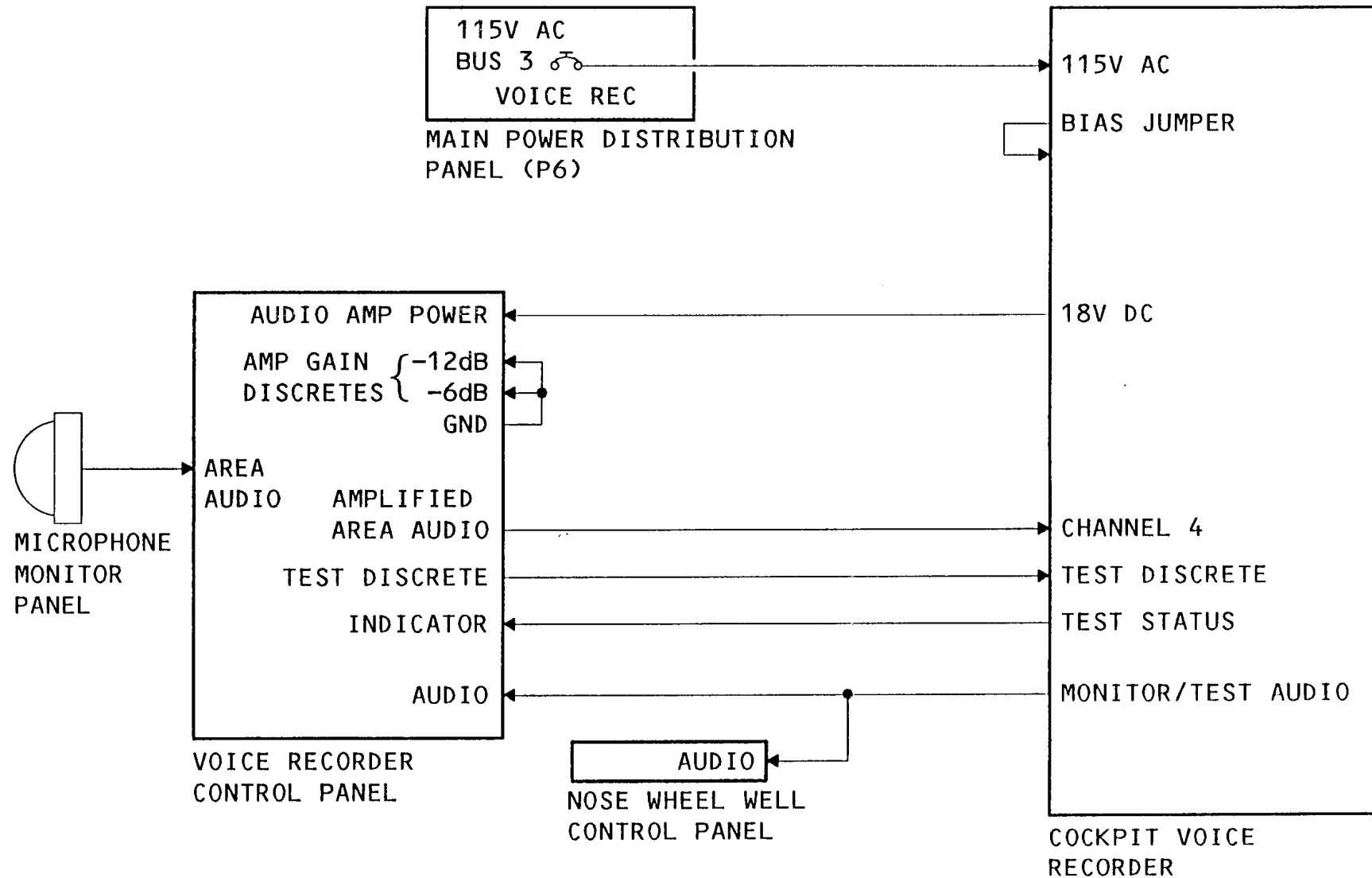
Microphone Monitor Panel

The microphone monitor panel sends audio to the control panel.

Voice Recorder Control Panel

The control panel sends:

- Audio to the channel 4 audio input of the CVR.
- A test and erase discrete to the CVR.
- Ground discretes to its own program pins to set the audio amplifier's gain to -18 db.

**Figure 8 CONTROL PANEL INTERFACE**

CVR



AUDIO MANAGEMENT UNIT INTERFACE

The audio management unit (AMU) sends the cockpit voice recorder (CVR):

- First observer's audio to record on channel 1
- First officer's audio to record on channel 2
- Captain's audio to record on channel 3.

Captain Emergency Communication

With the switch on the miscellaneous switch control panel in the VHF-L direct communication position, 28v dc from the main battery bus circuit breaker goes to the emergency communication relay R8732. The 28v dc energizes the emergency communication relay and connects the left VHF transceiver audio to the CVR.

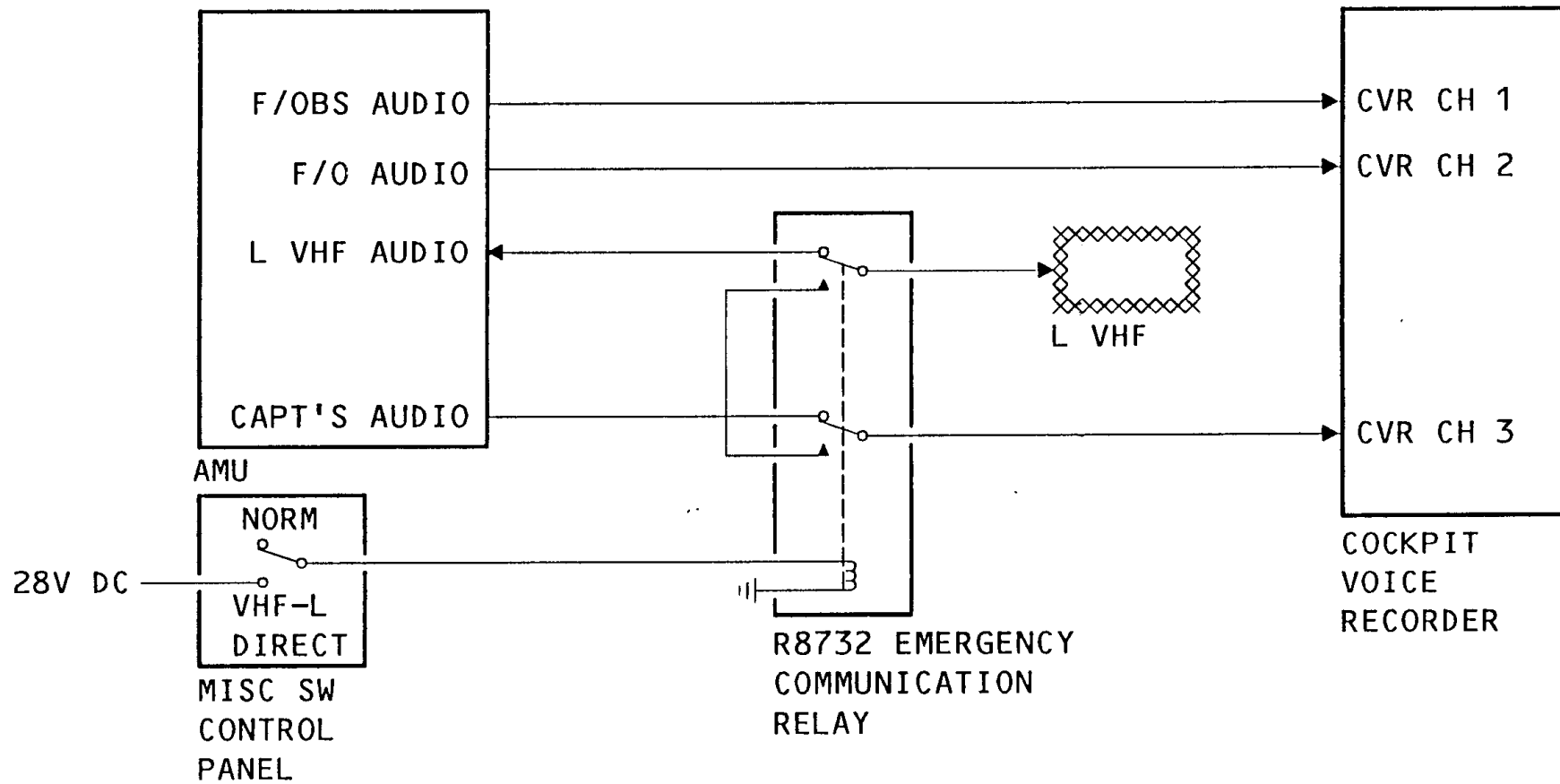


Figure 9 AUDIO MANAGEMENT UNIT INTERFACE

CVR



COCKPIT VOICE RECORDER

Purpose

The cockpit voice recorder (CVR) continuously records these flight deck sounds:

- Flight crew communications
- Conversations
- Aural warnings.

The recorder keeps the last 120 minutes of audio.

Physical Description

The CVR uses a solid-state memory as the record medium. The memory is in a separate crash survivable case. The case is watertight, shock resistant, and heat resistant.

The CVR has these physical characteristics:

- Height – 7.5 inches
- Width - 5.0 inches
- Depth - 14.5 inches
- Weight - 17 pounds maximum.

The CVR is bright orange with reflective stripes.

An LED indicator on the front panel shows the condition of continuous BITE. If the indicator is on, there is a failure.

An underwater locator beacon (ULB) is on the CVR front panel.

The ULB help locate the CVR in water.

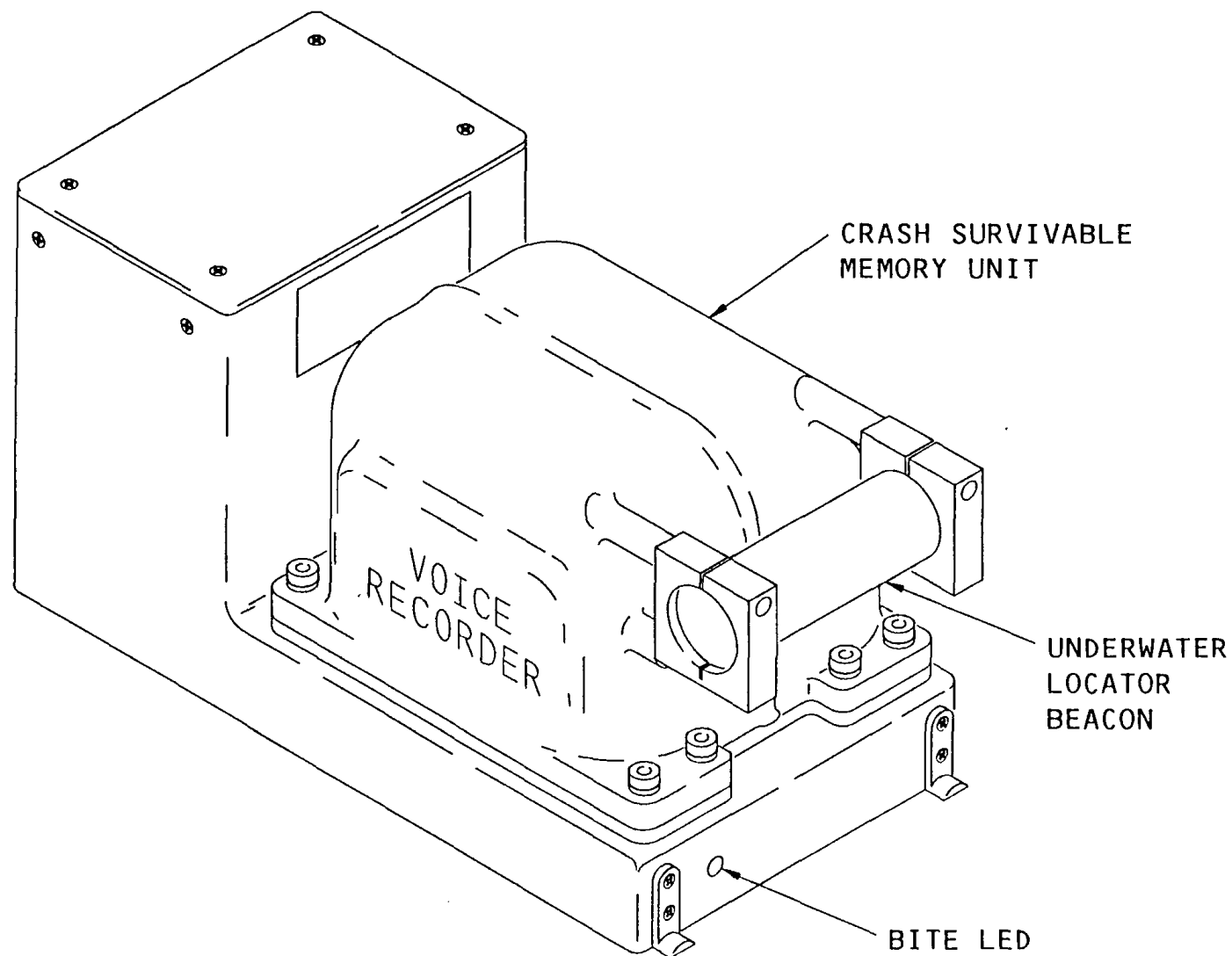


Figure 10 COCKPIT VOICE RECORDER (digital)

CVR



COCKPIT VOICE RECORDER

Purpose

The cockpit voice recorder (CVR) continuously records these flight deck sounds:

- Flight crew communications
- Conversations
- Aural warnings.

The recorder keeps the last 120 minutes of audio.

Physical Description

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An LED indicator on the front panel shows the condition of continuous BITE. If the indicator is on, there is a failure.

An underwater locator beacon (ULB) is on the CVR front panel.

The ULB help locate the CVR in water.



Figure 11 COCKPIT VOICE RECORDER (digital)



CVR

COCKPIT VOICE RECORDER PANEL

Purpose

Use the cockpit voice recorder panel to:

- Monitor the recorded audio
- Test the voice recorder system.

Controls and Indications

The cockpit voice recorder panel has these controls and indicators:

- STATUS indicator
- TEST switch
- ERASE switch
- 600 ohm headset jack.

The headset jack permits you to monitor the mixed audio of the four channels during record operation.

Test

The operation test of the voice recorder system does a check of the audio circuits of the cockpit voice recorder (CVR).

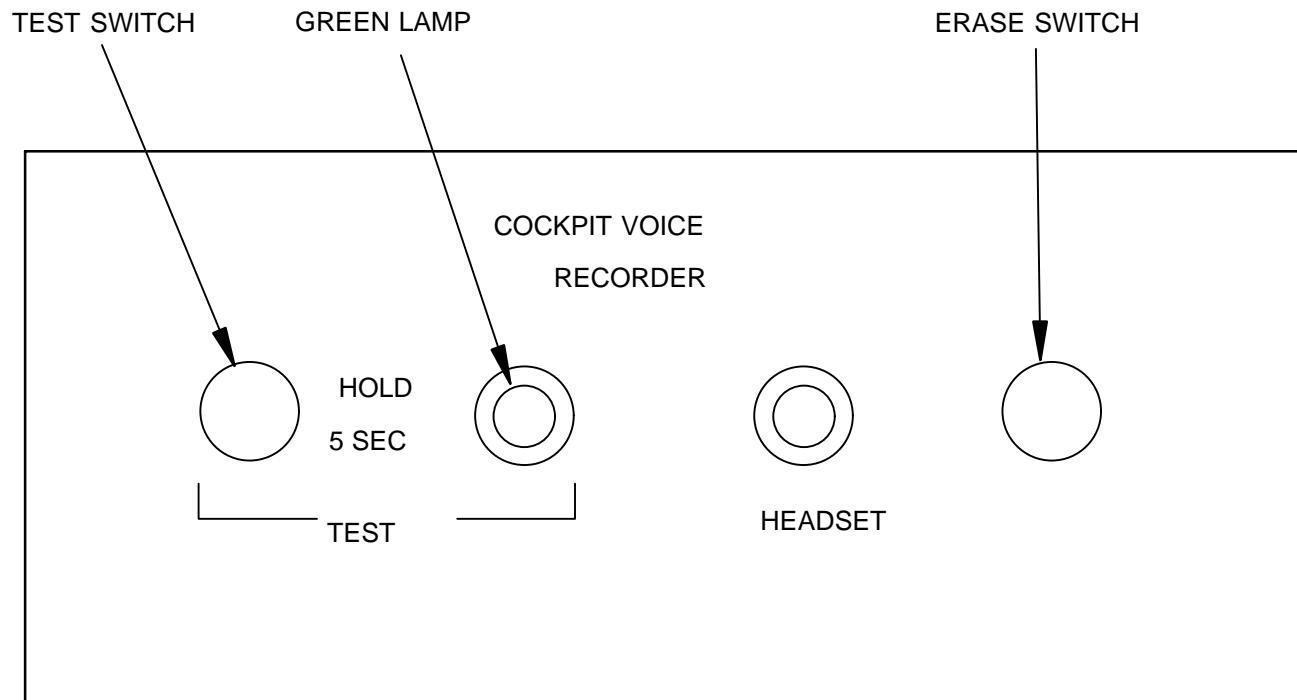


Figure 12 COCKPIT VOICE RECORDER PANEL



CVR

COCKPIT VOICE RECORDER PANEL

Purpose

Use the cockpit voice recorder panel to:

- Monitor the recorded audio
- Test the voice recorder system.

Controls and Indications

The cockpit voice recorder panel has these controls and indicators:

- MONITOR indicator
- TEST switch
- ERASE switch
- 600 ohm headset jack.

The headset jack permits you to monitor the mixed audio of the four channels during record operation.

Test

The operation test of the voice recorder system does a check of the audio circuits of the cockpit voice recorder (CVR).

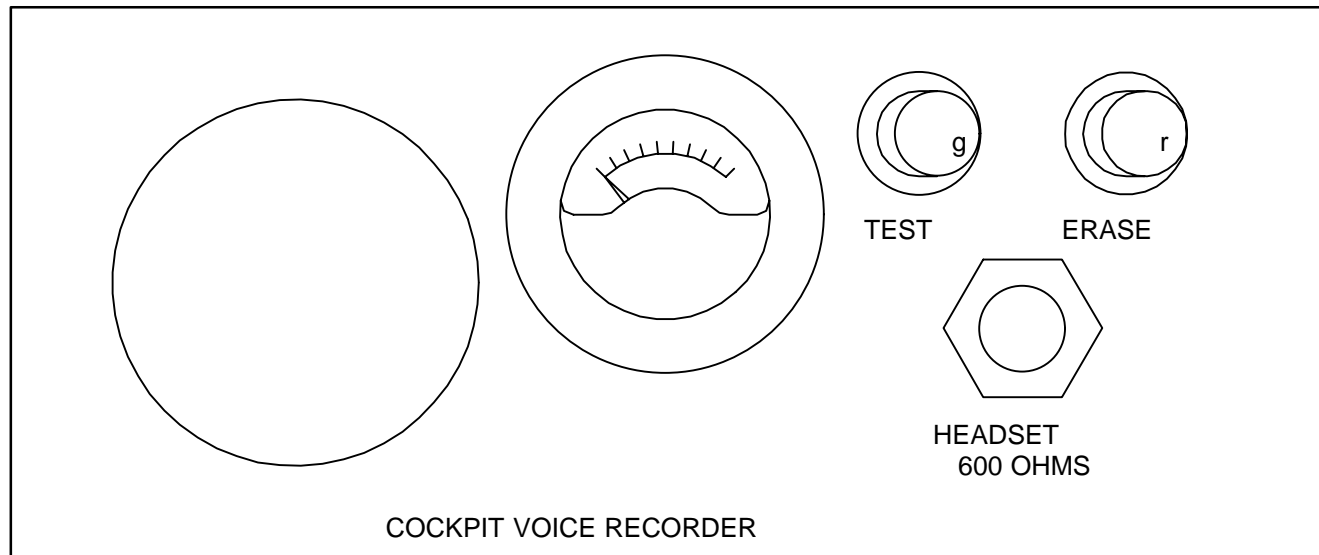


Figure 13 COCKPIT VOICE RECORDER PANEL (analog)

CVR

MICROPHONE MONITOR PANEL**Purpose**

The microphone picks up flight deck ambient sound.

Characteristics

The condensor-type microphone has a frequency range of 150 Hz - 50 kHz.

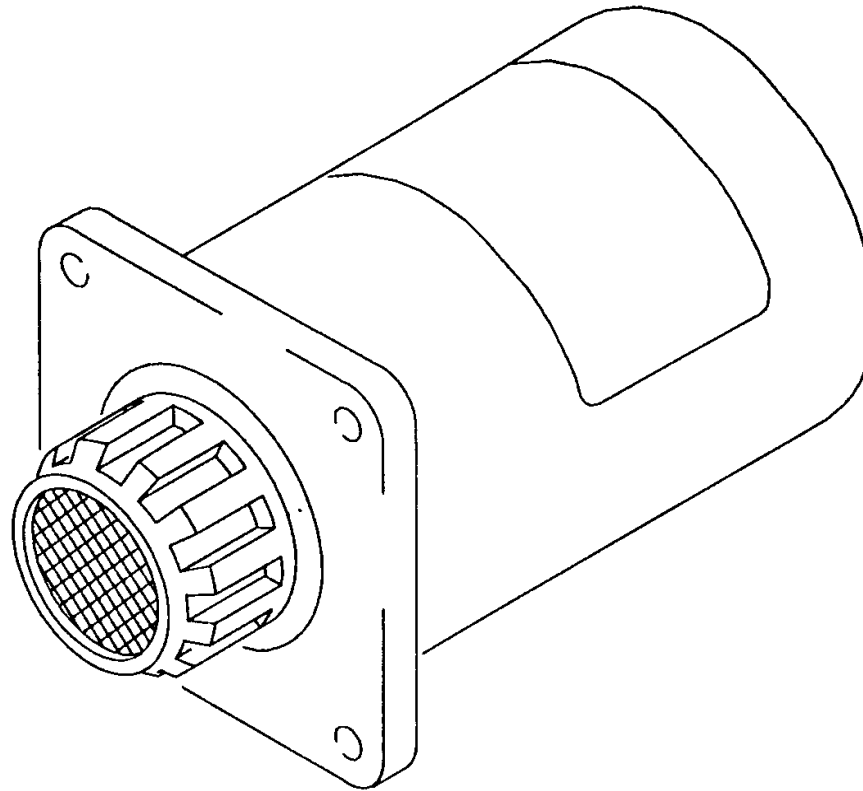


Figure 14 MICROPHONE MONITOR PANEL

CVR



UNDERWATER LOCATING BEACON

Purpose

The underwater locating device (ULD) is an ultrasonic beacon. It makes a water-submerged cockpit voice recorder easier to find.

Characteristics

The ULD is a self-contained unit that is 1.3 inches in diameter and 4 inches long. It weighs less than 12 ounces.

Operation

The ULD activates when it is submerged in water. It will operate to a maximum depth of 20,000 feet. It has a detection-range of 1800 to 3000 meters, which depends on sea conditions. Its operating life is 30 days.

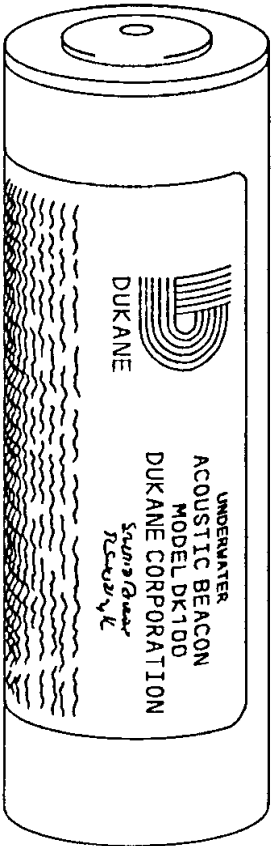
The ULD sends out an acoustic-pulse-tone of 37.5 kHz at a rate of one pulse per second.

Maintenance Practices - Model DK100

The DK100 ULD uses a lithium battery. It has an operating life (not activated) of six years. No battery maintenance is required. Keep the water switch contacts clean.

CAUTION: DO NOT DISASSEMBLE UNDERWATER LOCATING DEVICE (ULD).

WARNING: NO BATTERY MAINTENANCE IS REQUIRED FOR THE DK100 ULD (SIX YEAR WARRANTY PER TECHNICAL MANUAL). DO NOT REMOVE BATTERY AT ANY TIME. AVOID ANY SITUATION THAT COULD POSSIBLY CRUSH OR PENETRATE ULD CASE. DO NOT DISPOSE OF ULD. AT OR NEAR EXPIRATION DATE PRINTED ON CASE, RETURN ULD TO MANUFACTURER FOR SERVICE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN RELEASE OF HAZARDOUS CHEMICALS.



MODEL DK100

Figure 15 UNDERWATER LOCATING BEACON

CVR



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VOICE RECORDER JACK

This voice recorder jack lets ground personnel monitor voice recorder audio.

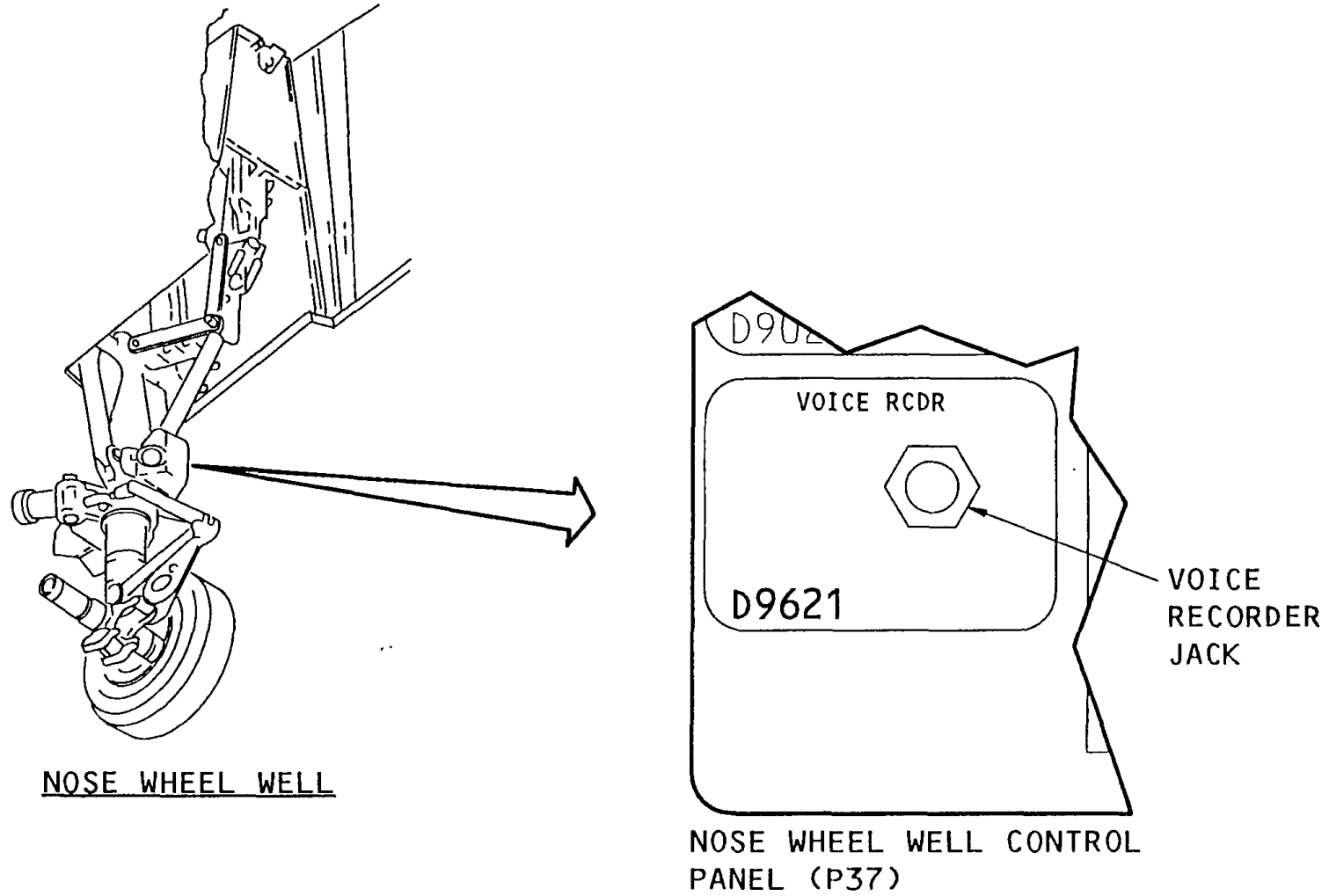


Figure 16 VOICE RECORDER JACK (optional)

CVR



CVR - SCHEMATIC DIAGRAM

Power

The cockpit voice recorder (CVR) uses 115v ac. It sends 18v dc to the preamplifier in the voice recorder control panel.

It also supplies power to circuitry in the CVR.

Normal Operation

Four audio channels go to the CVR. Channels 1, 2, and 3 are from the audio management unit (AMU). Each channel corresponds to audio from one crew member's flight interphone audio. The audio on each channel is the sum of:

- Hot mic audio - microphone audio when there is no PTT.
- Receive audio as selected on the crew member's audio control panel (ACP).
- Sidetone audio to the crew member.

The microphone monitor panel sends ambient flight deck audio to the control panel. The control panel's pre-amplifier amplifies the audio and sends it to the CVR. This is the channel 4 audio. The microphone monitor preamp is wired for a gain setting of -18 db. A bias jumper disables the record function when playback of the recorded voice is desired.

The CVR gets three cockpit audio channels from the AMU, plus the microphone monitor channel from the control panel. The audio goes to the aircraft interface card for conditioning. The audio then goes to the audio processor card.

The audio processor gets the cockpit audio channels and converts the audio to a digital format to store in its solid state memory. The audio inputs are amplified, and equalized as necessary. The signals are then converted to digital pulse code modulation (PCM). The PCM signals go to the store processor. The process is in reverse order playback.

The store processor encodes the data and supplies it to the crash protected non volatile memory. In addition, the store processor provides functional controls for test, and playback functions.

The non volatile memory consists of flash EEPROM devices that are electrically erasable and programmable. The memory is protected within a hardened, insulated metal enclosure to ensure survivability in the event of an airplane crash.

Test Operation

To start a test of the CVR, push the test switch on the control panel. The audio processor develops and sends a 800 Hz test tone to each channel, one at a time. The test tone is processed, and stored in memory, read from memory, and checked for frequency and amplitude. The 800 Hz tone is monitored at any of headphone jacks while the test switch is pushed.

ULD

The underwater locating device (ULD) emits an acoustic signal when submerged in water. The signal is 37.5 kHz and is pulsed once per second.

The ULD is battery operated. The water activated switch makes contact when submerged in water. The oscillator oscillates at 37.5 kHz. The transducer converts the electrical signal into an acoustic signal, and emits the signal once per second.

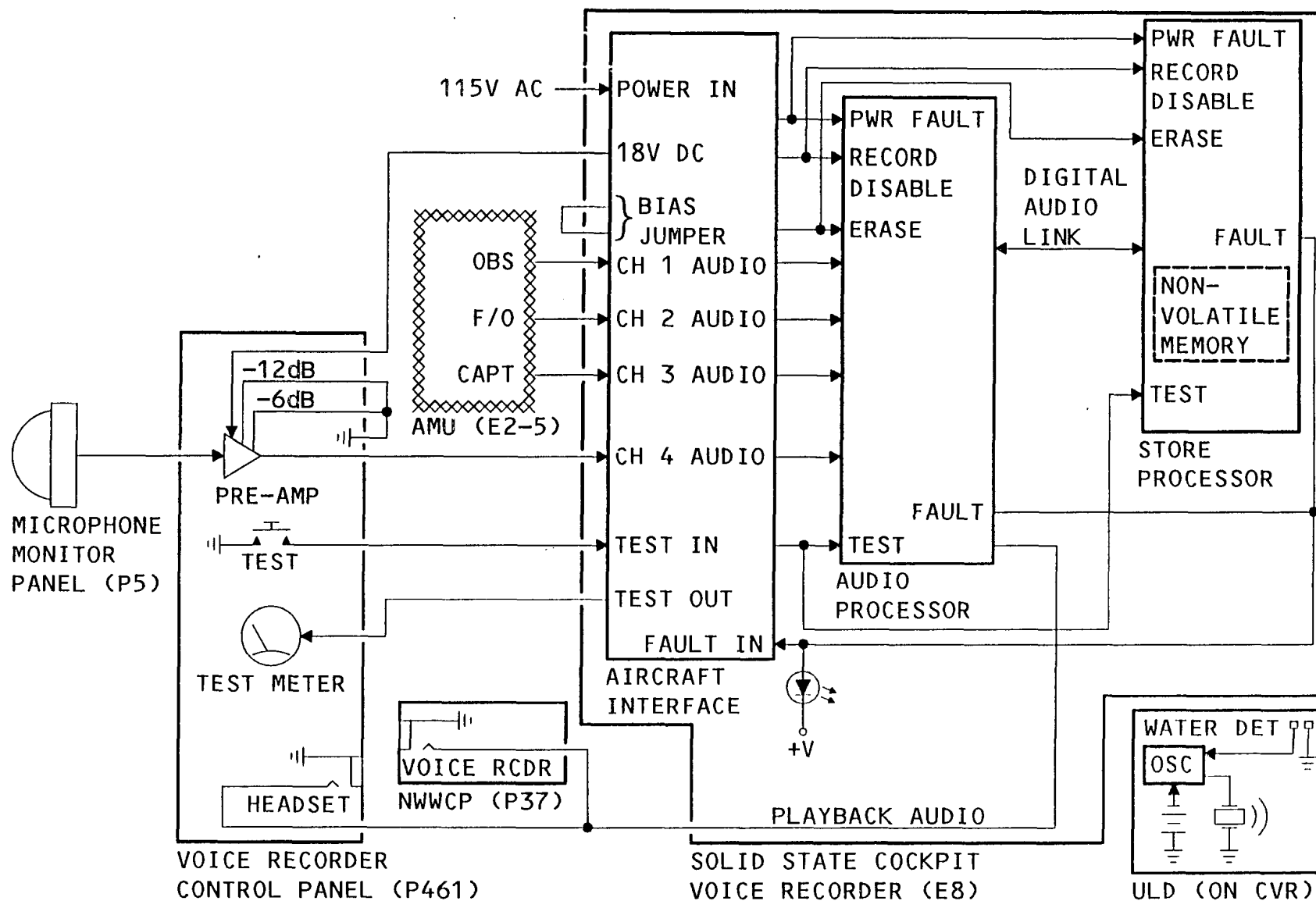


Figure 17 CVR - SCHEMATIC DIAGRAM (digital)

CVR



CVR - SCHEMATIC DIAGRAM

Power

The cockpit voice recorder (CVR) uses 115v ac. It sends 18v dc to the preamplifier in the voice recorder control panel.

It also supplies power to circuitry in the CVR.

Normal Operation

Four audio channels go to the CVR. Channels 1, 2, and 3 are from the audio management unit (AMU). Each channel corresponds to audio from one crew member's flight interphone audio. The audio on each channel is the sum of:

- Hot mic audio - microphone audio when there is no PTT.
- Receive audio as selected on the crew member's audio control panel (ACP).
- Sidetone audio to the crew member.

The microphone monitor panel sends ambient flight deck audio to the control panel. The control panel's pre-amplifier amplifies the audio and sends it to the CVR. This is the channel 4 audio. The microphone monitor preamp is wired for a gain setting of -18 db.

A bias jumper disables the record function when playback of the recorded voice is desired.

The CVR gets three cockpit audio channels from the AMU, plus the microphone monitor channel from the control panel. The audio goes to the aircraft interface card for conditioning. The audio then goes to the audio processor card.

The audio processor gets the cockpit audio channels and converts the audio to a digital format to store in its solid state memory. The audio inputs are amplified, and equalized as necessary. The signals are then converted to digital pulse code modulation (PCM). The PCM signals go to the store processor. The process is in reverse order playback.

The store processor encodes the data and supplies it to the crash protected non volatile memory. In addition, the store processor provides functional controls for test, and playback functions.

The non volatile memory consists of flash EEPROM devices that are electrically erasable and programmable. The memory is protected within a hardened, insulated metal enclosure to ensure survivability in the event of an airplane crash.

Test Operation

To start a test of the CVR, push the test switch on the control panel. The audio processor develops and sends a 800 Hz test tone to each channel, one at a time. The test tone is processed, and stored in memory, read from memory, and checked for frequency and amplitude. The 800 Hz tone is monitored at any of headphone jacks while the test switch is pushed.

ULD

The underwater locating device (ULD) emits an acoustic signal when submerged in water. The signal is 37.5 kHz and is pulsed once per second.

The ULD is battery operated. The water activated switch makes contact when submerged in water. The oscillator oscillates at 37.5 kHz. The transducer converts the electrical signal into an acoustic signal, and emits the signal once per second.



Figure 18 CVR - SCHEMATIC DIAGRAM (analog)

CVR



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CVR

SCHEMATIC DIAGRAM

Power

The cockpit voice recorder (CVR) uses 115v ac. It sends:

- An erase enable signal to the parking brake valve closed relay.
- 18v dc to the pre-amplifier in the voice recorder control panel.

It also supplies power to circuitry in the CVR.

Normal Operation

Four audio channels go to the CVR. Channels 1, 2, and 3 are from the audio management unit (AMU). Each channel corresponds to audio from one crew member's flight interphone audio.

The audio on each channel is the sum of:

- Hot mic audio (microphone audio when there is no PTT).
- Receive audio as selected on the crew member's audio control panel (ACP).
- Sidetone audio to the crew member.

The microphone monitor panel sends ambient flight deck audio to the control panel. The control panel's pre-amplifier amplifies the audio and sends it to the CVR. This is the channel 4 audio. The microphone monitor preamp is wired for a gain setting of -18 db.

A bias jumper disables the record function when playback of the recorded voice is desired.

The CVR gets three cockpit audio channels from the AMU, plus the microphone monitor channel from the control panel. The audio goes to the aircraft interface card for conditioning. The audio then goes to the audio processor card.

The audio processor gets the Cockpit audio channels and converts the audio to a digital format to store in its solid state

memory. The audio inputs are amplified, and equalized as necessary. The Signals are then converted to digital pulse code modulation (PCM). The PCM Signals go to the Store processor. The process is in reverse order for playback.

The Store processor encodes the data and supplies it to the Crash protected non volatile memory. In addition, the store processor provides functional controls for bulk erase, test, and playback functions.

The non volatile memory consists of flash EEPROM devices that are electrically erasable and programmable. The memory is protected within a hardened, insulated metal enclosure to ensure survivability in the event of an airplane crash.

Test Operation

To start a test of the CVR, push the test switch on the control panel. The audio processor develops and sends a 620 Hz test tone to each channel, one at a time. The test tone is processed, and stored in memory, read from memory, and checked for frequency and amplitude. The results of the self test show on the status indicator on the control panel. The 620 Hz tone is monitored at any of headphone jacks while the test switch is pushed.

Bulk Erase Operation

To erase all the recorded audio from the CVR these conditions must be true:

- The airplane is on the ground.
- The parking brake is Set.
- Push erase switch for 2 or more seconds and then release.

The aircraft interface card provides the Signals used to erase the non volatile memory.

**CVR****ULD**

The underwater locating device (ULD) emits an acoustic signal when submerged in water. The signal is 37.5 kHz and is pulsed once per second.

The ULD is battery operated. The water activated switch makes contact when submerged in water. The oscillator oscillates at 37.5 kHz. The transducer converts the electrical signal into an acoustic signal, and emits the signal once per second.

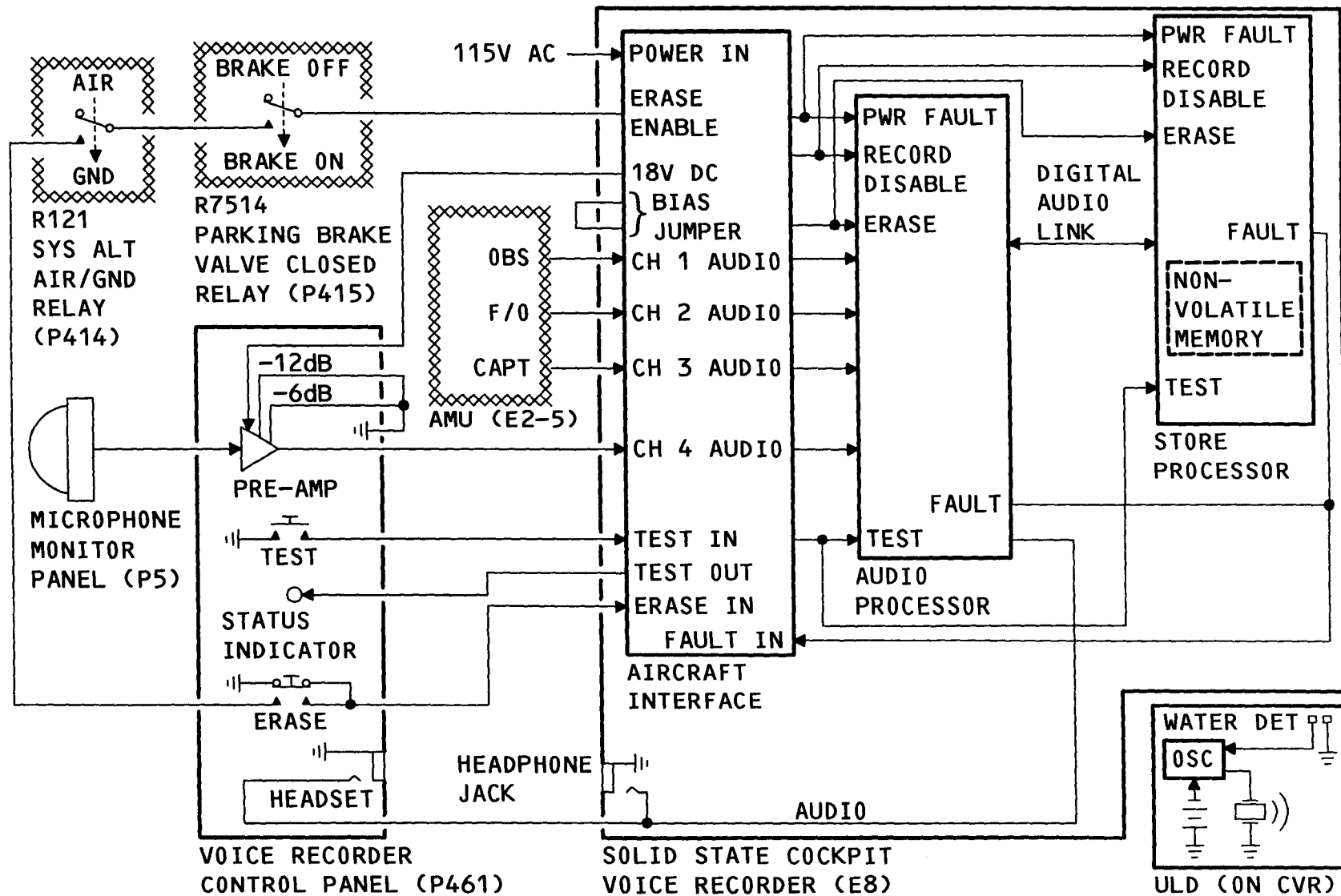


Figure 19 SCHEMATIC DIAGRAM

CVR



VOICE RECORDER SYSTEM - TEST

General

The operation test of the voice recorder system does a check of the audio circuits of the CVR. The results of the test show in two ways:

- On the CVR panel
- Audio tone from the headset jack on the CVR panel

Operation

To do the test, connect a headset to the headset jack on the CVR panel. Press and hold the TEST switch for a minimum of one second. These are the results of a good test:

- On the CVR panel illuminates the green LED.
- You hear a 800 Hz tone on the headset.

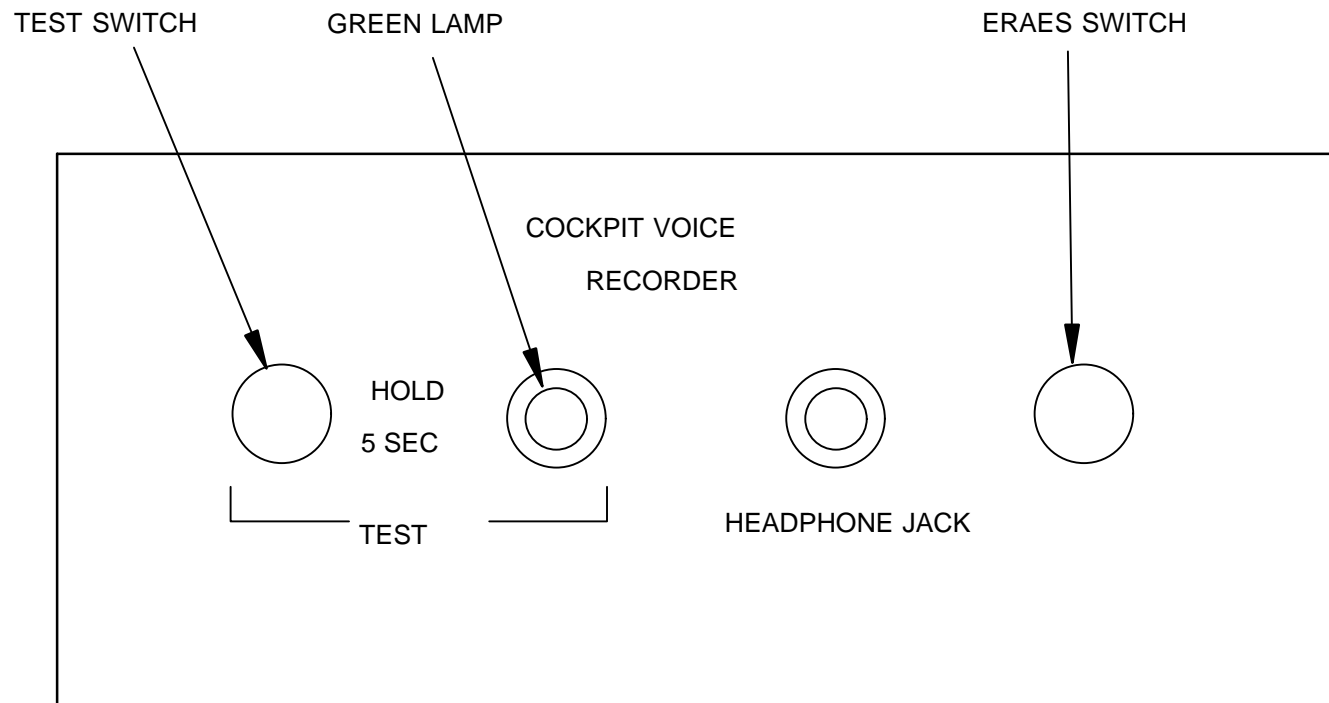


Figure 20 VOICE RECORDER SYSTEM - TEST (digital)

CVR



VOICE RECORDER SYSTEM - TEST

General

The operation test of the voice recorder system does a check of the audio circuits of the CVR. The results of the test show in two ways:

- On the CVR panel
- Audio tone from the headset jack on the CVR panel

Operation

To do the test, connect a headset to the headset jack on the CVR panel. Press and hold the TEST switch for a minimum of one second. These are the results of a good test:

- The meter on the CVR panel shows in the green band.
- You hear a 400 Hz tone on the headset.

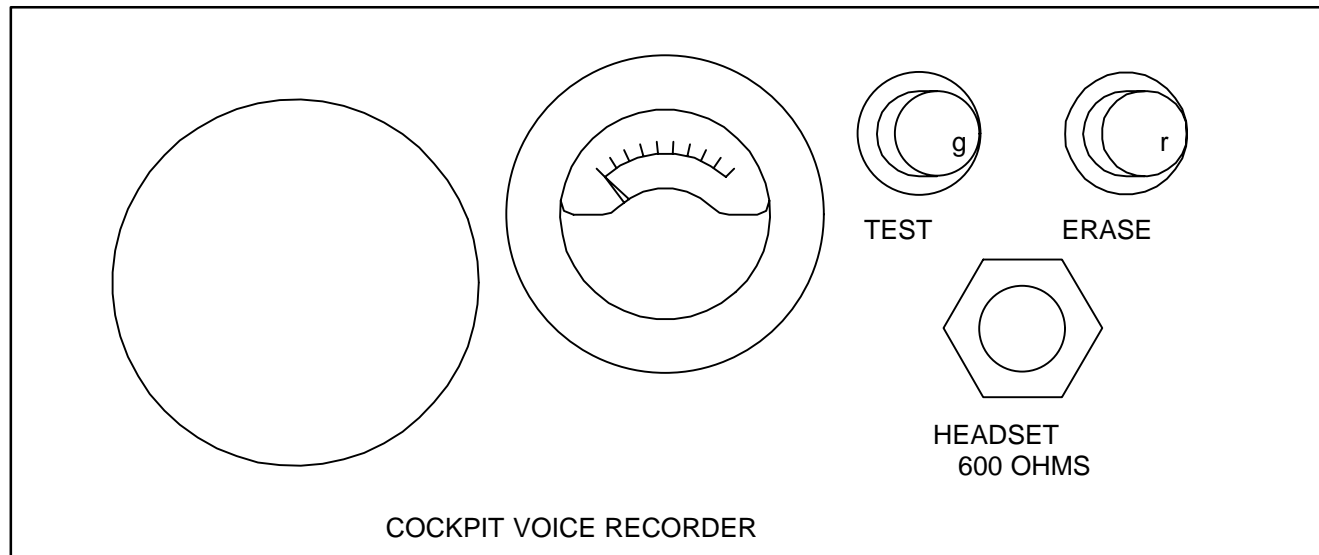


Figure 21 VOICE RECORDER SYSTEM - TEST (analog)



CVR

TEST

General

The operation test of the voice recorder system does a check of the audio circuits of the CVR. The results of the test show in two ways:

- On the CVR panel
- Audio tone from the headset jack an the CVR panel

Operation

To do the test, connect a headset to the headset jack an the CVR panel. Press and hold the TEST switch for a minimum of one second. These are the results of a good test:

- The LED an the CVR panel flashes green once
- You hear a 800 Hz tone an the headset.

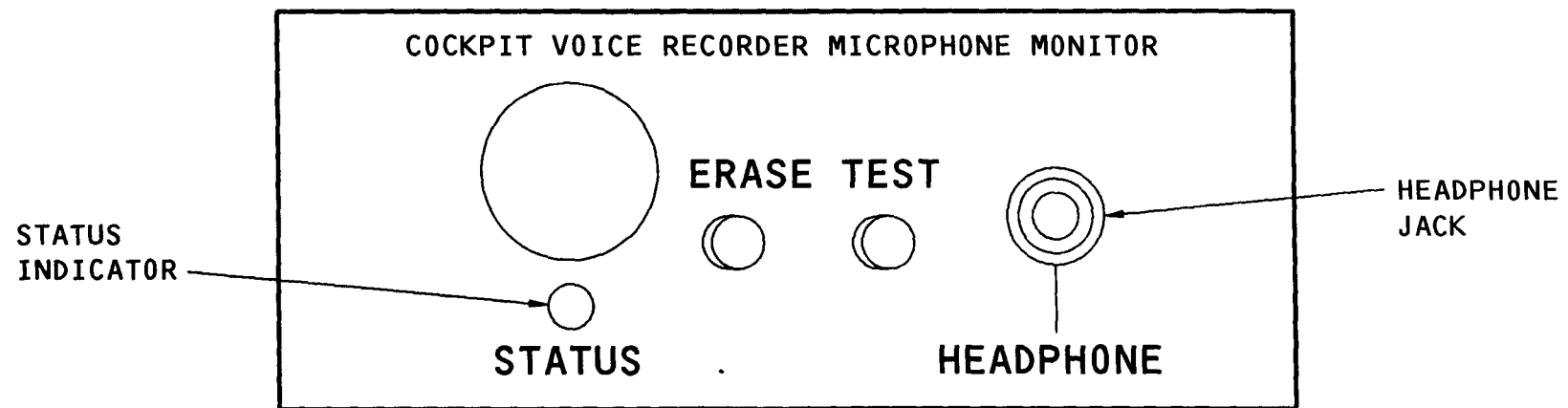


Figure 22 TEST

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