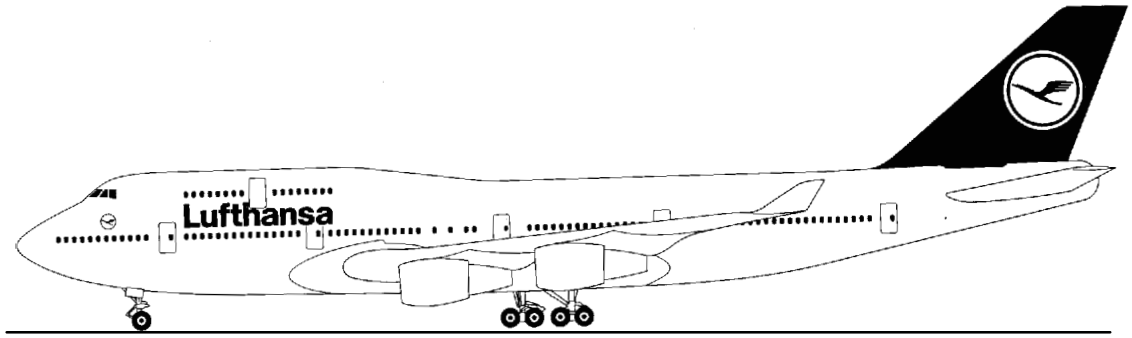
Lufthansa Technical Training

Training Manual B 747-400



ATA 34-32
MARKER BEACON

ATA Spec. 104 levle 3

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ATA 34-32 MARKER BEACON

MARKER BEACON SYSTEM INTRODUCTION

The marker beacon system provides visual and aural annunciations when the airplane flies over ground based marker beacon transmitters. The different transmitter stations include airways, backcourse, inner, middle and outer markers.

The marker identifiers show an the primary flight display. The outer marker is identified by OM. The middle marker is identified by MM and the inner marker is identified by IM. The airways and backcourse markers are identified as IM.

The aural tones include:

- Airways: 3000 Hz tone with a morse code identifier
- Backcourse: 3000 Hz tone keyed as pairs of continuous dots
- Inner: 3000 Hz tone keyed as continuous dots
- Middle: 1300 Hz tone keyed as alternate dots and dashes
- Outer: 400 Hz tone keyed as continuous dashes

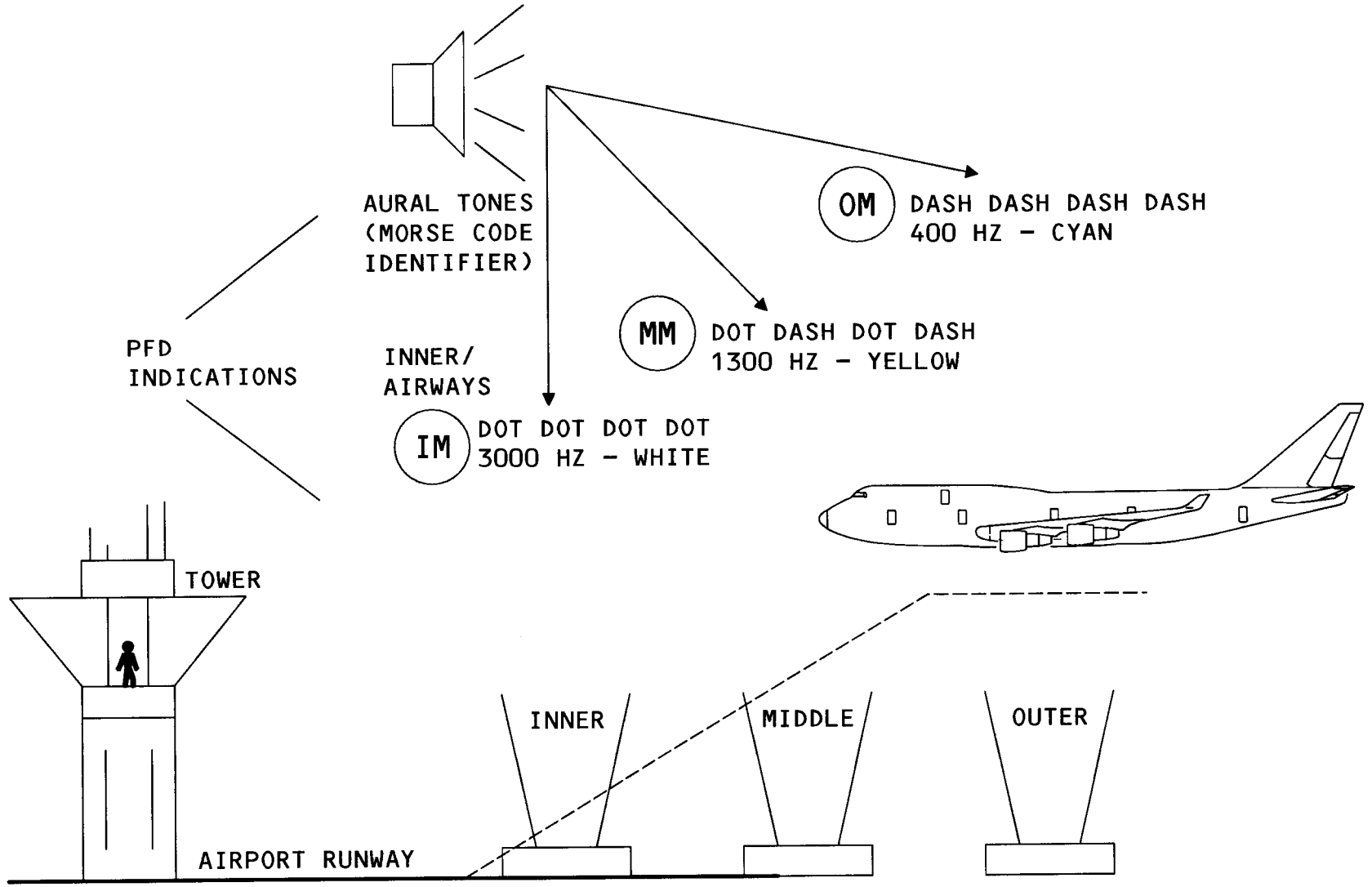


Figure 1 MARKER BEACON SYSTEM INTRODUCTION

MARKER BEACON SYSTEM

The marker beacon system Shows the flight crew that the airplane is passing directly over specific geographic points. These points can be along an airway or along an instrument landing path.

The marker beacon system consists of a single antenna and a VOR/MKR receiver. The marker beacon receiver module is enabled only in the left VOR/MKR receiver. The marker beacon receiver module sends these outputs:

- Audio to the audio management unit (AMU)
- Marker beacon data to the EFIS/EICAS interface units (EIUs) for display an the primary flight displays (PFDS)

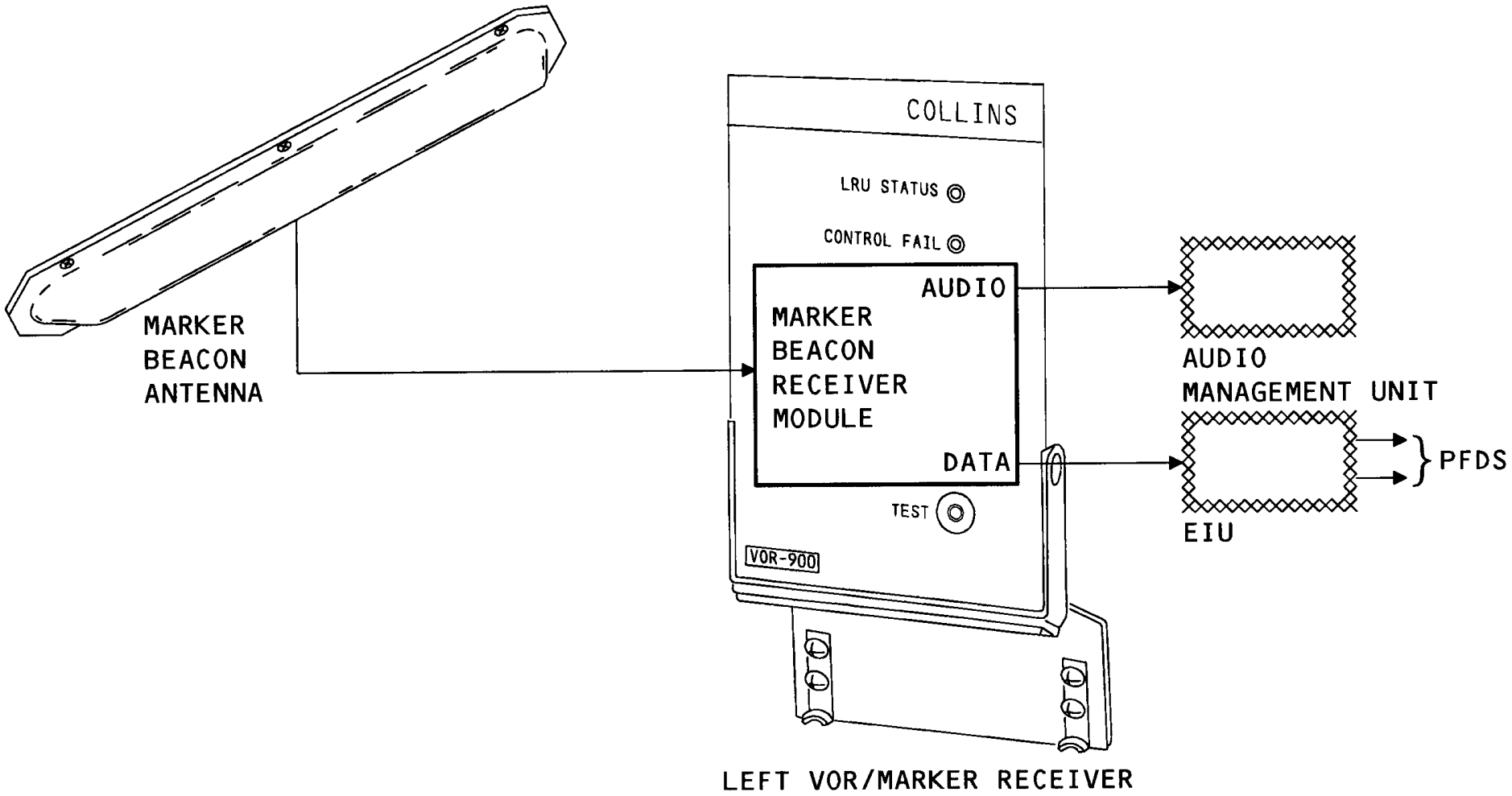


Figure 2 MARKER BEACON SYSTEM

COMPONENT LOCATIONS - FLIGHT DECK

The marker beacon system component is:
- MKR/VOR L circuit breaker

The displays for the marker beacon system are:
- Left PFD
- Right PFD.

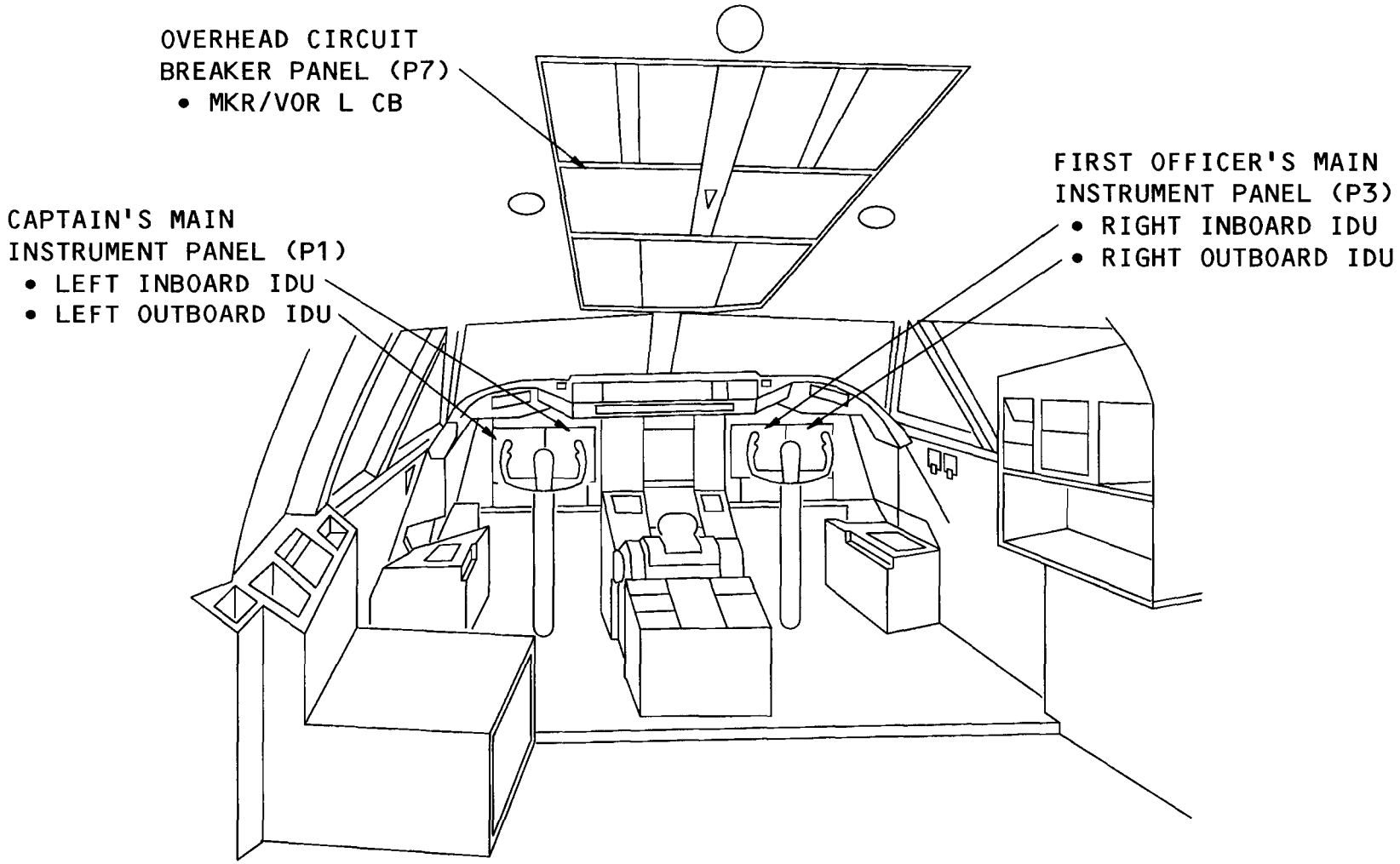


Figure 3 COMPONENT LOCATION FLIGHT DECK

COMPONENT LOCATIONS

The marker beacon system components are:

- Left VOR/MKR receiver
- Marker beacon antenna

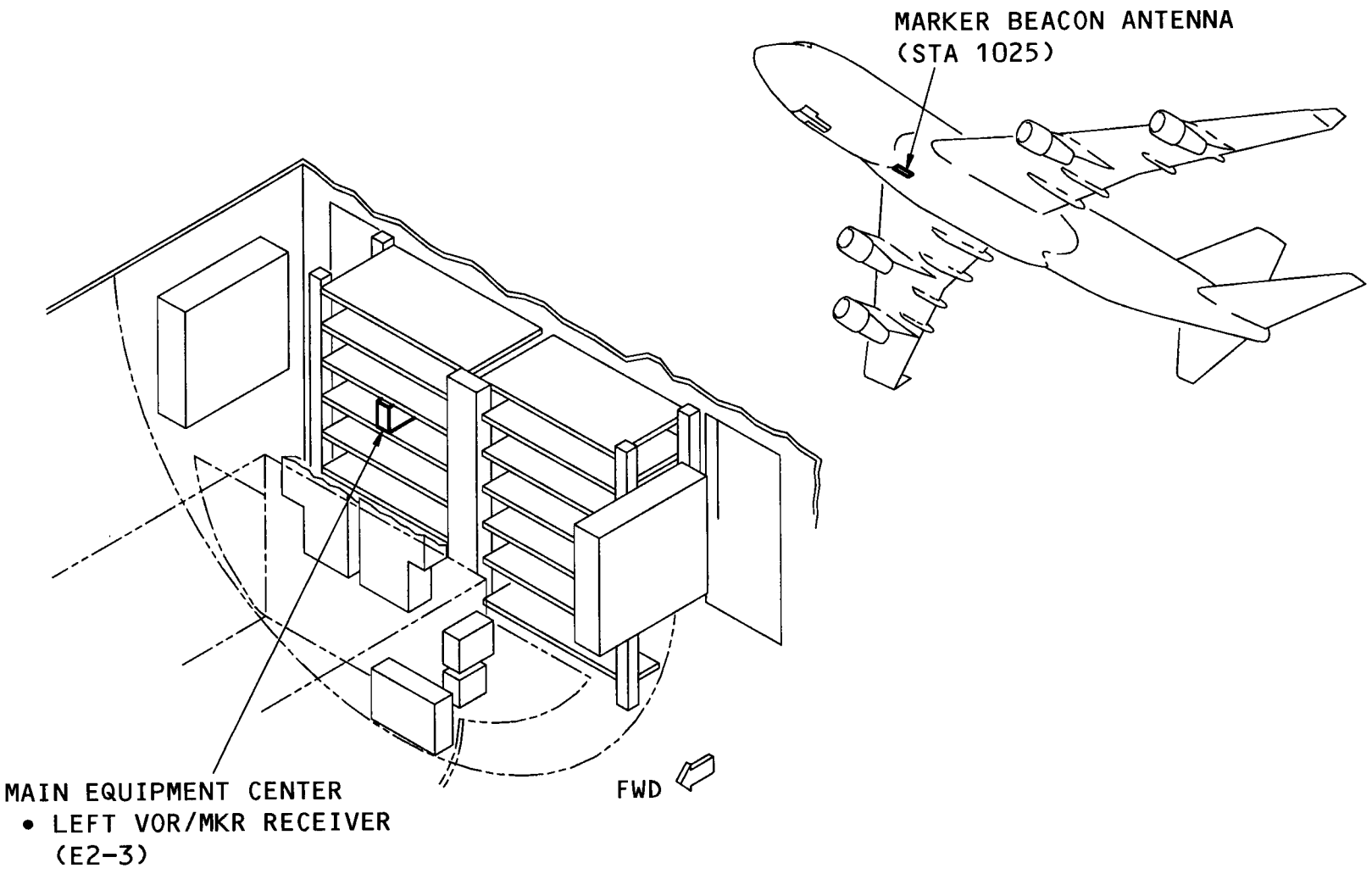


Figure 4 COMPONENT LOCATION

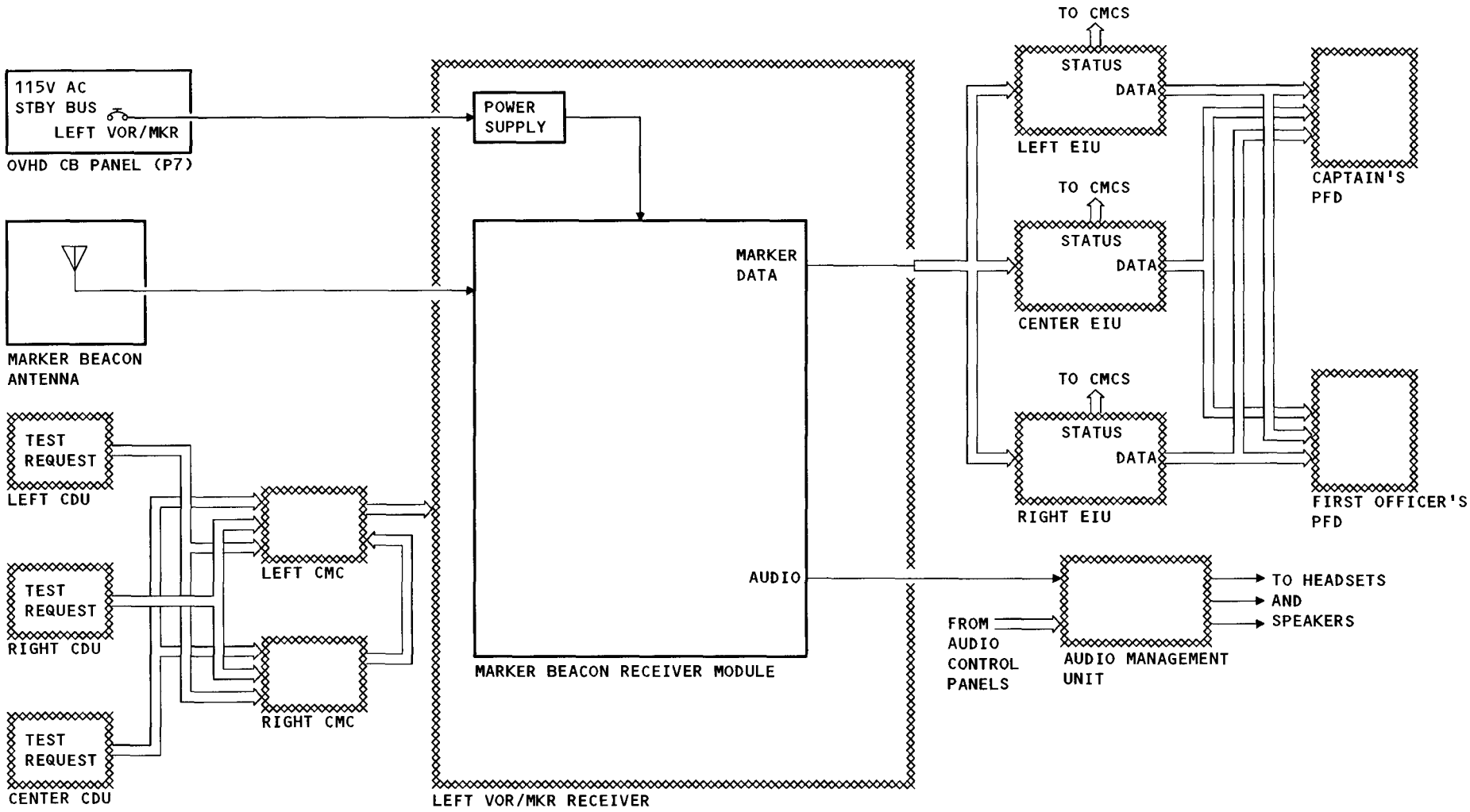


Figure 5 MKR BCN INTERFACE DIAGRAM

POWER AND ANTENNA INPUTS

The marker beacon system receives power through the left MKR/VOR circuit breaker from the 115v ac 400 Hz STBY bus.

The marker beacon antenna detects a 75 MHz signal from a ground station and sends the signal to the marker beacon receiver module.

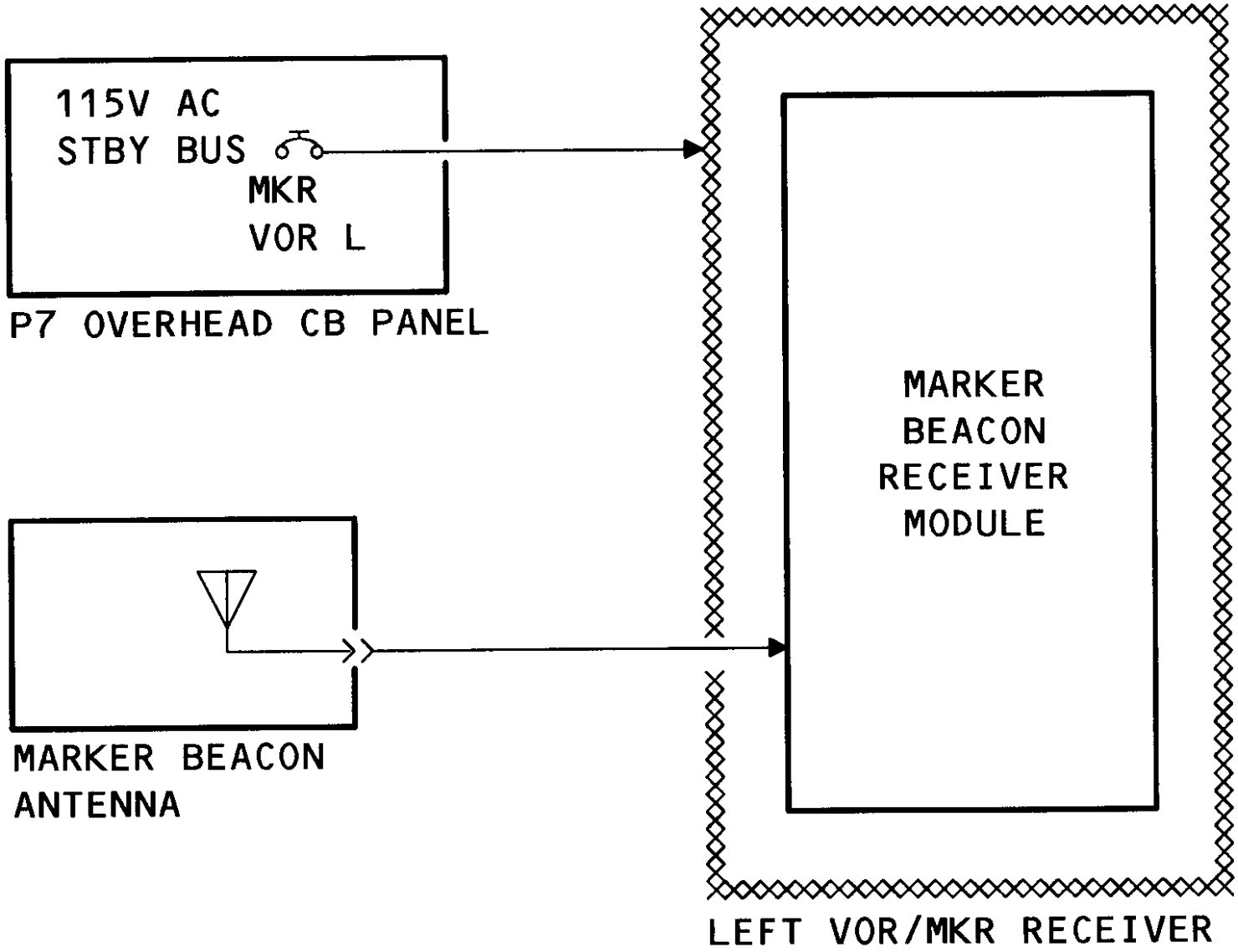


Figure 6 POWER AND ANTENNA INPUTS

CMC INPUTS

Any one of the three CDUs can initiate a test of the VOR/MKR receiver through the CMCs.

Normally the left CMC sends a digital test discrete to initiate a test. If the left CMC fails, a relay in the left CMC energizes, and sends right CMC data to the left VOR/MKR receiver.

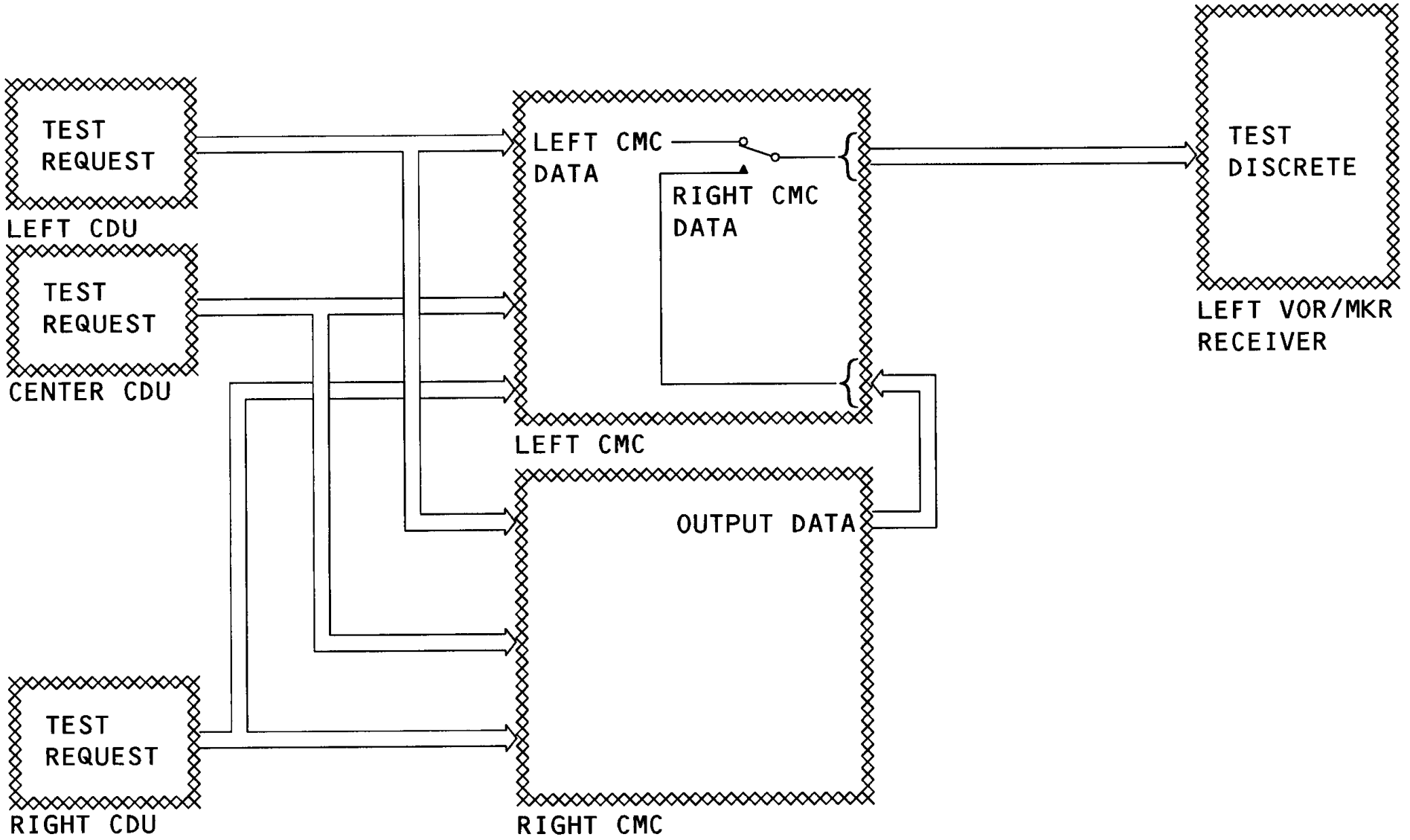


Figure 7 CMC INPUTS

MKR BCN - OUTPUTS

The left VOR/MKR receiver sends marker beacon data an a data bus to the left, center, and right EIUs.

The EIUs multiplex the marker beacon data.

The EIUs send information to create marker beacon annunciations an the PFDs.

The EIUs also send status information to the CMCs.

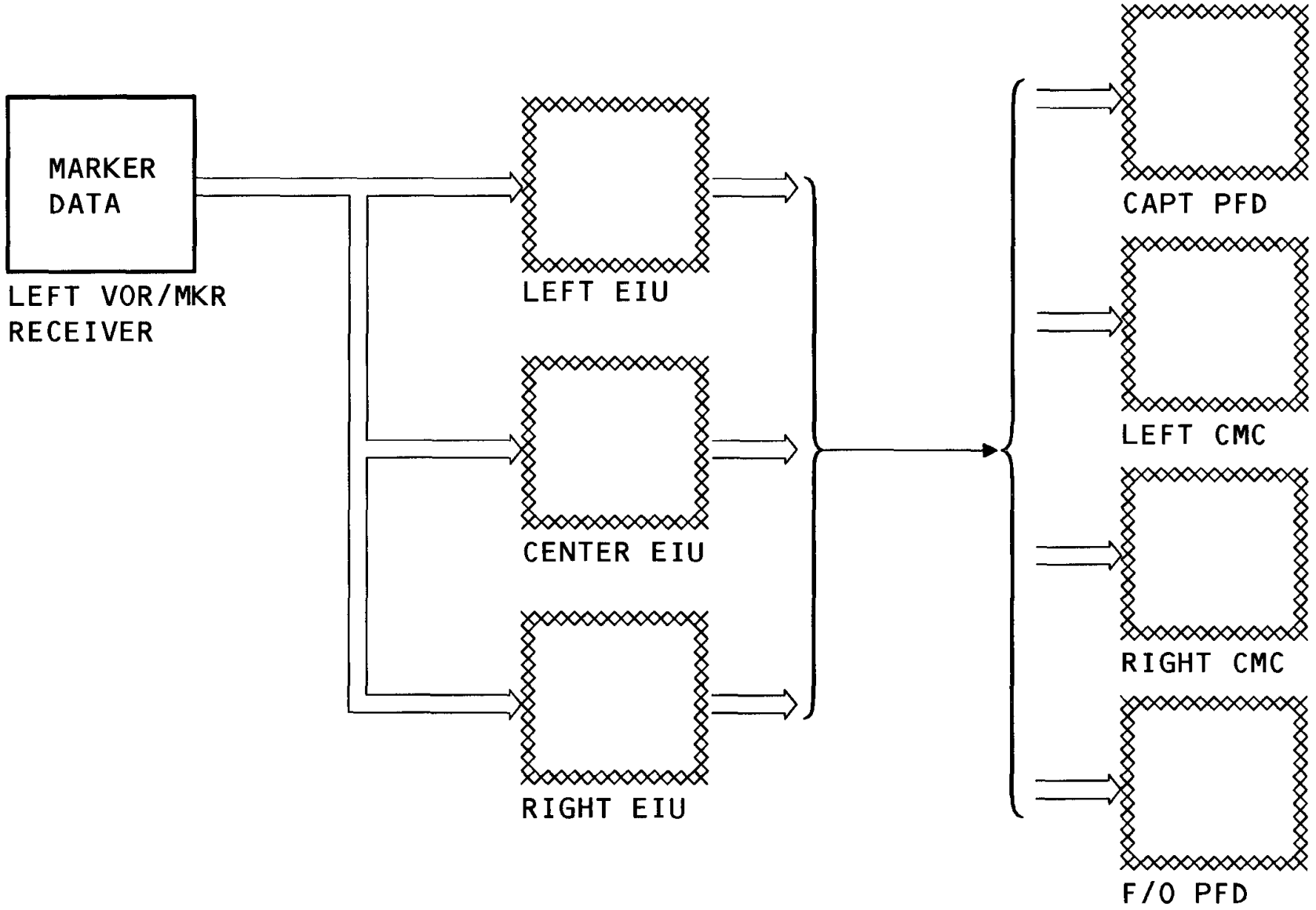


Figure 8 OUTPUTS

AUDIO OUTPUTS

Marker beacon audio is sent to the audio management unit. Control for these audio signals comes from the flight deck audio control panels. The audio signals are sent from the audio management unit to the pilots' headsets and flight-deck speakers.

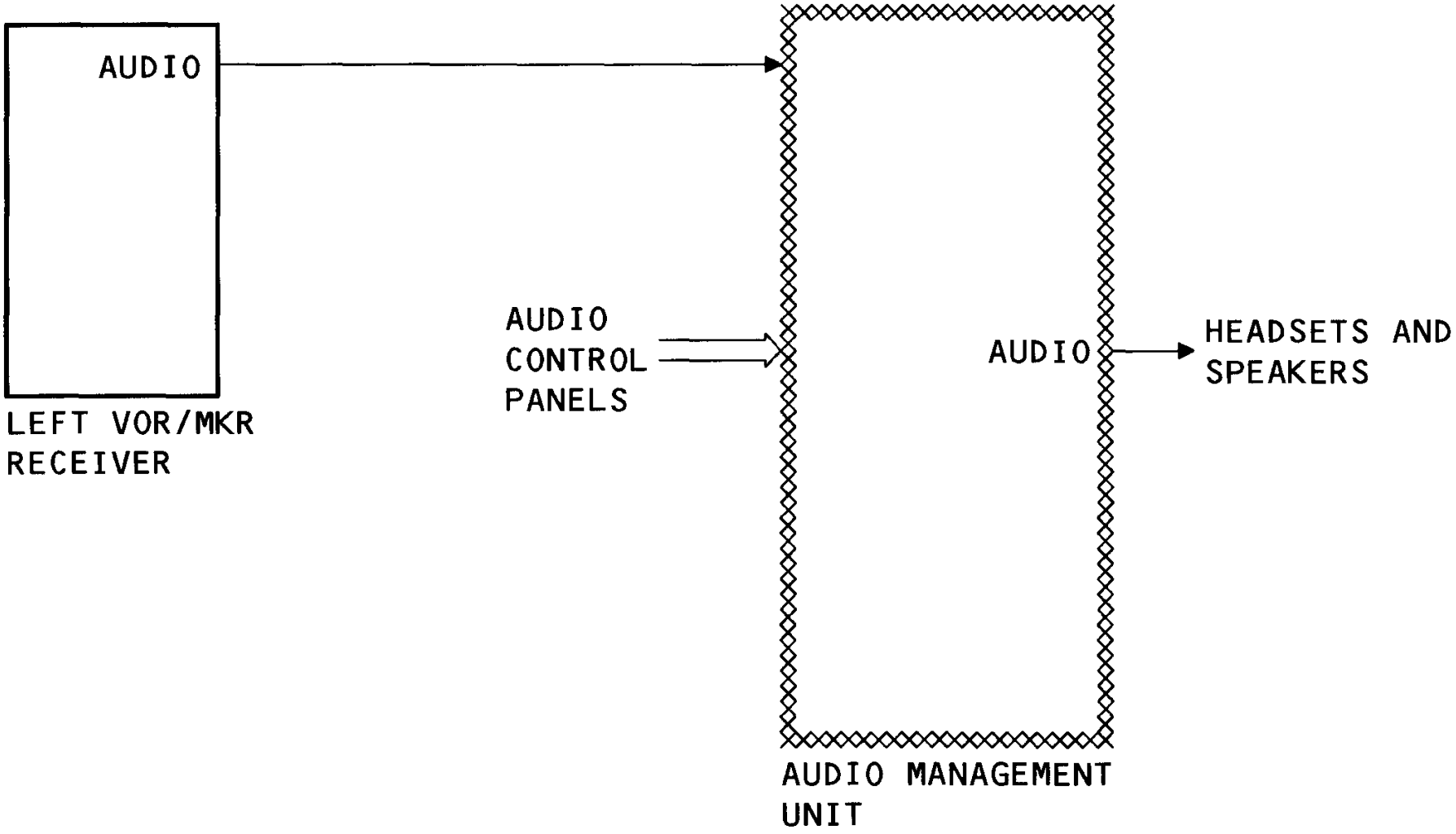


Figure 9 AUDIO OUTPUTS

VOR/MKR RECEIVER

General

The purpose of the VOR/MKR receiver is to process antenna inputs and send marker beacon outputs an the VOR data bus. The VOR/MKR receiver contains a VOR receiver and a marker beacon receiver. The marker beacon receiver module is tuned to 75 MHz.

Bite

The BITE will test and monitor both the VOR receiver and the marker beacon receiver modules.

Flight Fault Memory

The VOR/MKR receiver has a non-volatile memory that records flight faults. Fault memory data is available through the ATE connector at the rear of the receiver.

Control and Monitor

The VOR/MKR receiver front panel features are:

- - The TEST switch initiates a self-test of both the VOR and marker beacon receiver modules.
- - The LRU STATUS LED Shows a detected failure in the VOR/MKR receiver if red and Shows no failure if green.
- - The CONTROL FAIL LED Shows red when there is a tuning source that is not valid.

CAUTION: STATIC SENSITIVE. DO NOT HANDLE BEFORE READING PROCEDURE FOR HANDLING ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (REF 20-41-02/201). CONTAINS DEVICES THAT CAN BE DAMAGED BY STATIC DISCHARGE.

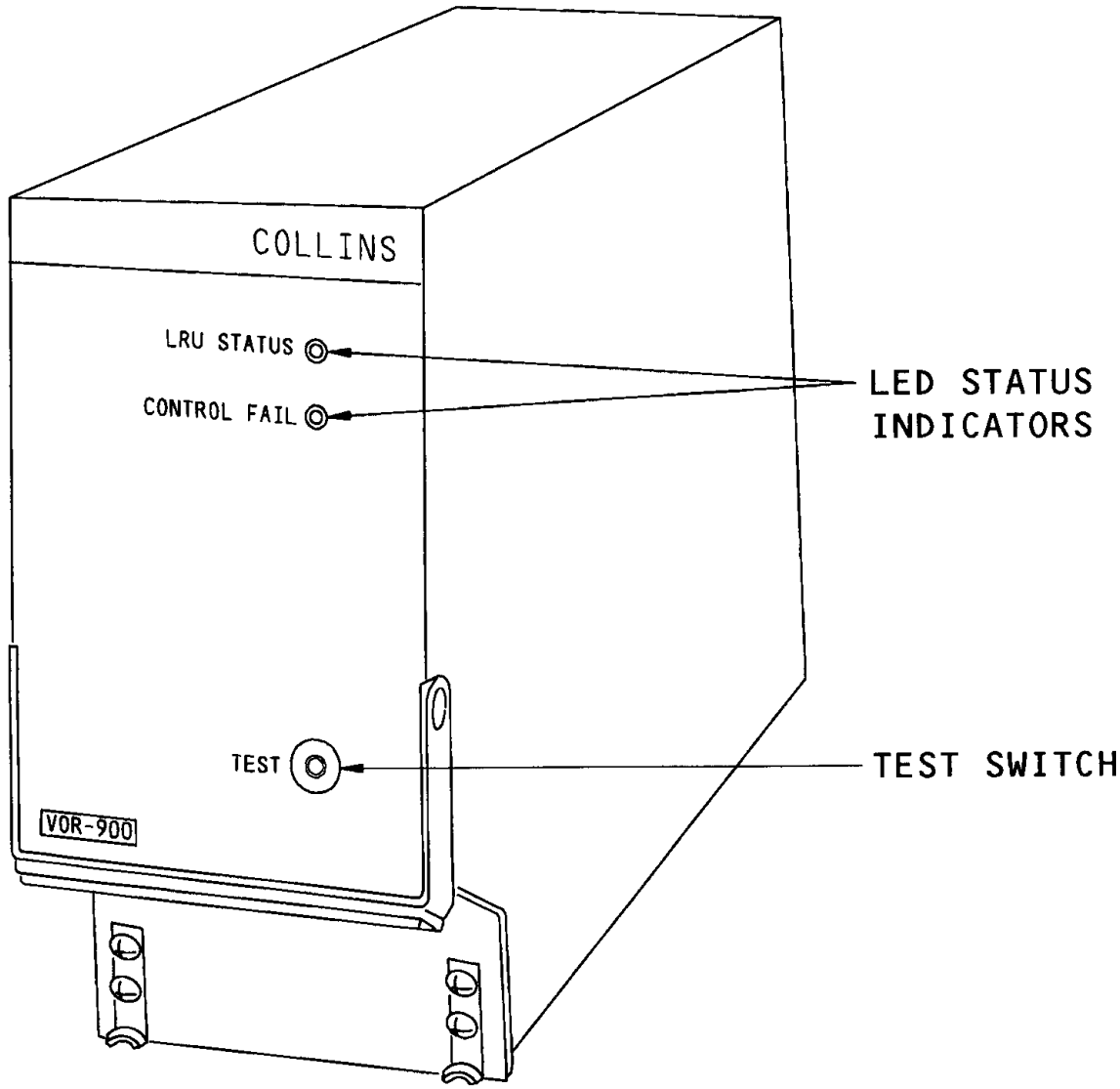


Figure 10 VOR/MKR RECEIVER (COLLINS VOR-900)

MKR BCN - ANTENNA

The antenna receives rf energy from a marker beacon ground station.

The antenna is flush-mounted and tuned for a 75 MHz signal. It is installed an the bottom of the airplane with six mounting screws.

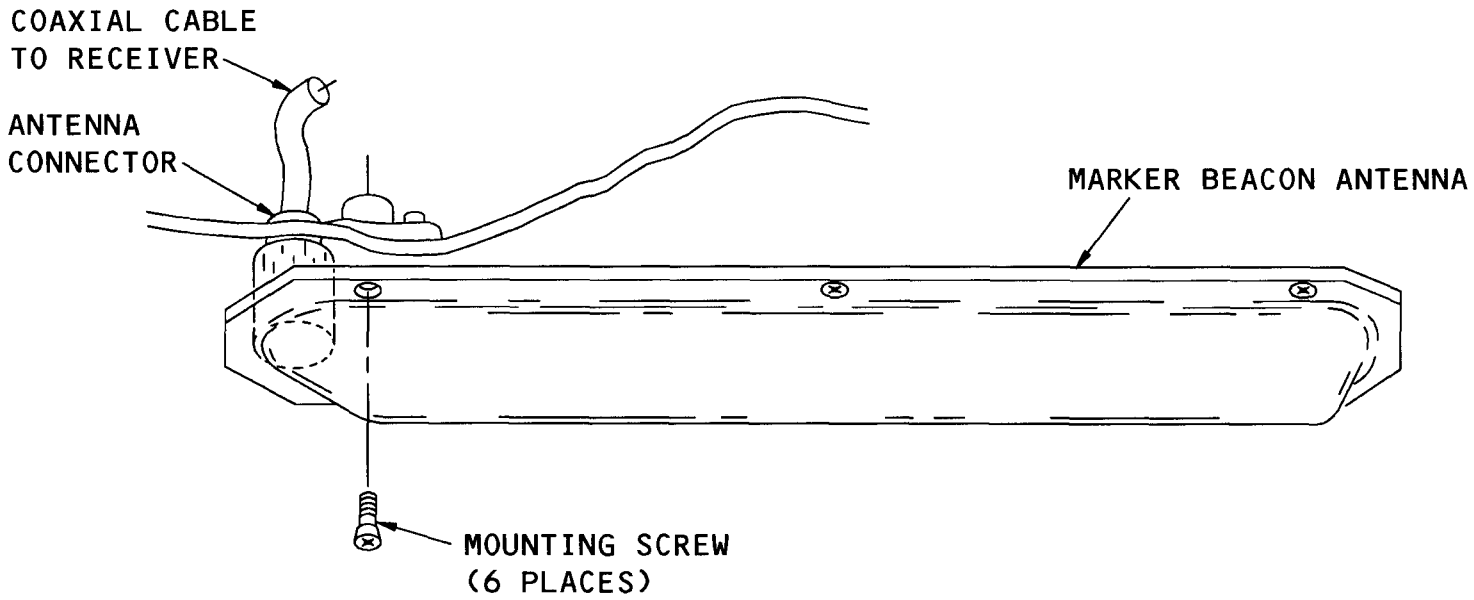


Figure 11 MKR BCN ANTENNA

AUDIO CONTROL

General

The audio control panel provides inputs to the audio management unit. These inputs determine which audio signal will be heard over the flight deck speakers and the pilots' headsets.

Operation

To get marker beacon audio signals:

- Select marker beacon audio with the approach receiver selector switch.
- Push the receiver volume control switch to turn an the marker beacon audio. Rotate the switch to change the volume level.

Audio Outputs

The audio outputs are:

- The outer marker is 400 Hz, continuous dashes
- The middle marker is 1300 Hz alternate dots and dashes
- The inner marker is 3000 Hz, continuous dots
- The airways marker is 3000 Hz, morse code identifier
- The backcourse marker is 3000 Hz, continuous paired dots

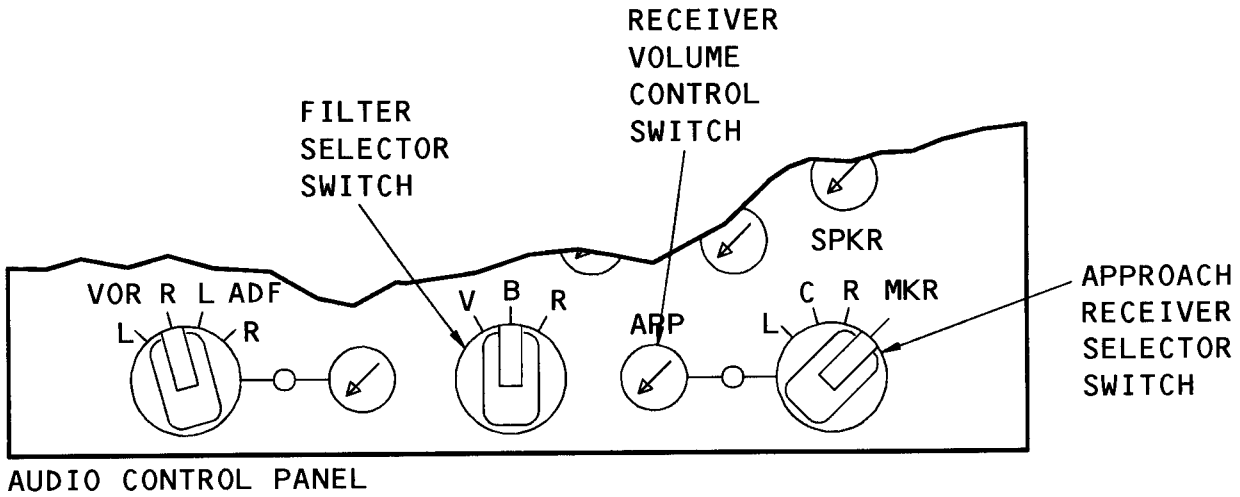


Figure 12 AUDIO CONTROL

MKR BCN - DISPLAYS

Marker beacon data is shown an the PFD. The marker beacon displays are:

- OM shows that the airplane is passing over the outer marker. The color of the OM display is cyan.
- MM shows that the airplane is passing over the middle marker. The color of the MM display is yellow.
- IM shows that the airplane is passing over the inner marker or an airways marker. The color of the IM display is white.
- FT shows when the left VOR/MKR receiver is in test. The color of the FT display is white.

All marker beacon displays are highlighted by a white circle.

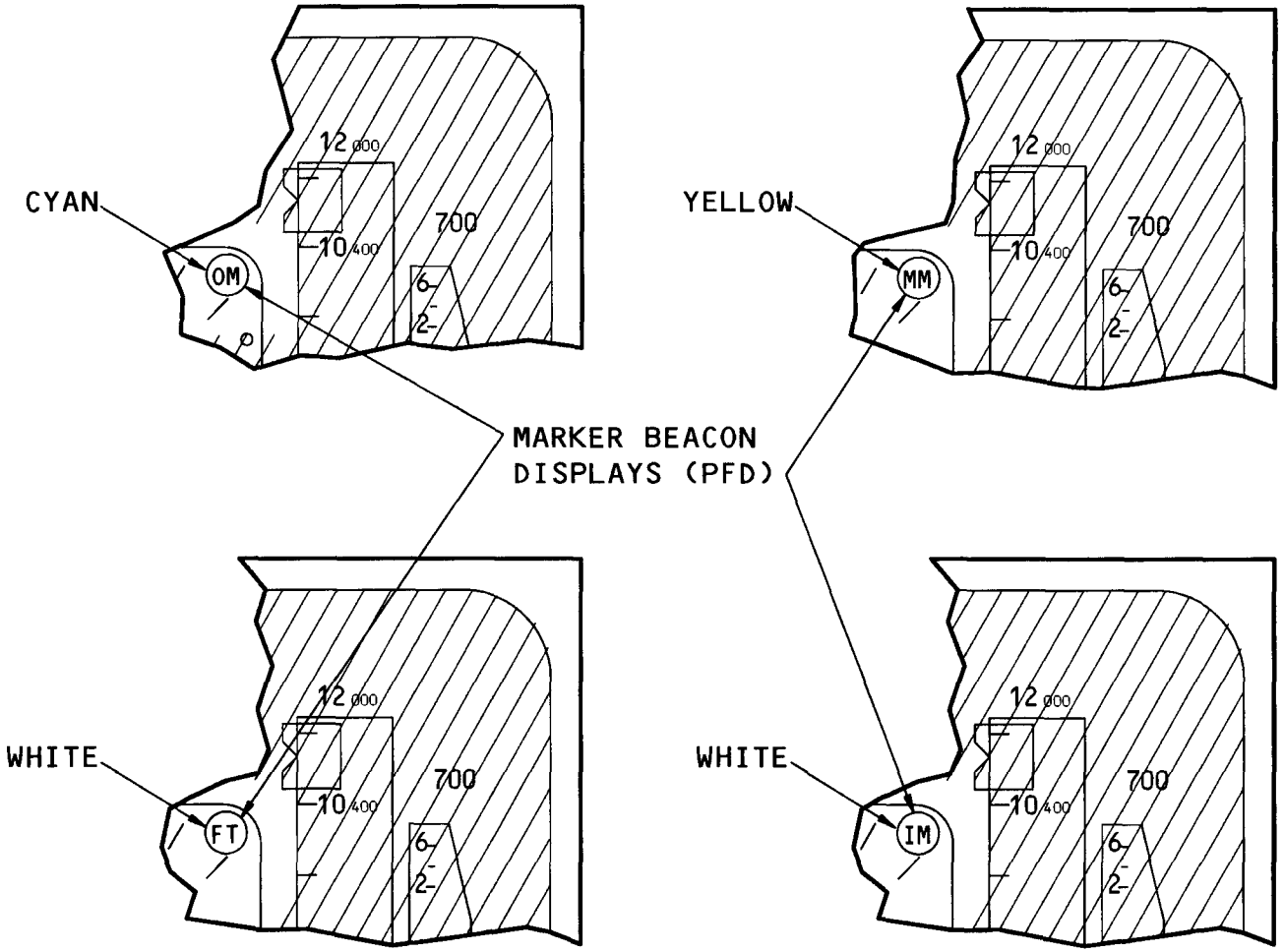


Figure 13 DISPLAY

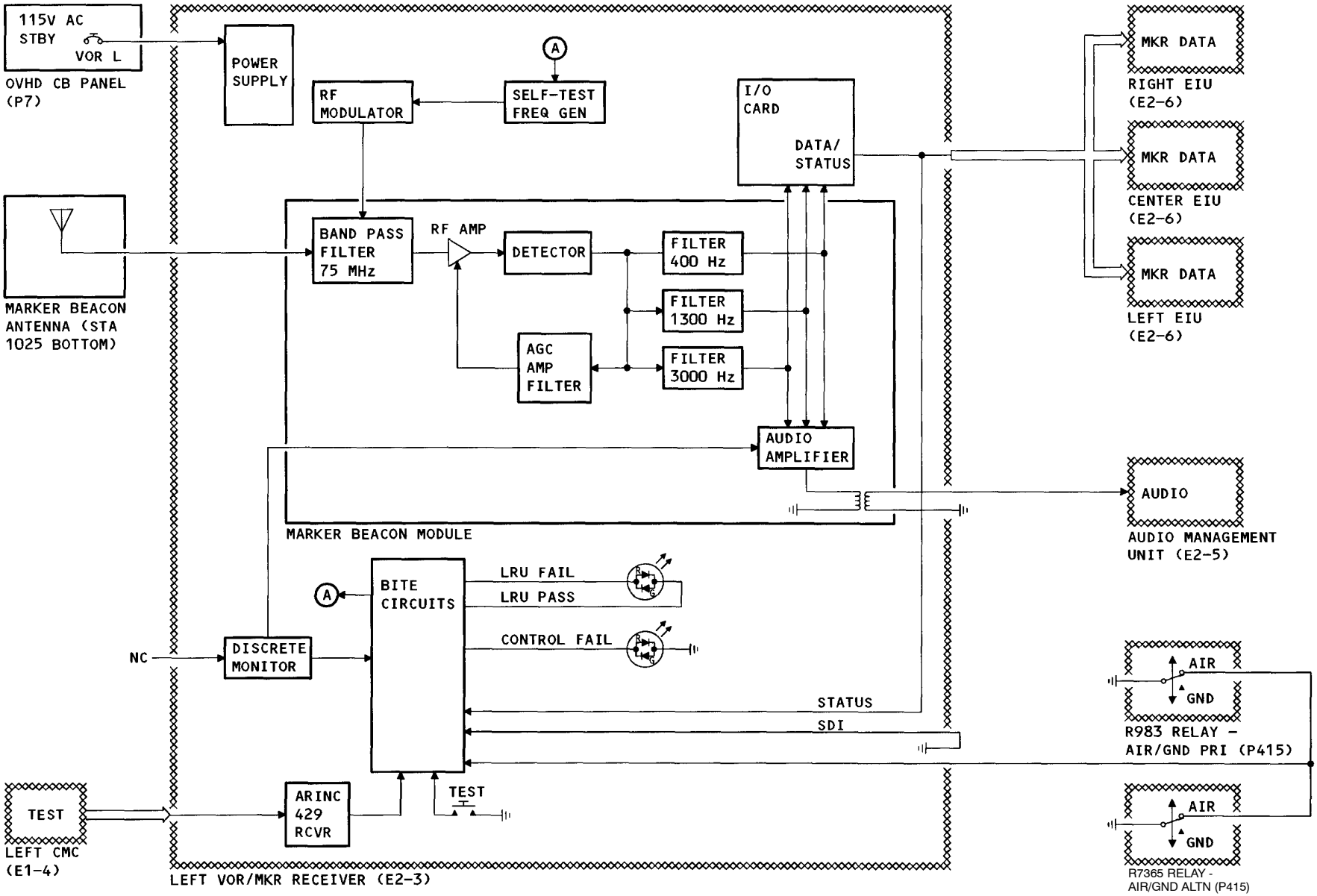


Figure 14 MKR BCN SCHEMATIC DIAGRAM

SIGNAL PROCESSING

The VOR/MKR receiver contains:

- Power supply module
- Marker beacon receiver module
- Input/output card

Signal Processing

The 75 MHz signal from the antenna is applied to a 75 MHz filter. This filter provides tuning and rejection of unwanted signals. The output is sent to an RF amplifier. A detector receives the amplifier output and sends the demodulated signal to the audio system and the AGC filter. The AGC filter monitors the signal level and maintains a constant output level.

The marker beacon audio system applies the signal to three audio bandpass filter circuits. The active filters, centered at 400 Hz, 1300 Hz and 3000 Hz send the signal to an audio amplifier. The audio amplifier sends audio tones to the audio management unit. The tones are:

- 400 Hz outer marker - continuous dashes
- 1300 Hz middle marker - alternate dots and dashes
- 3000 Hz inner marker - continuous dots
- 3000 Hz backcourse marker - paired dots
- 3000 Hz airways marker - morse code ID

The filters also send a dc signal to the I/0 card which sends the data to the EIUs.

A program pin enables the marker beacon functions in the VOR/MKR receivers. A discrete monitor enables the function when an open is present an the program pin.

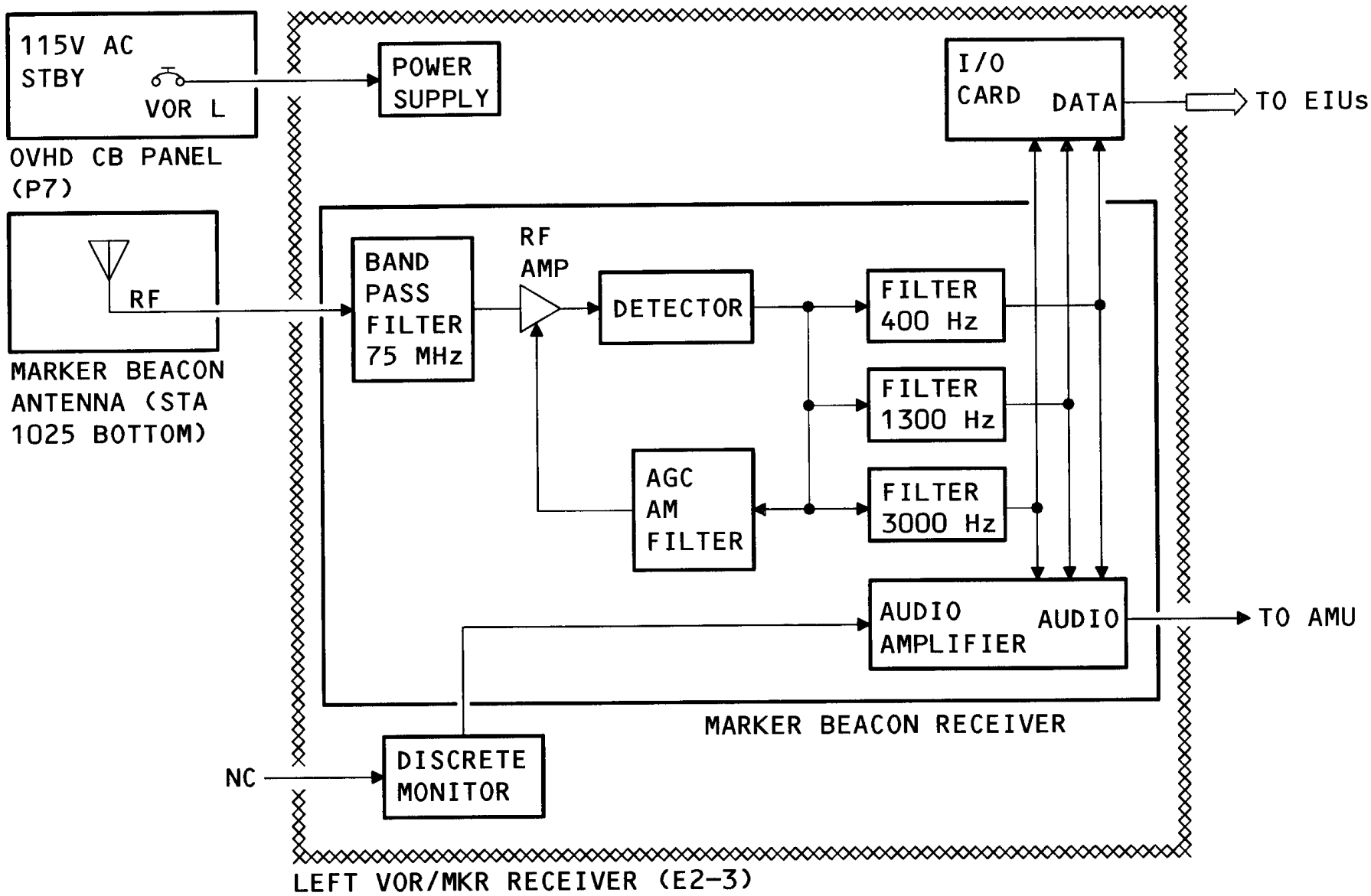


Figure 15 SIGNAL PROCESSING

BITE AND TEST

BITE

The VOR/MKR receiver built-in test equipment (BITE) continuously monitors marker receiver module performance. Faults are sent through the EIUs to the central maintenance computer system (CMCS). Faults can be accessed from any CDU through the CMCS.

Test

A test of the marker beacon module is done any time the left VOR test is started. The test can be started from the VOR/MKR receiver front panel switch or from any CDU through the CMCS. If the marker beacon module fails, the LRU status LED is red.

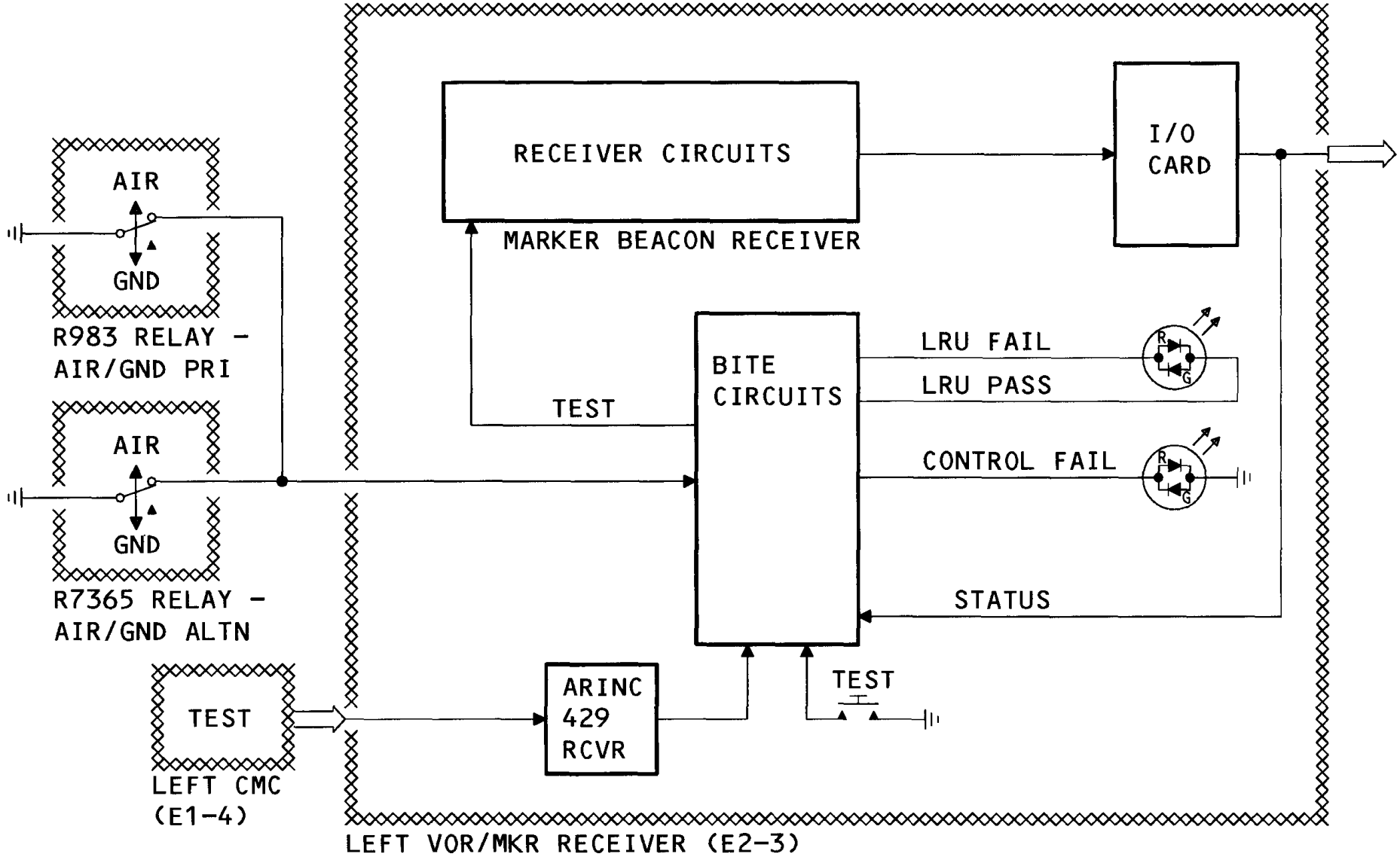


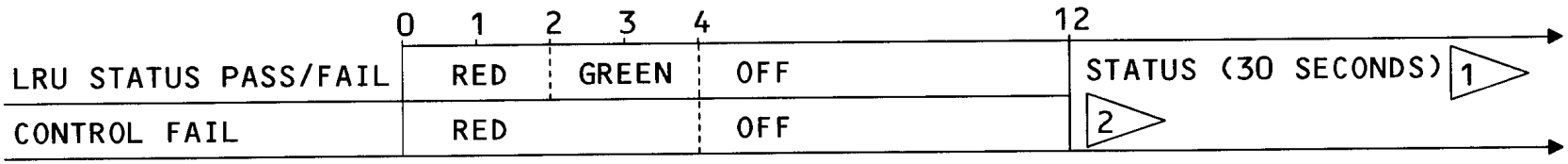
Figure 16 BITE AND TEST

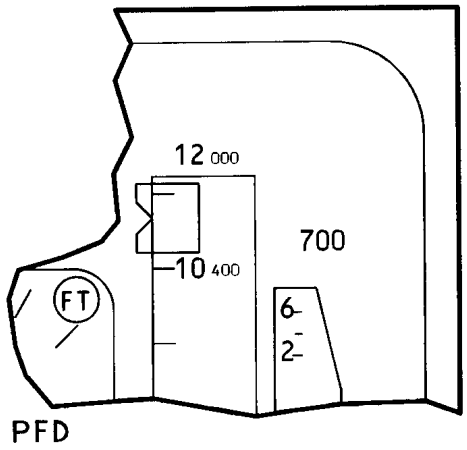
VOR/MKR RECEIVER SELF-TEST

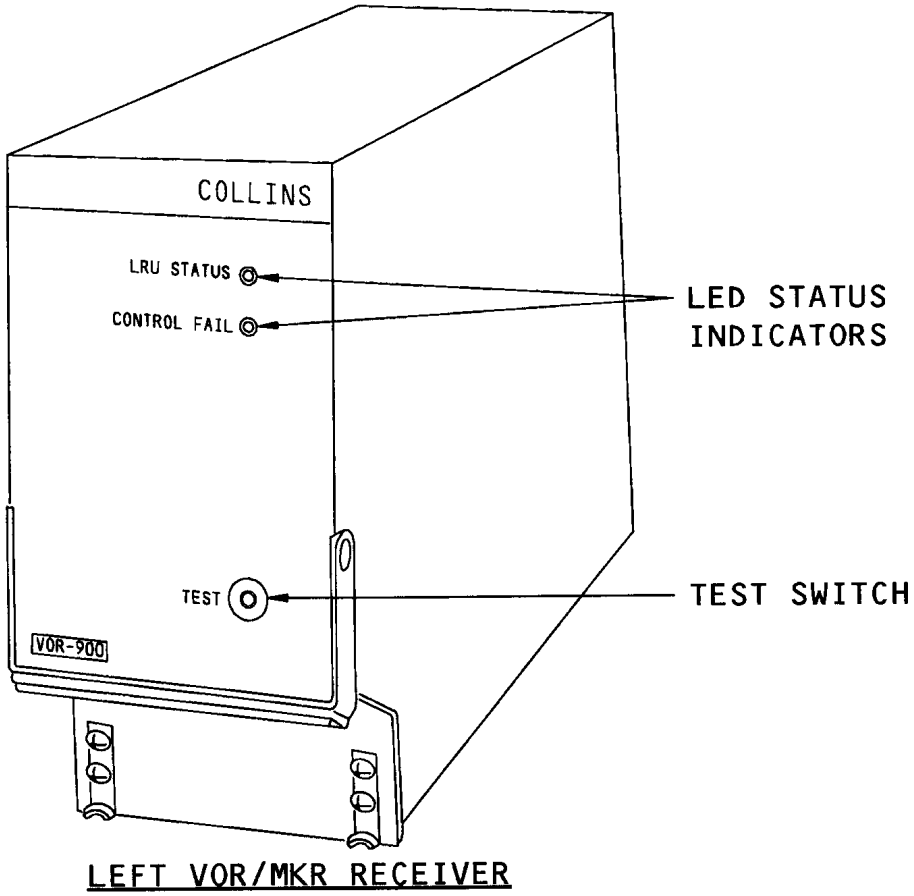
Push and release the TEST switch an the front panel of the VOR/MKR receiver to start the self-test. With no internal faults the front panel will Show the following sequence:

- LRU STATUS will Show red for the first two seconds. It will Show green the next two seconds. It will then blank for eight seconds. Next, it will show status for thirty seconds.
- CONTROL FAIL will show red for the first four seconds and then blank for the duration of the test.

In the flight deck, FT will be shown an both PFDs, when a marker beacon functional test is in progress.







1 FOR LRU FAIL, LED WILL BE RED FOR 30 SECONDS

2 FOR CONTROL FAIL, LED WILL BE RED FOR 30 SECONDS

Figure 17 VOR/MKR RECEIVER SELF-TEST

GROUND TEST

Ground Test

When the CDU line select key next to VOR-L/MKR BCN is pushed a test pre-condition screen shows. Observe the preconditions station and then push the LSK next to START TEST to complete the left VOR/MKR ground test. This test is the Same as the self-test that can be performed from the VOR/MKR receiver front panel.

Ground Test Results

The word PASS (on the CDU) shows that the ground test has passed. Failure of the ground test is shown by the word FAIL. When the adjacent line select key is pushed, it shows the GROUND TEST MSG page. This page gives more information about the test failure.

To show a failure in the marker beacon receiver module, the message an the test message page will be MARKER BEACON RECEIVER FAIL.

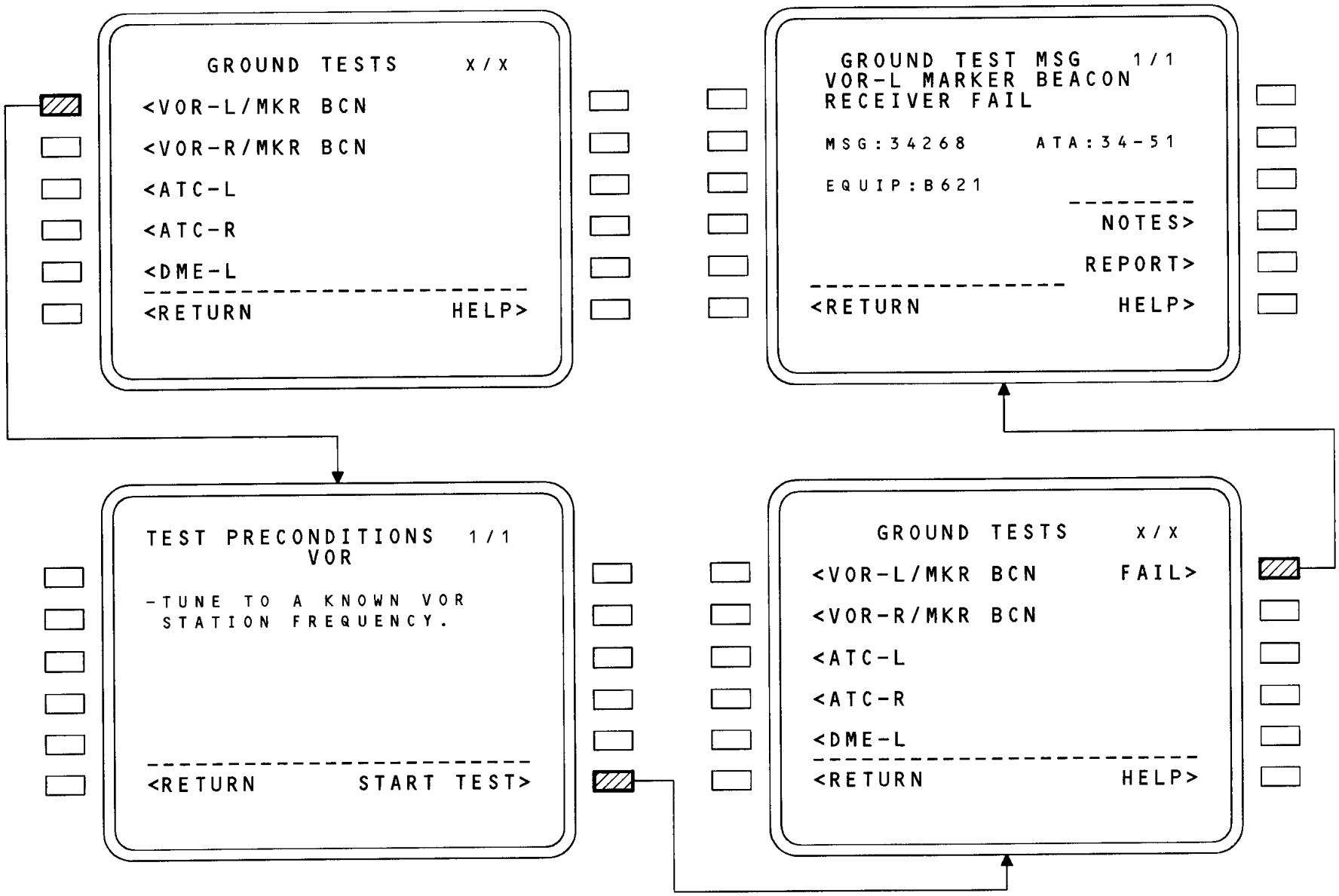


Figure 18 GROUND TEST

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