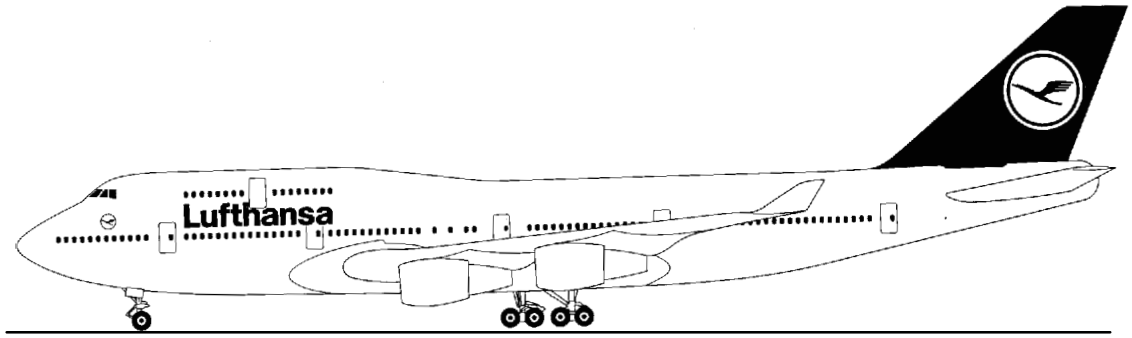
Lufthansa Technical Training

Training Manual
B 747-400



ATA 34-57
ADF

ATA Spec. 104 Level 3

Book No:

Lufthansa
Technical Training GmbH
Lufthansa Base

Issue: Nov 2001
For Training Purposes Only

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ATA 34-57 ADF

AUTOMATIC DIRECTION FINDER SYSTEM INTRODUCTION

The automatic direction finder (ADF) system is a navigational aid. ADF finds the bearing to a ground station relative to the center line of the airplane. It also supplies the audio identifier of the station.

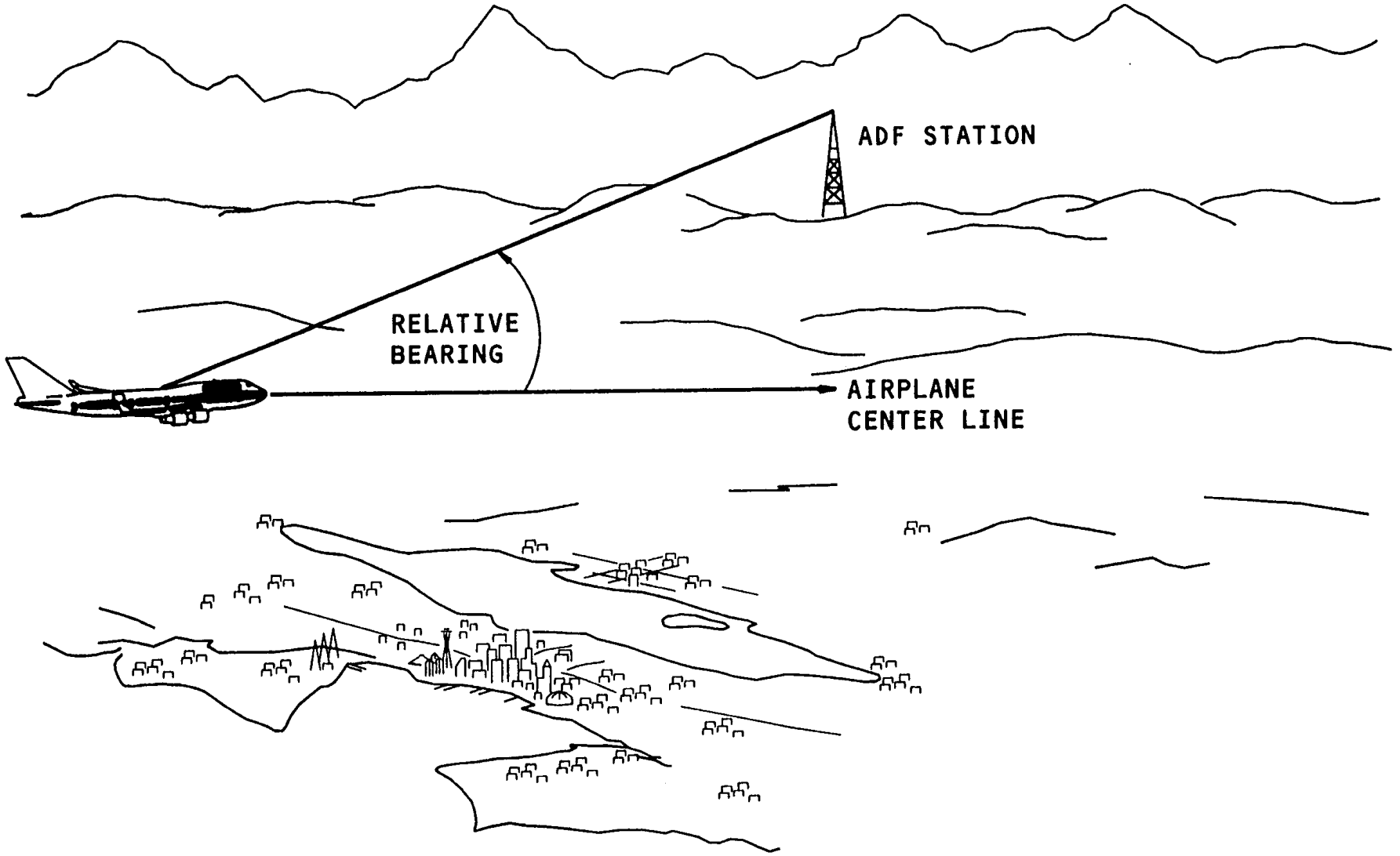

Figure 1 AUTOMATIC DIRECTION FINDER SYSTEM INTRODUCTION

ADF SYSTEM

System Description

The dual ADF system has two independent ADF receivers. Each receiver gets RF from a dedicated antenna. The system operates in the low and broadcast band frequency ranges. These frequencies range from 190 kHz to 1750 kHz.

Modes

The available modes are:

- ADF
- ANT (antenna)
- BFO (beat frequency oscillator)

In the ADF mode, the system finds relative bearing and receives audio from ground stations.

In the ANT mode, the system provides only audio.

In the BFO (beat frequency oscillator) mode, the system adds a 1020 Hz tone.

Operation

The antennas receive signals from the ground station and send them to the ADF receivers. The ADF receivers use these signals to calculate the relative bearing and to make the audio identifier. The receivers send the relative bearing to the EIUs (EFIS/EICAS interface units) to show it on the NDs (navigation displays). The ADF receivers send the audio identifier to the AMU (audio management unit) for audio selection in the flight deck.

Control

The flight crew manually tunes the ADF receivers and sets the mode on the CDUs (control display units). The CDUs send these control signals to the FMCs (flight management computers). One of the FMCs is the master FMC. The FMC master switch relay connects the master FMC to the ADF receivers. The master FMC sends the ADF control signals to the ADF receivers.

In the air if the master FMC does not operate, or on the ground if both FMCs do not operate, the onside CDU sends the ADF control signals directly to the onside ADF receiver.

Test and Status

Maintenance personnel set ground test commands and status requests on the CDUs. The CDUs send these signals to the ADF receivers through the CMCs (central maintenance computers).

The ADF receivers send status data to the CMCs through the EIUs.

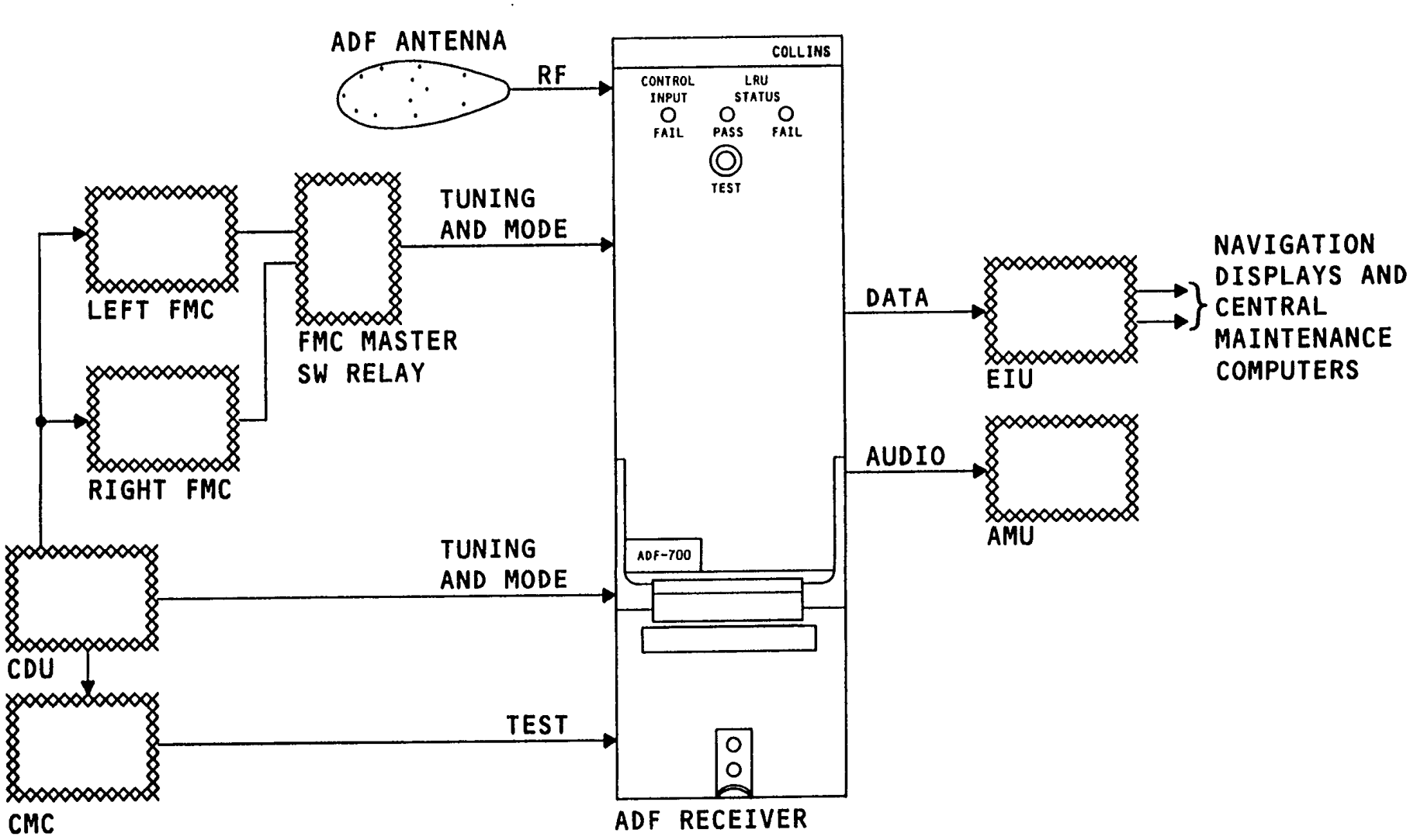

Figure 2 ADF SYSTEM (COLLINS ADF-700)

ADF SYSTEM

System Description

The dual ADF system has two independent ADF receivers. Each receiver gets RF from a dedicated antenna. The system operates in the low and broadcast band frequency ranges. These frequencies range from 190 kHz to 1750 kHz.

Operation

The antennas receive signals from the ground station and send them to the ADF receivers. The ADF receivers use these signals to calculate the relative bearing and to make the audio identifier. The receivers send the relative bearing to the EIUs for display. The ADF receivers send the audio identifier to the AMU for audio selection in the flight deck.

Control

The flight crew manually tunes the ADF receivers and sets the mode on the CDUs. The CDUs send these control signals through the FMCs.

Test and Status

Maintenance personnel set ground test commands and status requests on the CDUs. The CDUs send these signals to the ADF receivers through the CMCs.

The ADF receivers send status data to the CMCs through the EIUs.

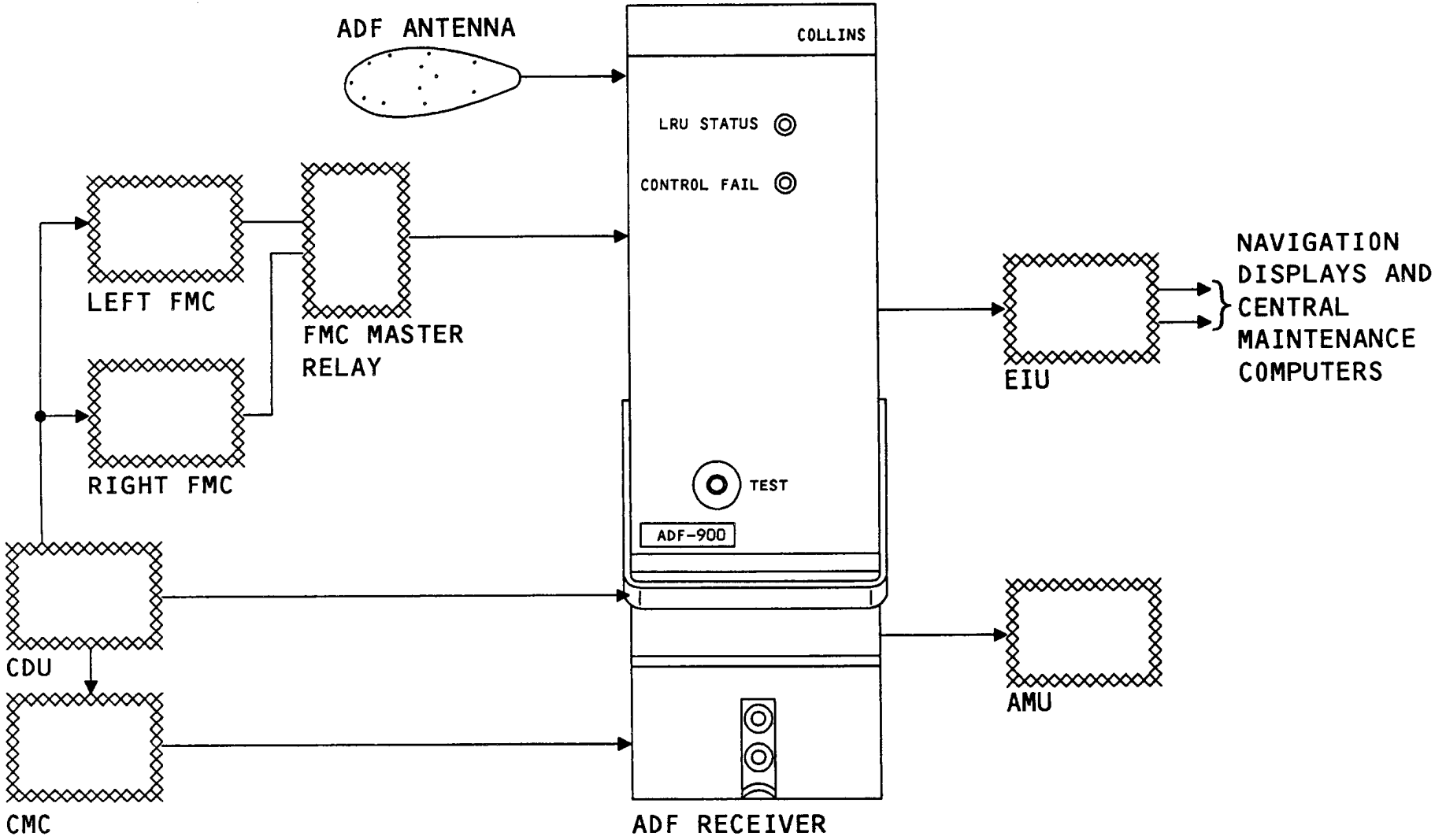

Figure 3 ADF SYSTEM (COLLINS ADF-900)

COMPONENT LOCATIONS

The ADF system components are:

- Left ADF receiver
- Right ADF receiver
- Left ADF antenna
- Right ADF antenna

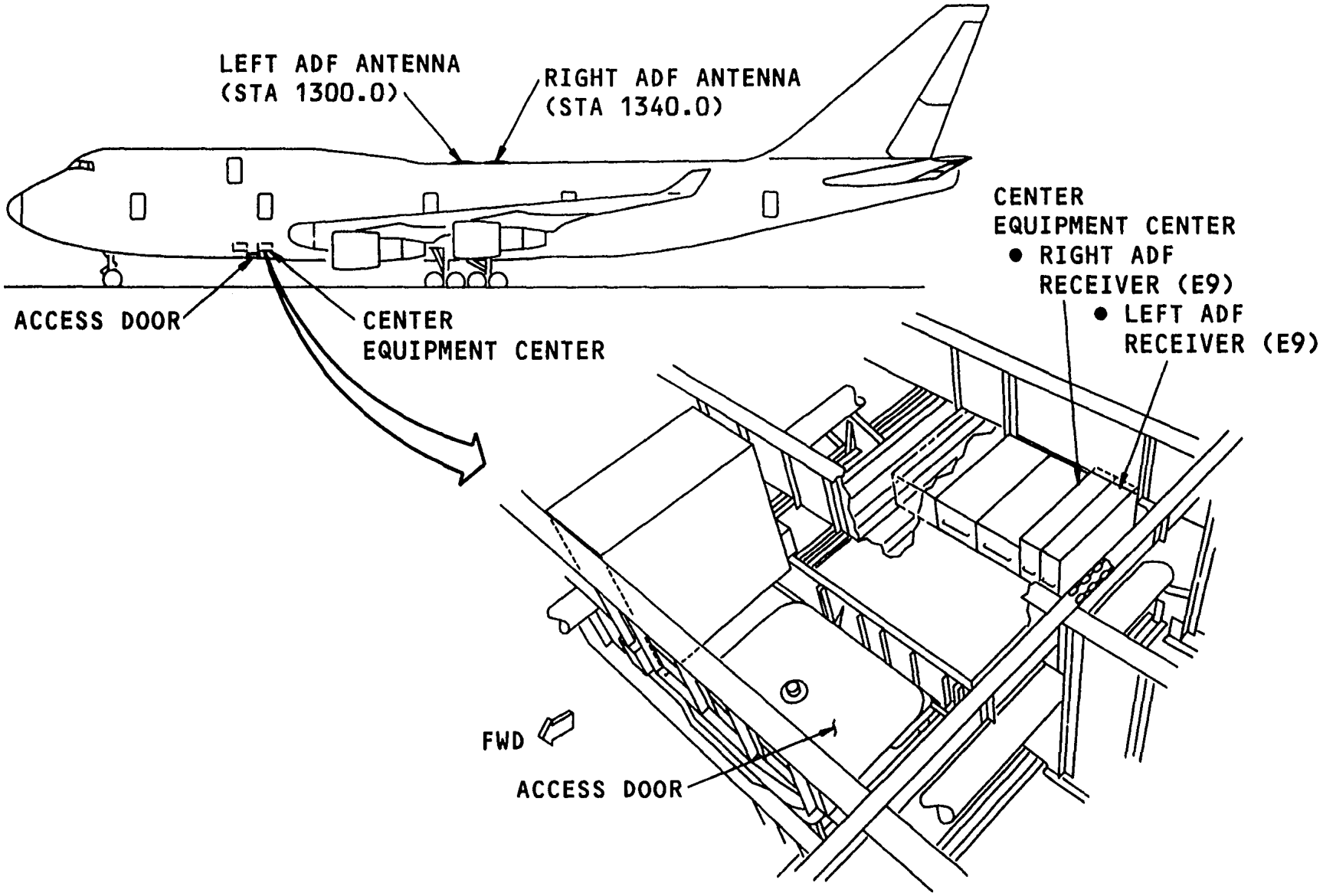

Figure 4 COMPONENT LOCATIONS

COMPONENT LOCATIONS - FD

The ADF system components are:

- Left ADF circuit breaker
- Right ADF circuit breaker

The components that interface with the ADF system are:

- Left CDU
- Right CDU
- Left inboard IDU
- Right inboard IDU
- Lower IDU
- Left EFIS control panel
- Right EFIS control panel
- Audio control panels

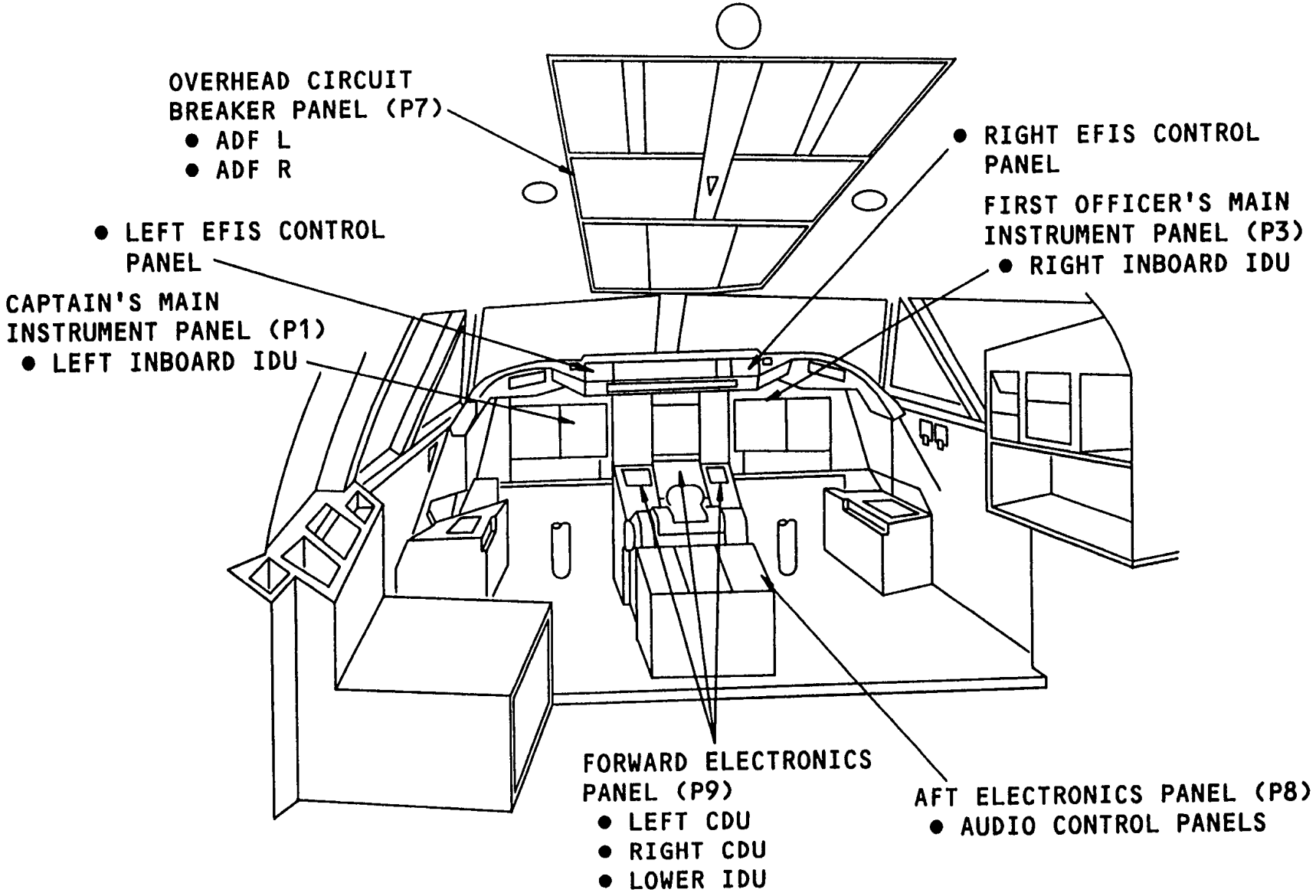

Figure 5 COMPONENT LOCATIONS - FD

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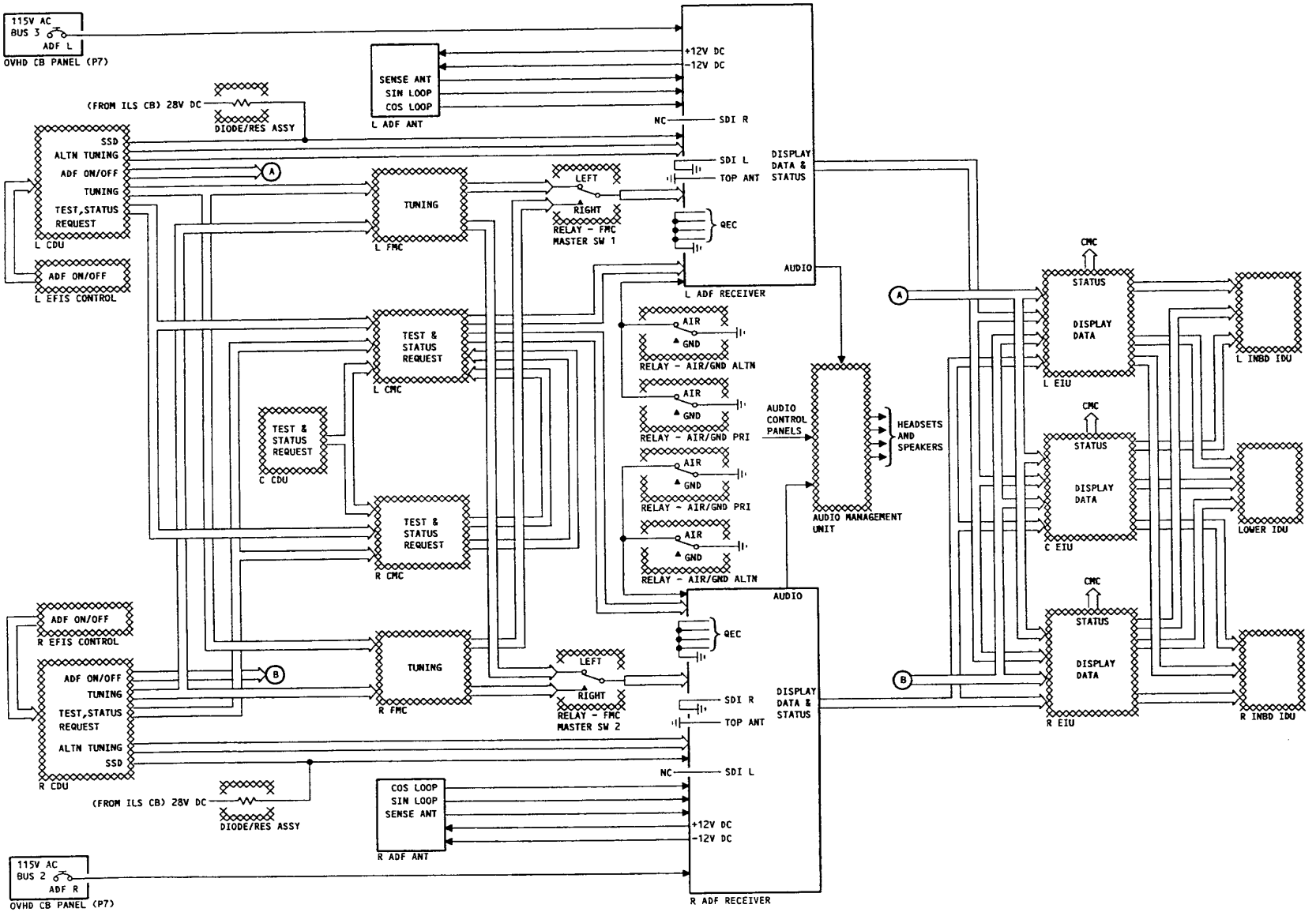

Figure 6 ADF INTERFACE DIAGRAM

POWER AND ANTENNA INPUTS

Power is supplied to the ADF receiver from its onside circuit breaker. Power is supplied to the ADF antenna from the onside receiver.

Each ADF antenna supplies rf signals to its onside ADF receiver.

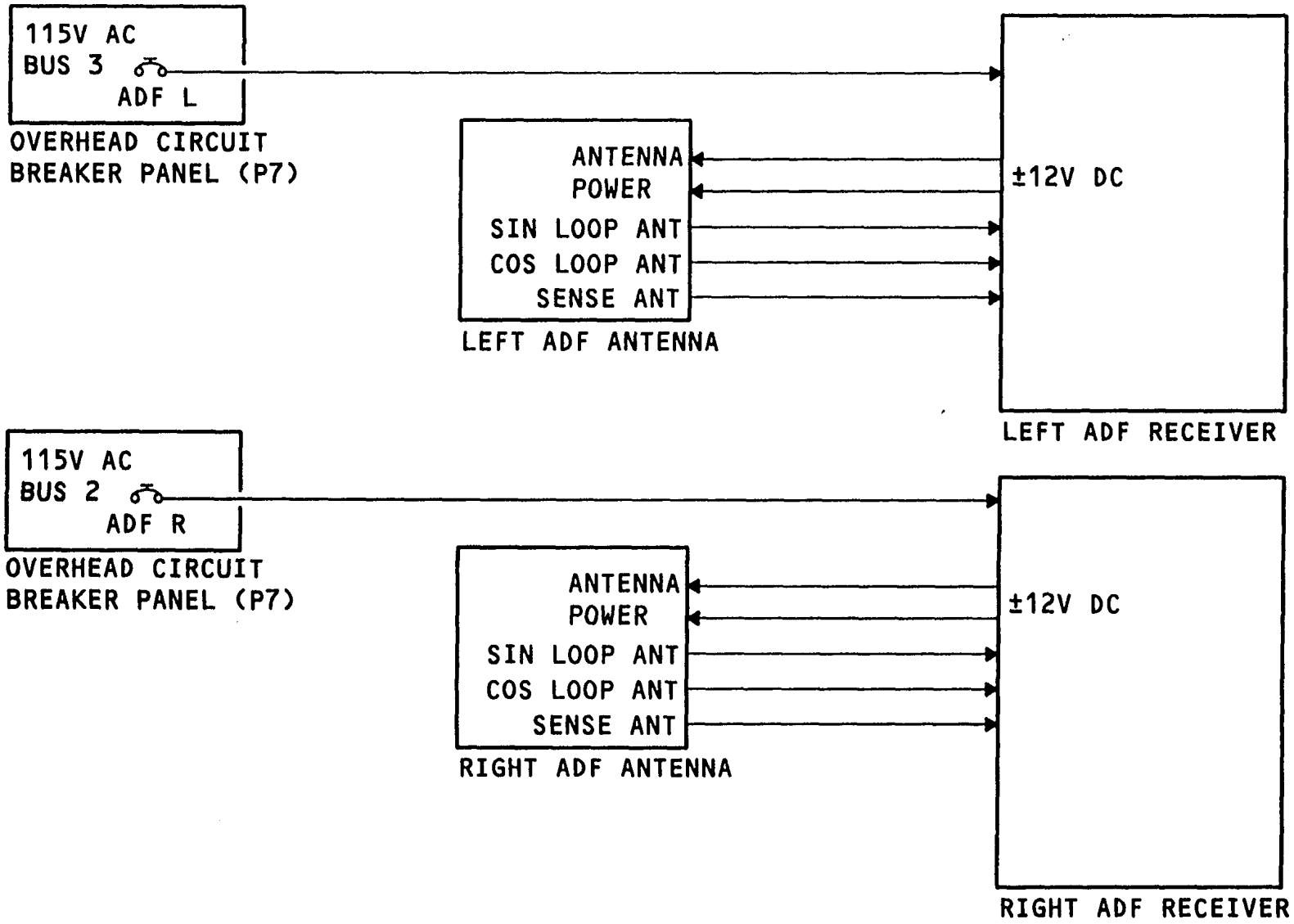

Figure 7 POWER AND ANTENNA INPUTS

TUNING INPUTS

General Description

The control display units (CDUs) tune the ADF receivers directly or through the flight management computers (FMCs).

Operation

Frequency and mode data are entered on the left or right CDU. The CDUs send frequency and mode data on an ARINC 429 bus to both FMCs. The master FMC sends the tuning information to both ADF receivers. The master FMC sends tuning data on bus 1 to the left ADF receiver and on bus 2 to the right ADF receiver.

The master FMC is set by the FMC master switch. A move of this switch from left to right causes the FMC master switch relays 1 and 2 to change positions.

In the air when the master FMC fails or on the ground when both FMCs fail, the onside CDU tunes each ADF receiver directly.

Internal logic circuits switch from port B to port A.

The onside CDU source select discrete provides control.

A resistant diode circuit applies 28v dc as source select discrete (SSD) bias.

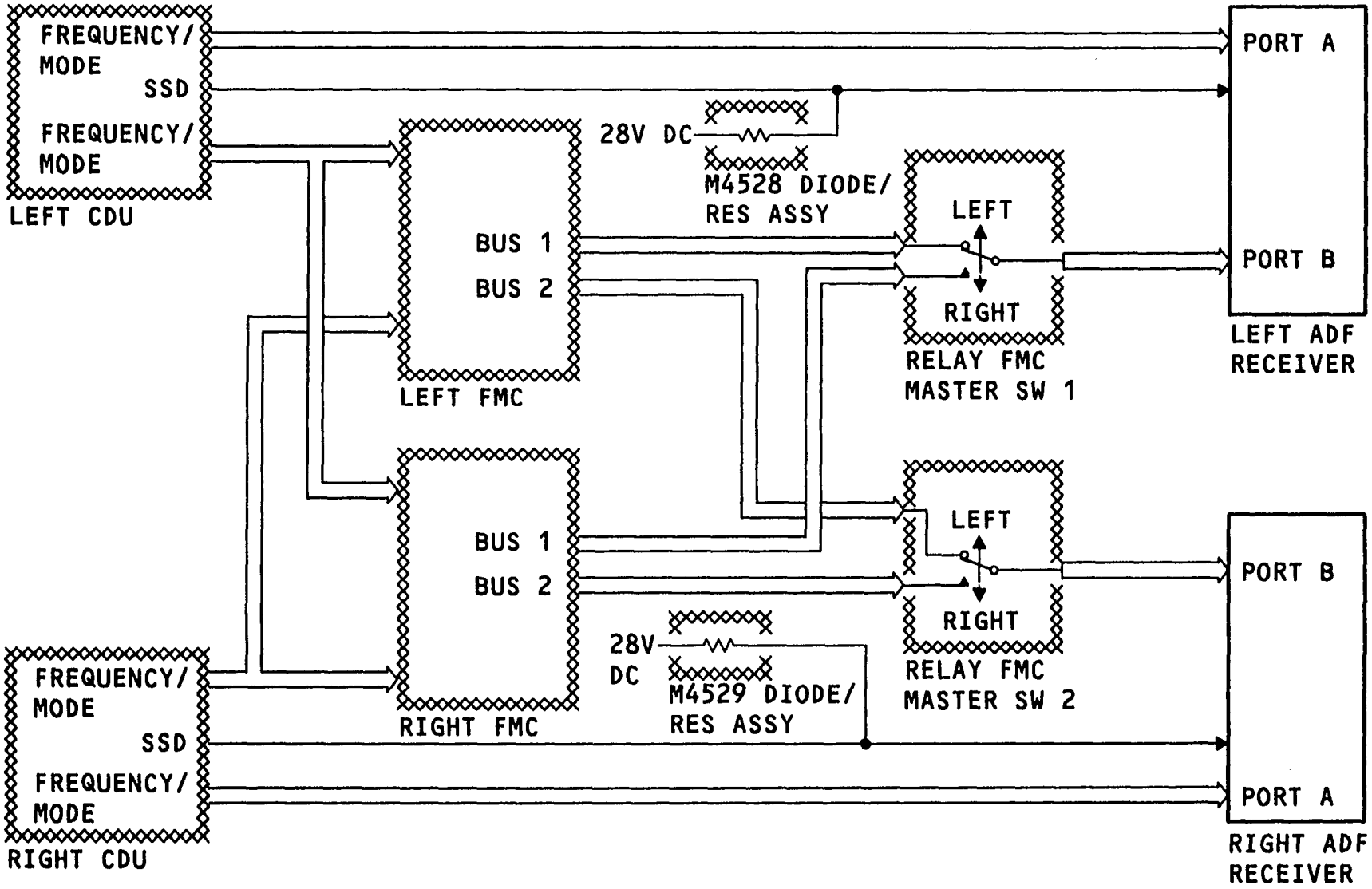

Figure 8 TUNING INPUTS

CMC INPUTS

Any one of the three CDUs can request fault information and initiate ground tests of the ADF receivers through the CMCs. The left CMC normally provides outputs to the ADF receivers. When the left CMC fails, the right CMC automatically provides outputs to the ADF receivers.

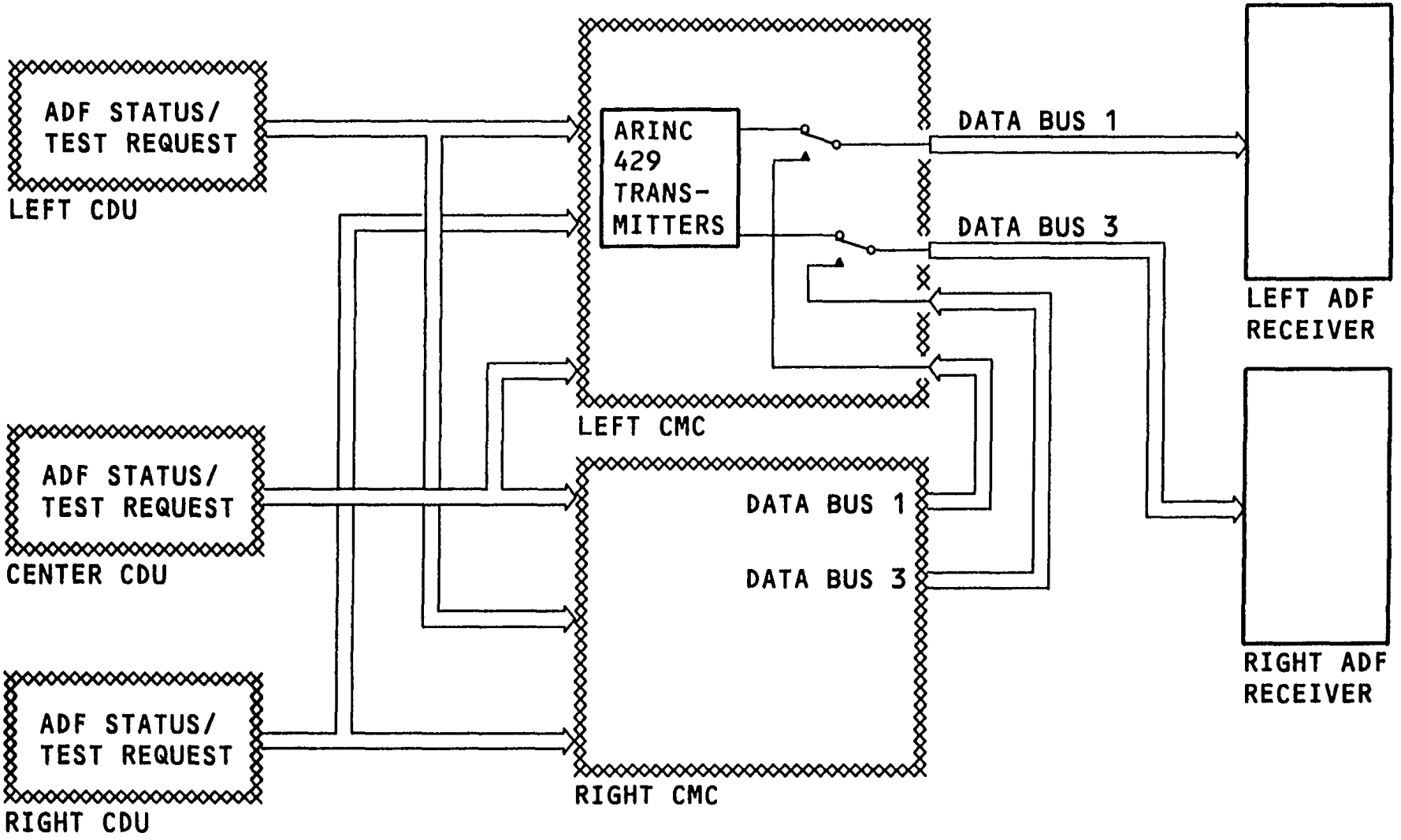

Figure 9 CMC INPUTS

DATA AND STATUS OUTPUTS

ADF data and status information from each ADF receiver goes on an ARINC 429 bus to the left, right, and center EIUs.

All EIUs send bearing and status information to both the captain's and the first officer's NDs. The EIU's also send ADF status information to the central maintenance computer.

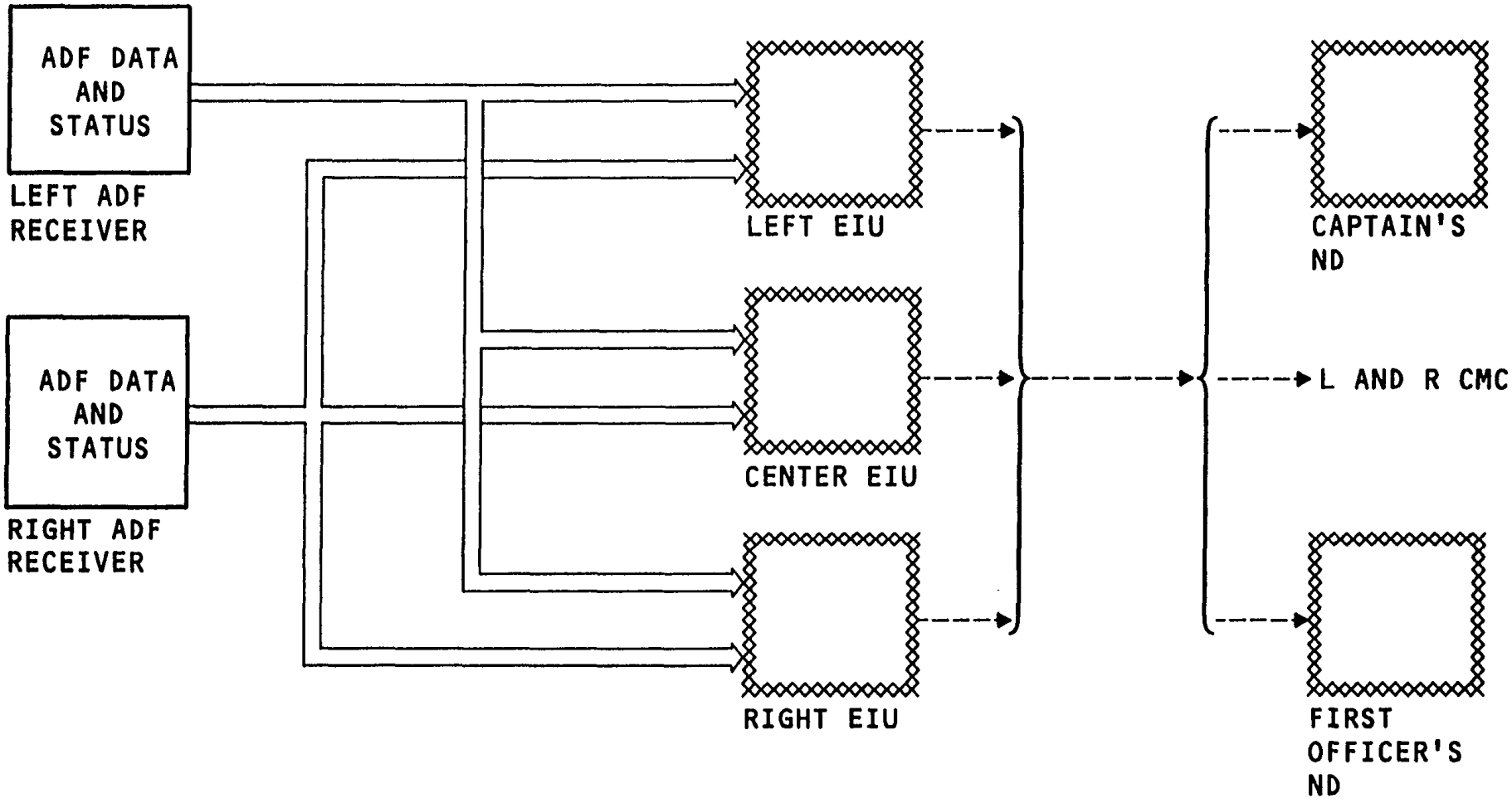

Figure 10 DATA AND STATUS OUTPUTS

AUDIO OUTPUTS

The left and right ADF receivers send audio to the AMU. The audio control panels supply control. The AMU sends the audio signals to the headsets and speakers.

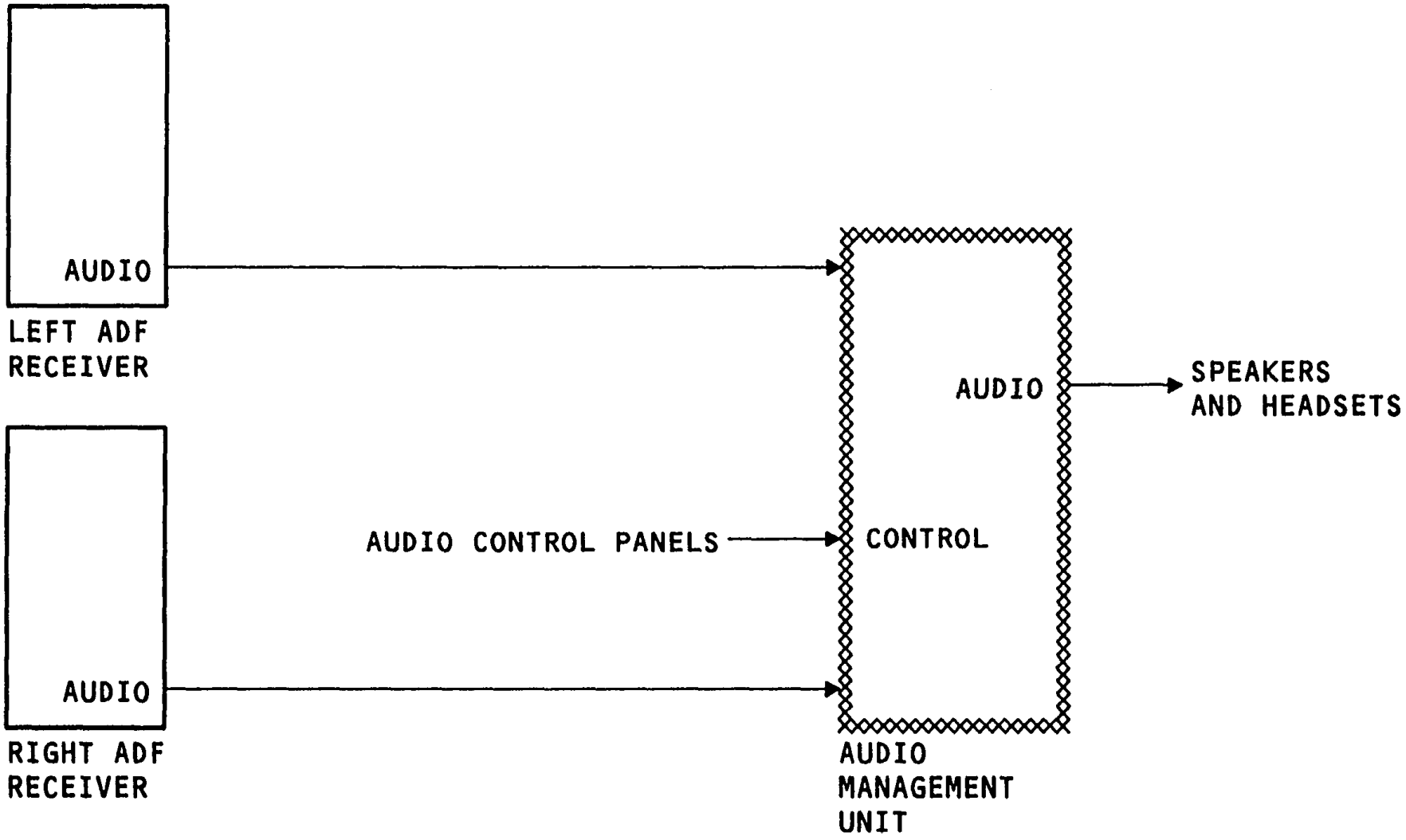

Figure 11 AUDIO OUTPUTS

ANALOG DISCRETES

Program Pins

The program pin inputs are:

- Quadrantal error correction (QEC)
- Source/destination identifier (SDI)
- Top antenna location identifier

QEC

QEC makes allowances for airplane-caused RF field distortions. The ADF receiver manufacturer sets the QEC. The QEC is the same for all aircraft of that model (747-400).

The grounding of specified program pins gives the correct QEC. Each program pin is a given correction angle value. The values vary for the left and right antennas.

SDI

The SDI identifies the left or right ADF system. A specified program pin identifies the left ADF receiver. A different program pin identifies the right ADF receiver.

Top Antenna

A program pin identifies the location of the antenna, on the top or on the bottom of the fuselage. On the 747-400, the ADF antennas are on the top of the fuselage.

Air/Ground Inputs

Each one of the ADF receivers gets an input from two air/ground relays in parallel.

The functions are to:

- Prevent ground tests while the airplane is in the air.
- Increment the flight leg in the nonvolatile memory of the ADF receiver if the CMC (central maintenance computer) fails.

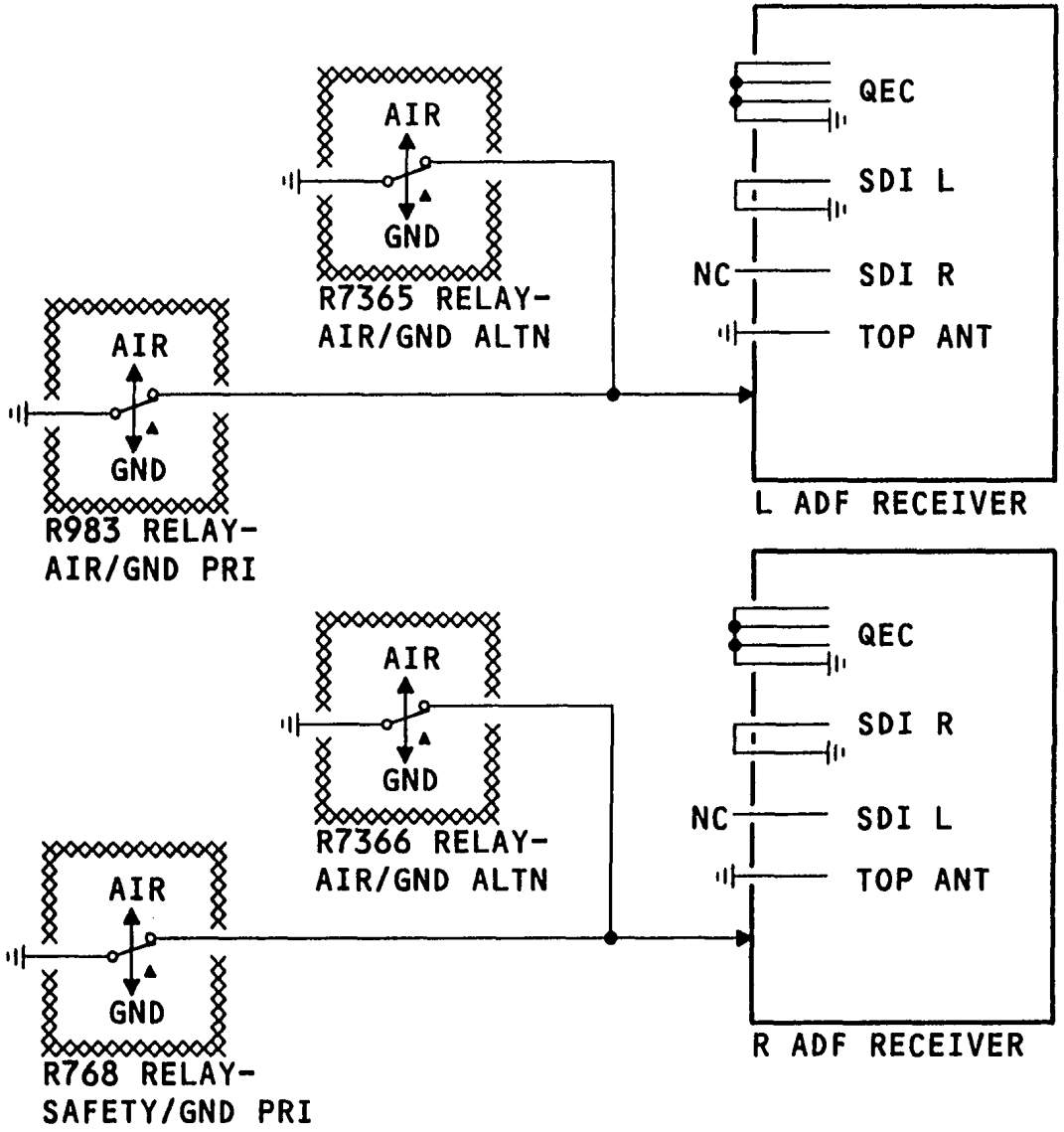

Figure 12 ANALOG DISCRETES

ADF RECEIVER

Purpose

The ADF receiver calculates relative bearing to a station that transmits in the 190 kHz to 1750 kHz frequency range. The receiver also receives station identifiers and AM broadcast audio.

Characteristics

The ADF receiver has a non-volatile fault memory for recording faults. Fault recording is done by flight legs. The fault memory data is available at the automatic test equipment (ATE) connector at the back of the receiver.

Power

The ADF receiver operates on 115v ac.

Control and Monitor

The ADF receiver receives control inputs on an ARINC 429 data bus.

The front panel features include a control for test and LED status indicators which illuminate in test. They consist of the:

- TEST switch which starts a self-test of the ADF receiver.
- LRU STATUS FAIL LED (red) which shows an ADF receiver failure.
- LRU STATUS PASS LED (green) which shows correct ADF receiver operation.
- CONTROL INPUT FAIL LED (red) which shows a bad tuning source (FMC or CDU) .

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.

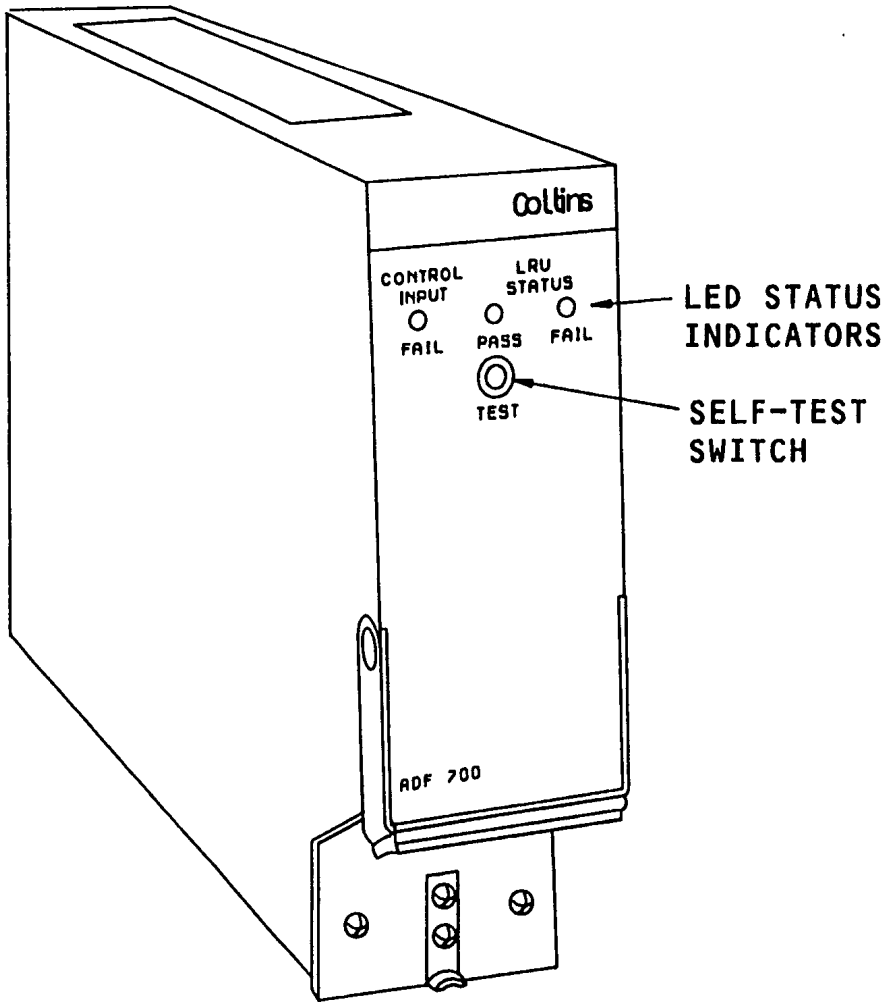

Figure 13 ADF RECEIVER (ADF-700)

ADF RECEIVER

Purpose

The ADF receiver calculates relative bearing to a station that transmits in the 190 kHz to 1750 kHz frequency range. The receiver also receives station identifiers and AM broadcast audio.

Characteristics

The ADF receiver has a non-volatile fault memory for recording faults. Fault recording is done by flight legs. The fault memory data is available at the automatic test equipment (ATE) connector at the back of the receiver.

Power

The ADF receiver operates on 115v ac.

Control and Monitor

The ADF receiver receives control inputs on an ARINC 429 data bus.

The front panel features include a control for test and LED status indicators which illuminate in test. They consist of the:

- TEST switch which starts a self-test of the ADF receiver.
- LRU STATUS LED - shows a failure found in the ADF receiver if red and shows no failure if green.
- CONTROL FAIL LED - shows red for an invalid tuning source. The source could be the FMC or CDU.

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.

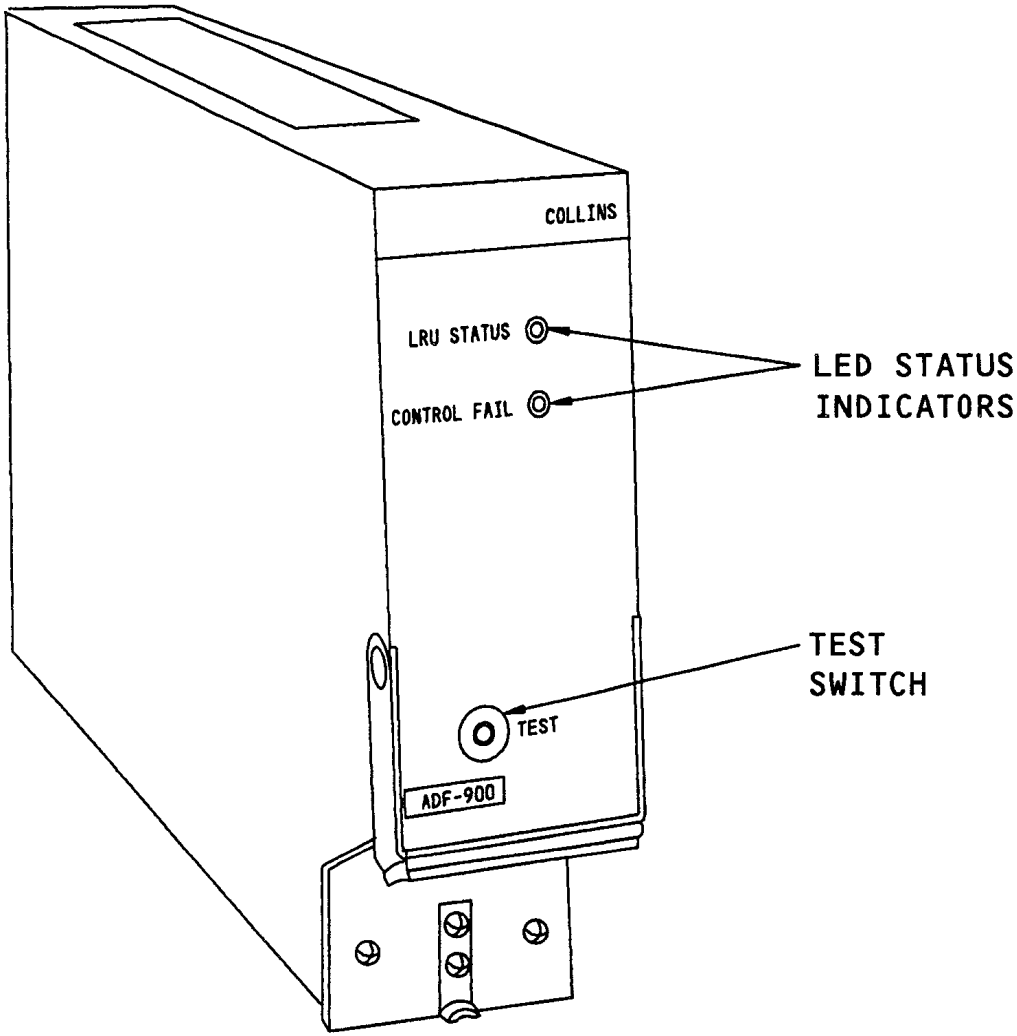

Figure 14 ADF RECEIVER (COLLINS ADF-900)

ADF ANTENNA

Purpose

The ADF antenna receives radio frequency (rf) signals from a ground station. It amplifies these signals and transmits them to the ADF receiver.

Construction

The antenna assembly is a one-piece molded shell. The antenna assembly contains:

- Two loop antenna elements
- One sense antenna element
- One electronics assembly which includes amplifier circuits and output transformers for each antenna element.

The top surface of the antenna is covered with antistatic paint for the purpose of precipitation-static protection. A conductive gasket made of woven aluminum impregnated cloth gives electrical bond as well as environmental protection.

The sense antenna element removes the 180 degree ambiguity in the relative bearing calculations and is the source for audio.

The loop antenna elements give the directional signals. They have two perpendicular loops that are the same. one is the sine loop which is parallel to the longitudinal axis of the airplane. The other is the cosine loop which is parallel to the lateral axis of the airplane.

Power

The ADF antenna receives +/- l2v dc from its onside ADF receiver.

Installation

Use twelve captive mounting screws on installation of the antenna. one screw has a tab/washer to make resistance measurements.

An O-ring gives a seal between the airplane skin and the antenna.

Do a resistance check between the airplane and the antenna to ensure proper ADF operation.

The electrical connector connects antenna transmission lines and power between the antenna and its receiver. Transmission lines from the sense and loop outputs are two wire shielded cables. Power from the receiver is a twisted pair (+/- l2v dc) and a ground wire. The cables and wires are enclosed by a shield to form a wire bundle.

CAUTION: EXTRA FORCE ON THE ANTENNA BASE MAY BE REQUIRED TO BREAK THE WEATHER-PROOF - ING SEAL. TO PREVENT DAMAGE TO THE AIR- PLANE SKIN OR THE ELECTRICAL CABLE AT THE ANTENNA BASE, CAREFULLY PRY AROUND THE ANTENNA WITH THE SEALANT REMOVAL TOOL.
STATIC SENSITIVE. DO NOT HANDLE BEFORE READING PROCEDURE FOR HANDLING ELEC- TROSTATIC DISCHARGE SENSITIVE DEVICES (REF 20-42-02/201). CONTAINS DEVICES THAT CAN BE DAMAGED BY STATIC DISCHARGE.

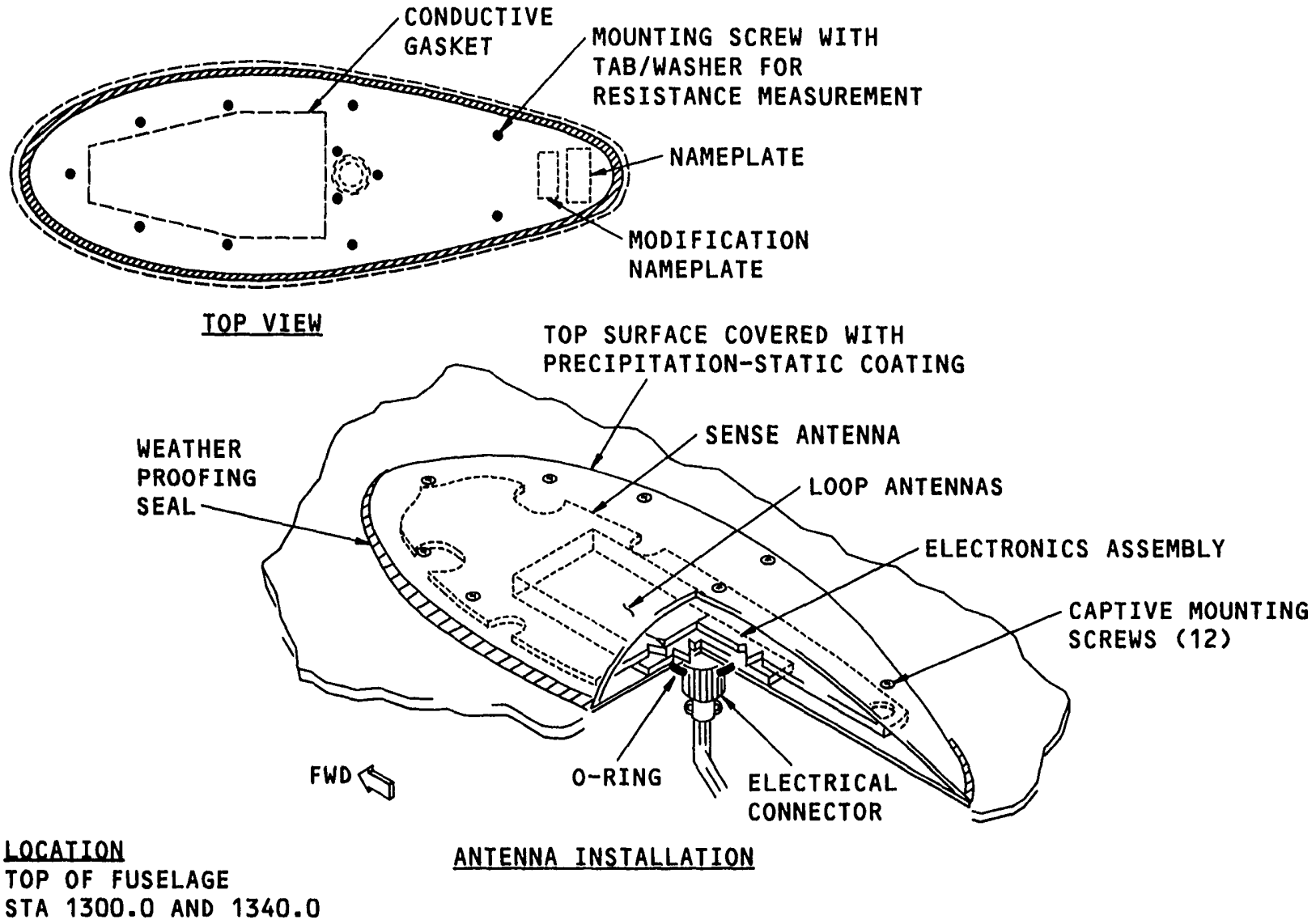

Figure 15 ADF ANTENNA

AUDIO CONTROL

The audio control panel supplies inputs to the audio management unit. These inputs control which audio signals are heard on the flight deck speakers and on the pilots' headsets.

To hear ADF audio:

- Set left or right ADF with the VOR/ADF receiver selector switch.
- Push the receiver control switch to turn the ADF audio on. Turn the switch to adjust the volume.
- Turn the speaker switch on

Use the filter selector switch to set voice (V), range (R) or both (B). The selection of range permits the Morse code identification to be heard.

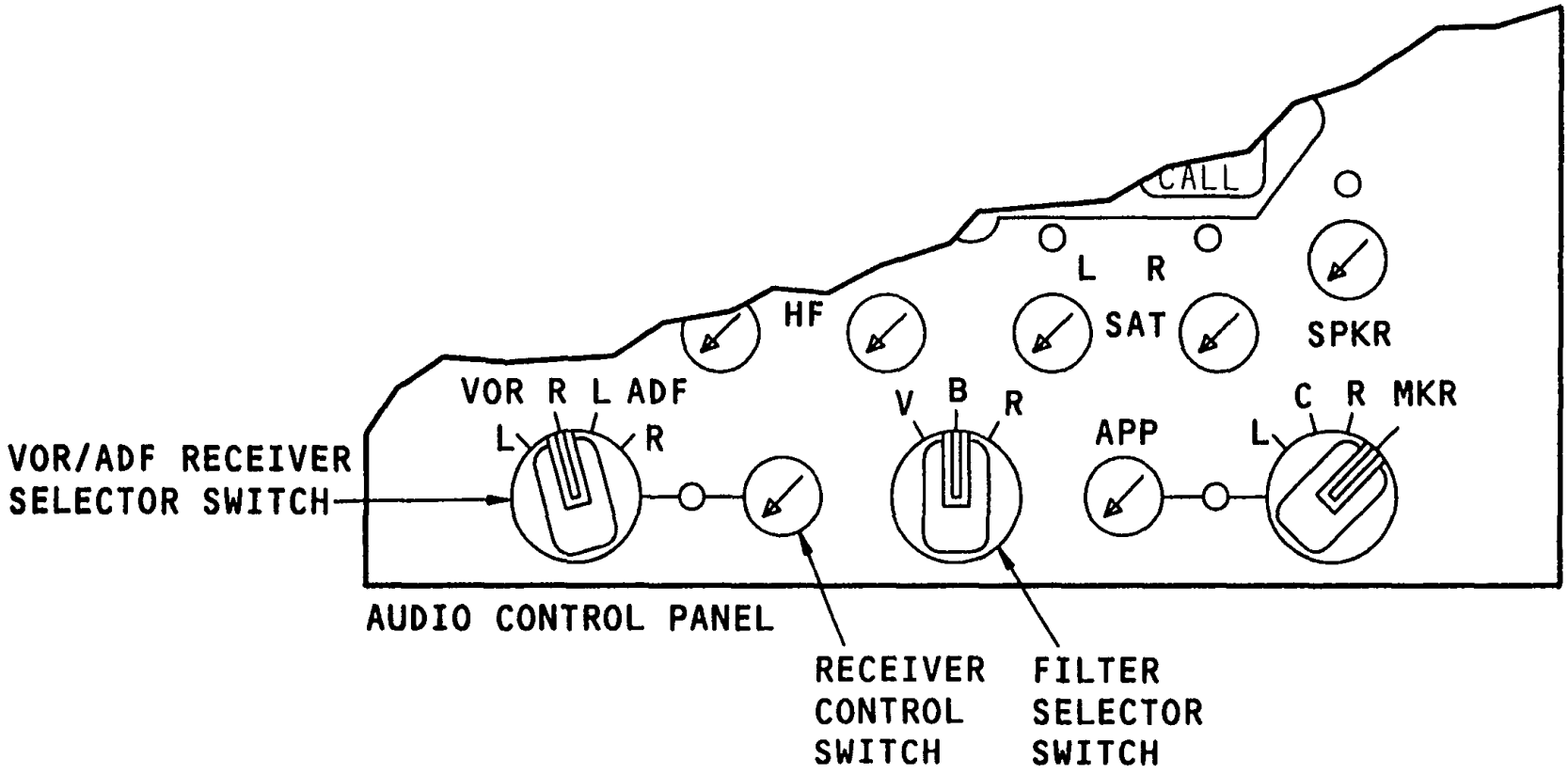

Figure 16 AUDIO CONTROL

NAV RADIO TUNING

Tuning

Tuning and mode selection of both ADF receivers is done from the NAV radio page on either the left or the right CDU. This data is sent to both FMCs. The ADF receivers get tuning data from the master FMC. The master FMC is set by the position of the FMC master switch. To tune an ADF receiver, put a valid ADF frequency on the line position next to ADF L for the left receiver, or ADF R for the right receiver. The ADF receiver cannot be tuned by use of the station identifier. When only the frequency is put in, the ADF receiver goes to the ADF mode.

Use the PRESELECT line position to store alternate ADF frequency and mode selection data. To use the preselect data, push line select key 6L. The data transfers to the scratch pad Push the line select key 3L or 3R: The data transfers to ADF L or ADF R.

ANT Mode

Set the letter A after the frequency to select the antenna (ANT) mode. ANT will be displayed after the frequency. Use the delete (DEL) key on the CDU to go back to the ADF mode.

BFO Mode

Selection of BFO (beat frequency oscillator) mode lets the Morse-code station identifier be heard if the signal from the ground station is an unmodulated carrier keyed by the morse code station identifier. If the signal from the ground is a carrier that is amplitude-modulated by the Morse-code 1020 Hz station identifier, no BFO selection is required to hear the station identifier. Selection of BFO in this case would result in a superimposed continuous 1020 Hz tone over the station ID audio. BFO selection is done by putting the letter B after the frequency. BFO will show after the frequency. Use the delete (DEL) key to return to the ADF mode.

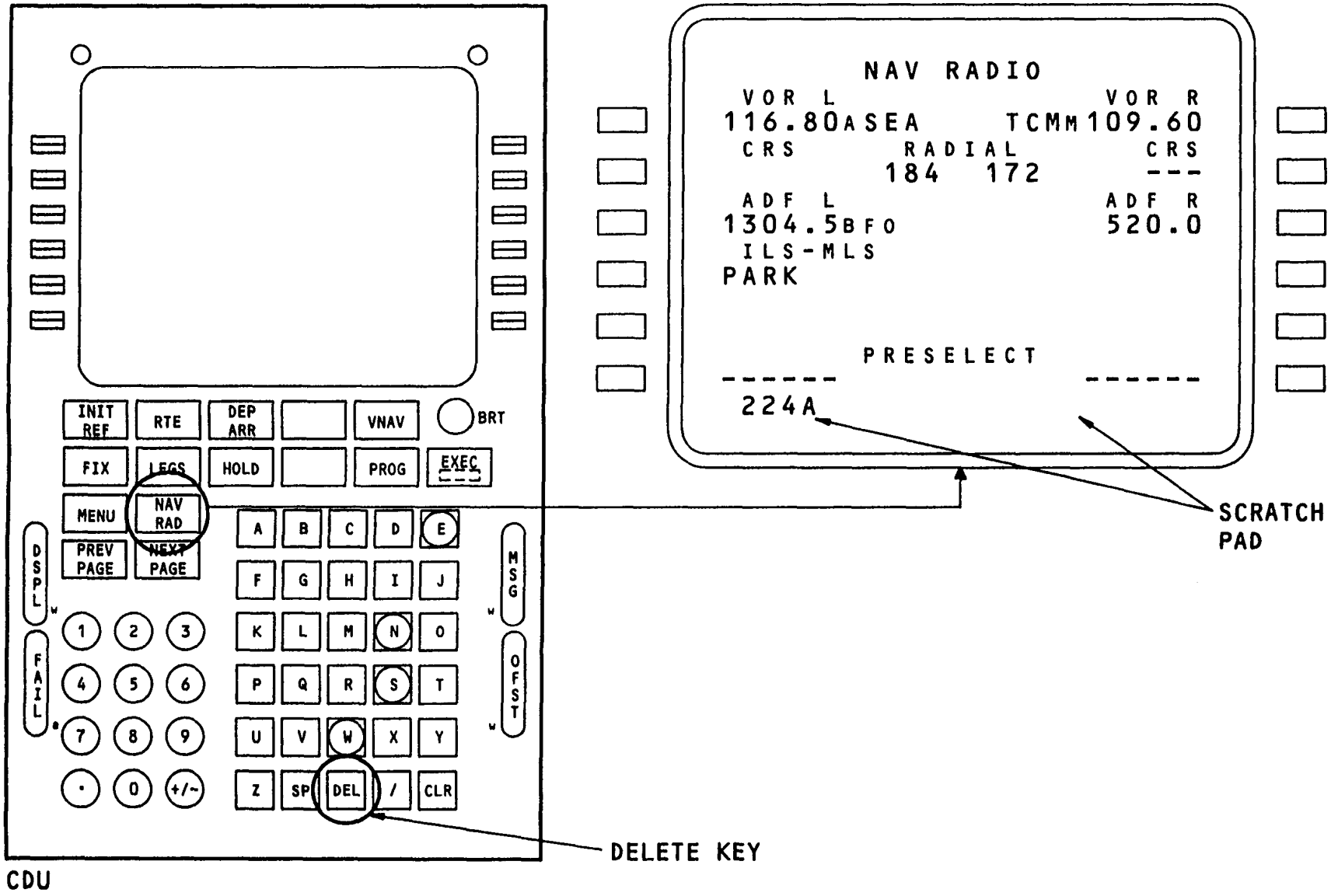

Figure 17 NAV RADIO TUNING

ALTERNATE NAV RADIO TUNING

When the FMC input to the ADF receiver has a failure, the ADF receiver stays tuned to the last valid frequency. To tune to a new frequency, the alternate NAV radio page is used.

Alternate tuning is used in the air when the master FMC has a failure or on the ground when both FMCs have a failure. Then tuning is done from the onside CDU only. The tuning and mode data go directly from the CDU to the ADF receiver.

Push the NAV RAD key on the left or right CDU to show the ALTN NAV radio page on the associated CDU. To tune the left ADF receiver, put a valid ADF frequency on the line position next to ADF on the left CDU. To tune the right ADF receiver, put a valid ADF frequency on the line position next to ADF on the right CDU.

The preselect line position may be used to store alternate ADF frequency and mode selection data. Press the line select key next to preselect, which has valid ADF data, and then press the line select key next to left or right ADF.

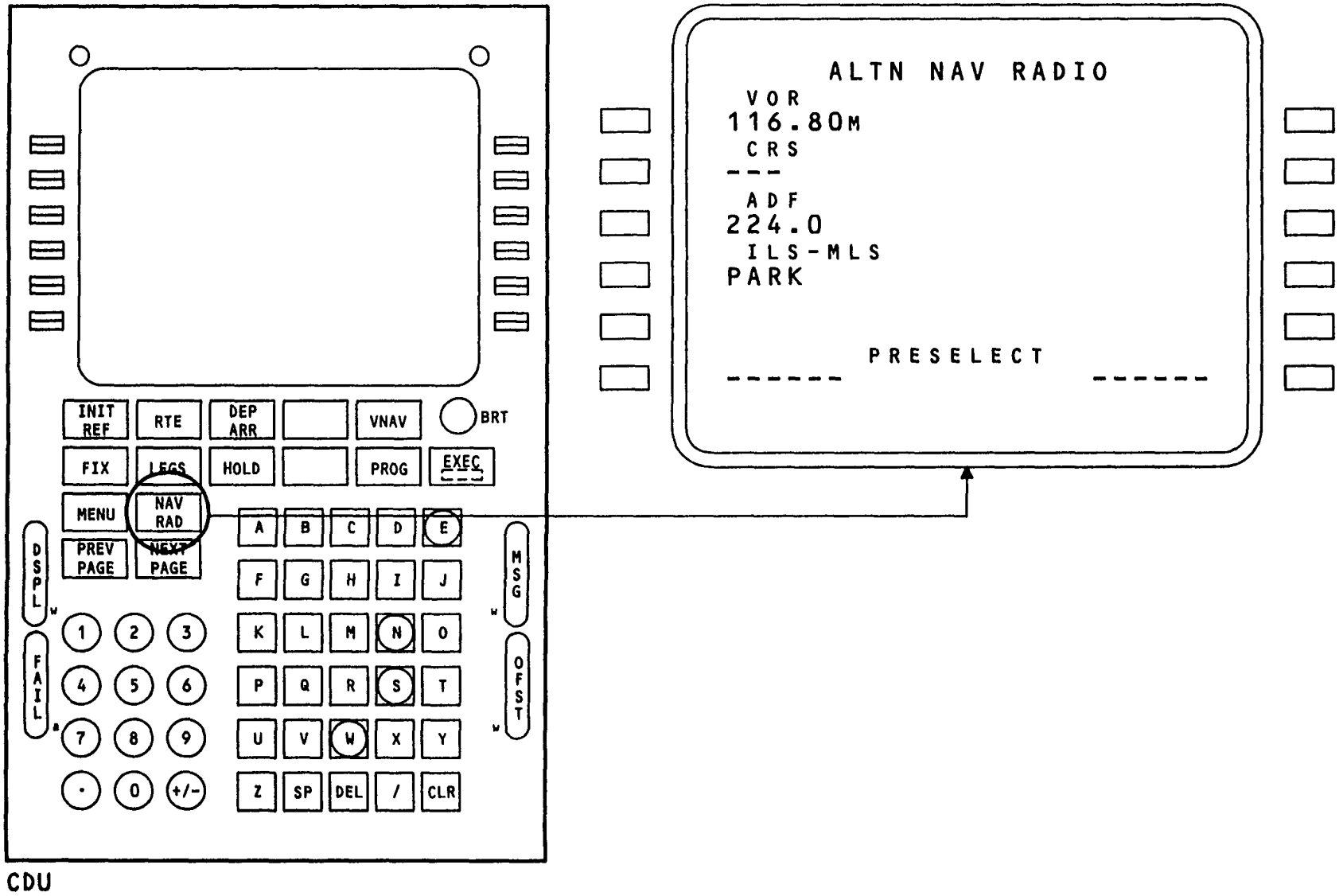

Figure 18 ALTERNATE NAV RADIO TUNING

ADF DISPLAYS - ND

In all EFIS modes but PLN (plan), when the EFIS control panel VOR/ADF switch is in the ADF position the:

- ADF pointer and/or reciprocal pointer shows.
- ADF source and identifier or frequency shows.

When ADF is set on the CDU alternate EFIS control, both left and right ADF data show on the onside navigation display.

The station identifier replaces the frequency when that data is valid from the ADF receiver.

When the ANT mode is selected, the ADF pointers are removed.

The pointer(s), frequency or identifier, and source annunciation go blank when the VOR/ADF switch is in the OFF position or when VOR switch is selected on the CDU.

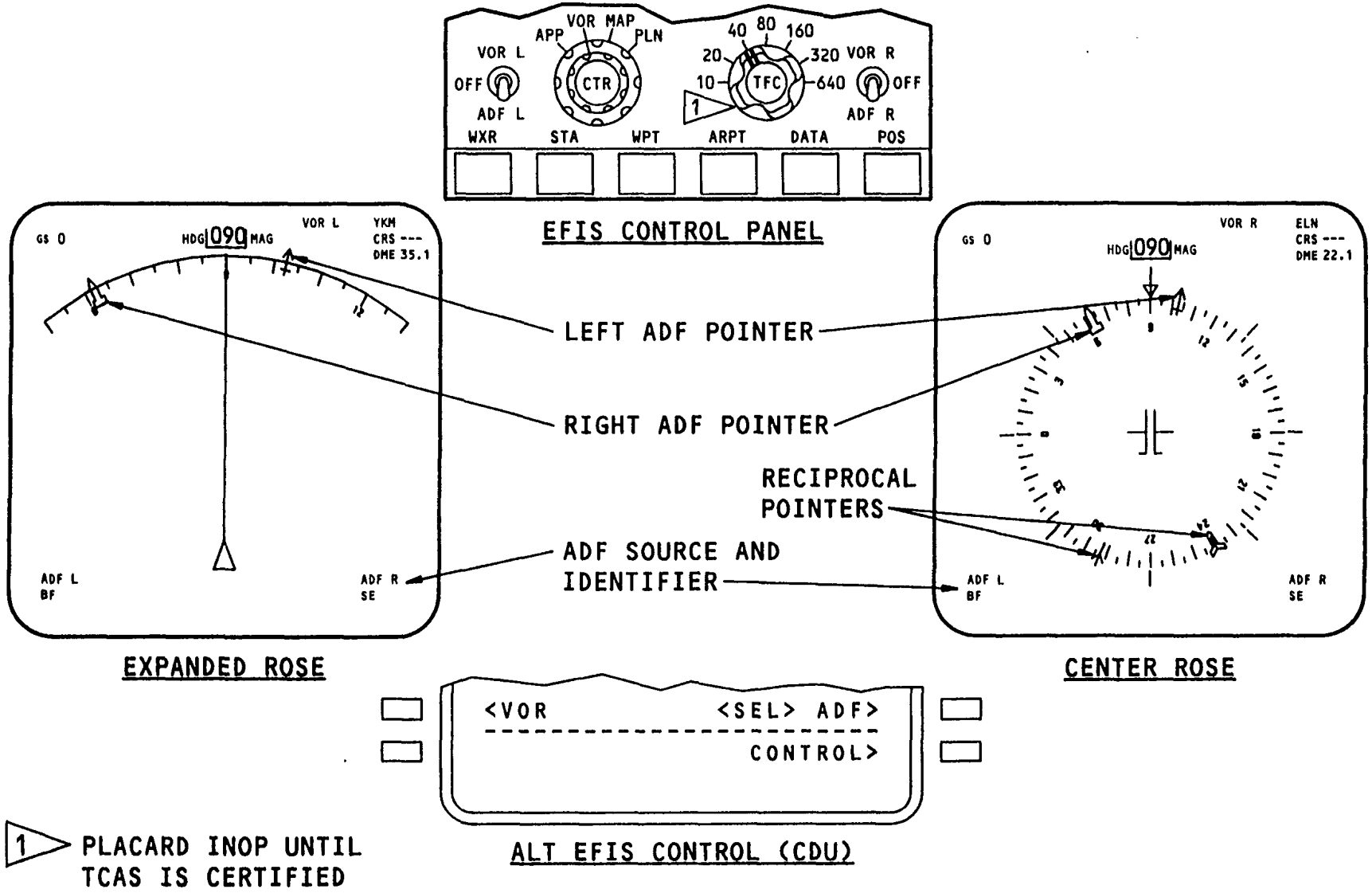

Figure 19 ADF DISPLAYS - ND

ND-NCD AND INVALID DISPLAY

The ND ADF pointers are removed for no computed data (NCD). The source annunciator and frequency still show.

For invalid data, the ADF pointers are removed and the ADF flag(s) are shown.

The flags and/or source annunciator and frequency are removed when the VOR/ADF switch is moved out of the ADF position.

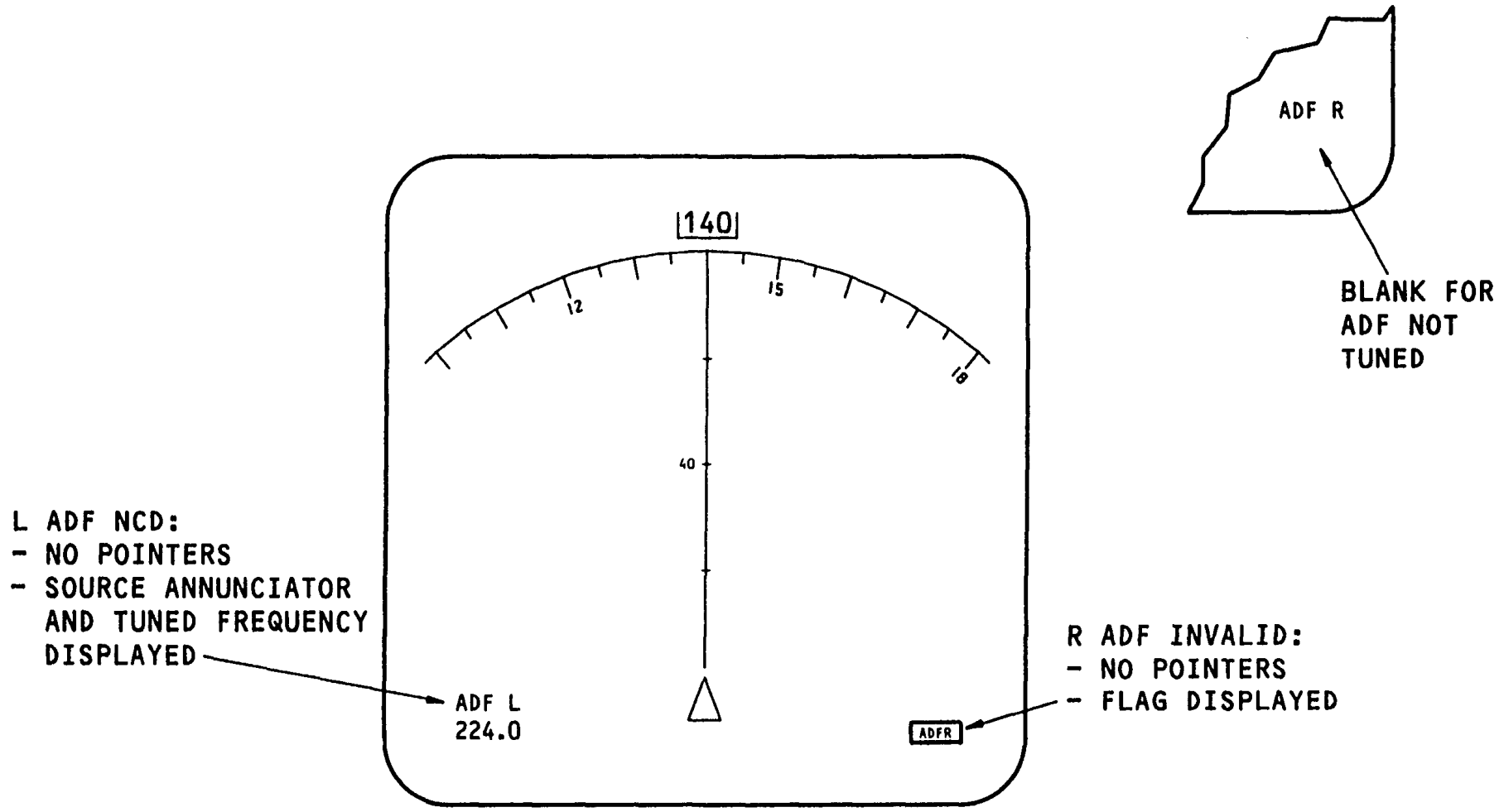

Figure 20 ND-NCD AND INVALID DISPLAY

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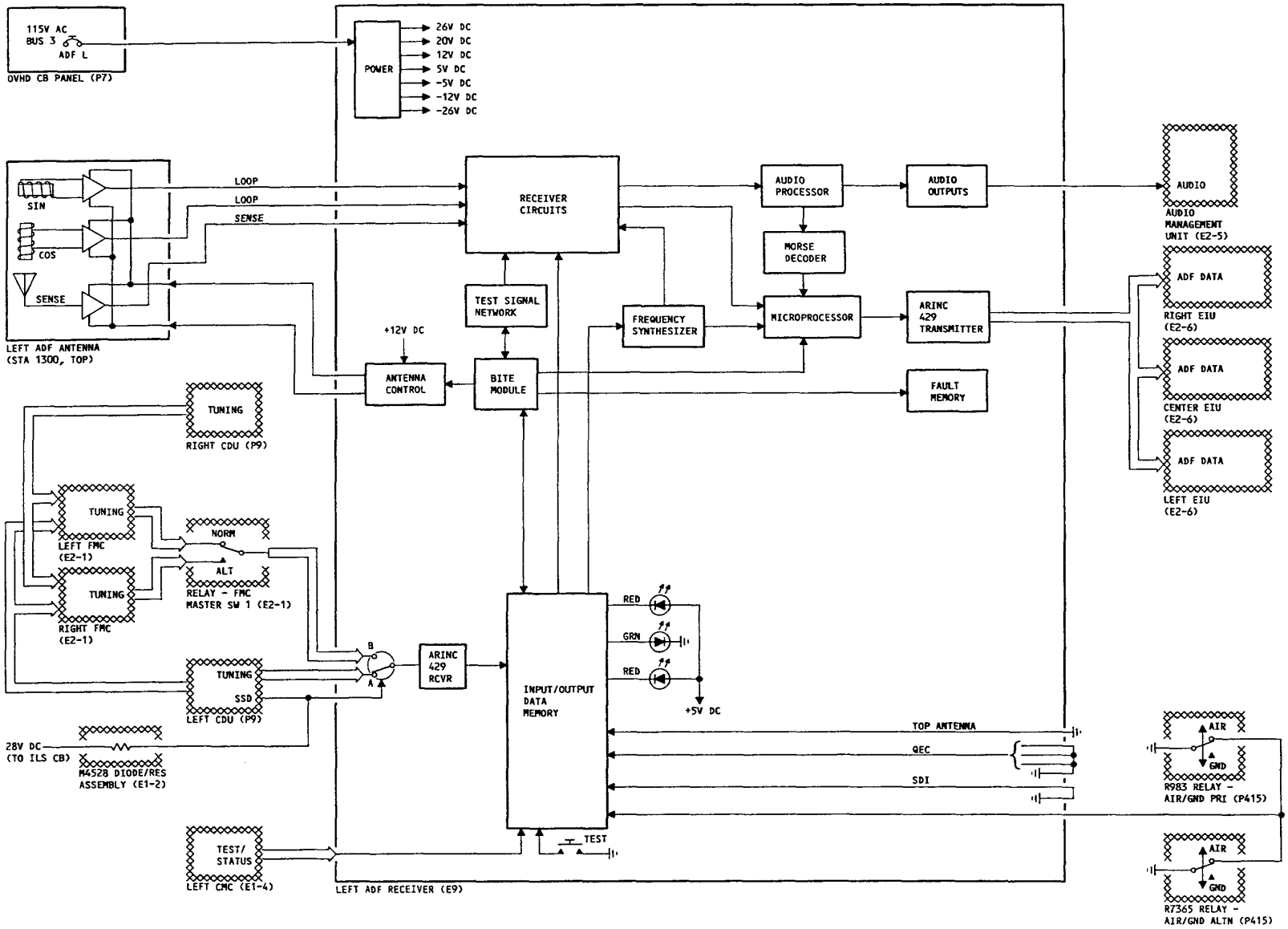


Figure 21 ADF – SCHEMATIC DIAGRAM

TUNING / SIGNAL PROCESSING

Control

The flight crew manually tunes either ADF receiver and sets the mode on either the left or the right CDU (control display unit). The CDU sends these control signals to the ADF receiver input port B through the master FMC (flight management computer). In air, if the master FMC fails or on the ground if both FMCs fail, the on-side CDU sends a ground-level SSD (source select discrete) to the ADF receiver which switches the control input from port B to port A.

Now the onside CDU sends the control signals directly to the ADF receiver, port A.

Tuning

In the ADF receiver, the input/output circuit and data memory receives the control signals. It uses these signals to tune the receiver circuits, to set the modes in the receiver circuits, and to cause the frequency synthesizer to

make the frequencies necessary for the processing of the received signals and for the bearing calculation.

Antenna Operation

The three antenna elements receive the signals from the ground station. The two loop antenna elements send directional signals to the ADF receiver. The sense antenna sends non-directional signals.

The ADF receiver sends +/- 12v dc to the antenna for the electronics assembly.

Signal Processing

The receiver circuits use the outputs from the three antenna elements, along with frequencies from the frequency synthesizer, to make a composite signal whose phase angle is a measure of the station bearing. The receiver circuits send this composite signal to the bearing computation microprocessor. The microprocessor compares the signal with a reference signal from the frequency synthesizer. The phase difference between these two signals gives the relative bearing. The ADF receiver sends the computed relative bearing to the using systems.

Audio

If the station audio identifier is a morse-code 1020 Hz amplitude-modulating signal, the receiver circuits detect it and send it to the audio processor. In the audio processor, the audio signal goes through filters and an amplifier, to the audio output circuits and from there to the AMU (audio management unit). If the station audio identifier

is a keyed morse-code carrier, the receiver circuits cannot detect it, and no audio can be heard. To hear audio, the operator selects the BFO mode. The BFO mode causes the frequency synthesizer to send a 1020 Hz frequency into the receiver circuits to modulate the signals received from the ground. Now the receiver circuits can detect and process the audio identifier.

Station Identifier

When the audio processor receives an audio identifier signal, it sends it to the morse decoder. The morse decoder changes this signal to digital format. The microprocessor sends the digital signal to the EIUs (EFIS/EICAS interface units) to show on the NDs (navigation displays).

Program Pins

The input/output data memory receives inputs from these program pins:

- TOP ANT is a program pin that identifies the top location of the antennas.
- QEC (quadrantal error correction) are program pins that compensate for airplane induced RF field distortions.
- SDI are program pins that identifies the left or the right ADF receiver.

The program pin inputs go into input/output-data memory. From here, these inputs set the related functions in the receiver circuit and in the microprocessor.

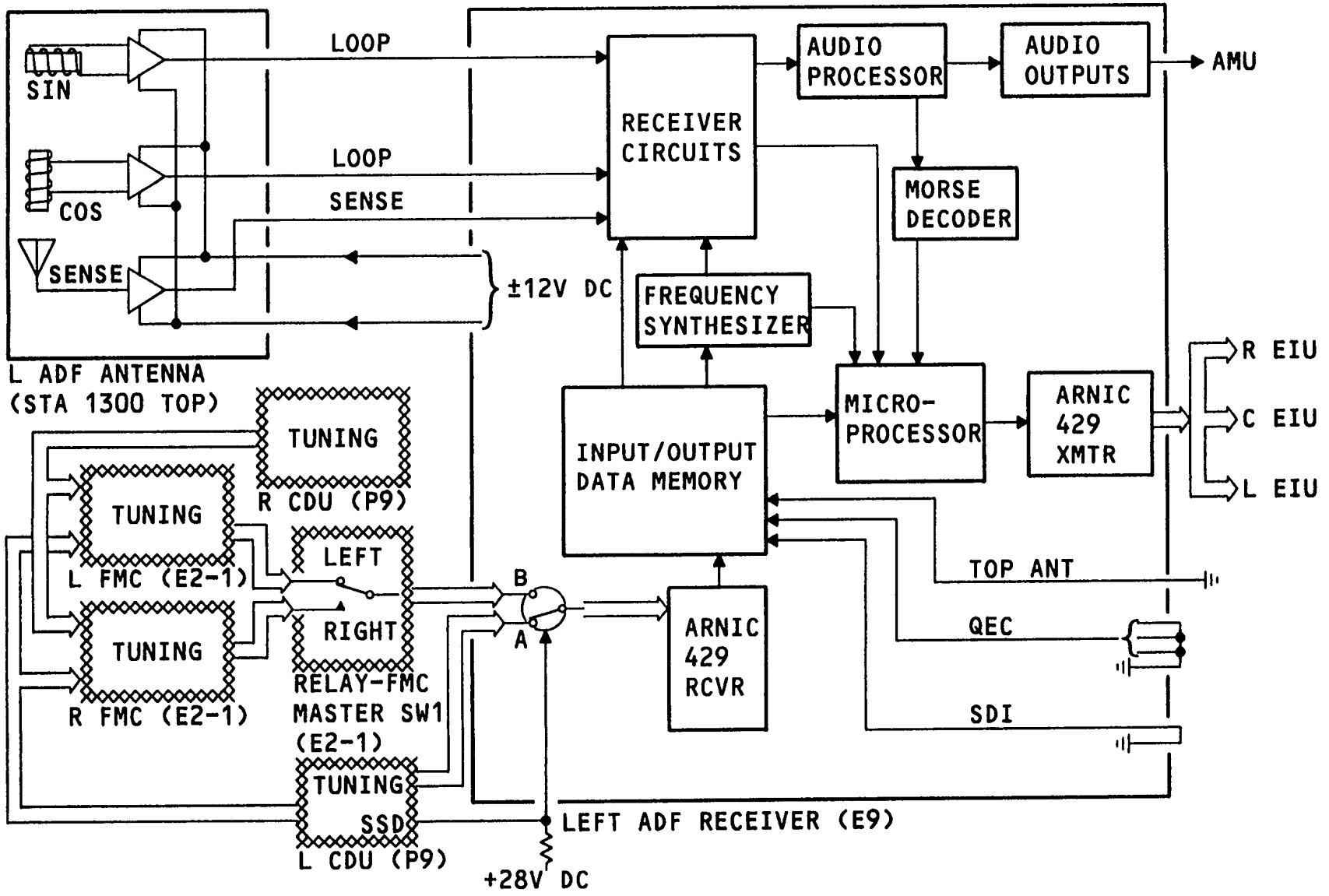


Figure 22 TUNING / SIGNAL PROCESSING

TEST OPERATION

Test Start

The ADF test is started from:

- The self-test switch on the ADF receiver front panel
- The ground test page from the CDU (control display unit). The CDU sends the test command to the ADF receiver through the CMC (central maintenance computer).

Both tests are the same and give the same results.

Test Command

The test commands come in to the input/output data memory, which sends it to the BITE module. If the airplane is in the air, an input from the air/ground relays stops the ground test command, but not the self-test command from the ADF receiver front panel. When the BITE module gets the test command, it sends it to the test signal network and to the antenna control. It also does the test sequence of the ADF receiver front panel LED status indicators.

Test Signal Flow

When the test signal network receives the test command, it makes and sends test signals into the receiver circuits. These signals are test frequencies that carry relative bearing information of 135 degrees with 1020 Hz audio. The receiver circuits process these test signals. The result is a 135 degree relative bearing and a 1020 Hz tone output. During test, the BITE module stops the +/- l2v dc flow from antenna control to the antenna. This stops operation of the antenna.

Fault Memory

The BITE module receives status information of internal circuits and of the tuning data from the FMC (flight management computer) or from the CDU (control display unit) and records it by flight legs in the non-volatile fault memory. An input from the CMC defines the beginning and the end of each flight leg. When the CMCs do not operate, the air/ground relays supply this information.

Status Data

The BITE module continuously sends real time status data:

- Through the microprocessor to the EIUs to show on the NDs
- To the CMCs

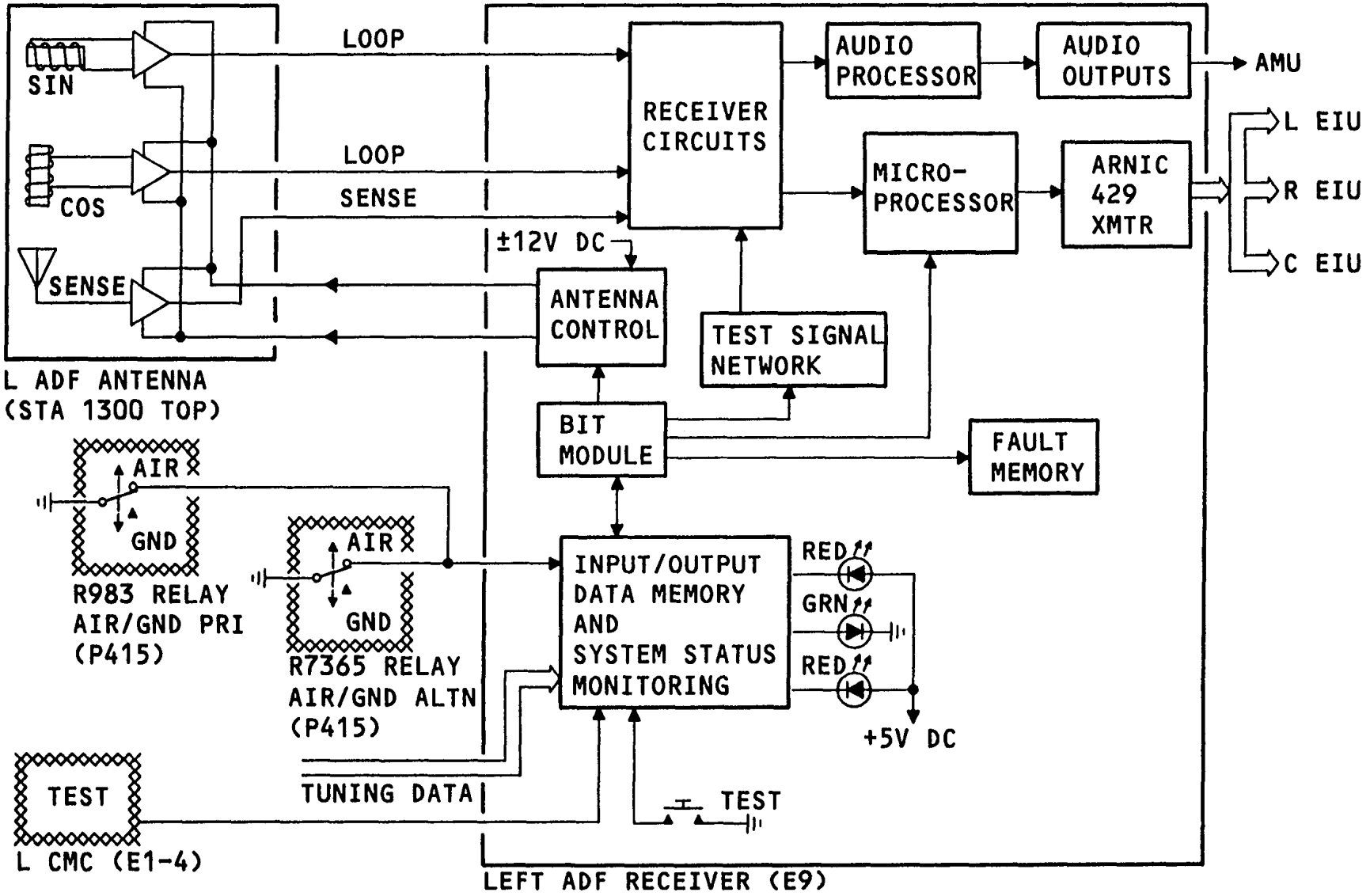


Figure 23 TEST OPERATION (ADF-700)

TEST OPERATION

Test Start

The ADF test is started from:

- The self-test switch on the ADF receiver front panel
- The ground test page from the CDU (control display unit). The CDU sends the test command to the ADF receiver through the CMC (central maintenance computer).

Both tests give the same results on the RMI and ND.

Test Command

The test commands come in to the input/output data memory, which sends it to the BITE module. If the airplane is in the air, the ADF cannot be tested. When the BITE module gets the test command, it sends it to the test signal network and to the antenna control. The front panel LED STATUS indicators do a test sequence when the self-test switch is pushed and released.

Test Signal Flo

When the test signal network receives the test command, it makes and sends test signals into the receiver circuits. These signals are test frequencies that carry relative bearing information of 135 degrees with 1020 Hz audio. The receiver circuits process these test signals. The result is a 135 degree relative bearing and a 1020 Hz tone output. During test, the BITE module does not use the antennas.

Fault Memory

The BITE module receives status information of internal circuits and of the tuning data from the FMC or from the CDU, and records it by flight legs in the non-volatile fault memory. An input from the air/ground relays defines the beginning and end of the flight legs.

Status Data

The BITE module continuously sends real-time status data:

- To the EFIS/EICAS interface units (EIUs) to show on the NDs.

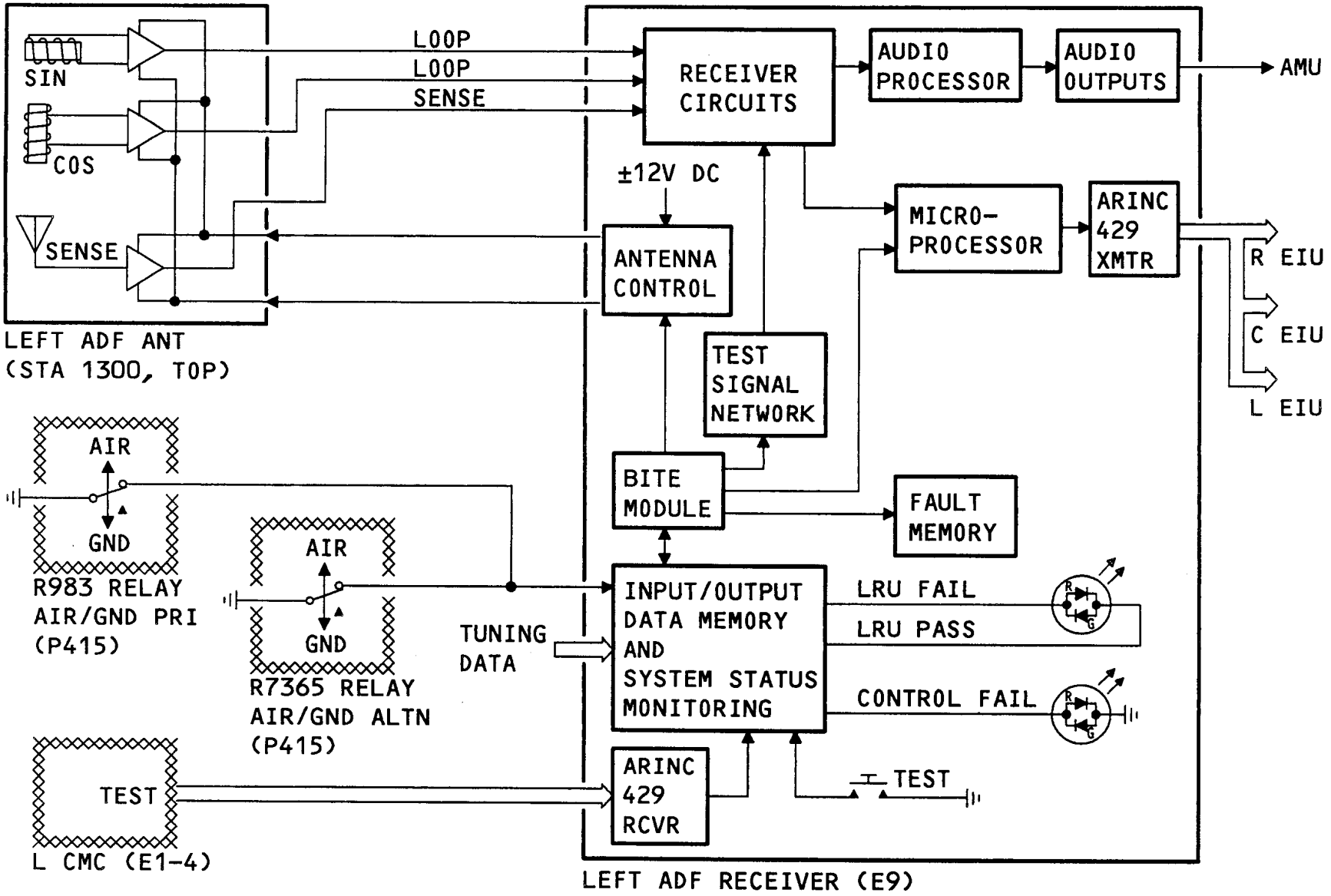


Figure 24 TEST OPERATION (ADF-900)

SELF-TEST RECEIVER INDICATIONS

To start the self-test put a valid frequency in the CDU and push the TEST switch on the front of the the ADF receiver and hold.

Check the front panel of the receiver for this sequence:

- All LEDs come on for the first three seconds
- All LEDs go out for the next three seconds
- The green LRU STATUS-P ASS LED will come on for three seconds for a valid self-test (no failures detected).
- When there is a failure in the ADF receiver, the red LRU STATUS-F AIL LED comes on.
- When there is an invalid tuning source, the red data in CON-TROL INPUT-FAIL LED comes on.

The ADF receiver returns to normal operation after 16 seconds and to start the self-test again, press the TEST switch as mentioned above.

NOTE*:* IF THE TEST SWITCH IS PRESSED LESS THAN 16 SECONDS, ALL TEST INDICATIONS WILL CEASE AT THE TIME THE SWITCH IS RELEASED.

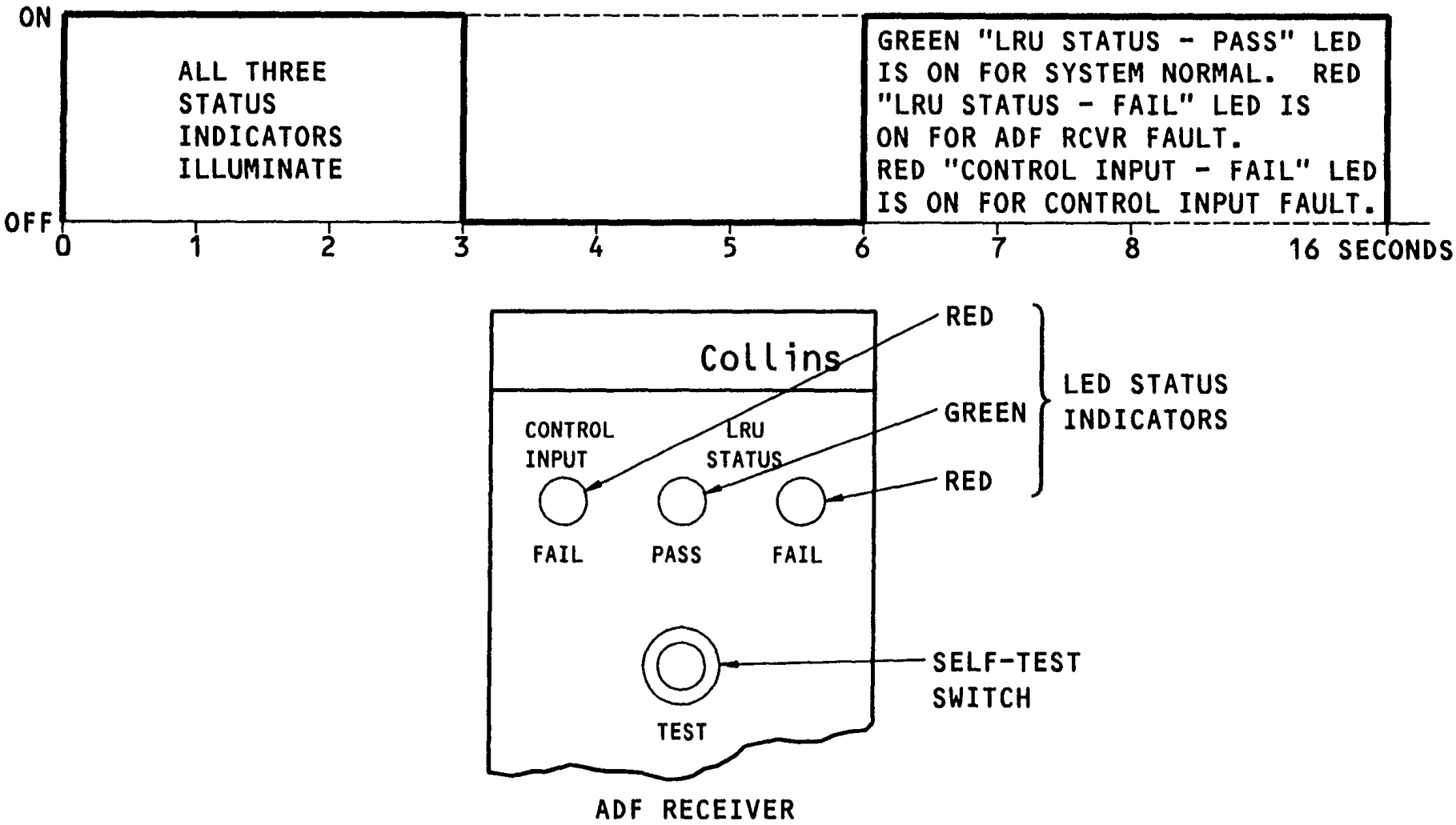
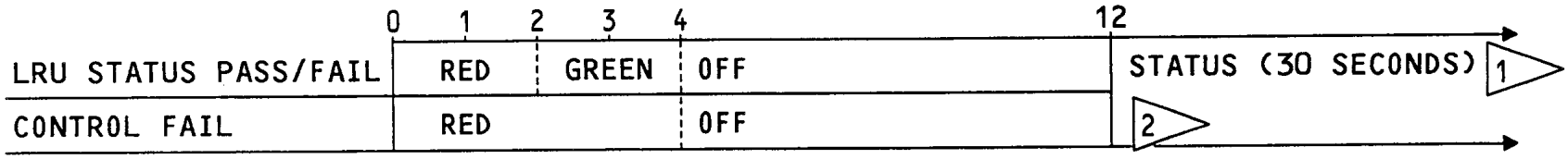


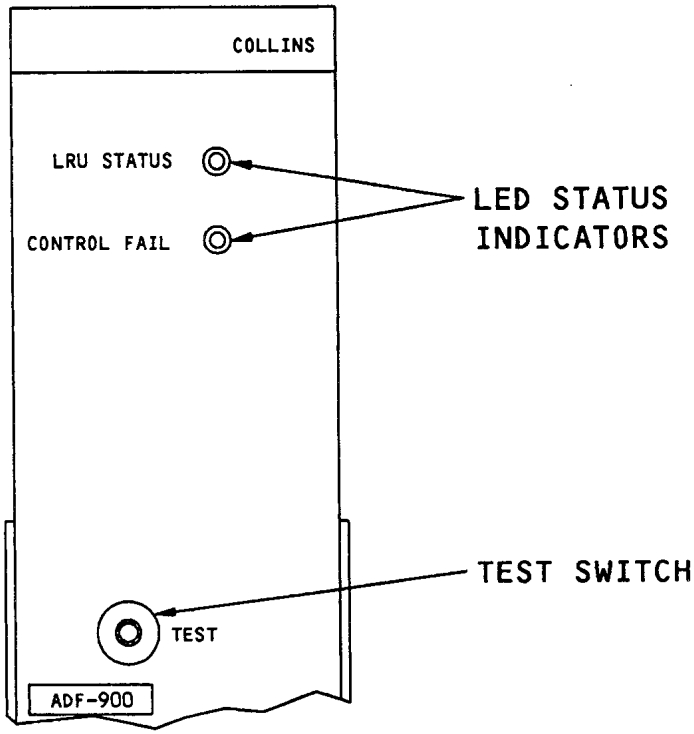
Figure 25 SELF-TEST RECEIVER INDICATIONS (ADF-700)

SELF-TEST RECEIVER INDICATIONS

To start the self-test put a valid frequency in the CDU and push the TEST switch on the front of the the ADF receiver and release. Check the following sequence:

- LRU STATUS will show red for two seconds. It will show green the next two seconds. It will be off for eight seconds. It will show status for thirty seconds.
- CONTROL FAIL will show red for the first four seconds, off for eight seconds, and status for the duration of the test.
- When there is an internal LRU fault the LRU STATUS will show red for 30 seconds.
- When there is a control input fault then the CONTROL FAIL LED will show red for 30 seconds.





ADF RECEIVER

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

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

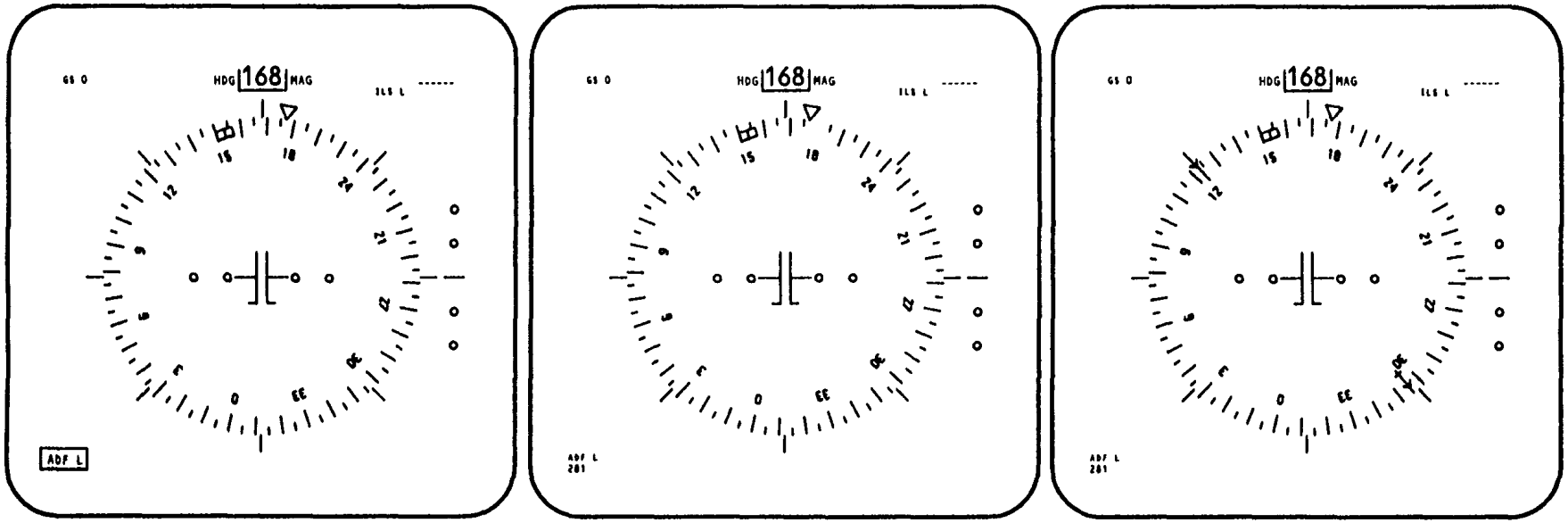
Figure 26 SELF-TEST RECEIVER INDICATIONS (ADF-900)

SELF TEST ND INDICATIONS

The selection of any mode except PLAN, on the EFIS control panel, with the raw data switch in the ADF position, allows the test indication to be shown. CTR mode lets the pointer and its reciprocal be shown.

The self-test indications on the ND are:

- The first three seconds show invalid data. The ADF flag shows on the ND and the ADF pointers are removed.
- The next three seconds show no computed data (NCD). The ADF pointers are removed from the ND.
- Until test completion: valid data shows. The ADF pointer indicates 1350 relative to the lubber line.



FIRST 3 SECONDS
INVALID DATA:
- FLAG DISPLAYED

NEXT 3 SECONDS
NO COMPUTED DATA:
- NO FLAG
- NO POINTERS

UNTIL TEST COMPLETION:
- VALID DATA
- 135° RELATIVE BEARING

NOTE: L ADF TEST SHOWN

Figure 27 SELF TEST ND INDICATIONS

GROUND TEST

Ground Test

The selection of CMC on any CDU shows the ground test menu, which allows the operator to perform ground tests of specific line replaceable units (LRUs). Push the line select key next to ADF-L to do a ground test of the left ADF receiver. This brings up a pre-condition screen that requires a valid ADF radio freq be entered on the receiver being tested. Push the START Test LSK to activate the test. This test is the same as the self-test that can be performed from the ADF receiver.

In the air, CMC ground tests are inhibited by the air/ground relay input.

Ground Test Results

The word PASS on the same line shows a passed ground test.

Failure of the ground test is shown by the word FAIL. Push the adjacent line select key to show the GROUND TESTS MSG page. This gives more data about the test failure.

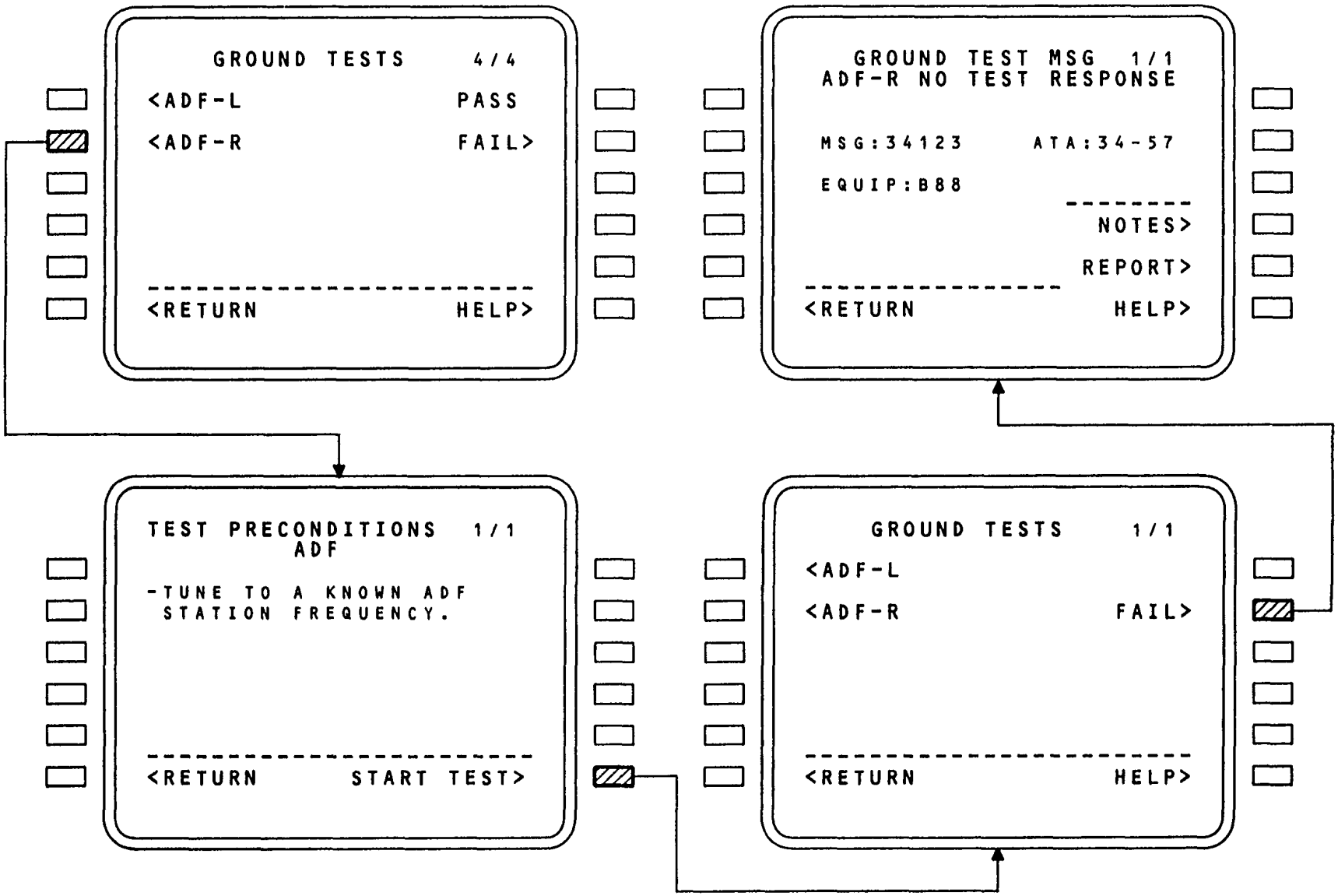


Figure 28 GROUND TEST

FLIGHT DECK EFFECTS AND CMC MESSAGES

Flight Deck Effects

A left or right ADF system failure causes: - ADF flags to show on the ND (navigation display) when the applicable ADF/VOR switch is set on the EFIS control panel.

- A status message to show on the auxiliary EICAS display.

CMC Messages

The different types of CMC messages displayed for the ADF system are:

- ADF-X RECEIVER FAIL (ADF-X receiver reports a failure)
- ADF-X NO TEST RESPONSE (The ADF-X receiver failed to respond after a CMC ground test was started from the CDU)
- CDU-X - - ADF-X BUS FAIL (ARINC 429 CDU to ADF-X bus failure)
- EIU-Z FAIL OR ADF-X - - EIU-Z BUS FAIL (ARINC 429 ADF-X to EIU-Z bus failure)
- ADF-X FAIL or ADF-X Transmitter output FAIL (ARINC 429 ADF-X to EIU left, center and right bus failure).
- FMC-X - - ADF-X BUS FAIL (ARINC 429 FMC to ADF-X bus failure)
- ADF-X FAIL OR CMC - - ADF-X BUS FAIL (ARINC 429 CMC to ADF bus failure)

NOTE: X = L (LEFT) OR R (RIGHT)
Z = L (LEFT), C (CENTER), OR R (RIGHT)

ADF-X to EIU bus failures or ADF receiver failures can be correlated to the ADF flag FDEs.

FLIGHT DECK EFFECT	TYPE	DESCRIPTION
ADF-X 1	EFIS (ND) FLAG	LEFT OR RIGHT ADF FAILURE
ADF LEFT	STATUS MESSAGE	LEFT ADF FAILURE
ADF RIGHT	STATUS MESSAGE	RIGHT ADF FAILURE

CMC MESSAGES

ADF-X RECEIVER FAIL 1
ADF-X NO TEST RESPONSE
CDU-X ~ ADF-X BUS FAIL
EIU-Z FAIL OR ADF-X ~ EIU-Z BUS FAIL 2
ADF-X FAIL OR ADF-X TRANSMITTER OUTPUT FAIL
FMC-X ~ ADF-X BUS FAIL
ADF-X FAIL OR CMC ~ ADF-X BUS FAIL

1 X = L (LEFT) OR R (RIGHT)

2 Z = L (LEFT), C (CENTER) OR R (RIGHT)

Figure 29 FLIGHT DECK EFFECTS AND CMC MESSAGES

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