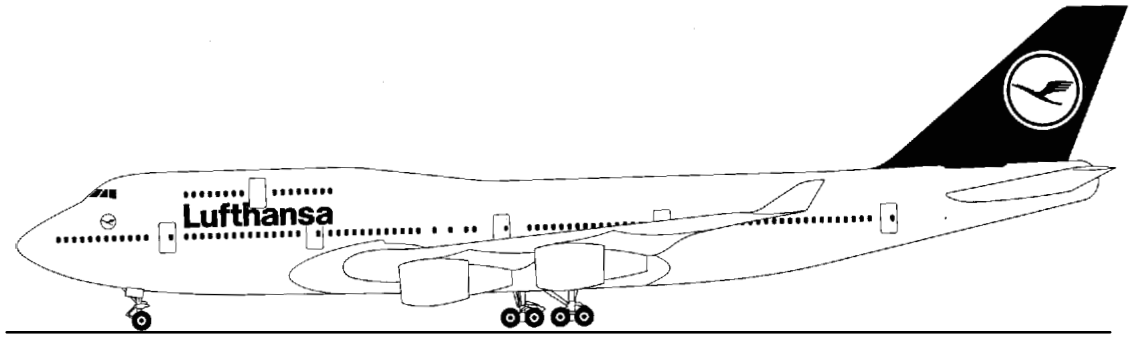
Lufthansa
Technical Training

Training Manual
B 747-400



ATA 31
Indicating/ Recording Systems
31-31 Flt Data Recorder System

Level 3

Book No: B747-400 31-31 L3 e

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Issue: Apr. 2003

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31-30 RECORDERS

31-31 FLIGHT DATA RECORDER SYSTEM

INTRODUCTION

The flight data recorder system records flight parameters. These parameters provide data on flight conditions and airplane systems operation.

This data is used for the analysis of flight conditions if there is an accident.

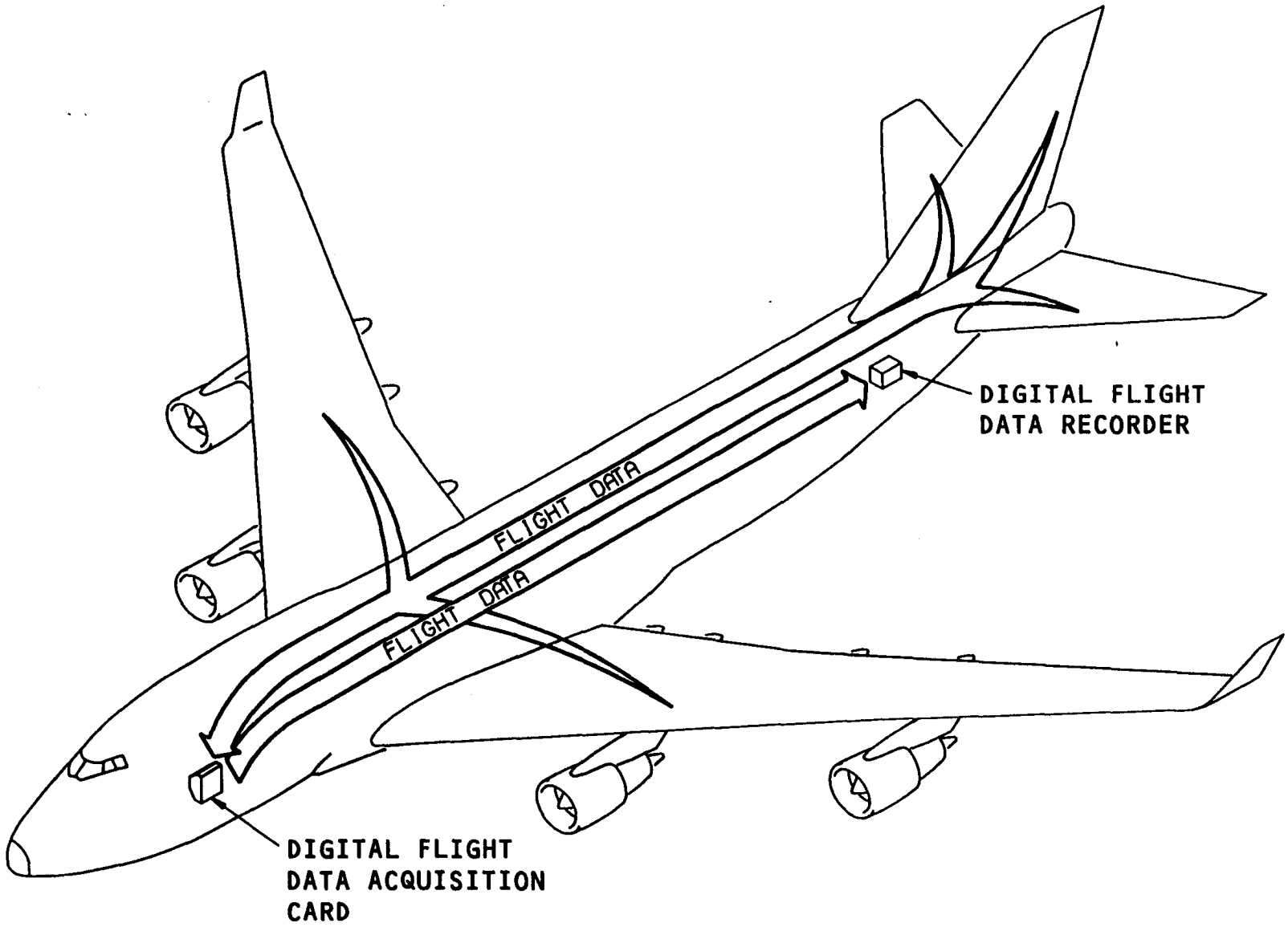


Figure 1 Flight Data Recorder System Introduction

FLIGHT DATA RECORDER SYSTEM

General

The Digital Flight Data Recorder (DFDR) records flight data in memory chips. The Digital Flight Data Acquisition Card (DFDAC) receives all the flight recorder data. The DFDAC then processes the data and sends it to the DFDR where it is stored.

The flight data recorder system operates, when

- one or more engine(s) is (are) operational
- or when the airplane is in the air.

The DFDR records the most recent 25 hours of flight.

DFDAC

The Digital Flight Data Acquisition card (DFDAC) is in the Modularized Avionics Warning Electronics Assembly (MAWEA). The DFDAC receives all flight parameters to be recorded. It converts the parameters into a Harvard bi-phase format and sends them to the DFDR.

EIUS

The left, center, and right EFIS/EICAS Interface Units (EIUs) send flight data to the DFDAC on high speed ARINC 429 data buses.

Fault status information goes to the EIUs when a flight data recorder system failure occurs.

Communication Radios

The left and right HF, and the left, center, and right VHF communication radios send discrete signals to the DFDAC when the radios are keyed.

Flight Recorder Accelerometer

The flight recorder accelerometer sends lateral, vertical, and longitudinal acceleration to the DFDAC.

Air/ Gnd Relay

The air/ground relay sends air/ground information to the DFDAC.

DMU

The data management unit (DMU) receives return data from the DFDR through the DFDAC.

CMCS

The central maintenance computers (CMCs) send test commands to the DFDAC. The DFDAC sends test results and fault status of the flight data recorder system to the CMCs.

DFDR

The DFDR sends data to the DFDAC. The DFDAC monitors the data to determine proper operation.

The DFDR sends discrete signals to the DFDAC. The discretes indicate-fault status.

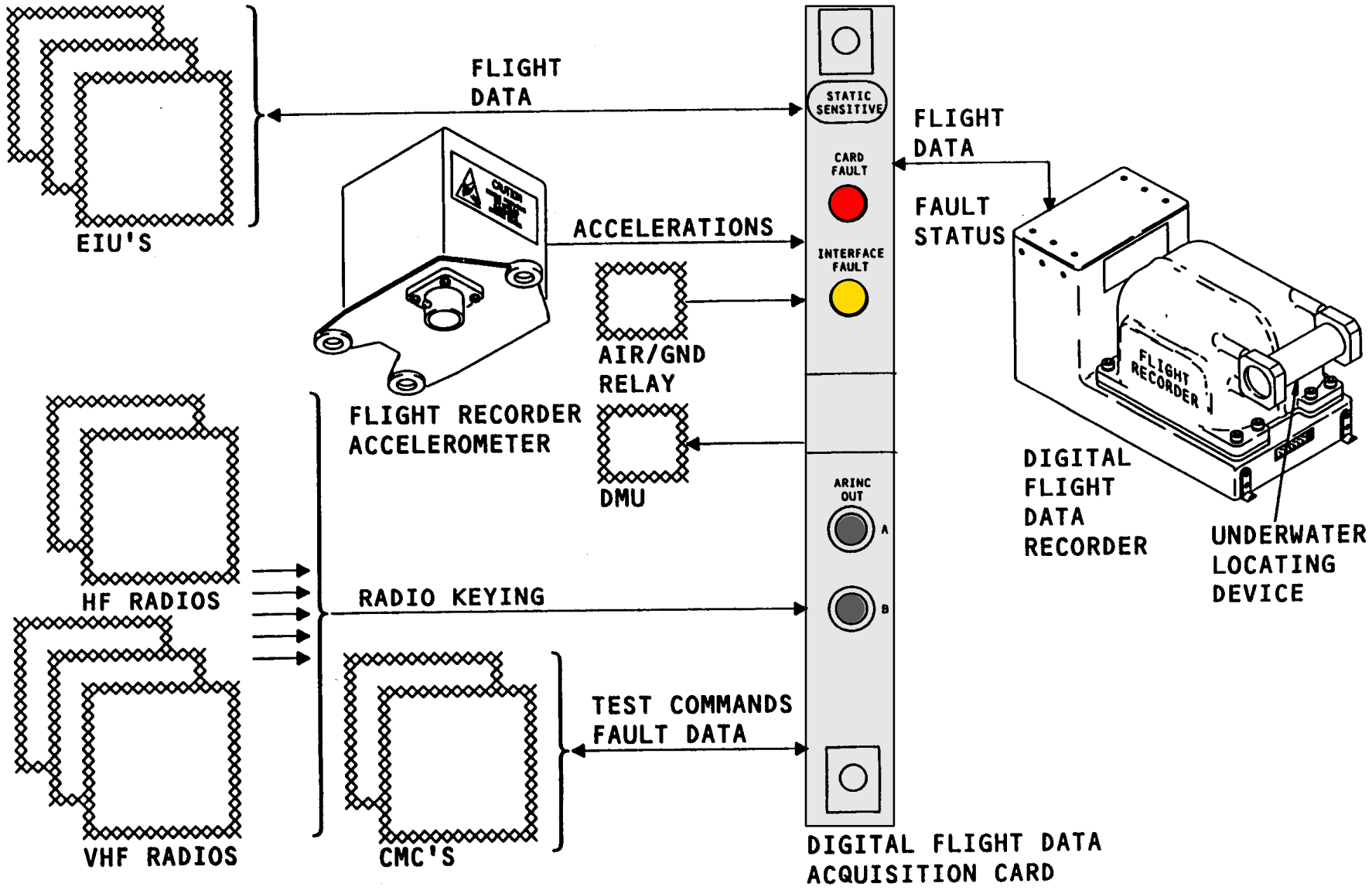


Figure 2 Flight Data Recorder System

LOCATION

Flight Deck

The overhead circuit breaker panel (P7) contains:

- MAWEA PWR A
- MAWEA PWR B

MEC

The right power distribution panel (P415) contains the FLT REC ac circuit breaker.

The dc power distribution panel (P180) contains the FLT REC dc circuit breaker.

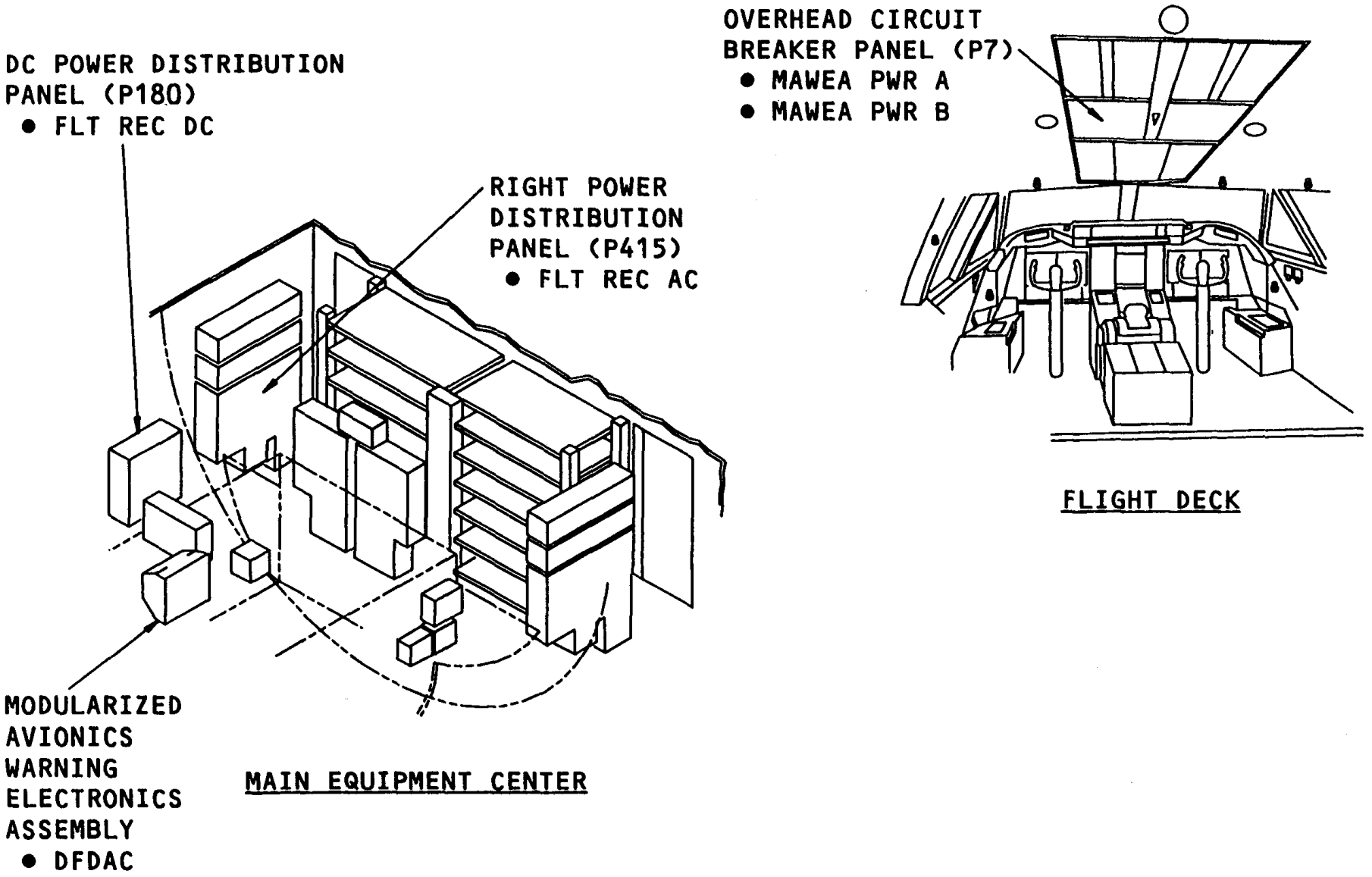


Figure 3 Flt Data Recorder System Components Location

DFDR COMPONENTS LOCATIONS

The digital flight data acquisition card (DFDAC) is in the modularized avionics warning and electronics assembly (MAWEA).

DIGITAL FLIGHT DATA ACQUISITION CARD

The digital flight data acquisition card (DFDAC) is in the modularized avionics warning and electronics assembly (MAWEA).

Power supplies A and B are also in the MAWEA.

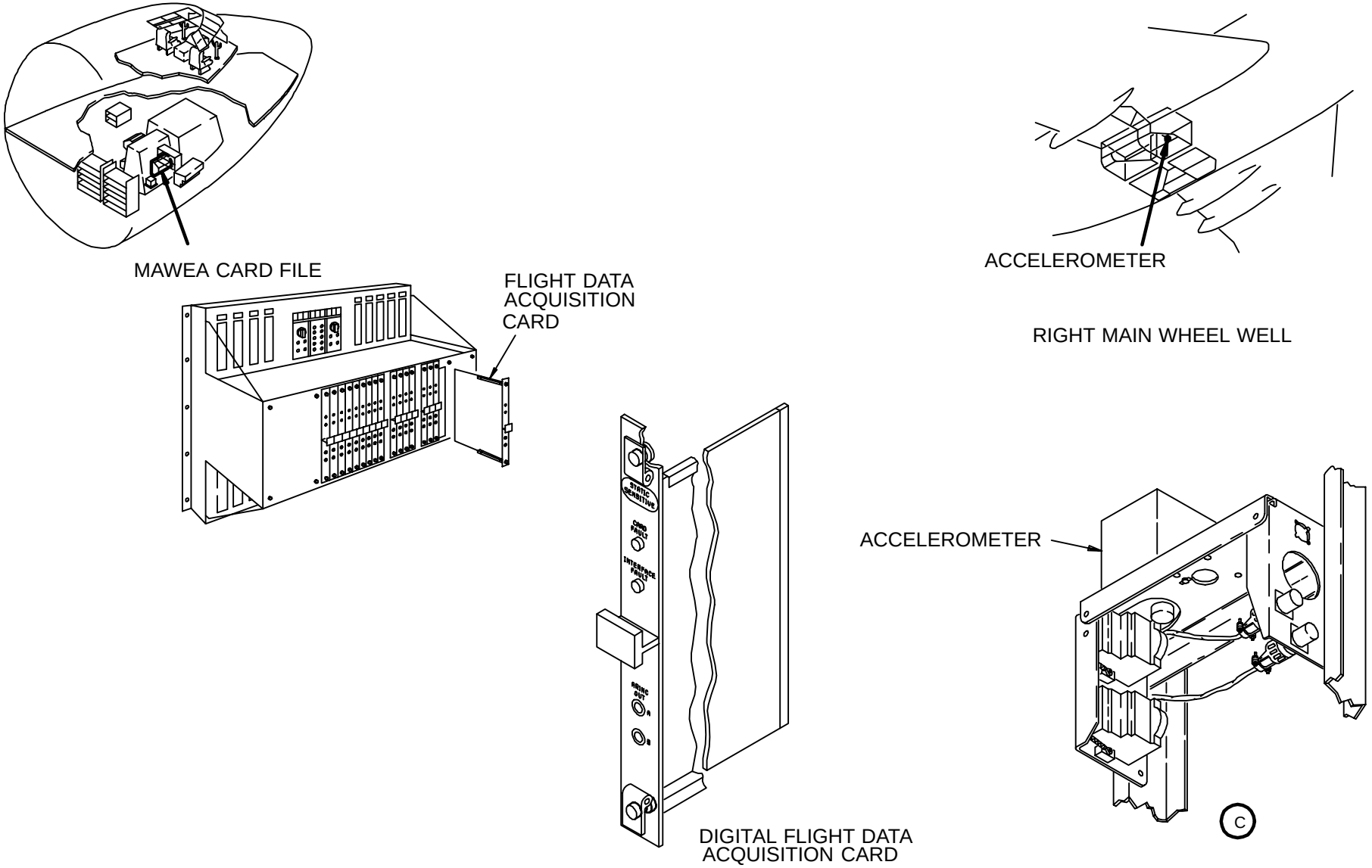


Figure 4 FR COMPONENT LOCATION

DFDR - LOCATION

The digital flight data recorder (DFDR) is in the aft equipment center (E8).

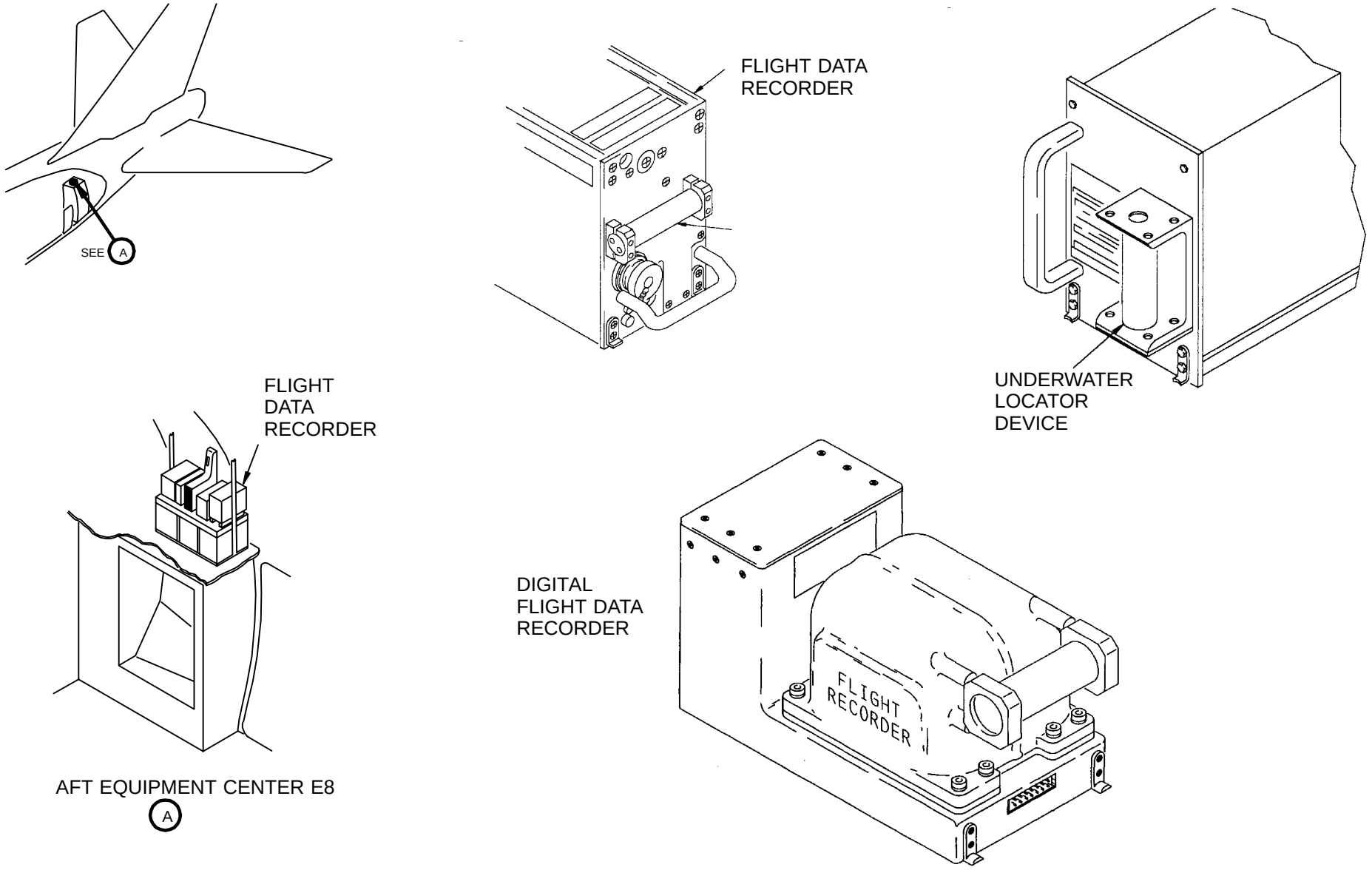


Figure 5 DFDR Location

POWER SUPPLY

DFDAC Power and Reset

Power supply A receives 115v ac from the standby bus. Power supply A provides +12v dc, -12v dc, and +5v dc to the DFDAC.

Power supply B receives 115v ac from the first officer's instrument transfer bus. Power supply B provides the same voltages to the DFDAC as power supply A.

The voltage inputs to the DFDAC can be monitored at the modularized avionics warning and electronics assembly (MAWEA) monitor panel.

Failure of one power supply does not affect DFDAC operation.

Reset pulses go to the DFDAC when each power supply first receives power. The pulses reset the DFDAC microprocessor.

Digital Flight Data Recorder Power

The DFDAC controls power to the DFDR. The DFDAC turns the DFDR on when:

- the airplane is in the air (air/ ground relay) or
- one or more engines are operating (EIU signal)

When the DFDR is on, it receives 115v ac from bus 3 through a relay.

Flight Recorder Accelerometer Power

The FLT REC DC circuit breaker sends 28v dc to:

- Flight recorder accelerometer
- Relay

The flight recorder accelerometer uses the 28v dc for operational power.

Relay uses the 28v dc for coil voltage.

FLIGHT DATA RECORDER SYSTEM - DIGITAL INTERFACES

EIUs

The EFIS/EICAS interface units (EIUs) send flight data to the digital flight data acquisition card (DFDAC) on high speed ARINC 429 data buses.

The DFDAC uses data from the EIU selected by the captain's EIU source select switch.

DMU

The data management unit (DMU) receives playback data for airplane condition monitoring system (ACMS) functions.

CMCS

The central maintenance computers (CMCs) receive fault status and test results from the DFDAC. The left CMC sends test commands to the DFDAC.

DFDR

The DFDAC converts the flight parameters to harvard bi-phase data and sends it-to the digital flight data recorder (DFDR). The DFDR records the data and sends return data to the DFDAC.

FLIGHT DATA RECORDER SYSTEM - ANALOG INTERFACES

VHF & HF Radios

The VHF and HF communication radios send a PTT signal to the digital flight data acquisition card (DFDAC) each time a radio is keyed.

Flight Recorder Accelerometer

The flight recorder accelerometer sends three analog inputs to the DFDAC. Each input is a dc voltage which represents the measured acceleration along an axis.

Air/Gnd Relay

The air/ground relay sends air/ground status to the DFDAC.

DFDR

The digital flight data recorder (DFDR) sends two discretes to the DFDAC:

- Maintenance flag
- System status flag

The DFDR sets a maintenance flag when it detects a DFDR internal fault. The DFDR sets a system status flag when it detects a system level fault.

EIUs

The DFDAC sends a discrete to the EFIS/EICAS interface units (EIUs) when a flight recorder system failure occurs.

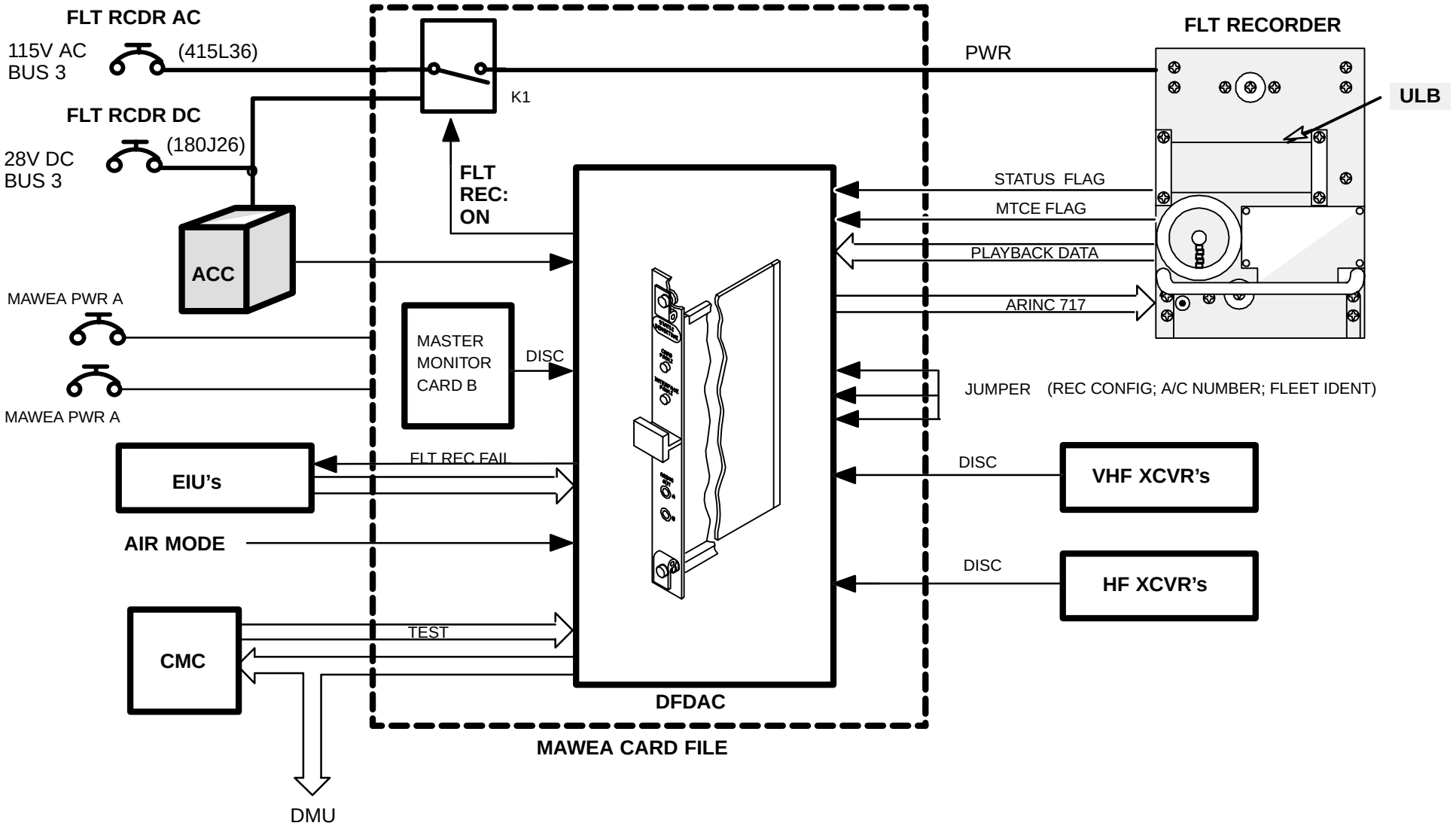


Figure 6 Flight Data Recorder System - Digital Interfaces

DIGITAL FLIGHT DATA ACQUISITION CARD

Purpose

The digital flight data acquisition card (DFDAC) receives all flight data. The DFDAC processes the flight data and sends it to the DFDR to be stored.

Characteristics

The DFDAC is controlled by a microprocessor and has these features:

- one red LED to show faults in the DFDAC.
- one yellow LED to show interface faults.
- one pair of monitor-jacks to monitor the ARINC 429 output bus.

Power

The DFDAC uses +12v dc, -12v dc, and +5v dc for operation.

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.

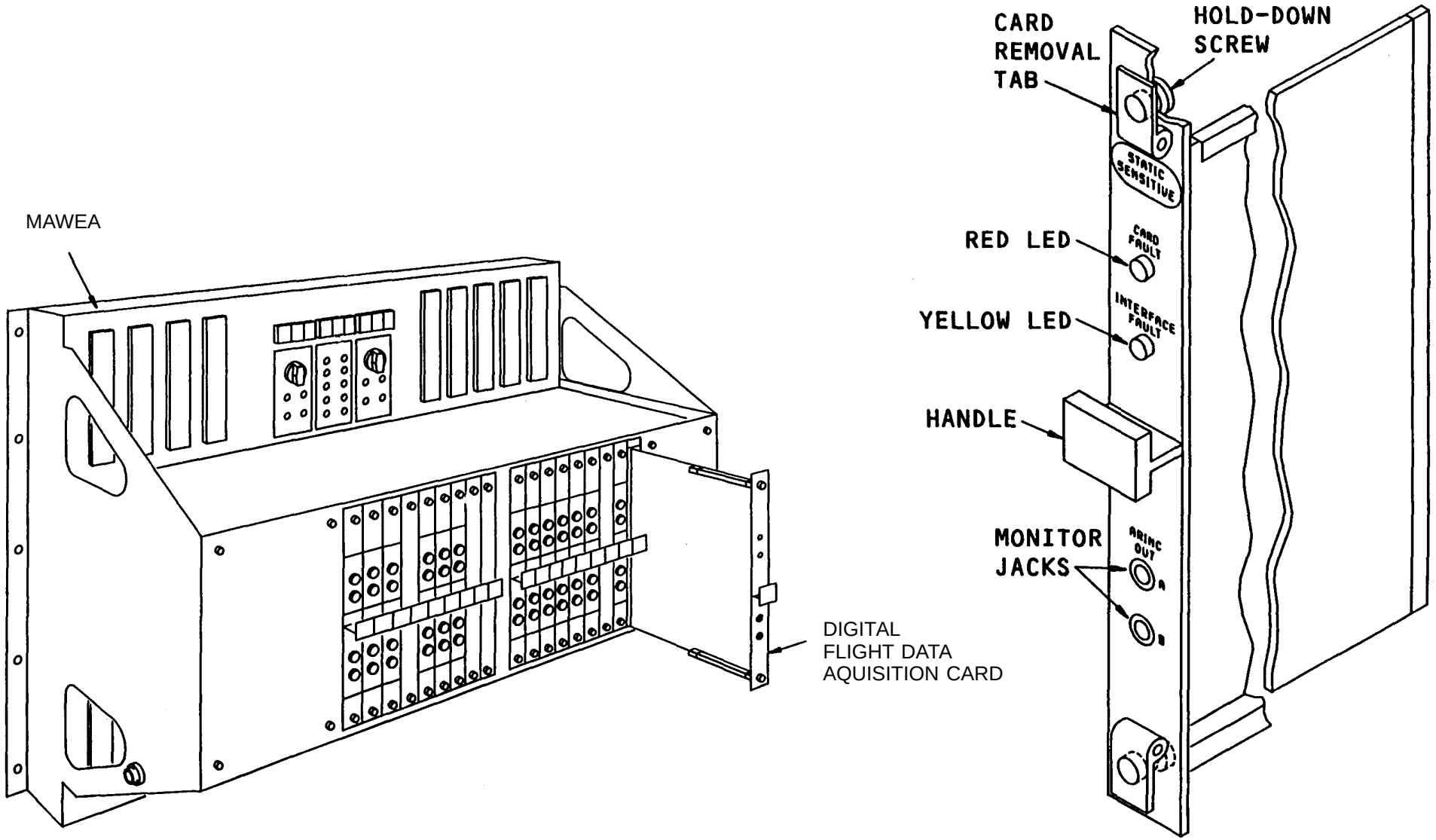


Figure 7 Digital Flight Data Acquisition Card

DIGITAL FLIGHT DATA RECORDER

Purpose

The digital flight data recorder records flight data in solid state computer memory chips.

Characteristics

The DFDR is made of stainless steel. The memory chips are called non-volatile memory (NVM) and are contained in a crash-proof, waterproof and fireproof enclosure.

The DFDR is international orange with black letters on the left and right sides.

A connector is on the front of the unit. It is used to interface with a computer for testing and data down loading.

The DFDR weighs 18 pounds.

Flight data is recorded in non-volatile memory. The capacity of the memory is 25 hours. Old flight data is replaced by new flight data.

ULD

An underwater locating device (ULD) is mounted on the front of the unit. This device transmits an ultrasonic acoustic output when it is in water.

Power

The DFDR requires 115v ac single-phase power for operation.

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.

UNDERWATER LOCATING DEVICE

Purpose

The underwater locating device (ULD) is an ultrasonic beacon. It makes a watersubmerged digital state flight data 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.

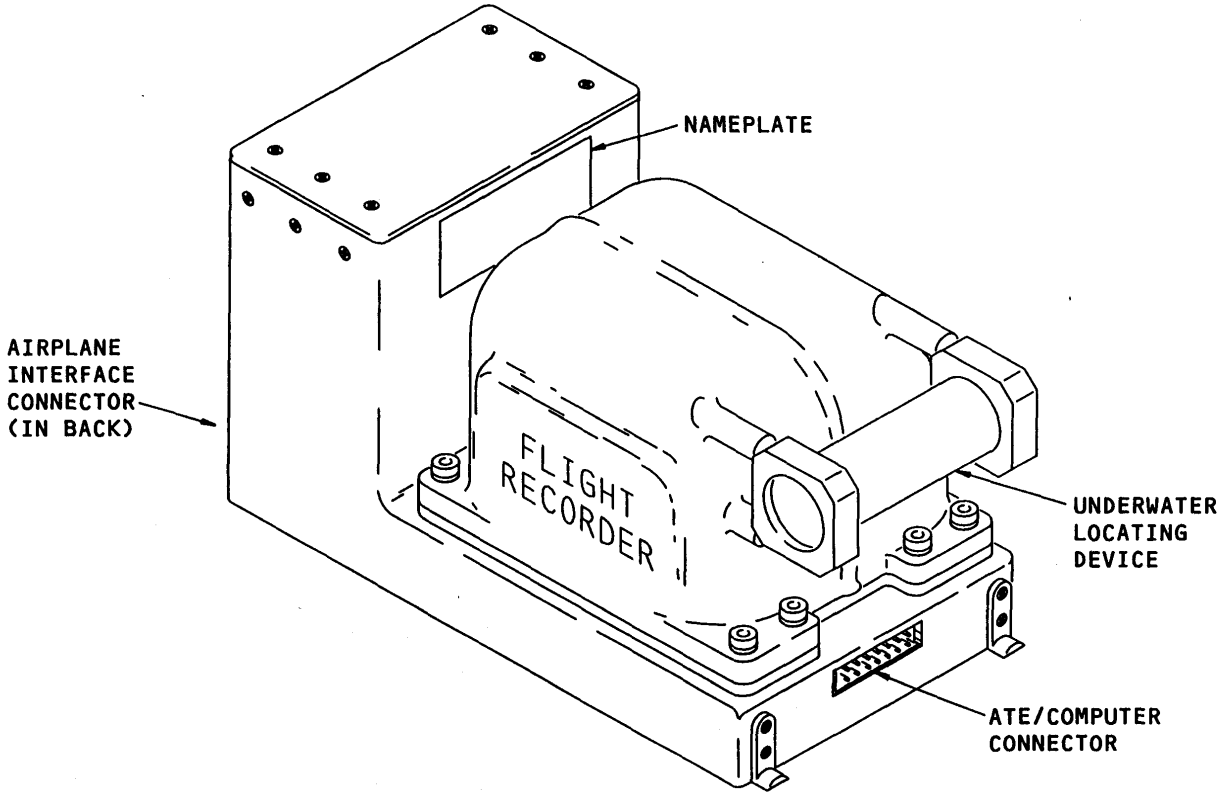
The ULD sends out an acoustic pulsetone of 37.5 kHz at a rate of one pulse-per-second.

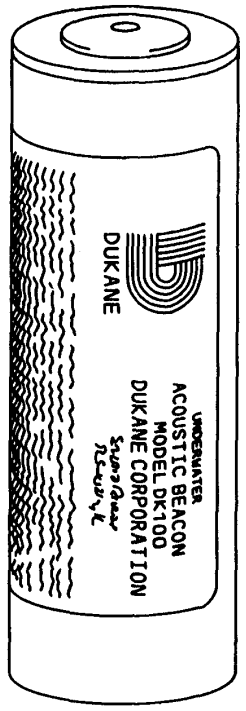
Maintenance Practices - Model DK100

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

UNDERWATER
LOCATING DEVICE

Figure 8 Digital Flight Data Recorder / ULD

FLIGHT RECORDER ACCELEROMETER

Purpose

The flight recorder accelerometer measures acceleration along the vertical, lateral, and longitudinal axes for the DFDR.

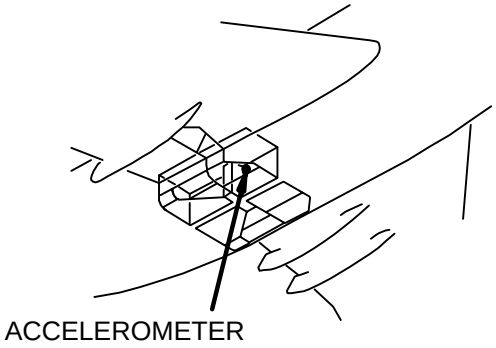
Characteristics

The flight recorder accelerometer is electro-static sensitive. It does not require calibration or scheduled maintenance. It is pressure-sealed.

Power

The flight recorder accelerometer requires +28v dc for operation.

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.



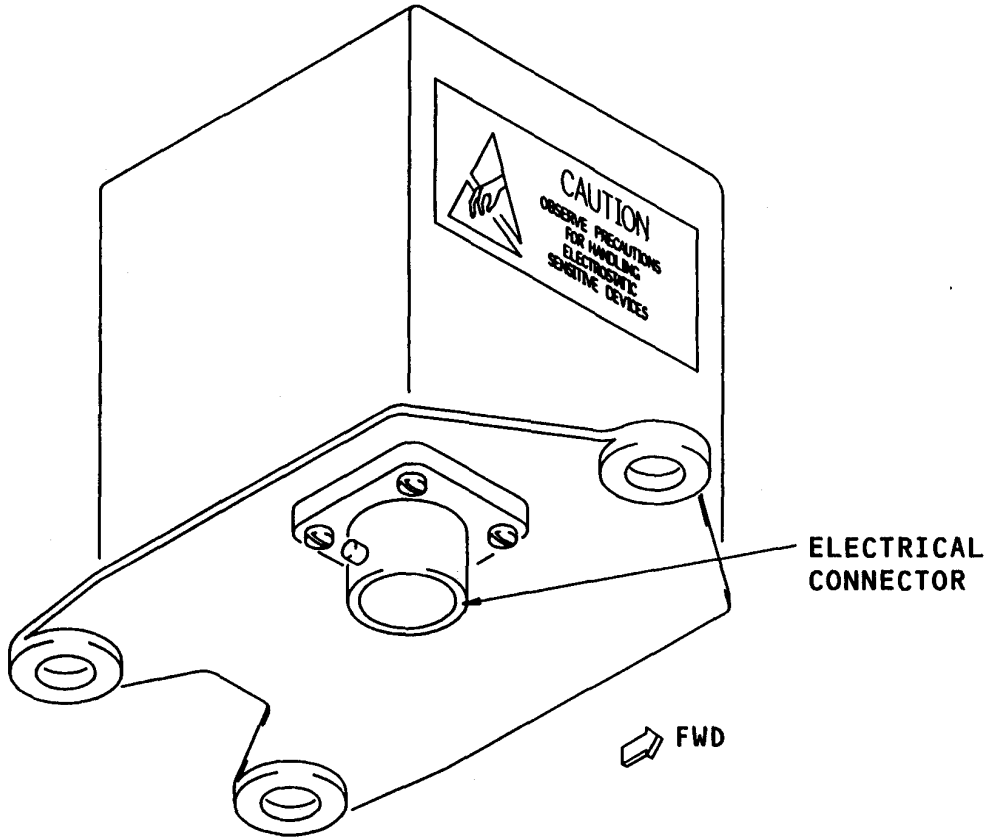


Figure 9 Flight Recorder Accelerometer

GROUND TESTS - FLIGHT RECORDER

The flight data recorder system is tested by the central maintenance computer (CMC) when selected through the control display unit (CDU).

To start a test, push the line select key (LSK) next to FLIGHT RECORDER.

If the airplane is on the ground and the engines are off, the test starts.

If both conditions do not exist, the test enable page shows.

When the conditions are met push the RETURN key.

Push the LSK next to FLIGHT RECORDER.

IN PROGRESS shows above FLIGHT RECORDER for 32 seconds.

After 32 seconds PASS or FAIL shows.

If FAIL shows, press the line select key next to FAIL to see the fault message.

The flight data recorder system ground test is inhibited anytime the system is operating (airborne or any engine running).

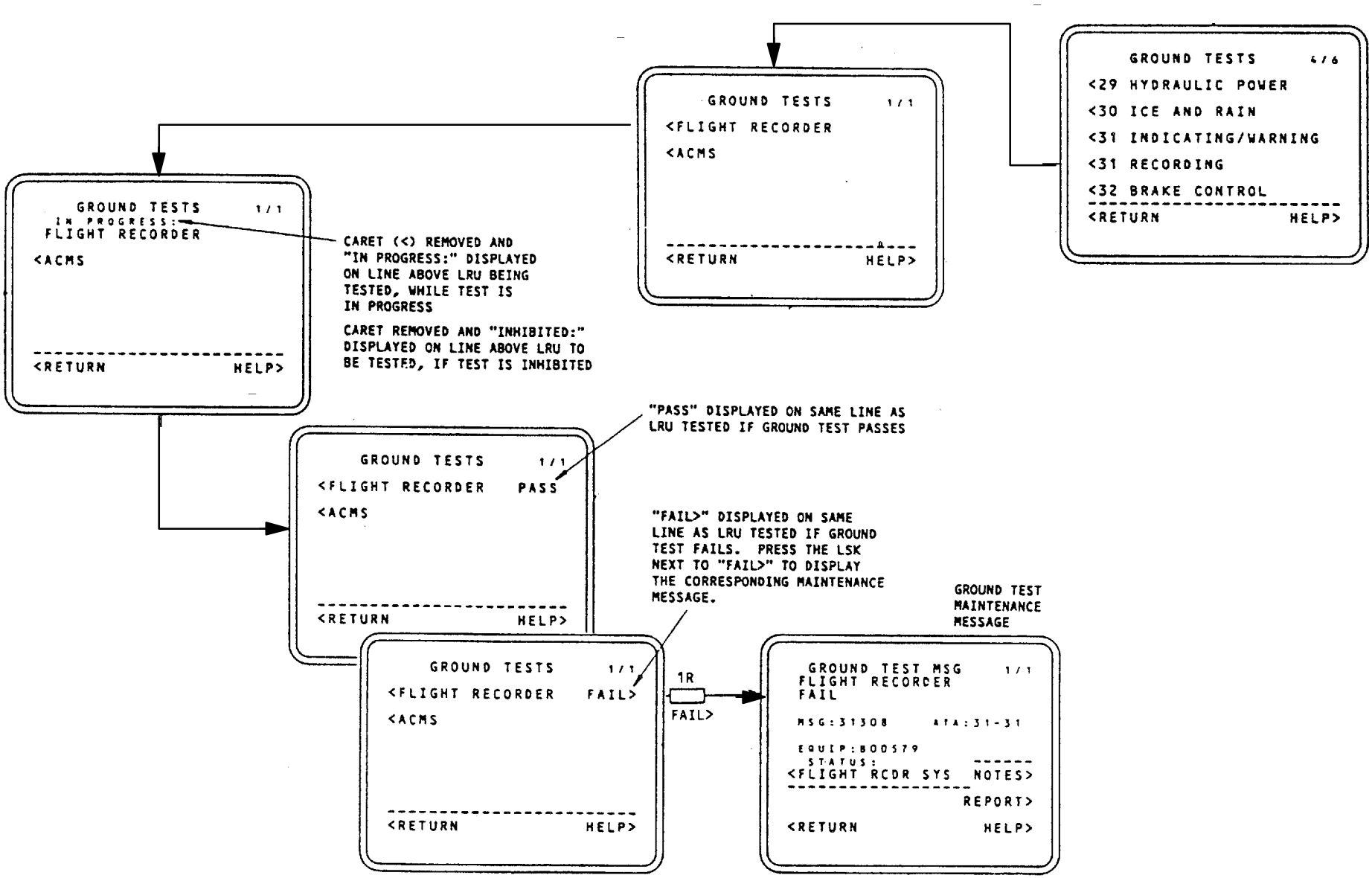


Figure 10 Ground Tests - FLIGHT RECORDER

DIGITAL BUS MONITORING

A bus analyzer can be used to analyze the DFDAC input and output ARINC 429 busses.

The left high speed EFIS/EICAS interface unit (HS EIU) input is monitored at the MAWEA monitor panel. The right and center EIU inputs cannot be monitored.

The ARINC 429 output from the DFDAC is monitored on the DFDAC monitor jacks.

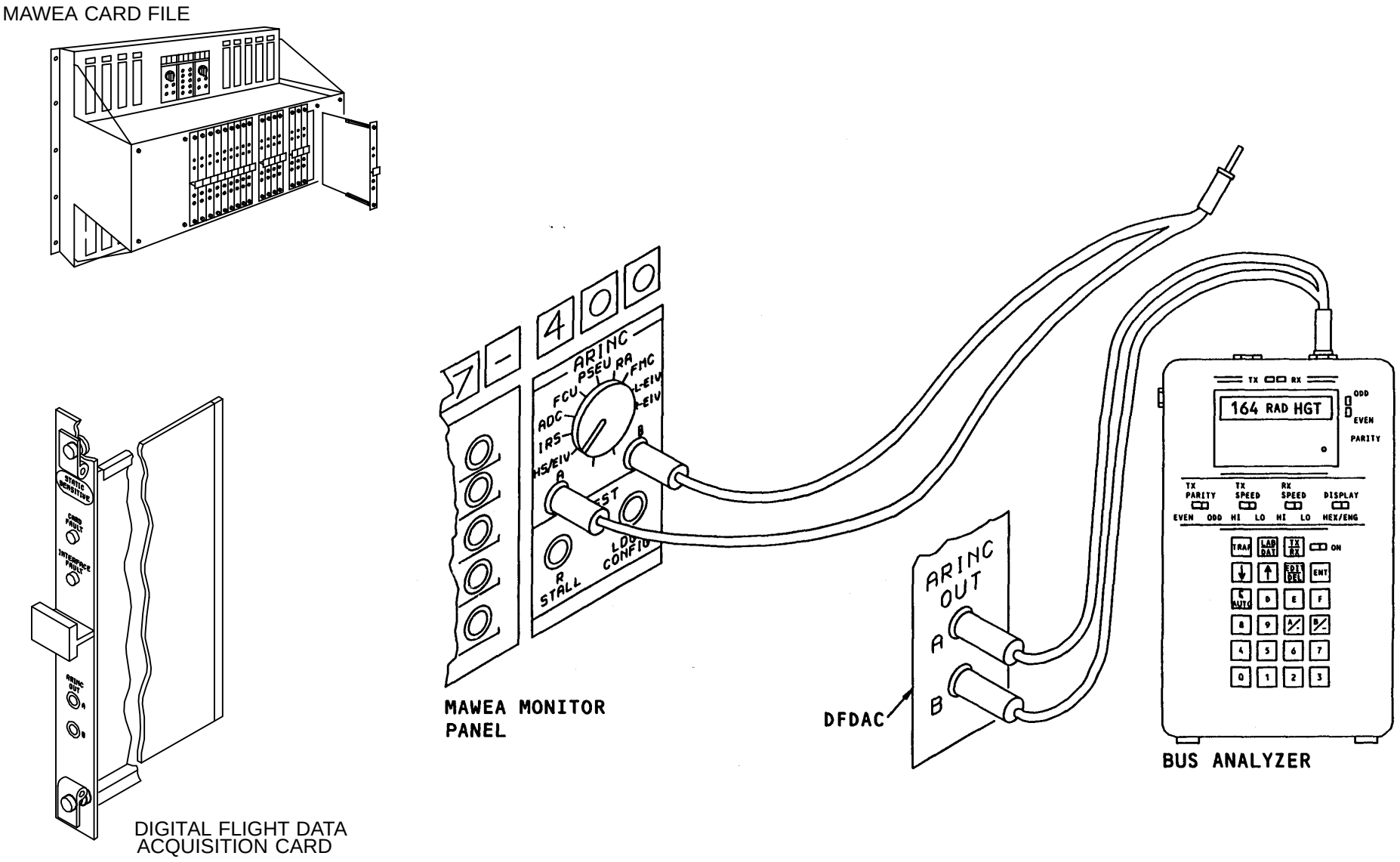


Figure 11 Flight Data Recorder System - Digital Bus Monitoring

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