

CHAPTER

31

Indicating and Recording Systems

**CHAPTER 31
INDICATING AND RECORDING SYSTEMS**

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O 16	Jun 15/2016		12	Feb 15/2015	
17	Feb 15/2015		13	Feb 15/2015	
18	BLANK		14	Feb 15/2015	
31-53-00			15	Feb 15/2015	
1	Feb 15/2015		16	Feb 15/2015	
2	Feb 15/2015		17	Feb 15/2015	
3	Feb 15/2015		18	Feb 15/2015	
4	Feb 15/2015		19	Feb 15/2015	
5	Feb 15/2015		20	Feb 15/2015	
6	BLANK		21	Feb 15/2015	
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R 2	Jun 15/2016		R 24	Jun 15/2016	
3	Jun 15/2015		25	Feb 15/2015	
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80	Feb 15/2015		O 98.5	Jun 15/2016	
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O 98.78	Jun 15/2016		O 98.101	Jun 15/2016	
O 98.79	Jun 15/2016		O 98.102	Jun 15/2016	
O 98.80	Jun 15/2016		O 98.103	Jun 15/2016	
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O 98.82	Jun 15/2016		O 98.105	Jun 15/2016	
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O 98.129	Jun 15/2016		O 98.152	Jun 15/2016	
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O 98.136	Jun 15/2016		O 98.159	Jun 15/2016	
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O 98.171	Jun 15/2016		O 98.194	Jun 15/2016	
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31-25-00	CLOCKS - INTERFACES	6	AKS ALL
31-25-00	CLOCKS - CLOCK	8	AKS ALL
31-25-00	CLOCKS - DATE/TIME SELECTION	10	AKS ALL
31-25-00	CLOCKS - TIME SET	12	AKS ALL
31-25-00	CLOCKS - DATE SET	14	AKS ALL
31-25-00	CLOCKS - ELAPSED TIME	16	AKS ALL
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31-31-00	FDRS - FLIGHT COMPARTMENT COMPONENT LOCATION	4	AKS ALL
31-31-00	DFDRS - ELECTRONIC EQUIPMENT COMPARTMENT COMPONENT LOCATION	6	AKS ALL
31-31-00	DFDRS - NOSE WHEEL WELL COMPONENT LOCATION	8	AKS ALL
31-31-00	FDRS - AIRPLANE COMPONENT LOCATION	10	AKS ALL
31-31-00	FDRS - AFT CABIN COMPONENT LOCATION	12	AKS ALL
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31-31-00	DFDRS - DFDAU DISCRETE INTERFACE - 2	36	AKS ALL
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31-31-00	DFDRS - CONTROL WHEEL POSITION SENSOR	50	AKS ALL
31-31-00	DFDRS - CONTROL COLUMN POSITION TRANSMITTER	52	AKS ALL
31-31-00	DFDRS - RUDDER PEDAL POSITION SENSOR	54	AKS ALL
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31-31-00	DFDRS - AILERON POSITION TRANSMITTER	60	AKS ALL
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31-31-00	FDRS - SYSTEM SUMMARY	76	AKS ALL
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31-33-00	PRINTER SYSTEM - INTERFACES	6	AKS ALL
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31-51-00	AURAL WARNING SYSTEM - AURAL WARNING MODULE	10	AKS ALL
31-51-00	AURAL WARNING SYSTEM - FUNCTIONAL DESCRIPTION	12	AKS ALL
31-51-00	AURAL WARNING SYSTEM - OPERATION - TAKEOFF 1	14	AKS ALL
31-51-00	AURAL WARNING SYSTEM - OPERATION - TAKEOFF 2	16	AKS ALL

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CHAPTER 31
INDICATING AND RECORDING SYSTEMS

<u>CH-SC-SU</u>	<u>SUBJECT</u>	<u>PAGE</u>	<u>EFFECT</u>
31-51-00	AURAL WARNING SYSTEM - OPERATION - LANDING	18	AKS ALL
31-51-00	AURAL WARNING SYSTEM - OPERATION - FIRE	20	AKS ALL
31-51-00	AURAL WARNING SYSTEM - OPERATION - AUTOPILOT DISCONNECT, OVERSPEED, CABIN PRESSURE	22	AKS ALL
31-51-00	AURAL WARNING SYSTEM - OPERATION - FLIGHT COMPARTMENT CALL	24	AKS ALL
31-51-00	AURAL WARNING SYSTEM - TEST	26	AKS ALL
31-51-00	AURAL WARNING SYSTEM - SUMMARY	28	AKS ALL
31-52-00	MASTER CAUTION SYSTEM - INTRODUCTION	2	AKS ALL
31-52-00	MASTER CAUTION SYSTEM - GENERAL DESCRIPTION	4	AKS ALL
31-52-00	MASTER CAUTION SYSTEM - COMPONENT LOCATION - FLIGHT COMPARTMENT - 1	8	AKS ALL
31-52-00	MASTER CAUTION SYSTEM - COMPONENT LOCATION - FLIGHT COMPARTMENT - 2	10	AKS ALL
31-52-00	MASTER CAUTION SYSTEM - INTERFACES	12	AKS ALL
31-52-00	MASTER CAUTION SYSTEM - INTERFACES - CONTROL	15	AKS ALL
31-53-00	TAKEOFF WARNING - INTRODUCTION	2	AKS ALL
31-53-00	TAKEOFF WARNING - FUNCTIONAL DESCRIPTION	4	AKS ALL
31-62-00	COMMON DISPLAY SYSTEM - INTRODUCTION	1	AKS ALL
31-62-00	CDS - GENERAL DESCRIPTION	6	AKS ALL
31-62-00	CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 1	8	AKS ALL
31-62-00	CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 2	10	AKS ALL

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INDICATING AND RECORDING SYSTEMS

CH-SC-SU	SUBJECT	PAGE	EFFECT
31-62-00	CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 3	12	AKS ALL
31-62-00	CDS - EE COMPARTMENT COMPONENT LOCATION	14	AKS ALL
31-62-00	CDS - POWER INTERFACES	16	AKS ALL
31-62-00	CDS - PROGRAM PINS INTERFACE	20	AKS ALL
31-62-00	CDS - DISPLAY ELECTRONICS UNIT INTERFACES	22	AKS ALL
31-62-00	CDS - BRIGHTNESS INTERFACES	24	AKS ALL
31-62-00	CDS - CONTROLS INTERFACES	26	AKS ALL
31-62-00	CDS - CROSS CHANNEL INTERFACES	29	AKS ALL
31-62-00	CDS - EXTERNAL INTERFACE INTRODUCTION	33	AKS ALL
31-62-00	CDS - NAVIGATION INTERFACES - 1	43	AKS ALL
31-62-00	CDS - NAVIGATION INTERFACES - 2	47	AKS ALL
31-62-00	CDS - NAVIGATION INTERFACES - 3	51	AKS ALL
31-62-00	CDS - NAVIGATION INTERFACES - 4	54	AKS ALL
31-62-00	CDS - INDICATING AND RECORDING INTERFACES	56	AKS ALL
31-62-00	CDS - AUTOFLIGHT INTERFACES	59	AKS ALL
31-62-00	CDS - HYDRAULIC AND LANDING GEAR INTERFACES	62	AKS ALL
31-62-00	CDS - AIR CONDITIONING AND PNEUMATIC INTERFACES	64	AKS ALL
31-62-00	CDS - ICE AND RAIN PROTECTION INTERFACES	66	AKS ALL
31-62-00	CDS - FUEL AND ELECTRICAL INTERFACES	68	AKS ALL
31-62-00	CDS - ENGINE INTERFACES - 1	71	AKS ALL

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INDICATING AND RECORDING SYSTEMS

<u>CH-SC-SU</u>	<u>SUBJECT</u>	<u>PAGE</u>	<u>EFFECT</u>
31-62-00	CDS - ENGINE INTERFACES - 2	74	AKS ALL
31-62-00	CDS - ENGINE INTERFACES - 3	76	AKS ALL
31-62-00	CDS - ENGINE INTERFACES - 4	78	AKS ALL
31-62-00	CDS - ENGINE INTERFACES - 5	80	AKS ALL
31-62-00	CDS - ENGINE INTERFACES - 6	82	AKS ALL
31-62-00	CDS - COAX COUPLER	84	AKS ALL
31-62-00	CDS - REMOTE LIGHT SENSOR	86	AKS ALL
31-62-00	CDS - DISPLAY UNIT	88	AKS ALL
31-62-00	CDS - DU - FUNCTIONAL DESCRIPTION	90	AKS ALL
31-62-00	CDS - BRIGHTNESS CONTROLS	92	AKS ALL
31-62-00	CDS - DISPLAY ELECTRONICS UNIT	94	AKS ALL
31-62-00	CDS - DEU - FUNCTIONAL DESCRIPTION	97	AKS ALL
31-62-00	CDS - EFIS CONTROL PANEL	98.3	AKS ALL
31-62-00	CDS - PRIMARY FLIGHT DISPLAY OVERVIEW	98.6	AKS ALL
31-62-00	CDS - PFD - AIRSPEED INDICATIONS	98.9	AKS ALL
31-62-00	CDS - PFD - ATTITUDE INDICATIONS	98.13	AKS ALL
31-62-00	CDS - PFD - ALTITUDE INDICATIONS	98.19	AKS ALL
31-62-00	CDS - PFD - VERTICAL SPEED INDICATIONS	98.24	AKS ALL
31-62-00	CDS - PFD - HEADING INDICATION	98.26	AKS ALL
31-62-00	CDS - PFD - FLIGHT MODE ANNUNCIATIONS	98.28	AKS ALL

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INDICATING AND RECORDING SYSTEMS

CH-SC-SU	SUBJECT	PAGE	EFFECT
31-62-00	CDS - PFD - LANDING INDICATIONS	98.30	AKS ALL
31-62-00	CDS - PFD - RADIO ALTITUDE AND RADIO MINIMUMS INDICATIONS	98.36	AKS ALL
31-62-00	CDS - PFD - TIME CRITICAL ANNUNCIATIONS	98.38	AKS ALL
31-62-00	CDS - PFD - SYMBOLOGY - 1	98.40	AKS ALL
31-62-00	CDS - PFD - SYMBOLOGY - 2	98.44	AKS ALL
31-62-00	CDS - PFD - SYMBOLOGY - 3	98.48	AKS ALL
31-62-00	CDS - PFD - SYMBOLOGY - 4	98.50	AKS ALL
31-62-00	CDS - PFD - SYMBOLOGY - 5	98.52	AKS ALL
31-62-00	CDS - PFD - SYMBOLOGY - 6	98.54	AKS ALL
31-62-00	CDS - PFD - SYMBOLOGY - 7	98.56	AKS ALL
31-62-00	CDS - PFD - FAULT INDICATIONS	98.58	AKS ALL
31-62-00	CDS - NAVIGATION DISPLAY OVERVIEW	98.60	AKS ALL
31-62-00	CDS - ND - EXPANDED APPROACH	98.62	AKS ALL
31-62-00	CDS - ND - CENTERED APPROACH	98.64	AKS ALL
31-62-00	CDS - ND - EXPANDED VOR	98.66	AKS ALL
31-62-00	CDS - ND - CENTERED VOR	98.68	AKS ALL
31-62-00	CDS - ND - EXPANDED MAP MODE	98.70	AKS ALL
31-62-00	CDS - ND - CENTERED MAP	98.72	AKS ALL
31-62-00	CDS - ND - PLAN MODE	98.74	AKS ALL
31-62-00	CDS - ND - VERTICAL SITUATION DISPLAY MODE	98.76	AKS ALL

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<u>CH-SC-SU</u>	<u>SUBJECT</u>	<u>PAGE</u>	<u>EFFECT</u>
31-62-00	CDS - ND - SYMBOLOGY - 1	98.78	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 2	98.80	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 3	98.84	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 4	98.86	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 5	98.88	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 6	98.90	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 7	98.92	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 8	98.94	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 9	98.96	AKS ALL
31-62-00	CDS - ND - SYMBOLOGY - 10	98.98	AKS ALL
31-62-00	CDS - ND - VSD - SYMBOLOGY - 1	98.100	AKS ALL
31-62-00	CDS - VSD - SYMBOLOGY - 2	98.102	AKS ALL
31-62-00	CDS - VSD - SYMBOLOGY - 3	98.104	AKS ALL
31-62-00	CDS - VSD - SYMBOLOGY - 4	98.106	AKS ALL
31-62-00	CDS - VSD - SYMBOLOGY - 5	98.108	AKS ALL
31-62-00	CDS - ND - APPROACH MODE FAILURE FLAGS	98.110	AKS ALL
31-62-00	CDS - ND - VOR MODE FAILURE FLAGS	98.112	AKS ALL
31-62-00	CDS - ND - MAP MODE FAILURE FLAGS	98.114	AKS ALL
31-62-00	CDS - ND - PLAN MODE FAILURE FLAGS	98.116	AKS ALL
31-62-00	CDS - ND - VERTICAL SITUATION DISPLAY FAILURE FLAG	98.118	AKS ALL

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<u>CH-SC-SU</u>	<u>SUBJECT</u>	<u>PAGE</u>	<u>EFFECT</u>
31-62-00	CDS - ND - SYMBOLS - 8	98.120	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - INTRODUCTION	98.122	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - COMPACTED ENGINE DISPLAY	98.125	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - MISCELLANEOUS INDICATIONS	98.130	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - CREW ALERT MESSAGES	98.132	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - N1 INDICATION	98.136	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - EGT INDICATION	98.140	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - N2 INDICATION	98.142	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - FUEL INDICATIONS	98.144	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - OIL INDICATIONS	98.148	AKS ALL
31-62-00	CDS - ENGINE DISPLAY - ENGINE VIBRATION INDICATIONS	98.150	AKS ALL
31-62-00	CDS - SYSTEMS DISPLAY - INTRODUCTION	98.152	AKS ALL
31-62-00	CDS - SYSTEMS DISPLAY - HYDRAULIC INDICATIONS	98.154	AKS ALL
31-62-00	CDS - SYSTEMS DISPLAY - FLIGHT CONTROL SURFACE POSITIONS INDICATIONS	98.156	AKS ALL
31-62-00	CDS - OPERATION - SWITCHING - NORM POSITION	98.158	AKS ALL
31-62-00	CDS - OPERATION - SWITCHING - OUTBD PFD POSITION	98.160	AKS ALL
31-62-00	CDS - OPERATION - SWITCHING - INBD ENG PRI POSITION	98.162	AKS ALL
31-62-00	CDS - OPERATION - SWITCHING - INBD PFD POSITION	98.164	AKS ALL
31-62-00	CDS - OPERATION - SWITCHING - INBD MFD POSITION	98.166	AKS ALL
31-62-00	CDS - OPERATION - SWITCHING - LOWER ENG POSITION	98.168	AKS ALL

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<u>CH-SC-SU</u>	<u>SUBJECT</u>	<u>PAGE</u>	<u>EFFECT</u>
31-62-00	CDS - OPERATION - SWITCHING - LOWER ND POSITION	98.170	AKS ALL
31-62-00	CDS - OPERATION - SWITCHING - AUTOMATIC	98.172	AKS ALL
31-62-00	CDS - OPERATION - DISPLAY SOURCE SELECTOR	98.174	AKS ALL
31-62-00	CDS - OPERATION - CONTROL PANEL SELECT SWITCH	98.176	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - MAINTENANCE MESSAGES	98.179	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - SOFTWARE LOADING	98.183	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - CDS BITE MAIN MENU	98.186	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - CURRENT STATUS	98.188	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS	98.190	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS BULK ERASE	98.192	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - GROUND TESTS MENU	98.194	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DEU SELF TEST 1	98.196	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DEU SELF-TEST 2	98.198	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DU LOOP TEST	98.200	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DU OPTICAL TEST	98.202	AKS ALL

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31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - WXR/TERR DISPLAY TEST	98.204	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - WXR/TERR DISPLAY TEST - TERR DISPLAY	98.206	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - IDENT/CONFIG	98.208	AKS ALL
31-62-00	CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INPUT MONITORING	98.210	AKS ALL
31-62-00	CDS - SYSTEM SUMMARY	98.212	AKS ALL

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CLOCKS - GENERAL DESCRIPTION

Purpose

The clocks give time reference to the flight crew and other airplane systems.

General

This is the data that the clock shows:

- Time and date set manually from the clock
- Global positioning system (GPS) time and date from the multi-mode receiver (MMR)
- Elapsed time
- Chronograph time.

The captain clock sends time and date to these components:

- Flight management computer (FMC)
- Flight data acquisition unit (FDAU)
- Voice recorder.

These units use the clock time and date for internal timing functions.

NOTE: The flight management computer (FMC) does not use the clock data if the FMC is programmed to use the global positioning system (GPS).

Abbreviations and Acronyms

- bat - battery
- chr - chronograph
- FDAU - flight data acquisition unit
- ET - elapsed time
- FMC - flight management computer
- F/O - first officer
- GMT - Greenwich mean time
- GPS - global positioning system
- hld - hold

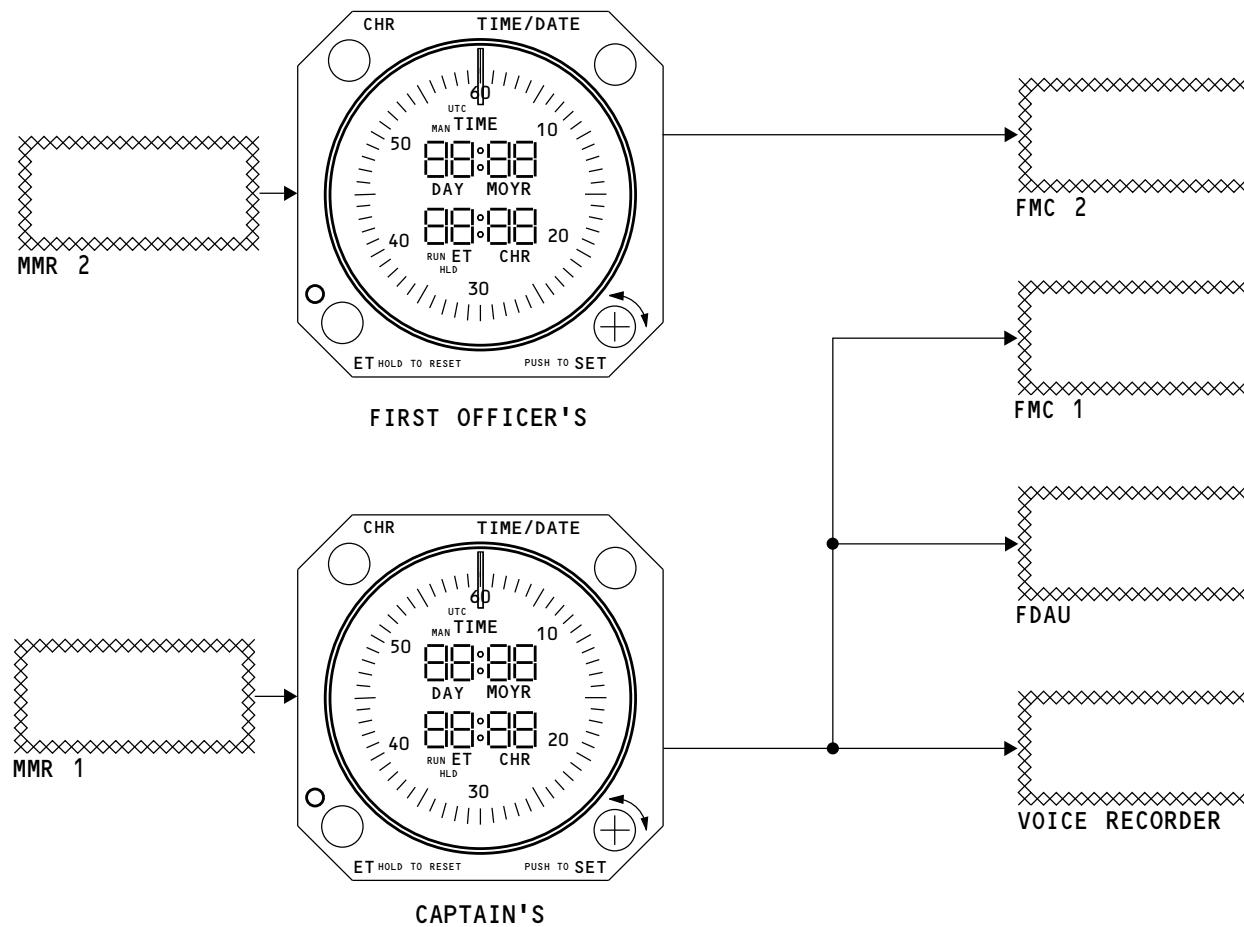
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D68330 S0000163282_V2

CLOCKS - GENERAL DESCRIPTION



CLOCKS - COMPONENT LOCATION

General

These are the clock system components:

- Captain clock
- First officer clock.

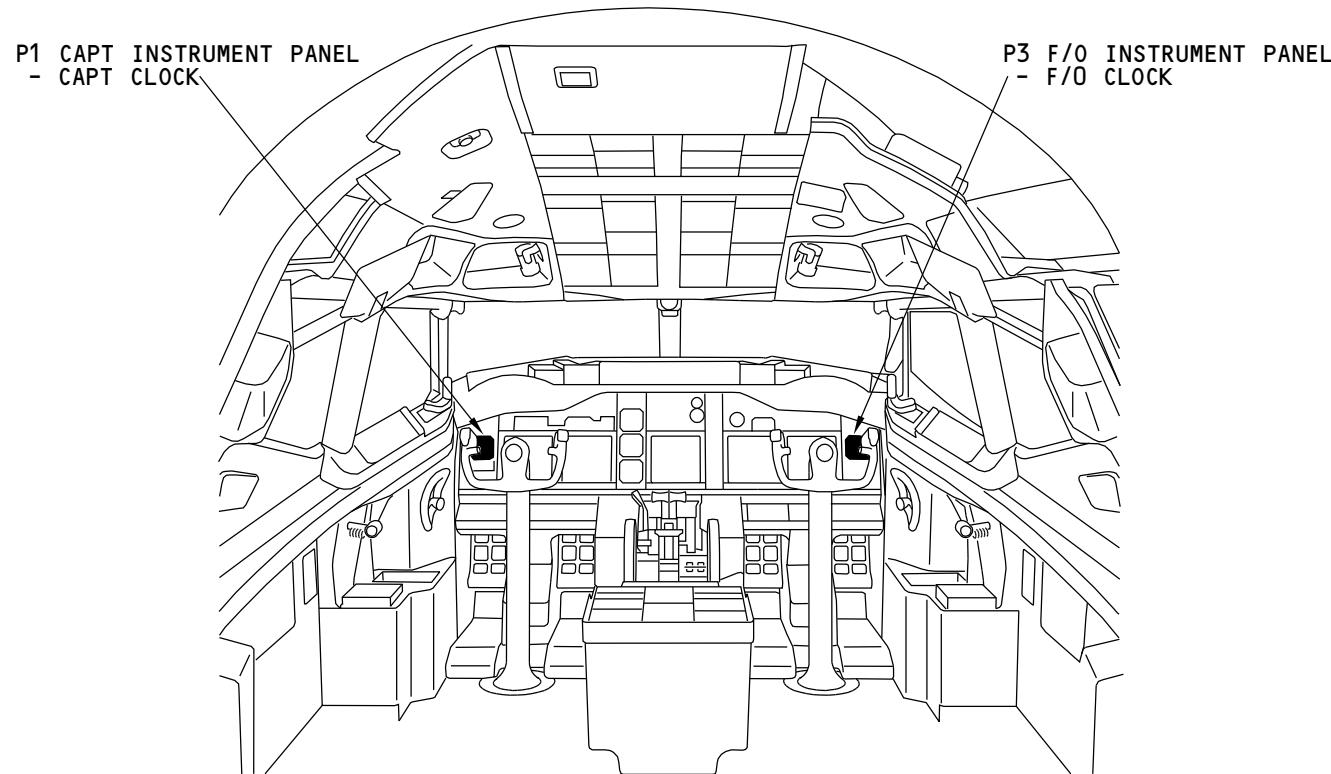
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M75665 S0004626570_V1

CLOCKS - COMPONENT LOCATION

31-25-00-003

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CLOCKS - INTERFACES

Power

The clocks get power from the 28v dc hot battery bus through the CLOCK circuit breaker. 28v dc through the CLOCK DISPLAY circuit breaker supplies power to the clocks to let the clocks show date and time data. Each clock gets 5v ac from master dim and test for its internal instrument lights.

Digital Input

The multi-mode receiver (MMR) sends global positioning system time and date to the captain and first officer clocks.

Digital Output

The captain clock sends date and time data to the FMC 1, the FDAU, and the voice recorder on an ARINC 429 data bus. The first officer clock sends date and time to the FMC 2.

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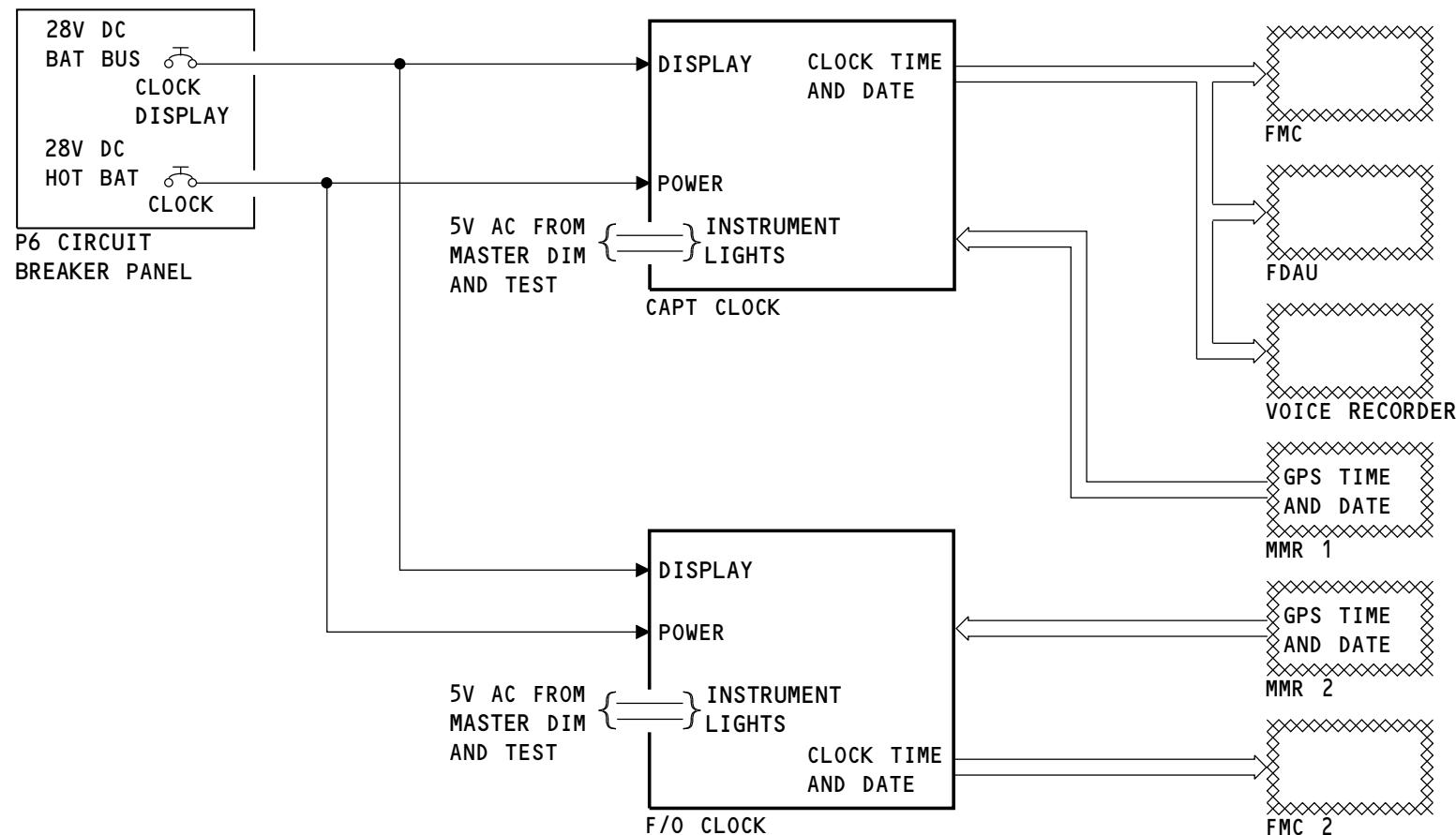
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M75681 S0004626579_V2

CLOCK - INTERFACES
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CLOCKS - CLOCK

Displays

The clock is an LCD display.

Chronograph Switch

The chronograph switch is a pushbutton switch. Use this switch to start, stop, and reset the chronograph function.

Sweep Second Hand

The sweep second hand only works with the chronograph function of the clock.

The second hand shows chronograph seconds when active and stays in the 12:00 position when not in use.

Elapsed time and Reset Pushbutton

The elapsed time pushbutton controls the elapsed time function of the clock. Select the pushbutton once starts the elapsed time cycle and pressing it again holds the elapsed time. Pressing the button a third time restarts the elapsed time.

The elapsed time resets to 0 when the button is held down for two seconds

Time/Date Pushbutton

When UTC is displayed, pressing the Time/Date pushbutton selects the UTC date. Pressing a second time displays MAN time and pressing it again selects MAN date. The UTC time and date are shown when the button is pressed a fourth time .

In the MAN position, clock time and date come from the clock. In the UTC (universal time coordinated) position, clock time and date come from the global positioning system.

SET Control knob

The SET control knob changes the MAN time and date. Push the knob to select the function selected by the Time/Date control. Rotate the knob clockwise or counterclockwise to change the display.

Ambient Light Compensation

The intensity of the LCD backlighting is obtain from the aircraft dimming bus and a measurement of the ambient light in the cockpit. The ambient light is sensed by a photodiode on the front bezel.

EFFECTIVITY

AKS ALL

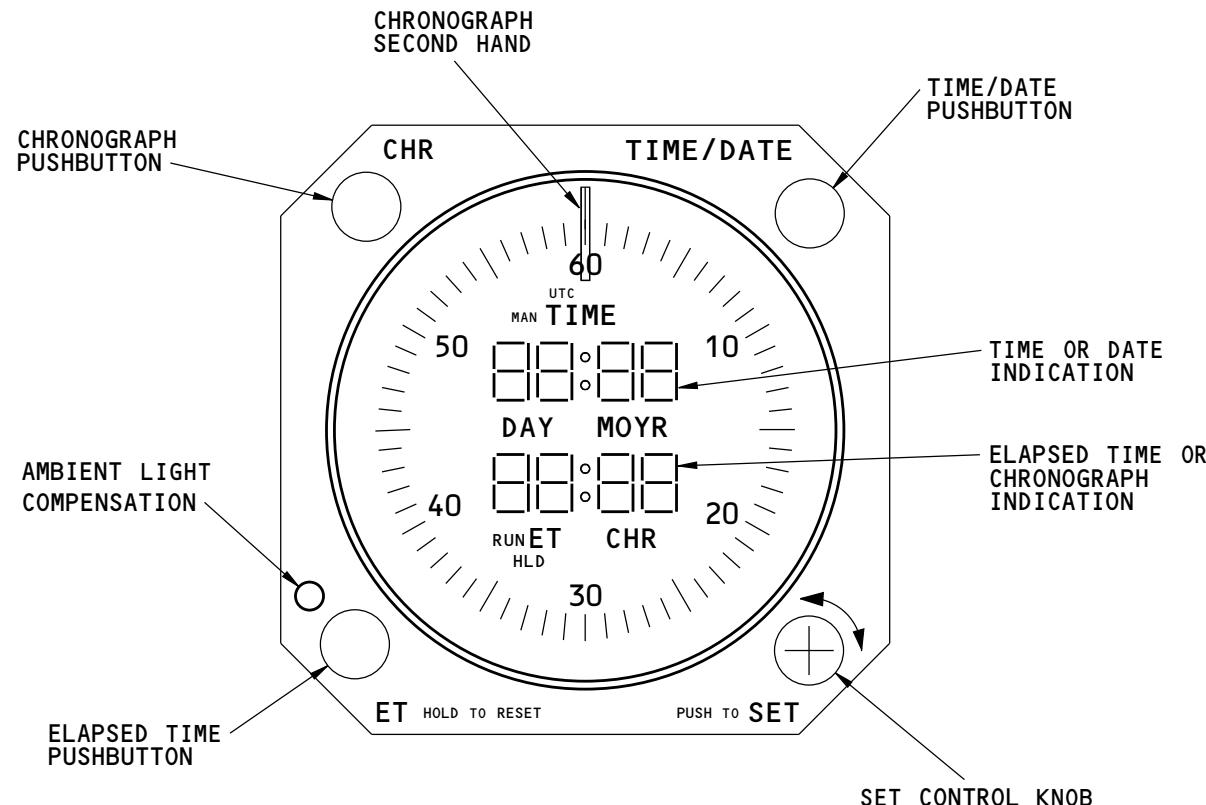
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D66653 S0000163158_V1

CLOCKS - CLOCK
31-25-00

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CLOCKS - DATE/TIME SELECTION

Date/Time Selection

Push the time/date pushbutton to show these modes, in this order:

- UTC time
- UTC date
- MAN time
- MAN date

When a date shows, the day/month and the year show alternatively for one second each.

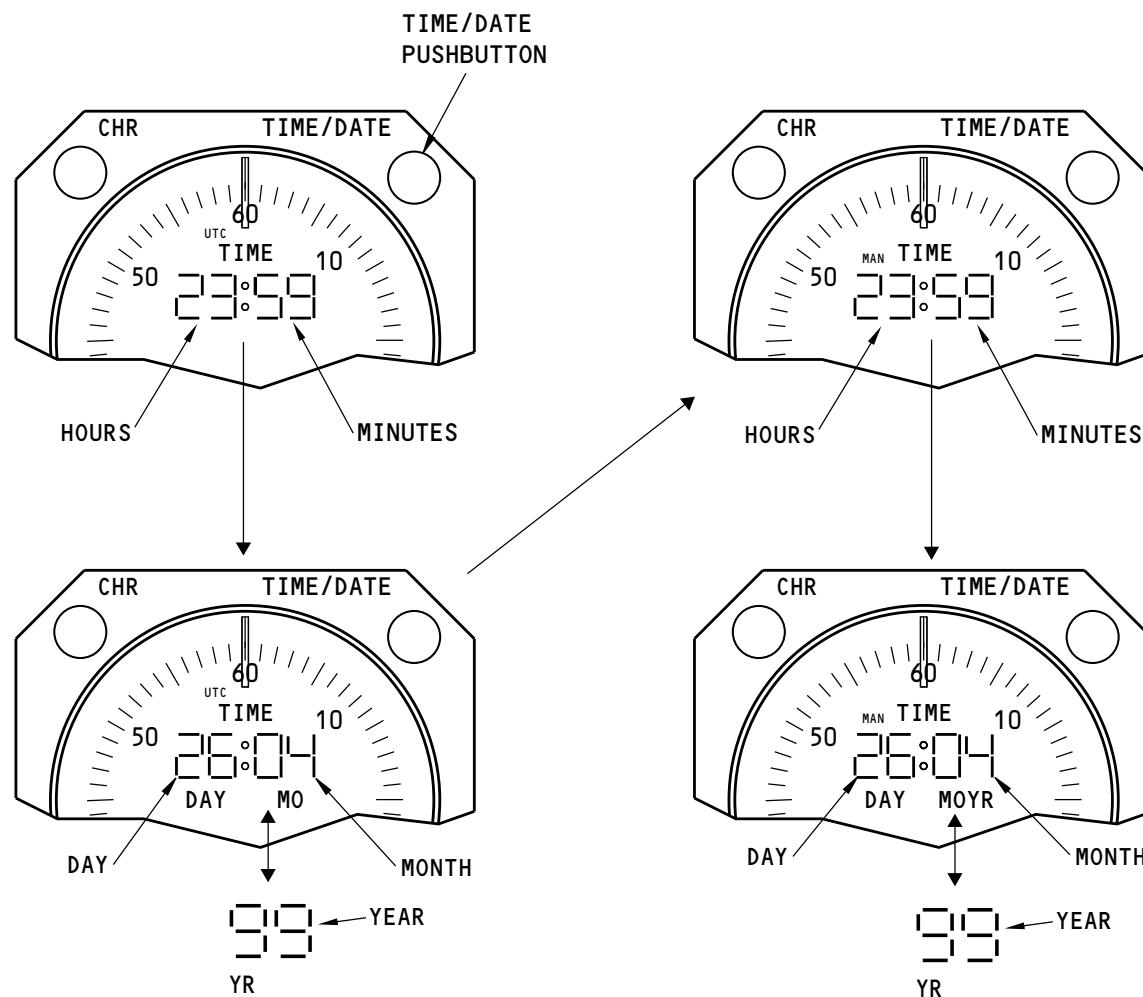
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D68428 S0000163315_V1

CLOCKS - DATE/TIME SELECTION
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CLOCKS - TIME SET

General

To set the time, push the time/date pushbutton until you see MAN time. If no manual time has previously been set, the UTC time shows for the manual time.

Use the SET control knob to set the time. Push the SET control knob and the hours flash. Rotate the knob to adjust the hours. Push the SET control knob again and the minutes flash. Rotate the knob to adjust the minutes. Push the SET control knob again to run the time.

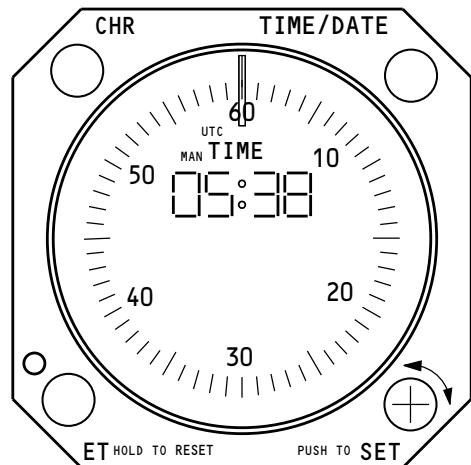
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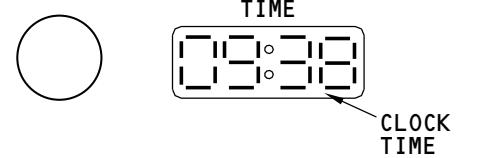
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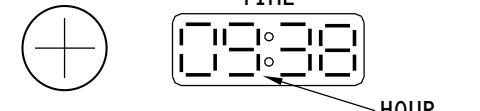
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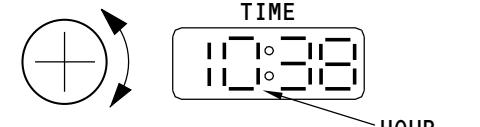
① PUSH TIME/DATE
PUSHBUTTON UNTIL
MAN TIME SHOWS



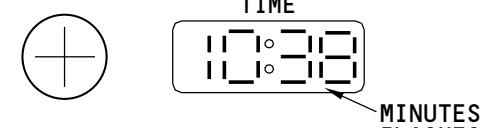
② PUSH SET
CONTROL KNOB,
HOUR FLASHES



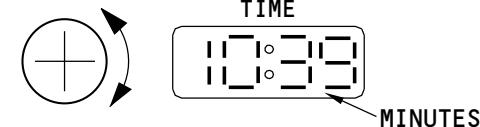
③ ROTATE SET
CONTROL KNOB



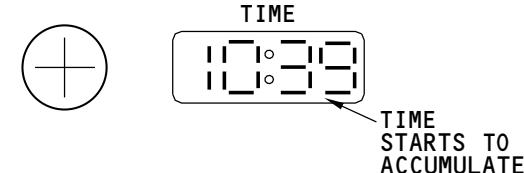
④ PUSH SET
CONTROL KNOB,
MINUTES FLASHES



⑤ ROTATE SET
CONTROL KNOB



⑥ PUSH SET
CONTROL KNOB,
RUN TIME



CLOCKS TIME SET

D68342 S0000163353_V1

EFFECTIVITY

AKS ALL

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CLOCKS - DATE SET

General

To set the date, push the time/date pushbutton until you see MAN date.

Push the SET control knob once and the day flashes. Rotate the knob to select the day. Push the knob again and the month flashes. Rotate the knob to select the month. Push the knob again and the year flashes. Rotate the knob to select the year. Push the knob again and the manual date displays.

NOTE: If a delay of one minute or more is experienced when setting the time or date, the clock returns to the previous time/date setting.

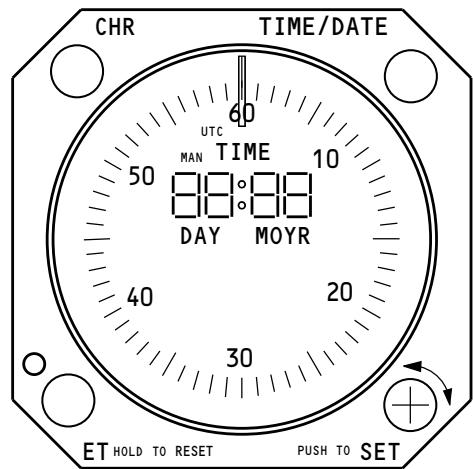
EFFECTIVITY

AKS ALL

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- ① PUSH THE TIME/DATE PUSHBUTTON UNTIL MAN AND DAY MOYR SHOWS



22 05
DAY MOYR

- ② PUSH THE SET CONTROL KNOB ONCE, DAY FLASHES



22 05
DAY

- ③ ROTATE THE KNOB, DAY CHANGES



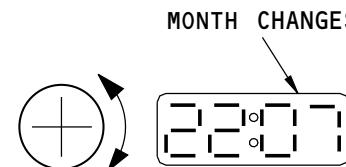
22 05
DAY/MONTH

- ④ PUSH THE SET CONTROL KNOB AGAIN, THE MONTH FLASHES



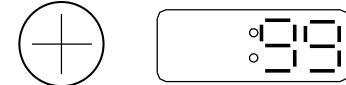
22 05
MO

- ⑤ ROTATE THE KNOB, MONTH CHANGES



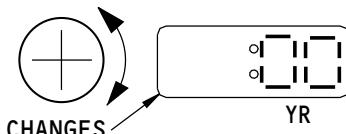
MONTH CHANGES
22 05
DAY MO

- ⑥ PUSH THE SET CONTROL KNOB AGAIN, THE YEAR FLASHES



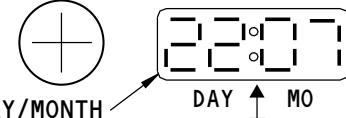
05 15
YR

- ⑦ ROTATE THE SET KNOB, YEAR CHANGES



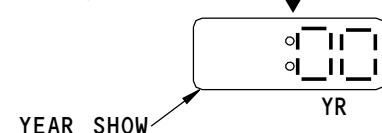
YEAR CHANGES
05 15
YR

- ⑧ PUSH THE SET CONTROL KNOB AGAIN, MANUAL DATE DISPLAYS



22 05
DAY/MONTH

- ⑨ TO VIEW THE YEAR, PUSH THE KNOB AGAIN



YEAR SHOW
05 15
YR

NOTE: IF A DELAY OF MORE THAN ONE MINUTE IS EXPERIENCED WHEN SETTING THE TIME OR DATE, THE CLOCK RETURNS TO THE PREVIOUS TIME/DATE SETTING.

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CLOCKS - DATE SET

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CLOCKS - ELAPSED TIME

General

Use the ET pushbutton to control the elapsed time function.

Push the ET button once to start the elapsed time cycle. Push it again to hold the elapsed time. Push it a third time continues elapsed time. Holding the ET button for two seconds resets the elapsed time to 0.

The ET and RUN or HLD symbols are display below the elapsed time display.

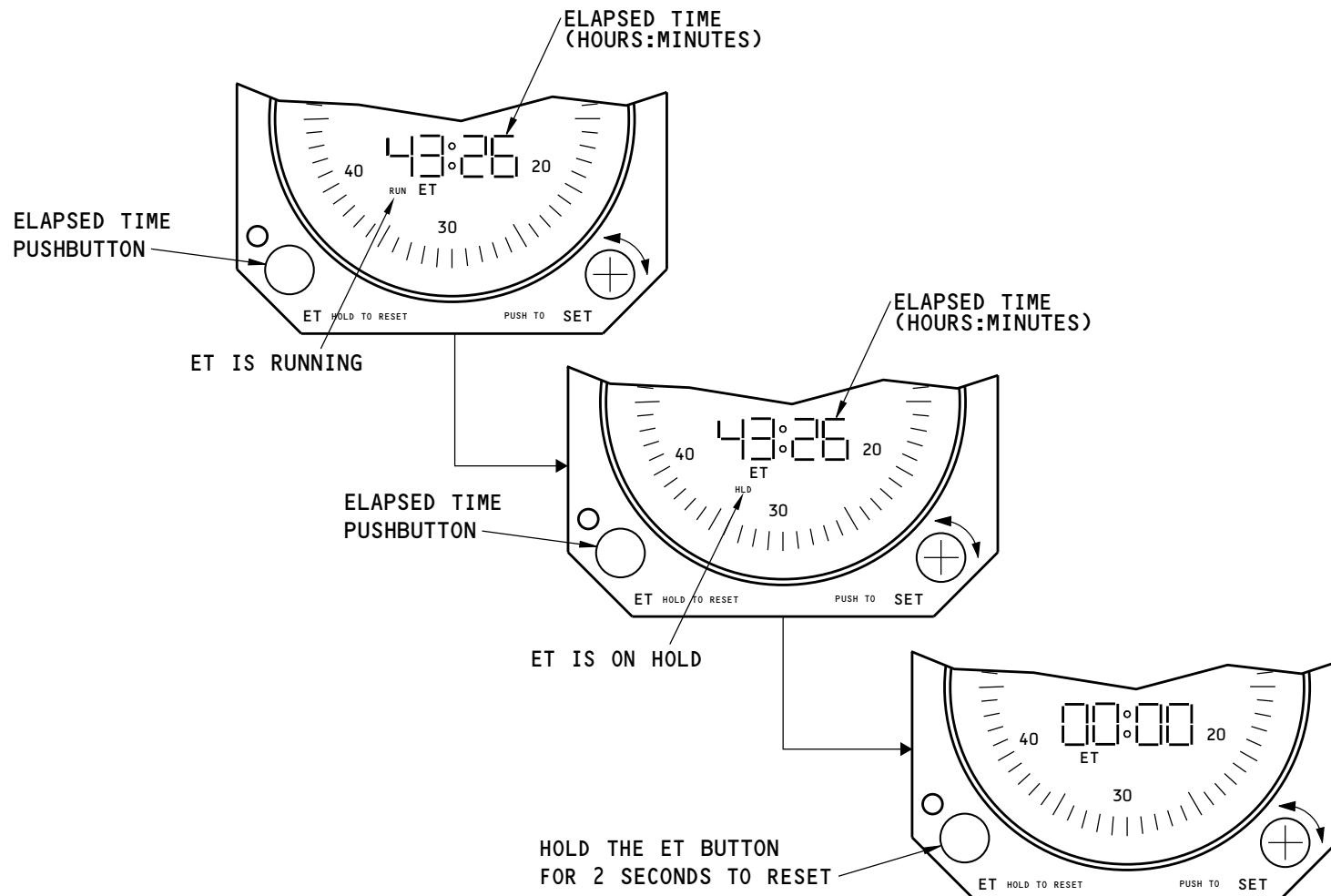
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CLOCKS - ELAPSED TIME
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CLOCKS - CHRONOGRAPH FUNCTION

General

The minutes show on the lower display. The sweep second hand indicates the seconds. The chronograph function does not calculate hours.

When the chronograph time shows, the clock continues to update the elapsed time function internally.

Use the chronograph control switch on the clock to start, stop, and reset the chronograph.

EFFECTIVITY

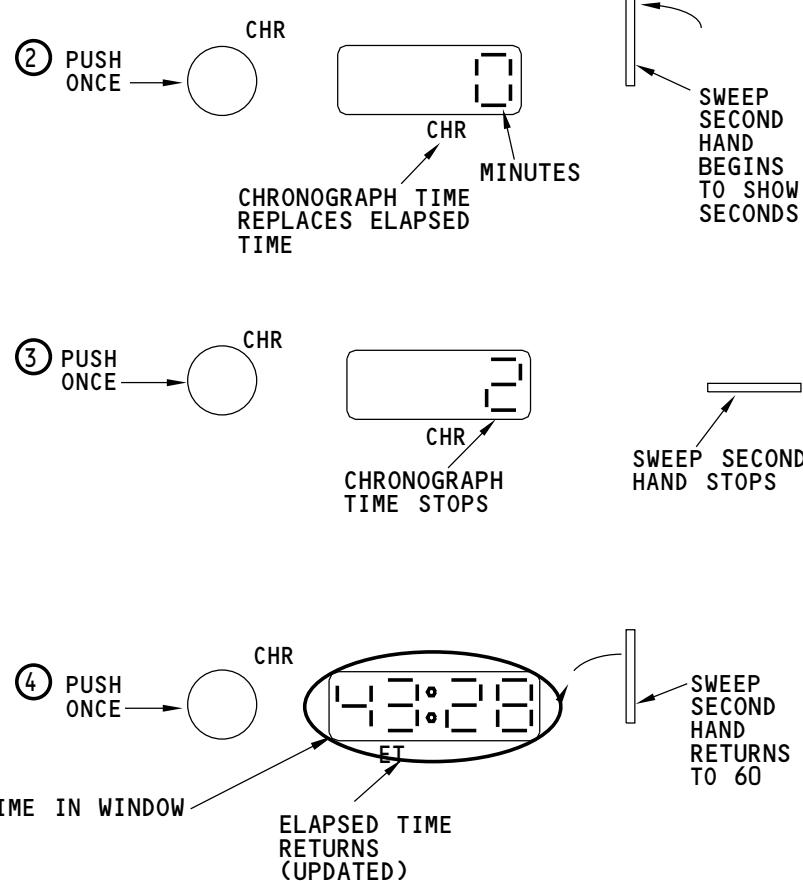
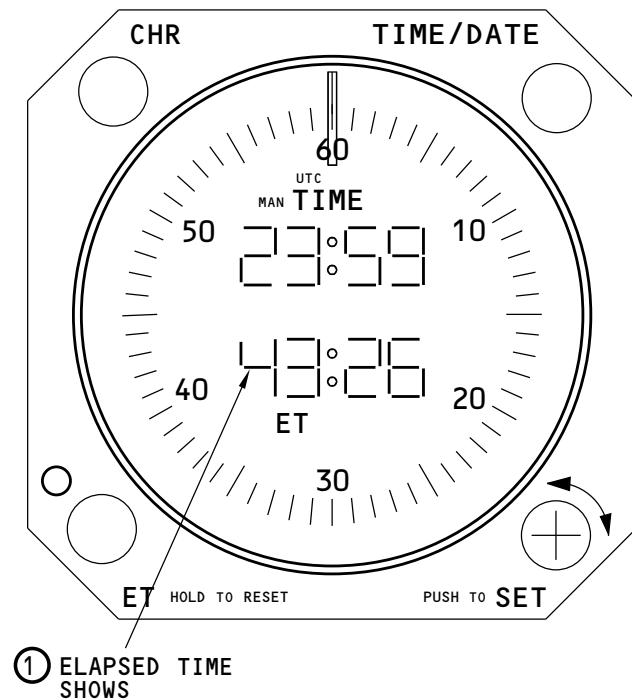
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CLOCKS - CHRONOGRAPH FUNCTION

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CLOCKS - FUNCTIONAL DESCRIPTION

Inputs

The clock gets 28v dc for power and clock displays.

The microprocessor senses the inputs from all the bezel controls.

The bezel light sensor senses the ambient light in the flight compartment and sends the data to the microprocessor.

The global positioning system (GPS) sends time and date information to the clock.

Power

Power for the operation of the clock and to keep the time base comes from the battery bus. When the battery bus is not available for more than 200ms, the clock uses hot battery bus power. The hot battery bus power keeps the time base but does not supply power for the display or output of clock data. This lets the clock time base continue operation when power is not available from the battery bus.

Calculations and Outputs

A microprocessor does all the time calculations and controls the outputs of the clock.

An LCD driver supplies display information to the clock display.

ARINC 429 clock data goes to the FDAU, the FMC and the voice recorder.

Output to FDAU, FMC, and Voice Recorder

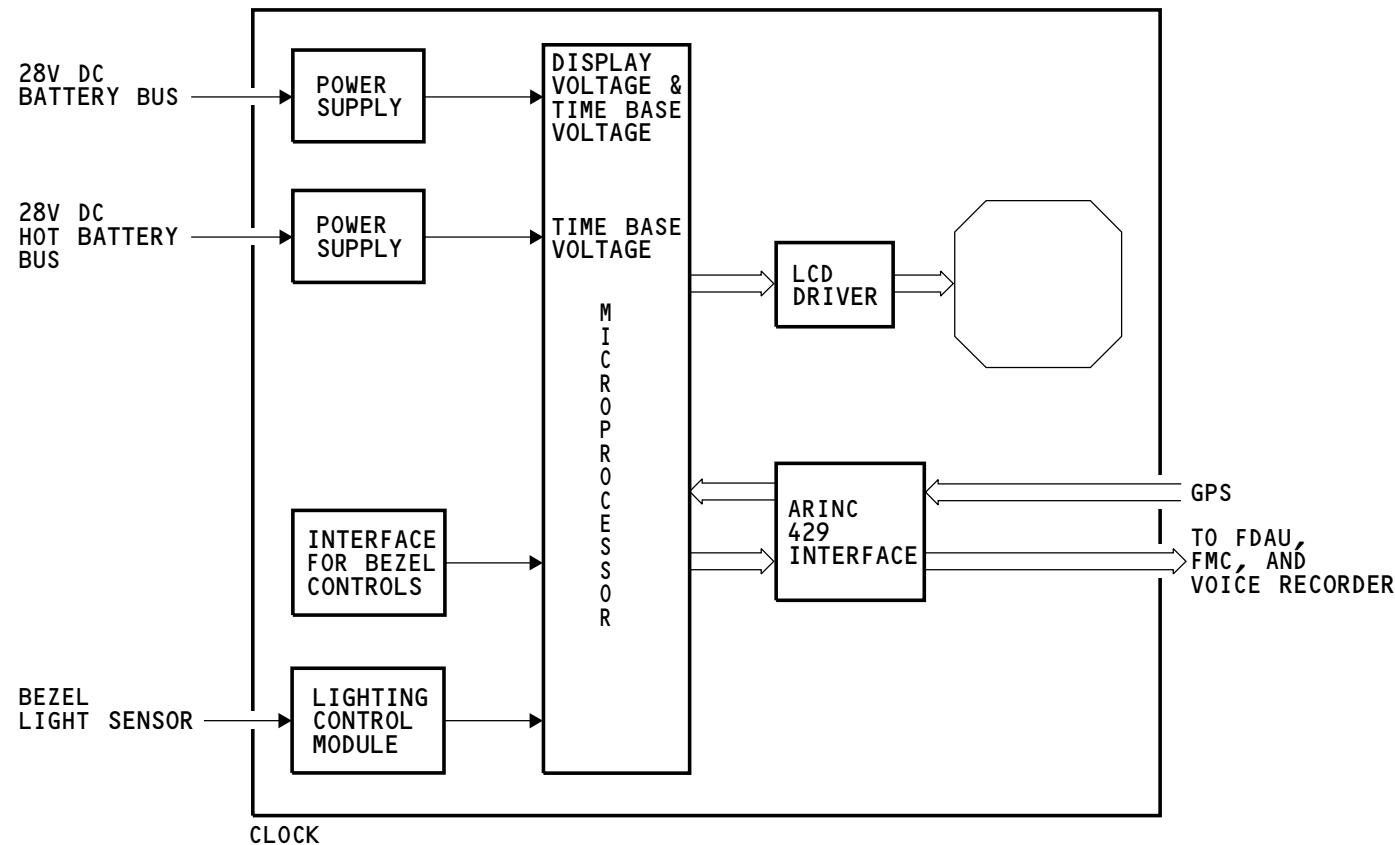
The clock sends this data to the FDAU, the FMC, and the voice recorder:

- Clock time
- Clock date.

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CLOCKS - FUNCTIONAL DESCRIPTION
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CLOCKS - SYSTEM SUMMARY

Power

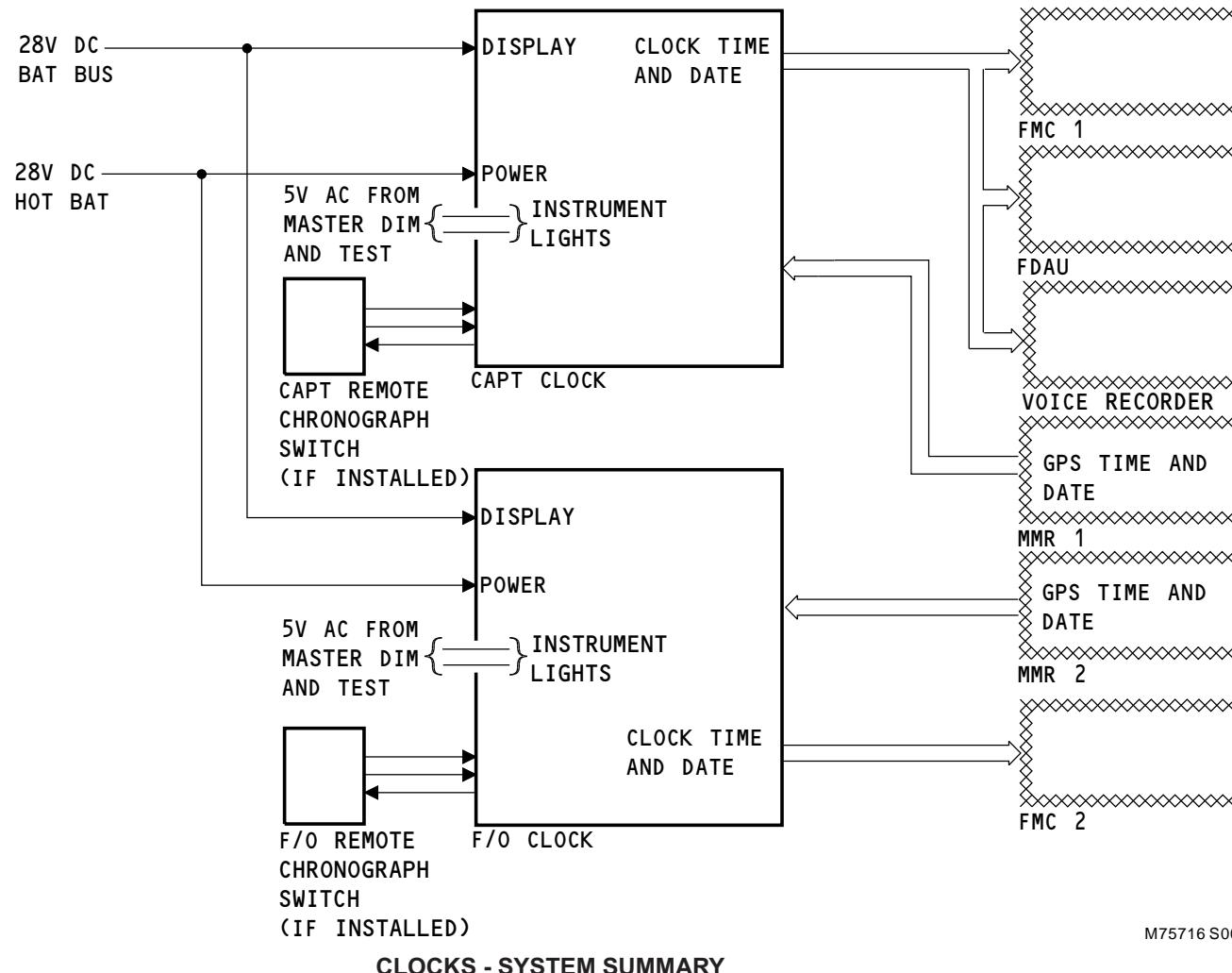
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DIGITAL FLIGHT DATA RECORDER SYSTEM - INTRODUCTION

Purpose

The Digital Flight Data Recorder System (DFDRS) stores airplane parameters and system data for the last 25 hours of operation.

The Solid-State Flight Data Recorder (SSFDR) protects the parameters and the system data. If there is an airplane incident, these parameters supply data on flight conditions and airplane systems operation. Airline personnel can also use the data to make an analysis of system performance during airplane maintenance.

The following acronyms are used interchangeably throughout this section and they represent the same system and device respectively:

- DFDRS and FDRS
- SSFDR, FDR and DFDR

Abbreviations and Acronyms

- ac - alternating current
- A/C - aircraft
- ACARS - aircraft communications addressing and reporting system
- ACMS - aircraft conditioning monitoring system
- A/D - analog to digital
- ADC - air data computer
- ADIRU - air data inertial reference unit
- ADL - airborne data loader
- ADV - advance
- ALRT - alert
- ALT - alternate
- alt - altitude
- A/P - autopilot
- APU - auxiliary power unit
- ARINC - aeronautical radio incorporated
- A/T - autothrottle

- ATE - automatic test equipment
- BITE - built in test equipment
- CPU - central processor unit
- dc - direct current
- DEU - display electronics unit
- DFDAU - digital flight data acquisition unit
- DFDMU - digital flight data management unit
- DFDR - digital flight data recorder
- DIP - dual inline package
- DME - distance measuring equipment
- DMP - data management processor
- DMU - data management unit
- ECU - electronic control unit
- EE - electronic equipment
- ELEC - electric
- EPROM - erasable programmable read only memory
- EVSC - engine vibration signal conditioner
- FCC - flight control computer
- FDAU - flight data acquisition unit
- FDR - flight data recorder
- FDRS - flight data recorder system
- FMC - flight management computer
- FMCS - flight management computer system
- FSEU - flap slat electronics unit
- GND - ground
- GPWC - ground proximity warning computer
- GSE - ground support equipment
- HF - high frequency
- hyd - hydraulic
- Hz - Hertz

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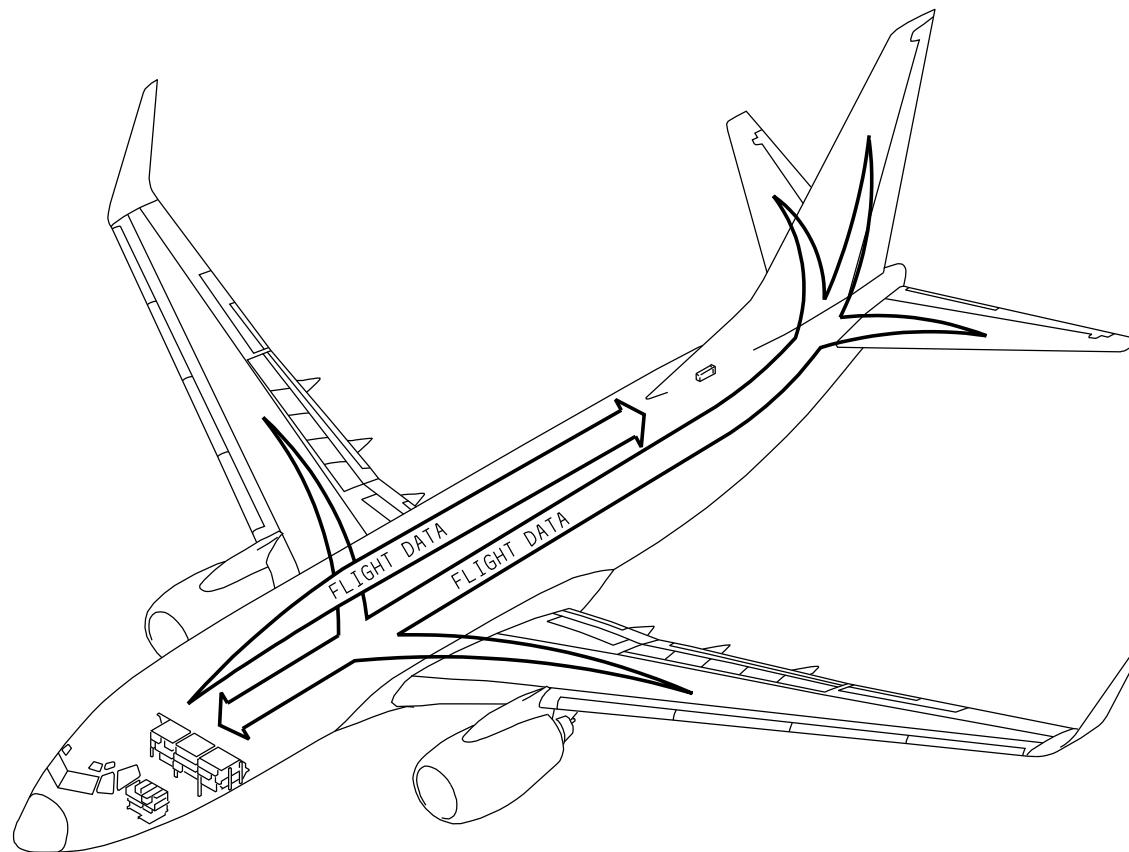
DIGITAL FLIGHT DATA RECORDER SYSTEM - INTRODUCTION

- IDU - interactive display unit
- IFSAU - integrated flight systems accessory unit
- ILS - instrument landing system
- kg - kilogram
- lav - lavatory
- LED - light emitting diode
- LRU - line replaceable unit
- MD&T - master dim and test
- MLS - microwave landing system
- MMR - multi mode receiver
- OVHT - overheat
- PCMCIA - personal computer memory card international association
- PPR - paper
- posn - position
- press - pressure
- pwr - power
- QAR - quick access recorder
- REC - recorder
- RST - reset
- SEL - select
- SRAM - static random access memory
- TCAS - traffic alert and collision avoidance system
- ULD - underwater locating device
- V AC - volts alternating current
- V DC - volts direct current
- VOR - very high frequency omni range
- XFR - transfer

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DIGITAL FLIGHT DATA RECORDER SYSTEM - INTRODUCTION

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FDRS - FLIGHT COMPARTMENT COMPONENT LOCATION

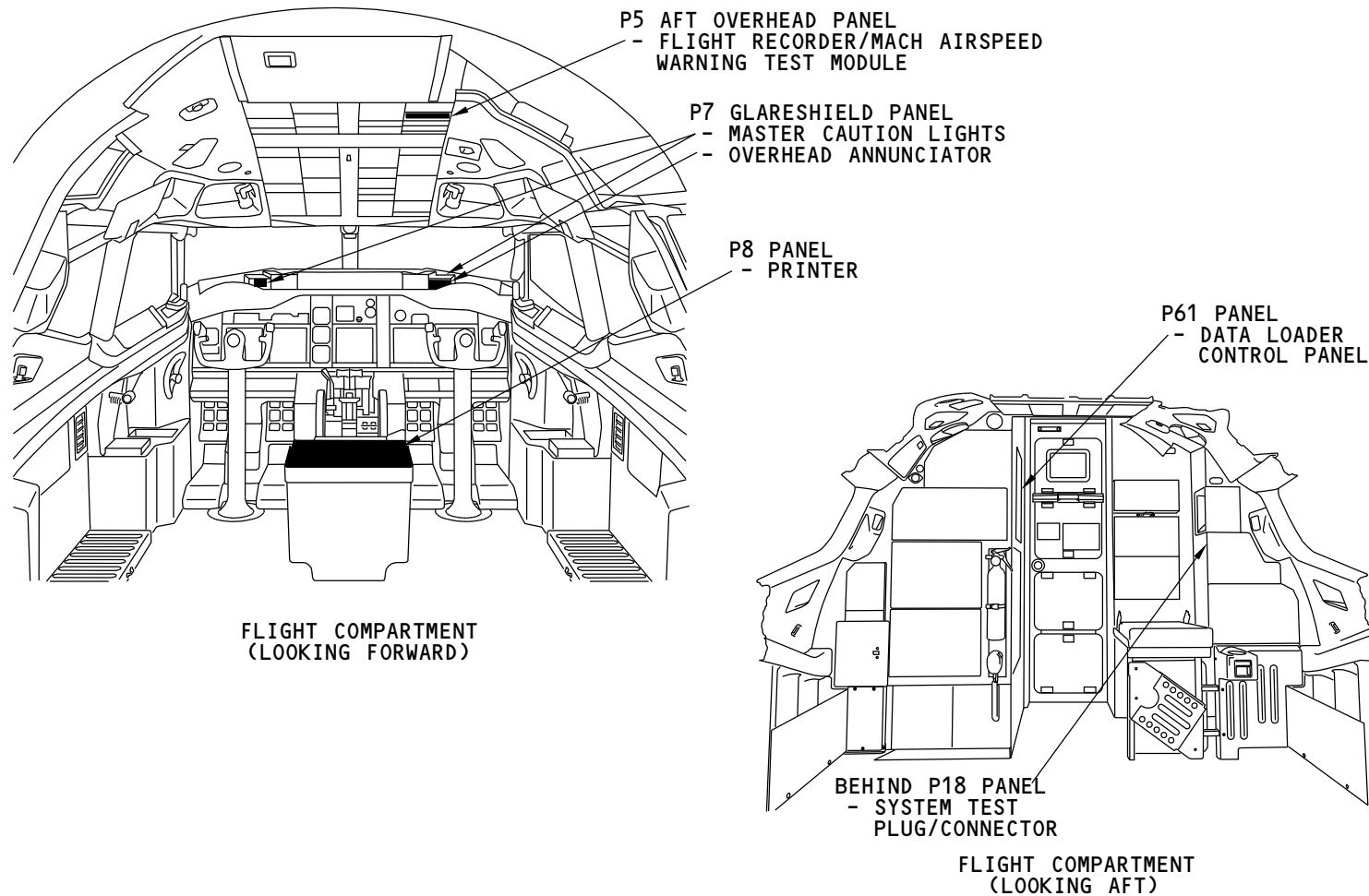
Flight Compartment

These are the flight data recorder system components in the flight compartment:

- Flight recorder/mach airspeed warning test module on the P5 aft overhead panel
- System test plug/connector on the outer wall behind the P18 circuit breaker panel.

These are the components in the flight compartment that interface with the flight data recorder system:

- Printer on the aft electronic panel P8
- Master caution lights and OVERHEAD caution annunciator on the P7 panel
- Data loader control panel on the P61 panel.



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FDRS - FLIGHT COMPARTMENT COMPONENT LOCATION



DFDRS - ELECTRONIC EQUIPMENT COMPARTMENT COMPONENT LOCATION

Digital Flight Data Acquisition Unit Location

The Digital Flight Data Acquisition Unit (DFDAU) is on the E3-2 shelf in the EE compartment. The program switch module is near the rear of the equipment rack.

The quick access recorder is on the E3-3 rack.

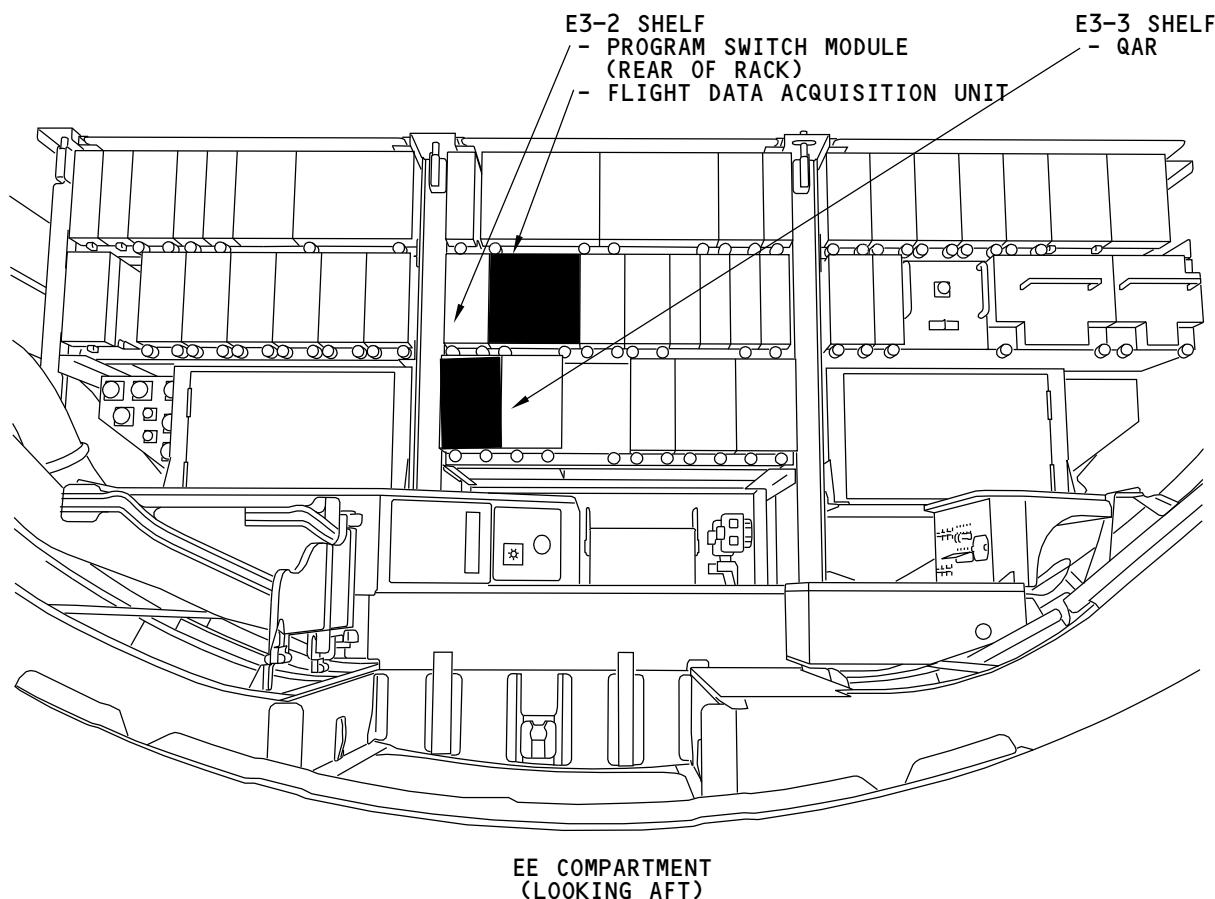
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| DFDRS - ELECTRONIC EQUIPMENT COMPARTMENT COMPONENT LOCATION31-31-00
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DFDRS - NOSE WHEEL WELL COMPONENT LOCATION

| FDAU Status Relay

The FDAU status relay is on the right side of the nose wheel well on the J24 panel.

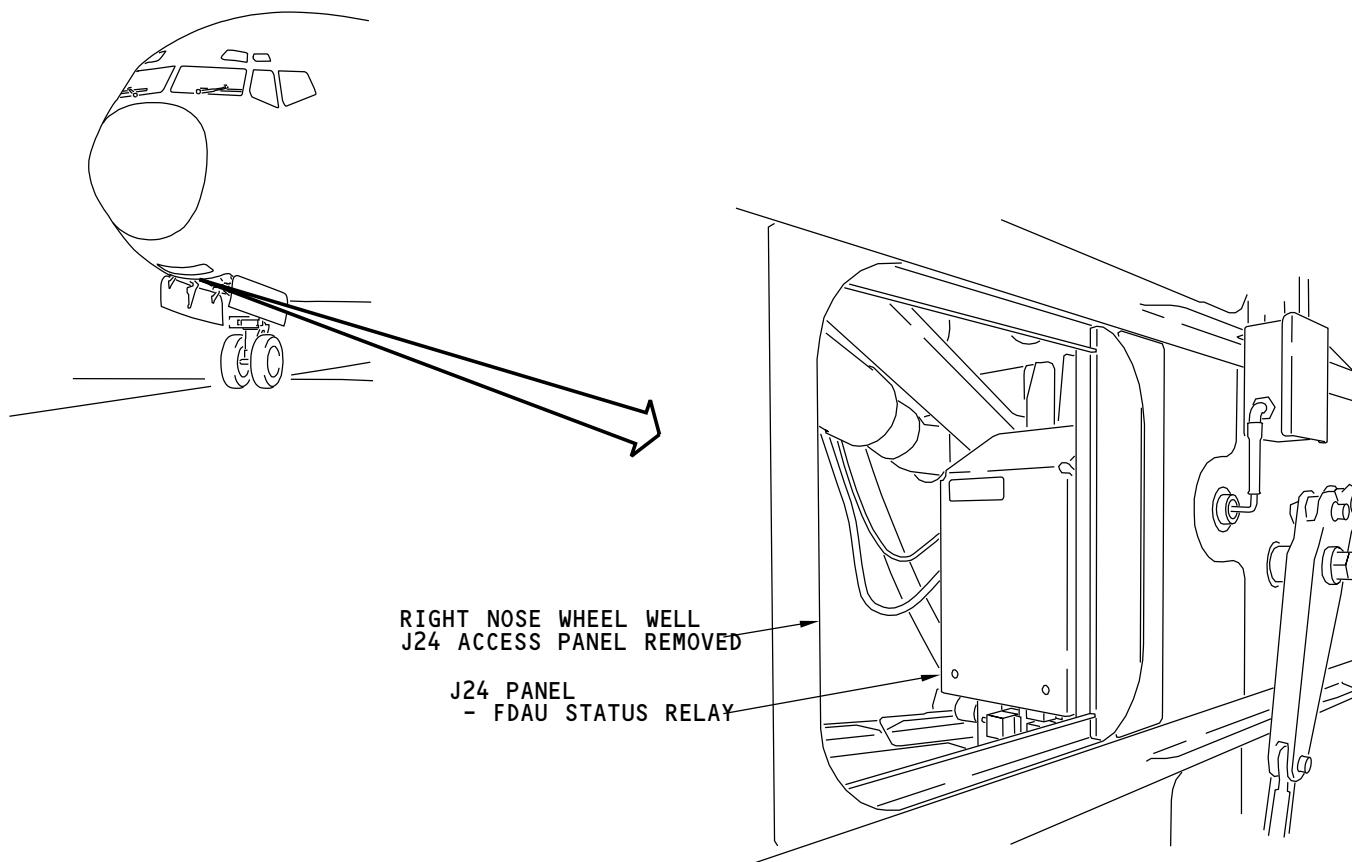
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| DFDRS - NOSE WHEEL WELL COMPONENT LOCATION

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FDRS - AIRPLANE COMPONENT LOCATION

Transmitter Locations

The tail area has these transmitters that have an interface with the FDRS:

- Rudder position transmitter
- Left and right elevator position transmitters.

The rudder pedal force transducer is located in the horizontal stabilizer and has an interface with the FDRS.

The left and right aileron position transmitters in the wings have an interface with the FDRS.

Position Sensor Locations

The control column (2), control wheel (2), and rudder pedal (1) sensors are in the forward equipment center under the flight compartment floor.

The stabilizer position A sensor is in the tailcone adjacent to the elevator feel and centering unit.

Accelerometer

The three-axis accelerometer is on the forward side of the right wheel well.

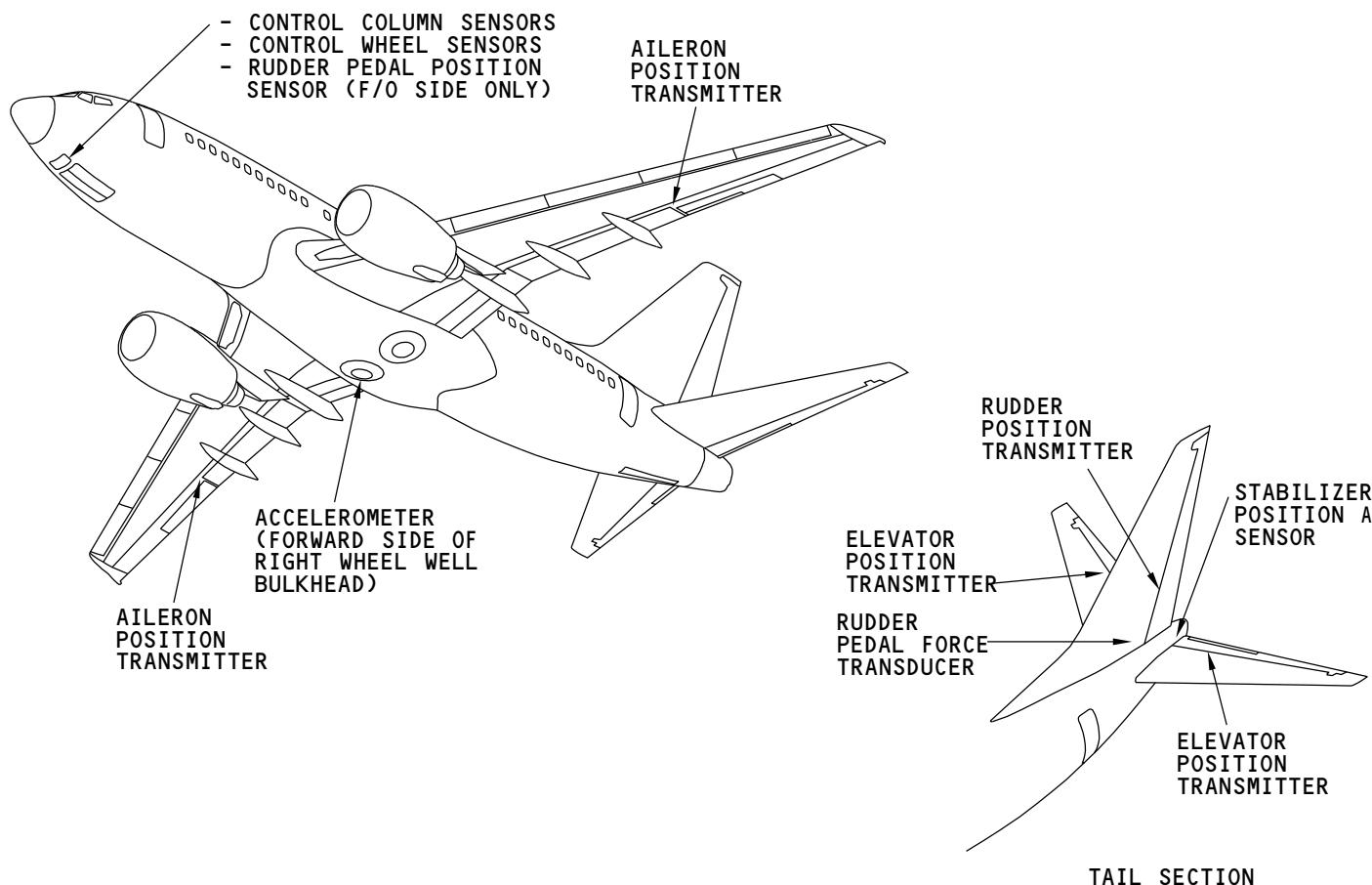
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FDRS - AIRPLANE COMPONENT LOCATION

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FDRS - AFT CABIN COMPONENT LOCATION

FDR Location

The flight data recorder (FDR) is in the aft cabin overhead. Access is through a hinged ceiling panel.

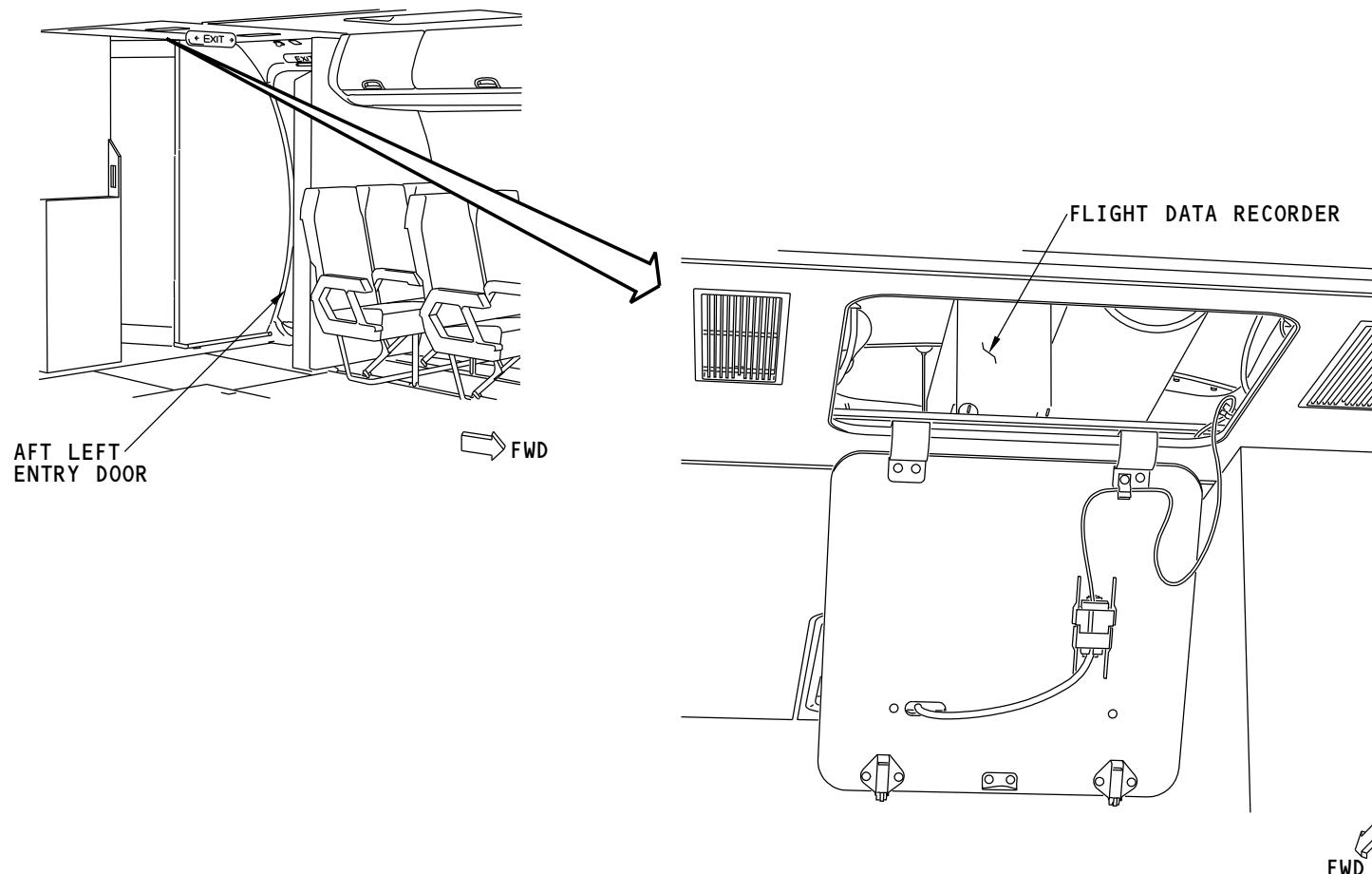
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FDRS - AFT CABIN COMPONENT LOCATION

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DFDRS - POWER, SIGNAL, AND BITE INTERFACE

General

The Digital Flight Data recorder system (DFDRS) collects, formats, and stores digital, discrete, and analog data. The Solid-State Flight Data Recorder (SSFDR) gets 115v ac power from the P18 circuit breaker panel.

Power Input

These components get 28v dc power:

- FDAU status relay
- Flight recorder test module
- FDR fault logic.

115v ac goes through a system test plug to the Digital Flight Data Acquisition Unit (DFDAU). 115v ac also goes to a relay in the flight recorder/mach airspeed warning panel to turn on the SSFDR. 26v ac goes to the DFDAU for reference voltage for the DFDRS sensors.

115v ac also goes to the QAR for power.

FDAU Status Relay

The FDAU status relay controls the flight recorder OFF light. Normally, the DFDAU BITE out signal causes the FDAU status relay to energize. This removes the ground from the flight recorder OFF light and it goes out. If the DFDAU finds a fault, the BITE out signal removes the ground from the FDAU status relay. A ground connects to the flight recorder OFF light and the flight recorder light comes on.

Flight Recorder/Mach Airspeed Warning Test Module

The flight recorder/mach airspeed warning test module has an OFF light and a TEST/NORMAL switch. The flight recorder OFF light comes on when one of these conditions occurs:

- Airplane is on the ground and both engines are off
- FDAU status relay is not energized because of a fault
- SSFDR status flag signal shows a fault.

Select TEST to connect 115v ac to the SSFDR. Do this to give power to the SSFDR on the ground for maintenance purposes.

When the switch is in the NORMAL position, the SSFDR gets 115v ac when the engine running relays or the ground sensing relay sends a ground to the flight recorder test module. The ground is sent for either one of these conditions:

- Engine 1 or engine 2 is running. (Engine running is when N2 > 50%)
- Airplane is in the air.

Digital Flight Data Acquisition Unit

The DFDAU gets digital, discrete, and analog inputs. The DFDAU changes the inputs to serial digital data. This data goes to the SSFDR. The DFDAU gets playback data from the SSFDR and monitors for the presence of sync words. This senses if the SSFDR is operational.

The program switch module sends a code to the DFDAU. The DFDAU uses this code to identify the type of airplane.

The DFDAU also sends digital outputs to the printer. The printer sends digital signals to the DFDAU to show status.

The DFDAU also sends digital outputs to the QAR for recording. The QAR sends digital signals to the DFDAU to show status.

The SSFDR sends a maintenance flag signal to the DFDAU. A SSFDR fault condition causes the flight recorder fail light on the DFDAU to come on.

System Test Plug

The system test plug sends 115v ac to the DFDAU. It can also send 115v ac to some test equipment. You can monitor SSFDR signals at the system test plug. The test plug gets two data inputs. The data that goes to the flight recorder also goes to the system test plug. If the data to the flight recorder is not all logic ones and not all logic zeros, the flight recorder sends the data back to the DFDAU. This data is the playback data. The DFDAU also sends the playback data from the flight recorder to the system test plug.

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DFDRS - POWER, SIGNAL, AND BITE INTERFACE

| Solid State Flight Data Recorder

The flight data recorder gets the data and keeps it in a solid state memory.

BITE gives these outputs:

- Status flag - Gives fault signal to the flight recorder test module to turn on the OFF light
- Maintenance flag - Gives fault signal to the DFDAU.

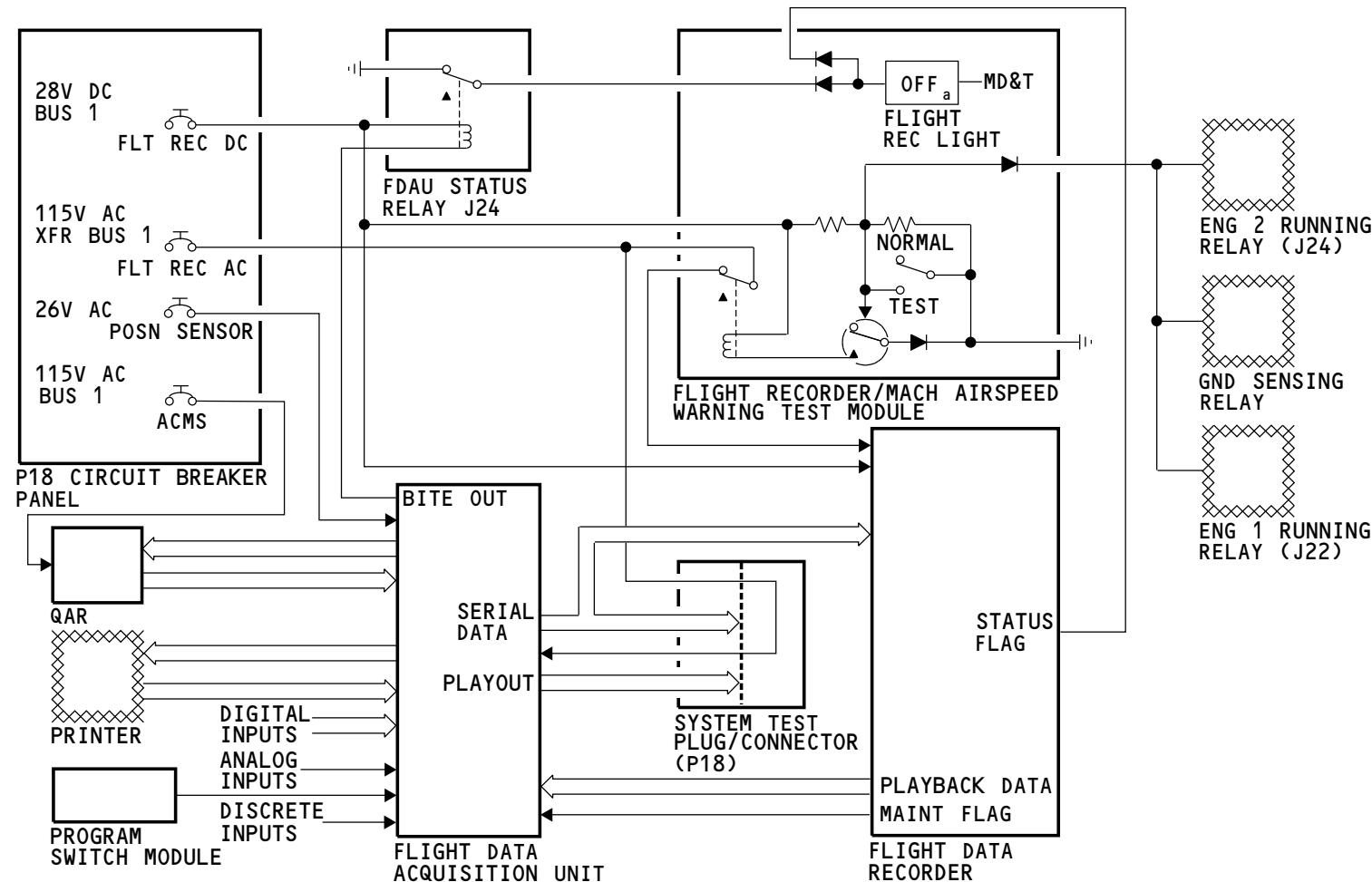
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DFDRS - POWER, SIGNAL, AND BITE INTERFACE
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DFDRS - DATA LOADER INTERFACE

General

You can transfer software from a data loader to the Digital Flight Data Recorder (DFDR). The data loader control panel selects where the software goes.

You can also transfer data from the ACMS part of the DFDR to a data loader.

The DFDR connects to the data loader control panel.

Airborne Data Loader

An airborne data loader connects to the data loader control panel. You can put a disk in the data loader for data transfer.

AKS 002-999

Data Loader Plug

A portable data loader connects to the data loader plug. You can put a disk in the data loader for data transfer.

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Data Transfer

Two ARINC 429 data buses bring data into the data loader control panel. These buses are DATA IN 1 and DATA IN 2. DATA IN 2 sends the ACMS data to the control panel.

The data output port transfers software to the DFDR. This software goes to the ACMS interface or the mandatory interface.

The discrete enable signals from the data loader control panel tell the DFDR whether the software goes to the ACMS interface or to the mandatory interface.

Data Loader Control Panel Switches

The data load selector switch on the data loader control panel has three positions. The switch must be in the SINGLE SYS (single system) position in order for the data loader to send software to the DFDR.

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The system select switch on the data loader control panel has these DFDRS selections:

- NORM - Data loader can get ACMS data
- ACMS - Software goes from the data loader to the ACMS interface in the DFDR
- FDAU - Software goes from the data loader to the mandatory interface in the DFDR.

DFDAU

The DFDR has these sections:

- ACMS interface
- Mandatory interface.

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The ACMS interface sends ACMS data through the data loader control panel to the data loader plug and to the airborne data loader. This data goes to the data loader when the airplane is on the ground.

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The ACMS interface sends ACMS data through the data loader control panel to the airborne data loader. This data goes to the airborne data loader disk when the airplane is on the ground.

Software goes to the ACMS or mandatory interface on the data output bus. A discrete from the data loader control panel tells the DFDR where to send the software. While the software is loading, the DFDR sends handshake signals to the data loader. These signals give the data loader the status of the procedure.

Flight Management Computer

The data loader control panel sends information from the ACMS or the mandatory processor in the DFDR to the flight management computer (FMC). The ACMS and mandatory processors send the software part number to the FMC.

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DFDRS - DATA LOADER INTERFACE

The FMC shows the software part number on the control display unit (CDU).
To see the software part number on the CDU you must do these things:

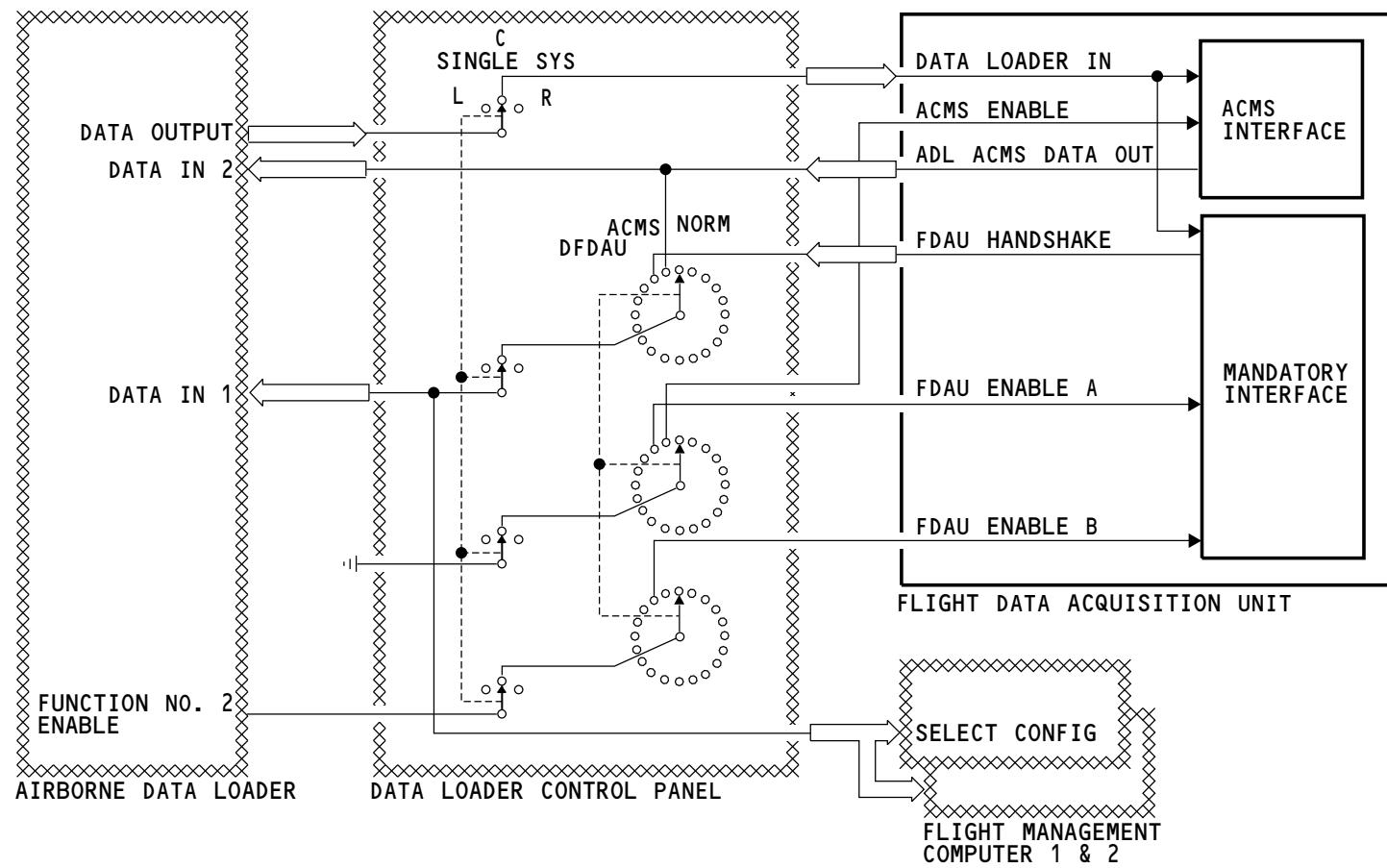
- Select the system on the data loader control panel
- Select the SEL CONFIG (select configuration) prompt on the INIT/REF (initialization reference) INDEX page on the CDU.

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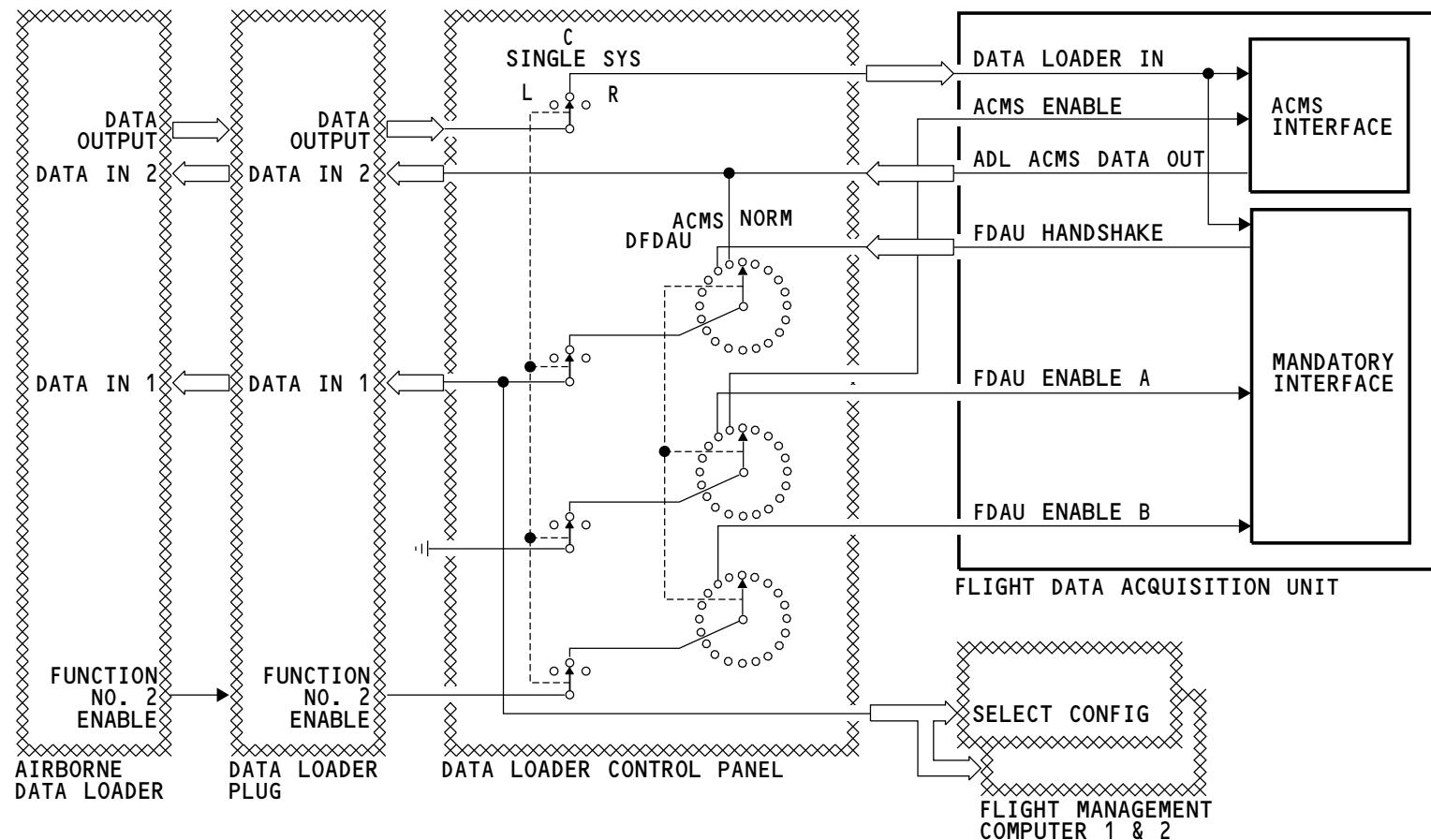
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DFDRS - DATA LOADER INTERFACE
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DFDRS - DATA LOADER INTERFACE

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DFDRS - DFDAU DIGITAL INTERFACE

General

These Line Replaceable Unit (LRU)s send data to the Digital Flight Data Acquisition Unit (DFDAU) in Aeronautical Radio Incorporated (ARINC) 429 digital format:

- Distance measuring equipment (DME) interrogators (1 and 2)
- Instrument landing system (ILS)/Multi-mode receivers
- Very high frequency omni range (VOR)/marker beacon receivers
- Ground proximity warning computer (GPWC)
- Radio altimeter transceivers
- Traffic alert and collision avoidance system (TCAS) computer
- Air data inertial reference unit (ADIRU)
- Clock(s)
- Display electronic units (DEUs)
- Auxiliary power unit (APU) electronic control unit (ECU)
- Stall management yaw dampers
- Flight control computers (FCCs)
- Auto throttle computer
- Engine vibration signal conditioner (EVSC)
- Flight management computers (FMCs)
- FMC control display units (CDU)
- Flap slat electronics unit (FSEU)

Digital Interface

The DFDAU gets digital data from many different airplane systems. The mandatory data goes to the SSFDR through the DFDAU. The data that each operator records in the SSFDR is dependant on their aviation authority.

The DME 1 and 2 interrogators send these parameters to the DFDAU:

- DME distance
- DME failure
- Antenna failure

- DME display discrete.

The ILS/MMR(s) send these parameters to the DFDAU:

- Frequency
- Mode
- Glideslope deviation
- Localizer deviation
- Glideslope receiver failure
- Localizer receiver failure
- Glideslope antenna failure
- Localizer antenna failure
- Receiver failure.

The VOR/marker beacon 1 and 2 receivers send these data to the DFDAU:

- VOR frequency
- VOR failure
- MB failure
- 3000 Hz marker
- 1300 Hz marker
- 400 Hz marker.

The GPWS sends these parameters to the DFDAU:

- Wind shear caution
- Wind shear
- Terrain pull up
- Minimums
- Glideslope
- Too low terrain
- Too low flap
- Too low gear
- Don't sink

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DFDRS - DFDAU DIGITAL INTERFACE

- Terrain
- Pull up
- Sink rate
- GPWC failure.

The radio altimeter 1 and 2 transceivers send these parameters to the DFDAU:

- Radio altitude
- LRRA receiver antenna
- LRRA transmit antenna
- LRRA failure.

The TCAS computer sends these parameters to the DFDAU:

- Altitude Select
- Sensitivity level control
- SPI
- Altitude reporting
- Down advisory
- Up advisory
- Vertical control
- Combined control
- Advisory rate to maintain
- RI field
- TCAS sensitivity level
- TCAS system status
- TCAS computer unit.

The left and right ADIRU sends these parameters to the DFDAU:

- AD/IR fault
- Excess motion error
- No IR initialization

- Align fault
- On DC
- IR fault
- ADC fault
- DC fail
- Altitude invalid
- Set heading
- Nav mode
- Rev attitude mode
- Align mode not ready
- Auto nav realign
- IR A/C ident code invalid
- Variable align select
- ADIRU select.

The clock sends these parameters to the DFDAU:

- GMT
- GMT (hrs/min)
- GMT (second)
- Date (day)
- Date (month)
- Date (year).

DEU 1 and 2 send these parameters to the DFDAU:

- Engine system parameters
- Brake system parameters
- Hydraulic system oil parameters
- Hydraulic system pressure parameters
- Fuel system parameters
- Radio altitude
- Localizer and glideslope deviation

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DFDRS - DFDAU DIGITAL INTERFACE

- ADIRU parameters
- Displayed indications
- Autopilot system parameters
- Electrical system parameters
- CDS display unit formats
- TCAS parameters
- VOR parameters
- ADF parameters
- FMCS parameters
- CDS EFIS control panel selections
- GPWS parameters
- CDS fault annunciations.

The APU electronic control unit sends these parameters to the DFDAU:

- N1
- Oil temperature
- EGT
- Fuel flow
- Low oil quantity
- Bleed valve open
- Any fault detected
- Bleed air switch
- Ready to load.

The stall management yaw dampers 1 and 2 send these parameters to the DFDAU:

- Rudder position
- Rudder command
- Angle of attack
- Stick shaker speed
- Minimum airspeed for flap retraction

- Minimum operating speed
- High speed buffet
- Auto slat enable
- Yaw damper engage
- Auto slat command
- Auto slat valid.

The FCC 1 and 2 send these parameters to the DFDAU:

- Selected course
- Selected heading
- Selected altitude
- Selected airspeed
- Selected vertical speed
- Selected mach
- Spoiler position number 2
- Spoiler position number 7
- MCP speed
- L Nav mode oper
- CWS roll
- CWS pitch
- A/P off
- Single channel
- TO/GA
- V/S engaged
- Altitude hold
- Altitude acquire
- Heading select
- VOR/LOC engage
- G/S engage
- Flare engage
- Local limited master

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DFDRS - DFDAU DIGITAL INTERFACE

- G/S deviation warning
- Localizer deviation warning
- A/T speed warning
- ILS deviation warning
- Visual altitude alert
- CWS B
- CWS A
- CMD B
- CMD A
- F/D B on
- F/D A on
- CWS warning
- Indicated airspeed display
- Vertical speed PB lite
- V Nav PB lite
- Level change PB lite
- Altitude hold PB lite
- N1 PB lite
- Speed PB lite
- Approach PB lite
- Heading select PB lite
- VOR/LOC PB lite
- L Nav PB lite
- B master light
- A master light.

The auto throttle sends these parameters to the DFDAU:

- Throttle rate command
- Throttle servo motor tachometer
- Throttle torque
- Motor power from ASM

- Auto Throttle disconnect
- ARM
- GA
- MCP speed
- A/T limit
- FMC speed
- N1
- Retard
- A/T engage
- Minimum speed.

The EVSC sends these parameters to the DFDAU:

- CN1 tracked vibration
- CN2 tracked vibration
- TN1 tracked vibration
- TN2 tracked vibration
- Fan balance angle
- Fan balance mass.

The FMC(s) send these parameters to the DFDAU:

- Distance to go
- Origin character
- Destination character
- Destination ETA hours
- Destination ETA minutes
- Gross weight
- Engine out engaged
- Flight number
- NDB effectivity day
- NDB effectivity month
- NDB effectivity year

EFFECTIVITY

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31-31-00



DFDRS - DFDAU DIGITAL INTERFACE

- PMC on
- FMC valid
- N1 limit mode
- Target N1
- VREF speed
- V2 speed
- VR speed
- V1 speed
- Present position latitude
- Present position longitude
- Track angle true
- Wind speed
- Wind direction true
- Drift angle
- Flight path angle.

MCDU / CDU Inputs

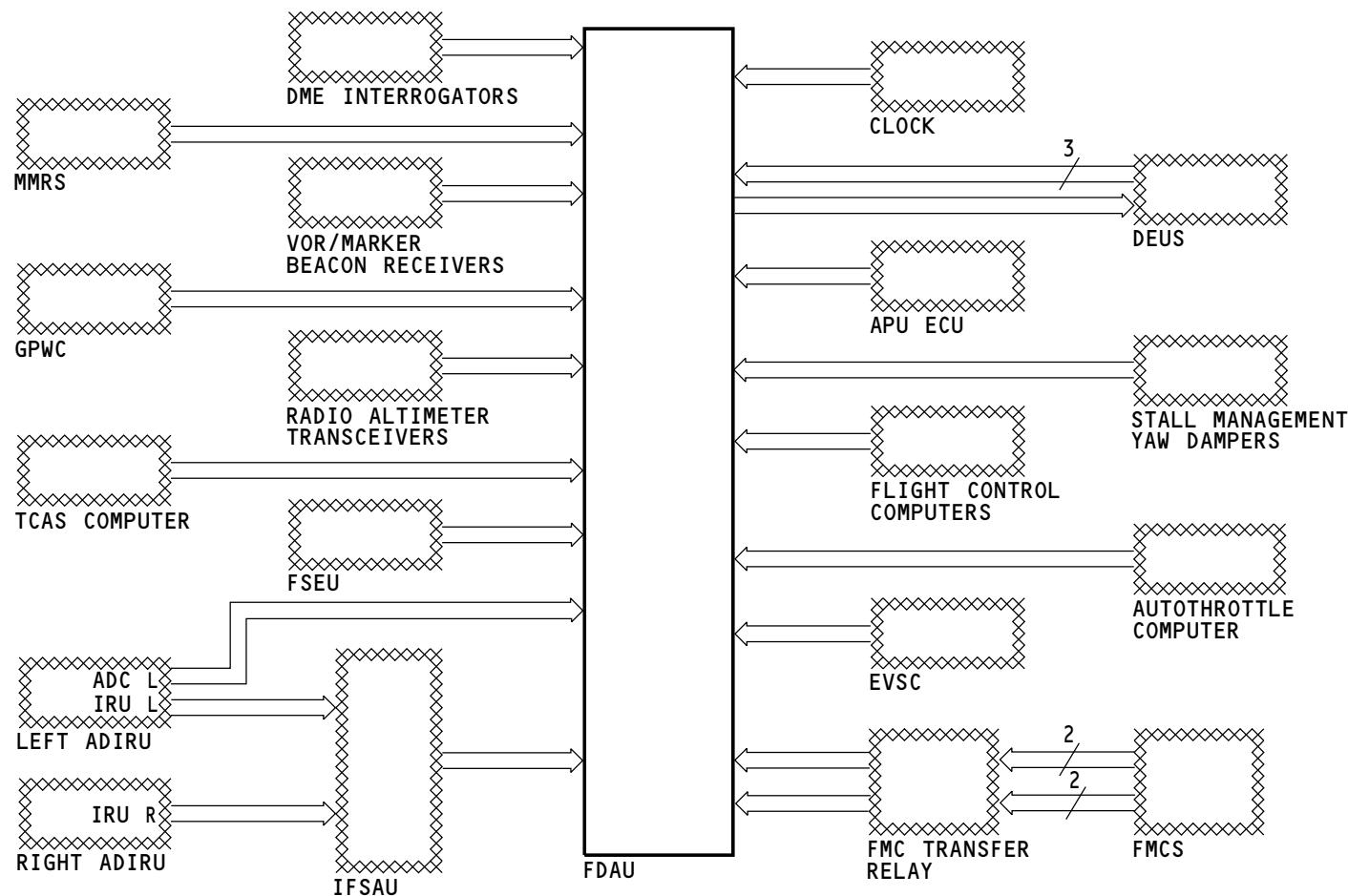
The Multifunction Control Display Unit (MCDU) / CDUs can control the operation of the Airplane Condition And Monitoring System (ACMS) portion of the DFDAU. The MCDU / CDUs can call up reports and control the optional printer. You can also verify the ACMS software part numbers on the MCDU / CDU.

DEU Inputs

Each DEU sends engine information to the DFDAU on two data buses.

DEU Outputs

The DFDAU sends flight surface position information to the DEUs.



M76850 S0004626823_V1

| DFDRS - DFDAU DIGITAL INTERFACE



DFDRS - DFDAU ACMS INTERFACE

General

These Line Replaceable Unit (LRU)s send data to and receive data from the Data Management Unit (DMU) master controller in the Digital Flight Data Acquisition Unit (DFDAU):

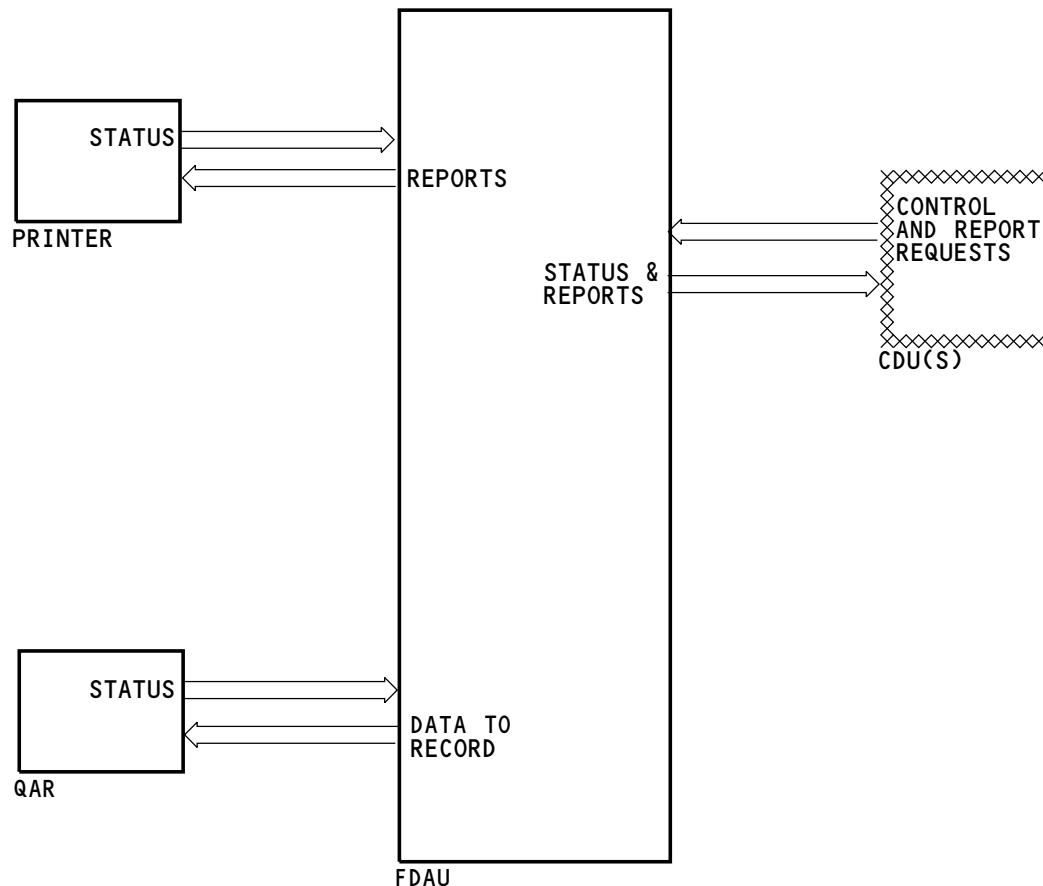
- Printer - The printer prints reports and sends status to the DFDAU on an output data bus.
- Quick access recorder (QAR) - The QAR records data on a data bus and sends status to the DFDAU on an output data bus.

EFFECTIVITY

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DFDRS - DFDAU ACMS INTERFACE

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DFDRS - DFDAU ANALOG INTERFACE

General

Analog inputs to the Digital Flight Data Acquisition Unit (DFDAU) come from these sources:

- Accelerometer
- Sensors
- Transducers
- Transmitters.

These inputs go to an analog interface in the DFDAU. The analog interface changes analog signals to digital data. The DFDAU processes the digital data.

Accelerometer

The accelerometer supplies these three analog outputs to the DFDAU:

- Vertical acceleration
- Lateral acceleration
- Longitudinal acceleration.

The DFDAU gives 28v dc to the accelerometer for power.

Sensors

Eight sensors give inputs to the analog interface in the DFDAU.

The stabilizer position sensor gives pitch trim position to the DFDAU.

The spoiler position sensor gives these inputs to the DFDAU:

- Spoiler 3 position
- Spoiler 10 position.

The control wheel position sensor gives these inputs to the DFDAU:

- Capt control wheel position
- F/O control wheel position.

The control column position sensor gives these inputs to the DFDAU:

- Capt control column position
- F/O control column position.

The rudder pedal position sensor gives position input to the DFDAU.

Transducers

The rudder pedal force transducer gives force input to the DFDAU.

Transmitters

Six transmitters give inputs to the analog interface in the DFDAU.

The rudder position transmitter gives position input to the DFDAU.

The right and left aileron position transmitters give position inputs to the DFDAU.

The right and left elevator position transmitters give position inputs to the DFDAU.

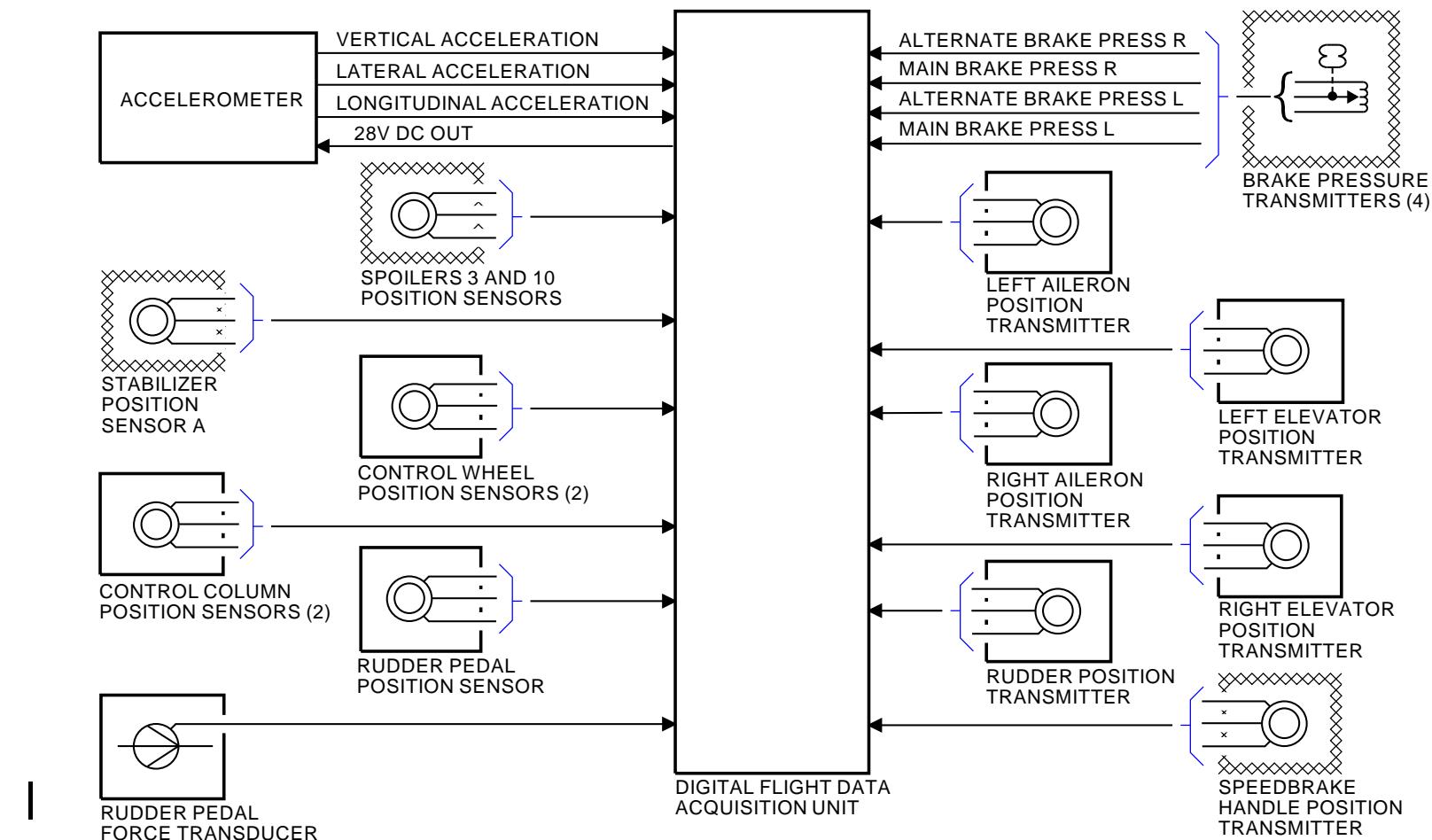
The brake pressure transmitter gives these inputs to the DFDAU:

- Main brake pressure right
- Alternate brake pressure right
- Main brake pressure left
- Alternate brake pressure left.

EFFECTIVITY

AKS ALL

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DFDRS - DFDAU ANALOG INTERFACE
31-31-00



DFDRS - DFDAU DISCRETE INTERFACE - 1

General

Discrete signals come into the Digital Flight Data Acquisition Unit (DFDAU).
The DFDAU processes the digital data.

Regulatory agencies require mandatory parameters come into the DFDAU.
Airlines also record selected parameters.

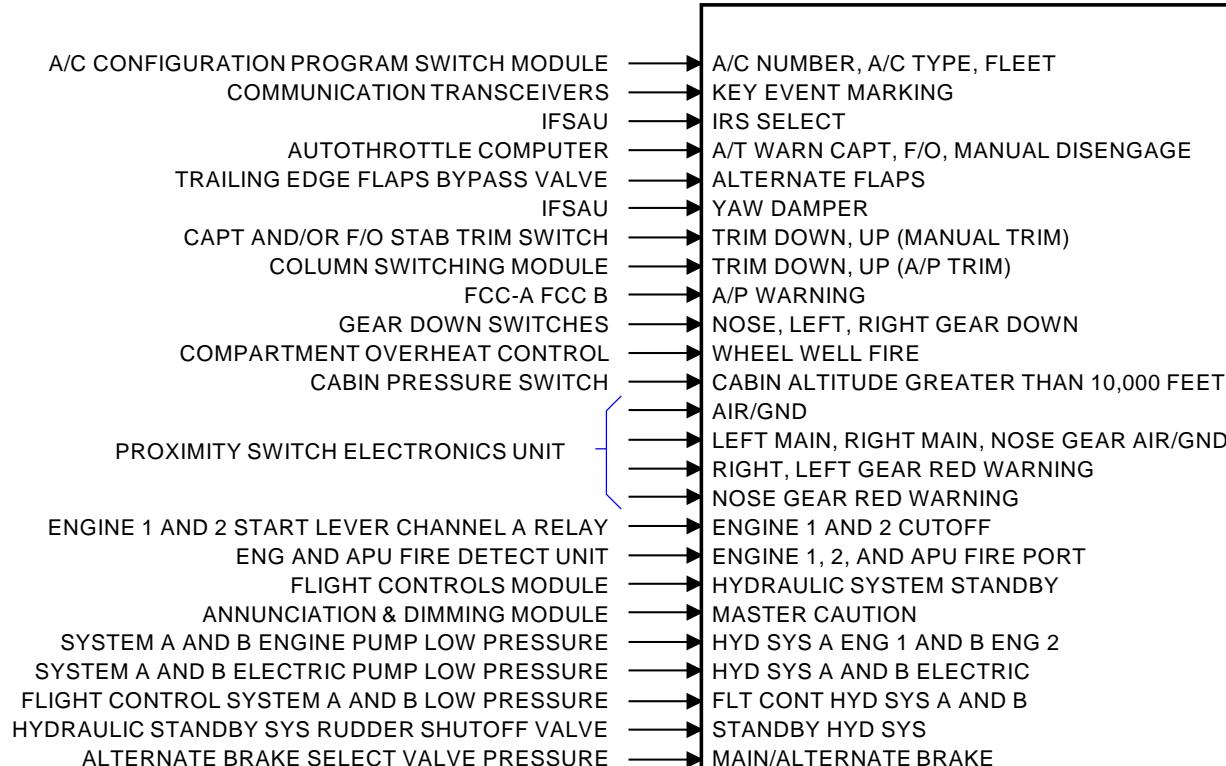
EFFECTIVITY

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DIGITAL FLIGHT DATA ACQUISITION UNIT

M76913 S0004626855_V2

DFDRS - DFDAU DISCRETE INTERFACE - 1



DFDRS - DFDAU DISCRETE INTERFACE - 2

General

Discrete signals come into the Digital Flight Data Acquisition Unit (DFDAU).
The DFDAU processes the digital data.

Regulatory agencies require mandatory parameters for the DFDAU. Airlines
also record selected parameters.

EFFECTIVITY

AKS ALL

31-31-00



AUTO BRAKE VALVE	→	AUTO BRAKE APPLICATION
AUTO SPEED BRAKE MODULE	→	AUTO SPEED BRAKE EXTEND, DO NOT ARM, ARMED
RUDDER TRIM CONTROL MODULE	→	NOSE, LEFT, RIGHT GEAR DOWN
COMPARTMENT OVERHEAT CONTROL	→	RUDDER TRIM NOSE LEFT, NOSE RIGHT
AILERON TRIM CONTROL PANEL	→	AILERON TRIM LEFT WING DOWN, RIGHT WING DOWN
BATTERY BUS	→	28 VOLTS DC
DC BUS 1	→	28 VOLTS DC
HOT BATTERY BUS	→	28 VOLTS DC
SWITCHED HOT BATTERY BUS	→	28 VOLTS DC
AC STANDBY BUS	→	115 VOLTS AC
DC STANDBY BUS	→	28 VOLTS DC
DC BUS 2	→	28 VOLTS DC
TRANSFER BUS 2	→	115 VOLTS AC
FMCS TRANSFER SWITCH (OPTION)	→	FMC SELECT
EVENT MARKER (OPTION)	→	EVENT MARKER
MLS SELECT SWITCHES (OPTION)	→	MLS SELECT
LAVATORY SMOKE DETECTOR (OPTION)	→	LAVATORY SMOKE

DIGITAL FLIGHT DATA ACQUISITION UNIT

M77139 S0004626857_V2

DFDRS - DFDAU DISCRETE INTERFACE - 2

EFFECTIVITY

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31-31-00



FDRS - FLIGHT DATA RECORDER

General

The flight data recorder (FDR) stores the flight data in a solid-state memory.

Physical Description

The FDR is made of hard steel alloys to give protection. It weighs approximately 18 pounds (8.2 kg). The memory storage assembly in the FDR is crush-proof up to 5000 pounds (2273 kg). The FDR case also supplies protection for these conditions:

- Up to 3400 Gs of impact
- Deep sea pressures to 20,000 feet (6100 meters)
- Fire temperatures up to 1100C for 1/2 hour.

These items are on the front of the FDR:

- An underwater location device (ULD)
- An ATE connector
- A yellow BITE light.

The yellow BITE light turns on when there is an FDR fault.

The ATE connector lets you connect portable test equipment and copy information from the solid-state memory.

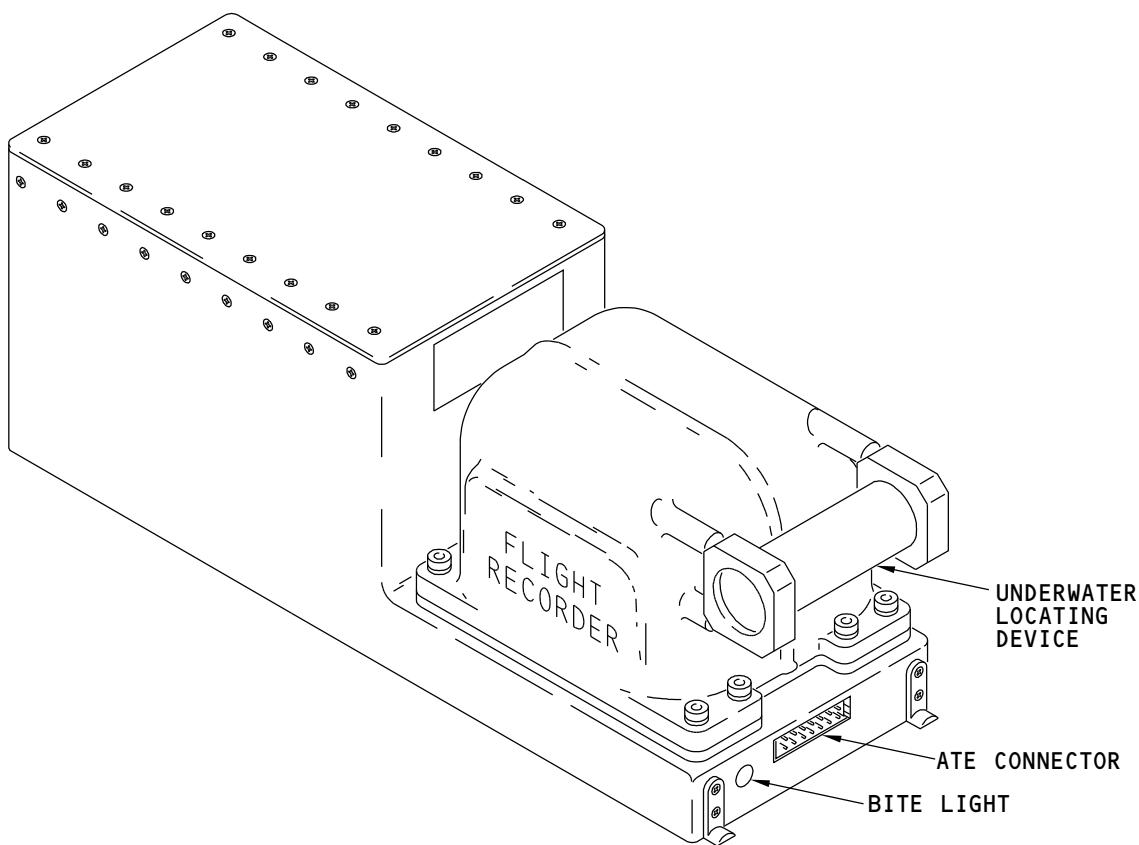
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M76916 S0004626859_V1

FDRS - FLIGHT DATA RECORDER**31-31-00**Page 39
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FDRS - UNDERWATER LOCATING DEVICE

Purpose

The underwater locating device (ULD) is an ultrasonic beacon. It makes the flight data recorder (FDR) easier to find if it is under water.

Physical Description

Some ULDs are line replaceable units. For these units, you send the unit to the manufacturer to replace the battery. For some ULDs, the battery is an LRU. The ULD is 1.3 inches (3.3 cm) in diameter and 4 inches (10.2 cm) long. It weighs less than 12 ounces (0.34 kg).

To replace the battery, grip the ULD with a gripping device such as a split rubber hose. Do not grip the ULD with a vise because you will damage the ULD.

Functional Description

The ULD has these operation characteristics:

- Operates when it is put into water
- Operates to a maximum depth of 20,000 feet (6096 meters)
- Has a detection range of 7,000 (2134 meters) to 12,000 feet (3658 meters)

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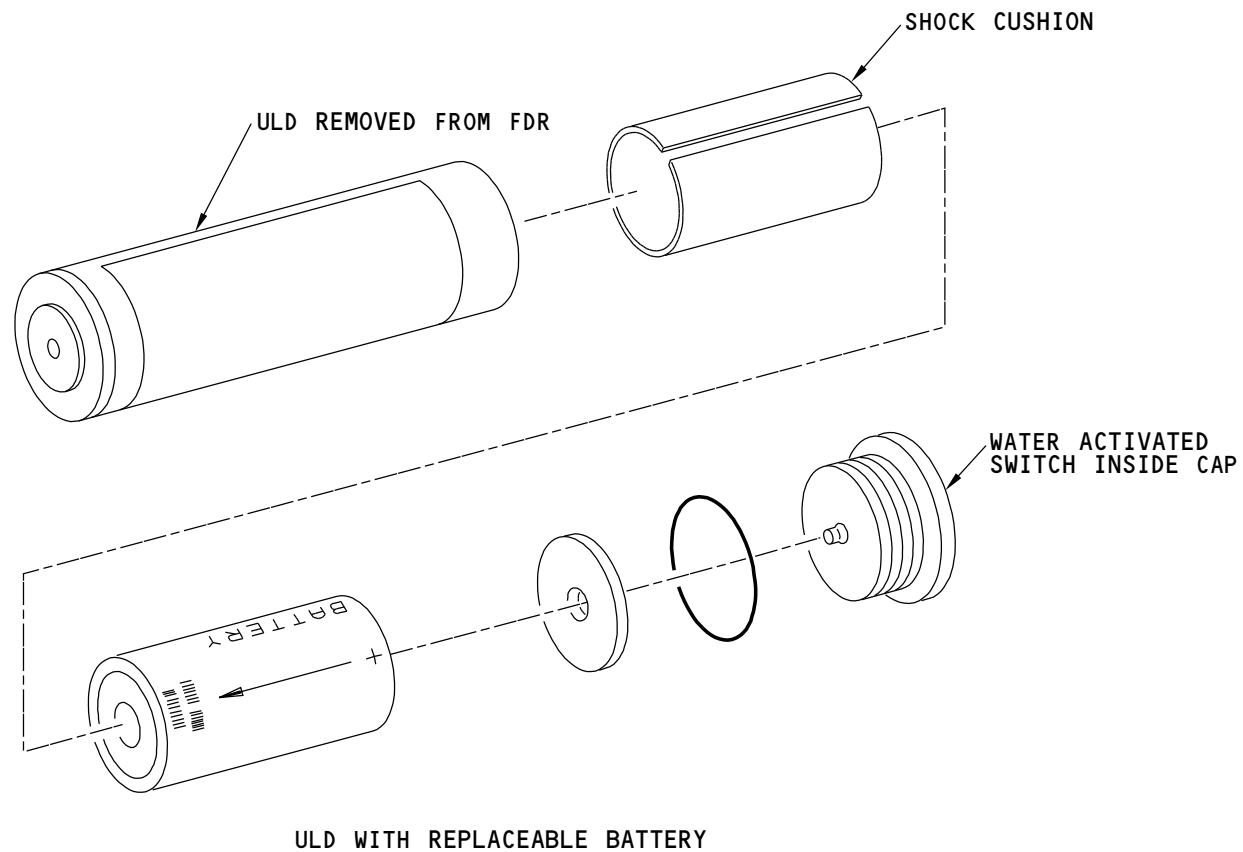
- Can operate under water for a minimum of 30 days

AKS 023-999

- Can operate under water for a minimum of 90 days

AKS ALL

- Sends out an acoustic pulse tone of 37.5 khz at a rate of one pulse-per-second.


FDRS - UNDERWATER LOCATING DEVICE

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DFDRS - DFDAU

Purpose

The Digital Flight Data Acquisition Unit (DFDAU) collects, multiplexes and changes inputs into a standard digital format. The inputs come from many airplane systems and sensors. The Solid State Flight Data Recorder (SSFDR) stores the processed signals from the DFDAU.

Power Requirement

The DFDAU uses 115v ac, 400 Hz, single phase power.

Features

The DFDAU has a data management unit (DMU). The DMU does data monitoring. The DMU keeps ACMS data in a solid state memory until you download the data.

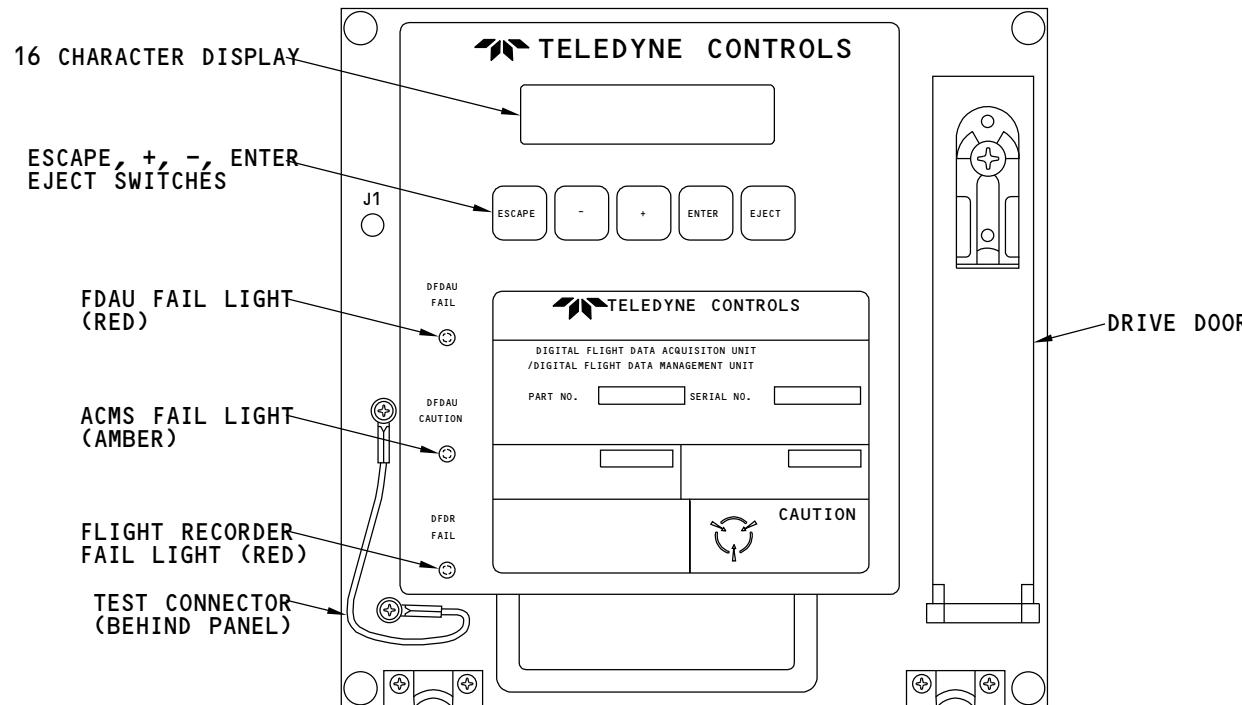
The front of the DFDAU has these features:

- 16-character alphanumeric display
- +/- switches - moves the display within each menu
- ENTER switch - moves the display down the menu structure or starts a menu screen function
- Test connector - you can connect portable test equipment to the DFDAU and do a test while the DFDAU is in the airplane
- DFDAU FAIL red light - comes on with a DFDAU fault in the mandatory parameters processing
- DFDR red fail light - comes on when the SSFDR is disconnected from the DFDAU or if the SSFDR has a fault when powered.

EFFECTIVITY

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| DFDRS - DFDAU
31-31-00



DFDRS - FLIGHT RECORDER/MACH AIRSPEED WARNING TEST MODULE

Purpose

The flight recorder/mach airspeed warning test module gives the flight crew visual indications of the flight recorder operation. You can manually apply power to the flight recorder at this panel.

Features

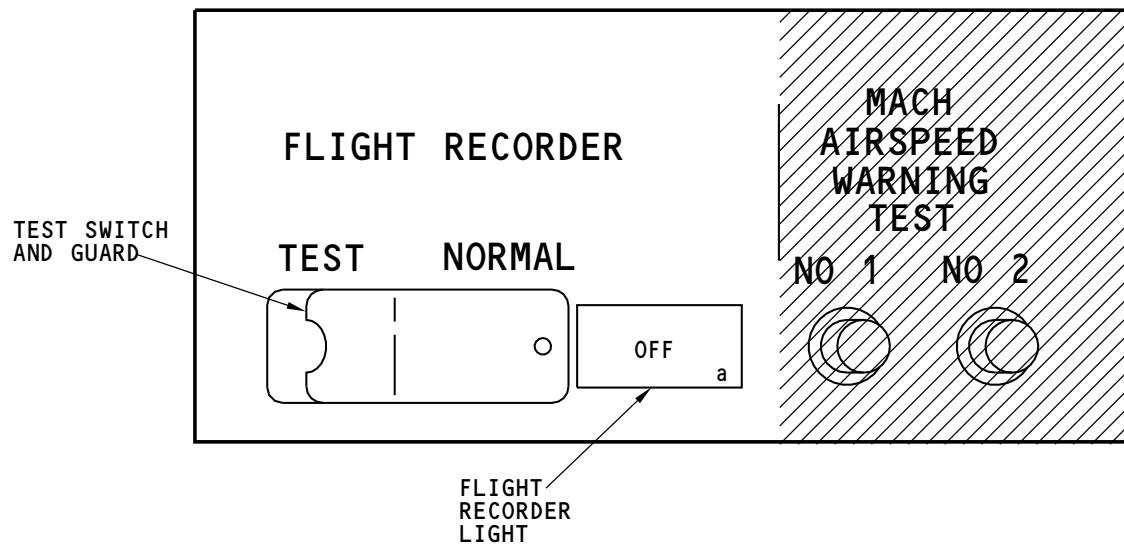
Put the TEST/NORMAL switch in the TEST position to apply power to the Digital Flight Data Recorder System (DFDRS) for maintenance purposes.

The flight recorder light comes on when the Solid-State Flight Data Recorder (SSFDR) or the Digital Flight Data Acquisition Unit (DFDAU) finds a critical fault. The flight recorder light also comes on when the DFDRS is not in operation.

EFFECTIVITY

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M76951 S0004626875_V1

| DFDRS - FLIGHT RECORDER/MACH AIRSPEED WARNING TEST MODULE31-31-00
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DFDRS - ACCELEROMETER

Purpose

The three-axis accelerometer measures acceleration along the vertical, lateral, and longitudinal axes. The accelerometer sends acceleration data to the Digital Flight Data Acquisition Unit (DFDAU).

Features

The accelerometer can measure accelerations up to ten times the normal operation range. No calibration or scheduled maintenance is necessary.

Power

The flight recorder accelerometer gets 28v dc from the DFDAU.

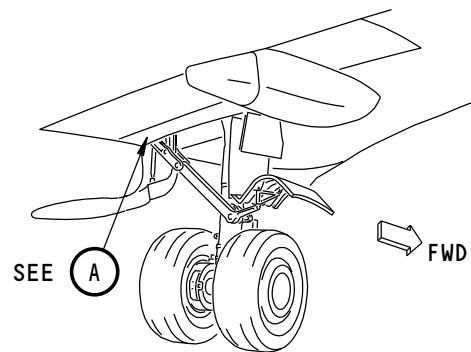
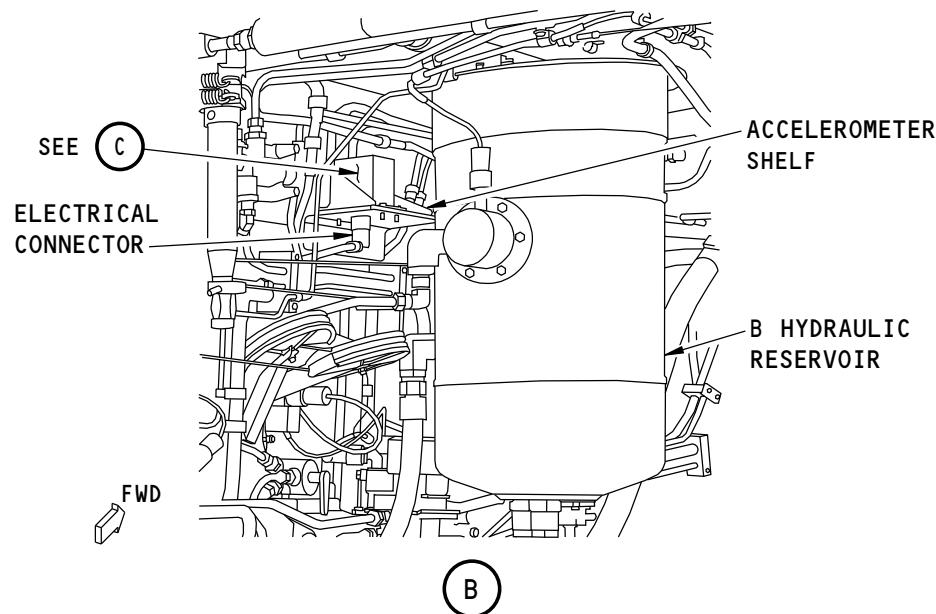
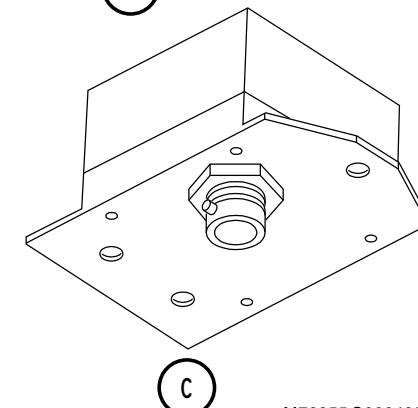
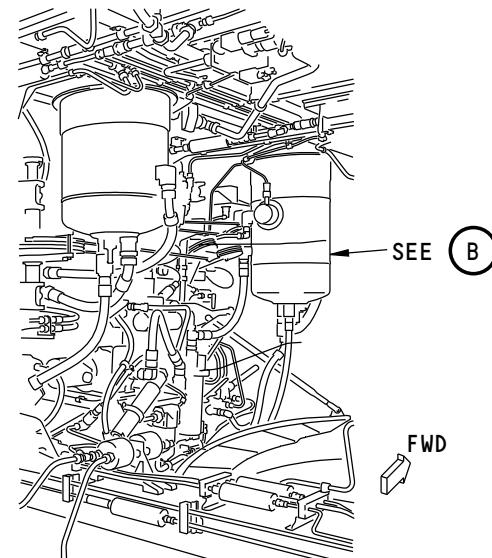
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RIGHT MAIN WHEEL WELL

DFDRS - ACCELEROMETER


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FDRS - QUICK ACCESS RECORDER

Purpose

The quick access recorder (QAR) stores data. It gives you access to airplane performance data. The QAR gets data from the FDAU. It holds the data on removable cartridges.

The Wireless GroundLink - quick access recorder (WQAR) stores, records data. It is capable of automatically transmitting the recorded data over a commercial wireless data link, while it also provides for manual removal of recorded data using a removable recording media. While the aircraft is on the ground, the recorded data is compressed, encrypted and transmitted securely over the wireless cellular data link.

Operation

The WQAR has these indicators and controls on the front panel:

- An alphanumeric display - displays menus and messages.
- Four push buttons - MODE, SEL, +, -.
- A fail indicator - lights when power is initially applied, recording media is not inserted and recording media memory is low or full.
- A manual eject button - allows the recording media to be ejected manually.
- An access door - protects and provides access to the recording media.
- Recording media slot - allows installation of the recording media.
- ATE Connector - provides connection of external Automatic Test Equipment (ATE).
- Cellular antenna mounting holes - provisions for front panel antenna installation.

Upon power up, the fail indicator light is on and after successful completion of the power up, then the fail indicator light is off.

When the wireless transmission mode is enabled and the airplane is on the ground, the WQAR first determines whether there are any recorded data in need of transmission. Data is transmitted in two steps. First, it transmits any file that was previously abnormally terminated in the middle of transmission. Second, it transmits any new recorded data from the last transmission time. Prior to transmission, the recorded file is compressed and then the file is encrypted for wireless transmission.

Disk Operations

Not applicable

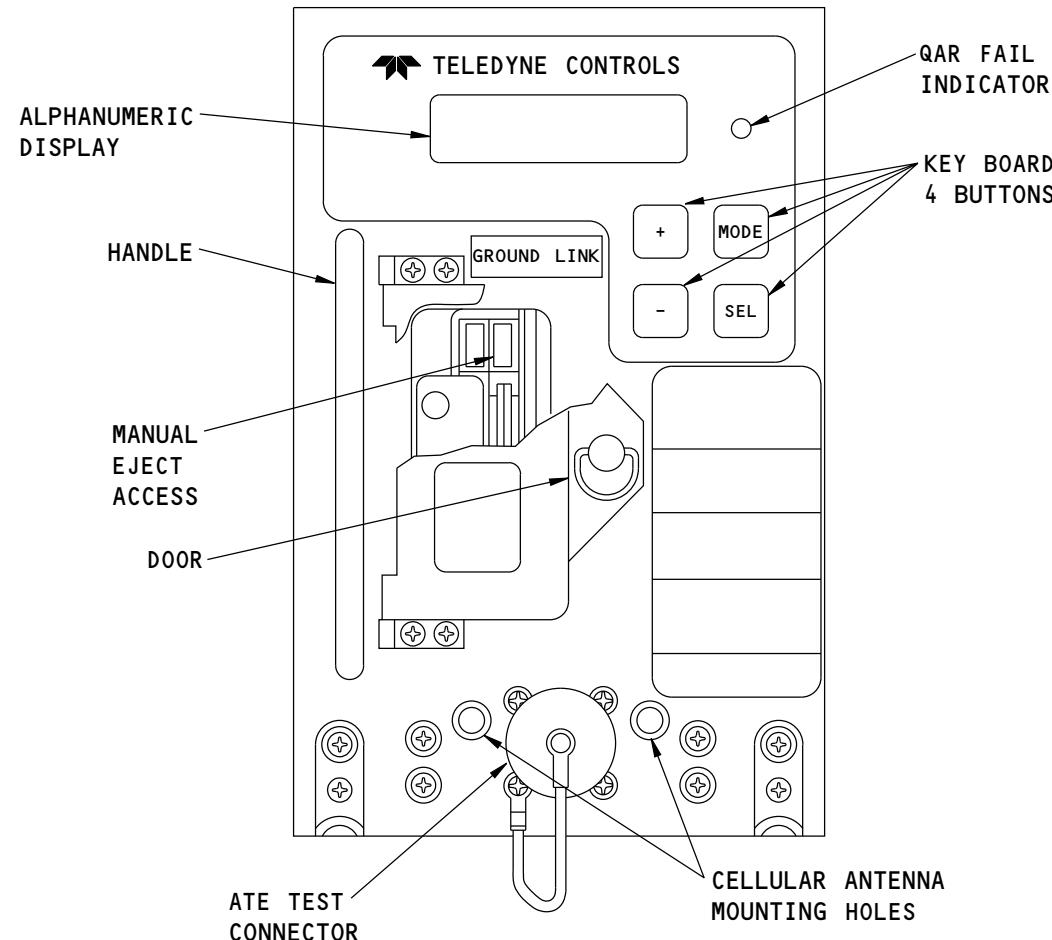
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FDRS - QUICK ACCESS RECORDER

U81509 S0000218024_V1



DFDRS - CONTROL WHEEL POSITION SENSOR

| General

The control wheel position sensors measure the position of the control wheel. The sensors send this data to the Digital Flight Data Acquisition Unit (DFDAU).

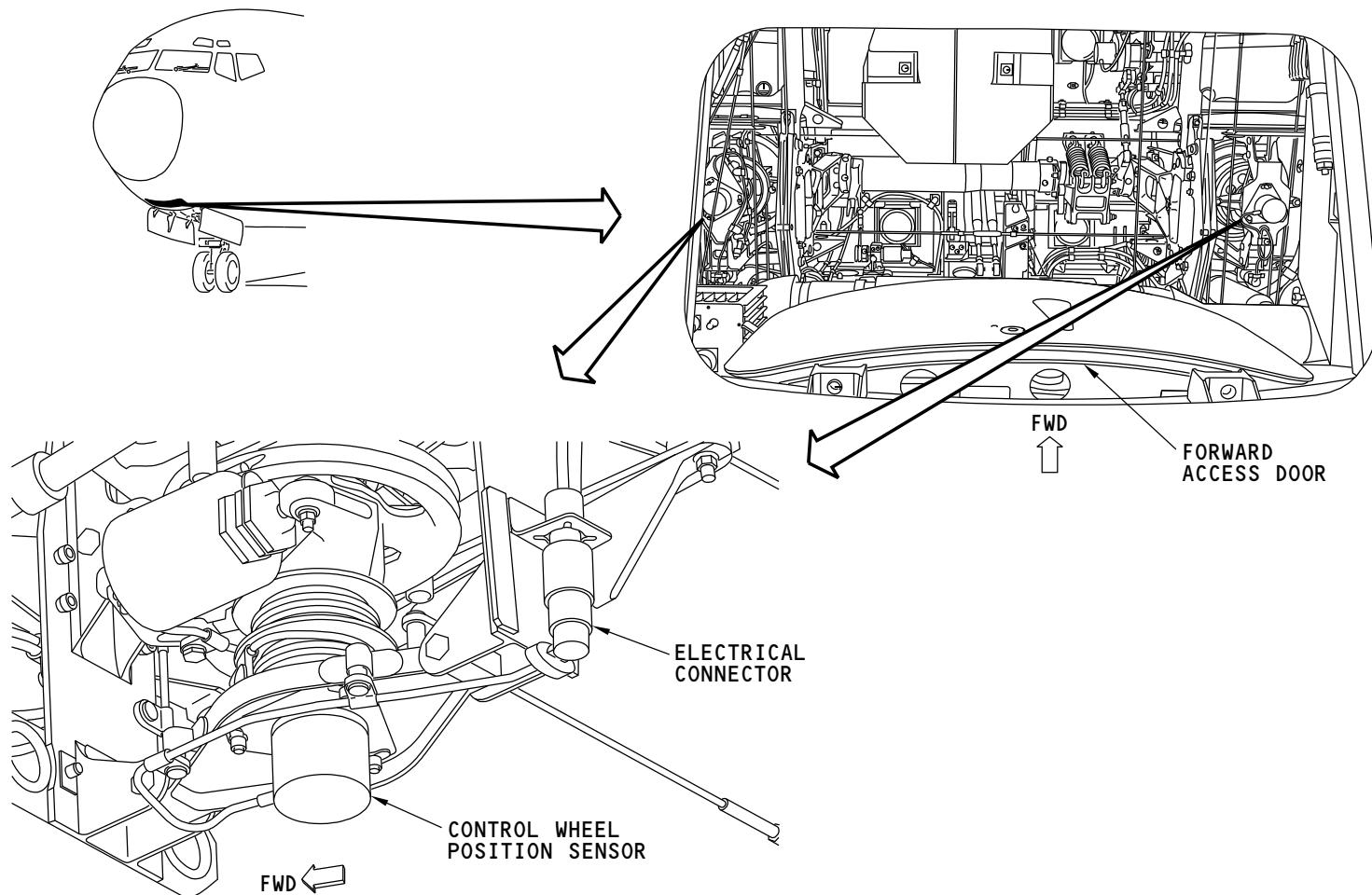
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| DFDRS - CONTROL WHEEL POSITION SENSOR

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DFDRS - CONTROL COLUMN POSITION TRANSMITTER

General

Control column position transmitters send control column position information to the Digital Flight Data Acquisition Unit (DFDAU).

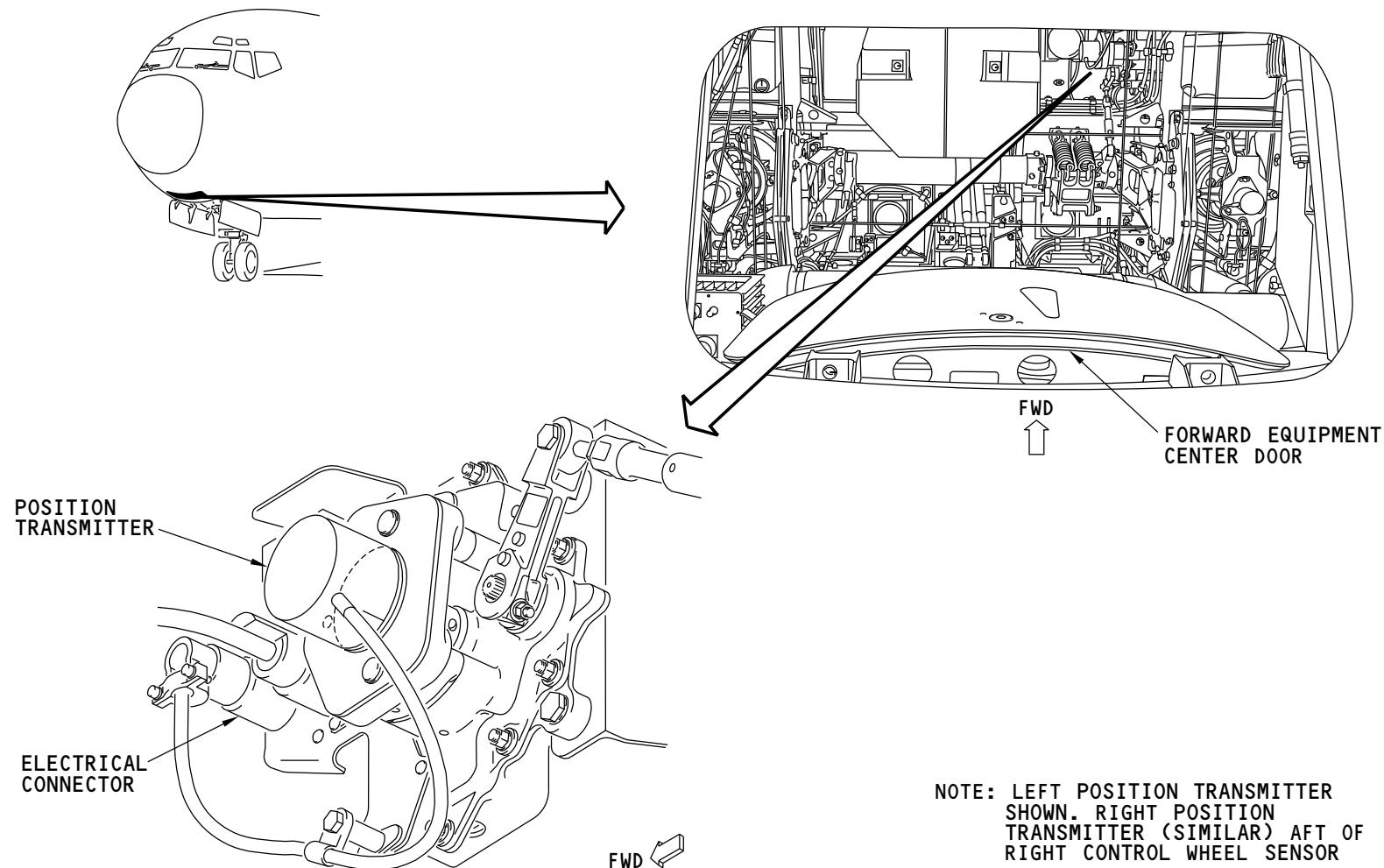
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| DFDRS - CONTROL COLUMN POSITION TRANSMITTER

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DFDRS - RUDDER PEDAL POSITION SENSOR

| General

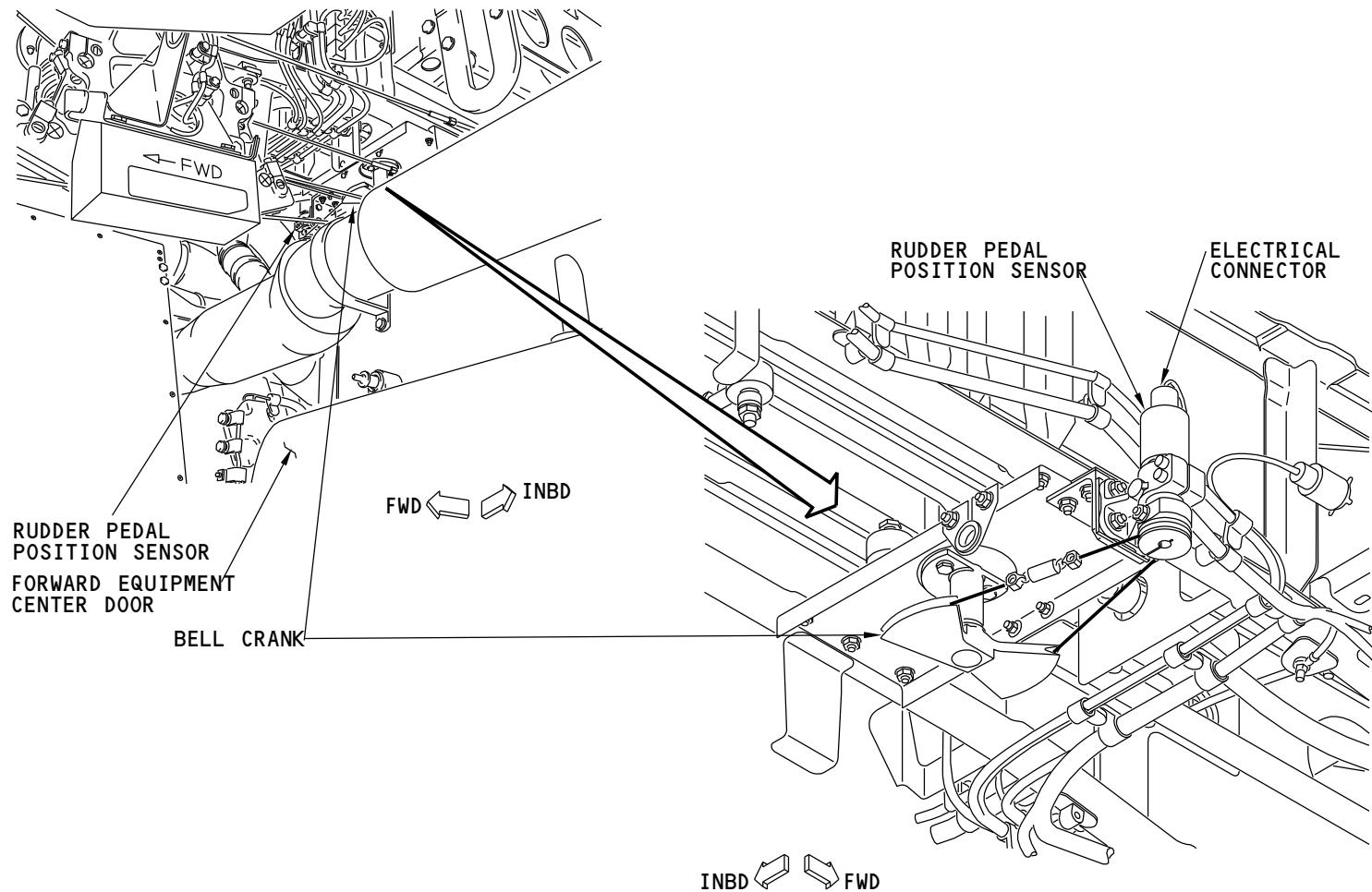
Rudder pedal position sensor sends rudder pedal position information to the Digital Flight Data Acquisition Unit (DFDAU).

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| DFDRS - RUDDER PEDAL POSITION SENSOR

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DFDRS - RUDDER PEDAL FORCE TRANSDUCER

| Purpose

The rudder pedal force transducer sends rudder pedal force information to the Digital Flight Data Acquisition Unit (DFDAU).

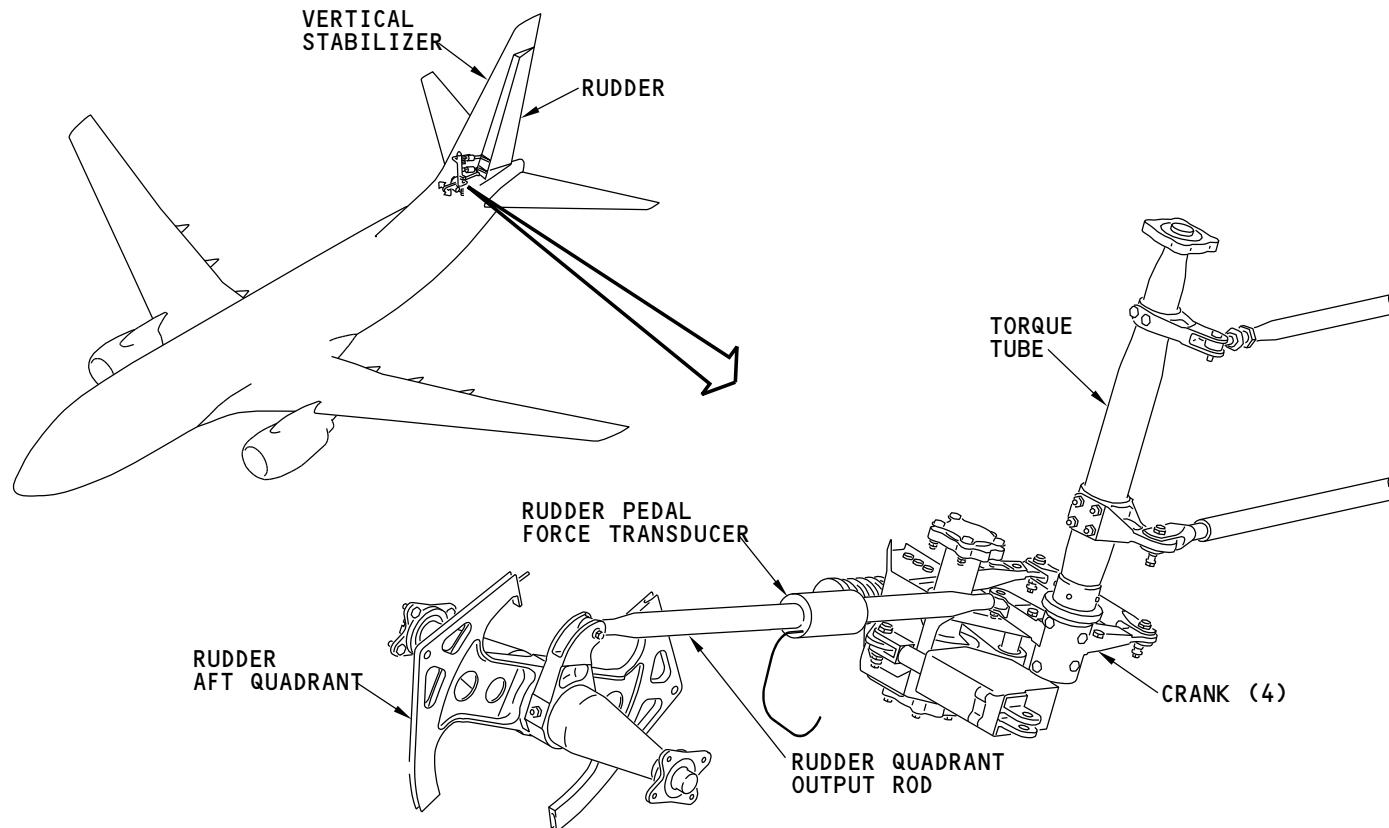
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DFDRS - RUDDER PEDAL FORCE TRANSDUCER
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DFDRS - RUDDER POSITION TRANSMITTER

| General

The rudder position transmitter measures the position of the rudder. The transmitter sends this data to the Digital Flight Data Acquisition Unit (DFDAU).

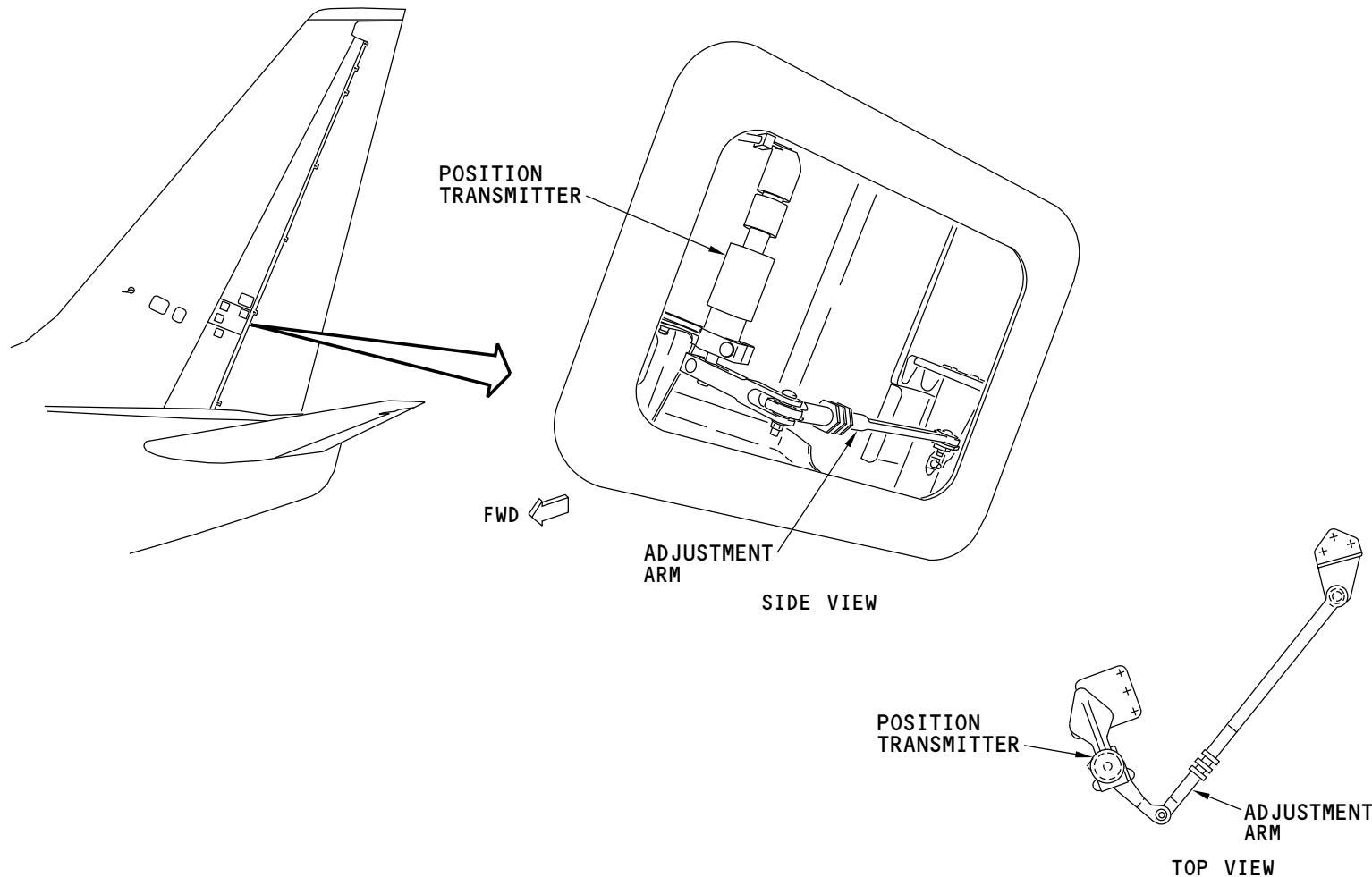
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DFDRS - RUDDER POSITION TRANSMITTER

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DFDRS - AILERON POSITION TRANSMITTER

| General

The aileron position transmitters send aileron position information for each wing to the Digital Flight Data Acquisition Unit (DFDAU). These transmitters are aft of the wing rear spar. You turn the center nut to make small adjustments.

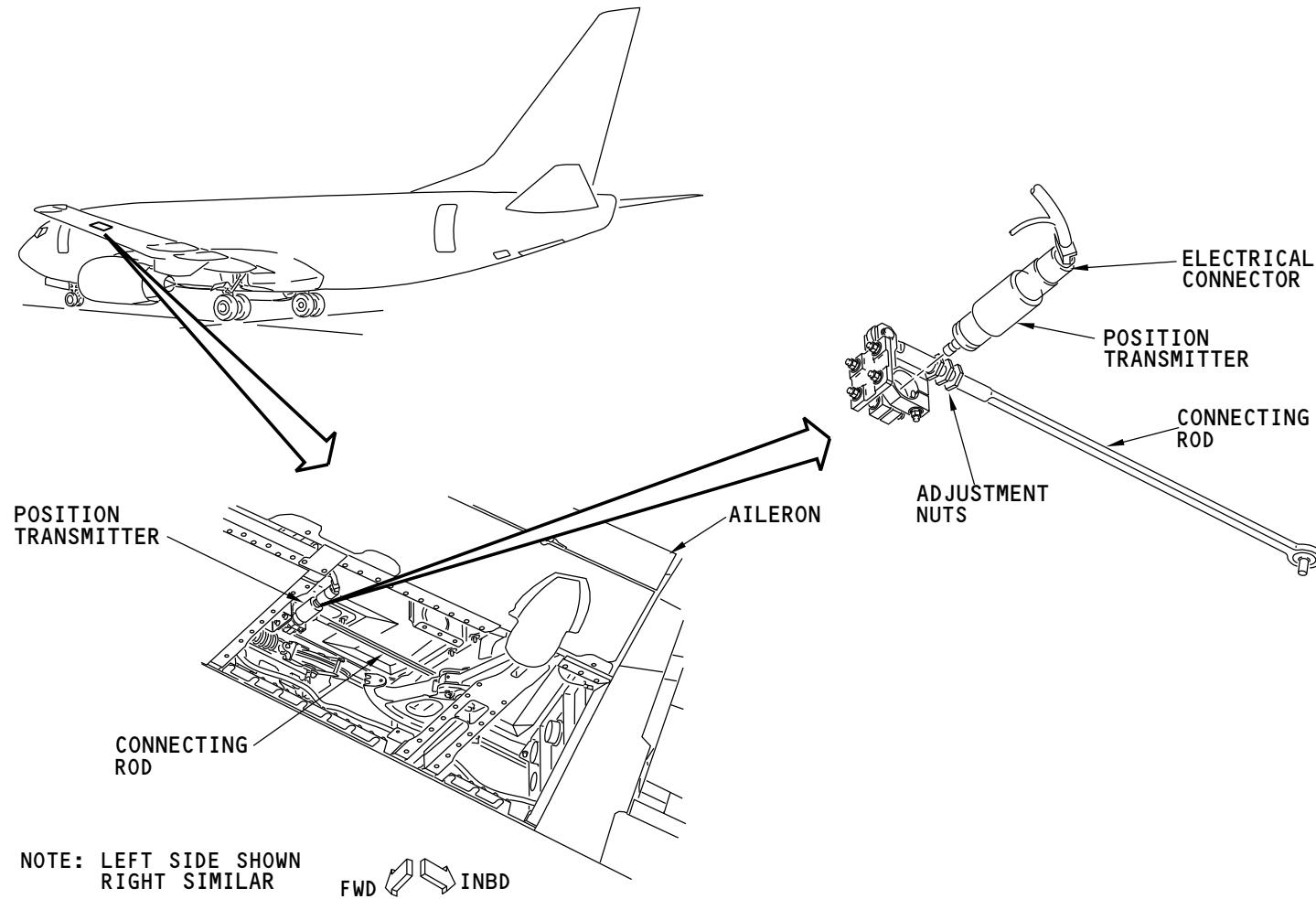
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DFDRS - AILERON POSITION TRANSMITTER
31-31-00



DFDRS - ELEVATOR POSITION TRANSMITTER

| General

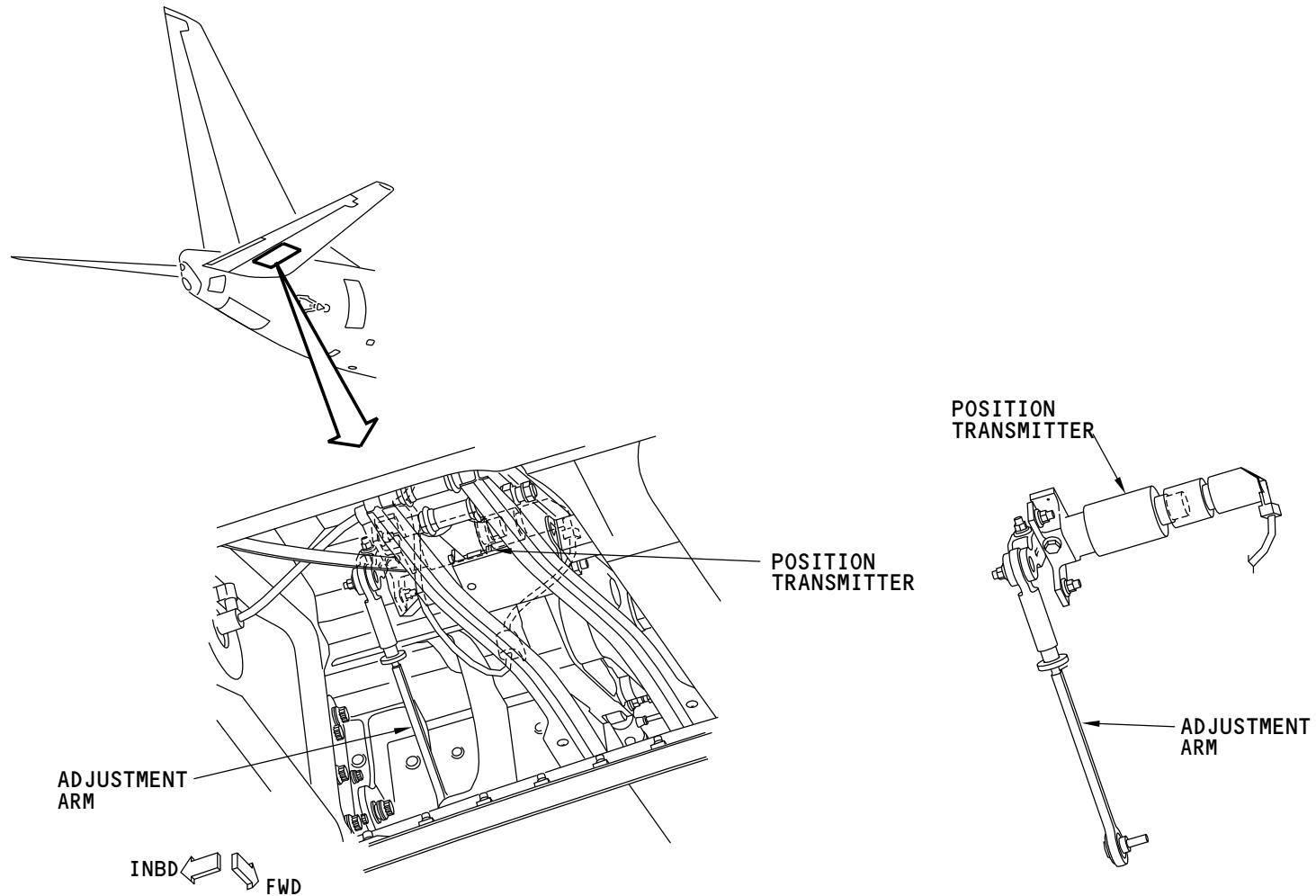
There is an elevator position transmitter in each stabilizer. They send elevator position information to the Digital Flight Data Acquisition Unit (DFDAU). An adjustable control rod connects the transmitter to the elevator.

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| DFDRS - ELEVATOR POSITION TRANSMITTER
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DFDRS - SSFDR FUNCTIONAL DESCRIPTION

General

The Solid-State Flight Data Recorder (SSFDR) receives and keeps the last 25 hours of flight data. The SSFDR receives the data from the Digital Flight Data Acquisition Unit (DFDAU). The data is in a crash-proof, fire-resistant container. The SSFDR does a self test at power-up to make sure the recorder is good. It also has a continuous test to find any faults.

Recording Data

The SSFDR receives data from the DFDAU in Harvard bi-phase format. The input/output interface buffer puts data on the data bus. It also sends the received data back to the DFDAU.

The central processor unit (CPU) controls the data movement. It also does self-tests and sends the test results to the BITE monitor.

BITE

The BITE monitor does a check of the power supply and the SSFDR functions. The BITE monitor controls two relays. The relays give these fault indications:

- System status flag
- Maintenance flag
- BITE light.

These conditions cause a system status flag fault output:

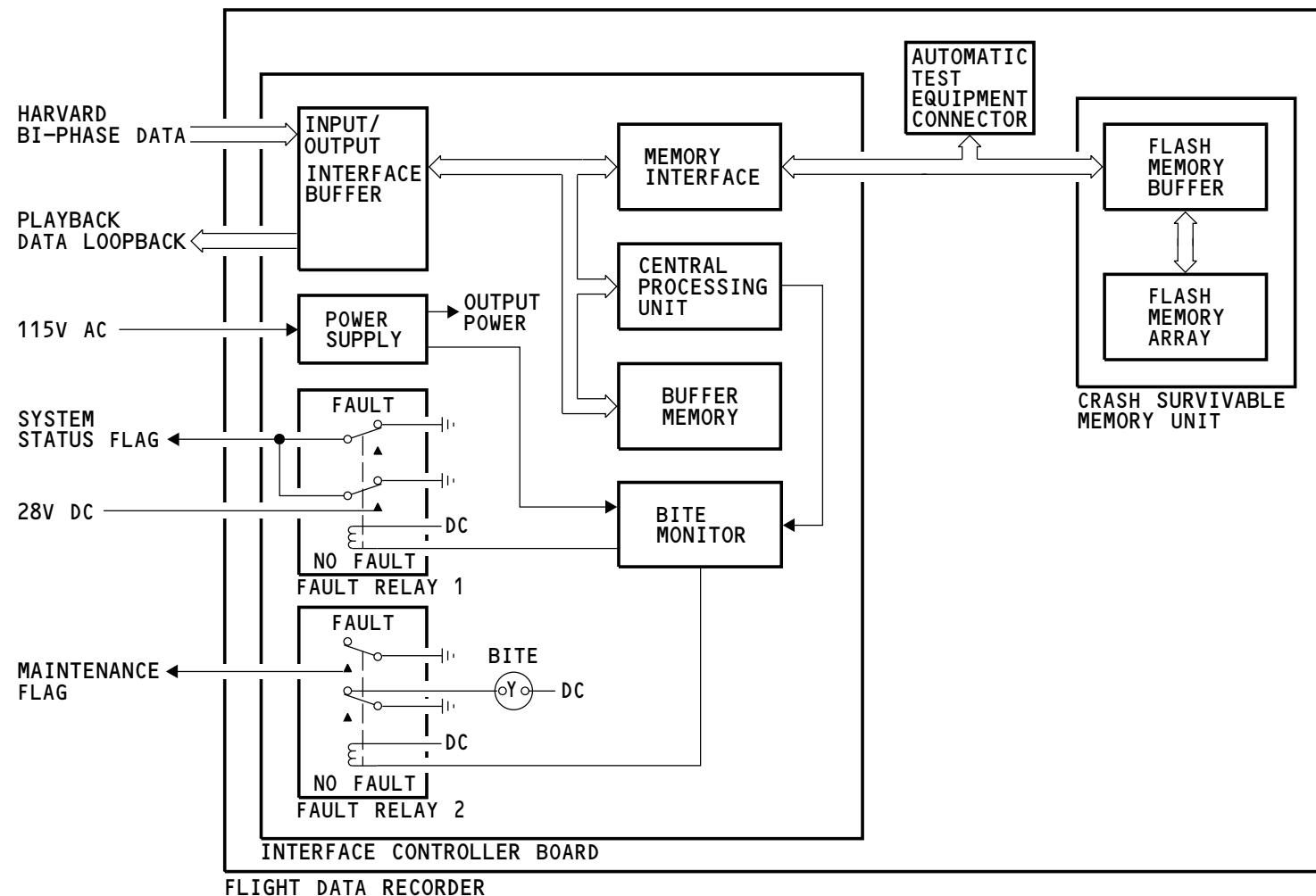
- Loss of input power
- Loss of input data
- Catastrophic central processor unit failure
- Not enough memory because of defective memory devices
- Faults found in the software
- Bad data rate inputs
- Data not properly recorded
- Test mode.

These conditions cause a maintenance flag fault indication:

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DFDRS - SSFDR FUNCTIONAL DESCRIPTION
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FDRS - FDAU FUNCTIONAL DESCRIPTION

General

The flight data acquisition unit (FDAU) gets aircraft data from digital, discrete and analog sources. The FDAU uses this data to make serial digital data for the flight data recorder (FDR).

The FDAU also collects data for the airplane condition monitoring system (ACMS). The FDAU stores the ACMS data. You can move this data to a disk at the data loader control panel.

Power Requirements

The FDAU gets 115v ac, 400 Hz, single phase power from the P18 panel through the system test plug. An internal power supply makes all the necessary dc voltages. The FDAU also gets 26v ac reference voltage for the analog transmitters and sensors.

The FDAU sends 28v dc to the flight recorder accelerometer.

Analog Inputs

Analog input signals are processed in this sequence:

- Analog interface circuits receive analog signals
- Analog to digital (A/D) converters change analog signals to digital data
- The master controller receives the digital data.

The master controller does continuous self test and calibration.

Discrete Inputs

Discrete input signals are processed in this sequence:

- Discrete interface circuits receive discrete signals
- A multiplexer samples each input
- The master controller receives the discrete data.

Digital Inputs

The digital interface receives and processes ARINC 429 digital signals. The FDAU master controller checks parity and status bits before sending the data to the FDR.

When the FDAU gets power, a software routine does a check of all digital input channels. If the test fails, the DFDAU FAIL light comes on and the BITE out discrete to the status relay changes to an open.

Master Controller Signal Processing

The master controller contains the mandatory interface.

The master controller receives the flight data, puts it in a sequence, and sends it in serial mode to the ARINC 573/717 interface.

ARINC 573/717 Interface

This interface formats digital data to harvard biphasic code. The interface sends this code to the flight data recorder.

Data Management Unit (DMU) Master Controller Processing

The DMU master controller processes ACMS data. The DMU monitors FDAU inputs for specified ACMS parameters. When the DMU master controller sees the data change to a value to record, the ACMS makes a report of the parameters. Also, at various times during flight, the ACMS stores reports. The ACMS memory keeps the reports.

The DMU master controller gets data from the FDAU master controller on an internal data bus.

Solid State Memory

Solid state memory holds the data until you want to download reports.

EFFECTIVITY

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FDRS - FDAU FUNCTIONAL DESCRIPTION

Built In Test Equipment (BITE)

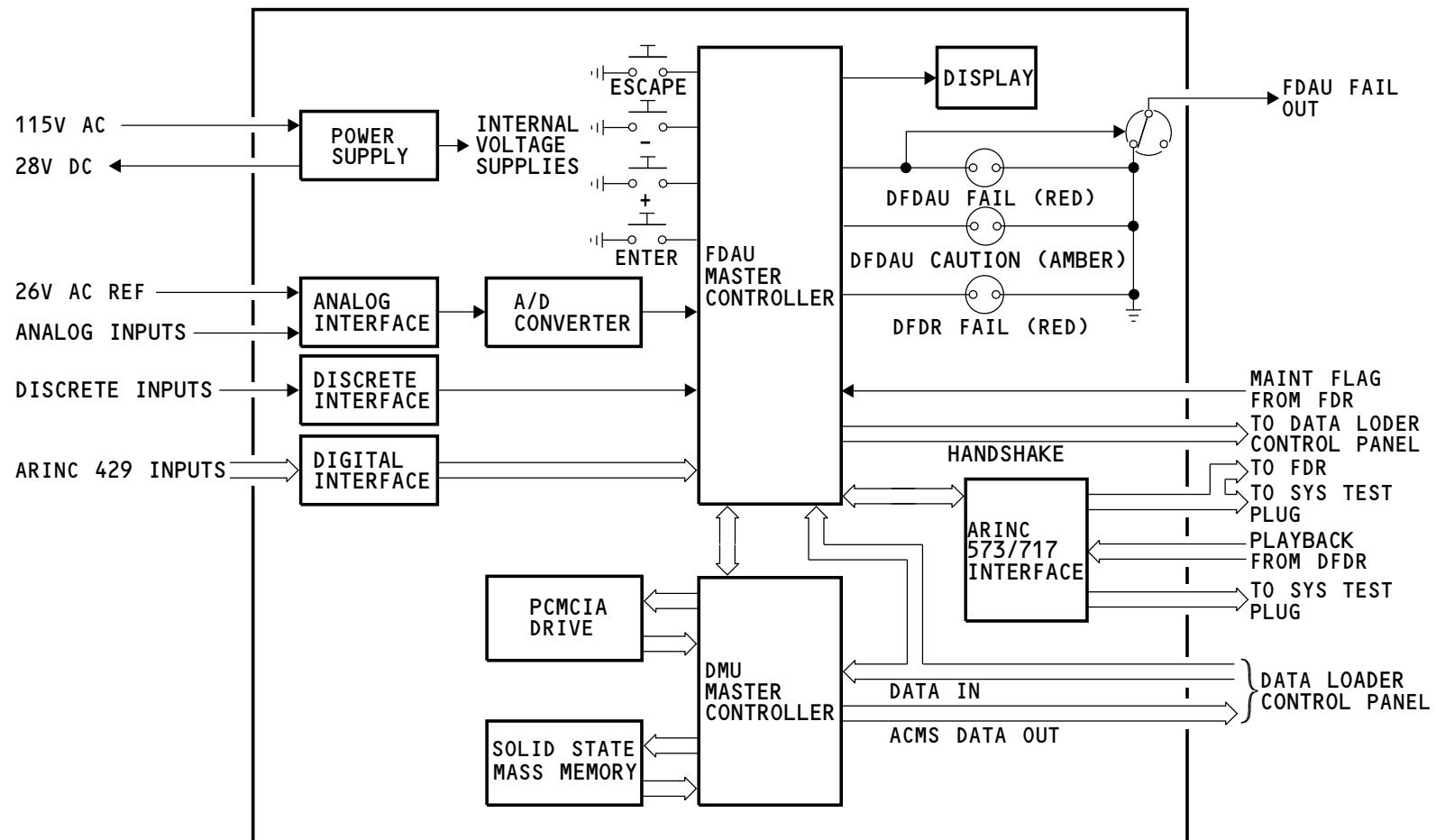
The FDAU fail signal (an open) goes to the status relay with a FDAU fault.

Self tests do a check of the system continuously. Configuration and BITE data show in the front panel display. The ESC, +/-, and ENT buttons control display.

Self tests do a check of the system continuously. Configuration and BITE data show in the front panel display. The ESCAPE, +/-, and ENTER buttons control display.

These lights come on with a fault:

- DFDR FAIL - FDR fault.



M77012 S0004626911_V1

FDRS - FDAU FUNCTIONAL DESCRIPTION
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DFDRS - SYSTEM TESTS

General

The Digital Flight Data Acquisition Unit (DFDAU) and Solid-State Flight Data Recorder (SSFDR) do continuous self-tests. These tests are active when an engine is in operation or the airplane is in the air. For flight recorder system faults, the FLIGHT RECORDER light comes ON.

You can give power to the flight recorder on the ground with the engines not in operation. To turn on the flight recorder, set the FLIGHT RECORDER/MACH AIRSPEED WARNING TEST module TEST/NORMAL switch to the TEST position.

DFDAU Faults

If the DFDAU has a fault with the process of data for the flight recorder, these lights come ON:

- DFDAU FAIL light on the front of the DFDAU
- FLIGHT RECORDER OFF light on the FLIGHT RECORDER/MACH AIRSPEED WARNING TEST module
- Both MASTER CAUTION lights
- OVERHEAD caution annunciator.

If the DFDAU has a fault with the process of data for the Airplane Condition And Monitoring System (ACMS), the DFDAU CAUTION light comes ON.

SSFDR Faults

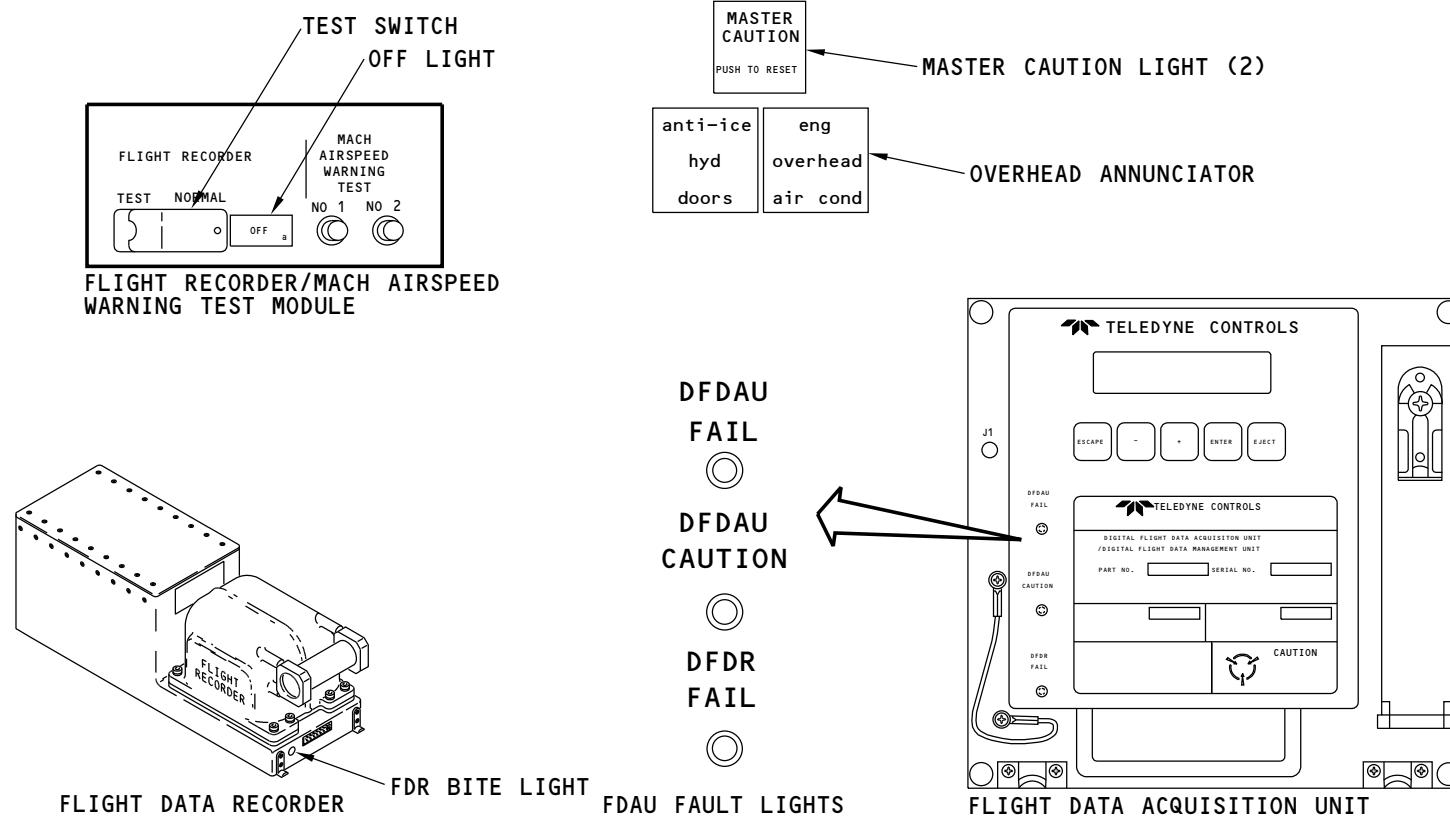
Faults in the SSFDR cause these lights to come ON:

- BITE light on the SSFDR
- Flight recorder fail light on the DFDAU
- FLIGHT RECORDER OFF light on the FLIGHT RECORDER/MACH AIRSPEED WARNING TEST module
- Both MASTER CAUTION lights
- The OVERHEAD caution annunciator.

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DFDRS - SYSTEM TESTS

M77030 S0004626925_V1



DFDRS - TRAINING INFORMATION POINT - DFDAU BITE

General

The Digital Flight Data Acquisition Unit (DFDAU) has built-in test equipment (BITE) and self-test software. BITE does these functions:

- Causes the fault lights to come ON
- Shows the failure codes
- Holds fault messages.

Fault Lights

The DFDAU has these indicator lights on the front panel:

- DFDAU FAIL
- DFDAU CAUTION
- DFDR FAIL.

The DFDAU FAIL light comes ON with any power supply fault, with an output data fault to the Solid-State Flight Data Recorder (SSFDR), with a fault in the program memory, or with a fault in the mandatory input data. With this failure, the DFDAU does not send data to the SSFDR.

The DFDAU CAUTION light comes ON for DMU processor faults. The DFDAU continues to send data and the SSFDR continues to store data.

The DFDR FAIL light comes ON with a fault in the SSFDR. The DFDAU continues to send data to the SSFDR.

BITE Fault Code Display

A sixteen-digit alphanumeric display shows faults and DFDAU information. Use the ENTER, ESCAPE, + and - keys to look at the menus and faults. The ENTER key moves down through the menus. The ESCAPE key moves up through the menus. The + and - keys move within the selected menu. The main display is TELEDYNE CNTRLS. Push any key to show this display.

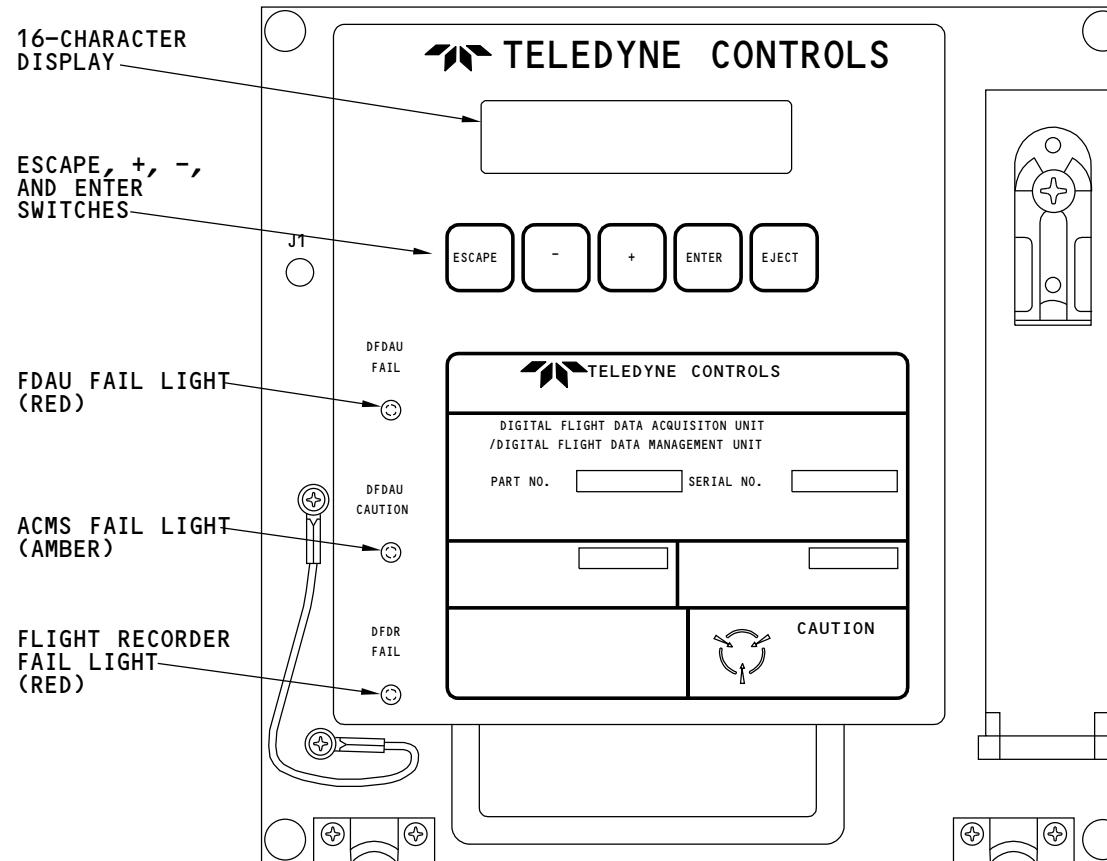
These are the menus:

- MANDATORY MENU - shows faults, active frame, and loaded frames

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M77086 S0004626933_V1

| DFDRS - TRAINING INFORMATION POINT - DFDAU BITE
31-31-00



DFDRS - TRAINING INFORMATION POINT - SOFTWARE LOADING AND REPORT DOWNLOAD DATA LOADER

Software or Data Load

You can load software into the Digital Flight Data Acquisition Unit (DFDAU) or download data from the Airplane Condition And Monitoring System (ACMS).

The software contains standard computer programs for maintenance and operations. It also has computer programs for special needs.

- | ACMS can download reports to a diskette.

Operation to Load Software

To load software into the ACMS, use the data loader control panel. On the top switch, select SINGLE SYS. On the bottom switch, select the ACMS position on the data loader control panel to load software for the Data Management Unit (DMU) master controller or the Q Processor Module2 (QPM2). Select the DFDAU position to load software for the DFDAU master controller or Q Processor Module1 (QPM1).

Put the diskette in the airborne data loader.

When the data load is complete, you can verify the new software part number on the DFDAU front panel.

Operation to Download Report Data

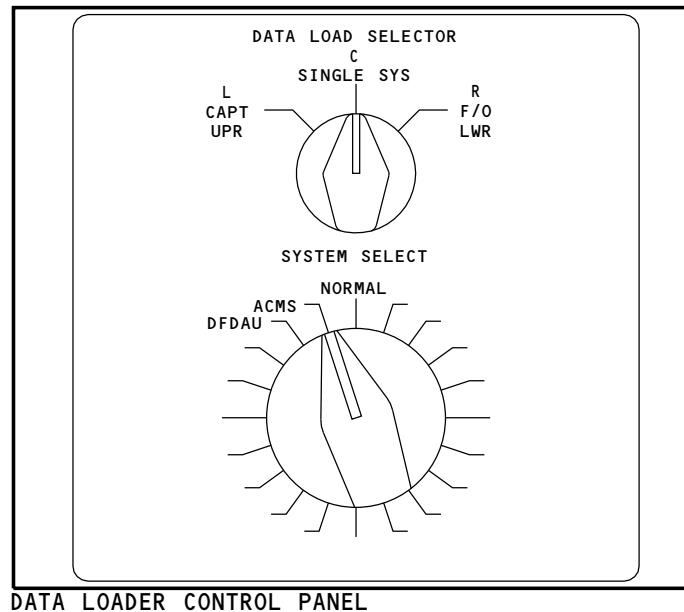
| The ACMS can download report data to a diskette. The diskette must be preformatted to accept the download of report data.

| To download the report data, select the ACMS position on the data loader control panel. Put the formatted diskette in the airborne data loader. When the airplane is on the ground, the DFDAU automatically downloads the report data to the diskette. The airborne data loader shows that the load is done.

EFFECTIVITY

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M77094 S0004626937_V1

| DFDRS - TRAINING INFORMATION POINT - SOFTWARE LOADING AND REPORT DOWNLOAD DATA LOADER

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FDRS - SYSTEM SUMMARY

General

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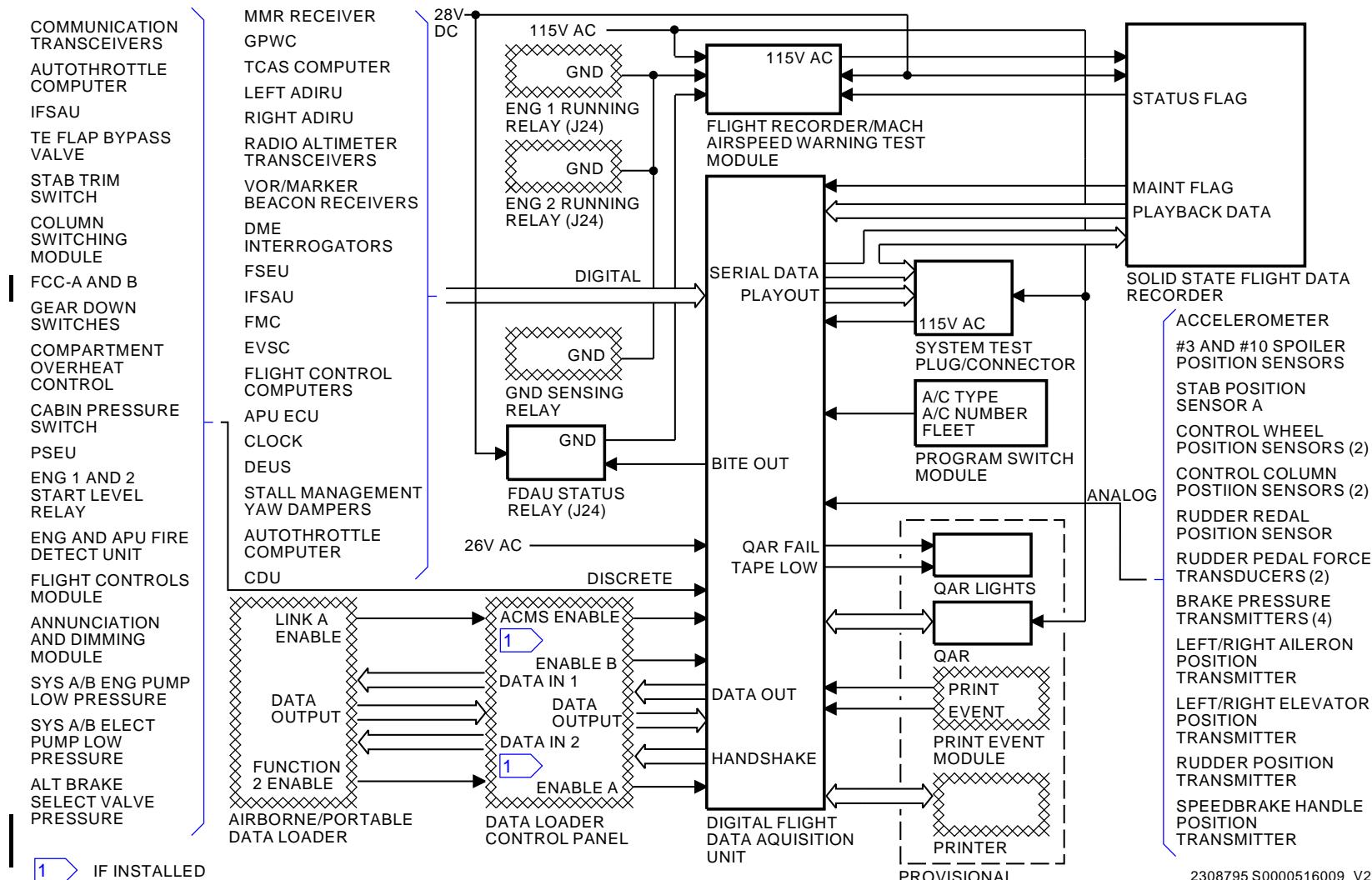
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DFDRS - SYSTEM SUMMARY
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PRINTER SYSTEM - GENERAL DESCRIPTION

General

The purpose of the printer system is to give the flight crew and maintenance personnel printed reports when they ask for them. The flight compartment printer receives reports from connected systems.

- v dc - volts direct current

Input Signals

The printer gets signals and commands from the FDRS FDAU.

Abbreviations and Acronyms

- ac - alternating current
- A/C - aircraft
- ACARS - aircraft communications addressing and reporting system
- ACMS - aircraft conditioning monitoring system
- A/D - analog to digital
- alt - alternate
- ARINC - Aeronautical Radio, Inc.
- ATE - automatic test equipment
- BITE - built-in test equipment
- CPU - central processor unit
- dc - direct current
- FDAU - flight data acquisition unit
- FDR - flight data recorder
- FDRS - flight data recorder system
- FMCS - flight management computer system
- gnd - ground
- Hz - Hertz
- IDU - interactive display unit
- LED - light emitting diode
- LRU - line replaceable unit
- sel - select
- v ac - volts alternating current

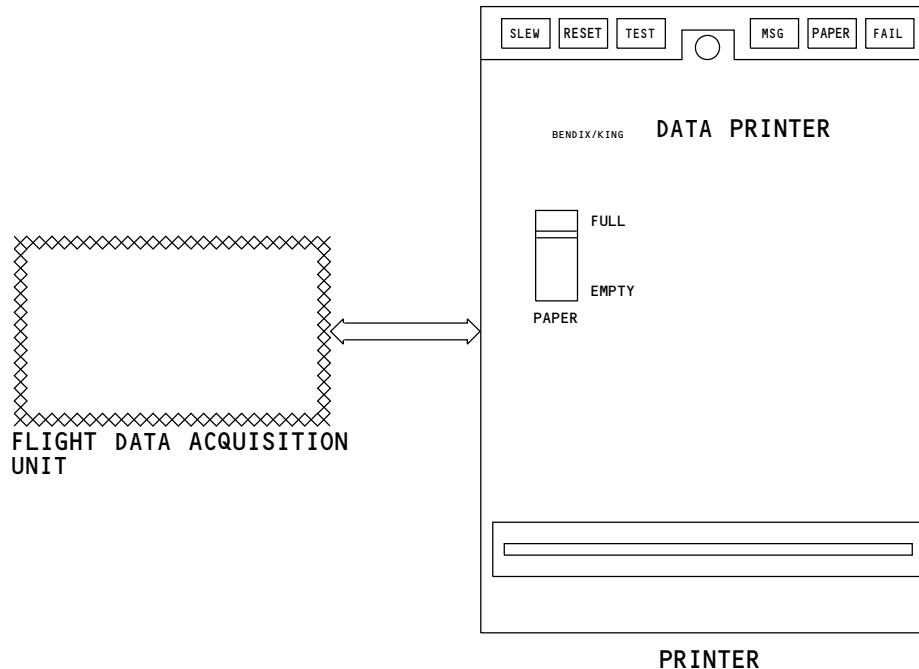
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M77295 S0004626990_V1

PRINTER SYSTEM - GENERAL DESCRIPTION



PRINTER SYSTEM - COMPONENT LOCATIONS

Flight Compartment

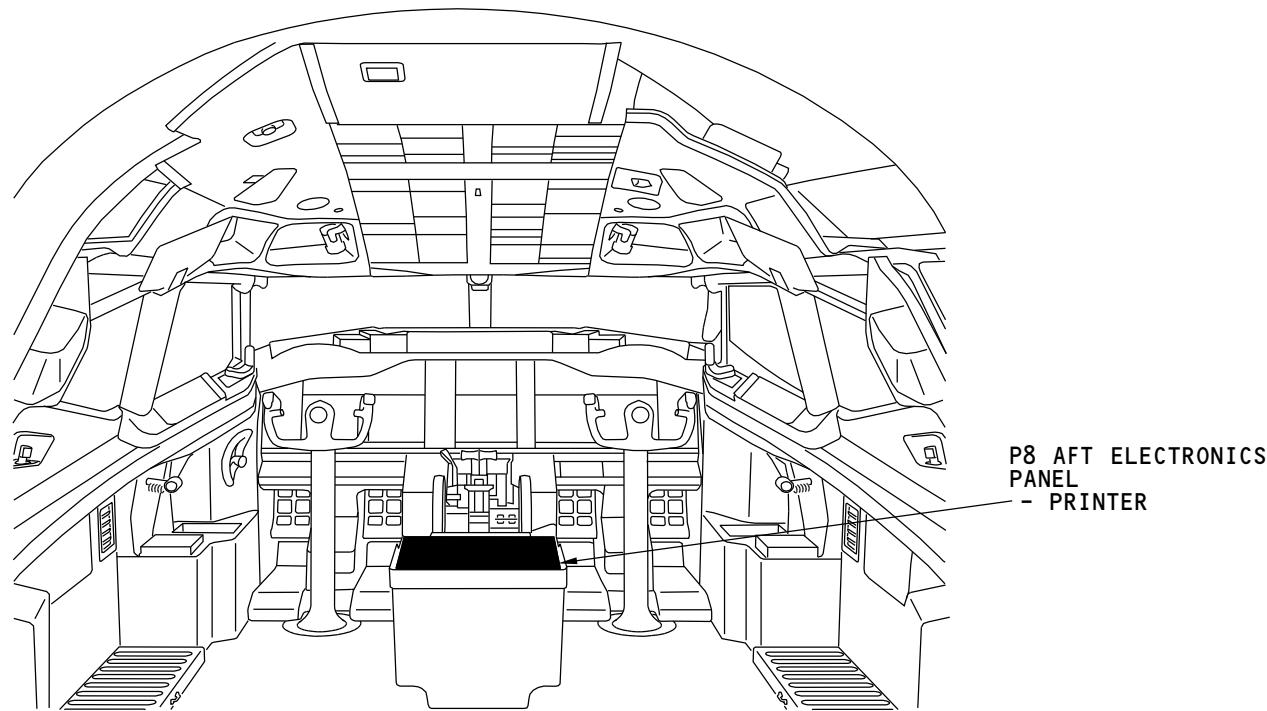
The printer is on the aft electronics panel P8.

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M77327 S0004627005_V1

PRINTER SYSTEM - COMPONENT LOCATIONS

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PRINTER SYSTEM - INTERFACES

General

The flight data recorder system FDAU sends reports to the printer on an ARINC 429 data bus. The FDAU sends the reports when it gets a command. The printer sends status and handshake to the FDAU on an ARINC 429 data bus.

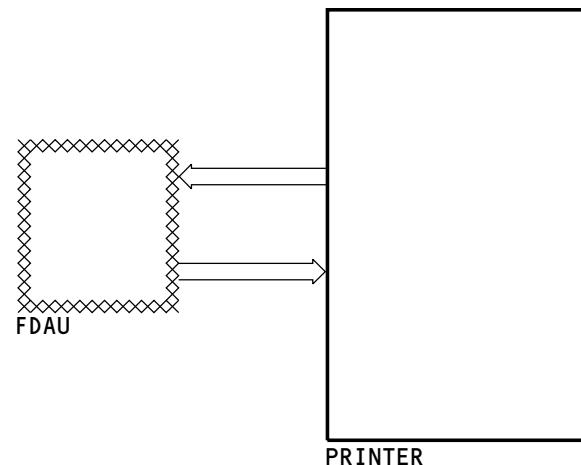
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M77353 S0004627016_V1

PRINTER SYSTEM - INTERFACES

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PRINTER SYSTEM - PRINTER

Purpose

The printer gives a paper copy of reports.

Features

The printer has 12 ARINC 429 data bus inputs and 1 status/control output ARINC 429 data bus. The printer uses white thermal sensitive paper.

Controls and Indicators

These are the printer controls:

- SLEW switch (green) - moves the paper
- RESET switch (green) - turns off the message light
- TEST switch (green) - starts the built-in test.

These are the printer indicators:

- MSG light (blue) - comes on when you get a report
- PAPER light (yellow) - comes on when there is no paper in the printer
- FAIL light (yellow) - comes on if the self test finds a failure
- PAPER FULL-EMPTY indicator - shows the quantity of paper remaining in the printer.

Turn the latch counterclockwise to open the front panel door. This gives you access to the paper roll.

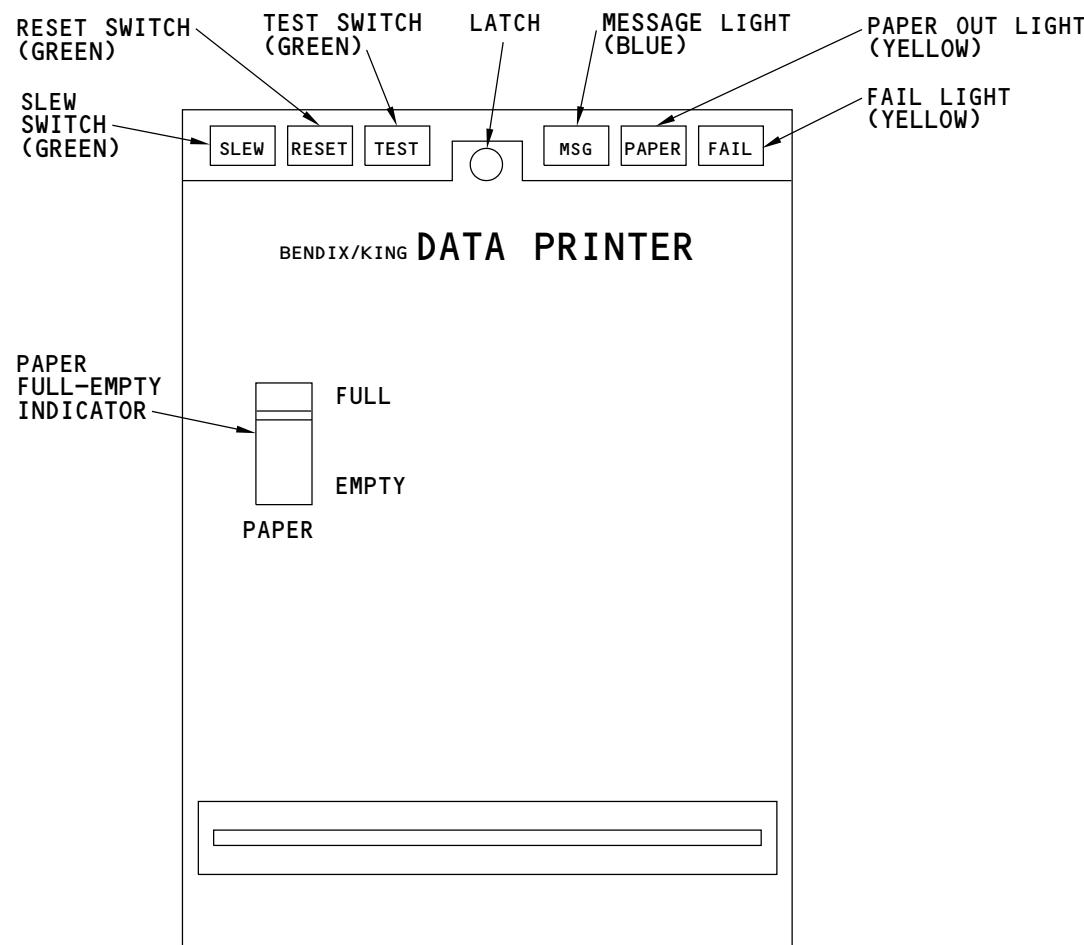
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M77366 S0004627018_V1

PRINTER SYSTEM - PRINTER



PRINTER SYSTEM - PRINTER FUNCTIONAL DESCRIPTION

General

The printer prints reports when it gets a command. It monitors all printer operations and the printer paper supply.

Power

The printer gets 115v ac from transfer bus 1.

Operation

The printer accepts up to 12 inputs from various LRUs. The inputs are ARINC 429 data buses.

The input data goes from the ARINC 429 receiver to the microprocessor and the printer data buffer. The microprocessor controls the data buffer and the motor driver and prints the data using the thermal print head.

The microprocessor sends printer status and handshake data to all connected LRUs on an ARINC 429 data bus.

The paper indicator shows the amount of paper on the paper roll and tells the microprocessor if the paper roll is empty. The microprocessor also monitors the door switch. The microprocessor stops all print operations if the door is open or if the printer is out of paper.

The microprocessor controls the lights on the front of the printer and turns the printer lights on or off for printer operation.

BITE

The microprocessor monitors printer operation and does BITE tests.

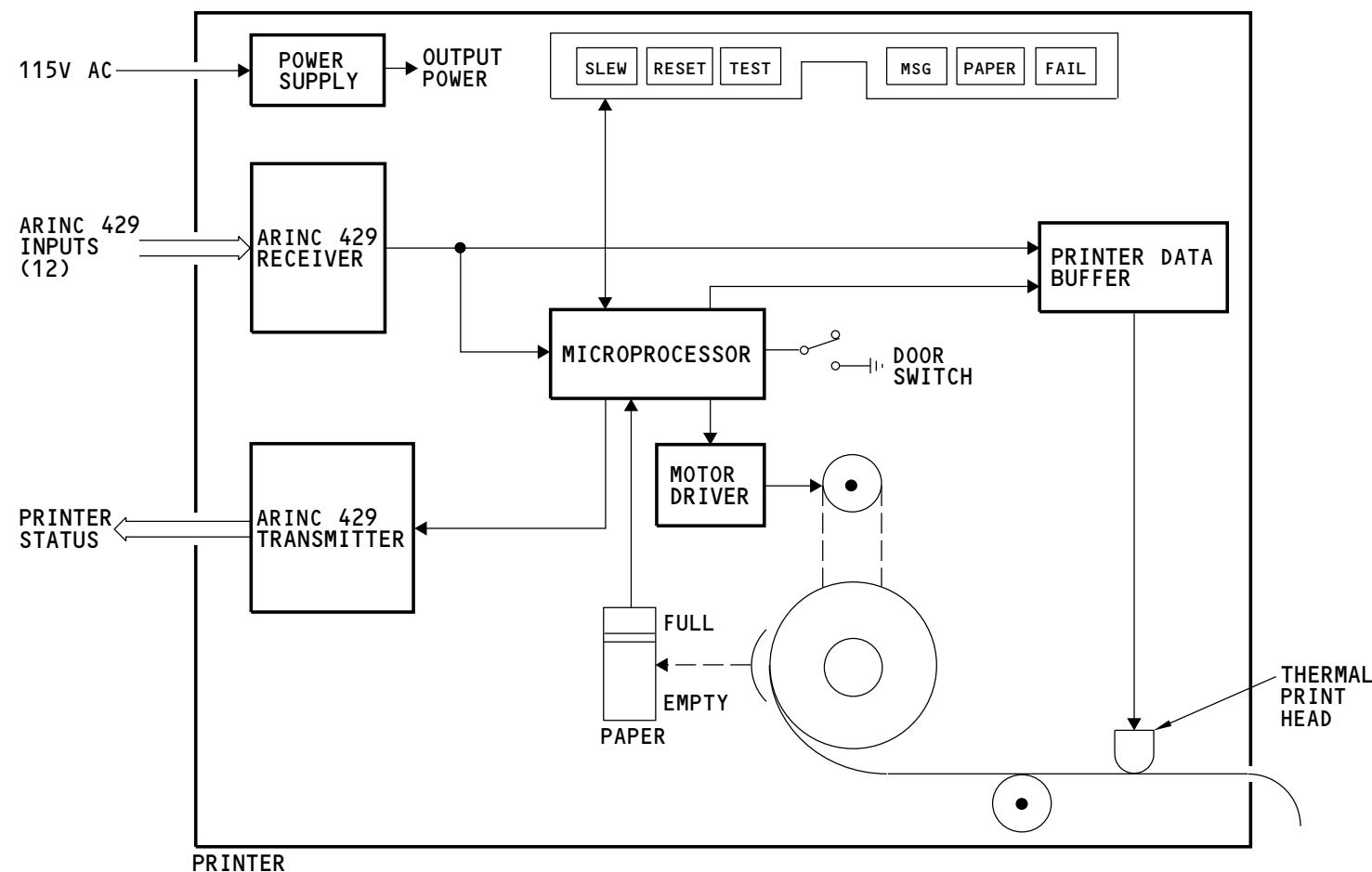
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M77380 S0004627025_V1

PRINTER SYSTEM - PRINTER FUNCTIONAL DESCRIPTION

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PRINTER SYSTEM - TESTS

General

These are the printer tests:

- Self-test
- Printed test that shows all the characters the printer can print.

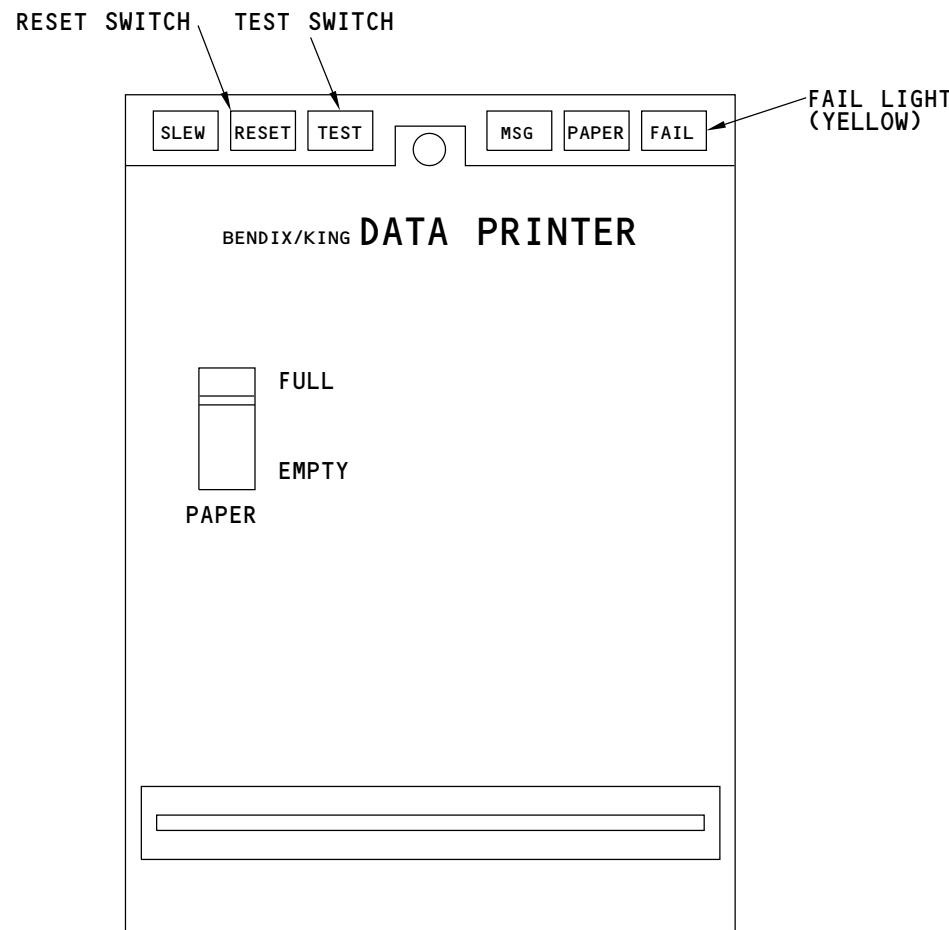
Printer Tests

Push the TEST switch to make the printer do a BITE test. The printer prints the results of the test. Push and hold both the TEST and RESET switches at the same time to print a test pattern. The test pattern includes diagnostic messages and an active port list.

EFFECTIVITY

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M77386 S0004627032_V1

PRINTER SYSTEM - TESTS**31-33-00**



PRINTER SYSTEM - TRAINING INFORMATION POINT - LOAD PRINTER PAPER

General

Replace printer paper when the end of the paper roll is at the print head.
These show that you need to replace the paper:

- The paper indicator comes on
- The paper level display shows empty
- The print head is not active.

Load Paper

These steps show how to replace the printer paper:

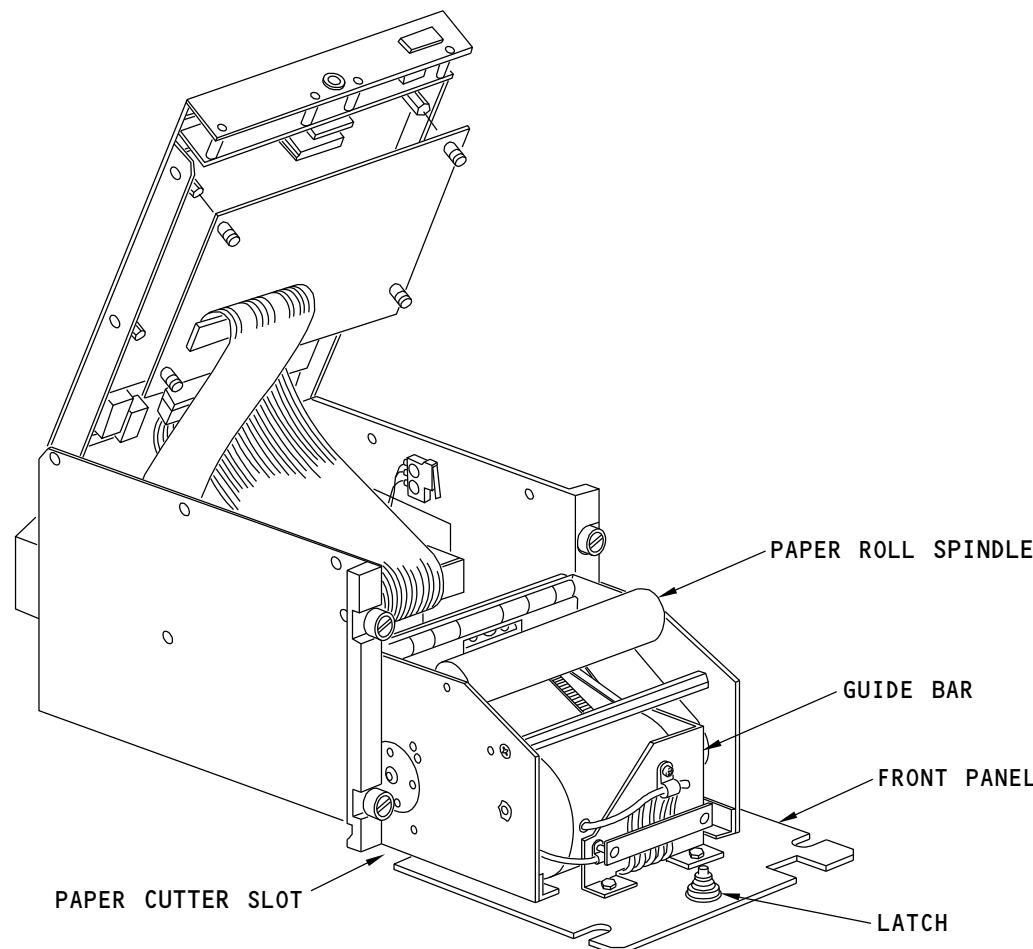
- Turn the latch counterclockwise to release the front panel
- Release the hinged paper roll spindle
- Load the new paper roll onto the spindle
- Close the spindle
- Put the spindle into place
- Thread the end of paper through the guide bar and out the paper cutter slot
- Close and secure the front panel
- Push the slew switch. The paper should advance six inches.

EFFECTIVITY

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M77404 S0004627039_V1

PRINTER SYSTEM - TRAINING INFORMATION POINT - LOAD PRINTER PAPER31-33-00
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PRINTER SYSTEM - SYSTEM SUMMARY

General

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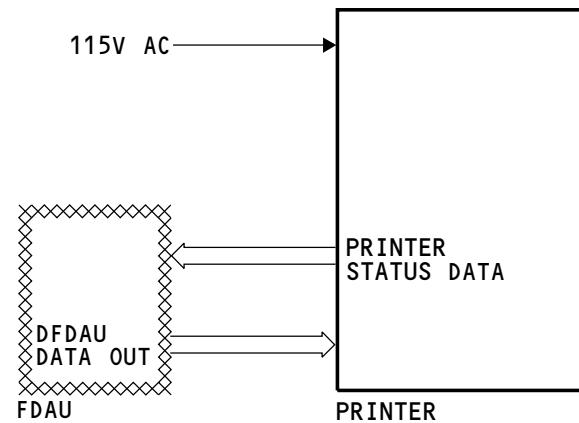
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M77413 S0004627048_V1

PRINTER SYSTEM - SYSTEM SUMMARY

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AURAL WARNING SYSTEM - INTRODUCTION

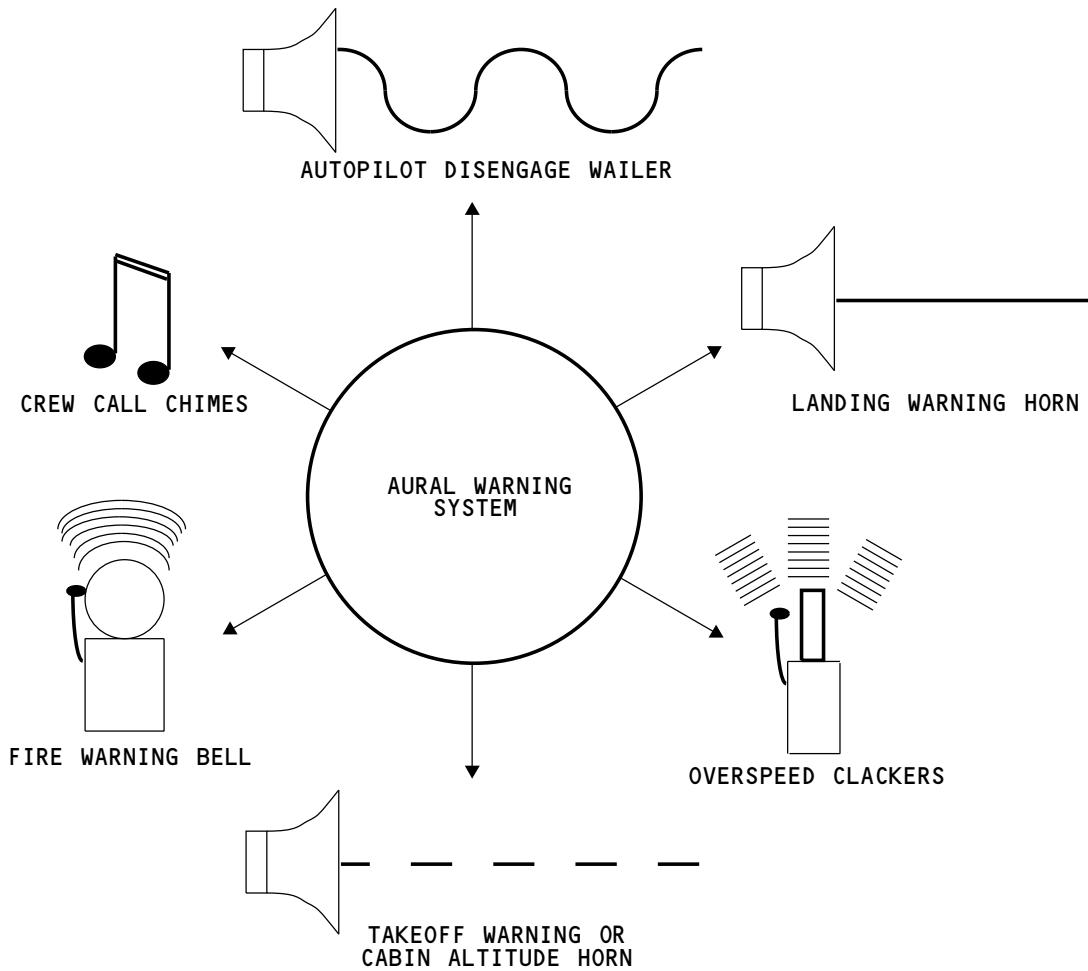
General

The flight compartment aural warning system supplies audio signals to alert the flight crew of incorrect airplane system conditions.

Abbreviations and Acronyms

- ADIRU - air data inertial reference unit
- alt - altitude
- APU - auxiliary power unit
- bat - battery
- BITE - built-in test equipment
- cont - control
- capt - captain
- db - decibel
- dc - direct current
- DFCS - digital flight control system
- emerg - emergency
- evac - evacuation
- fwd - forward
- F/O - first officer
- ma - master
- maint - maintenance
- MCP - mode control panel
- pwr - power
- press - pressure
- SELCAL - selective calling system
- sw - switch
- sys - system
- v - volt
- warn - warning
- wrn - warning

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M77415 S0004627052_V1

AURAL WARNING SYSTEM - INTRODUCTION



AURAL WARNING SYSTEM - GENERAL DESCRIPTION

General

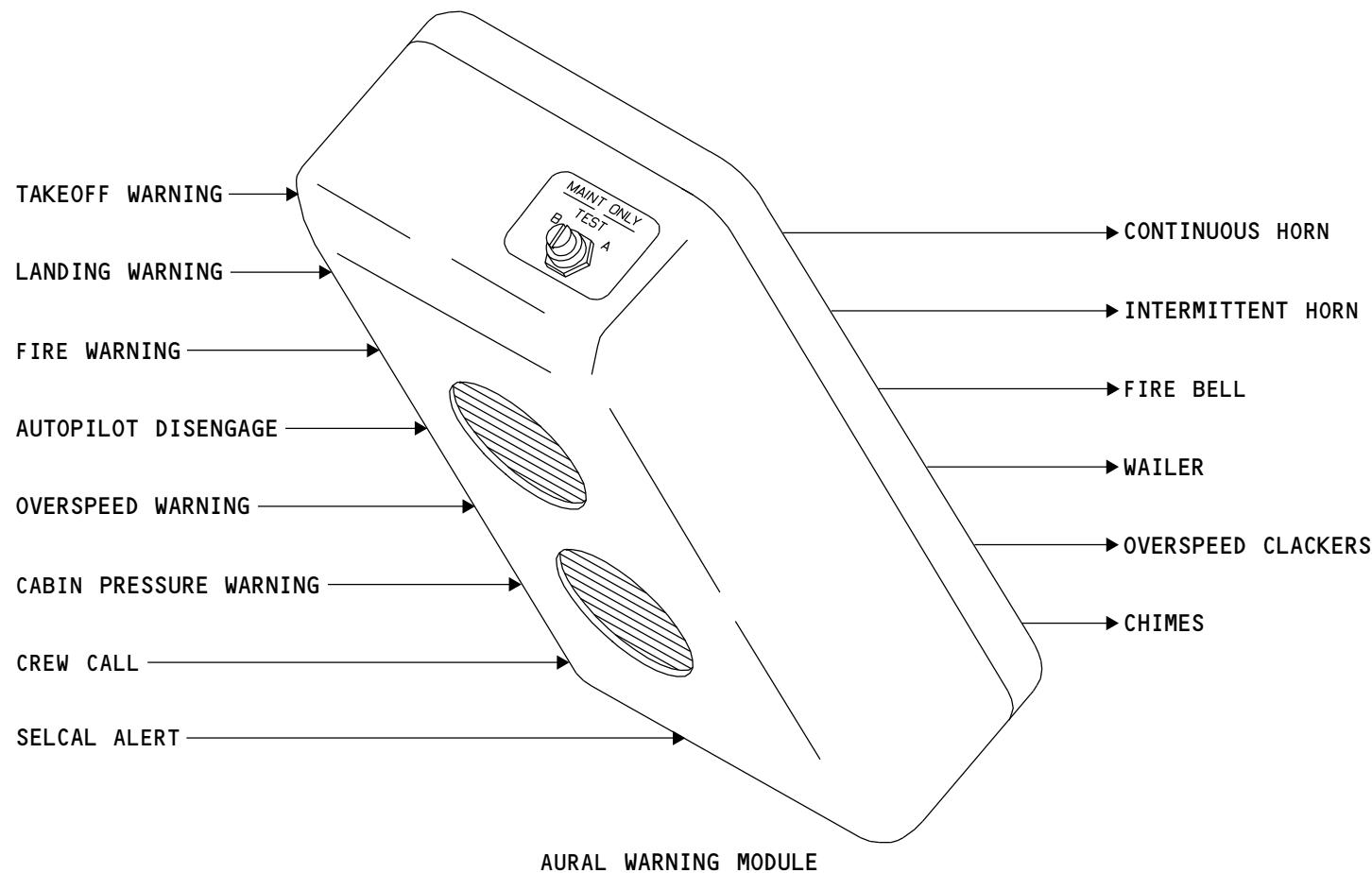
The aural warning module is the only component in the aural warning system. System monitor circuits detect incorrect system conditions and flight crew alerts. The monitor circuits supply discrete signals to the aural warning module.

These are the discrete inputs to the aural warning system:

- Unsafe landing warning
- Unsafe takeoff warning
- Cabin pressure warning
- Autopilot disengage
- Overspeed warning
- Fire warning
- SELCAL alert
- Crew call.

The aural warning module gives these sounds in the flight compartment:

- Fire bells
- Chimes
- Overspeed clackers
- Wailer
- Continuous horn
- Intermittent horn.



M77416 S0004627056_V1

AURAL WARNING SYSTEM - GENERAL DESCRIPTION



AURAL WARNING SYSTEM - COMPONENT LOCATION

General

The aural warning module is in the flight compartment. It is on the aft right face of the P9 forward electronic panel.

The altitude horn cutout switch is on the P5 forward overhead panel.

The master fire warning lights are on the P7 glareshield panel.

The landing gear warning horn cutout switch is on the P10 control stand.

The fire warning bell cutout switch is on the P8 aft electronic panel.

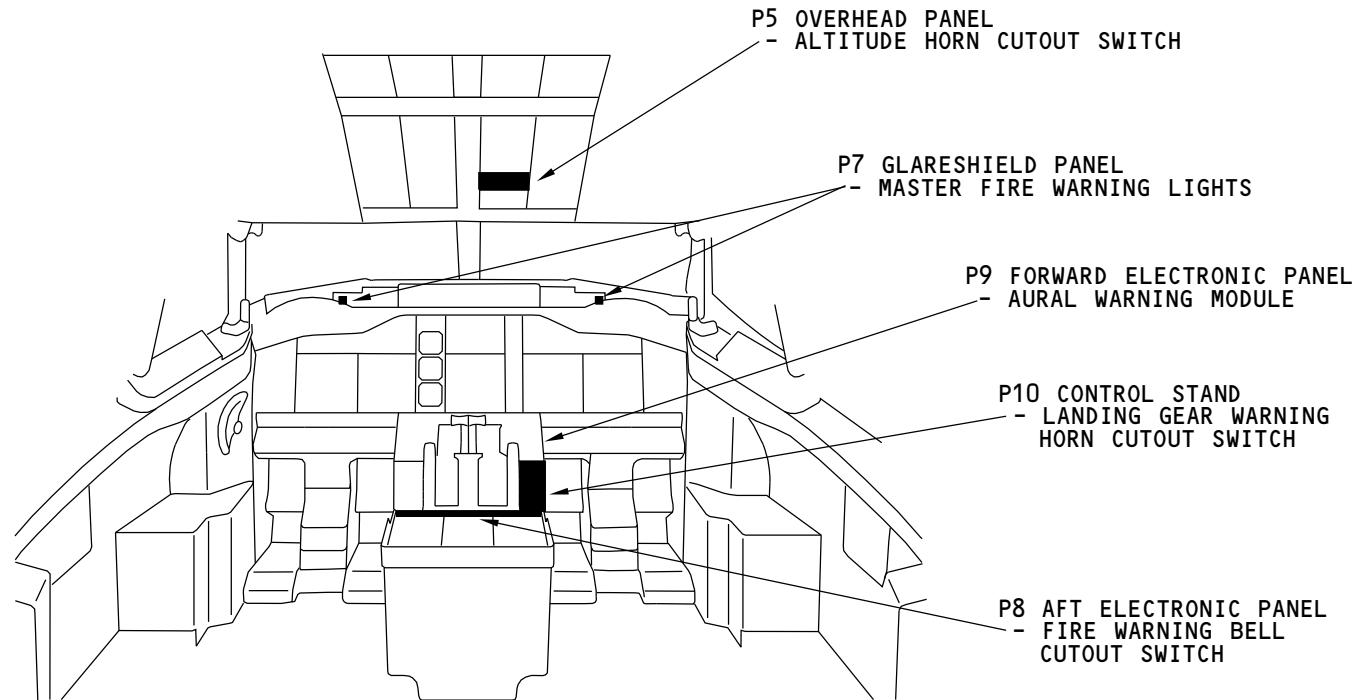
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M77424 S0004627063_V1

AURAL WARNING SYSTEM - COMPONENT LOCATION

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AURAL WARNING SYSTEM - INTERFACES

Power

The aural warning module receives 28v dc from four circuit breakers. Each circuit breaker supplies power for different audio sounds.

Continuous Horn Inputs

To make the continuous horn sound, the aural warning module receives a discrete input from the proximity switch electronics unit (PSEU) for a landing warning.

Intermittent Horn Inputs

To make the intermittent horns sound, the aural warning module receives discrete inputs from these units:

- Proximity switch electronics unit (PSEU) for a takeoff warning
- Cabin altitude panel for a cabin altitude warning.

Bell Inputs

To make the bell sound, the aural warning module receives discrete inputs from these units:

- Engine and APU fire detection module for an engine or APU fire
- Cargo smoke detection and fire suppression panel for smoke detection in the forward or aft cargo compartment
- Compartment overheat detection controller for a wheel well fire.

Wailer Inputs

To make the wailer sound, the aural warning module receives discrete inputs from the digital flight control system (DFCS) mode control panel (MCP) for the autopilot disconnect warning.

Clacker Inputs

To make the clacker sound, the aural warning module receives discrete inputs from the left or right air data inertial reference unit (ADIRU) for an overspeed warning.

HI Chime Inputs

To make the HI chime sound, the aural warning module receives discrete inputs from these units:

- Capt call switch for a call from someone on the ground at the external power panel
- Forward and aft attendant panels for a call from someone at the attendant stations.

HI/LO Chime Inputs

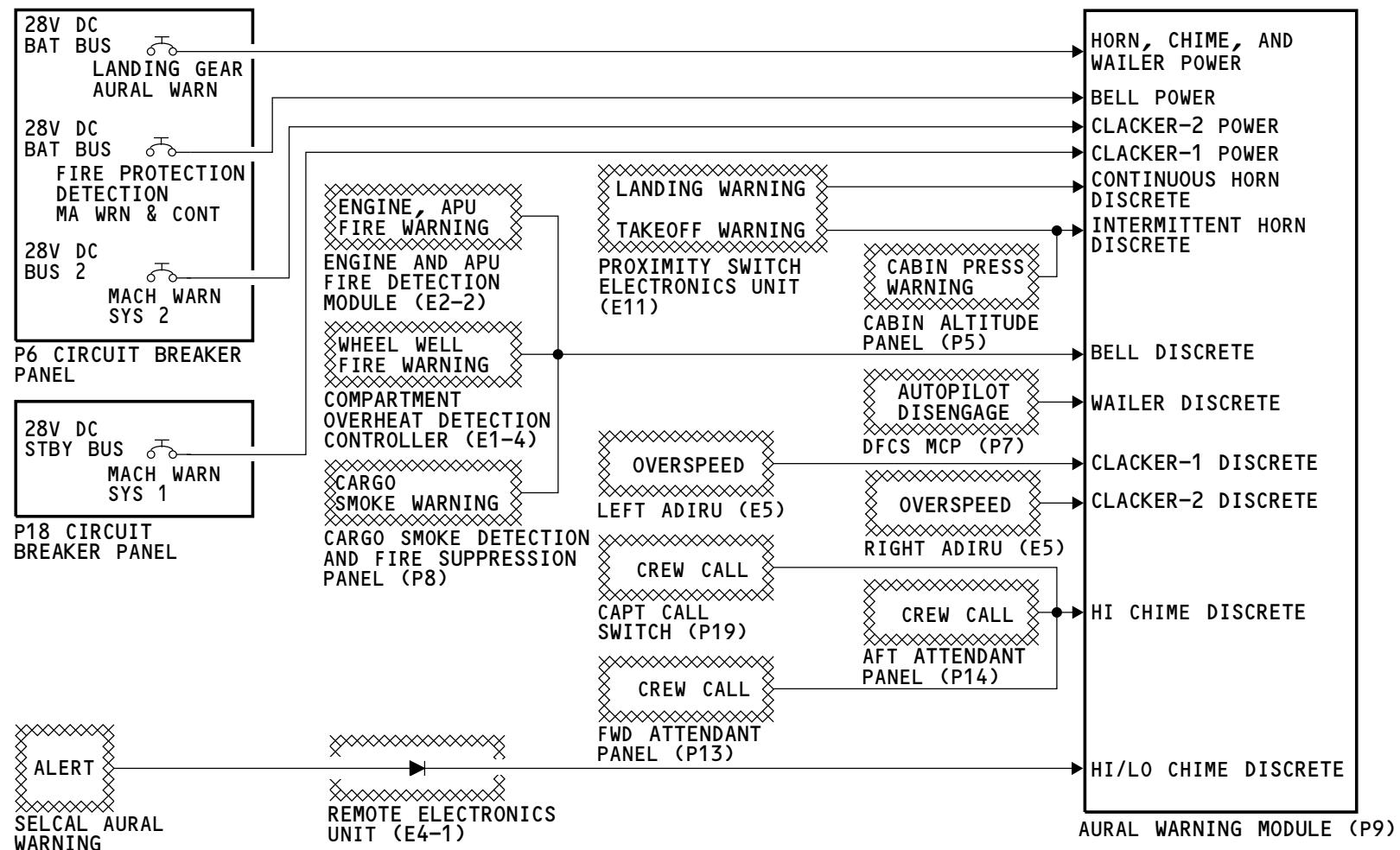
To make the HI/LO chime sound, the aural warning module receives a discrete input from the remote electronics unit.

The remote electronics unit receives a signal from the SELCAL aural warning relay when the SELCAL decoder receives a SELCAL call from the ground station.

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AURAL WARNING SYSTEM - INTERFACES

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AURAL WARNING SYSTEM - AURAL WARNING MODULE

Purpose

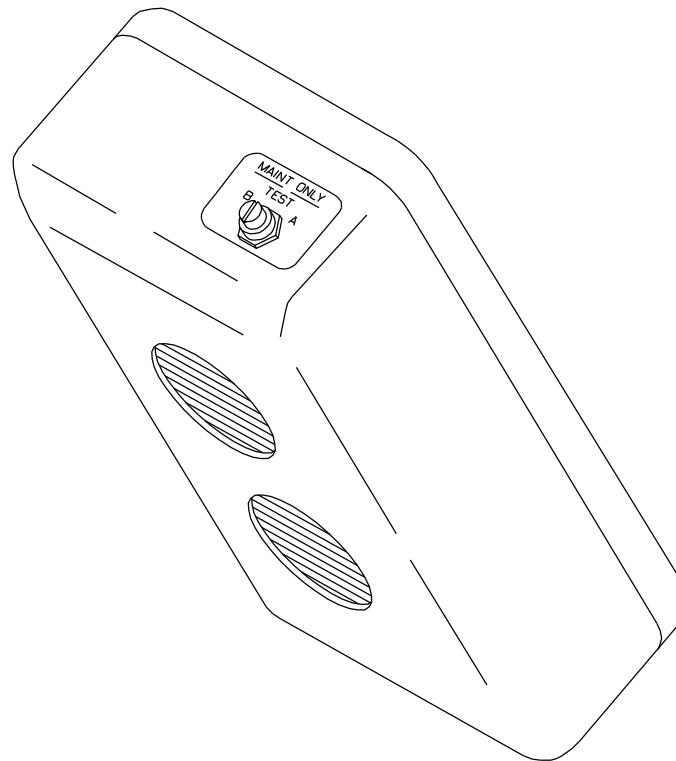
The aural warning module receives discrete inputs from various systems. The aural warning module uses these inputs to make aural alert sounds for the flight crew.

Aural Warning Module Channels

The aural warning module has two channels. Each channel is the same. The two channels are connected in parallel. If one channel fails, the audio output of the aural warning module will decrease by 6db.

Test Switch

A test switch is on the top of the aural warning module. The test switch checks operation of both channels of the aural warning module.



AURAL WARNING MODULE

M77445 S0004627082_V1

AURAL WARNING SYSTEM - AURAL WARNING MODULE

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AURAL WARNING SYSTEM - FUNCTIONAL DESCRIPTION

General

The aural warning module has two parallel channels, channel A and channel B. Both channels receive inputs from the airplane systems. Both channels operate at the same time.

If one channel fails, the flight crew will hear a 6db decrease in volume from the aural warning module.

Each channel has these components:

- Power supply
- Discrete ground input circuit
- Discrete power input circuit
- Controller circuit
- Two aural synthesizers
- Analog amplifier
- Speaker.

There is a built-in test equipment (BITE) switch on the aural warning module. Each channel receives a signal from the BITE switch.

Input Circuit

Each channel has two input circuits. One circuit receives discrete ground inputs, the other receives power (28v dc) discrete inputs.

Discrete inputs from the crew call system and the SELCAL system are power discretes. All other inputs are discrete grounds.

Controller

The controller receives signals from both input circuits and causes the aural synthesizer to make sounds. It controls the sequence of some sounds made by the synthesizer. This is the sequence of the sounds from most important to least important:

- Intermittent horn
- Steady horn

- Wailer.

The bell, the clacker, and the chime sounds do not have a sequence. The controller permits these sounds at the same time as any other sound.

Aural Synthesizer

The aural synthesizers make all the sounds that the pilots hear from the aural warning module. One aural synthesizer makes the bell and clacker sounds. The other aural synthesizer makes the horn, wailer, and chime sounds. The synthesizers can make more than one sound at a time.

Analog Amplifier

The analog amplifier adds the signals from both synthesizers. The amplifier also increases the signal strength from the aural synthesizers and sends it to the speaker.

Speaker

The speakers provide the sound. Channel A drives the top speaker. Channel B drives the bottom speaker. When there is an aural warning, both speakers provide sound at the same time.

BITE Switch

The BITE switch lets the operator do a test of each channel of the aural warning module.

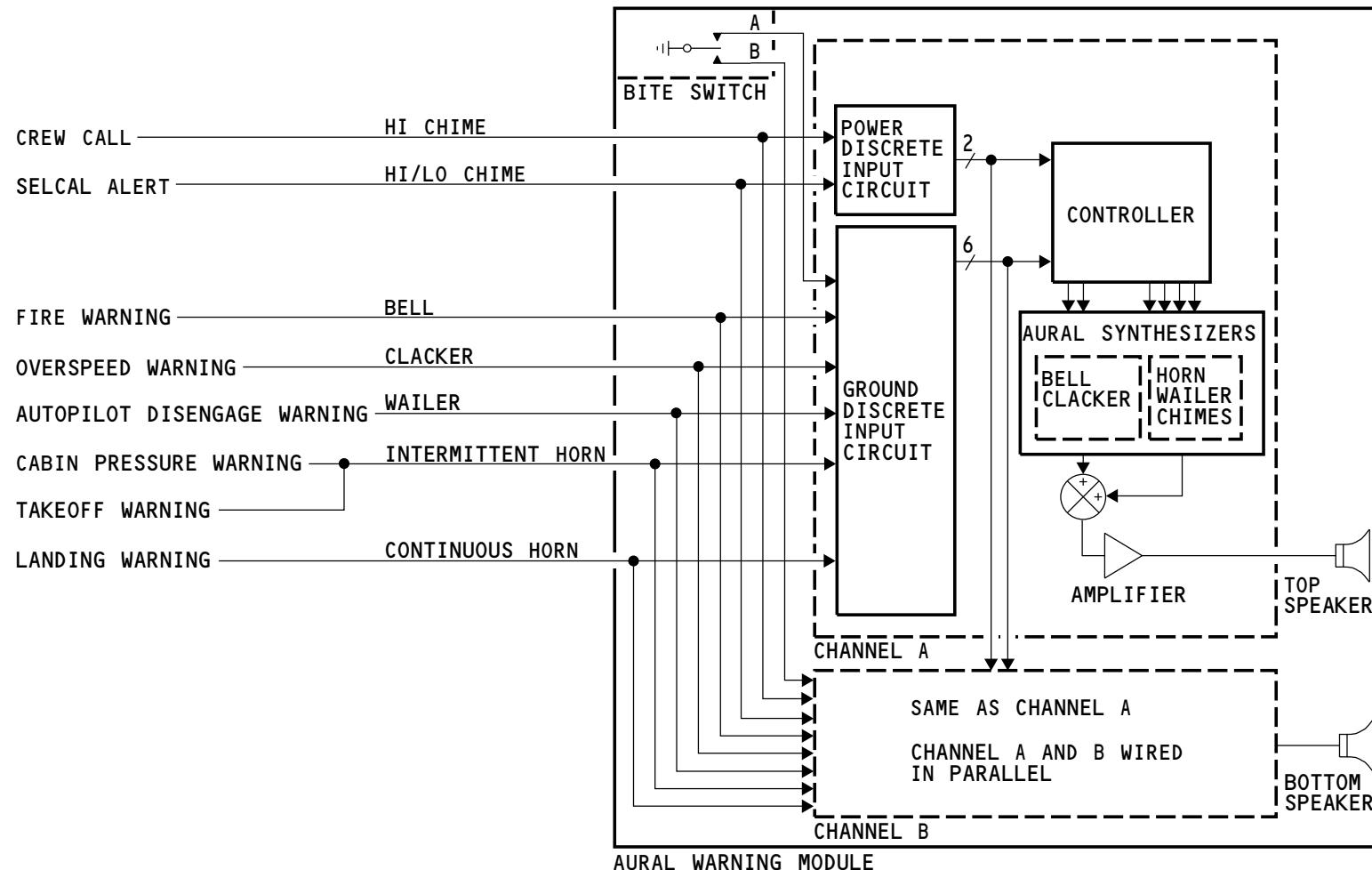
When you move the switch to the A position, channel A causes the aural synthesizer to make the intermittent horn sound. When you release the switch, channel A causes the aural synthesizer to make the clacker sound. The sound comes out of the top speaker.

When you put the switch to the B position and release it, channel B makes the horn and clacker sounds. The sound comes out of the bottom speaker.

EFFECTIVITY

AKS ALL

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M77447 S0004627085_V1

AURAL WARNING SYSTEM - FUNCTIONAL DESCRIPTION

EFFECTIVITY

AKS ALL

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AURAL WARNING SYSTEM - OPERATION - TAKEOFF 1

General

The aural warning module gives the sound of an intermittent horn for a takeoff warning.

On the Ground

These are the conditions that cause the takeoff warning on the ground:

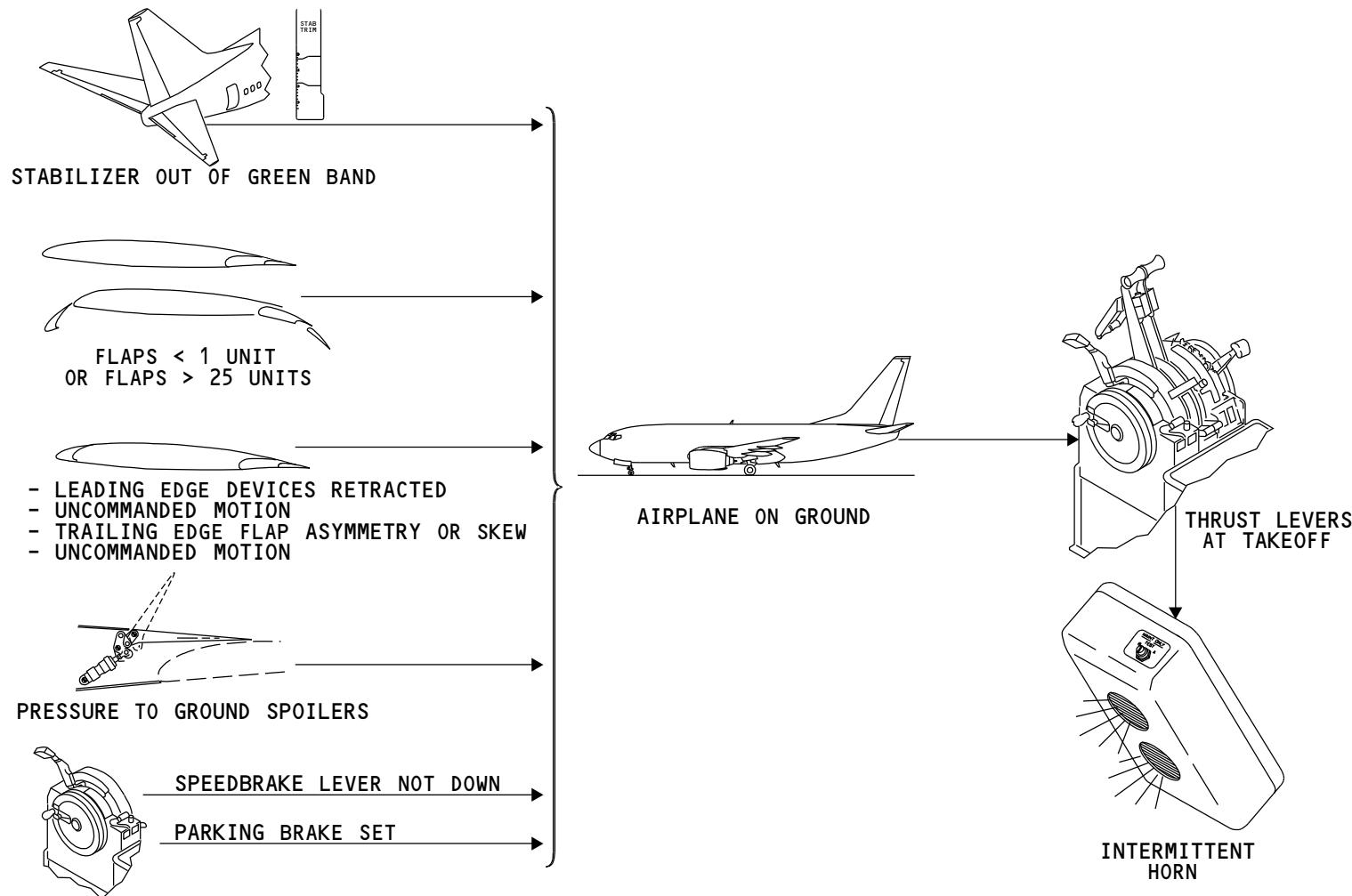
- Position of the horizontal stabilizer is out of the green band
- Trailing edge flaps are less than 1 unit or more than 25 units
- Leading edge devices are retracted or there is uncommanded motion
- | • Trailing edge flaps are asymmetric, skewed, or there is uncommanded motion
- Ground spoilers have hydraulic pressure
- Speedbrake lever is not down
- Parking brake is set.

The airplane must be on the ground and you must move the thrust levers towards takeoff power before the aural warning system gives the takeoff warning sound for the conditions above.

EFFECTIVITY

AKS ALL

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M77451 S0004627089_V1

AURAL WARNING SYSTEM - OPERATION - TAKEOFF 1

EFFECTIVITY

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31-51-00



AURAL WARNING SYSTEM - OPERATION - TAKEOFF 2

General

The aural warning module gives the sound of an intermittent horn for a takeoff warning.

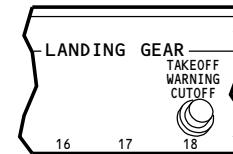
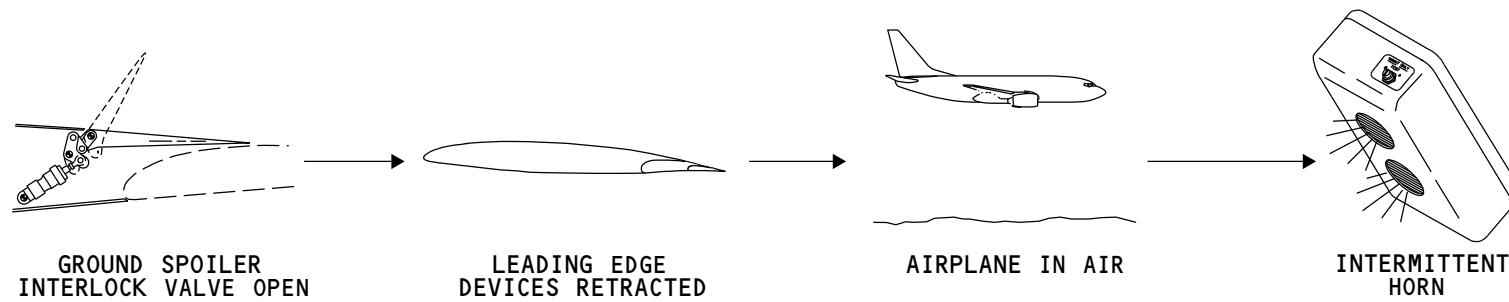
In the Air

The aural warning system can give the takeoff warning when the airplane is in the air. This warning tells the flight crew that the ground spoiler interlock valve is open.

You hear the warning when all of the following conditions are true:

- The ground spoiler interlock valve is open
- The leading edge flaps are retracted
- The airplane is in the air.

To stop the warning, open the LANDING GEAR, TAKEOFF WARNING CUTOFF circuit breaker on the load control panel (P6).



**LANDING GEAR
TAKEOFF WARNING CUTOFF
CIRCUIT BREAKER (P6-3)**

M77458 S0004627091_V1

AURAL WARNING SYSTEM - OPERATION - TAKEOFF 2



AURAL WARNING SYSTEM - OPERATION - LANDING

General

The aural warning module gives the sound of a continuous horn for a landing warning.

There are four sets of conditions which cause the landing warning.

In the first set of conditions, the horn sounds when these conditions are true:

- Gear is not down and locked
- Flap position is from 0 to 10 units
- Thrust levers are set for landing
- Radio altitude is between 200 and 800 feet.

For the first set of conditions, push the horn cutout switch near the flap lever to stop the horn.

In the second set of conditions, the horn sounds when these conditions are true:

- Gear is not down and locked
- Flap position is from 0 to 10 units
- Thrust levers are set for landing
- Radio altitude is less than 200 feet.

For the second set of conditions, the pilot cannot stop the horn.

In the third set of conditions, the horn sounds when these conditions are true:

- Gear is not down and locked
- Flap position is from 15 to 25 units
- Thrust levers are set for landing.

For this set of conditions, the pilot cannot stop the horn.

In the fourth set of conditions, the horn sounds when the gear is not down and locked and the flap position is more than 25 units. The pilot cannot stop the horn.

When the airplane is in the fourth set of conditions, the system inhibits the landing warning horn during a go-around. The system inhibits the warning for 12 seconds after the pilot puts the gear lever in the up position.

EFFECTIVITY

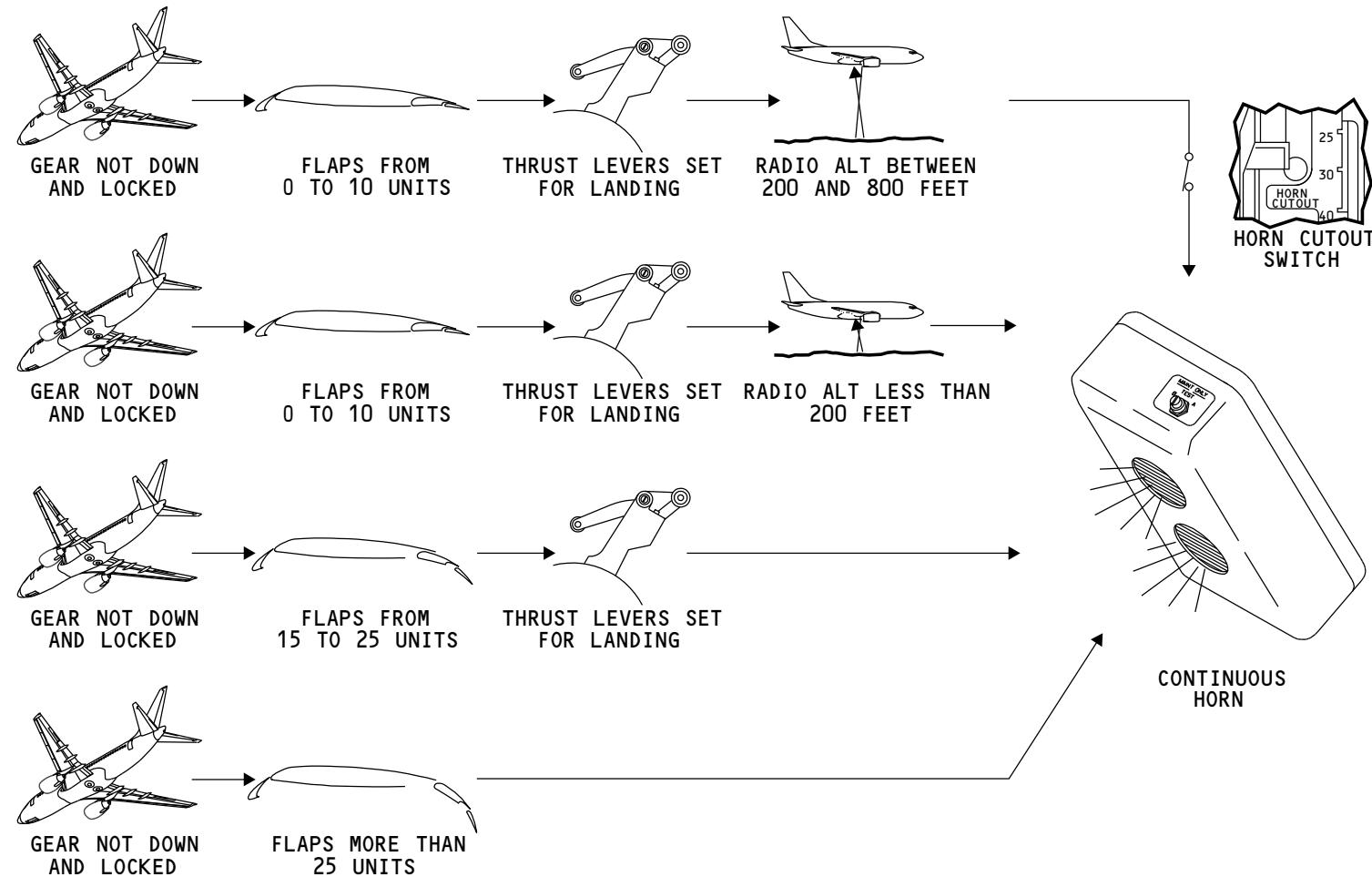
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AURAL WARNING SYSTEM - OPERATION - LANDING

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AURAL WARNING SYSTEM - OPERATION - FIRE

General

The aural warning module gives the sound of a fire bell for a fire warning.

These are the conditions which cause the fire warning:

- Engine fire
- Cargo smoke
- Wheel well fire
- APU fire.

The fire bell stops when you push the bell cutout switch or the fire warning light.

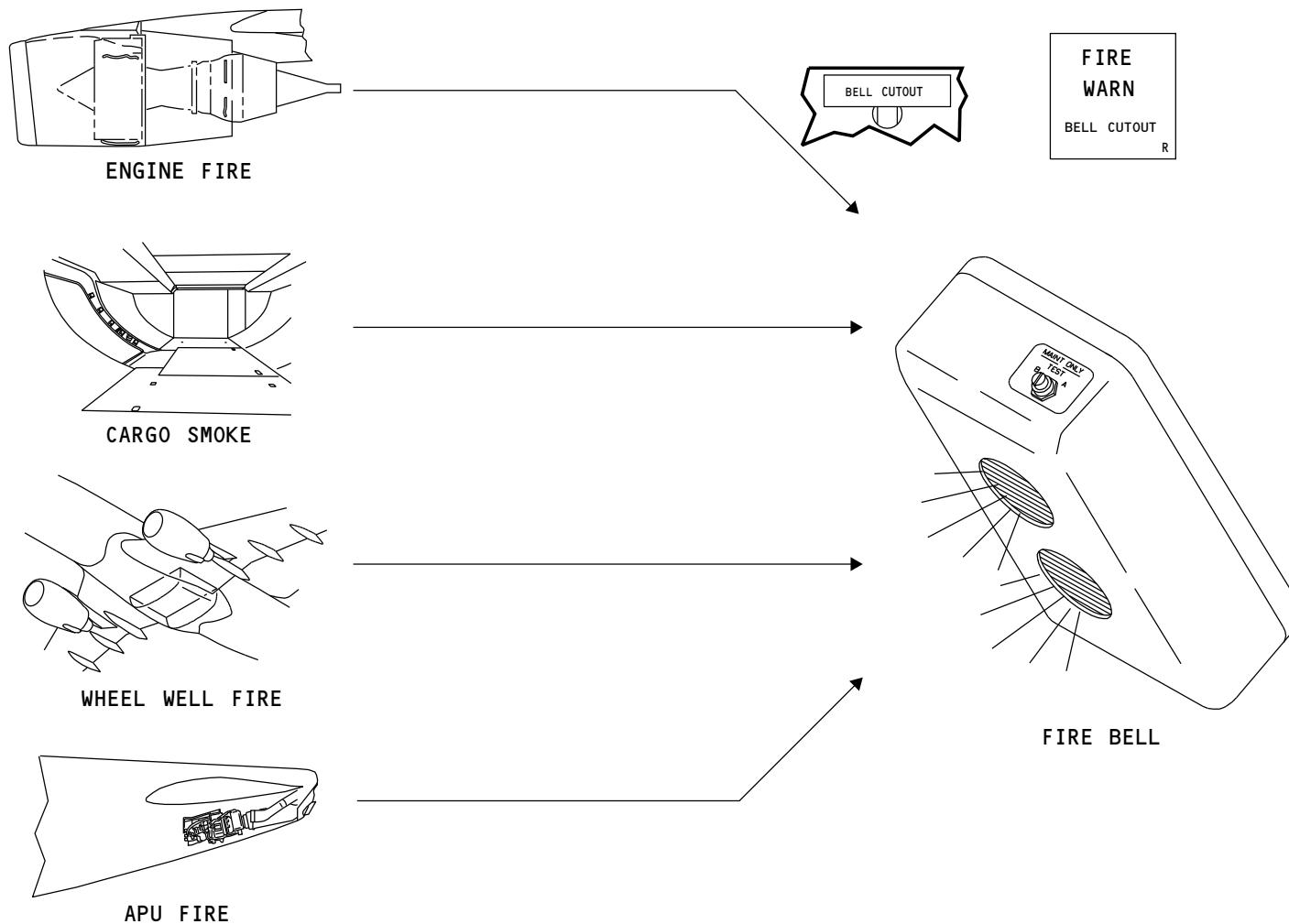
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AURAL WARNING SYSTEM - OPERATION - FIRE
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**AURAL WARNING SYSTEM - OPERATION - AUTOPILOT DISCONNECT, OVERSPEED, CABIN PRESSURE****General**

The aural warning module gives the sound of a wailer for an autopilot disconnect warning. Do one of these things to stop the wailer:

- Push the autopilot disconnect switch
- Push the autopilot P/RST switch
- Engage the autopilot again.

The aural warning module gives the sound of a clacker for an airplane overspeed warning.

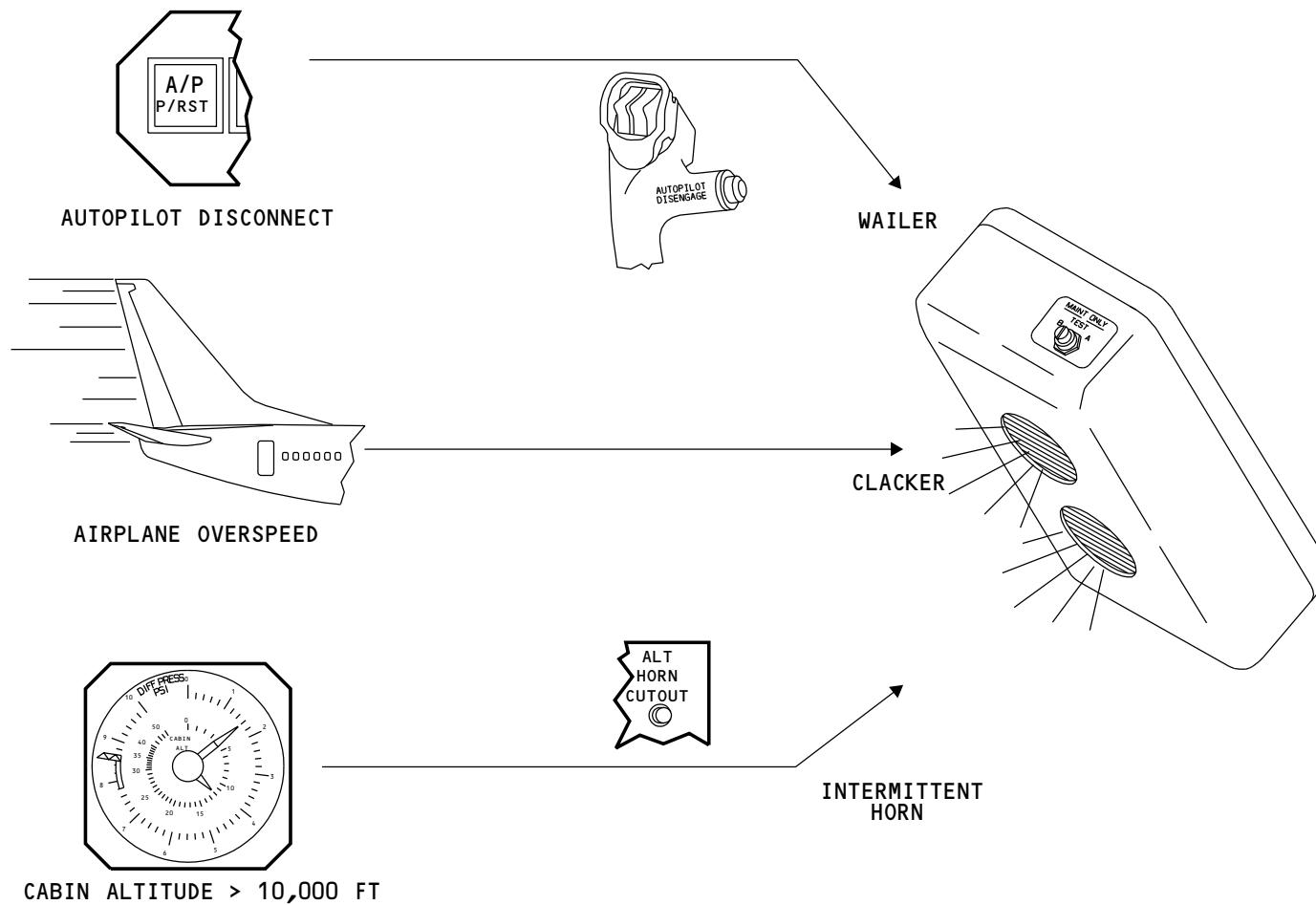
The aural warning module gives the sound of an intermittent horn for a cabin pressure warning. Push the altitude horn cutout switch on the P5 overhead panel to stop the intermittent horn.

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AURAL WARNING SYSTEM - OPERATION - AUTOPILOT DISCONNECT, OVERSPEED, CABIN PRESSURE

**AURAL WARNING SYSTEM - OPERATION - FLIGHT COMPARTMENT CALL****General**

The aural warning unit gives the sound of a single high chime for a flight crew call.

When the flight attendant calls the flight crew, there is a single high chime.

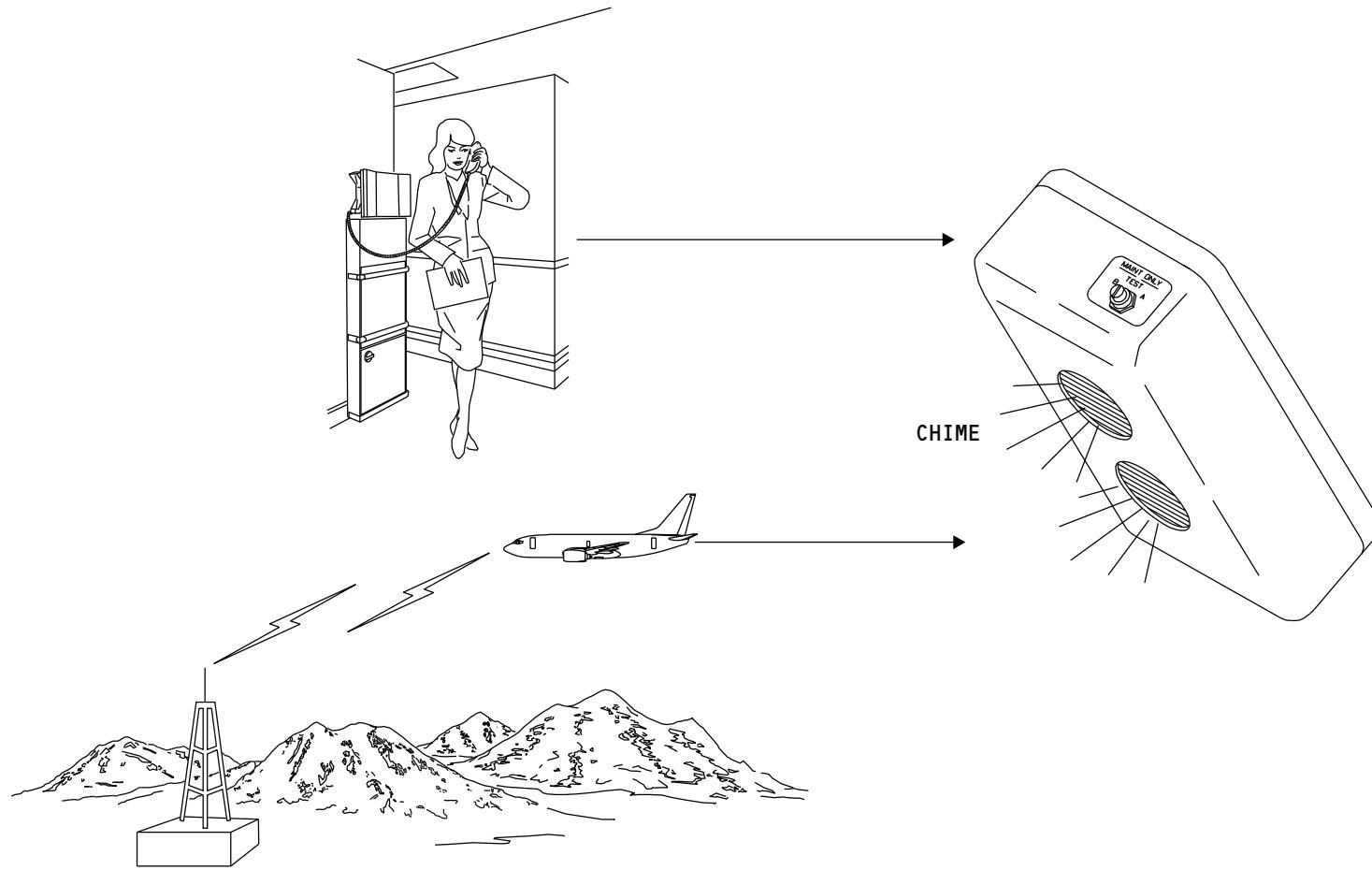
When the ground station uses SELCAL to call the flight crew, there is a single high/low chime.

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AURAL WARNING SYSTEM - OPERATION - FLIGHT COMPARTMENT CALL

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AURAL WARNING SYSTEM - TEST

General

The aural warning system test checks the aural warning module for correct operation. You hear the intermittent horn and the clacker sounds for a good test.

A test switch is on the top of the aural warning module. The test switch is spring loaded so that it returns to center when it is released. Use a screwdriver to turn the switch. Turn the switch clockwise to test channel A. Turn the switch counterclockwise to test channel B.

Turn the switch to hear the intermittent horn. Release the switch to hear the clacker.

The clacker stops at the end of the test.

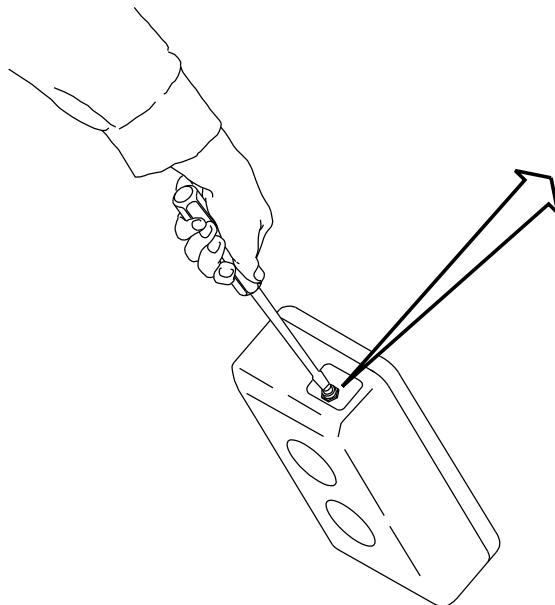
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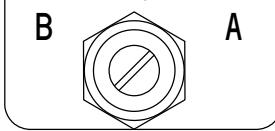
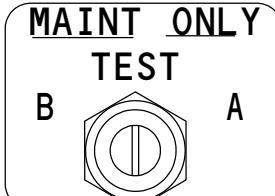
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	CHANNEL A TEST	CHANNEL B TEST
TURN TEST SWITCH	MAINT ONLY TEST  "BEEP-BEEP-BEEP-BEEP" (INTERMITTENT HORN SOUND)	MAINT ONLY TEST  "BEEP-BEEP-BEEP-BEEP" (INTERMITTENT HORN SOUND)
RELEASE TEST SWITCH	MAINT ONLY TEST  "CLACK-CLACK-CLACK-CLACK" (CLACKER SOUND)	MAINT ONLY TEST  "CLACK-CLACK-CLACK-CLACK" (CLACKER SOUND)

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AURAL WARNING SYSTEM - TEST

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AURAL WARNING SYSTEM - SUMMARY

General

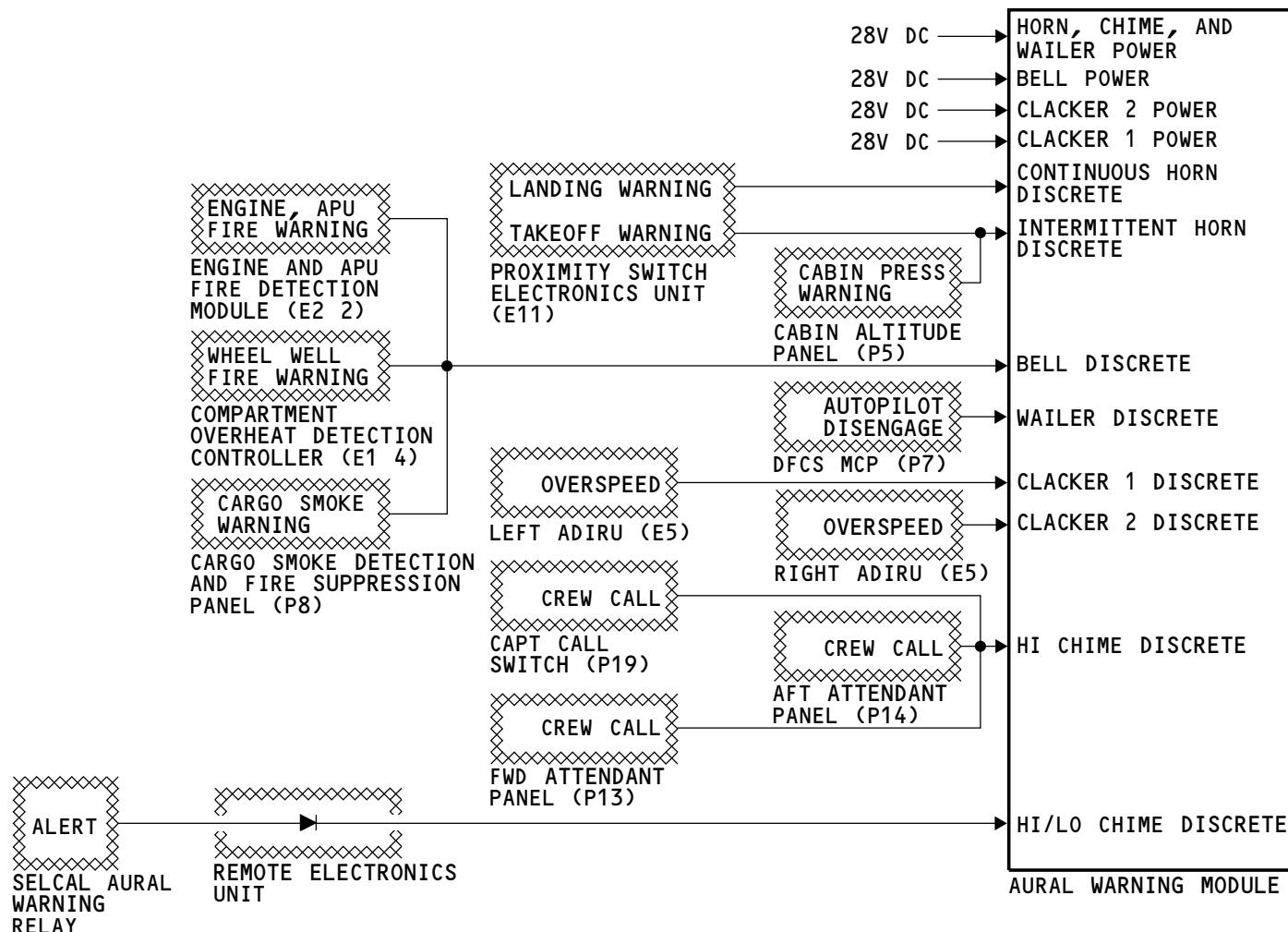
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AURAL WARNING SYSTEM - SUMMARY

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MASTER CAUTION SYSTEM - INTRODUCTION

General

The master caution system provides a visual alert to the flight crew for incorrect airplane systems operation.

Abbreviations and Acronyms

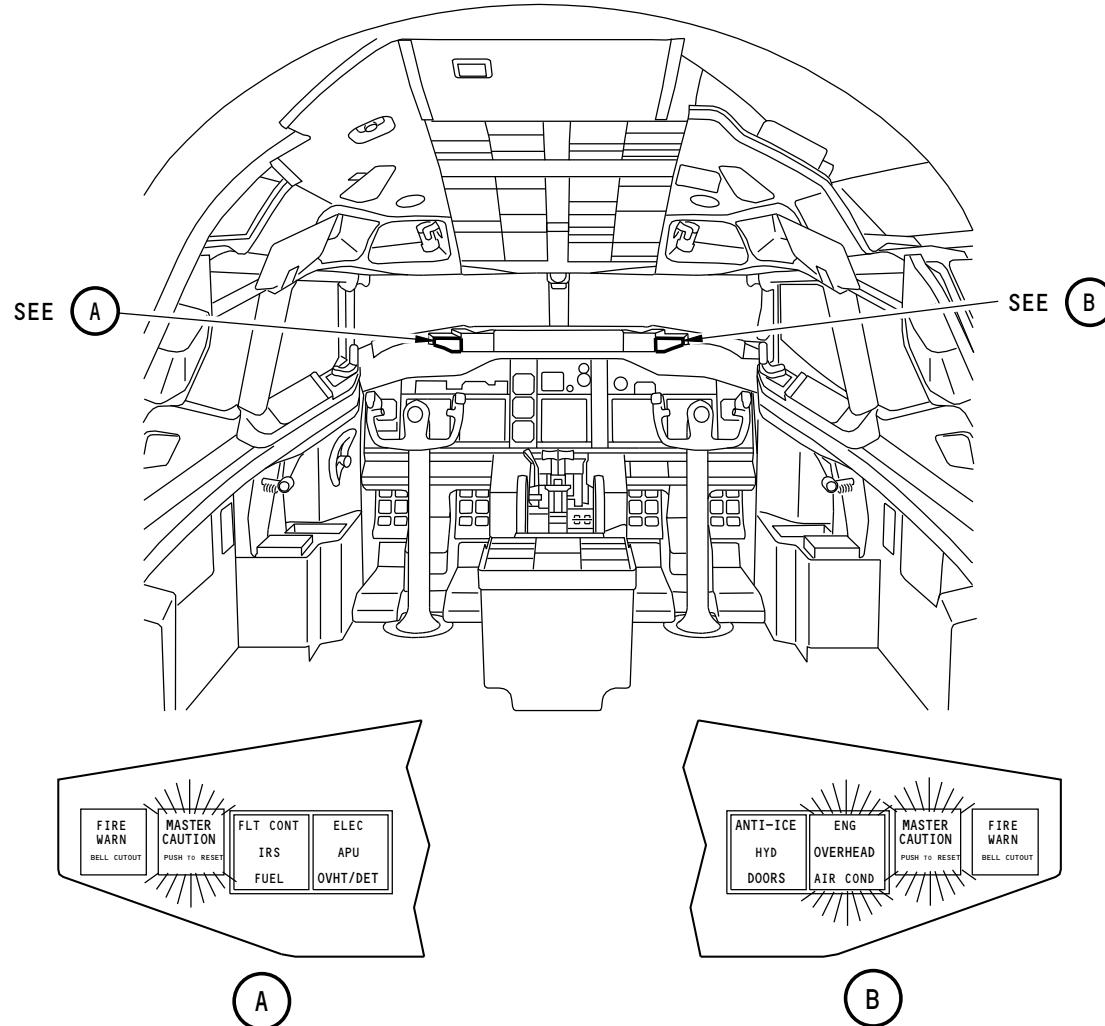
- ac - alternating current
- altn - alternate
- annun - annunciator
- APU - auxiliary power unit
- aux - auxiliary
- bat - battery
- brt - bright
- cab - cabin
- capt - captain
- cond - condition/conditioning
- cont - control
- cowl - cowling
- ctr - center
- dc - direct current
- det - detector/detection
- EEC - electronic engine control
- elec - electric/electrical
- ELT - emergency locator transmitter
- emer - emergency
- eng - engine
- equip - equipment
- flt - flight
- F/O - first officer
- fwd - forward
- gen - generator

- GPS - global positioning system
- hyd - hydraulic
- inop - inoperative
- IRS - inertial reference system
- L - left
- Lt - light
- ma wrn - master warning
- ovht - overheat
- oxy - oxygen
- press - pressure
- PSEU - proximity system electronics unit
- pwr - power
- R - right
- rcdn - recorder
- rec - recorder
- sched - scheduled
- stby - standby
- sw - switch
- temp - temperature
- v - volts
- warn - warning

EFFECTIVITY

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MASTER CAUTION SYSTEM - INTRODUCTION
31-52-00



MASTER CAUTION SYSTEM - GENERAL DESCRIPTION

General

The master caution system receives discrete ground signals from many airplane systems. The discrete ground signals cause the MASTER CAUTION lights and the system annunciator lights to come on. This gives a visual alert of system failures.

Hydraulic Panel

The hydraulic panel causes both MASTER CAUTION lights and the HYD light on the right system annunciator lights to come on when one or more of these hydraulic system lights come on:

- System A Elec 2 Low Press
- System A Elec 2 Overheat
- System A Eng 1 Low Press
- System B Elec 1 Low Press
- System B Elec 1 Overheat
- System B Eng 2 Low Press.

Flight Control Panel

The flight control panel causes both MASTER CAUTION lights and the FLT CONT light on the left system annunciator lights to come on when one or more of these flight control system lights come on:

- Speed Trim
- Feel Diff Press
- Flt Cont A Low Press
- Flt Cont B Low Press
- Auto Slat Fail
- Mach Trim Fail
- Stby Hyd Low Press
- Stby Hyd Low Quantity
- Yaw Damper.

Generator Drive and Standby Power Panel

The generator drive and standby power panel causes both MASTER CAUTION lights and the ELEC light on the left system annunciator lights to come on when one or more of these lights come on:

- Batt Discharge
- TR Unit
- Elec
- Gen 2 Xfr Bus Off
- Gen 2 Source Off
- Gen 1 Xfr Bus Off
- Gen 1 Source Off
- Standby Power Off.

APU Indicator Panel

The APU indicator panel causes both MASTER CAUTION lights and the APU light on the left system annunciator lights to come on when one or more of these APU lights come on:

- APU Low Oil Press
- APU Fault
- APU Overspeed.

Fuel Control Panel

The fuel control panel causes both MASTER CAUTION lights and the FUEL light on the left system annunciator lights to come on as follows:

- When the Eng 1 Filter Bypass light comes on
- When the Eng 2 Filter Bypass light comes on
- When both Tank 1 Fwd and Aft Low Press lights come on
- When both Tank 2 Fwd and Aft Low Press lights come on
- When the Ctr Tank L Low Press light comes on
- When the Ctr Tank R Low Press comes on.

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EFFECTIVITY

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MASTER CAUTION SYSTEM - GENERAL DESCRIPTION

- There is a 10 second delay after the fuel LOW PRESSURE light comes on, before the master caution lights come on.

Overheat/Fire Protection Panel

The overheat/fire protection panels causes both MASTER CAUTION lights and the OVHT/DET light on the left system annunciator lights to come on when one or more of these system lights come on:

- Eng 1 Overheat
- Eng 2 Overheat
- APU Det Inop.

Air Conditioning/Bleed Air Control Panel

The air conditioning/bleed air control panel causes both MASTER CAUTION lights and the AIR COND light on the right system annunciator lights to come on when one or more of these air conditioning system lights come on:

- L Pack Off
- R Pack Off
- Cont Cab Zone Temp
- Fwd Cab Zone Temp
- Aft Cab Zone Temp
- Auto Fail
- Off Sched Descent
- L Wing Body Ovht
- R Wing Body Ovht
- L Bleed Trip Off
- Dual Bleed
- R Bleed Trip Off.

Window Heat and Probe Heat Panels

The window heat and probe heat panels cause the MASTER CAUTION lights and the ANTI-ICE light on the right system annunciator lights to come on when one or more of these lights come on:

- Capt Pitot
- F/O Pitot
- L Elevator Pitot
- Aux Pitot
- Temp Probe
- R Elevator Pitot
- L Alpha Vane
- R Alpha Vane
- Eng 1 Cowl Anti-Ice
- Eng 2 Cowl Anti-Ice
- L Front Window Ovht
- R Front Window Ovht
- L Side Window Ovht
- R Side Window Ovht.

Engine Panel

The engine panel causes both MASTER CAUTION lights and the ENG light on the right system annunciator lights to come on when one or more of these lights come on:

- Eng 1 Reverser Fault
- Eng 1 EEC Altn Sw
- Engine 1 Engine Control
- Eng 2 Reverser Fault
- Eng 2 EEC Altn Sw
- Engine 2 Engine Control.

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MASTER CAUTION SYSTEM - GENERAL DESCRIPTION

System Annunciators

The system annunciators cause both MASTER CAUTION lights and the DOORS light on the right system annunciator lights to come on when one or more of these lights come on:

- Fwd Cargo Door
- Aft Cargo Door
- Fwd Service Door
- Aft Service Door
- Fwd Entry Door
- Aft Entry Door
- Equipment Door
- Overwing Exit Door.

IRS Master Caution Unit

The IRS master caution unit causes both MASTER CAUTION lights and the IRS light on the left system annunciator lights to come on when one or more of these lights come on:

| AKS 001-013, 015-018, 020-025

- GPS Fault

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- L Fault
- L On DC
- L DC FAIL
- R Fault
- R On DC
- R DC Fail.

Flight Recorder/Mach Airspeed Warning Panel

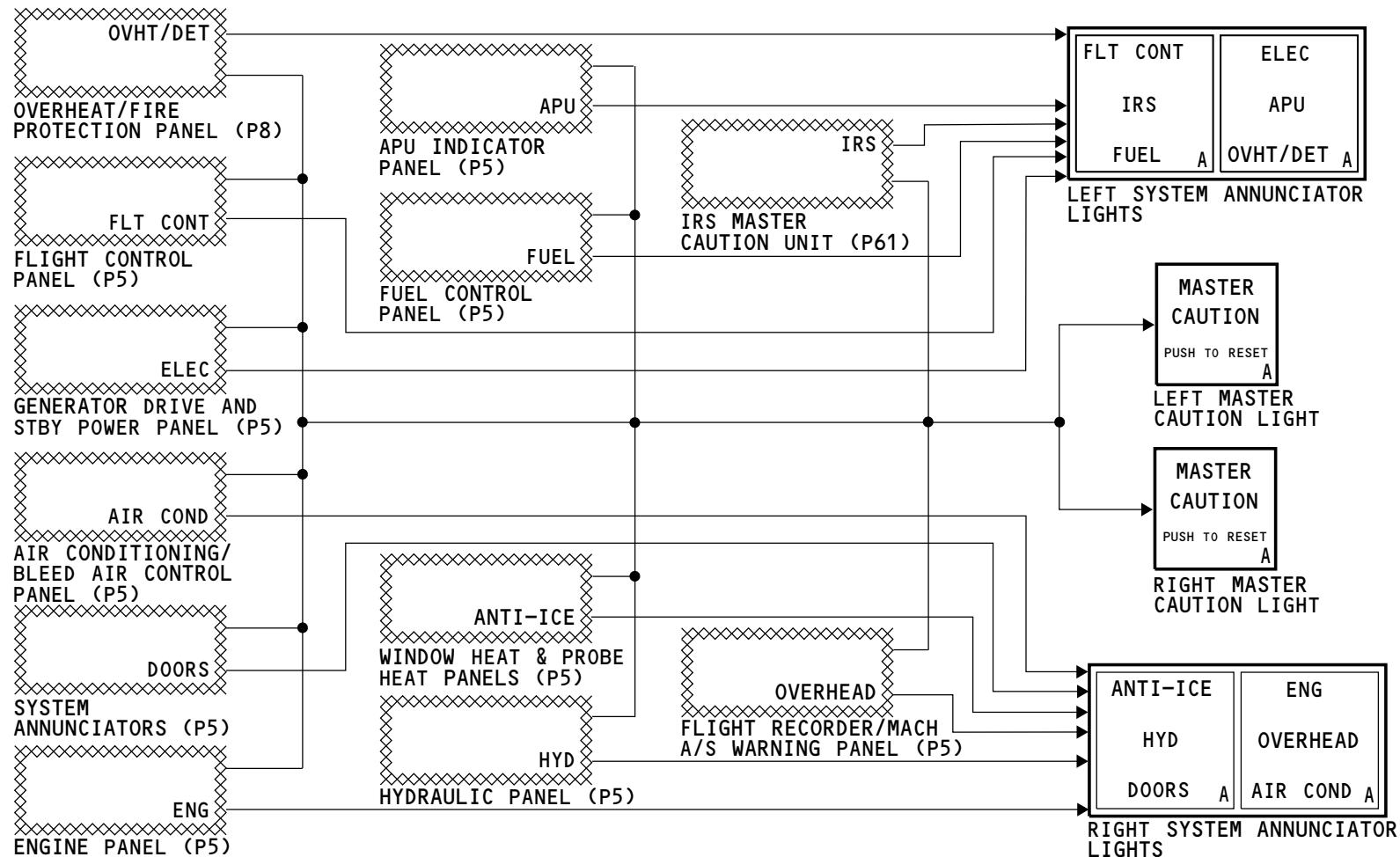
The flight recorder/Mach airspeed warning panel causes both MASTER CAUTION lights and the OVERHEAD light on the right system annunciator lights to come on when one or more of these lights come on:

- Pass Oxy On
- Emer Exit Not Armed
- Flt Rcdr Off
- ELT
- Equip Cooling Exhaust Off
- Equip Cooling Supply Off
- PSEU Fault.

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MASTER CAUTION SYSTEM - GENERAL DESCRIPTION

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MASTER CAUTION SYSTEM - COMPONENT LOCATION - FLIGHT COMPARTMENT - 1

General

The components for the master caution system are in the flight compartment.

Master Caution System Components

These are the master caution system components on the P7 glareshield panel:

- Master caution lights
- Left system annunciator lights
- Right system annunciator lights.

Input Components

Many systems provide discrete inputs to the master caution system.

These are the components on the P5 aft overhead panel:

- IRS mode select unit
- Engine panel
- Flight recorder/Mach airspeed warning panel.

These are the components on the P5 forward overhead panel:

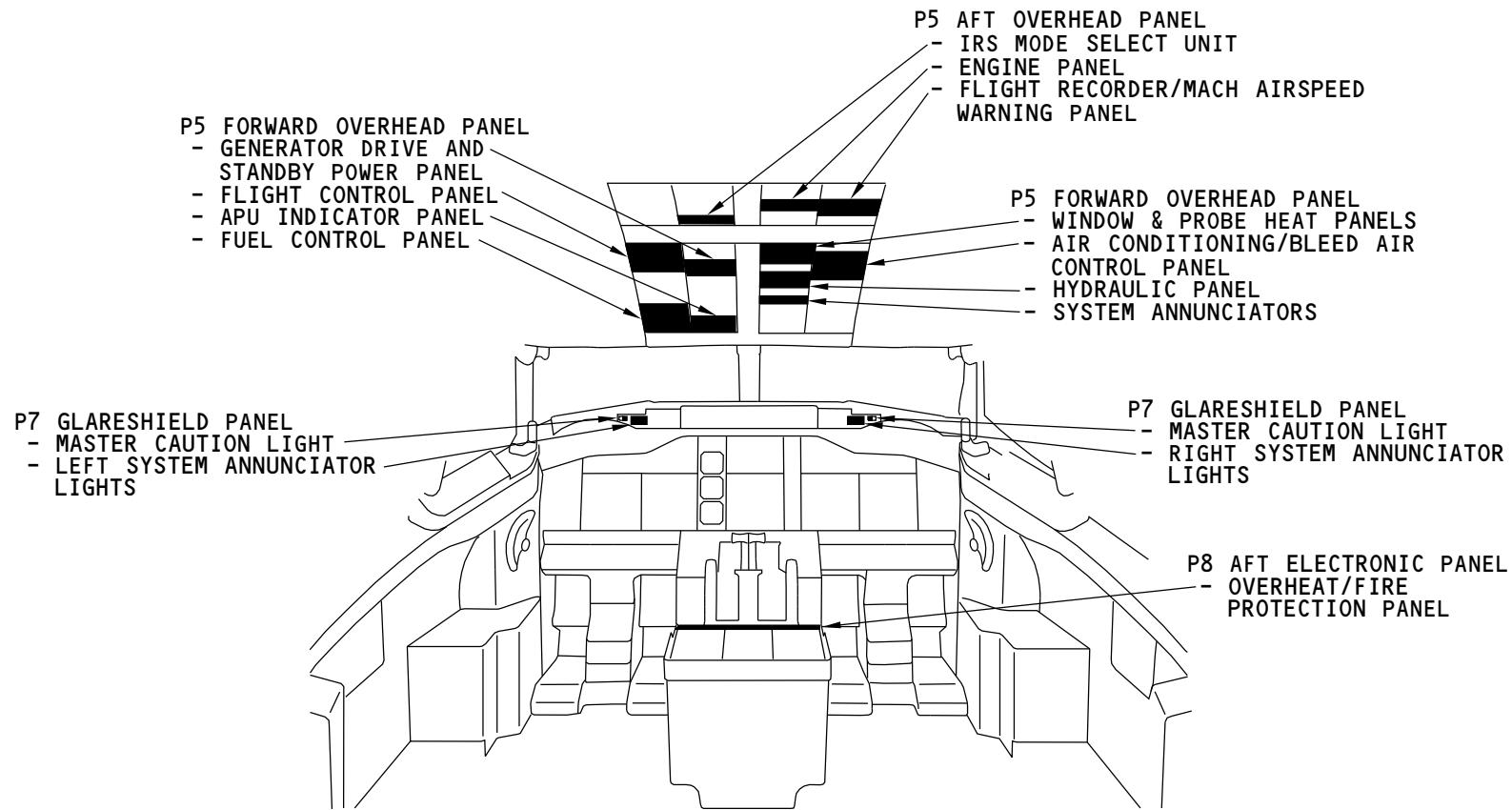
- Flight control panel
- Fuel control panel
- Generator drive and standby power panel
- APU indicator panel
- Window heat panel
- Probe heat panel
- Hydraulic panel
- System annunciators
- Air conditioning/bleed air controls panel.

The overheat/fire protection panel is on the P8 aft electronic panel.

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MASTER CAUTION SYSTEM - COMPONENT LOCATION - FLIGHT COMPARTMENT - 1



MASTER CAUTION SYSTEM - COMPONENT LOCATION - FLIGHT COMPARTMENT - 2

General

The IRS master caution unit provides discrete inputs to the master caution system. The IRS master caution unit is on the P61 panel in the flight compartment.

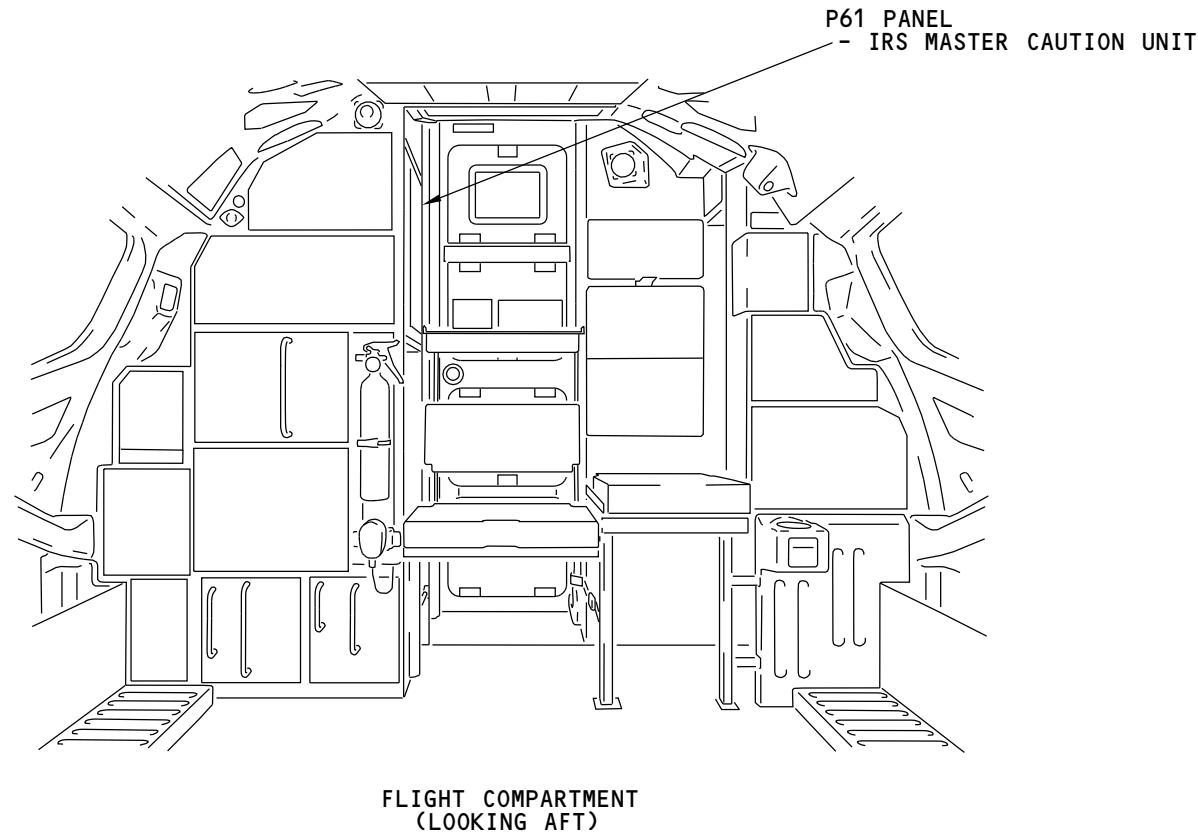
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MASTER CAUTION SYSTEM - COMPONENT LOCATION - FLIGHT COMPARTMENT - 2

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MASTER CAUTION SYSTEM - INTERFACES

Lights

The 28v dc battery bus and the 28v dc bus 1 supply power for the master caution lights and the system annunciation lights.

The 28v dc power goes through switches in the master caution lights.

The power goes through the annunciation and dimming module. When you select bright (BRT) on the master lights control on P1, the voltage is 28 volts. When you select DIM on the master lights control, the voltage is 16 volts.

Control

Power for the control of the master caution annunciation goes through separate circuit breakers on P6 to the control panels on the overhead panel (P5) and the aft electronic stand (P8).

The MASTER CAUTION ANNUNCIATOR CONT 1 circuit breaker supplies power to the logic in these panels:

- Flight control panel
- Fuel control panel.

The MASTER CAUTION ANNUNCIATOR CONT 2 circuit breaker supplies power to the logic in these panels:

- Hydraulic panel
- Window heat panel
- System annunciators.

The MASTER CAUTION ANNUNCIATOR CONT 3 circuit breaker supplies power to the logic in these panels:

- Air conditioning/bleed air control panel
- Engine panel.

The MASTER CAUTION ANNUNCIATOR CONT 4 circuit breaker supplies power to the logic in these panels:

- IRS master caution unit

- Flight recorder/Mach airspeed warning panel.

The DC BUS INDICATION BAT circuit breaker supplies power to the logic in the APU indicator panel and the generator drive and standby power panel.

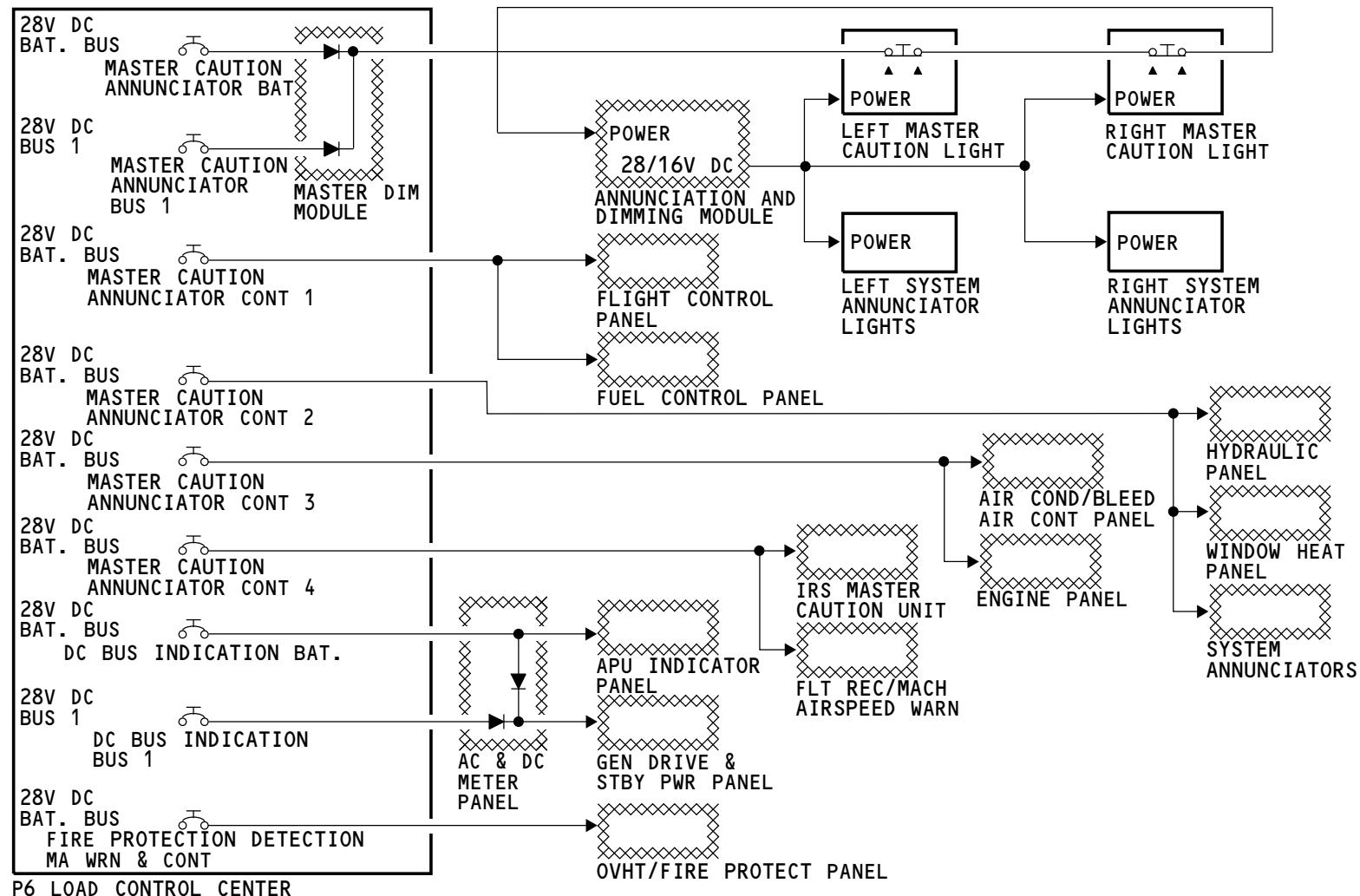
The DC BUS INDICATION BUS 1 circuit breaker supplies power to the logic in the generator drive and standby power panel.

The FIRE PROTECTION DETECTION MA WRN & CONT circuit breaker supplies power to the logic in the overheat/fire protection panel.

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MASTER CAUTION SYSTEM - INTERFACES
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MASTER CAUTION SYSTEM - INTERFACES - CONTROL

Power

The 28v dc battery bus and the 28v dc bus 1 supply power for the master caution lights and the system annunciation lights.

The 28v dc power goes through switches in the master caution lights.

The power goes through the annunciation and dimming module. When you select bright (BRT) on the master lights control on P1, the voltage is 28 volts. When you select DIM on the master lights control, the voltage is 16 volts.

Control of the Master Caution Light

The control of the left and right master caution lights come from these components:

- Flight control panel
- IRS master caution unit
- Flight control panel
- Generator drive and standby power panel
- APU indicator panel
- Overheat/fire protection panel
- Window heat panel
- Hydraulic panel
- System annunciations
- Engine panel
- Flight recorder/Mach airspeed warning panel
- Air conditioning/bleed air control panel.

The annunciation and dimming module receive these discrete signals. When any one of the discrete signals is at ground, the annunciation and dimming module sends a master caution signal (ground) on the control line. This causes both master caution lights to come on.

The annunciation and dimming module sends the master caution signal to the flight data acquisition unit.

Control of the System Annunciator Lights

The control of the left system annunciation lights come from these components:

- Flight control panel (FLT CONT)
- IRS master caution unit (IRS)
- Flight control panel (FUEL)
- Generator drive and standby power panel (ELEC)
- APU indicator panel (APU)
- Overheat/fire protection panel (OVHT/DET).

The control of the right system annunciation lights come from these components:

- Window heat panel (ANTI-ICE)
- Hydraulic panel (HYD)
- System annunciations (DOORS)
- Engine panel (ENG)
- Flight recorder/Mach airspeed warning panel (OVERHEAD)
- Air conditioning/bleed air control panel (AIR COND).

Reset of the Master Caution Light

When you push the master caution light, you remove power to all the master caution circuits. This causes the circuits to reset the master caution annunciation. These results occur:

- Master caution lights go off
- System annunciation lights go off
- Fault lights on the individual panels remain on if the panel still senses a fault.

The master caution lights and the system annunciation lights remain off until a new fault occurs.

When a new fault occurs, these lights come on:

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MASTER CAUTION SYSTEM - INTERFACES - CONTROL

- Fault light on the individual panel which senses the fault
- Master caution lights
- Light on the system annunciator which agrees with the fault.

Recall of the System Annunciator Lights

When you push and hold the system annunciator lights, the recall signal goes to all the components which cause the lights on the system annunciators to come on. This causes all the lights on the system annunciators to come on.

When you release the system annunciator lights, the system annunciator lights show only the systems which have faults.

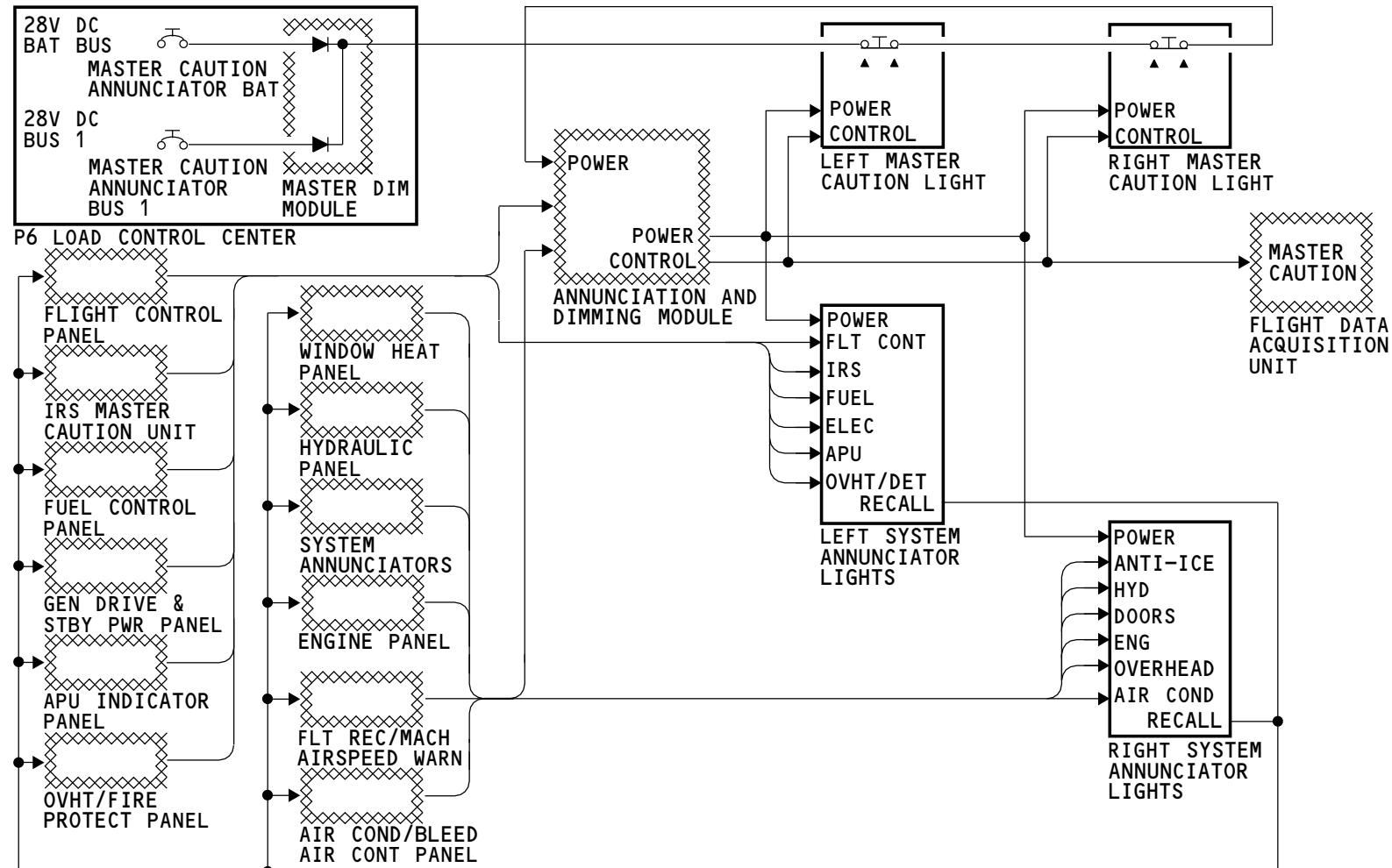
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MASTER CAUTION SYSTEM - INTERFACES - CONTROL

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TAKEOFF WARNING - INTRODUCTION

General

The takeoff warning function gives the following indications if the airplane is in an unsafe condition during takeoff or if the ground spoiler interlock valve remains open after takeoff:

- An aural warning sound
- TAKEOFF CONFIG indicator lights on the P1-3 and P3-1 panels illuminate

Abbreviations and Acronyms

- asym - asymmetry
- FSEU - flap/slat electronics unit
- gnd - ground
- LE - leading edge
- PSEU - proximity switch electronic unit
- SMYD - stall management yaw damper
- spdbk - speedbrake
- sw - switch
- TE - trailing edge
- TO - takeoff
- UCM - uncommanded motion
- warn - warning

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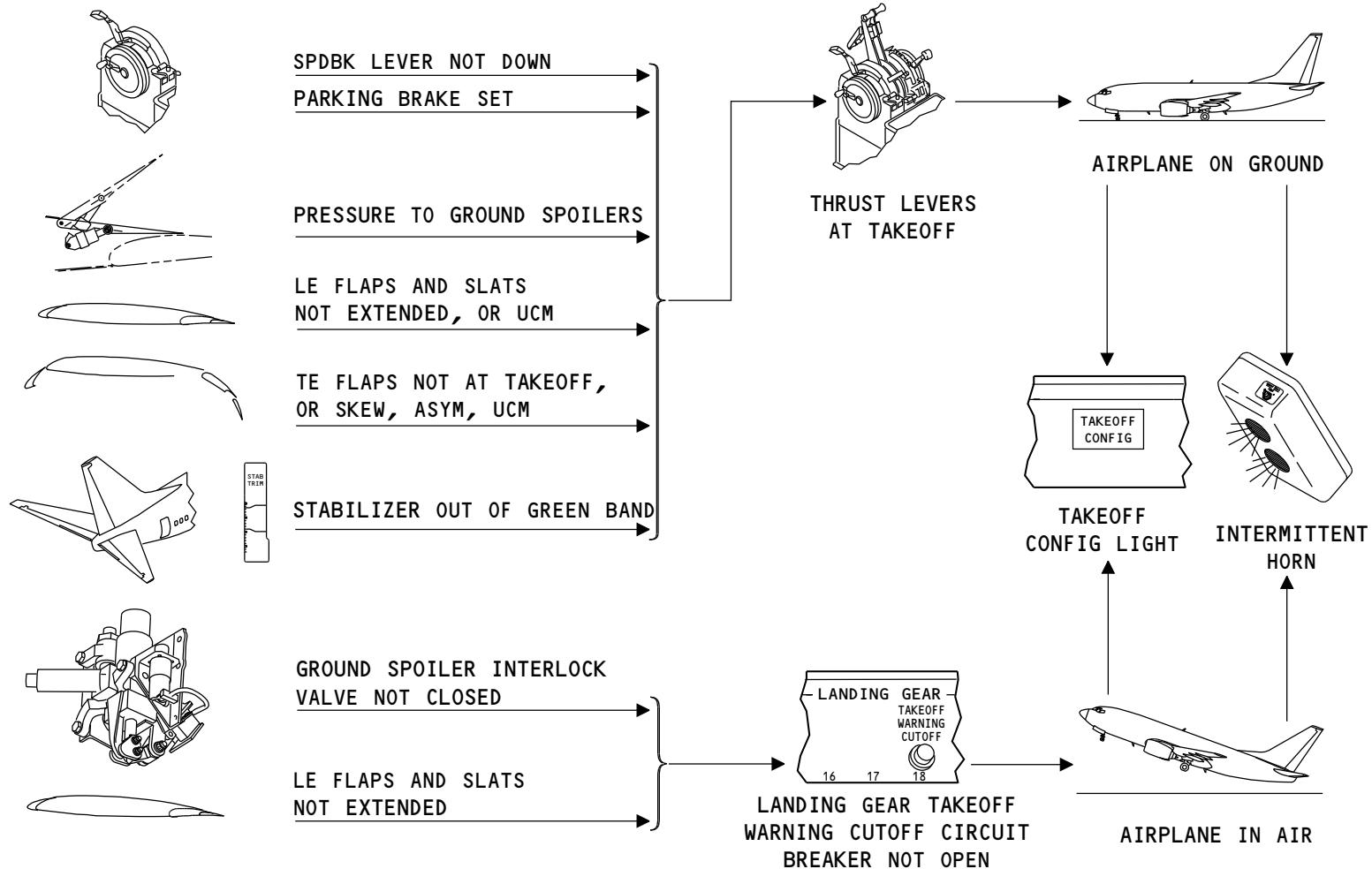
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TAKETOFL WARNING - INTRODUCTION

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TAKEOFF WARNING - FUNCTIONAL DESCRIPTION

General Description

The takeoff warning function is in the proximity switch electronics unit (PSEU). The aural warning module gives the sound of an intermittent horn for a takeoff warning on the ground and in the air.

The TAKEOFF CONFIG indicator lights on the P1-3 and P3-1 panels illuminate for a takeoff warning on the ground and in the air.

On the Ground

When the airplane is on the ground and the thrust levers are at the takeoff power position (thrust resolver angle more than 53 degrees), the aural warning system gives the takeoff warning indication if any of these conditions occur:

- Speedbrake lever is not down
- Parking brake is set
- Ground spoilers have pressure
- LE flaps and slats are not extended, or have an uncommanded motion (UCM)
- TE flaps are not in a takeoff position, or are in a skew or asymmetry condition, or have an uncommanded motion (UCM)
- Stabilizer is out of the green band.

System 1 and system 2 each calculate separate output signals and are combined for a takeoff warning. This turns on the following warning indications:

- Intermittent horn in the aural warning module
- TAKEOFF CONFIG lights illuminate

In the Air

When the airplane is in the air and the landing gear takeoff warning cutoff circuit breaker is closed, the aural warning system gives a takeoff warning sound if both of these conditions occur:

- LE flaps and slats are not extended

- Ground spoiler interlock valve is open.

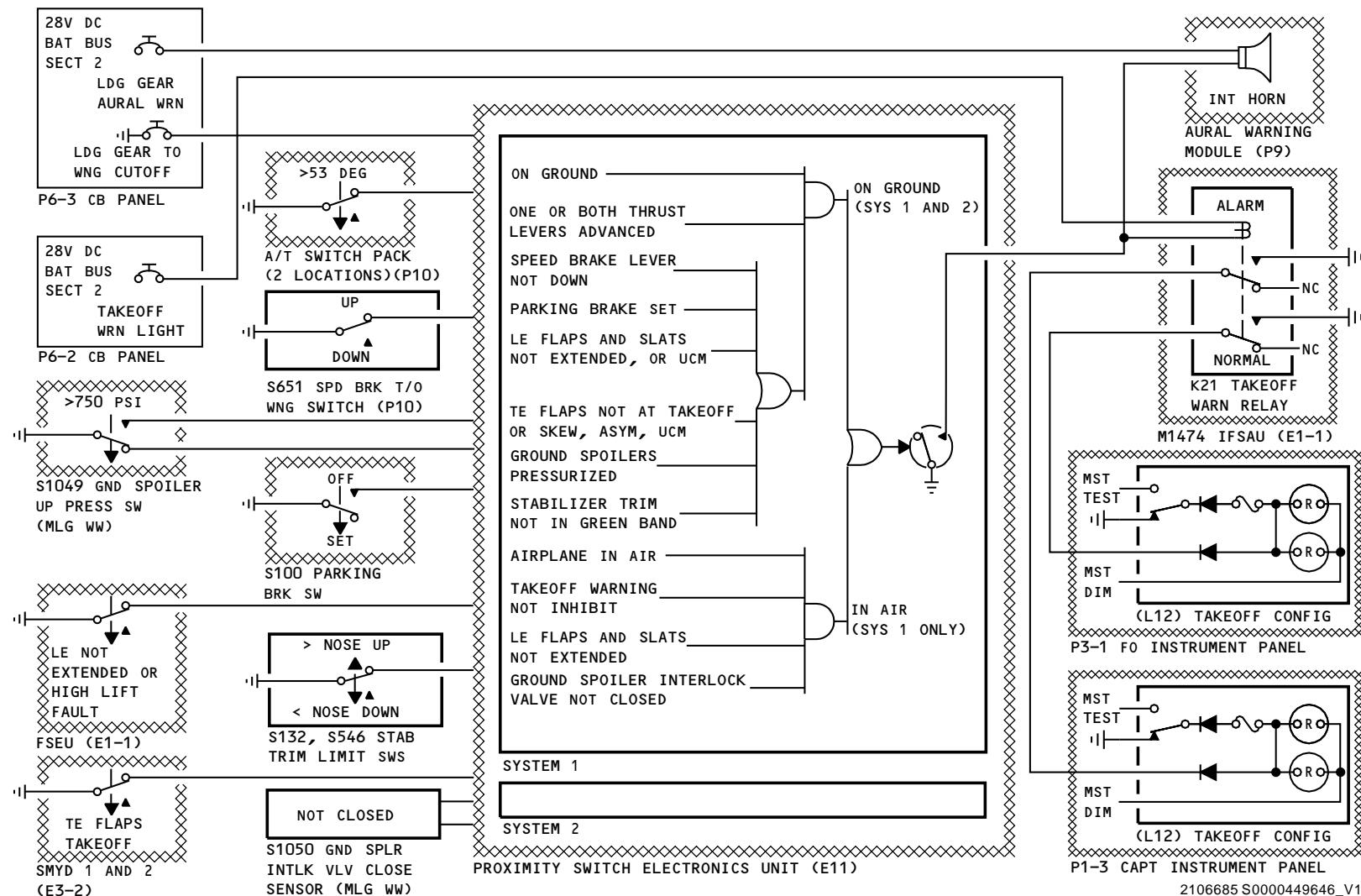
Only system 1 is used to calculate the aural warning when the airplane is in the air. This turns on the following warning indications:

- Intermittent horn in the aural warning module
- TAKEOFF CONFIG lights illuminate

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TAKEOFF WARNING - FUNCTIONAL DESCRIPTION
EFFECTIVITY
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COMMON DISPLAY SYSTEM - INTRODUCTION

General

The common display system (CDS) shows performance, navigation and engine information in many different formats on six display units in the flight compartment.

Abbreviations and Acronyms

- A/C - air conditioning
- ACMS - airplane condition monitoring system
- acq - acquisition
- ADF - automatic direction finder
- ADI - attitude director indication
- ADIRU - air data inertial reference unit
- ADL - airborne data loader
- ADR - air data reference
- alt - altitude
- altn - alternate
- ANP - actual navigation performance
- AOA - angle of attack
- app - approach
- APU - auxiliary power unit
- arpt - airport
- A/T - autothrottle
- baro - barometric
- BITE - built-in test equipment
- BLS - bezel light sensor
- capt - captain
- CCA - circuit card assembly
- CCN - compatibility class number
- CDS - common display system
- CDU - control display unit

- CL - center lower
- clb - climb
- cmd - command
- con - continuous
- CP - control panel
- crz - cruise
- ctr - center
- CU - center upper
- DEU - display electronics unit
- DFDAU - digital flight data acquisition unit
- DME - distance measuring equipment
- DSM - display select module
- dsply - display
- DU - display unit
- DUDB - display unit data base
- ECS - environmental control system
- ECU - electronic control unit
- EEC - electronic engine controller
- EFIS - electronic flight instrument system
- EGPWS - enhanced ground proximity warning system
- EGT - exhaust gas temperature
- EIS - engine indicating system
- eng - engine
- ETA - estimated time of arrival
- E-W - east-west
- FCC - flight control computer
- FD - flight director
- FDAU - flight data acquisition unit
- FF - fuel flow
- FU - fuel used

EFFECTIVITY

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COMMON DISPLAY SYSTEM - INTRODUCTION

- FMC - flight management computer
- F/O - first officer
- FPV - flight path vector
- FQPU - fuel quantity processor unit
- FSEU - flap slat electronics unit
- FT - functional test
- GA - go-around
- GCU - generator control unit
- GG - graphics generator
- GG CCA - graphics generator circuit card assembly

| AKS 014, 019, 026-999

- GLS - GNSS landing system

AKS ALL

- GNSS - global navigation satellite system
- GPS - global positioning system
- GPWC - ground proximity warning computer
- GPWS - ground proximity warning system
- G/S - glideslope
- GS - ground speed
- hdg - heading
- HIRF - high intensity radiation field
- HG - mercury
- hld - hold
- HPA - hecto pascals
- HSI - horizontal situation indication
- hyd - hydraulic
- ign - ignition
- ILS - instrument landing system
- IM - inner marker

- in - inches
- inbd - inboard
- inop - inoperative
- instr - instrument
- I/O - input/output
- IOC - input output controller
- IOP - input/output processor
- IR - inertial reference
- IRS - inertial reference system
- kg - kilograms
- km - kilometer
- L - left
- lb - pounds
- LC - lower center
- LCD - liquid crystal display
- LIB - left inboard
- LNAV - lateral navigation
- LOB - left outboard
- loc - localizer
- LRU - line replaceable unit
- LSK - line select key
- mag - magnetic
- MASI - mach air speed indication
- MCDU - multi-purpose control display unit
- MCP - mode control panel
- MFD - multi-function display
- mins - minimums
- MM - middle marker
- MMO - mach, maximum operating
- MMR - multi-mode receiver

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COMMON DISPLAY SYSTEM - INTRODUCTION

- mtrs - meters
- N1 - engine fan speed
- N2 - engine core speed
- nav - navigation
- NCD - no computed data
- ND - navigation display
- NM - nautical miles
- NPS - navigation performance scales
- N-S - north-south
- NV - non-volatile
- norm - normal
- OM - outer marker
- OPC - operational program configuration
- OPS - operational software
- outbnd - outboard
- PDL - portable data loader
- PFD - primary flight display
- pln - plan
- pos - position
- pri - primary
- PROM - programmeable read only memory
- pth - path
- PWS - predictive windshear system
- R - right
- R-CLB - reduced thrust climb
- R-TO - reduced thrust take off
- RA - radio altitude
- RAM - random access memory
- rcv - receiver
- ref - reference
- RIB - right inboard
- RLS - remote light sensor
- RNP - required navigation performance
- ROB - right outboard
- rst - reset
- SDI - source destination identifier
- sel - select
- SMYD - stall management yaw damper
- spd - speed
- SSEC - static source error correction
- SSM - sign status matrix
- sta - station
- STD - standard
- SWDL - software data loader
- TAI - thermal anti-ice
- TAS - true airspeed
- TAT - total air temperature
- TCAS - traffic alert and collision avoidance system
- T/E - trailing edge
- terr - terrain
- tfc - traffic
- thr - thrust
- TO - take off
- TRA - thrust resolver angle
- trk - track
- TRU - true
- UC - upper center
- vib - vibration
- vlv - valve
- VMO - velocity, maximum operating

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COMMON DISPLAY SYSTEM - INTRODUCTION

- VNAV - vertical navigation
- VOR - very high frequency omnidirectional range
- V/S - vertical speed
- VSD - vertical situation display
- VSI - vertical speed indicator
- wpt - waypoint
- WTAI - wing thermal anti-ice
- WXR - weather radar
- xmtr - transmitter

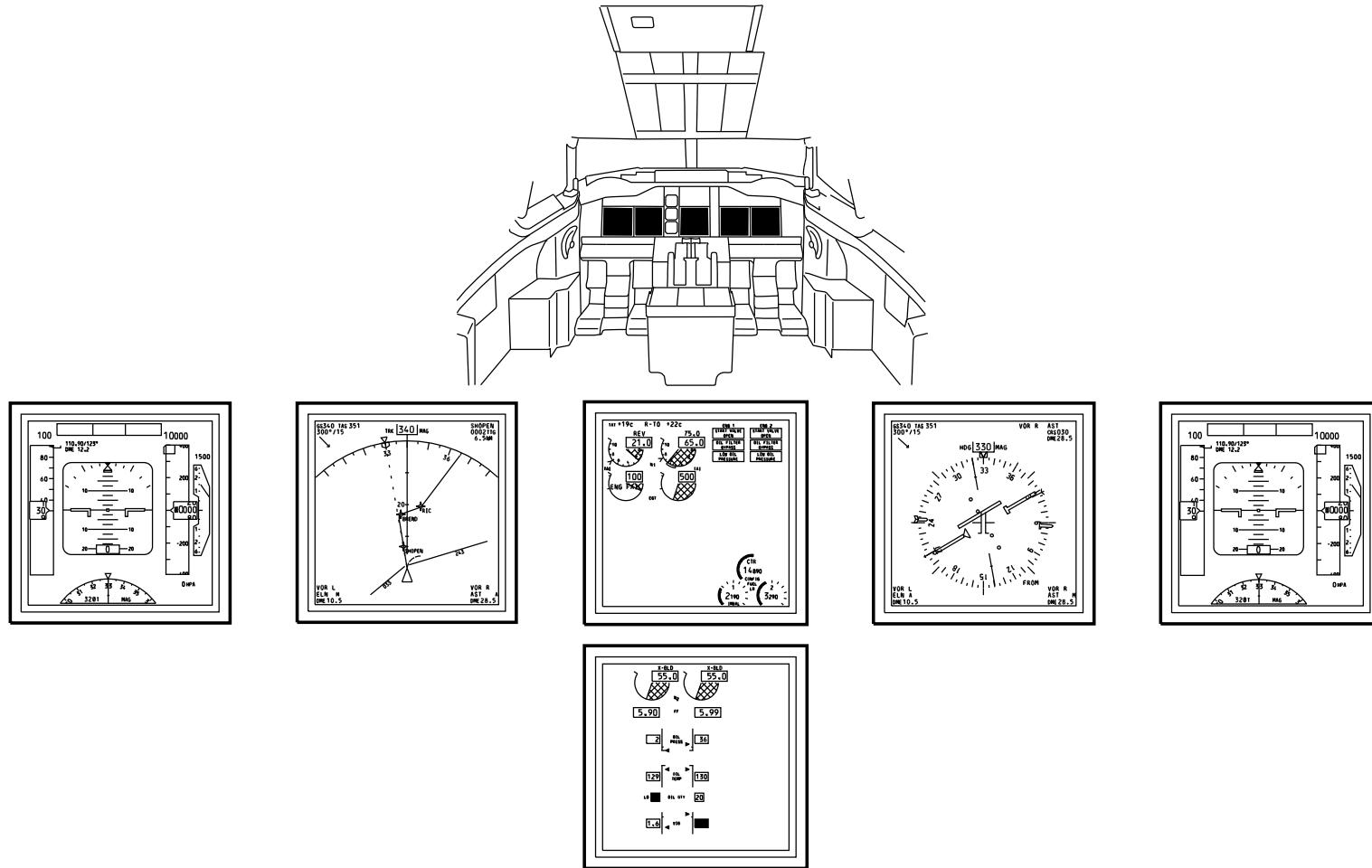
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COMMON DISPLAY SYSTEM - INTRODUCTION
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CDS - GENERAL DESCRIPTION

Purpose

The purpose of the common display system (CDS) is to supply navigation and engine information to the flight crew.

External Interfaces

The computer for the CDS is the display electronics unit (DEU). Many avionic and airframe systems interface with the DEUs. These systems send ARINC 429, analog, and discrete data to the DEUs. The DEUs send ARINC 429, analog, and discrete data to these systems.

Components

These are the components of the common display system:

- Two display select panels
- An engine display control panel
- Two EFIS control panels
- Two display source selectors
- Two display electronics units (DEUs)
- Four coax couplers
- Six identical display units (DUs)
- Two brightness control panels
- Two remote light sensors (RLSs).

Operation

These are the things that determine the information that shows on the displays units:

- Display unit status
- Display unit location
- Selections made on the control panels and modules.

These are the formats that show on the display units:

- Primary flight display (PFD)

- Navigation display (ND)
- Engine display.

Functional Description

The DEUs collect data from many avionic and airframe systems. The DEU changes this data into a video signal and sends the data out on a coax cable. A coax coupler splits the video signal and sends the data to all six display units. Both DEUs send data to all six display units.

The DEUs also are the interface between some avionic and airframe systems. For example, the DEUs receive BITE data from the electronic engine controller (EEC) and auxiliary power unit (APU). The DEUs send this data to the flight management computer. The DEUs also send EEC data to other avionic systems.

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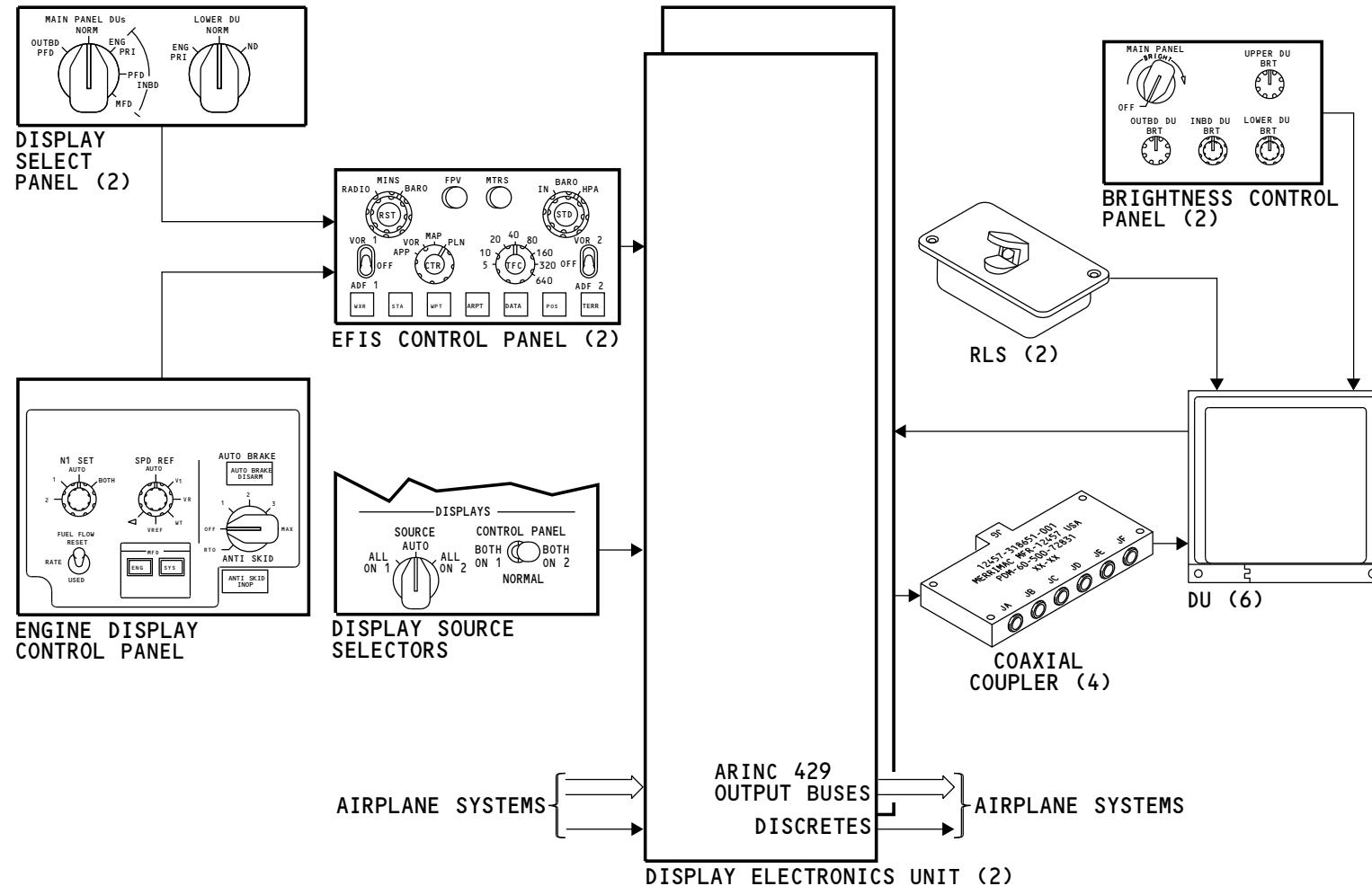
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CDS - GENERAL DESCRIPTION
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CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 1

Component location

These are the CDS components in the flight compartment:

- Left outboard DU
- Left inboard DU
- Right outboard DU
- Right inboard DU
- Upper center DU
- Lower center DU
- Captain EFIS control panel
- First officer EFIS control panel
- Captain display select panel
- First officer display select panel
- Engine display control panel
- Left remote light sensor
- Right remote light sensor
- Captain brightness controls
- First officer brightness controls
- Display source selectors.

The flight management computer system control display units (CDU) show CDS BITE data.

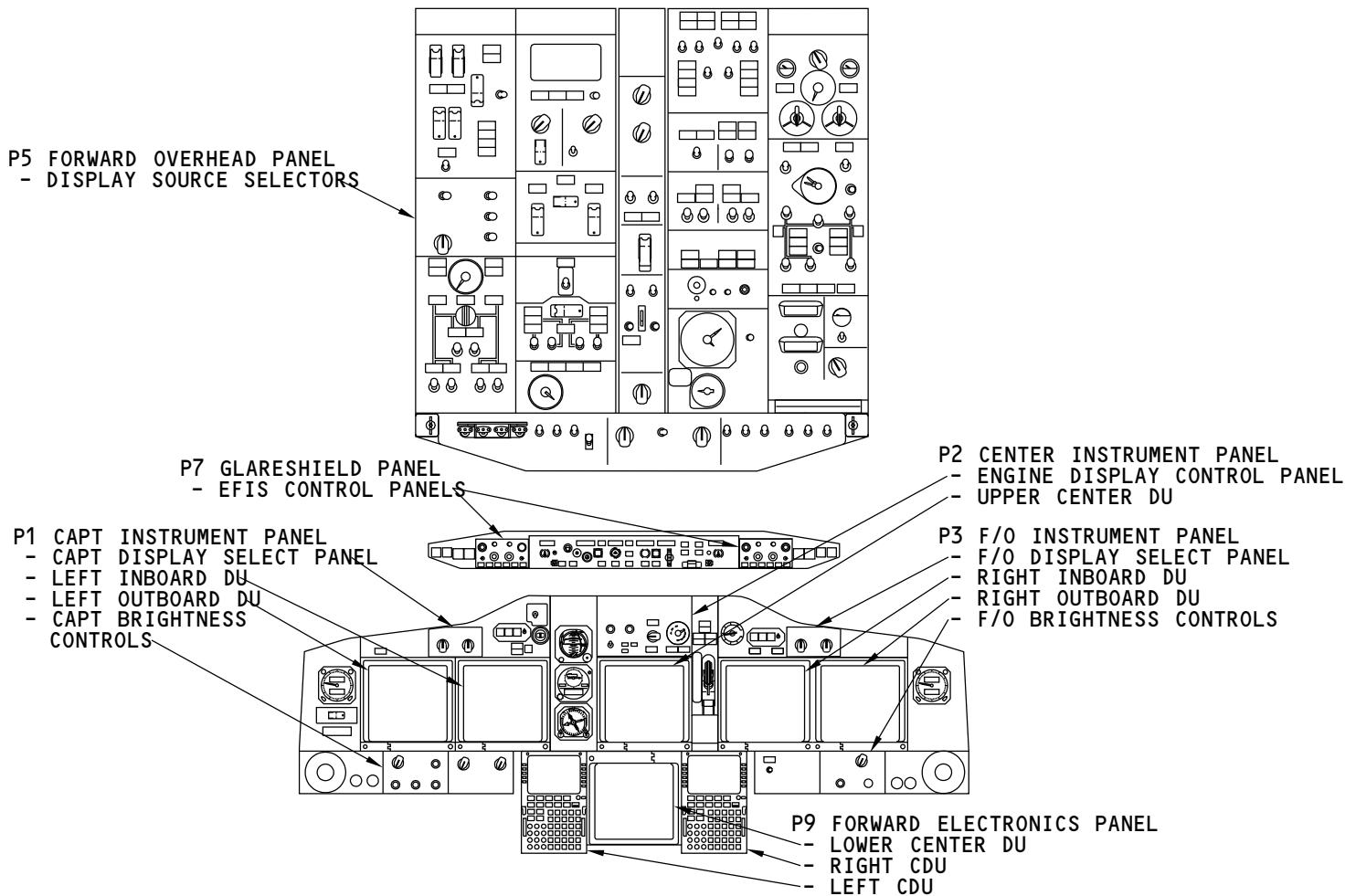
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CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 1



CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 2

Coax Couplers

There are four coax couplers. Coax couplers 1 and 3 are to the right of the captain rudder pedals. Coax couplers 2 and 4 are to the left of the first officer rudder pedals.

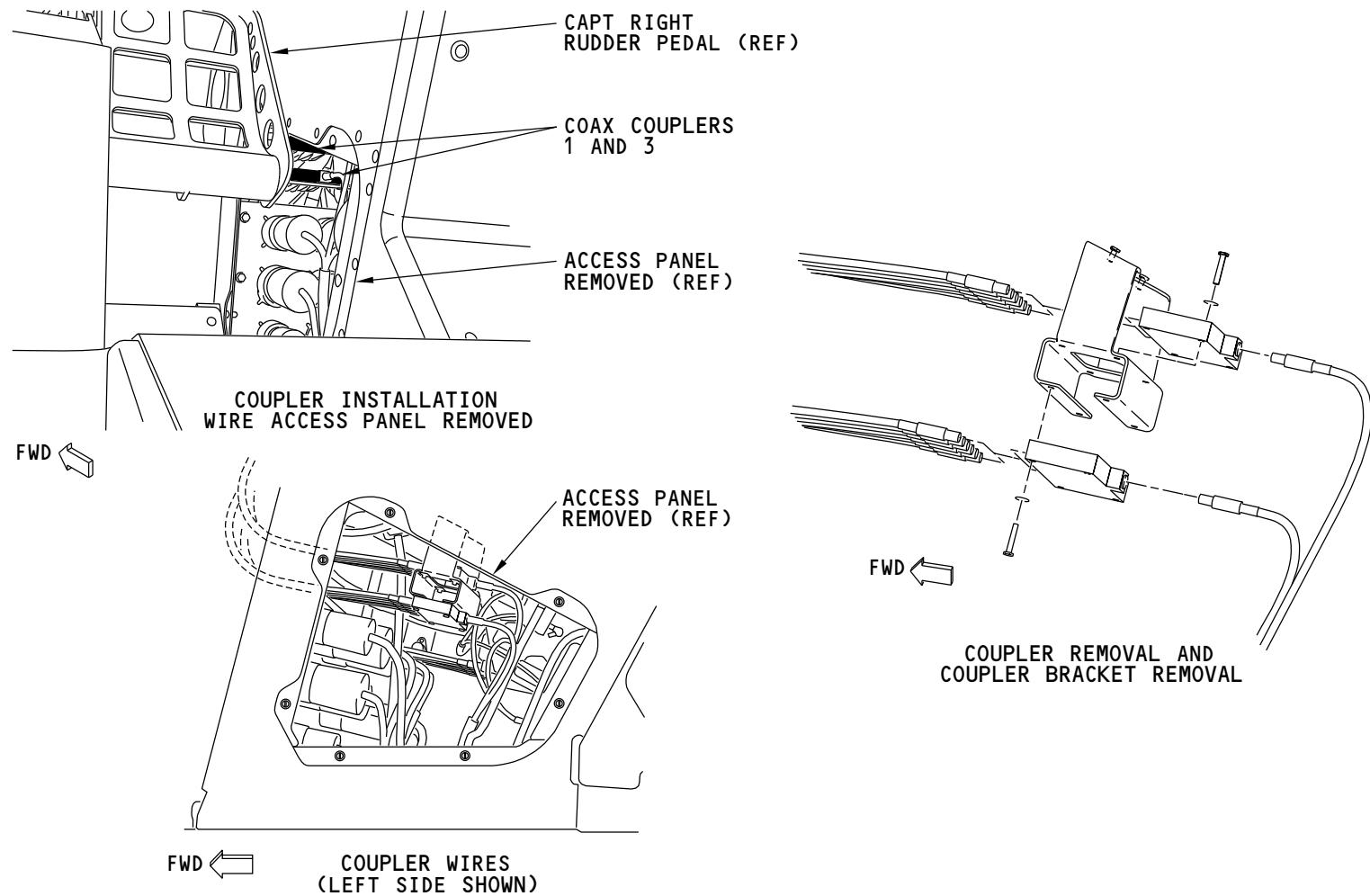
To get access to the coax couplers, remove the access panel on the inboard side of the rudder pedals. This lets you disconnect the coaxial connectors. Then remove the flight management computer (FMC) control display unit (CDU) to remove the bracket. The coax couplers are on the bracket.

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CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 2



CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 3

Remote Light Sensors

The remote light sensors are on the forward part of the glareshield. The sensors face forward.

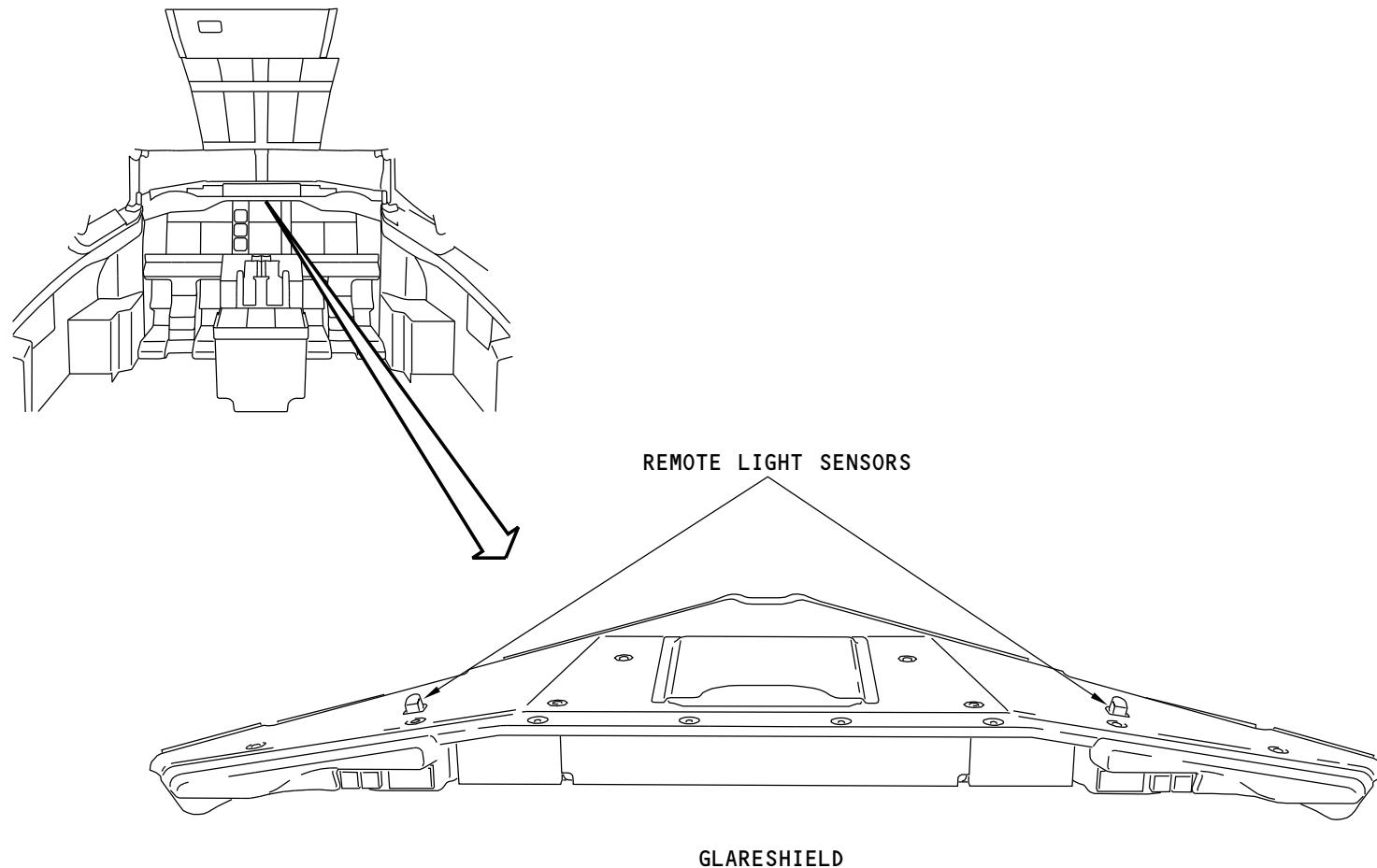
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CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 3



CDS - EE COMPARTMENT COMPONENT LOCATION

EE Compartment

The display electronics units (DEUs) are on the E3-1 shelf.

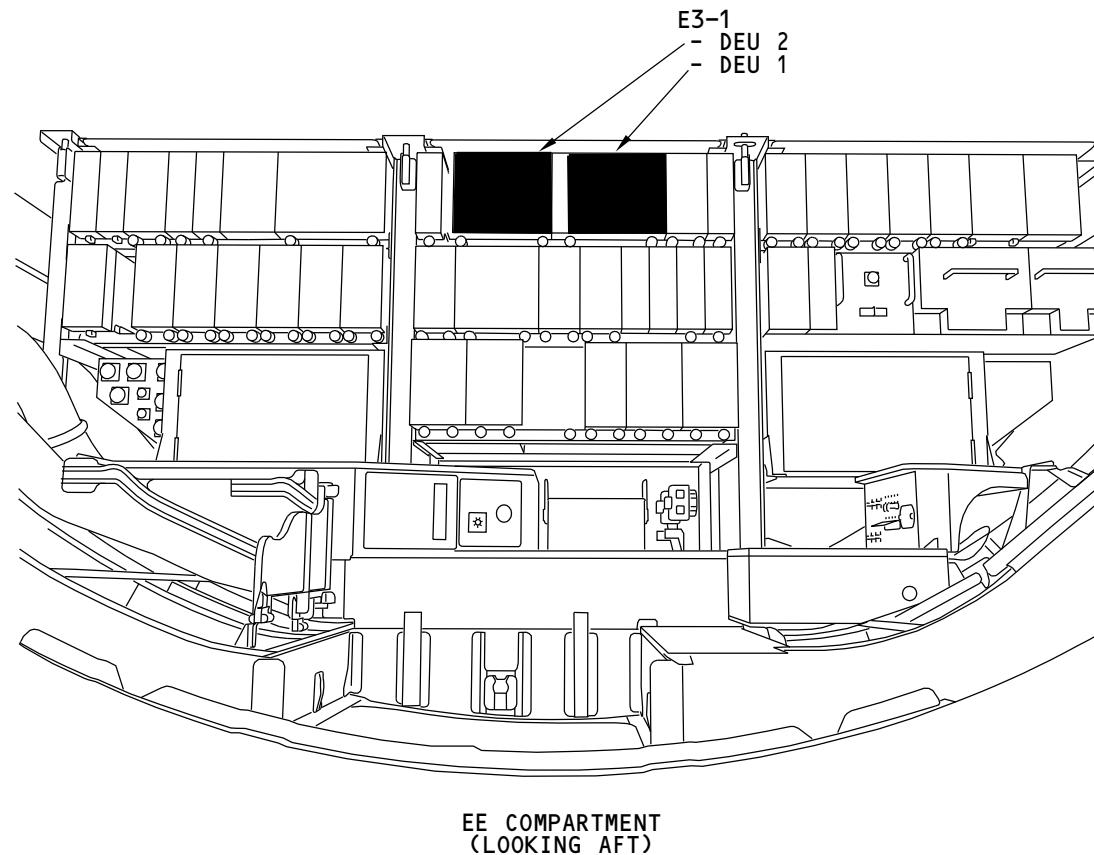
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CDS - EE COMPARTMENT COMPONENT LOCATION



CDS - POWER INTERFACES

Power

The 28v dc standby bus supplies power to these components:

- Left outboard display unit
- Left inboard display unit
- Upper center display unit
- Captain EFIS control panel
- Display electronics unit (DEU) 1.

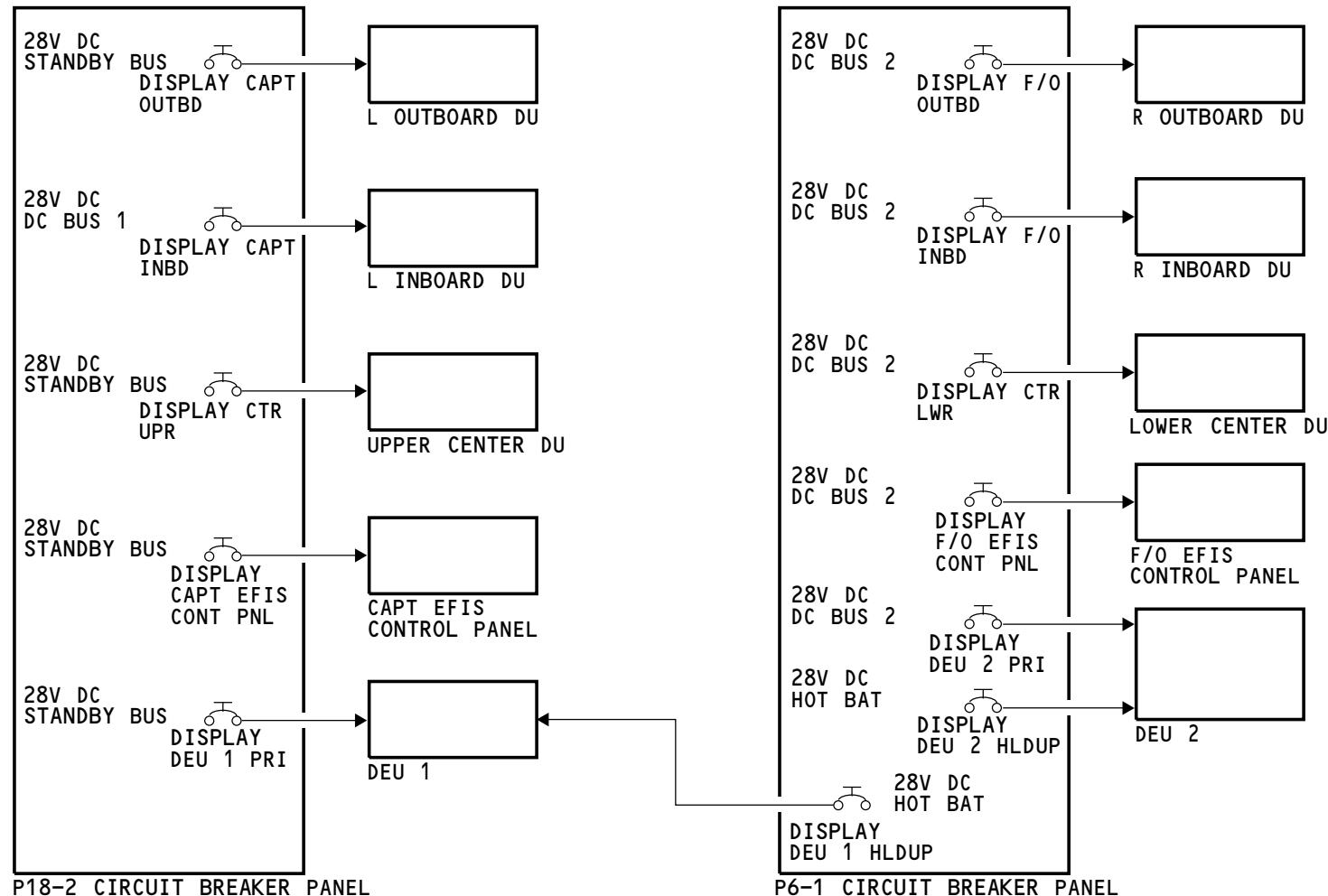
The 28v dc bus 1 supplies power to the left inboard display unit.

The 28v dc bus 2 supplies power to these components:

- Right outboard display unit
- Right inboard display unit
- Lower center display unit
- First Officer EFIS control panel
- DEU 2.

The 28v dc hot battery bus also supplies power to the DEU 1 and DEU 2. This power is called the hold up voltage. The DEU uses the hold up voltage to maintain operation during power transients. The DEU can lose the primary power for less than 2 seconds and use the hold up voltage. If the DEU loses primary power for more than 2 seconds, the DEU does a shut down. After a shut down, it will take 90 seconds to start the DEU operation.

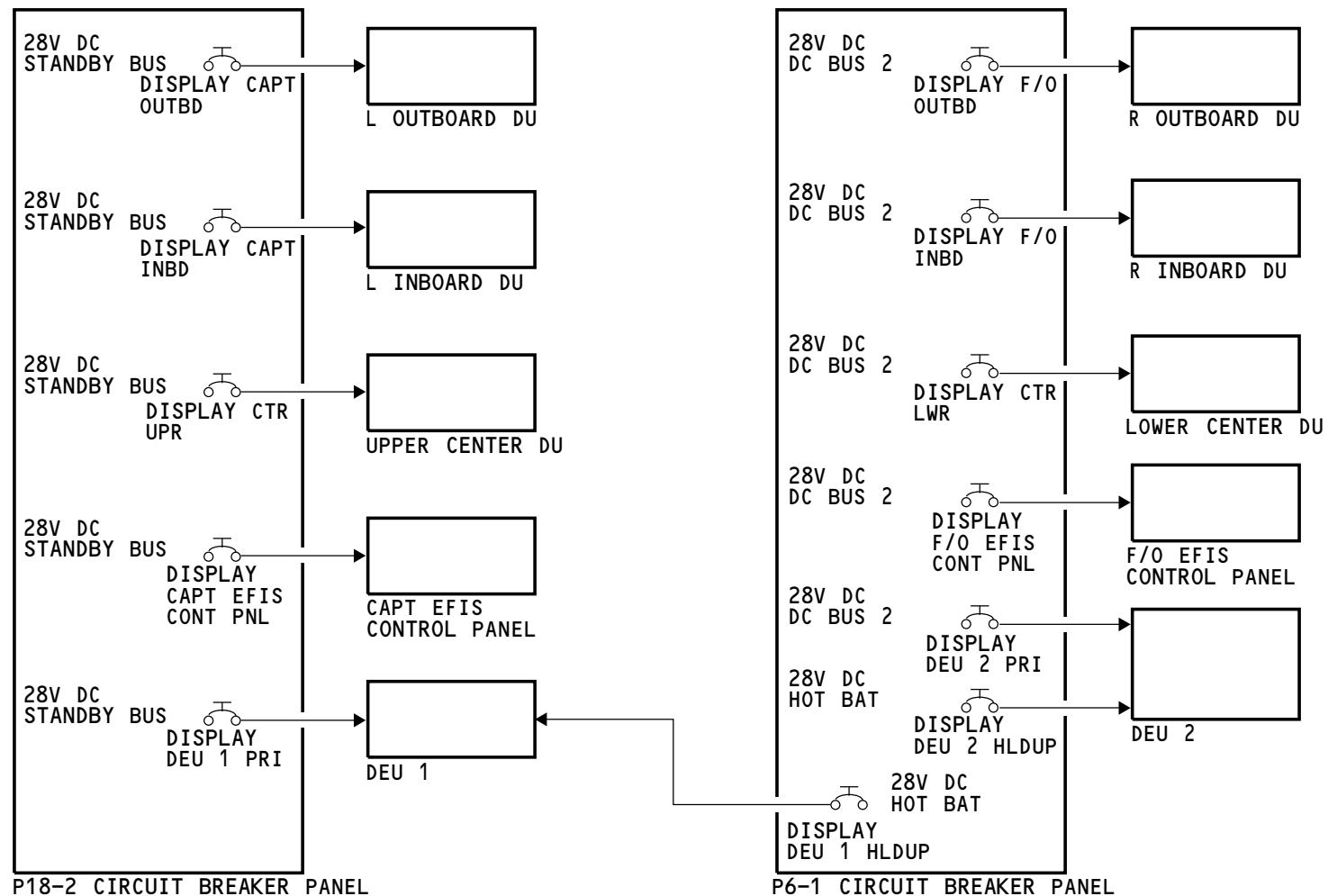
The DEU also uses the hold up voltage to shut down the DEU processor. The DEU could have faults in random access memory or be executing a command when it loses primary power. When the DEU loses primary power, it uses the hold up voltage to store any faults in nonvolatile memory and to do an orderly shut down of the processor. At this time, the DEU can use the hold up voltage for up to 10 seconds.



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CDS - POWER INTERFACES
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CDS - PROGRAM PINS INTERFACE

Program Pins

The display electronics units (DEU) and the display units (DU) have hardware program pins.

DEU Program Pins

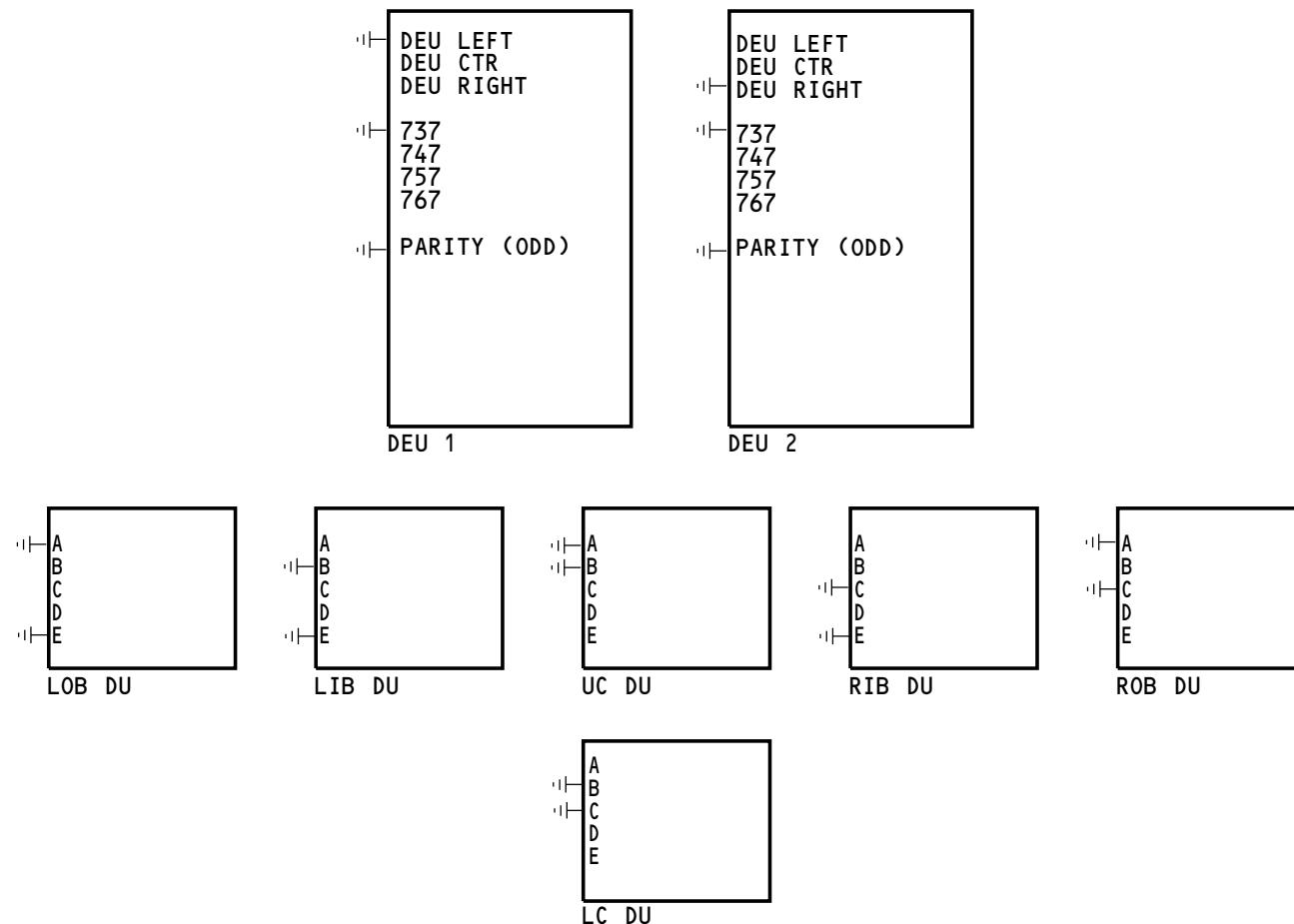
These are the two types of program pins for the DEU:

- DEU position
- Airframe type.

DU Program Pins

Each DU has different program pins grounded. The program pins identify the DU's location. These are the DU locations:

- Left outboard (LOB)
- Left inboard (LIB)
- Upper center (UC)
- Lower center (LC)
- Right inboard (RIB)
- Right outboard (ROB).



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CDS - PROGRAM PINS INTERFACE
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CDS - DISPLAY ELECTRONICS UNIT INTERFACES

General

Each display electronics unit (DEU) has two graphics generator circuit card assemblies (GG CCA). Each GG CCA can send information to all six display units (DUs).

Coaxial Cable

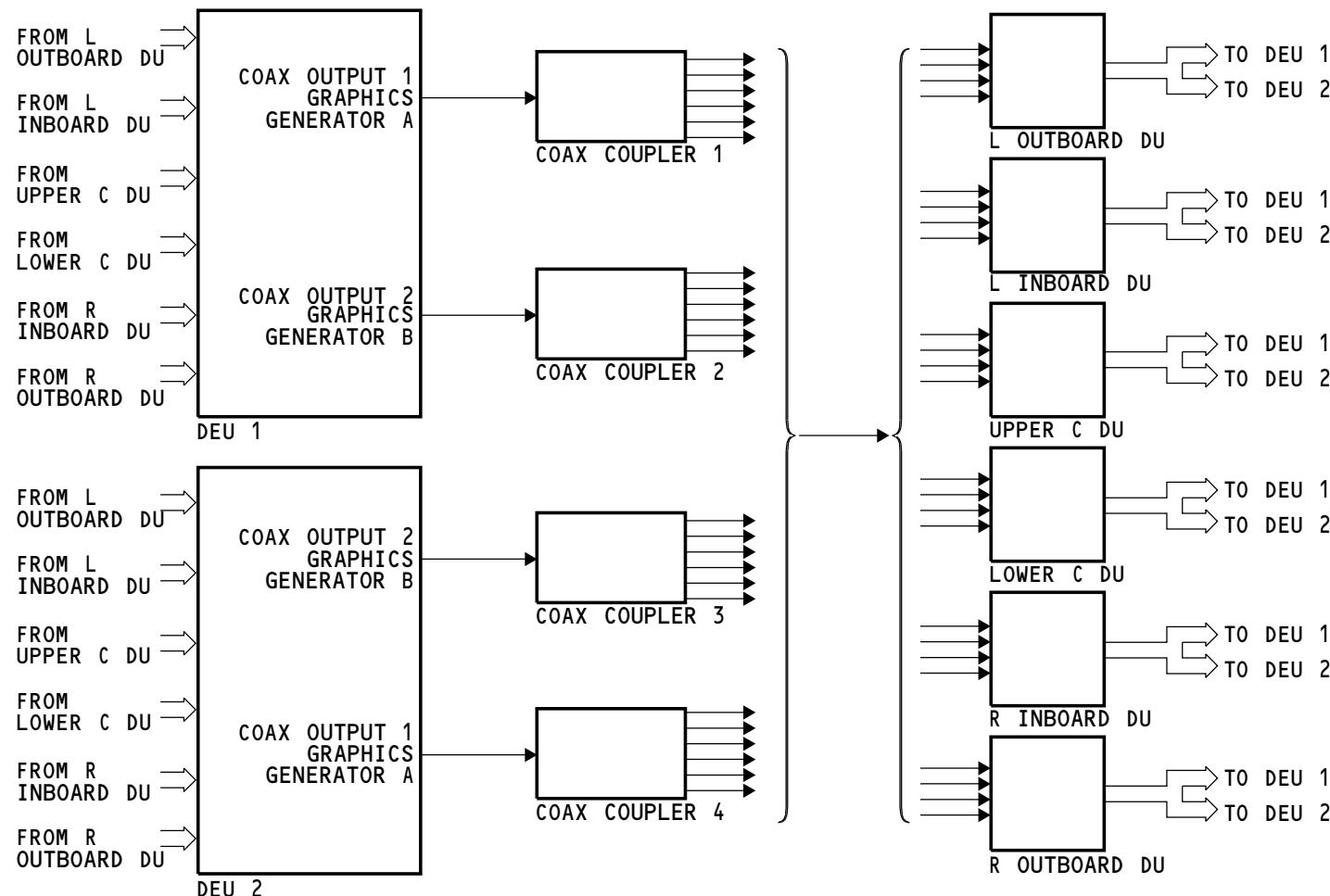
Each GG CCA sends graphic data on a coax cable to a coax coupler. The coax coupler splits the signal and sends the graphics data to each DU.

ARINC 429 Status Bus

The display units monitor themselves for failures. Detected failures go on an ARINC 429 bus back to each DEU.

The ARINC 429 status bus has this data:

- DU health data
- DU program pins
- Remote light sensor (RLS) data
- Coax connection data.



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CDS - BRIGHTNESS INTERFACES

General

The DUs get brightness control from the DEUs. These are the brightness inputs to the DEUs:

- Brightness control panel
- Remote light sensors
- Bezel light sensors.

Manual Brightness Control

The flight crew use the brightness controls to control the brightness of each display unit (DU). The left and right inboard DUs and the lower center DU also have a brightness control for the weather radar or terrain display from the ground proximity warning system display.

Each DU receives a three-wire input from a dedicated control potentiometer in the brightness control panel. These brightness control inputs are converted to a digital signal in the DUs and go to the DEUs on the ARINC 429 status bus so that the DEUs can set the manual brightness for each DU separately.

Automatic Brightness Control

The automatic brightness control function uses inputs from both the remote light sensors (RLS) on the glareshield and the bezel light sensors (BLS) on the individual DUs.

The remote light sensors send inputs to the outboard DUs and then on the ARINC 429 status bus to the DEUs. The power for the RLS is +/- 15v dc from the onside outboard DU. The DUs also send bezel light sensor values to both DEUs on this ARINC 429 bus.

The DEUs divide the DUs into these pairs for the brightness control function:

- Left outboard and inboard DUs
- Upper and lower center DUs
- Right outboard and inboard DUs.

The DEUs use the brightest value of the remote light sensor inputs and the brightest value from the bezel light sensor pairs to set the brightness of the DU pairs.

When the remote or bezel light sensors detect a rapid change to bright light in the flight compartment, the DEUs rapidly increase the DU brightness. If the ambient light decreases, the DEUs decrease the DU brightness slowly. This is similar to the way the human eye operates.

NOTE: When the DUs are very bright, the manual brightness controls do not affect the displays or have a limited effect.

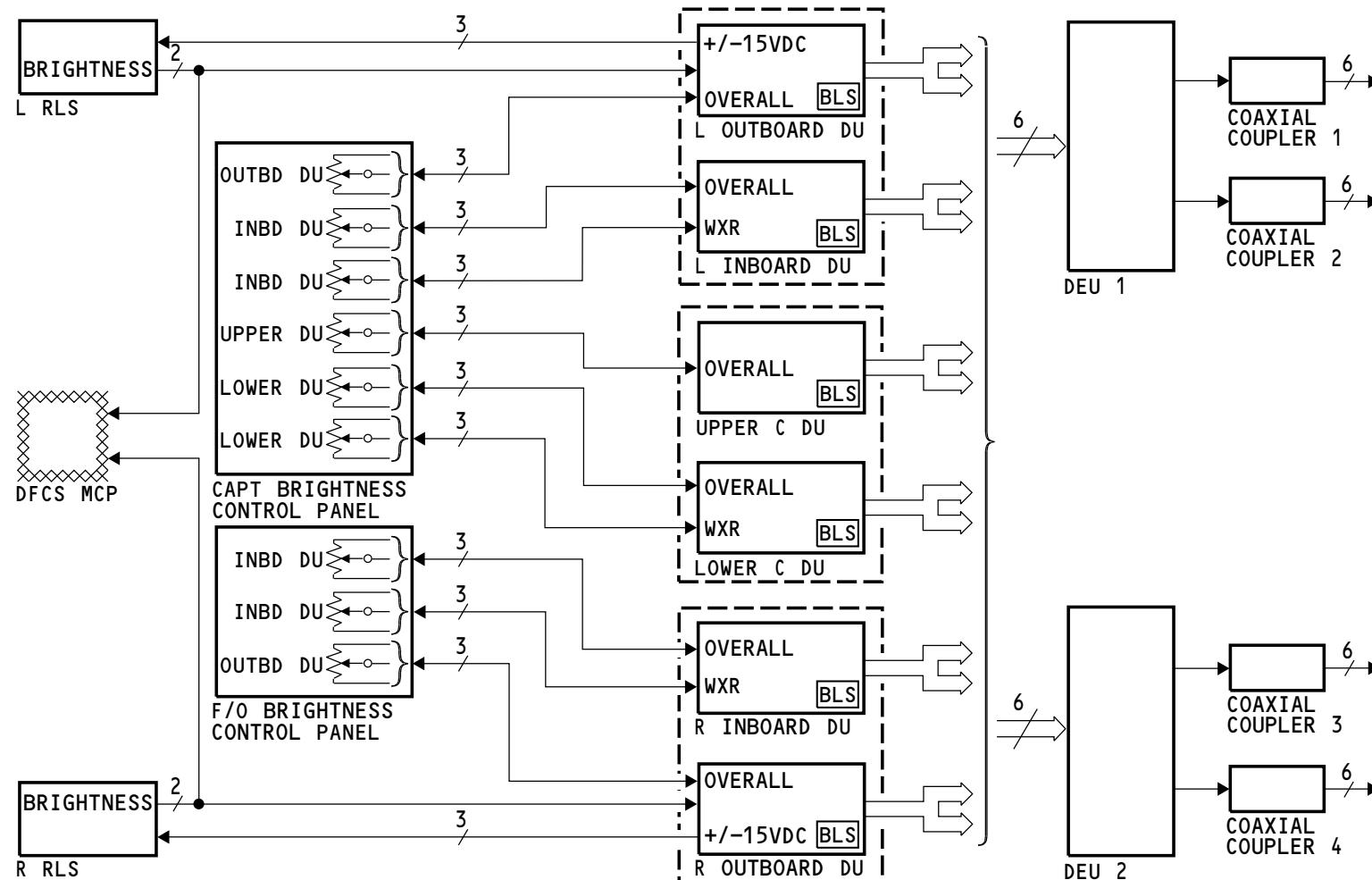
Training Information Point

The remote light sensors are monitored by the DEUs and any faults are logged in BITE.

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CDS - BRIGHTNESS INTERFACES
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CDS - CONTROLS INTERFACES

Control Panels

These are the six control panels:

- Captain's display select panel
- First officer's display select panel
- Engine display control panel
- Captain's EFIS control panel
- First officer's EFIS control panel
- Instrument switching module.

Display Select Panels

The display select panels send 8 ground discretes to each EFIS control panel. These discretes show the positions of the main panel DU selector switch and the lower DU selector switch.

Engine Display Control Panel

The engine display control panel sends 16 ground discretes to each EFIS control panel. These discretes show the N1 SET, SPD REF, fuel used/reset switch and the ENG/SYSTEM switch selection status.

EFIS Control Panels

The EFIS control panels have inputs from the display select panels and the engine display control panel. The EFIS control panels convert these ground discretes to an ARINC 429 format. This discrete data and the EFIS control panel selection data is then sent to the display electronic units (DEU).

The EFIS control panel busses have this general data:

- Minimums data
- FPV and MTRS switch status
- Baro correction data
- VOR 1/ADF 1 switch status
- Mode selection data
- Selected range data

- TFC switch status
- VOR 2/ADF 2 switch status
- Weather on/off switch status
- Map switches status
- Terrain on/off switch status
- Display select panel switch data
- Engine display control panel switch data.

Instrument Switching Module

These are two switches in this panel:

- Display source select switch
- EFIS control panel select switch.

The displays source select switch controls which DEU is supplying data to the DUs. It sends 3 ground discretes to each DEU to show switch position.

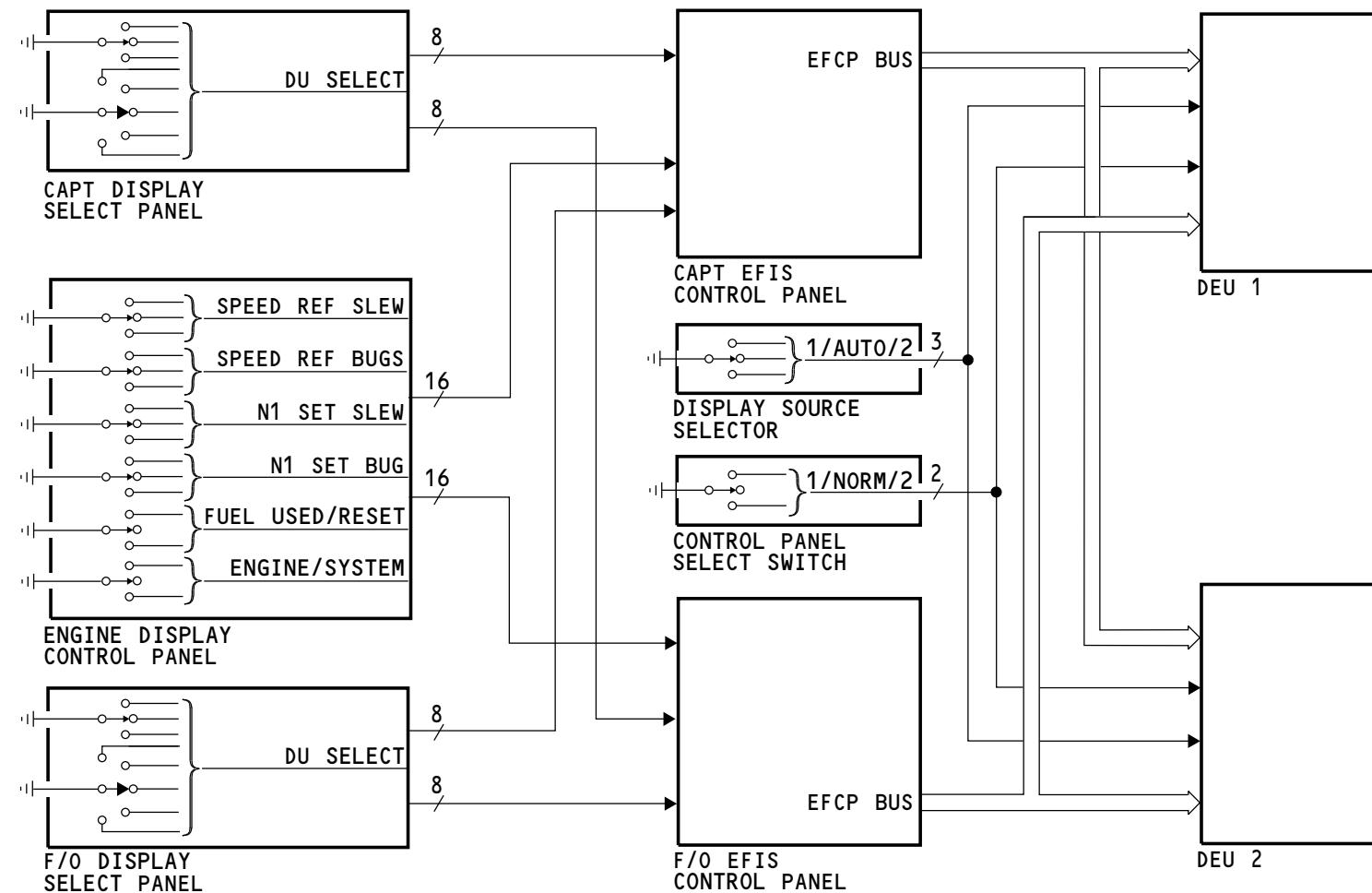
The EFIS control panel select switch determines which EFIS control panel is controlling the left and right PFD/ND displays. It sends 2 ground discretes to each DEU to show switch position.

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CDS - CONTROLS INTERFACES
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CDS - CROSS CHANNEL INTERFACES

Cross Talk Bus

Each display electronic unit (DEU) sends data on two ARINC 429 high speed cross talk buses to the other DEU. The DEUs use two buses because there is too much data to update on one bus. Usually, the two buses have different data, but some data can be transmitted on both buses.

The cross talk buses have this data:

- DEU hardware part number
- OPS software part number
- OPC software part number
- Brake temperatures 1 - 4
- N1 bug drive data (engine 1 and 2)
- SWDL status
- CDS intra system maintenance data (BITE)
- DEU analog discrete status
- DEU discrete 1
- DEU maintenance word
- CP and DU maintenance word
- Sensor status maintenance word
- Mode discrete word 1
- Display data
- DEU output bus data.

The DEU analog discrete status word has this data:

- Air data source selected
- SMYD selected
- DME selected
- Mag/True status
- Inertial data source selected
- Comparator enable
- ILS selected

- Flight path management enable
- Map source selected
- WXR source selected
- VOR selected
- FMC selected
- MCDU selected
- Navigation source
- Air/ground status.

The DEU discrete word 1 has this data:

- Comparator fault
- Roll comparator alert
- Pitch comparator alert.

The DEU maintenance word has this data:

- IOP I
- IOP A
- Main processor 2
- Program pin parity
- NV memory
- RAM memory
- I/O processor 1 - 3
- Digital output
- Controller
- Display sequencer
- Display drive
- PROM memory
- Main processor 1
- Overtemperature.

The CP and DU maintenance word has this data:

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CDS - CROSS CHANNEL INTERFACES

- TCAS RA health
- TCAS system status.

The sensor status maintenance word has this data:

- WXR fault
- ILS fault
- RA fault
- DME fault
- VOR fault
- Air data fault
- Inertial reference data fault
- A/T fault
- FMC fault
- FCC fault.

The modes discrete word 1 has this data:

- L-WXR data fault
- R-WXR data fault
- L-ILS data fault
- R-ILS data fault
- LOB DU fault
- ROB DU fault
- L-MCDU fault
- R-MCDU fault
- L-SMYD fault
- R-SMYD fault
- DEU fault
- RIB DU fault
- LIB DU fault
- L-EFIS CP fault
- R-EFIS CP fault

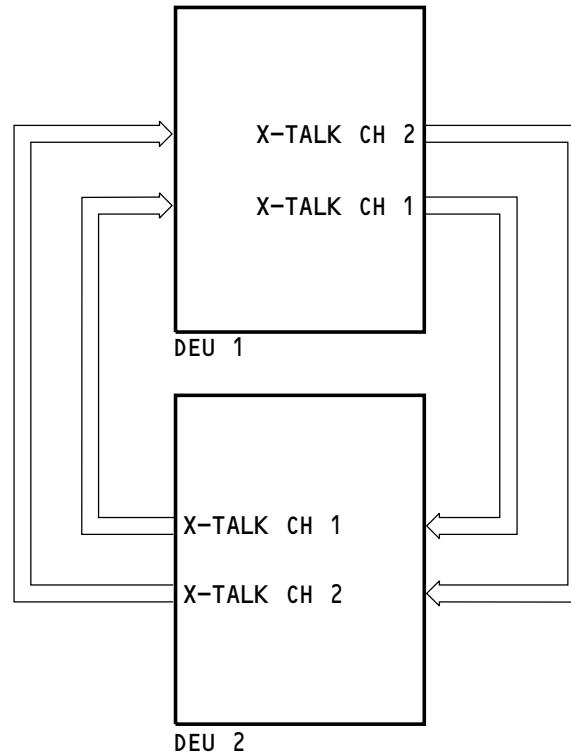
- CU DU fault
- CL DU fault.

The DEUs compare critical input signals that are received by both DEUs on the same ARINC 429 input bus. The onside values are compared with the offside values. If the critical comparison data is not the same, CDS shows CDS FAULT on the CDS displays.

This is the critical comparison data:

- Engine fan speed (N1)
- Engine core speed (N2)
- Engine exhaust gas temperature (EGT)
- FMC bus 08 data
- FMC bus 09 data.

NOTE: This comparison test is done when the SSM of the data is normal or test. The test is not done if the SSM is invalid or NCD.



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CDS - EXTERNAL INTERFACE INTRODUCTION

General

The display electronic units (DEU) receive ARINC 429 digital data and analog discretes from various airplane systems. The DEUs use this data to make the displays for the display units (DU).

The DEUs also send data to other airplane systems. Each DEU sends ARINC 429 data and analog discretes. These are the ARINC 429 output buses:

- CDS general purpose bus
- Control panel feedthru buses (2)
- Data loader bus
- DEU - FMC bus
- Engine EEC buses (2)
- EEC/APU bus.

CDS General Purpose (GP) Bus

The DEUs send data on the GP bus to these airplane systems:

- Flight control computer (FCC) A and B
- Stall management yaw damper (SMYD) 1 and 2
- Flight data acquisition unit (FDAU).

The GP bus also sends data to the CDS test connector in the E4 rack in the EE compartment. This is used for functional test.

The GP bus has this general data:

- Stabilizer position
- Control column position
- Control wheel position
- Rudder pedal position
- Left and right elevator position
- Left and right aileron position
- Speed brake handle position

- Rudder position
- Main engine indication data
- Main engine internal data
- Main landing gear brake temperatures
- Main hydraulic system pressures
- Main hydraulic system quantities
- Pitch attitude
- Roll attitude
- Heading data
- Groundspeed
- Radio altitude
- Radio minimums data
- Minimum decision altitude data
- Localizer and glideslope deviation
- Main fuel tank quantities
- Aux. fuel quantity
- Main engine EEC status words
- DEU status words 1 and 2
- CDS EFIS CP modes 1 and 2 discrete words
- Display discrete words 1 and 2
- Captain EFIS CP discrete word 1 and 2
- F/Os EFIS CP discrete word 1 and 2
- CDS discrete words
- CDS DEU discrete word 3.

The main engine EEC status words have this general data:

- EEC data
- Manufacturer and option data
- Thrust rating/airplane model data
- Exceedance data
- Internal protection status

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CDS - EXTERNAL INTERFACE INTRODUCTION

- TRA data
- Thrust reverser status data
- Engine air systems status data
- ADIRU input data status.

The DEU status word 1 has this data:

- Thrust reverser position data
- Engine fault dispatch level data
- Engine starter enable data
- EEC backup power control data
- Engine running status
- Generator enable data.

The DEU status word 2 has this data:

- Main engine N1 exceedance data
- Main engine N2 exceedance data
- Main engine EGT exceedance data
- Main engine oil system caution/warning data
- Fuel filter impending bypass data.

The CDS EFIS CP modes 1 discrete word has this data:

- TFC selected
- Center display format
- Baro minimums aural enabled
- VOR left selected
- VOR right selected
- ADF left selected
- ADF right selected
- Heading up map format
- Airports selected
- Route data selected

- Waypoints selected
- Navaid data selected
- Position data selected
- PFD/ND display format
- Plan mode selected
- Approach mode selected
- VOR mode selected
- Map mode selected.

The CDS EFIS CP modes 2 discrete word has this data:

- Baro minimums selected
- RA health
- GPWC V1 callout enabled
- FPV selected
- Meters selected
- STD selected
- HPA selected
- HG selected
- Terrain selected
- WXR selected.

The displays discrete word 1 has this data:

- LOB display unit status data
- LIB display unit status data
- CU display unit status data
- CL display unit status data
- RIB display unit status data
- ROB display unit status data.

The displays discrete word 2 has this data:

- Fuel configuration alert status

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CDS - EXTERNAL INTERFACE INTRODUCTION

- Fuel imbalance alert status
- Fuel low quantity alert status
- Mag/true status
- Autothrottle limit message status
- Engine fail message status
- Start valve open message status
- Low oil pressure message status
- Oil filter bypass message status
- Display source message status
- CDS maint message status
- CDS fault message status.

The captains EFIS CP discrete word 1 has this data:

- Fuel used
- Fuel used reset
- Secondary engine
- DSM CAPT LOWER ND
- DSM CAPT LOWER NORM
- DSM CAPT LOWER ENG
- DSM CAPT INBD PFD
- DSM CAPT INBD ENG
- DSM CAPT INBD MFD
- DSM CAPT NORM
- DSM CAPT OUTBD PFD

The captains EFIS CP discrete word 2 has this data:

- Systems page
- DSM F/O LOWER ND
- DSM F/O LOWER NORM
- DSM F/O LOWER ENG
- DSM F/O INBD PFD

- DSM F/O INBD ENG
- DSM F/O INBD MFD
- DSM F/O NORM
- DSM F/O OUTBD PFD

The F/O EFIS CP discrete word 1 has this data:

- Fuel used
- Fuel used reset
- Secondary engine
- DSM CAPT LOWER ND
- DSM CAPT LOWER NORM
- DSM CAPT LOWER ENG
- DSM CAPT INBD PFD
- DSM CAPT INBD ENG
- DSM CAPT INBD MFD
- DSM CAPT NORM
- DSM CAPT OUTBD PFD

The F/O EFIS CP discrete word 2 has this data:

- Systems page
- DSM F/O LOWER ND
- DSM F/O LOWER NORM
- DSM F/O LOWER ENG
- DSM F/O INBD PFD
- DSM F/O INBD ENG
- DSM F/O INBD MFD
- DSM F/O NORM
- DSM F/O OUTBD PFD

The CDS discrete words have this general data:

- DEU source select status

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CDS - EXTERNAL INTERFACE INTRODUCTION

- EFIS CP source select status
- Fuel pump low pressure data
- Fuel cutoff switch position status
- Engine ignition switch status
- PWS caution/warning/fail status
- IRS source select status
- Navigation source select status
- FMC source select status
- Fire switch status
- TAI valve status
- Engine alternate mode select status
- Engine start switch status
- Engine bleed air status
- ECS status
- ILS/VOR tune status
- Air/ground status.

The CDS DEU discrete word 3 has this data:

- ECS isolation valve position
- WTAI switch position
- Engine cowl anti-ice switch positions
- ECS pack flow switch positions
- ECS pack switch positions
- Engine bleed switch positions
- T/E flap position (>13)
- Air/ground system 2 status.

Control Panel Feedthru Bus

The DEUs send data on two CP Feedthru buses to these airplane systems:

- Air data inertial reference units (ADIRUs)

- Ground proximity warning computer (GPWC)
- Weather radar (WXR) transceiver.

Two buses are used to isolate the barometric correction data that goes to the individual air data inertial reference units.

The CP Feedthru buses have this data:

- V speeds (V1, Vr, and Vref)
- Selected speed bug
- Selected gross weight
- Set landing altitude
- Barometric correction
- Selected range
- Selected baro minimums
- Selected radio minimums
- CDS EFIS CP modes 1 discrete word
- CDS EFIS CP modes 2 discrete word
- Ground proximity discrete word 2
- Captain EFIS CP discrete word 2.

The CDS EFIS CP modes 1 discrete word has this data:

- TFC selected
- Center display format
- Baro minimums aural enabled
- VOR left selected
- VOR right selected
- ADF left selected
- ADF right selected
- Heading up map format
- Airports selected
- Route data selected
- Waypoints selected

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CDS - EXTERNAL INTERFACE INTRODUCTION

- Navaid data selected
- Position data selected
- PFD/ND display format
- Plan mode selected
- Approach mode selected
- VOR mode selected
- Map mode selected.

The CDS EFIS CP modes 2 discrete word has this data:

- Baro minimums selected
- RA health
- GPWC V1 callout enable
- FPV selected
- Meters selected
- STD selected
- HPA selected
- HG selected
- Terrain selected
- WXR selected.

The GPWC discrete word 2 has this data:

- Terrain unavailable (position)
- Terrain status fail
- Terrain caution
- Terrain warning
- Windshear caution
- Windshear warning
- Ground proximity warning.

The EFIS CP discrete word 2 has this data:

- Systems page

- DSM F/O LOWER ND
- DSM F/O LOWER NORM
- DSM F/O lower ENG
- DSM F/O INBD PFD
- DSM F/O INBD ENG
- DSM F/O INBD MFD
- DSM F/O NORM
- DSM F/O OUTBD PFD.

Data Loader Bus

The DEUs send CDS BITE fault history data on the data loader bus.

DEU-FMC Bus

The DEUs send this data to the flight management computer system (FMCS) on the DEU-FMC bus:

- CDS EFIS CP modes 1 discrete word
- CDS EFIS CP modes 2 discrete word
- TCAS RA status
- TCAS system status
- BITE response data.

The CDS EFIS CP modes 1 discrete word has this data:

- TFC selected
- Center display format
- Baro minimums aural enable
- VOR left selected
- VOR right selected
- ADF left selected
- ADF right selected
- Heading up map format
- Airports selected

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- Route data selected
- Waypoints selected
- Navaid data selected
- Position data selected
- PFD/ND display format
- Plan mode selected
- Approach mode selected
- VOR mode selected
- Map mode selected.

The CDS EFIS CP modes 2 discrete word has this data:

- Baro minimums selected
- RA health
- GPWC V1 callout enable
- FPV selected
- Meters selected
- STD selected
- HPA selected
- HG selected
- Terrain selected
- WXR selected.

The FMCS uses this data:

- CDS EFIS CP 1 discrete word data
- CDS EFIS CP 2 discrete word data
- BITE response data.

The BITE response data is for these LRUs:

- DEUs
- EECs
- APU.

EEC/APU Bus

The DEUs send data to the main engine electronic engine control (EEC) and APU electronic control unit (ECU) on the EEC/APU bus. Only DEU 1 sends data to the APU ECU.

The EEC/APU bus has this data:

- Flight number
- Baro corrected altitude
- Mach number
- Total air temperature
- Total pressure
- Static pressure
- Time/date
- Target N1
- ADR discrete word
- CDS DEU discrete word 1
- CDS DEU discrete word 2
- CDS DEU discrete word 3
- BITE test word.

The ADR discrete word has this data:

- Angle of attack data
- SSEC data
- VMO/MMO data
- Overspeed warning status
- Anti-ice system status
- ADR fail status.

The CDS DEU discrete word 1 has this data:

- Engine running status
- Engine start valve status

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CDS - EXTERNAL INTERFACE INTRODUCTION

- Main landing gear position status
- Flaps position data.

The CDS DEU discrete word 2 has this data:

- Engine alternate mode select status
- Engine start lever position status
- Engine ignition switch status
- Engine start switch position status.

The CDS DEU discrete word 3 has this data:

- ECS isolation valve status
- ECS pack status
- ECS pack flow status
- Anti-ice status
- Engine bleed switch status
- Flap position data
- Air/ground system status.

Engine EEC Bus

The DEUs send EEC data on the engine EEC buses. The DEUs send all the labels received from the four EEC buses to the main engine test connectors in the EE compartment. EEC channel A data comes from DEU 1 and EEC channel B data comes from DEU 2.

The engine EEC bus has this general data:

- EEC data
- Manufacturer and configuration data
- Thrust rating/airplane model data
- Exceedance data
- Internal protection status
- Engine internal sensing data
- Fuel system status

- Oil system status
- Engine air systems status data
- Maintenance data
- TRA data
- Thrust reverser status data
- ADIRU input data status.

Engine EEC Bus

The DEUs send EEC data on the engine EEC buses. The DEUs send all the labels received from the four EEC buses to the FDU. This information is used for the airplane condition monitoring system. The data also goes to the main engine test connectors in the EE compartment. EEC channel A data comes from DEU 1 and EEC channel B data comes from DEU 2.

The engine EEC bus has this general data:

- EEC data
- Manufacturer and configuration data
- Thrust rating/airplane model data
- Exceedance data
- Internal protection status
- Engine internal sensing data
- Fuel system status
- Oil system status
- Engine air systems status data
- Maintenance data
- TRA data
- Thrust reverser status data
- ADIRU input data status.

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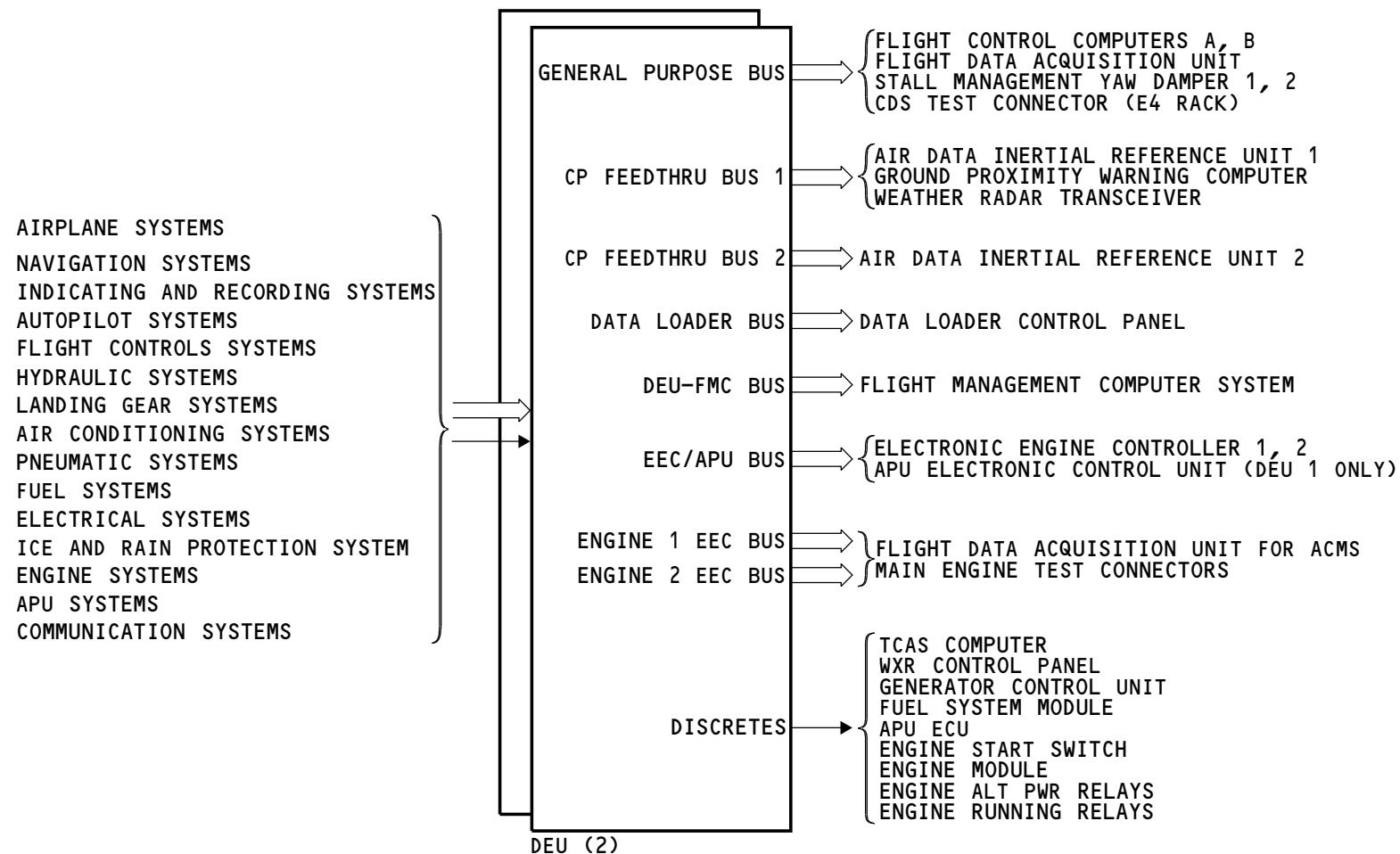


CDS - EXTERNAL INTERFACE INTRODUCTION

Analog Discrete Outputs

These are the discrete outputs from the DEUs:

- TCAS display status to the TCAS computer
- Weather radar (WXR) on/off signal to the WXR control panel
- Generator control unit (GCU) enable discrete
- Fuel filter bypass annunciator discretes to the fuel system panel
- BITE power up discrete to the APU ECU
- Engine start switch hold discretes to the engine start switches
- Engine control annunciator discretes to the engine control module
- Discretes to the engine alternate (ALT) power (PWR) relays
- Discretes to the engine running relays when the engine is running or the start levers are in idle for longer than 5 minutes.



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CDS - NAVIGATION INTERFACES - 1

Air Data Inertial Reference Unit

The air data inertial reference units (ADIRUs) send data to and receive data from the display electronic units (DEU) on ARINC 429 busses.

The ADIRUs send this air data to the DEUs:

- Uncorrected altitude
- Baro corrected altitude
- Mach number
- Computed airspeed
- VMO/MMO
- True airspeed
- Total air temperature
- Indicated angle of attack (AOA)
- Total pressure
- Static pressure
- ADR discrete word 1.

The ADR discrete word 1 has this data:

- AOA fail warning
- Overspeed warning
- Primary AOA heat
- Secondary AOA heat
- TAT heat
- Pitot static heat
- Air data system fault.

The ADIRUs send this inertial reference data to the DEUs:

- Magnetic track angle
- True track angle
- Magnetic heading
- True heading

- Present position
- Groundspeed
- Wind speed and direction
- Drift angle
- Flight path angle
- Flight path acceleration
- Pitch angle
- Roll angle
- Body pitch rate
- Body roll rate
- Body yaw rate
- Body longitudinal acceleration
- Body lateral acceleration
- Track angle rate
- Pitch attitude rate
- Roll attitude rate
- Inertial altitude
- Along track horizontal acceleration
- Cross track horizontal acceleration
- Vertical acceleration
- Inertial vertical speed
- N-S velocity
- E-W velocity.

The DEUs use this data for the CDS display function and also send it to other user systems in the airplane.

The DEUs send data to the ADIRUs on the CP Feedthru busses. The ADIRUs only use barometric correction from these buses. The left ADIRU uses the barometric correction set on the captain EFIS control panel and the right ADIRU uses the barometric correction set on the first officer EFIS control panel.

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CDS - NAVIGATION INTERFACES - 1

Two CP feedthru buses are used to isolate the barometric correction data that goes to the ADIRUs.

Instrument Switching Module

The instrument switching module has a three-position switch for the IRS source select function. The switch positions are:

- BOTH ON L
- NORMAL
- BOTH ON R.

The instrument switching module sends ground discretes to the DEUs to show data selection for the captain and F/O displays.

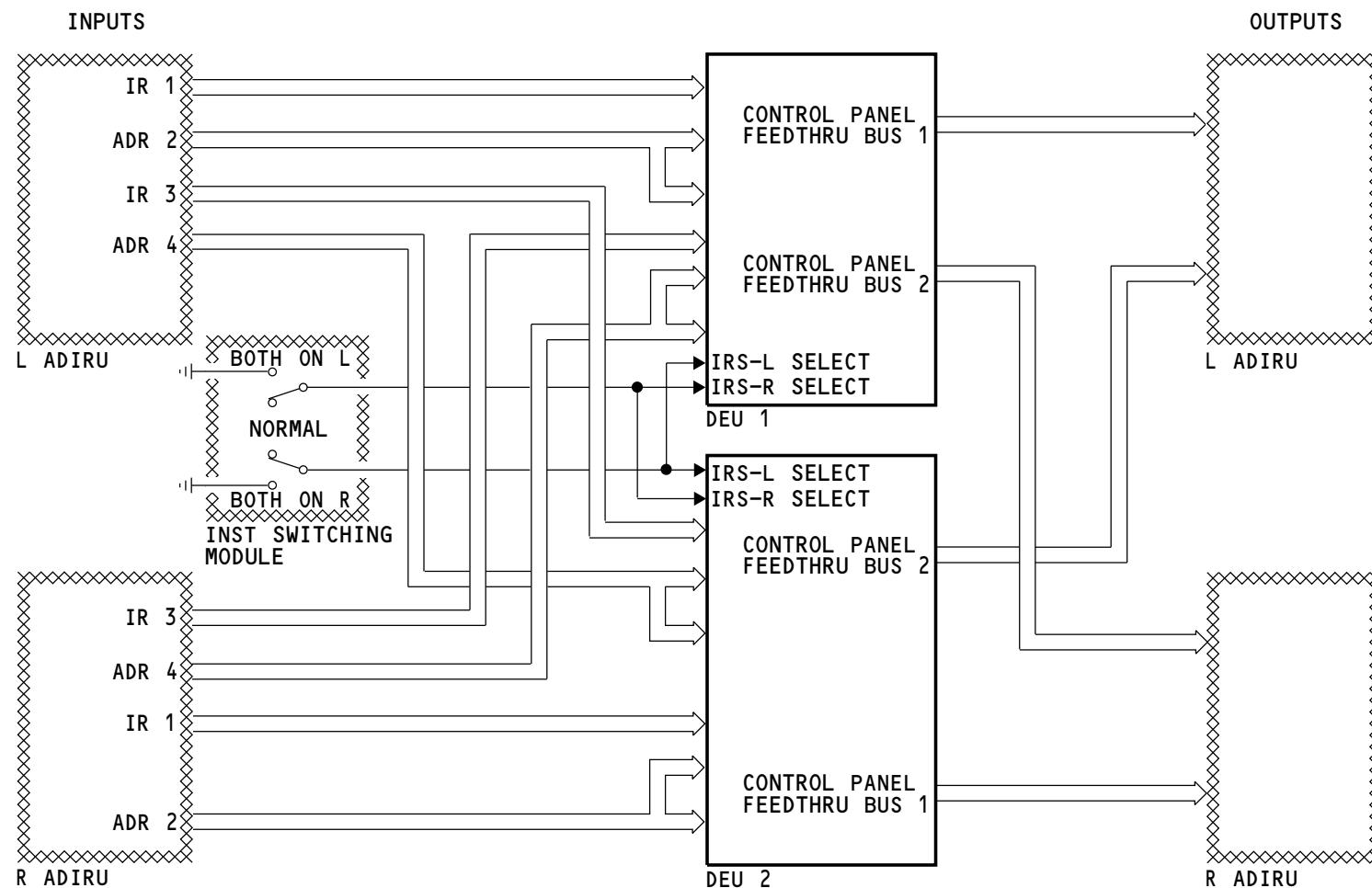
In the NORMAL position, the captain displays show inertial reference (IR) data from the L ADIRU and the F/O displays show IR data from the R ADIRU.

When BOTH ON L or BOTH ON R is selected, the captain and the F/O displays show IR data from the same source.

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CDS - NAVIGATION INTERFACES - 2

Weather Radar Transceiver

The DEUs send range data to the weather radar transceiver on the ARINC 429 CP feedthru buses.

The weather radar transceiver sends this data to the DEUs through the terrain/weather relays on two ARINC 453 buses:

- Reflectivity data
- Scan angle
- Range data
- Gain status
- Antenna tilt
- Operating mode
- Transceiver fault
- Control panel fault
- Attitude input fault
- Gain calibration fault
- Display fault
- Cooling fault
- Antenna stabilization limits
- Alert data.

The weather radar transceiver also sends three analog discretes to the DEUs. These ground discretes show these warnings on the DUs:

- PWS caution
- PWS warning
- PWS fail.

Weather Radar Control Panel

When the weather radar is selected on the EFIS control panel and a correct display mode is selected, the DEUs send an analog discrete to the weather radar control panel. The weather radar control panel then sends the discrete to the weather radar transceiver. This ground discrete turns the weather radar transceiver on.

Ground Proximity Warning Computer

The DEUs send data to the GPWC on ARINC 429 CP feedthru buses.

The GPWC uses this data from the CP feedthru bus:

- Range data
- CDS EFIS CP modes 1 discrete word
- CDS EFIS CP modes 2 discrete word
- Selected baro minimums data
- Selected radio minimums data.

The CDS EFIS CP modes 1 discrete word has this data:

- TFC selected
- Center display format
- Baro minimums aural enable
- VOR left selected
- VOR right selected
- ADF left selected
- ADF right selected
- Heading up map format
- Airports selected
- Route data selected
- Waypoints selected
- Navaid data selected
- Position data selected
- PFD/ND display format

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CDS - NAVIGATION INTERFACES - 2

- Plan mode selected
- Approach mode selected
- VOR mode selected
- Map mode selected.

The CDS EFIS CP modes 2 discrete word has this data:

- Baro minimums selected
- RA health
- GPWC V1 callout enable (optional)
- FPV selected
- Meters selected
- STD selected
- HPA selected
- HG selected
- Terrain selected
- WXR selected.

The GPWC sends system status, caution and warning data on an ARINC 429 GPWC data bus to the DEUs. The DEUs show the system status, caution or warnings on the DUs.

The GPWC bus has this data:

- Ground proximity discrete word 2
- Fault summary word 2
- Input discrete word 2.

The ground proximity discrete word 2 has this data:

- Terrain unavailable (position)
- Terrain status fail
- Terrain caution
- Terrain warning
- Windshear caution

- Windshear warning
- Ground proximity warning.

The fault summary word 2 has this data:

- Terrain relay 1 fail
- Terrain relay 2 fail.

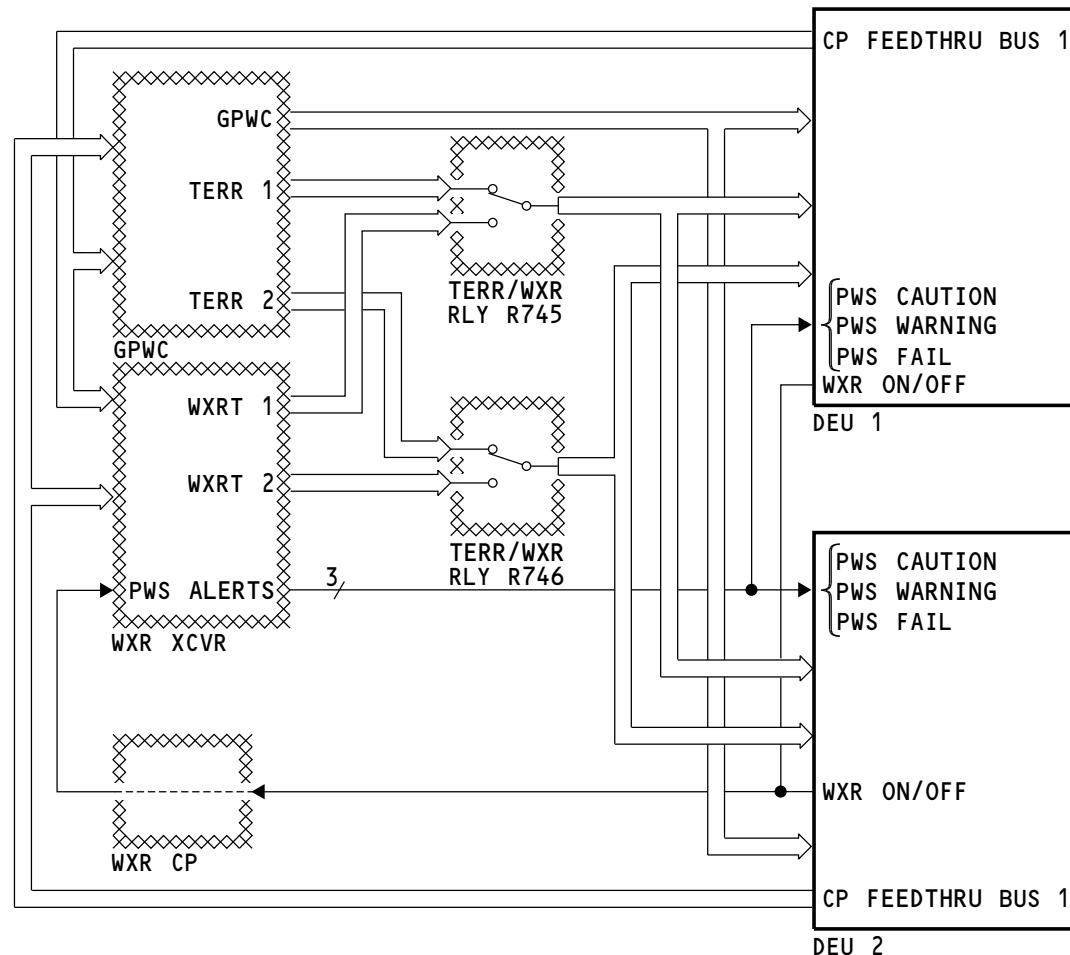
The input discrete word 2 has terrain override data.

The GPWC also sends terrain display data on ARINC 453 data buses to the DEUs through the terrain/weather relays. These relays are controlled by the TERR select switches on the EFIS control panels or the pop up function within the GPWC.

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CDS - NAVIGATION INTERFACES - 3

Flight Management Computer System

The flight management computer system (FMCS) sends data to and receives data from the display electronic units (DEU) on ARINC 429 buses. FMC output buses 01 and 02 go through FMC transfer relay 1. FMC output buses 08 and 09 go directly to both DEUs.

The DEUs send data to the flight management computers (FMC) on the DEU-FMC bus. The DEU-FMC bus has this data:

- CDS EFIS CP modes 1 discrete word
- CDS EFIS CP modes 2 discrete word
- CP and DU maint word
- BITE response data.

The CDS EFIS CP modes 1 discrete word has this data:

- TFC selected
- Center display format
- Baro minimums aural enable
- VOR left selected
- VOR right selected
- ADF left selected
- ADF right selected
- Heading up map format
- Airports selected
- Route data selected
- Waypoints selected
- Navaid data selected
- Position data selected
- PFD/ND display format
- Plan mode selected
- Approach mode selected
- VOR mode selected

- Map mode selected.

The CDS EFIS CP modes 2 discrete word has this data:

- Baro minimums selected
- RA health
- GPWC V1 callout enable (optional)
- FPV selected
- Meters selected
- STD selected
- HPA selected
- HG selected
- Terrain selected
- WXR selected.

The CP and DU maint word has this data:

- TCAS RA status
- TCAS system status.

The FMCS uses this data to format the MAP and PLAN display data that will be transmitted to the DEUs.

The BITE response data is for these other airplane systems:

- DEUs
- Main engine electronic controls (EEC)
- APU electronic control unit (ECU).

The FMCS sends data to the DEUs on four ARINC 429 data buses. These buses are:

- FMC 01
- FMC 02
- FMC 08
- FMC 09.

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CDS - NAVIGATION INTERFACES - 3

FMC 01 and FMC 02 data goes through the FMC transfer relay 1 so that the primary FMC is supplying the data to the DEUs. These buses have this data:

- Gross weight
- Greenwich mean time (GMT)
- Selected temperature (takeoff derate)
- Flight number
- Date
- Target N1
- N1 bug drive
- FMC discrete word 1
- FMC discrete word 3
- BITE test word.

FMC discrete word 1 has this data:

- Takeoff bump
- EEC on status
- Isolation valve position status
- Wing anti-ice status
- Engine cowl anti-ice status
- ECS pack on status
- ECS pack flow status
- Engine bleed status.

FMC discrete word 3 has takeoff derate data.

The DEUs use this data to show the thrust modes on the center upper DU. Target N1 shows on the engine display and gross weight is used by DEUs to calculate the flap maneuver speeds that are shown on the PFD speed tape. GMT and date are used in BITE for fault data storage.

FMC 08 and FMC 09 data is sent directly to both DEUs. These buses have this data:

- Distance to go (waypoint)
- Estimated time of arrival (ETA)
- V speeds
- GPS latitude and longitude
- Range to altitude
- Vertical deviation
- Set landing altitude
- DME elevation
- Transition altitude
- FMC position
- Groundspeed
- Track angle (magnetic and true)
- Wind speed and direction
- Dynamic data
- Map background data
- Message text
- FMC discrete word 2.

FMC discrete word 2 has this data:

- QFE altitude reference
- VNAV ALT
- Display IRS position difference.

The DEUs use this data to make the MAP and PLAN displays on the navigation displays (ND).

FMC Transfer Relays

The transfer relays are controlled from the FMC source select switch in the flight deck. This switch position determines which FMC is the primary.

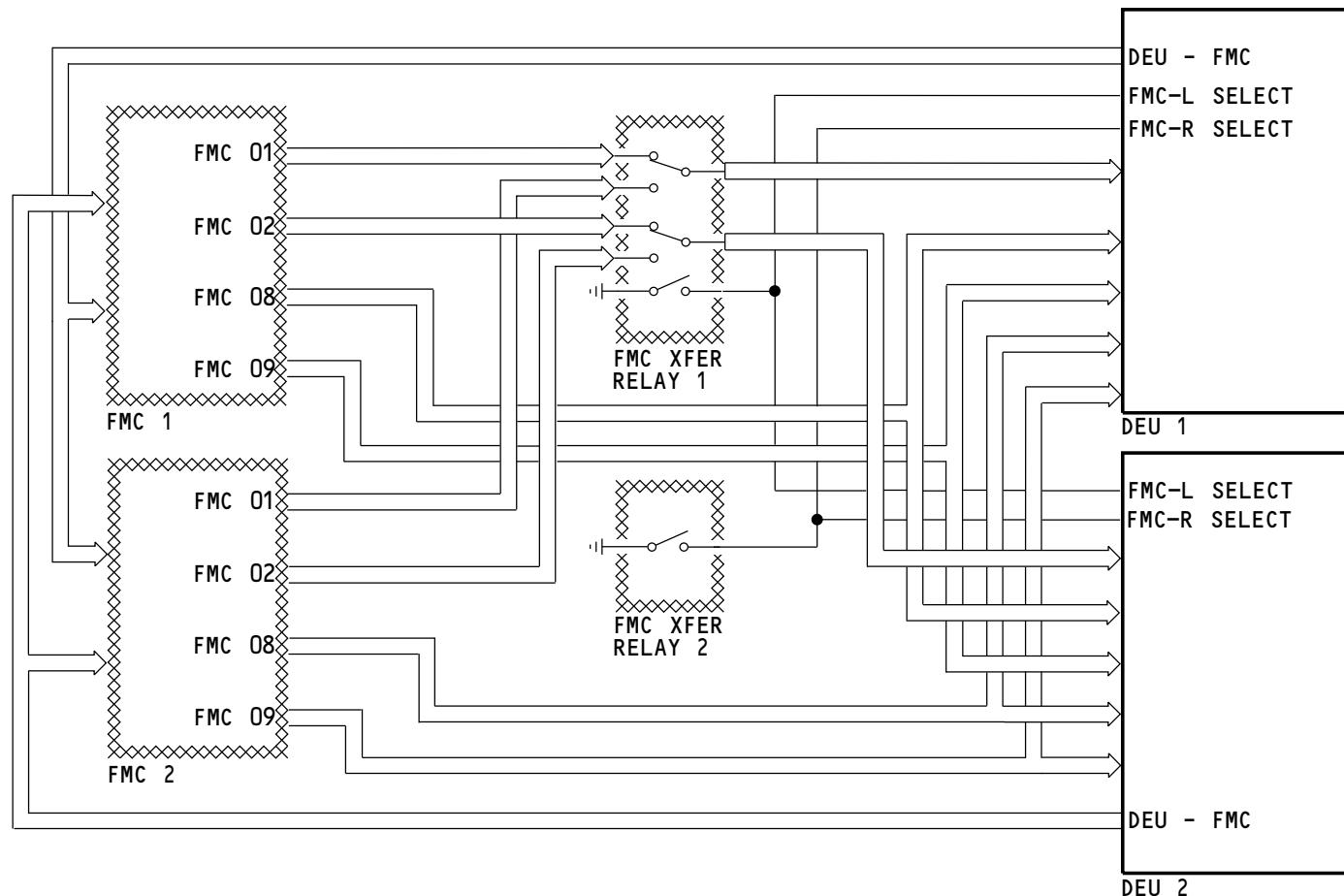
The transfer relays send analog discretes to the DEUs depending on the position of the FMC source select switch. These ground/open discretes show the DEUs which FMC is the primary.

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CDS - NAVIGATION INTERFACES - 4

Multi-Mode Receiver

The ILS receivers in the multi-mode receivers (MMRs) send this data to both DEUs on ARINC 429 buses:

- ILS frequency
- Station identifier
- Localizer deviation
- Glideslope deviation.

The ILS inputs go to both input output controllers (IOCs) in each DEU to meet integrity requirements. A comparison is done between these two ILS inputs in each DEU.

VHF Omnidirectional Ranging (VOR) Receiver

The VOR receivers send this data to both DEUs on ARINC 429 buses:

- VOR frequency
- Station identifier
- Bearing data
- Marker beacon discrete bits
- Fault status.

NOTE: Marker beacon data is only sent from VOR/MB receiver 1.

Distance Measuring Equipment Interrogator

The DME interrogators send this data to both DEUs on ARINC 429 buses:

- DME frequency
- Station identifier
- Slant range distance.

Navigation Control Panel

The navigation control panels send a ground discrete to the DEUs to show that an ILS frequency was tuned on the navigation control panel.

If a VOR frequency is tuned on the navigation control panel and the approach mode is selected on the EFIS control panel, the message, EFIS MODE/NAV FREQ DISAGREE shows on the navigation display. The same message also shows if an ILS frequency is tuned on the navigation control panel and the VOR mode is selected on the EFIS control panel.

Instrument Switching Module

The instrument switching module has a three-position switch for the VHF NAV function. The switch positions are:

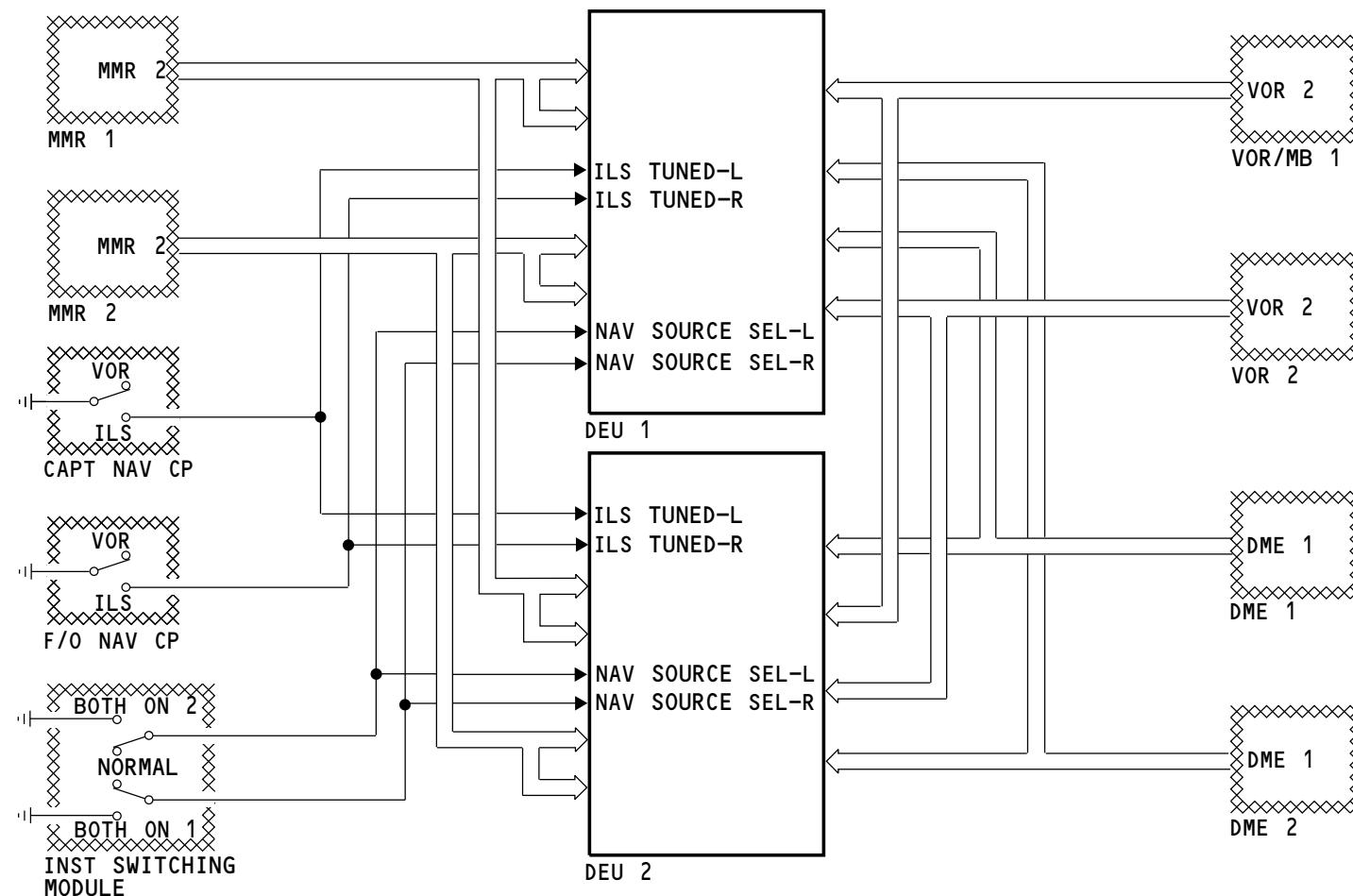
- BOTH ON 1
- NORMAL
- BOTH ON 2.

The instrument switching module sends ground discretes to the DEUs to show data selection for the captain and F/O displays.

In the NORMAL position, the captain displays show data from MMR 1, VOR 1, and DME 1 systems and the F/O displays show data from MMR 2, VOR 2, and DME 2 systems.

When BOTH ON 1 or BOTH ON 2 is selected, the captain and the F/O displays show navigation data from the selected source.

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CDS - INDICATING AND RECORDING INTERFACES

Data Loader Control Panel**AKS 001**

The data loader control panel sends information to the display electronic units (DEU) from the airborne data loader (ADL). Software can be uploaded to the DEUs in this manner.

AKS 002-999

The data loader control panel sends information to the display electronic units (DEU) from the airborne data loader (ADL) or the portable data loader (PDL). Software can be uploaded to the DEUs in this manner.

AKS ALL

The control panel also receives data from the DEUs on the DFDAU bus. This function is used to download fault history from the DEUs

A function discrete from the data loader is switched through the data loader control panel to the DEUs. This ground discrete is the load enable signal to the DEUs.

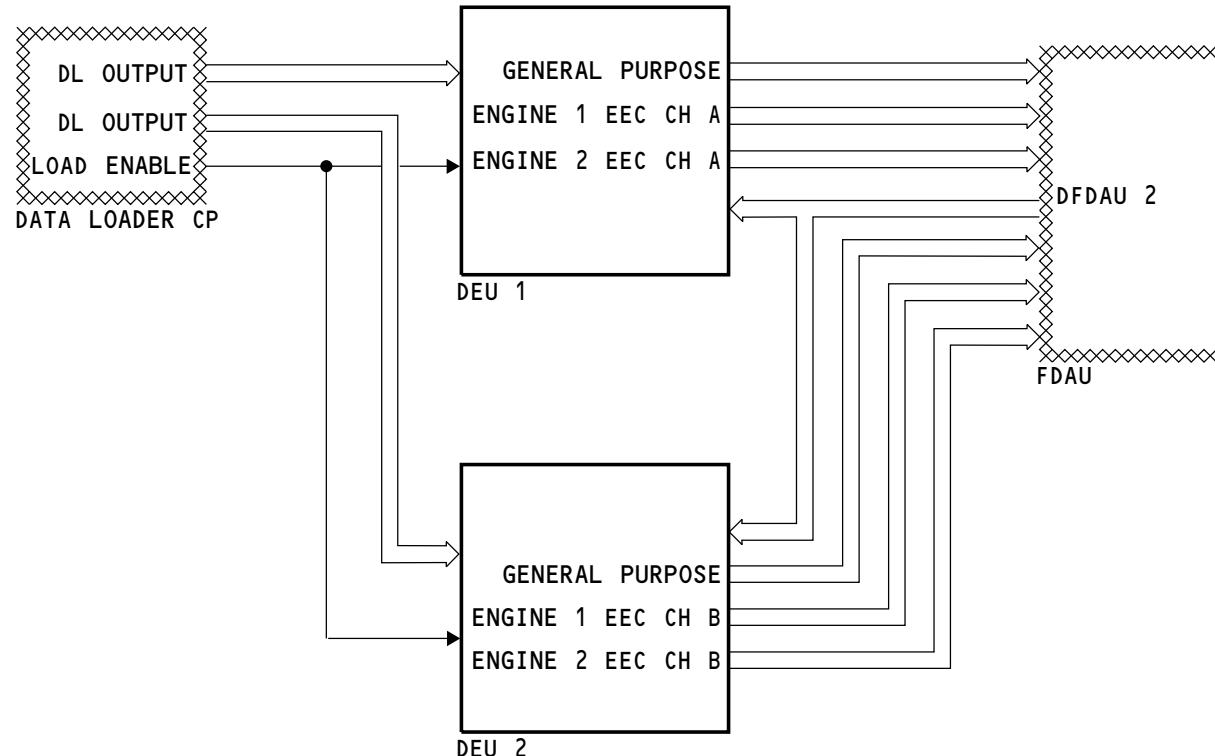
Airplane Condition Monitoring System

The DEUs send EEC data on the ENGINE EEC buses. The DEUs send all the labels received from the four EEC input buses to the FDAU. EEC channel A data for both engines goes from DEU 1 and EEC channel B data for both engines goes from DEU 2. This data is used by the airplane condition monitoring system.

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CDS - AUTOFLIGHT INTERFACES

Mode Control Panel

The mode control panel (MCP) sends data to the display electronic units (DEUs) on ARINC 429 buses. The MCP 1 bus has this data:

- Selected course 1
- Selected heading
- MCP selected altitude.

The MCP 2 bus has this data:

- Selected course 2
- Selected heading
- MCP selected altitude.

The DEUs use this data to show on the flight and navigation displays.

Flight Control Computers

The flight control computers (FCCs) send data to and receive data from the DEUs on ARINC 429 buses.

The FCCs send this data to the DEUs:

- Target mach number
- Local selected course
- Selected heading
- Selected altitude
- Selected vertical speed
- Selected mach number
- Flap position
- Flight director commands (pitch)
- Flight director commands (roll)
- Airspeed bug drive
- Spoiler position (left and right)
- AFDS discrete word 2

- AFDS discrete word 3
- AFDS discrete word 4.

The AFDS discrete word 2 has this data:

- FLARE ARM
- CWS ROLL
- CWS PITCH
- SINGLE CH
- TO/GA
- V/S ENGAGE
- ALT HOLD
- ALT ACQ
- HDG SEL
- VOR/LOC ENGAGE
- G/S ENGAGE
- FLARE ENGAGE.

The AFDS discrete word 3 has this data:

- IAS/MACH select
- Altitude hold (MCP or VNAV)
- Altitude acquire (MCP or VNAV).

The AFDS discrete word 4 has this data:

- Altitude alert flash
- Test display
- G/S deviation warn
- LOC deviation warn
- CMD-A
- CMD-B
- F/D A ON
- F/D B ON

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CDS - AUTOFLIGHT INTERFACES

- VNAV SPD
- VNAV PTH.

The DEUs use this data from the FCCs to show flight director commands and DFCS status on the displays.

The FCCs use engine N1 from the DEU general purpose bus for the speed trim and the flight control neutral shift functions. DEU discrete data is also used to show the FCCs which DEU sends data to which display unit.

Flight Control Computer - A

The Flight Control Computer (FCC-A) sends the following data to the DEUs as a discrete word on an ARINC 429 bus:

- ARM
- GA
- MCP SPD
- A/T LIMIT
- FMC SPD
- N1
- RETARD
- TEST.

The FCC-A sends a ground discrete to the DEUs for the throttle hold mode.

The DEUs use this data to show the active autothrottle mode in the flight mode annunciator on the primary flight displays. The A/T LIMIT annunciation shows when FMCS thrust mode annunciation data is invalid.

Autothrottle Computer

The autothrottle computer sends the following data to the DEUs as a discrete word on an ARINC 429 bus:

- ARM
- GA
- MCP SPD

- A/T LIMIT
- FMC SPD
- N1
- RETARD
- TEST.

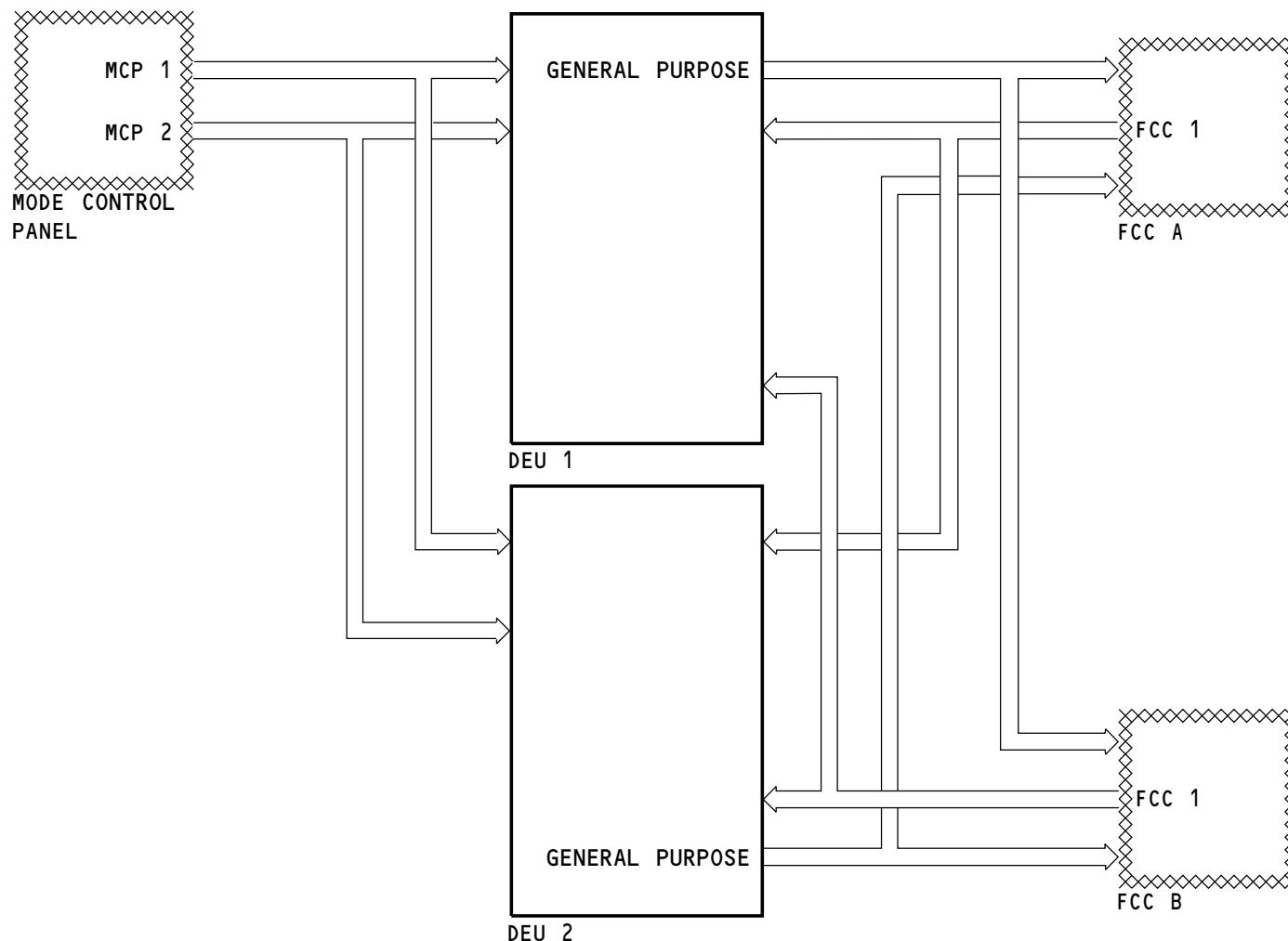
The autothrottle computer sends a ground discrete to the DEUs for the throttle hold mode.

The DEUs use this data to show the active autothrottle mode in the flight mode annunciator on the primary flight displays. The A/T LIMIT annunciation shows when FMCS thrust mode annunciation data is invalid.

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CDS - AUTOFLIGHT INTERFACES
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CDS - HYDRAULIC AND LANDING GEAR INTERFACES

Hydraulic System Pressure

Hydraulic system A pressure transmitter sends hydraulic pressure as an analog signal to DEU 1. Hydraulic system B pressure transmitter sends an analog signal to DEU 2.

The DEU sends an 8v dc reference voltage to the transmitter and the resultant current flow represents the hydraulic pressure. The DEU then changes this current into a pressure value for display. Nominal current is 16 mA at a hydraulic pressure of 3000 psi.

The hydraulic system pressure data goes on the DEU cross channel bus so that both DEUs receive hydraulic system pressure from both system A and system B.

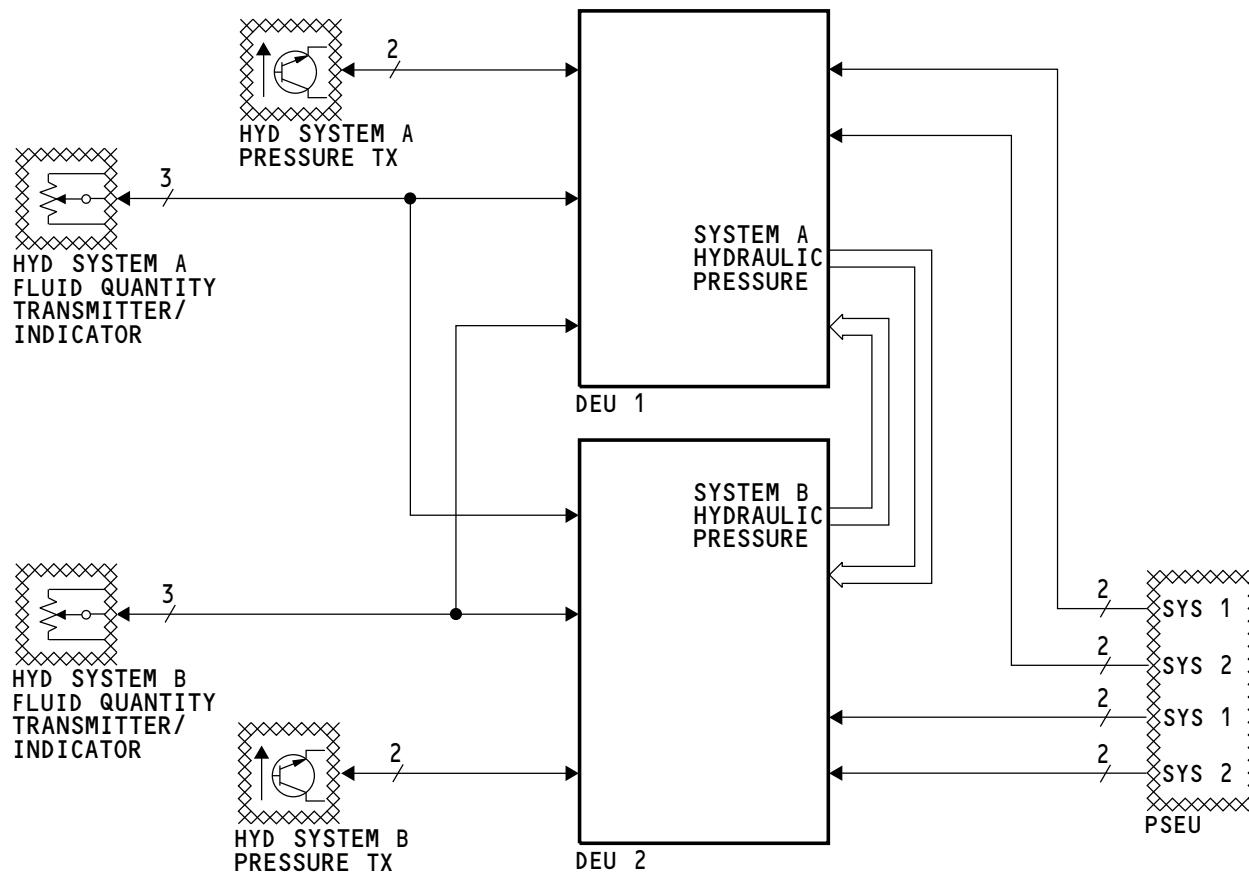
Hydraulic Fluid Quantity

The hydraulic fluid quantity transmitter/indicators for hydraulic system A and B send hydraulic fluid quantity as an analog signal to both DEUs.

The DEU sends an 8v dc reference voltage to the quantity transmitter and the resultant output voltage from the potentiometer in the transmitter is proportional to the hydraulic quantity. The DEU then changes this voltage into a hydraulic quantity value for display. Nominal voltage is 0.8147 V/Vref for a FULL reservoir indication.

Proximity Switch Electronics Unit

The proximity switch electronics unit sends four ground discretes to each DEU. They are air ground signals from air/ground system 1 and air/ground system 2. These discretes are used for the display enable function in the DEUs and also flight leg counting in BITE.



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CDS - HYDRAULIC AND LANDING GEAR INTERFACES

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CDS - AIR CONDITIONING AND PNEUMATIC INTERFACES

General

The display electronic units (DEU) receive discretes from these air conditioning and pneumatic systems:

- Air conditioning relays
- Pack flow control and shutoff valves
- Bleed air isolation valve
- Air conditioning module.

The DEUs send the data out on the general purpose buses and the EEC/APU buses. This data is used by these airplane systems:

- Digital flight data acquisition unit
- Main engine electronic controls
- APU electronic control unit.

Air Conditioning Relays

The air conditioning relays send ground discretes to both DEUs. The DEUs use these discretes to determine the position of the left and right pack valve normal relays.

Flow Control and Shutoff Valves

The left and right pack flow control and shutoff valves send ground discretes to both DEUs. The DEUs use these discretes to determine the position of the flow control and shutoff valves.

Bleed Air Isolation Valve

The bleed air isolation valve sends a ground discrete to both DEUs. The DEUs use these discretes to determine the position of the isolation valve.

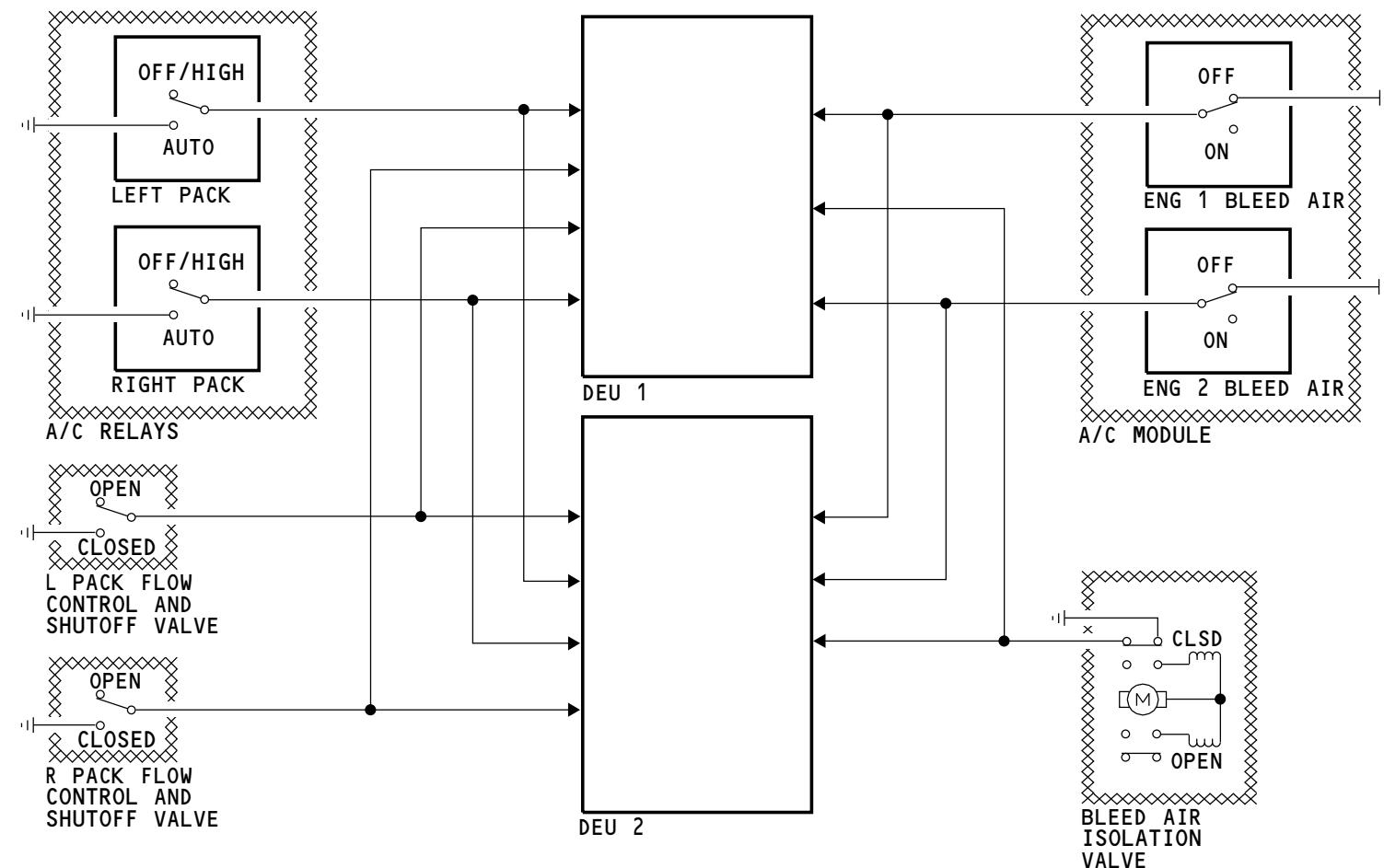
Air Conditioning Module

The air conditioning (AC) module sends two discretes to both DEUs. The DEUs use these discretes to determine the position of the main engine bleed air switches on the P5 panel.

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CDS - AIR CONDITIONING AND PNEUMATIC INTERFACES

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CDS - ICE AND RAIN PROTECTION INTERFACES

General

The display electronic units (DEU) receive discretes from these ice and rain protection components:

- Engine and wing anti-ice module
- Engine cowl anti-ice valves.

Engine and Wing Anti-Ice Module

The engine and wing anti-icing module sends three ground discretes to both DEUs. The discretes show the position of these switches:

- Wing anti-ice switch
- Engine 1 anti-ice switch
- Engine 2 anti-ice switch.

The DEUs send the anti-icing switch position data out on the general purpose buses and the EEC/APU buses. The data is used by these airplane systems:

- Digital flight data acquisition unit
- Main engine electronic controls
- APU electronic control unit.

Engine Cowl Thermal Anti-Ice Valve.

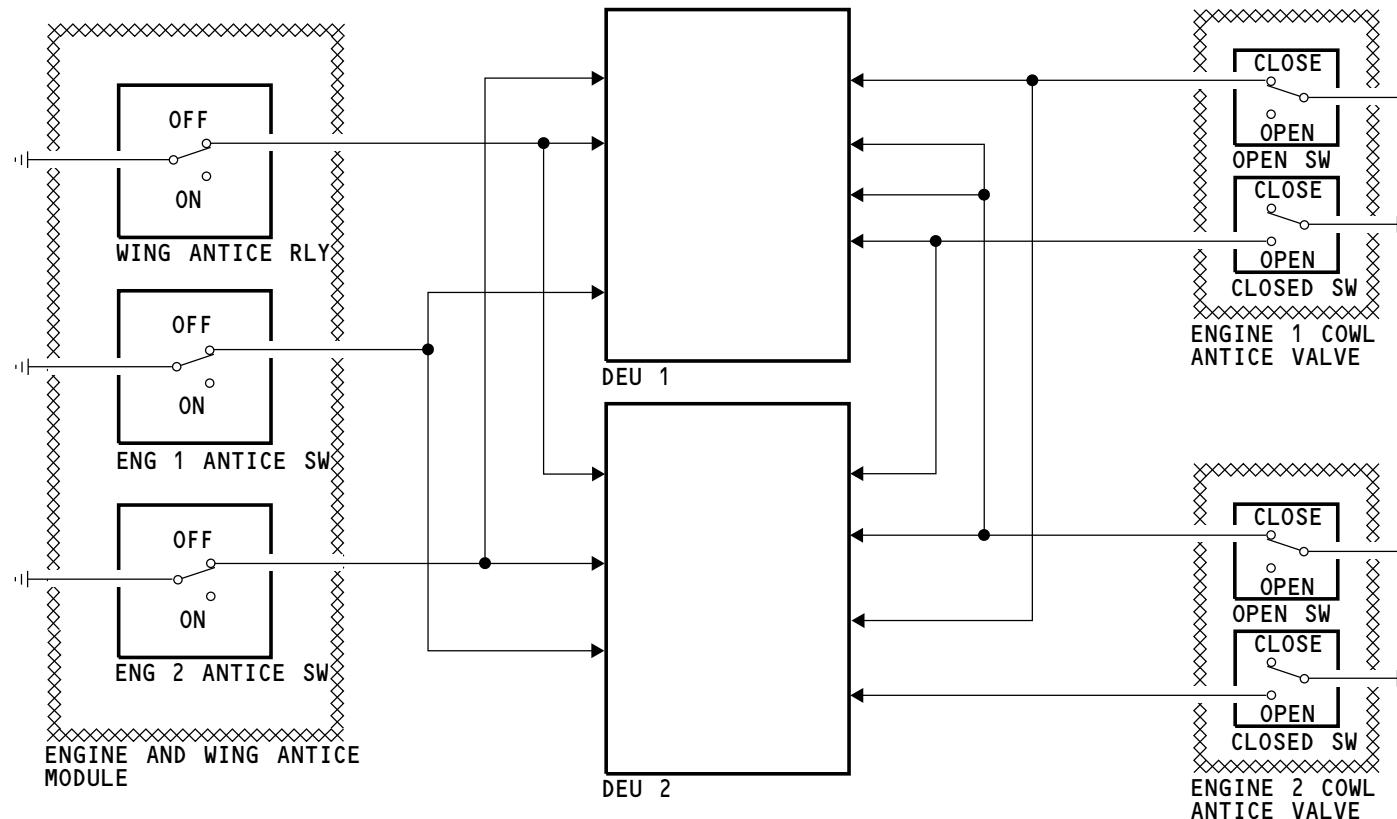
The engine cowl thermal anti-icing valves send two ground discretes to both DEUs. These discretes indicate the position of the valves.

- | The DEUs use engine cowl anti-icing valve position to show the TAI message on the engine display. This message is green.
- | The DEUs also use engine cowl anti-icing switch and valve position data to determine if the valve is not in the commanded position. If it is not, the TAI message is amber.

EFFECTIVITY

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CDS - ICE AND RAIN PROTECTION INTERFACES

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CDS - FUEL AND ELECTRICAL INTERFACES

Fuel Quantity Processor Unit

The fuel quantity processor unit (FQPU) sends fuel quantity data for the left, right, and center tank systems to the display electronic units (DEU) on ARINC 429 buses.

Center Tank Fuel Boost Pumps

The center tank left and right boost pumps send a low pressure signal to the DEUs. The DEUs use this ground discrete to show a fuel configuration alert.

The CONFIG message shows when these conditions are true:

- Output pressure from both center tank boost pumps is low
- 1,600 lb (725 kg) or more fuel in the center tank
- Either main engine operating.

Fuel System Module

Each DEU sends two ground discretes to the fuel system module, one for each of the fuel filter bypass lights. The DEU is the interface for the electronic engine controllers (EEC) to turn on these annunciators when the EECs detect a fuel filter bypass condition.

Generator Control Units

The DEUs send a GCU enable discrete to the generator control units (GCUs) when the engine is at idle speed. The GCUs use this 28v dc discrete to close the generator contactor breaker.

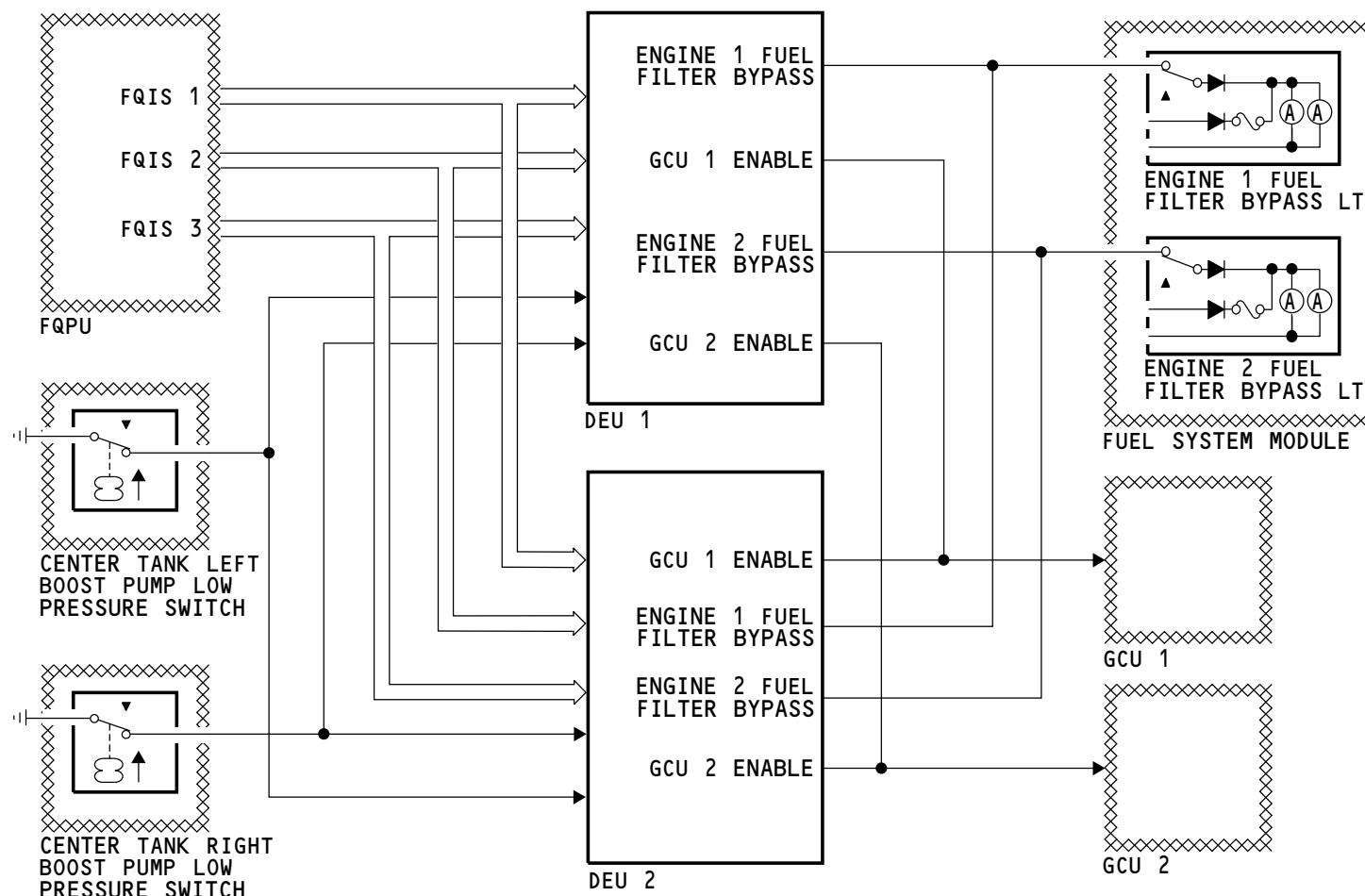
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CDS - FUEL AND ELECTRICAL INTERFACES



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CDS - ENGINE INTERFACES - 1

Electronic Engine Controllers

The main engine electronic control units (EECs) send data to and receive data from the display electronic units (DEU) on ARINC 429 data buses.

The DEUs send data to the main engine EECs on the EEC/APU buses. The EEC/APU buses have this data:

- Flight number
- Baro corrected altitude
- Mach number
- Total air temperature
- Total pressure
- Static pressure
- Time/date
- Target N1
- ADR discrete word
- CDS DEU discrete word 1
- CDS DEU discrete word 2
- CDS DEU discrete word 3
- BITE test word.

The ADR discrete word has this data:

- Angle of attack data
- SSEC data
- VMO/MMO data
- Overspeed warning status
- Anti-ice system status
- ADR fail status.

The CDS DEU discrete word 1 has this data:

- Engine running status
- Engine start valve status

- Main landing gear position status
- Flaps position data.

The CDS DEU discrete word 2 has this data:

- Engine alternate mode select status
- Engine start lever position status
- Engine ignition switch status
- Engine start switch position status.

The CDS DEU discrete word 3 has this data:

- ECS isolation valve status
- ECS pack status
- ECS pack flow status
- Anti-ice status
- Engine bleed switch status
- Flap position data
- Air/ground system status.

The EECs use this data in the engine control function.

The EECs send data to the DEUs on two separate EEC buses. One bus has EEC channel A data and the other has EEC channel B data. The EEC buses have this data:

- BITE data
- Engine start mode
- Engine starting status
- Ignition system status
- Engine running status
- Control mode switch position
- Minimum idle
- Idle selected
- N1 speed data

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CDS - ENGINE INTERFACES - 1

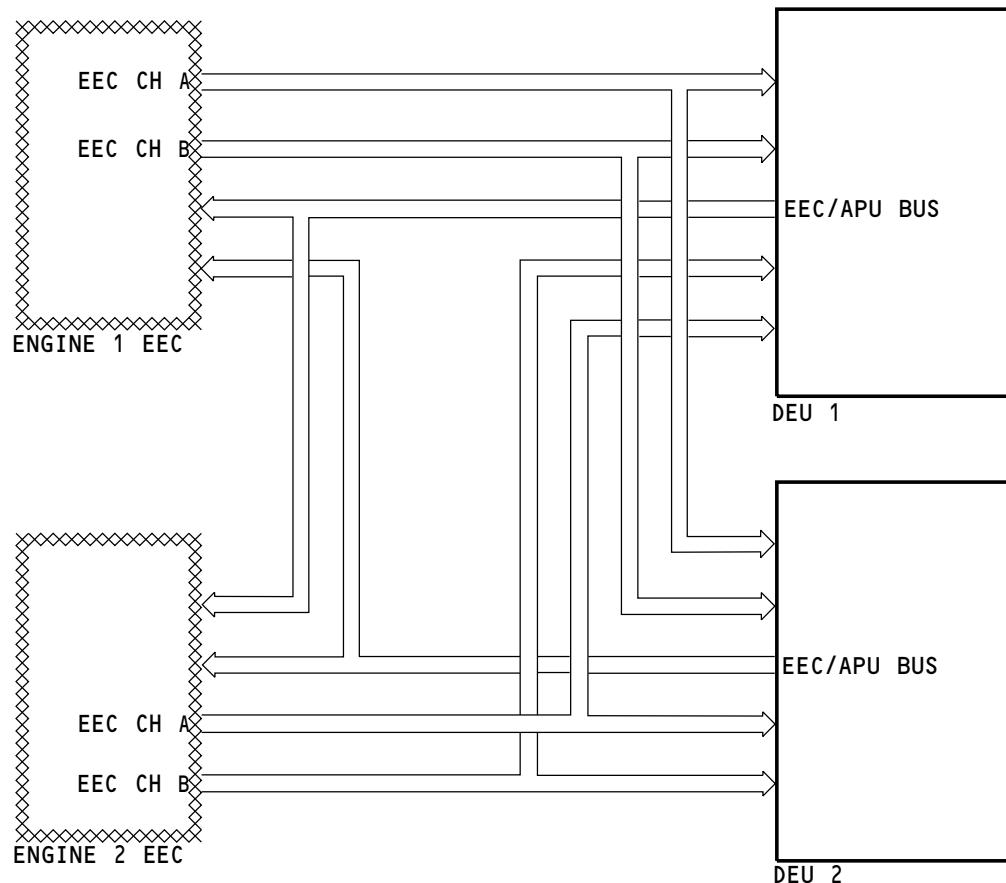
- N2 speed data
- Overspeed governor status
- Engine starter cutout
- Exhaust gas temperature (EGT) data
- Fuel flow data
- Fuel filter status
- Oil pressure data
- Oil temperature data
- Oil filter status
- Thrust resolver angle (TRA) data
- Thrust reverser status
- Engine thrust
- Engine sensor data
- EEC software version
- Engine serial number
- Engine actuator positions
- Combustor fuel air ratio
- EEC channel in control
- Start lever position
- Airplane on ground selection status
- Engine thrust rating and airplane model compatibility
- Airplane model
- Engine rating
- Engine options
- EEC alternator status
- Engine position
- Engine bleed load
- Air data status from ADIRUs
- Internal EEC fault status.

The DEUs use this data for the engine display function and the BITE/monitoring function via the CDUs.

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CDS - ENGINE INTERFACES - 1



CDS - ENGINE INTERFACES - 2

Engine Start Switch

The engine start switches send two ground discretes to the display electronic units (DEUs). One discrete gives a signal that the engine start switch is in the flight position. The other discrete gives a signal that the engine start switch is in the ground or continuous position.

The DEUs also send a ground discrete to the engine start switches when N2 is less than 55%. This holdup discrete energizes the engine start switch solenoid to hold the switch in the GRD position. When engine N2 is more than 55%, the ground is removed and the start switch returns to the OFF position.

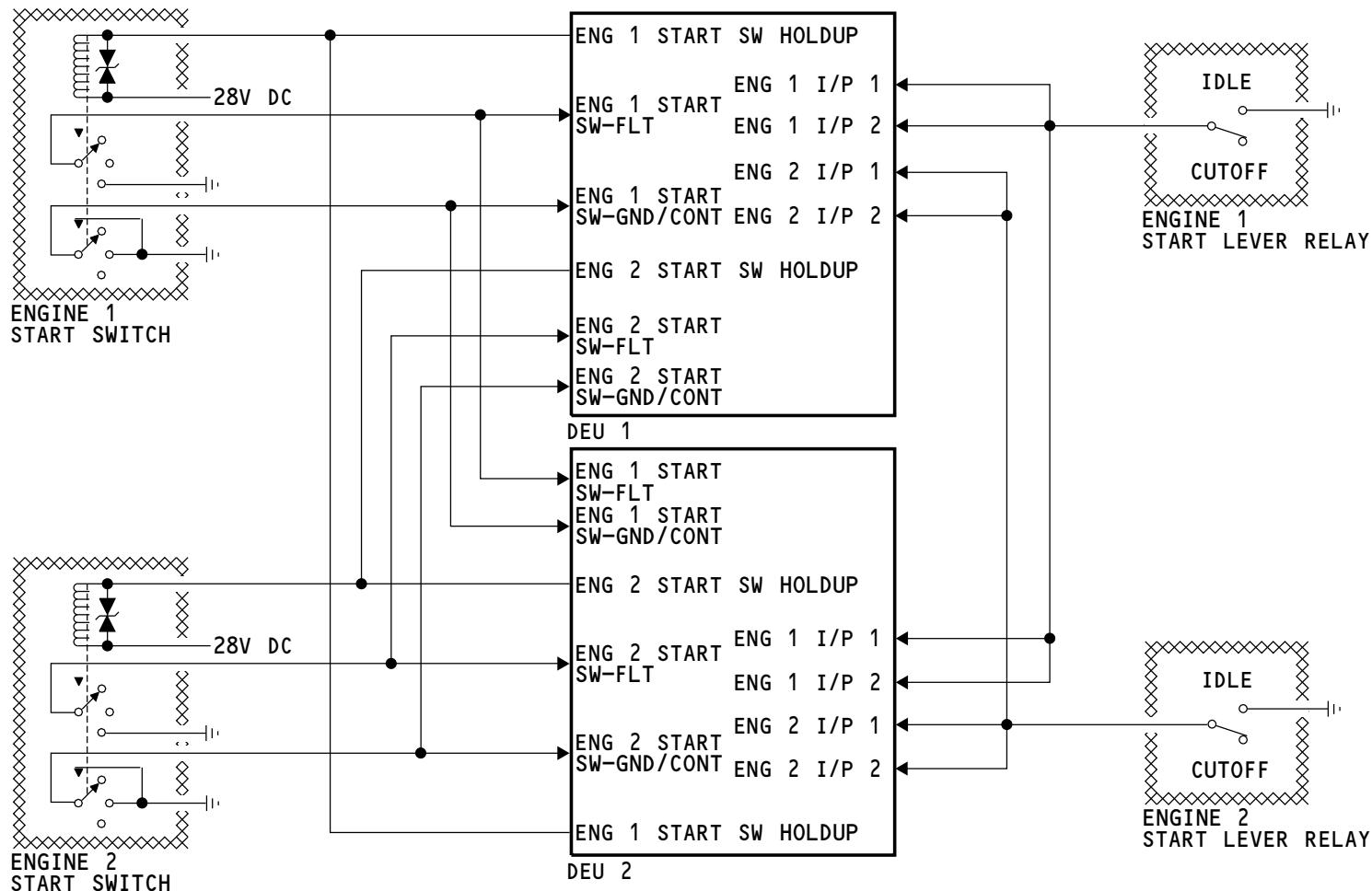
Engine Start Lever Relay

The engine start lever relays send ground discretes to the DEUs to indicate the engine start lever position (idle or cutoff).

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CDS - ENGINE INTERFACES - 2



CDS - ENGINE INTERFACES - 3

Engine Oil Quantity Transmitter

The engine oil quantity transmitters send an analog signal to both display electronic units (DEUs).

The DEUs send an 8v dc reference voltage to the transmitters and the oil quantity output signal is proportional to the oil quantity level. The transmitter uses a floating magnet and reed switches.

Engine Module

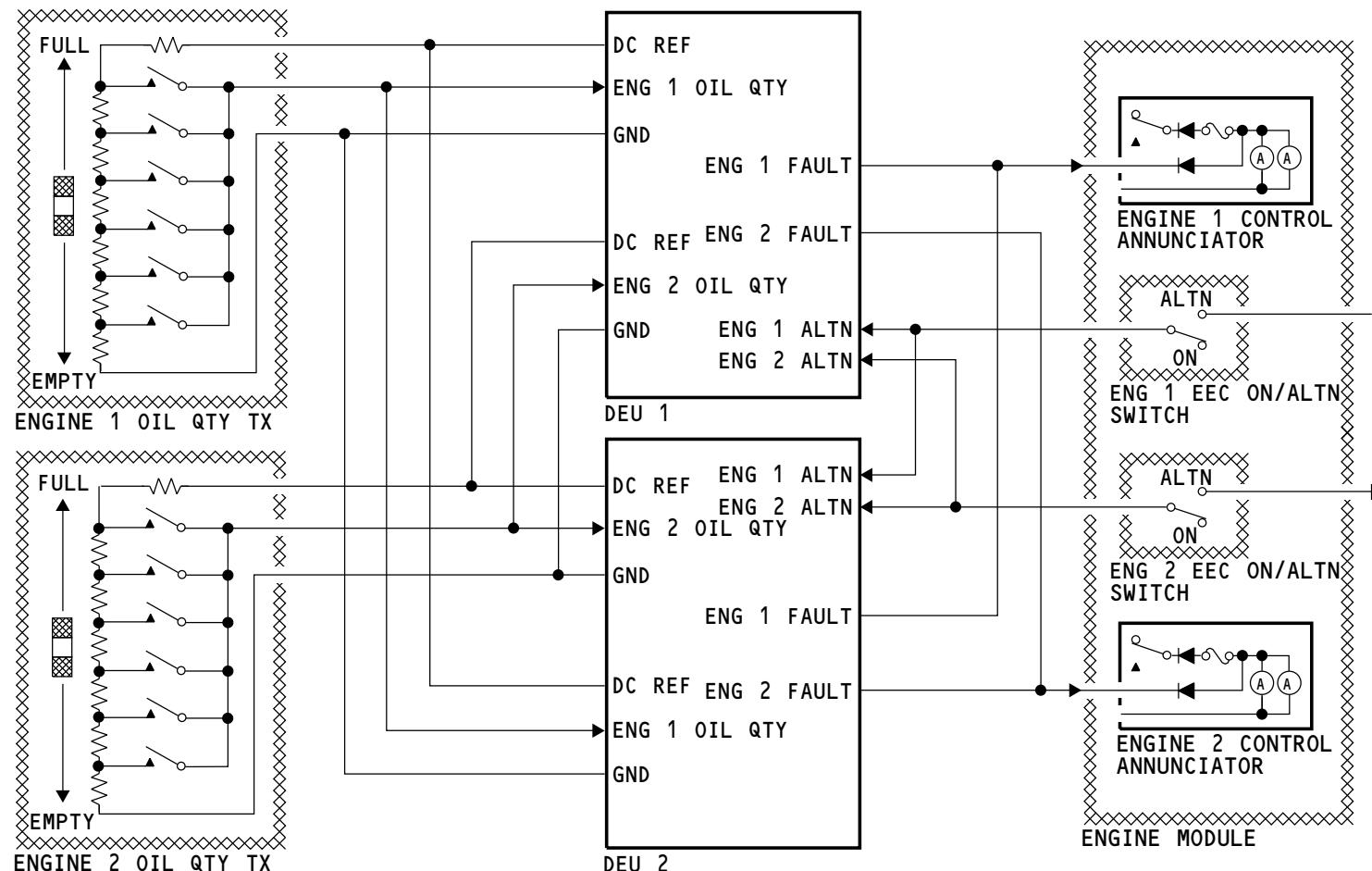
The engine module sends two ground discretes to both DEUs. These discretes show the position of the EEC ON/ALTN switch. This data is sent to the EECs.

When an EEC detects an engine control fault, the DEUs send two ground discretes to the engine module. This turns on the engine control annunciator for that particular engine.

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CDS - ENGINE INTERFACES - 3



CDS - ENGINE INTERFACES - 4

N1 and N2 Speed Sensor

The engine speed sensors send analog frequency signals to both display electronic units (DEUs). N1 is low pressure rotor speed and N2 is high pressure rotor speed.

Usually, the DEUs use the N1 and N2 data from the engine electronic controls (EECs) for display on the center display units (DUs). When the EECs do not have power, the DEUs use the analog inputs from the engine speed sensors.

The DEUs also send N1 and N2 data to other airplane systems on the general purpose bus and the engine EEC buses.

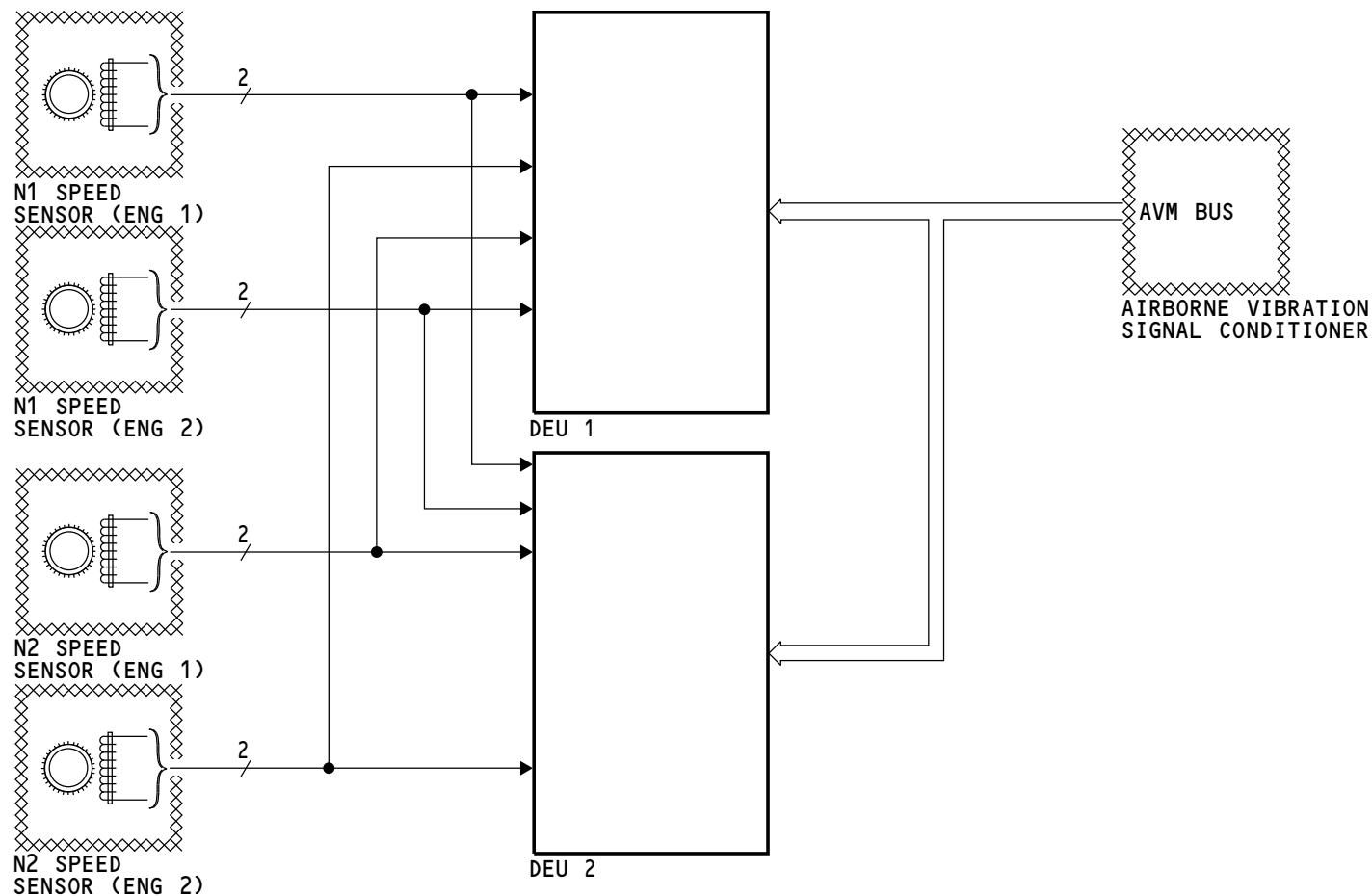
Airborne Vibration Monitor

The airborne vibration signal conditioner sends vibration data for engine 1 and 2 to the DEUs on an ARINC 429 bus. This data shows in scalar units on the center DUs.

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CDS - ENGINE INTERFACES - 4



CDS - ENGINE INTERFACES - 5

Engine Ignition Selector

The engine ignition switch sends two ground discretes to the display electronic units (DEUs). These discretes show the position of the engine ignition switch (L IGN, BOTH, or R IGN). The DEUs send this data to the engine electronic controls (EEC) on the EEC/APU buses.

Engine Start Valve

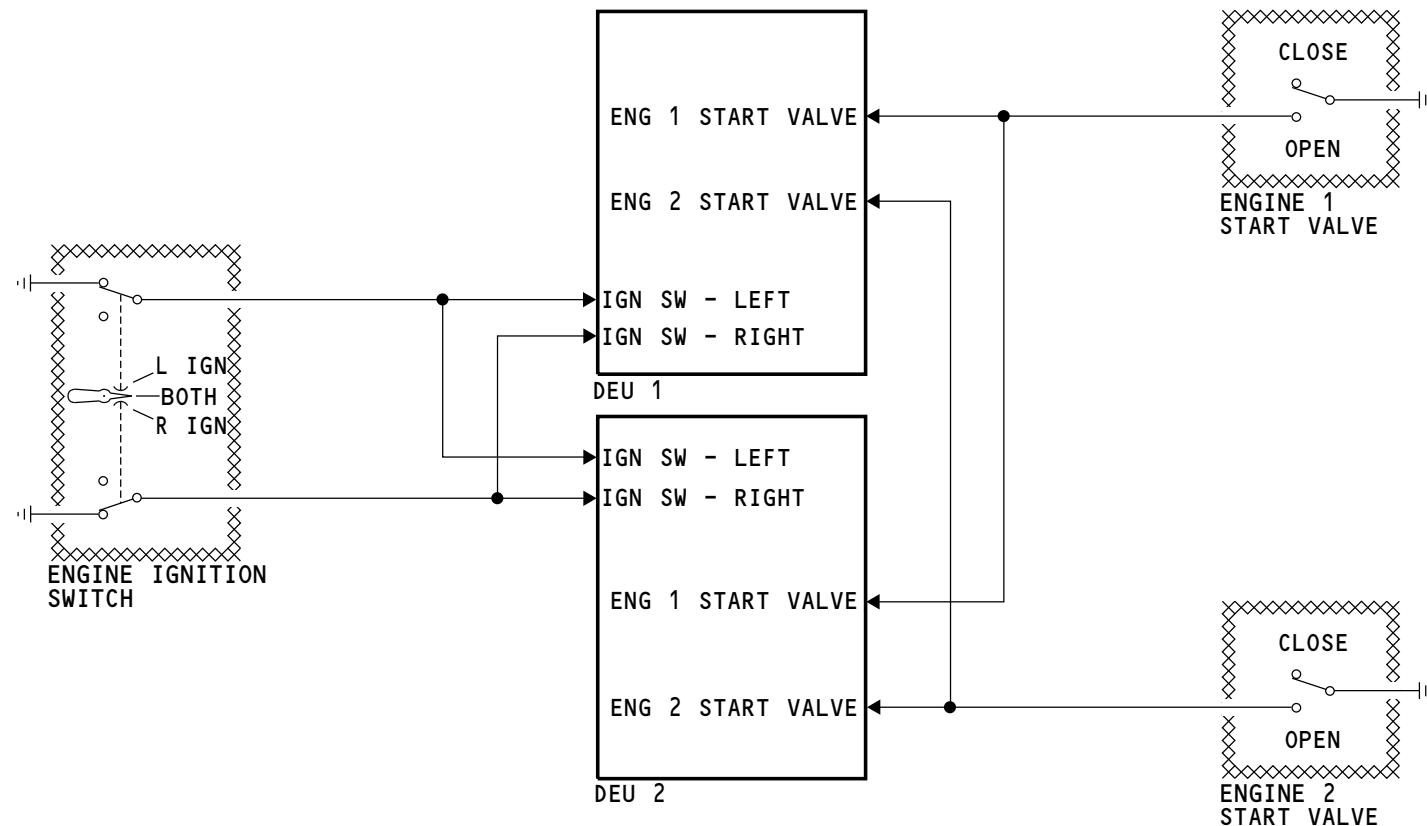
The engine start valves send a ground discrete to the DEUs when the valve is in the open position. The DEUs use this data for the START VALVE OPEN indication on the center display units (DUs). This data also goes to the EECs on the EEC/APU buses.

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CDS - ENGINE INTERFACES - 5



CDS - ENGINE INTERFACES - 6

Engine Alternate Power Relay

The display electronic units (DEUs) send ground discretes to the engine alternate power relays. The relays supply electrical power from the transfer buses to the engine electronic controls (EEC).

The DEUs send the engine alternate power discretes when one of these is true:

- Engine start lever is set to idle
- Engine start switch is set to GRD
- Engine start switch is set to CONT
- Control display unit (CDU) set to engine BITE.

Engine Running Relay

The DEUs send the ground discretes to the engine running relays. These relays supply engine running status to other airplane systems.

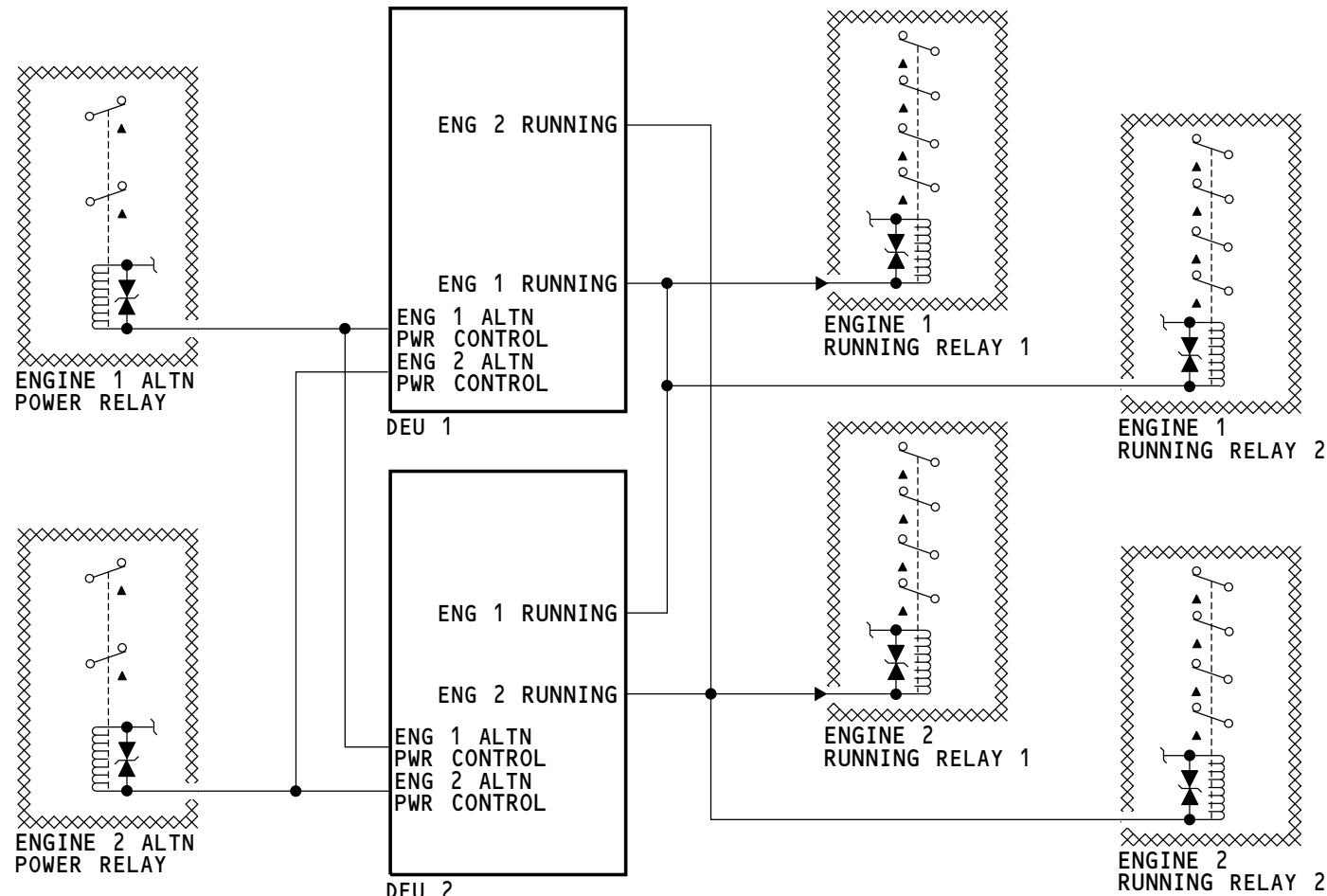
The DEUs send the engine running discretes when one of these is true:

- EEC digital discrete is set to run
- N2 is $\geq 50\%$ RPM
- Engine start lever is set to idle for 5 minutes.

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CDS - ENGINE INTERFACES - 6



CDS - COAX COUPLER

General

There are four coaxial couplers. Each DEU channel sends an output to a coaxial coupler. There are two channels in each DEU.

The coax coupler splits the signal and sends an output to each of the six display units.

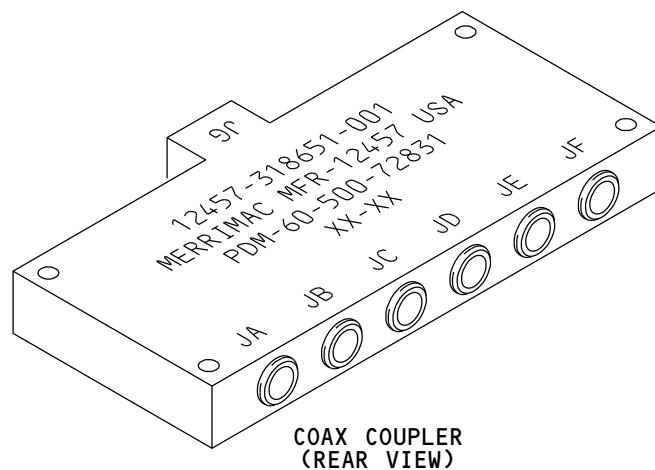
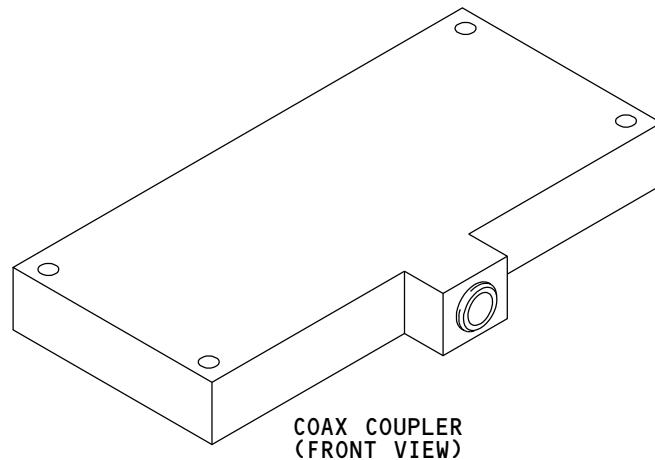
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CDS - COAX COUPLER

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CDS - REMOTE LIGHT SENSOR

General

Two remote light sensors (RLSs) are on the top forward part of the glareshield. The sensors point forward. The RLSs measure ambient light with a photodiode sensor and supply an analog signal in proportion to the ambient light. The left RLS sends the analog signal to the left outboard display unit. The right RLS sends an analog signal to the right outboard display unit. The display unit sends these values to the DEU. The DEU uses this input with other manual and automatic inputs to calculate the brightness value for all display units.

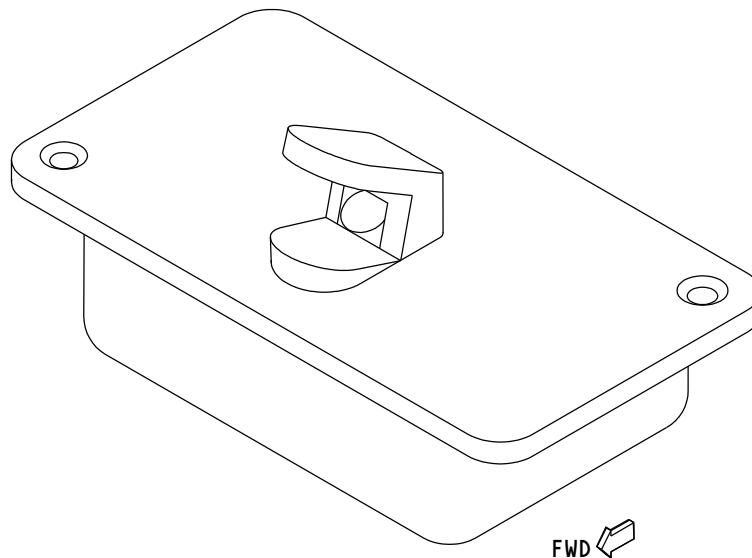
Physical Description

Each sensor weighs less than 1/2 pound. The RLS has a field of view of 70 degrees left, 70 degrees right, 40 degrees up and 15 degrees down.

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CDS - REMOTE LIGHT SENSOR

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CDS - DISPLAY UNIT

General

The common display system uses six identical, flat panel, liquid crystal display (LCD) units. The display units (DUs) show this type of information:

- Primary flight information
- Navigation information
- Engine information.

Physical Description

The DUs are rack mounted. The DUs are 8 inches (20.3 cm) by 8 inches and are 9.75 inches (24.8 cm) deep. Each DU weighs approximately 18 pounds (8.2 kg).

There is a bezel light sensor (BLS) at the bottom edge of the face plate.

Internal Temperature Detectors

Each DU has internal temperature detectors. If the internal temperature gets too hot, the power supply shuts down the display unit. When the DU cools, the display unit comes on again.

The left outboard, left inboard, and lower center display units use blow-through cooling. The right outboard, right inboard, and upper center display units use draw-through cooling.

CAUTION: DO NOT USE COMPRESSED AIR TO CLEAN THE SCREEN IN THE COOLING AIR INLET. COMPRESSED AIR WILL PUSH CONTAMINATION INTO THE DISPLAY UNIT AND CAUSE EQUIPMENT FAILURE.

Training Information Point

The six DUs are interchangeable. Because of the viewing angle limitations of LCD technology, the installation of the lower DU is turned 180 degrees from the other DUs. The lower center DU handle is at the top.

Training Information Point

When you remove or install the inboard or outboard DUs, you must move the control column.

WARNING: KEEP PERSONS AND EQUIPMENT CLEAR OF THE FLIGHT CONTROL SURFACES, THE THRUST REVERSERS, AND THE LANDING GEAR. THESE COMPONENTS CAN MOVE SUDDENLY WHEN YOU MOVE THE CONTROL COLUMN. THIS CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

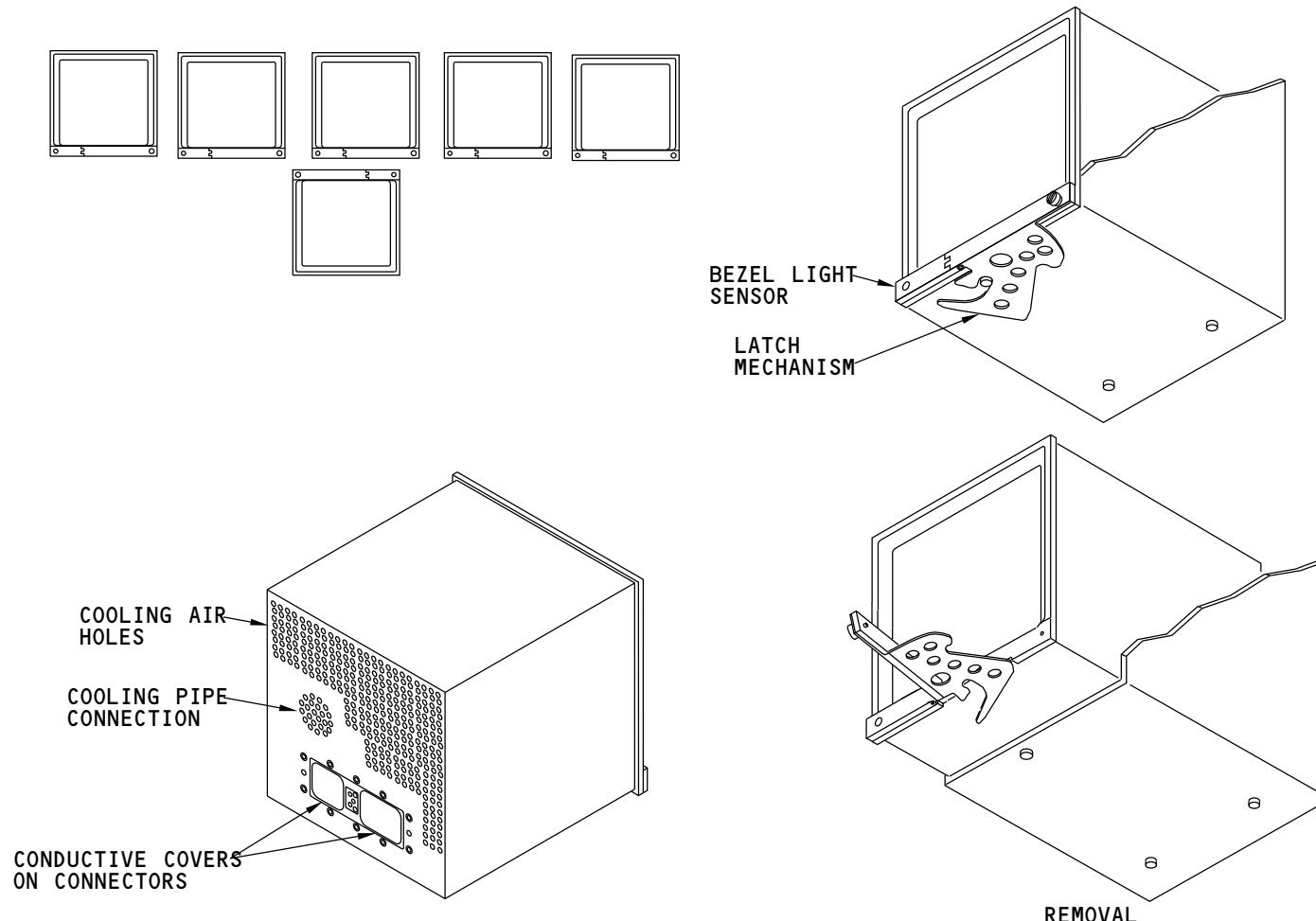
CAUTION: DO NOT USE ABRASIVE MATERIALS WHEN YOU CLEAN THE DISPLAY SURFACE. DO NOT TOUCH THE DISPLAY SURFACE WITH YOUR SKIN. THERE IS AN OPTICAL COATING ON THE DISPLAY SURFACE. YOUR SKIN OR ABRASIVE MATERIALS WILL CAUSE SCRATCHES IN THE OPTICAL COATING.

NOTE: Remove the conductive plastic covers from the connectors before you install a DU.

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CDS - DISPLAY UNIT

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CDS - DU - FUNCTIONAL DESCRIPTION

Display Unit

The display unit (DU) is a flat panel liquid crystal display (LCD) unit. The LCD makes a high resolution color image of the flight data.

DU Rear Connector

All electrical interfaces go through the DU rear connector. The graphic generators in the DEU send display data to the DUs. The DUs send temperature, light intensity levels, and BITE data to the DEUs.

The rear connector also has HIRF protection.

Interconnect Board

The interconnect board applies all power, grounds, and signals necessary for transmission between functions.

EMI Filter

The +28v dc input power goes through the EMI filter before it goes to the interconnect board.

Power Supply

The power supply supplies all the DU internal voltages except for the LCD and heater voltages. The power supply converts +28v dc into +5v, +/-15v, +30v, and +375v.

Input/Output Controller

The input/output controller (IOC) controls all digital data into and out of the DU. This includes the graphics image data from the DEU, the discrete data input for display unit identification, and the ARINC 429 bus output.

The IOC also does the BITE functions for the DU.

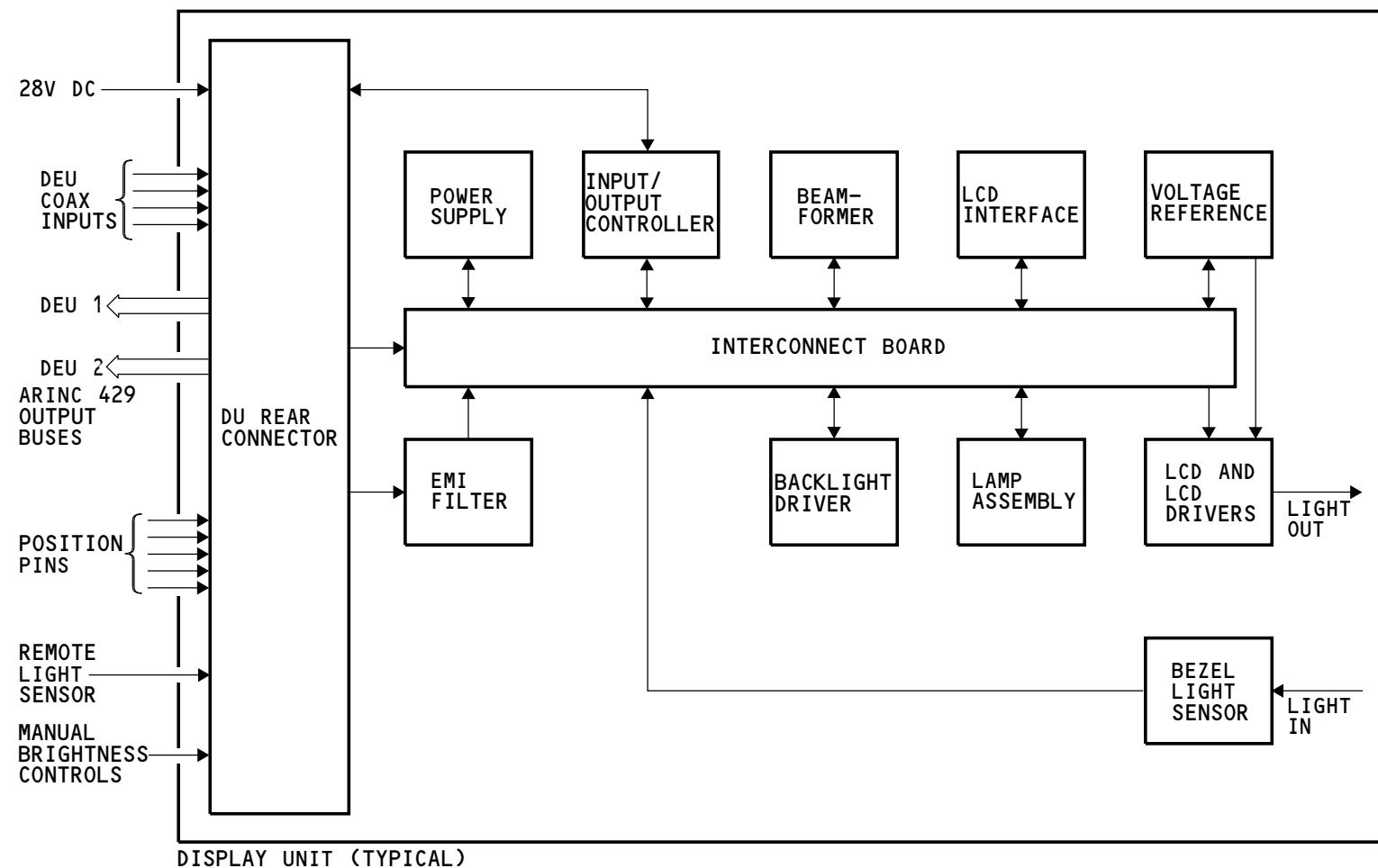
Beamformer

The beamformer decompresses the graphics image data from the DEU to graphics image data for the LCD interface.

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CDS - DU - FUNCTIONAL DESCRIPTION

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CDS - BRIGHTNESS CONTROLS

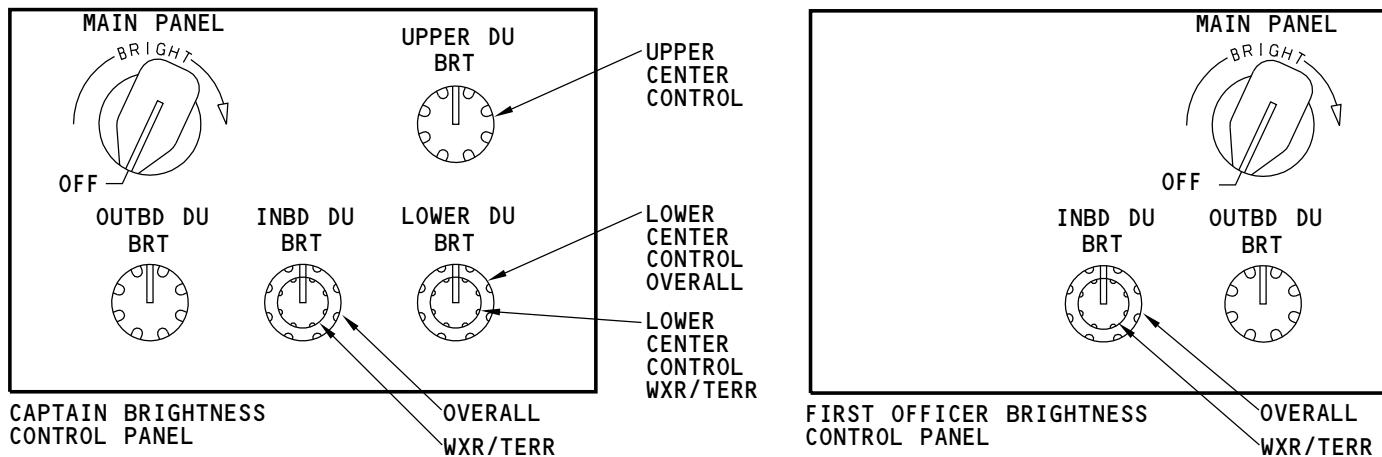
General

Two brightness control panels are below the captain and first officer displays. The panels set the manual brightness of the displays. The controls for the inboard DUs and the lower center DU are dual controls. The larger knob controls the overall brightness of the DU. The small knob controls the weather radar (WXR) or the terrain display relative brightness when the WXR or enhanced ground proximity warning system terrain display is on.

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CDS - BRIGHTNESS CONTROLS



CDS - DISPLAY ELECTRONICS UNIT

General

The common display system has two display electronics units (DEUs). The DEUs do these functions:

- Collect data from airplane systems
- Change the data to a video signal to show on the display units
- Send data to other airplane systems.

The DEU monitors the presence, status, and validity of inputs and cross compares inputs with the other DEU.

Physical Description

The DEU is an 8-MCU enclosure. The DEU is approximately 10 inches (25.4 cm) wide, 7.5 inches (19 cm) tall, and 15 inches (38 cm) deep.

The DEU weighs approximately 31.5 pounds (14.3 kg).

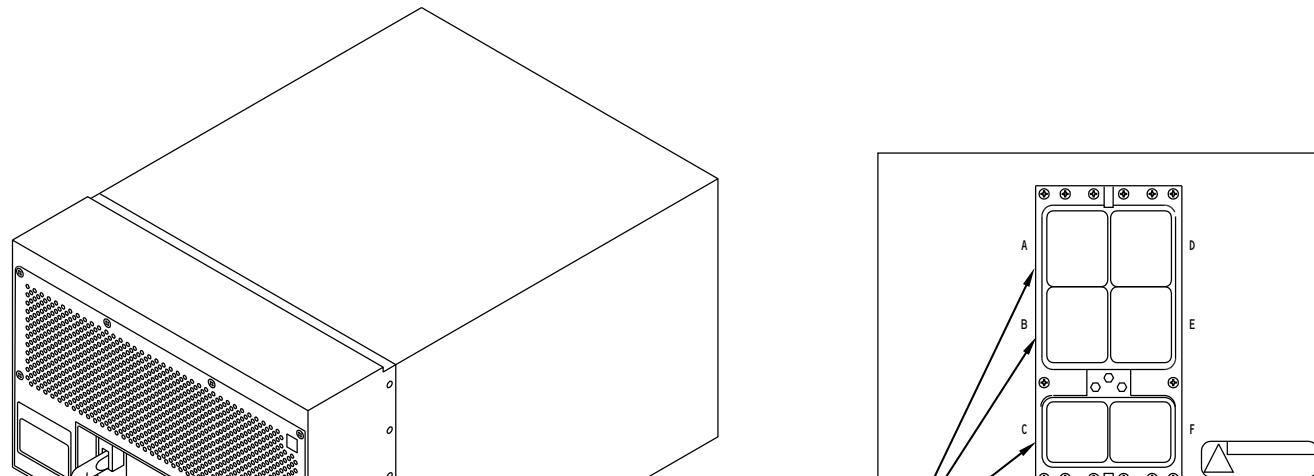
Rear Connector

On the rear of the DEU there are electrical connectors. There are letters next to each connector. You can use these letters for CDS BITE discrete input monitoring.

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CDS - DISPLAY ELECTRONICS UNIT

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CDS - DEU - FUNCTIONAL DESCRIPTION

General

The DEU collects data from other airplane systems and changes the data to a video signal. The DEU also sends some airplane system data to other systems.

The DEU has nine circuit card assemblies. They are not line replaceable units. These are the cards in the DEU:

- Two input/output controller (IOC) and ARINC 429 input/outputs (I/O)
- Two discrete input/outputs (I/O)
- One analog input/output (I/O)
- One processor
- Two graphics generators
- One power supply.

When a card fails, there are maintenance messages that show.

IOC and ARINC 429 I/O

There are two IOC and ARINC 429 I/Os. Each IOC and ARINC 429 I/O has two functions. The ARINC 429 input/output function has 39 receivers and 12 transmitters for the ARINC 429 buses. The IOC function formats all the input data to transmit on the backplane bus to the processor.

Discrete I/O

There are two discrete I/Os. Each discrete I/O supplies an interface for 108 discrete inputs and 24 discrete outputs. These inputs are digitized and sent on the I/O bus to the IOC function. The IOC function sends data back on the I/O bus for the discrete I/O to send outputs.

Analog I/O

There is one analog I/O. The analog I/O supplies an interface for 21 analog inputs and 4 analog outputs. The inputs are digitized and sent on the I/O bus to the IOC function. The IOC function sends data back on the I/O bus for the analog I/O to send outputs.

Processor

The processor receives data from and sends data to the IOC function over the backplane bus. There are two identical microprocessors in the processor. The microprocessors do the same operation and use the same software from the memory. The processor compares the output from both microprocessors. If the data is not the same, there is a failure in the processor.

The processor also compares critical data that comes from the two IOC functions. If this data is not the same, there is a failure in one of the IOC and ARINC 429 I/Os.

The processor sends data to the graphics generator over the core processor bus.

Graphic Generator

There are two identical graphic generators. The GGs receive data from the processor over the CP bus. The GG uses the data from the processor to make all the vector art. The GG also has the ARINC 453 receivers to receive weather radar data and enhanced ground proximity warning system (GPWS) data. The WXR data shows when you push the WXR switch on the EFIS control panel. The GPWS data shows when you push the TERR switch on the EFIS control panel. The vector art data and the ARINC 453 data are compressed and go out on a coax cable to the display units.

Power Supply

The power supply supplies all the cards with power. It converts the 28v dc to the voltages required.

Operation with Two DEUs

A Graphics Generator can make three images. Not all of the image capability of the two DEUs is used. In the usual configuration DEU 1's GGA operates the LOB DU and LIB DU (the third image capability of the GGA is not used), while DEU 1's GGB operates the CU DU (and two images capabilities are not used). The DEU 2's GGA operates the CL DU, while DEU 2's GGB operates the ROB DU and RIB DU.

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CDS - DEU - FUNCTIONAL DESCRIPTION

Operation with One DEU

In single DEU operation, all the image capability of the DEU is used. In the single DEU configuration with no other failures, GGA operates LOB, LIB and CU, while GGB operates CL, RIB and ROB. The system will try to operate LOB and LIB (the Captain's EFIS displays) together by the same GG channel. The system will also try to operate ROB and RIB (the First Officer's EFIS displays) together. The Captain's ND cannot show on the CL since CL is being operated by GGB (GGB is supporting the First Officer's images on the RIB and ROB DUs). As a result, if the Captain's ND is selected on the CL DU, the CL DU will be blank. The CL DU can show the First Officer's ND since GGB also operates the RIB DU.

Maintenance Messages

Failures in the cards cause some maintenance messages to show on the display units. These are the maintenance messages:

- CDS MAINT
- CDS FAULT.

The message CDS MAINT shows when one of these circuit cards fails in either DEU:

- Graphic generator
- Discrete input/output
- Analog input/output.

The message CDS FAULT shows when there is a total DEU failure. A total DEU failure is when any one of these circuit cards fails:

- Input/output controller and ARINC 429 input/output
- Power supply
- Processor.

The message CDS FAULT shows if two or more of these cards fail in a DEU or one fails in each DEU:

- Graphic generator

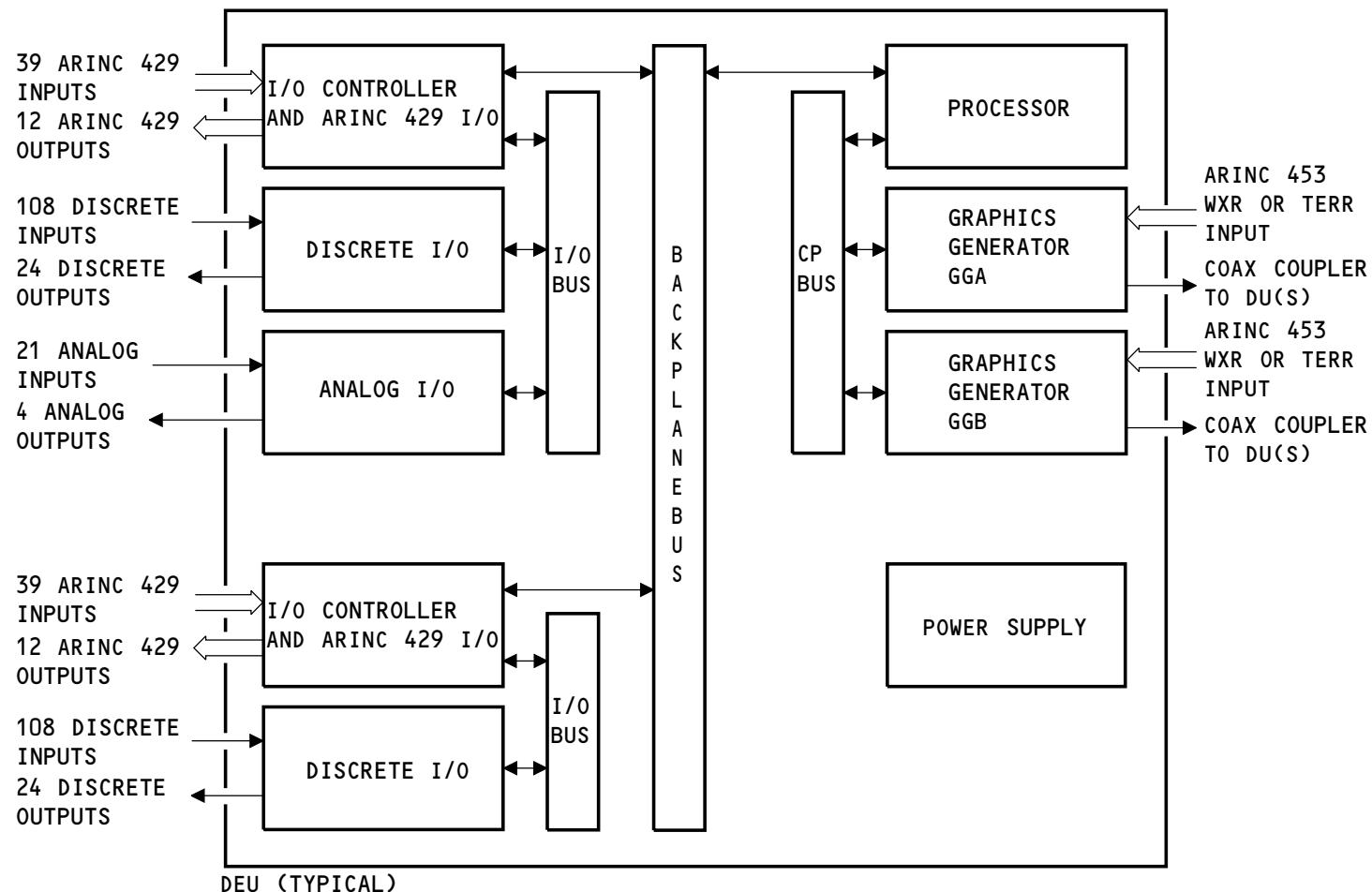
EFFECTIVITY

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- Discrete input/output
- Analog input/output.

For example, if the graphics generator fails in DEU 1 and the analog input/output fails in DEU 2, the message CDS FAULT shows.

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CDS - DEU - FUNCTIONAL DESCRIPTION

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CDS - EFIS CONTROL PANEL

General

There are two EFIS control panels that are interchangeable. The EFIS control panels control the information that shows on the display units. These are the controls on the panel (not all switches may be active and these will be marked INOP):

- Minimums controls
- Flight path vector switch
- Meters switch
- Barometric controls
- VOR/ADF switches
- Mode controls
- Range selector 3
- Traffic switch
- Weather radar switch
- Terrain switch
- Map switches.

The EFIS control panel is 4.6 inches (11.7 cm.) by 2.5 inches (6.3 cm.) and 6.5 inches (16.5 cm.) deep. The panel weighs approximately 2.7 pounds (1.2 kg).

Minimums Controls

You use the minimums controls to select and set the radio and barometric minimum altitude. These are the minimums controls:

- Minimums reference selector
- Minimums selector
- Minimums reset switch.

The outer control is the minimums reference selector.

It selects either radio or barometric (baro) as the reference for the minimum altitude.

The middle control is the minimums selector and it sets the altitude.

The inner control is the minimums reset (RST) switch. This switch resets the radio altitude alert when the minimums reference selector is in the radio position. When the minimums reference selector is in the baro position, the reset switch resets the baro altitude alert from amber to white.

Flight Path Vector Switch

The flight path vector (FPV) switch lets you show the FPV symbol on the attitude display.

Meters Switch

The meters switch (MTRS) is an alternate action switch. When you select MTRS, these indications show in meters and feet:

- Altitude
- MCP select altitude.

Barometric Controls

The barometric controls select and set the barometric reference. These are the barometric controls:

- Barometric reference selector
- Barometric selector
- Barometric standard switch.

The outer control is the barometric reference selector. It selects either inches of mercury (IN) or hectopascals (hPa) as the barometric reference. The middle control is the barometric selector and it sets the barometric correction. The inner control is the barometric standard switch. It selects the standard baro setting of 29.92 inches Hg or 1013 hPa.

VOR/ADF Switches

The VOR/ADF switch is a three position toggle switch. The switch lets you show the VOR or ADF bearing pointers on the display. These bearing pointers show on the navigation display (ND) in all modes except PLAN.

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CDS - EFIS CONTROL PANEL

Mode Controls

The mode controls select the mode that shows on the ND. The mode controls are the mode selector and the center switch. The mode selector is a four position switch. These are the four positions:

- APP
- VOR
- MAP
- PLN.

The center (CTR) switch lets you show the expanded or centered mode for VOR, APP, and MAP modes.

Range Selector

The range selector is an eight position selector. The selector controls the range that shows in the MAP and PLAN modes. This selector also controls the weather radar range and TCAS intruder symbol range in all modes.

Traffic Switch

The traffic (TFC) switch lets you show TCAS information on the display.

Weather Radar Switch

The WXR switch turns on the weather radar and allows the weather radar data to show in the expanded modes and centered map mode. Weather radar does not show in the plan mode.

Terrain Switch

The TERR switch lets you show enhanced ground proximity warning system displays on the ND.

Map Switches

The map switches let you show additional map information in the MAP mode. These are the map switches:

- STA, for navigation aids not in the route

- WPT, for waypoints not in the route
- ARPT, for airports not in the route
- DATA, for selection of vertical situation display and for a range setting of 160 nm or greater, altitude and ETA of route waypoints
- POS, for position comparison information.

Control Panel Failure

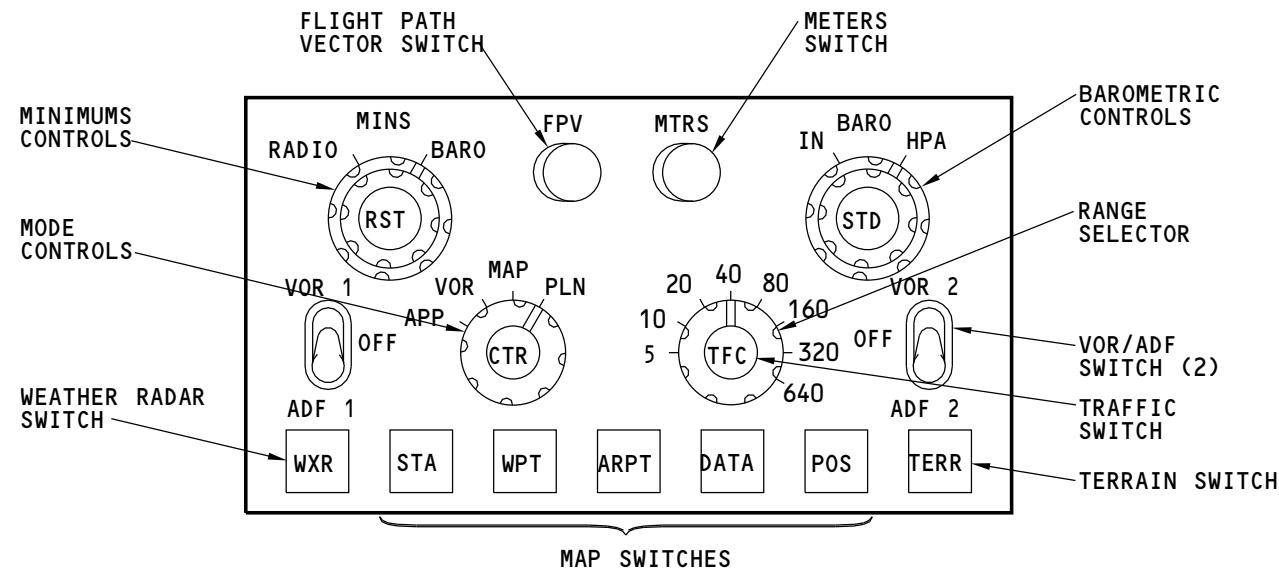
If a control panel fails, the navigation display changes. These are the changes you see if a control panel fails:

- The VOR and ADF selections stay the same
- All map switches are off and do not operate
- The expanded map mode shows
- A range of 40 miles shows
- The weather radar comes on and shows (in the air only).

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NOTE: SOME SWITCHES MAY BE MARKED INOP

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CDS - EFIS CONTROL PANEL

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CDS - PRIMARY FLIGHT DISPLAY OVERVIEW

General

The primary flight display (PFD) shows these indications:

- Airspeed
- Attitude
- Altitude
- Heading
- Vertical speed
- Flight modes
- Flight director commands
- Landing indications
- Radio altitude
- Time critical annunciations.

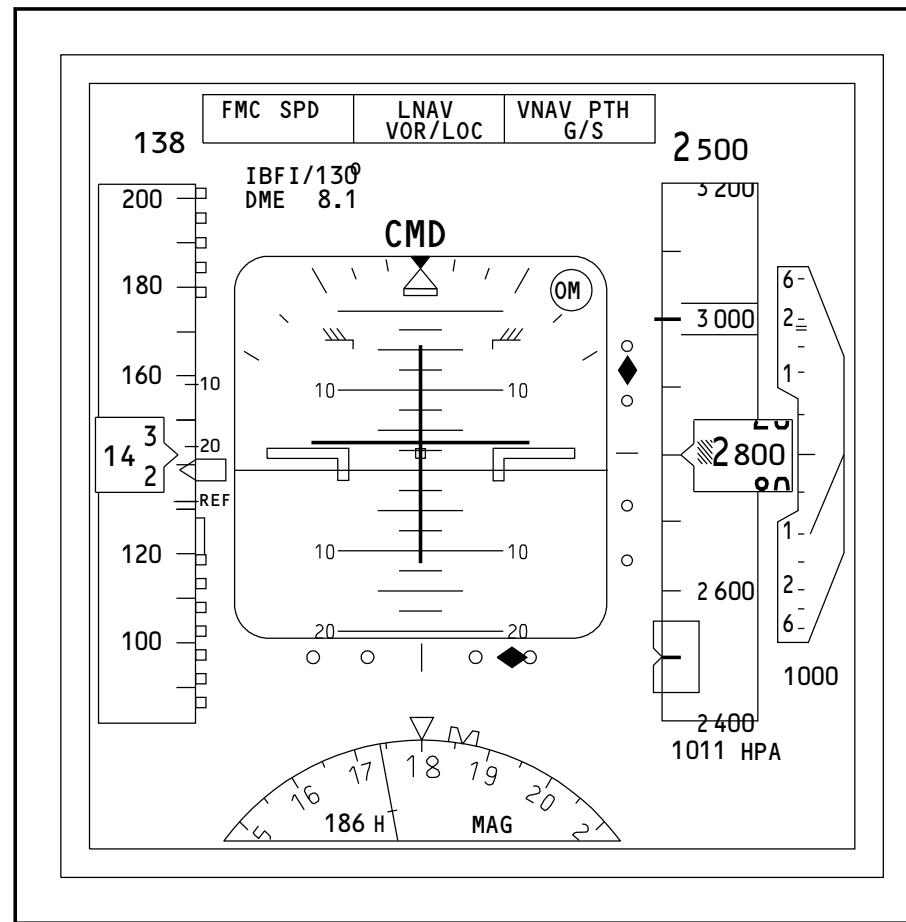
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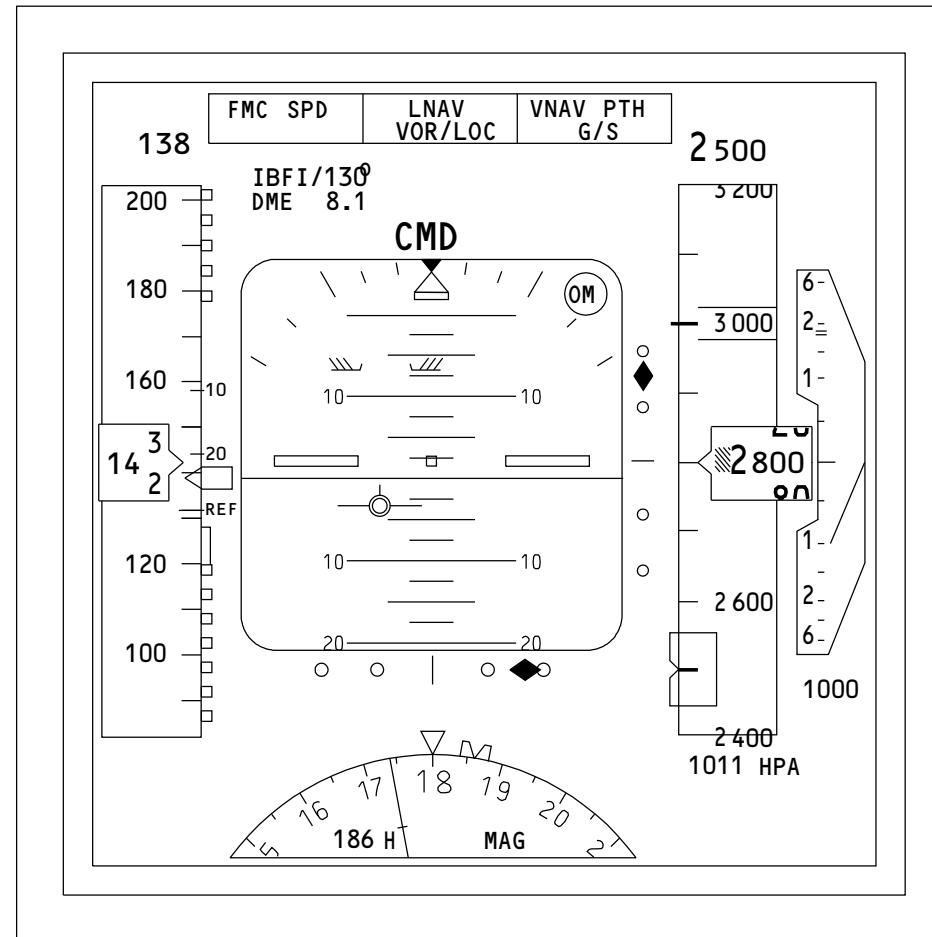
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M77550 S0004627245_V1

CDS - PRIMARY FLIGHT DISPLAY OVERVIEW
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2347313 S0000535139_V1

CDS - PRIMARY FLIGHT DISPLAY OVERVIEW

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CDS - PFD - AIRSPEED INDICATIONS

Airspeed Indication

The airspeed indication shows air data inertial reference system (ADIRS) airspeed and other airspeed related information from airplane systems.

Speed Tape and Current Airspeed

The speed tape shows the computed airspeed from the ADIRU on a moving scale. Current airspeed shows as a digital readout. The digital readout box points to the value on the speed tape. When the airspeed is below 30 knots, 30 knots shows.

Airspeed Disagree Message

If the captain and first officer airspeed disagrees by 5 knots or more, the IAS DISAGREE message shows at the bottom of the speed tape. The message is amber.

Mach Number

Mach number shows as a digital readout. It shows below the airspeed tape when the Mach number is more than 0.4. The display does not show when the Mach number is below 0.38 or if the Mach number display fails.

Speed Trend Vector

The speed trend vector shows the predicted airspeed in 10 seconds based on current acceleration or deceleration. This vector shows when the speed trend is more than 4.5 knots.

Selected Speed/Selected Mach Number

There is a selected speed bug and a digital readout. The value of the selected speed or Mach number is the value the pilot selects on the mode control panel (MCP) or the value the FMC calculates. The bug points to the selected speed on the speed tape. The digital readout above the speed tape shows the selected speed or the selected Mach number.

When the selected speed or Mach number is off the scale, only half of the bug shows at the top or the bottom of the speed tape.

See the digital flight controls section for more information on selected speed. (SECTION 22-11)

Takeoff Reference Speeds

The speed tape shows these reference speeds for takeoff:

- Reminder for airspeed callout at 80 knots (optional)
- Reminder for airspeed callout at 100 knots (optional)
- Decision speed (V1)
- Rotation speed (VR)
- Selected target speed (V2)
- Selected target speed plus 15 knots (V2 + 15).

The DEUs set the reminder for airspeed callout. This indication is blank after takeoff when the pilot first retracts the flaps or when the pilot enters Vref on the CDU (optional).

For takeoff, the pilot sets V2 on the mode control panel. The DEU calculates V2 + 15 and shows it on the speed tape.

The pilot can manually set a white bug with the engine display control panel speed reference selector. The pilot can set this white bug at any value more than 60 knots. It shows on the speed tape and the numeric value shows on the bottom right of the speed tape when the speed reference selector is in the triangle position.

The NO VSPD flag shows when V1 or VR is not valid or is not entered in the flight management computer system. If a route of flight is not entered, you will see this flag.

See the flight management computer system section for more information on takeoff reference speeds and the speed reference bug. (SECTION 34-61)

Landing Reference Speeds

The landing reference speed bugs are Vref and Vref + 15.

The landing reference speed bugs are Vref and Vref + 20.

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CDS - PFD - AIRSPEED INDICATIONS

The FMC calculates Vref. The pilot can set Vref manually with the speed reference selector on the engine display control panel.

The DEU calculates Vref + 15.

The DEU calculates Vref + 20.

See the flight management computer system section for more information on landing reference speeds. (SECTION 34-61)

Manually Entered Weight

The pilot can enter the airplane weight with the speed reference selector on the engine display control panel. The weight shows in pounds or kilograms adjacent to the speed tape.

See the flight management computer system section for more information on airplane weight. (SECTION 34-61)

Limit Speeds

Maximum speed shows as red and black alternate squares. If the maximum speed value is on the speed tape, the maximum speed display starts at the top of the speed tape and goes down to the maximum operating speed.

The maximum maneuver speed shows as a hollow amber bar. It shows the highest speed before the start of the high speed buffet.

Minimum speed shows as red and black alternate squares. If the minimum speed value is on the speed tape, the minimum speed display starts at the bottom of the speed tape and goes up to the minimum operating speed.

The minimum maneuver speed shows as a hollow amber bar. It shows the lowest speed before the start of the stick shaker.

If the airspeed is less than 70 percent of the minimum maneuver speed, the digital airspeed readout shows amber. The readout shows amber until the airspeed is more than the minimum maneuver speed.

See the stall warning system section for more information on the limit speeds see (SECTION 27-32).

Flap Maneuver Speeds

The flap maneuver speed for flap retraction or extension shows on the speed tape. The flap maneuver speed shows as a tick mark with the flap selection.

See the flight management computer system section for more information on flap maneuver speeds. (SECTION 34-61)

Vref Flap/Speed Annunciation

The Vref flap/speed annunciation shows the Vref flap position and speed. It shows at the base of the speed tape. It only shows when the FMC sets Vref values (set the Speed Reference on the Engine Control Panel to "Auto"). Set the Vref value at the Engine Control Panel to "Auto", or the Vref flap/speed annunciation will not show.

EFFECTIVITY

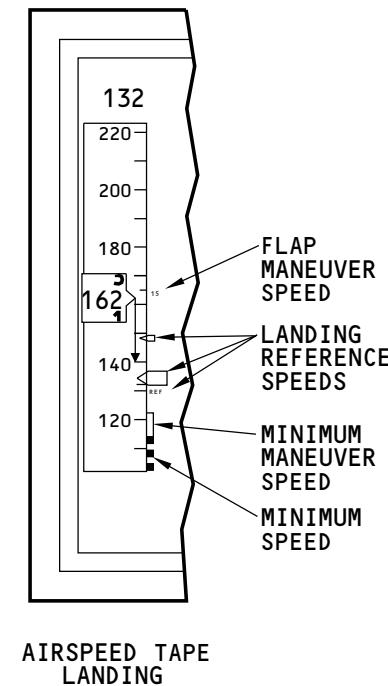
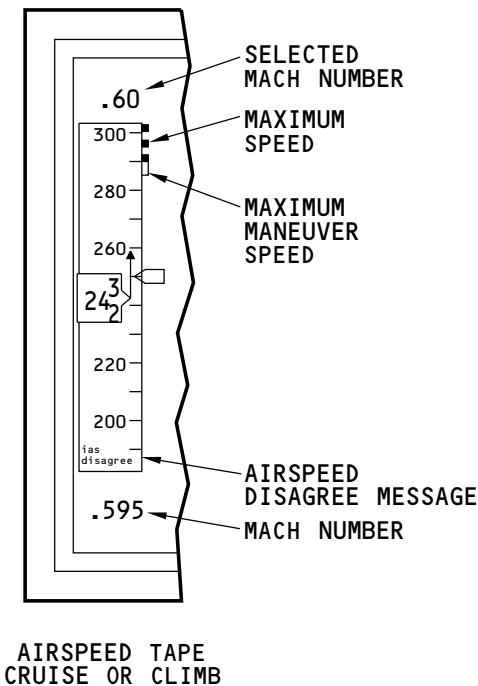
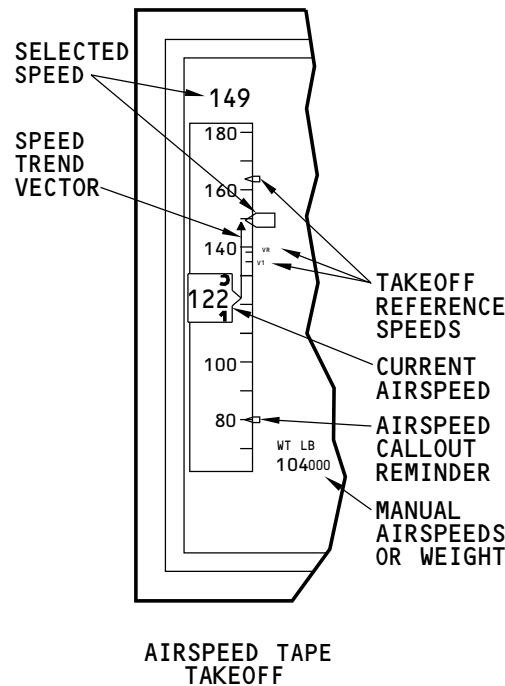
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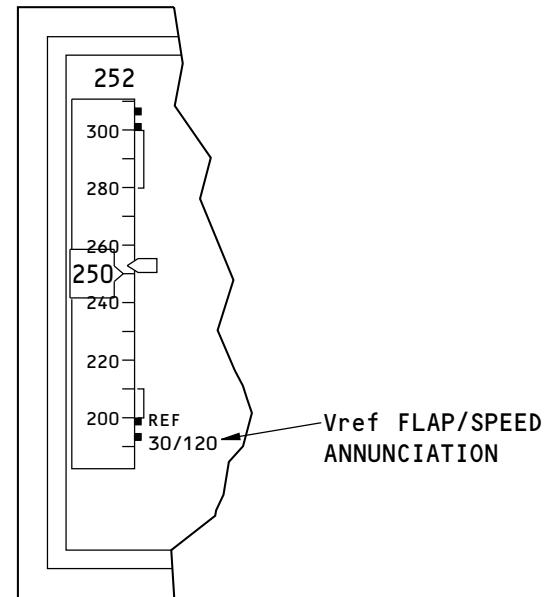
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M77555 S0004627251_V2

CDS - PFD - AIRSPEED INDICATIONS



J75226 S0000178099_V1

CDS - PFD - AIRSPEED INDICATIONS - VREF FLAP/SPEED

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CDS - PFD - ATTITUDE INDICATIONS

General

The attitude area shows the pitch and the roll attitude of the airplane. Pitch and roll data comes from the air data inertial reference system (ADIRS). These are other indications that show in the attitude area:

- Flight director commands
- Traffic alert and collision avoidance system (TCAS) resolution advisories
- Slip/skid
- Pitch limit
- Flight path vector
- Comparator function annunciations
- Navigation Performance Scales (NPS)

Flight Director Commands

The flight director commands show when the flight director is on. The pitch and roll commands come from the flight control computers.

TCAS Resolution Advisories

TCAS resolution advisories show when the TCAS finds that a traffic conflict exists. The red bars show pitch attitudes that the pilots must avoid in a traffic encounter.

Slip/Skid Indication

The slip/skid indication shows the lateral acceleration of the airplane. The displacement of the lower portion of the bank pointer shows the lateral acceleration. If there is no lateral acceleration, the roll pointer and slip/skid indication align. The slip/skid indication is filled white when the lateral acceleration is more than a threshold value. Also, if the roll attitude is more than 35 degrees, the slip/skid indication changes to filled amber.

Pitch Limit Indication

The pitch limit indication shows the limit that you can pitch the airplane before the stick shaker starts.

EFFECTIVITY

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CDS - PFD - ATTITUDE INDICATIONS

The VNAV deviation scale and pointer show to the right of the ADI. The pointer shows the vertical direction that the plane must go to get back to the FMC specified path.

If you use Heading Select to deviate from the LNAV path, the NPS scales continue to show during this condition:

- The plane position is less than two RNP values from the FMC lateral path

Deviation Scale Identifier

The deviation scale identifier shows that the lateral and vertical deviation scales are in the NPS mode. For more deviation scales and identifiers, see 31-62-00-307.

ANP/RNP Bars

The RNP value measures the precision of the navigation system. The ANP value measures the FMC's estimate of the quality of its position estimate. When quality of the FMC position estimate is high, the ANP value is low. The difference between the RNP and ANP is the permitted flight technical error. In some conditions, the flight crew can turn from the center of the FMC path, to the limit of the flight technical error.

The outer scale marks on the deviation scales show the RNP values in nautical miles. The ANP/RNP bars show at the ends of the deviation scales. The bars show the ANP value in nautical miles. The space between the ends of the bars shows the quantity of the flight technical error.

If ANP is zero, the bars do not show. If ANP is smaller than RNP, the bars extend from the edges to the scale center. If ANP is larger than RNP, the bars show overlap. After 10 seconds of overlap, the bars show as amber. When ANP is larger than RNP, the FMC can not be sure that the plane is in the navigation limits. An UNABLE REQD NAV PERF-RNP flag shows. If the FMC does not supply an ANP value to the CDS, no bars show.

Anticipation cues

The NPS supplies anticipation cues (ghost pointers) for a smooth entry to the landing approach. The anticipation cues show when the flight crew tunes an ILS or some other landing system. The cues move to the scale center while the plane follows the LNAV/VNAV path to the landing path. When the cues touch the scale center, the plane goes into the armed landing mode. When the plane goes into the landing mode, the landing indications replace the NPS indications. For landing indications, see 31-62-00-307.

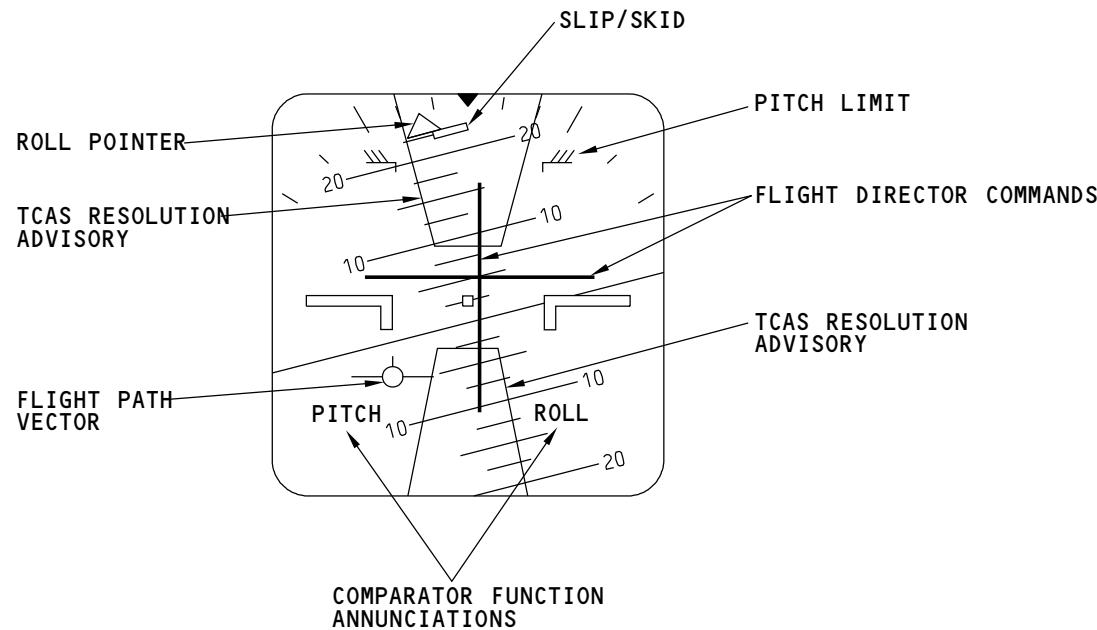
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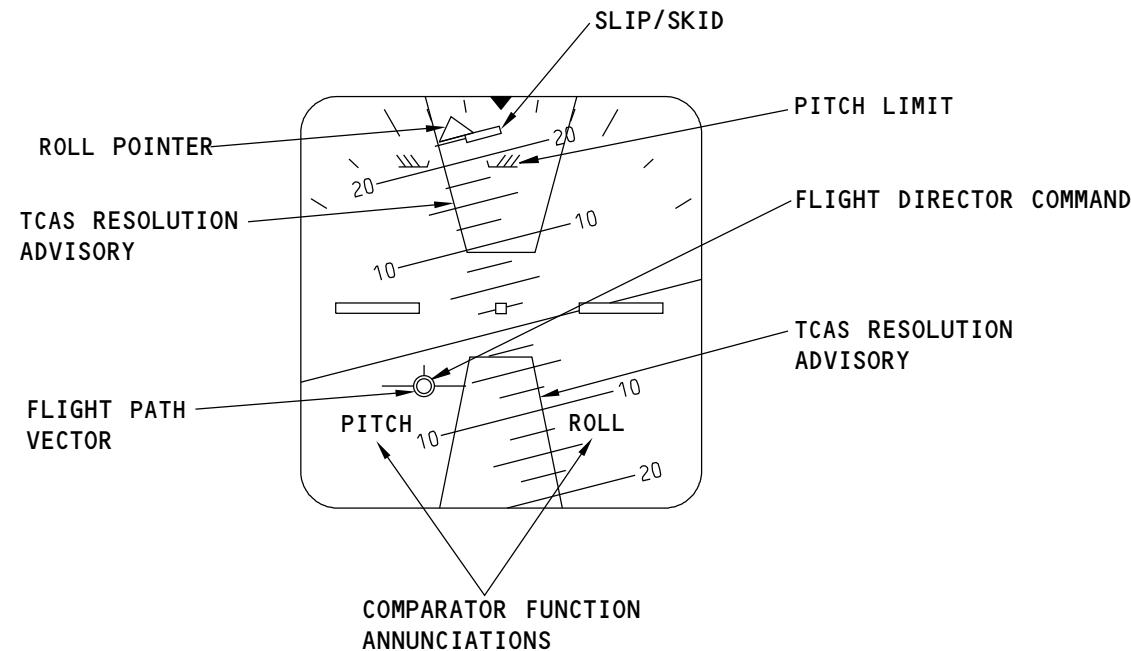
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CDS - PFD - ATTITUDE INDICATIONS



2347314 S0000535175_V1

CDS - PFD - ATTITUDE INDICATIONS
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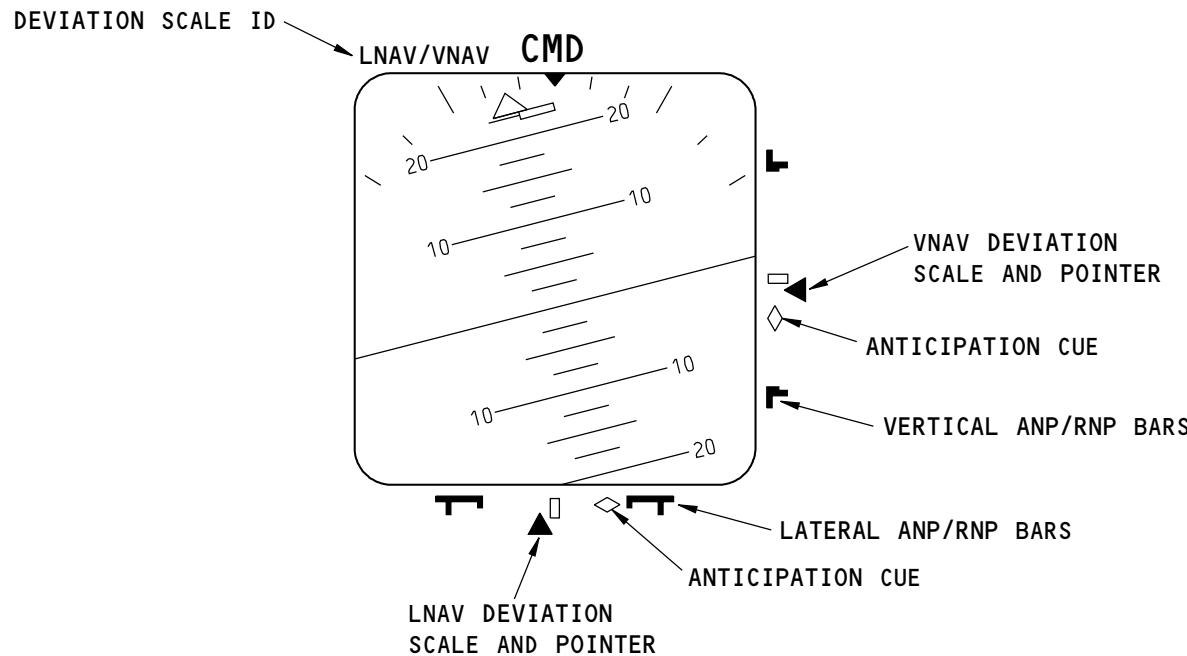
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J88585 S0000181835_V1

CDS - PFD - ATTITUDE INDICATIONS - NPS

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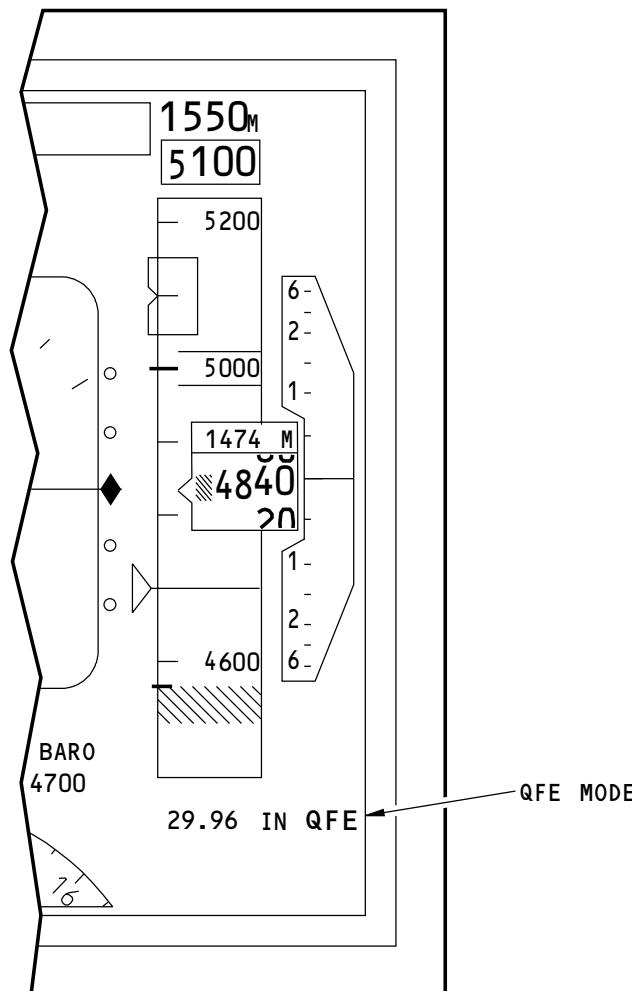
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1339958 S0000238021_V1

CDS - PFD - ALTITUDE INDICATIONS
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CDS - PFD - ALTITUDE INDICATIONS

Altitude Indication

The altitude indication shows barometric altitude from the air data inertial reference system (ADIRS) and other related altitude information from various systems.

Altitude Tape and Current Altitude

The altitude tape shows the barometric altitude on a moving scale. It can show a range of 806 feet. The current altitude shows in a digital readout box. The digital readout box points to the value on the altitude tape.

Selected Altitude and Altitude Alert

There is a selected altitude bug and a digital readout. The pilot uses the mode control panel to set the selected altitude. The bug points to the selected altitude on the altitude tape. When the selected altitude is offscale, only half the bug shows at the top or bottom of the altitude tape. The selected altitude digital readout shows above the altitude tape.

When the airplane approaches the selected altitude, there is an altitude alert. When there is an altitude alert, a white box shows around the selected altitude digital readout.

See digital flight control system section for more information about altitude alert. (SECTION 22-11)

Metric Altitude and Metric Selected Altitude

When you select MTRS on the EFIS control panel, the altitude in meters shows as a digital value above the digital readout box. The selected altitude in meters also shows. It shows above the selected altitude digital readout.

Landing Altitude Indications

The landing altitude indication shows as a crosshatched area on the altitude tape.

Altitude Disagree Message

If the captain and first officer altitudes are different by more than 200 feet, the amber ALT DISAGREE message shows at the bottom of the altitude tape.

Selected Barometric Minimums

There is a selected barometric minimum bug and a digital readout. The pilot selects the barometric minimum from the EFIS control panel. The bug points to the selected barometric minimum value on the altitude tape. The digital readout shows below the attitude display and shows BARO above the value.

If the barometric minimums alert is active and the airplane descends through the selected BARO altitude these displays change to amber:

- Barometric minimums bug
- The word BARO
- Digital display.

To reset the alert, the pilot does one of these:

- Climb above the selected barometric minimums
- Push the RST button on the EFIS control panel
- Land.

To make the barometric minimums displays blank, the pilot does one of these:

- Push the reset (RST) button on the EFIS control panel while the switch is set to BARO minimums
- Select radio minimums on the EFIS control panel to make the BARO minimums digital value blank. The BARO minimums bug stays in view.
- Select BARO minimums of -1000 feet or more.

EFFECTIVITY

AKS ALL



CDS - PFD - ALTITUDE INDICATIONS

Barometric Reference

You select the barometric reference from the EFIS control panel, and it shows below the altitude tape. If you select the barometric reference in inches, IN shows next to the digital barometric reference value. If you select the barometric reference in hectopascals, HPA shows next to the digital barometric reference value. If you select the standard barometric reference, STD shows.

QFE shows to the right of the digital barometric reference.

AOA DISAGREE Annunciation

The AOA DISAGREE annunciation shows if the AOA sensors are different by more than 10 degrees for more than 10 seconds. The fault condition is recorded in CDS BITE.

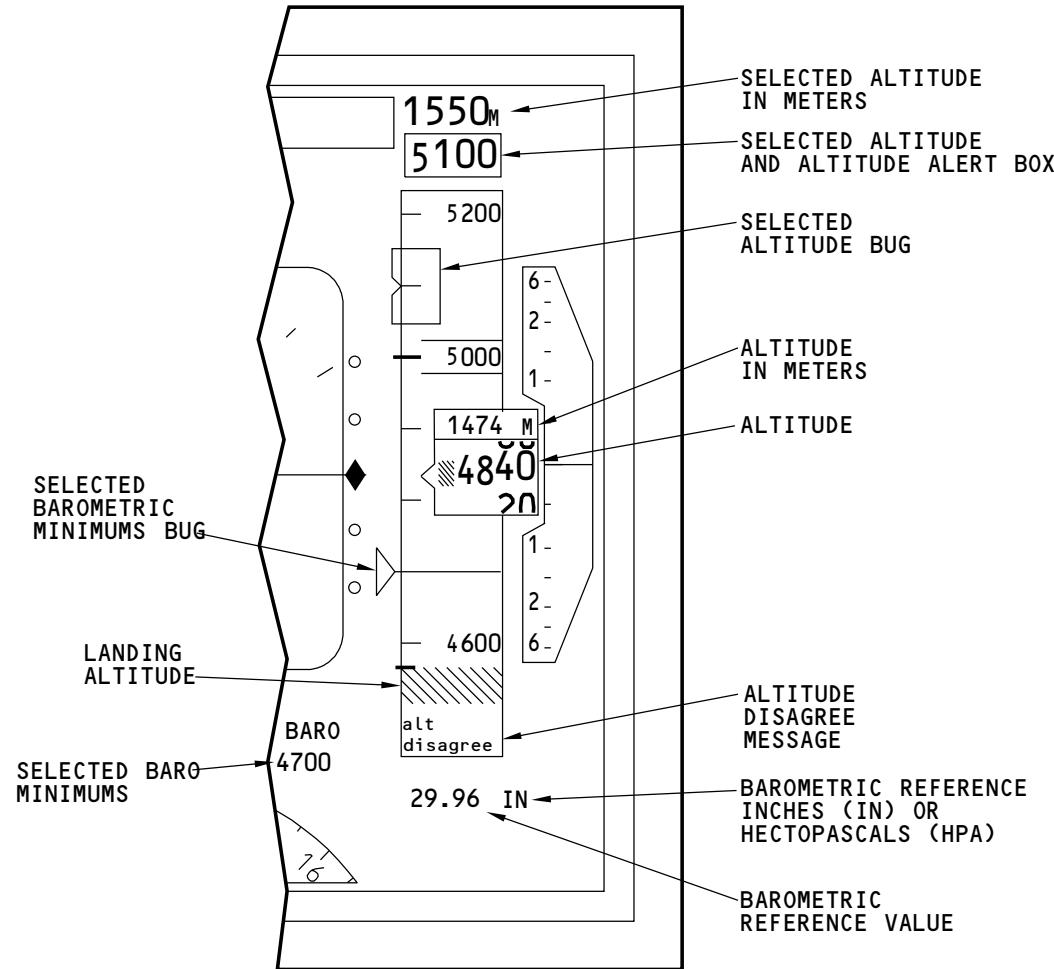
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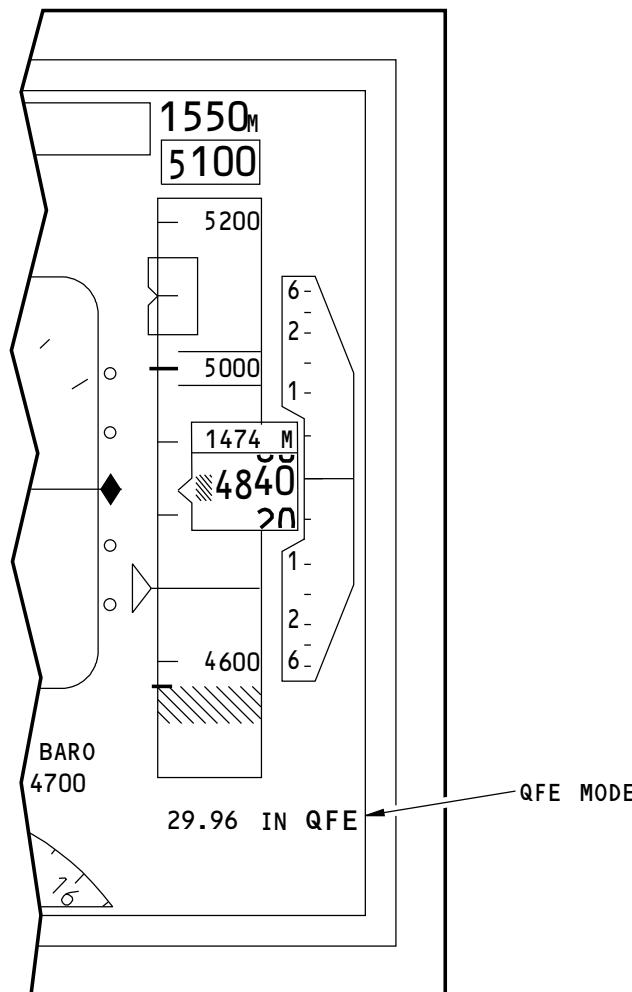
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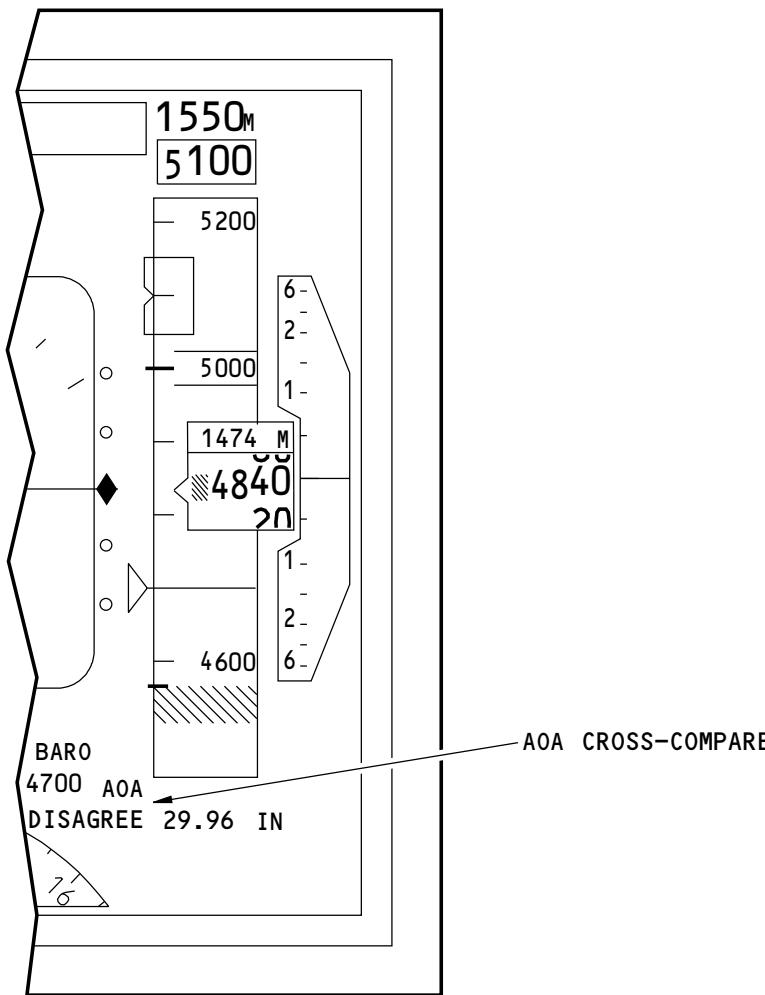
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CDS - PFD - ALTITUDE INDICATIONS
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1339958 S0000238021_V1

CDS - PFD - ALTITUDE INDICATIONS
31-62-00



U31745 S0000191336_V1

CDS - PFD - ALTITUDE INDICATIONS - AOA DISAGREE

EFFECTIVITY

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CDS - PFD - VERTICAL SPEED INDICATIONS

Vertical Speed Indications

The vertical speed indication shows vertical speed from the air data inertial reference system (ADIRS). Vertical speed shows with a white pointer against the speed scale. If the vertical speed is more than 400 feet per minute, then vertical speed shows as a digital value. The digital value shows above the vertical speed scale if it is a positive vertical speed. The digital value shows below the vertical speed scale if it is a negative vertical speed.

There is a selected vertical speed bug. You use the mode control panel to set the selected vertical speed.

The TCAS resolution advisories show on the vertical speed scale. A TCAS climb advisory shows as a red bar that extends from the bottom of the vertical speed scale. A TCAS descend advisory shows as a red bar that extends from the top of the vertical speed scale.

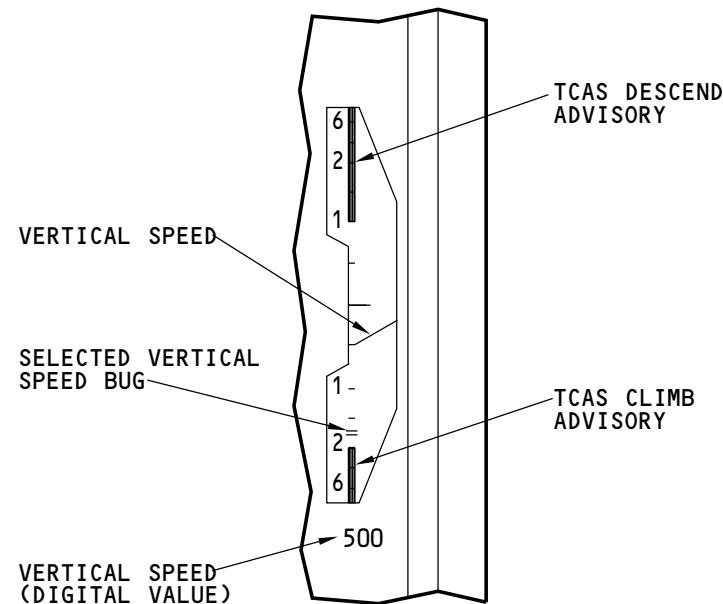
See the Air Data Inertial Reference System section for more information on vertical speed information. (SECTION 34-21)

EFFECTIVITY

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CDS - PFD - VERTICAL SPEED INDICATIONS

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CDS - PFD - HEADING INDICATION

Heading Indications

The heading indication shows on a partial compass rose at the bottom of the primary flight display (PFD).

Heading and Track

The current heading shows as a triangular pointer at the top of the compass rose. The track shows as a line that extends from the center of the compass rose. The heading reference to true or magnetic north shows with a MAG or TRU indication.

Selected Heading

The selected heading shows with a bug and a digital readout. You use the mode control panel to set the selected heading.

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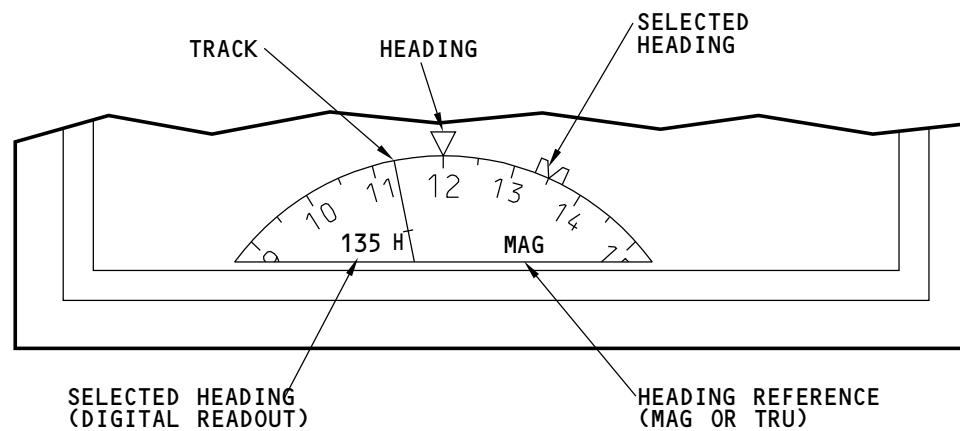
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CDS - PFD - HEADING INDICATION**31-62-00**



CDS - PFD - FLIGHT MODE ANNUNCIATIONS

Flight Mode Annunciations

These are the types of flight mode annunciations (FMA):

- Autothrottle
- Pitch
- Roll
- Autopilot status.

Autothrottle Mode Annunciation

The autothrottle mode annunciation shows in column one of the FMA. One line of annunciation is available.

A mode change highlight box shows around the mode for 10 seconds when the autothrottle mode changes.

See the autothrottle system section for more information on the autothrottle modes. (SECTION 22-31)

Roll Mode Annunciations

The roll mode annunciation shows in column two of the FMA. Two lines of annunciation are available. The first line shows the engaged roll mode. The second line shows the armed roll mode.

A mode change highlight box shows around the mode for 10 seconds when the engaged roll mode changes.

A second armed roll mode can show with LNAV. The two modes show on the same line with a space between them.

See the Digital Flight Control System section for more information on the roll modes. (SECTION 22-11)

Pitch Mode Annunciations

The pitch mode annunciation shows in column three of the FMA. Two lines of annunciation are available. The first line shows the engaged pitch mode. The second line shows the armed pitch mode.

A mode change highlight box shows around the mode for 10 seconds when the engaged pitch mode changes.

See the Digital Flight Control System section for more information on the pitch modes. (SECTION 22-11)

Autopilot and Flight Director Status

The autopilot and flight director status shows above the attitude roll indication. These are the indications that may show:

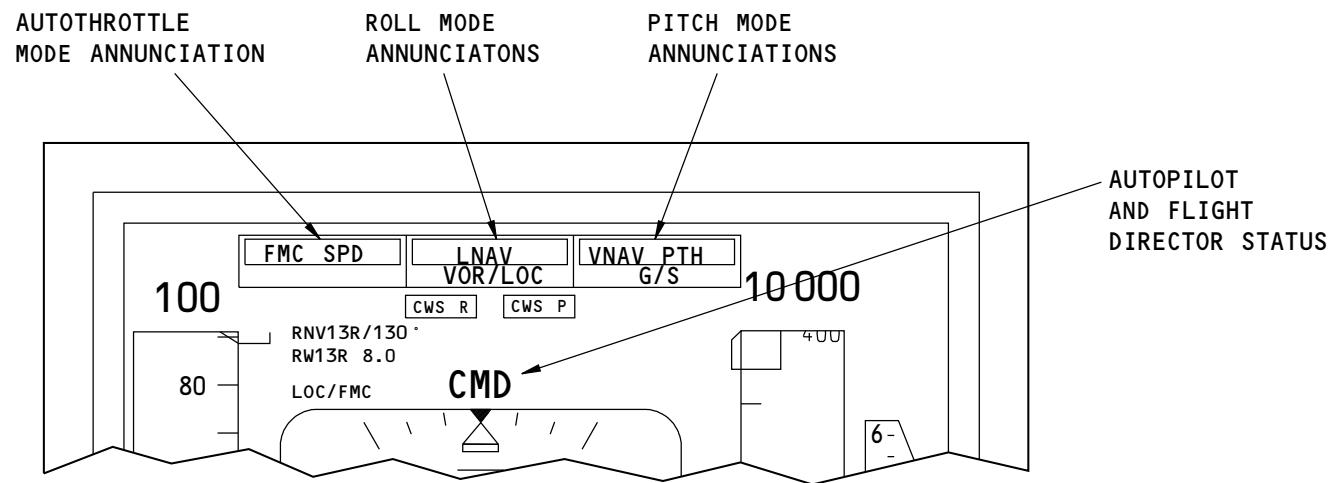
- CMD when FCC is engaged in command
- FD when the flight director is on
- TEST when the FCC is in self test
- CWS R when control wheel steering engaged in roll axis
- CWS P when control wheel steering engaged in pitch axis
- AUTO PILOT when Auto Pilot is engaged
- NO AUTOLAND when autoland is unavailable
- >LAND 2< when autoland mode 2 is engaged
- LAND 3 when autoland mode 3 is engaged
- SINGLE CH for a single channel approach

See the Digital Flight Control System section for more information on the autopilot and flight director indications. (SECTION 22-11)

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NOTE: THE DATA SHOWN ON THE DISPLAY IS ONLY AN EXAMPLE.

W47921 S0000124807_V1

CDS - PFD - FLIGHT MODE ANNUNCiations

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CDS - PFD - LANDING INDICATIONS

Landing Indications

These are the landing indications:

- Approach scale identifier
- Approach deviation indications
- Approach reference data
- Rising runway indications
- Marker beacon indications.

Approach Scale Identifier

The approach scale identifier shows the approach selection.

"ILS" shows for an ILS approach. If the CDS receives no data from the MMR, the "ILS" indicator is removed.

AKS 014, 019, 026-999

"GLS" shows for a GLS approach. If the CDS receives no data from the MMR, the "GLS" indicator is removed.

AKS ALL

"FMC" shows for an IAN approach.

"LOC/ G/P" shows for a mixed mode approach with "GLIDESLOPE OFF" set to OFF at the CDU.

Approach Deviation Indications

The approach deviation scales and pointers show lateral and vertical deviation from the approach path.

The lateral deviation shows at the bottom of the attitude area. The deviation shows with a triangular pointer against a scale. There are two scales: standard and expanded. The expanded scale shows for some autopilot modes or if the lateral deviation is more than the standard scale. It also shows when the flight director is on. The expanded localizer deviation scale does not show for an FMC approach. If the FCC sends a warning for lateral deviation, the scale and pointer change to amber and the pointer flashes.

The vertical deviation shows on the right of the attitude area. The deviation shows with a triangular pointer against a scale. If the FCC sends a warning for vertical deviation, the scale and pointer change to amber and the pointer flashes.

ILS Approach Indications

For an ILS approach, the scales show when the ILS receiver is tuned to an applicable frequency. The pointers show when the ILS receives the localizer and glideslope signal.

The lateral deviation indication adjusts when necessary to show a correct back course approach. During a back course approach, the vertical pointer does not show.

When the localizer data is NCD, the pointer and scale do not show. When the localizer data is not received, a LOC flag shows. When the glideslope data is NCD, the pointer and scale do not show. A G/S flag shows when the glideslope data is not received.

See the ILS section for more information. (SECTION 34-31)

AKS 014, 019, 026-999

GLS Approach Indications

For a GLS approach, the scales show when the ILS receiver is tuned to an applicable channel. The pointers show when the ILS receives the localizer and glideslope signal.

The lateral deviation indication adjusts when necessary to show a correct back course approach. During a back course approach, the vertical pointer does not show.

When the localizer data is NCD, the pointer and scale do not show. When the localizer data is not received, a LOC flag shows. When the glideslope data is NCD, the pointer and scale do not show. A G/S flag shows when the glideslope data is not received.

See the ILS section for more information. (SECTION 34-31)

EFFECTIVITY

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CDS - PFD - LANDING INDICATIONS

AKS ALL

IAN Approach Indications

For an IAN approach, the scales and pointers show deviation from the FAC and the Glide Path received from the FMC.

When the FAC data is NCD, the pointer and scale do not show. When the FAC data is not received, an FAC flag shows. When the glide path data is NCD, the pointer and scale do not show. A G/P flag shows when the glide path data is not received.

For a mixed mode approach, the horizontal scale and pointer show the localizer when the ILS receives an applicable signal. The vertical scale and pointer show the FMC glide path (G/P).

See the FMC section for more information. (SECTION 34-61)

Approach Reference Data

The localizer identifier shows when the ILS receiver is tuned to an applicable frequency. If the localizer identifier is not available, then the frequency shows in its position. The runway heading set on the mode control panel shows to the right of the localizer identifier.

The same identifiers show for a mixed mode approach.

AKS 014, 019, 026-999

For a GLS approach, the localizer identifier shows when the ILS receiver is tuned to an applicable GPS channel. If the localizer identifier is not available, then the channel shows in its position. The runway heading set on the mode control panel shows to the right of the localizer identifier.

AKS ALL

For an IAN approach, the localizer identifier is replaced by an identifier which shows the approach set in the CDU. The runway heading set on the mode control panel shows to the right of the localizer identifier.

The DME distance shows when the ILS receiver is tuned to an applicable frequency. The indication shows the distance to a co-located DME station.

EFFECTIVITY

AKS ALL

AKS 014, 019, 026-999

For a GLS approach, the distance indicator shows when the ILS receiver is tuned to an applicable GPS channel. The indication shows the distance to the runway.

AKS ALL

For an IAN approach, the distance indicator shows the distance to the missed approach point.

Localizer Disagree

An indication shows if the captain and the first officer set different ILS frequencies. The frequency display changes to amber and an amber horizontal line shows through the frequency. If one of the ILS receivers is not tuned to an applicable frequency, the indication does not show.

AKS 014, 019, 026-999

For a GLS approach, an indication shows if the captain and the first officer set different GPS channels. The channel display changes to amber and an amber horizontal line shows through the channel. If one of the ILS receivers is not tuned to an applicable channel, the indication does not show.

AKS ALL

Runway Disagree

An indication shows if the captain and the first officer set different runway headings. The runway heading display changes to amber and an amber horizontal line shows through the runway heading.

Rising Runway Indication

The rising runway shows when the plane is in a landing approach, and the radio altitude is below 2500 feet. The rising runway shows at the bottom of the attitude display until 200 feet radio altitude. When the radio altitude shows less than 200 feet, the rising runway moves up. The rising runway symbol touches the bottom of the airplane symbol at 0 feet radio altitude.

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CDS - PFD - LANDING INDICATIONS

Marker Beacon Indications

The marker beacon indication shows when the airplane flies over an inner, middle or outer marker beacon. The indication flashes at the rate of the marker beacon identifier.

See the marker beacon system section for more information.
(SECTION 34-32)

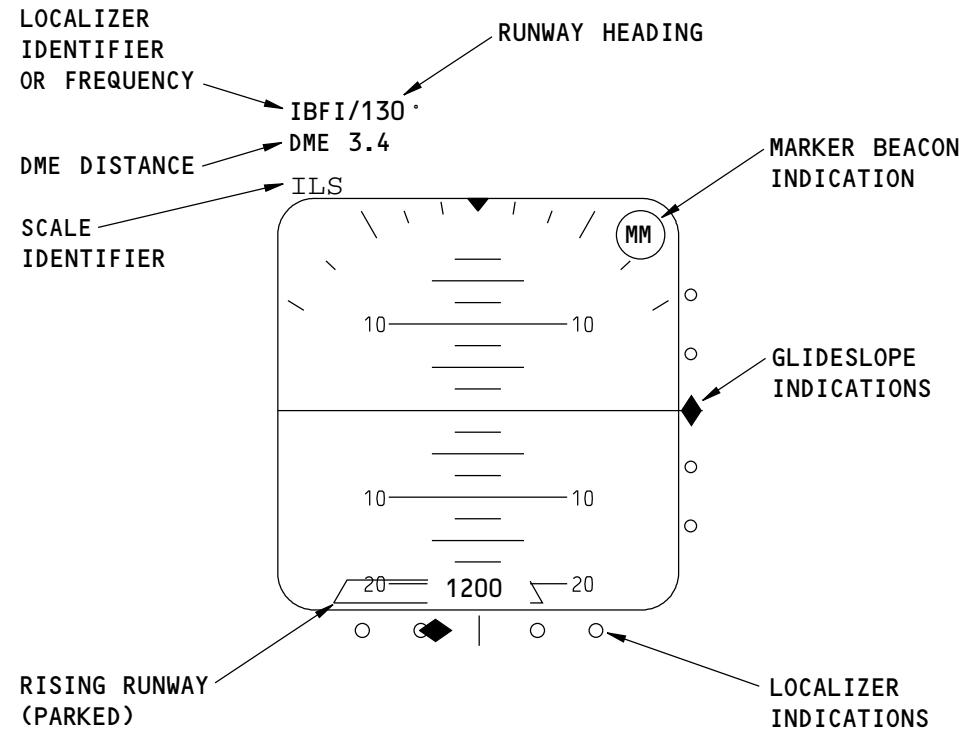
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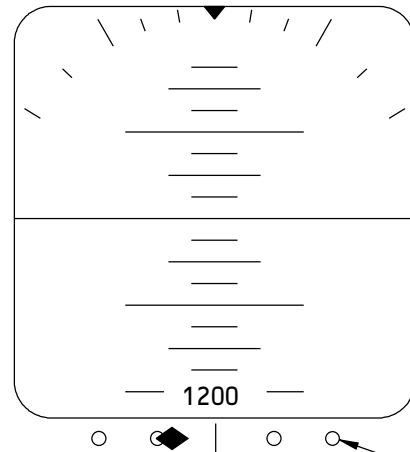
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CDS - PFD - LANDING INDICATIONS
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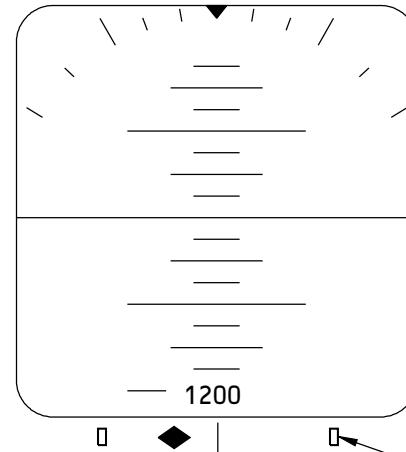
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STANDARD
LOCALIZER
INDICATIONS



EXPANDED
LOCALIZER
INDICATIONS

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CDS - PFD - STANDARD AND EXPANDED LOCALIZER DEVIATION SCALE

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CDS - PFD - RADIO ALTITUDE AND RADIO MINIMUMS INDICATIONS

General

The radio altitude indication shows radio altitude from the radio altimeter. The indication shows below 2500 feet radio altitude.

Radio Altitude

The radio altitude shows as a digital value.

Radio Minimums

The radio minimum altitude that you select on the EFIS control panel shows below the attitude indication. During descent when the radio altitude is equal to the radio minimum altitude, the radio minimum altitude turns amber and flashes for 3 seconds. After 3 seconds the display remains amber until reset.

You can reset the radio minimums alert by doing one of the following:

- Push the RST (reset) button on the EFIS control panel
- Climb above the radio minimums value
- Land.

| You can make the radio minimums displays blank by doing one of the following:

- Select a radio minimums value of less than zero
- Push the RST (reset) button on the EFIS control panel while not having the radio minimums alert
- Select BARO minimums on the EFIS control panel.

If the radio minimums display is blank and you have selected radio minimums, you can see the value of the radio minimums by pushing the RST switch.

If the radio minimums display is blank, the radio minimums alert display does not occur.

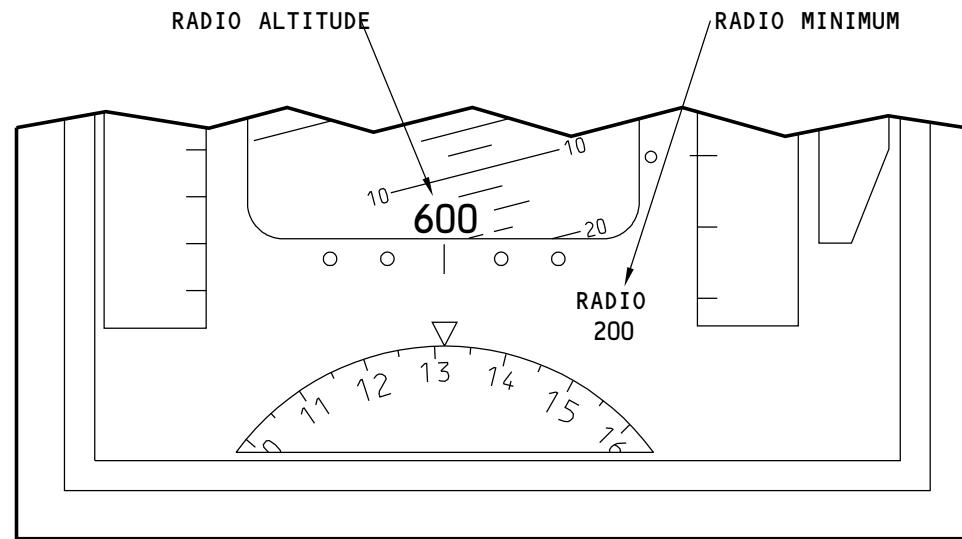
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CDS - PFD - RADIO ALTITUDE AND RADIO MINIMUMS INDICATIONS

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CDS - PFD - TIME CRITICAL ANNUNCIATIONS

Ground Proximity Warning System Time Critical Annunciations

The ground proximity warning system (GPWS) time critical annunciations show below the attitude indication. Only one GPWS annunciation shows at a time. These are the GPWS annunciations:

- WINDSHEAR warning
- PULL UP warning

| AKS 025-999

- SPEEDBRAKE warning
- MAX REVERSE warning
- GO AROUND warning.

AKS ALL

See the GPWS section for more information on GPWS indications.
(SECTION 34-46)

Instrument Switch Annunciation

The INSTR SWITCH (instrument switch) annunciation shows below the altitude tape. The annunciation shows when the captain and first officer select the same source of IRU information.

The instrument switch indication is amber.

Display Source and Maintenance Annunciations

The display source and maintenance time critical annunciations show below the speed tape. Only one annunciation shows at a time. These are the annunciations:

- DSPLY SOURCE - amber
- CDS FAULT - amber
- CDS MAINT - white.

DSPLY Source

The DSPLY (display) source annunciation shows in the air for CDS faults. The annunciation shows on the ground or in the air if the display source switch is in the ALL ON 1 or ALL ON 2 position.

CDS Fault

The CDS FAULT annunciation shows on the ground for a failure of the CDS.

CDS Maint

The CDS MAINT (maintenance) annunciation shows on the ground for a partial failure of the CDS.

EFFECTIVITY

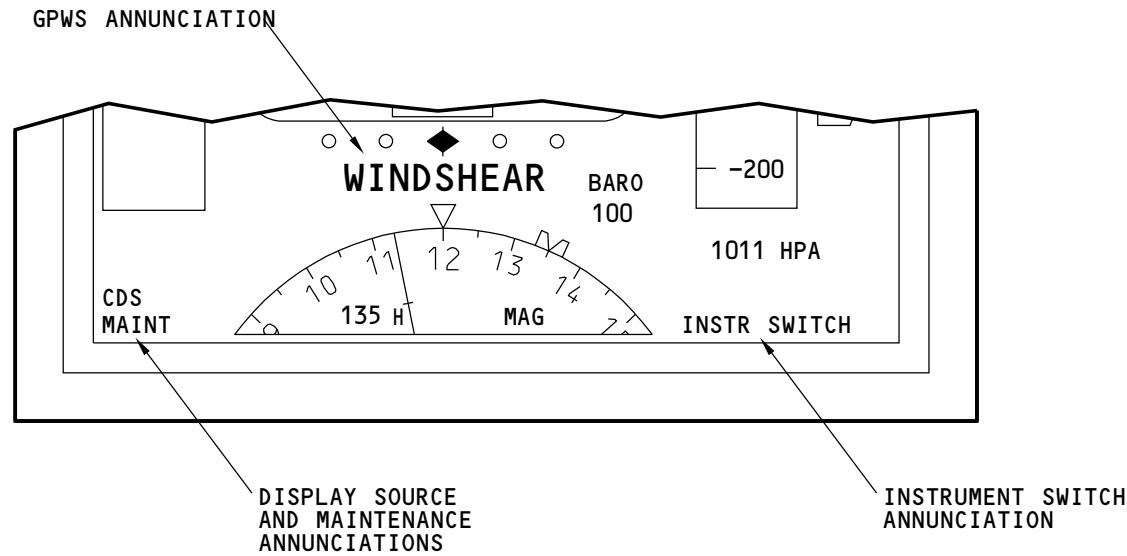
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CDS - PFD - TIME CRITICAL ANNUNCIATIONS

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CDS - PFD - SYMBOLOGY - 1

Primary Flight Display Symbology

The primary flight display shows many different symbols and data. These symbols and data show in these tables.

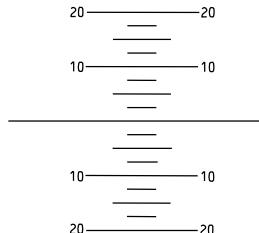
These are the colors for the symbols and data that show on the PFD. This is what the colors usually mean:

- Green (G) - Dynamic conditions
- White (W) - Present status, scales
- Magenta (M) - Command information, symbols
- Cyan (C) - Non-active or background information
- Amber (A) - Cautions, faults, flags
- Red (R) - Warnings.

EFFECTIVITY

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SYMBOL	NAME	REMARKS
	AIRPLANE SYMBOL (W)	SHOWS AGAINST MOVING PITCH AND ROLL DISPLAYS SOURCE: DEU
	FLIGHT DIRECTOR (M)	SHOWS WITH FLIGHT DIRECTOR SWITCH ON AND VALID STEERING COMMANDS. SOURCE: FCC
	PITCH LIMIT (A)	BOTTOM EDGE SHOWS PITCH LIMIT SOURCE: SMYD
	PITCH SCALE (W)	MOVING SCALE SHOWS PITCH. CENTER LINE IS HORIZON. SOURCE: ADIRU
	ROLL SCALE (W) ROLL POINTER (W) (ALERT A) SLIP SKID INDICATOR (W) (ALERT FILLED W)	FIXED SCALE SHOWS ROLL VALUE. ROLL POINTER MOVES AGAINST SCALE. WHEN ROLL MORE THAN 35 DEGREES, ALERT ROLL POINTER SHOWS. SLIP SKID INDICATOR FILLS WHEN LATERAL ACCELERATION EQUALS 0.1G. SOURCES: ROLL - ADIRU; ALERTS - DEU
	FLIGHT PATH VECTOR (W)	SHOWS ACTUAL PATH THROUGH AIR AS DETERMINED BY ADIRU. EFIS CONTROL PANEL CONTROLS DISPLAY. SOURCE: ADIRU
PITCH ROLL	PITCH/ROLL FLAGS (A)	SHOWS WHEN ADIRU PITCH AND/OR ROLL DIFFERENCE IS 5 DEGREES OR MORE. AS AN OPTION, DISPLAY FLASHES FOR FIRST 10 SECONDS. SOURCE: DEU

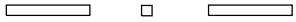
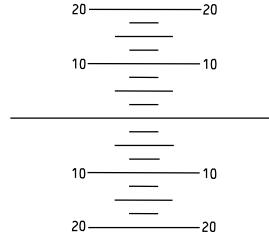
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SYMBOL	NAME	REMARKS
	AIRPLANE SYMBOL (W)	SHOWS AGAINST MOVING PITCH AND ROLL DISPLAYS SOURCE: DEU
○	FLIGHT DIRECTOR (M)	SHOWS WITH FLIGHT DIRECTOR SWITCH ON AND VALID STEERING COMMANDS. SOURCE: FCC
	PITCH LIMIT (A)	BOTTOM EDGE SHOWS PITCH LIMIT SOURCE: SMYD
	PITCH SCALE (W)	MOVING SCALE SHOWS PITCH. CENTER LINE IS HORIZON. SOURCE: ADIRU
	ROLL SCALE (W) ROLL POINTER (W) (ALERT A) SLIP SKID INDICATOR (W) (ALERT FILLED W)	FIXED SCALE SHOWS ROLL VALUE. ROLL POINTER MOVES AGAINST SCALE. WHEN ROLL MORE THAN 35 DEGREES, ALERT ROLL POINTER SHOWS. SLIP SKID INDICATOR FILLS WHEN LATERAL ACCELERATION EQUALS 0.1G. SOURCES: ROLL - ADIRU; ALERTS - DEU
	FLIGHT PATH VECTOR (W)	SHOWS ACTUAL PATH THROUGH AIR AS DETERMINED BY ADIRU. EFIS CONTROL PANEL CONTROLS DISPLAY. SOURCE: ADIRU
PITCH ROLL	PITCH/ROLL FLAGS (A)	SHOWS WHEN ADIRU PITCH AND/OR ROLL DIFFERENCE IS 5 DEGREES OR MORE. AS AN OPTION, DISPLAY FLASHES FOR FIRST 10 SECONDS. SOURCE: DEU

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CDS - PFD - SYMBOLOGY - 2

Primary Flight Display Symbology

Additional symbology shows in these tables.

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SYMBOL	NAME	REMARKS
(OM) (MM) (IM) (FT)	MARKER BEACON DISPLAYS OM (C) MM (A) IM (W) FT (W)	OM IS OUTER MARKER. MM IS MIDDLE MARKER. IM IS INNER MARKER, BACKCOURSE MARKER, OR AIRWAYS MARKER. FT IS FUNCTIONAL TEST. SOURCE: VOR/MB 1
○ ◆ ○ ○	LOCALIZER DEVIATION SCALE (W) WARNING (A) LOCALIZER DEVIATION POINTER (M)	POINTER SHOWS LOCALIZER DEVIATION OR FINAL APPROACH COURSE DEVIATION. WHEN POINTER IS LESS THAN 2.5 DOTS DEVIATION, THE POINTER IS FILLED. IF CDS DETERMINES A BACKCOURSE APPROACH, THE SENSE OF DEVIATION REVERSED. FOR DEVIATION WARNING, SCALE CHANGES COLOR (A) AND POINTER FLASHES. SOURCES: LOC - ILS RECEIVER, ILS MMR, OR FMC; BACKCOURSE - DEU; DEVIATION WARNING - FCC
□ □	EXPANDED LOCALIZER DEVIATION SCALE (W)	POINTER SHOWS LOCALIZER DEVIATION WHEN POINTER IS LESS THAN 5/8 DOT AND THE AUTOPILOT IS IN COMMAND. SOURCE: DEU
○ ○ ◆ ○ ○	GLIDESLOPE DEVIATION SCALE (W) WARNING (A) GLIDESLOPE DEVIATION POINTER (M)	POINTER SHOWS GLIDESLOPE OR GLIDE PATH DEVIATION. WHEN POINTER IS LESS THAN 2.5 DOTS DEVIATION, THE POINTER IS FILLED. IF CDS DETERMINES A BACKCOURSE APPROACH, POINTER IS REMOVED. FOR DEVIATION WARNING, SCALE CHANGES COLOR (A) AND POINTER FLASHES. SOURCES: GLIDESLOPE - ILS RECEIVER OR MMR; GLIDE PATH - FMC; BACKCOURSE - DEU; DEVIATION WARNING - FCC
IBFI/130 ° DME 3.4 (typical)	LOC FREQUENCY/ IDENTIFIER (W) WARNING (A) SELECTED RUNWAY HEADING (W) WARNING (A) DME DISPLAY (W)	SHOWS LOC FREQUENCY UNTIL RECEIVER SENDS STATION IDENTIFIER. IF CAPT AND F/O FREQUENCIES DISAGREE, SHOWS AMBER. SHOWS SELECTED RUNWAY HEADING. IF CAPT AND F/O SELECTIONS DISAGREE, SHOWS AMBER. DME DISTANCE FOR CO-LOCATED STATION SHOWS. SOURCES: FREQ/IDENT - LOC RECEIVER OR MMR; SELECTED RUNWAY HEADING - MCP; DME DISTANCE - DME; DISAGREE LOGIC - DEU
ILS GLS FMC LOC / G/P	APPROACH SCALE IDENTIFIER (W)	ILS IS ILS LOCALIZER AND GLIDESLOPE. GLS IS GLS LOCALIZER AND GLIDESLOPE. FMC IS FINAL APPROACH COURSE (FAC) AND GLIDE PATH. LOC / G/P IS ILS LOCALIZER AND FMC GLIDE PATH. SOURCE: SCALE LOGIC - DEU

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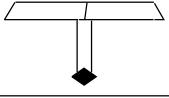
EFFECTIVITY

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SYMBOL	NAME	REMARKS
(OM) (MM) (IM) (FT)	MARKER BEACON DISPLAYS OM (C) MM (A) IM (W) FT (W)	OM IS OUTER MARKER. MM IS MIDDLE MARKER. IM IS INNER MARKER, BACKCOURSE MARKER, OR AIRWAYS MARKER. FT IS FUNCTIONAL TEST. SOURCE: VOR/MB 1
○ ◆ ○ ○	LOCALIZER DEVIATION SCALE (W) WARNING (A) LOCALIZER DEVIATION POINTER (M)	POINTER SHOWS LOCALIZER DEVIATION. WHEN POINTER IS LESS THAN 2.5 DOTS DEVIATION, THE POINTER IS FILLED. IF CDS DETERMINES A BACKCOURSE APPROACH, THE SENSE OF DEVIATION REVERSED. FOR DEVIATION WARNING, SCALE CHANGES COLOR (A) AND POINTER FLASHES. SOURCES: LOC - ILS RECEIVER OR MMR; BACKCOURSE - DEU; DEVIATION WARNING - FCC
□ □	EXPANDED LOCALIZER DEVIATION SCALE (W)	POINTER SHOWS LOCALIZER DEVIATION WHEN POINTER IS LESS THAN 5/8 DOT AND THE AUTOPILOT IS IN COMMAND. SOURCE: DEU
○ ○ ◆ ○ ○	GLIDESLOPE DEVIATION SCALE (W) WARNING (A) GLIDESLOPE DEVIATION POINTER (M)	POINTER SHOWS GLIDESLOPE DEVIATION. WHEN POINTER IS LESS THAN 2.5 DOTS DEVIATION, THE POINTER IS FILLED. IF CDS DETERMINES A BACKCOURSE APPROACH, POINTER IS REMOVED. FOR DEVIATION WARNING, SCALE CHANGES COLOR (A) AND POINTER FLASHES. SOURCES: GLIDESLOPE - ILS RECEIVER OR MMR; BACKCOURSE - DEU; DEVIATION WARNING - FCC
IBFI/130 ° DME 3.4 (typical)	LOC FREQUENCY/ IDENTIFIER (W) WARNING (A) SELECTED RUNWAY HEADING (W) WARNING (A) DME DISPLAY (W)	SHOWS LOC FREQUENCY UNTIL RECEIVER SENDS STATION IDENTIFIER. IF CAPT AND F/O FREQUENCIES DISAGREE, SHOWS AMBER. SHOWS SELECTED RUNWAY HEADING. IF CAPT AND F/O SELECTIONS DISAGREE, SHOWS AMBER. DME DISTANCE FOR CO-LOCATED STATION SHOWS. SOURCES: FREQ/IDENT - LOC RECEIVER OR MMR; SELECTED RUNWAY HEADING - MCP; DME DISTANCE - DME; DISAGREE LOGIC - DEU
	RISING RUNWAY (G) STEM (M)	SHOWS AFTER LOCALIZER CAPTURE. PARKED AT BOTTOM OF ADI UNTIL RADIO ALTITUDE DECREASES BELOW 200 FEET. RISES TO AIRPLANE SYMBOL ON LANDING. SOURCE: RA
ILS GLS	APPROACH SCALE IDENTIFIER (W)	ILS IS ILS LOCALIZER AND GLIDESLOPE. GLS IS GLS LOCALIZER AND GLIDESLOPE. SOURCE: SCALE LOGIC - DEU

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CDS - PFD - SYMBOLOGY - 3

Primary Flight Display Symbology

Additional symbology shows in these tables.

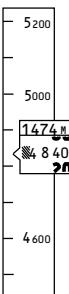
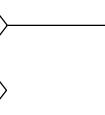
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SYMBOL	NAME	REMARKS
RADIO200 -4	RADIO ALTITUDE (W) RADIO MINIMUMS READOUT (G) ALERT (A)	DIGITAL DISPLAY SHOWS RADIO ALITITUDE. RADIO VALUE SHOWS RADIO MINIMUMS. ALERT SHOWS ON DESCENT IF VISIBLE. TO RESET RADIO MINS ALERT PUSH RST ON EFIS CONTROL PANEL. TO MAKE RADIO MINS BLANK, SELECT RADIO MINS BELOW ZERO OR PUSH RST WHILE NOT IN ALERT CONDITION. SOURCES: ALTITUDE - RA; MINS - EFIS CP
 A vertical scale from 4600 to 5200 feet. A cursor highlights the number 1474, with a smaller number 840 below it.	ALTITUDE TAPE (W)	MOVING INDICIES AND NUMBERS. MASK COVERS LEADING NUMBER BELOW 10,000 FEET. ALTITUDE SHOWS IN METERS WHEN MTR PUSHED ON EFIS CONTROL PANEL. NUMBERS SHOW EVERY 200 FEET UNLESS COVERED BY CURSOR. SOURCE: ADIRU
1550M 5100 	SELECTED ALTITUDE IN METERS (M) M DISPLAY (C) SELECTED ALTITUDE (M) SELECTED ALTITUDE BUG (M)	SHOWS SELECTED ALTITUDE IN METERS ABOVE SELECTED ALTITUDE. TURN OFF/TURN ON BY PUSH OF MTRS SWITCH. SOURCE: DEU
BARO1400 	BARO MINIMUMS (G) ALERT (A) BARO MINS BUG (G) ALERT (A) BARO MINS BUG (G) (RADIO MINS ACTIVE)	WORD BARO AND VALUE SHOW WHEN BARO MINS SELECETED. BLANK WHEN RADIO MINS SELECTED. BUG WITH BAR SHOWS WHEN BARO MINS SELECTED. BUG ONLY SHOWS WHEN RADIO MINS SELECTED. ALERT SHOWS ON DESCENT ONLY. PUSH RST ON EFIS CP TO RESET. PUSH RST WHILE NOT IN ALERT OR SELECT -1001 FT TO BLANK. SOURCES: VALUE - EFIS CP; ALERT - DEU

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EFFECTIVITY

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Primary Flight Display Symbology

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SYMBOL	NAME	REMARKS
	ALTITUDE TAPE WITH LANDING ALTITUDE REFERENCE (A)	LANDING ALTITUDE REFERENCE SHOWS FMC ROUTE LANDING ALTITUDE. SOURCE: FMC
	VERTICAL SPEED TAPE TCAS RESOLUTION ADVISORY VERTICAL SPEED BUG DIGITAL READOUT TAPE (W) READOUT (W) RA (R) BUG (M) SPEED POINTER (W) SPEED POINTER (R)	VERTICAL SPEED SHOWS FROM +/- 6000 FPM. TCAS RESOLUTION ADVISORY BARS SHOW VERTICAL SPEED TO AVOID. VERTICAL SPEED BUG SHOWS SELECTED VERTICAL SPEED. DIGITAL READOUT SHOWS WHEN VERTICAL SPEED GREATER THAN 400 FPM. READOUT SHOWS ABOVE FOR + VERTICAL SPEED AND BELOW FOR - VERTICAL SPEED. IF POINTER IN RANGE OF TCAS RA POINTER WILL BE RED OTHERWISE POINTER WILL BE WHITE. SOURCES: RA - TCAS; BUG - FCC; VERTICAL SPEED - ADIRU; READOUT LOGIC - DEU
29.96 IN 1011 HPA STD STD	BARO REFERENCE INCHES (G) ALERT (A) BARO REFERENCE HECTO PASCAL (G) ALERT (A) STANDARD BARO REF (G) STANDARD BARO REF ALERT (A)	BAROMETRIC REFERENCE SHOWS IN INCHES OR HECTO PASCAL. ABOVE TRANSITION ALTITUDE STANDARD SHOULD BE SELECTED. IF STD NOT SELECTED ABOVE TRANSITION ALT, ALERT SHOWS. IF BARO SELECT NOT SELECTED BELOW TRANSITION ALTITUDE, ALERT SHOWS. SOURCES: TRANSITION ALTITUDE - FMC; BARO SET, STD - EFIS CP
WINDSHEAR PULL UP	WINDSHEAR ANNUNCIATION (R) WINDSHEAR ANNUNCIATION (A) PULL UP ANNUNCIATION (R)	WINDSHEAR OR PULL UP SHOWS AS APPROPRIATE. SOURCE: GPWS RED WINDSHEAR ALERT OR AMBER WINDSHEAR CAUTION SOURCE: WXR

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CDS - PFD - SYMOLOGY - 4

EFFECTIVITY

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Primary Flight Display Symbology

Additional symbology shows in these tables.

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SYMBOL	NAME	REMARKS
	SPEED TAPE (W) SPEED TREND (G)	AIRSPEED TAPE SHOWS SPEED FROM 30 TO 450 KNOTS. SPEED TREND SHOWS UP OR DOWN AND SHOWS PREDICTED AIRSPEED IN 10 SECONDS. SOURCES: AIRSPEED - ADIRU; TREND VECTOR - DEU
.455 GS 100	MACH (W) HIGHLIGHT (W) GROUNDSPEED (W)	MACH SHOWS FOR MACH GREATER THAN 0.4 GROUNDSPEED SHOWS WHEN MACH DOES NOT SHOW. HIGHLIGHT SHOWS FOR 10 SECONDS WHEN DISPLAY CHANGES. SOURCES: MACH - ADIRU; GROUNDSPEED - FMC/ADIRU; HIGHLIGHT - DEU;
290 .39 	SELECTED AIRSPEED (M) SELECTED MACH (M) SELECTED AIRSPEED BUG (M)	SELECTED AIRSPEED OR MACH SHOWS ABOVE THE SPEED TAPE. THE SELECTED AIRSPEED BUG SHOWS THE SELECTED AIRSPEED OR MACH. SOURCE: MCP
	MAXIMUM OPERATING SPEED (R/BBLACK) HIGH SPEED BUFFET (A) MINIMUM MANUVER SPEED (A) STICK SHAKER SPEED (R/BBLACK)	SPEEDS SHOW AT TOP AND BOTTOM OF AIRSPEED TAPE WHEN SPEED SHOWS. SOURCE: SMYD
UP, -1, -2, -5, -10, -15, -25	FLAP RETRACTION/EXTENSION SPEEDS (G)	FLAP MANUVER SPEEDS SHOW NEXT TO THE AIRSPEED TAPE. SOURCES: FSEU; FCC; DEU
V1, REF, Vref, VR, R, 	DECISION SPEED, REFERENCE SPEED (G) ROTATION SPEED (G) SPEED BUG (G)	SPEED TAPE REFERENCE SPEEDS. SOURCE: DEU

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CDS - PFD - SYMOLOGY - 5

EFFECTIVITY

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Primary Flight Display Symbology

Additional symbology shows in these tables.

EFFECTIVITY

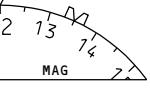
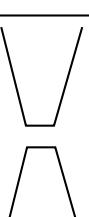
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SYMBOL	NAME	REMARKS
	COMPASS (W) HEADING INDEX (W) MAG/TRU ANNUNCIATION (G) SEL HDG (M) SEL HDG READOUT (M) TRACK LINE (W)	PFD HEADING/TRACK INDICATION. SOURCES: HEADING - ADIRU; MAG/TRU - ADIRU; SEL HDG - MCP; TRACK - FMC/ADIRU
FMC SPD (TYPICAL)	AUTHRROTLE MODE (G) ARM MODE (W)	SOURCE: A/T COMPUTER
HDG SEL (TYPICAL)	ROLL MODE (G) ARMED MODE (W)	SOURCE: FCC
TO/GA (TYPICAL)	PITCH MODE (G) ARMED MODE (W)	SOURCE: FCC
CMD, FD, TEST SINGLE CH CWS R, CWS P	A/P STATUS (G) A/P APPROACH STATUS (A) CONTROL WHEEL STEERING STATUS (A)	SOURCE: FCC
	TCAS RESOLUTION ADVISORY (R)	SOURCES: TCAS, DEU

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CDS - PFD - SYMBOLOGY - 6

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CDS - PFD - SYMBOLOGY - 7

Primary Flight Display Symbology

Additional symbology shows in these tables.

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SYMBOL	NAME (COLOR)	REMARKS
LNAV/VNAV	DEVIATION SCALE ID (W)	THIS ID SHOWS IN PLACE OF THE LANDING SCALE ID WHEN NPS IS ACTIVE. SOURCE: DEU.
□ ▲	LNAV DEVIATION SCALE (W) LNAV DEVIATION POINTER (M)	THE POINTER SHOWS LATERAL DEVIATION FROM LNAV PATH CENTER. THE POINTER IS NORMALLY FILLED. WHEN THE POINTER IS AT A SCALE LIMIT, IT IS UNFILLED. SOURCE: FCC.
— —	LNAV ANP/RNP BARS (W) WARNING (A)	SHOWS AMOUNT OF LOSS OF NAVIGATION SYSTEM PRECISION DUE TO LESS THAN OPTIMAL PERFORMANCE. BARS CHANGE COLOR (A) AFTER 10 SECONDS OF OVERLAP. SOURCE: FCC.
◇	LNAV ANTICIPATION CUE (W)	THE ANTICIPATION CUE SHOWS AN APPROACHING ARMED LANDING PATH. SOURCE: ILS (OR MMR, OR FMC).
— □◀	VNAV DEVIATION SCALE (W) VNAV DEVIATION POINTER (M)	THE POINTER SHOWS VERTICAL DEVIATION FROM VNAV PATH CENTER. THE POINTER IS NORMALLY FILLED. WHEN THE POINTER IS AT A SCALE LIMIT, IT IS UNFILLED. SOURCE: FCC.
—	VNAV ANP/RNP BARS (W) WARNING (A)	SHOWS AMOUNT OF LOSS OF NAVIGATION SYSTEM PRECISION DUE TO LESS THAN OPTIMAL PERFORMANCE. BARS CHANGE COLOR (A) AFTER 10 SECONDS OF OVERLAP. SOURCE: FCC.
◊	VNAV ANTICIPATION CUE (W)	THE ANTICIPATION CUE SHOWS AN APPROACHING ARMED LANDING PATH. SOURCE: ILS (OR MMR, OR FMC).

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CDS - PFD - SYMOLOGY - 7



CDS - PFD - FAULT INDICATIONS

General

The PFD shows NCD and fault conditions for the system data on the display. For most NCD conditions and some fault conditions, the PFD does not show the annunciation. For some fault conditions, the PFD removes the data and shows a failure flag. These are the PFD flags:

- ATT - attitude failure from ADIRS
- FPV - flight path vector failure from ADIRS
- FD - flight director failure from FCC
- G/S - glideslope failure from ILS
- LOC - localizer failure from ILS
- ALT - altitude failure from ADIRS
- VERT - vertical speed failure from ADIRS
- SPD - speed failure from ADIRS
- RA - radio altitude failure from radio altimeter
- DISPLAYS CONTROL PANEL - failure of EFIS control panel
- HDG - heading failure from ADIRS
- SEL SPD - selected speed failure from MCP
- SPD LIM - speed limit failure from SMYD
- NO VSPD - decision or rotate speeds failure from FMC, or decision and rotate speeds not entered in FMC CDU
- LDG ALT - landing altitude failure from FMC, or landing altitude data not entered in FMC CDU
- DME - distance measuring equipment failure.

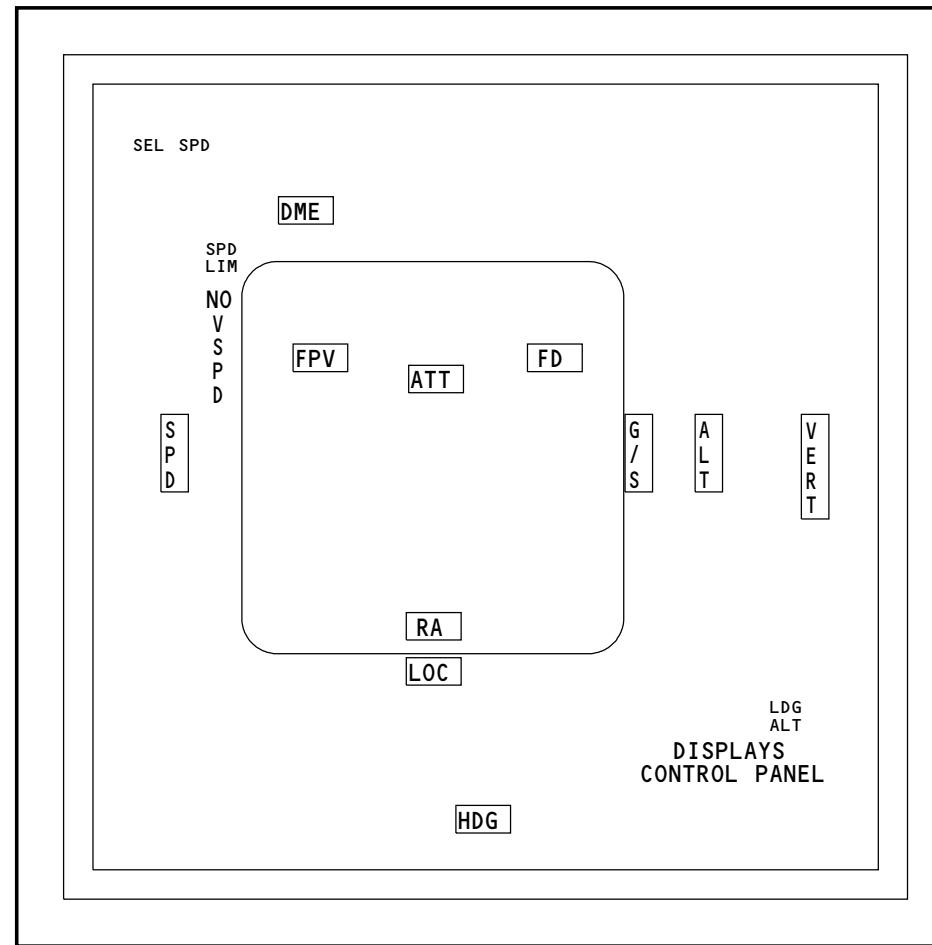
Other fault indications

Some fault indications can change if the mode of operation is changed. When an IAN approach is set, the G/S and LOC flags are replaced. The G/S flag will show as G/P if the FMC does not send the glide path data. The LOC flag will show as FAC if the FMC does not send the data for the final approach course.

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CDS - PFD - FAULT INDICATIONS
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CDS - NAVIGATION DISPLAY OVERVIEW

ND Overview

These are the navigation display modes:

- Plan mode
- Expanded and centered map modes
- Expanded and centered VOR modes
- Expanded and centered APP modes.
- Vertical Situation Display mode.

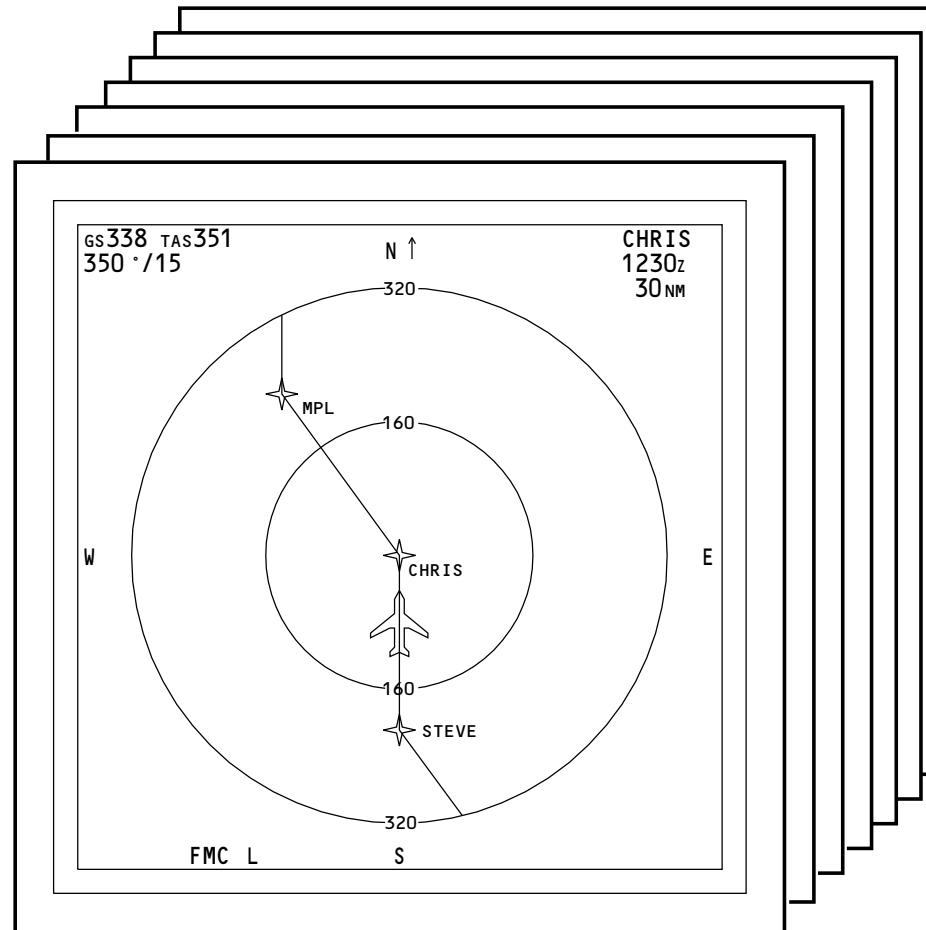
These are some of the indications that show on the ND:

- Heading
- Track
- Ground speed
- True airspeed
- Wind
- Route
- Weather Radar
- TCAS data
- Enhanced GPWS data
- VOR/ADF pointers
- VOR deviation
- LOC and G/S deviations.

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CDS - NAVIGATION DISPLAY OVERVIEW**31-62-00**EFFECTIVITY
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CDS - ND - EXPANDED APPROACH

Approach

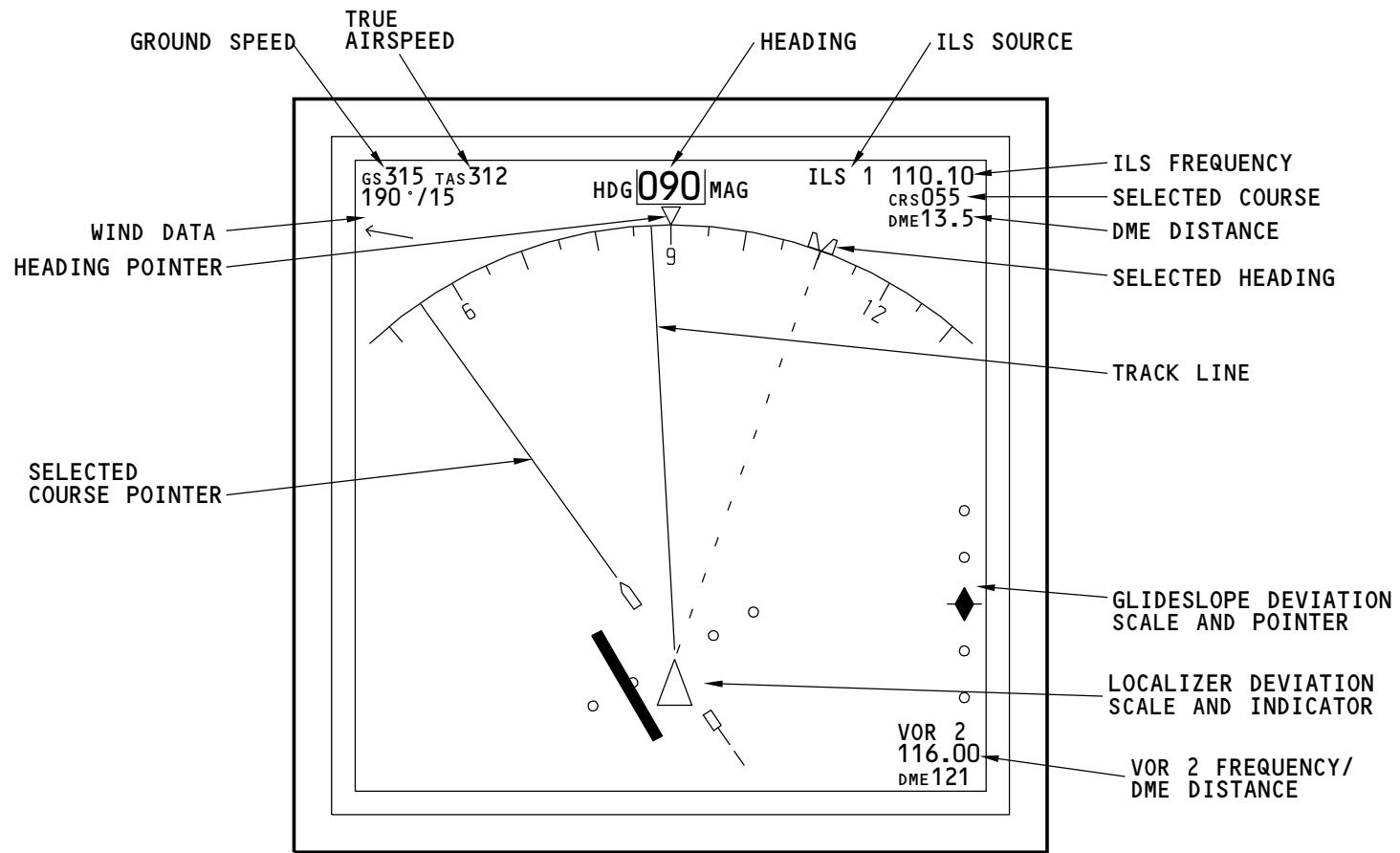
To show the approach display, select the APP mode on the EFIS control panel. If you do not tune an ILS frequency on the navigation control panel, the message EFIS MODE/NAV FREQ DISAGREE shows.

The approach display shows localizer and glideslope deviation to the tuned ILS station.

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CDS - ND - EXPANDED APPROACH
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CDS - ND - CENTERED APPROACH

Centered Approach

To show the centered approach display, select the APP position on the EFIS control panel and push the CTR switch. If you do not tune an ILS frequency on the navigation control panel, the message EFIS MODE/NAV FREQ DISAGREE shows.

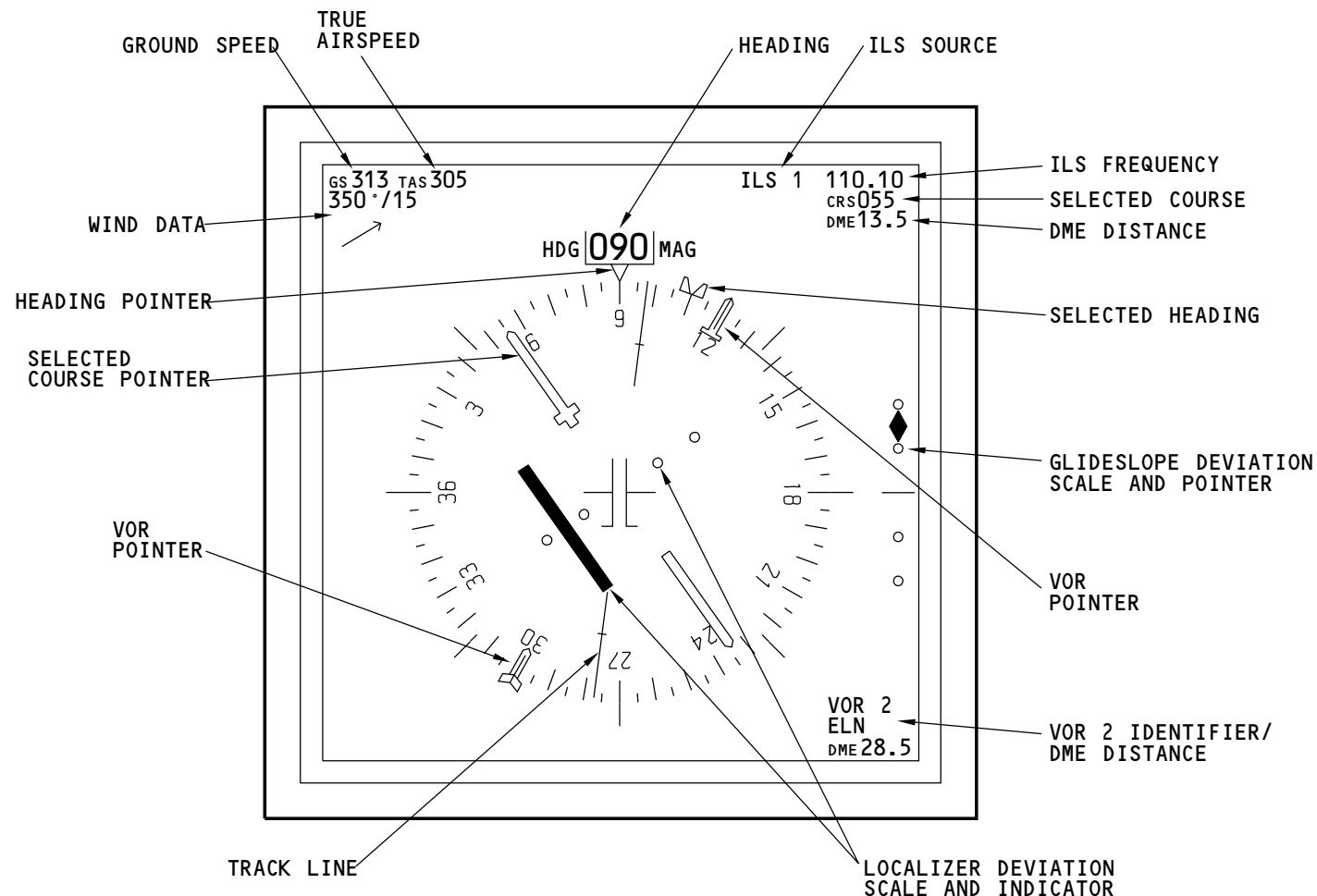
The approach display shows localizer and glideslope deviation to the tuned ILS station.

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CDS - ND - CENTERED APPROACH
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CDS - ND - EXPANDED VOR

Expanded VOR

To show the expanded VOR display, select the VOR position on the EFIS control panel. If you do not tune a VOR frequency on the navigation control panel, the message EFIS MODE/NAV FREQ DISAGREE shows.

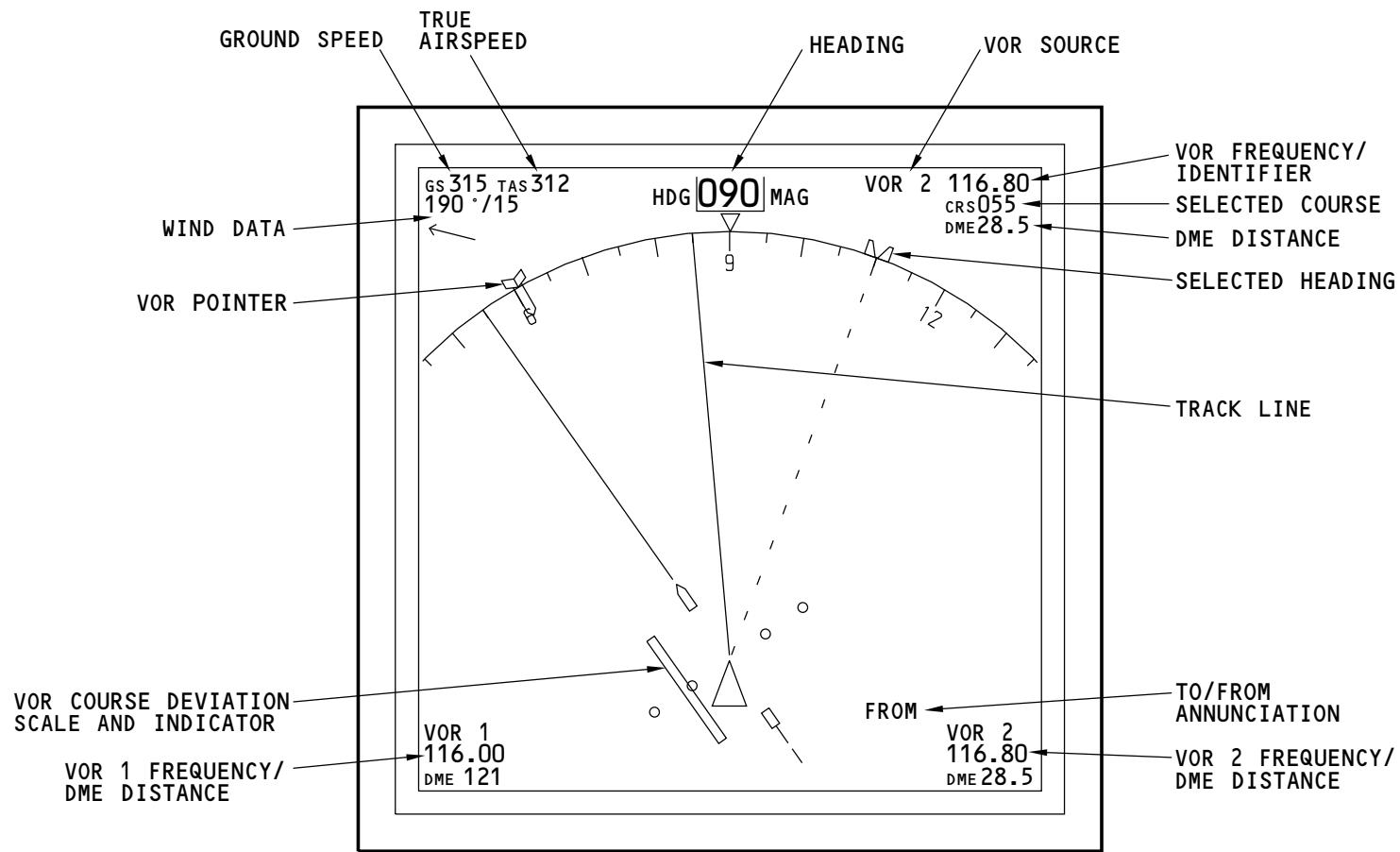
The VOR display shows VOR deviation from the selected course for the tuned VOR station.

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CDS - ND - EXPANDED VOR
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CDS - ND - CENTERED VOR

Centered VOR

To show the centered VOR display, select the VOR position on the EFIS control panel and push the CTR switch. If you do not tune a VOR frequency on the navigation control panel, the message EFIS MODE/NAV FREQ DISAGREE shows.

The VOR display shows VOR deviation from the selected course for the tuned VOR station and TO/FROM displays.

EFFECTIVITY

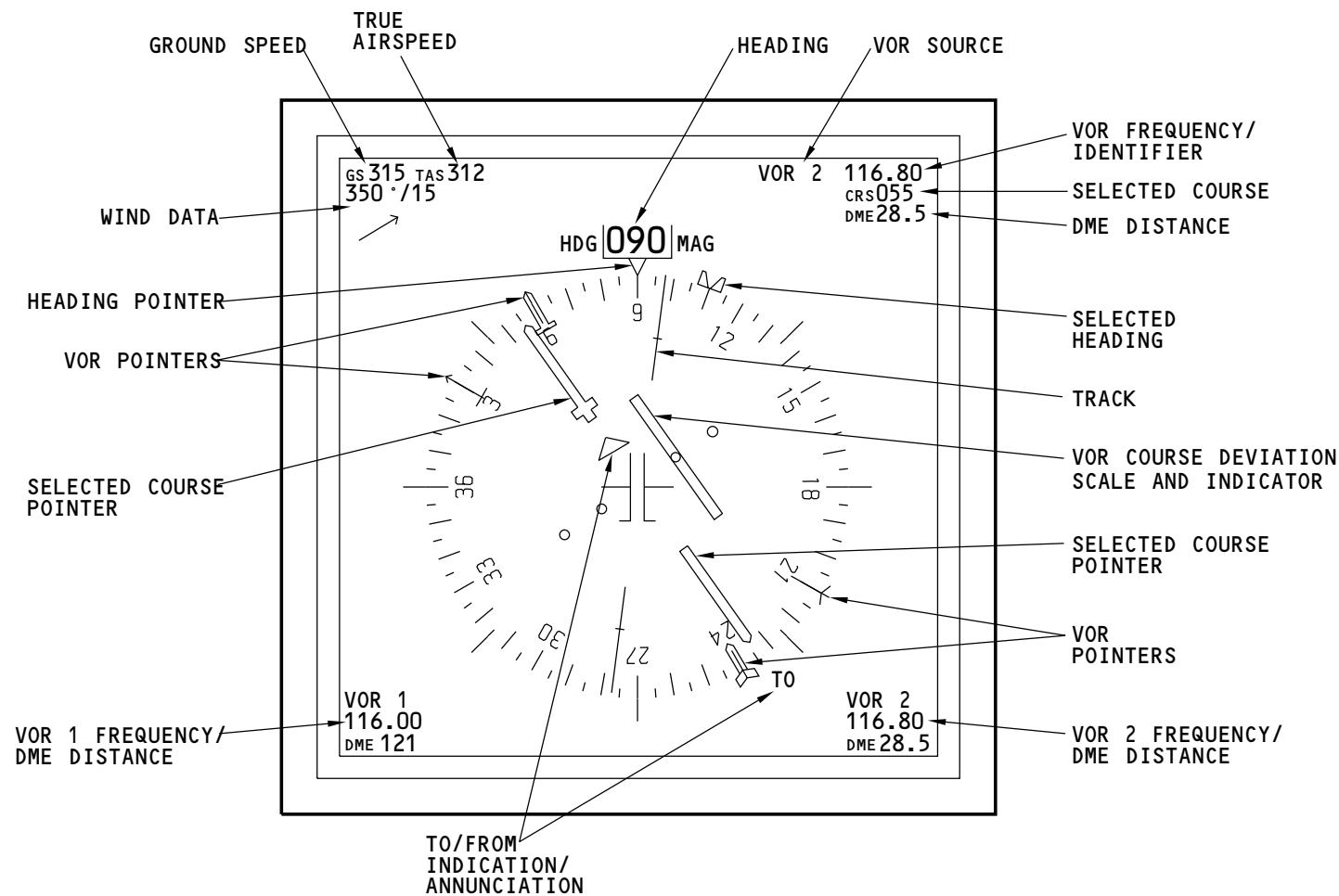
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CDS - ND - CENTERED VOR
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**CDS - ND - EXPANDED MAP MODE****Expanded Map Mode**

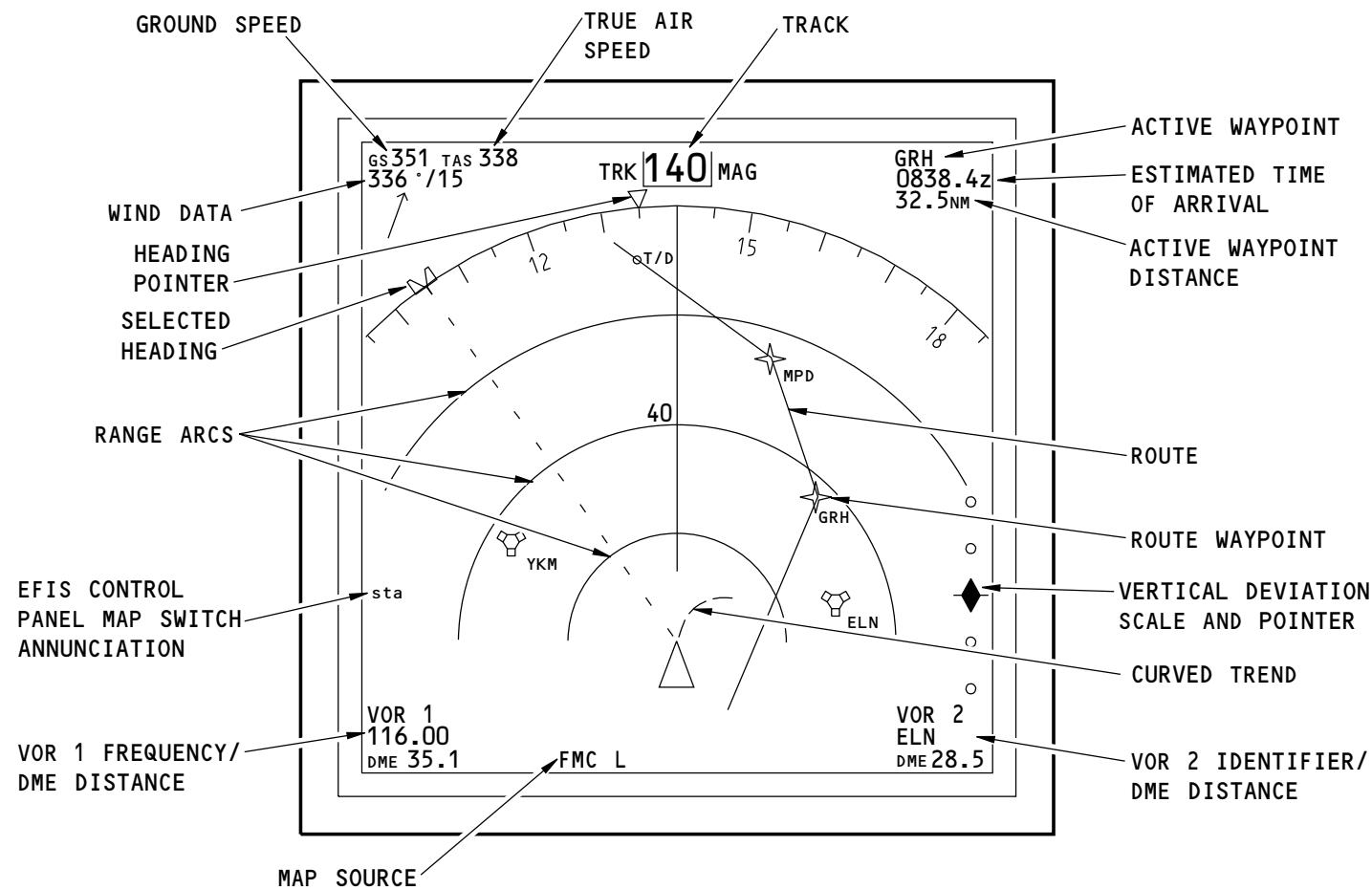
To show the expanded map display, select the map position on the EFIS control panel.

The map display shows the flight plan and other navigation data. To see additional map data, use the map switches on the EFIS control panel.

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CDS - ND - EXPANDED MAP MODE
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CDS - ND - CENTERED MAP

Centered Map Mode

To show the centered map display, select the map mode on the EFIS control panel and push the CTR switch.

The map display shows the flight plan and other navigation data. To see additional map data, use the map switches on the EFIS control panel.

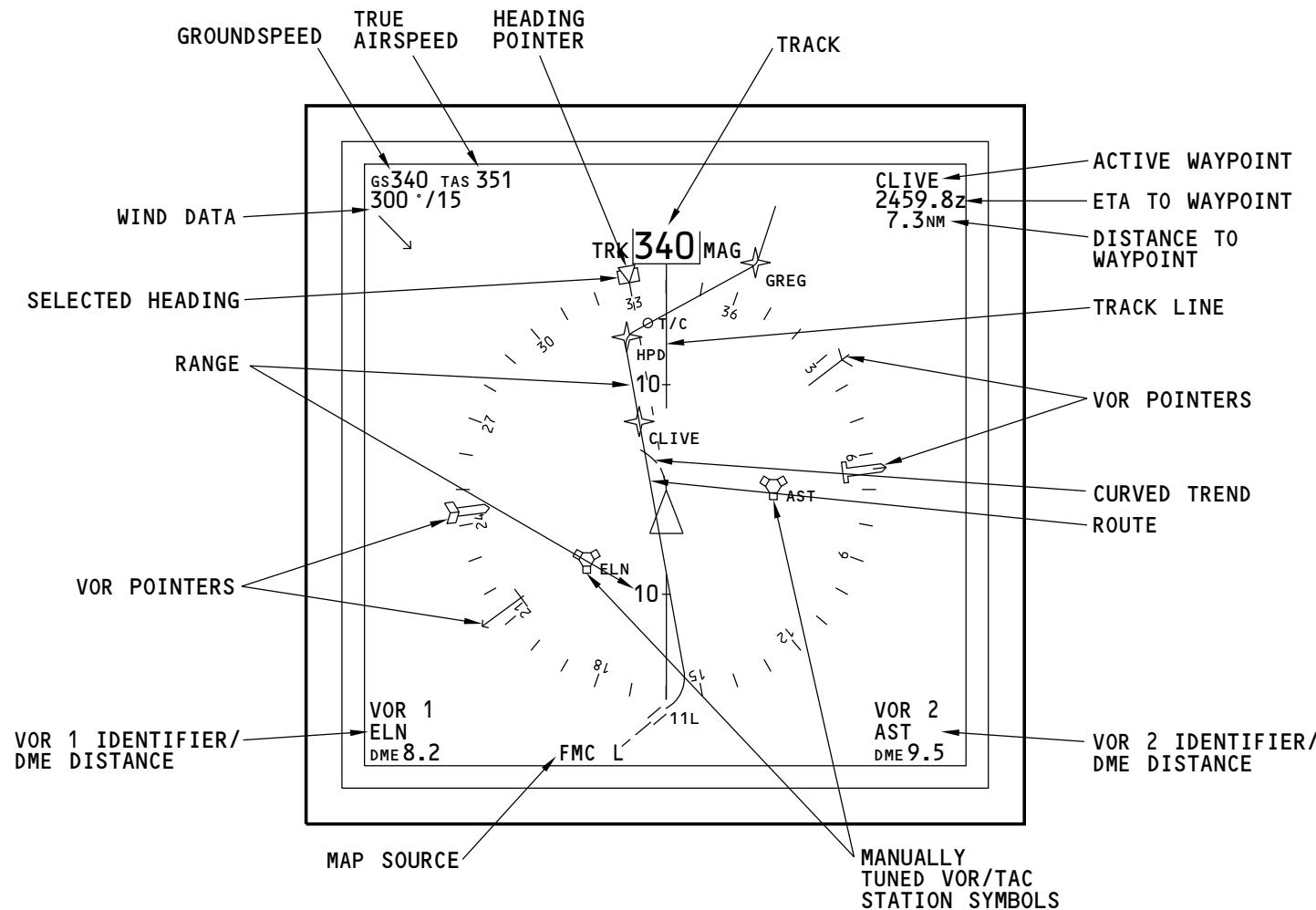
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CDS - ND - CENTERED MAP
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CDS - ND - PLAN MODE

Plan

To show the plan display, select the plan mode on the EFIS control panel.

The plan display shows the flight plan data.

Select the STEP prompt on the CDU LEGS page to step through and see the entire flight plan.

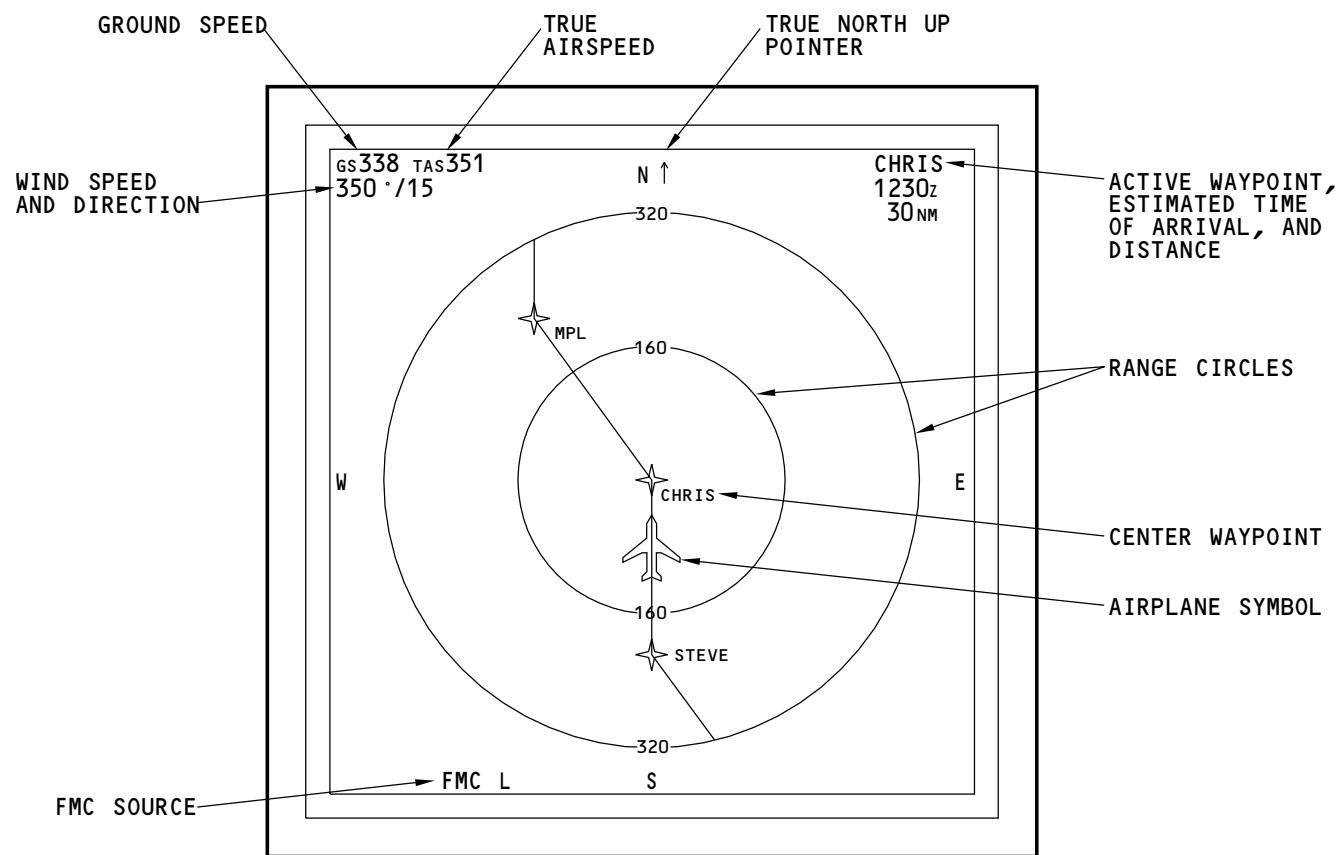
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CDS - ND - PLAN MODE

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CDS - ND - VERTICAL SITUATION DISPLAY MODE

Vertical Situation Display (VSD)

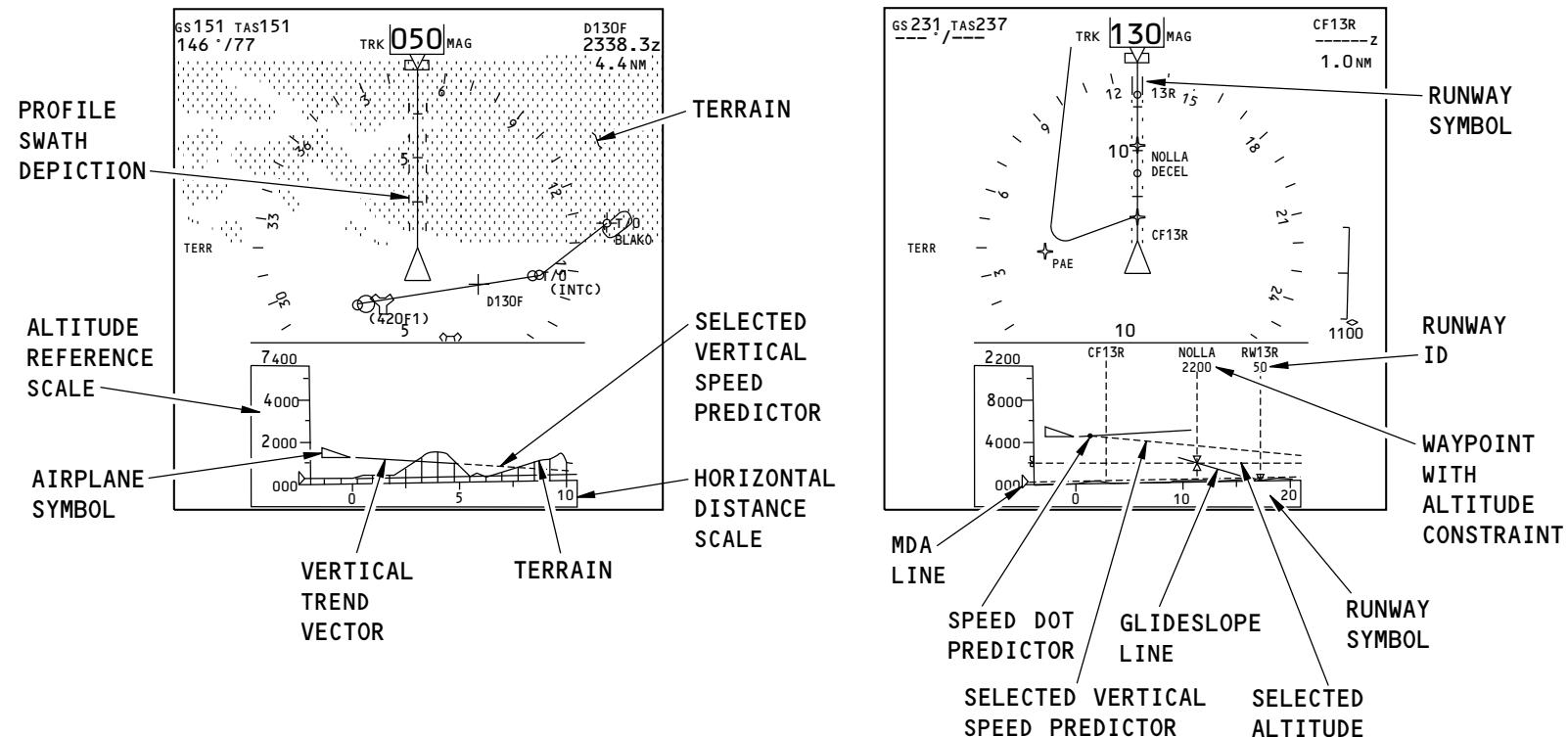
The VSD shows in the lower 30% of the Centered Map display. To control the lateral Map display, see the description of the Centered Map Mode. (31-62-00-316)

To show the VSD, use controls on the EFIS control panel.

- To show the VSD, set the map mode on the EFIS control panel, then push the CTR switch two times.

To change from the Expanded Map to the Centered Map, push the CTR switch on the EFIS control panel. To change from the Centered Map to the Centered Map with VSD, push the CTR switch again. To change from the Centered Map with VSD to the Expanded Map, push the CTR switch again.

See the GPWS - VSD section for more information. (34-46-00)



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CDS - ND - VERTICAL SITUATION DISPLAY

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CDS - ND - SYMBOLOGY - 1

Navigation Display Symbology

The navigation display (ND) modes show several symbols and data. These symbols and data show in these tables.

These are the colors for the symbols and data that show on the ND:

- Green (G) - Dynamic conditions
- White (W) - Present status, range scales
- Magenta (M) - Command information, pointers, and symbols
- Cyan (C) - Non-active or background information
- Amber (A) - Cautions, faults, and flags
- Red (R) - Warnings.

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SYMBOL	NAME	MODE(S)	REMARKS
GS 310	GROUND SPEED INDICATION (W)	ALL	GROUND SPEED
TAS 312	TRUE AIRSPEED INDICATION (W)	ALL	TRUE AIRSPEED SHOWS ABOVE 100 KTS.
350 ° / 15 ↙	WIND DIRECTION/SPEED (W) DIRECTION ARROW (W)	VOR, VOR CTR, APP, APP CTR, MAP, MAP CTR, PLAN	DIGITAL WIND DIRECTION AND SPEED SHOWS ABOVE AN ANALOG WIND DIRECTION ARROW. ARROW DOES NOT SHOW IN THE PLAN MODE.
VOR 1,2 ILS 1,2	RECEIVER REFERENCE (G)	VOR, VOR CTR, APP, APP CTR	SHOWS RECEIVER REFERENCE FOR THE DISPLAY.
VOR 1,2 ADF 1,2	RECEIVER REFERENCE VOR (G), ADF (C)	VOR, VOR CTR, APP, APP CTR, MAP, MAP CTR	SHOWS RECEIVER REFERENCE FOR THE DISPLAY POINTERS.
116.80 OR SEA	ILS (G)/VOR (G) FREQUENCY OR STATION IDENTIFIER	VOR, VOR CTR, APP, APP CTR, MAP, MAP CTR	FREQUENCY SHOWS WHILE NCD OR UNTIL THE IDENTIFIER IS DECODED. IDENTIFIER REPLACES THE FREQUENCY. MEDIUM FONT SHOWS FOR VOR/DME RECEPTION, SMALL FONT SHOWS FOR DME RECEPTION ONLY.
520 OR BF	ADF (C) FREQUENCY OR STATION IDENTIFIER	VOR, VOR CTR, APP, APP CTR, MAP, MAP CTR	FREQUENCY SHOWS WHILE NCD OR UNTIL THE IDENTIFIER IS DECODED. IDENTIFIER REPLACES THE FREQUENCY.
WINDSHEAR	WINDSHEAR ANNUNCIATION (R) (A)	VOR, APP, MAP, MAP CTR	RED WINDSHEAR ALERT OR AMBER WINDSHEAR CAUTION SOURCE: WXR
TERRAIN	TERRAIN ANNUNCIATION (R) (A)	VOR, APP, MAP, MAP CTR	RED TERRAIN ALERT OR AMBER TERRAIN CAUTION SOURCE: GPWS

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CDS - ND - SYMBOLOLOGY - 1

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CDS - ND - SYMBOLOGY - 2

Navigation Display Symbology

Additional symbology shows in these tables.

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SYMBOL	NAME	MODE(S)	REMARKS
DME 24.6	DME DISTANCE DISPLAY (G)	VOR, VOR CTR, APP, APP CTR, MAP, MAP CTR	SHOWS DME DISTANCE TO THE REFERENCE NAVAID.
124 NM	WAYPOINT DISTANCE (W)	MAP, MAP CTR, PLAN	DISTANCE TO GO TO THE ACTIVE WAYPOINT
N ↑	NORTH POINTER (G)	PLAN	SHOWS MAP BACKGROUND IS ORIENTED AND REFERENCED TO TRUE NORTH.
0835.4z	ESTIMATED TIME OF ARRIVAL (ETA) DISPLAY (W)	MAP, MAP CTR, PLAN	SHOWS FMCS CALCULATED ETA FOR THE ACTIVE WAYPOINT.
FMC  FMC L  FMC R 	MAP SOURCE ANNUNCIATION (G)	MAP, MAP CTR, PLAN	SHOWS ND MAP SOURCE.
	COMPASS (W)	MAP, APP, VOR MAP CTR, VOR CTR, APP CTR	60 DEGREES SHOW IN THE EXPANDED MODE. 360 DEGREES SHOW IN THE CENTERED MODE.

 AIRPLANES WITH SINGLE FMC

 AIRPLANES WITH DUAL FMC

1700488 S0000310527_V2

CDS - ND - SYMBOLOLOGY - 2

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SYMBOL	NAME	MODE(S)	REMARKS
[]	VERTICAL DEVIATION POINTER (M) AND SCALE (W)	MAP, MAP CTR	SHOWS DEVIATION FROM THE VERTICAL PROFILE CALCULATED BY THE FMC. SCALE SHOWS ± 400 FEET DEVIATION. A DIGITAL READOUT SHOWS WHEN THE POINTER IS OVER ± 30 FEET. IF THE DEVIATION IS MORE THAN ± 430 FEET, THEN THE POINTER PARKS AT THE SCALE LIMIT. [4] VERTICAL DEVIATION FROM THE CALCULATED VERTICAL PROFILE (POINTER) SHOWS AT THE TOP OF DESCENT (T/D) AND DURING DESCENT ONLY. SCALE SHOWS ± 400 FEET DEVIATION. IF THE DEVIATION IS MORE THAN ± 430 FEET, THEN THE POINTER PARKS AT THE SCALE LIMIT AND A DIGITAL READOUT SHOWS. [5]
<input type="radio"/> IRS 1 2 <input type="radio"/> GPS 1 2 [3] <input type="radio"/> FMC, radio	POSITIONS (G)	PLAN	SHOWS POSITIONS WHEN POSITION SHIFT PAGE SELECTED ON FMC CONTROL DISPLAY UNIT.

[3] > AIRPLANES WITH GPS

[4] > AIRPLANES WITH SOFTWARE BLOCK 04 OR ABOVE AND NAVIGATION PERFORMANCE SCALES

[5] > AIRPLANES WITHOUT SOFTWARE BLOCK 04 OR ABOVE OR WITHOUT NAVIGATION PERFORMANCE SCALES

1700697 S0000310529_V2

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CDS - ND - SYMBOLOGY - 3

Navigation Display Symbology

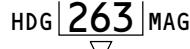
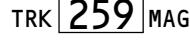
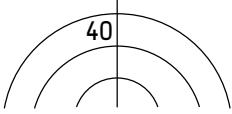
Additional symbology shows in these tables.

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SYMBOL	NAME	MODE(S)	REMARKS
HDG 	HEADING: REFERENCE (G) READOUT (W) ORIENTATION (G) pointer (W)	VOR, VOR CTR, APP, APP CTR	BOX SHOWS HEADING. POINTER SHOWS HEADING ON THE COMPASS ROSE.
TRK 	TRACK: REFERENCE (G) READOUT (W) ORIENTATION (G)	MAP, MAP CTR	BOX SHOWS TRACK.
	HEADING POINTER (W)	MAP, MAP CTR	POINTER SHOWS HEADING ON THE COMPASS ROSE.
MAG or 	HEADING/TRACK REFERENCE (G) BOX (W/A/G)	VOR, VOR CTR, APP, APP CTR, MAP, MAP CTR	SHOWS HEADING/TRACK TO MAGNETIC NORTH OR TRUE NORTH. IF THE ADIRU SWITCHES FROM TRU TO MAG A BOX SHOWS AROUND MAG FOR TEN SECONDS
	TRACK POINTER WITH RANGE (W)	VOR, VOR CTR, APP, APP CTR, MAP	SHOWS AIRPLANE TRACK AND LOCATION ON THE COMPASS ROSE. RANGE SHOWS NEXT TO THE MIDDLE RANGE ARCS IN MILES.
20+ 20+	TRACK POINTER WITH RANGE (W)	MAP CTR	SHOWS AIRPLANE TRACK AND LOCATION ON THE COMPASS ROSE. RANGE SHOWS NEXT TO THE RANGE MARKS IN MILES.
	SELECTED HEADING CURSOR (M) AND VECTOR (M)	VOR, VOR CTR, APP, APP CTR, MAP, MAP CTR	SHOWS THE HEADING SET ON THE MCP. A DASH LINE (M) EXTENDS FROM THE CURSOR TO THE AIRPLANE SYMBOL IN THE EXPANDED AND MAP CTR MODES.

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CDS - ND - SYMOLOGY - 3



CDS - ND - SYMBOLOGY - 4

Navigation Display Symbology

Additional symbology shows in these tables.

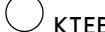
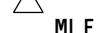
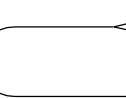
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SYMBOL	NAME	MODE(S)	REMARKS
	RUNWAY (W) AND AIRPORT IDENTIFIER	MAP, MAP CTR, PLAN	SHOWS IF THE RANGE IS >/= 80 AND YOU SELECT A RUNWAY ON THE FMC CDU.
	RUNWAY (W) AND AIRPORT IDENTIFIER	MAP, MAP CTR, PLAN	SHOWS IF THE RANGE </= 40 NM AND YOU SELECT A RUNWAY ON THE FMC CDU.
	AIRPORT (C)	MAP, MAP CTR	AIRPORTS WITHIN THE MAP AREA SHOW WITH SELECTION OF THE ARPT SWITCH ON THE EFIS CONTROL PANEL.
	ROUTE WAYPOINT: ACTIVE (M) INACTIVE (W)	MAP, MAP CTR, PLAN	ACTIVE - THE NEXT GO TO WAYPOINT. INACTIVE - OTHER WAYPOINTS ON THE ACTIVE ROUTE.
	OFF ROUTE WAYPOINT (C)	MAP, MAP CTR, PLAN	SHOWS WITH SELECTION OF THE WPT SWITCH ON THE EFIS CONTROL PANEL.
	FLIGHT PLAN ROUTE: ACTIVE (M) MODIFIED (W) INACTIVE (C)	MAP, MAP CTR, PLAN	ACTIVE - THE ACTIVE ROUTE SHOWS MAGENTA WITH A CONTINUOUS LINE BETWEEN WAYPOINTS. MODIFIED - ACTIVE ROUTE MODIFICATIONS SHOW WITH SHORT DASHES (W) BETWEEN WAYPOINTS. INACTIVE - INACTIVE ROUTES SHOW WITH LONG DASHES (C) BETWEEN WAYPOINTS.
	ROUTE DATA: ACTIVE WPT (M) INACTIVE WPT (W)	MAP, MAP CTR	THE ENTERED OR PROCEDURAL ALTITUDE AND ETA FOR ROUTE WAYPOINTS SHOW WHEN YOU SELECT THE DATA SWITCH ON THE EFIS CONTROL PANEL.
	HOLDING PATTERN: ACTIVE ROUTE (M) MODIFIED ROUTE (W) INACTIVE ROUTE (C)	MAP, MAP CTR, PLAN	A HOLDING PATTERN SHOWS WHEN IN THE FLIGHT PLAN.
	PROCEDURE TURN: ACTIVE ROUTE (M) MODIFIED ROUTE (W) INACTIVE ROUTE (C)	MAP, MAP CTR, PLAN	A PROCEDURE TURN SHOWS WHEN IN THE FLIGHT PLAN.

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Navigation Display Symbology

Additional symbology shows in these tables.

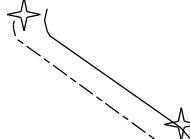
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SYMBOL	NAME	MODE(S)	REMARKS
	OFFSET PATH AND IDENTIFIER: ACTIVE ROUTE (M) MODIFIED ROUTE (W)	MAP, MAP CTR, PLAN	A PARALLEL OFFSET LINE WITH DASHES SHOWS FROM THE ACTIVE OR MODIFIED ROUTE. THIS OCCURS WHEN AN ENTRY IS MADE FROM THE FMCS-CDU ROUTE PAGE AND THE AIRPLANE IS IN THE AIR.
	ALTITUDE RANGE ARC (G)	MAP, MAP CTR	SHOWS THE LOCATION ON THE FLIGHT WHEN THE AIRPLANE REACHES THE MCP ALTITUDE. THE CAPTURE POINT IS BASED ON VERTICAL SPEED AND GROUND SPEED.
 T/D	ALTITUDE PROFILE POINT AND IDENTIFIER (G)	MAP, MAP CTR	SHOWS THE FMC CALCULATED T/C (TOP OF CLIMB), T/D (TOP OF DESCENT), S/C (STEP CLIMB), AND E/D (END OF DESCENT).
	VOR (C) DME/TACAN (C) VORTAC (C)	MAP, MAP CTR	NAVAIDS THAT RELATE TO STATIONS SHOW WHEN YOU SELECT THE STA SWITCH ON THE EFIS CONTROL PANEL.
	SELECTED REFERENCE POINT AND BEARING DISTANCE INFORMATION (G)	MAP, MAP CTR, PLAN	SHOWS THE REFERENCE POINT SELECTED ON THE FMCS-CDU FIX PAGE. BEARING AND/OR DISTANCE FROM THE FIX SHOW WITH GREEN DASHES.
ARPT	MAP OPTION SELECTIONS(C)	MAP, MAP CTR, PLAN	ARPT SWITCH SELECTED ON THE EFIS CONTROL PANEL
WPT			WPT SWITCH SELECTED ON THE EFIS CONTROL PANEL
STA			STA SWITCH SELECTED ON THE EFIS CONTROL PANEL

M77615 S0004627369_V1

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EFFECTIVITY

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Navigation Display Symbology

Additional symbology shows in these tables.

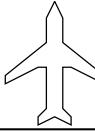
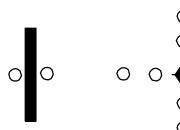
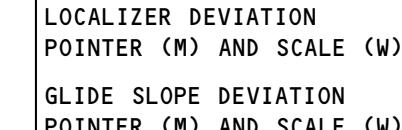
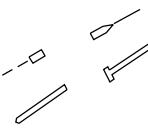
EFFECTIVITY

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SYMBOL	NAME	MODE(S)	REMARKS
	AIRPLANE SYMBOL (W)	MAP, MAP CTR, VOR, APP	CURRENT AIRPLANE POSITION IS AT THE POINT OF THE AIRPLANE SYMBOL. SOURCE: DEU
	AIRPLANE SYMBOL (W)	VOR CTR, APP CTR	CURRENT AIRPLANE POSITION IS AT THE TOP CENTER OF THE AIRPLANE SYMBOL. SOURCE: DEU
	MINIATURE AIRPLANE (W)	PLAN	SHOWS ACTUAL POSITION AND TRACK ALONG ROUTE IN THE PLAN MODE ONLY. SOURCE: DEU
	TREND VECTOR (W), DASH(S)	MAP, MAP CTR	SHOWS AIRPLANE PREDICTED POSITION AT THE END OF 30, 60, AND 90 SECOND INTERVALS. EACH SEGMENT SHOWS 30 SECONDS AND IS BASED ON BANK ANGLE AND GROUND SPEED. SOURCE: DEU
 	LOCALIZER DEVIATION POINTER (M) AND SCALE (W) GLIDE SLOPE DEVIATION POINTER (M) AND SCALE (W)	APP, APP CTR	SHOWS LOCALIZER DEVIATION. DEVIATION POINTER SHOWS THE DEVIATION ERROR. SHOWS GLIDE SLOPE DEVIATION. POINTER SHOWS THE DIRECTION OF THE GLIDE SLOPE CENTERLINE. THE POINTERS ARE FILLED FOR DEVIATION LESS THAN 2.5 DOTS. SOURCE: DEU
	COURSE DEVIATION POINTER (M) AND SCALE (W)	VOR, VOR CTR	SHOWS VOR DEVIATION. DEVIATION POINTER SHOWS THE COURSE DEVIATION ERROR. SOURCE: DEU
	SELECTED COURSE POINTER (W) AND LINE (M) SELECTED COURSE POINTER (W)	VOR, APP VOR, APP CTR	SHOWS VOR OR LOC SELECTED COURSE. SOURCE: DEU

M77617 S0004627371_V2

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CDS - ND - SYMBOLOGY - 7

Navigation Display Symbology

Additional symbology shows in these tables.

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SYMBOL	NAME	MODE(S)	REMARKS
DECEL	DECCELERATION DISPLAY (G)	MAP, MAP CTR	SHOWS A POINT THAT MARKS THE BEGINNING OF A DECELERATION PART OF A ROUTE OF FLIGHT. SOURCE: DEU
△	TO/FROM INDICATOR (W)	VOR CTR	SHOWS NEAR AIRPLANE SYMBOL. SHOWS VOR TO/FROM INDICATION. SOURCE: DEU
TO FROM	TO/FROM DISPLAY (W)	VOR, VOR CTR	SHOWS VOR TO/FROM INDICATION. SOURCE: DEU
↑ ↓	#1: VOR (G) OR ADF (C) BEARING	VOR, VOR CTR APP, APP CTR MAP, MAP CTR	SHOWS BEARING TO (HEAD) OR FROM (TAIL) A TUNED STATION, IF A RADIO IS SELECTED ON THE EFIS CONTROL PANEL. SOURCE: DEU
↑ ↓	#2: VOR (G) OR ADF (C) BEARING	MAP, MAP CTR	
R-020 * ×	VOR STATION AND RADIAL(G) IRS POSITION (W) MGPS POSITION (W)	MAP, MAP CTR	WHEN YOU SELECT POS ON THE EFIS CONTROL PANEL, RADIALS TO VOR STATIONS SHOW, THE IRS POSITIONS SHOW AND THE GPS POSITIONS SHOW. IF THE IRS OR GPS POSITIONS ARE THE SAME, ONLY ONE SYMBOL SHOWS. SOURCE: DEU

M77624 S0004627374_V2

CDS - ND - SYMOLOGY - 7



CDS - ND - SYMBOLOGY - 8

Navigation Display Symbology

Additional symbology shows in these tables.

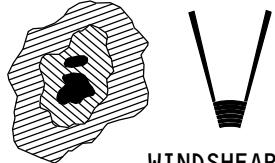
EFFECTIVITY

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SYMBOL	NAME	MODE(S)	REMARKS
	WEATHER RADAR RETURNS (M, R, A, AND G) WEATHER RADAR WINDSHEAR MESSAGES (R, A) WINDSHEAR SYMBOL (B, R, AND A)	MAP, MAP CTR, VOR, APP	WEATHER RADAR RETURNS AND WINDSHEAR SHOW WHEN THE WXR SWITCH IS ON. RETURNS SHOW AS: <ul style="list-style-type: none"> • TURBULENCE (M) • INTENSE RETURNS (R) • MEDIUM INTENSITY (A) • LOW INTENSITY (G) • WINDSHEAR SHOWS FOR CAUTION (A), WARNING (R) • WINDSHEAR SYMBOL MARKS WINDSHEAR EVENTS WITH RED AND BLACK ARCS. AMBER LINES EXTEND FROM ARCS. SOURCE: WXR
	TERRAIN DISPLAY (R, A, G, AND M) TERR ANNUNCIATION	MAP, MAP CTR, VOR, APP	TERRAIN DISPLAYS SHOW WHEN THE TERR SWITCH IS ON. DISPLAYS ALSO SHOW WHEN GPWS CAUSES POP UP. TERR ANNUNCIATION SHOWS WHEN TERR PUSHED OR DURING POP UP. SOURCE: GPWX
TERRAIN	TERRAIN CAUTION (A) TERRAIN WARNING (R)	VOR, APP, MAP, MAP CTR	GPWS TERRAIN MESSAGES. CAN POP UP. SOURCE: GPWX
VAR/WX+T +15	WEATHER RADAR ANNUNCIATION	VOR, APP, MAP, MAP CTR	WEATHER RADAR RECEIVER GAIN, OPERATIONAL MODE, AND ANTENNA TILT. SOURCE: WXR

M77625 S0004627382_V2

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CDS - ND - SYMBOLOGY - 9

Navigation Display Symbology

Additional symbology shows in these tables.

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SYMBOL	NAME	MODE(S)	REMARKS
TRAFFIC	TCAS TRAFFIC ALERT MESSAGE (RA-R, TA-A)	ALL	SHOWS THERE IS A TCAS RA OR TA WITH OR WITHOUT THE TFC SWITCH SELECTED. SOURCE: TCAS, DEU
OFFSCALE	TCAS OFFSCALE MESSAGE (RA-R, TA-A)	MAP, MAP CTR, APP, VOR	SHOWS RA OR TA TRAFFIC IS OUTSIDE THE TRAFFIC AREA OF THE ND RANGE. TFC SWITCH MUST BE ON. SOURCE: TCAS, DEU
TFC	TCAS MODE (C)	MAP, MAP CTR, APP, VOR	SHOWS THAT THE CDS WILL SHOW TRAFFIC ON THE ND. TFC SWITCH IS ON. SOURCE: TCAS, DEU
TA ONLY	TCAS MODE (C)	ALL	SHOWS WHEN TRAFFIC ADVISORIES ONLY SELECTED ON ATC TCAS CONTROL PANEL. SOURCE: TCAS, DEU
TCAS TEST	TCAS MODE (C)	ALL	TCAS COMPUTER IS IN THE TEST MODE. SOURCE: TCAS, DEU
TCAS OFF	TCAS MODE (A)	ALL	TCAS IS SELECTED OFF. SOURCE: TCAS, DEU
TCAS FAIL	TCAS MODE (A)	ALL	SHOWS THERE IS A FAULT IN TCAS DATA OR THE CDS CANNOT SHOW TCAS. THE DISPLAY SHOWS WITH OR WITHOUT THE TFC SWITCH ON. THE TFC SWITCH CONTROLS THE DISPLAY AFTER IT SHOWS. SOURCE: TCAS, DEU

M77635 S0004627391_V2

CDS - ND - SYMBOLOLOGY - 9

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CDS - ND - SYMBOLOGY - 10

Navigation Display Symbology

Additional symbology shows in these tables.

EFFECTIVITY

AKS ALL

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SYMBOL	NAME	MODE(S)	REMARKS
RNP 400 ANP 60	VERTICAL RNP LABEL AND VALUE (G) ALERT (A) VERTICAL ANP LABEL AND VALUE (G) ALERT (A)	MAP, MAP CTR	VERTICAL DEVIATION SCALE SHOWN FOR REFERENCE. SHOWS VERTICAL RNP AND ANP VALUES FROM PRIMARY FLIGHT DISPLAY. IF ANP IS MORE THAN RNP, LABELS AND VALUES SHOW AMBER.
△ 3.2R	LATERAL DEVIATION NUMERIC (W)	MAP, MAP CTR	AIRPLANE SYMBOL SHOWN FOR REFERENCE. SHOWS DISTANCE AND DIRECTION FROM LNAV PATH IN NAUTICAL MILES. VALUE IS BLANK IF MORE THAN 99.95 nm.
△ 0.0 RNP ANP 1.00 0.04	LATERAL RNP LABEL AND VALUE (G) ALERT (A) LATERAL ANP LABEL AND VALUE (G) ALERT (A)	MAP, MAP CTR	AIRPLANE SYMBOL AND DEVIATION NUMERIC SHOWN FOR REFERENCE. SHOWS LATERAL RNP AND ANP VALUES FROM PRIMARY FLIGHT DISPLAY. IF ANP IS MORE THAN RNP, LABELS AND VALUES SHOW AMBER.
[]	VERTICAL DEVIATION BAND (M)	MAP, MAP CTR	VERTICAL DEVIATION SCALE SHOWN FOR REFERENCE. SHOWS ACCEPTABLE DEVIATION FROM VNAV PATH (VERTICAL RNP VALUE). BAND END DOES NOT SHOW IF MORE THAN TOP OR BOTTOM LIMITS OF DEVIATION SCALE.
[]♦	VERTICAL DEVIATION BAND (M) WITH PARKED POINTER	MAP, MAP CTR	VERTICAL DEVIATION SCALE SHOWN FOR REFERENCE. SHOWS WHEN VERTICAL DEVIATION IS MORE THAN 430 FEET FROM VNAV PATH. BAND END MOVES TO POINTER WHEN DEVIATION INCREASES. BAND DOES NOT SHOW AFTER BAND END REACHES PARKED POINTER.

J88624 S0000181848_V2

CDS - ND - SYMOLOGY - 10



CDS - ND - VSD - SYMOLOGY - 1

Navigation Display - VSD Mode - Symbology

In the VSD Mode, the navigation display shows a centered map and a vertical situation display (VSD). The VSD shows in the lower third of the display. The centered map shows in the top part of the display. Symbology for the centered map is specified in the Primary Flight Display Symbology.

The top part of the display in the VSD mode is the lateral map. More symbols show in the lateral map to show the relation between the map and the VSD.

These are the colors for the symbols and data that show on the VSD. This is what the colors usually mean:

- Green (G) - Dynamic conditions
- White (W) - Present status, scales
- Magenta (M) - Command information, symbols
- Cyan (C) - Non-active or background information
- Amber (A) - Cautions, faults, flags
- Red (R) - Warnings.

SYMBOL	NAME (COLOR)	REMARKS
	ENROUTE SWATH (C)	(AIRPLANE SYMBOL SHOWN FOR REFERENCE) SHOWS IN THE LATERAL MAP. IDENTIFIES THE SLICE OF TERRAIN THAT SHOWS IN THE VERTICAL SITUATION DISPLAY. SOURCE: FMC.
	RUNWAY SYMBOL (W)	(ENROUTE SWATH SHOWN FOR REFERENCE) SHOWS IN THE LATERAL MAP. SOURCE: FMC.

J74337 S0000177034_V1

CDS - ND - VSD - SYMOLOGY - 1

EFFECTIVITY	
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CDS - VSD - SYMBOLOGY - 2

VSD Symbology

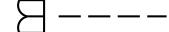
Additional symbology shows in this table.

EFFECTIVITY

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SYMBOL	NAME (COLOR)	REMARKS
—	RUNWAY SYMBOL (W)	SHOWS RUNAWAY ALTITUDE. SOURCE: FMC.
	AIRPLANE SYMBOL (W)	THE BASE OF THE SYMBOL ALIGNS WITH THE AIRPLANE'S ALTITUDE. THE NOSE OF THE SYMBOL ALIGNS WITH THE "0" HORIZONTAL TICK. SOURCE: DEU.
	FLIGHT PATH VECTOR (W)	(AIRPLANE SYMBOL SHOWN FOR REFERENCE) SHOWS THE VERTICAL TREND OF THE AIRPLANE. SOURCE: FMC AND ADIRU.
— • —	RANGE TO TARGET SPEED DOT (G)	(FLIGHT PATH VECTOR SHOWN FOR REFERENCE) SHOWS THE POINT WHERE THE AIRPLANE WILL REACH THE TARGET SPEED. SOURCE: FMC AND ADIRU.
5000 (TYP)	SELECTED ALTITUDE READOUT (M)	SHOWS THE ALTITUDE SET ON THE MCP. SOURCE: DEU.
	SELECTED ALTITUDE BUG AND VECTOR (M)	

J74361 S0000177277_V1

CDS - VSD - SYMOLOGY - 2
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CDS - VSD - SYMOLOGY - 3

VSD Symbology

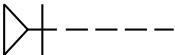
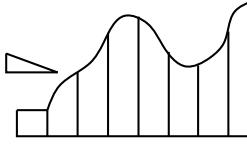
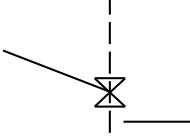
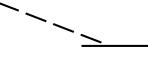
Additional symbology shows in this table.

EFFECTIVITY

AKS ALL

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SYMBOL	NAME (COLOR)	REMARKS
	MINIMUM DESCENT ALTITUDE (MDA) BUG AND VECTOR (G/A)	BUG AND VECTOR CHANGE FROM GREEN TO AMBER WHEN THE AIRPLANE DESCENDS PAST THE VECTOR. TO RESET, PUSH THE MINIMUMS (MIN) RESET (RST) BUTTON ON THE EFIS CP. SOURCE: DEU.
	TERRAIN PROFILE (G, A, R)	SHOWS THE ALTITUDE OF TERRAIN WITHIN THE ENROUTE SWATH MARKED ON THE LATERAL MAP. COLOR MATCHES TERRAIN COLOR IN THE LATERAL MAP. GREEN: TERRAIN 250-500 FT (76-152 METERS) OR MORE BELOW THE AIRPLANE. AMBER: TERRAIN FROM 250-500 FT (76-152 METERS) BELOW TO 2000 FT (610 METERS) ABOVE THE AIRPLANE. RED: TERRAIN MORE THAN 2000 FT (610 METERS) ABOVE THE AIRPLANE. SOURCE: DEU.
	GLIDE PATH ANGLE (M)	(RUNWAY SYMBOL AND MISSED APPROACH POINT WITH ALTITUDE CONSTRAINT SHOWN FOR REFERENCE) SHOWS GLIDE PATH ANGLE. SOURCE: FMC.
	DEFAULT 3° APPROACH ANGLE (M)	(RUNWAY SYMBOL SHOWN FOR REFERENCE) SHOWS THE DEFAULT APPROACH ANGLE WHEN THE GLIDE PATH IS NOT AVAILABLE. SOURCE: DEU.

J74397 S0000177279_V1

CDS - VSD -SYMOLOGY - 3

EFFECTIVITY

AKS ALL

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CDS - VSD - SYMOLOGY - 4

VSD Symbology

Additional symbology shows in this table.

EFFECTIVITY

AKS ALL

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D633A101-AKS

SYMBOL	NAME (COLOR)	REMARKS
NOLLA 	WAYPOINT ID WAYPOINT VECTOR	(M: ACTIVE; W: INACTIVE) SHOWS ROUTE WAYPOINT WITH NO ALTITUDE CONSTRAINT. SOURCE: FMC.
NOLLA 2000B ▽ 	WAYPOINT ID AT OR BELOW ALTITUDE WAYPOINT VECTOR ALTITUDE CONSTRAINT	(M: ACTIVE; W: INACTIVE) SHOWS ROUTE WAYPOINT WITH ALTITUDE CONSTRAINT. SOURCE: FMC.
NOLLA 4000A △ 	WAYPOINT ID AT OR ABOVE ALTITUDE ALTITUDE CONSTRAINT WAYPOINT VECTOR	
NOLLA 4000B 2000A ▽ 	WAYPOINT ID AT OR BELOW ALTITUDE WAYPOINT VECTOR ALTITUDE CONSTRAINTS	

J74477 S0000177280_V1

CDS - VSD - SYMOLOGY - 4



CDS - VSD - SYMOLOGY - 5

VSD Symbology

Additional symbology shows in this table.

EFFECTIVITY

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SYMBOL	NAME (COLOR)	REMARKS
NOLLA 3000 	WAYPOINT ID AT ALTITUDE WAYPOINT VECTOR ALTITUDE CONSTRAINT	(M: ACTIVE; W: INACTIVE) SHOWS ROUTE WAYPOINT WITH ALTITUDE CONSTRAINT. SOURCE: FMC.
NOLLA 15000A 	WAYPOINT ID OUT OF VIEW ALTITUDE WAYPOINT VECTOR	

J74479 S0000177281_V1

CDS - VSD - SYMOLOGY - 5
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CDS - ND - APPROACH MODE FAILURE FLAGS

General

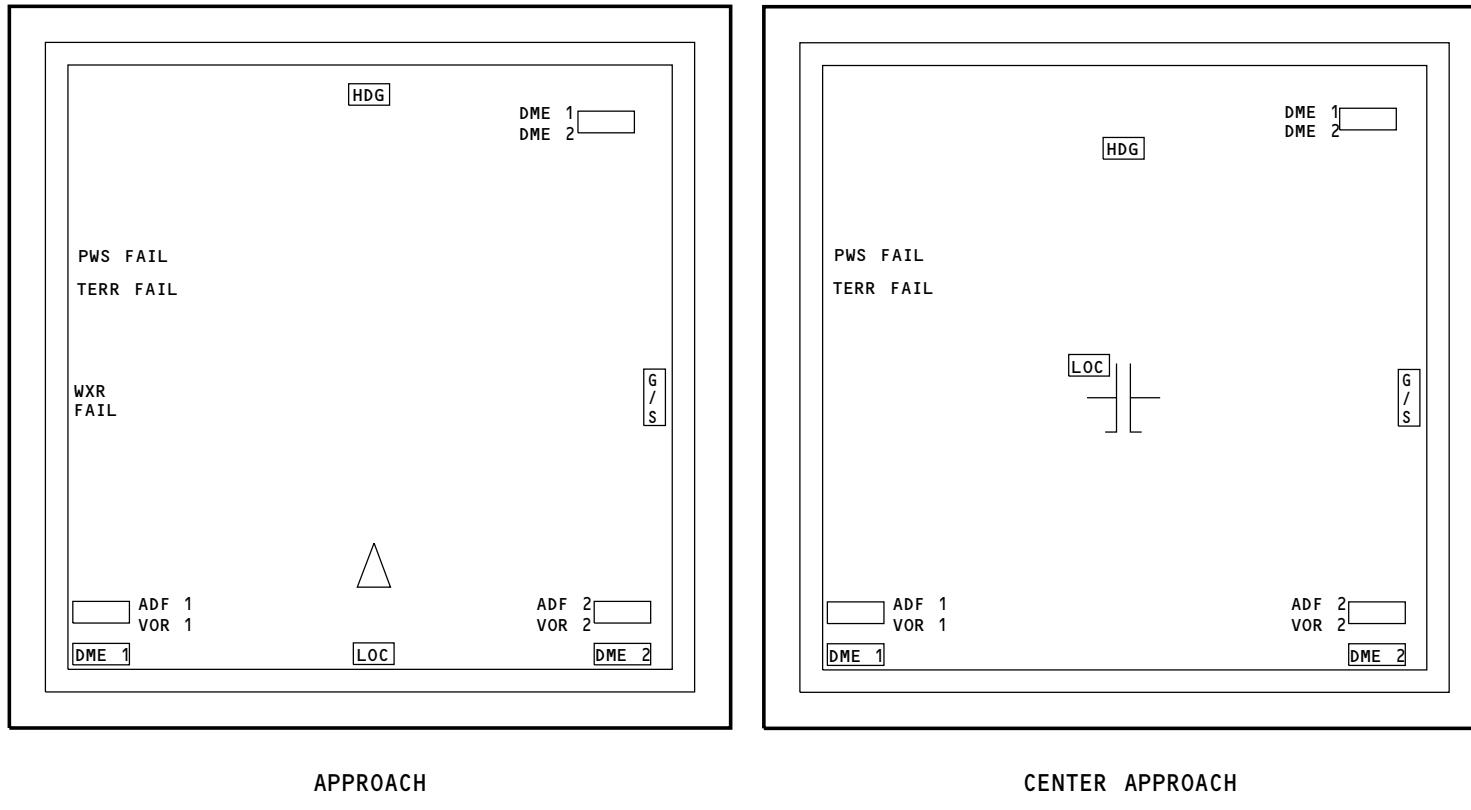
Failures of input data cause data to be blank and failure flags to show.

All flags are amber.

Failure Flags

These flags can show in the approach modes:

- HDG - ADIRU
- WXR FAIL - WXR failed
- PWS FAIL - WXR R/T predictive windshear fail
- TERR FAIL - GPWS terrain function fail
- DME 1/2 - DME interrogator (DME station collocated with ILS or VOR station)
- ADF 1/2 - ADF receiver (select ADF on EFIS control panel)
- VOR 1/2 - VOR receiver (select VOR on EFIS control panel).



APPROACH

CENTER APPROACH

M77649 S0004627394_V1

CDS - ND - APPROACH MODE FAILURE FLAGS



CDS - ND - VOR MODE FAILURE FLAGS

General

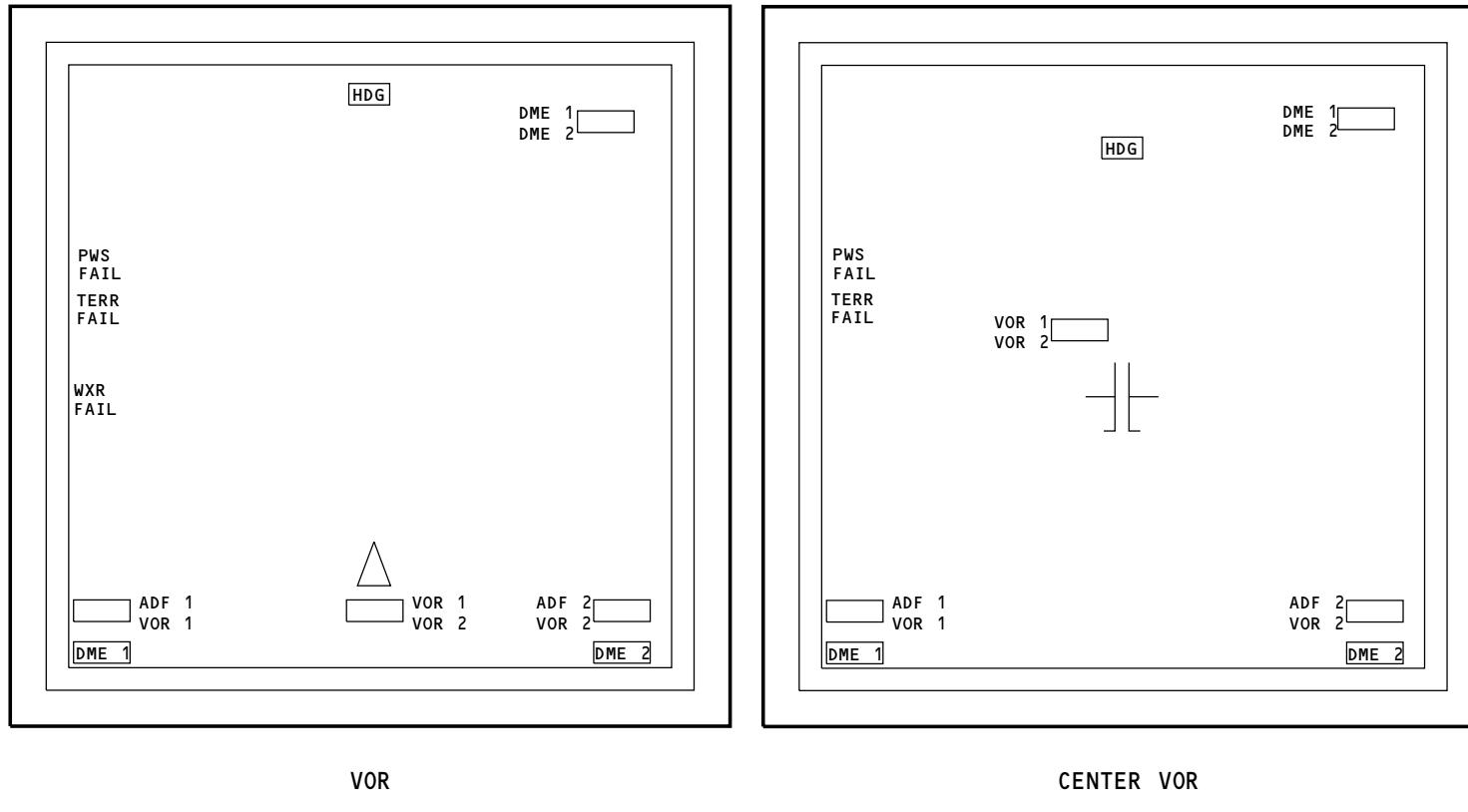
Failures of input data cause data to be blank and failure flags to show.

All flags are amber.

Failure Flags

These flags show in the VOR modes:

- HDG - ADIRU
- VOR 1/2 - VOR receiver (tuned)
- DME 1/2 - DME interrogator (DME station collocated with VOR station)
- WXR FAIL - WXR failed
- PWS FAIL - WXR R/T predictive windshear fail
- TERR FAIL - GPWS terrain function fail
- ADF 1/2 - ADF receiver (select ADF on EFIS control panel)
- VOR 1/2 - VOR receiver (select VOR on EFIS control panel).



M77657 S0004627405_V1

CDS - ND - VOR MODE FAILURE FLAGS

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CDS - ND - MAP MODE FAILURE FLAGS

General

Failures of input data cause data to be blank and failure flags to show.

All flags are amber.

Failure Flags

These flags show in the map modes:

- TRK - FMC and ADIRU
- MAP - FMC
- VTK - FMC
- WXR FAIL - WXR failed
- PWS FAIL - WXR R/T predictive windshear fail
- TERR FAIL - GPWS terrain function fail
- DME 1/2 - DME interrogator (DME station collocated with VOR station)
- ADF 1/2 - ADF receiver (select ADF on EFIS control panel)
- VOR 1/2 - VOR receiver (select VOR on EFIS control panel).

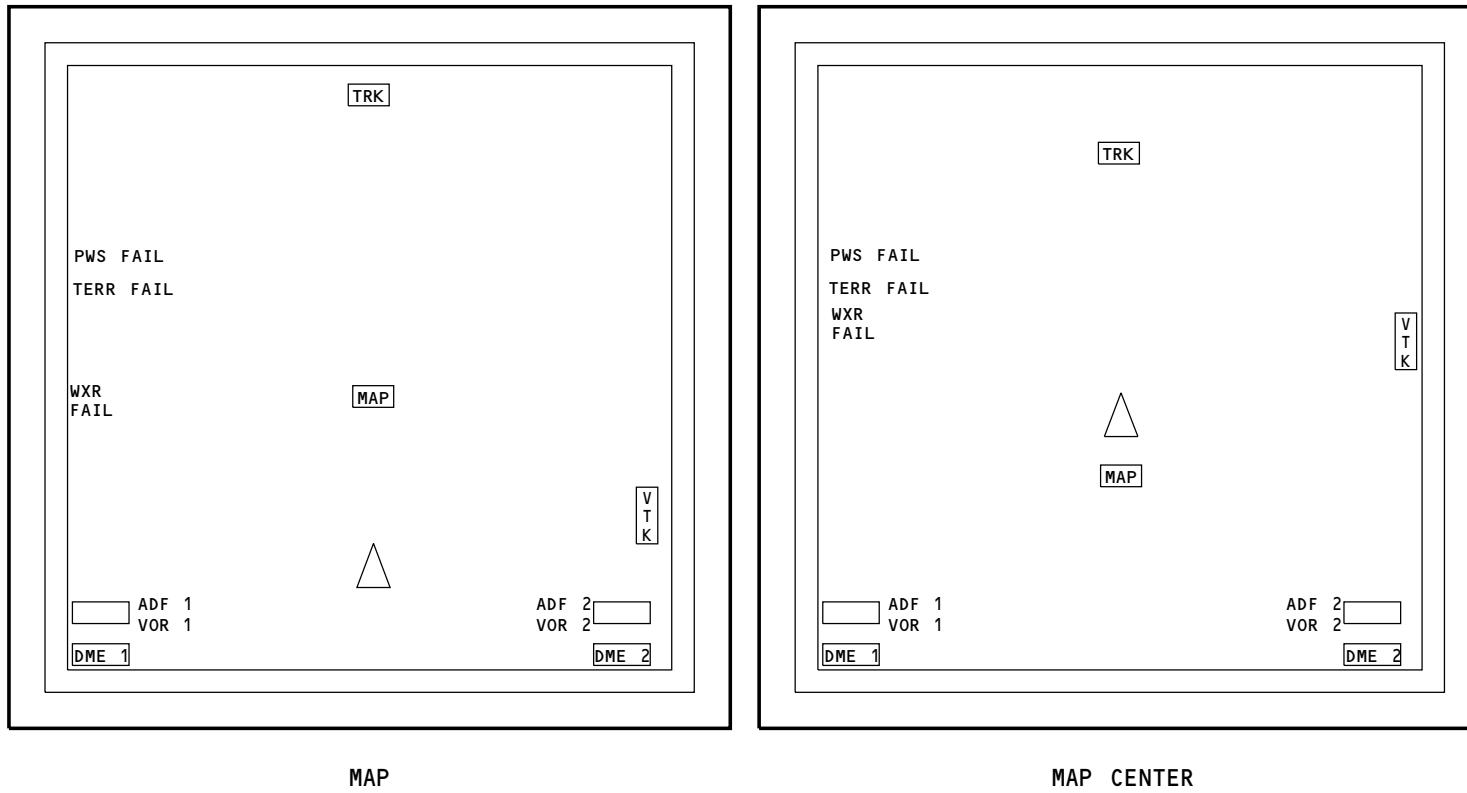
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CDS - ND - MAP MODE FAILURE FLAGS

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**CDS - ND - PLAN MODE FAILURE FLAGS****General**

Failures of input data cause data to be blank and failure flags to show.

The flag is amber.

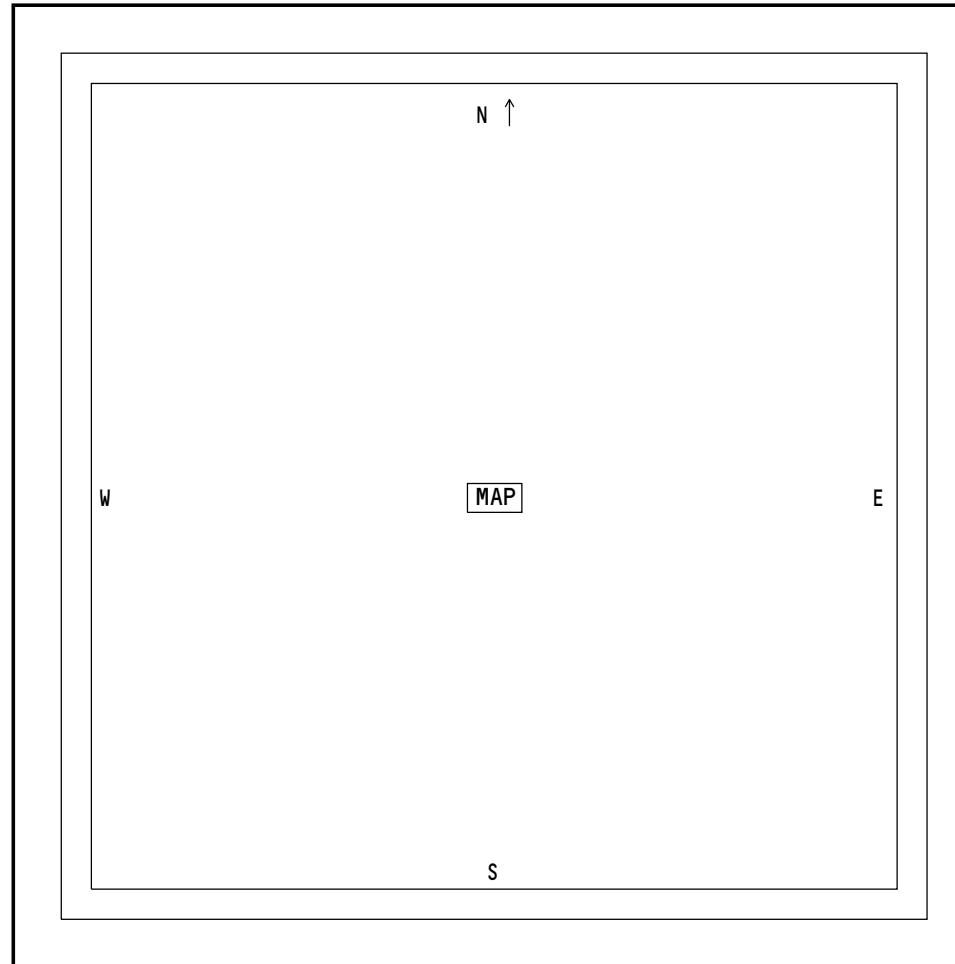
Failure Flag

The MAP flag can show in the plan mode. It shows a failure of the map from the FMCS.

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M77677 S0004627433_V1

CDS - ND - PLAN MODE FAILURE FLAGS**31-62-00**

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CDS - ND - VERTICAL SITUATION DISPLAY FAILURE FLAG

General

For information about failure flags in the lateral map, see the description of Map Mode Failure flags. (31-62-00-329)

Advisory Flags

Advisory flags show if the DEU receives data for the VSD from sources that do not agree. These flags are white:

- MAP/TERR RANGE DISAGREE - the two conditions below occur at the same time
- MAP RANGE DISAGREE - map range set on the EFIS CP does not agree with FMC map range (shows instead of MAP/TERR RANGE DISAGREE)
- TERR RANGE DISAGREE - terrain range set on the EFIS CP does not agree with EGPWC terrain range (shows instead of MAP/TERR RANGE DISAGREE)
- MOD RTE - FMC route is being changed
- RWY DATA - invalid runway elevation received from FMC
- VSD TERR INHIBIT - the Terrain Inhibit switch (TERR) on the EFIS CP is engaged

Failure Flags

If the DEU does not receive input data for the VSD, failure flags replace the display data. These flags are amber:

- VSD TERR - EGPWC fail
- VSD - invalid altimeter data

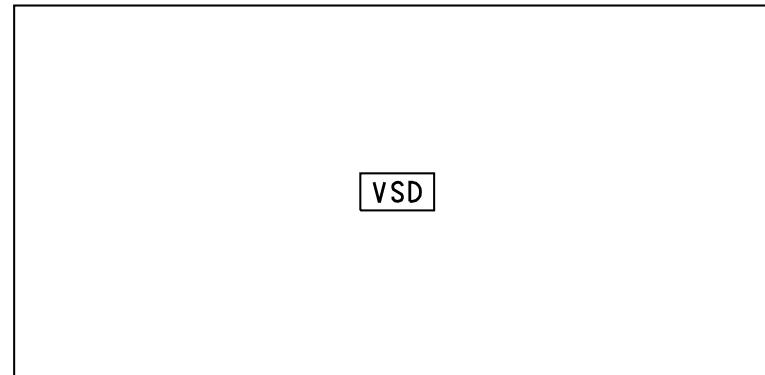
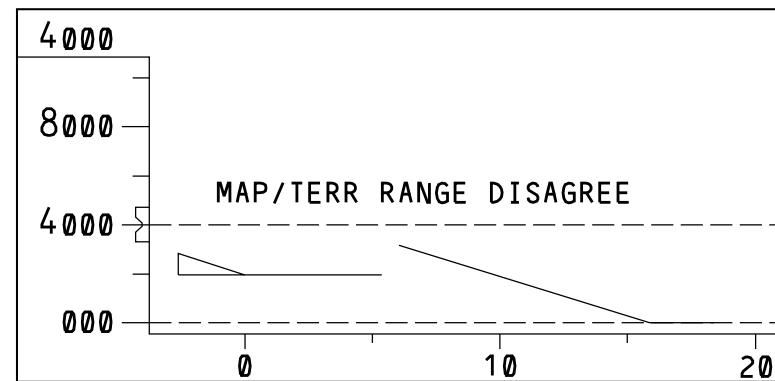
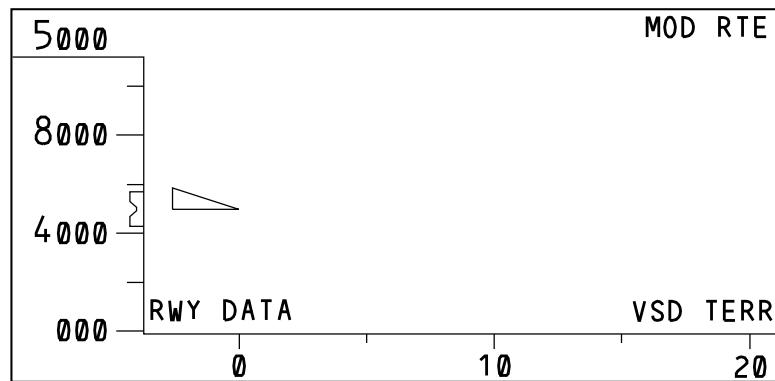
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J73435 S0000177078_V1

CDS - ND - VERTICAL SITUATION DISPLAY FAILURE FLAGS

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CDS - ND - SYMBOLOGY - 8

Navigation Display Symbology

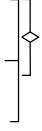
Additional symbology shows in these tables.

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AKS ALL

31-62-00

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SYMBOL	NAME	MODE(S)	REMARKS
RNP 200 ANP 60	VERTICAL RNP LABEL AND VALUE (G) ALERT (A) VERTICAL ANP LABEL AND VALUE (G) ALERT (A)	MAP, MAP CTR	VERTICAL DEVIATION SCALE SHOWN FOR REFERENCE. SHOWS VERTICAL RNP AND ANP VALUES FROM PRIMARY FLIGHT DISPLAY. IF ANP IS MORE THAN RNP, LABELS AND VALUES SHOW AMBER.
 RNP 1.00 ANP 0.04	LATERAL RNP LABEL AND VALUE (G) ALERT (A) LATERAL ANP LABEL AND VALUE (G) ALERT (A)	MAP, MAP CTR	AIRPLANE SYMBOL SHOWN FOR REFERENCE. SHOWS LATERAL RNP AND ANP VALUES FROM PRIMARY FLIGHT DISPLAY. IF ANP IS MORE THAN RNP, LABELS AND VALUES SHOW AMBER.
	VERTICAL DEVIATION BAND (M)	MAP, MAP CTR	VERTICAL DEVIATION SCALE SHOWN FOR REFERENCE. SHOWS ACCEPTABLE DEVIATION FROM VNAV PATH (VERTICAL RNP VALUE). BAND END DOES NOT SHOW IF MORE THAN TOP OR BOTTOM LIMITS OF DEVIATION SCALE.
	VERTICAL DEVIATION BAND (M) WITH PARKED POINTER	MAP, MAP CTR	VERTICAL DEVIATION SCALE SHOWN FOR REFERENCE. SHOWS WHEN VERTICAL DEVIATION IS MORE THAN 430 FEET FROM VNAV PATH. BAND END MOVES TO POINTER WHEN DEVIATION INCREASES. BAND DOES NOT SHOW AFTER BAND END REACHES PARKED POINTER.

J88249 S0000182331_V1

CDS - ND - SYMOLOGY - 8



CDS - ENGINE DISPLAY - INTRODUCTION

Engine Display

The engine indications show on a primary and secondary display. These are the major indications that show:

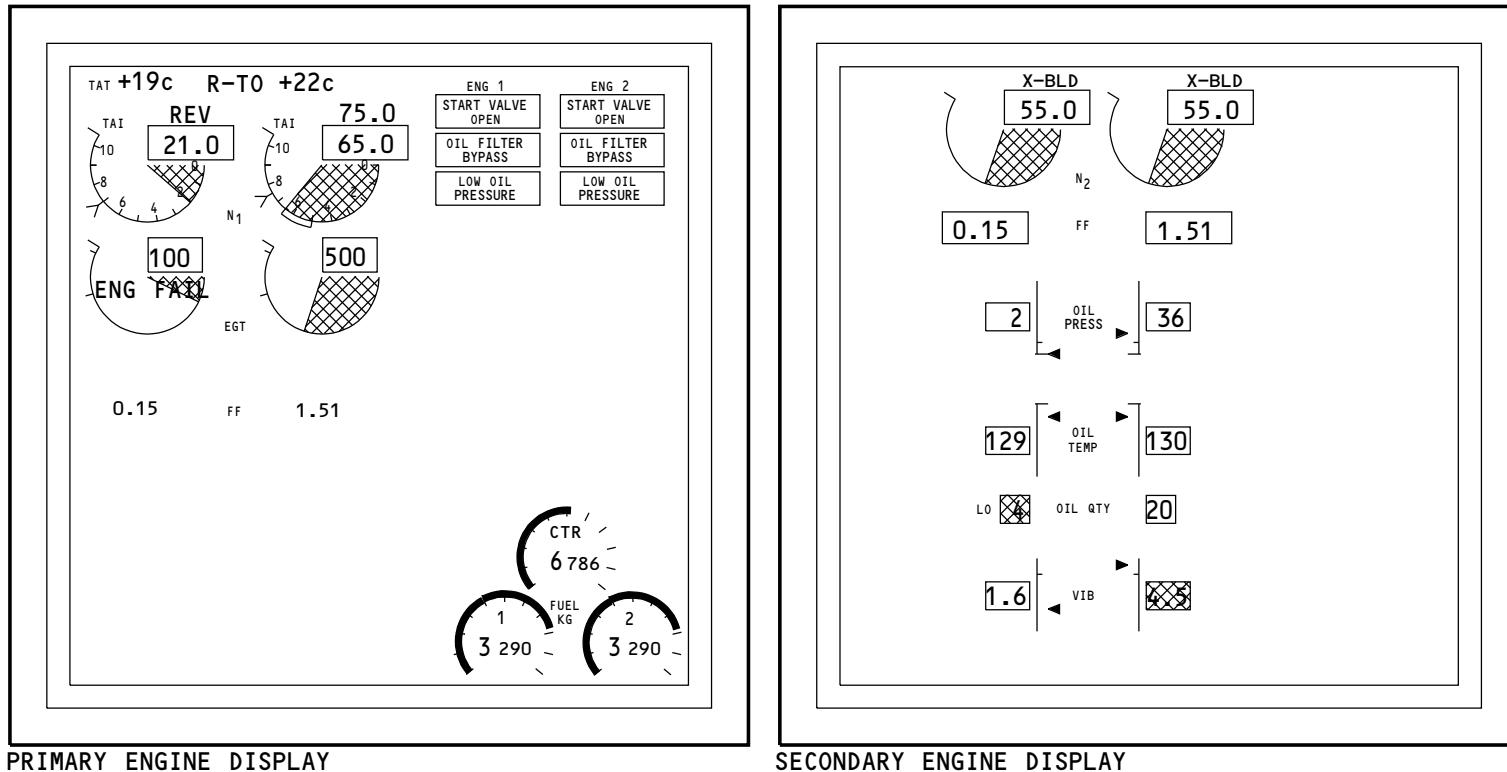
- Autothrottle limit message, thrust mode and TAT
- N1
- EGT
- Fuel flow
- N2
- Fuel flow/fuel used, and fuel quantity
- Crew alert messages
- Oil pressure, temperature and quantity
- Engine vibration.

EFFECTIVITY

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CDS - ENGINE DISPLAY - INTRODUCTION



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CDS - ENGINE DISPLAY - COMPACTED ENGINE DISPLAY

General

All of the data on the primary engine display and secondary engine display can show on the compacted engine display.

These are the indications on the compacted engine display:

- Autothrottle limit message, thrust mode and TAT
- N1
- EGT
- N2
- Fuel flow/fuel used and fuel quantity
- Oil pressure, temperature and quantity
- Engine vibration
- Crew alert messages.

Center DUs	Data shown before failure	Failure	Data shown after failure
Upper	Primary Engine		Primary Engine
Lower	blank	Lower	blank
Upper	Primary Engine		Compacted Engine
Lower	Secondary Engine	Lower	blank
Upper	Primary Engine	Upper	blank
Lower	System Data		Primary Engine
Upper	Primary Engine		Primary Engine
Lower	System Data	Lower	blank

If an exceedance occurs during normal operation and the lower center DU shows system data, then the upper center DU shows the compacted engine display. If an exceedance occurs during a center DU failure, then the compacted engine display replaces the primary engine display.

If one of the center DUs is defective, you can manually control the data that shows on the other DU. To change between the compacted engine display and the primary engine display, push the ENG button on the engine display control panel.

Manual Selection of the Compacted Engine Display

You can manually control the data that shows on the center DUs. Use the MFD keys on the engine display control panel as shown in the table below.

Center DUs	Data shown before action	MFD key	Data shown after action
Upper	Primary Engine		Primary Engine
Lower	blank	ENG	Secondary Engine

EFFECTIVITY

AKS ALL

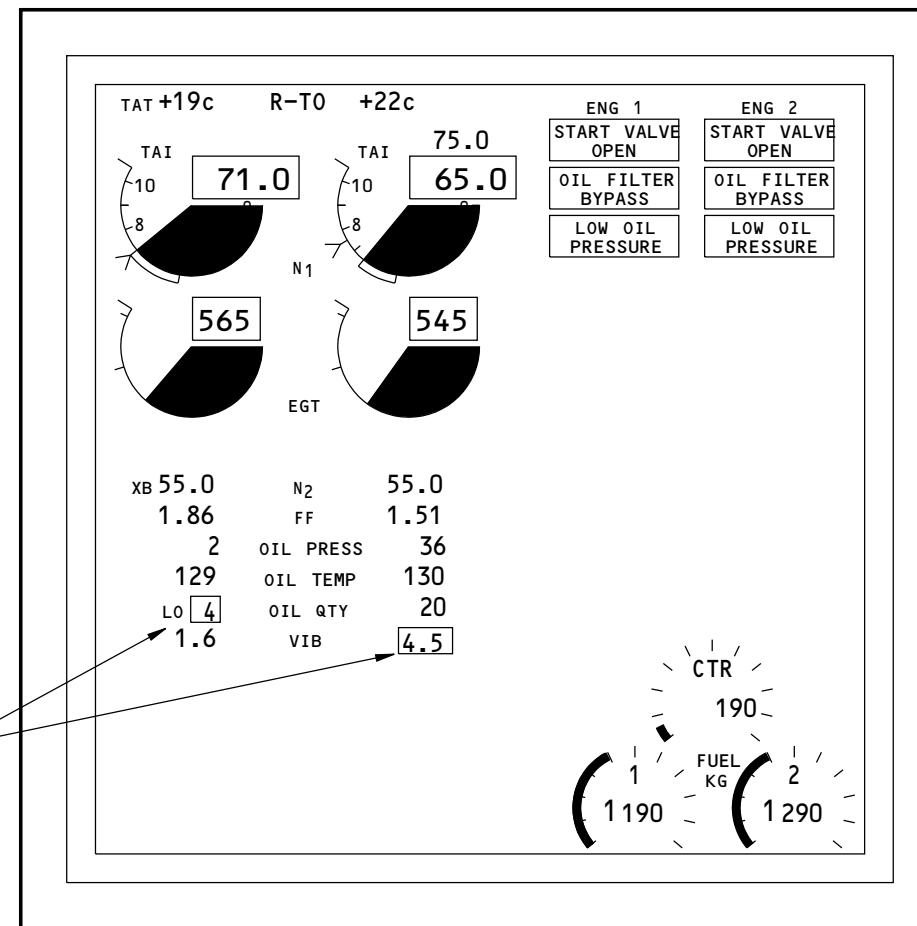
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CDS - ENGINE DISPLAY - COMPACTED ENGINE DISPLAY

(Continued)

Center DUs	Data shown before action	MFD key	Data shown after action
Upper	Primary Engine	ENG	Compacted Engine
Lower	Secondary Engine		blank
Upper	Compacted Engine	ENG	Primary Engine
Lower	blank		blank
Upper	Primary Engine	SYS	Primary Engine
Lower	blank		System Data
Upper	Primary Engine	SYS	Primary Engine
Lower	System Data		blank
Upper	Compacted Engine	SYS	Compacted Engine
Lower	blank		System Data
Upper	Primary Engine	ENG	Primary Engine
Lower	System Data		Secondary Engine
Upper	Compacted Engine	ENG	Primary Engine
Lower	System Data		System Data



M75643 S0004627630_V2

CDS - ENGINE DISPLAY - COMPACTED ENGINE DISPLAY

EFFECTIVITY

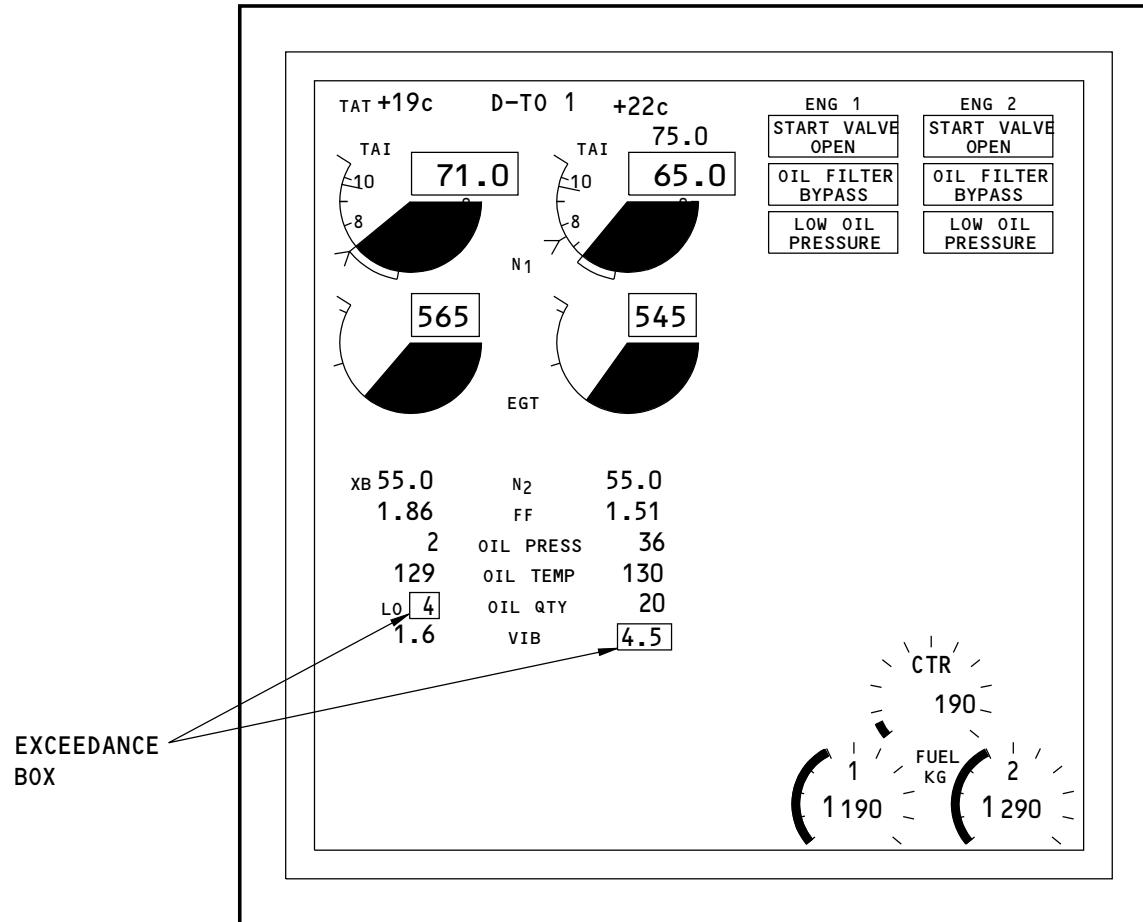
AKS 005

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J75159 S0000178232_V1

CDS - ENGINE DISPLAY - COMPACTED ENGINE DISPLAY



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CDS - ENGINE DISPLAY - MISCELLANEOUS INDICATIONS

Autothrottle Limit Message

The autothrottle limit message (A/T LIM) shows when the FCC-A sets the N1 reference.

Thrust Modes

These are the thrust modes that can show:

- TO
- CLB
- CON
- CRZ
- G/A

AKS 005

- R-TO
- R-CLB

AKS 001-004, 006-999

- TO 1
- TO 2
- D-TO
- D-TO 1
- D-TO 2
- CLB 1
- CLB 2

AKS ALL

- MAN

The thrust mode does not show if the autothrottle (A/T) limit shows.

Total Air Temperature

The total air temperature (TAT) shows as a digital indication.

EFFECTIVITY

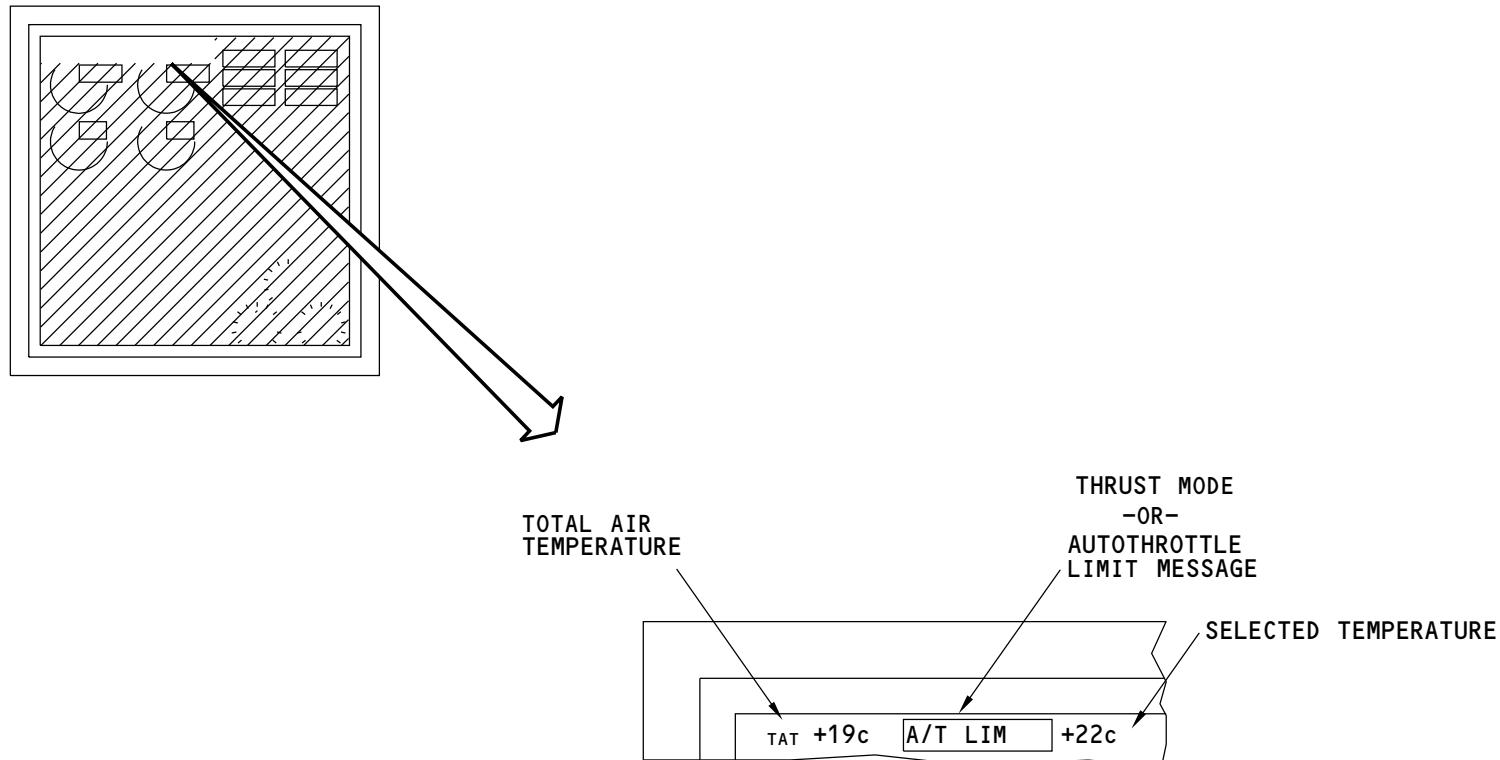
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M77831 S0004627596_V1

CDS - ENGINE DISPLAY - MISCELLANEOUS INDICATIONS

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CDS - ENGINE DISPLAY - CREW ALERT MESSAGES

Crew Alert Messages

These are the crew alert messages for each engine:

- START VALVE OPEN
- OIL FILTER BYPASS
- LOW OIL PRESSURE.

See the engine starting section for more information on the START VALVE OPEN message. (SECTION 80-00)

See the engine indicating section for more information on the OIL FILTER BYPASS and LOW OIL PRESSURE messages. (SECTION 79-30)

COMM Messages

These are the COMM messages:

- ATC.

The COMM messages show in a list with new messages at the top. New COMM messages do not show during the takeoff or landing. If you push the Cancel/Recall button (C/R) on the Engine Control Panel, the COMM messages do not change.

The .ATC message is a medium level COMM message. The message shows when the FMC or the ACARS receives a DISPLAYABLE ATC uplink. When the message shows, the Aural Warning System makes a Hi-Low chime sound. Only one .ATC message shows at a time.

Cat IIIb Messages

Cat IIIb messages show below the crew alert messages. If you push the Cancel/Recall button (C/R) on the Engine Control Panel, the messages are removed. After you cancel a message, the Recall Cue shows. While the Recall Cue shows, you can push the Cancel/Recall button (C/R) to make the cancelled messages show again.

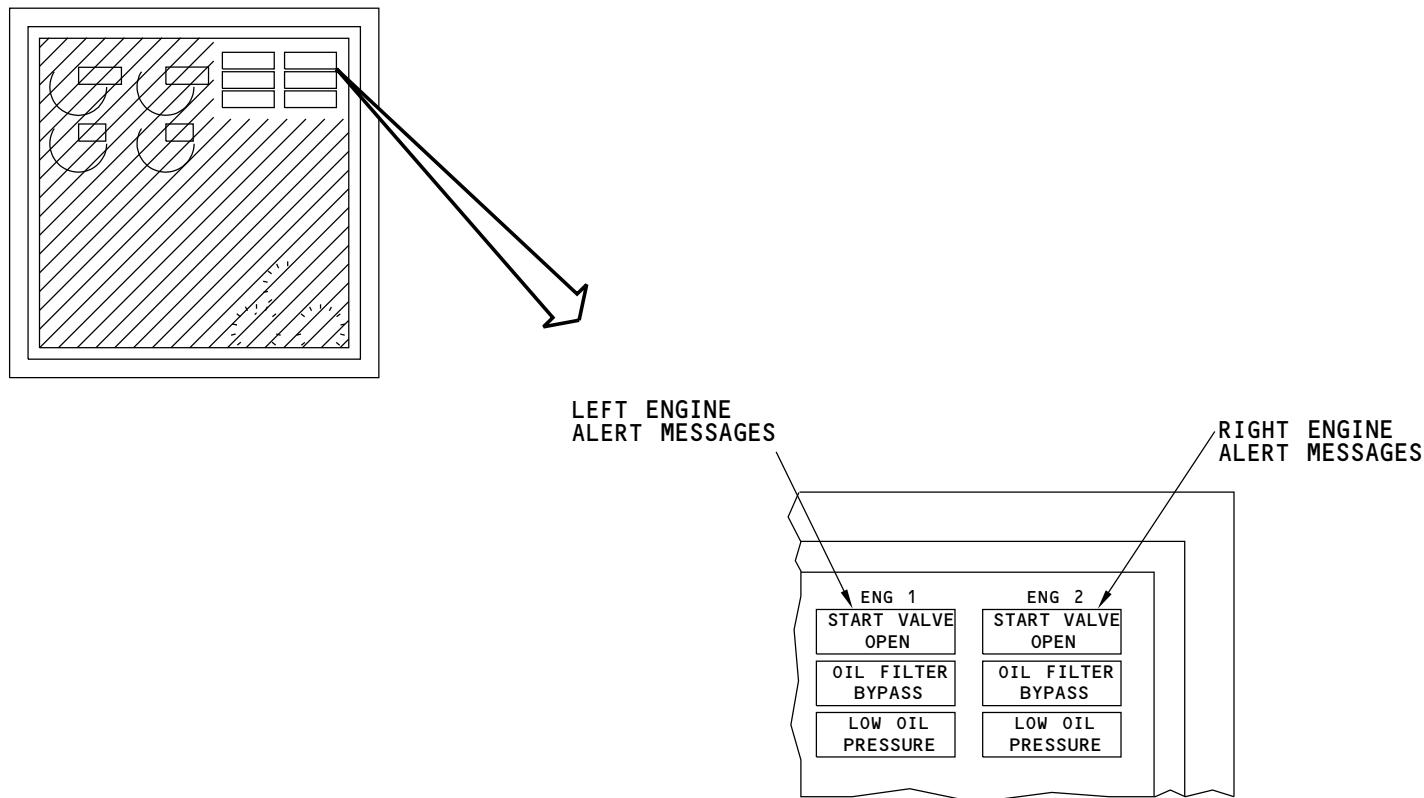
These are the Cat IIIb messages that can show:

- NO AUTOLAND

EFFECTIVITY

AKS ALL

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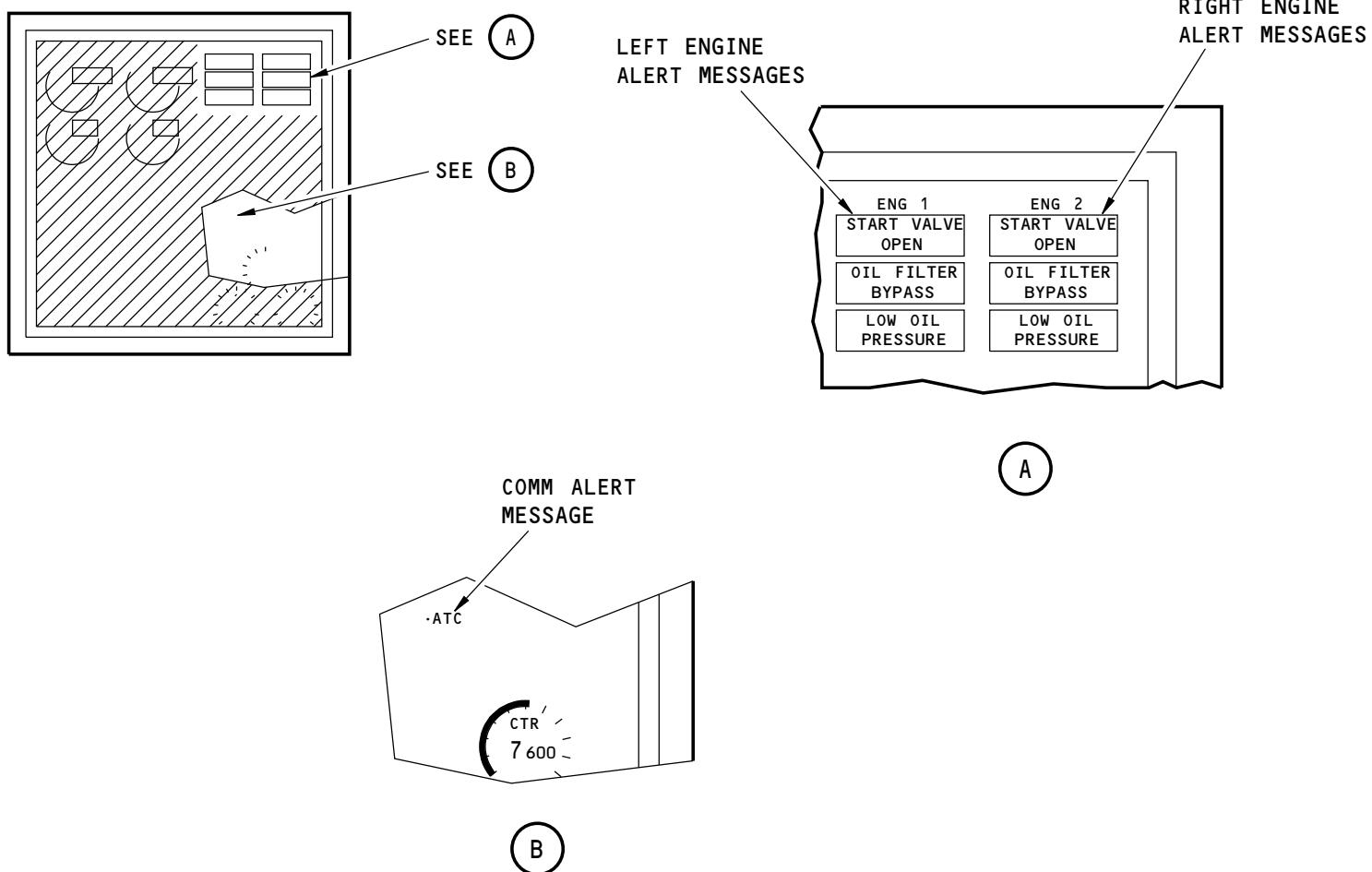
M77834 S0004627599_V1

CDS - ENGINE DISPLAY - CREW ALERT MESSAGES

EFFECTIVITY

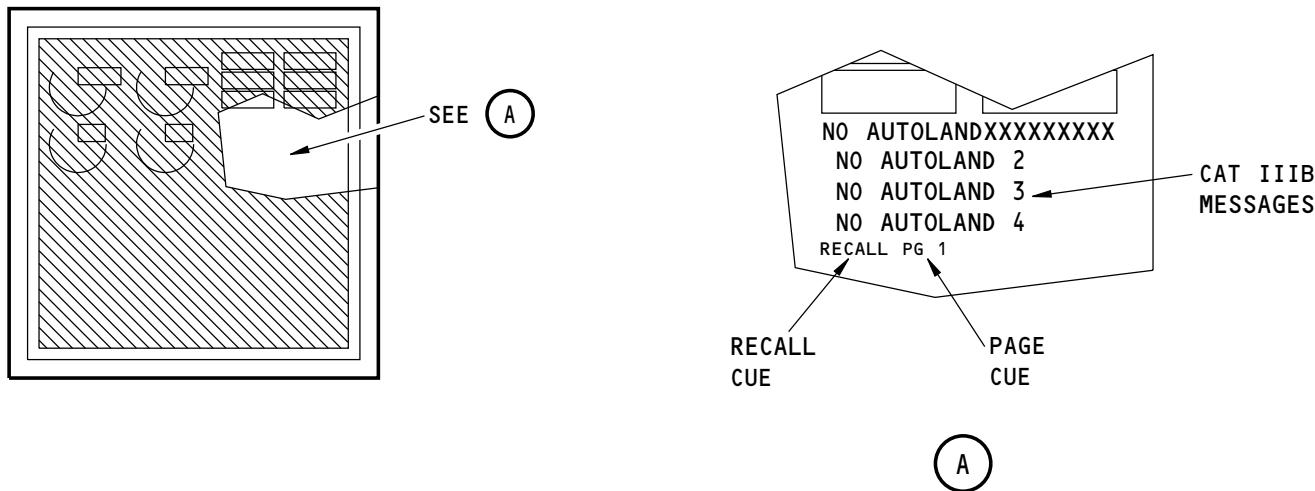
AKS ALL

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J65645 S0000174593_V1

CDS - ENGINE DISPLAY - CREW ALERT MESSAGES
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CDS - ENGINE DISPLAY - CAT IIIB MESSAGES

U33460 S0000192695_V1

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CDS - ENGINE DISPLAY - N1 INDICATION

N1

The N1 value shows as a digital indication and an analog indication.

In the normal operation range, the digital and analog indications are white. If the N1 value gets to the redline limit, the digital and analog indications are red.

See the engine tachometer system section for more information on N1. (SECTION 77-11)

N1 Command Sector

The N1 command sector shows on the analog scale. It shows the difference between the commanded thrust and the actual thrust.

N1 Reference Readout

The reference N1 readout shows above the N1 indication. The reference N1 bug also shows on the N1 analog scale. You can set the reference N1 value with the N1 set controls. These controls are on the engine control module.

See the flight management computer system section for more information on N1 reference value. (SECTION 34-61)

AKS 001-004, 006-999

N1 Maximum Indication

The N1 maximum indication shows as an amber marker in the N1 dial. The EEC calculates the N1 maximum value.

See the flight management computer system section for more information on N1 maximum value. (SECTION 34-61)

AKS ALL

Thrust Reverser Message

The thrust reverser message shows when the thrust reverse operates. If the thrust reverser message shows, it replaces the reference N1 readout for that engine.

EFFECTIVITY

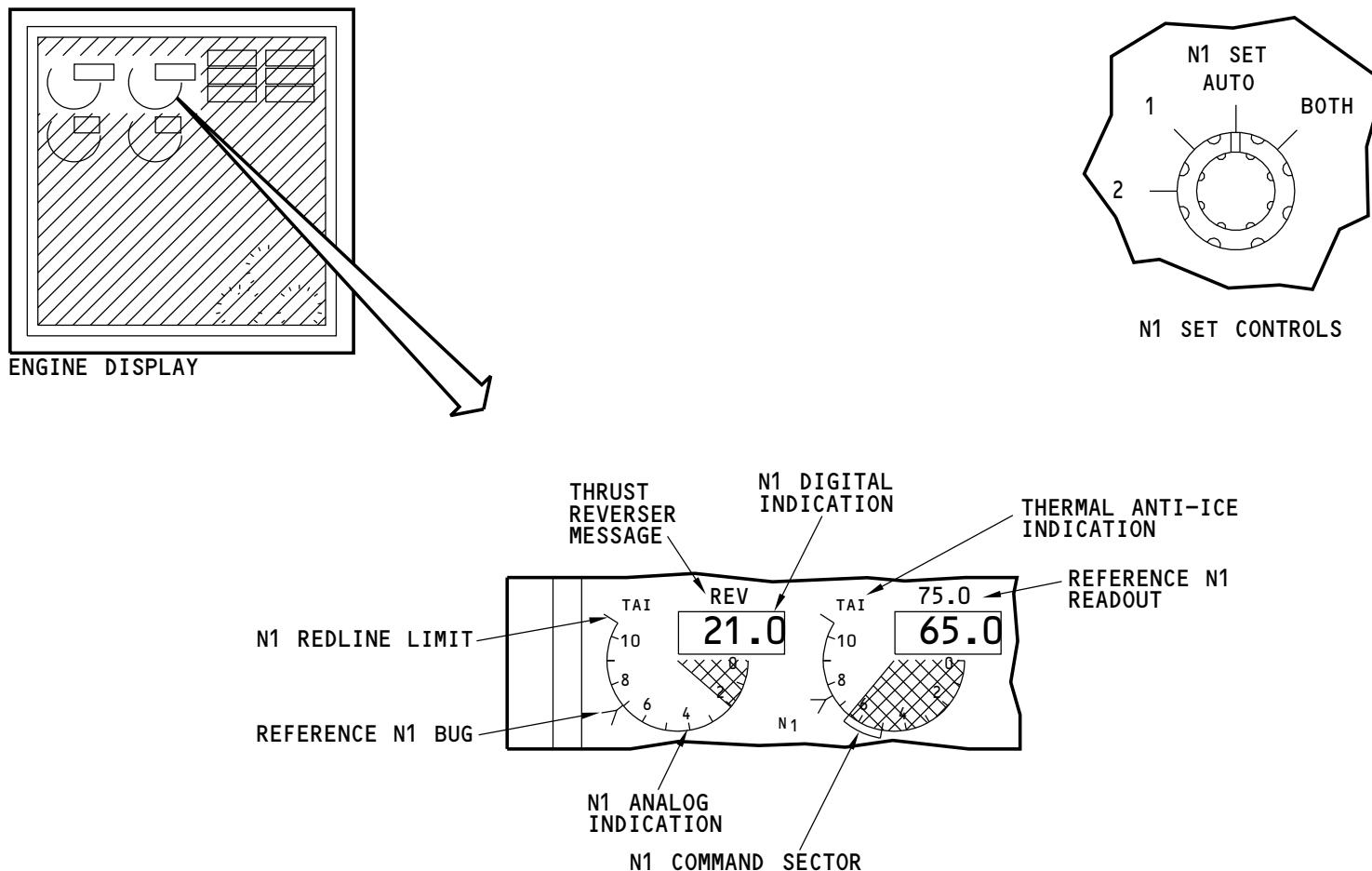
AKS ALL

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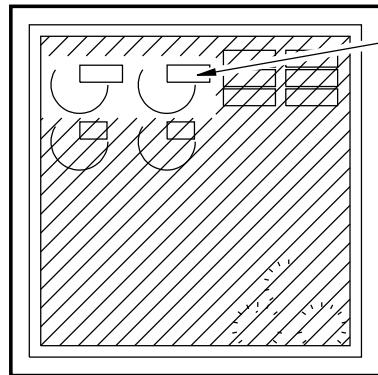
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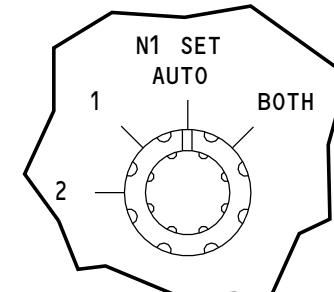


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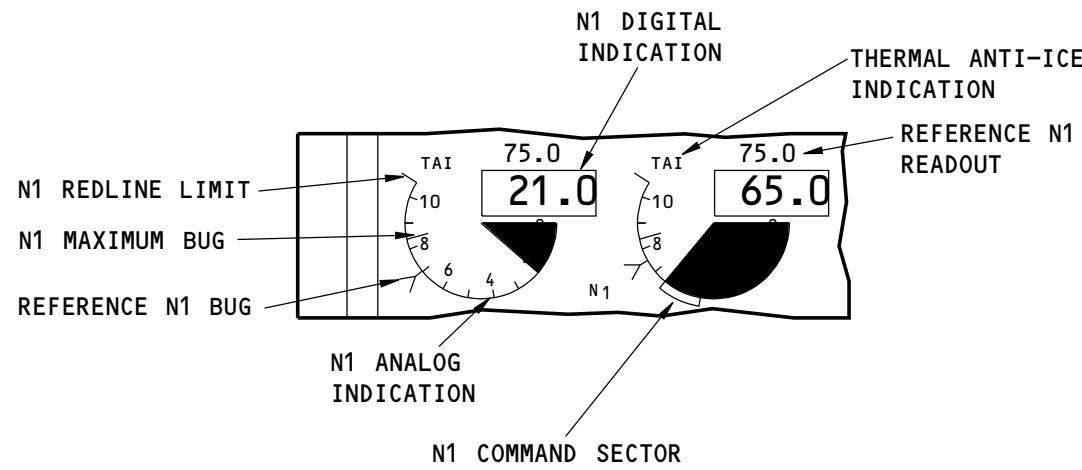
CDS - ENGINE DISPLAY - N1 INDICATION
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 SEE 

ENGINE DISPLAY



N1 SET CONTROLS




J75170 S0000178228_V1

CDS - ENGINE DISPLAY - N1 INDICATIONS
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CDS - ENGINE DISPLAY - EGT INDICATION

Engine Exhaust Gas Temperature Indication

The engine exhaust gas temperature (EGT) indication shows as a digital and an analog indication.

In the normal operation range, the digital and analog indications are white. If an EGT value gets to the amber band limit, the digital and analog indications are amber. If the EGT value gets to the redline limit, the digital and analog indications are red.

The EGT hot start limit shows when these conditions exist:

- Airplane is on the ground
- Engines are off
- Fire switch is not on.

See the EGT indicating system section for more information.
(SECTION 77-21)

Engine Failures Message

The engine failure message shows on the EGT indication. The message is amber.

See the EGT indicating system section for more information on the engine failure message. (SECTION 77-21)

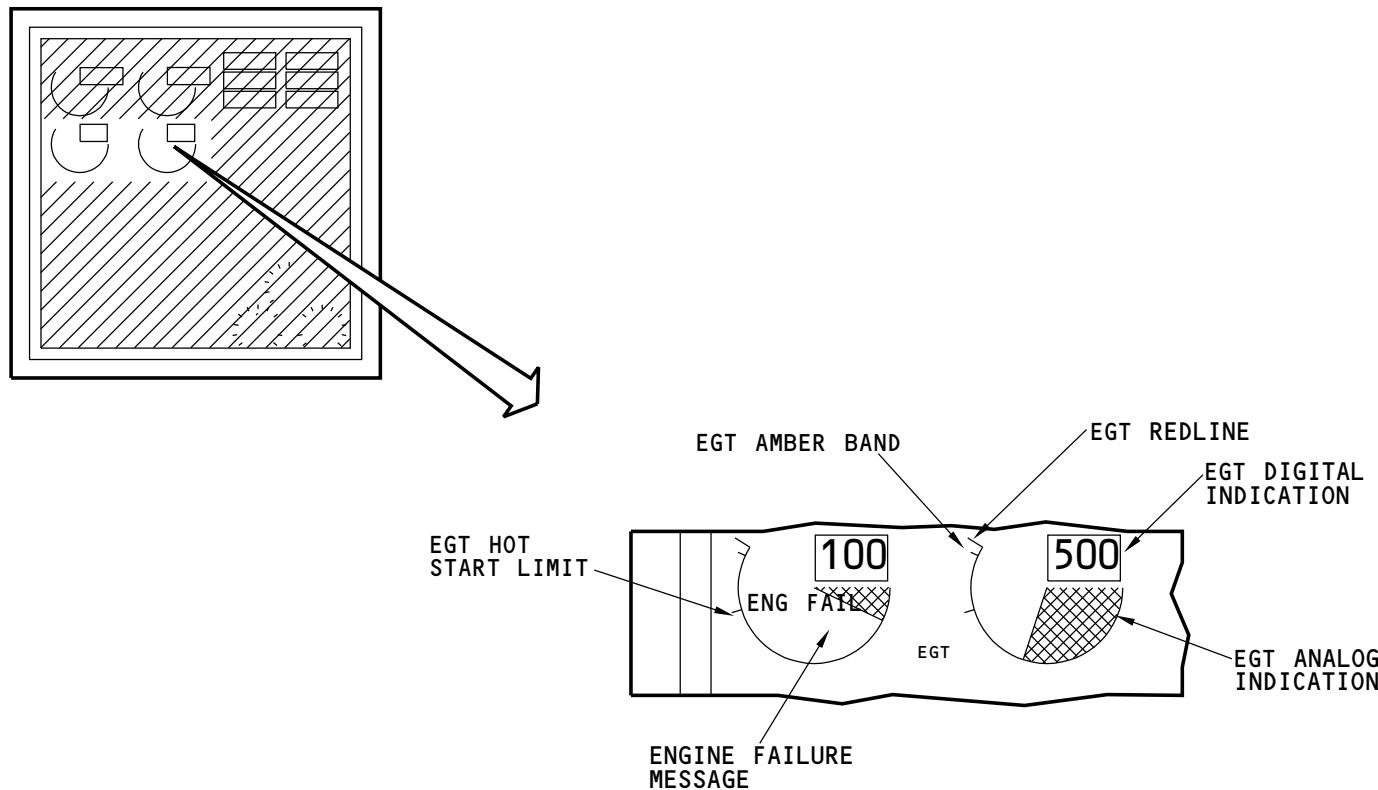
EFFECTIVITY

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M75637 S0004627605_V1

CDS - ENGINE DISPLAY - EGT INDICATION



CDS - ENGINE DISPLAY - N2 INDICATION

N2

The N2 value shows as a digital indication and an analog indication.

In the normal operation range, the digital and analog indication are white. If the N2 value gets to the redline limit, the digital and analog indication are red.

See the engine tachometer system section for more information on the N2 indication. (SECTION 77-11)

Cross Bleed Start Message

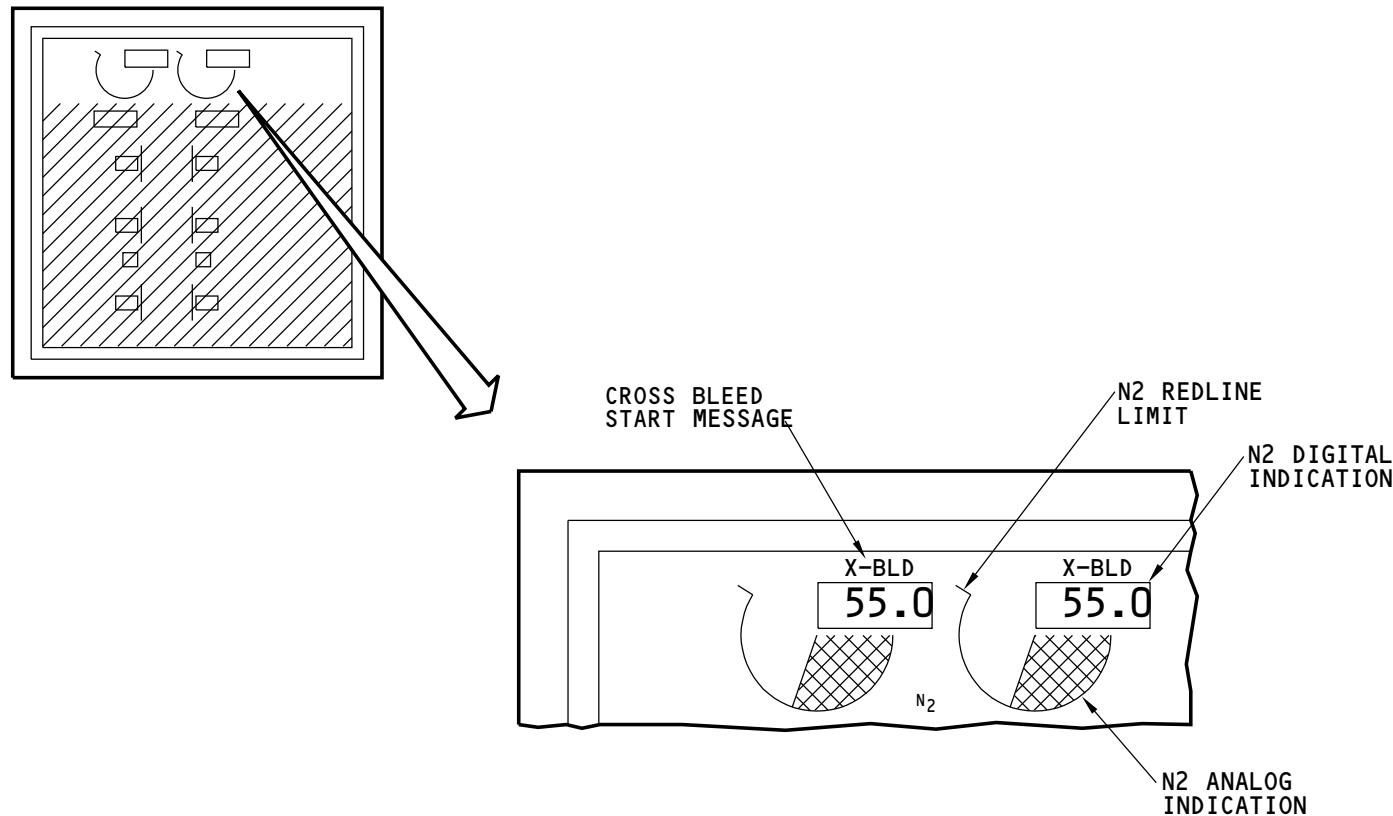
The cross bleed start message shows above the N2 digital indication.

See the engine starting chapter for more information. (CHAPTER 80)

EFFECTIVITY

AKS ALL

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CDS - ENGINE DISPLAY - N2 INDICATION

M75603 S0004627611_V1

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CDS - ENGINE DISPLAY - FUEL INDICATIONS

Fuel Indications

These are the fuel indications:

- Fuel quantity
- Fuel flow/fuel used

Fuel Quantity

The fuel quantity shows as a digital indication for each tank, plus a sum total.

See the fuel chapter for more information on the fuel quantity indications.
(CHAPTER 28)

Fuel Flow/Fuel Used

Fuel flow shows on the primary engine display. Fuel flow/fuel used shows on the secondary engine display. All the displays are digital. On the secondary display, fuel flow usually shows.

To show the fuel used, select the USED position on the fuel flow switch. To reset fuel used to zero, select the RESET position on the fuel flow switch.

See the engine fuel and control chapter 73 for more information on the fuel indications. (CHAPTER 73)

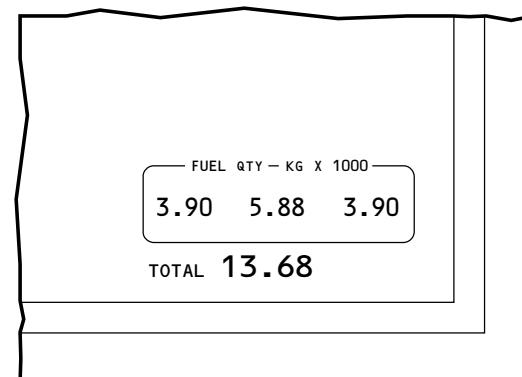
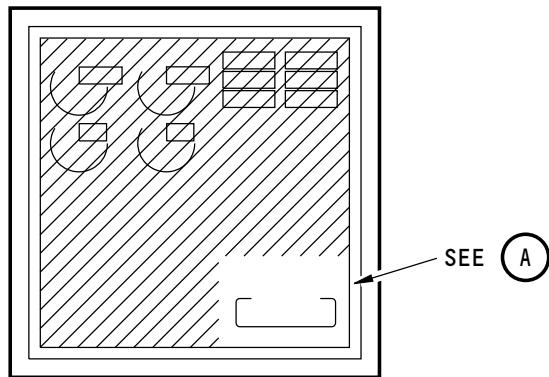
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FUEL QUANTITY



J79244 S0000179420_V1

CDS - ENGINE DISPLAY - FUEL INDICATIONS

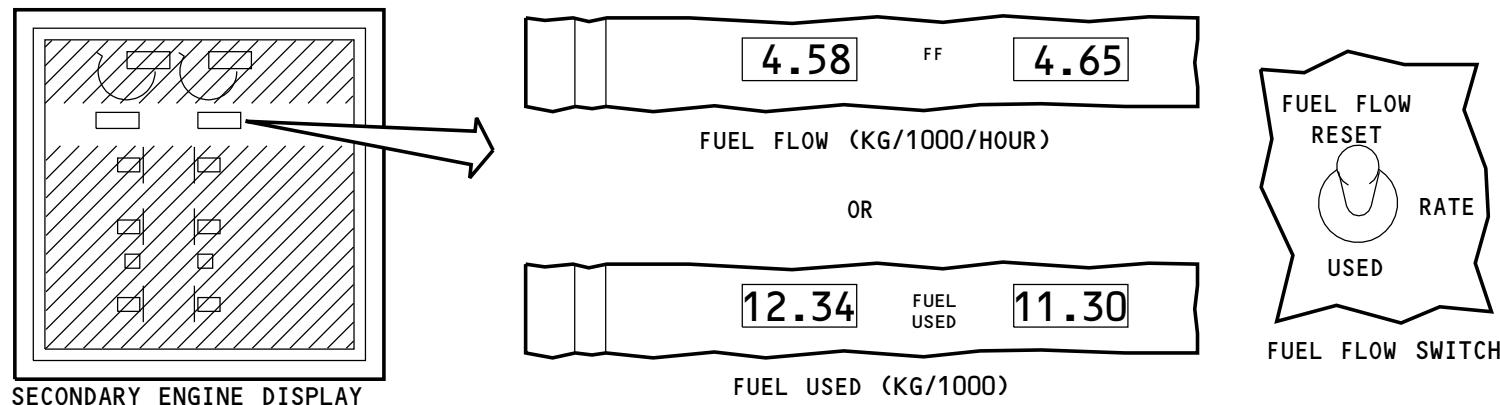
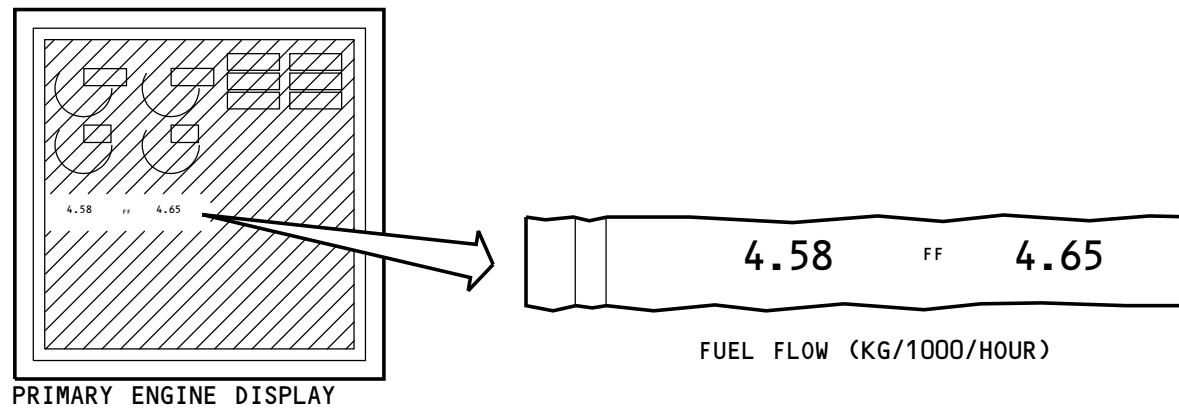
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CDS - ENGINE DISPLAY - FUEL INDICATIONS
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CDS - ENGINE DISPLAY - OIL INDICATIONS

Oil Indications

These are the oil indications:

- Oil pressure
- Oil temperature
- Oil quantity.

See the engine oil chapter for more information on oil indications.
(CHAPTER 79)

Oil Pressure

The oil pressure shows as an analog and digital indication. In the normal operation range, the scale, the pointer, and the digital display are white. When the oil pressure is in the low amber band limit, the scale, the pointer, and the digital display are amber. When the oil pressure is in the low redline limit, the scale, the pointer, and the digital display are red.

Oil Temperature

The oil temperature shows as an analog and digital indication. In the normal operation range, the scale, the pointer, and the digital display are white. When the oil temperature is in the high amber band limit, the scale, the pointer, and the digital display are amber. When the oil temperature is in the high redline limit, the scale, the pointer, and the digital display are red.

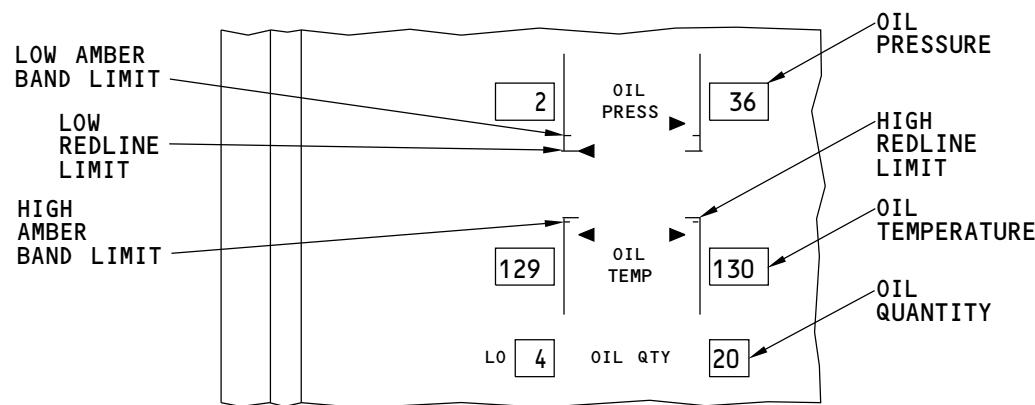
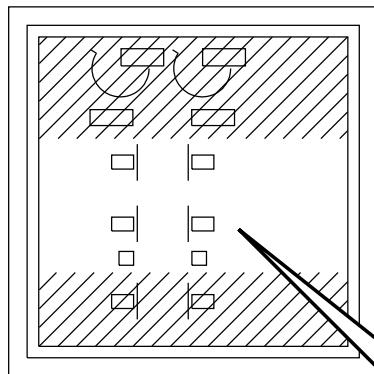
Oil Quantity

The oil quantity shows as a digital indication. The display and box are white.

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CDS - ENGINE DISPLAY - OIL INDICATIONS

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CDS - ENGINE DISPLAY - ENGINE VIBRATION INDICATIONS

Engine Vibration Indications

The engine vibration indications show as an analog and digital indication.
The scale and the pointer are white.

See the AVM system section for more information on engine vibration indications. (SECTION 77-31)

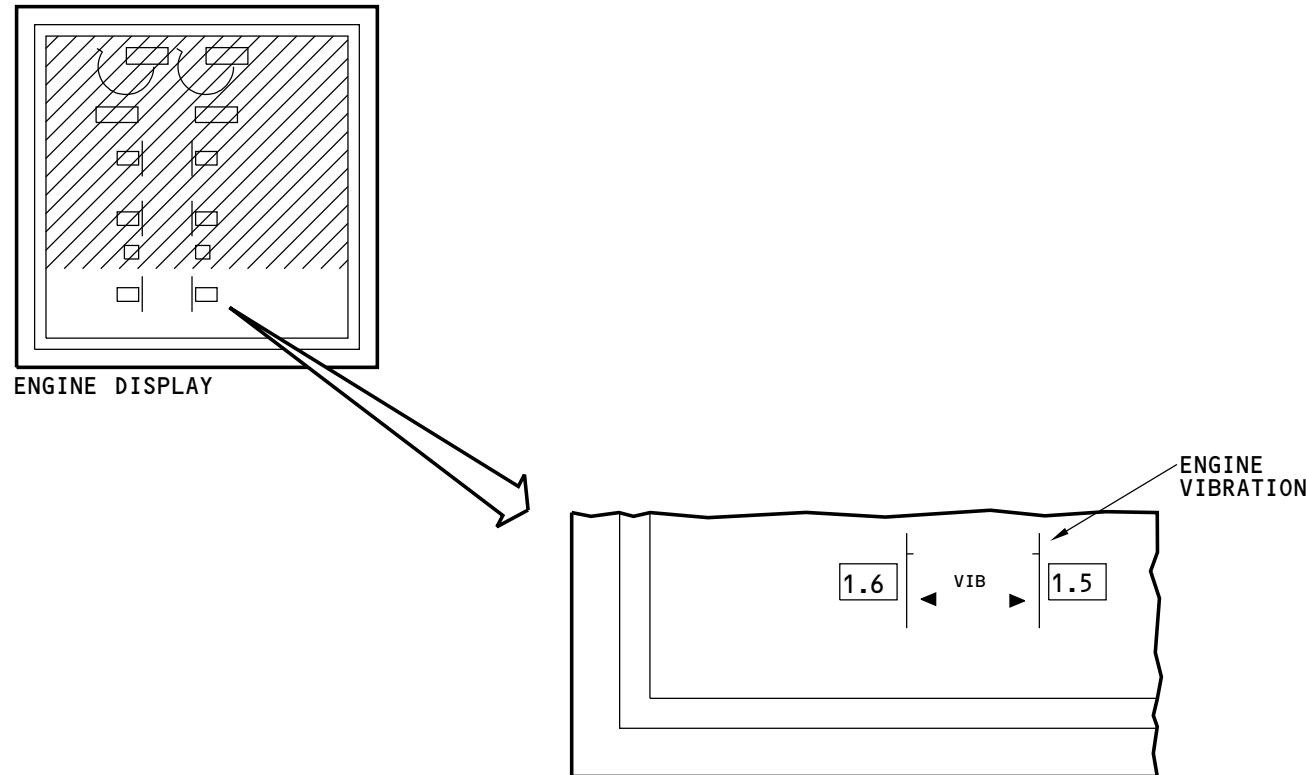
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CDS - ENGINE DISPLAY - ENGINE VIBRATION INDICATIONS

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CDS - SYSTEMS DISPLAY - INTRODUCTION

General

The systems display shows these indications:

- Hydraulic quantity
- Hydraulic pressure
- Flight control surface positions.

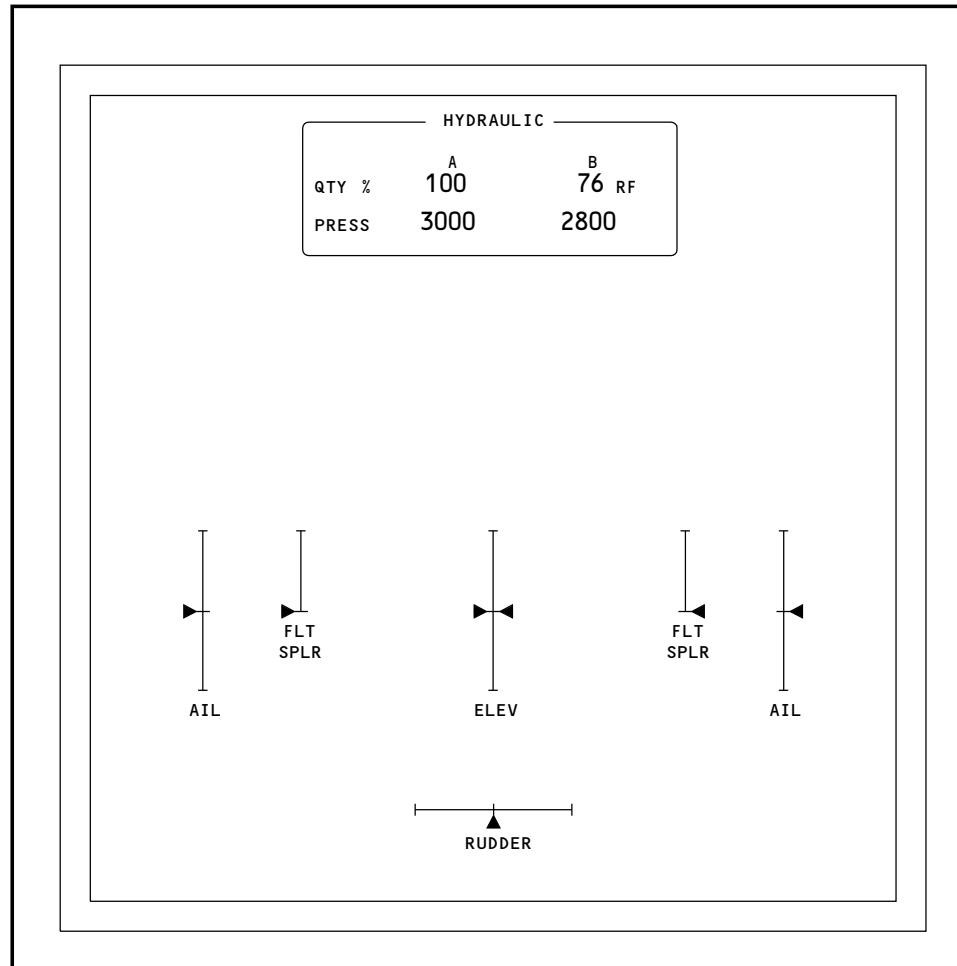
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CDS - SYSTEMS DISPLAY - INTRODUCTION



CDS - SYSTEMS DISPLAY - HYDRAULIC INDICATIONS

General

The hydraulic indications show hydraulic quantity and pressure for system A and B.

Hydraulic quantity shows as a percentage of full.

When the quantity in the A or B hydraulic reservoir is less than or equal to 76 percent, a white RF message shows on the display adjacent to the quantity indication. The RF message can show only when the airplane is on the ground and either the trailing edge flaps are retracted or both engines are not running.

Hydraulic pressure shows in units of pounds per square inch (PSI).

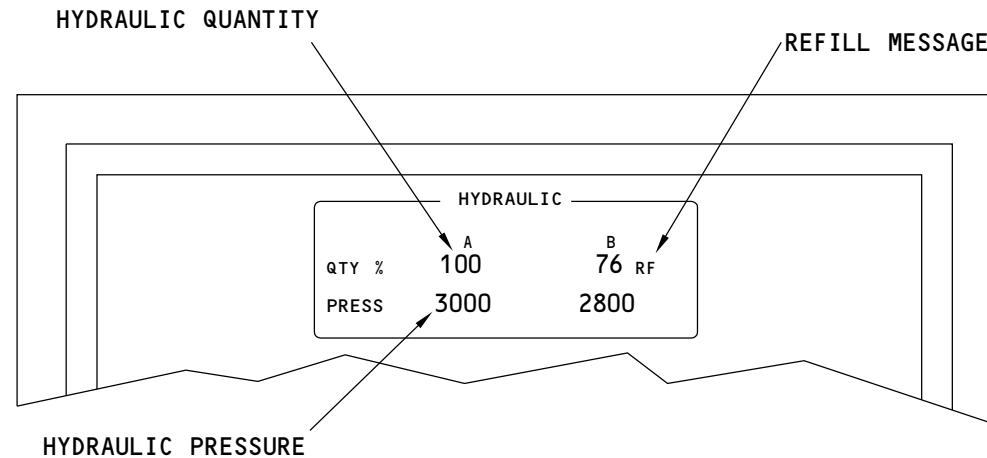
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CDS - SYSTEMS DISPLAY - HYDRAULIC INDICATIONS
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CDS - SYSTEMS DISPLAY - FLIGHT CONTROL SURFACE POSITIONS INDICATIONS

General

The flight control surface position indications show the position of the ailerons, elevators, and rudder. The indications show as an analog indication with a pointer on a vertical or horizontal scale.

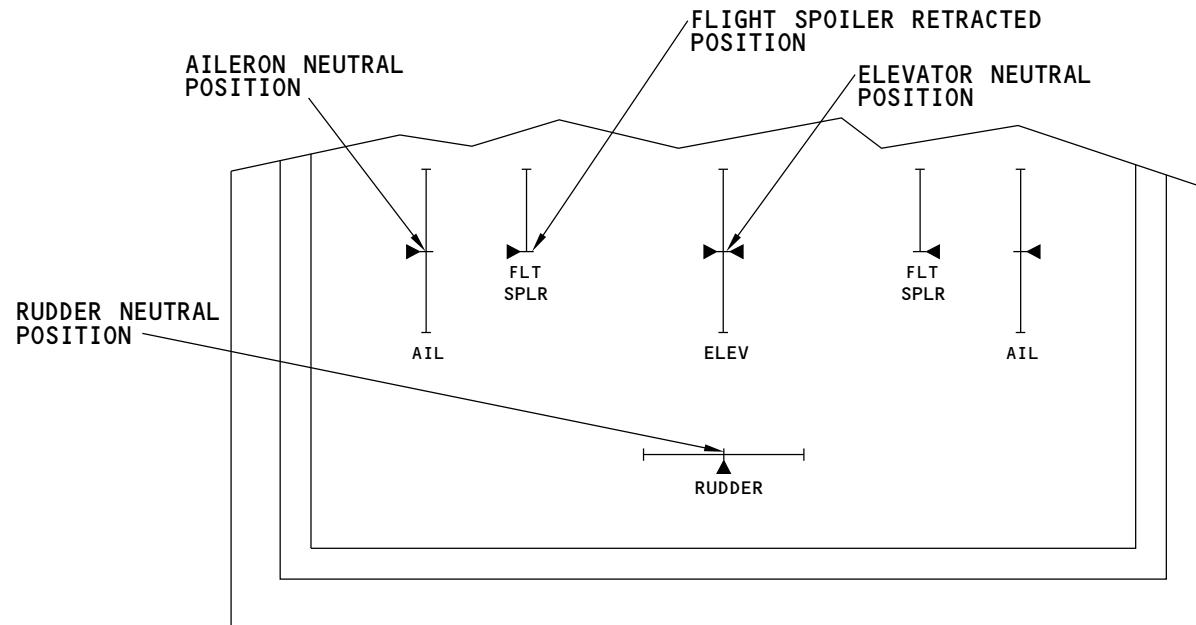
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CDS - SYSTEMS DISPLAY - FLIGHT CONTROL SURFACE POSITIONS INDICATIONS

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CDS - OPERATION - SWITCHING - NORM POSITION

Display Control

The Display Select Panels for the captain and first officer let you control the data that shows on the display units. The Main Panel DUs switch controls the data that shows on the inboard and outboard DUs. The Lower DU switch controls the data that shows on the Lower Center DU.

NORM

The NORM selections on the Display Select Panels shows this data on the display units:

- Left outboard: captain's primary flight display
- Left inboard: captain's navigation display
- Right inboard: FO's navigation display
- Right outboard: FO's primary flight display.
- Upper center: engine primary display
- Lower center: engine secondary display

Power-up

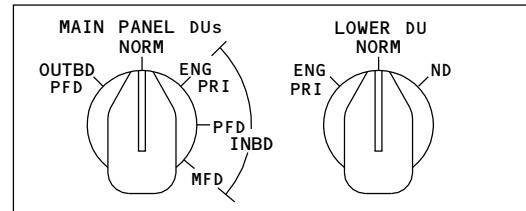
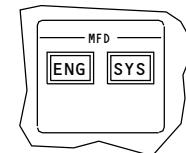
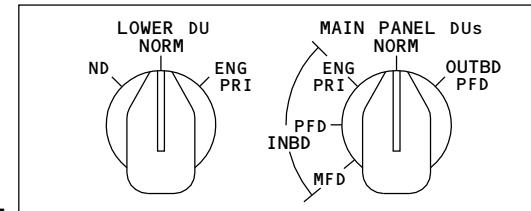
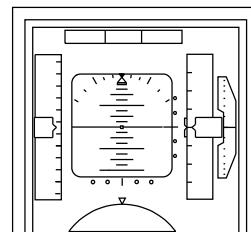
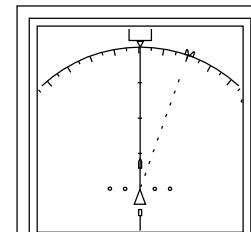
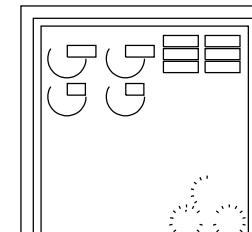
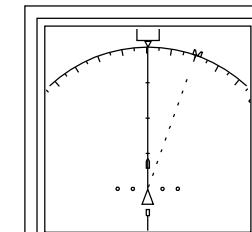
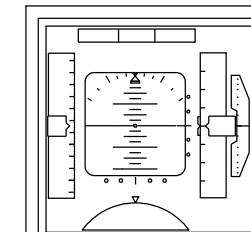
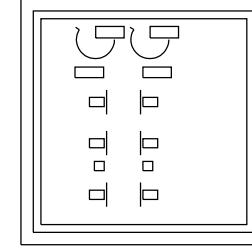
At power-up, each display unit reads its position pins and calculates its position. The position latches into the DU memory. If a DU fails to read the position pins, the DU is blank.

At power-up, the lower center display unit shows the secondary engine display. After power-up, with the display select panel lower DU selector in the NORM position, you can use the ENG switch or the SYS switch to control the format that shows on the lower center display unit.

EFFECTIVITY

AKS ALL

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CAPTAIN DISPLAY SELECT PANEL

ENGINE DISPLAY CONTROL PANEL

F/O DISPLAY SELECT PANEL
PRIMARY FLIGHT DISPLAY

LEFT OUTBOARD DU
NAVIGATION DISPLAY

LEFT INBOARD DU
PRIMARY ENGINE DISPLAY

UPPER CENTER DU
NAVIGATION DISPLAY

RIGHT INBOARD DU
PRIMARY FLIGHT DISPLAY

RIGHT OUTBOARD DU
SECONDARY ENGINE DISPLAY

LOWER CENTER DU

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CDS - OPERATION - SWITCHING - NORM POSITION
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CDS - OPERATION - SWITCHING - OUTBD PFD POSITION

OUTBD PFD

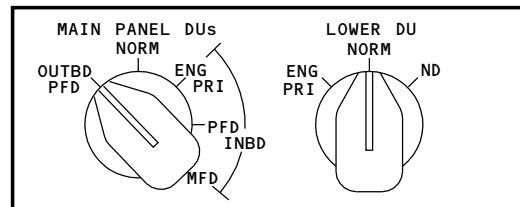
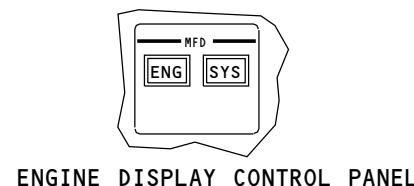
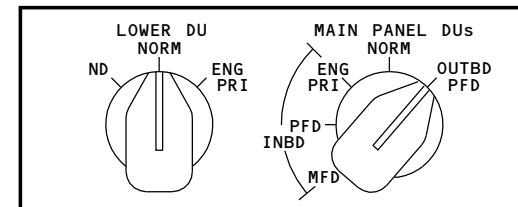
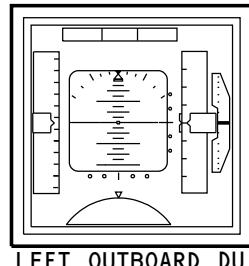
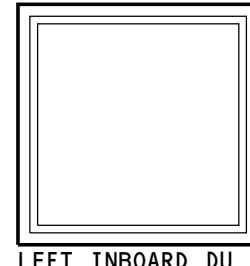
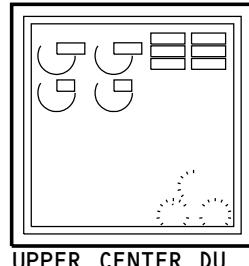
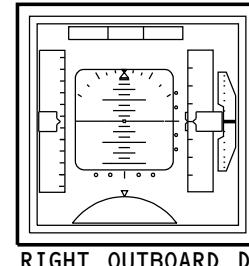
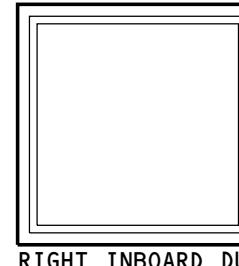
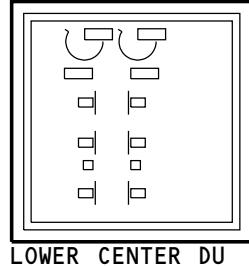
When you set the Main Panel DU switch on the Display Select Panel to OUTBD PFD, the primary flight display shows on the outboard display unit. The inboard display unit does not show data.

EFFECTIVITY

AKS ALL

31-62-00

D633A101-AKS


CAPTAIN DISPLAY SELECT PANEL

ENGINE DISPLAY CONTROL PANEL

F/O DISPLAY SELECT PANEL
**PRIMARY
FLIGHT DISPLAY**

LEFT OUTBOARD DU

LEFT INBOARD DU
**PRIMARY
ENGINE DISPLAY**

UPPER CENTER DU
**PRIMARY
FLIGHT DISPLAY**

RIGHT OUTBOARD DU

RIGHT INBOARD DU
SECONDARY ENGINE DISPLAY

LOWER CENTER DU

M77858 S0004627649_V1

CDS - OPERATION - SWITCHING - OUTBD PFD POSITION
EFFECTIVITY
AKS ALL
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CDS - OPERATION - SWITCHING - INBD ENG PRI POSITION

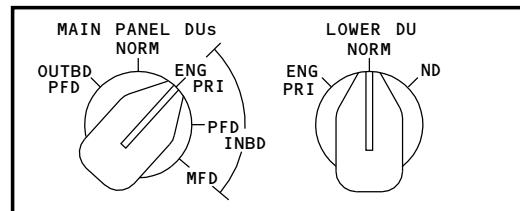
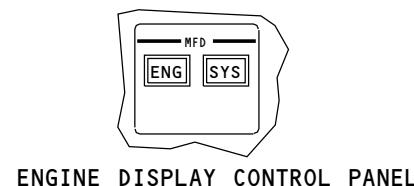
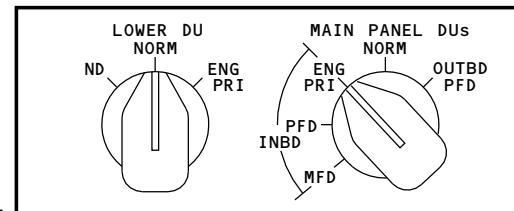
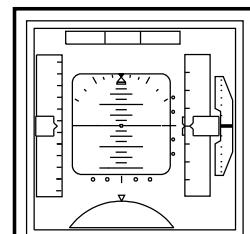
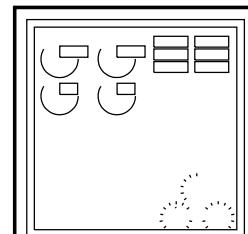
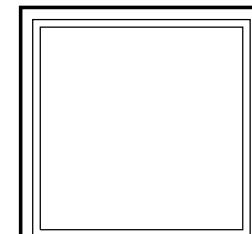
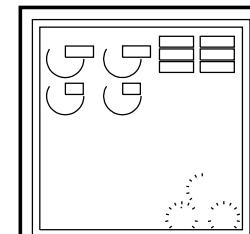
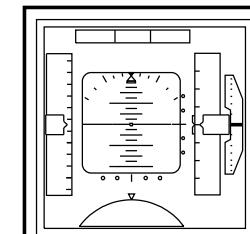
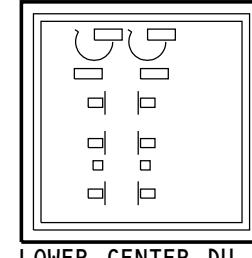
INBD ENGINE PRI

When you set the Main Panel DUs switch on the Display Select Panel to INBD ENGINE PRI, the primary engine display shows on the inboard display unit. The navigation display does not show and the upper center display unit does not show display data.

EFFECTIVITY

AKS ALL

31-62-00


CAPTAIN DISPLAY SELECT PANEL

ENGINE DISPLAY CONTROL PANEL

F/O DISPLAY SELECT PANEL
**PRIMARY
FLIGHT DISPLAY**

LEFT OUTBOARD DU
**PRIMARY
ENGINE DISPLAY**

LEFT INBOARD DU

UPPER CENTER DU
**PRIMARY
ENGINE DISPLAY**

RIGHT INBOARD DU
**PRIMARY
FLIGHT DISPLAY**

RIGHT OUTBOARD DU
SECONDARY ENGINE DISPLAY

LOWER CENTER DU

M77861 S0004627653_V1

CDS - OPERATION - SWITCHING - INBD ENG PRI POSITION
EFFECTIVITY
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CDS - OPERATION - SWITCHING - INBD PFD POSITION

INBD PFD

When you set the Main Panel DUs switch on the Display Select Panel to INBD PFD, the primary flight display shows on the inboard display unit. The outboard display unit does not show display data.

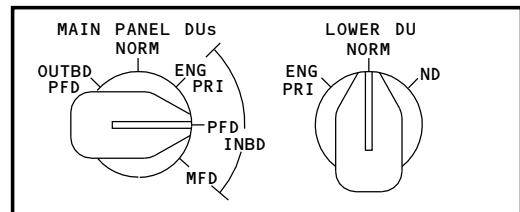
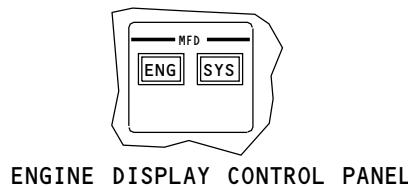
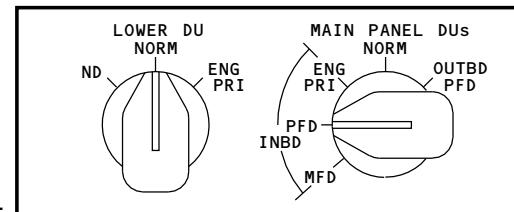
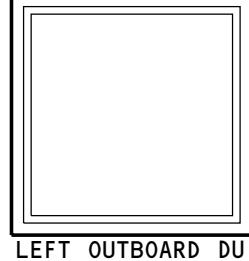
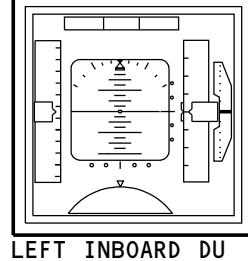
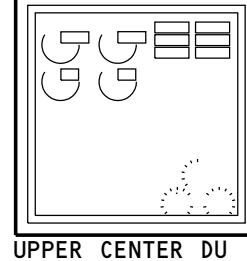
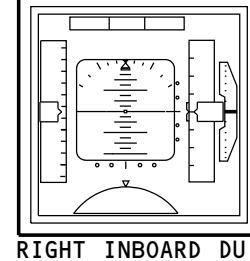
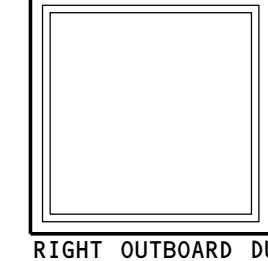
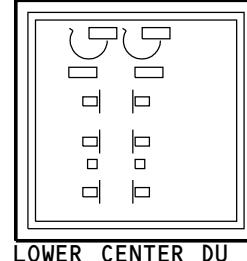
EFFECTIVITY

AKS ALL

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CAPTAIN DISPLAY SELECT PANEL

ENGINE DISPLAY CONTROL PANEL

F/O DISPLAY SELECT PANEL

LEFT OUTBOARD DU

LEFT INBOARD DU

UPPER CENTER DU

RIGHT INBOARD DU

RIGHT OUTBOARD DU
SECONDARY ENGINE DISPLAY

LOWER CENTER DU

M77864 S0004627657_V1

CDS - OPERATION - SWITCHING - INBD PFD POSITION
EFFECTIVITY
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CDS - OPERATION - SWITCHING - INBD MFD POSITION

INBD MFD

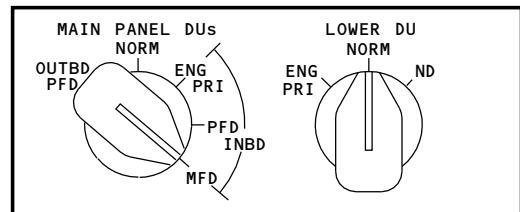
Set the Main Panel DUs switch on the Display Select Panel to INBD MFD to show the multi-function display (MFD) on the inboard display unit. Use the ENG and SYS keys on the engine display control panel to control the data that shows on the MFD. When you push the ENG key, the engine secondary display shows on the inboard display unit. When you push the SYS key, the systems display shows on the inboard display unit.

EFFECTIVITY

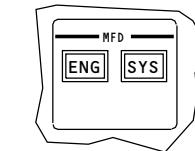
AKS ALL

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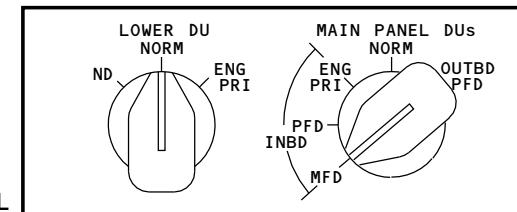
D633A101-AKS



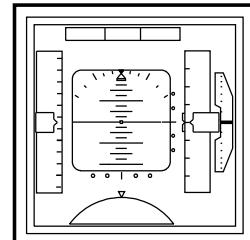
CAPTAIN DISPLAY SELECT PANEL



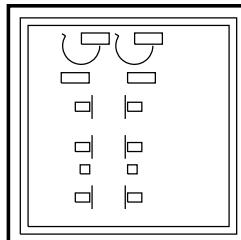
ENGINE DISPLAY CONTROL PANEL



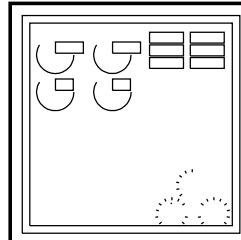
F/O DISPLAY SELECT PANEL

 PRIMARY
FLIGHT DISPLAY


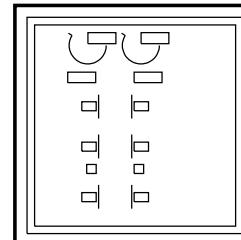
LEFT OUTBOARD DU

 SECONDARY
ENGINE DISPLAY


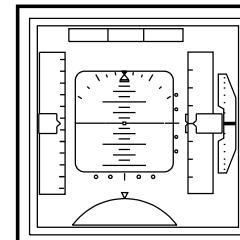
LEFT INBOARD DU

 PRIMARY
ENGINE DISPLAY


UPPER CENTER DU

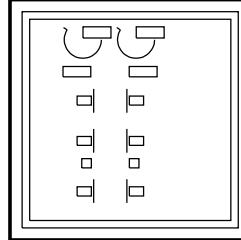
 SECONDARY
ENGINE DISPLAY


RIGHT INBOARD DU

 PRIMARY
FLIGHT DISPLAY


RIGHT OUTBOARD DU

SECONDARY ENGINE DISPLAY



LOWER CENTER DU

M77877 S0004627662_V1

CDS - OPERATION - SWITCHING - INBD MFD POSITION

EFFECTIVITY

AKS ALL

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CDS - OPERATION - SWITCHING - LOWER ENG POSITION

LOWER ENG

When you set the Lower DU switch on the Display Select Panel to ENG PRI, the primary engine display shows on the lower center display unit. The upper center display unit does not show data.

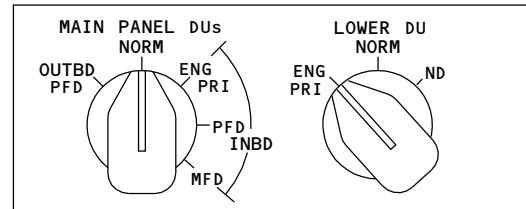
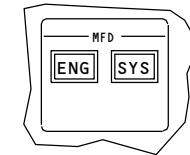
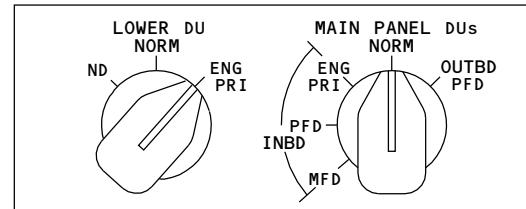
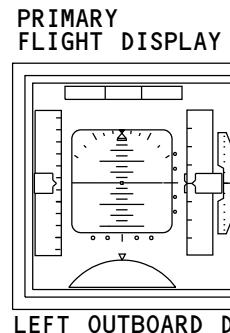
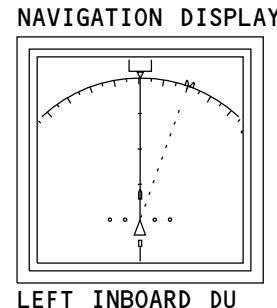
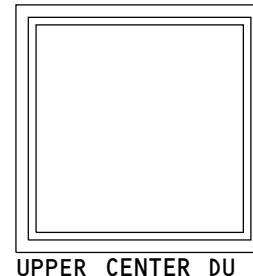
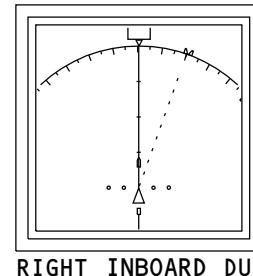
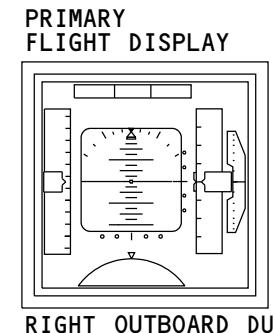
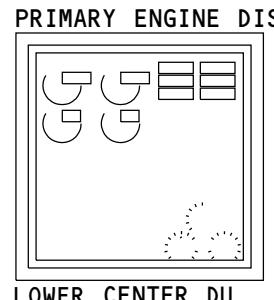
EFFECTIVITY

AKS ALL

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D633A101-AKS

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CAPTAIN DISPLAY SELECT PANEL

ENGINE DISPLAY CONTROL PANEL

F/O DISPLAY SELECT PANEL

LEFT OUTBOARD DU

LEFT INBOARD DU

UPPER CENTER DU

RIGHT INBOARD DU

RIGHT OUTBOARD DU

LOWER CENTER DU

CDS - OPERATION - SWITCHING - LOWER ENG POSITION

M77868 S0004627666_V1

EFFECTIVITY
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CDS - OPERATION - SWITCHING - LOWER ND POSITION

LOWER ND

If you set the Lower DU switch on the Display Select Panel to ND, the lower center display unit shows the navigation display.

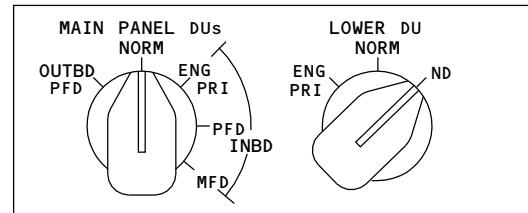
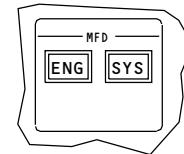
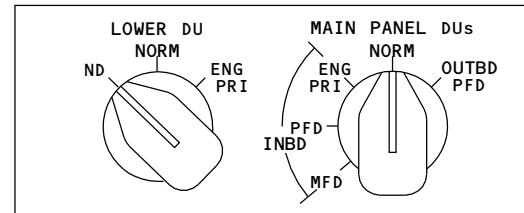
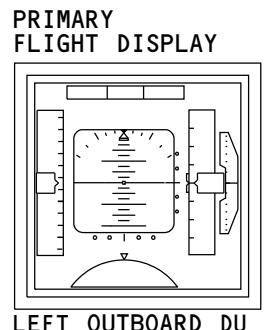
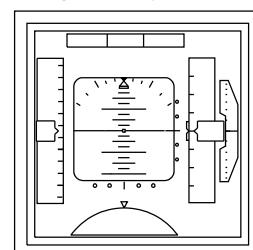
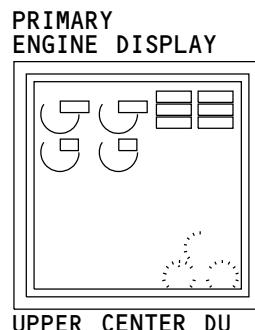
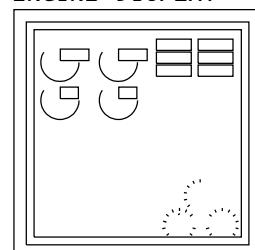
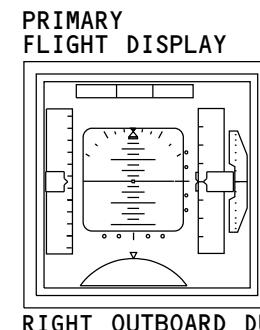
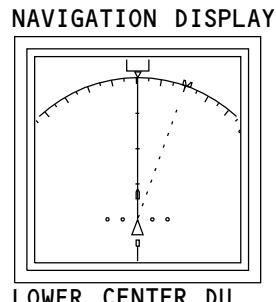
The captain and the first officer can each set the Lower DU switch on their Display Select Panels to ND. In that condition, the captain's navigation display shows on the lower center display unit.

EFFECTIVITY

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CAPTAIN DISPLAY SELECT PANEL

ENGINE DISPLAY CONTROL PANEL

F/O DISPLAY SELECT PANEL

PRIMARY FLIGHT DISPLAY

NAVIGATION DISPLAY

PRIMARY ENGINE DISPLAY

NAVIGATION DISPLAY

PRIMARY FLIGHT DISPLAY

NAVIGATION DISPLAY

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CDS - OPERATION - SWITCHING - LOWER ND POSITION



CDS - OPERATION - SWITCHING - AUTOMATIC

Inboard/Outboard Display Units

If the outboard display unit has a failure, the inboard display unit shows the primary flight display.

If the inboard display unit has a failure, the navigation display does not show.

Center Display Units

If the upper center display unit has a failure, the lower center display unit shows the primary engine display. If the secondary engine display already shows on the lower center display unit, the compacted engine display shows.

If the lower center display unit shows the secondary engine display and has a failure, then the upper center display unit shows the compacted engine display.

The lower center DU can show system data when the upper center DU shows the primary or compacted engine display. For this condition, if an exceedance occurs for secondary engine data, then the upper center display unit changes. The upper center display unit will show the compacted engine display with the exceedance data shown in a box.

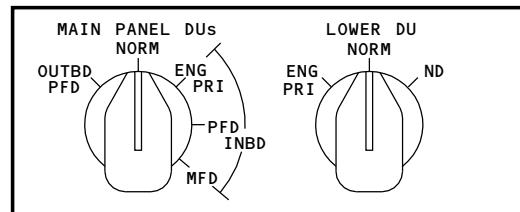
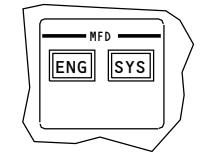
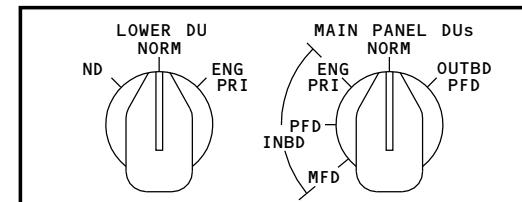
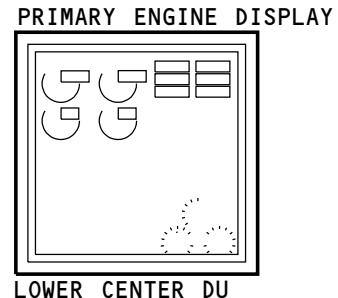
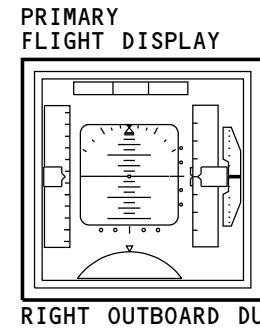
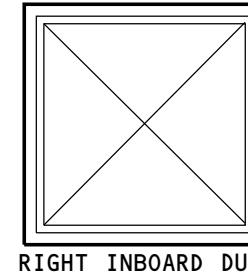
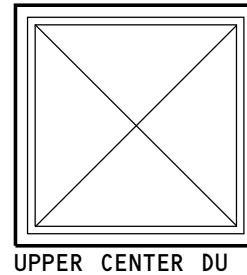
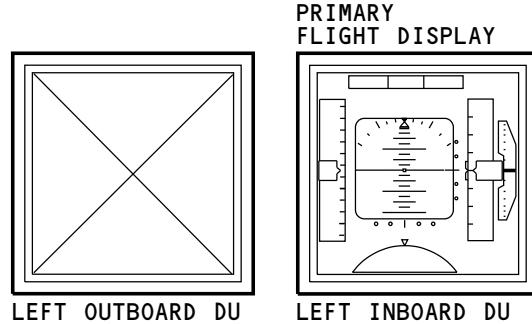
EFFECTIVITY

AKS ALL

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D633A101-AKS


CAPTAIN DISPLAY SELECT PANEL

ENGINE DISPLAY CONTROL PANEL

F/O DISPLAY SELECT PANEL


CDS - OPERATION - SWITCHING - AUTOMATIC

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CDS - OPERATION - DISPLAY SOURCE SELECTOR

Display Source Selector

The display source selector lets you select the DEU that controls the displays. For maintenance, use the switch to quickly find if there is a DEU failure or partial failure.

When the selector is in the AUTO position, DEU 1 controls the captain and upper center display units and DEU 2 controls the first officer and the lower center display units, if there are no failures.

If any of the graphics generators (GG) circuit card assemblies (CCA) fails in either DEU, the DEUs automatically change the GG CCA that controls the display units.

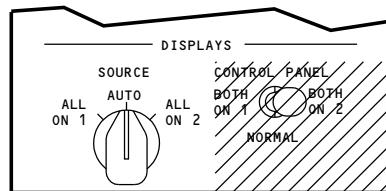
When the selector is in the ALL ON ONE position, DEU 1 controls all six display units. When the selector is in the ALL ON 2, DEU 2 controls all six display units.

EFFECTIVITY

AKS ALL

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DU		LOB	LIB	UPPER C	LOWER C	RIB	ROB
SELECTOR POSITION		FAILURES	DEU 1 GG A	DEU 1 GG A	DEU 1 GG B	DEU 2 GG A	DEU 2 GG B
AUTO	NONE	DEU 1 GG A	DEU 1 GG B	DEU 1 GG B	DEU 2 GG A	DEU 2 GG B	DEU 2 GG B
	DEU 1 GG A	DEU 1 GG B	DEU 1 GG B	DEU 2 GG A	DEU 2 GG A	DEU 2 GG B	DEU 2 GG B
	DEU 1 GG B	DEU 1 GG A	DEU 1 GG A	DEU 2 GG A	DEU 2 GG A	DEU 2 GG B	DEU 2 GG B
	DEU 2 GG A	DEU 1 GG A	DEU 1 GG A	DEU 1 GG B	DEU 1 GG B	DEU 2 GG B	DEU 2 GG B
	DEU 2 GG B	DEU 1 GG A	DEU 1 GG A	DEU 1 GG B	DEU 1 GG B	DEU 2 GG A	DEU 2 GG A
	DEU 1 GG A & B	DEU 2 GG A	DEU 2 GG A	DEU 2 GG A	DEU 2 GG B	DEU 2 GG B	DEU 2 GG B
	DEU 2 GG A & B	DEU 1 GG A	DEU 1 GG A	DEU 1 GG A	DEU 1 GG B	DEU 1 GG B	DEU 1 GG B
	DEU 1 GG A DEU 2 GG A	DEU 1 GG B	DEU 1 GG B	DEU 1 GG B	DEU 2 GG B	DEU 2 GG B	DEU 2 GG B
	DEU 1 GG A DEU 2 GG B	DEU 1 GG B	DEU 1 GG B	DEU 1 GG B	DEU 2 GG A	DEU 2 GG A	DEU 2 GG A
	DEU 1 GG B DEU 2 GG A	DEU 1 GG A	DEU 1 GG A	DEU 1 GG A	DEU 2 GG B	DEU 2 GG B	DEU 2 GG B
	DEU 1 GG B DEU 2 GG B	DEU 1 GG A	DEU 1 GG A	DEU 1 GG A	DEU 2 GG A	DEU 2 GG A	DEU 2 GG A
ALL ON 1		DEU 1 GG A	DEU 1 GG A	DEU 1 GG A	DEU 1 GG B	DEU 1 GG B	DEU 1 GG B
ALL ON 2		DEU 2 GG A	DEU 2 GG A	DEU 2 GG A	DEU 2 GG B	DEU 2 GG B	DEU 2 GG B

1 COAX OUTPUT 1 = GG A
COAX OUTPUT 2 = GG B

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CDS - OPERATION - DISPLAY SOURCE SELECTOR

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EFFECTIVITY
AKS ALL

D633A101-AKS

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CDS - OPERATION - CONTROL PANEL SELECT SWITCH

Control Panel Select Switch

The control panel select switch lets you select which EFIS control panel controls the PFD and ND displays. The control panel select switch is a three position toggle switch.

When the switch is in the NORMAL position, the captain EFIS control panel controls the captain PFD and ND displays and the first officer EFIS control panel controls the first officer PFD and ND displays.

When the switch is in the BOTH ON 1 position, the captain EFIS control panel controls the captain and the first officer PFD and ND displays.

When the switch is in the BOTH ON 2 position, the first officer EFIS control panel controls the captain and the first officer PFD and ND displays.

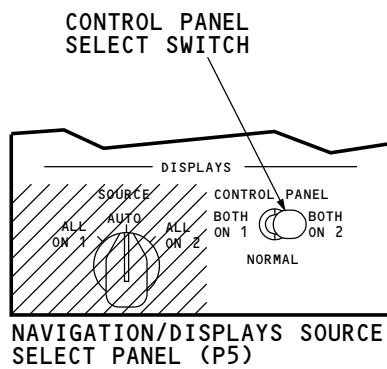
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SWITCH POSITION	DISPLAYS	CAPTAIN DISPLAYS	F/O DISPLAYS
NORMAL	CAPT EFIS CP	F/O EFIS CP	
BOTH ON 1	CAPT EFIS CP	CAPT EFIS CP	
BOTH ON 2	F/O EFIS CP	F/O EFIS CP	

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CDS - OPERATION - CONTROL PANEL SELECT SWITCH

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CDS - TRAINING INFORMATION POINT - MAINTENANCE MESSAGES

CDS Messages

These are the CDS messages that can show:

- INSTR SWITCH
- DSPLY SOURCE
- CDS MAINT
- CDS FAULT.

INSTR SWITCH Message

The INSTR SWITCH message shows when the captain and first officer displays use the same source for inertial reference data. This message shows on the captain and the first officer PFD.

DSPLY SOURCE Message

The DSPLY SOURCE message shows when all the display units get data from one DEU. This occurs when the display source selector is in the ALL ON 1 or the ALL ON 2 position.

NOTE: Set the display source selector 1-2 seconds between each position. Fast changes between each position of the display source selector can cause the two DEUs to show incorrect data.

After both engines are on, this message also shows when a DEU failure causes all the DUs to get data from one DEU. On the ground with the engines off, the CDS FAULT message replaces the DSPLY SOURCE message. The DSPLY SOURCE message does not replace CDS FAULT when the hot battery bus power is not available because both DEUs are still operating. The DSPLY SOURCE message does not replace CDS FAULT when the data load switch is in the DEU 1 or DEU 2 position. This is because the DEUs only load software on the ground when at least one engine is not running. If you have this fault and start both engines, the DEUs ignore the data loader and become operational.

This message shows on the captain and the first officer PFD.

CDS MAINT Message

The CDS MAINT message shows when one of these circuit cards fails in either DEU:

- Graphic generator
- Discrete input/output
- Analog input/output.

This message shows on the captain and the first officer PFD.

This message shows only when the airplane is on the ground and at least one engine is off.

CDS FAULT Message

The CDS FAULT message shows when there is a total DEU failure. A total DEU failure is when any one of these circuit cards fails:

- Input/output controller and ARINC 429 input/output
- Power supply
- Processor.

The CDS FAULT message shows if two or more of these circuit cards fail in a DEU or any one fails in both DEUs:

- Graphic generator
- Discrete input/output
- Analog input/output.

The CDS FAULT message shows if the DEU initializes and it detects that any of these are not compatible:

- Program pins in DEU 1 and DEU 2
- OPS and airplane type
- OPS and OPC
- OPC and OPS in DEU 1 and DEU 2.

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**CDS - TRAINING INFORMATION POINT - MAINTENANCE MESSAGES**

For these conditions, the CDS FAULT message shows and is removed when both engines start:

- Hot battery power is not available when the DEU initializes
- Data loader switch is in the DEU 1 or DEU 2 position.

The CDS FAULT message shows if there is a miscompare of the N1, N2, or EGT data between DEU 1 and DEU 2.

This message shows on the captain and the first officer PFD.

The CDS FAULT message shows only when the airplane is on the ground and at least one engine is off.

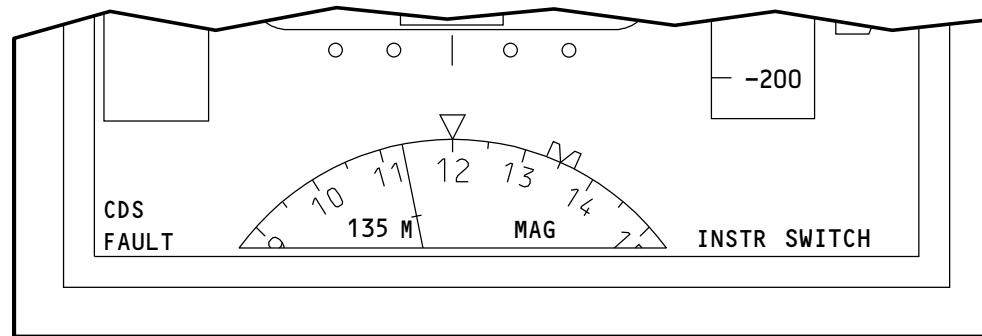
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INSTR SWITCH	INERTIAL REFERENCE DATA FROM SAME SOURCE
CDS MAINT	ONE DEU HAS SUFFERED A PARTIAL FAILURE AFFECTING A DEU GRAPHICS GENERATOR. SHOWN WHEN ON THE GROUND AND AT LEAST ONE ENGINE IS NOT RUNNING. REMOVED AFTER 2ND ENGINE STARTED OR IN THE AIR.
CDS FAULT	DEU FAILURE OR BOTH DEUS HAVE A PARTIAL FAILURE, OR A SINGLE DEU PARTIAL FAILURE AFFECTING I/O PROCESSING CAPABILITY OR INCOMPATIBLE S/W, OR HOT BATTERY BUS NOT AVAILABLE, OR DATA LOAD SWITCH IN DEU 1 OR DEU 2 POSITION, OR DISPLAYS SOURCE SWITCH IN ALL ON 1 OR ALL ON 2 POSITION. SHOWN WHEN ON THE GROUND AND AT LEAST ONE ENGINE IS NOT RUNNING. REMOVED AFTER 2ND ENGINE STARTED OR IN THE AIR.
DSPLY SOURCE	SHOWS AFTER 2ND ENGINE STARTED OR IN THE AIR FOR A DEU TOTAL FAILURE, OR A SINGLE DEU PARTIAL FAILURE AFFECTING I/O PROCESSING CAPABILITY, OR DISPLAYS SOURCE SWITCH IN ALL ON 1 OR ALL ON 2 POSITION.

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CDS - TRAINING INFORMATION POINT - MAINTENANCE MESSAGES

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CDS - TRAINING INFORMATION POINT - SOFTWARE LOADING

DEU Software

You can load software in a DEU or download BITE data from a DEU.

These are the types of software you can load in the DEUs:

- Operational software
- Operational program configuration
- Display unit data base.

Operational Software (OPS)

The operation software is the software that operates the DEU.

It takes a maximum of 90 minutes to load the OPS into each DEU.

Operational Program Configuration (OPC)

The OPCs replace most of the hardware program pins used in other airplanes. The OPCs define the customers configuration options.

It takes approximately 5 minutes to load the OPC into each DEU.

Display Unit Data Base (DUDB)

There are several different types of display units for the common display system. The DUs are interchangeable. The DEU requires information about the drive signals for each type of DU. The DU data base has the information about the drive signals.

You can load the DUDB into the DEU. It takes approximately 5 minutes to load the DUDB into each DEU.

Operation to Load Software

To load software into the DEU, use the data loader control panel. The engines must be off.

Select the DEU position on the lower switch on the data loader control panel. Select the left or right position on the upper switch on the data loader control panel.

Put the diskette in the airborne data loader.

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Put the diskette in the portable data loader and connect the portable data loader to the data transfer unit receptacle.

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When the data load is complete, you can verify that the new software part number shows on the CDS IDENT/CONFIG page.

Compatibility Checks

The DEU determines if these are not compatible:

- OPS and DEU hardware
- Program pins in DEU 1 and DEU 2
- OPS to airplane type
- OPS to OPC
- DEU 1 to DEU 2 software.

If the OPS is not compatible with the DEU, the OPS will not load into the DEU. The other compatibility checks are done automatically at initialization. If the DEU finds anything that is not compatible, you see a CDS FAULT maintenance message.

Operation to Download BITE Data

The DEU can download BITE data to a diskette. The diskette must be preformatted to accept the download of the data.

To download the BITE data, put the formatted diskette in the airborne data loader. Select the DEU position on the lower switch on the data loader control panel. Select the L or R position on the upper switch on the data loader control panel. The DEU automatically downloads the data to the diskette. The airborne data loader shows that the load is done.

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CDS - TRAINING INFORMATION POINT - SOFTWARE LOADING

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To download the BITE data, put the formatted diskette in the portable data loader. Select the DEU position on the lower switch on the data loader control panel. Select the L or R position on the upper switch on the data loader control panel. The DEU automatically downloads the data to the diskette. The portable data loader shows that the load is done.

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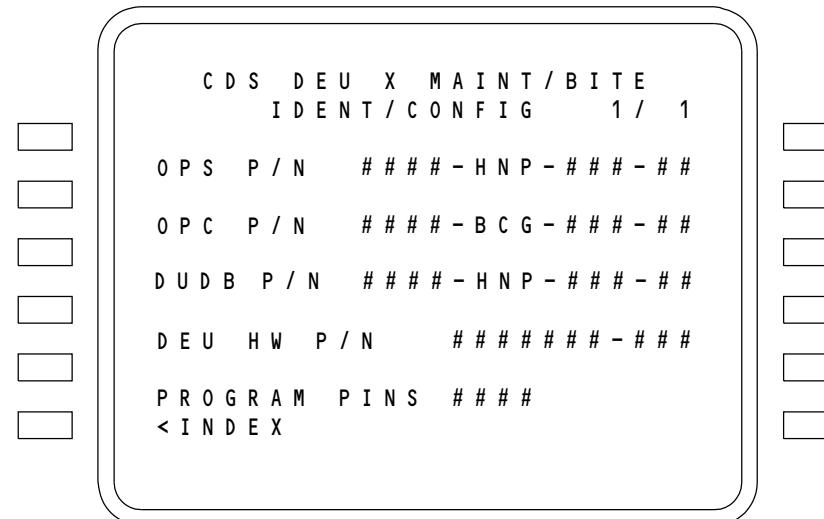
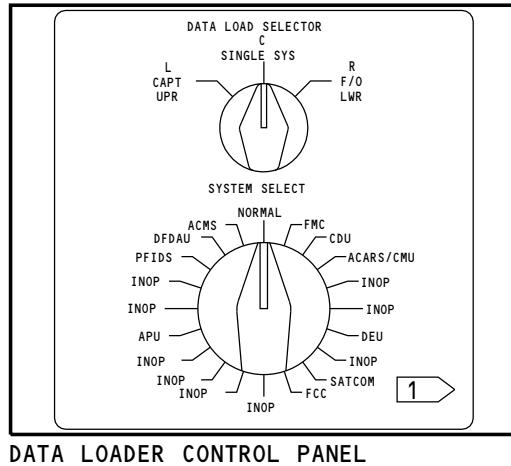
When you select a DEU on the data Loader control panel by positioning both switches, that DEU does not drive any display units. The other DEU provides the data for all 6 DUs, and CDS FAULT shows.

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1 ➤ OPTIONAL SYSTEMS NOT ACTIVE
ARE LABELED INOP.

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CDS - TRAINING INFORMATION POINT - SOFTWARE LOADING

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**CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - CDS BITE MAIN MENU****General**

The CDS has maintenance information that you can see on the flight management systems control display unit (CDU).

To get access to the maintenance information, select CDS on line select key (LSK) 5L from the MAINT BITE INDEX. This shows the CDS BITE page.

On the CDS BITE INDEX page, select either DEU 1 on LSK 1L or DEU 2 on LSK 2L. This shows the CDS MAINT/BITE main menu for the DEU 1 or DEU 2.

CDS BITE Main Menu

There are five maintenance procedures that you do through the CDS MAINT/BITE Main Menu. These are the procedures:

- Check of the current status
- Check of the inflight faults
- Ground tests
- Check of the identification and configuration information
- Check of the input monitoring discrete status.

To do a check of the current status, select LSK 1L.

To do a check of the inflight faults, select LSK 2L.

To operate a ground test, select LSK 3L. You can not operate a ground test if the engines are on because there is no carrot for LSK 3L.

To do a check of the identification and configuration information, select LSK 4L.

To do a check of the input monitoring discrete status, select LSK 5L.

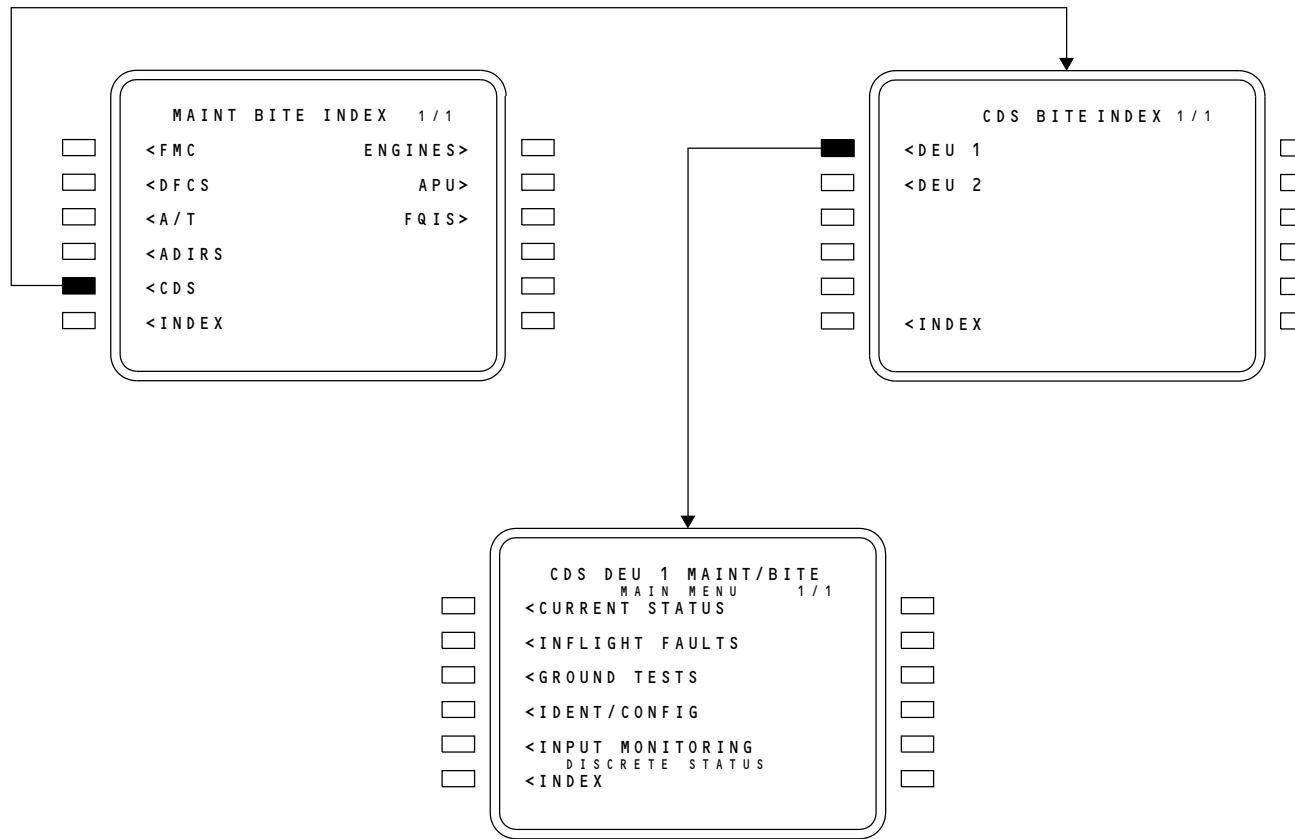
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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - CDS BITE MAIN MENU

**CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - CURRENT STATUS****General**

To do a check of the current status, select CURRENT STATUS on line select key (LSK) 1L from the CDS MAIN MENU. This shows the CURRENT STATUS page.

Any active faults detected by the DEU shows.

CURRENT STATUS Page

A single fault shows on a page. The number of current status pages show on the top right. The number of pages is the number of current status faults. To show the next current status fault, select the NEXT PAGE key on the FMC CDU keypad.

The faults show in the order that the DEU detects the faults. If the DEU detects a new fault while current faults show, the new fault page shows as the last page.

This information shows for a single fault:

- Maintenance message number
- Fault description
- Suspected LRUs.

The maintenance message number is a number assigned to this fault. You can use the maintenance message number index in the fault isolation manual (FIM) to find the correct fault isolation procedure to fix the fault.

The fault description is a short description of the fault.

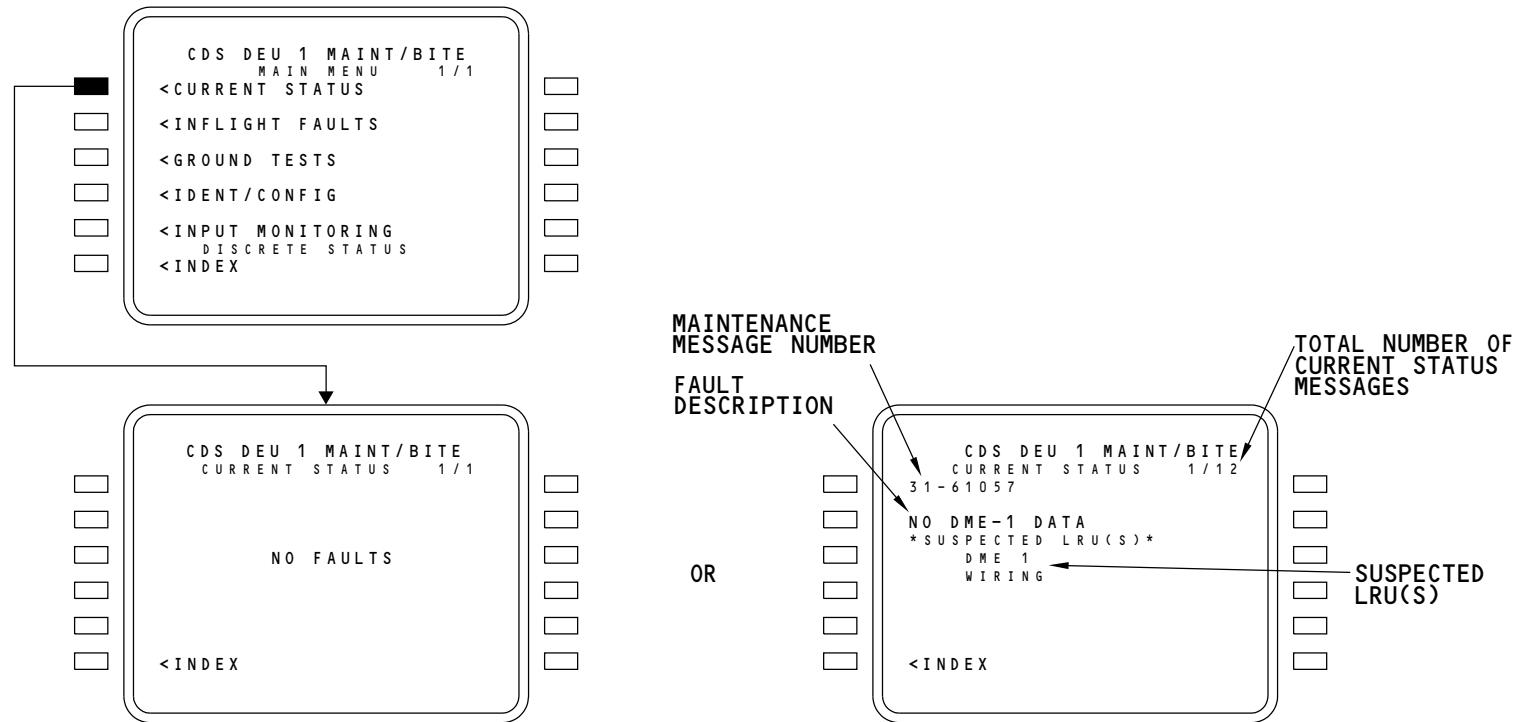
The suspected LRUs are in the order of most likely to least likely LRUs that made the fault occur. You should use this information with the fault isolation manual to fix the fault.

If a fault goes inactive while the page shows, the message NOT ACTIVE shows instead of the suspected LRUs.

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - CURRENT STATUS

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS

General

To do a check of the inflight faults, select INFLIGHT FAULTS on line select key (LSK) 2L from the CDS MAIN MENU. This shows the INFLIGHT FAULTS Leg Menu page.

The DEU stores faults for 64 flight legs. The DEU can store up to 32 faults for each flight leg.

A new flight leg starts when the airplane has an airspeed of more than 80 knots. The flight leg ends when the airspeed is less than 75 knots. If a fault occurs on the ground with engines off, the DEU shows the fault as a current fault in CURRENT STATUS. If the fault exists when a new flight leg starts, the DEU stores the fault in the new flight leg.

INFLIGHT FAULTS Leg Menu Page

The INFLIGHT FAULTS leg menu page shows a list of the flight legs that have faults in the DEU memory. The number of inflight faults for the flight leg shows next to the flight leg number. The time the flight leg started shows under the flight leg.

To show the faults for a flight leg, select the LSK next to the flight leg. This shows the first fault in that flight leg. Leg 01 is the most current flight leg.

INFLIGHT FAULTS Fault Page

A single fault shows on a page. The number of inflight faults for this flight leg shows on the top of the page. The number of pages is the number of inflight faults for this flight leg.

This information shows for a single fault:

- Maintenance message number
- If the fault was intermittent
- Fault description
- Suspected LRUs
- Flight number
- Date of fault
- Time of fault

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- Altitude the fault occurred
- Airspeed the fault occurred.

The maintenance message number is a number assigned to this fault. You can use the maintenance message number index in the fault isolation manual (FIM) to find the correct fault isolation procedure to fix the fault.

If the fault occurs more than once during the flight leg, you see the word INTERMITTENT near the top of the CDU page.

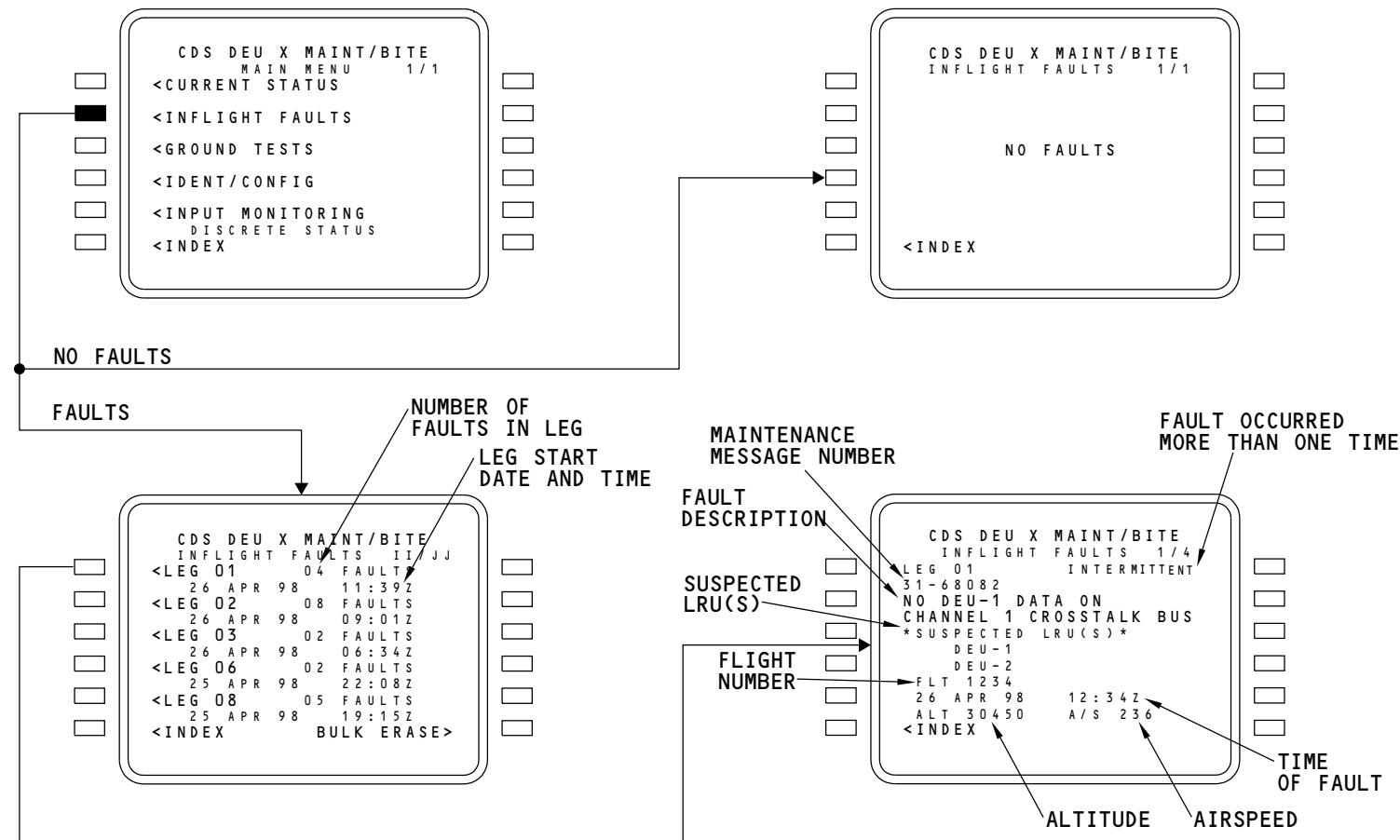
The fault description is a short description of the fault.

The suspected LRUs are in the order of most likely to least likely LRUs that made the fault occur. You should use this information with the fault isolation manual to fix the fault.

The flight number is the flight number that the pilot put in the FMC CDU for that flight.

The time of the fault is when the fault occurred. If the fault was intermittent in the flight leg, the time is the first time the fault occurred.

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS BULK ERASE

General

You can bulk erase all of the inflight faults from the INFLIGHT FAULTS Leg menu page. Select INFLIGHT FAULTS on LSK 2L from the CDS MAIN MENU. This shows the INFLIGHT FAULTS Leg Menu page. Then push LSK 6R, BULK ERASE.

ERASE FAULTS Page

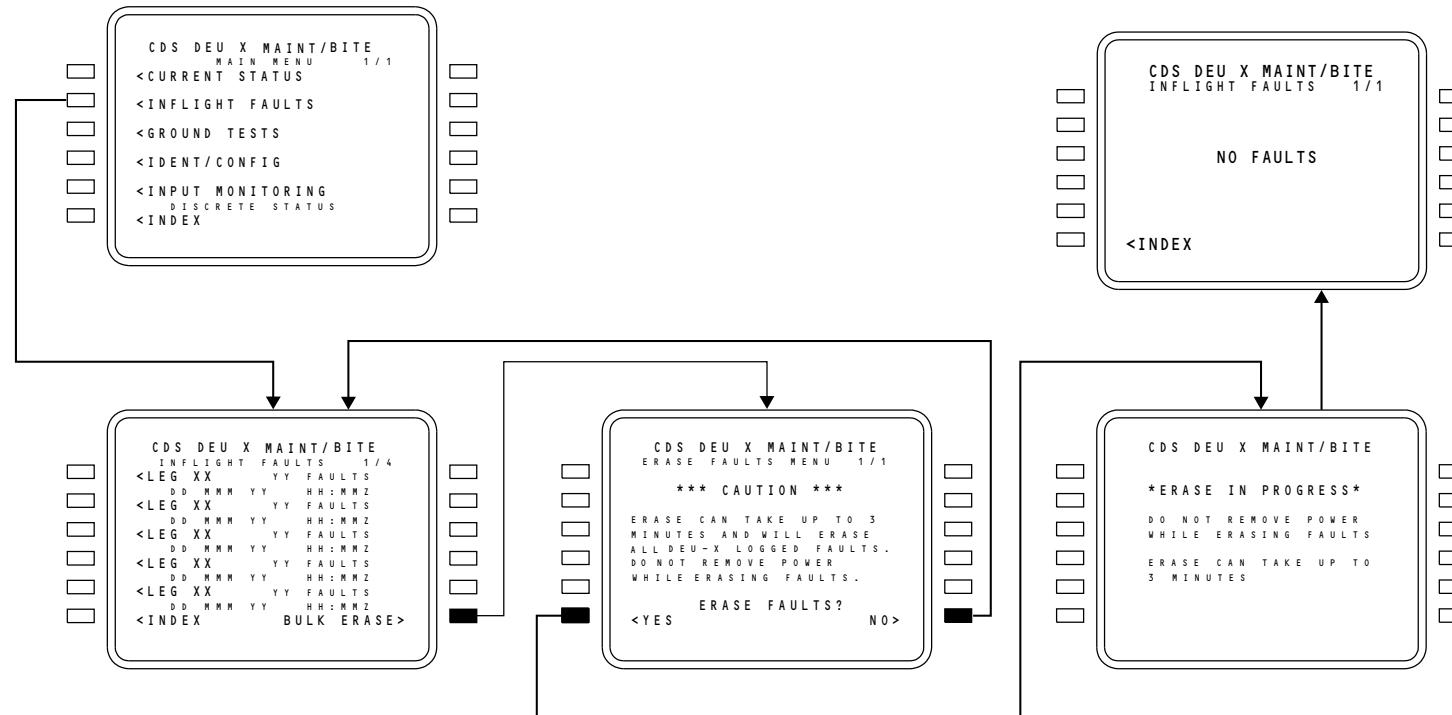
The ERASE FAULTS page shows a caution message that this action erases all faults that are in the DEU memory. If you want to erase all faults, push LSK 6L, YES. If you do not want to erase all faults, push LSK 6R, NO.

Faults stored in the other DEU are not effected.

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS BULK ERASE

**CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - GROUND TESTS MENU****General**

To operate a ground test, select line select key (LSK) 3L, GROUND TESTS from the CDS MAIN MENU. This shows the GROUND TESTS MENU page.

You can not do any ground tests with an engine on.

GROUND TESTS MENU Page

The GROUND TESTS MENU page shows a list of the ground tests you can do. These are the ground tests:

- DEU X self test
- DU loop test
- DU optical test
- WXR/TERR display test.

To operate the DEU X self test, select LSK 1L.

To operate the DU loop test, select LSK 2L.

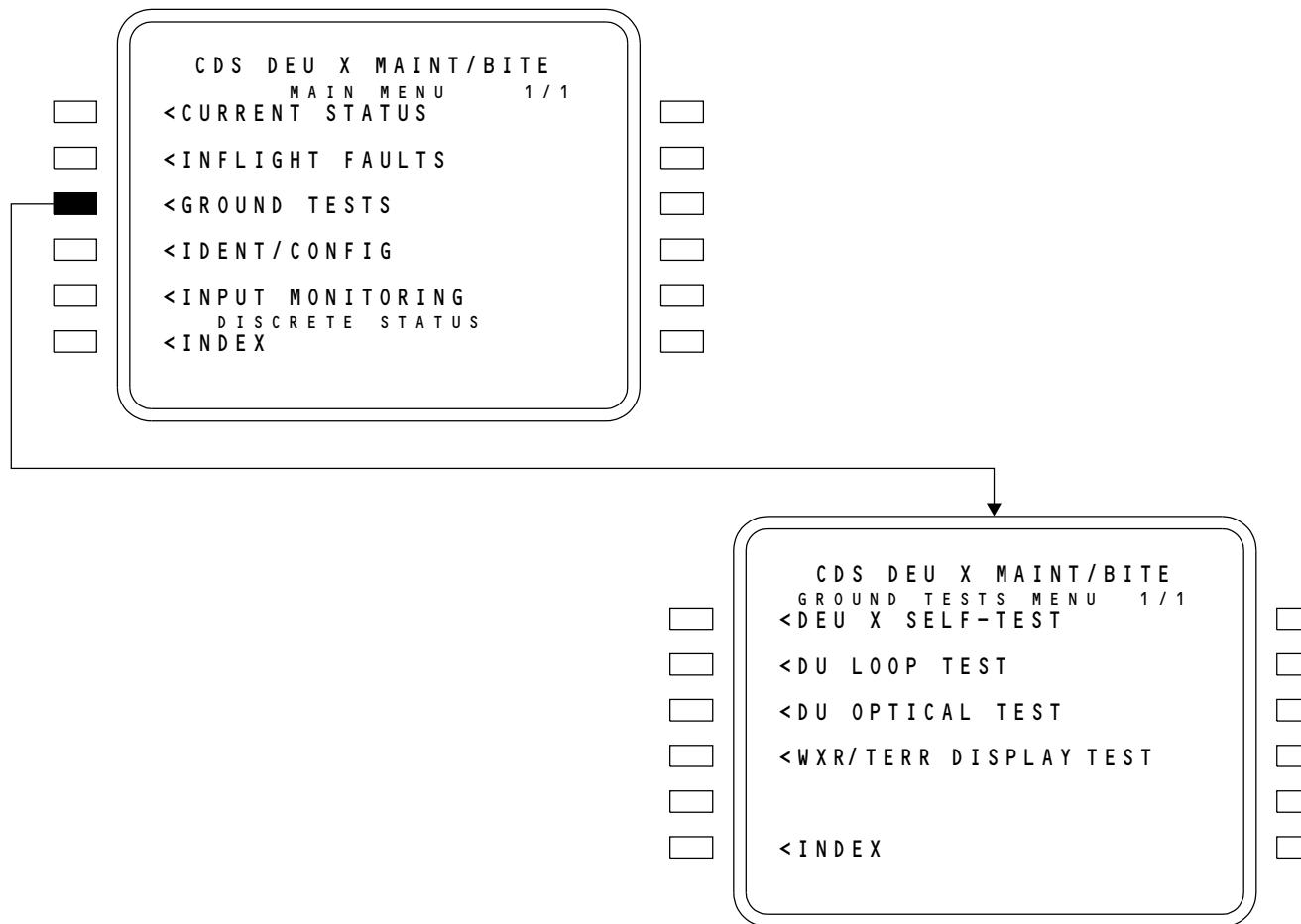
To operate the DU optical test, select LSK 3L.

To operate the WXR/TERR display tests, select LSK 4L.

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - GROUND TESTS MENU

**CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DEU SELF TEST 1****General**

To do the DEU self test, select line select key (LSK) 1L, DEU X (1 or 2) SELF TEST from the GROUND TEST MENU PAGE. This shows the SELF TEST MENU page.

SELF TEST MENU Page

The SELF TEST MENU page shows information about the self test.

The SELF TEST MENU page does not show test data during the self test.
The SELF TEST MENU page shows test data when the test is complete.

The test takes 75 seconds. The test can take up to 180 seconds because if the test fails the first time, the DEU operates the test a second time before it reports a fault.

To do the self test, select LSK 6R, RUN.

To not do the self test, select LSK 6L, INDEX.

DEU SELF-TEST Page

When you select RUN on the SELF TEST MENU page, the core software takes 7 to 10 seconds to reset. The control screen shows DEU SELF-TEST during the DEU reset. If the reset cannot occur because of an internal DEU fault, the DEU SELF-TEST FAIL screen shows. If the DEU BITE is inoperative, the DEU SELF-TEST page will stay in view.

SELF-TEST IN PROGRESS

If the reset operates correctly, you see the SELF-TEST IN PROGRESS page.

Training Information Point

If the DEU SELF-TEST page shows longer than 3 minutes, select the INIT REF key on the CDU.

EFFECTIVITY

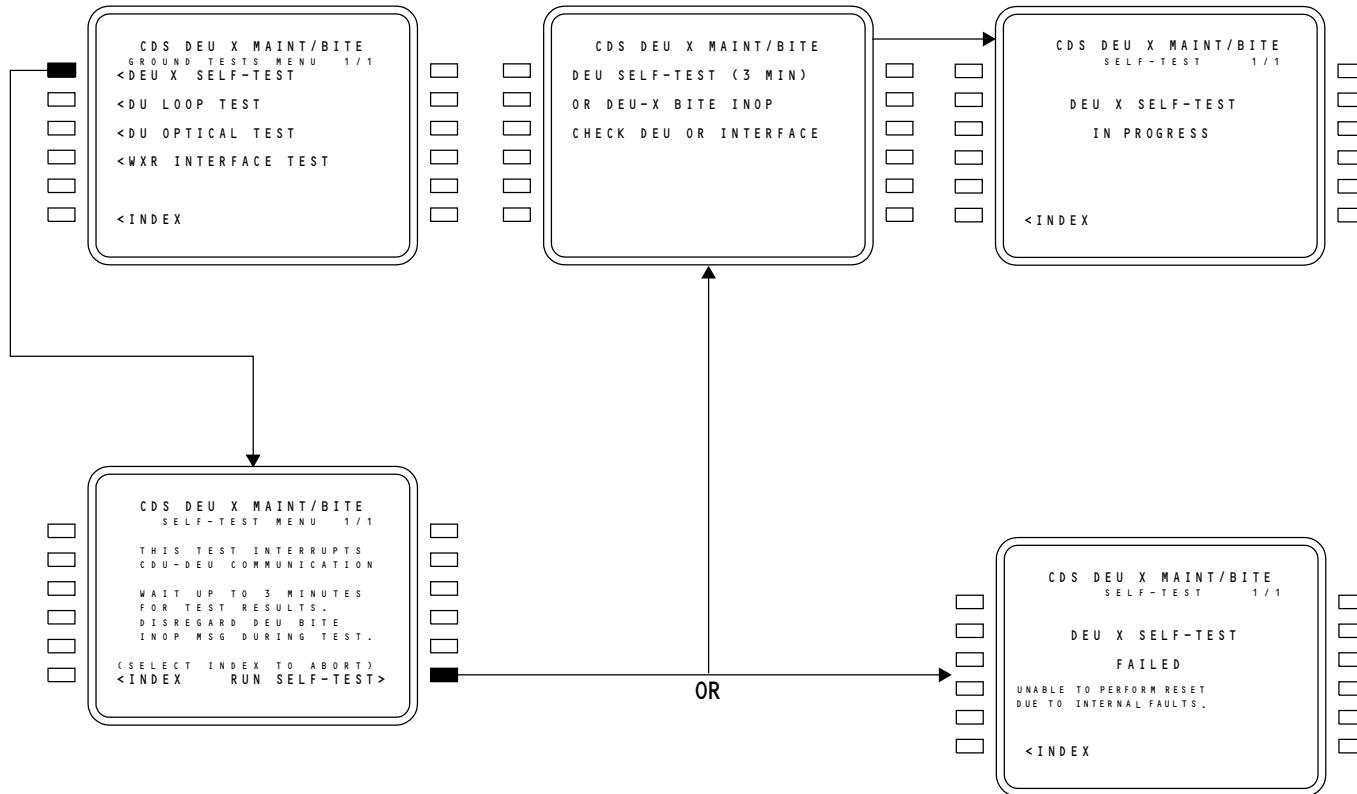
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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DEU SELF TEST 1
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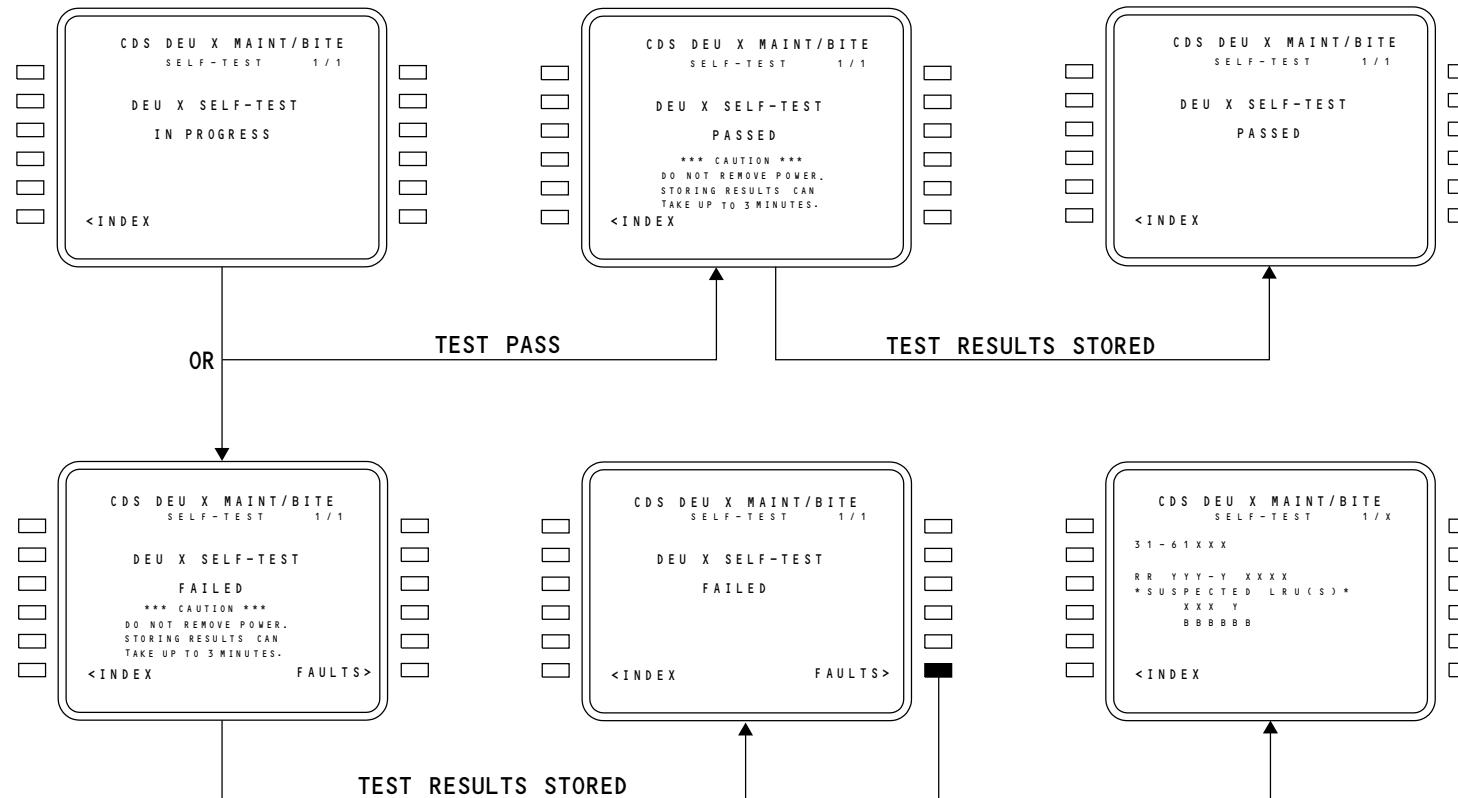


CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DEU SELF-TEST 2

DEU Self-Test Results

When the self-test is over, the CDU shows the results. If the DEU is OK, the CDU shows DEU SELF-TEST PASSED. The DEU stores the results of the self-test. The CDU shows the CAUTION display. Do not remove power to the DEU during this time. When the CDU shows the INDEX, the test results are stored.

If the DEU senses faults during the self-test, the CDU shows SELF-TEST FAILED. The DEU stores the results of the self-test. The CDU shows the CAUTION display. Do not remove power to the DEU during this time. When the DEU removes the CAUTION display, you can push LSK 6R to see the faults. When you are finished, push LSK 6L to return to the index.



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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DEU SELF-TEST 2
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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DU LOOP TEST

General

To do the DU loop test, select line select key (LSK) 2L, DU LOOP TEST from the GROUND TEST MENU PAGE. This shows the DU LOOP TEST MENU page.

DU LOOP TEST MENU Page

On the DU LOOP TEST MENU page you can select two tests.

To operate the first test, select LSK 2L. This makes the graphics generator (GG) A (coax 1) transmit data to the left DUs and the upper center DU; and the GG B (coax 2) transmit data to the right DUs and the lower center DU.

To operate the second test, select LSK 4L. This makes the graphics generator (GG) B (coax 2) transmit data to the left DUs and the upper center DU; and the GG A (coax 1) transmit data to the right DUs and the lower center DU.

Display Unit Display

When you operate the DU loop test, the display units show this information:

- DU location
- ARINC 429 loop status
- Remote light sensor brightness value
- Coax output source
- Coax cable input activity
- Bezel light sensor brightness value
- Unit brightness value.

The DU location shows:

- LOB for left outboard
- LIB for left inboard
- CU for upper center
- CL for lower center
- RIB for right inboard

- ROB for right outboard.

An invalid DU location shows as BAD.

The ARINC 429 loop status shows the status of the ARINC 429 bus from the DU to the DEUs. A PASS or FAIL shows.

The remote light sensor brightness value shows as a percentage of maximum value. The range is 0 to 100. BAD shows if the input is bad.

The coax output shows the GG that transmits data to the display unit. The sources show as:

- 1 for GG A in DEU 1 or DEU 2
- 2 for GG B in DEU 1 or DEU 2.

The coax cable input activity shows the status of the four coax cable inputs to the DU. A Y for yes and a N for no shows. A white highlight box shows around the specific coax cable input that currently transmits to the DU. From left to right the letters refer to these coaxial couplers:

- First letter for coax coupler 1 from DEU 1, GG A
- Second letter for coax coupler 2 from DEU 1, GG B
- Third letter for coax coupler 4 from DEU 2, GG A
- Fourth letter for coax coupler 3 from DEU 2, GG B.

The bezel light sensor brightness value shows as a percentage of maximum value. The range is 0 to 100. BAD shows if the input is bad.

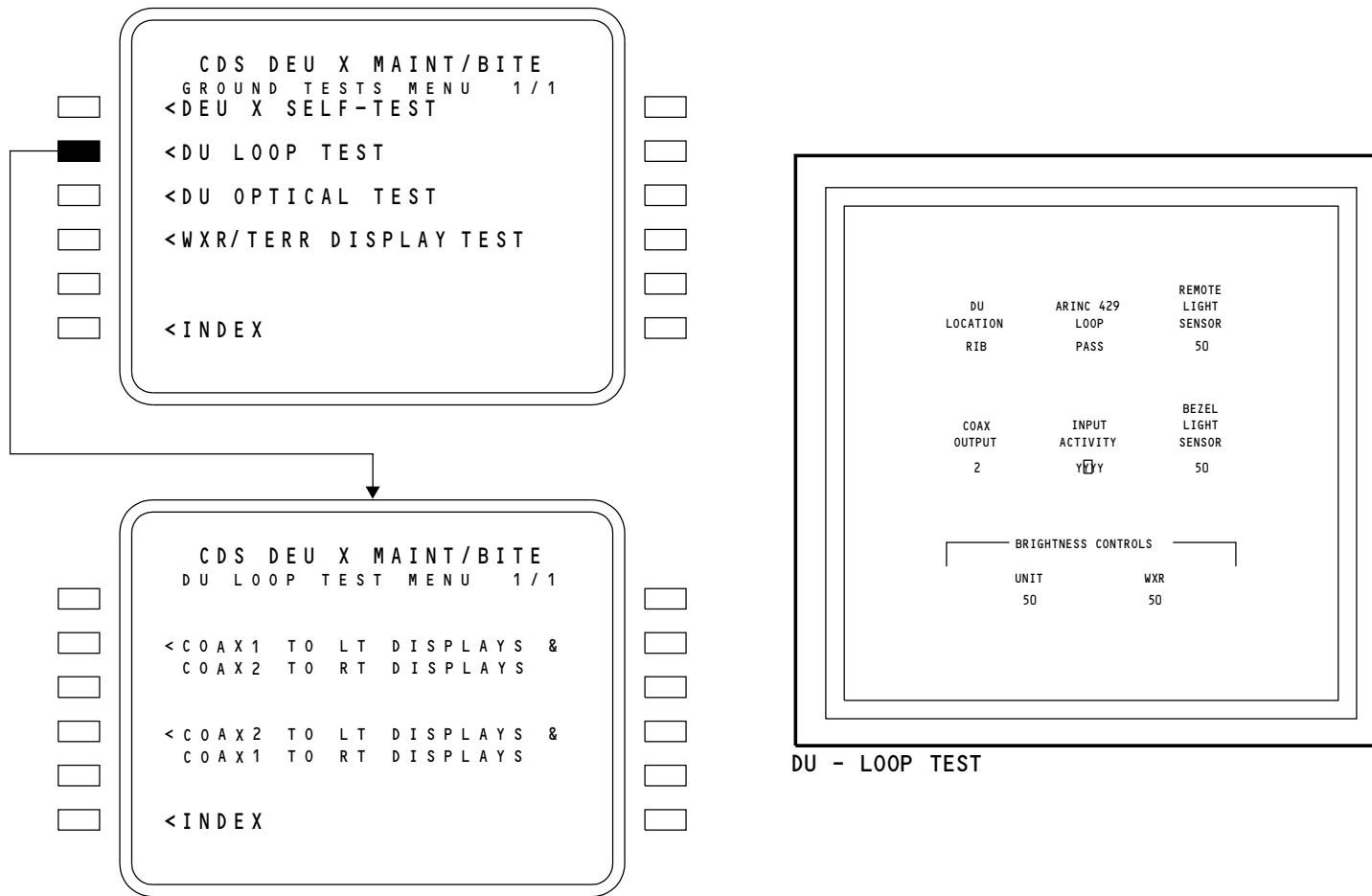
The unit brightness value shows as a percentage of maximum value. The range is 0 to 100. BAD shows if the input is bad. This value changes if you change the unit brightness with the brightness controls.

The WXR brightness value shows as a percentage of maximum value. For the left inboard, right inboard, and lower center display units, the range is 0 to 100. BAD shows if the input is bad. This value changes if you change the unit brightness with the brightness controls. For the left outboard, right outboard, and upper center display units, the value 0 shows.

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DU LOOP TEST
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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DU OPTICAL TEST

General

To do the DU optical test, select line select key (LSK) 3L, DU OPTICAL TEST from the GROUND TEST MENU PAGE. This shows the DU OPTICAL TEST MENU page.

You do these tests to examine the DU liquid crystal display (LCD). The DU BITE circuits do not monitor the LCD quality. The failures to look for are line defects and element defects in the LCD.

DU OPTICAL TEST MENU Page

On the DU OPTICAL TEST MENU page, these are the four tests that you can select:

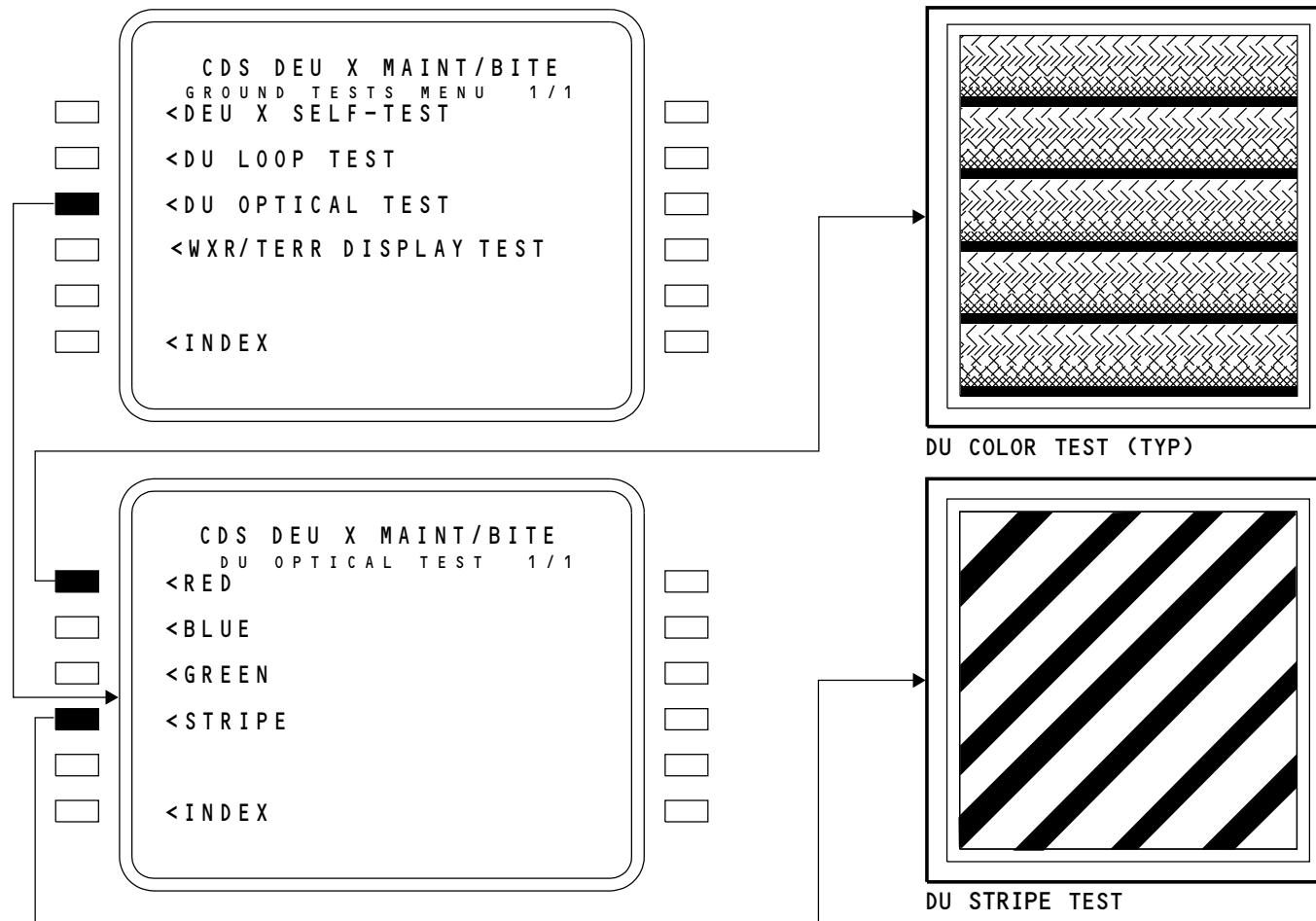
- RED
- BLUE
- GREEN
- STRIPE.

To do the RED test, select LSK 1L. This makes all the DUs show red lines. From the bottom of the display, each line shows less color intensity. The pattern repeats until you get to the top of the display.

All the DUs should look the same. A DU with a weak backlight driver looks different than the other DUs.

The BLUE and GREEN tests are similar to the RED test.

Do the STRIPE test the same as the RED test. For the STRIPE test, the DUs show diagonal white and black stripes. This test lets you see line defects easily. The line defects may not be as easy to see on a solid display.



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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DU OPTICAL TEST

**CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - WXR/TERR DISPLAY TEST****General**

To do the weather radar display test and the terrain display test, select line select key (LSK) 4L, WXR/TERR DISPLAY TEST, from the GROUND TEST MENU PAGE. This shows the WXR/TERR DISPLAY TEST page.

You do these tests to verify the weather radar and GPWS ARINC 453 interfaces to the DEUs.

WXR/TERR DISPLAY TEST Page

To do the WXR DISPLAY TEST, follow the directions on the CDU page. Select the test mode on the weather radar control panel.

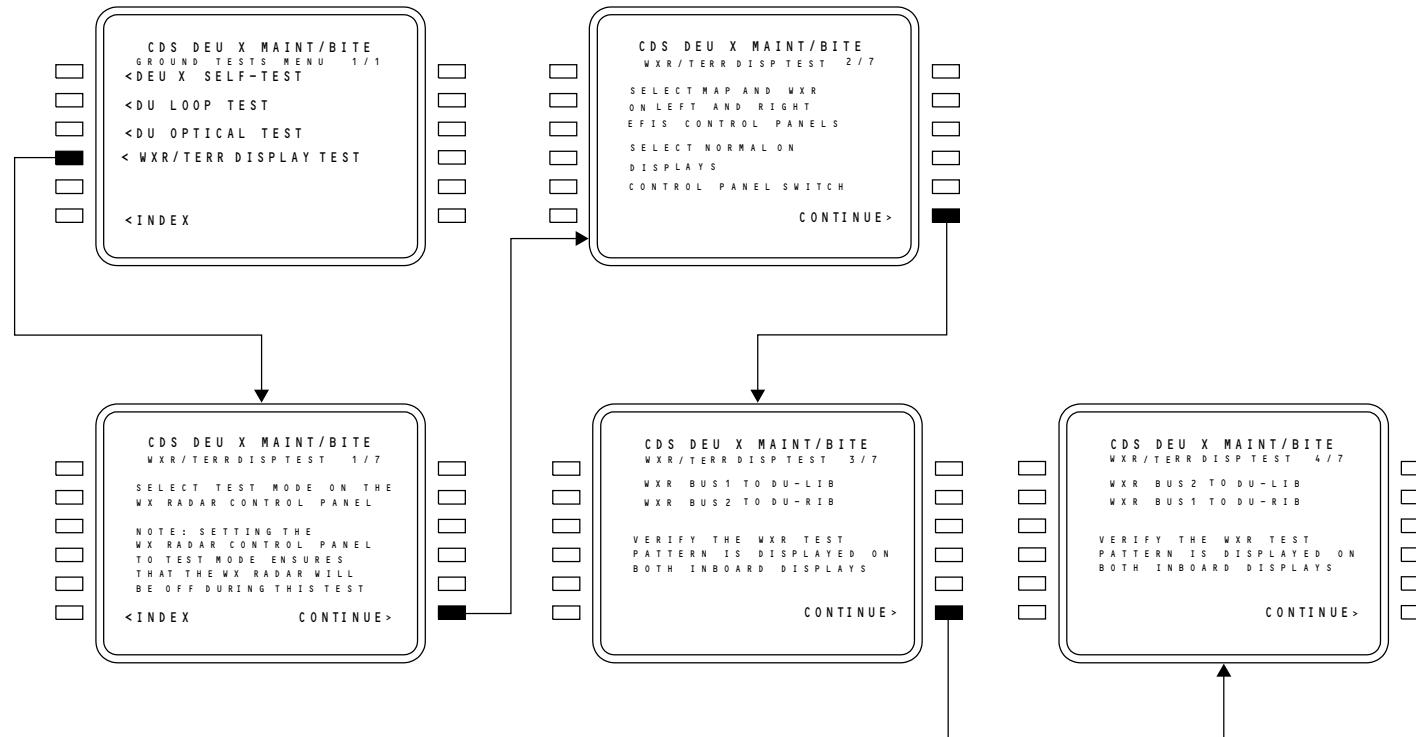
Then select the map mode and the WXR switch on the EFIS control panels. The weather radar pattern shows on the display units.

If one of the weather radar test patterns does not show when you do the test, the ARINC 453 interface to the graphics generator is bad.

Push LSK 6R, CONTINUE, to do a test of the terrain display.

EFFECTIVITY**AKS ALL****31-62-00**

D633A101-AKS



M77892 S0004627709_V1

CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - WXR/TERR DISPLAY TEST

EFFECTIVITY

AKS ALL

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - WXR/TERR DISPLAY TEST - TERR DISPLAY

General

You do this test to make sure the GPWS ARINC 453 interface to the DEUs is good.

WXR/TERR DISPLAY TEST Page 5

After the WXR display test is complete, you can do a test of the GPWS display. Follow the directions on the CDU page. Select TERR on both EFIS control panels. You should be in the correct mode on the navigation displays.

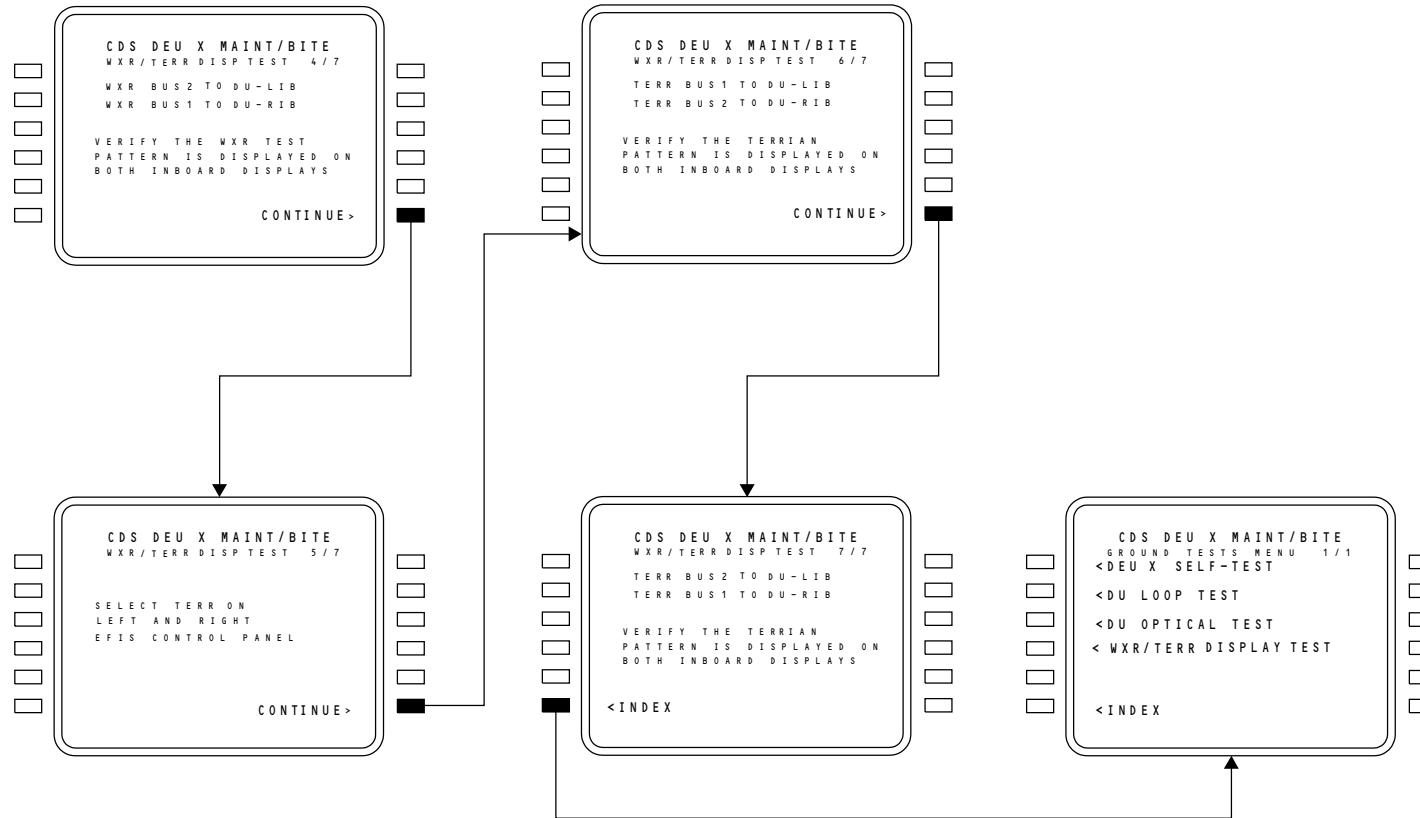
If one of the terrain patterns does not show when you do the test, the ARINC 453 interface to the graphics generator is bad or the WXR/TERR relay is failed.

To leave the test, push LSK 6R, CONTINUE. Then, push LSK 6L, INDEX.

EFFECTIVITY

AKS ALL

31-62-00



M77896 S0004627711_V1

CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - WXR/TERR DISPLAY TEST - TERR DISPLAY

EFFECTIVITY

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CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - IDENT/CONFIG

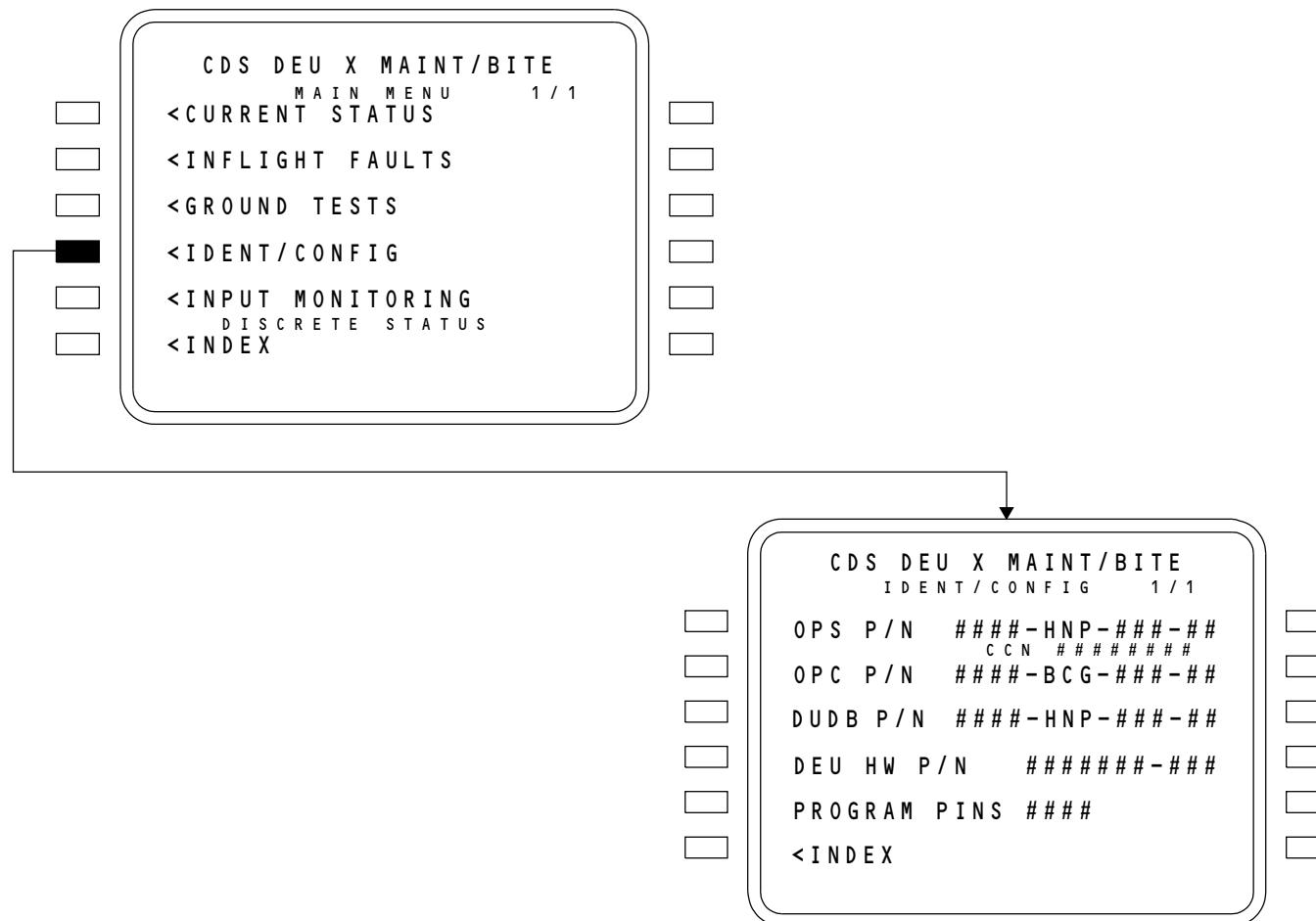
General

To do a check of the configuration information, select IDENT/CONFIG on line select key (LSK) 4L from the CDS MAIN MENU. This shows the IDENT/CONFIG page.

IDENT/CONFIG Page

The IDENT/CONFIG page shows this information:

- Operational software (OPS) part number
- OPS Configuration Class Number (CCN)
- Operational program configuration (OPC) software part number
- Display unit data base (DUDB) software part number
- DEU hardware part number
- Program pins.



J35622 S0000171092_V1

CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - IDENT/CONFIG

EFFECTIVITY

AKS ALL

31-62-00

**CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INPUT MONITORING****General**

To do a check of the discrete status inputs, select INPUT MONITORING on line select key (LSK) 5L from the CDS MAIN MENU. This shows the DISCRETE STATUS MENU page.

You can only monitor discrete input status with this page. You can not monitor ARINC 429 input status.

DISCRETE STATUS MENU Page

On the DISCRETE STATUS MENU page, you choose one of the five connectors. The connectors are A,B,D,E, and F.

DISCRETE STATUS Page

The DISCRETE STATUS pages shows a matrix of all the pins on the connector. This is what shows for the status of each pin:

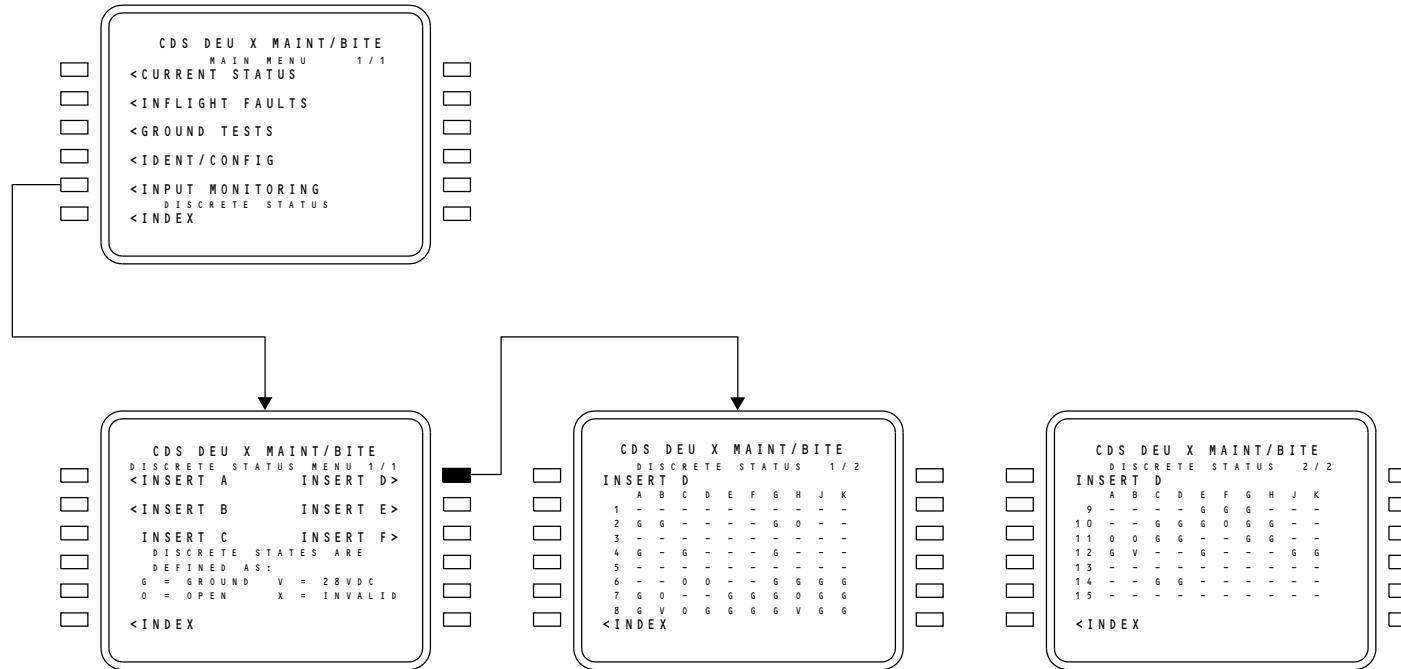
- G for grounded
- O for open
- V for 28V dc
- X for invalid
- - for no discrete input on this pin.

You can verify the status of a discrete input for detailed fault isolation procedures.

EFFECTIVITY

AKS ALL

31-62-00



M77894 S0004627715_V1

CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INPUT MONITORING

EFFECTIVITY

AKS ALL

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CDS - SYSTEM SUMMARY

General

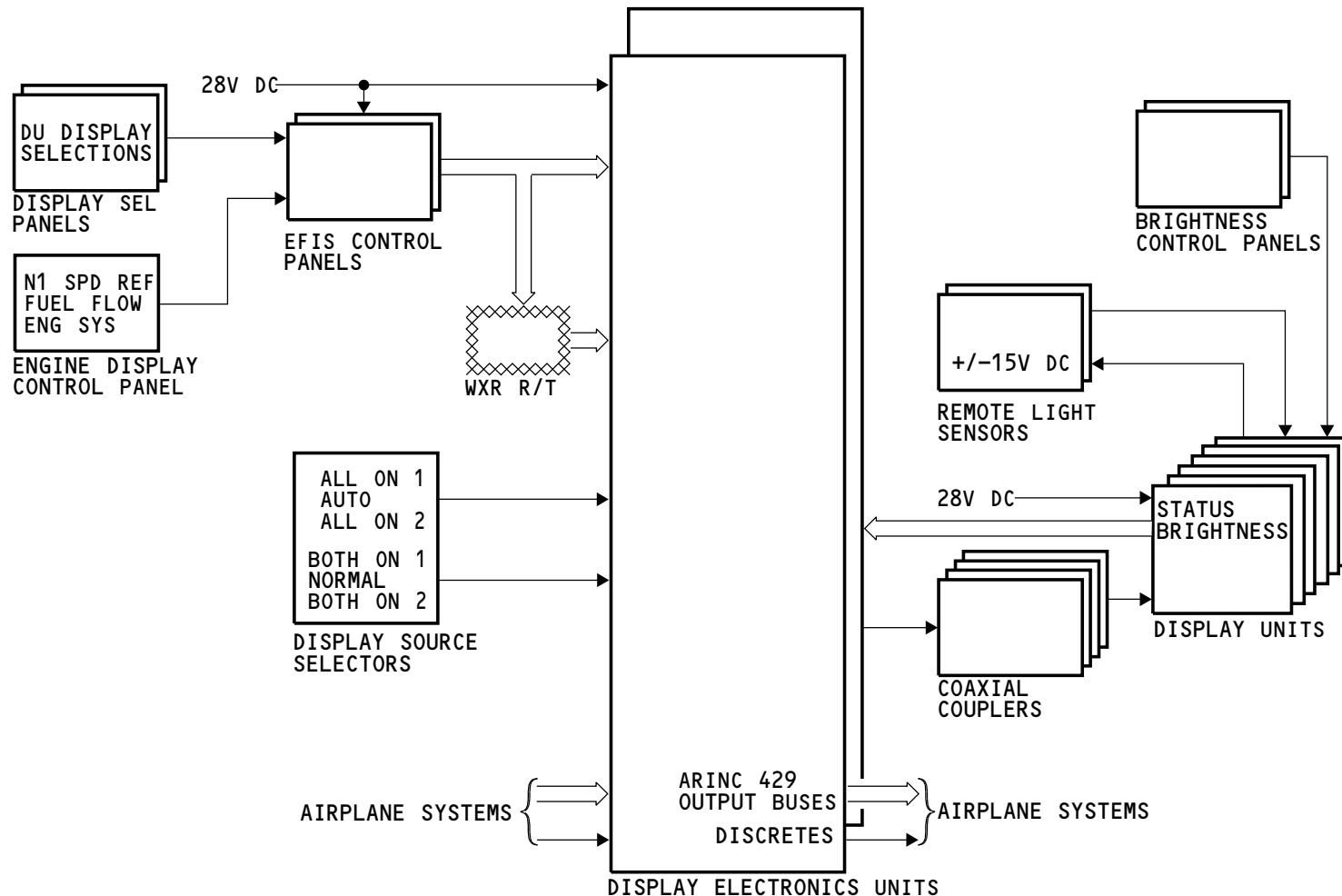
This graphic is for reference purposes.

EFFECTIVITY

AKS ALL

31-62-00

D633A101-AKS



M77898 S0004627717_V1

CDS - SYSTEM SUMMARY
31-62-00

