CHAPTER 31

Indicating and Recording Systems

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Indicating and Recording Systems

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16	BLANK		9	Feb 15/2009	
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O 1	Jun 15/2009		11	Jun 10/2007	
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O 3	Jun 15/2009		13	Feb 15/2009	
O 4	Jun 15/2009		14	Feb 15/2009	
O 5	Jun 15/2009		15	Jun 10/2007	
O 6	Jun 15/2009		16	Jun 10/2007	
O 7	Jun 15/2009		17	Feb 15/2009	
O 8	Jun 15/2009		18	Feb 15/2009	
O 9	Jun 15/2009		19	Jun 10/2007	
O 10	Jun 15/2009		20	Jun 10/2007	
O 11	Jun 15/2009		21	Feb 15/2009	
O 12	Jun 15/2009		22	Feb 15/2009	
31-25-00			23	Jun 10/2007	
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2	Feb 15/2009		25	Feb 15/2009	
3	Feb 15/2009		26	Feb 15/2009	
4	Oct 10/2005		27	Jun 10/2007	
5	Jun 10/2007		28	Jun 10/2007	
6	Jun 10/2007		29	Feb 15/2009	
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39	Feb 15/2009	
40	Feb 15/2009	
41	Jun 10/2007	
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43	Feb 15/2009	
44	Jun 10/2007	
45	Feb 15/2009	
46	Jun 10/2007	
47	Jun 10/2007	
48	BLANK	
31-31-00		
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3	Oct 10/2004	
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R 12	Jun 15/2009	
R 13	Jun 15/2009	
R 14	Jun 15/2009	
15	Oct 10/2006	
16	Oct 10/2006	
17	Oct 10/2006	
18	Oct 10/2006	
19	Oct 10/2006	
20	Oct 10/2006	
21	Oct 10/2006	
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33	Jun 15/2008	
34	Oct 10/2006	
35	Oct 10/2006	
36	Oct 10/2006	
37	Oct 10/2006	
38	Feb 15/2009	
39	Jun 15/2008	
40	Jun 15/2008	
41	Jun 15/2008	
42	Feb 15/2009	
43	Jun 10/2007	
R 44	Jun 15/2009	
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57	Oct 10/2006	
58	Oct 10/2006	
59	Oct 10/2006	
60	Oct 10/2006	
61	Oct 10/2006	
62	Oct 10/2006	
63	Oct 10/2006	
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65	Feb 15/2009	
66	Oct 10/2006	
67	Oct 10/2006	
68	Oct 10/2006	
69	Oct 15/2008	
R 70	Jun 15/2009	
R 71	Jun 15/2009	
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75	Oct 10/2006	
76	Oct 10/2006	
77	Oct 10/2006	
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79	Feb 15/2009	
80	Oct 10/2006	
81	Oct 10/2006	
82	Oct 10/2006	
83	Oct 10/2006	
84	Oct 10/2006	
85	Oct 10/2006	
86	Oct 10/2006	
87	Oct 10/2006	
88	Feb 10/2006	
89	Feb 15/2009	
90	Feb 15/2009	
91	Feb 15/2009	
92	Feb 15/2009	
93	Feb 15/2008	
94	Oct 10/2006	
95	Feb 15/2009	
96	Feb 15/2009	
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98	Oct 10/2006	
98.1	Feb 15/2009	
98.2	Feb 15/2009	
98.3	Jun 15/2008	
98.4	Feb 15/2009	
98.5	Oct 10/2006	
98.6	Oct 10/2006	
R 98.7	Jun 15/2009	
98.8	Jun 10/2007	
R 98.9	Jun 15/2009	
98.10	BLANK	
31-33-00		
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12	Oct 10/2005		12	Feb 15/2009	
13	Oct 10/2005		13	Jun 10/2007	
14	Oct 10/2005		14	Feb 15/2009	
15	Oct 10/2005		15	Jun 10/2007	
16	Oct 10/2005		16	Oct 10/2006	
17	Oct 10/2005		17	Oct 10/2006	
18	Oct 10/2005		18	Oct 10/2006	
19	Oct 10/2005		19	Feb 15/2009	
20	Oct 10/2005		20	Oct 10/2006	
21	Jun 10/2007		21	Jun 10/2007	
22	Feb 15/2009		22	Feb 15/2009	
31-51-00			23	Oct 10/2006	
1	Oct 10/2002		24	Oct 10/2006	
2	Jun 10/2007		25	Oct 10/2006	
3	Feb 10/2003		26	Oct 10/2006	
4	Feb 15/2009		27	Oct 10/2006	
5	Jun 10/2007		28	Oct 10/2006	
6	Feb 15/2009		29	Oct 10/2006	
7	Oct 10/2006		30	Jun 10/2007	
8	Oct 10/2006		31	Jun 10/2007	
9	Oct 10/2006		32	Jun 10/2007	
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38	Jun 10/2007	
39	Jun 10/2007	
40	Jun 10/2007	
41	Jun 10/2007	
42	Feb 15/2009	
31-52-00		
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3	Oct 15/2008	
4	Oct 10/2002	
5	Oct 10/2002	
6	Feb 15/2009	
7	Feb 15/2009	
8	Feb 10/2007	
9	Feb 10/2003	
10	Oct 10/2002	
11	Feb 10/2003	
12	Oct 10/2002	
13	Feb 10/2003	
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14	Oct 10/2002	
15	Feb 10/2003	
16	Oct 10/2002	
17	Oct 10/2002	
18	Oct 10/2002	
19	Feb 10/2003	
20	BLANK	
31-53-00		
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4	Oct 10/2004	
5	Oct 10/2004	
6	BLANK	
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11	Feb 10/2003	
12	Oct 10/2002	
13	Feb 10/2003	
14	Oct 10/2002	
15	Feb 10/2003	
16	Oct 10/2002	
17	Feb 10/2003	
18	Oct 10/2002	
19	Feb 10/2003	
20	Oct 10/2002	
21	Feb 10/2003	
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O 39	Jun 15/2009	
O 40	Jun 15/2009	
O 41	Jun 15/2009	
O 42	Jun 15/2009	
O 43	Jun 15/2009	
O 44	Jun 15/2009	
O 45	Jun 15/2009	
O 46	Jun 15/2009	
R 47	Jun 15/2009	C
R 48	Jun 15/2009	C
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O 51	Jun 15/2009	
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O 58	Jun 15/2009		O 81	Jun 15/2009	
O 59	Jun 15/2009		O 82	Jun 15/2009	
O 60	Jun 15/2009		O 83	Jun 15/2009	
O 61	Jun 15/2009		O 84	Jun 15/2009	
O 62	Jun 15/2009		O 85	Jun 15/2009	
O 63	Jun 15/2009		O 86	Jun 15/2009	
O 64	Jun 15/2009		O 87	Jun 15/2009	
O 65	Jun 15/2009		O 88	Jun 15/2009	
O 66	Jun 15/2009		O 89	Jun 15/2009	
O 67	Jun 15/2009		O 90	Jun 15/2009	
O 68	Jun 15/2009		O 91	Jun 15/2009	
O 69	Jun 15/2009		O 92	Jun 15/2009	
O 70	Jun 15/2009		O 93	Jun 15/2009	
O 71	Jun 15/2009		O 94	Jun 15/2009	
O 72	Jun 15/2009		O 95	Jun 15/2009	
O 73	Jun 15/2009		O 96	Jun 15/2009	
O 74	Jun 15/2009		O 97	Jun 15/2009	
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O 76	Jun 15/2009		O 98.1	Jun 15/2009	
O 77	Jun 15/2009		O 98.2	Jun 15/2009	

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O 98.5	Jun 15/2009		O 98.28	Jun 15/2009	
O 98.6	Jun 15/2009		O 98.29	Jun 15/2009	
O 98.7	Jun 15/2009		R 98.30	Jun 15/2009	
O 98.8	Jun 15/2009		R 98.31	Jun 15/2009	
O 98.9	Jun 15/2009		O 98.32	Jun 15/2009	
O 98.10	Jun 15/2009	C	O 98.33	Jun 15/2009	
R 98.11	Jun 15/2009		O 98.34	Jun 15/2009	
O 98.12	Jun 15/2009		R 98.35	Jun 15/2009	
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O 98.14	Jun 15/2009		O 98.37	Jun 15/2009	
O 98.15	Jun 15/2009		O 98.38	Jun 15/2009	
O 98.16	Jun 15/2009	C	O 98.39	Jun 15/2009	
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O 98.18	Jun 15/2009		O 98.41	Jun 15/2009	
O 98.19	Jun 15/2009		O 98.42	Jun 15/2009	
O 98.20	Jun 15/2009		O 98.43	Jun 15/2009	
O 98.21	Jun 15/2009		O 98.44	Jun 15/2009	
O 98.22	Jun 15/2009		O 98.45	Jun 15/2009	
O 98.23	Jun 15/2009		O 98.46	Jun 15/2009	
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O 98.52	Jun 15/2009		O 98.75	Jun 15/2009	
O 98.53	Jun 15/2009		O 98.76	Jun 15/2009	
O 98.54	Jun 15/2009		O 98.77	Jun 15/2009	
O 98.55	Jun 15/2009		O 98.78	Jun 15/2009	
O 98.56	Jun 15/2009		O 98.79	Jun 15/2009	
R 98.57	Jun 15/2009		O 98.80	Jun 15/2009	
O 98.58	Jun 15/2009		O 98.81	Jun 15/2009	
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O 98.63	Jun 15/2009		O 98.86	Jun 15/2009	
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O 98.65	Jun 15/2009		O 98.88	Jun 15/2009	C
O 98.66	Jun 15/2009		O 98.89	Jun 15/2009	
O 98.67	Jun 15/2009		O 98.90	Jun 15/2009	
O 98.68	Jun 15/2009		O 98.91	Jun 15/2009	
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O 98.70	Jun 15/2009		O 98.93	Jun 15/2009	
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O 98.101	Jun 15/2009	
O 98.102	Jun 15/2009	
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O 98.104	Jun 15/2009	
O 98.105	Jun 15/2009	
O 98.106	Jun 15/2009	
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O 98.123	Jun 15/2009	
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O 98.126	Jun 15/2009	
O 98.127	Jun 15/2009	
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O 98.130	Jun 15/2009	
O 98.131	Jun 15/2009	
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O 98.150	Jun 15/2009	
O 98.151	Jun 15/2009	
R 98.152	Jun 15/2009	
R 98.153	Jun 15/2009	
O 98.154	Jun 15/2009	
O 98.155	Jun 15/2009	
R 98.156	Jun 15/2009	
O 98.157	Jun 15/2009	
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O 98.170	Jun 15/2009	
O 98.171	Jun 15/2009	
O 98.172	Jun 15/2009	
O 98.173	Jun 15/2009	
O 98.174	Jun 15/2009	
O 98.175	Jun 15/2009	
O 98.176	Jun 15/2009	
O 98.177	Jun 15/2009	
O 98.178	Jun 15/2009	
O 98.179	Jun 15/2009	
O 98.180	Jun 15/2009	
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O 98.182	Jun 15/2009	
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O 98.192	Jun 15/2009	
O 98.193	Jun 15/2009	
O 98.194	Jun 15/2009	
O 98.195	Jun 15/2009	
O 98.196	Jun 15/2009	
O 98.197	Jun 15/2009	
O 98.198	Jun 15/2009	
O 98.199	Jun 15/2009	
O 98.200	Jun 15/2009	
O 98.201	Jun 15/2009	
O 98.202	Jun 15/2009	
O 98.203	Jun 15/2009	
O 98.204	Jun 15/2009	
O 98.205	Jun 15/2009	
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O 98.216	Jun 15/2009	
O 98.217	Jun 15/2009	
O 98.218	Jun 15/2009	
O 98.219	Jun 15/2009	
O 98.220	Jun 15/2009	
O 98.221	Jun 15/2009	
O 98.222	Jun 15/2009	
O 98.223	Jun 15/2009	
O 98.224	Jun 15/2009	
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O 98.237	Jun 15/2009	
O 98.238	Jun 15/2009	
O 98.239	Jun 15/2009	
O 98.240	Jun 15/2009	
O 98.241	Jun 15/2009	
O 98.242	Jun 15/2009	
O 98.243	Jun 15/2009	
O 98.244	Jun 15/2009	
O 98.245	Jun 15/2009	
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O 98.268	Jun 15/2009	
O 98.269	Jun 15/2009	
O 98.270	Jun 15/2009	
O 98.271	Jun 15/2009	
O 98.272	BLANK	
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D 98.274	Jun 15/2009	
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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

HAP 008-013, 015-026, 028-054, 101-999

- Global positioning system (GPS) time and date from the multi-mode receiver (MMR)

HAP ALL

- 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

HAP 001-007

- FS D - fast slew, date

HAP ALL

- GMT - Greenwich mean time

HAP 008-013, 015-026, 028-054, 101-999

- GPS - global positioning system

HAP ALL

- hld - hold

HAP 001-007

- HLD Y - hold, year

HAP ALL

- LCD - liquid crystal display

HAP 008-013, 015-026, 028-054, 101-999

- man - manual
- MMR - multi-mode receiver

HAP ALL

- MO - month

HAP 001-007

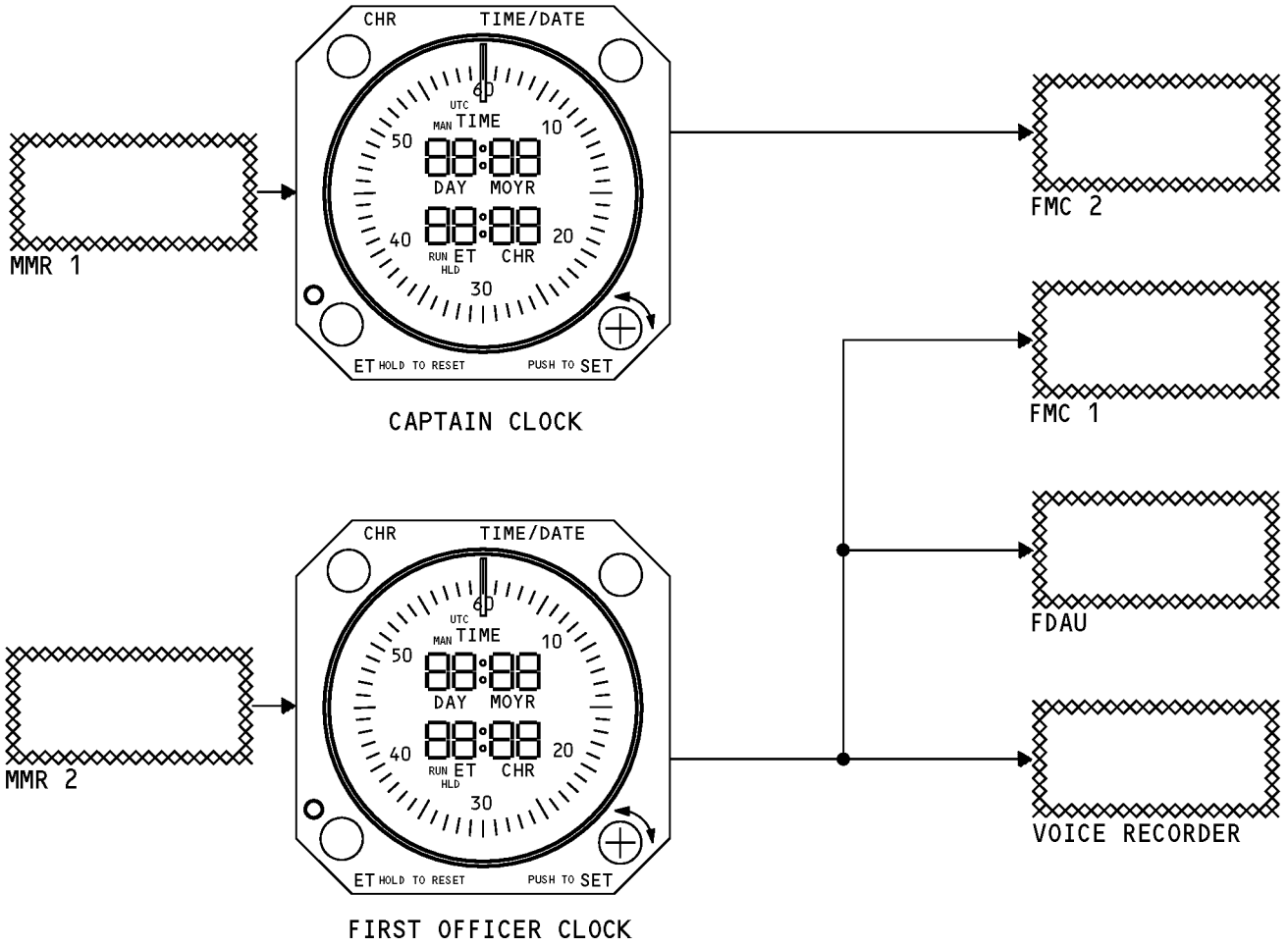
- SS M - slow slew, month

HAP 008-013, 015-026, 028-054, 101-999

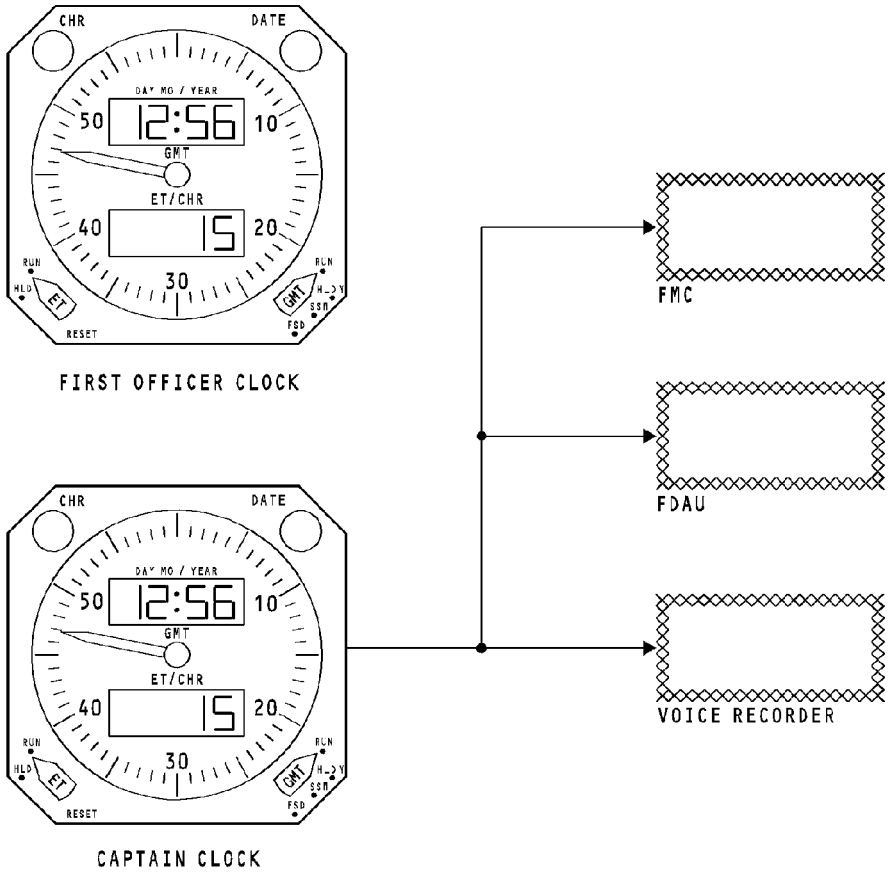
- UTC - universal time (coordinated)

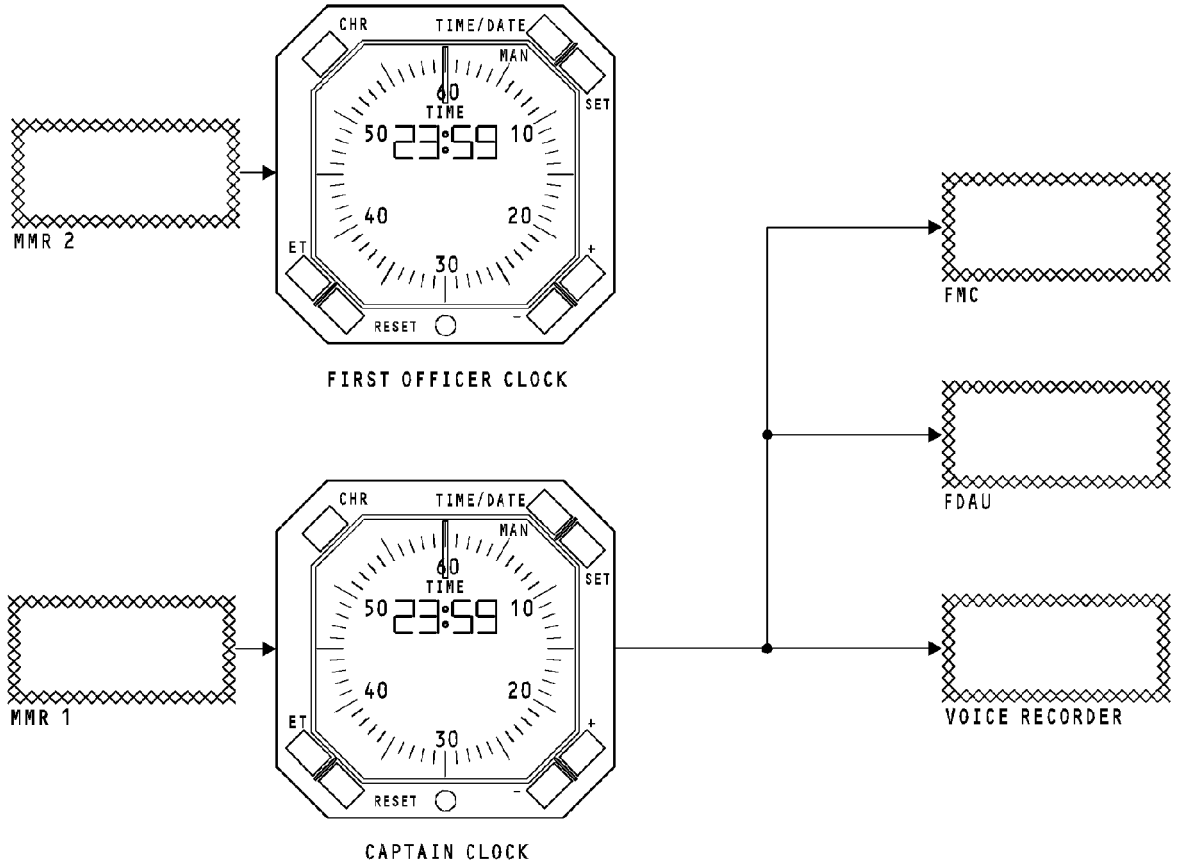
HAP ALL

- YR - year



CLOCKS - GENERAL DESCRIPTION



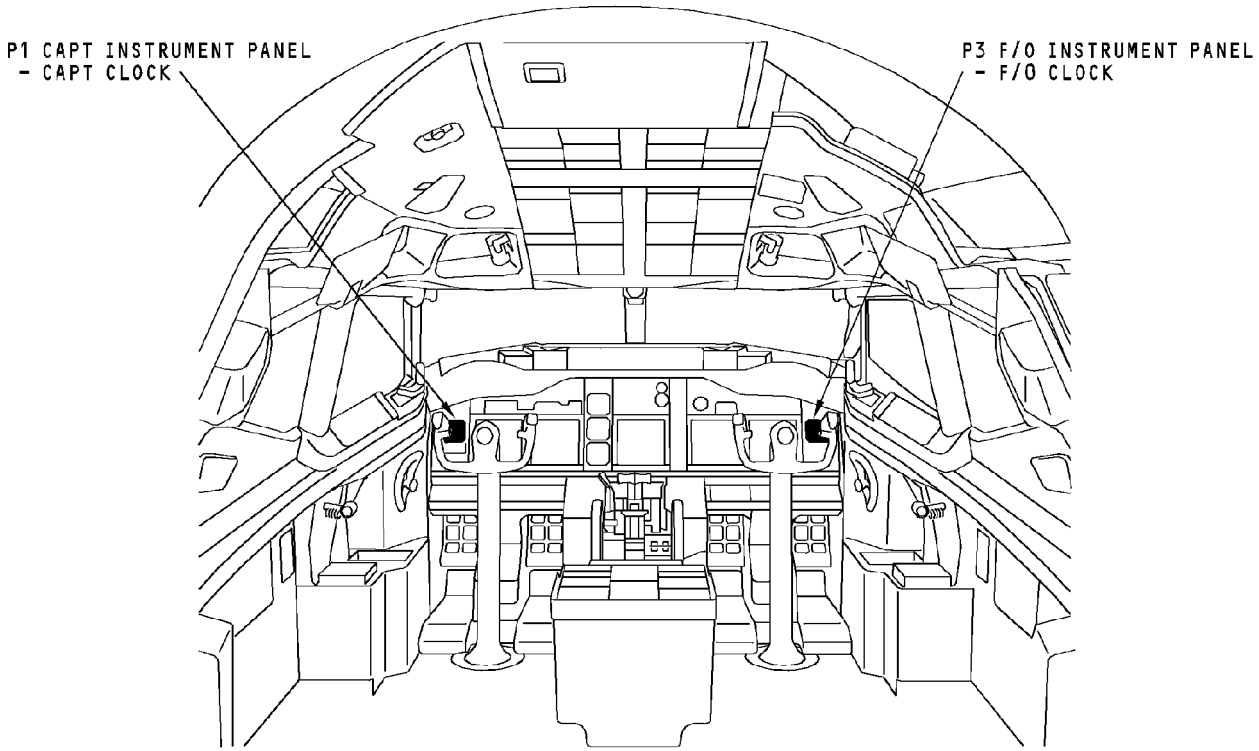


CLOCKS - GENERAL DESCRIPTION

General

These are the clock system components:

- Captain clock
- First officer clock.



CLOCKS - COMPONENT LOCATION

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.

HAP 008-013, 015-026, 028-030

Digital Input

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

HAP 031-054, 101-999

Digital Input

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

HAP ALL

Digital Output

HAP 001-013, 015-026, 028-036

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 does not have a digital output.

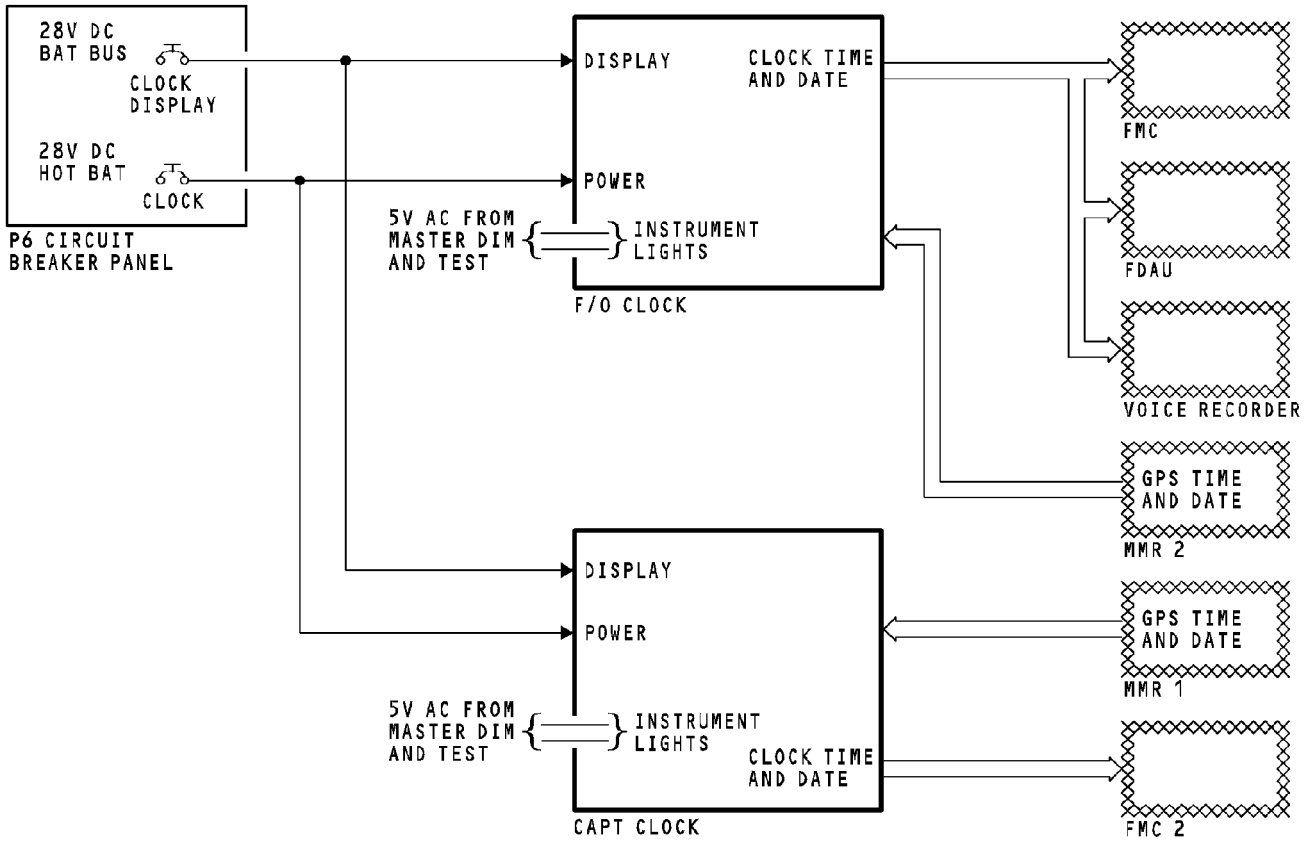
HAP 037-054, 101-999

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.

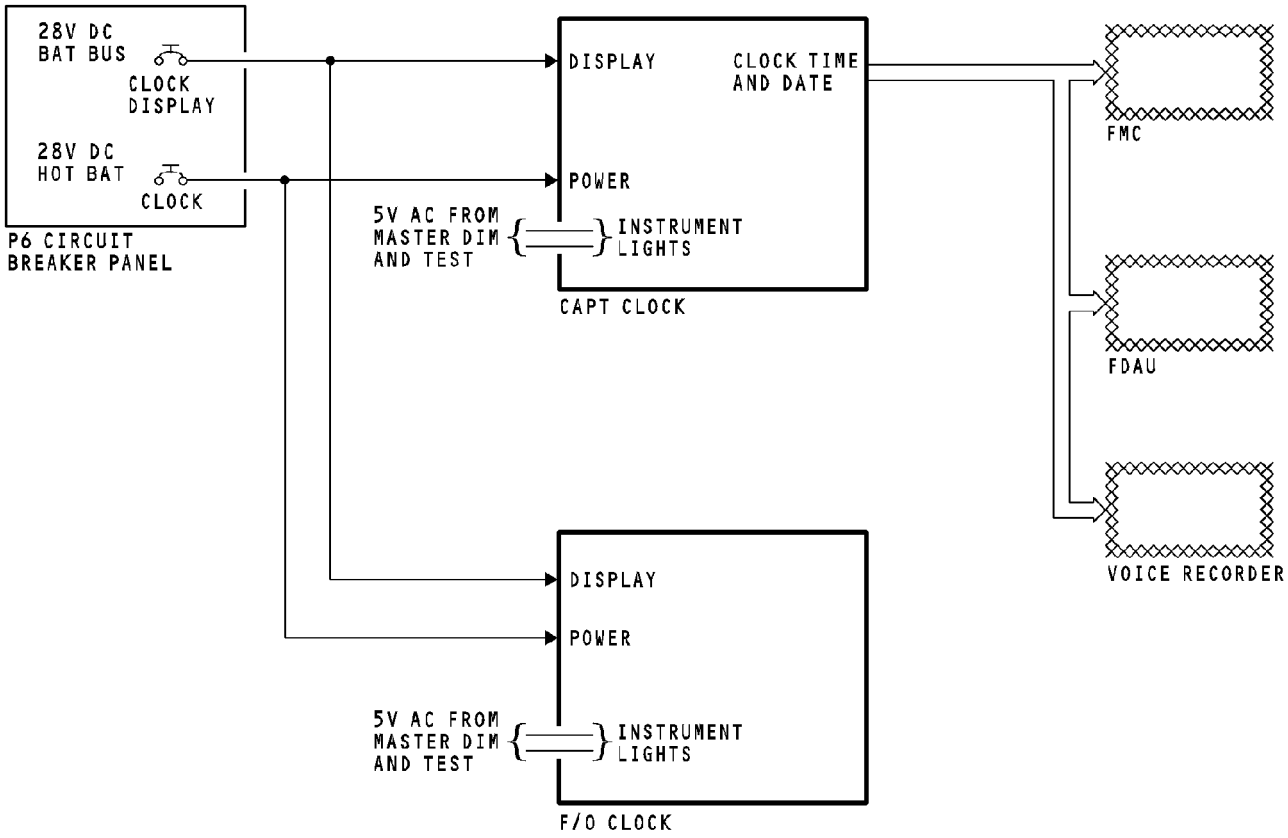
HAP ALL

EFFECTIVITY

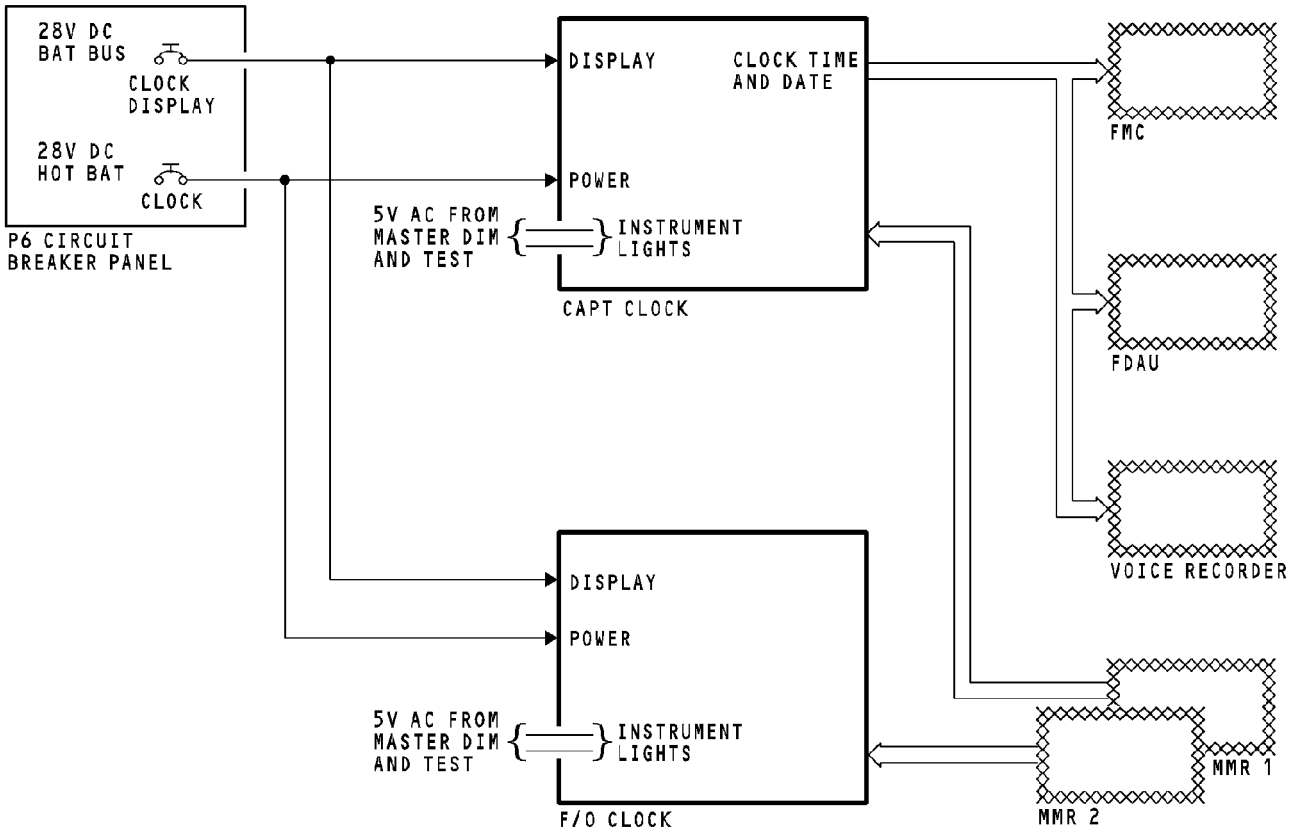
HAP ALL



CLOCK - INTERFACES



CLOCKS - INTERFACES



CLOCKS - INTERFACES

Displays

HAP 001-007

The clock has a time/date window and an elapsed time/ chronograph window. Both are liquid crystal displays (LCD).

HAP 008-013, 015-026, 028-030

The clock is an LCD display.

HAP 031-054, 101-999

The clock is an LCD display.

HAP ALL

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.

HAP 031-054, 101-999

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

HAP 008-013, 015-026, 028-030

The sweep second hand is an LCD display.

HAP 001-007

Elapsed time selector

The elapsed time selector is a three-position rotary switch. Use this selector to control the elapsed time function of the clock. These are the elapsed time selector positions:

- RESET - This is a spring-loaded position. Use this position to reset the elapsed time
- HLD (Hold) - Use this position to hold the elapsed time
- RUN - Use this position to let the clock start to accumulate elapsed time.

HAP 008-013, 015-026, 028-030

Elapsed Time and Reset Pushbutton

The elapsed time pushbutton controls the elapsed time function of the clock. Select the pushbutton once to run the elapsed time. Select the pushbutton again to hold the elapsed time. The word RUN or HLD shows on the lower left part of the LCD display.

The reset switch pushbutton the elapsed time to 0.

HAP 008-013, 015-026, 028-030 (Continued)
HAP 031-054, 101-999

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

HAP 001-007

Time/Date Switch

The time/date switch is a pushbutton switch. Use this switch to select time or date to show in the time/date window.

HAP 008-013, 015-026, 028-030

Time/Date and Set Pushbutton

The time/date pushbutton controls the mode the clock is in. These are the modes:

- UTC time
- UTC date
- Manual time
- Manual date.

Select the pushbutton once and to see the UTC (universal time coordinated) time. Select the pushbutton again to see UTC date. Select the pushbutton again to see manual time. Select the pushbutton again to see manual date. The word UTC or MAN (manual) shows on the upper right part of the LCD display. Time or date shows on the time/date window.

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.

The set pushbutton lets you set the MAN time or MAN date. If you see MAN time with the time/date pushbutton then you can set the time. Select the set pushbutton and the hours flash. Use the plus or minus pushbutton to adjust the hours. Select set again and the minutes flash. Use the plus or minus pushbutton to adjust the minutes. Select set again to run the time.

If you see MAN date with the time/date pushbutton then you can set the date. Select the set pushbutton and the day flashes. Use the plus or minus pushbutton to adjust the day. Select set again and the month flashes. Use the plus or minus pushbutton to adjust the month. Select the set pushbutton again and the year flashes. Use the plus or minus pushbutton to adjust the year. Select set again to run the date.

HAP 008-013, 015-026, 028-030 (Continued)
HAP 031-054, 101-999

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.

HAP 001-007

GMT Selector

The GMT selector is a four-position rotary switch. Use this selector to set or change the clock time and date. These are the GMT selector positions:

- FS D (fast slew, date) - Use this position to set the hour and the day.
- SS M (slow slew, month) - Use this position to set the minutes and the month.
- HLD Y (hold, year) - Use this position to hold the time or set the year.
- RUN - Use this position to let the clock begin the time update.

HAP 008-013, 015-026, 028-030

Plus and Minus Pushbutton

The plus and minus (+ and -) pushbutton let you set the manual time and date. Use the time/date pushbutton to select manual time or date. Use the set pushbutton to select what you want to set. Then use the plus or minus pushbutton to increase or decrease the value.

HAP 031-054, 101-999

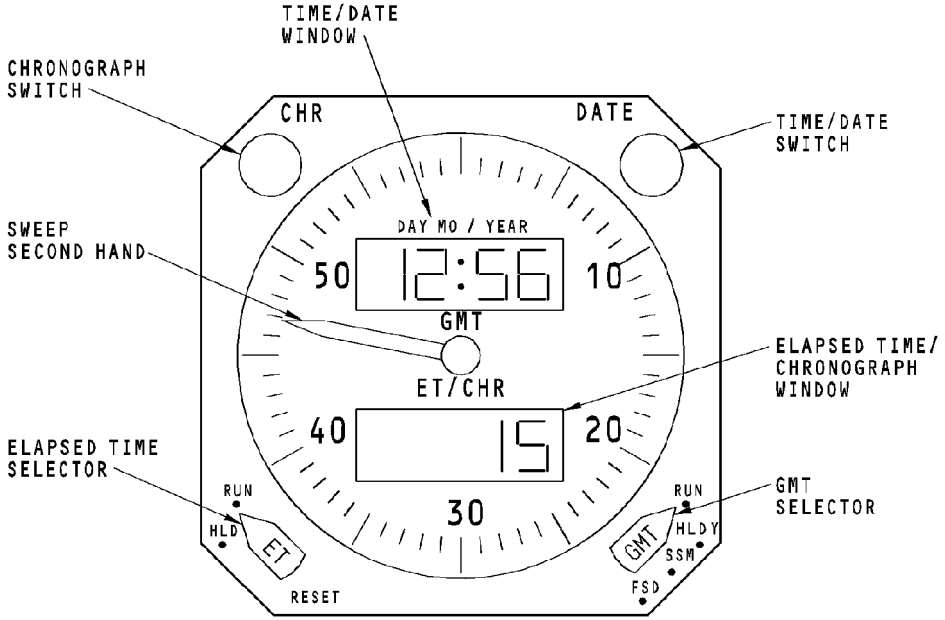
SET Control knob

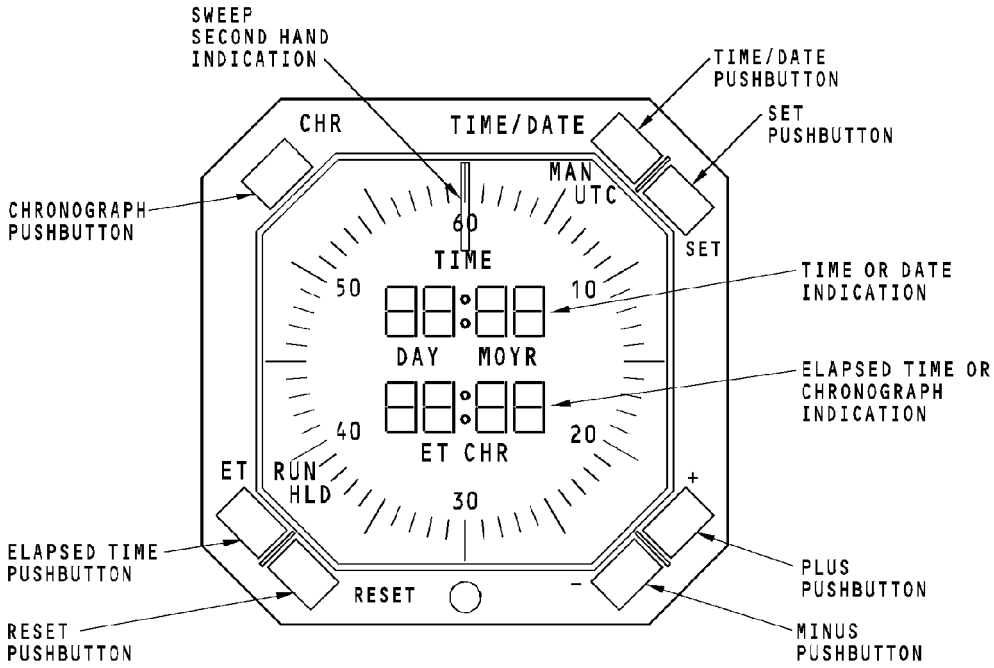
The SET control knob changes the MAN time and date. Push the knob to select the function selected by the Time/Date control. Rotate the knob clockwise or counterclockwise to change the display.

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.

HAP ALL





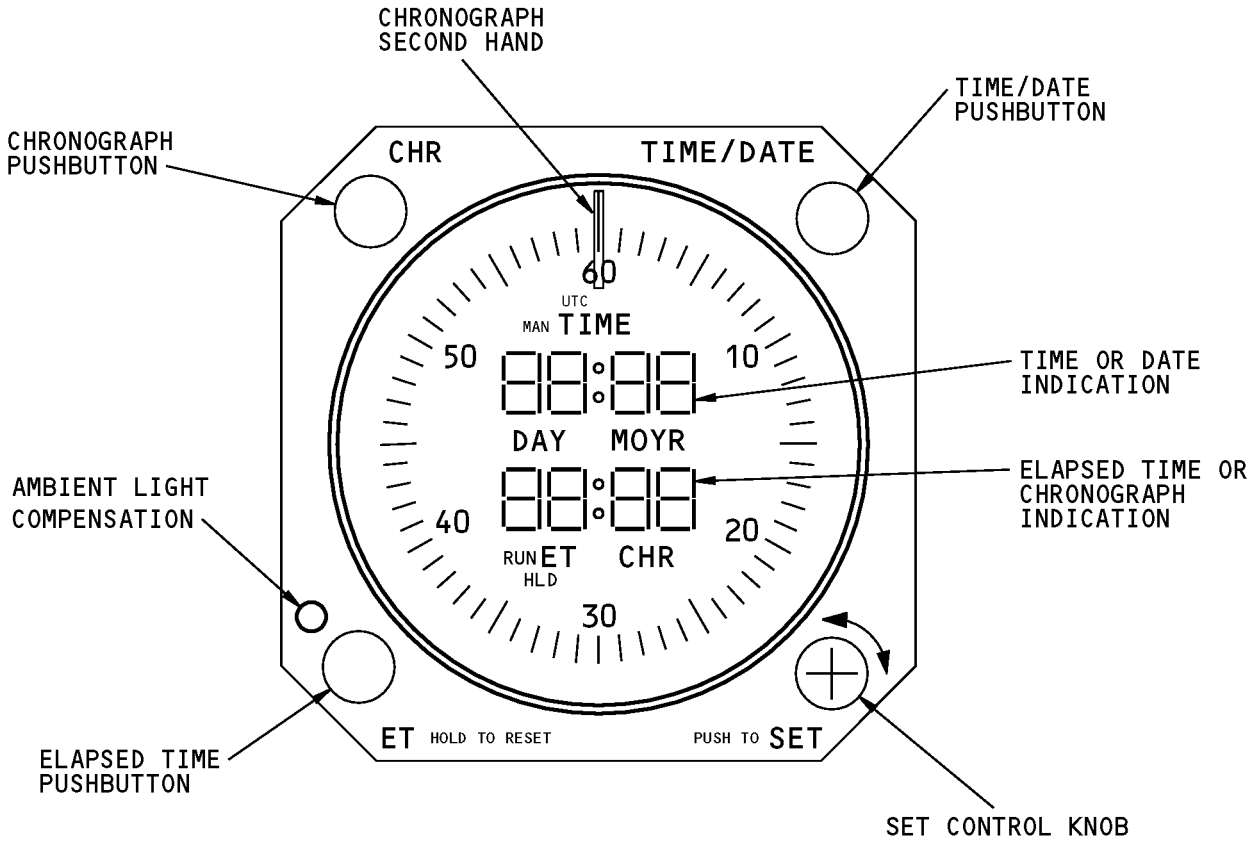
CLOCKS - CLOCK

EFFECTIVITY

HAP 008-013, 015-026, 028-030

31-25-00

31-25-00-005



Date/Time Selection

HAP 001-007

Push the time/date switch to show the date. Day/month and the year show alternately for one second each. Push the time/date switch to show the time again.

HAP 008-013, 015-026, 028-030

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

HAP 031-054, 101-999

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

HAP 008-013, 015-026, 028-030
- UTC time
- UTC date
- Manual time
- Manual date.

HAP 031-054, 101-999
- UTC time
- UTC date
- MAN time
- MAN date

HAP 008-013, 015-026, 028-030

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

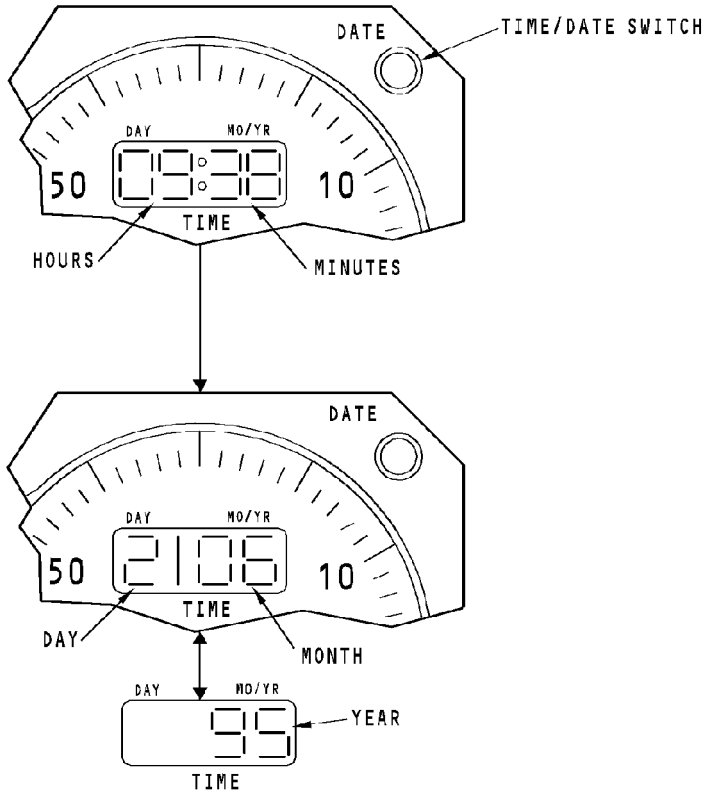
HAP 031-054, 101-999

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

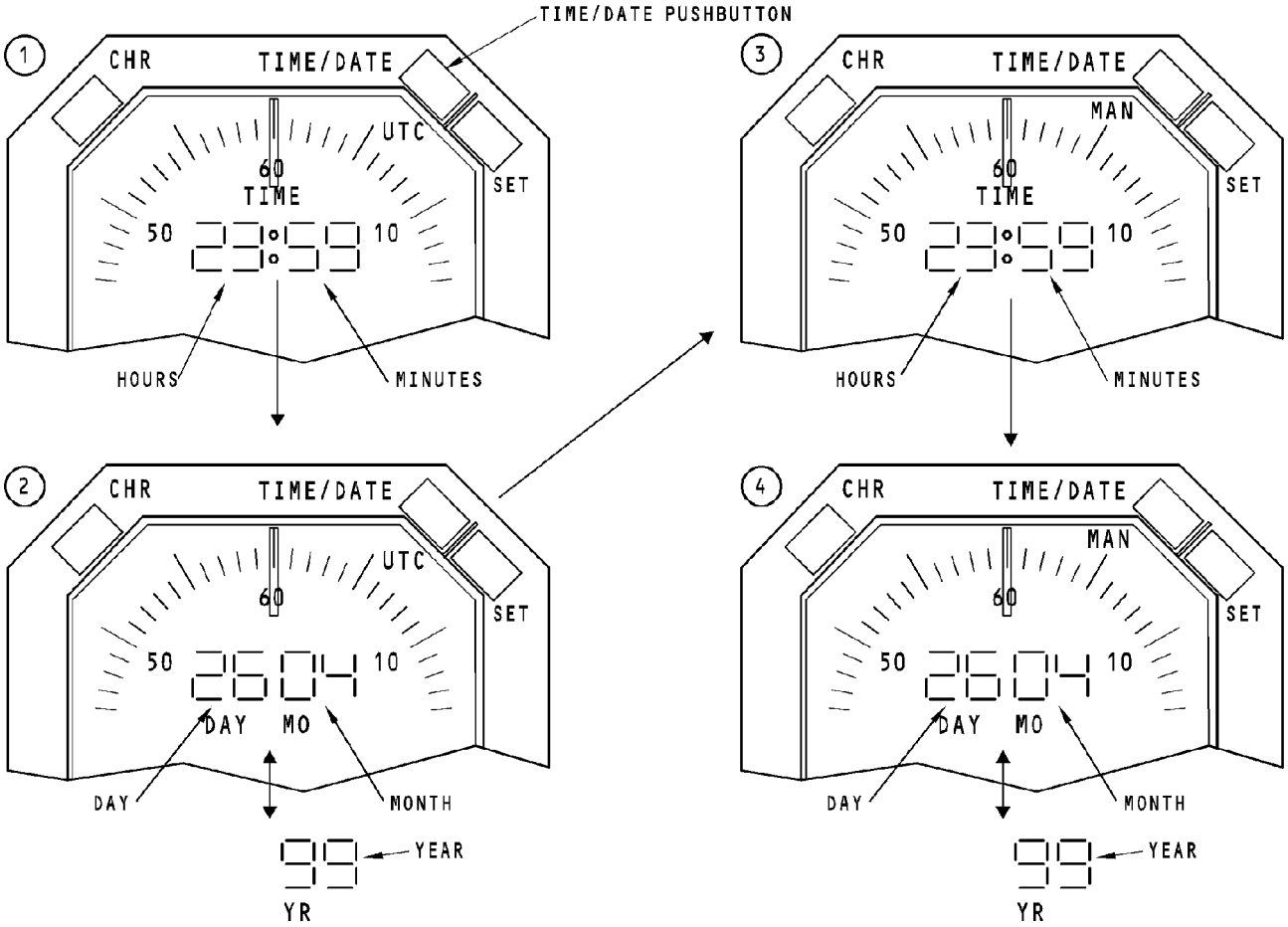
HAP ALL

EFFECTIVITY

HAP ALL



CLOCKS - DATE/TIME SELECTION

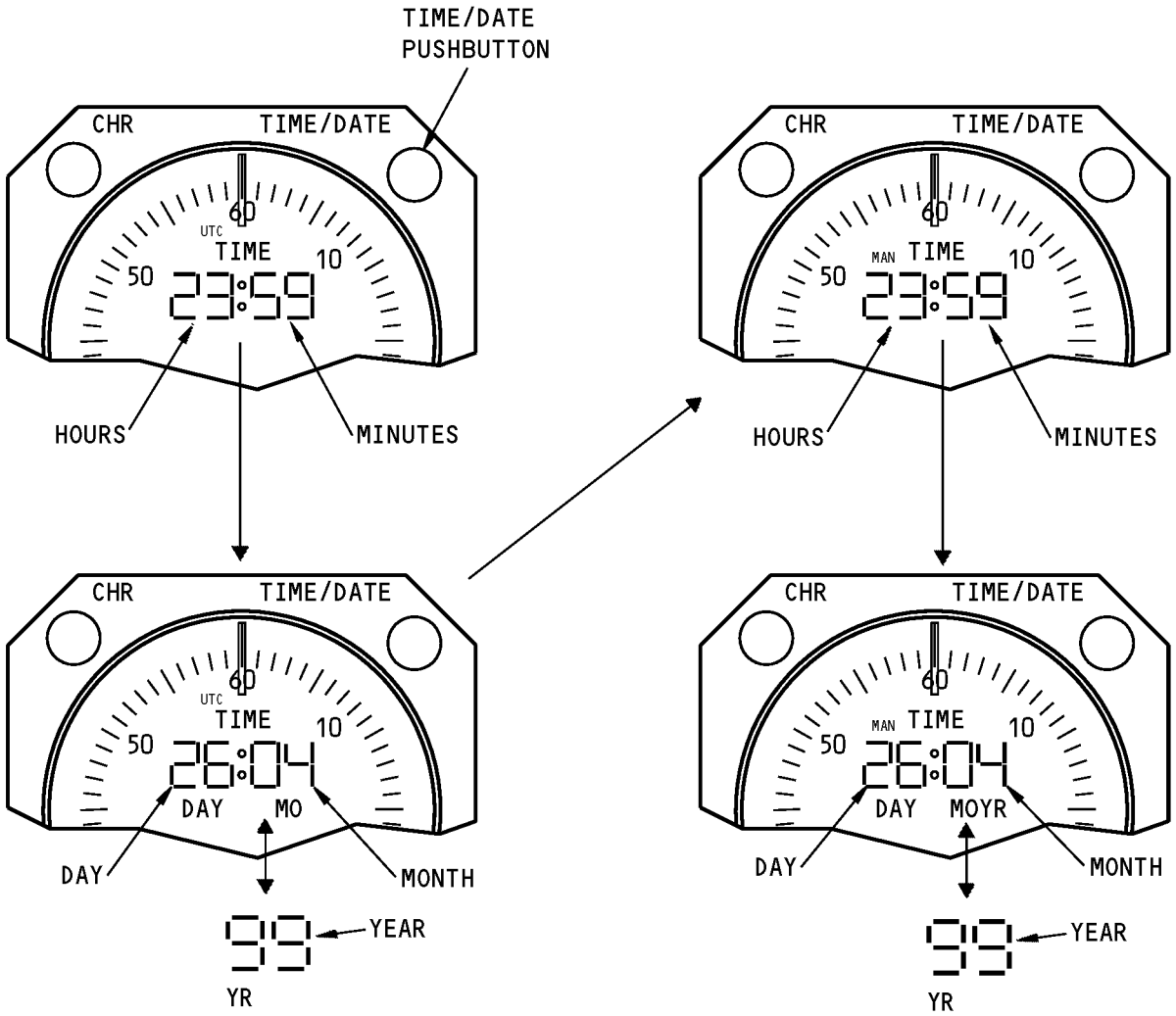


CLOCKS - DATE/TIME SELECTION

EFFECTIVITY

HAP 008-013, 015-026, 028-030

31-25-00



CLOCKS - DATE/TIME SELECTION

General

HAP 001-007

To set the time, push the time/date switch so the time mode is active.

Use the GMT selector switch to change the hours and minutes.

The FS D (fast slew, day) position changes the hours. The SS M (slow slew, month) position changes the minutes. The HLD Y (hold, year) position stops and holds the clock time. The RUN position makes the clock calculate the time update.

When you select the FS D or the SS M position the hours or minutes change until you select HLD Y or RUN. The rate of change is one hour per second or one minute per second.

HAP 031-054, 101-999

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.

HAP 008-013, 015-026, 028-030

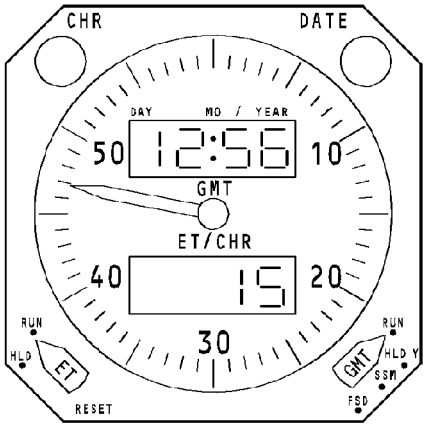
To set the time, push the time/date pushbutton until you see MAN time. If no manual time has previously been set, the UTC time shows for the manual time.

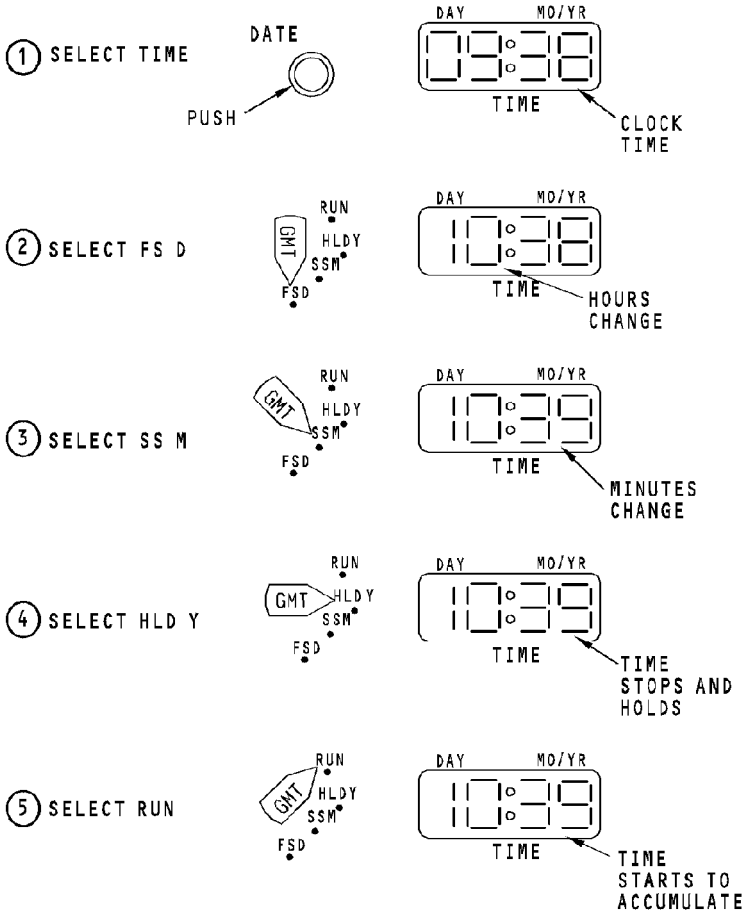
Use the set pushbutton to set the time. Select the set pushbutton and the hours flash. Use the plus and minus pushbuttons to adjust the hours. Select set again and the minutes flash. Use the plus and minus pushbuttons to adjust the minutes. Select set again to run the time.

HAP ALL

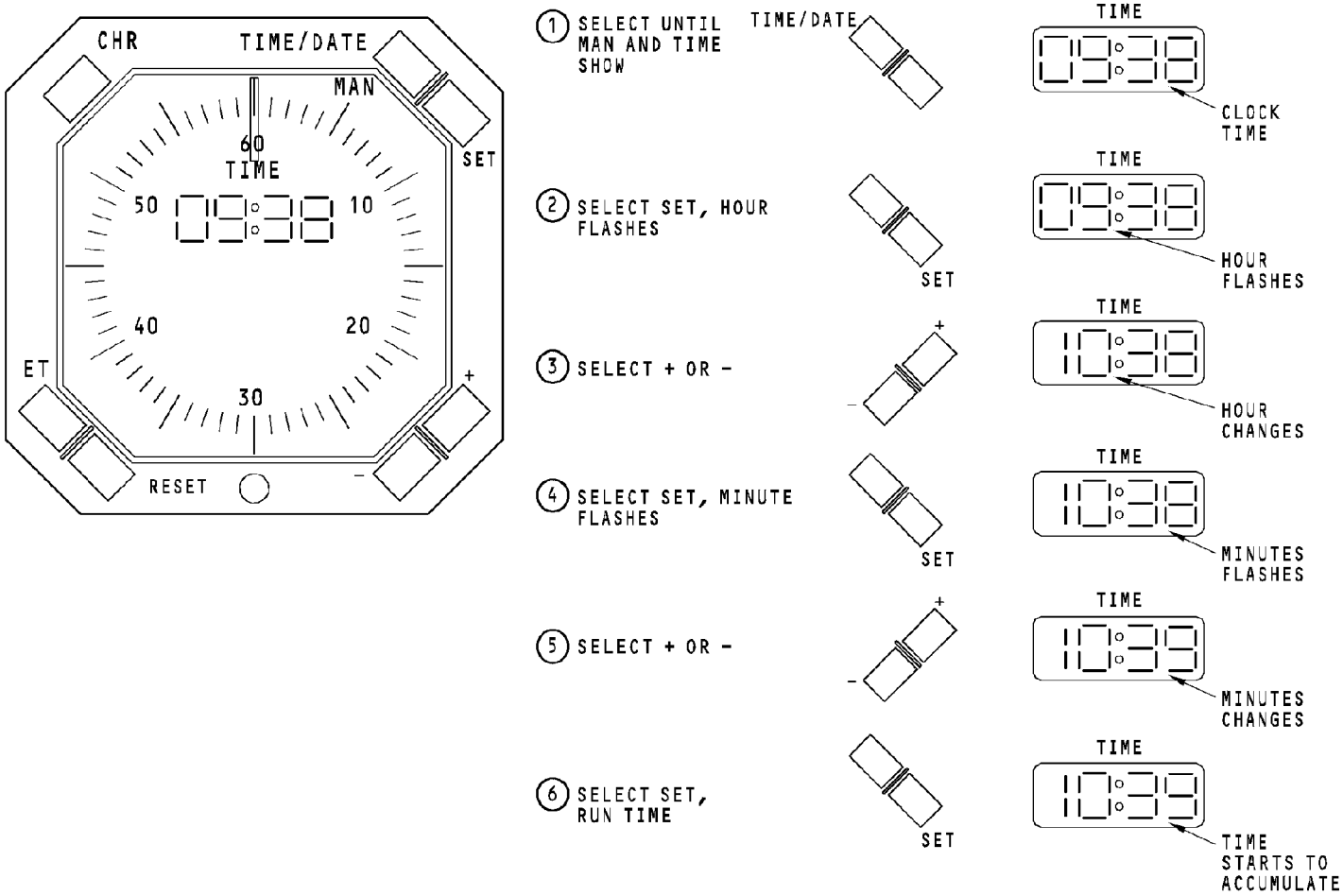
EFFECTIVITY

HAP ALL





CLOCKS - TIME SET

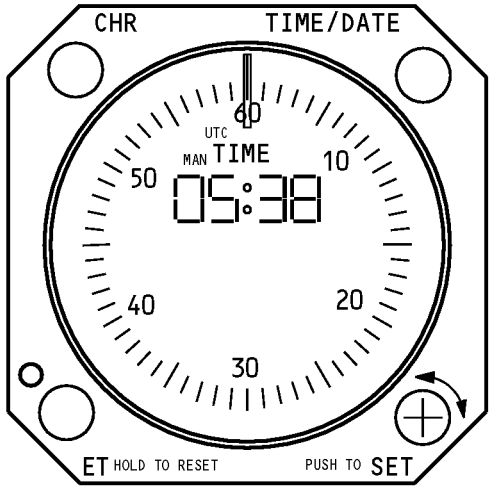


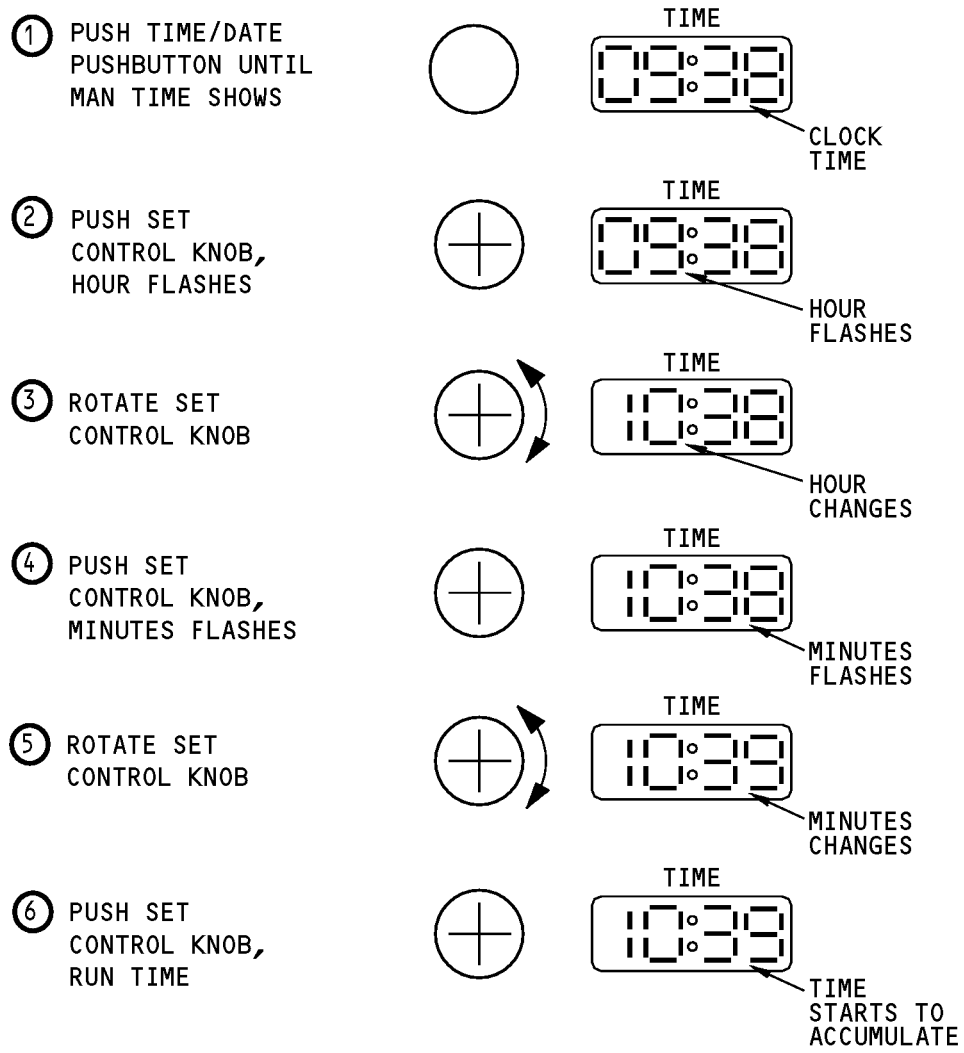
CLOCKS - TIME SET

EFFECTIVITY

HAP 008-013, 015-026, 028-030

31-25-00





CLOCKS TIME SET

General

HAP 001-007

To set the date, push the time/date switch so the date mode is active.

Use the GMT selector switch to change the days, the months, and the year.

The FS D position changes the day. The SS M position changes the month. The HLD Y position changes the year. The RUN position makes the clock calculate the date.

When you select FS D, SS M, or HLD Y, days, months or years change at a rate of one per second.

HAP 008-013, 015-026, 028-030

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

HAP 031-054, 101-999

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.

HAP ALL

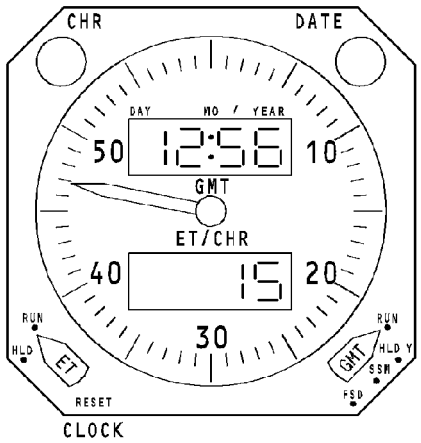
NOTE: If a delay of one minute or more is experienced when setting the time or date, the clock returns to the previous time/date setting.

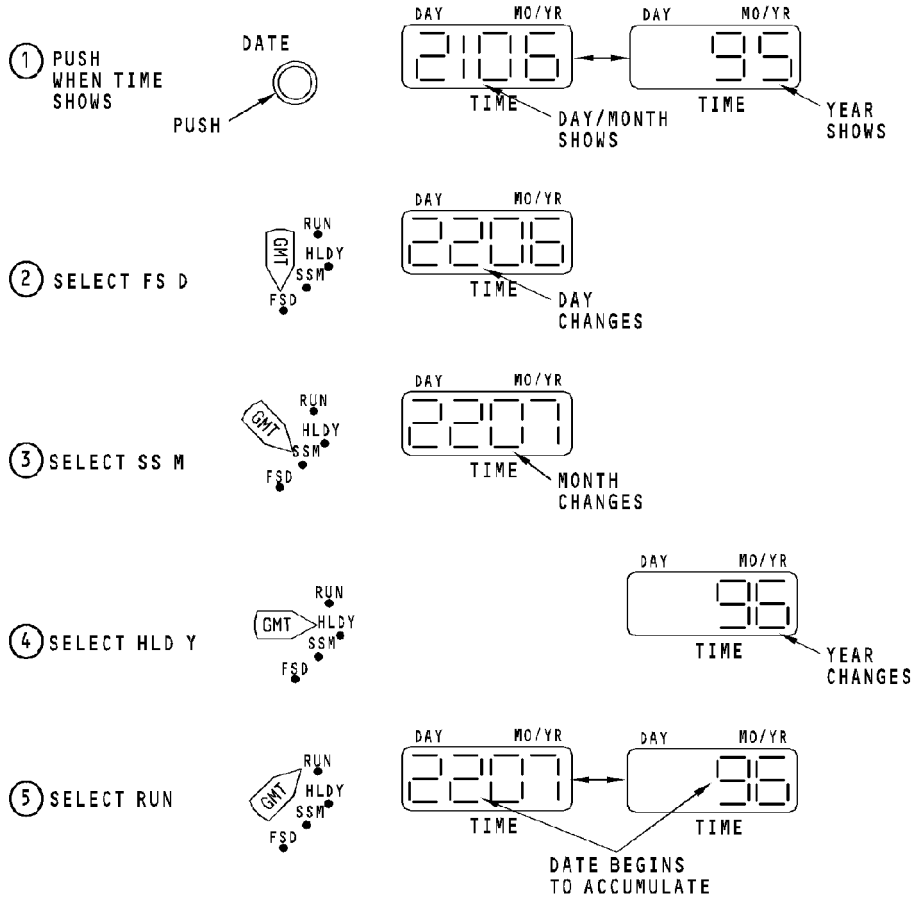
HAP 008-013, 015-026, 028-030

Use the set pushbutton to change the days, the months, and the year.

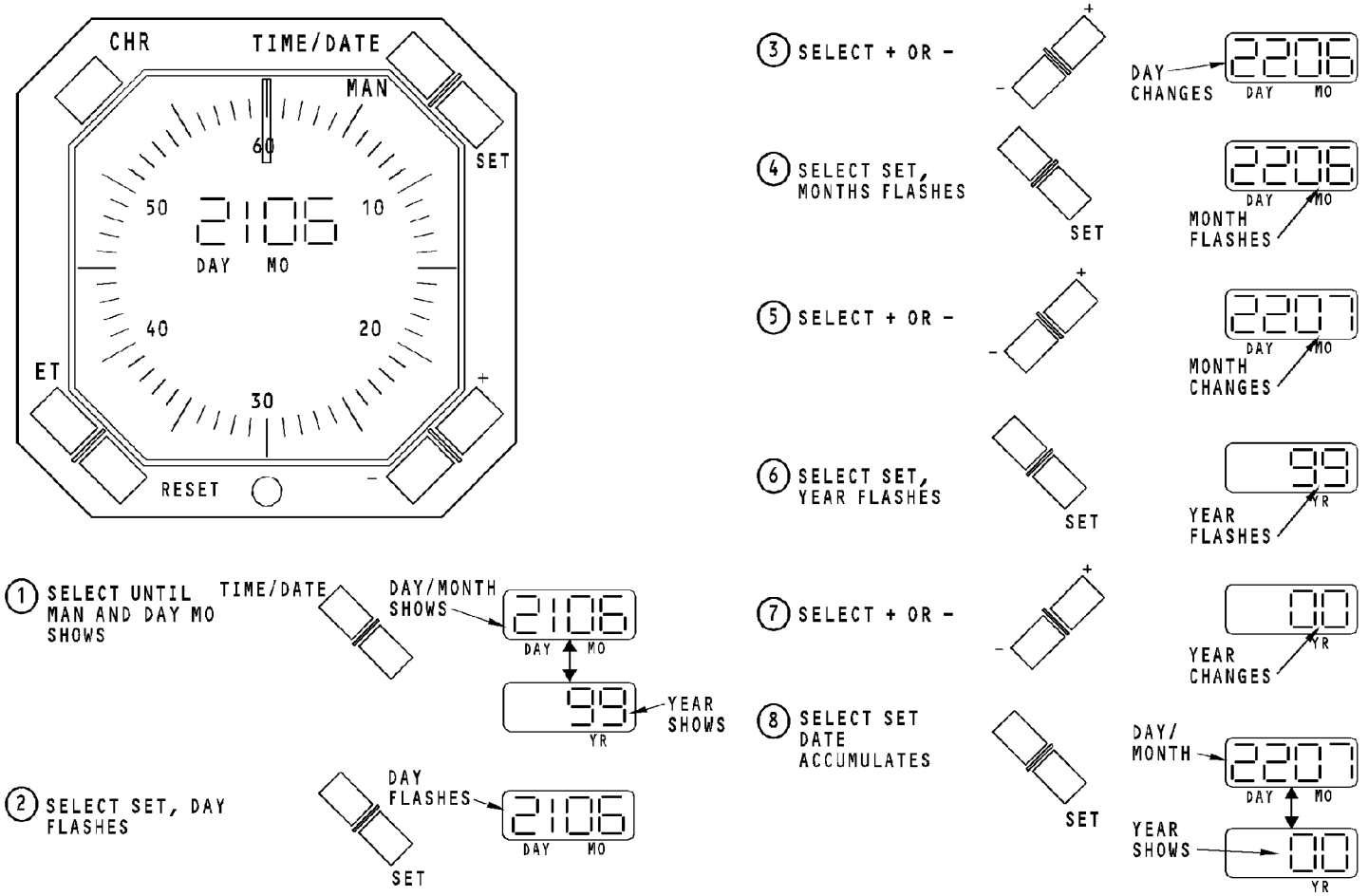
Select the set pushbutton and the day flashes. Use the plus and minus pushbuttons to adjust the day. Select set again and the month flashes. Use the plus and minus pushbuttons to adjust the month. Select the set switch again and the year flashes. Use the plus and minus pushbuttons to adjust the year. Select set again to run the date.

HAP ALL





CLOCKS - DATE SET

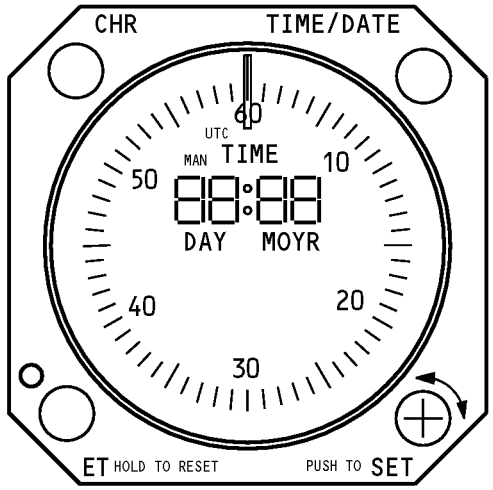


CLOCKS - DATE SET

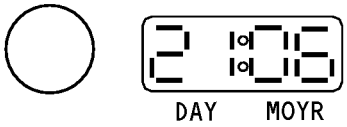
EFFECTIVITY

HAP 008-013, 015-026, 028-030

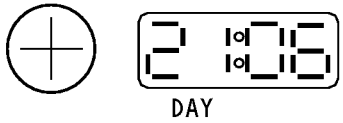
31-25-00



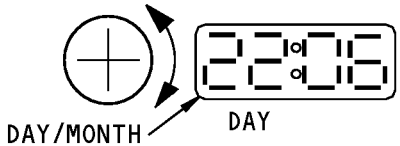
1. PUSH THE TIME/DATE PUSHBUTTON UNTIL MAN AND DAY MOYR SHOWS



2. PUSH THE SET CONTROL KNOB ONCE, DAY FLASHES

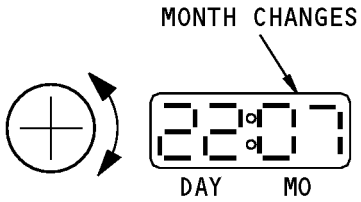


3. ROTATE THE KNOB, DAY CHANGES

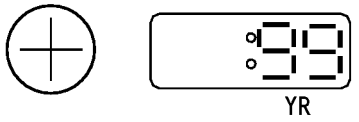


4. PUSH THE SET CONTROL KNOB AGAIN, THE MONTH FLASHES

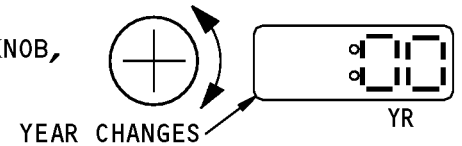
5. ROTATE THE KNOB, MONTH CHAGES



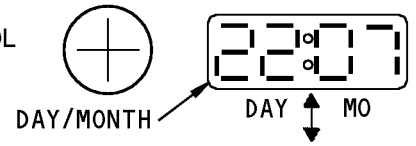
6. PUSH THE SET CONTROL KNOB AGAIN, THE YEAR FLASHES



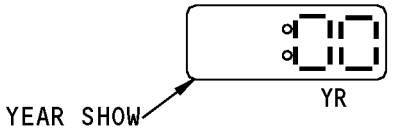
7. ROTATE THE SET KNOB, YEAR CHANGES



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



9. TO VIEW THE YEAR, PUSH THE KNOB AGAIN



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.

CLOCKS - DATE SET

EFFECTIVITY
HAP 031-054, 101-999

31-25-00

General

HAP 001-007

Use the elapsed time control switch to stop, start, and reset the elapsed time.

The elapsed time control switch has a spring in the RESET position. It will not stay in that position.

HAP 008-013, 015-026, 028-030

Use the elapsed time (ET) pushbutton to stop and start the elapsed time. Use the reset pushbutton to reset the elapsed time. The elapsed time is blank after 5 seconds.

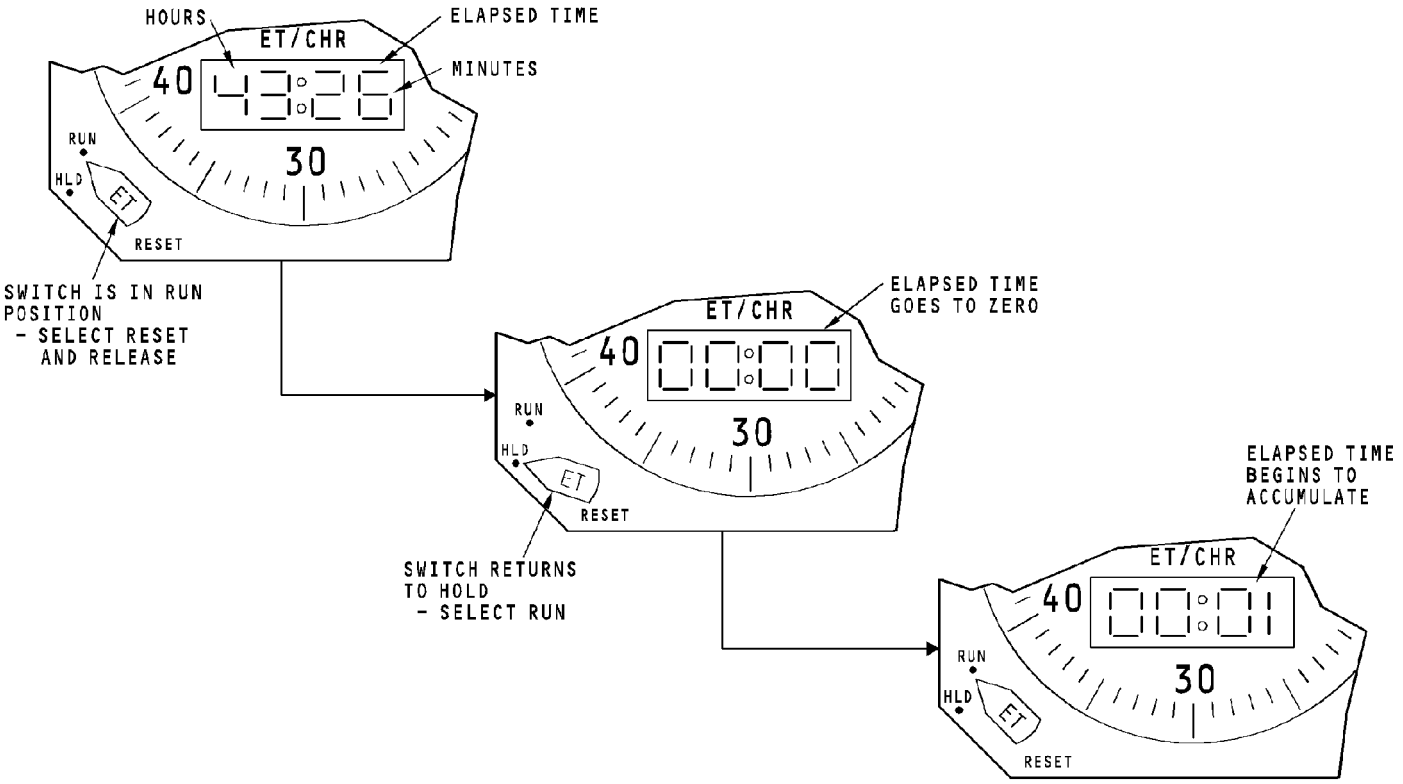
HAP 031-054, 101-999

Use the ET pushbutton to control the elapsed time function.

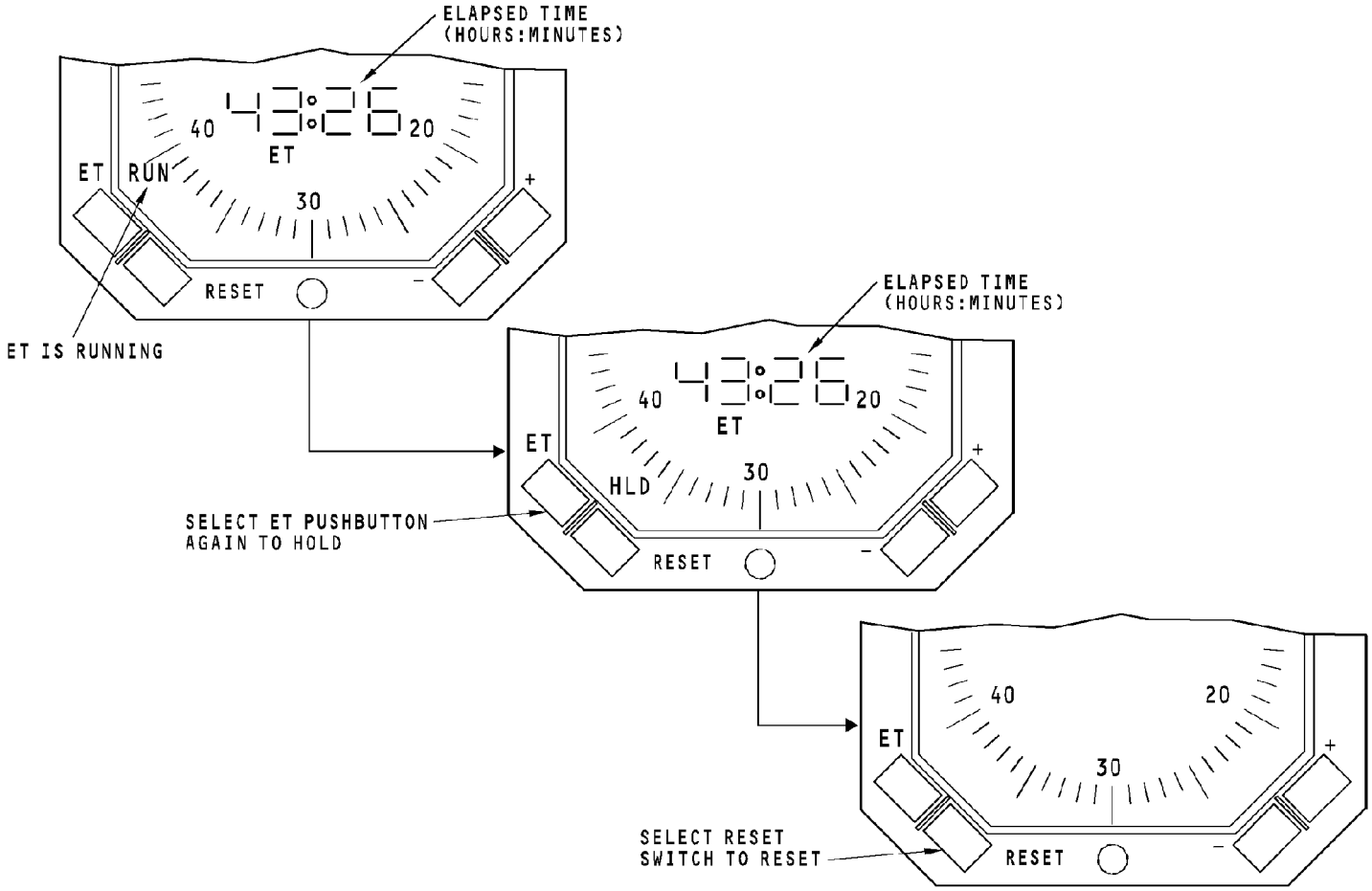
Push the ET button once to start the elapsed time cycle. Push it again to hold the elapsed time. Push it a third time continues elapsed time. Holding the ET button for two seconds resets the elapsed time to 0.

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

HAP ALL



CLOCKS - ELAPSED TIME

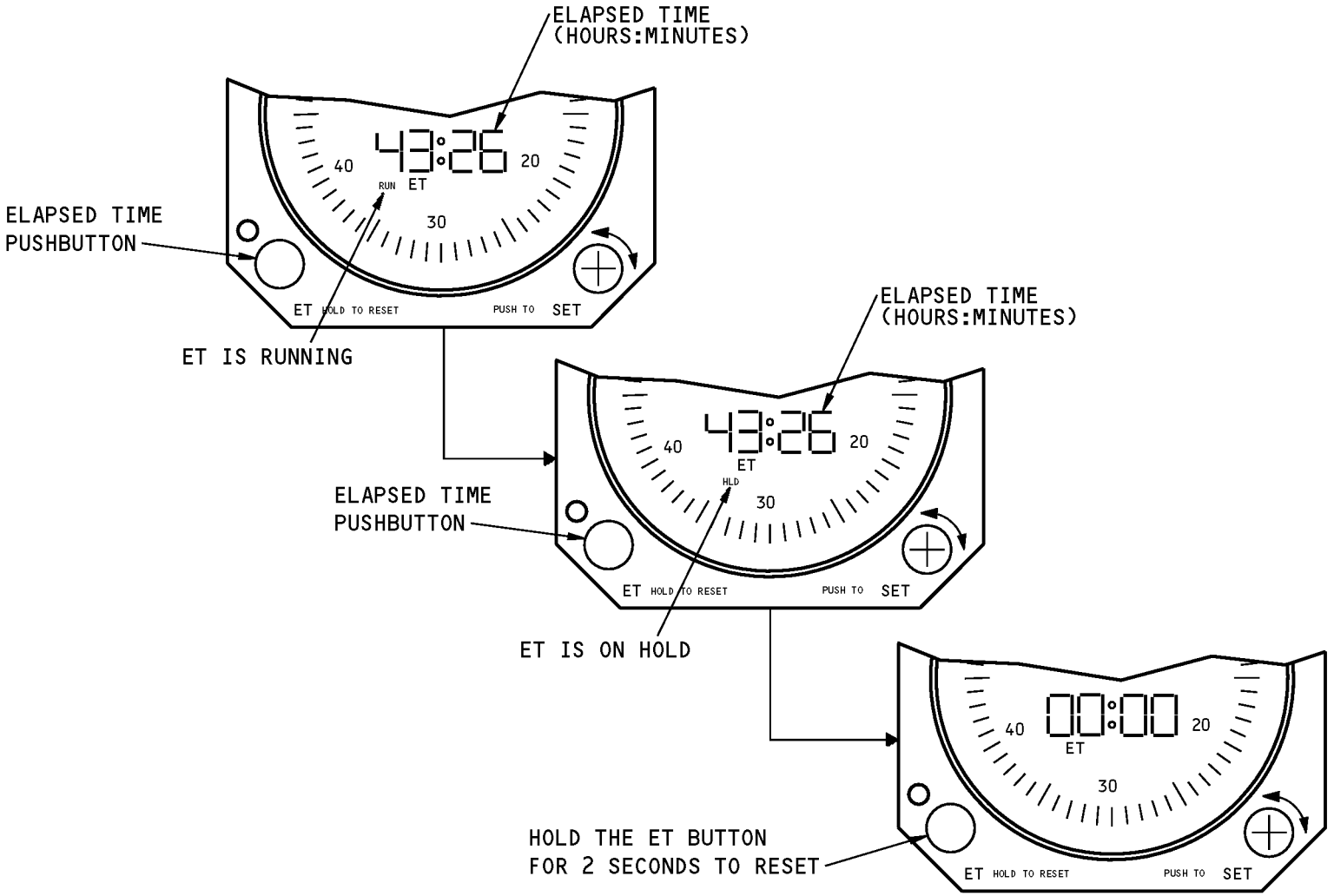


CLOCKS - ELAPSED TIME

EFFECTIVITY

HAP 008-013, 015-026, 028-030

31-25-00



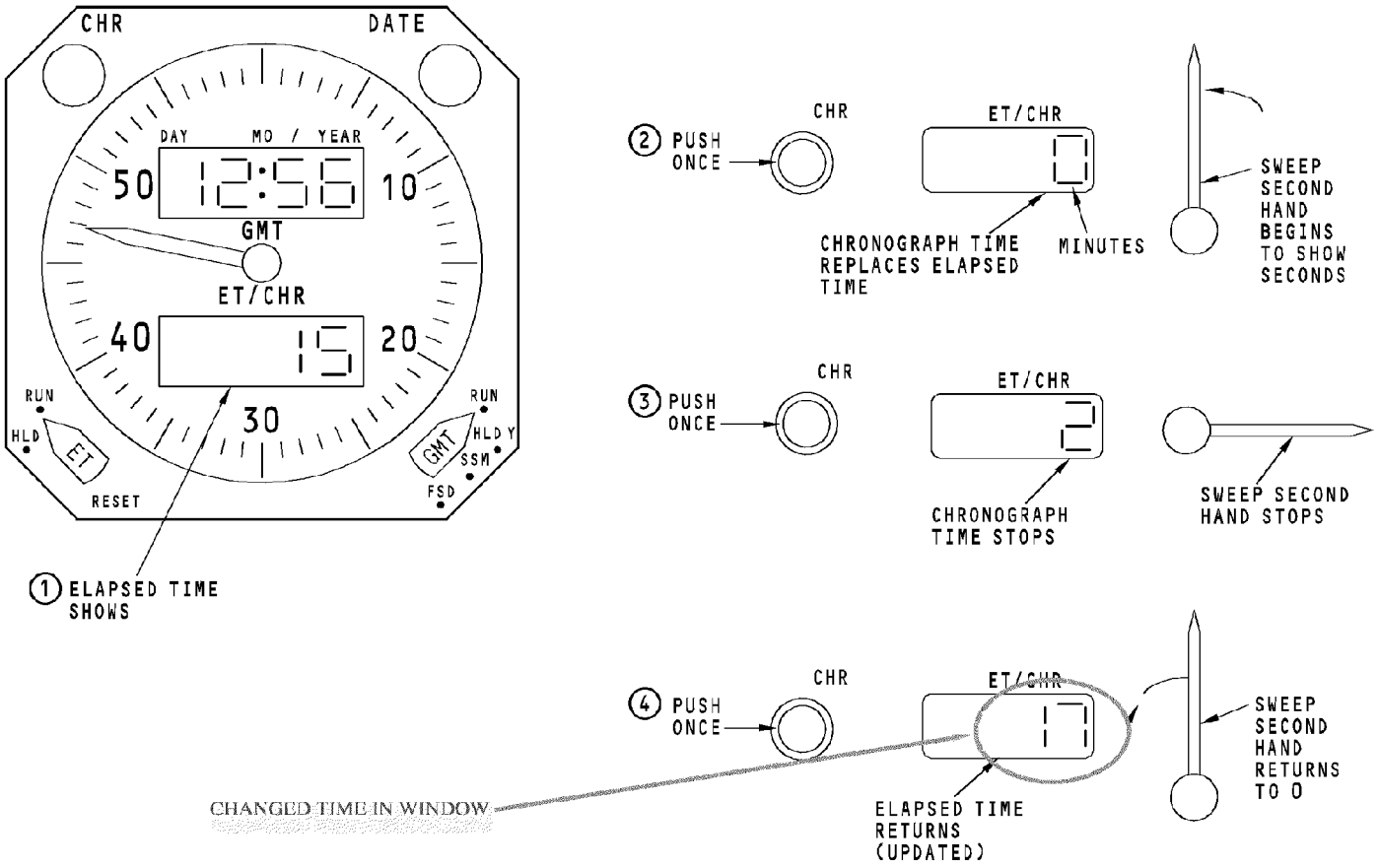
CLOCKS - ELAPSED TIME

General

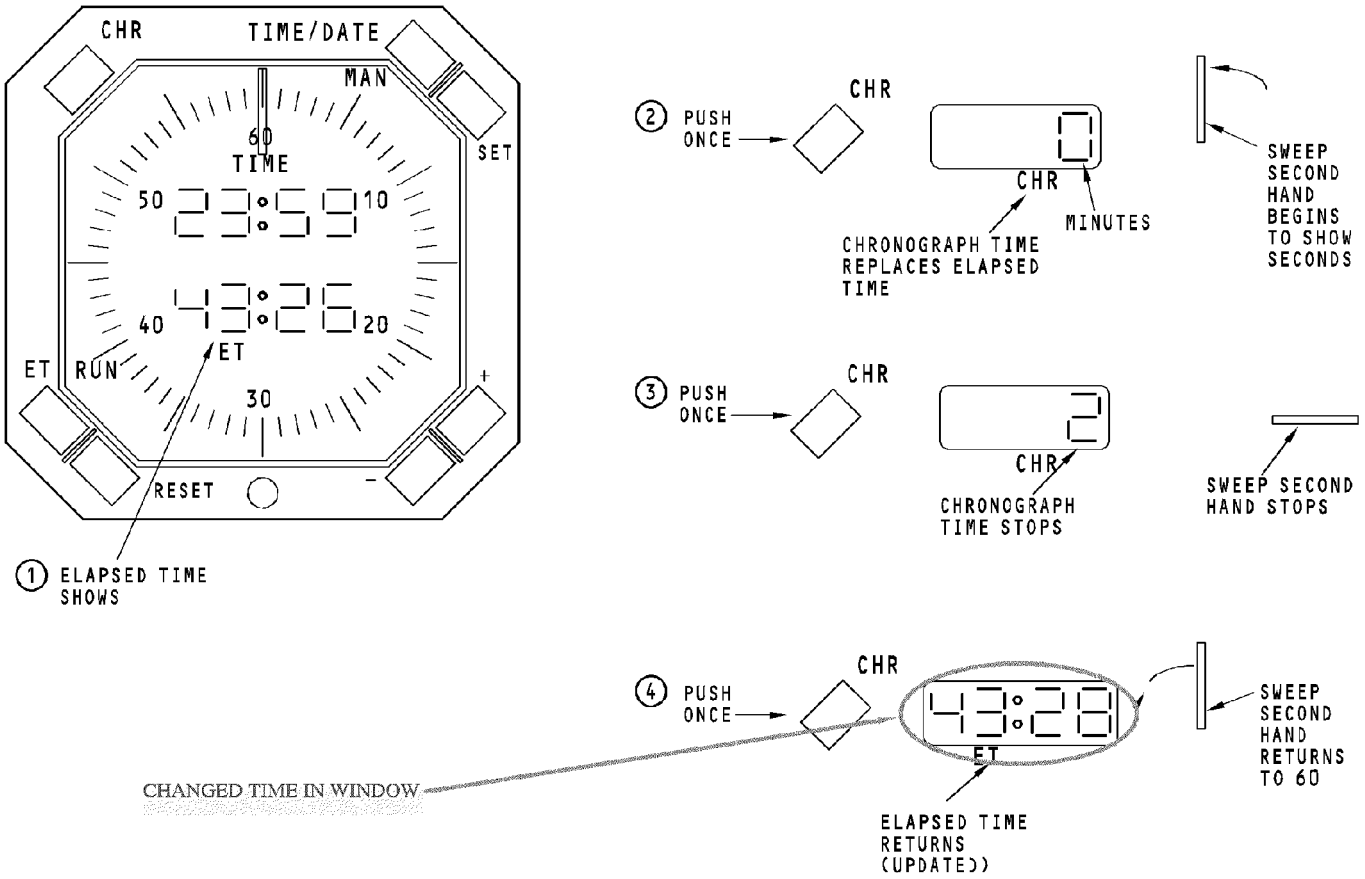
The minutes show on the lower display. The sweep second hand indicates the seconds. The chronograph function does not calculate hours.

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.



CLOCKS - CHRONOGRAPH FUNCTION

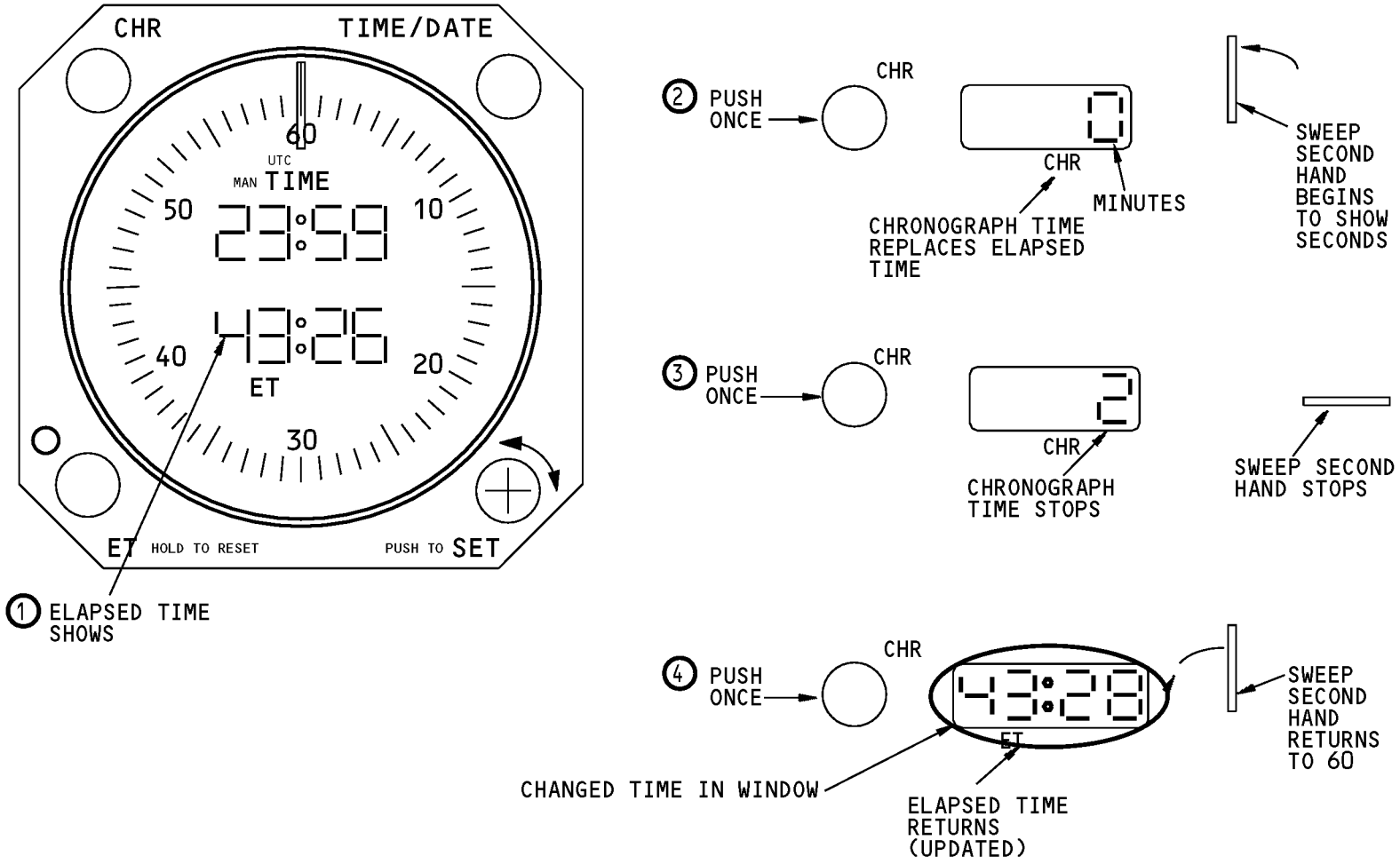


CLOCKS - CHRONOGRAPH FUNCTION

EFFECTIVITY

HAP 008-013, 015-026, 028-030

31-25-00



CLOCKS - CHRONOGRAPH FUNCTION

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Inputs

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

HAP 001-007

A multiplexer senses the position of all the switches on the clock.

HAP 008-013, 015-026, 028-030

The microprocessor senses the inputs from all the bezel controls.

HAP 031-054, 101-999

The microprocessor senses the inputs from all the bezel controls.

HAP 008-013, 015-026, 028-030

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

HAP 031-054, 101-999

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

HAP ALL

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

Power

HAP 001-007

Power for the operation of the clock and to keep the time base comes from the hot battery bus. This lets the clock time base continue operation when power is not available for the airplane.

When airplane power is on, 28v dc from the battery bus supplies power to the clock. This power lets the clock displays show clock data.

HAP 008-013, 015-026, 028-030

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.

HAP 008-013, 015-026, 028-030 (Continued)

HAP 031-054, 101-999

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.

HAP ALL

Calculations and Outputs

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

HAP 001-007

A stepper motor moves the sweep second hand with the chronograph function in use.

Display drivers supply display information to the clock displays.

HAP 008-013, 015-026, 028-030

An LCD driver supplies display information to the clock display.

HAP 031-054, 101-999

An LCD driver supplies display information to the clock display.

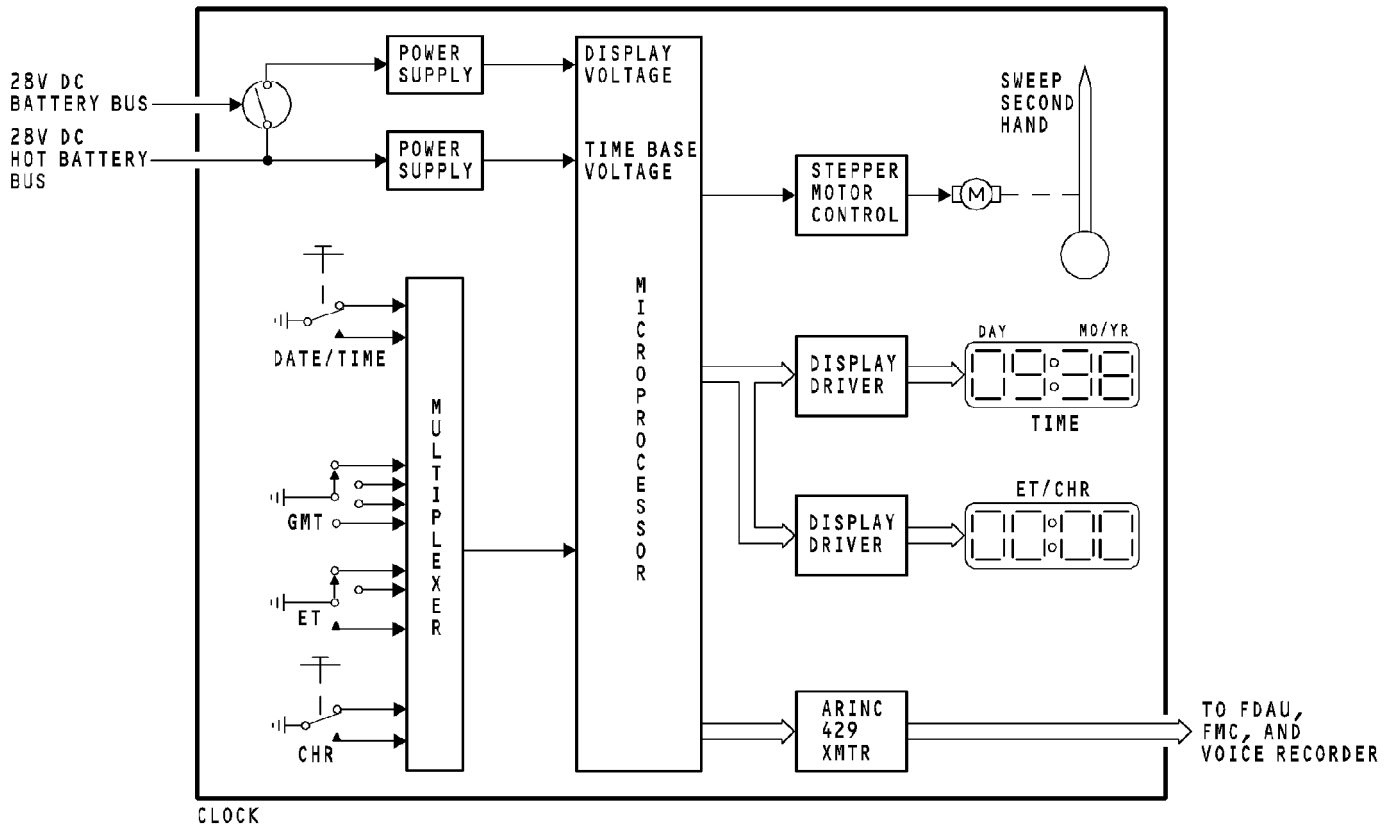
HAP ALL

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

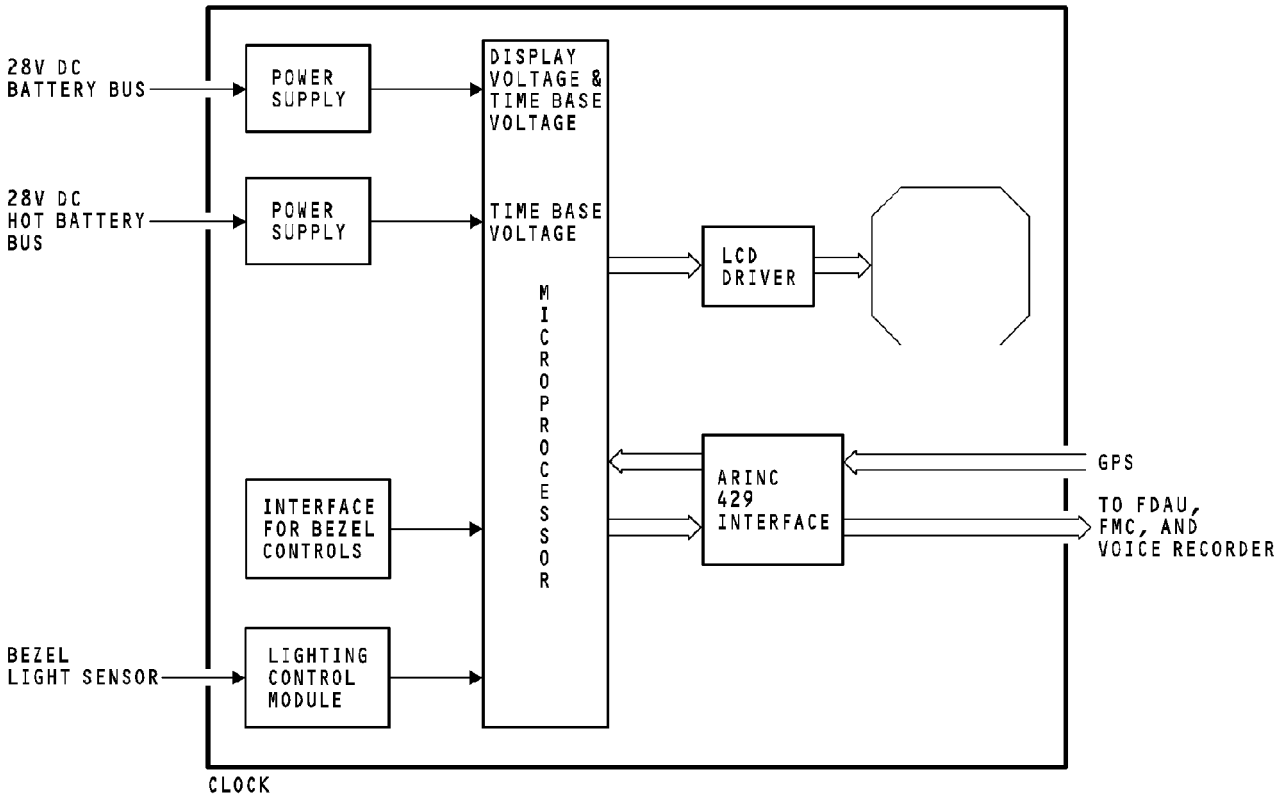
Output to FDAU, FMC, and Voice Recorder

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

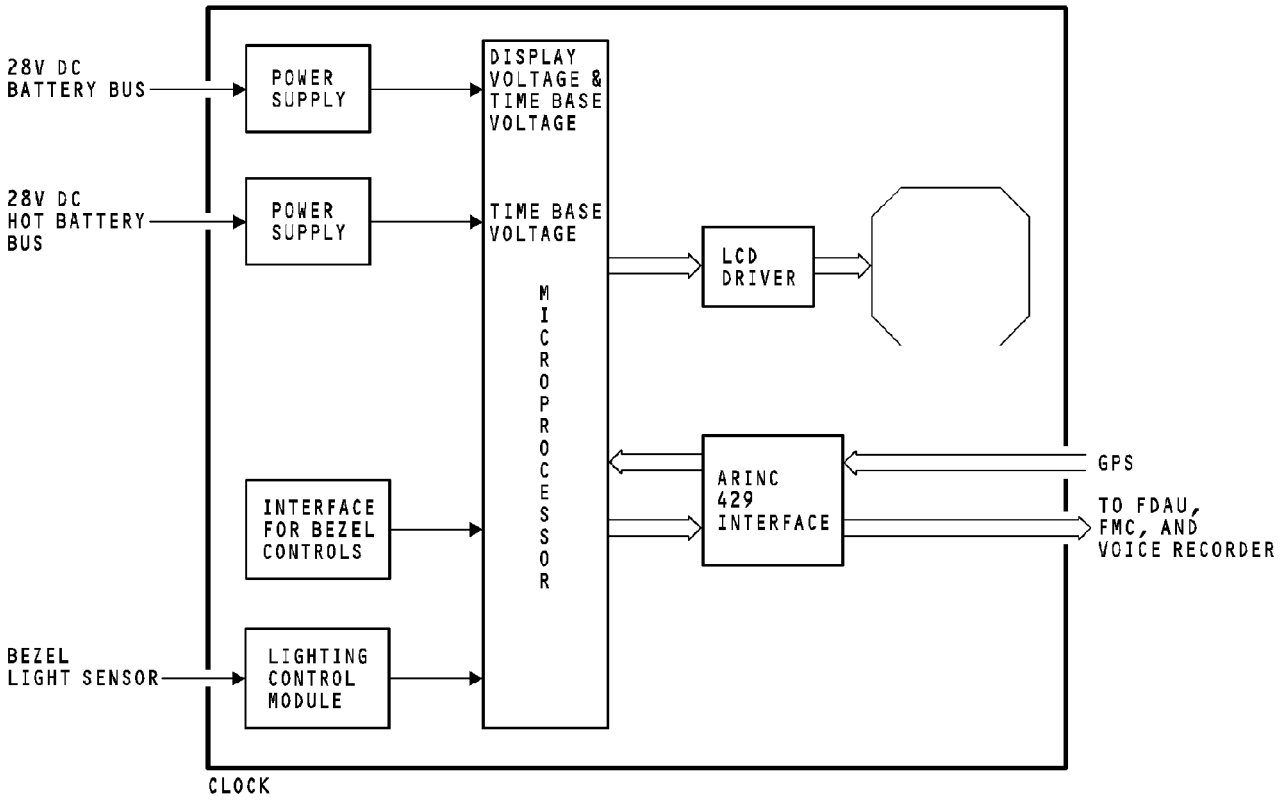
- Clock time
- Clock date.



CLOCKS - FUNCTIONAL DESCRIPTION



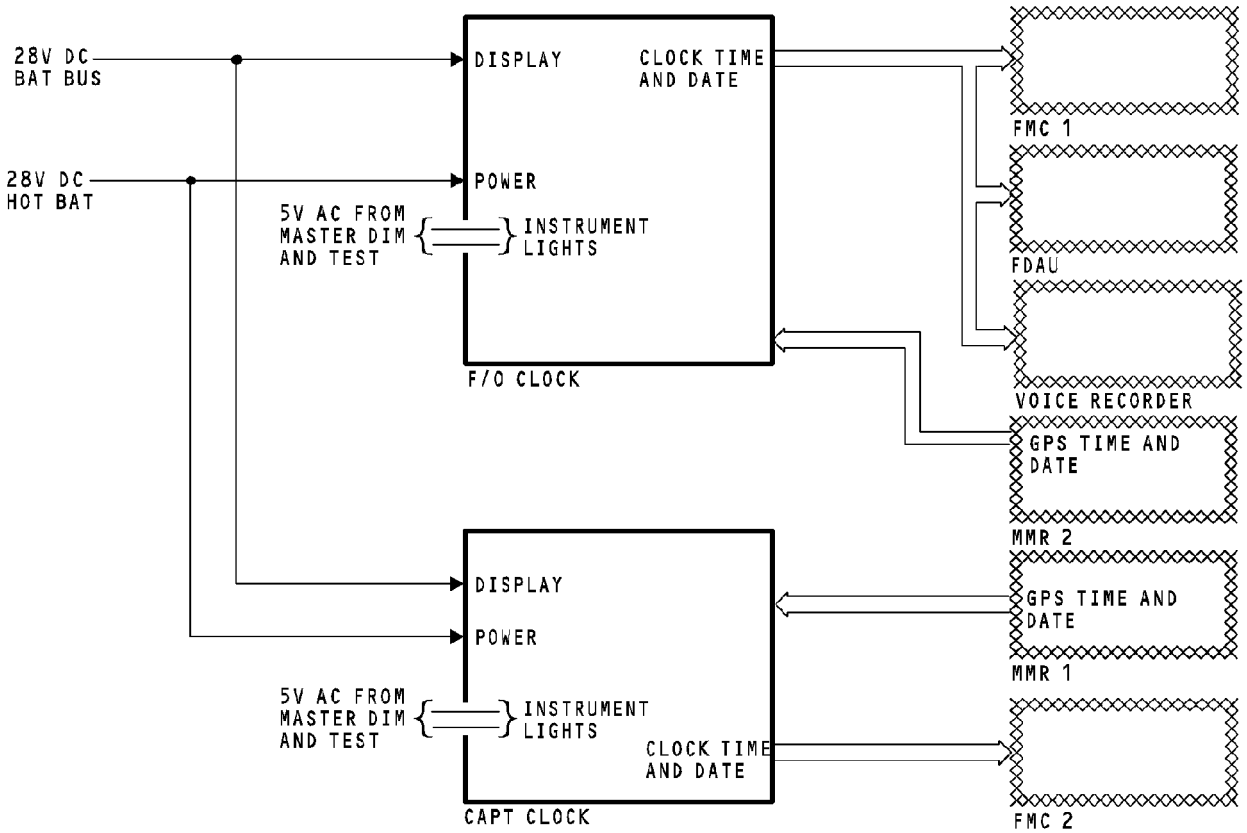
CLOCKS - FUNCTIONAL DESCRIPTION



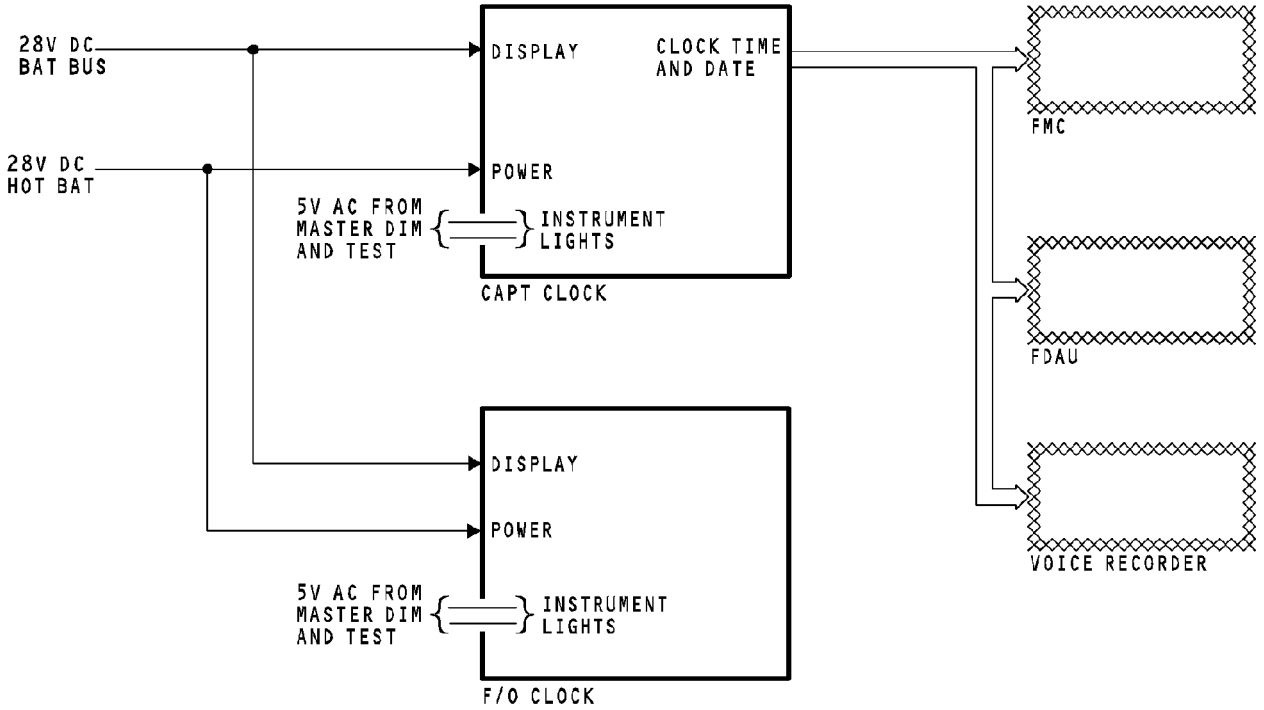
CLOCKS - FUNCTIONAL DESCRIPTION

Power

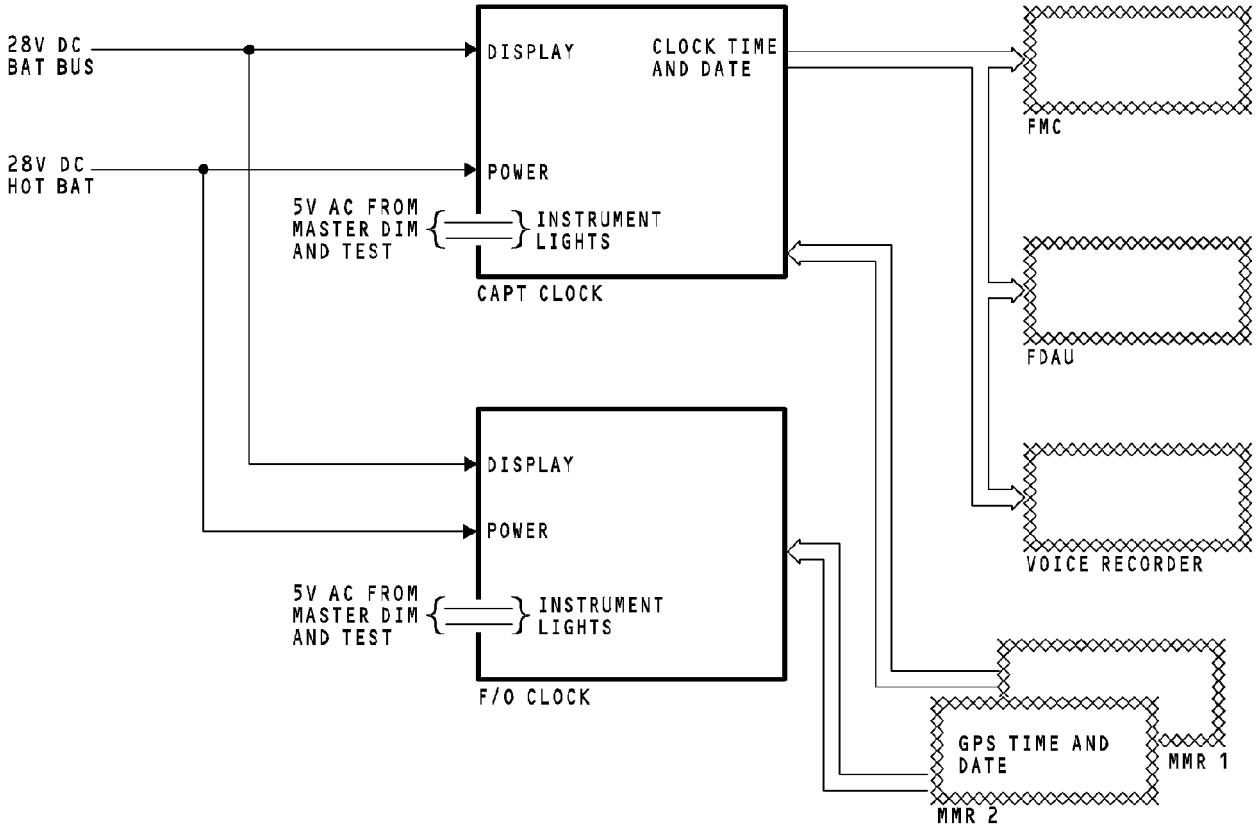
This graphic is for reference purpose only.



CLOCKS - SYSTEM SUMMARY



CLOCKS - SYSTEM SUMMARY



CLOCKS - SYSTEM SUMMARY

FLIGHT DATA RECORDER SYSTEM - INTRODUCTION

Purpose

The flight data recorder system (FDRS) stores airplane parameters and system data for the last 25 hours of operation.

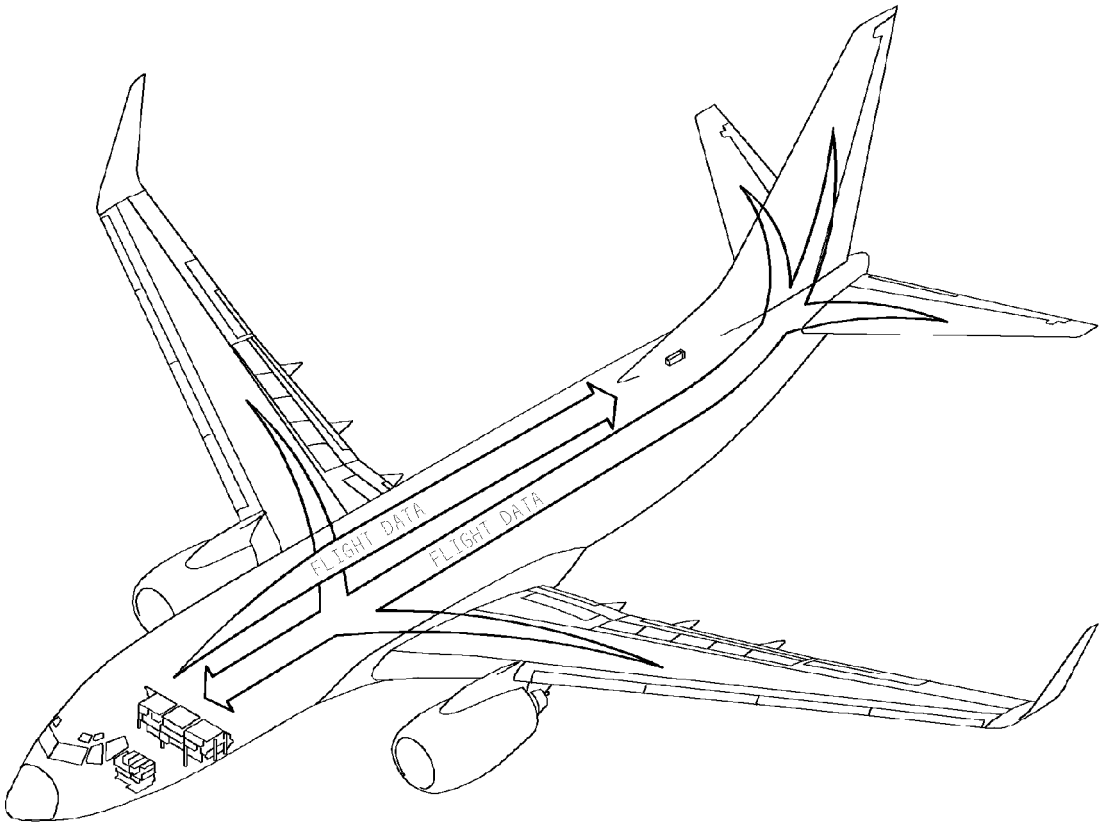
The flight data recorder (FDR) protects the parameters and the system data. If there is an airplane incident, these parameters supply data on flight conditions and airplane systems operation. Airline personnel can also use the data to make an analysis of system performance during airplane maintenance.

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
- IDU - interactive display unit
- IFSAU - integrated flight systems accessory unit
- ILS - instrument landing system
- kg - kilogram

EFFECTIVITY
HAP ALL

- 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



FLIGHT DATA RECORDER SYSTEM - INTRODUCTION

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FDRS - GENERAL DESCRIPTION

General

The flight data recorder system (FDRS) gets and stores airplane parameters from airplane systems and sensors. The flight data recorder (FDR) keeps this data for use during a flight mishap investigation. The FDR protects the data from heat and water. The FDR records parameters that are necessary for regulatory agencies.

The airline can also set additional parameters to record. This data is stored in the FDRS aircraft conditioning monitoring system (ACMS).

The FDRS has these components:

- Flight data recorder (FDR)
- Flight data acquisition unit (FDAU)
- FDAU status relay
- Flight recorder test module
- Accelerometer
- Flight control sensors
- Flight surface position transmitters
- System test plug/connector
- Program switch module.

The FDRS uses the printer to print reports and FDRS status.

ACMS data from the FDAU goes through the data loader control panel to a data loader. The data loader can store data from the FDAU on a disk. The data loader control panel switch lets you select the transfer of ACMS data.

You can transfer software from a disk in the data loader to the FDAU through the data loader control panel.

The control display unit (CDU) controls the ACMS functions in the FDAU.

The FDRS operates automatically when one of the engines is in operation or the airplane is in the air. It also operates on the ground when you put the TEST/NORMAL switch on the flight recorder test module in the TEST position.

Flight Recorder/Mach Airspeed Warning Test Module

The flight recorder test module shows the condition of the flight recorder system. If there is a system fault, an amber OFF light comes on. The OFF light also comes on when the system is off.

The flight recorder test module has a TEST/NORMAL switch. When this switch is in the TEST position, the FDR gets power.

Input Signals

The flight data acquisition unit (FDAU) processes analog, digital, and discrete signals from many sensors and systems.

A three-axis accelerometer gives acceleration data along the vertical, lateral, and longitudinal axis. The flight data recorder system sensors send data about the position of the flight surfaces and controls to the FDAU.

Aircraft Identification

A program switch module gives the aircraft identification number to the flight data acquisition unit (FDAU).

FDAU

The FDAU collects flight data for the flight data recorder. This is mandatory data.

The FDAU also collects aircraft condition monitoring system (ACMS) data for airline use. This is non-mandatory data.

The FDAU changes the mandatory data into the Harvard biphase format. This data goes to the flight data recorder.

The FDAU has ACMS software in its memory. This software selects input data to monitor. The data is changed to a digital format. The FDAU keeps it in memory. Data can go to the data loader control panel and then move to a disk in a data loader.

The FDAU status relay gets status from the FDAU. The status relay controls the FDRS OFF light.

FDR

The FDR gets formatted data from the FDAU and keeps it in solid state non-volatile memory. The flight recorder has the capacity to keep at least the last 25 hours of flight data.

The FDR is a fire and crash resistant LRU. An underwater locator beacon is on the front of the FDR.

System Test Plug/Connector

Connect ground support equipment to the system test plug to test the FDRS.

HAP 038, 041-047, 049-054, 102-106

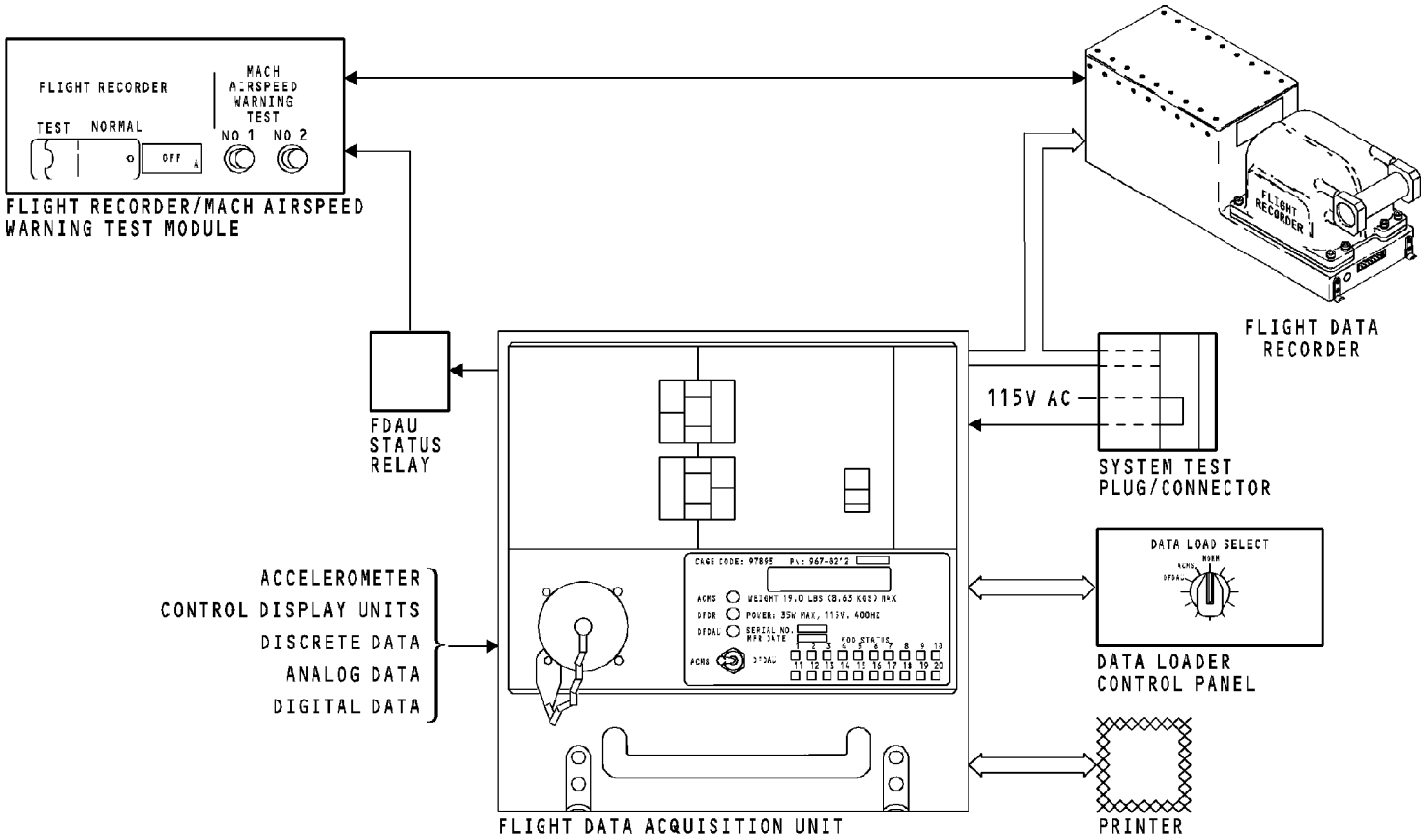
QAR

The FDAU sends the data that goes to the FDR to the QAR for recording and airline use.

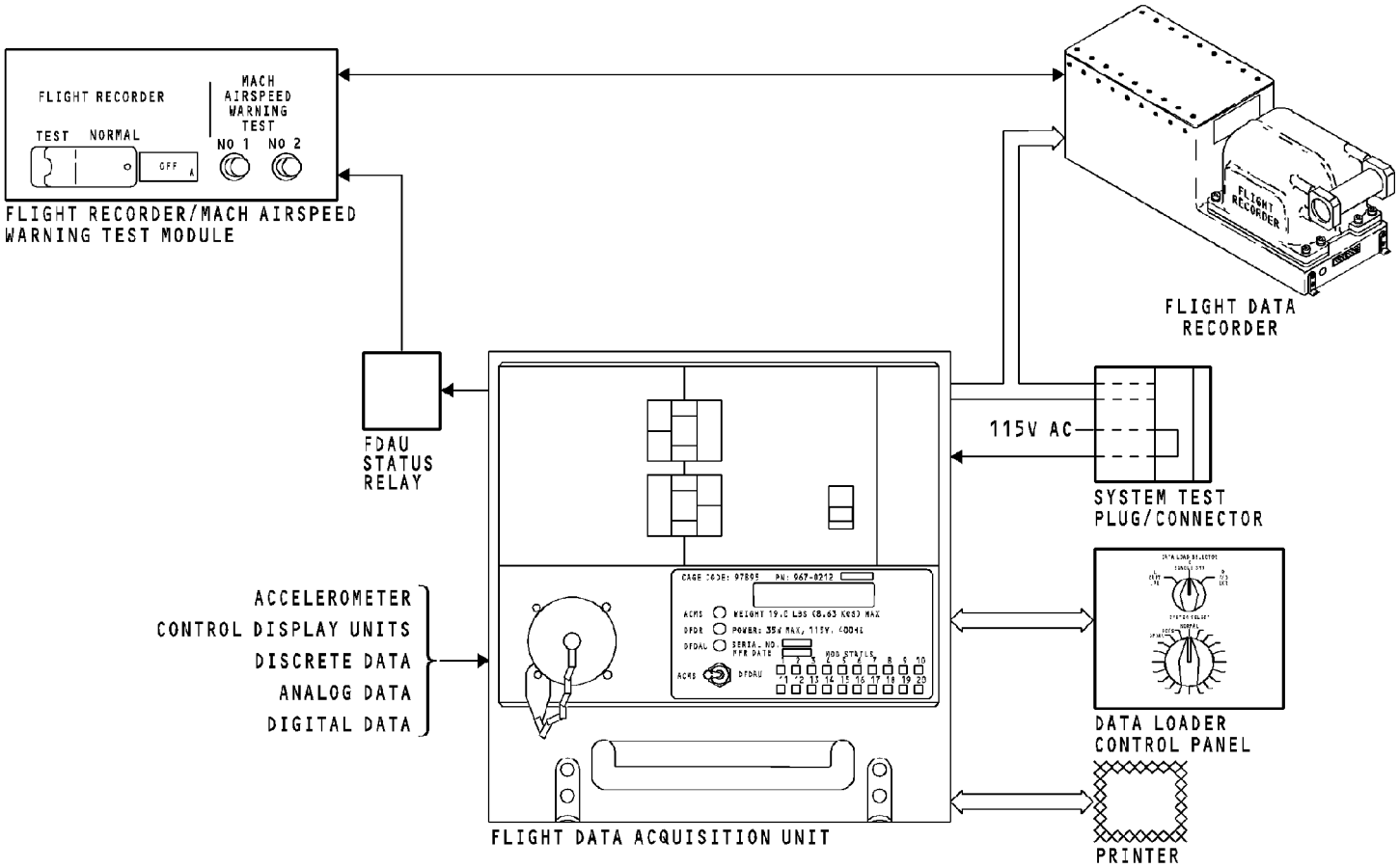
HAP ALL

EFFECTIVITY

HAP ALL



FDRS - GENERAL DESCRIPTION



FDRS - GENERAL DESCRIPTION

EFFECTIVITY

HAP 012, 013, 015-026, 028-054, 101-999; HAP 001-011 POST SB 737-31-1136

31-31-00

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FDRS - FLIGHT COMPARTMENT COMPONENT LOCATION

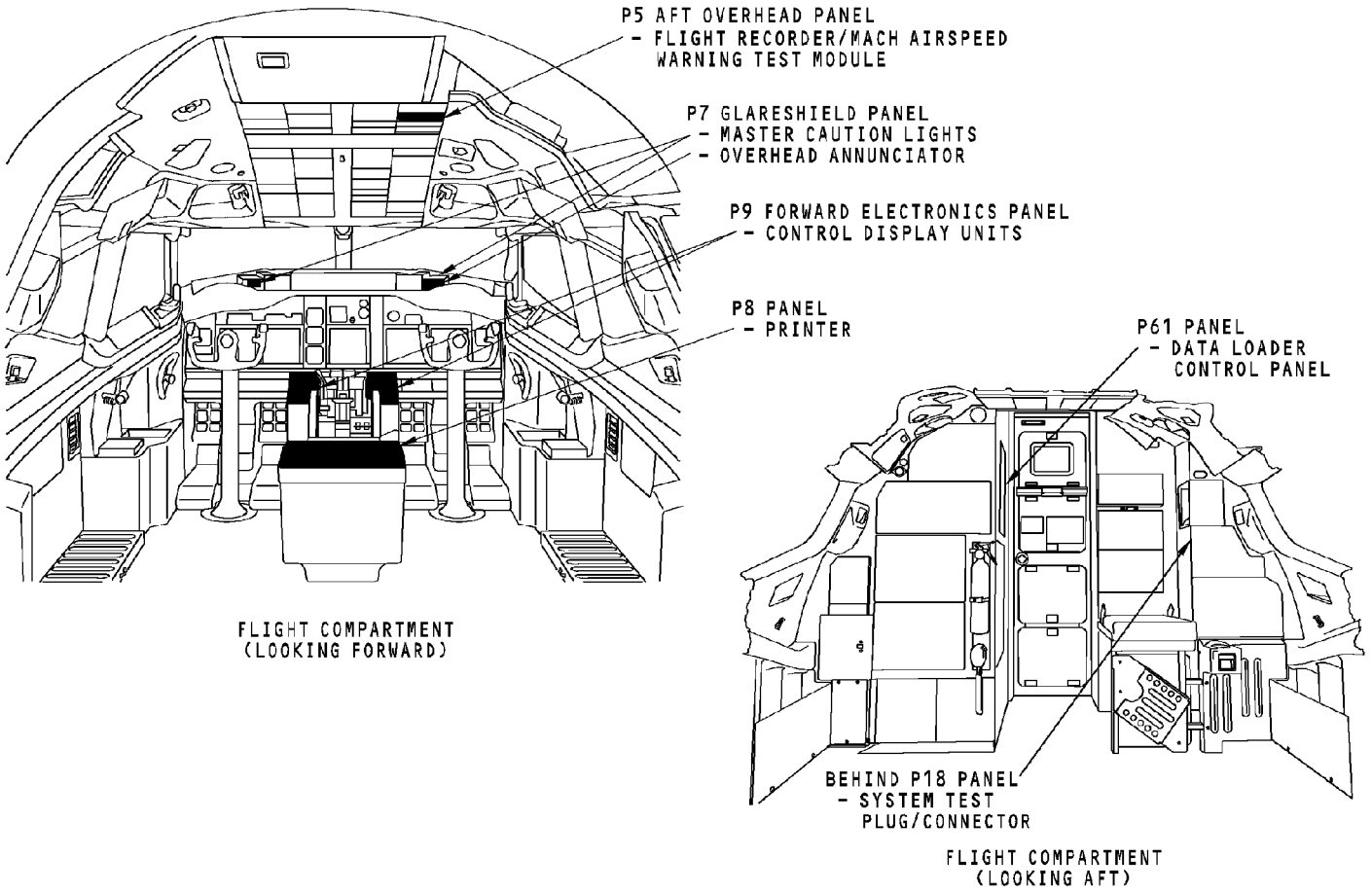
Flight Compartment

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
- Control display units on the P9 forward electronics panel
- Master caution lights and OVERHEAD caution annunciator on the P7 panel
- Data loader control panel on the P61 panel.



FDRS - FLIGHT COMPARTMENT COMPONENT LOCATION

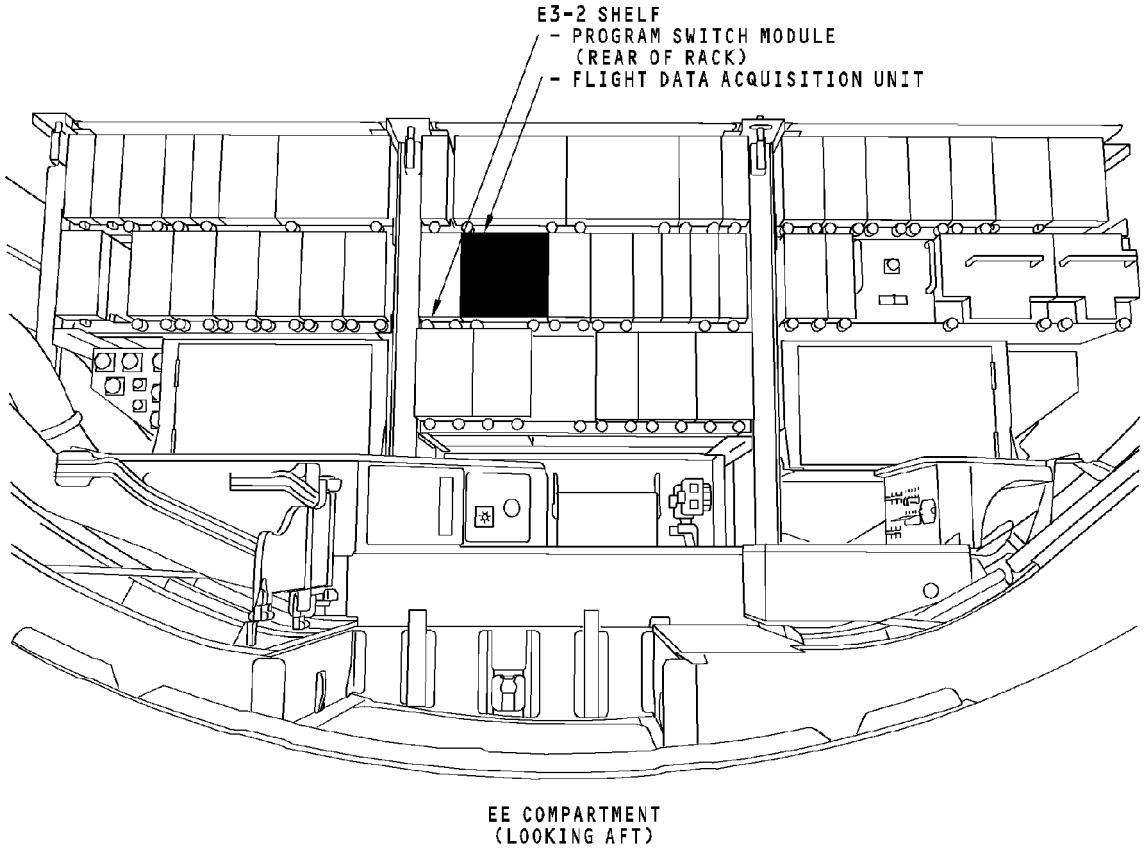
Flight Data Acquisition Unit Location

The flight data acquisition unit (FDAU) is on the E3-2 shelf in the EE compartment. The program switch module is near the rear of the equipment rack.

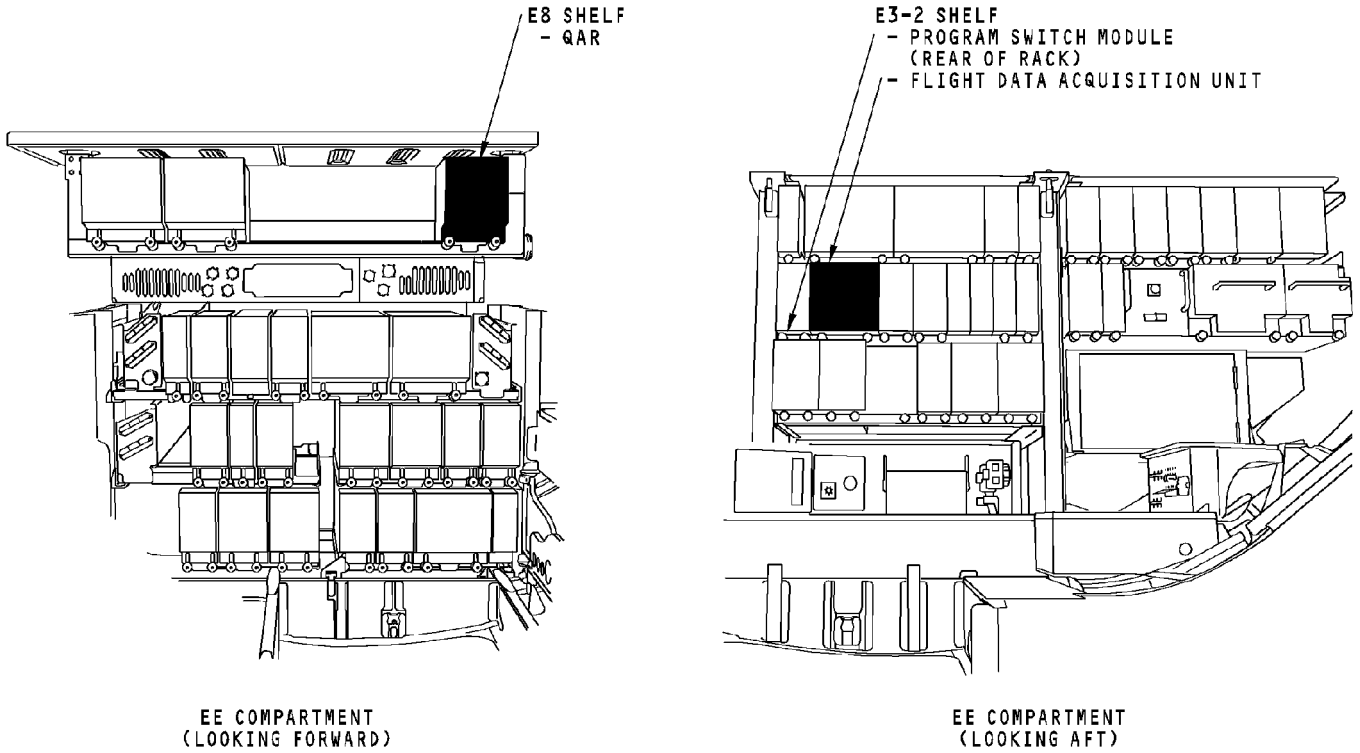
HAP 038, 041-047, 049-054, 102-106

The quick access recorder is on the E8 rack.

HAP ALL



FDRS - ELECTRONIC EQUIPMENT COMPARTMENT COMPONENT LOCATION



FDRS - ELECTRONIC EQUIPMENT COMPARTMENT COMPONENT LOCATION

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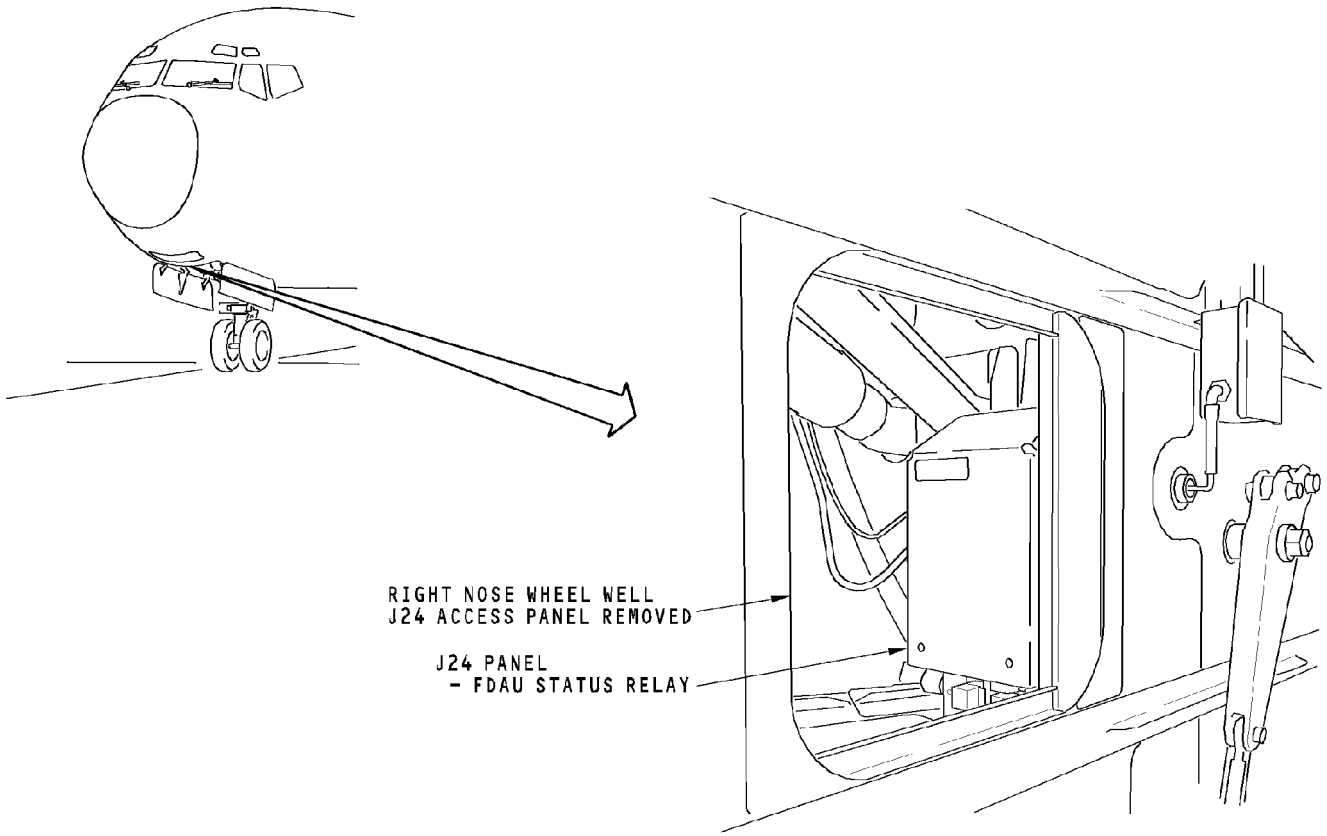
FDRS - NOSE WHEEL WELL COMPONENT LOCATION

FDAU Status Relay

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



FDRS - NOSE WHEEL WELL 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.

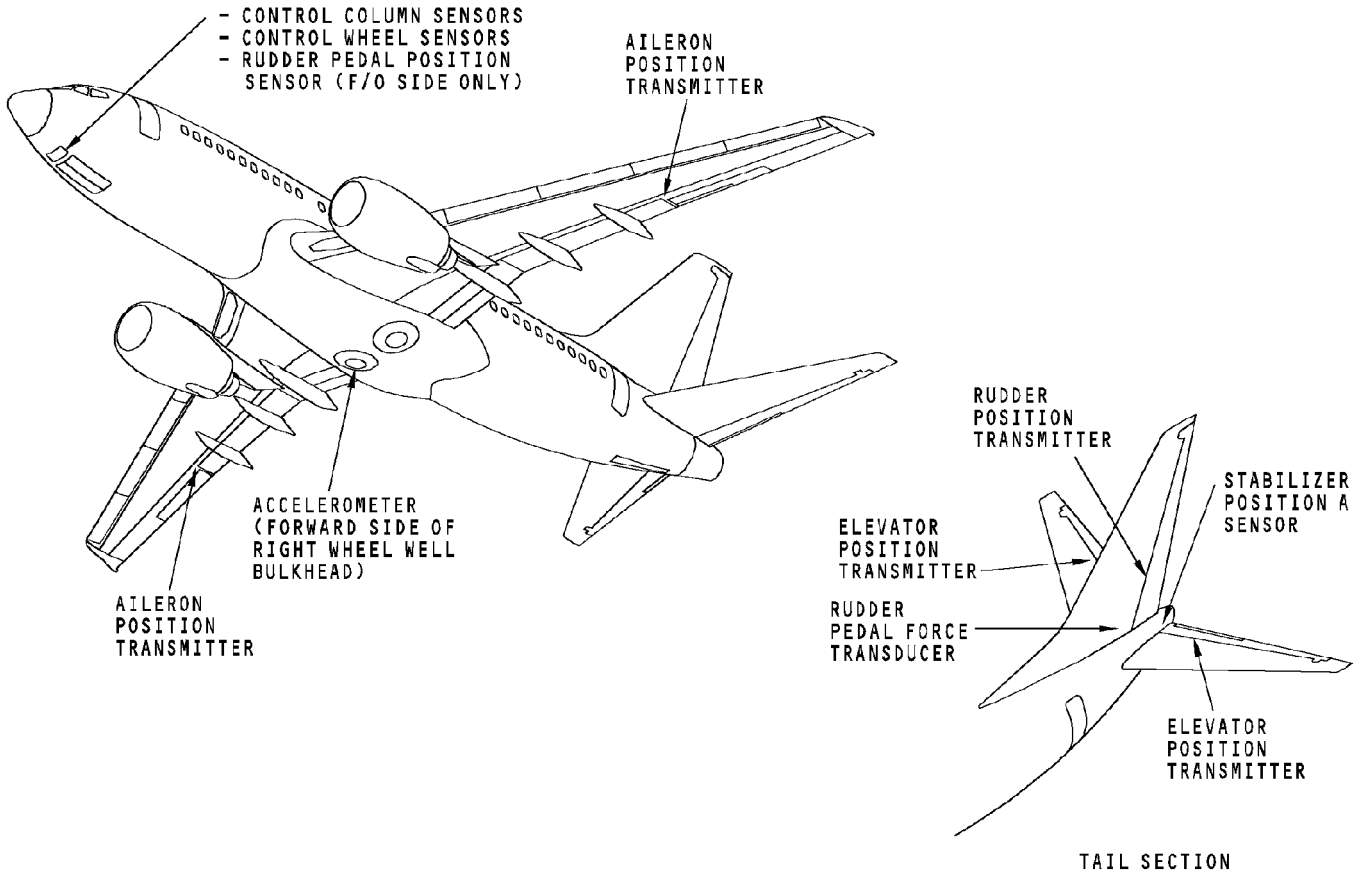
Position Sensor Locations

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.

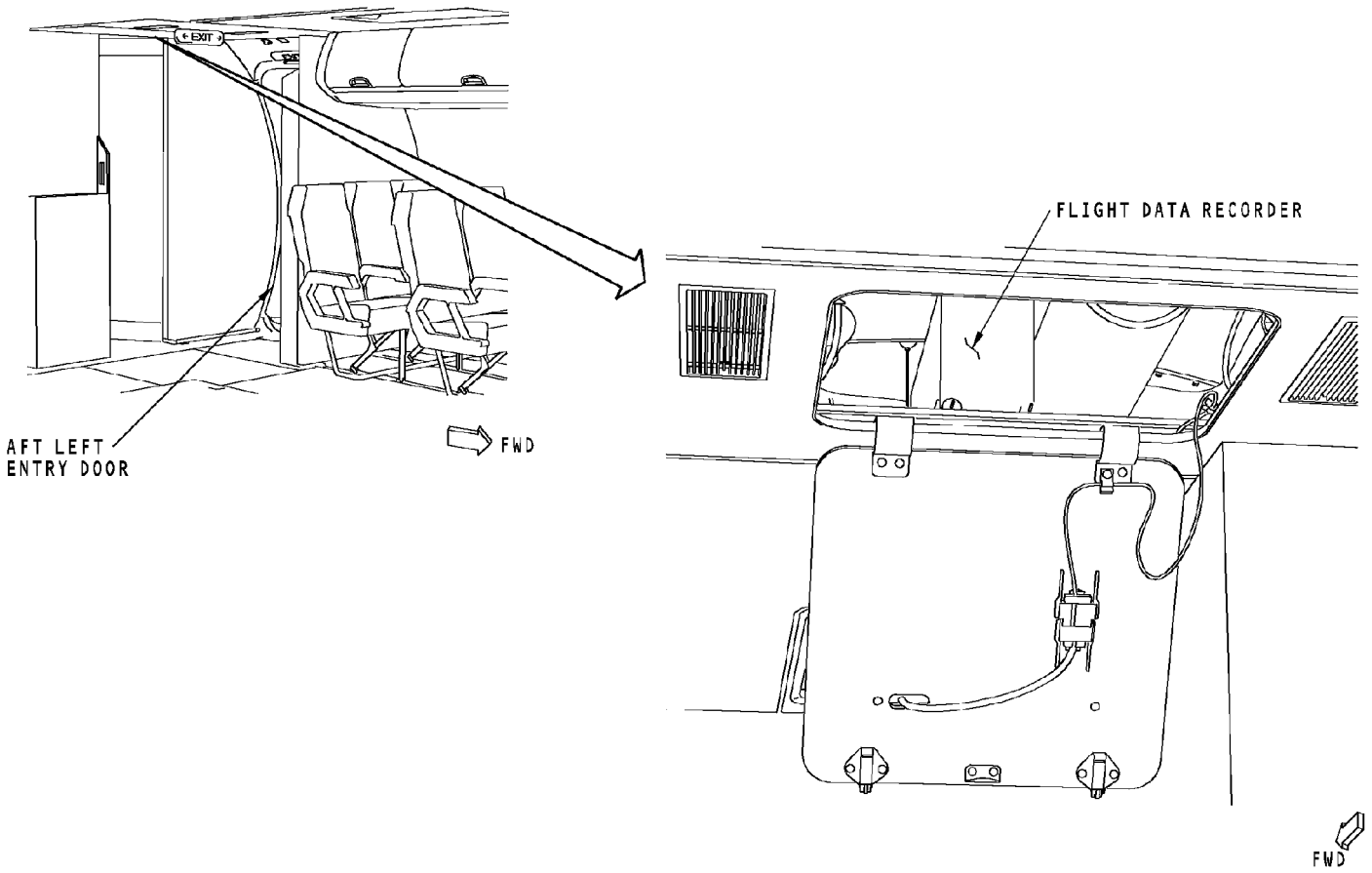


FDRS - AIRPLANE COMPONENT LOCATION

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.



FDRS - AFT CABIN COMPONENT LOCATION

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General

The flight data recorder system (FDRS) collects, formats, and stores digital, discrete, and analog data. The FDR 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 flight data acquisition unit. 115v ac also goes to a relay in the flight recorder/mach airspeed warning panel to turn on the FDR. 26v ac goes to the FDAU for reference voltage for the FDRS sensors.

HAP 038, 041-047, 049-054, 102-106

115v ac also goes to the QAR for power.

HAP ALL

FDAU Status Relay

The FDAU status relay controls the flight recorder OFF light. Normally, the FDAU 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 FDAU 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
- FDR status flag signal shows a fault.

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

When the switch is in the NORMAL position, the FDR 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.

Flight Data Acquisition Unit

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

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

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

HAP 038, 041-047, 049-054, 102-106

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

HAP ALL

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

System Test Plug

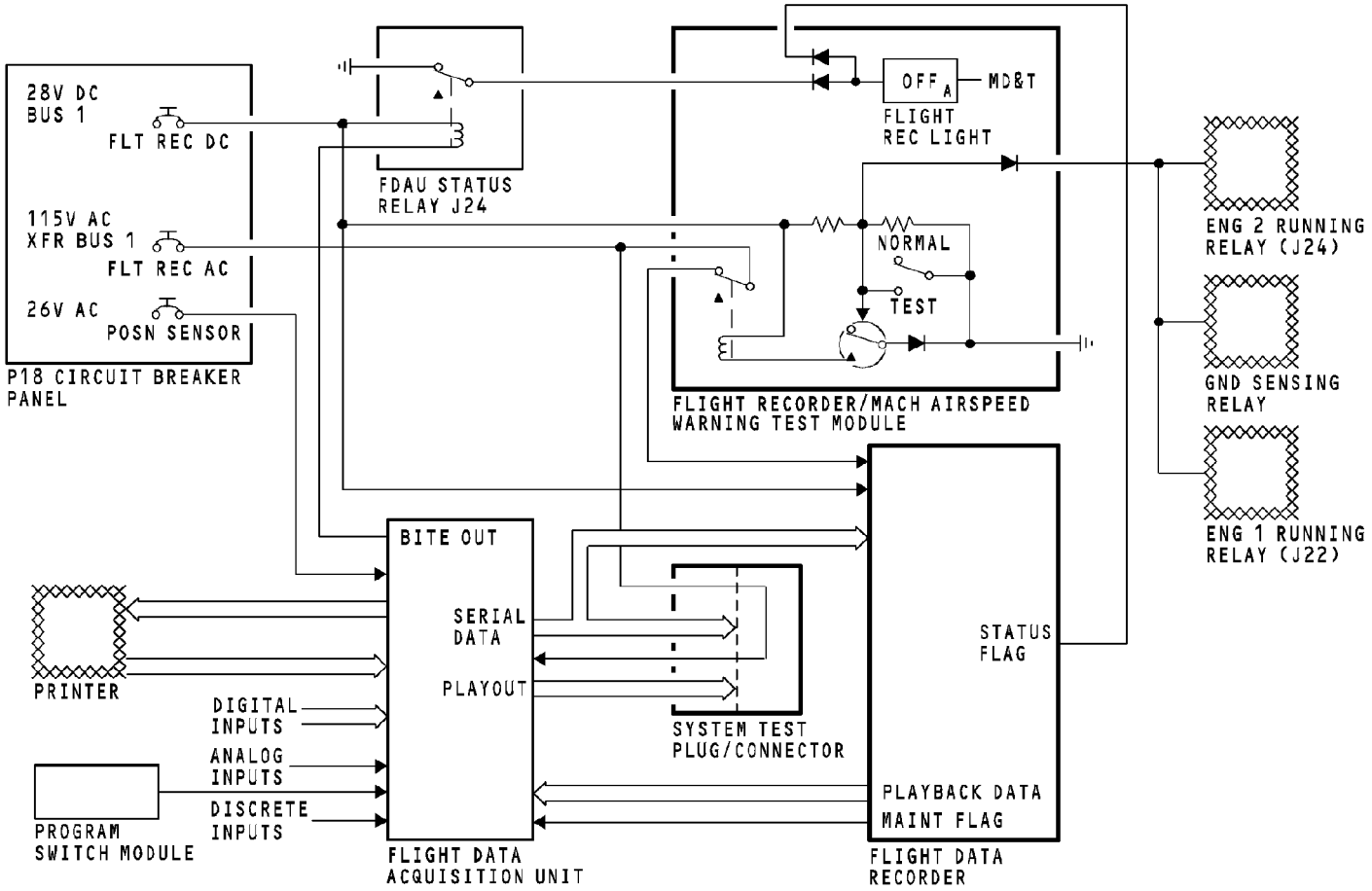
The system test plug sends 115v ac to the FDAU. It can also send 115v ac to some test equipment. You can monitor FDR signals at the system test plug. The test plug gets two data inputs. The data that goes to the flight recorder also goes to the system test plug. If the data to the flight recorder is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

Flight Data Recorder

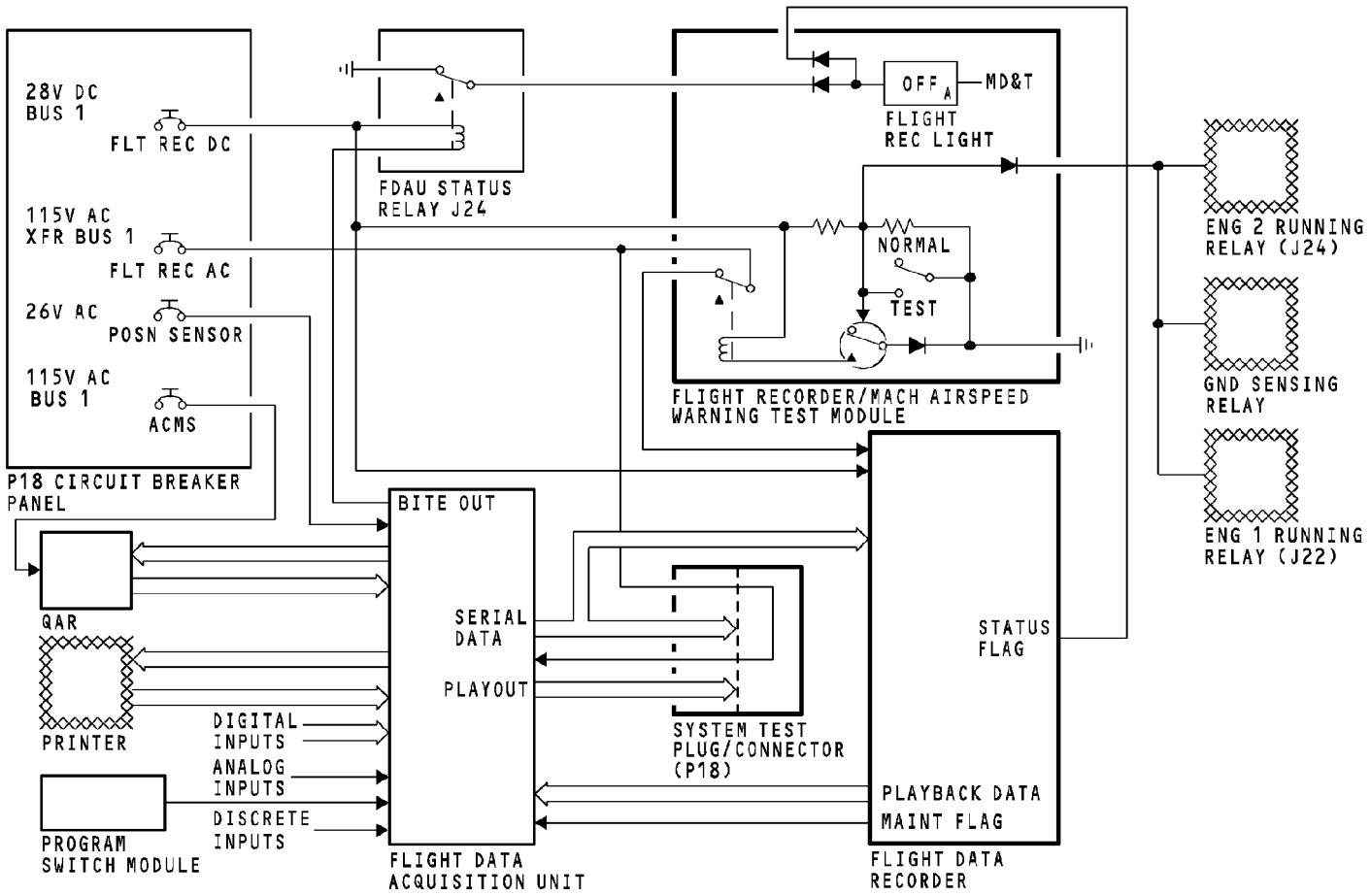
The flight data recorder gets the data and keeps it in a solid state memory.

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 FDAU.



FDRS - POWER, SIGNAL, AND BITE INTERFACE



FDRS - POWER, SIGNAL, AND BITE INTERFACE

General

You can transfer software from a data loader to the FDAU. The data loader control panel selects where the software goes.

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

The FDAU connects to the data loader control panel.

HAP 031-054, 101-999

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.

HAP 001-013, 015-026, 028-030

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.

HAP ALL

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 FDAU. This software goes to the ACMS interface or the mandatory interface.

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

HAP 001-011 PRE SB 737-31-1136

Data Loader Control Panel Switch

The data loader control panel has a switch with these FDRS selections:

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

HAP 012, 013, 015-026, 028-054, 101-999; HAP 001-011 POST SB 737-31-1136

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 FDAU.

EFFECTIVITY
HAP ALL

HAP 012, 013, 015-026, 028-054, 101-999; HAP 001-011 POST SB 737-31-1136 (Continued)

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

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

HAP ALL

FDAU

The FDAU has these sections:

- ACMS interface
- Mandatory interface.

HAP 001-013, 015-026, 028-030

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

HAP 031-054, 101-999

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.

HAP ALL

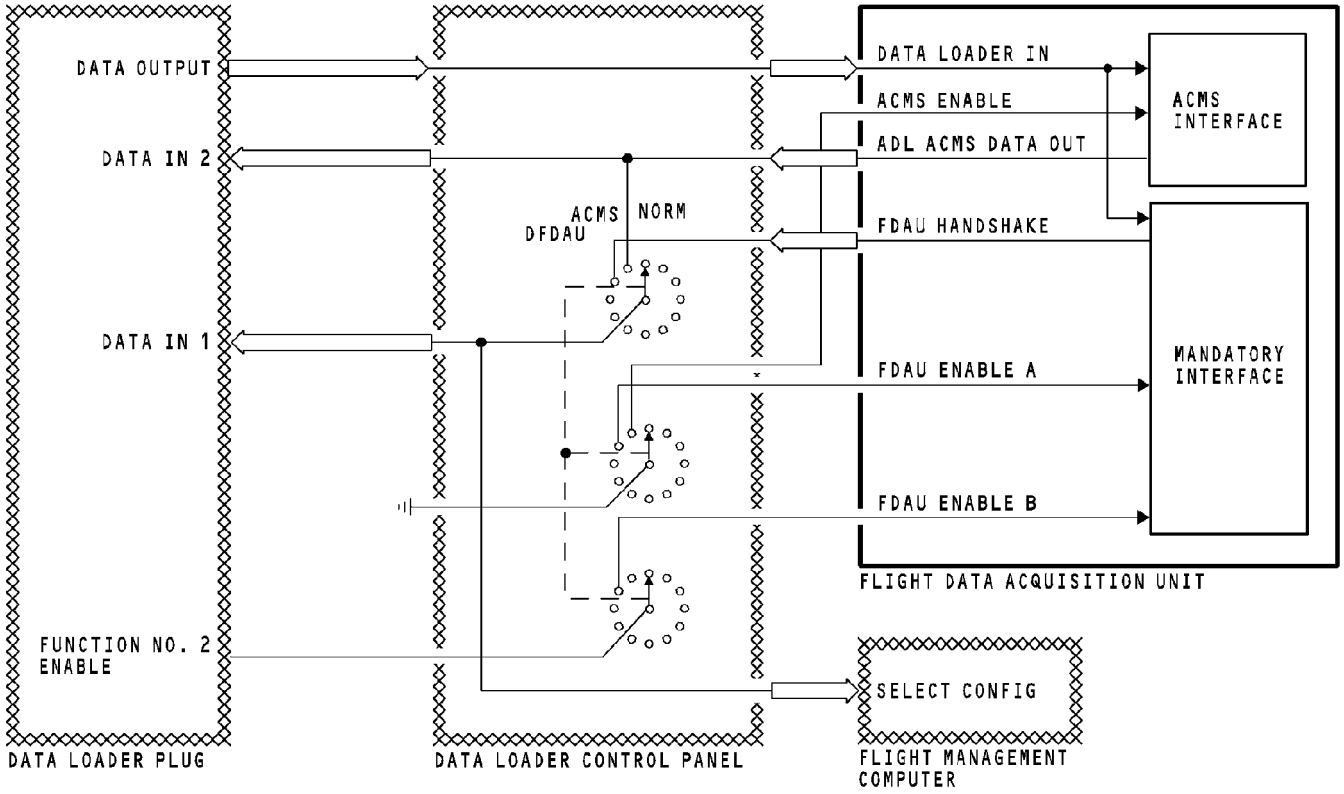
Software goes to the ACMS or mandatory interface on the data output bus. A discrete from the data loader control panel tells the FDAU where to send the software. While the software is loading, the FDAU sends handshake signals to the data loader. These signals give the data loader the status of the procedure.

Flight Management Computer

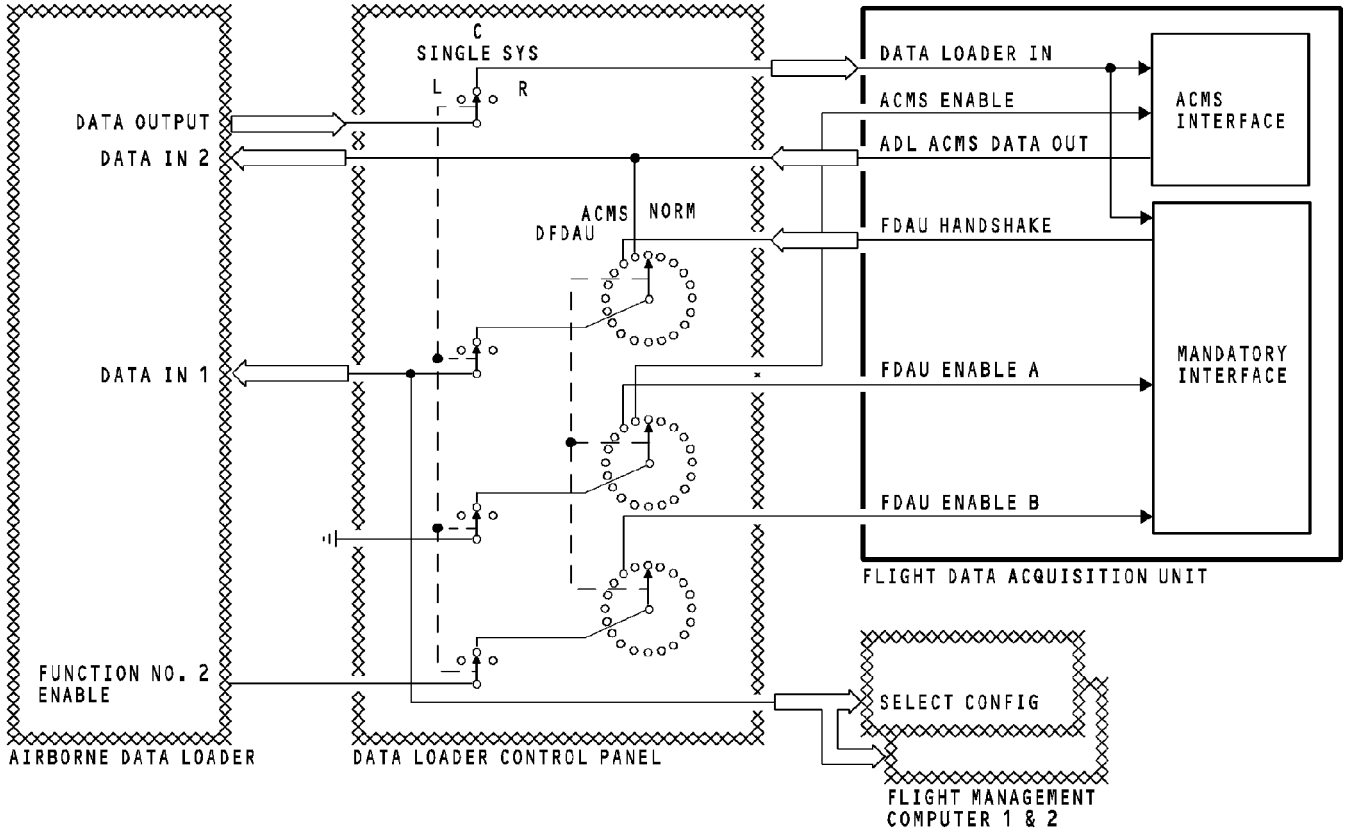
The data loader control panel sends information from the ACMS or the mandatory processor in the FDAU to the flight management computer (FMC). The ACMS and mandatory processors send the software part number to the FMC.

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:

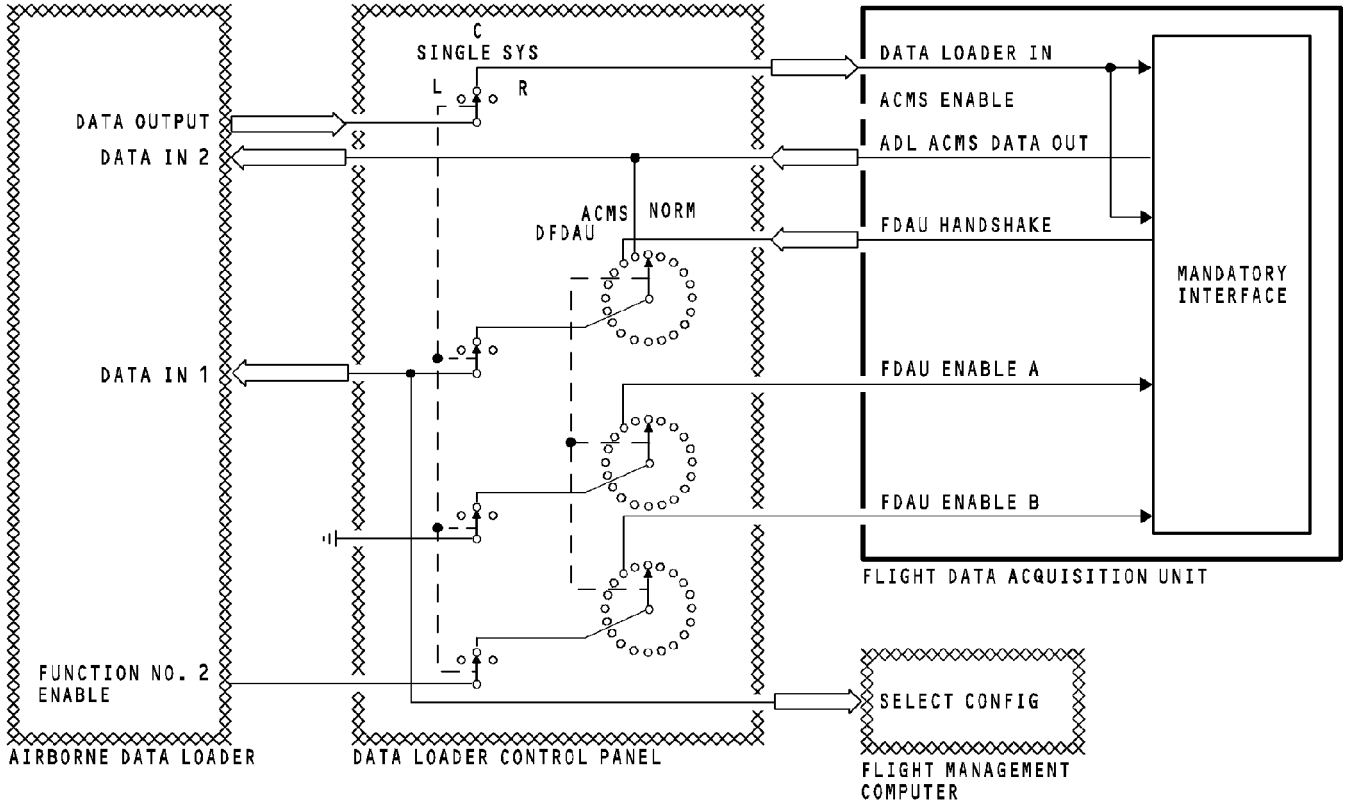
- Select the system on the data loader control panel
- Select the SEL CONFIG (select configuration) prompt on the INIT/REF (initialization reference) INDEX page on the CDU.



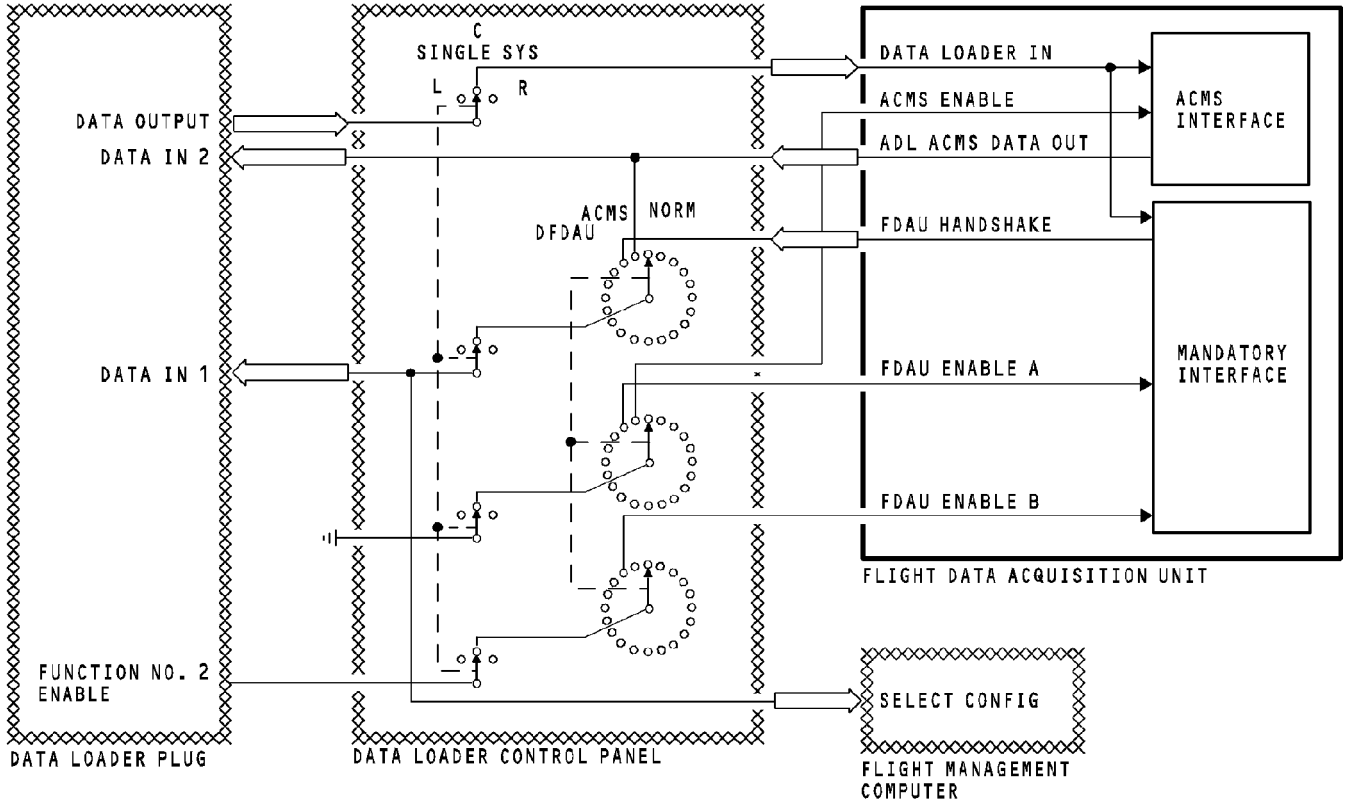
FDRS - DATA LOADER INTERFACE



FDRS - DATA LOADER INTERFACE



FDRS - DATA LOADER INTERFACE



FDRS - DATA LOADER INTERFACE

EFFECTIVITY

HAP 012, 013, 015-026, 028-030; HAP 001-011 POST SB 737-31-1136

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General

These line replaceable units (LRUs) send data to the FDAU in 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 FDAU gets digital data from many different airplane systems. The mandatory data goes to the FDR through the FDAU. The data that each operator records in the FDR is dependant on their aviation authority.

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

- DME distance
- DME failure
- Antenna failure
- DME display discrete.

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

- 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 FDAU:

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

The GPWS sends these parameters to the FDAU:

EFFECTIVITY
HAP ALL

- Wind shear caution
- Wind shear
- Terrain pull up
- Minimums
- Glideslope
- Too low terrain
- Too low flap
- Too low gear
- Don't sink
- Terrain
- Pull up
- Sink rate
- GPWC failure.

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

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

The TCAS computer sends these parameters to the FDAU:

- 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 FDAU:

- 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 FDAU:

- GMT
- GMT (hrs/min)
- GMT (second)
- Date (day)

- Date (month)
- Date (year).

DEU 1 and 2 send these parameters to the FDAU:

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

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

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

- 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 FDAU:

- 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

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- 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
- 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 FDAU:

- 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 FDAU:

- 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 FDAU:

- 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
- 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.

CDU Inputs

The CDUs can control the operation of the ACMS portion of the FDAU. The CDUs can call up reports and control the optional printer. You can also verify the ACMS software part numbers on the CDU.

HAP 001-007, 031-054, 101-999

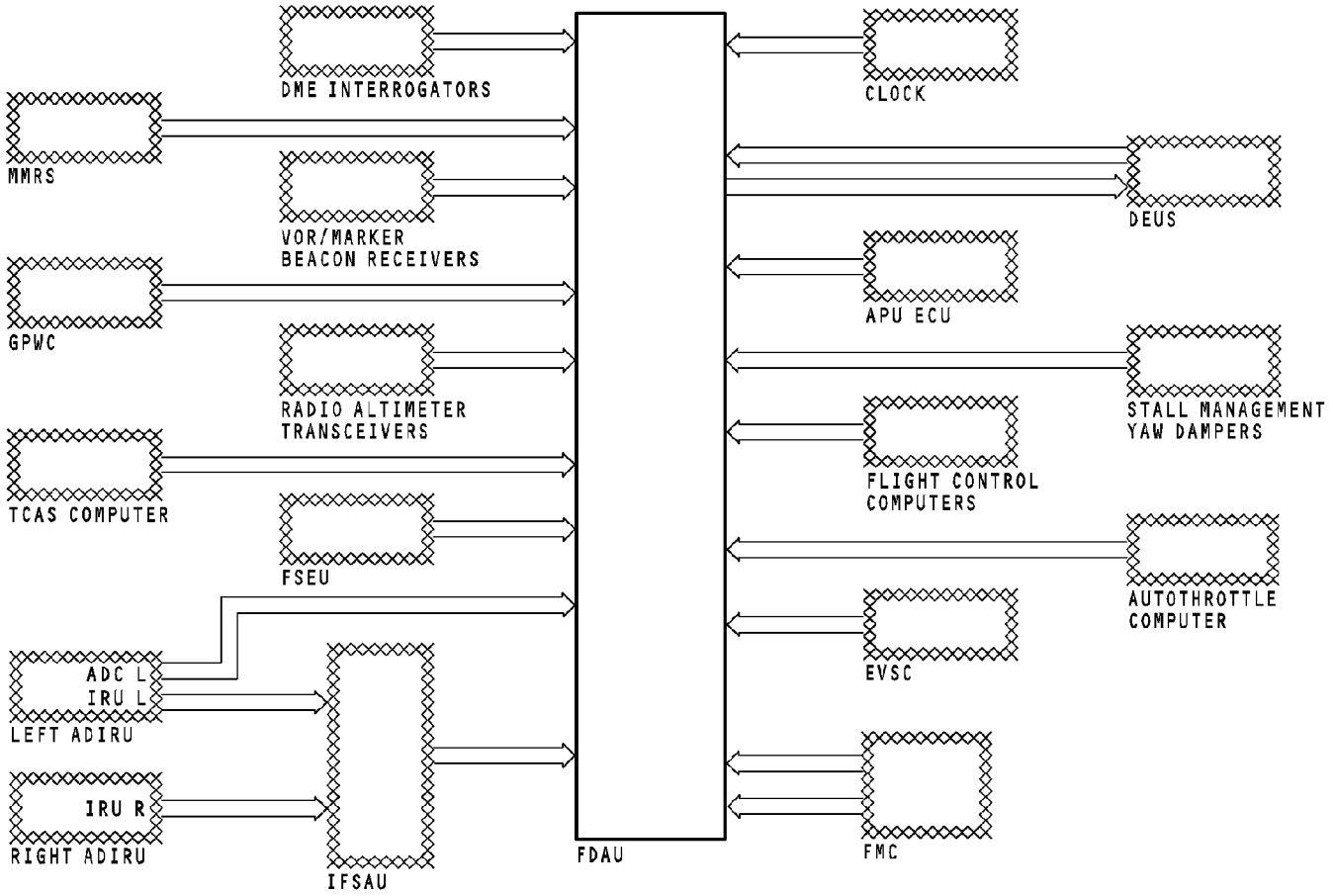
DEU Inputs

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

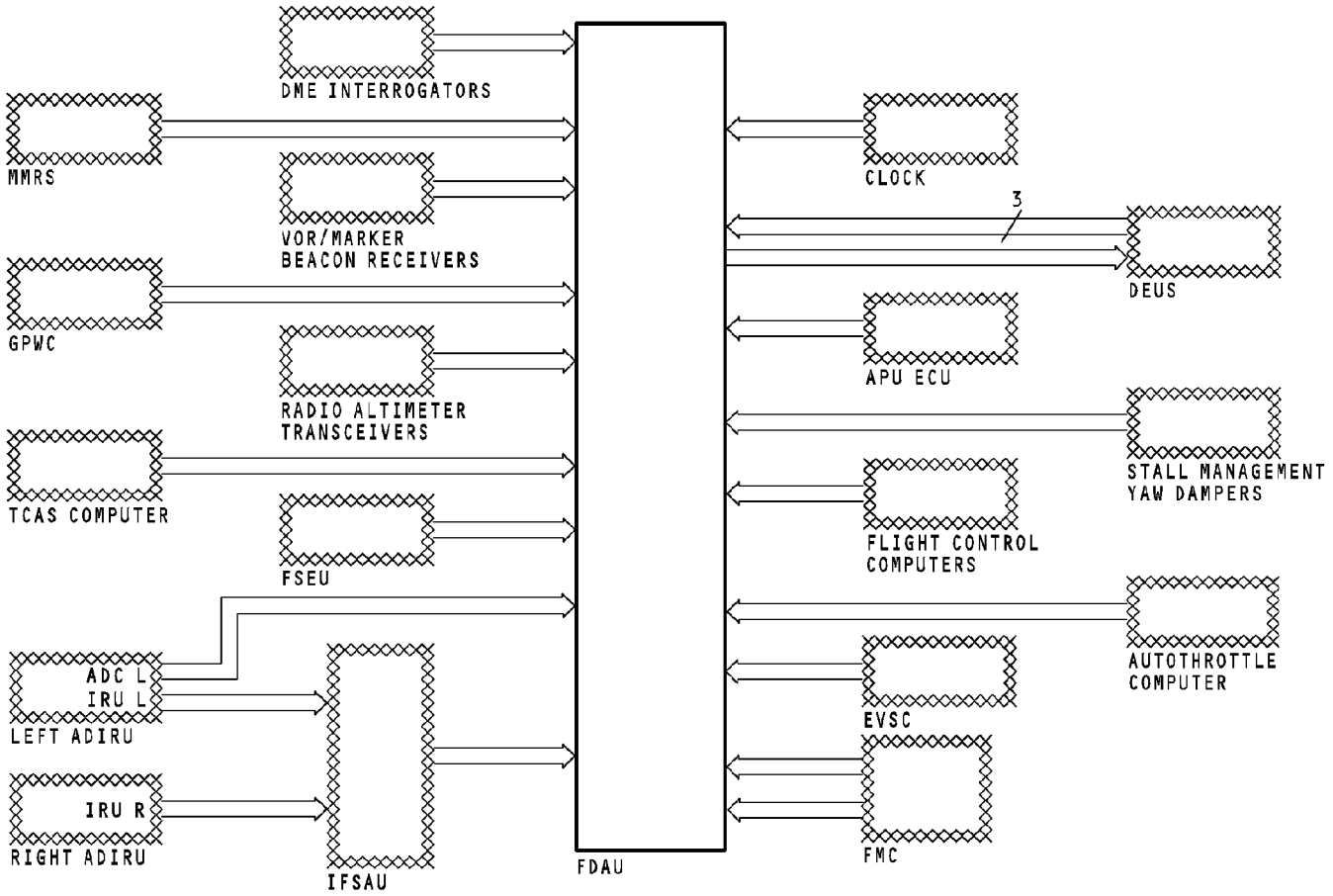
HAP ALL

DEU Outputs

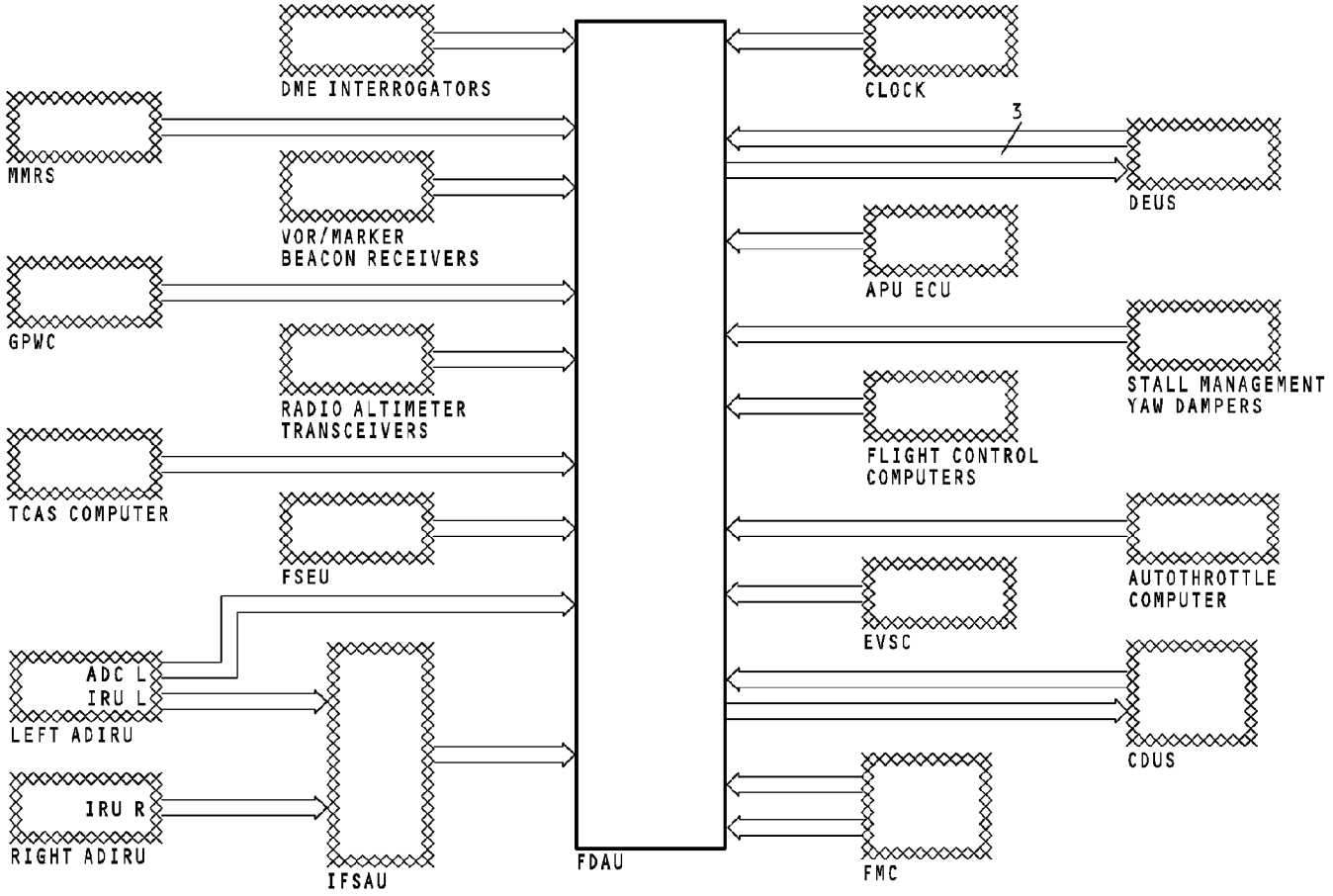
The FDAU sends flight surface position information to the DEUs.



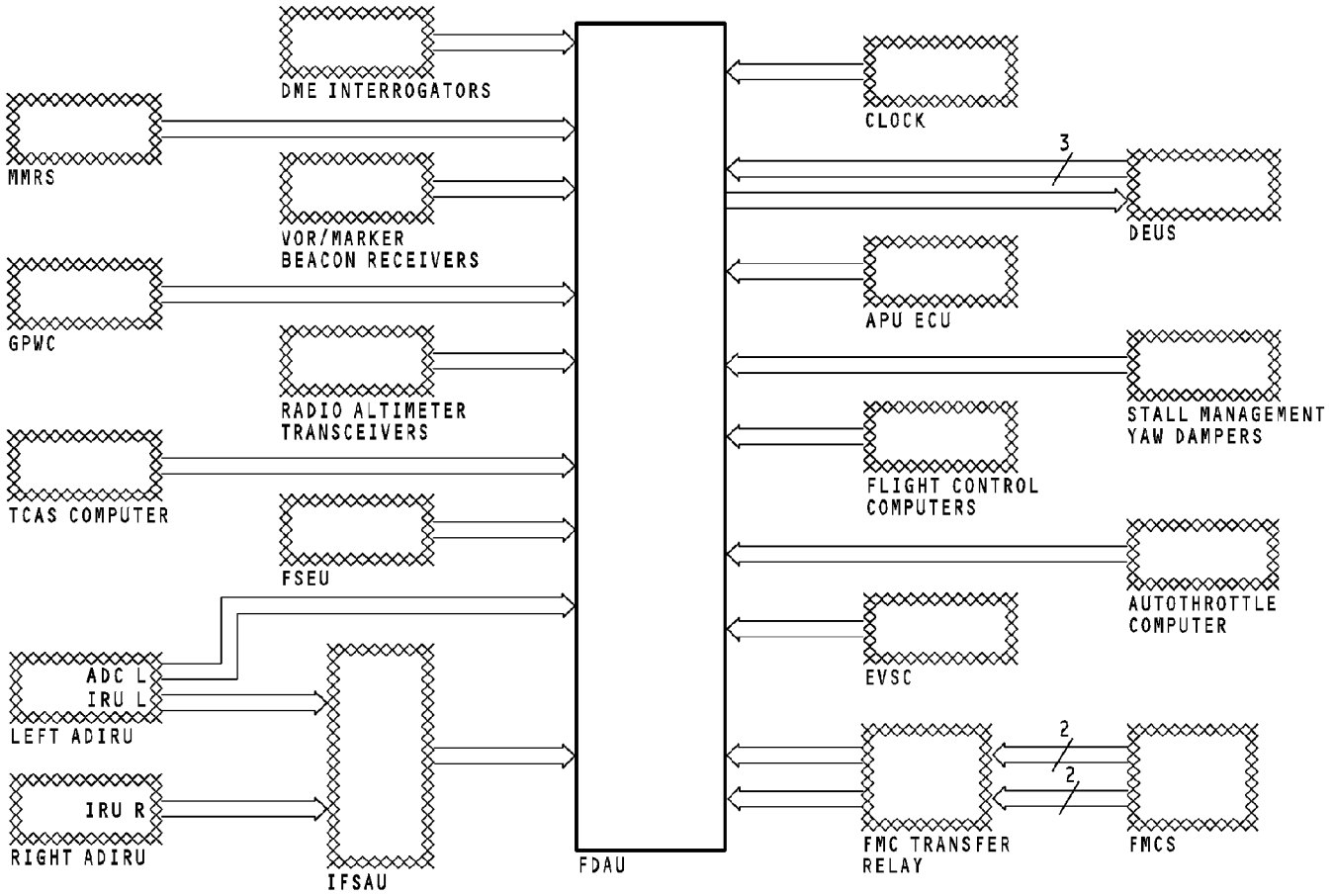
FDRS - FDAU DIGITAL INTERFACE



FDRS - FDAU DIGITAL INTERFACE



FDRS - FDAU DIGITAL INTERFACE



FDRS - FDAU DIGITAL INTERFACE

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General

These LRUs send data to and receive data from the data management unit (DMU) master controller in the FDAU:

- Printer - The printer prints reports and sends status to the FDAU on an output data bus.

HAP 038, 041-047, 049-054, 102-106

- Quick access recorder (QAR) - The QAR records data on a data bus and sends status to the FDAU on an output data bus.

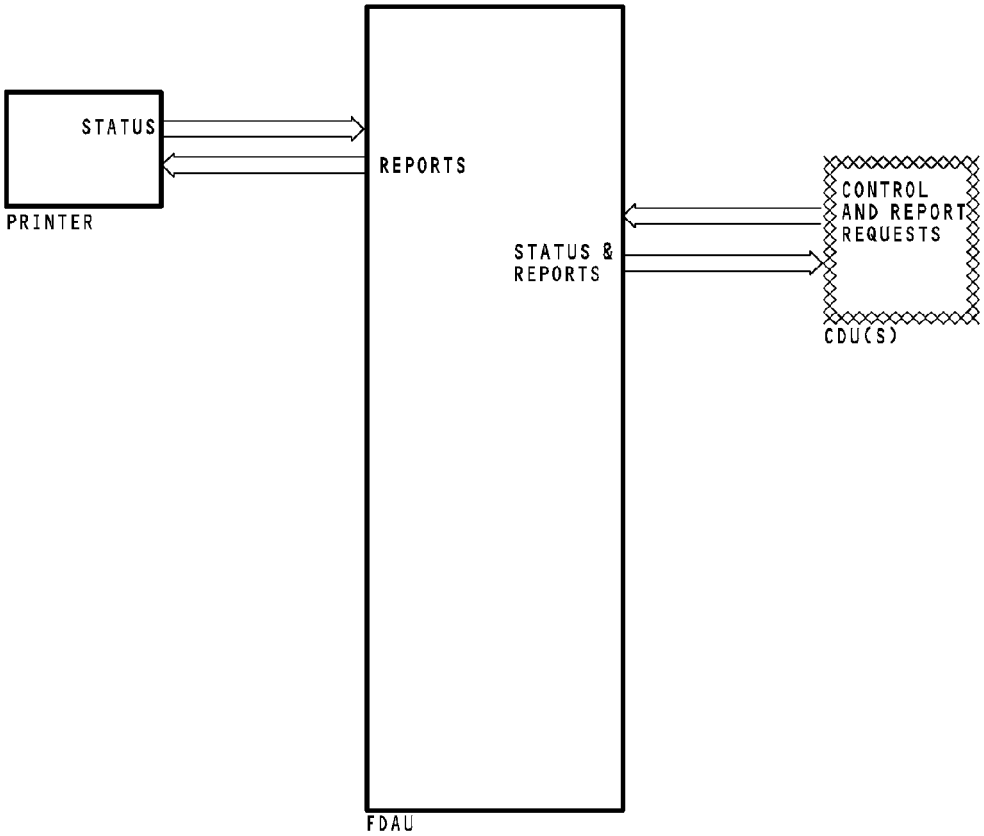
HAP ALL

- Control display units (CDUs) - The CDUs are the interface to the FDAU.

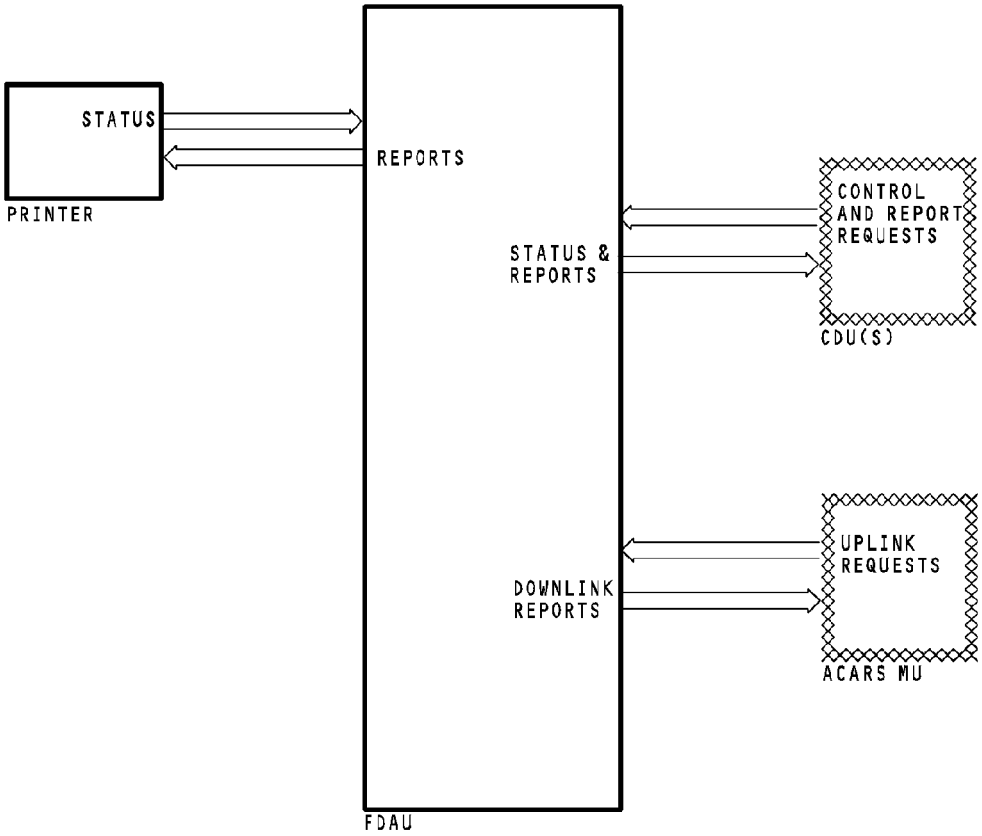
HAP 001-013, 015-026, 028-030

- Aircraft communication addressing and reporting system (ACARS) - ACARS sends requests to the FDAU for data and sends the data to the ground.

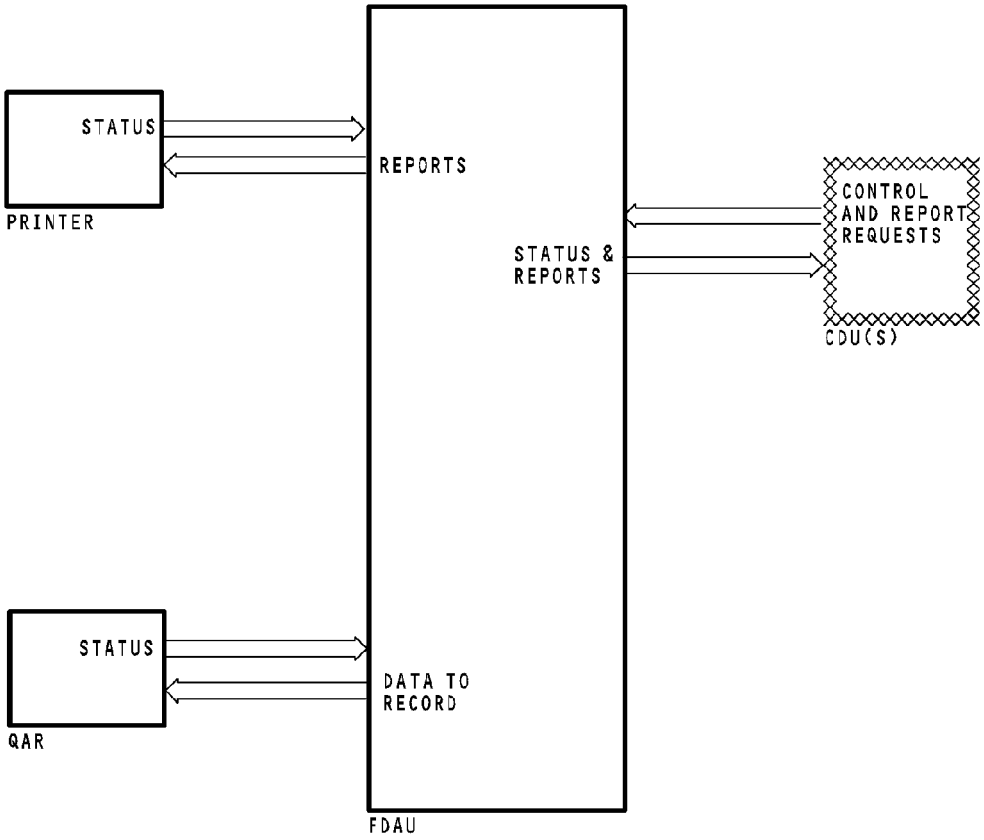
HAP ALL



FDRS - FDAU ACMS INTERFACE



FDRS - FDAU ACMS INTERFACE



FDRS - FDAU ACMS INTERFACE

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General

Analog inputs to the FDAU come from these sources:

- Accelerometer
- Sensors
- Transducers
- Transmitters.

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

Accelerometer

The accelerometer supplies these three analog outputs to the FDAU:

- Vertical acceleration
- Lateral acceleration
- Longitudinal acceleration.

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

Sensors

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

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

The spoiler position sensor gives these inputs to the FDAU:
- Spoiler 3 position
- Spoiler 10 position.

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

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

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

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

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

HAP 008-013, 015-026, 028-054, 101-999; HAP 001-007 POST SB 737-31-1124

Transducers

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

HAP ALL

Transmitters

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

EFFECTIVITY

HAP ALL

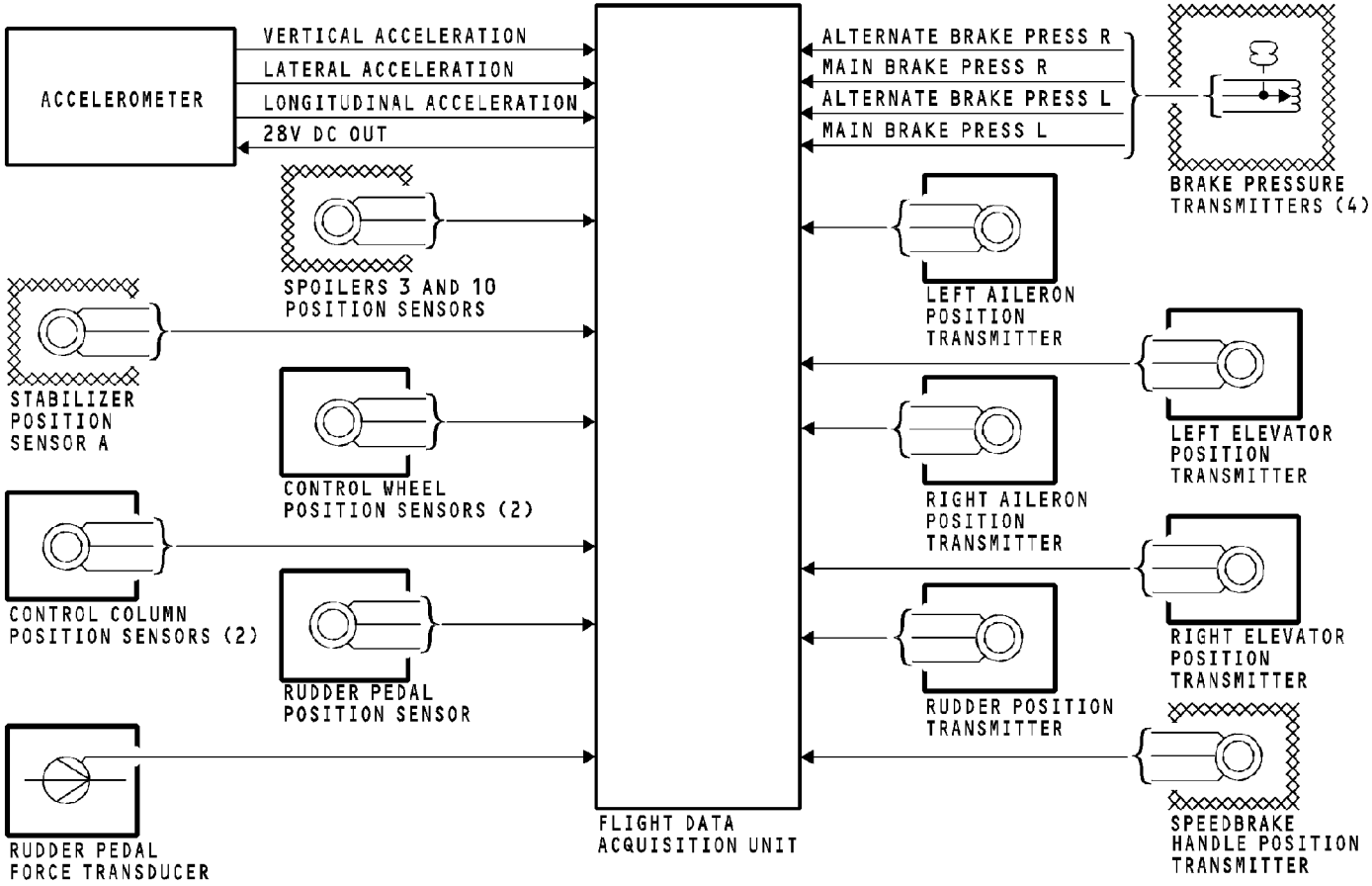
The rudder position transmitter gives position input to the FDAU.

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

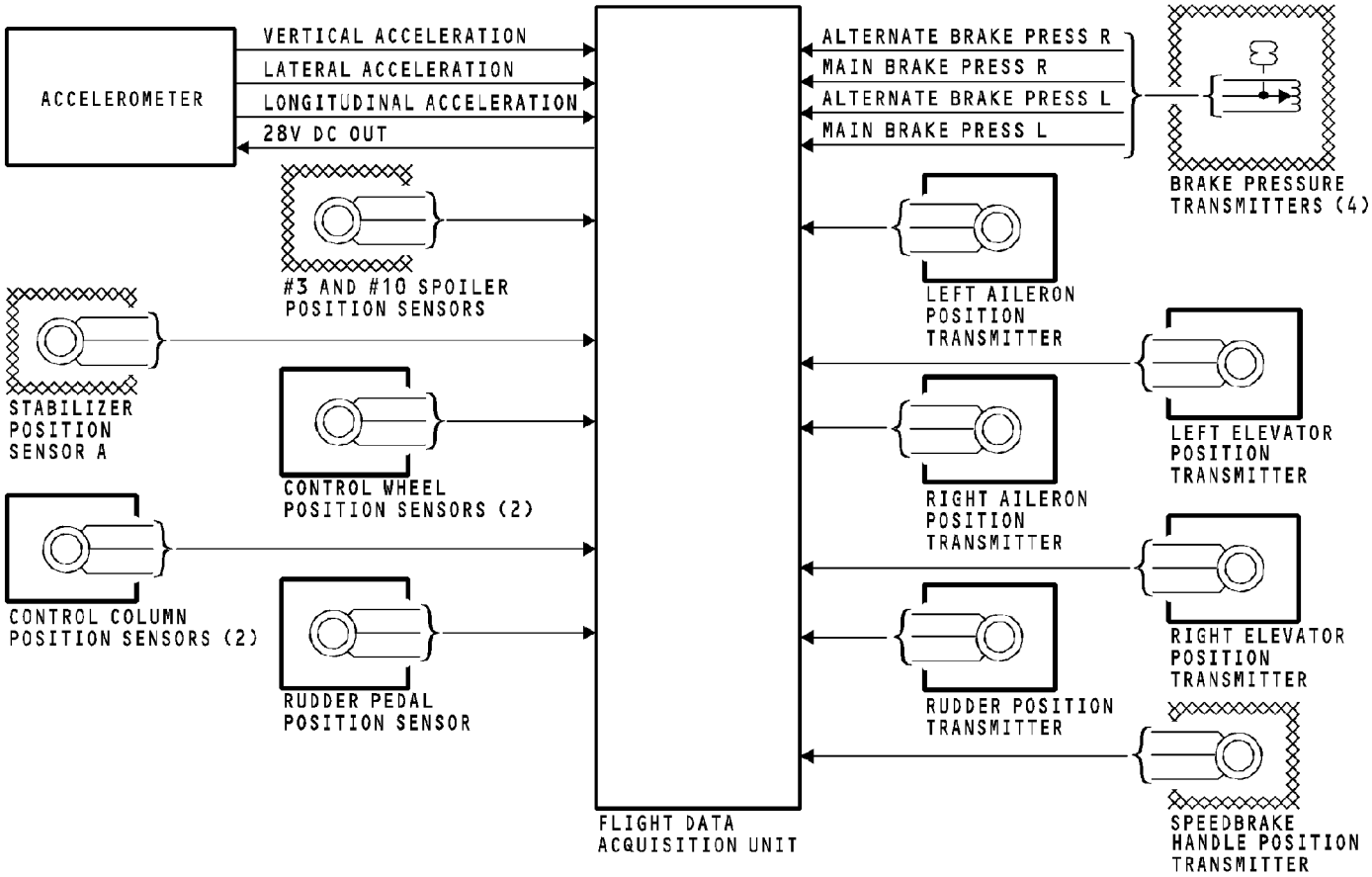
The right and left elevator position transmitters give position inputs to the FDAU.

The brake pressure transmitter gives these inputs to the FDAU:

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



FDRS - FDAU ANALOG INTERFACE



FDRS - FDAU ANALOG INTERFACE

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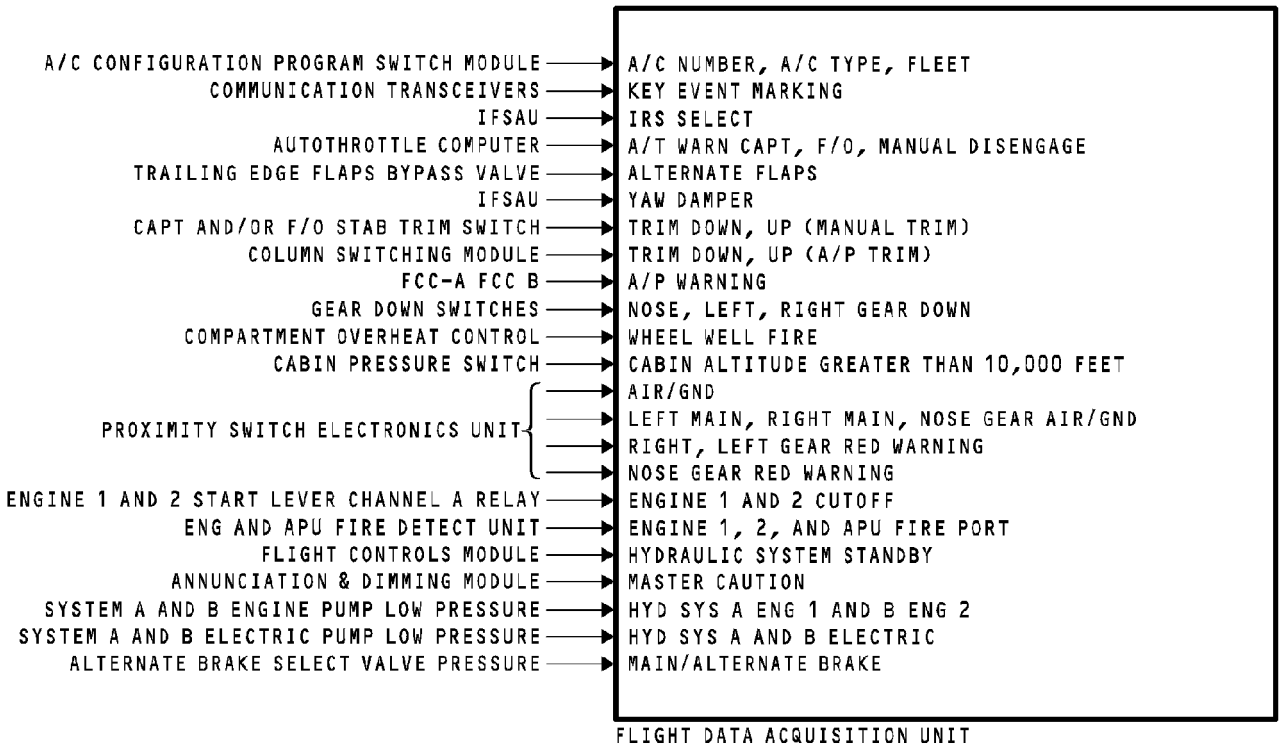
FDRS - FDAU DISCRETE INTERFACE - 1

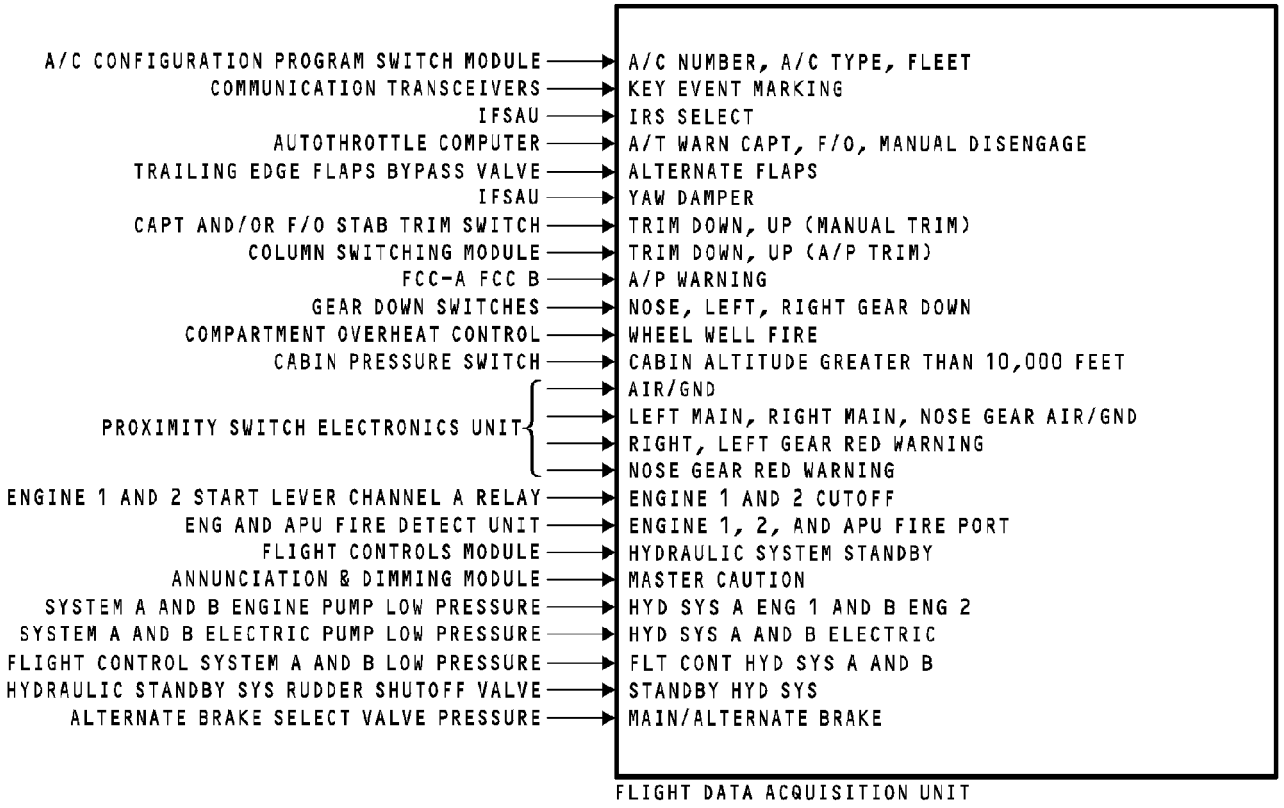
General

Discrete signals come into the FDAU. The FDAU processes the digital data.

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



FDRS - FDAU DISCRETE INTERFACE - 1



FDRS - FDAU DISCRETE INTERFACE - 1

EFFECTIVITY

HAP 020-026, 028-054, 101-999; HAP 001-013, 015-019 POST SB 737-31-1170

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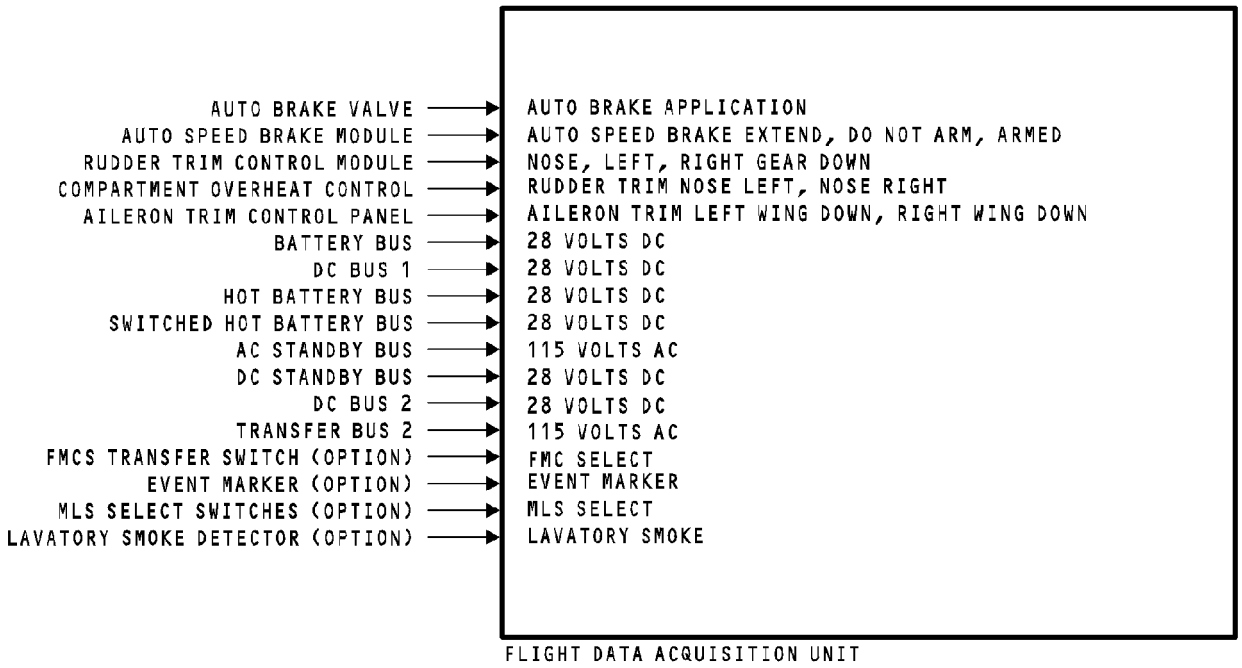
FDRS - FDAU DISCRETE INTERFACE - 2

General

Discrete signals come into the FDAU. The FDAU processes the digital data.

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



FDRS - FDAU DISCRETE INTERFACE - 2

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:

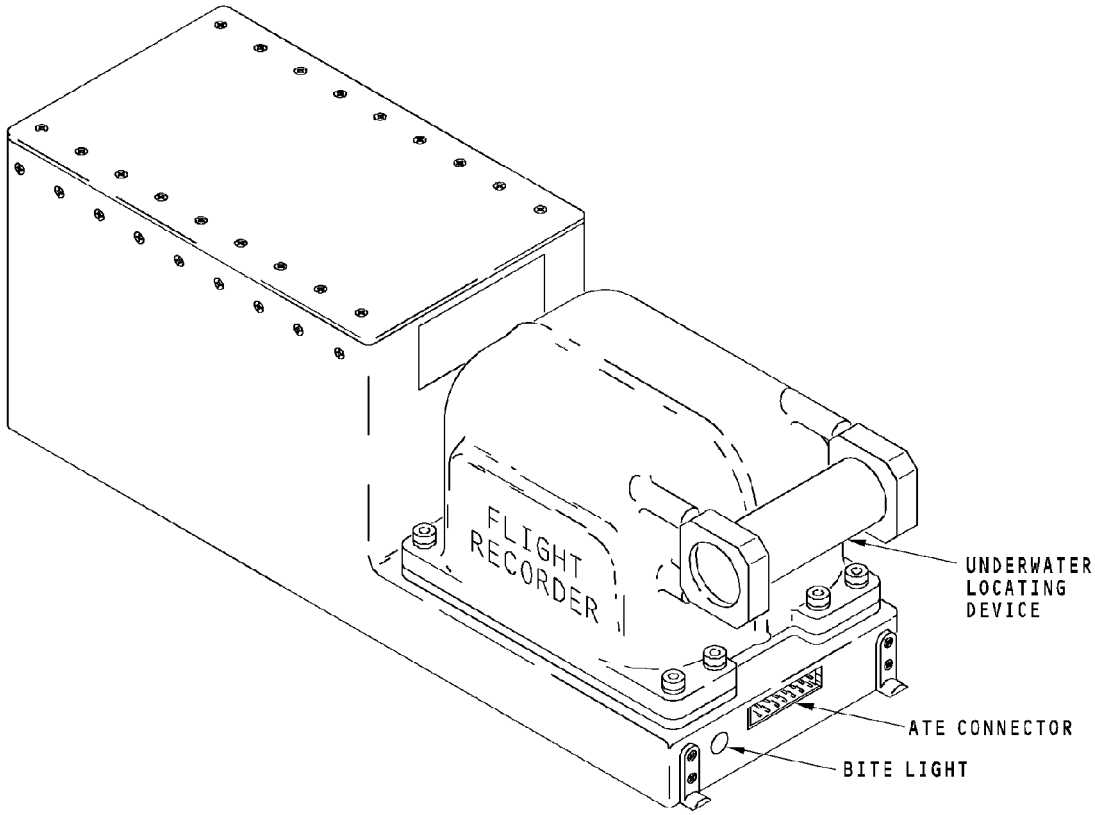
- Up to 3400 Gs of impact
- Deep sea pressures to 20,000 feet (6100 meters)
- Fire temperatures up to 1100C for 1/2 hour.

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.



FDRS - FLIGHT DATA RECORDER

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

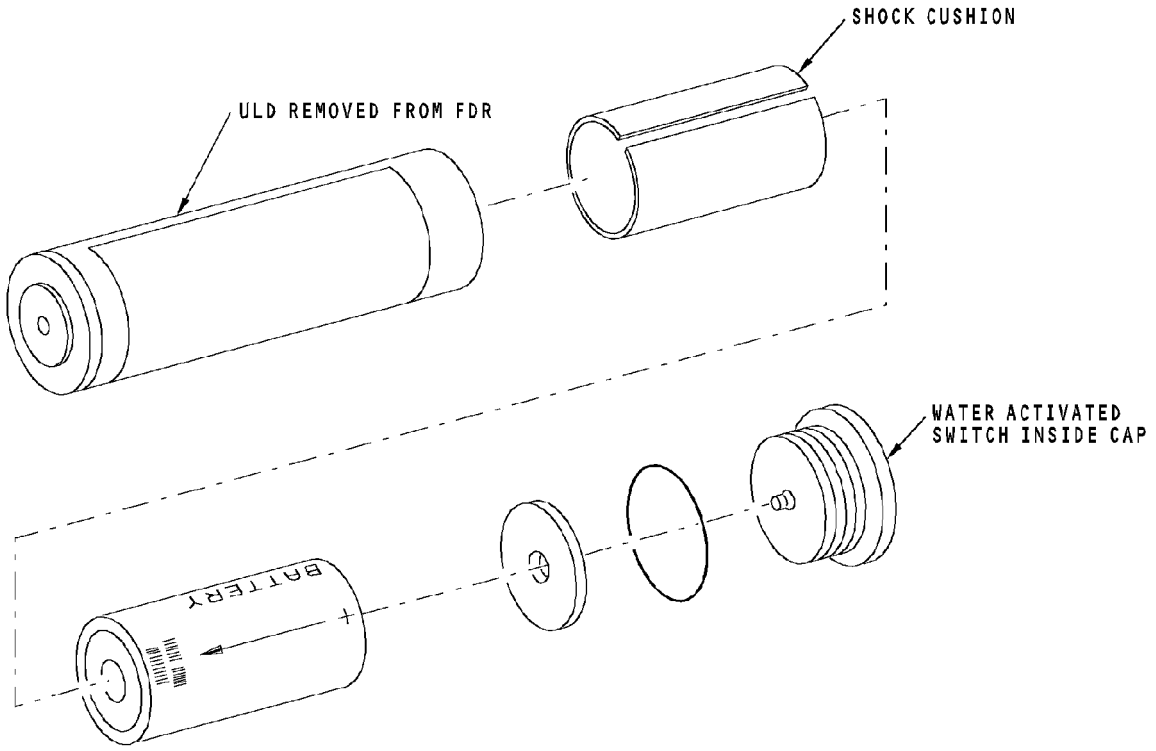
Some ULDs are line replaceable units. For these units, you send the unit to the manufacturer to replace the battery. For some ULDs, the battery is an LRU. The ULD is 1.3 inches (3.3 cm) in diameter and 4 inches (10.2 cm) long. It weighs less than 12 ounces (0.34 kg).

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)
- Can operate under water for a minimum of 30 days
- Sends out an acoustic pulse tone of 37.5 khz at a rate of one pulse-per-second.



ULD WITH REPLACEABLE BATTERY

FDRS - UNDERWATER LOCATING DEVICE

Purpose

The flight data acquisition unit (FDAU) collects, multiplexes and changes inputs into a standard digital format. The inputs come from many airplane systems and sensors. The flight data recorder (FDR) stores the processed signals from the FDAU.

Power Requirement

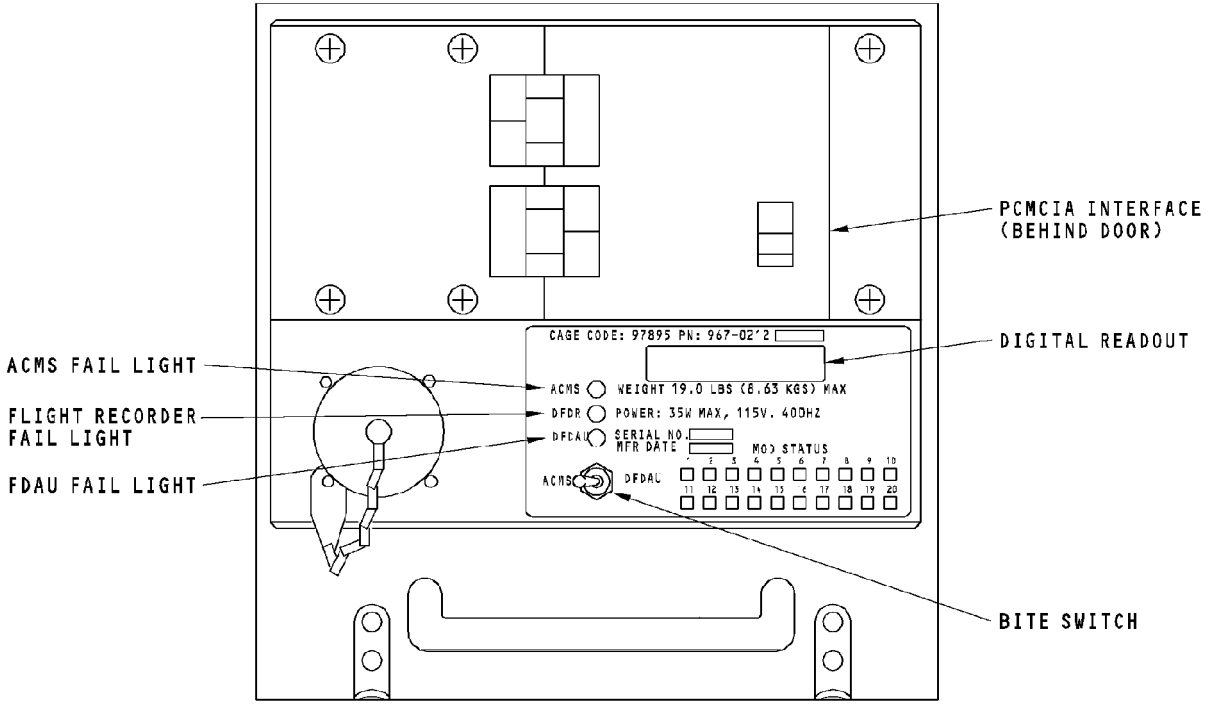
The FDAU uses 115v ac, 400 Hz, single phase power.

Features

The FDAU 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 FDAU has these features:

- Digital readout - gives a 7-digit display of BITE and software data
- A PCMCIA interface - the PCMCIA stores up to 500 megabytes of data
- BITE switch - A three position toggle switch lets you see BITE or software data
- ACMS fail light - shows an ACMS interface fault
- DFDR fail light - shows a FDR fault
- DFDAU fail light - shows a FDAU fault.



FDRS - FDAU

FDRS - FLIGHT RECORDER/MACH AIRSPEED WARNING TEST MODULE

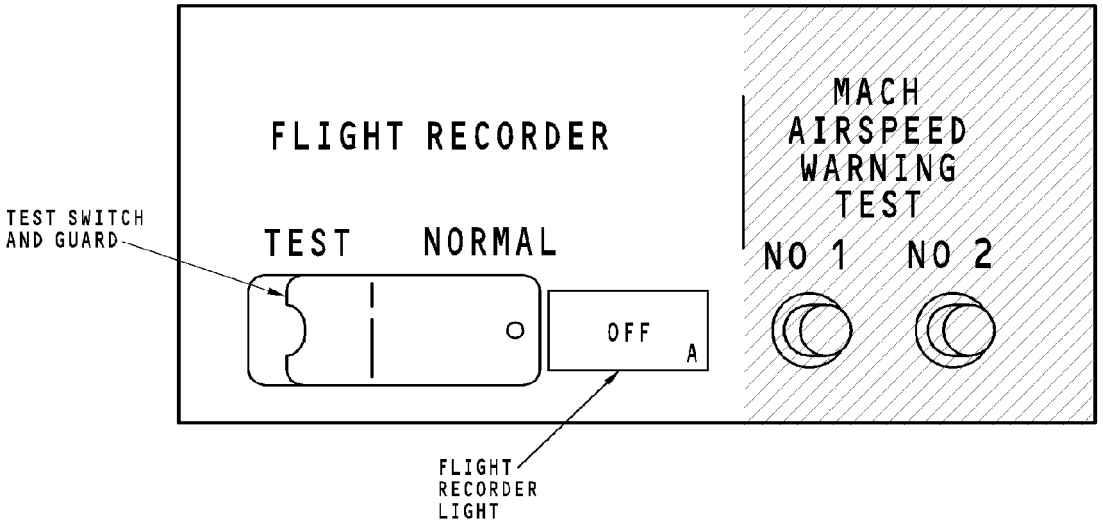
Purpose

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 flight recorder system for maintenance purposes.

The flight recorder light comes on when the FDR or FDAU finds a critical fault. The flight recorder light also comes on when the FDRS is not in operation.



FDRS - FLIGHT RECORDER/MACH AIRSPEED WARNING TEST MODULE

FDRS - ACCELEROMETER

Purpose

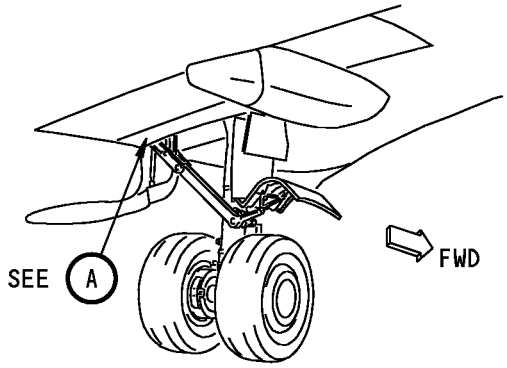
The three-axis accelerometer measures acceleration along the vertical, lateral, and longitudinal axes. The accelerometer sends acceleration data to the FDAU.

Features

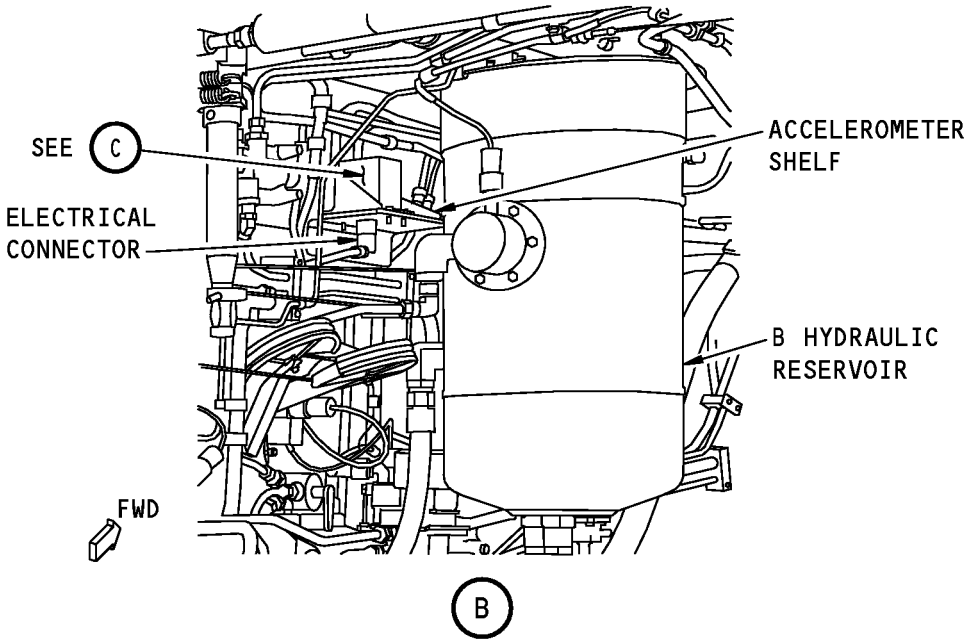
The accelerometer can measure accelerations up to ten times the normal operation range. No calibration or scheduled maintenance is necessary.

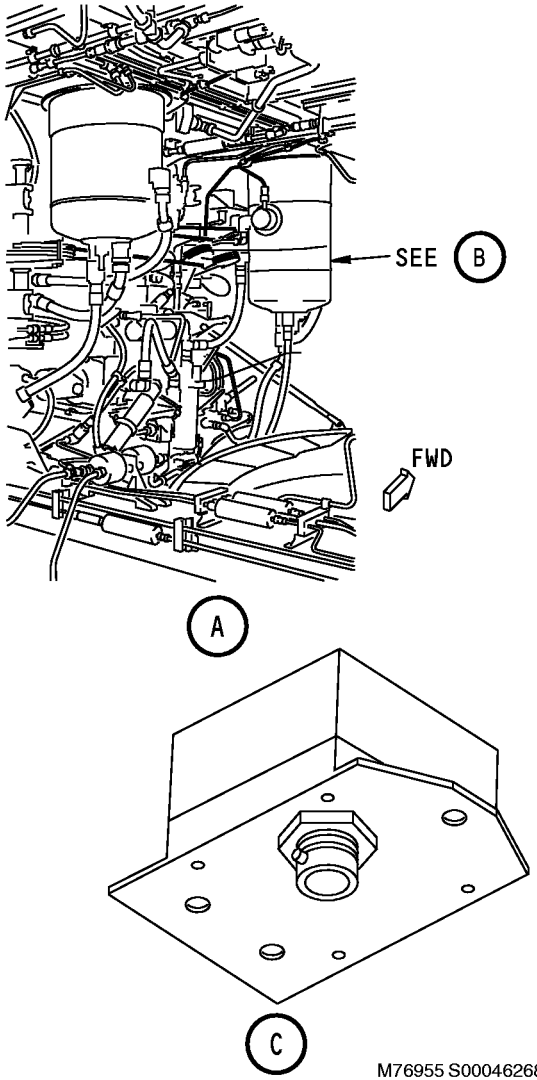
Power

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



RIGHT MAIN WHEEL WELL





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FDRS - ACCELEROMETER

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 (WGL-QAR) 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 PCMCIA card. While the aircraft is on the ground, the recorded data is compressed, encrypted and transmitted securely over the wireless cellular data link.

Operation

The WGL-QAR has these indicators and controls on the front panel:

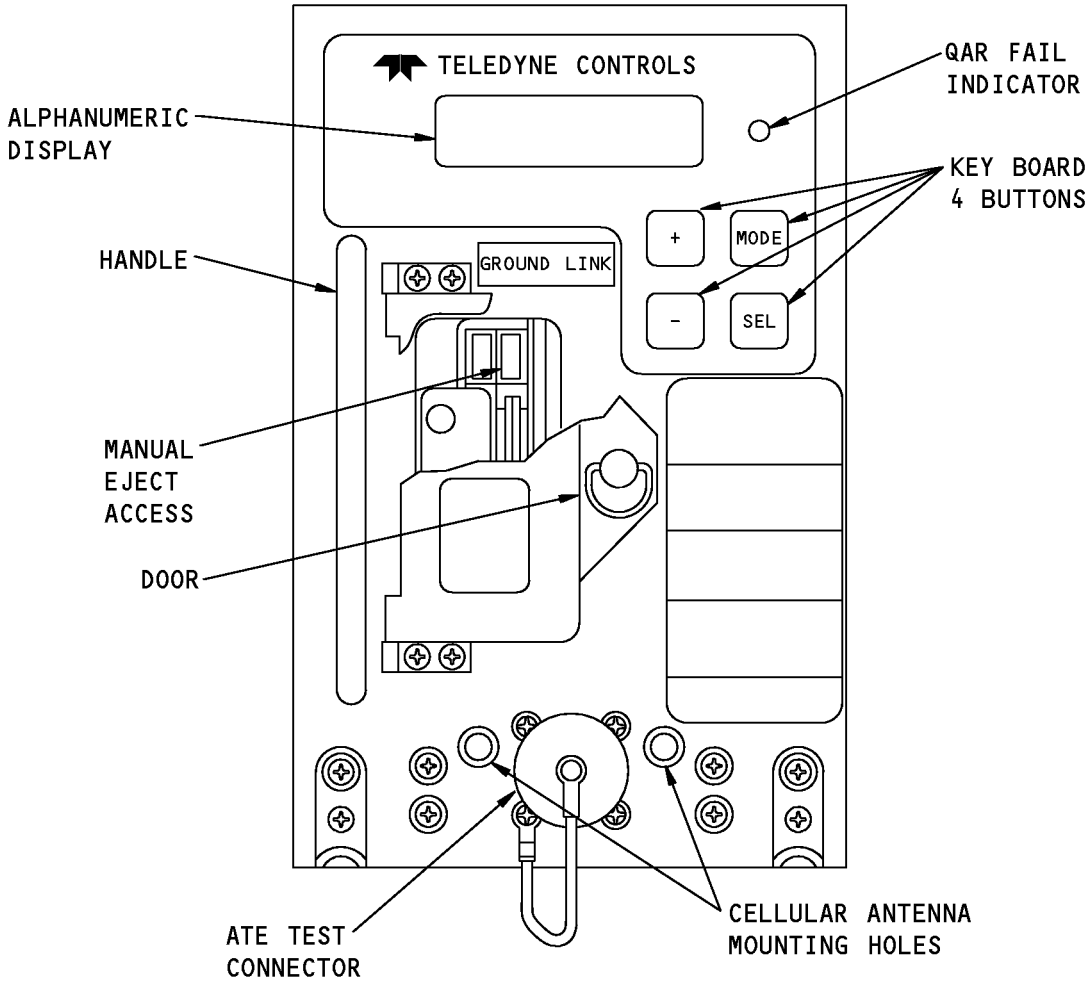
- An alphanumeric display - displays menus and messages.
- Four push buttons - MODE, SEL, +, -.
- A fail indicator - lights when power is initially applied, PCMCIA card is not inserted and PCMCIA card memory is low or full.
- A manual eject button - allows the PCMCIA card to be ejected manually.
- An access door - protects and provides access to the PCMCIA card.
- Internal PCMCIA card slot - provides internal storage and is not accessible to the user.
- Media PCMCIA card slot - allows installation of the PCMCIA card.
- 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 WGL-QAR 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

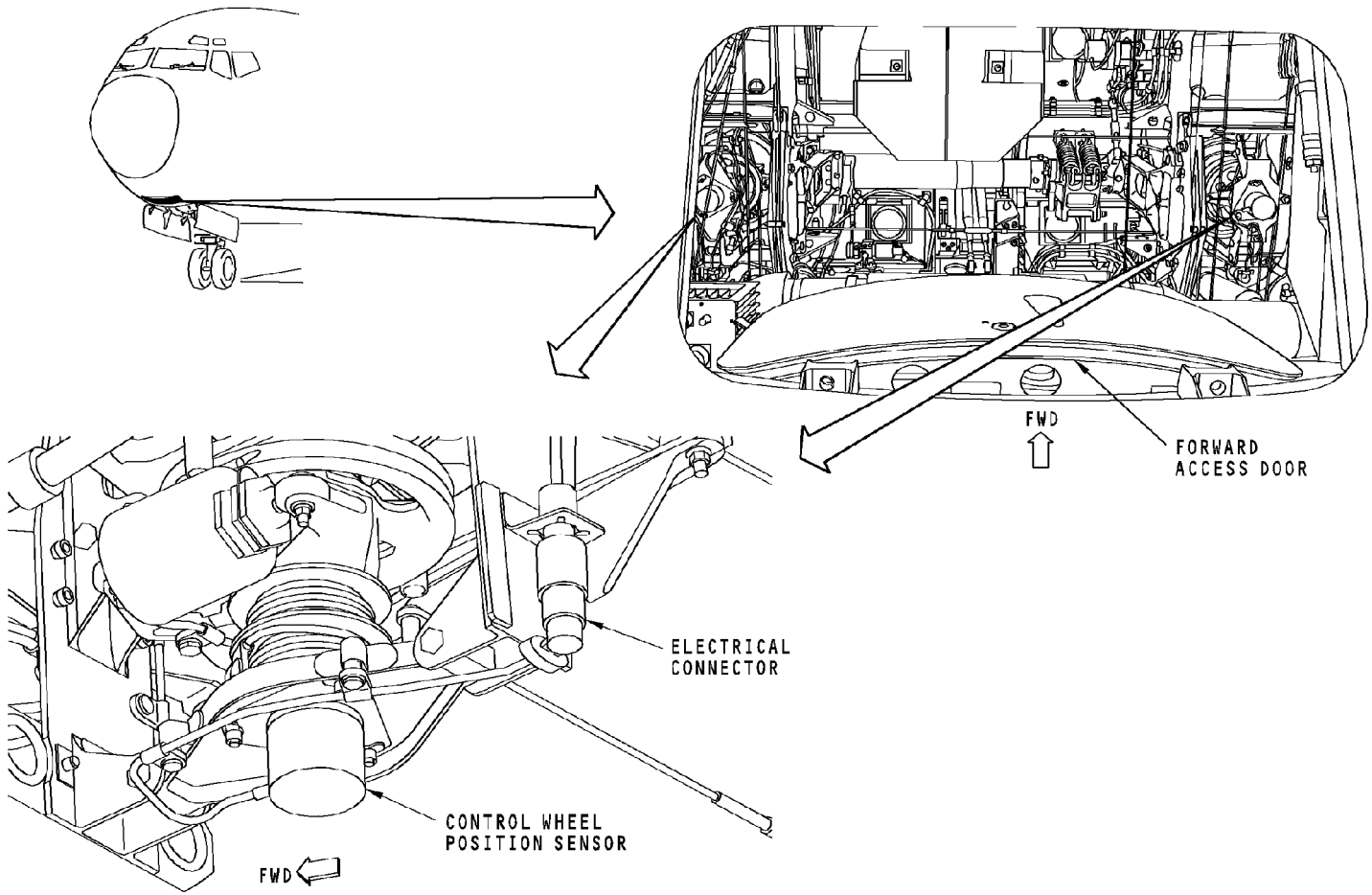


FDRS - QUICK ACCESS RECORDER

FDRS - CONTROL WHEEL POSITION SENSOR

General

The control wheel position sensors measure the position of the control wheel. The sensors send this data to the FDAU.

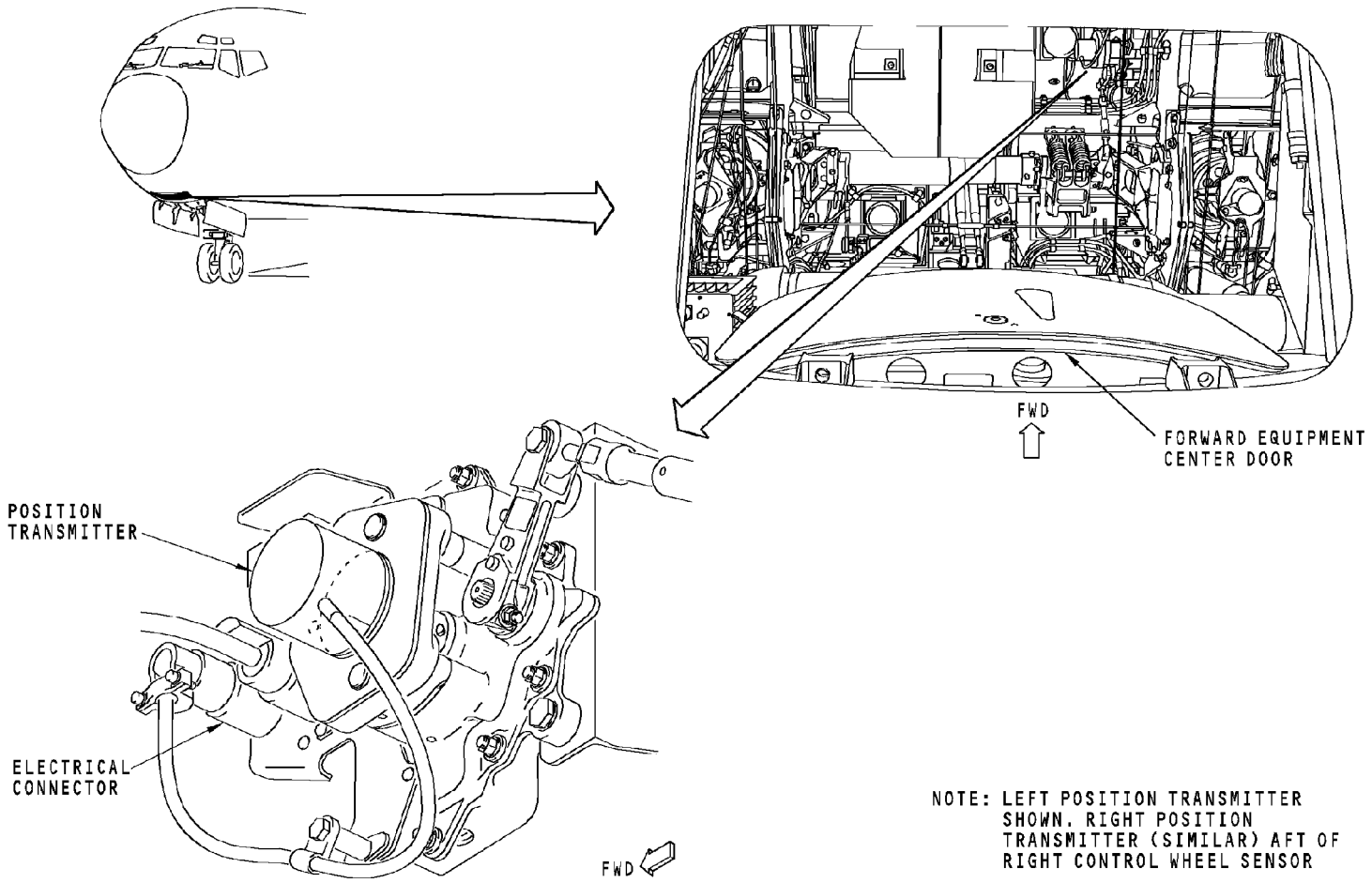


FDRS - CONTROL WHEEL POSITION SENSOR

FDRS - CONTROL COLUMN POSITION TRANSMITTER

General

Control column position transmitters send control column position information to the FDAU.

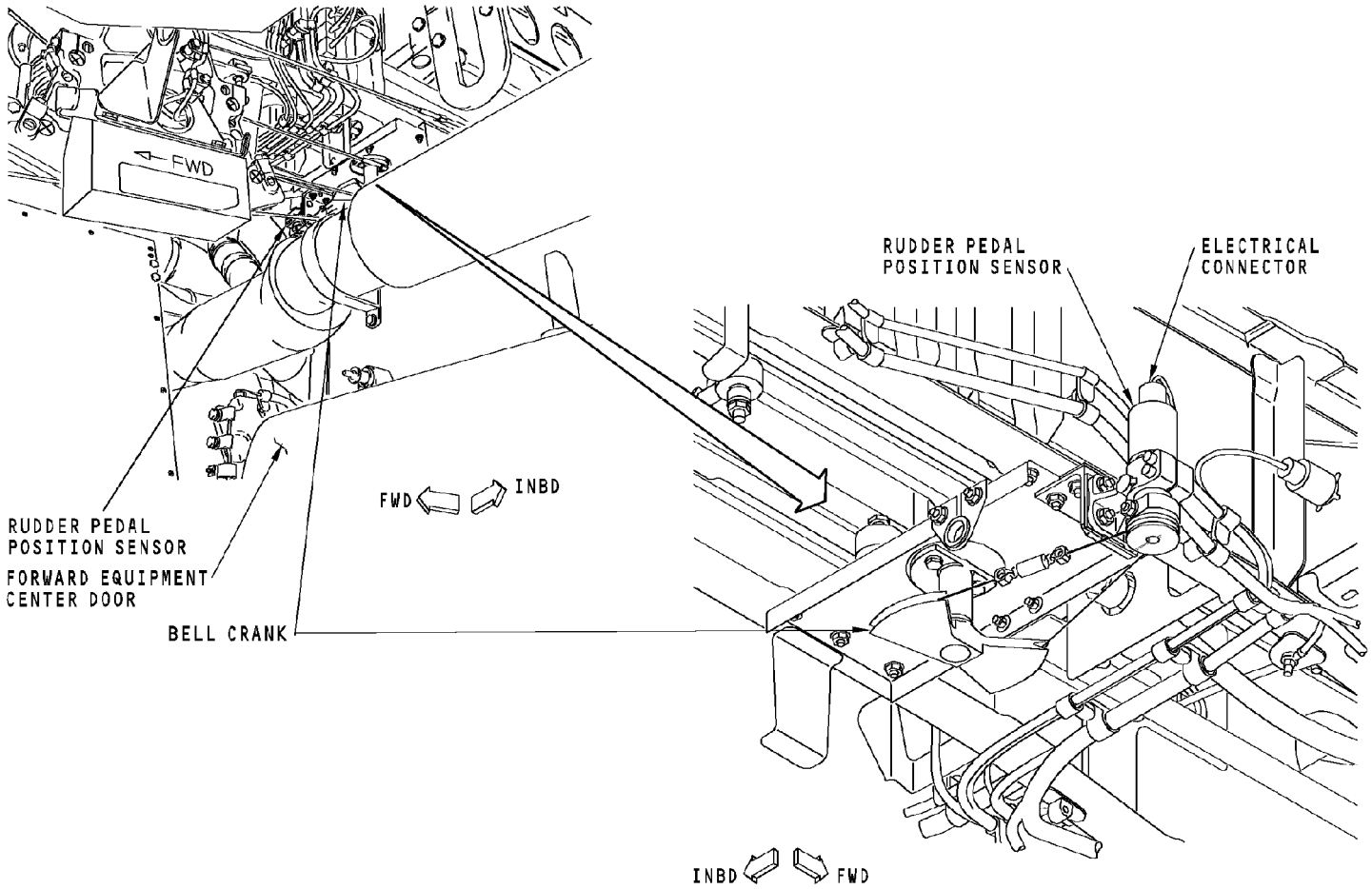


FDRS - CONTROL COLUMN POSITION TRANSMITTER

FDRS - RUDDER PEDAL POSITION SENSOR

General

Rudder pedal position sensor sends rudder pedal position information to the FDAU.



FDRS - RUDDER PEDAL POSITION SENSOR

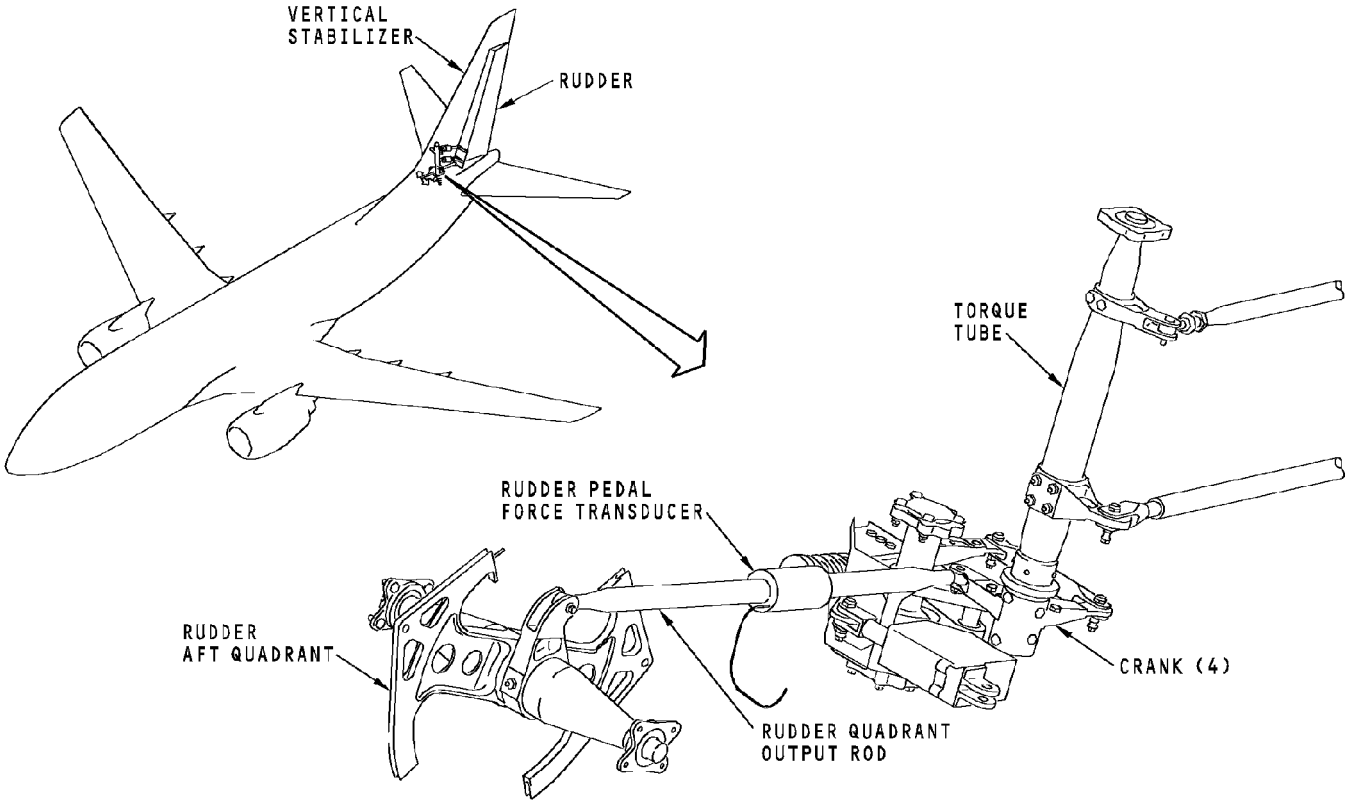
FDRS - RUDDER PEDAL FORCE TRANSDUCER

Purpose

The rudder pedal force transducer sends rudder pedal force information to the FDAU.

EFFECTIVITY

HAP 008-013, 015-026, 028-054, 101-999; HAP 001-007 POST SB 737-31-1124



FDRS - RUDDER PEDAL FORCE TRANSDUCER

EFFECTIVITY

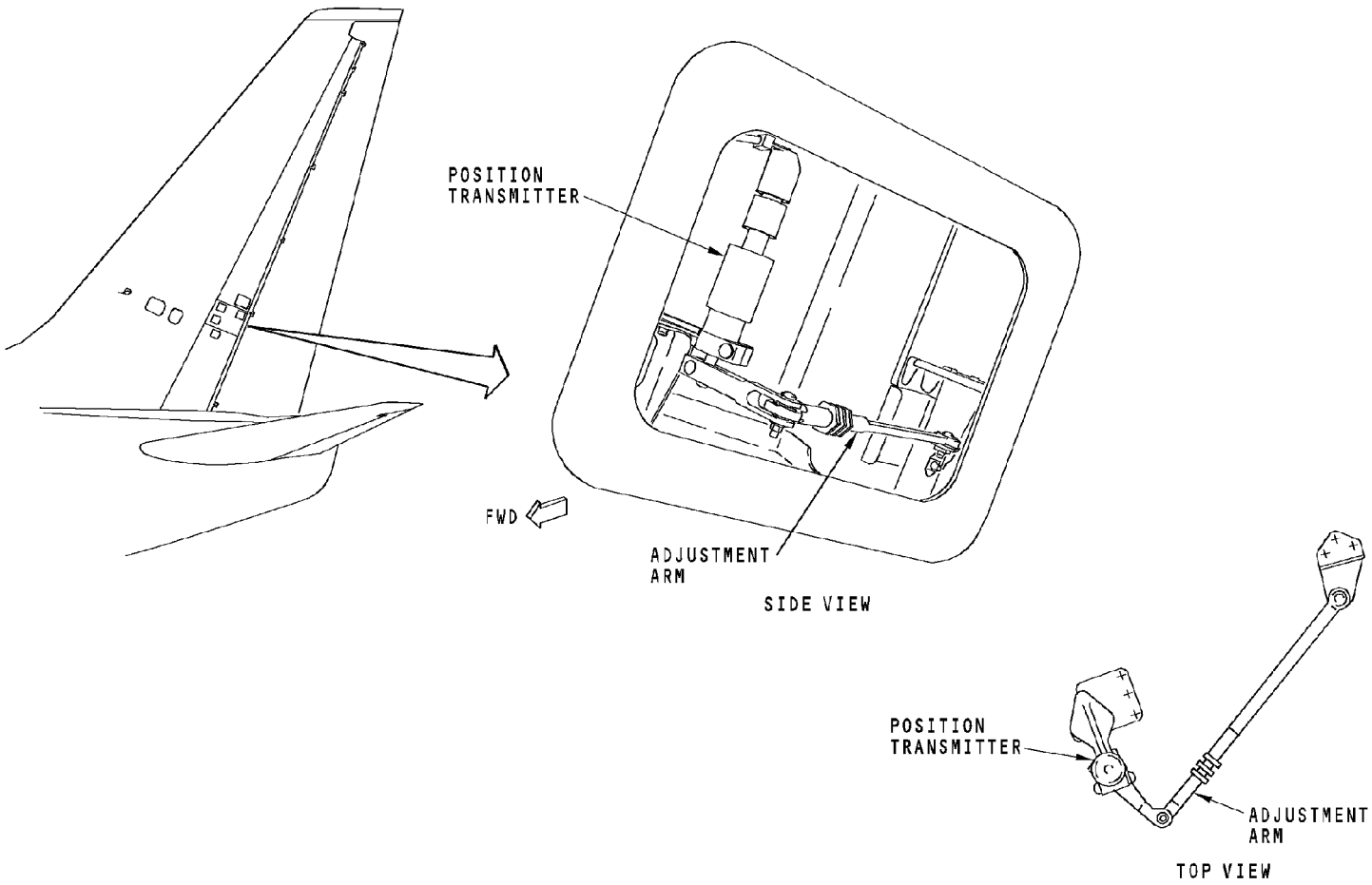
HAP 008-013, 015-026, 028-054, 101-999; HAP 001-007 POST SB 737-31-1124

31-31-00

FDRS - RUDDER POSITION TRANSMITTER

General

The rudder position transmitter measures the position of the rudder. The transmitter sends this data to the FDAU.

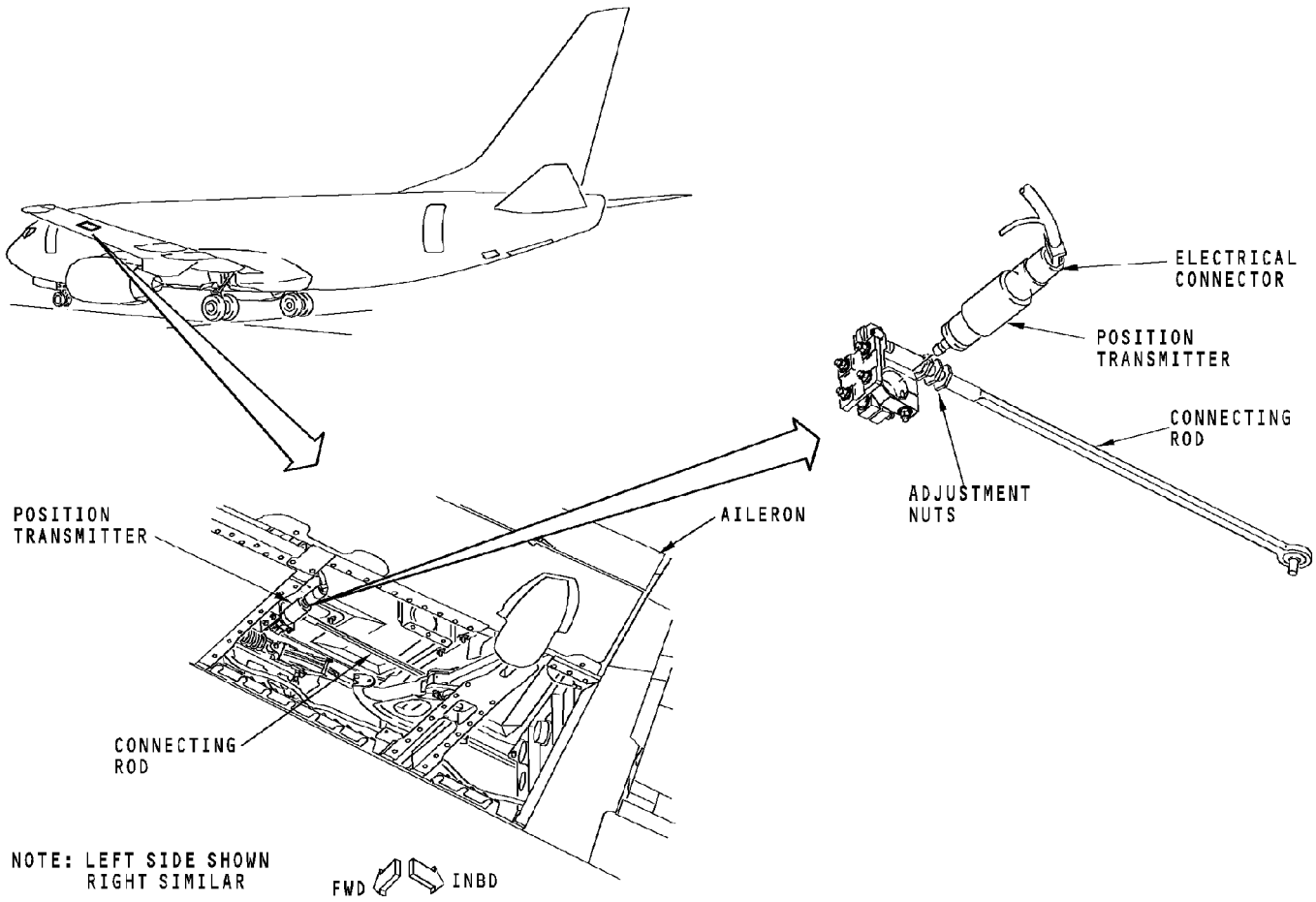


FDRS - RUDDER POSITION TRANSMITTER

FDRS - AILERON POSITION TRANSMITTER

General

The aileron position transmitters send aileron position information for each wing to the FDAU. These transmitters are aft of the wing rear spar. You turn the center nut to make small adjustments.

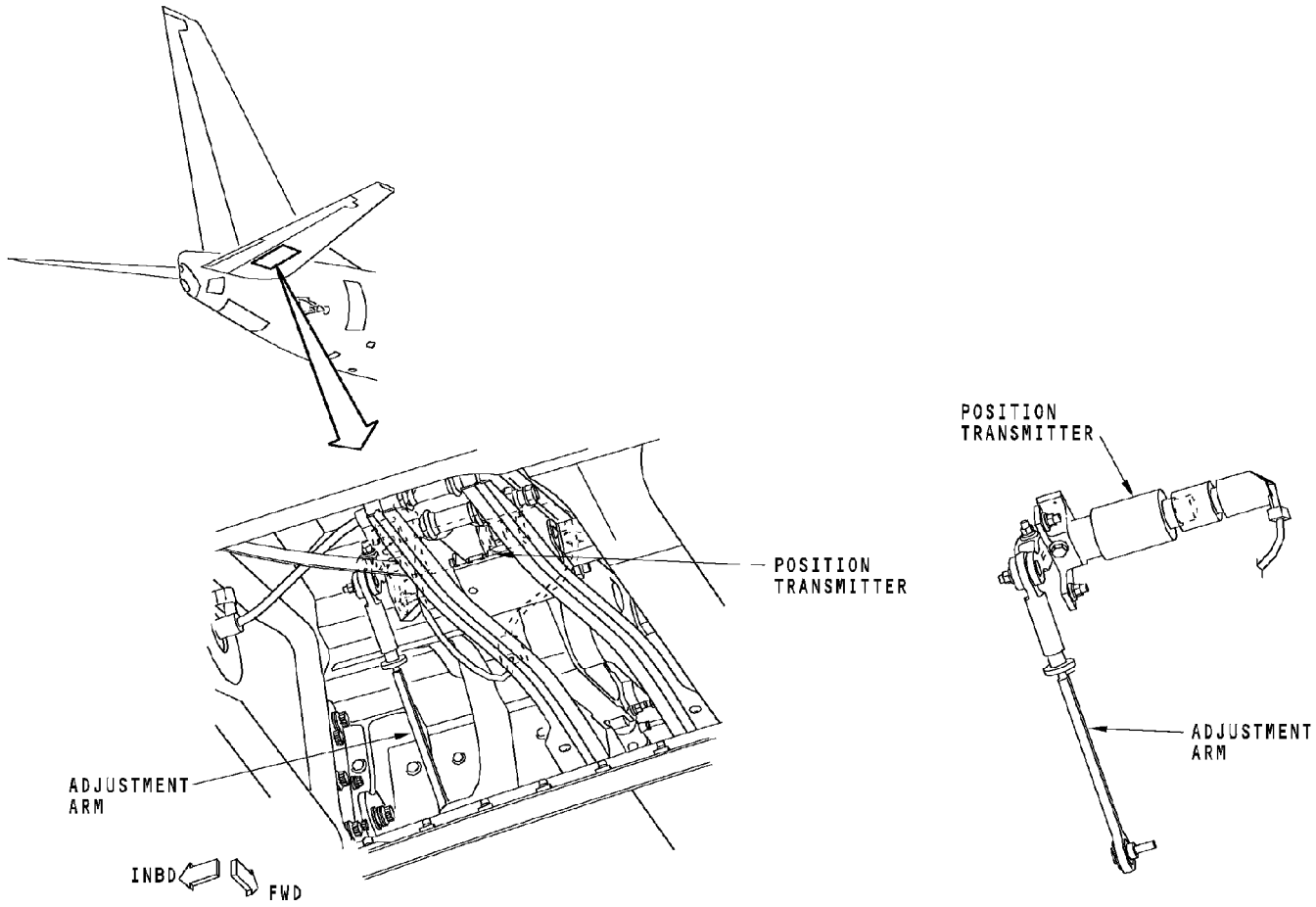


FDRS - AILERON POSITION TRANSMITTER

FDRS - ELEVATOR POSITION TRANSMITTER

General

There is an elevator position transmitter in each stabilizer. They send elevator position information to the FDAU. An adjustable control rod connects the transmitter to the elevator.



FDRS - ELEVATOR POSITION TRANSMITTER

General

The flight data recorder (FDR) receives and keeps the last 25 hours of flight data. The FDR receives the data from the flight data acquisition unit (FDAU). The data is in a crash-proof, fire-resistant container. The FDR 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 FDR receives data from the FDAU 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 FDAU.

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 FDR 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.

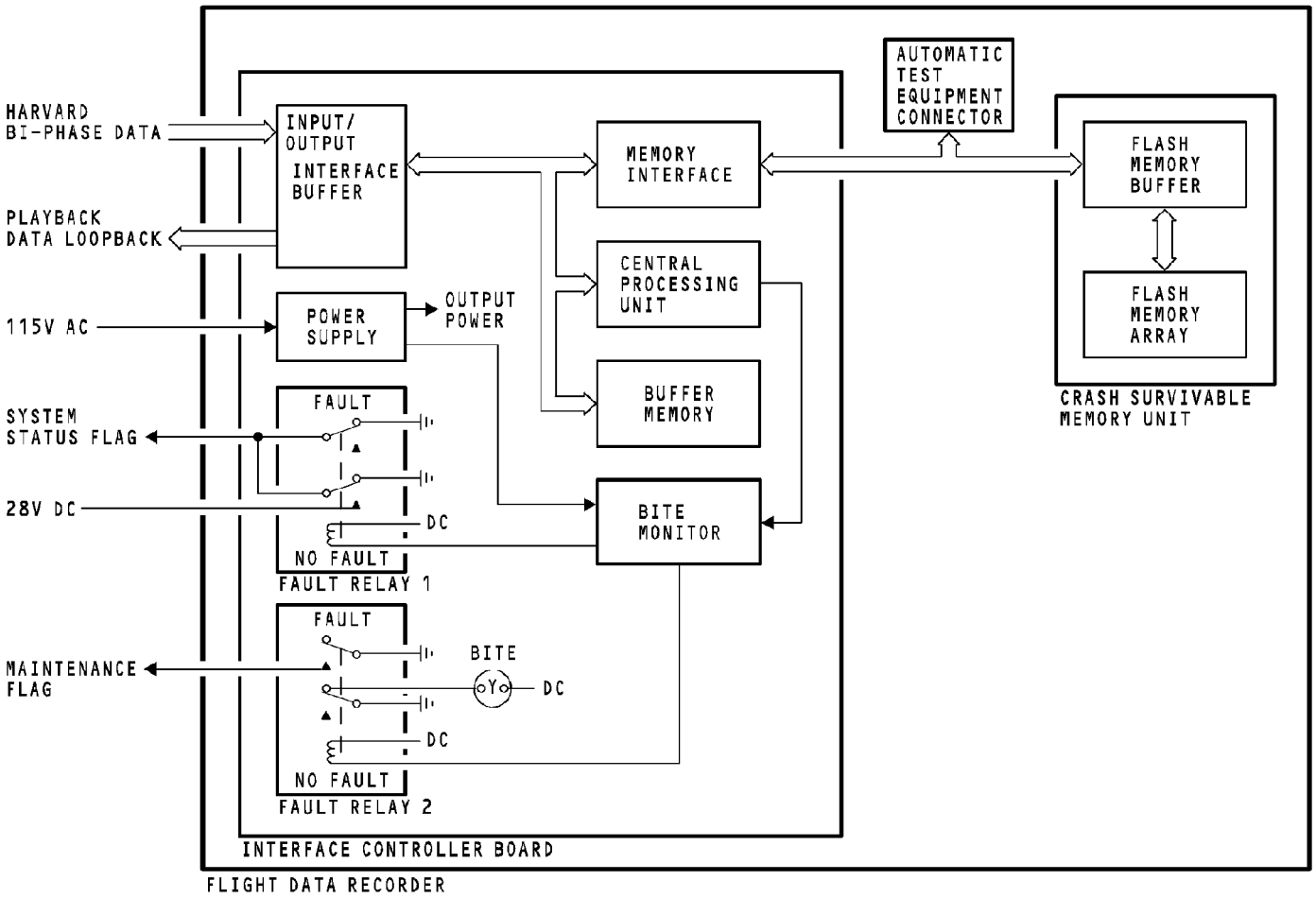
These conditions cause a maintenance flag fault indication:

- Hardware faults
- Faults found in the software
- Bad data rate inputs.

The status output goes to the flight recorder test module. This output is a ground and turns on the OFF light on the test module if the internal record function is bad. The output is 28v dc when recorder operation is correct.

The maintenance flag output goes to the FDAU. This output is an open with a recorder fault . The output is a ground when recorder operation is correct.

Failures or malfunctions are stored in memory. Ground support equipment can read the memory.



FDRS - FDR FUNCTIONAL DESCRIPTION

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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.

HAP 001-013, 015-026, 028-035, 038, 042, 043, 051-053

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

HAP ALL

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 biphase 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.

HAP 001-013, 015-026, 028-035, 038, 042, 043, 051-053

The DMU master controller contains the ACMS interface. The controller sends reports to the data loader control panel and the PCMCIA recorder. The airline can use a data loader or PCMCIA card to store the reports. The controller can get ACMS software from the data loader control panel.

HAP ALL

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.

HAP 001-013, 015-026, 028-035, 038, 042, 043, 051-053

Personal Computer Memory Card International Association (PCMCIA) Memory

A PCMCIA card slot gives access to PCMCIA memory cards. ACMS Data is kept on a memory card. You can configure PCMCIA cards as an internal quick access recorder. The memory card can record all mandatory parameters. Memory card removal or installation is possible from the front of the FDAU.

HAP ALL

Built In Test Equipment (BITE)

Select the BITE switch to ACMS or DFDAU to see software and data base part numbers and any active fault codes.

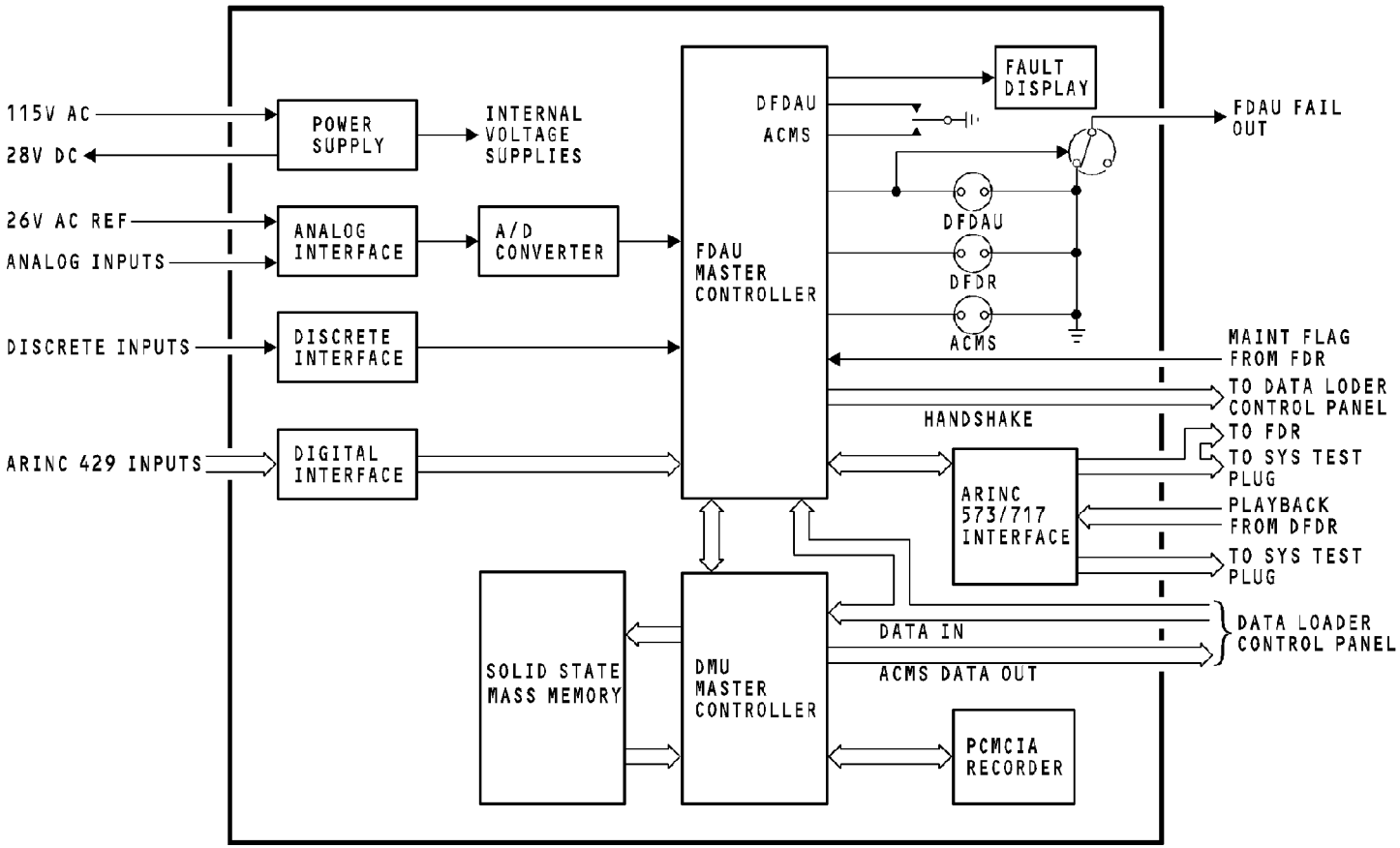
These lights come on with a fault:

- ACMS - ACMS fault
- DFDR - FDR fault
- DFDAU - FDAU fault.

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

EFFECTIVITY

HAP ALL



FDRS - FDAU FUNCTIONAL DESCRIPTION

General

The FDAU and FDR 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.

FDAU Faults

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

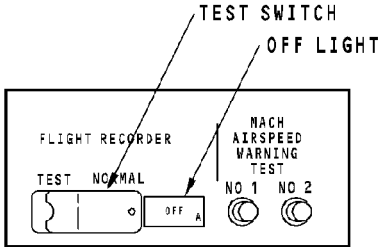
- DFDAU light on the front of the FDAU
- Flight recorder OFF light on the flight recorder/mach airspeed warning test module
- Both master caution lights
- OVERHEAD caution annunciator.

If the FDAU has a fault with the process of data for the aircraft conditioning monitoring system (ACMS), the ACMS light comes on.

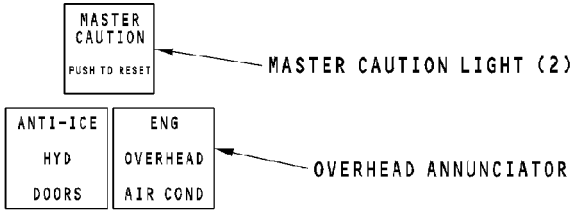
FDR Faults

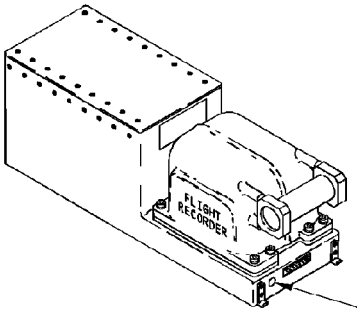
Faults in the FDR cause these lights to come on:

- BITE light on the FDR
- Flight recorder fail light on the FDAU
- Flight recorder OFF light on the flight recorder/mach airspeed warning test module
- Both master caution lights
- The OVERHEAD caution annunciator.

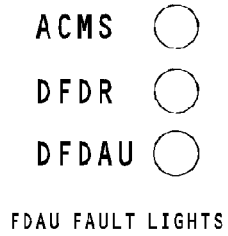


FLIGHT RECORDER/MACH AIRSPEED WARNING TEST MODULE

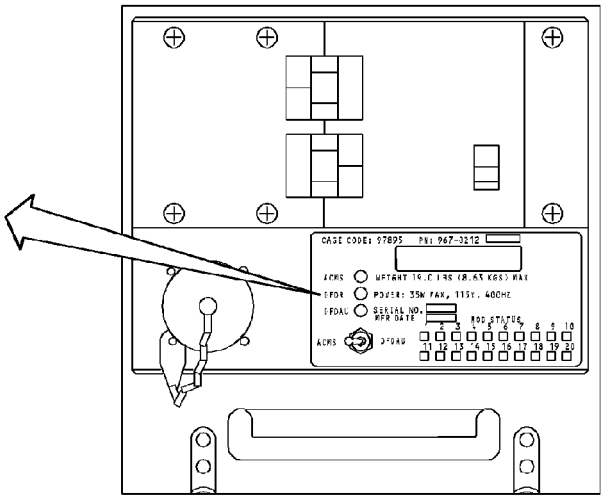




FLIGHT DATA RECORDER



FDAU FAULT LIGHTS



FLIGHT DATA ACQUISITION UNIT

FDRS - SYSTEM TESTS

EFFECTIVITY
HAP ALL

31-31-00

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FDRS - TRAINING INFORMATION POINT - FDAU BITE

General

The FDAU 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.

PCMCIA Drive and Cards

The FDAU also has two slots for Personal Computer Memory Card International Association (PCMCIA) cards. You can put a card in either slot. To eject the card, push the eject switch above the card. The PCMCIA cards can do these functions:

- Load software into the FDAU
- Store FDAU data.

To load software, put the card with the software in either PCMCIA slot. The FDAU turns on the IN PROG LED. When the transfer is complete, the FDAU turns on the XFER COMP LED. You can remove the card. If the software transfer fails, the FDAU turns on the XFER FAIL LED. To transfer data to a data card, put a formatted card in either slot and lower the card holder arm.

The DFM BITE LED comes on if the PCMCIA drive fails.

Fault Lights

The FDAU has these three failure indicator lights on the front panel:

- ACMS
- DFDR
- DFDAU.

The ACMS light comes on with input faults, DMU master controller faults, or mass memory faults. The FDAU continues to send data and the FDR continues to store data.

HAP 001-013, 015-026, 028-035, 038, 042, 043, 051-053

The DFDR FAIL light comes on with a fault in the FDR. The FDAU continues to send data to the FDR.

The DFDAU failure light comes on with a power supply fault, output data fault or erasable programmable read only memory (EPROM) fault in the FDAU. The EPROM holds the program for the FDAU. The FDAU does not send data to the FDR.

HAP ALL

BITE Fault Code Display

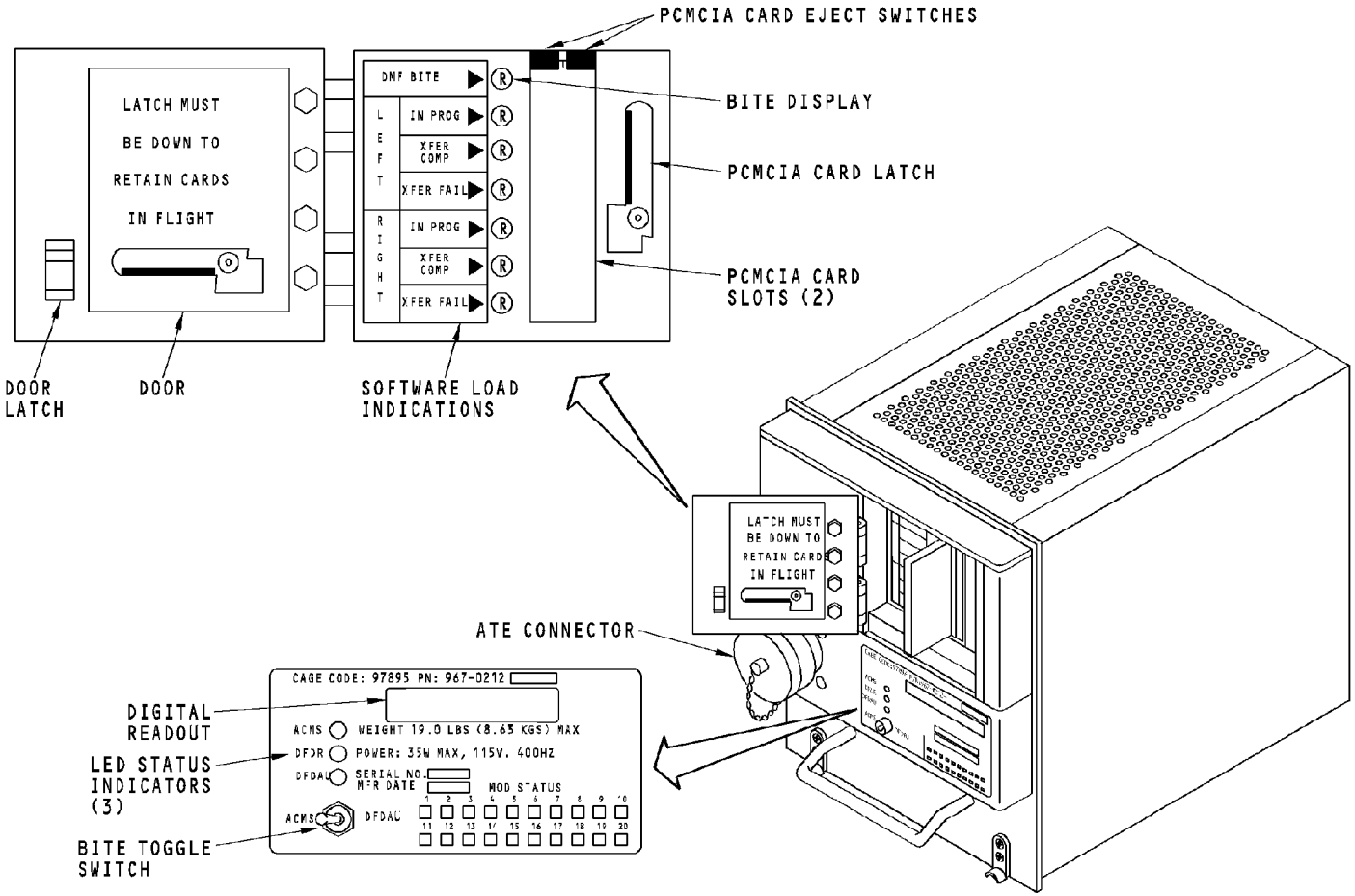
A seven-digit alphanumeric display shows fault codes if there is a fault in the FDAU. A three-position BITE toggle switch controls the fault code display. Set this switch to the left or right position to do the test. The spring loaded center position is off.

Move the switch to the right to start a FDAU test. You see these indications:

- Lamp test
- With no BITE errors, NO FAULT shows
- With FDAU errors, the error code shows.

When an error code shows, move the switch to the right again to show more error codes. The display is blank when there are no more error codes.

Move the switch to the left to look for ACMS errors. When there is an ACMS fault, the digital display shows the error codes. When an error code shows, move the switch to the right to show more error codes.



FDRS - TRAINING INFORMATION POINT - FDAU BITE

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Software or Data Load

You can load software into the FDAU or download data from the 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

HAP 001-011 PRE SB 737-31-1136

To load software into the ACMS, use the data loader control panel. Select the ACMS position on the data loader control panel to load software for the DMU master controller. Select the DFDAU position to load software for the FDAU master controller.

HAP 012, 013, 015-026, 028-054, 101-999; HAP 001-011 POST SB 737-31-1136

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 DMU master controller. Select the DFDAU position to load software for the FDAU master controller.

HAP 031-054, 101-999

Put the diskette in the airborne data loader.

HAP 001-013, 015-026, 028-030

Put the diskette in the portable data loader and connect the portable data loader to the data transfer unit receptacle.

HAP ALL

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

HAP 031-054, 101-999

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 FDAU automatically downloads the report data to the diskette. The airborne data loader shows that the load is done.

EFFECTIVITY

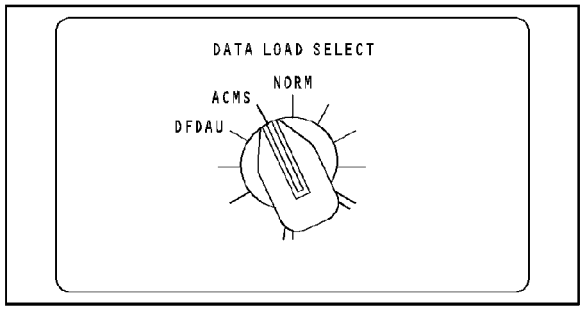
HAP ALL

HAP 031-054, 101-999 (Continued)

HAP 001-013, 015-026, 028-030

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

HAP ALL

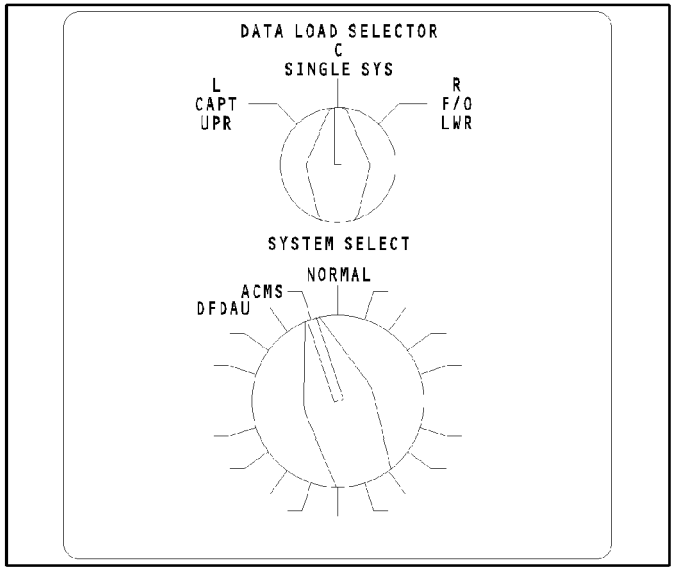


DATA LOADER CONTROL PANEL

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

EFFECTIVITY

HAP 001-011 PRE SB 737-31-1136



DATA LOADER CONTROL PANEL

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General

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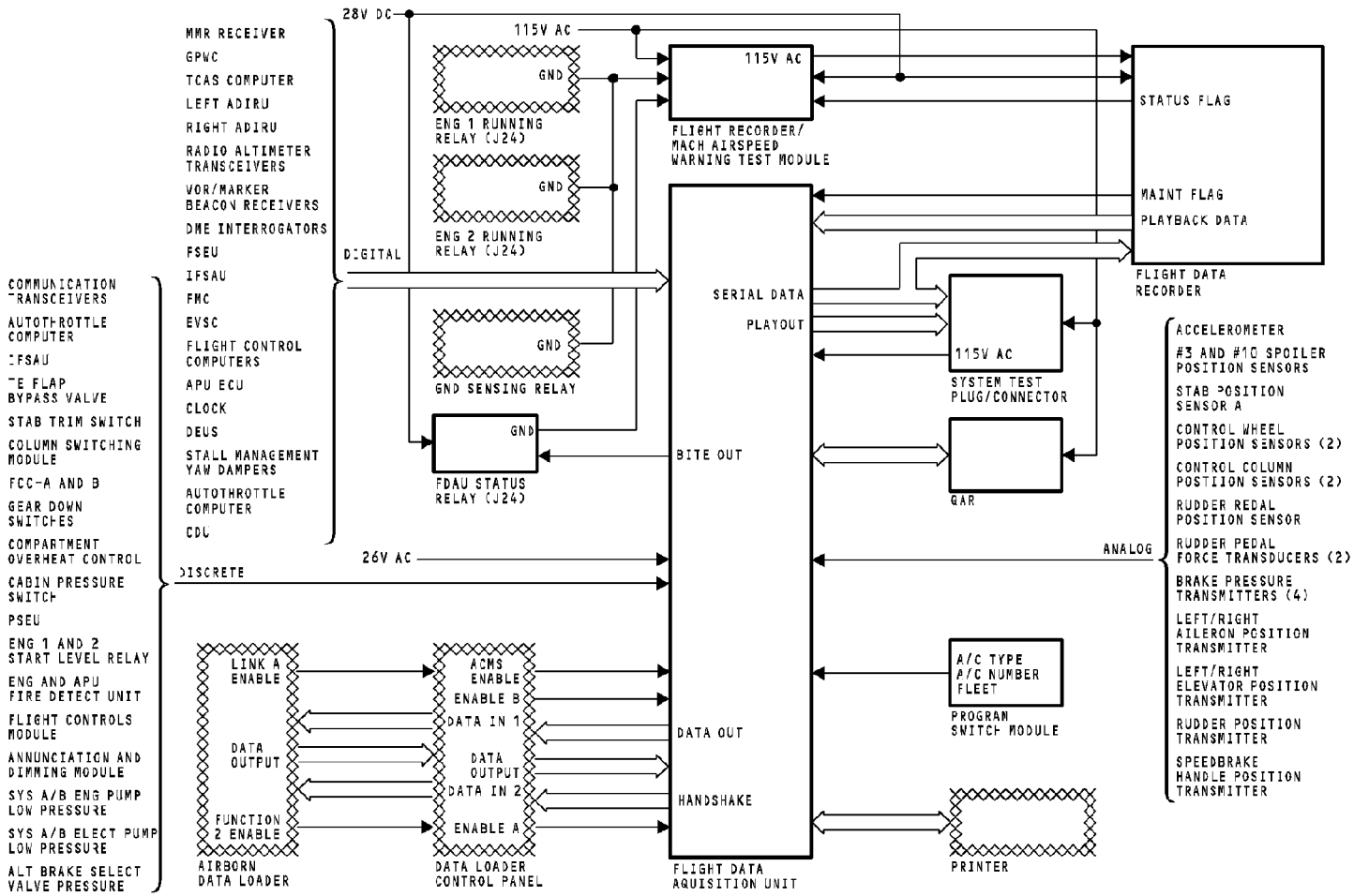
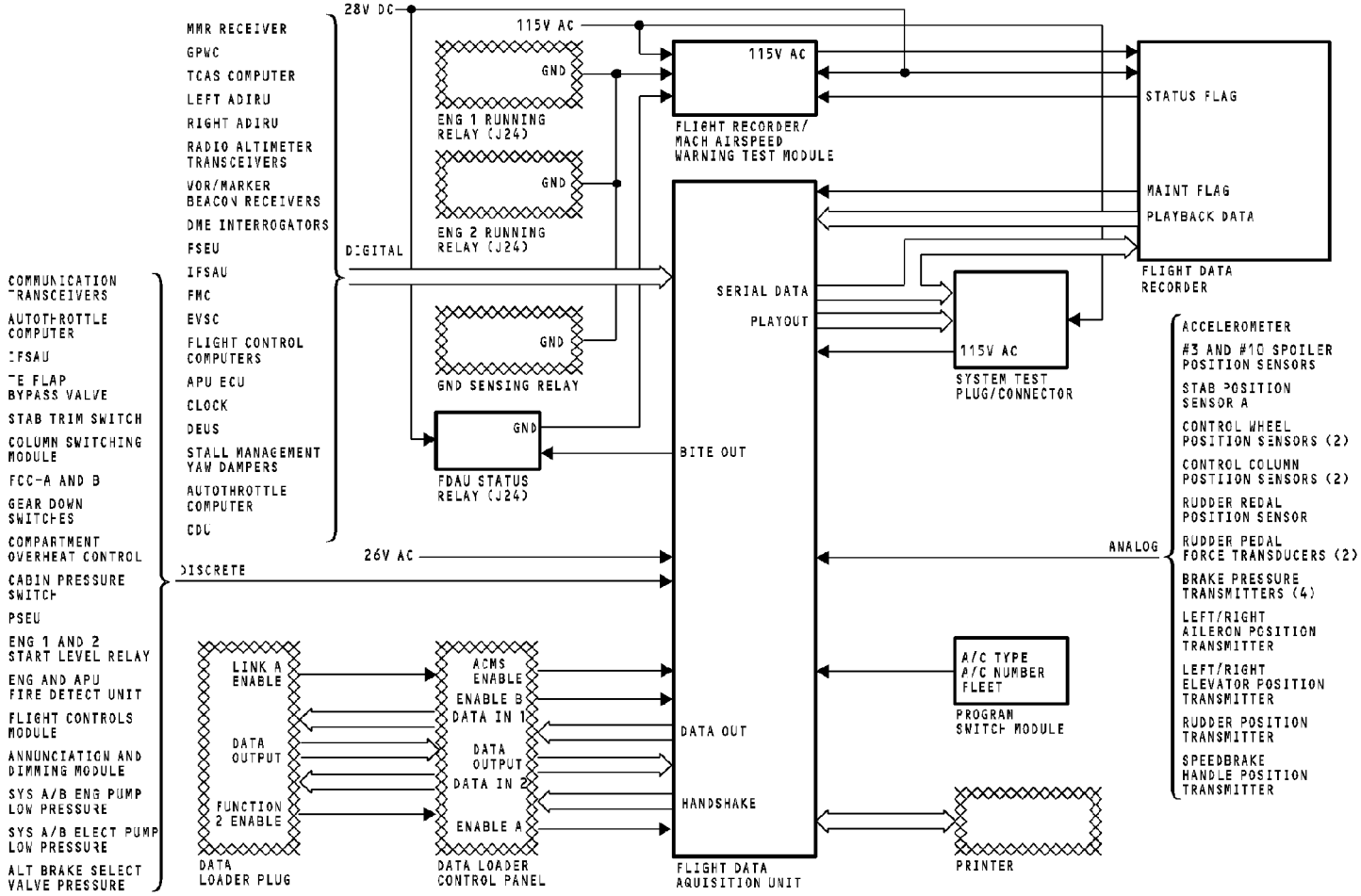


FDRS - SYSTEM SUMMARY

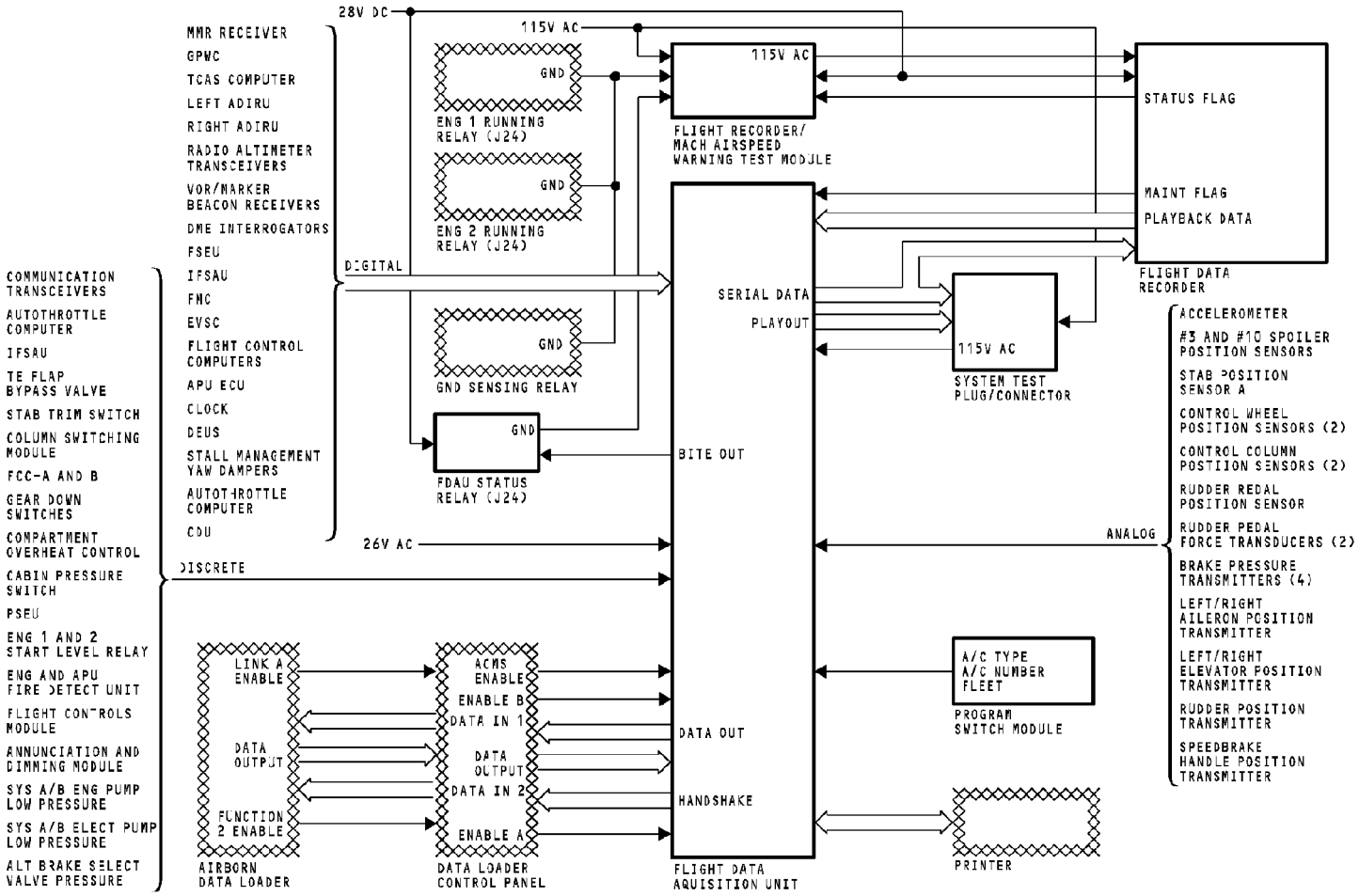


FDRS - SYSTEM SUMMARY

EFFECTIVITY

HAP 001-013, 015-026, 028-030

31-31-00



FDRS - SYSTEM SUMMARY

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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.

Input Signals

HAP 031-054, 101-999

The printer gets signals and commands from the FDRS FDAU.

HAP **HAP 001-013, 015-026, 028-030**

HAP The printer gets signals and commands from these systems:

HAP
- ACARS
- FDRS FDAU.

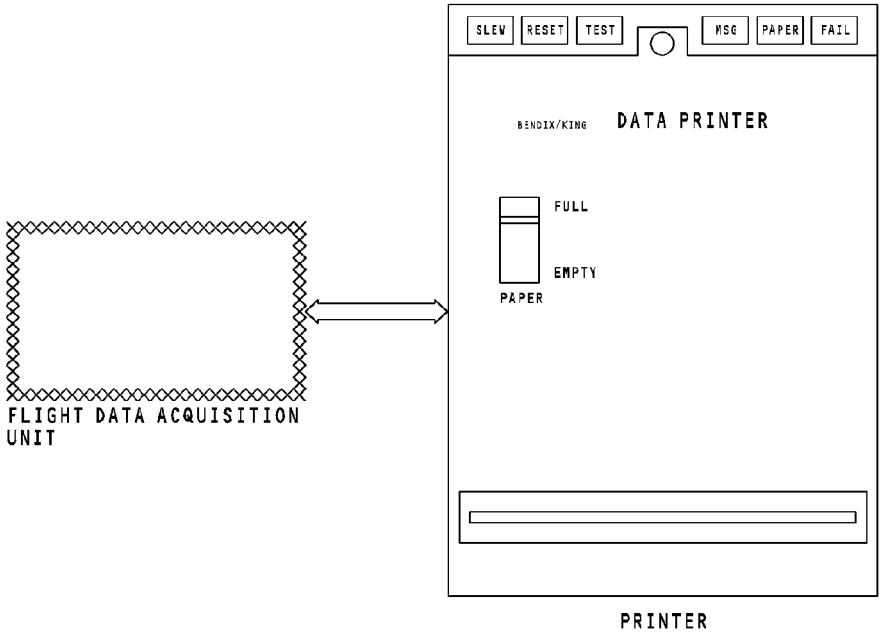
HAP ALL

Abbreviations and Acronyms

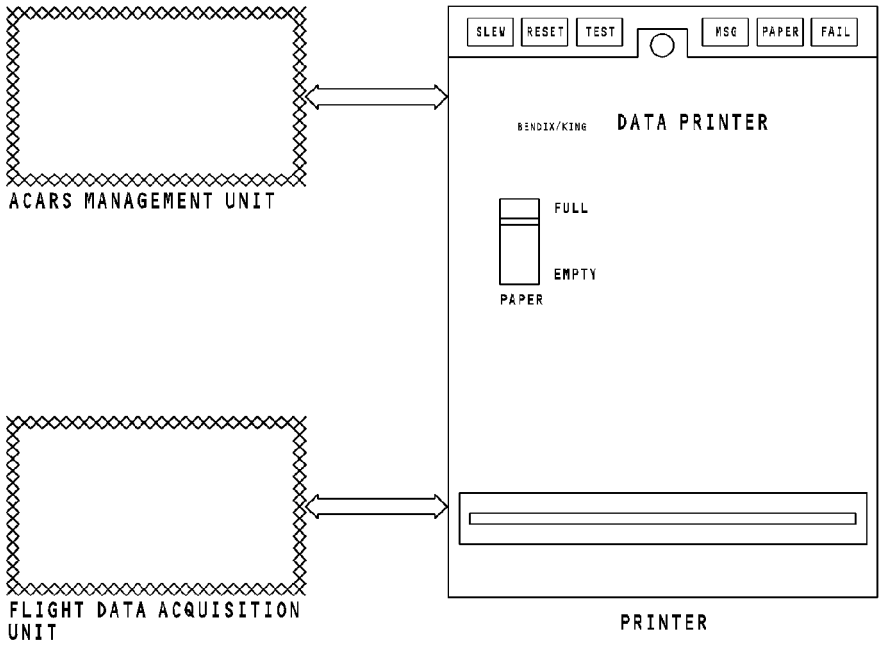
- ac - alternating current
- A/C - aircraft
- ACARS - aircraft communications addressing and reporting system
- ACMS - aircraft conditioning monitoring system
- A/D - analog to digital
- alt - alternate
- ARINC - Aeronautical Radio, Inc.
- ATE - automatic test equipment
- BITE - built-in test equipment
- 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
- v dc - volts direct current

EFFECTIVITY

HAP ALL



PRINTER SYSTEM - GENERAL DESCRIPTION



PRINTER SYSTEM - GENERAL DESCRIPTION

EFFECTIVITY

HAP 001-013, 015-026, 028-030

31-33-00

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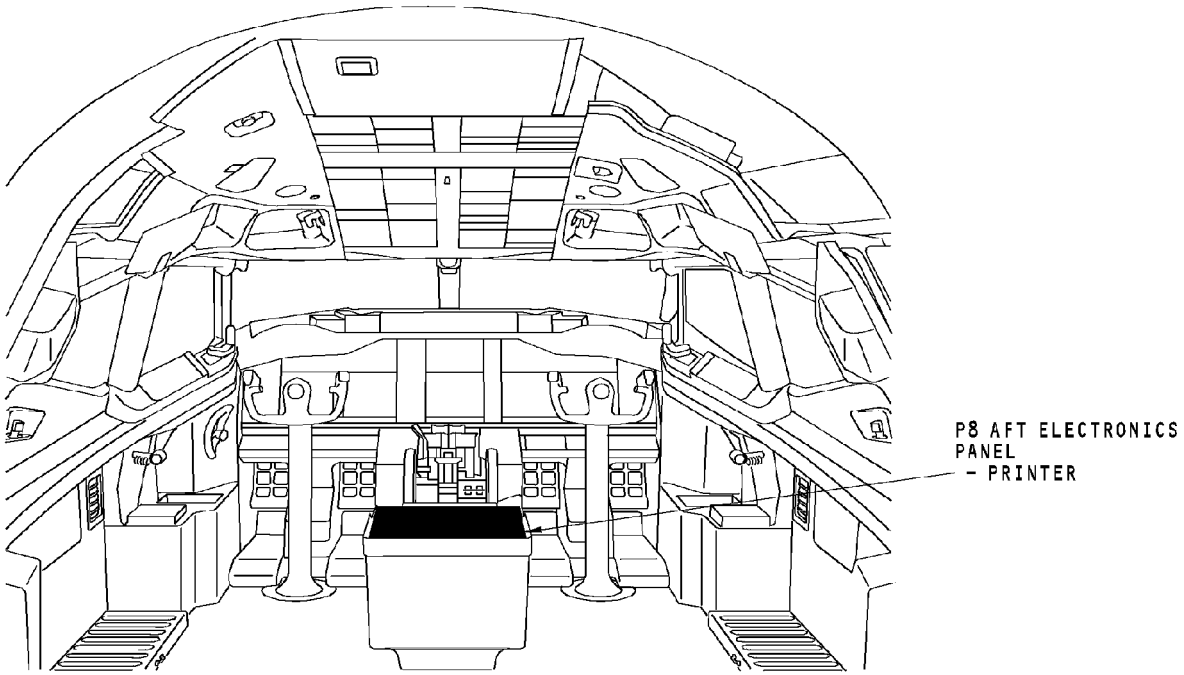
PRINTER SYSTEM - COMPONENT LOCATIONS

Flight Compartment

The printer is on the aft electronics panel P8.



PRINTER SYSTEM - COMPONENT LOCATIONS

General

HAP **HAP 001-013, 015-026, 028-030**

HAP The printer interfaces with these line replaceable units (LRUs):

HAP • ACARS management unit (MU) - sends reports to the printer
HAP on an ARINC 429 data bus. The MU sends the reports
HAP automatically or when it gets a command.
• 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.

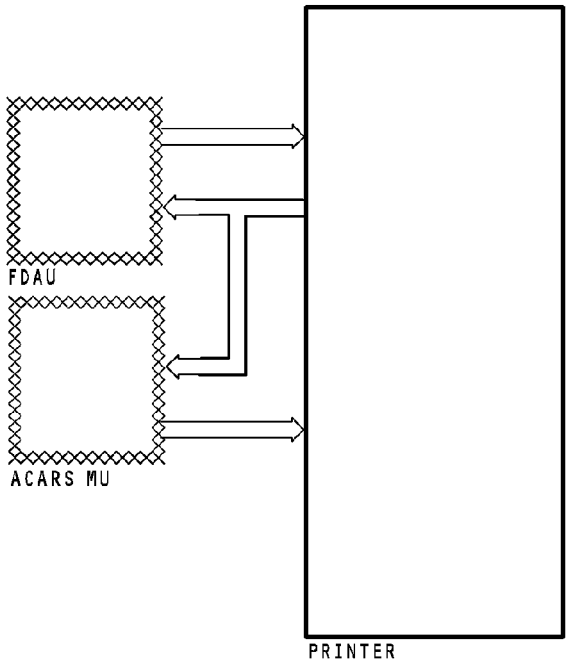
HAP 031-054, 101-999

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.

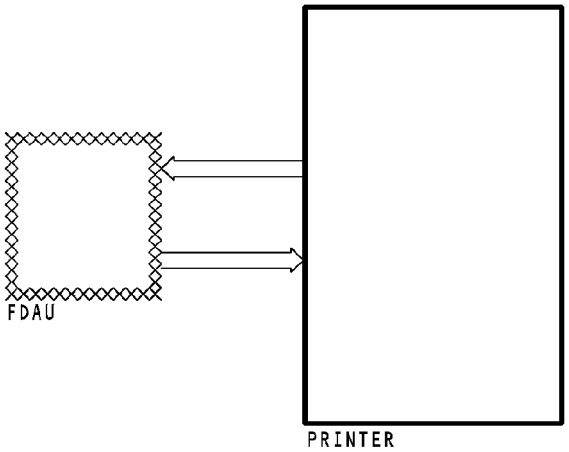
HAP **HAP 001-013, 015-026, 028-030**

HAP The printer sends status and handshake to the FDAU and the
HAP ACARS MU on ARINC 429 data buses.

HAP **HAP ALL**



PRINTER SYSTEM - INTERFACES



PRINTER SYSTEM - INTERFACES

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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

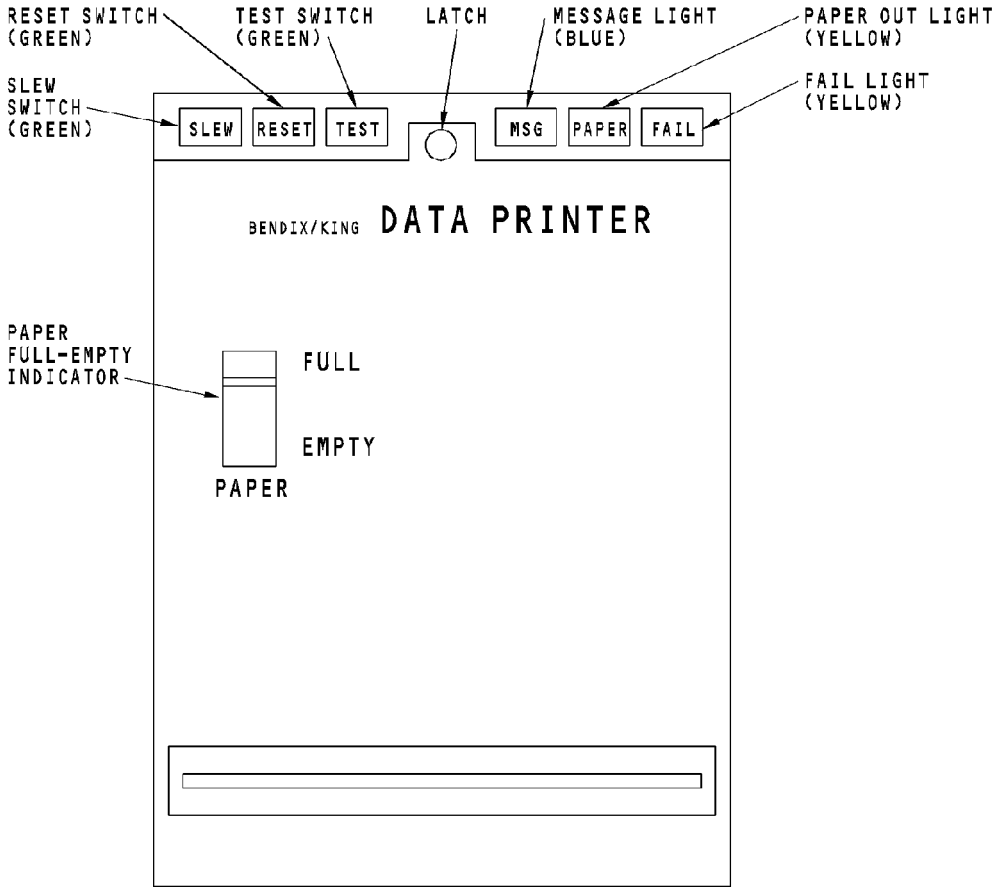
These are the printer controls:

- 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.



PRINTER SYSTEM - PRINTER

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.

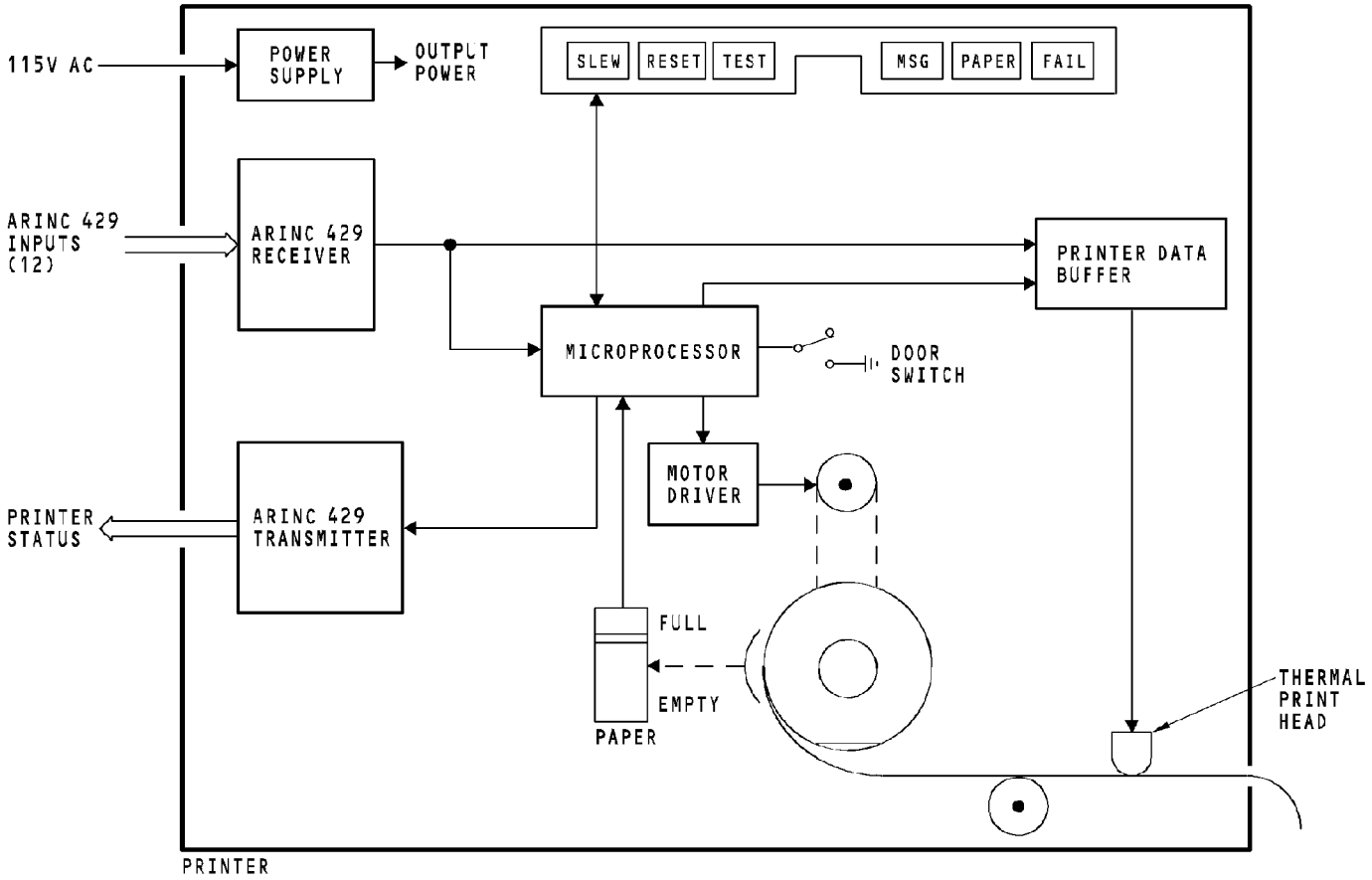
The paper indicator shows the amount of paper on the paper roll and tells the microprocessor if the paper roll is empty. The microprocessor also monitors the door switch. The microprocessor stops all print operations if the door is open or if the printer is out of paper.

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.

EFFECTIVITY
HAP ALL



PRINTER SYSTEM - PRINTER FUNCTIONAL DESCRIPTION

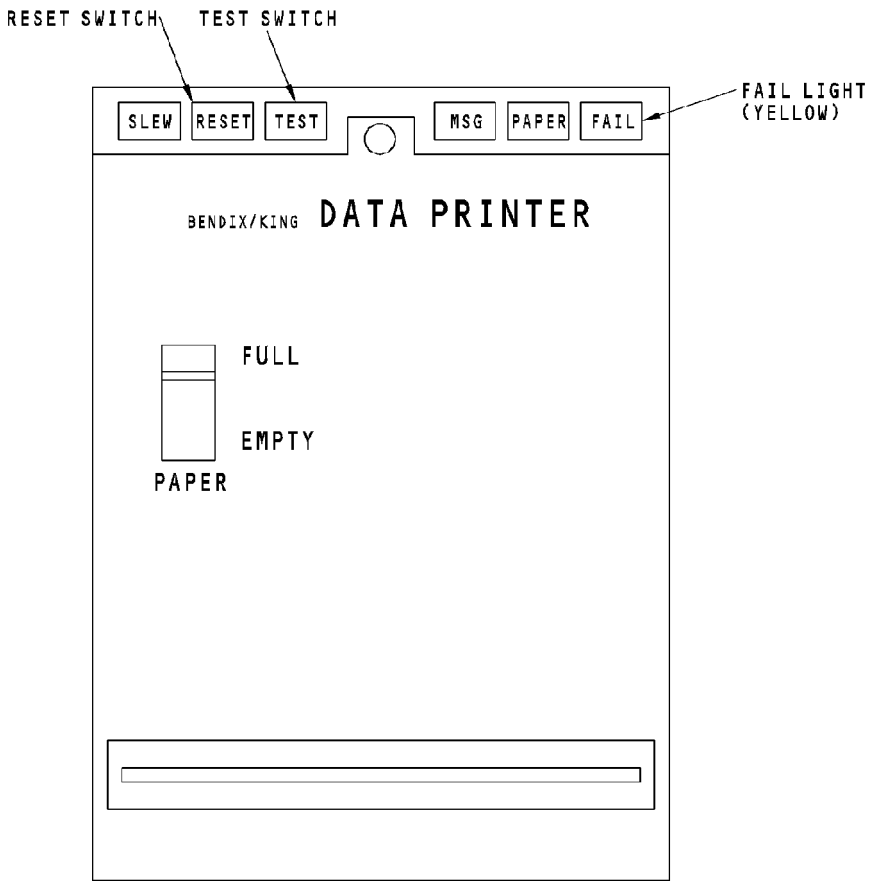
General

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.



PRINTER SYSTEM - TESTS

PRINTER SYSTEM - TRAINING INFORMATION POINT - LOAD PRINTER PAPER

General

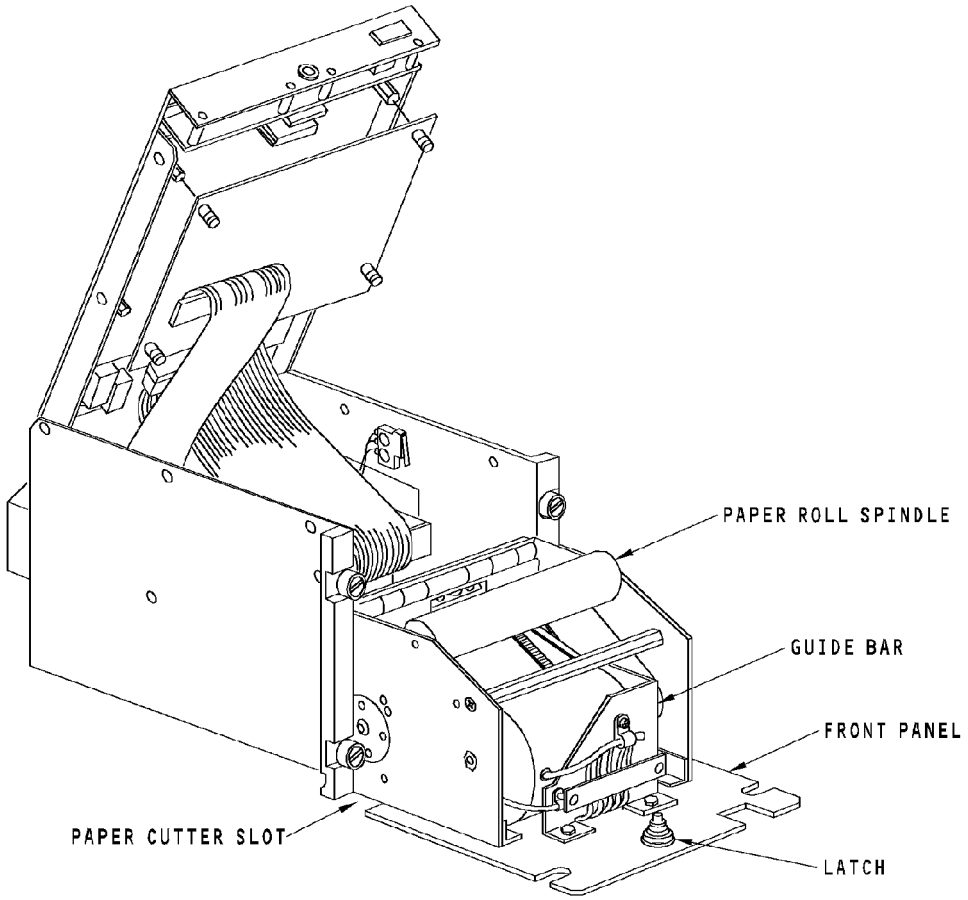
Replace printer paper when the end of the paper roll is at the print head. These show that you need to replace the paper:

- 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.



PRINTER SYSTEM - TRAINING INFORMATION POINT - LOAD PRINTER PAPER

General

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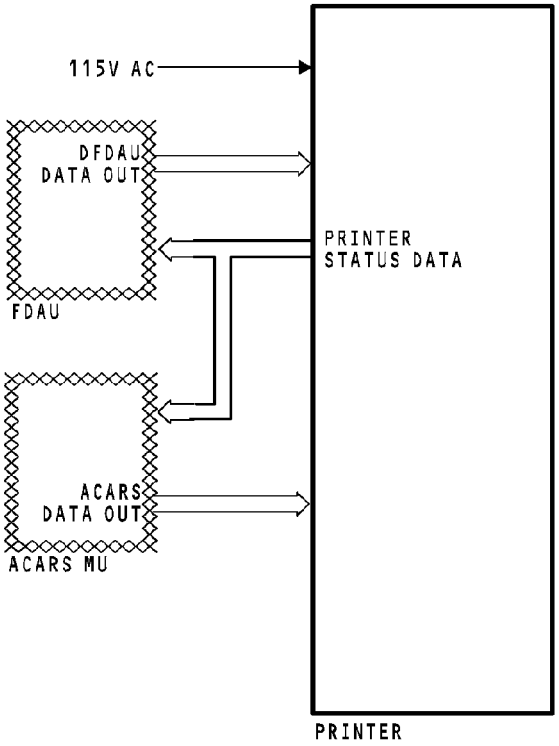
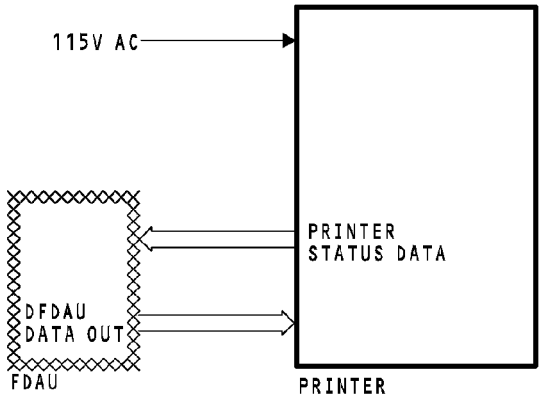


PRINTER SYSTEM - SYSTEM SUMMARY



PRINTER SYSTEM - SYSTEM SUMMARY

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General

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

Abbreviations and Acronyms

HAP 001-013, 015-026, 028-030

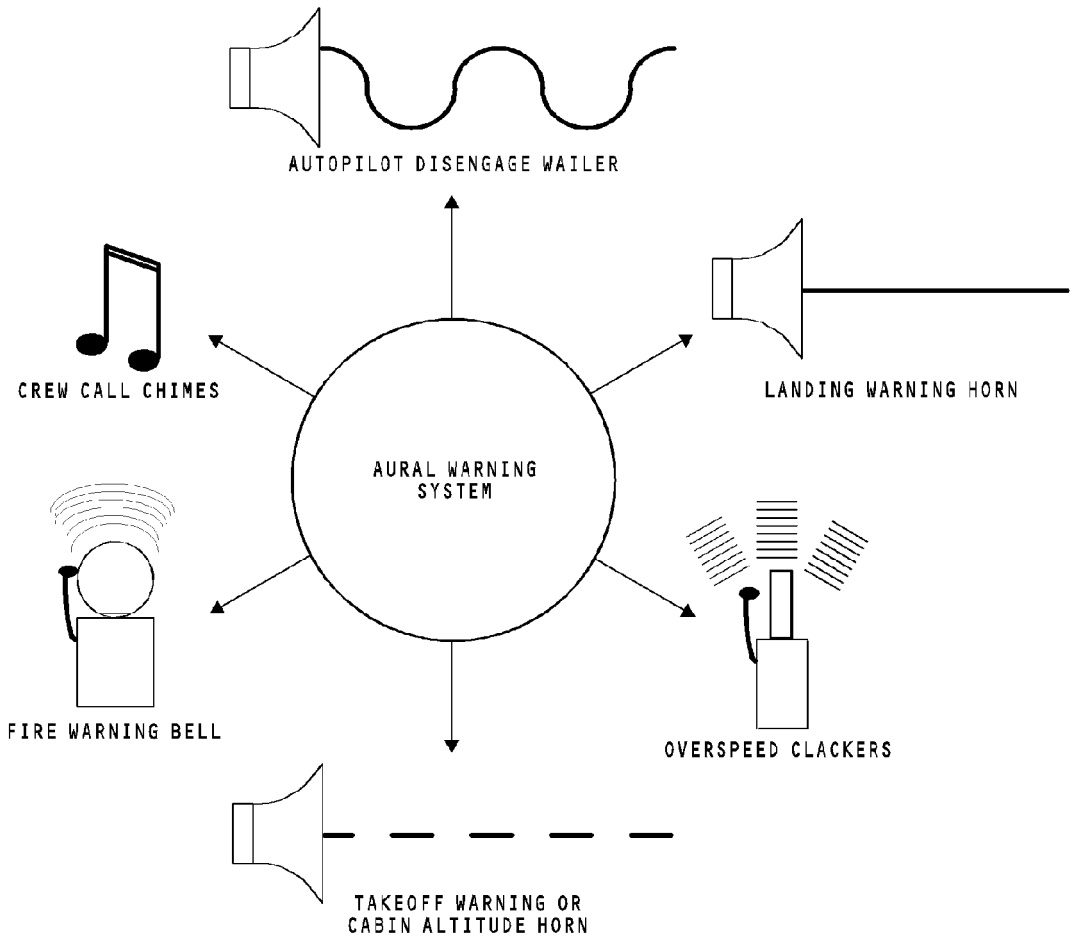
- ACARS - aircraft communications addressing and reporting system

HAP ALL

- 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

EFFECTIVITY

HAP ALL



AURAL WARNING SYSTEM - INTRODUCTION

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

HAP 037-054, 101-999

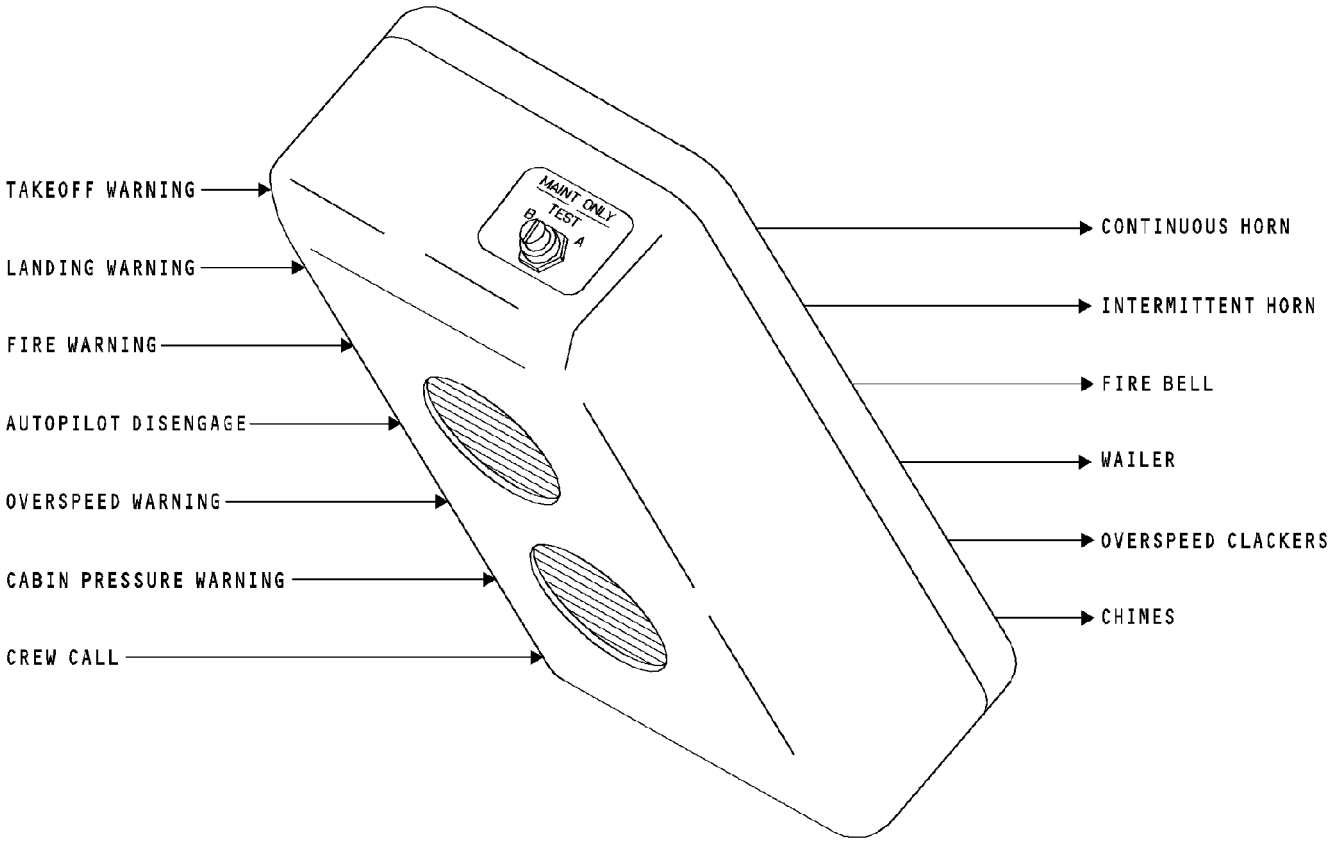
- SELCAL alert

HAP ALL

- Crew call.

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

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



AURAL WARNING MODULE

AURAL WARNING SYSTEM - GENERAL DESCRIPTION

EFFECTIVITY
HAP 001-013, 015-026, 028-036

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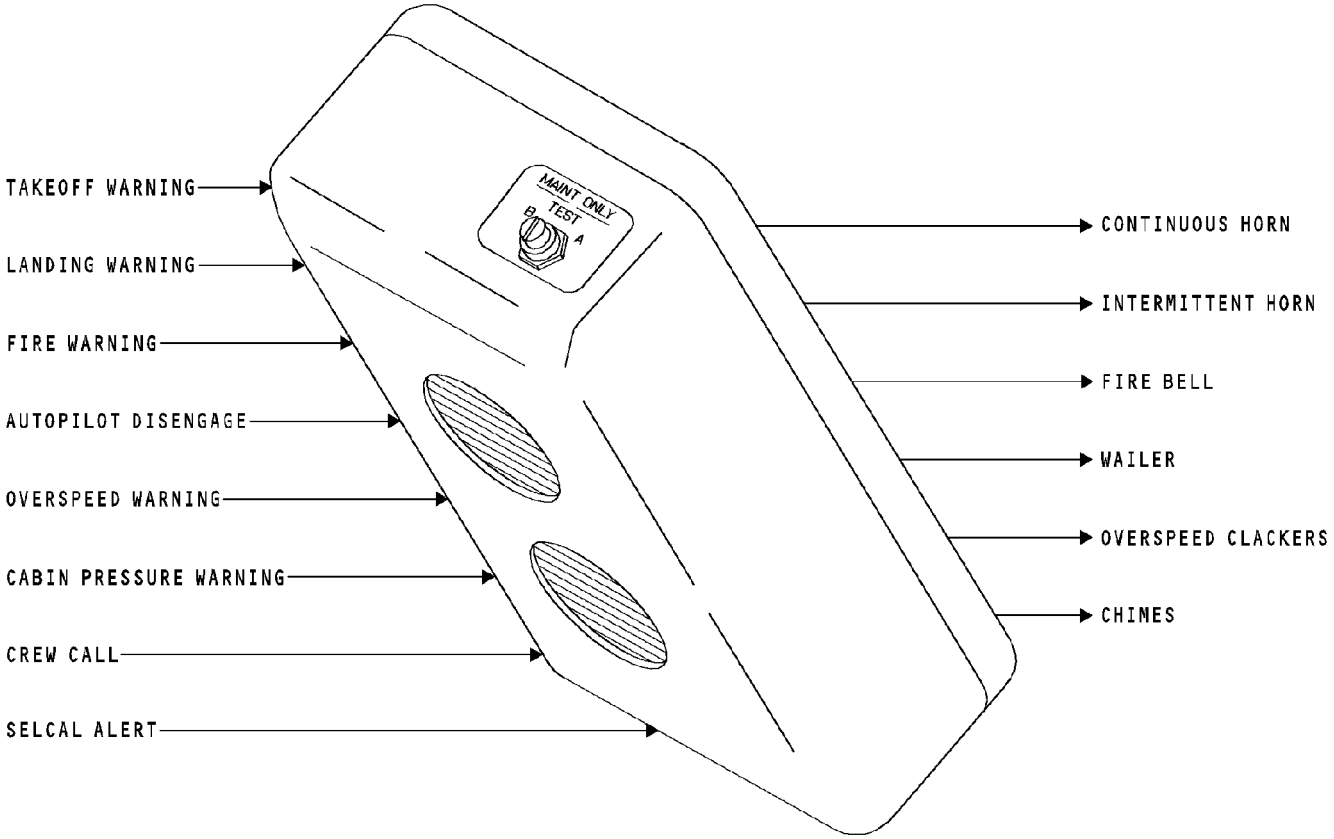

AURAL WARNING MODULE

AURAL WARNING SYSTEM - GENERAL DESCRIPTION

EFFECTIVITY
HAP 037-054, 101-999

31-51-00

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AURAL WARNING SYSTEM - COMPONENT LOCATION

General

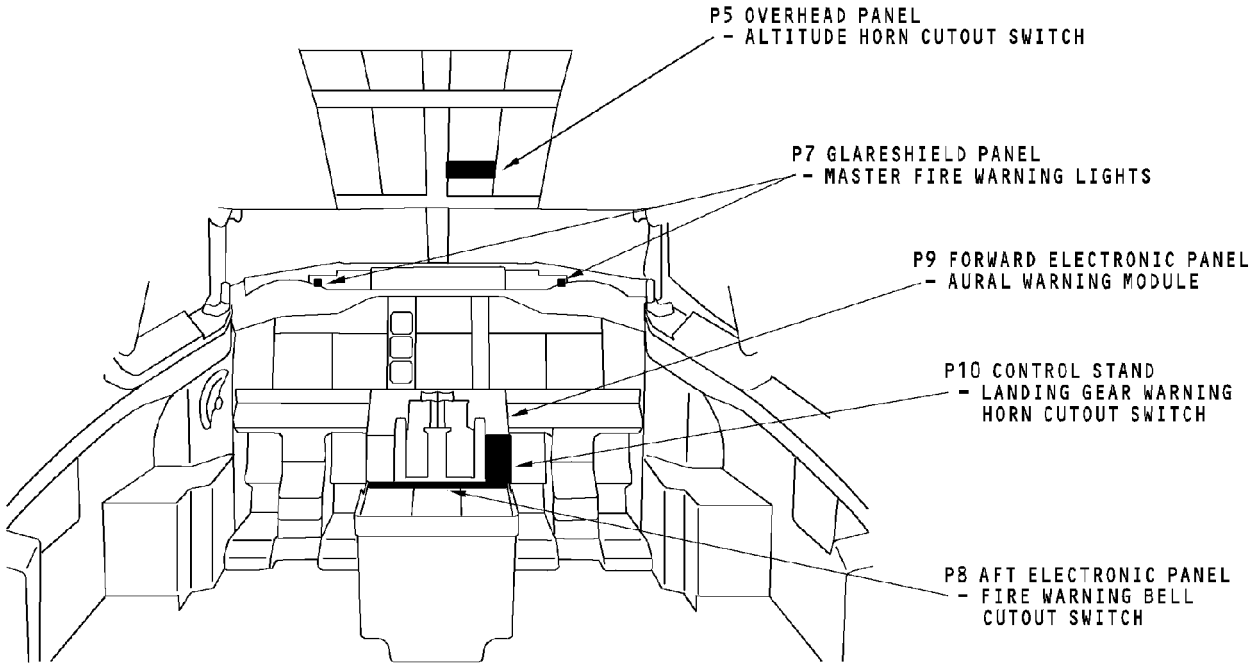
The aural warning module is in the flight compartment. It is on the aft right face of the P9 forward electronic panel.

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.



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.

HAP 037-054, 101-999

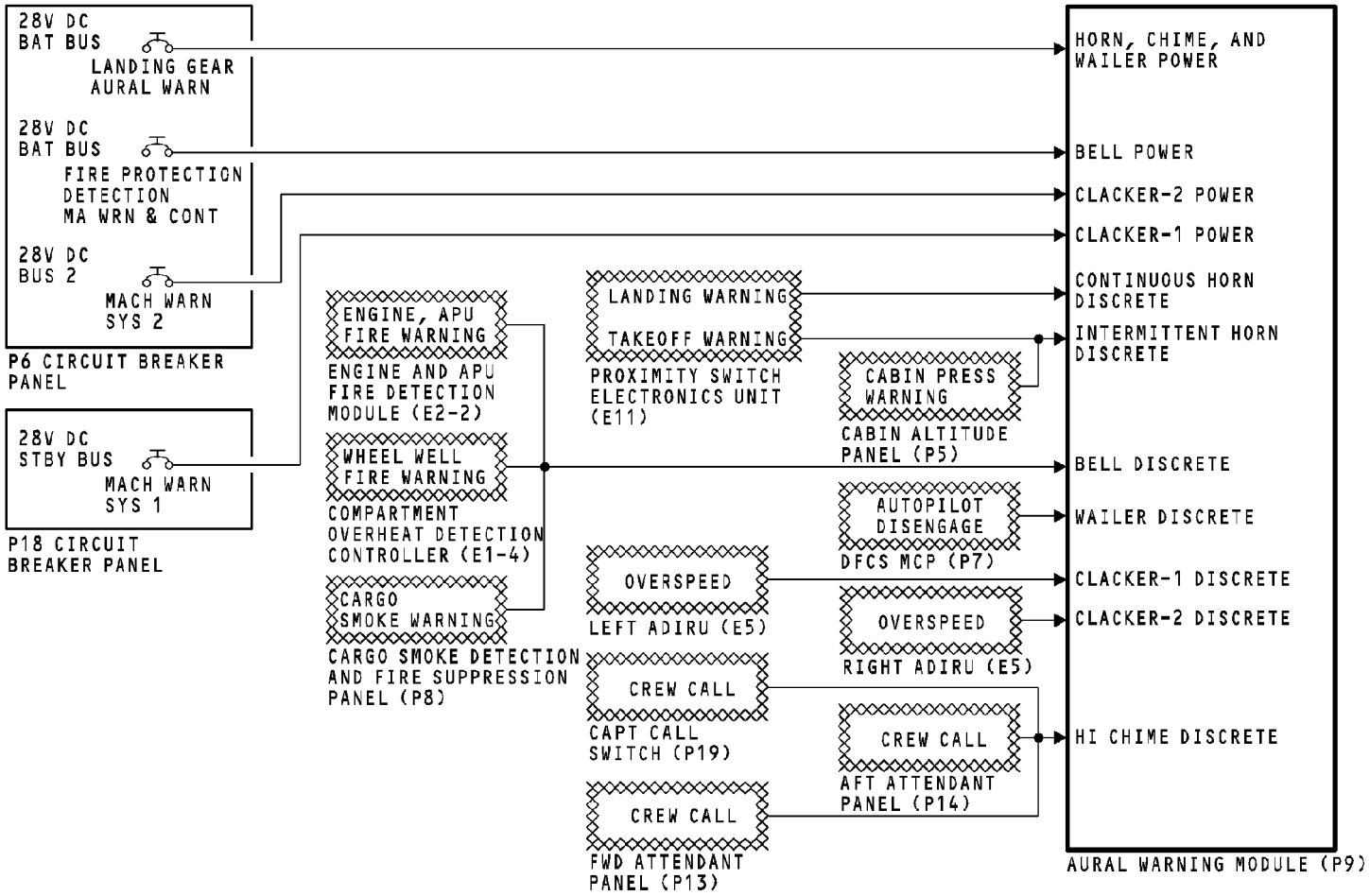
HI/LO Chime Inputs

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

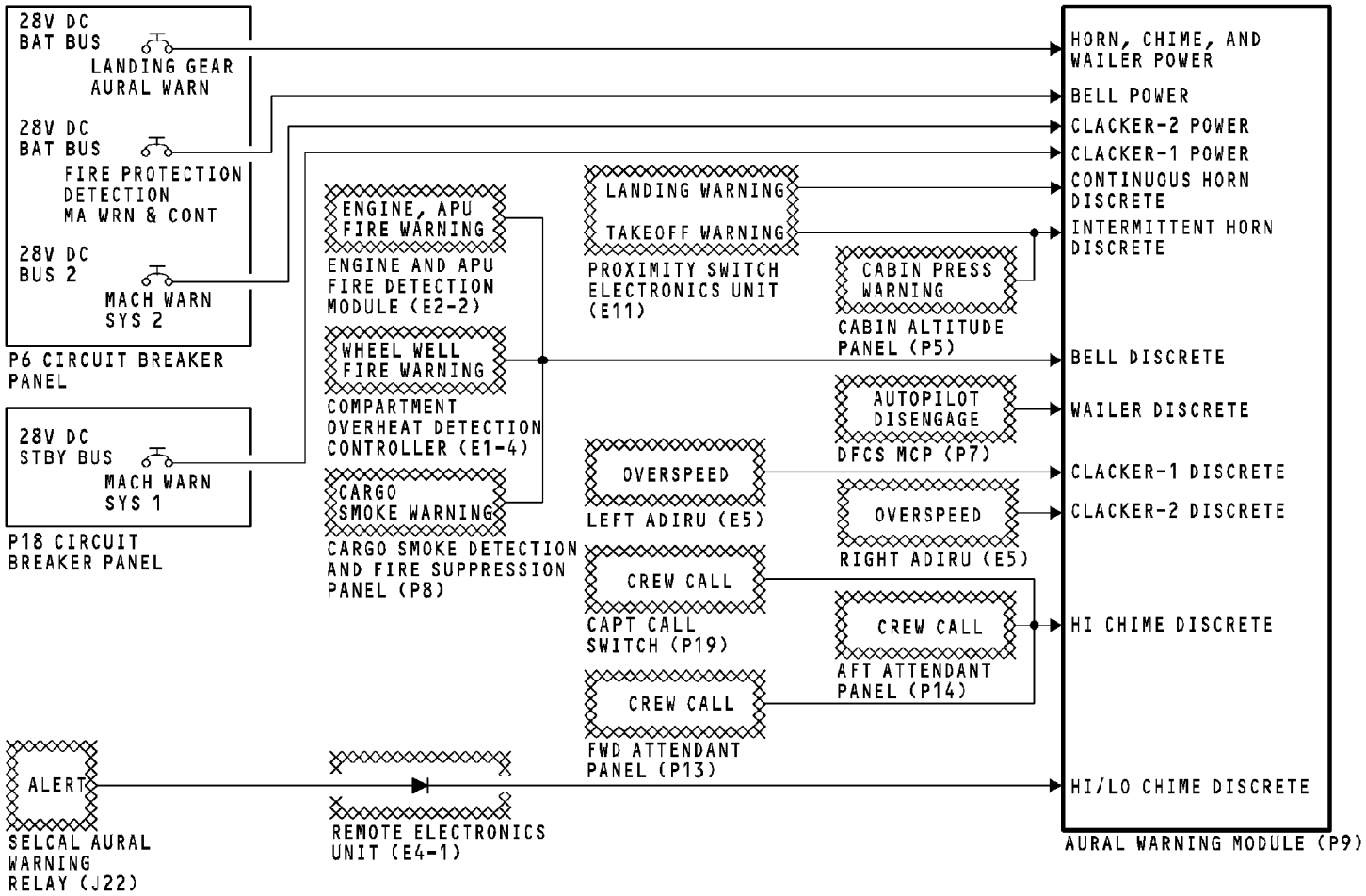
HAP 037-054, 101-999 (Continued)

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.

HAP ALL



AURAL WARNING SYSTEM - INTERFACES



AURAL WARNING SYSTEM - INTERFACES

EFFECTIVITY
HAP 037-054, 101-999

31-51-00

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Purpose

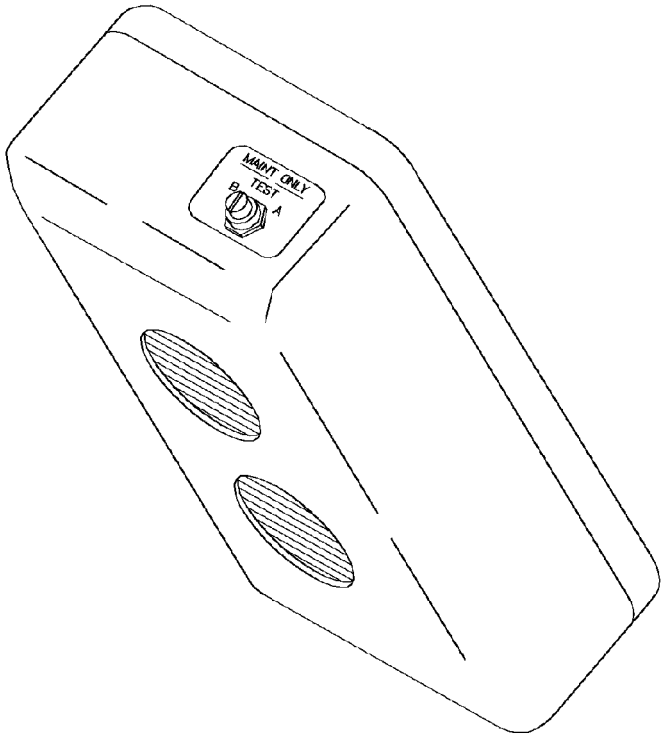
The aural warning module receives discrete inputs from various systems. The aural warning module uses these inputs to make aural alert sounds for the flight crew.

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

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.

HAP 001-013, 015-026, 028-036

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

HAP 037-054, 101-999

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

HAP ALL

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

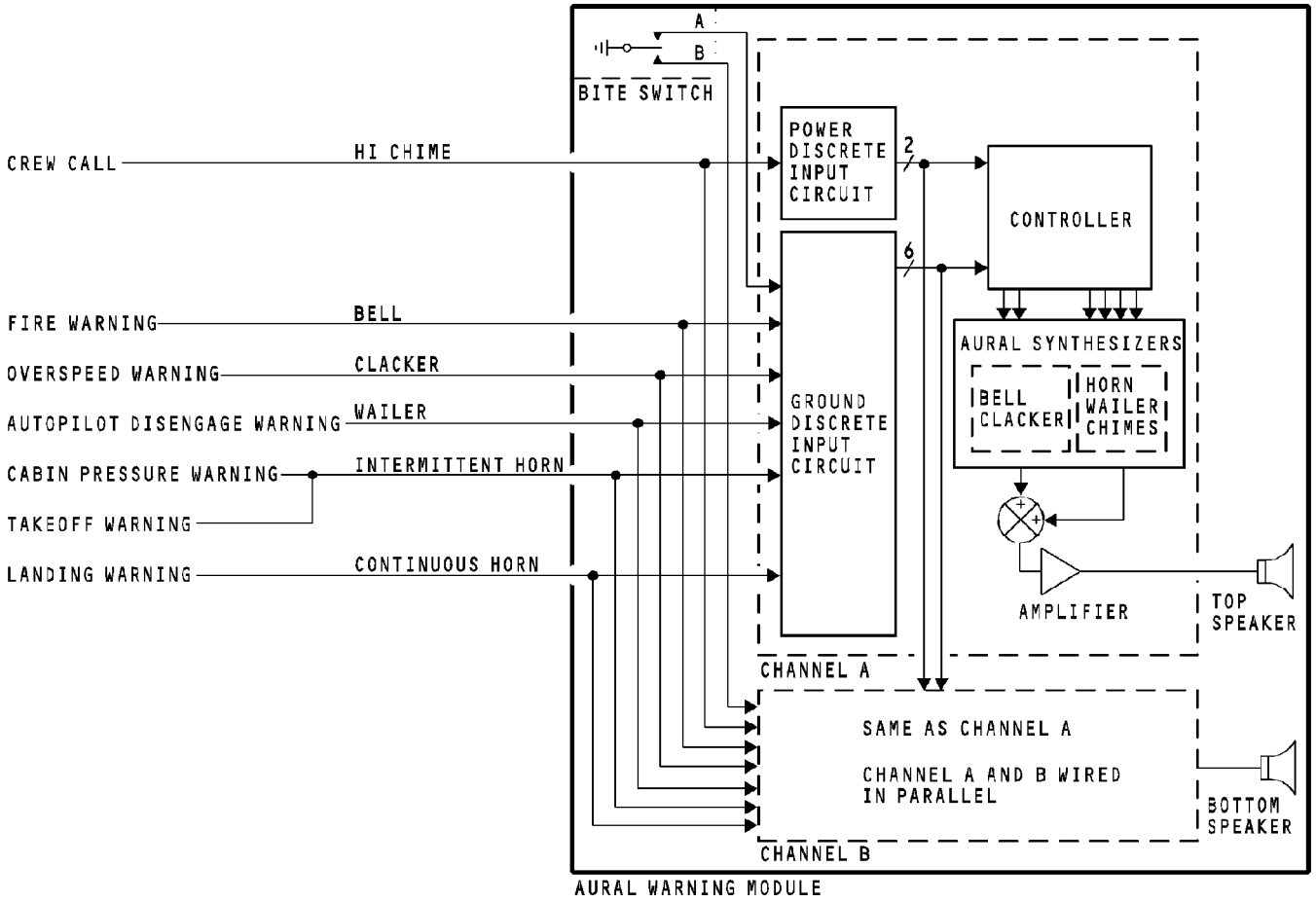
The speakers provide the sound. Channel A drives the top speaker. Channel B drives the bottom speaker. When there is an aural warning, both speakers provide sound at the same time.

BITE Switch

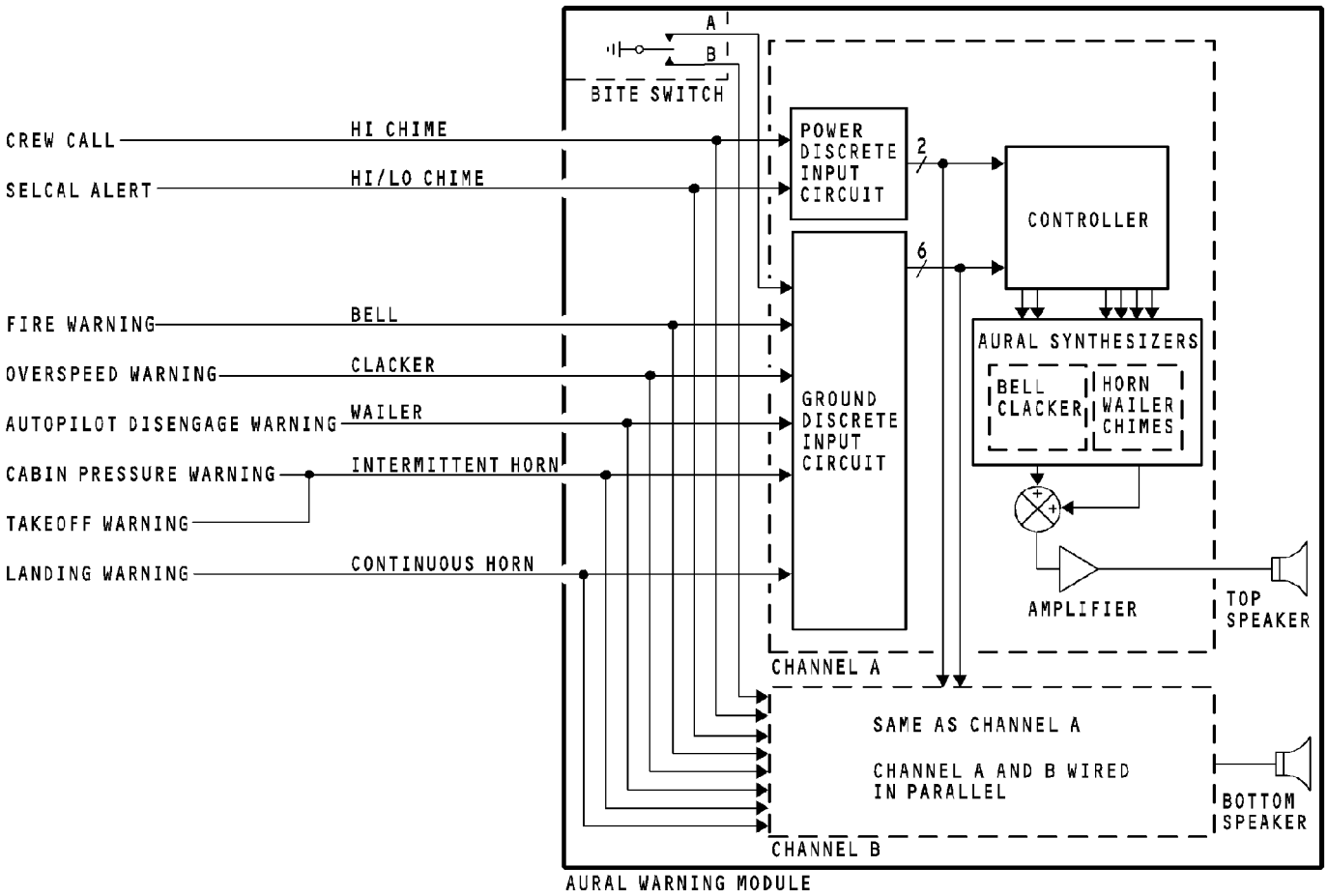
The BITE switch lets the operator do a test of each channel of the aural warning module.

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.



AURAL WARNING SYSTEM - FUNCTIONAL DESCRIPTION



AURAL WARNING SYSTEM - FUNCTIONAL DESCRIPTION

EFFECTIVITY
HAP 037-054, 101-999

31-51-00

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General

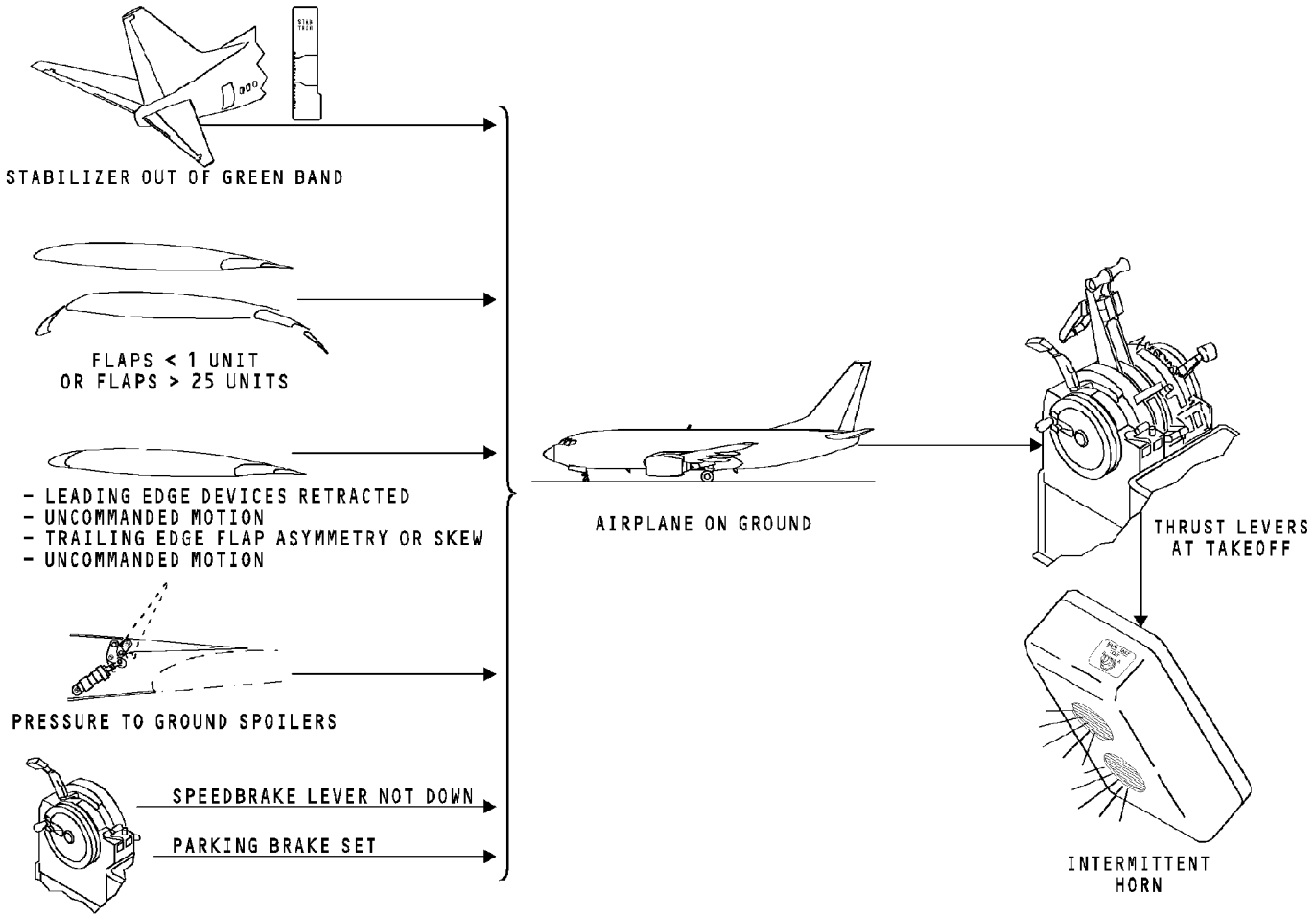
The aural warning module gives the sound of an intermittent horn for a takeoff warning.

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 assymetric, skewed, or there is uncommanded motion
- Ground spoilers have hydraulic pressure
- Speedbake 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.



AURAL WARNING SYSTEM - OPERATION - TAKEOFF 1

General

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

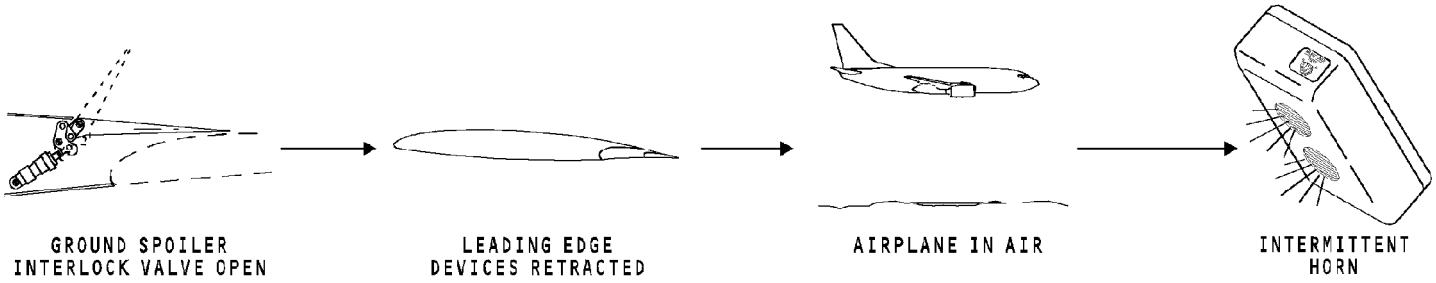
In the Air

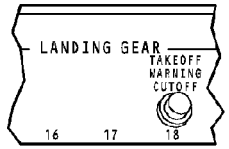
The aural warning system can give the takeoff warning when the airplane is in the air. This warning tells the flight crew that the ground spoiler interlock valve is open.

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)

AURAL WARNING SYSTEM - OPERATION - TAKEOFF 2

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.

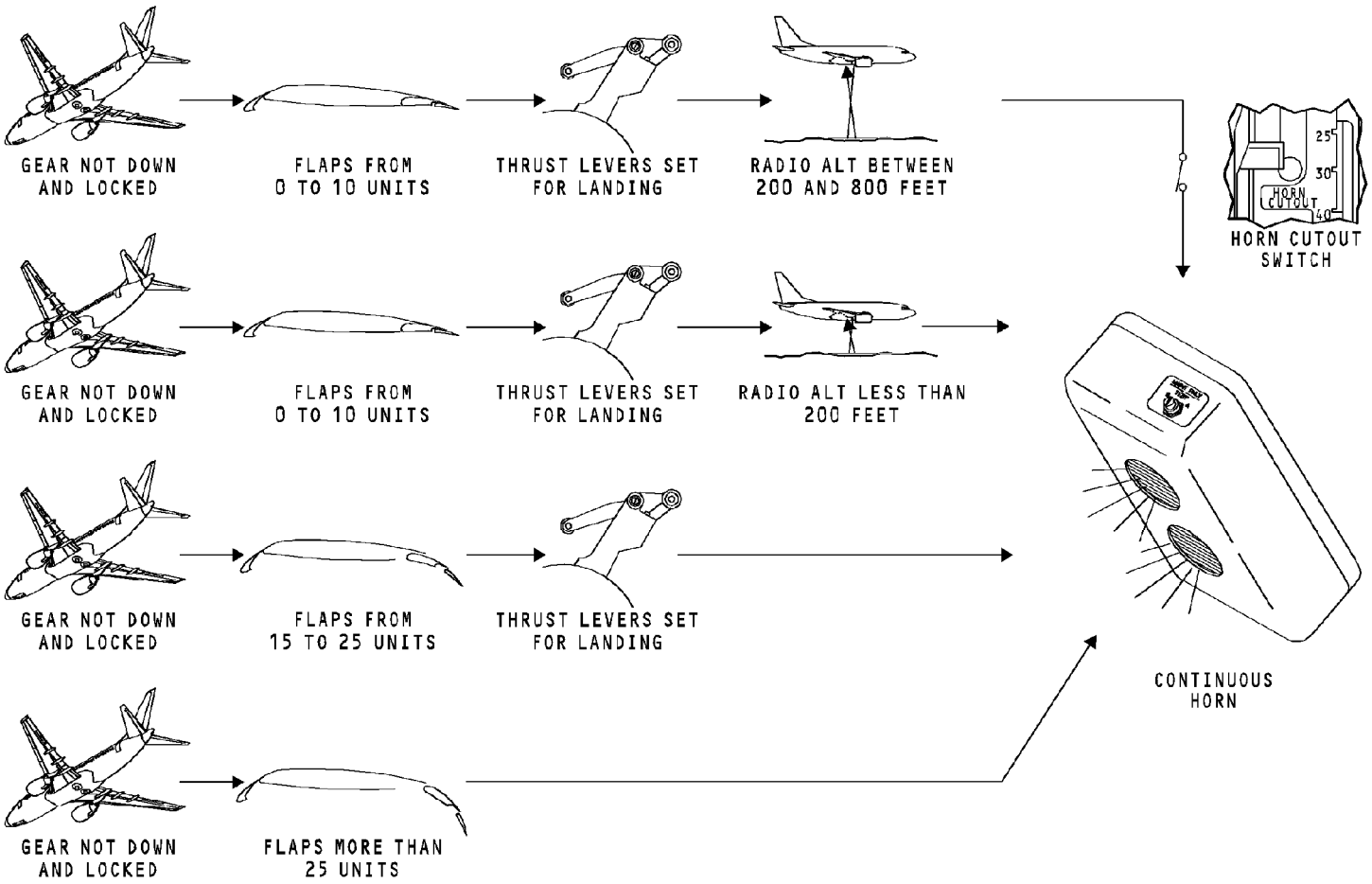
In the third set of conditions, the horn sounds when these conditions are true:

- 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.



AURAL WARNING SYSTEM - OPERATION - LANDING

AURAL WARNING SYSTEM - OPERATION - FIRE

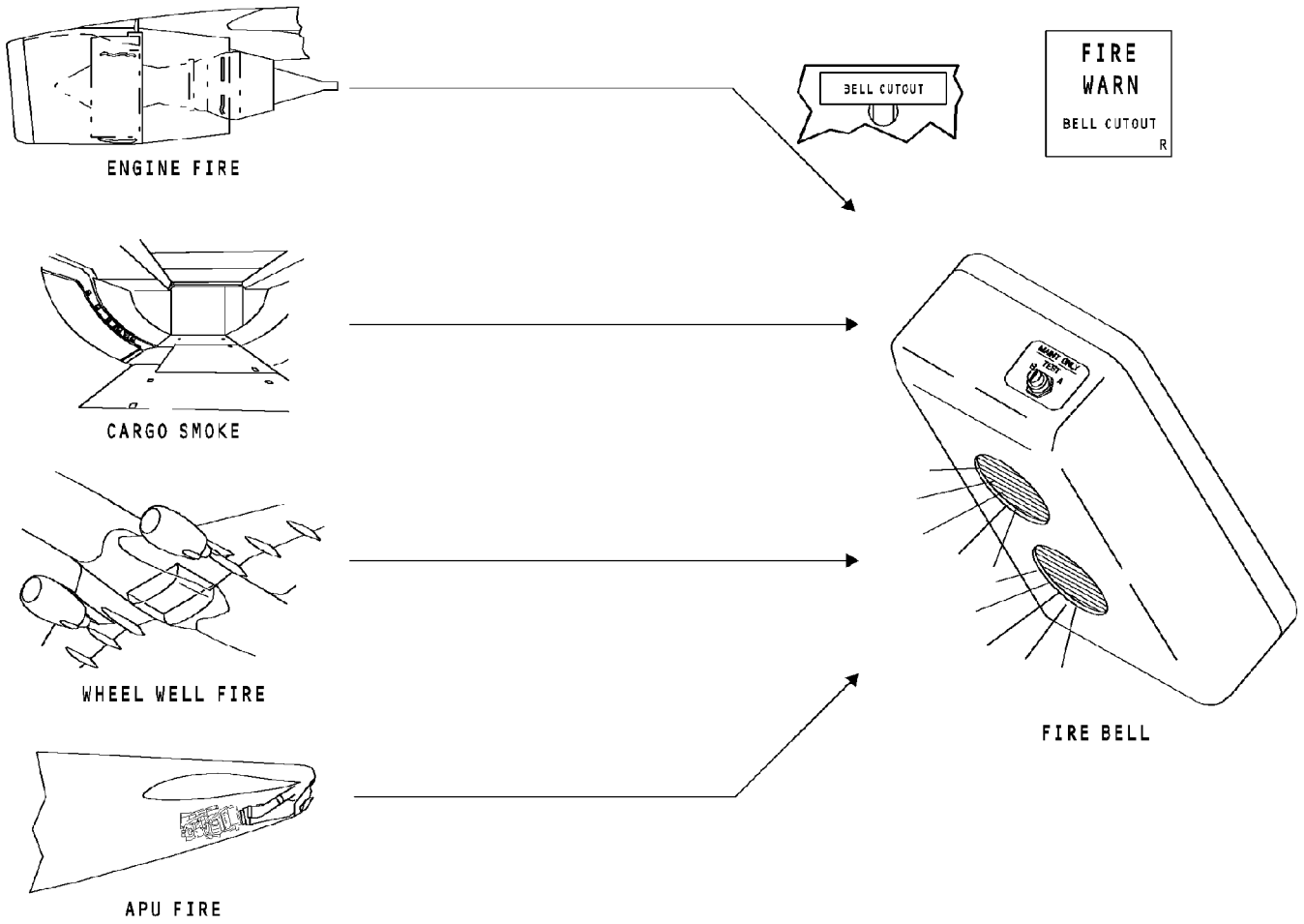
General

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.



AURAL WARNING SYSTEM - OPERATION - FIRE

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

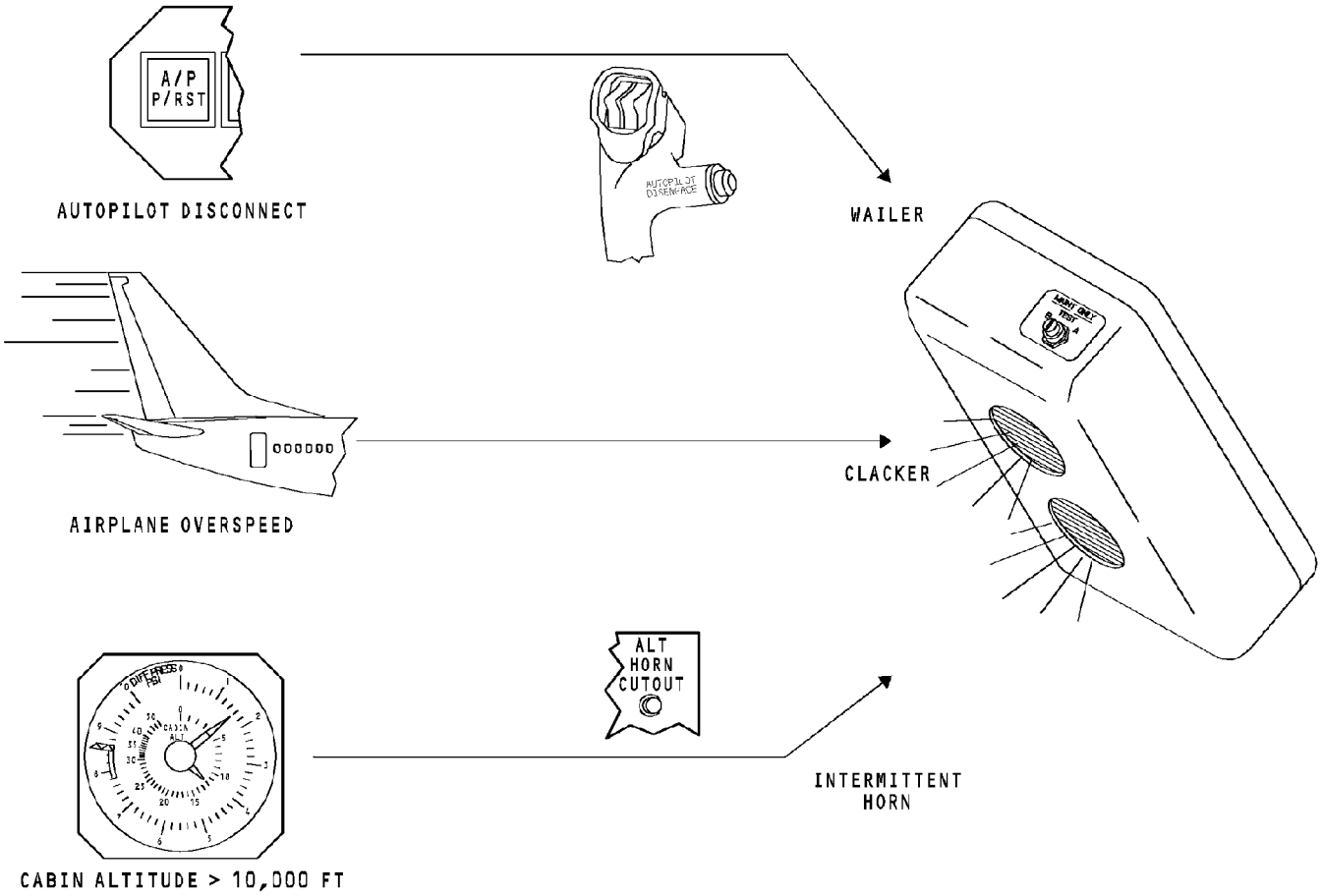
General

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.



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

AURAL WARNING SYSTEM - OPERATION - FLIGHT COMPARTMENT CALL

General

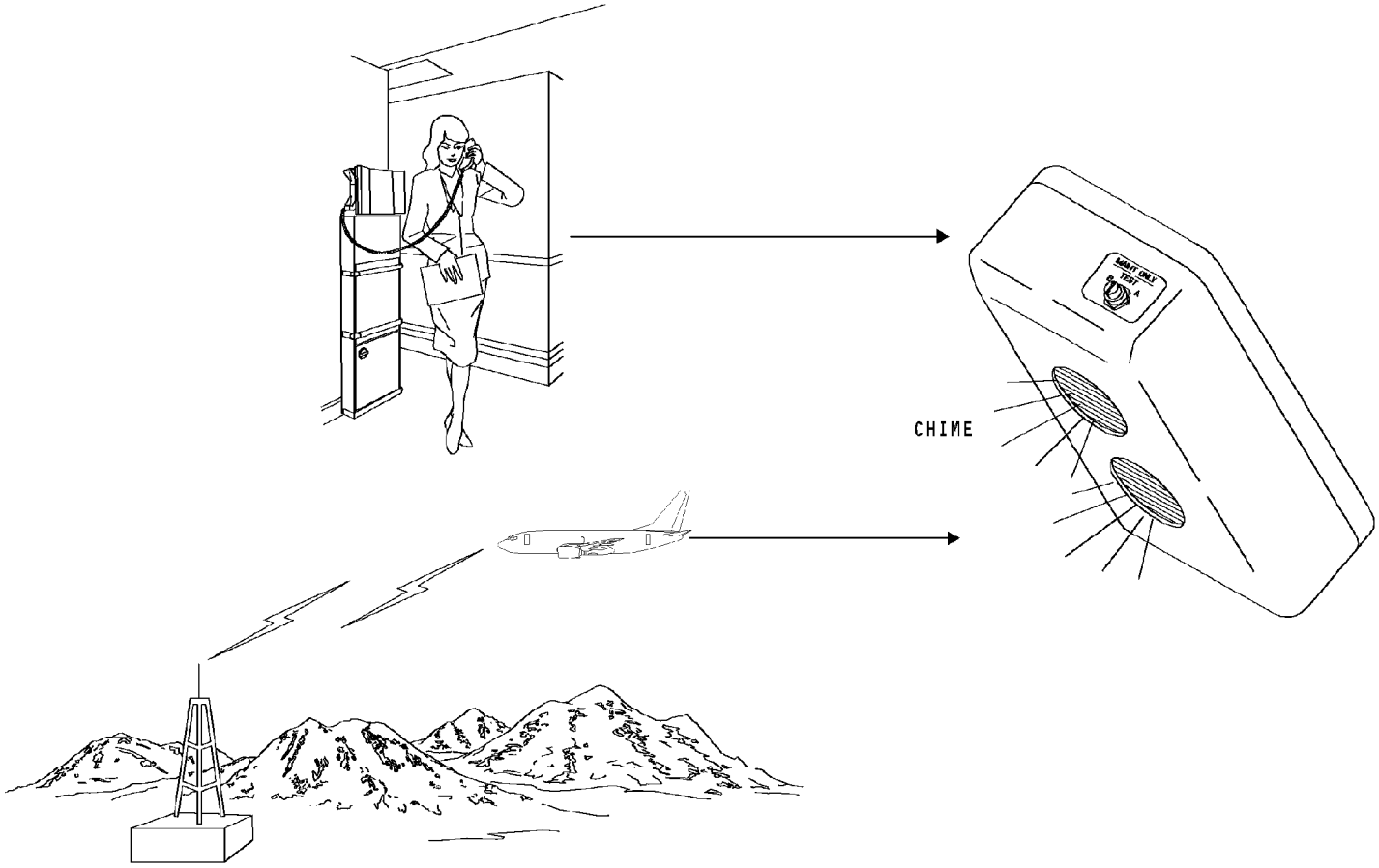
The aural warning unit gives the sound of a single high chime for a flight crew call.

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

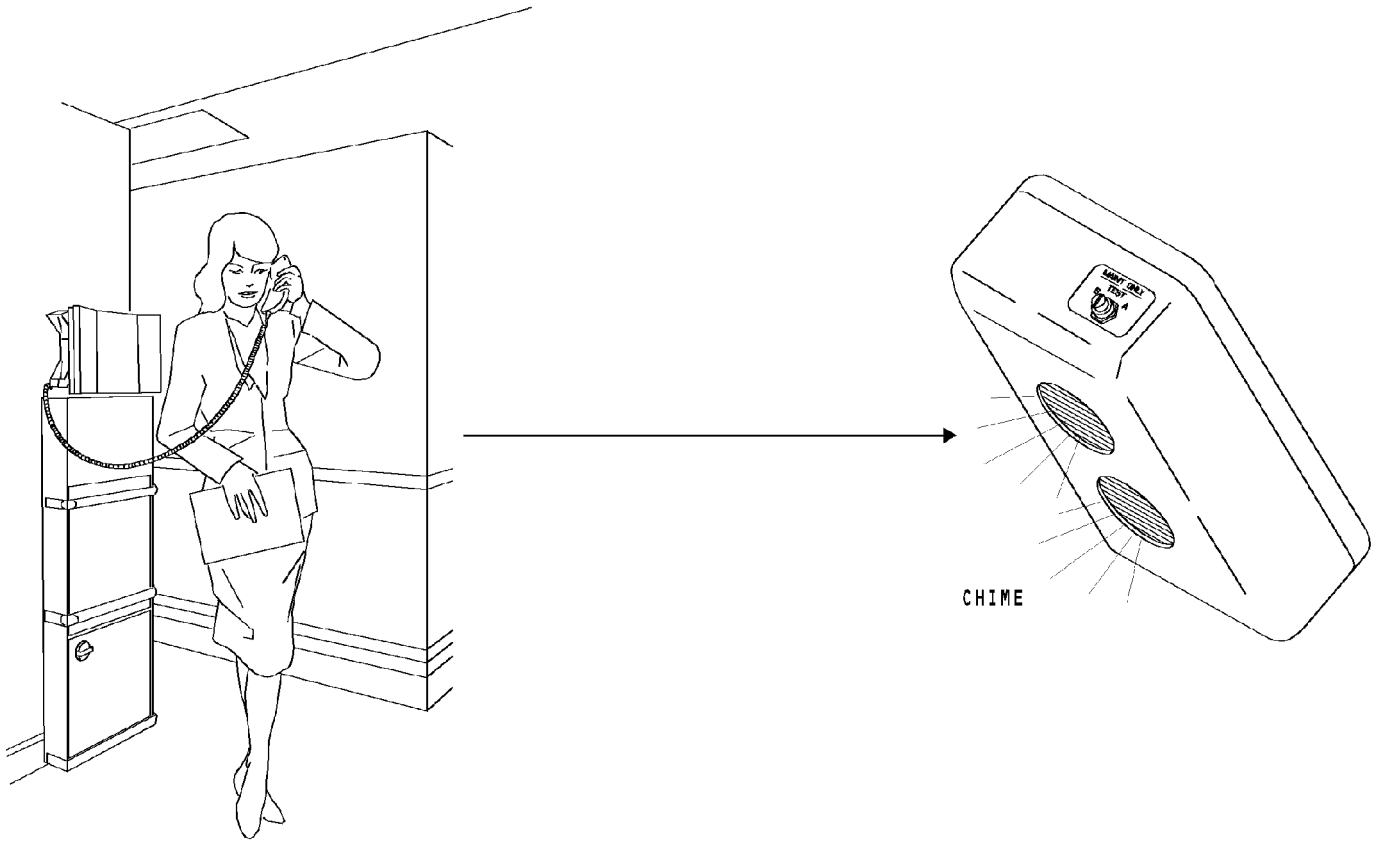
HAP 037-054, 101-999

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

HAP ALL



AURAL WARNING SYSTEM - OPERATION - FLIGHT COMPARTMENT CALL



AURAL WARNING SYSTEM - OPERATION - FLIGHT COMPARTMENT CALL

EFFECTIVITY

HAP 001-013, 015-026, 028-036

31-51-00

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AURAL WARNING SYSTEM - TEST

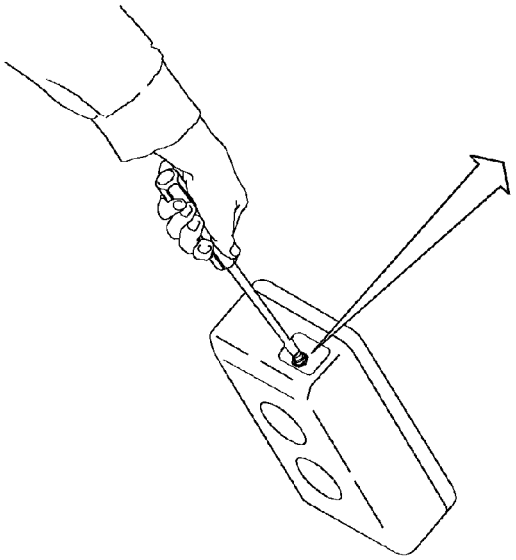
General

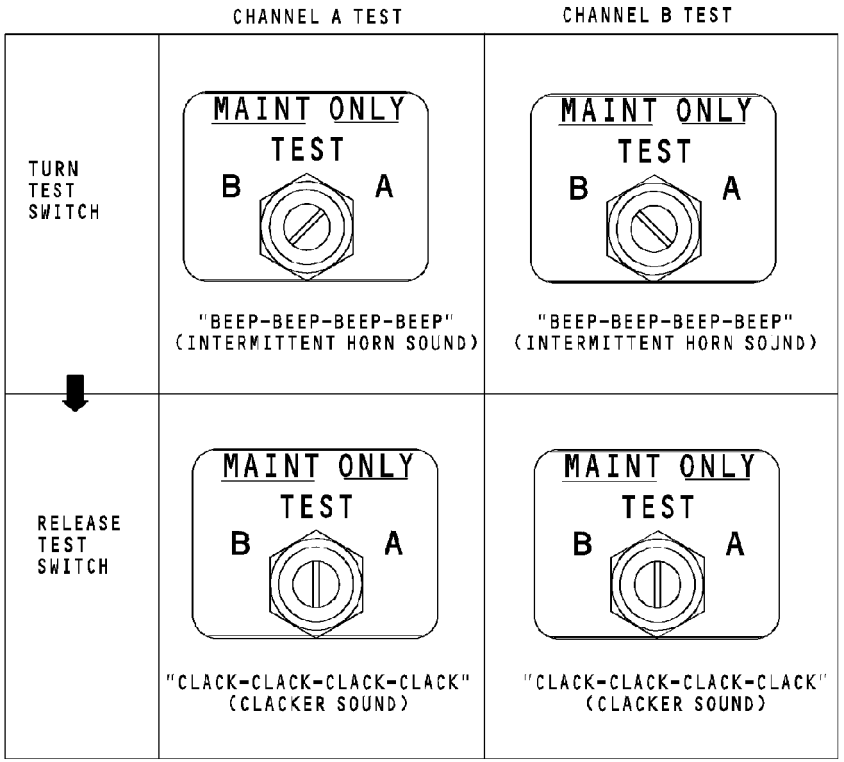
The aural warning system test checks the aural warning module for correct operation. You hear the intermittent horn and the clacker sounds for a good test.

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.





AURAL WARNING SYSTEM - SUMMARY

General

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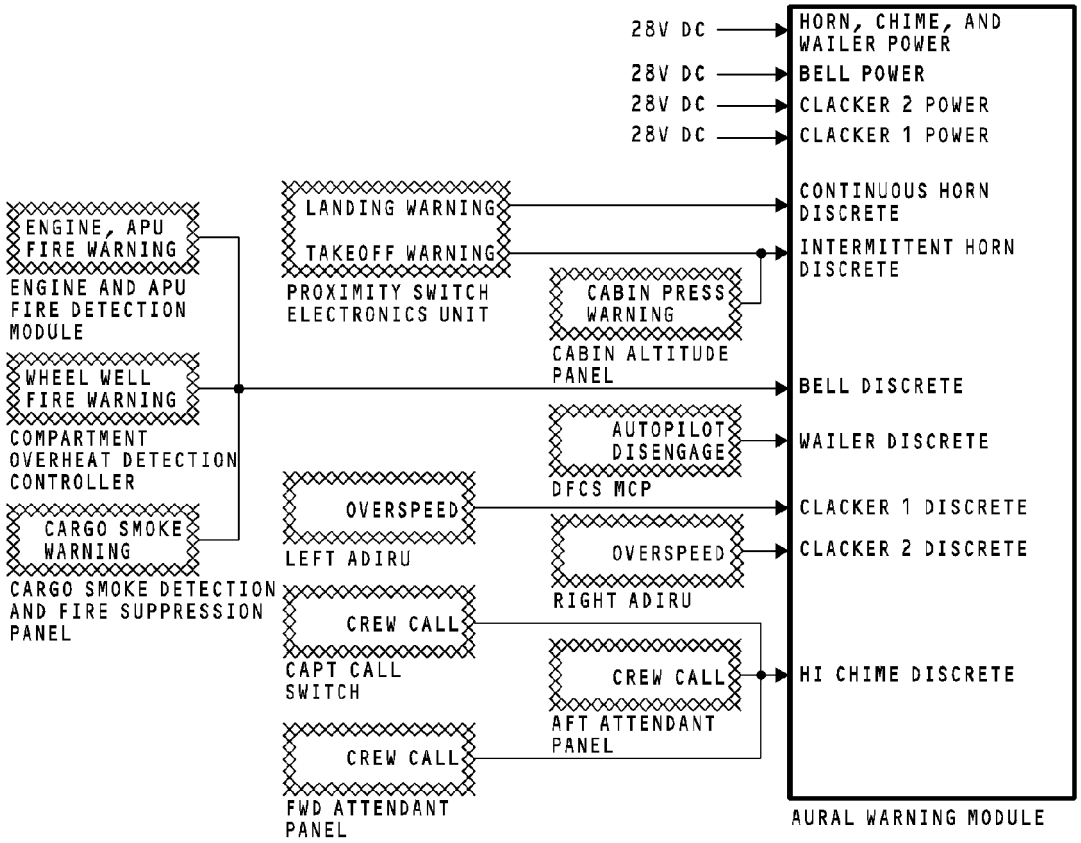
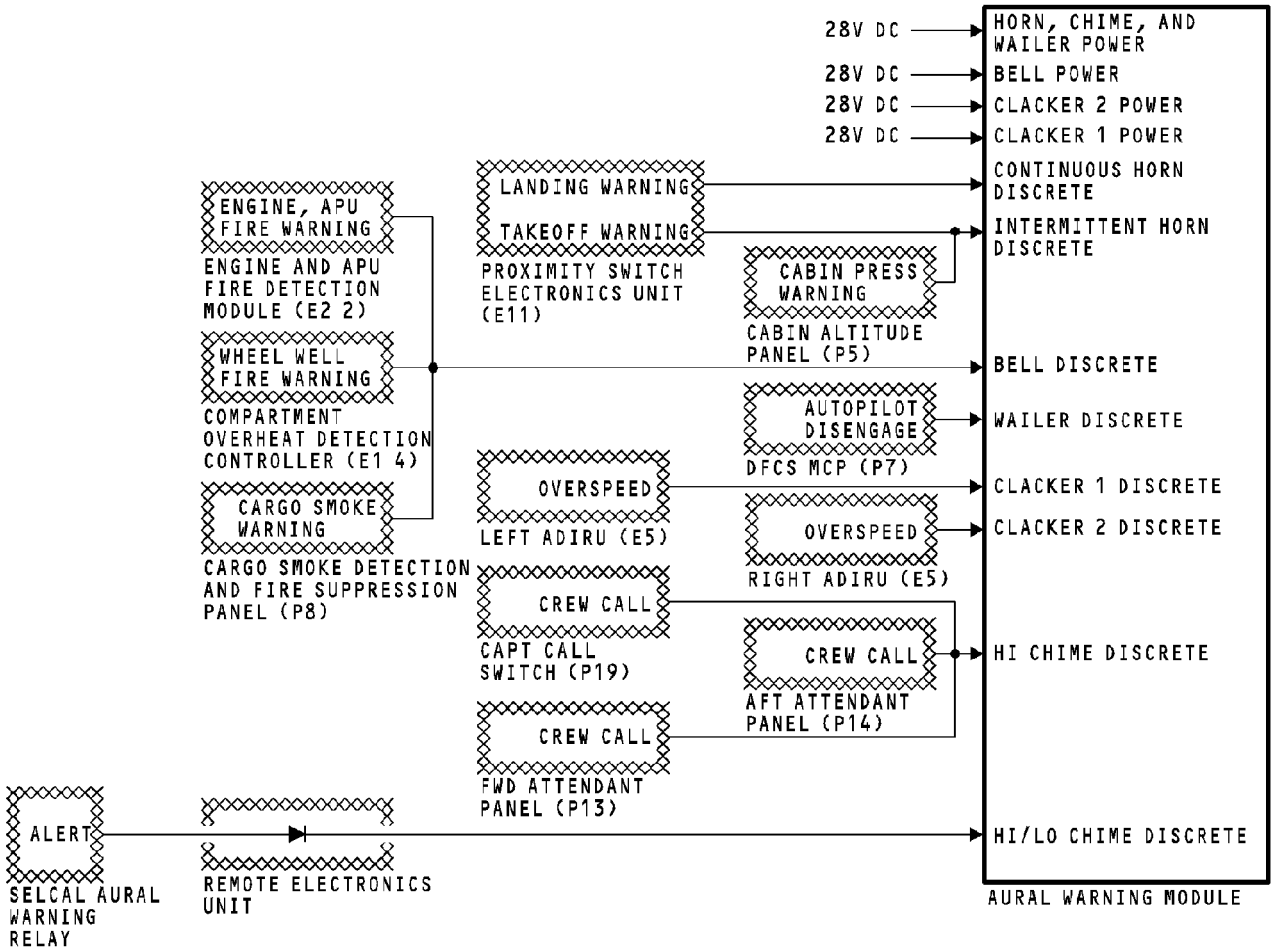


AURAL WARNING SYSTEM - SUMMARY



AURAL WARNING SYSTEM - SUMMARY

EFFECTIVITY
HAP 037-054, 101-999

31-51-00

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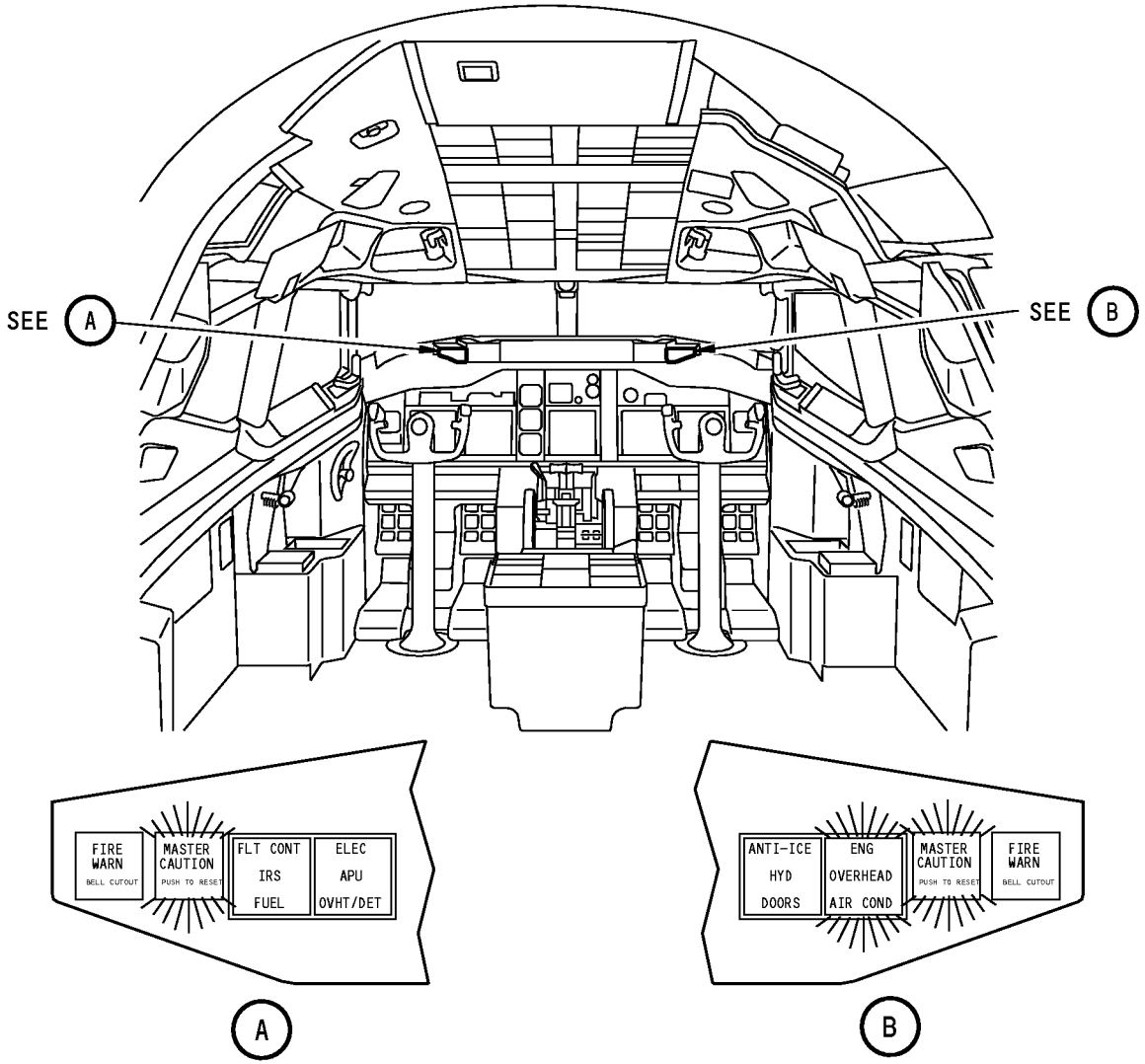
MASTER CAUTION SYSTEM - INTRODUCTION

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 - auxillary power unit
- aux - auxillary
- 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
- rcdr - recorder
- rec - recorder
- sched - scheduled
- stby - standby
- sw - switch
- temp - temperature
- v - volts
- warn - warning



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MASTER CAUTION SYSTEM - INTRODUCTION

EFFECTIVITY
HAP ALL

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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 when one or more of these fuel system lights come on:

- Eng 1 Filter Bypass
- Eng 2 Filter Bypass
- Tank 1 Fwd Low Press
- Tank 1 Aft Low Press
- Tank 2 Fwd Low Press
- Tank 2 Aft Low Press
- Ctr Tank L Low Press
- Ctr Tank R Low Press.

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:

HAP 101-999
- Cont Cab Duct Overheat
- Pass Cab Duct Overheat
- L Pack Trip Off
- R Pack Trip Off

HAP 001-013, 015-026, 028-054
- L Pack Off
- R Pack Off
- Cont Cab Zone Temp
- Fwd Cab Zone Temp
- Aft Cab Zone Temp

HAP ALL
- 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

EFFECTIVITY

HAP ALL

- 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.

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

HAP 006-010

- Air Stair Door

HAP ALL

- 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:

HAP 001-013, 015-026, 028-036, 038-054, 101-999

- GPS Fault

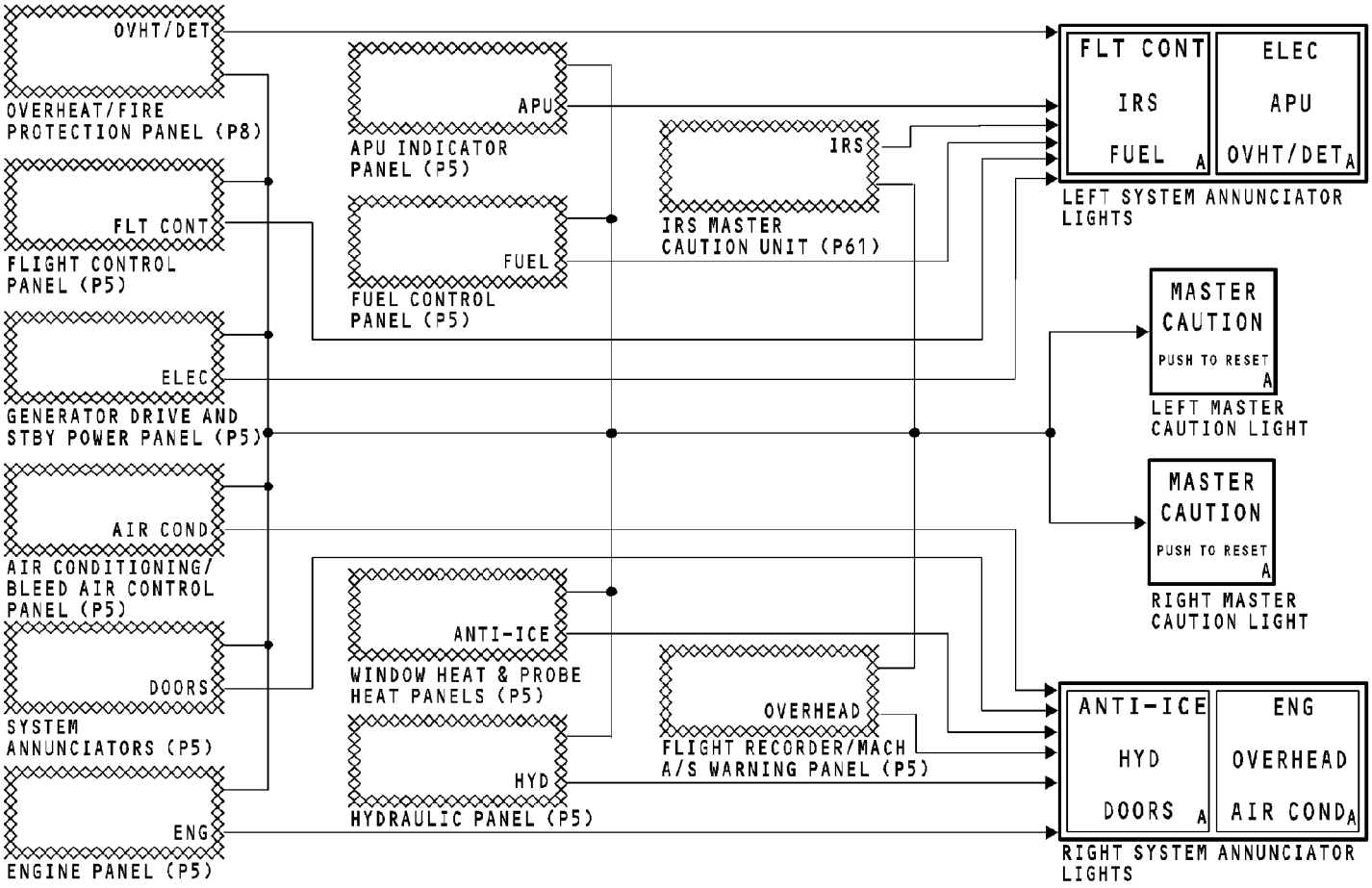
HAP ALL

- 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.



MASTER CAUTION SYSTEM - GENERAL DESCRIPTION

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 annunicator lights.

Input Components

Many systems provide discrete inputs to the master caution system.

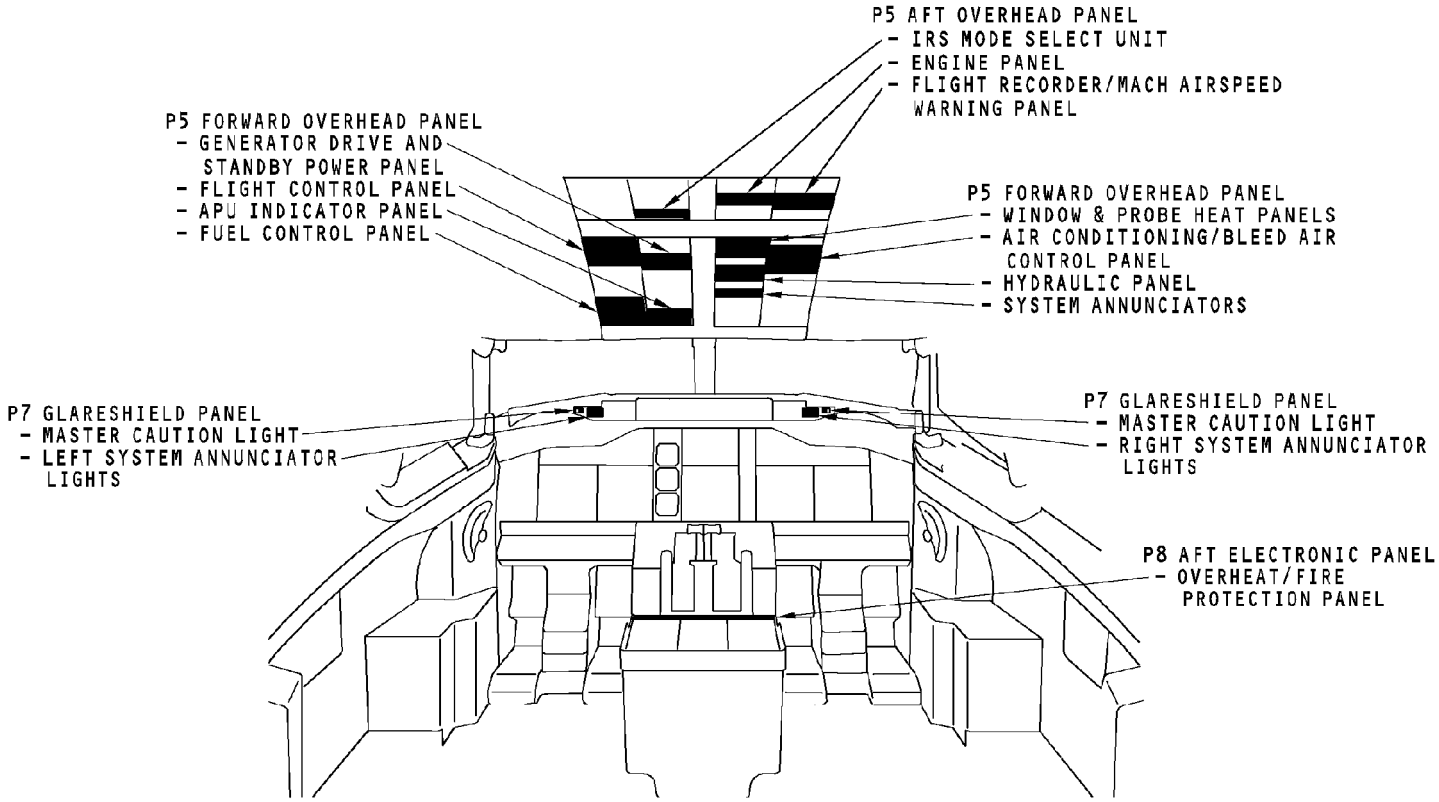
These are the components on the P5 aft overhead panel:

- 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.

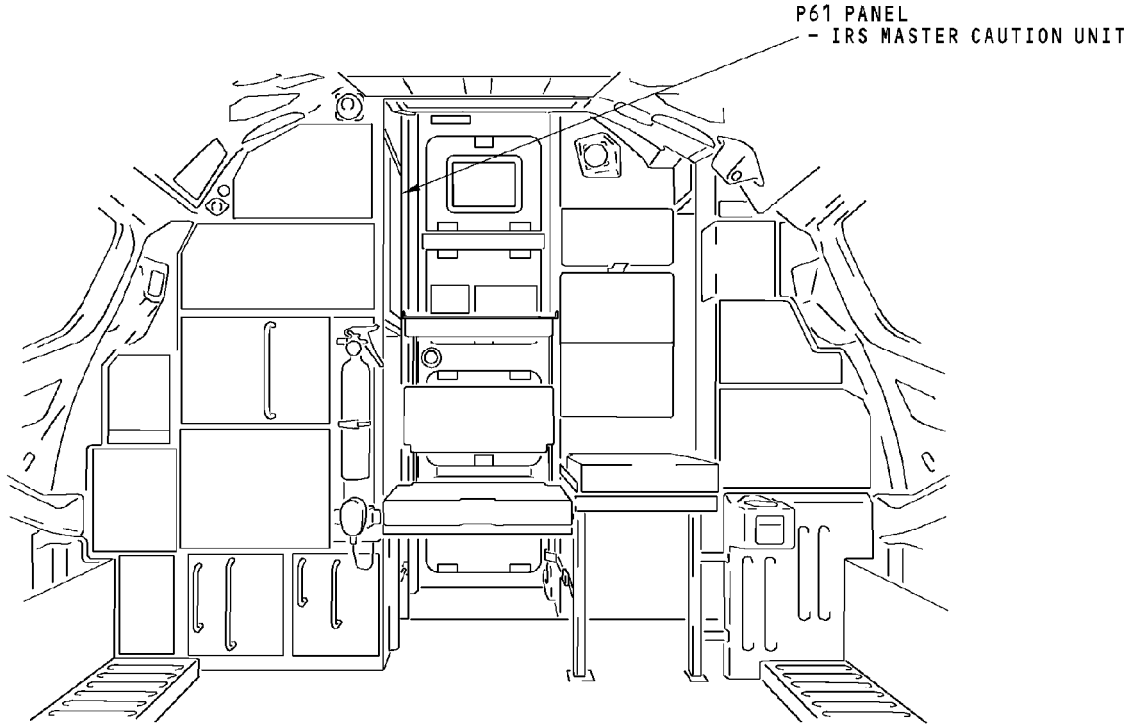


MASTER CAUTION SYSTEM - COMPONENT LOCATION - FLIGHT COMPARTMENT - 1

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.



MASTER CAUTION SYSTEM - COMPONENT LOCATION - FLIGHT COMPARTMENT - 2

Lights

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

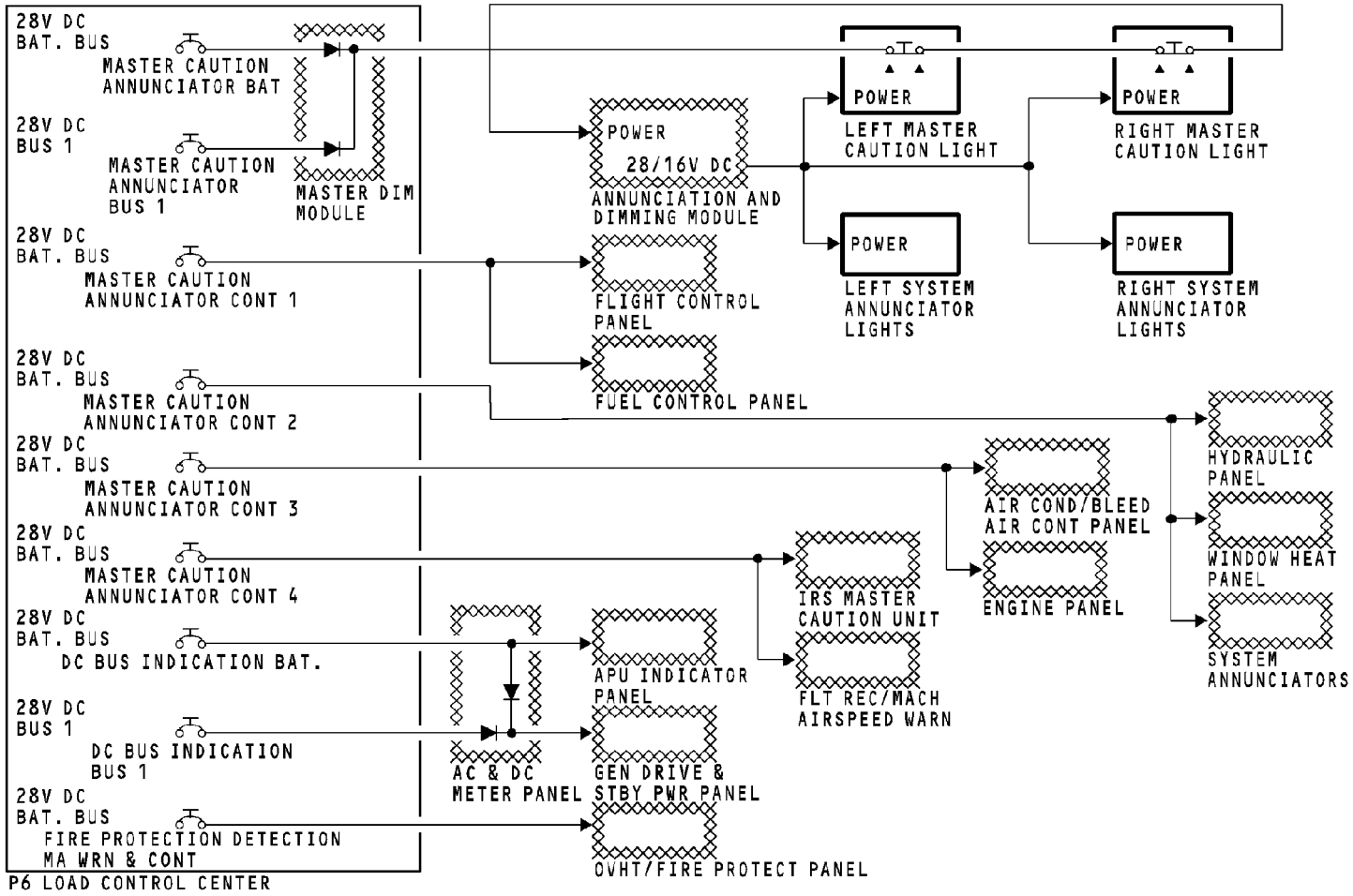
The MASTER CAUTION ANNUNCIATOR CONT 4 circuit breaker supplies power to the logic in these panels:

- IRS master caution unit
- Flight recorder/Mach airpseed 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.



MASTER CAUTION SYSTEM - INTERFACES

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Power

The 28v dc battery bus and the 28v dc bus 1 supply power for the master caution lights and the system annunciator 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 annunciators
- 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 annunciator 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 annunciator lights come from these components:

- Window heat panel (ANTI-ICE)
- Hydraulic panel (HYD)
- System annunciators (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 annunciator 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 annunciator lights remain off until a new fault occurs.

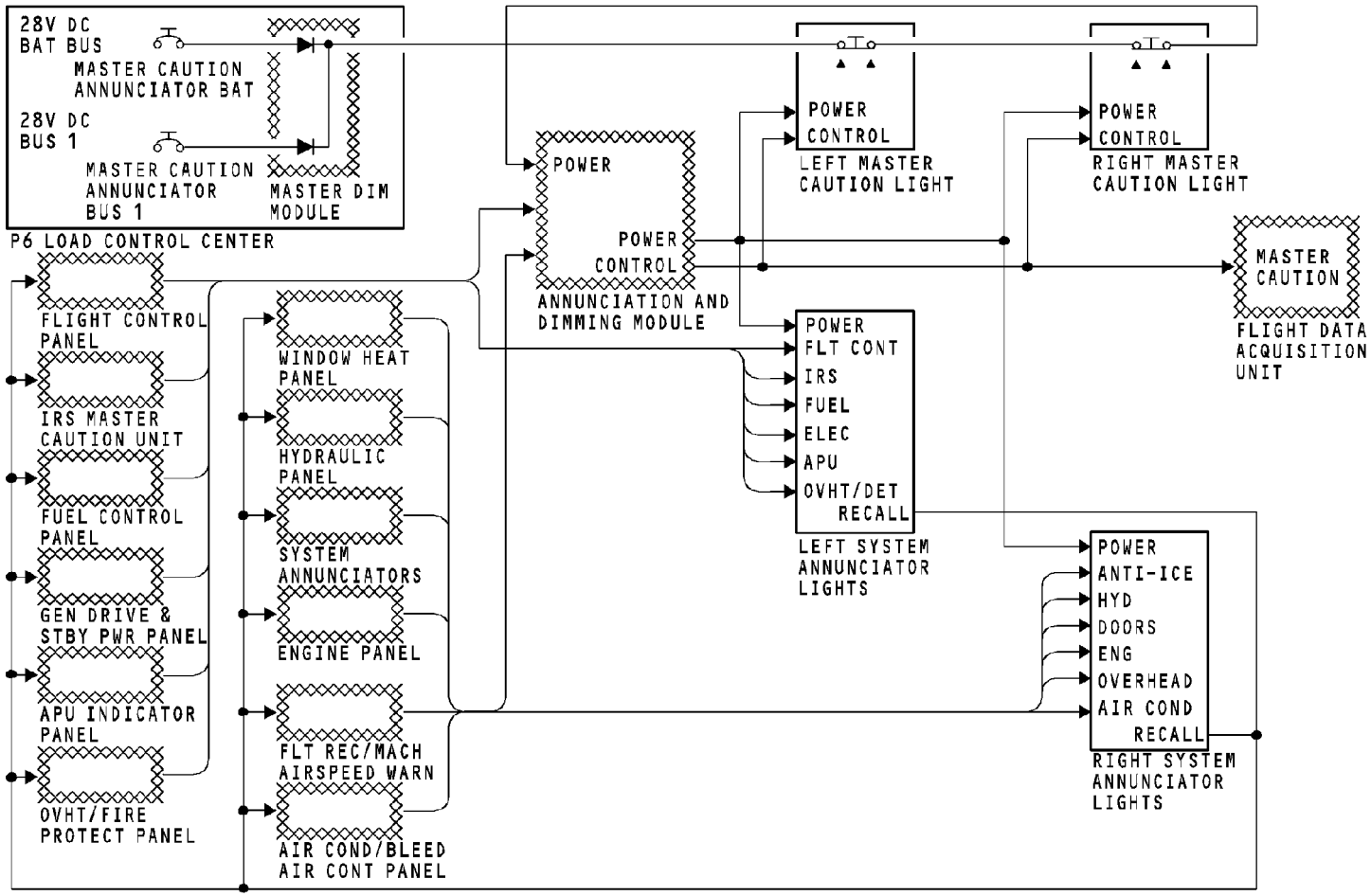
When a new fault occurs, these lights come on:

- 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.



MASTER CAUTION SYSTEM - INTERFACES - CONTROL

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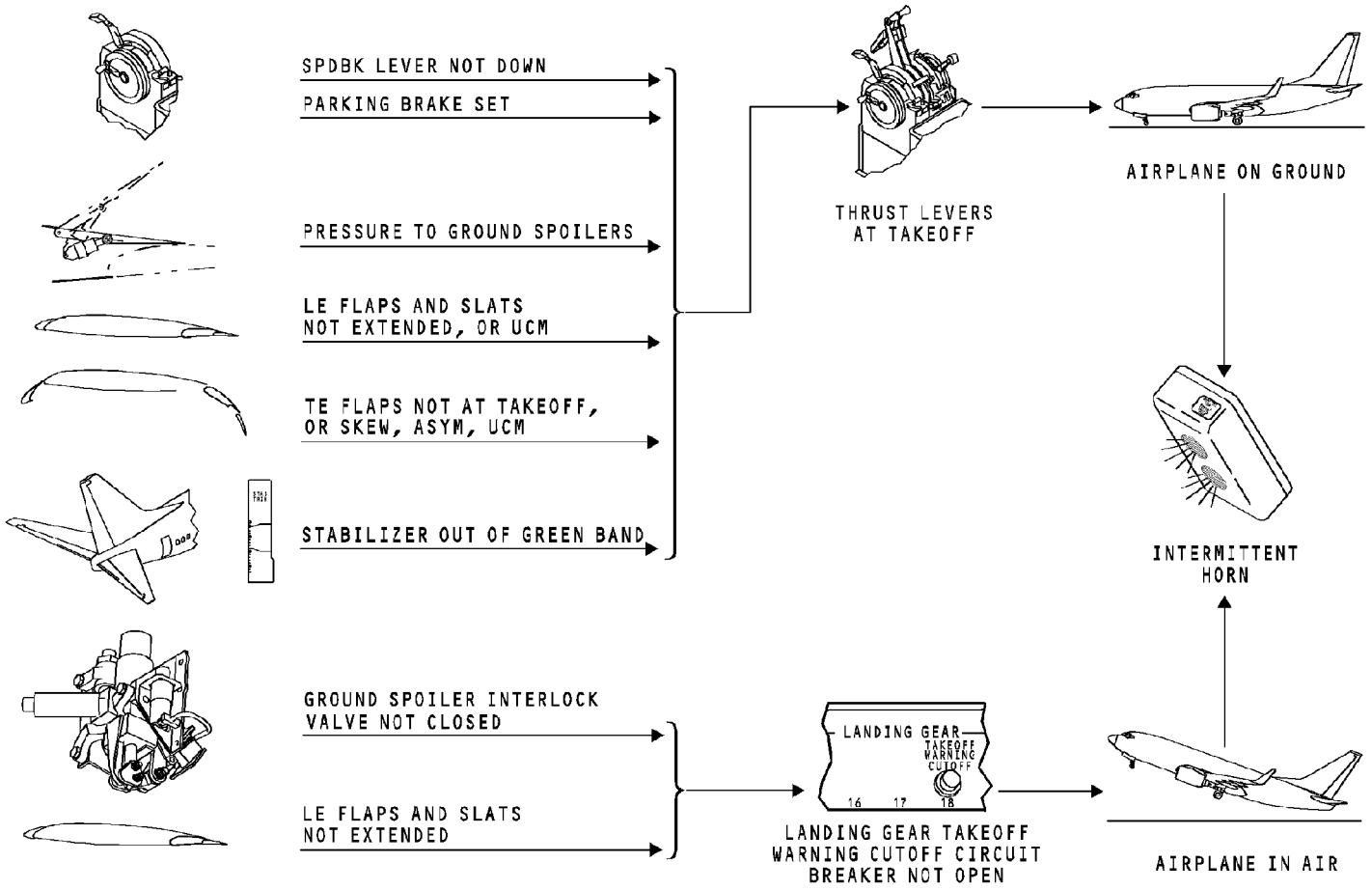
TAKEOFF WARNING - INTRODUCTION

General

The takeoff warning function gives an aural warning sound if the airplane is in an unsafe condition during takeoff or if the ground spoiler interlock valve remains open after takeoff.

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



TAKEOFF WARNING - INTRODUCTION

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.

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 sound 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.

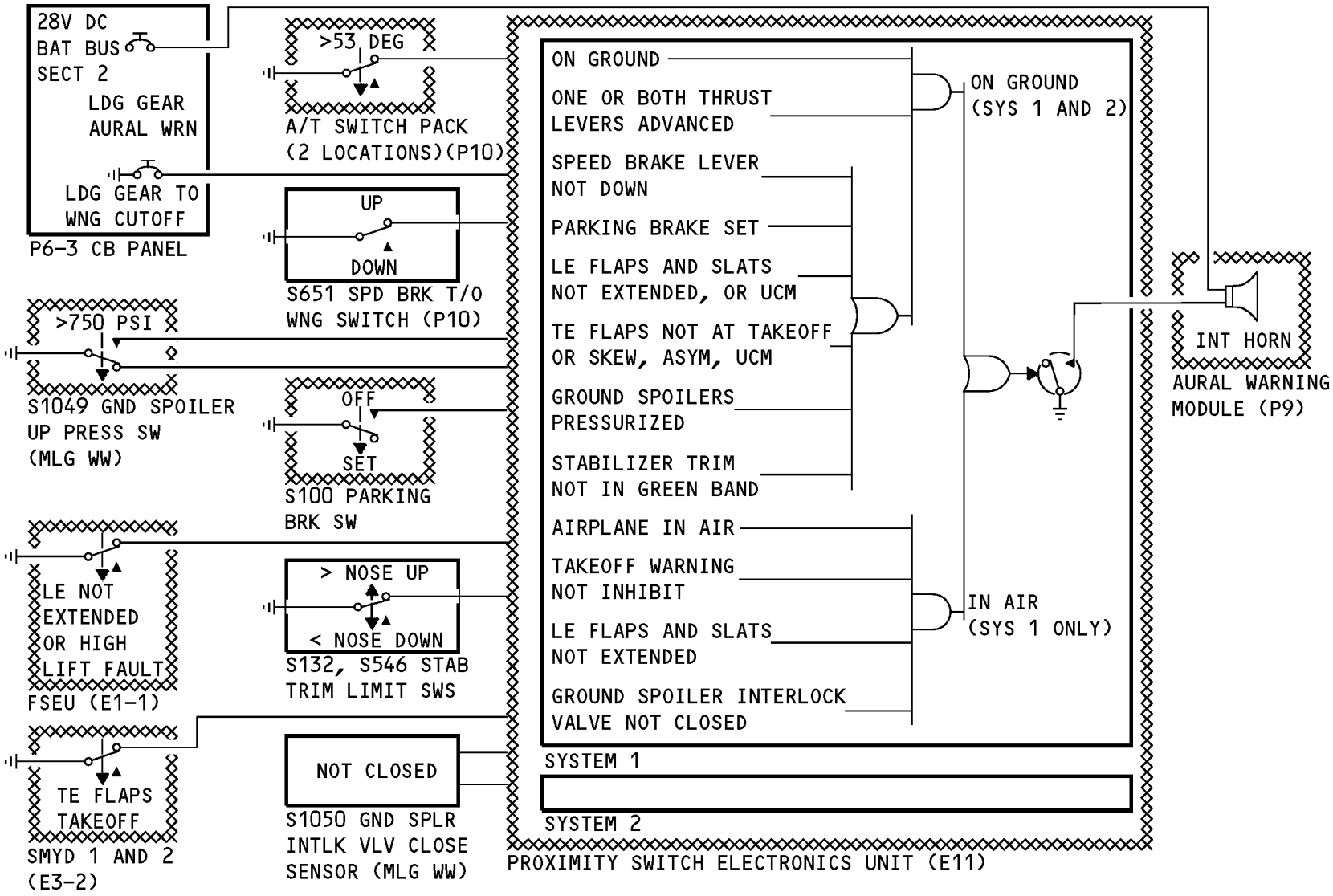
System 1 and system 2 each calculate separate output signals and are combined for a takeoff warning. This turns on the intermittent horn in the aural warning module.

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 intermittent horn in the aural warning module.



TAKEOFF WARNING - FUNCTIONAL DESCRIPTION

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

HAP 001-013, 015-026, 028-030

- ACARS - aircraft communication addressing and reporting system

HAP ALL

- 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

HAP 044-054, 102-999

- ANP - actual navigation performance

HAP ALL

- 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

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 (POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295

- CCN - compatibility class number

HAP ALL

- 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 HAP
- EGT - exhaust gas temperature
- EIS - engine indicating system
- eng - engine
- ETA - estimated time of arrival
- E-W - east-west

EFFECTIVITY

HAP ALL

- FCC - flight control computer
- FD - flight director
- FDAU - flight data acquisition unit
- FF - fuel flow
- FU - fuel used
- 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

HAP 037

- GLS - GNSS landing system
- GNSS - global navigation satellite system

HAP ALL

- 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

HAP 037

- MMR - multi-mode receiver

HAP ALL

EFFECTIVITY

HAP ALL

- mtrs - meters
- N1 - engine fan speed
- N2 - engine core speed
- nav - navigation
- NCD - no computed data
- ND - navigation display
- NM - nautical miles

HAP 044-054, 102-999

- NPS - navigation performance scales

HAP ALL

- N-S - north-south
- NV - non-volatile
- norm - normal
- OM - outer marker
- OPC - operational program configuration
- OPS - operational software
- outbd - outboard
- PDL - portable data loader
- PFD - primary flight display
- pln - plan
- pos - position
- pri - primary
- PROM - programmeable read only memory
- pth - path

HAP 008-013, 015-026, 028-054, 101-999

- PWS - predictive windshear system

HAP ALL

- 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

HAP 044-054, 102-999

- RNP - required navigation performance

HAP ALL

- 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

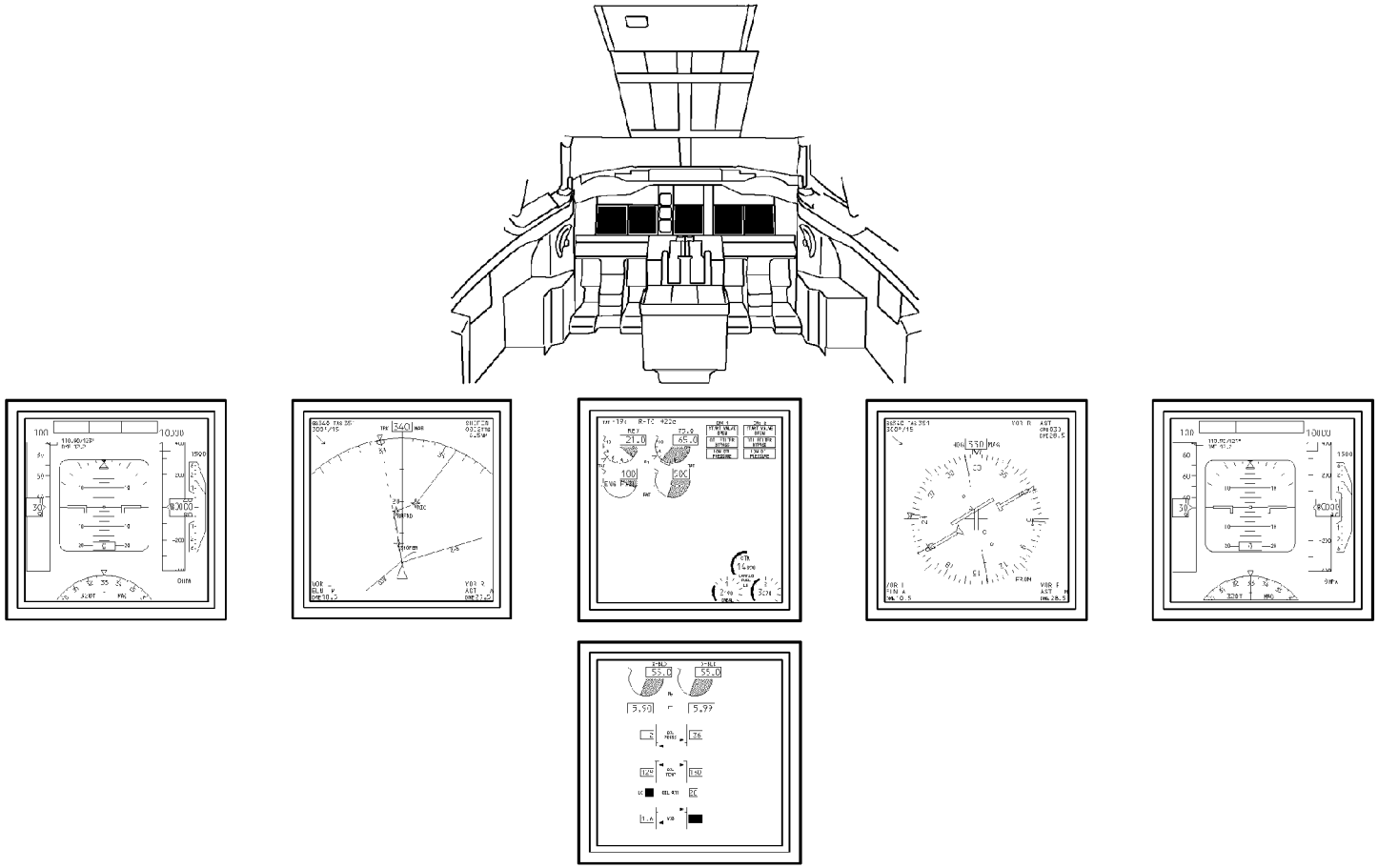
- VMO - velocity, maximum operating
- VNAV - vertical navigation
- VOR - very high frequency omnidirectional range
- V/S - vertical speed

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

- VSD - vertical situation display

HAP ALL

- VSI - vertical speed indicator
- wpt - waypoint
- WTAI - wing thermal anti-ice
- WXR - weather radar
- xmtr - transmitter



COMMON DISPLAY SYSTEM - INTRODUCTION

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.

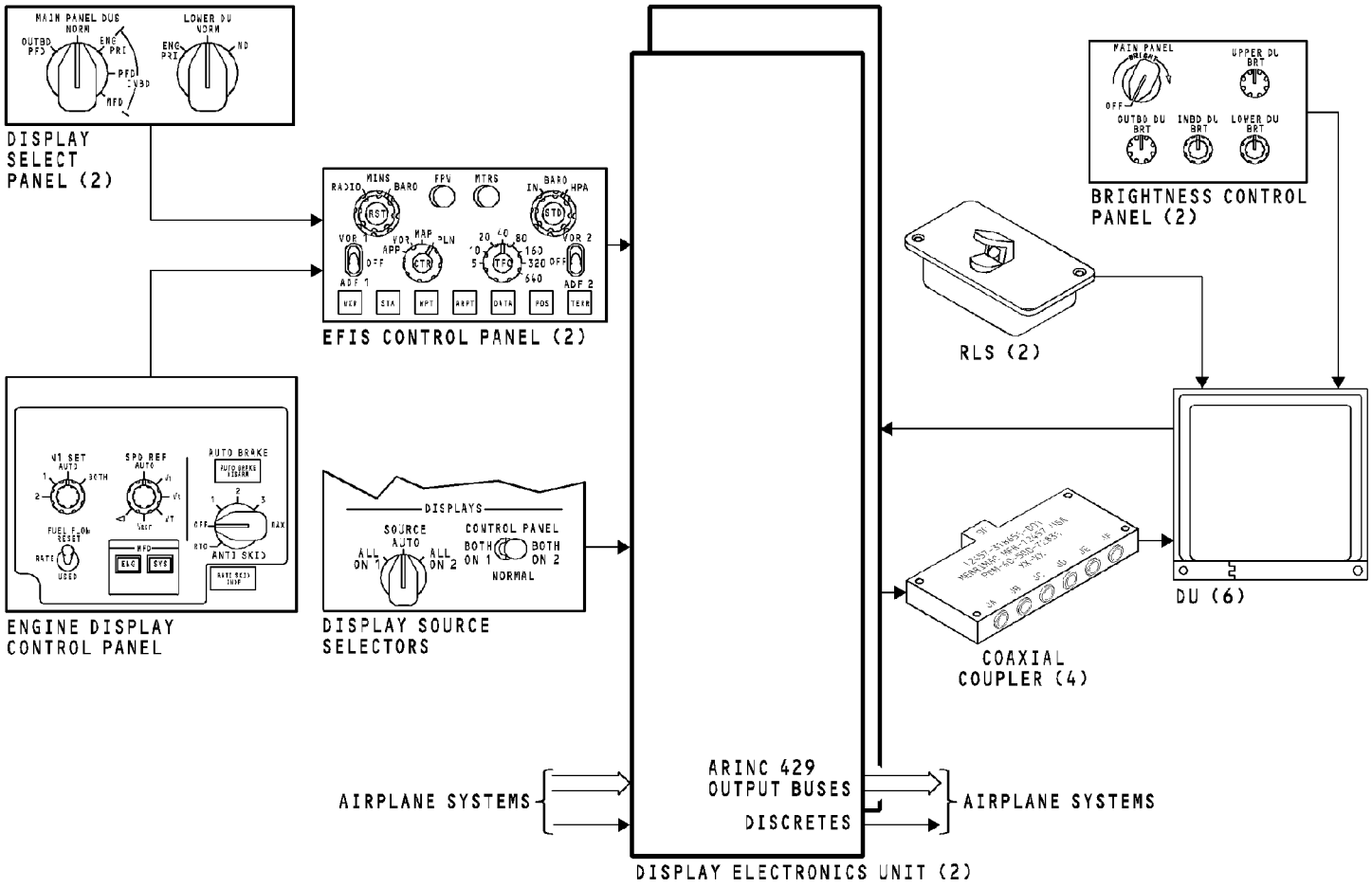
These are the formats that show on the display units:

- 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.



CDS - GENERAL DESCRIPTION

EFFECTIVITY
HAP ALL

31-62-00

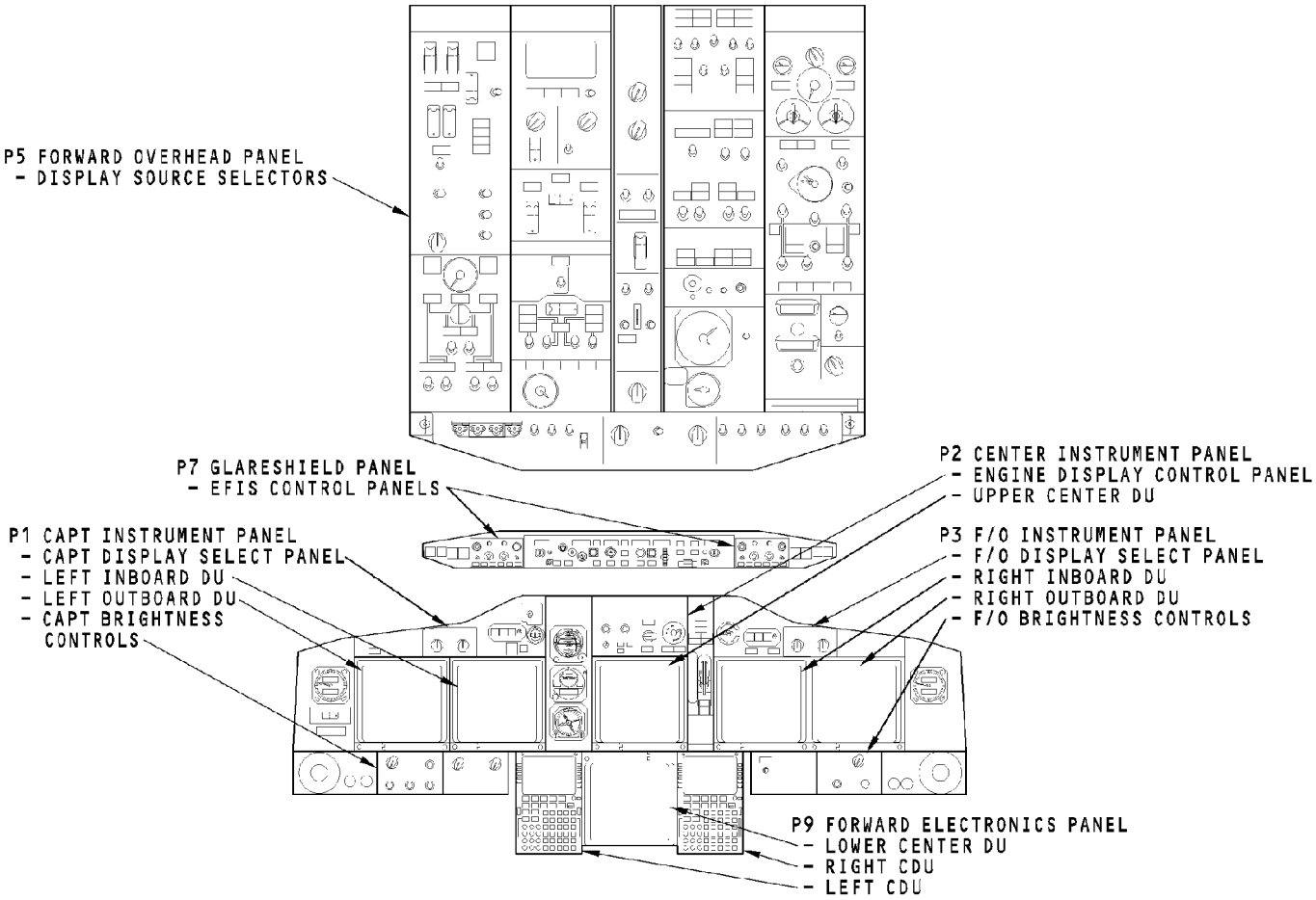
CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 1

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.

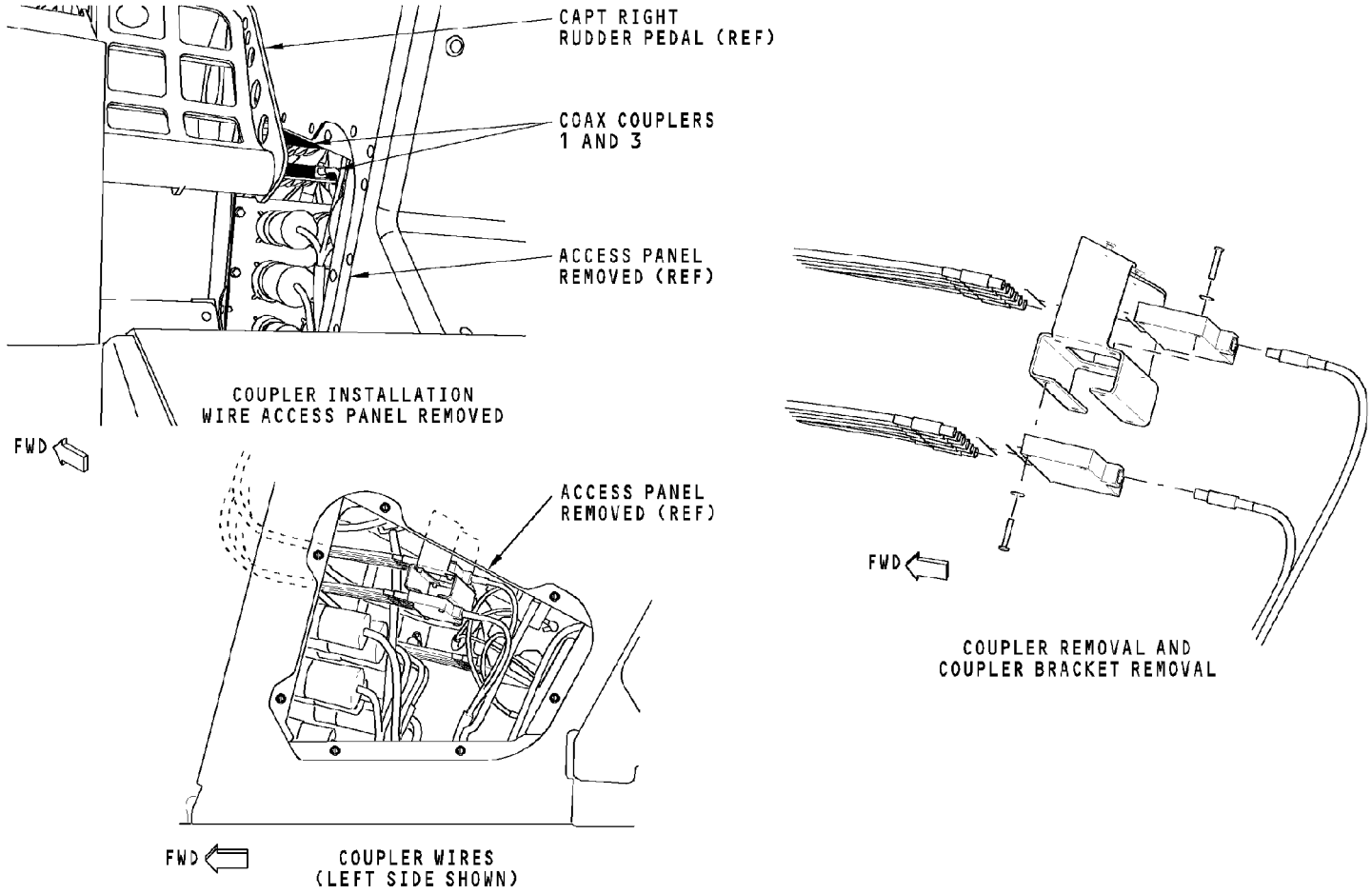


CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 1

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.

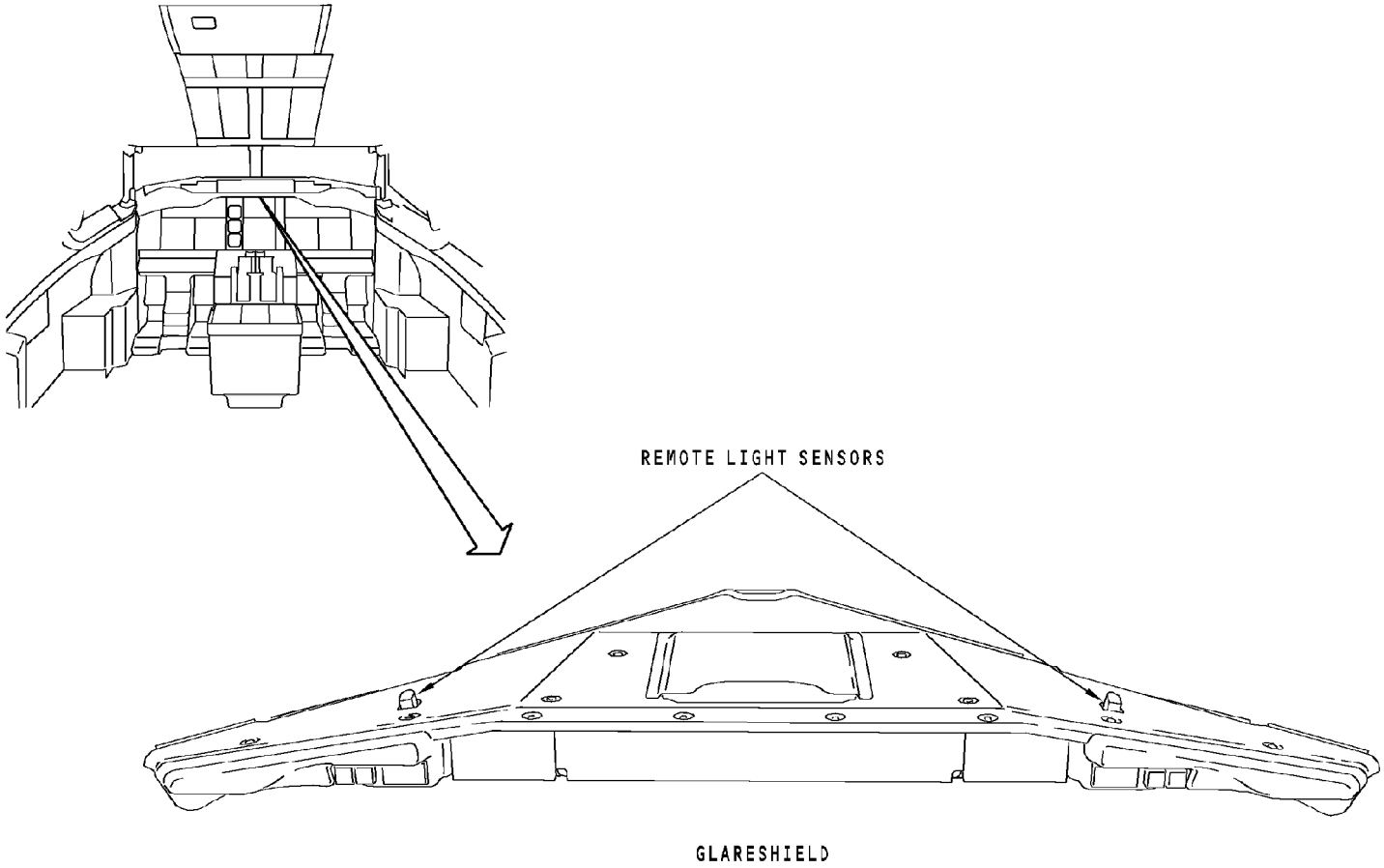
To get access to the coax couplers, remove the access panel on the inboard side of the rudder pedals. This lets you disconnect the coaxial connectors. Then remove the flight management computer (FMC) control display unit (CDU) to remove the bracket. The coax couplers are on the bracket.



CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 2

Remote Light Sensors

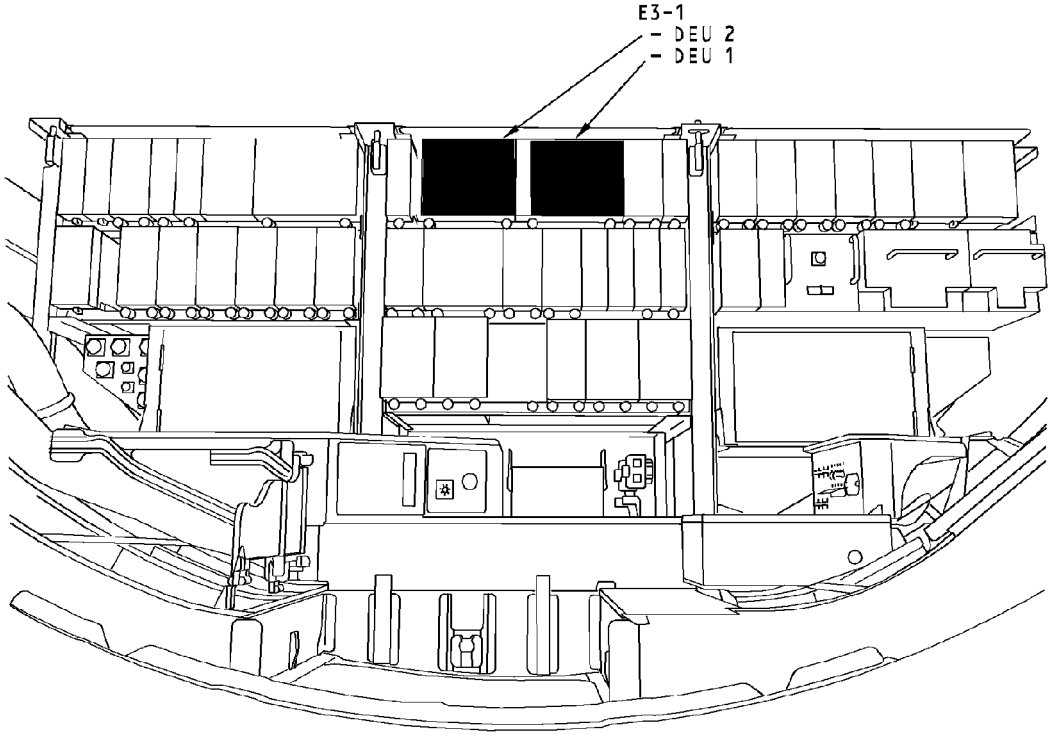
The remote light sensors are on the forward part of the glareshield. The sensors face forward.



CDS - FLIGHT COMPARTMENT COMPONENT LOCATION - 3

EE Compartment

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



CDS - EE COMPARTMENT COMPONENT LOCATION

Power

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

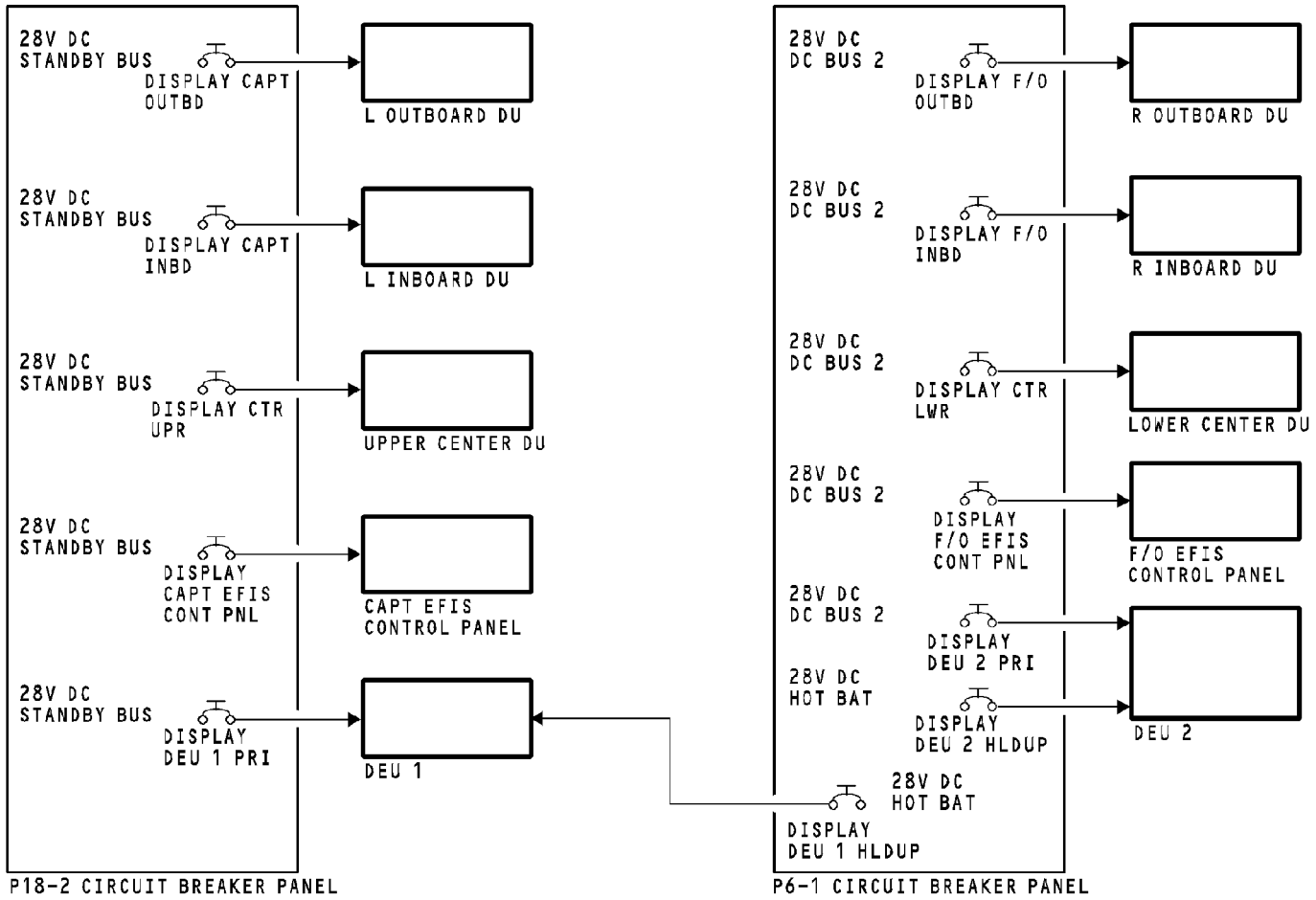
- Left outboard display unit
- Left inboard display unit
- Upper center display unit
- Captain EFIS control panel
- Display electronics unit (DEU) 1.

The 28v dc bus 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.



CDS - POWER INTERFACES

Program Pins

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

DEU Program Pins

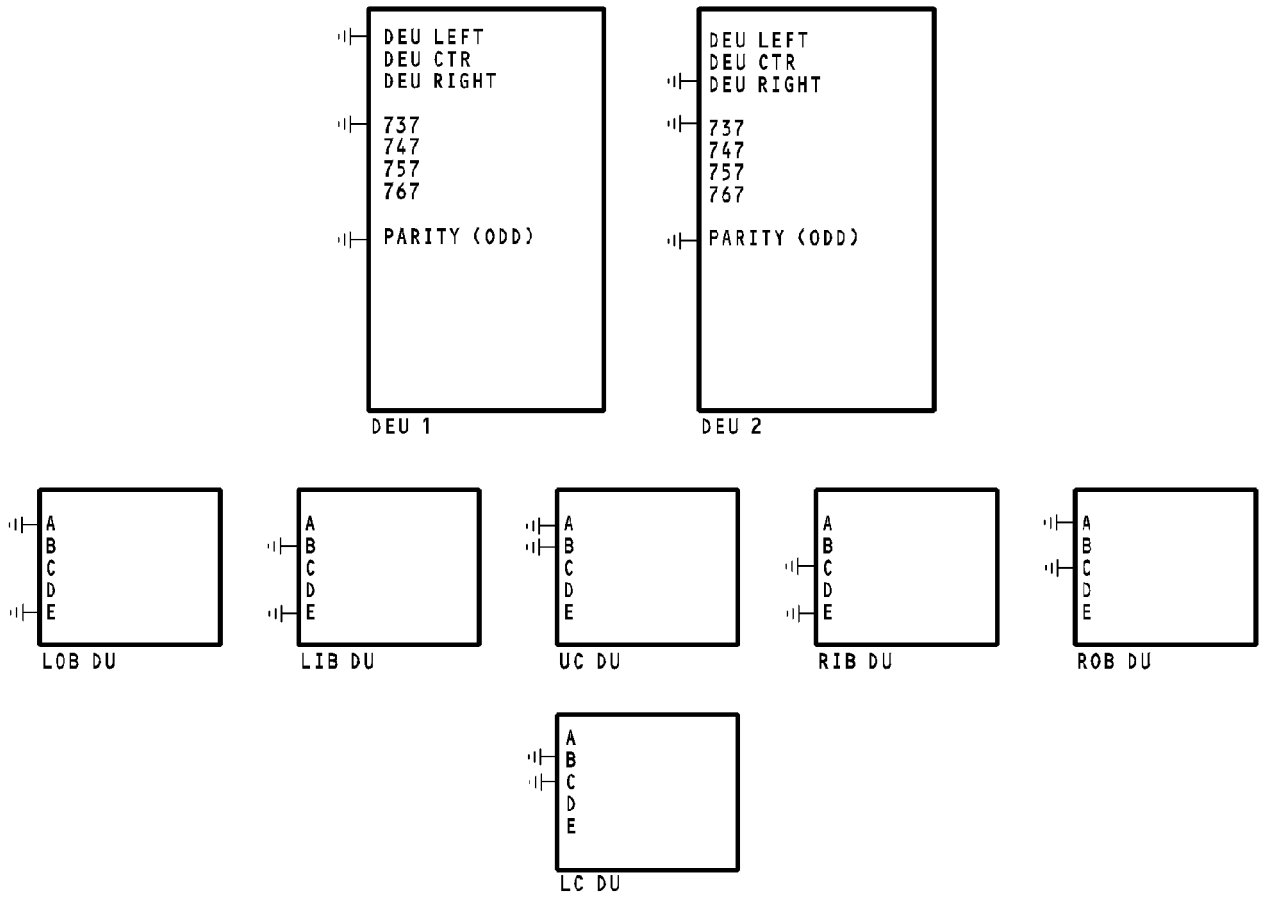
These are the two types of program pins for the DEU:

- 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).



CDS - PROGRAM PINS INTERFACE

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

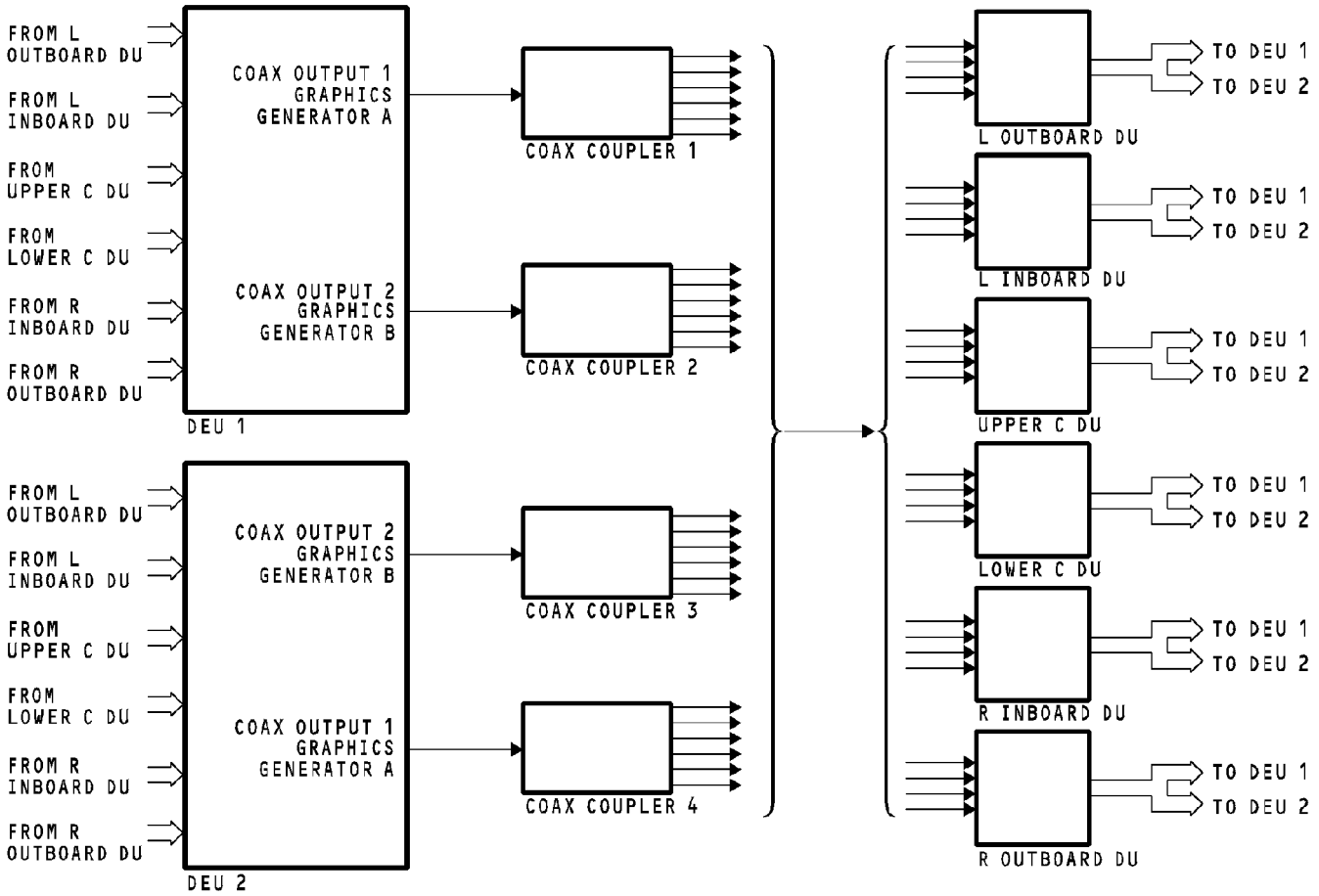
Each GG CCA sends graphic data on a coax cable to a coax coupler. The coax coupler splits the signal and sends the graphics data to each DU.

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.



CDS - DISPLAY ELECTRONICS UNIT 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

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

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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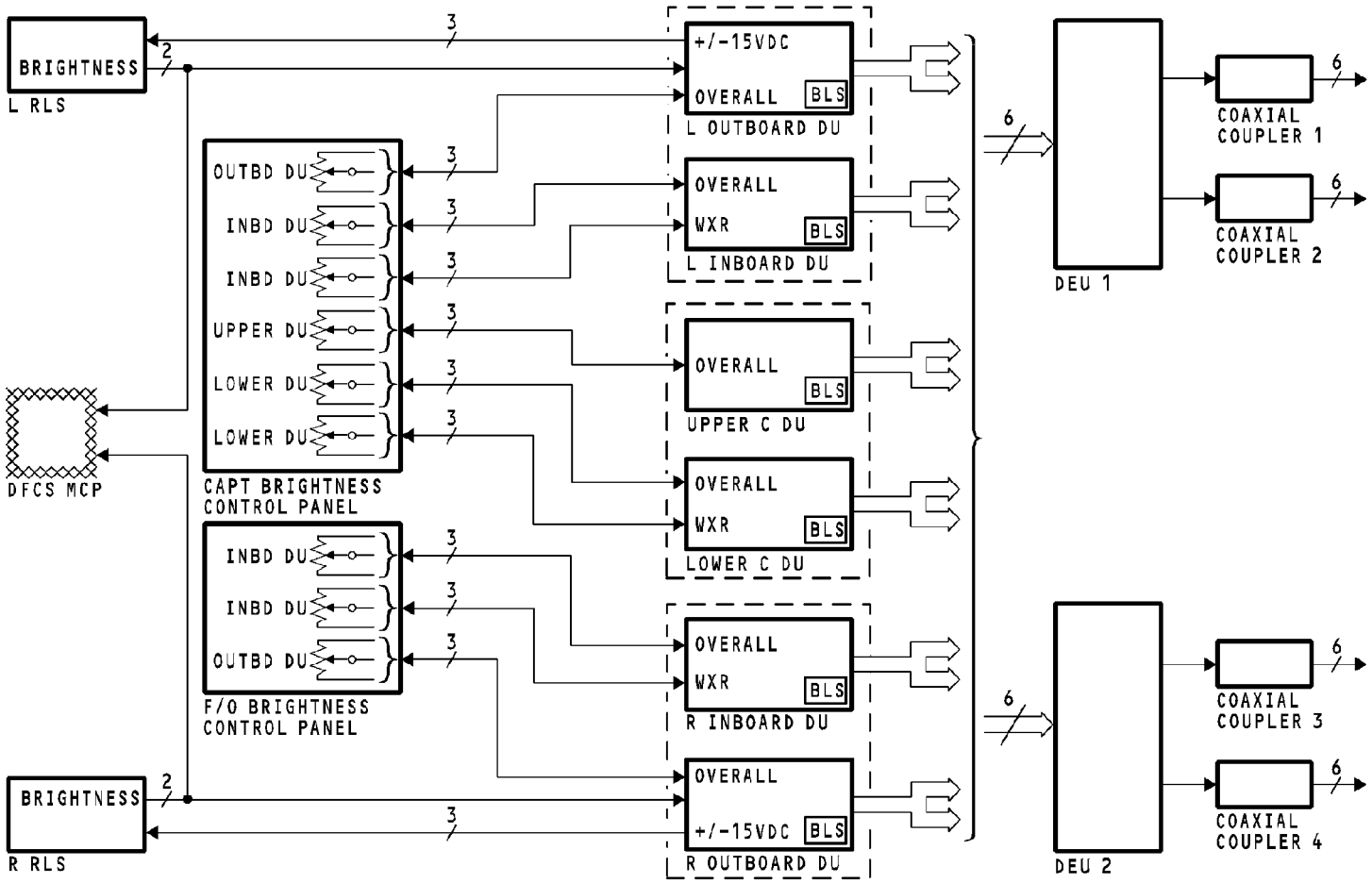


CDS - BRIGHTNESS INTERFACES

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.

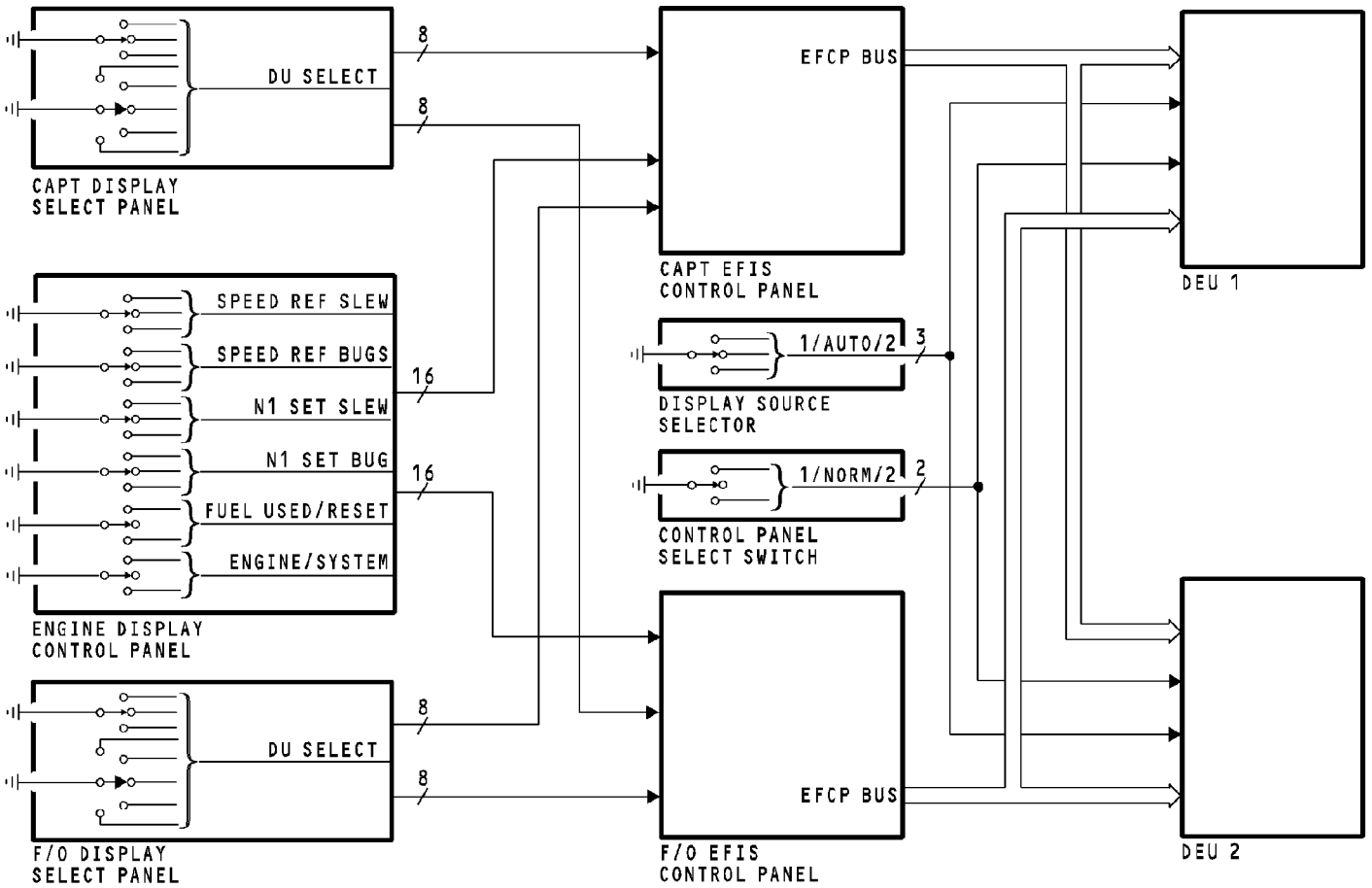
Instrument Switching Module

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.



CDS - CONTROLS INTERFACES

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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 memeory
- I/O processor 1 - 3
- Digital output
- Controller
- Display sequencer
- Display drive
- PROM memeory

- Main processor 1
- Overtemperature.

The CP and DU maintenance word has this data:

- 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:

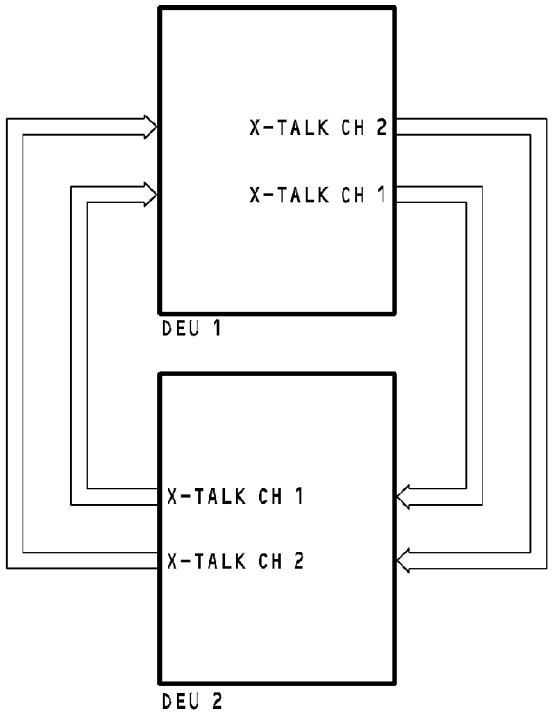
- L-WXR data fault
- R-WXR data fault
- L-ILS data fault
- R-ILS data fault
- LOB DU fault
- ROB DU fault
- L-MCDU fault
- R-MCDU fault
- L-SMYD fault
- R-SMYD fault
- DEU fault
- RIB DU fault
- LIB DU fault
- L-EFIS CP fault
- R-EFIS CP fault
- CU DU fault
- CL DU fault.

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.



CDS - CROSS CHANNEL INTERFACES

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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

HAP 001-007, 031-054, 101-999

- Engine EEC buses (2)

HAP 001-013, 015-026, 028-030

- ACARS datalink bus

HAP ALL

- 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
- 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.

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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
- 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
- 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 antice 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
- 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
- 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:

EFFECTIVITY

HAP ALL

- 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
- Antice 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
- Antice 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.

HAP 001-007, 031-054, 101-999

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 FDAU. 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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HAP 001-013, 015-026, 028-030 HAP

ACARS Datalink Bus HAP

The DEUs send data on the ACARS datalink bus to the ACARS system. This is a customer configured system. HAP HAP

HAP ALL HAP

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.

EFFECTIVITY

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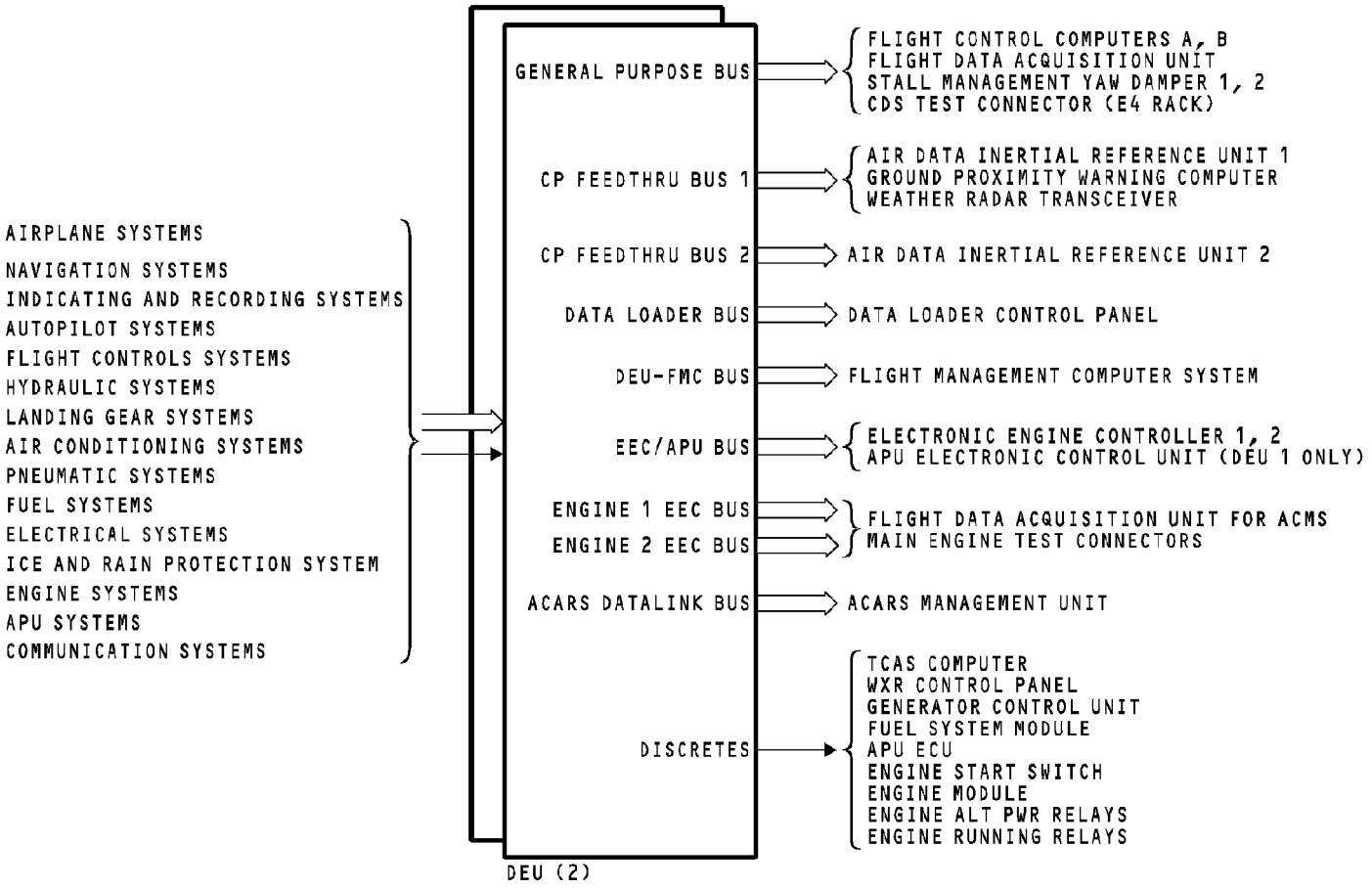
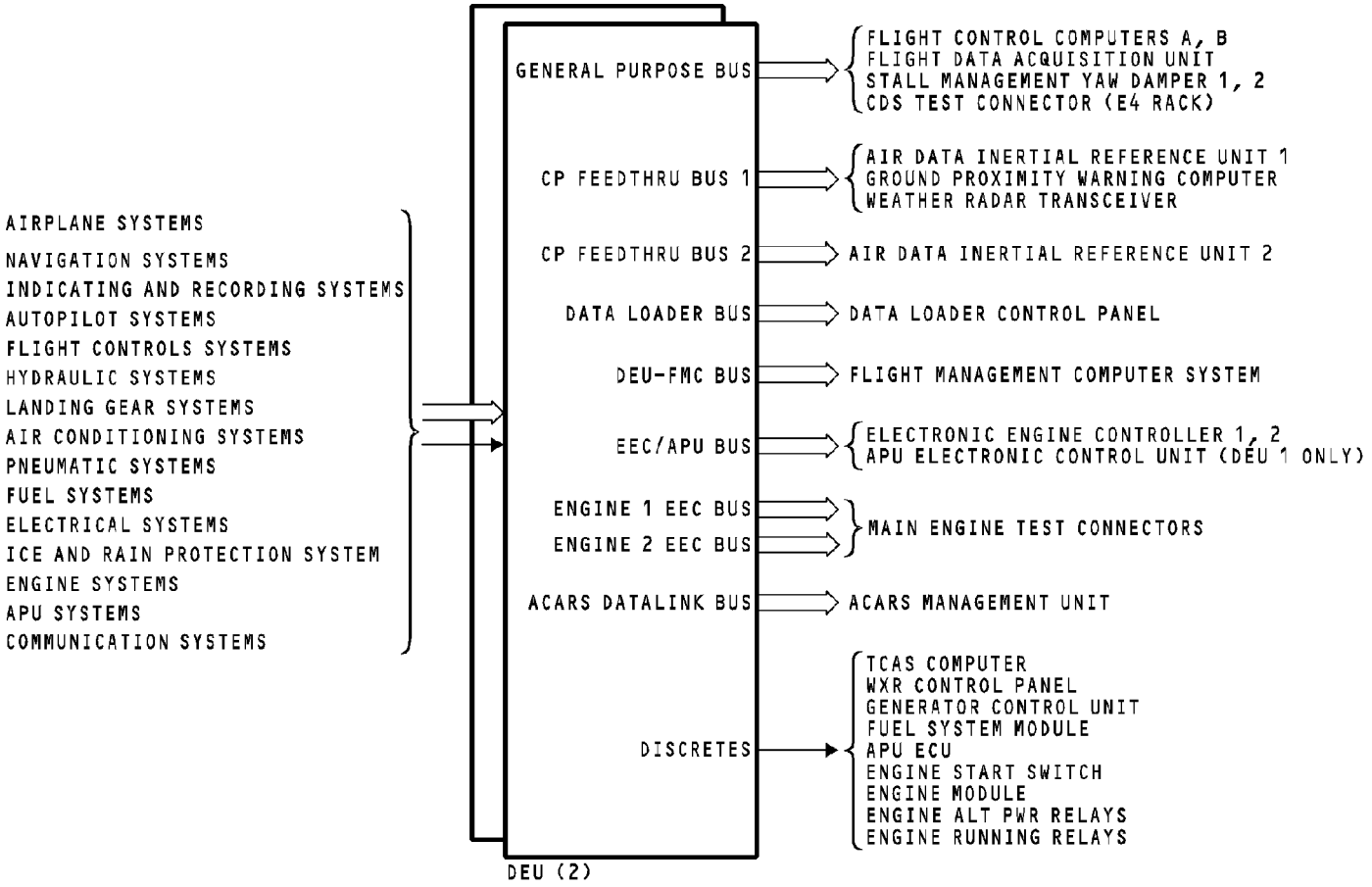
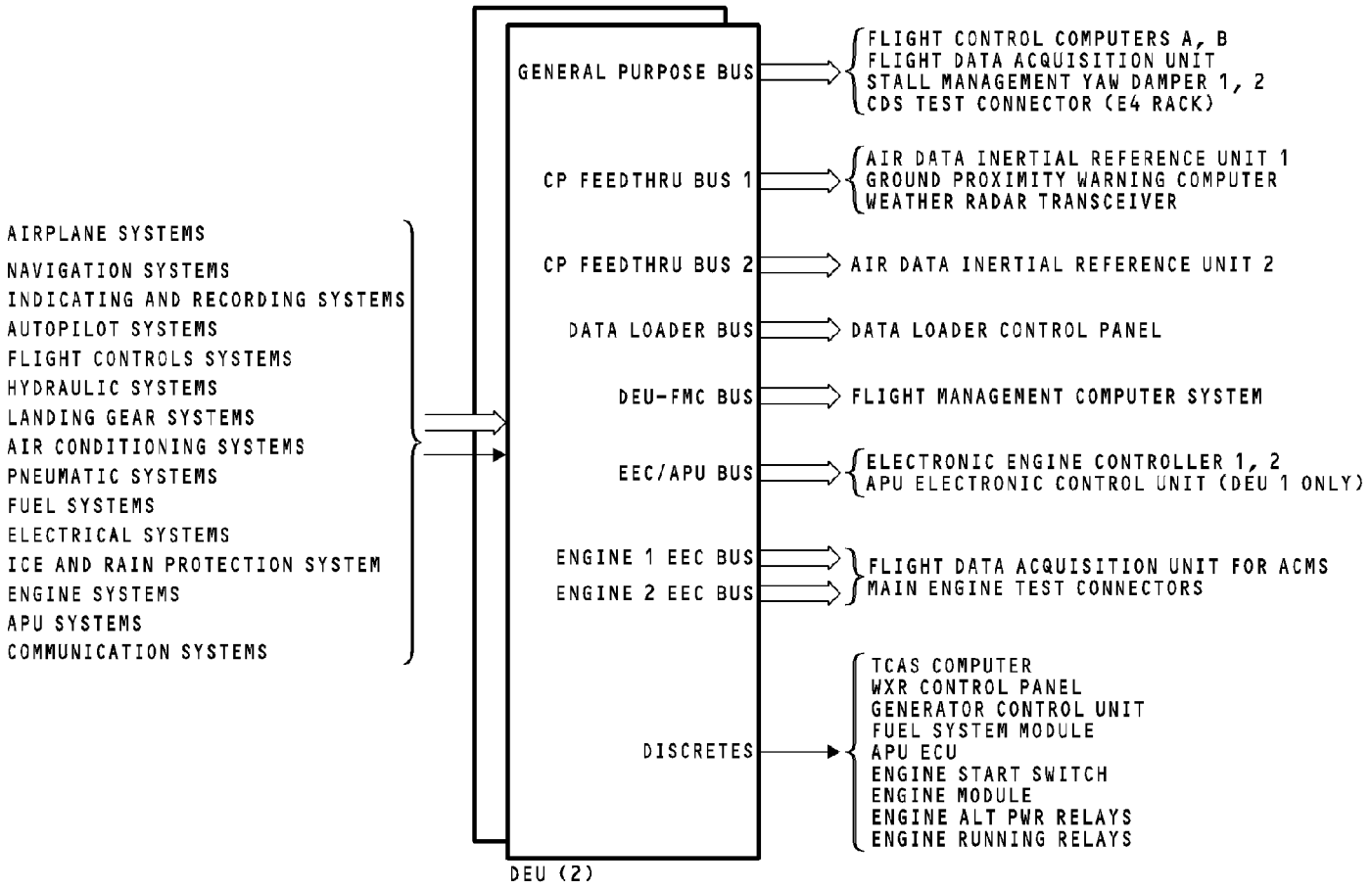


CDS - EXTERNAL INTERFACE INTRODUCTION



CDS - EXTERNAL INTERFACE INTRODUCTION



CDS - EXTERNAL INTERFACE INTRODUCTION

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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 buses.

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.

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

Instrument Switching Module

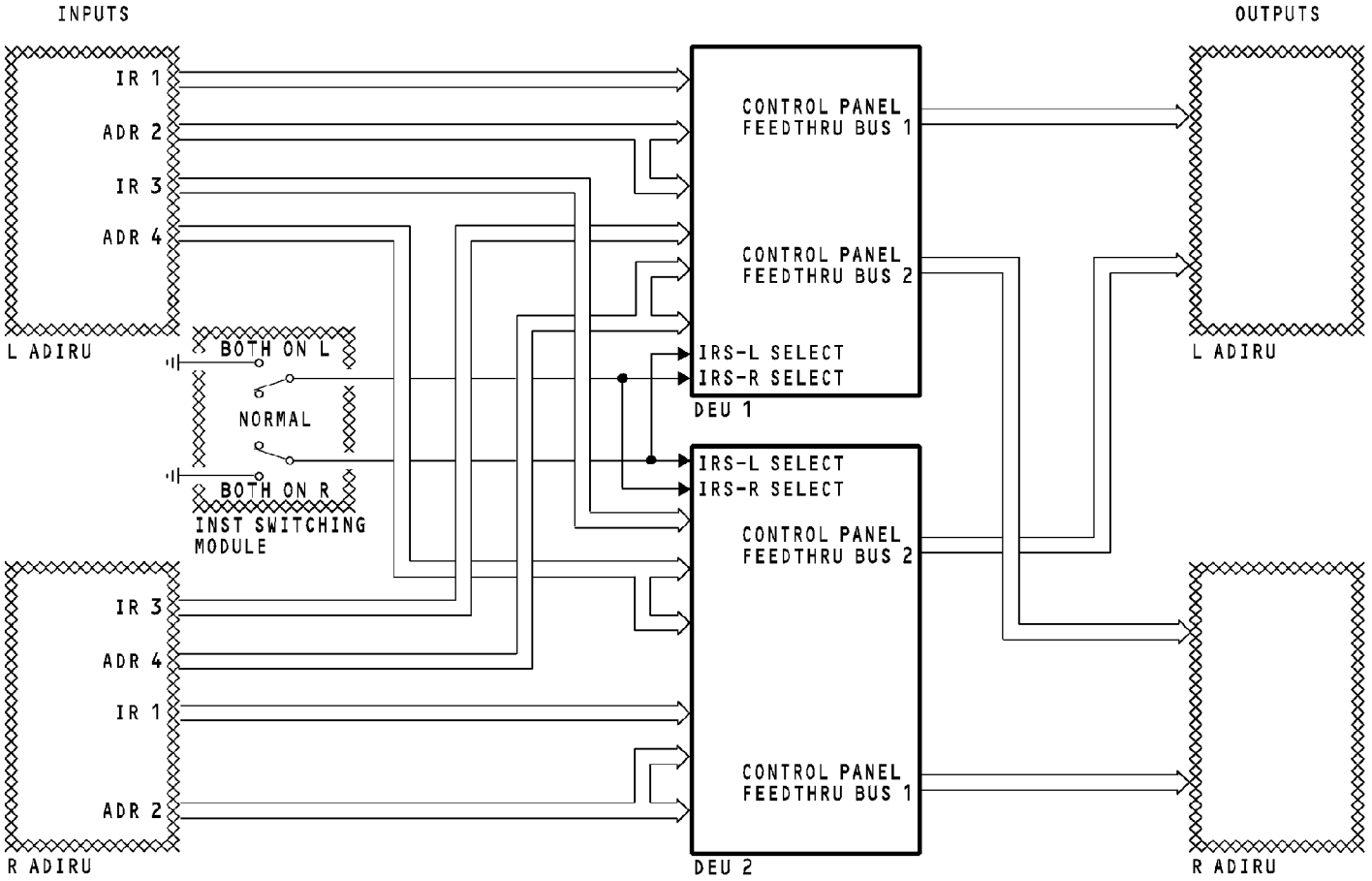
The instrument switching module has a three-position switch for the IRS source select function. The switch positions are:

- 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.



CDS - NAVIGATION INTERFACES - 1

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Weather Radar Transceiver

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

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

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

HAP **HAP 008-013, 015-026, 028-054, 101-999**

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.

HAP ALL

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 HAP

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

The GPWC uses this data from the CP feedthru bus: HAP

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

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

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

EFFECTIVITY
HAP ALL

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

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

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

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

HAP The GPWC bus has this data:

HAP • Ground proximity discrete word 2
HAP • Fault summary word 2
HAP • Input discrete word 2.

The ground proximity discrete word 2 has this data: HAP
• Terrain unavailable (position) HAP
• Terrain status fail HAP
• Terrain caution HAP
• Terrain warning HAP
• Windshear caution HAP
• Windshear warning HAP
• Ground proximity warning. HAP

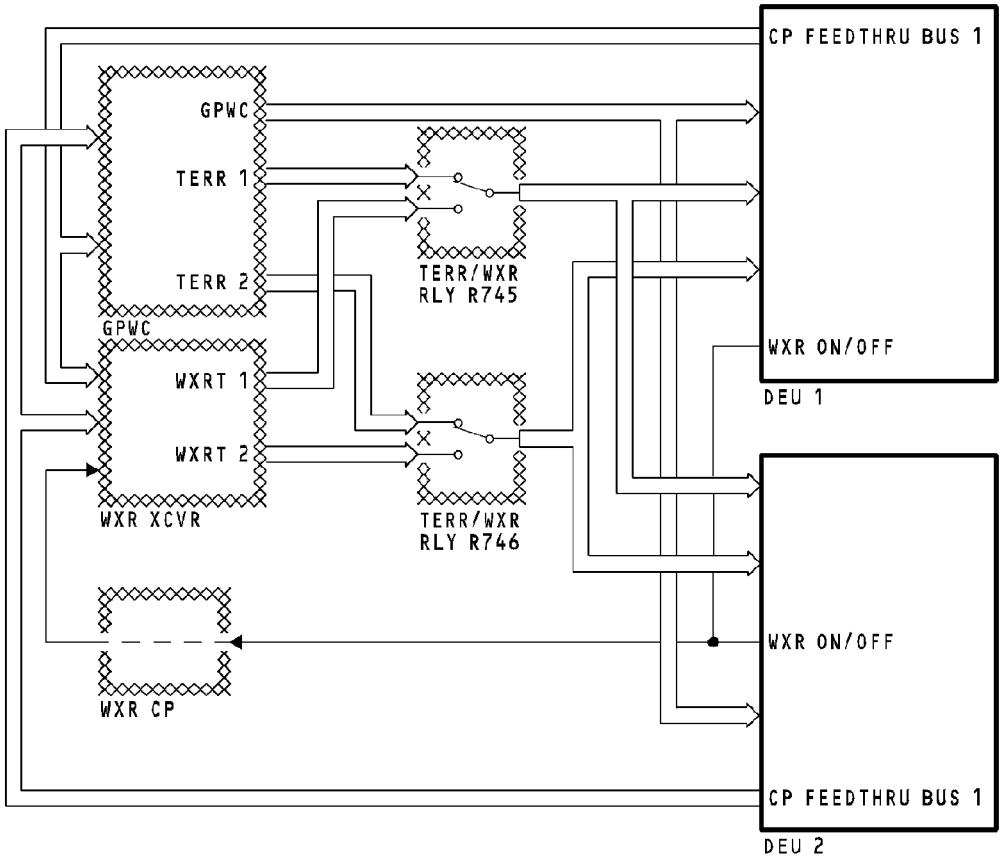
The fault summary word 2 has this data: HAP

• Terrain relay 1 fail HAP
• Terrain relay 2 fail. HAP

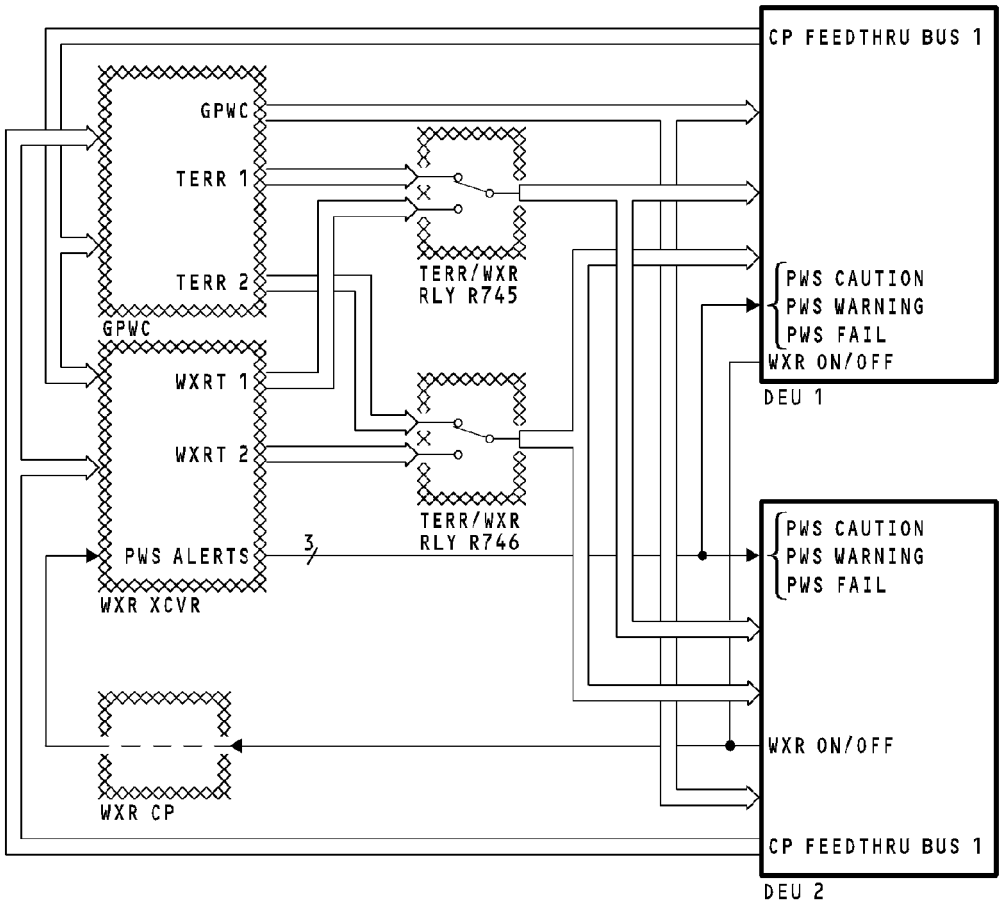
The input discrete word 2 has terrain override data. HAP

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

EFFECTIVITY
HAP ALL



CDS - NAVIGATION INTERFACES - 2



CDS - NAVIGATION INTERFACES - 2

EFFECTIVITY

HAP 008-013, 015-026, 028-054, 101-999

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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.

HAP 001-013, 015-026, 028-036

The DEUs send data to the flight management computer (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.

HAP 037-054, 101-999

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.

HAP ALL

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:

EFFECTIVITY

HAP ALL

- 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.

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 antice status
- Engine cowl antice 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:

HAP 050, 053, 054
- VNAV ALT

HAP ALL
- Display IRS position difference.

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

HAP 001-013, 015-026, 028-036

FMC Transfer Relays

The relays do not operate in this installation so that the FMC supplies the data to the DEUs.

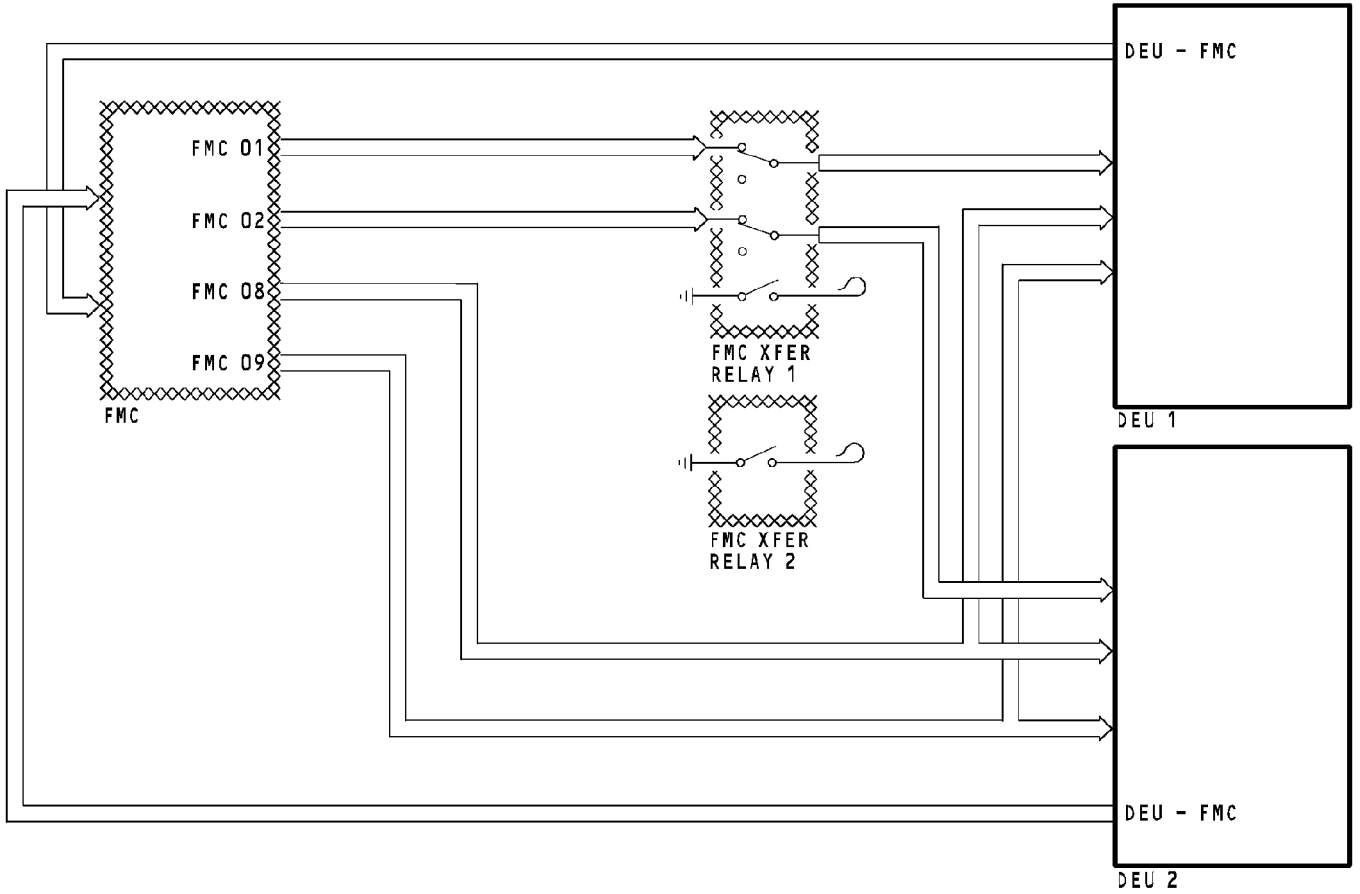
HAP 037-054, 101-999

FMC Transfer Relays

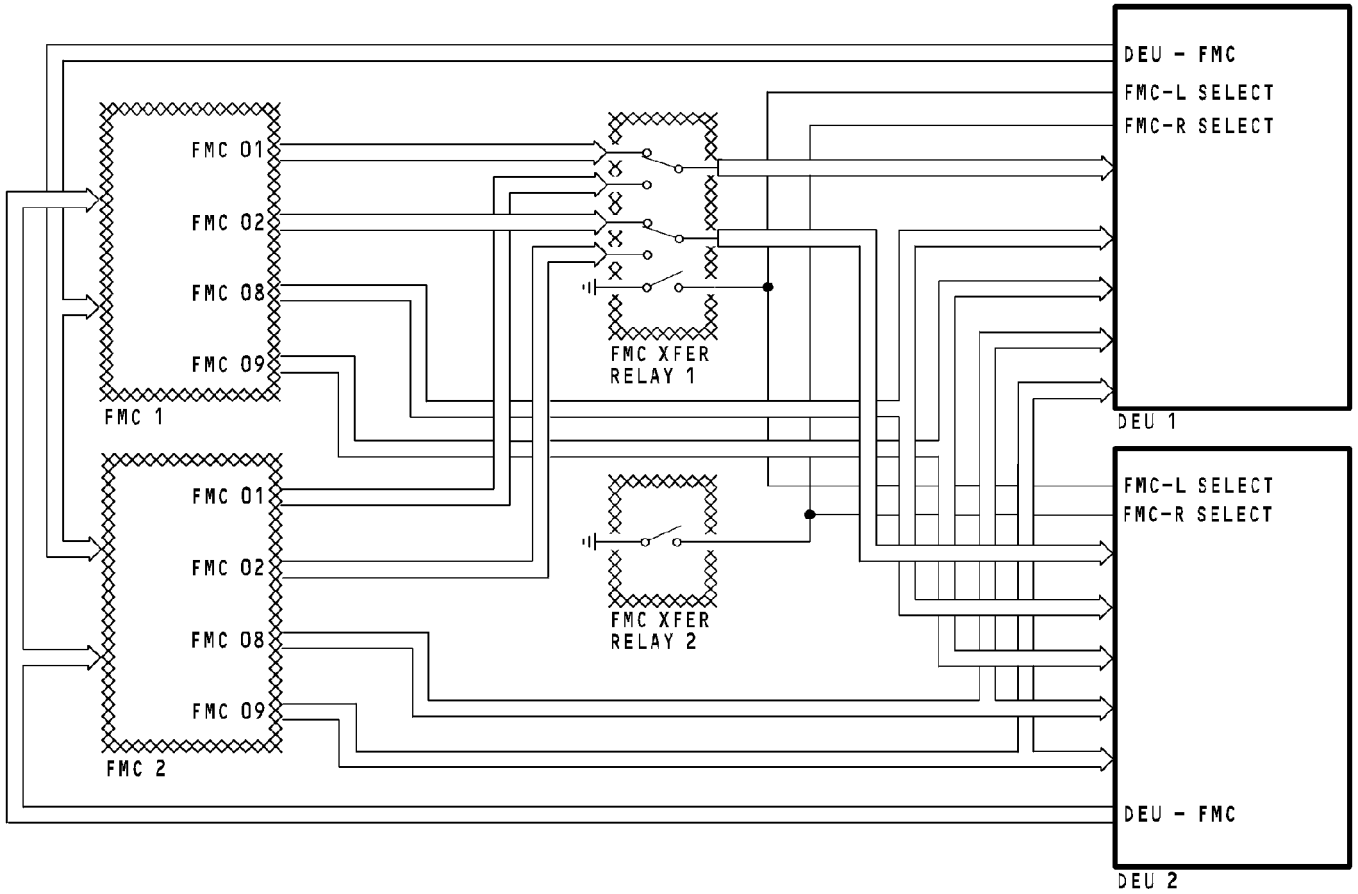
The transfer relays are controlled from the FMC source select switch in the flight deck. This switch position determines which FMC is the primary.

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.

HAP ALL



CDS - NAVIGATION INTERFACES - 3



CDS - NAVIGATION INTERFACES - 3

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

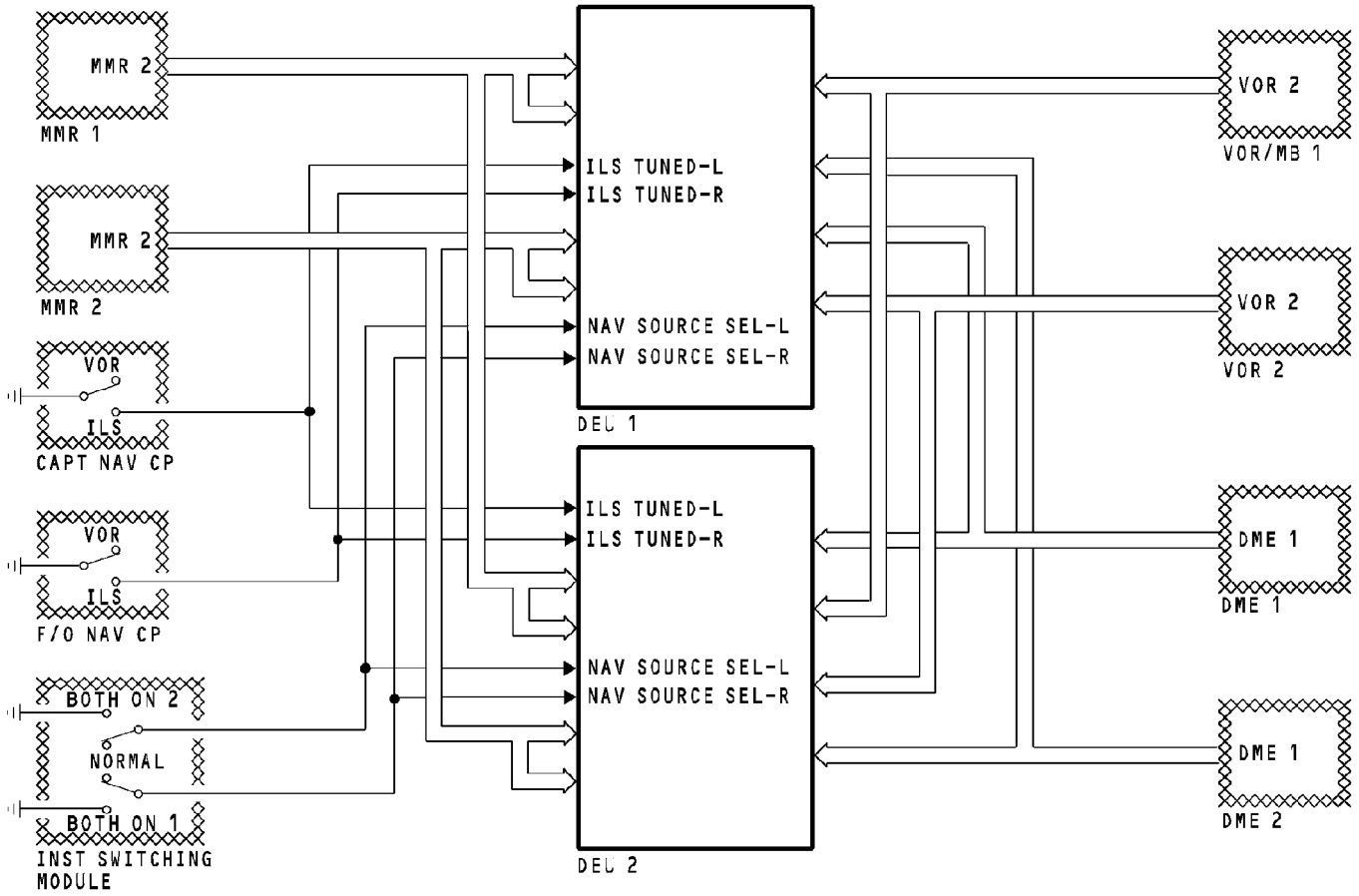
The instrument switching module has a three-position switch for the VHF NAV function. The switch positions are:

- 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.



CDS - NAVIGATION INTERFACES - 4

Data Loader Control Panel

HAP 031-054, 101-999

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.

HAP 001-013, 015-026, 028-030

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

HAP 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.

HAP 008-013, 015-026, 028-030

Flight Data Acquisition Unit

The flight data acquisition unit (FDAU) sends data to and receives data from the display electronic units (DEU) on ARINC 429 buses. The FDAU sends this surface position data to the DEUs:

- Stabilizer position
- Control column position
- Control wheel position
- Rudder pedal position
- Elevator position (left and right)
- Aileron position (left and right)
- Speedbrake handle position
- Rudder position.

The DEUs send this data to the FDAU on the CDS general purpose bus:

- 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

EFFECTIVITY

HAP ALL

HAP 008-013, 015-026, 028-030 (Continued)

- 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
- Captains 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
- 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

HAP 008-013, 015-026, 028-030 (Continued)

- 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 (optional)
- 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
- 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 captain 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 captain 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

EFFECTIVITY

HAP ALL

HAP 008-013, 015-026, 028-030 (Continued)

- 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
- 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 antice 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.

HAP 008-013, 015-026, 028-030 (Continued)

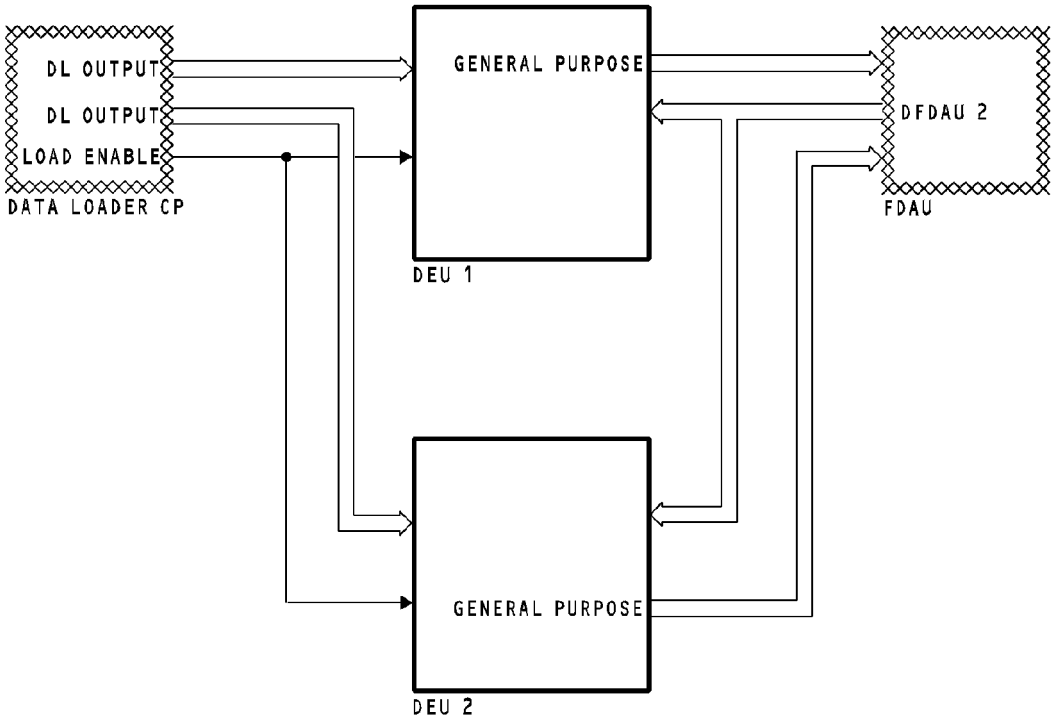
The FDAU uses these parameters to record data for the flight recorder and for the airplane condition monitoring system (ACMS).

HAP 001-007, 031-054, 101-999

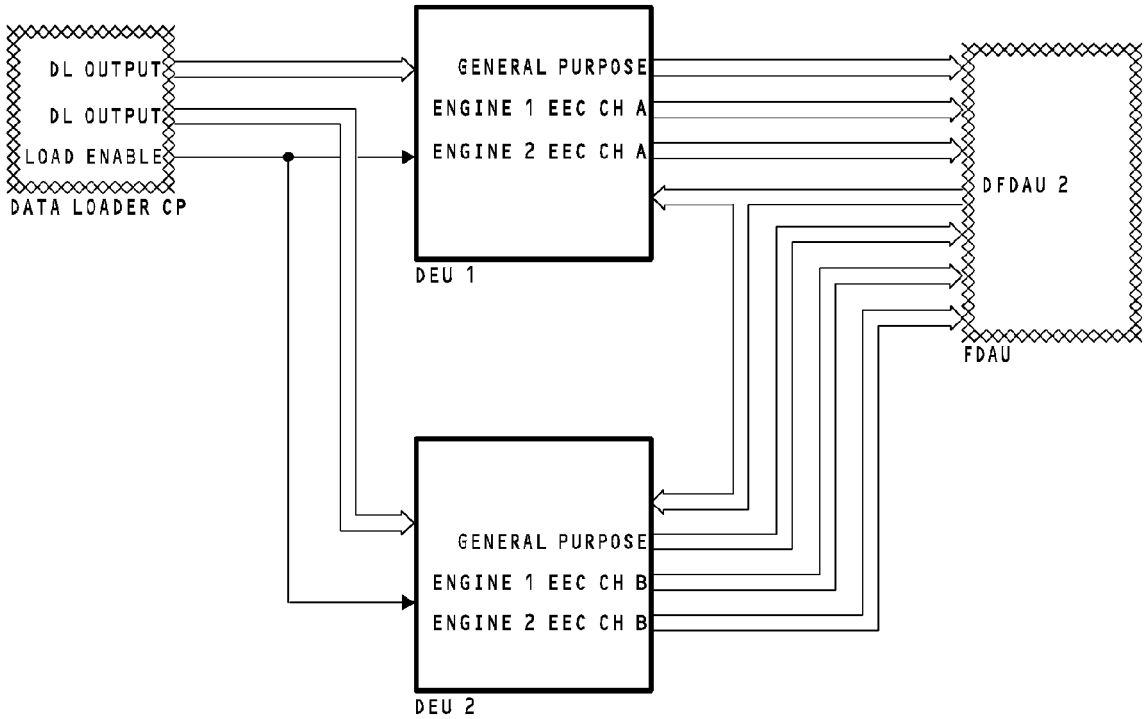
Airplane Condition Monitoring System

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.

HAP ALL



CDS - INDICATING AND RECORDING INTERFACES



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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

EFFECTIVITY

HAP ALL

- Test display
- G/S deviation warn
- LOC deviation warn
- CMD-A
- CMD-B
- F/D A ON
- F/D B ON
- 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.

HAP 031-054, 101-999

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.

HAP ALL

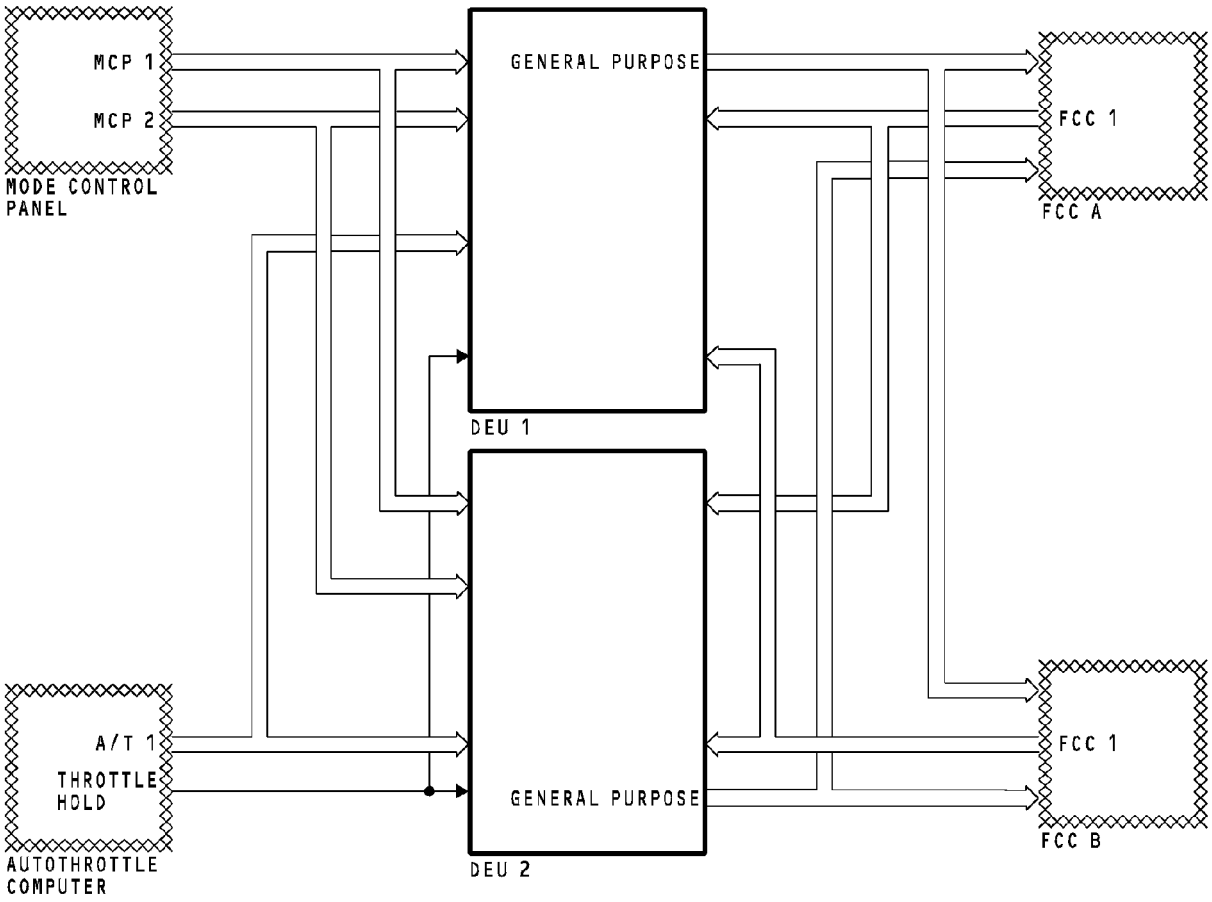
Autothrottle Computer

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

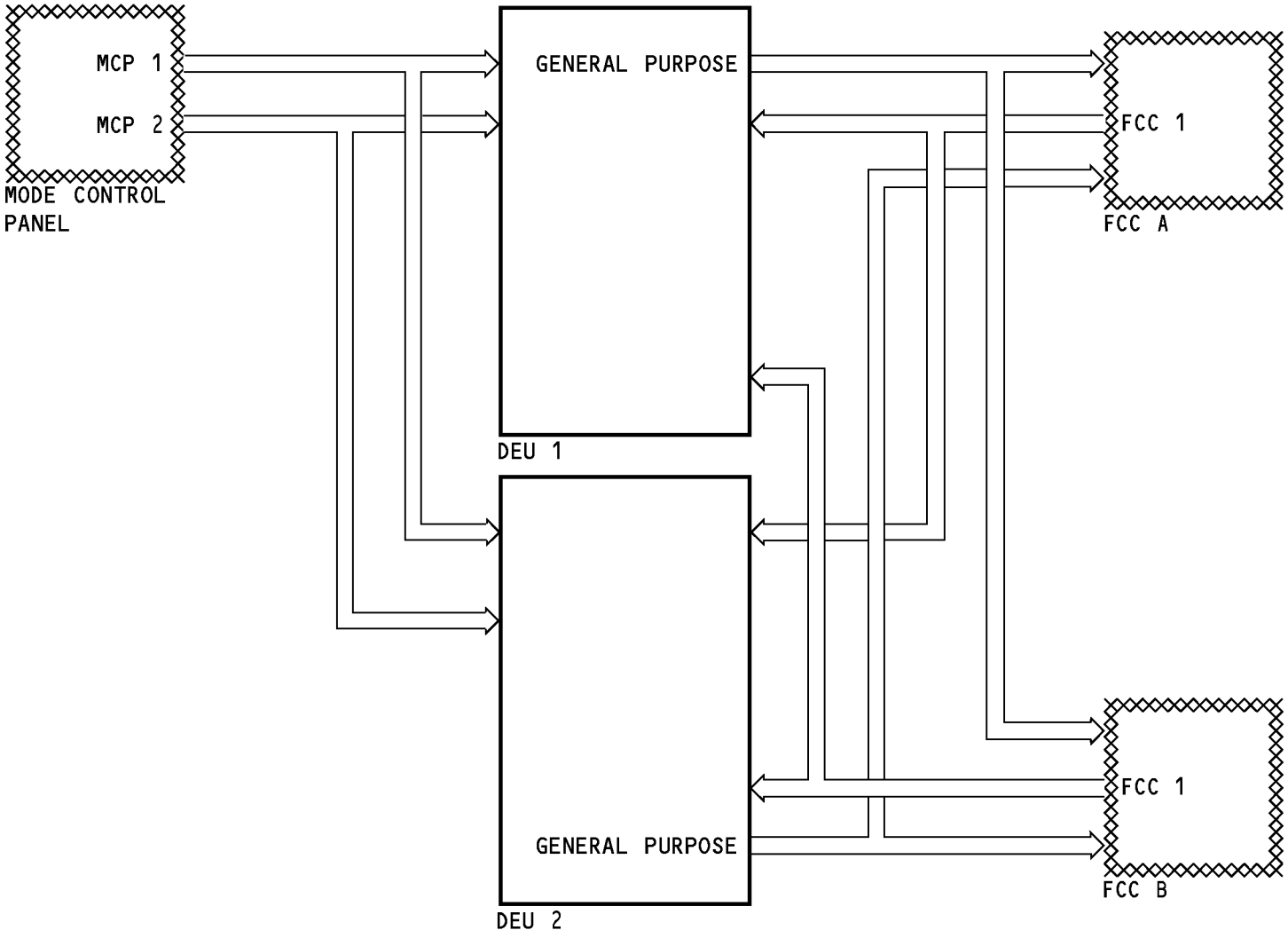
- ARM
- GA
- MCP SPD
- A/T LIMIT
- FMC SPD
- N1
- RETARD
- TEST.

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.



CDS - AUTOFLIGHT INTERFACES



CDS - AUTOFLIGHT INTERFACES

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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.

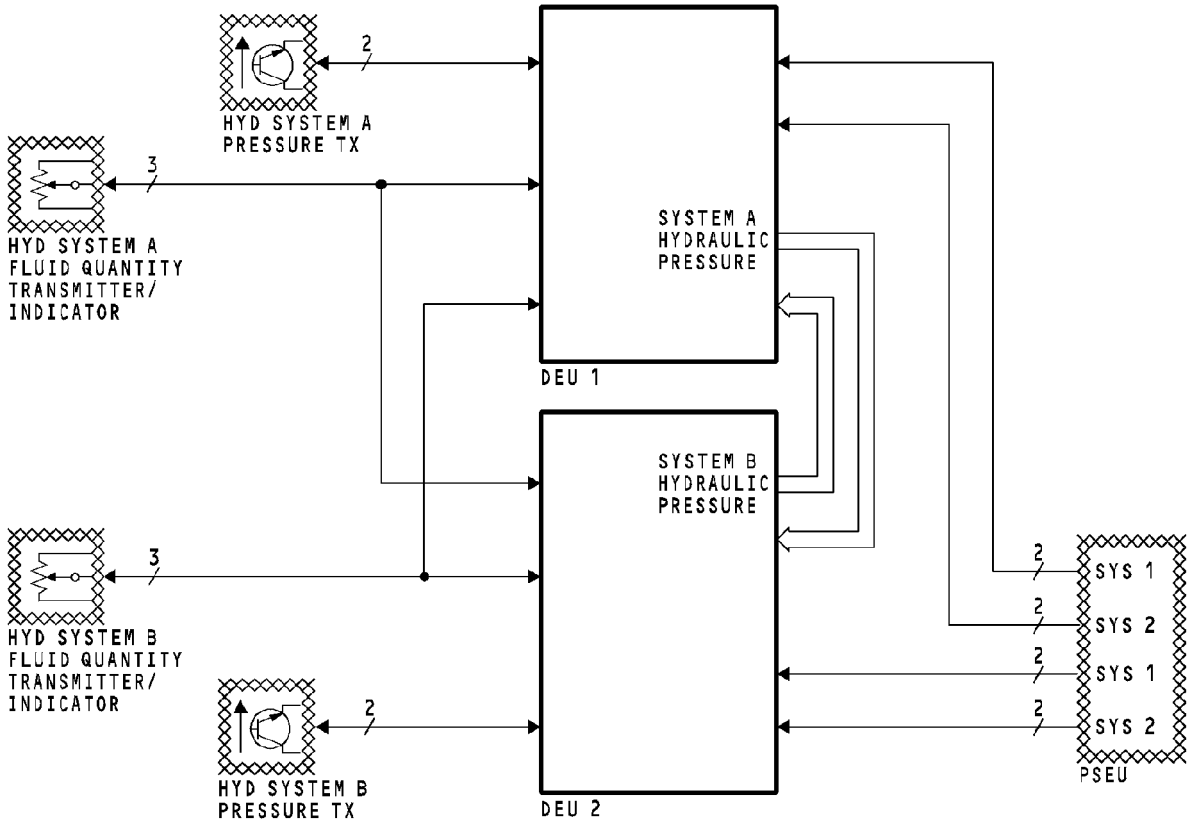
Hydraulic Fluid Quantity

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 swich 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.



CDS - HYDRAULIC AND LANDING GEAR 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

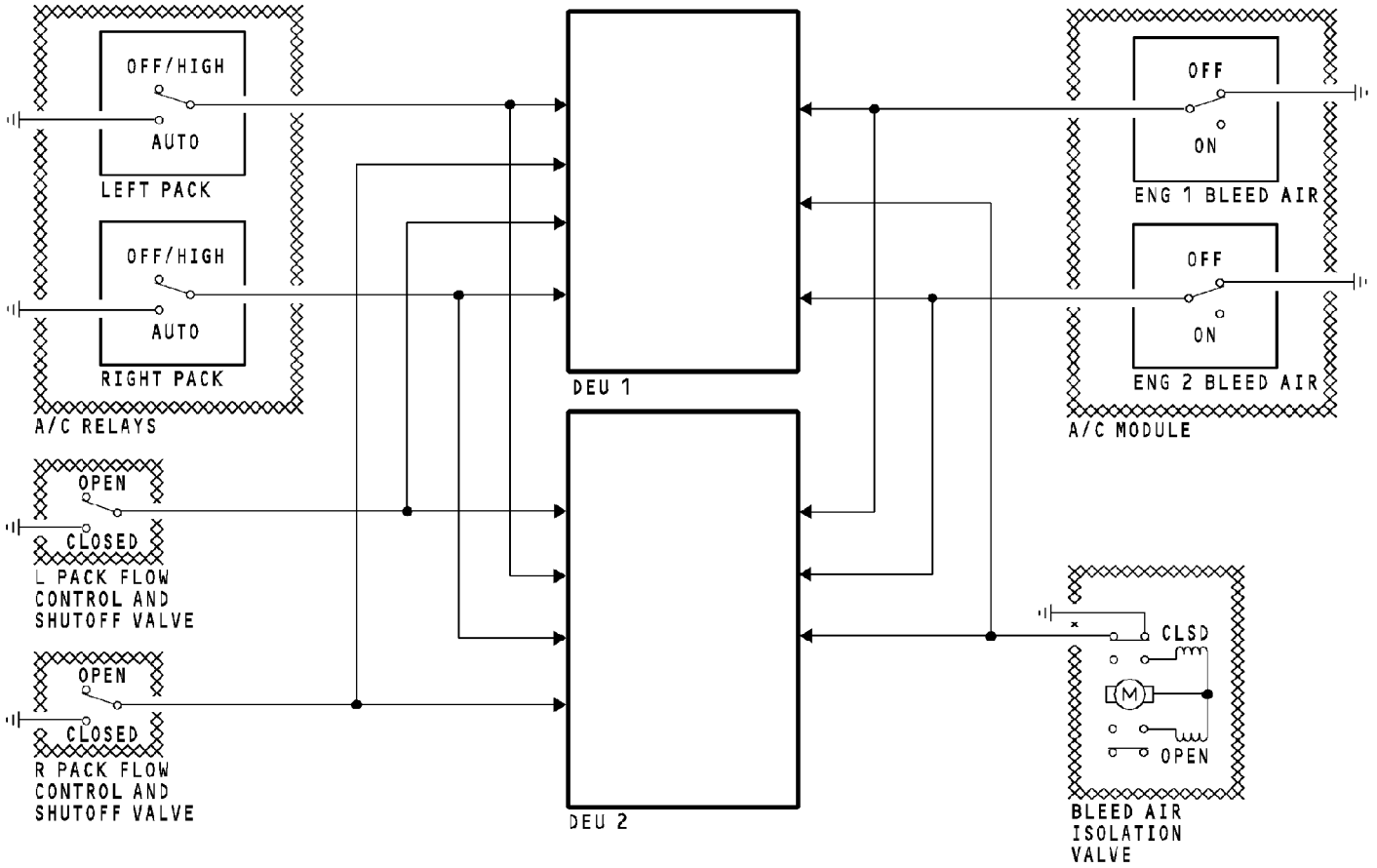
The left and right pack flow control and shutoff valves send ground discretes to both DEUs. The DEUs use these discretes to determine the position of the flow control and shutoff valves.

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.



CDS - AIR CONDITIONING AND PNEUMATIC INTERFACES

General

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

- Engine and wing antice module
- Engine cowl antice valves.

Engine and Wing Antice Module

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

- Wing antice switch
- Engine 1 antice switch
- Engine 2 antice switch.

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

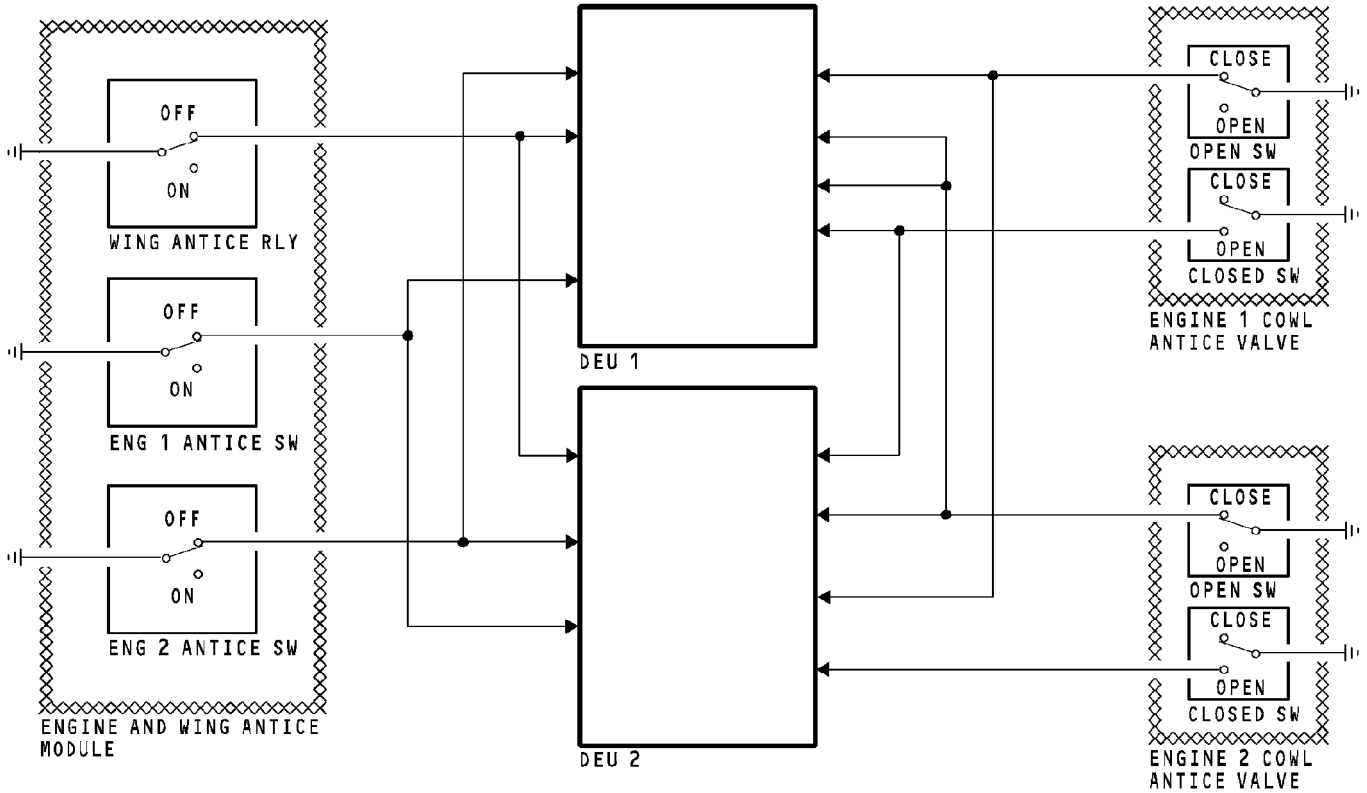
- Digital flight data acquisition unit
- Main engine electronic controls
- APU electronic control unit.

Engine Cowl Thermal Anti-Ice Valve.

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

The DEUs use engine cowl antice valve position to show the TAI message on the engine display. This message is green.

The DEUs also use engine cowl antice 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.



CDS - ICE AND RAIN PROTECTION 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:

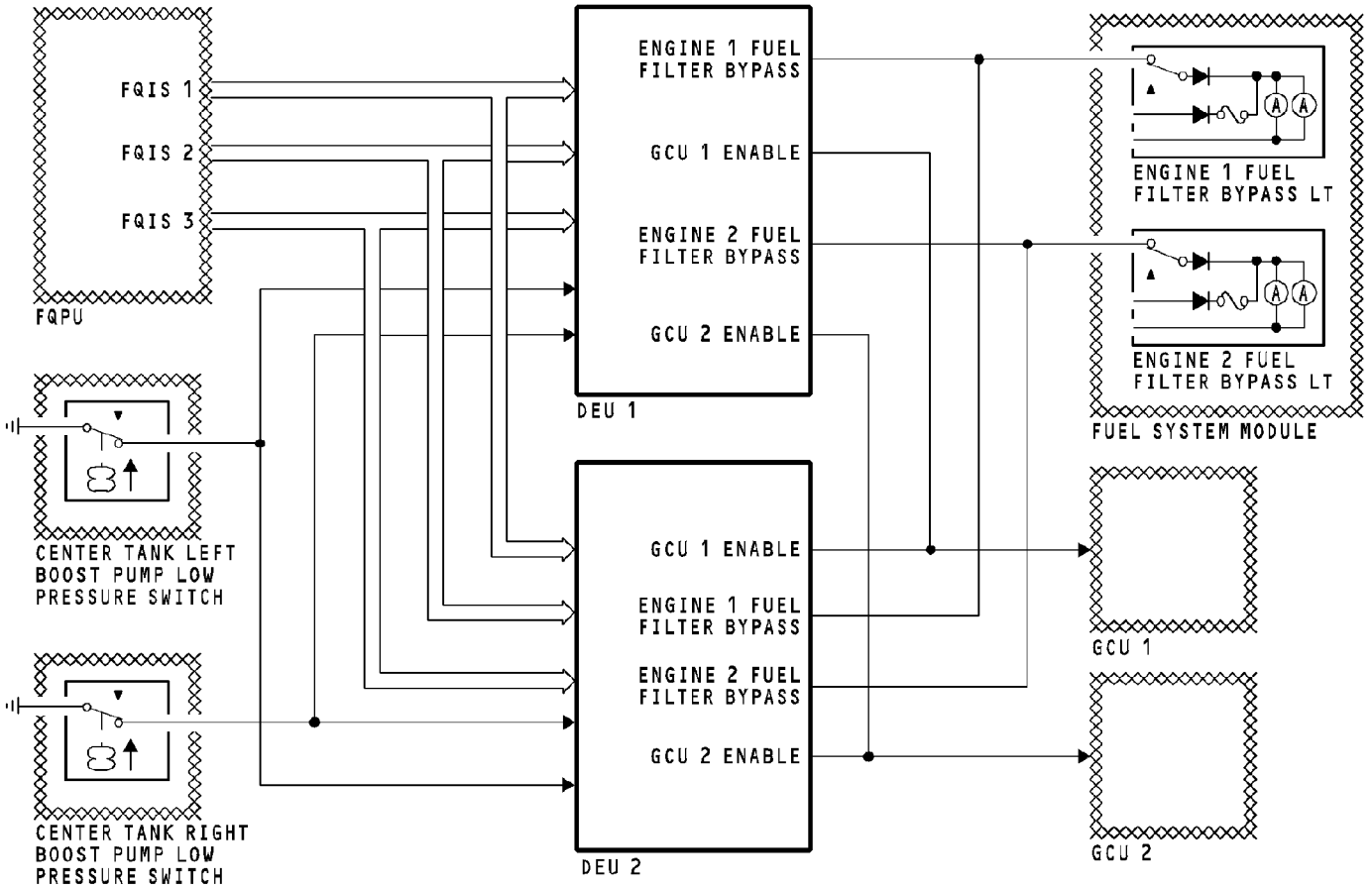
- Output pressure from both center tank boost pumps is low
- 1,600 lb (725 kg) or more fuel in the center tank
- Either main engine operating.

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.



CDS - FUEL AND ELECTRICAL INTERFACES

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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
- Antice 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
- Antice status
- Engine bleed switch status
- Flap position data
- Air/ground system status.

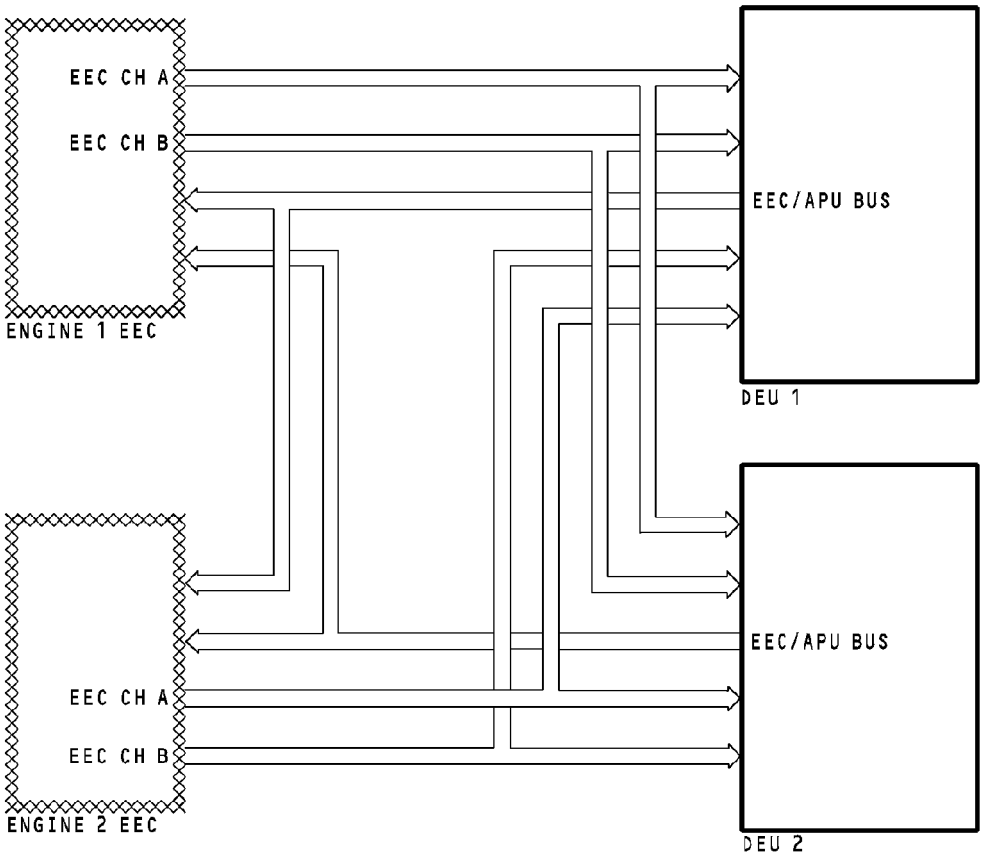
The EECs use this data in the engine control function.

The EECs send data to the DEUs on two seperate 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
- 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.



CDS - ENGINE INTERFACES - 1

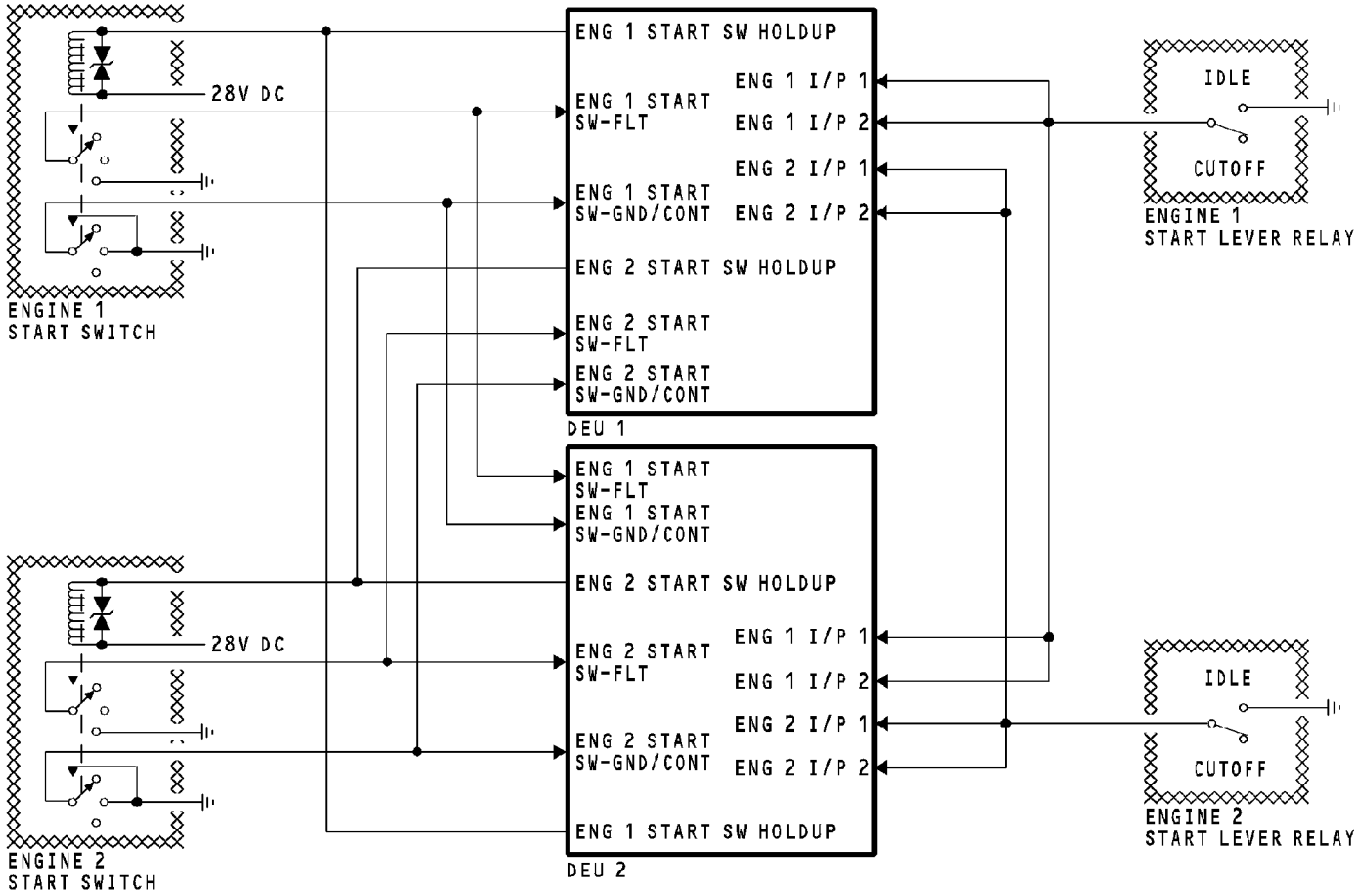
Engine Start Switch

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).



CDS - ENGINE INTERFACES - 2

Engine Oil Quantity Transmitter

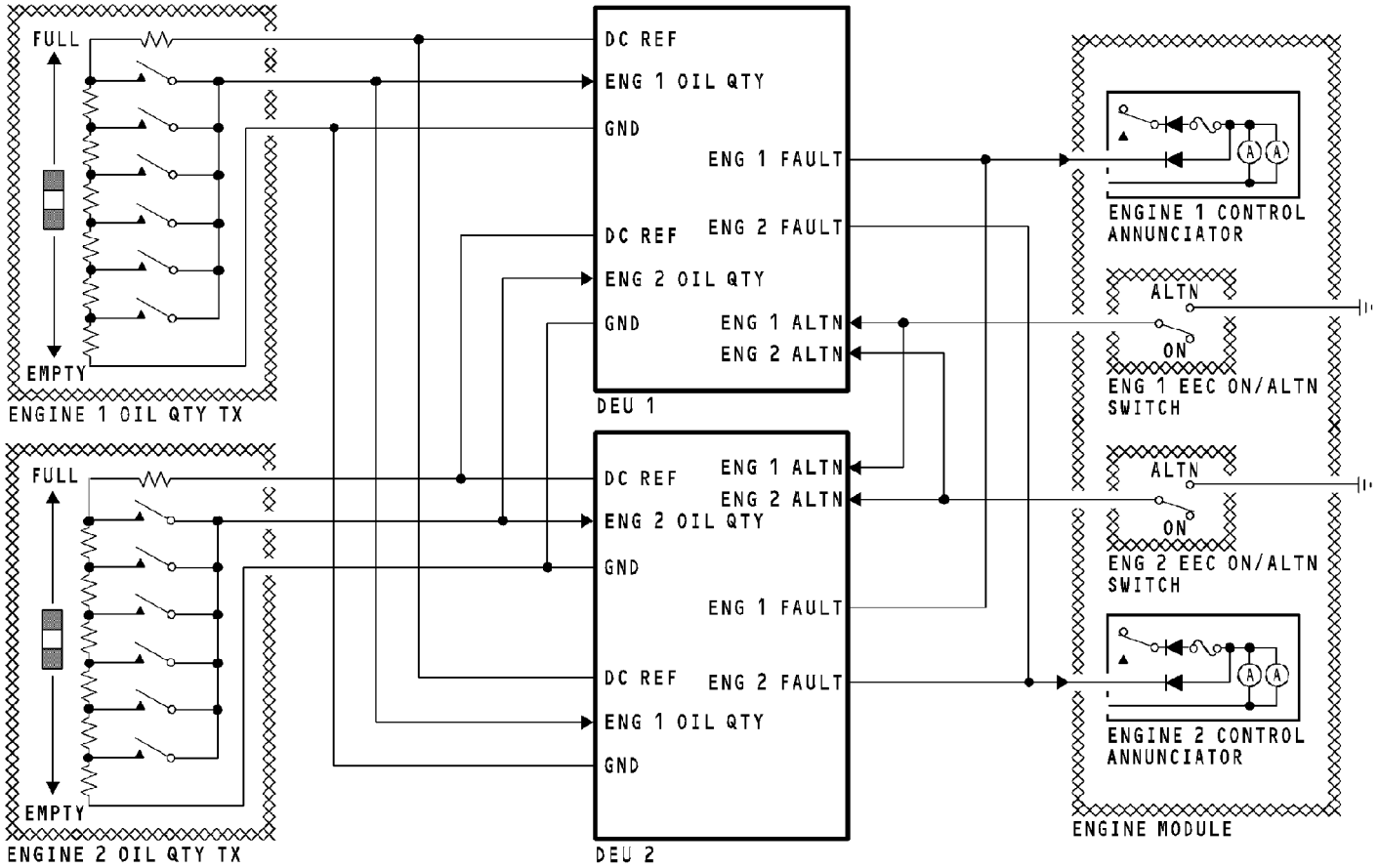
The engine oil quantity transmitters send an analog signal to both display electronic units (DEUs).

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.



CDS - ENGINE INTERFACES - 3

N1 and N2 Speed Sensor

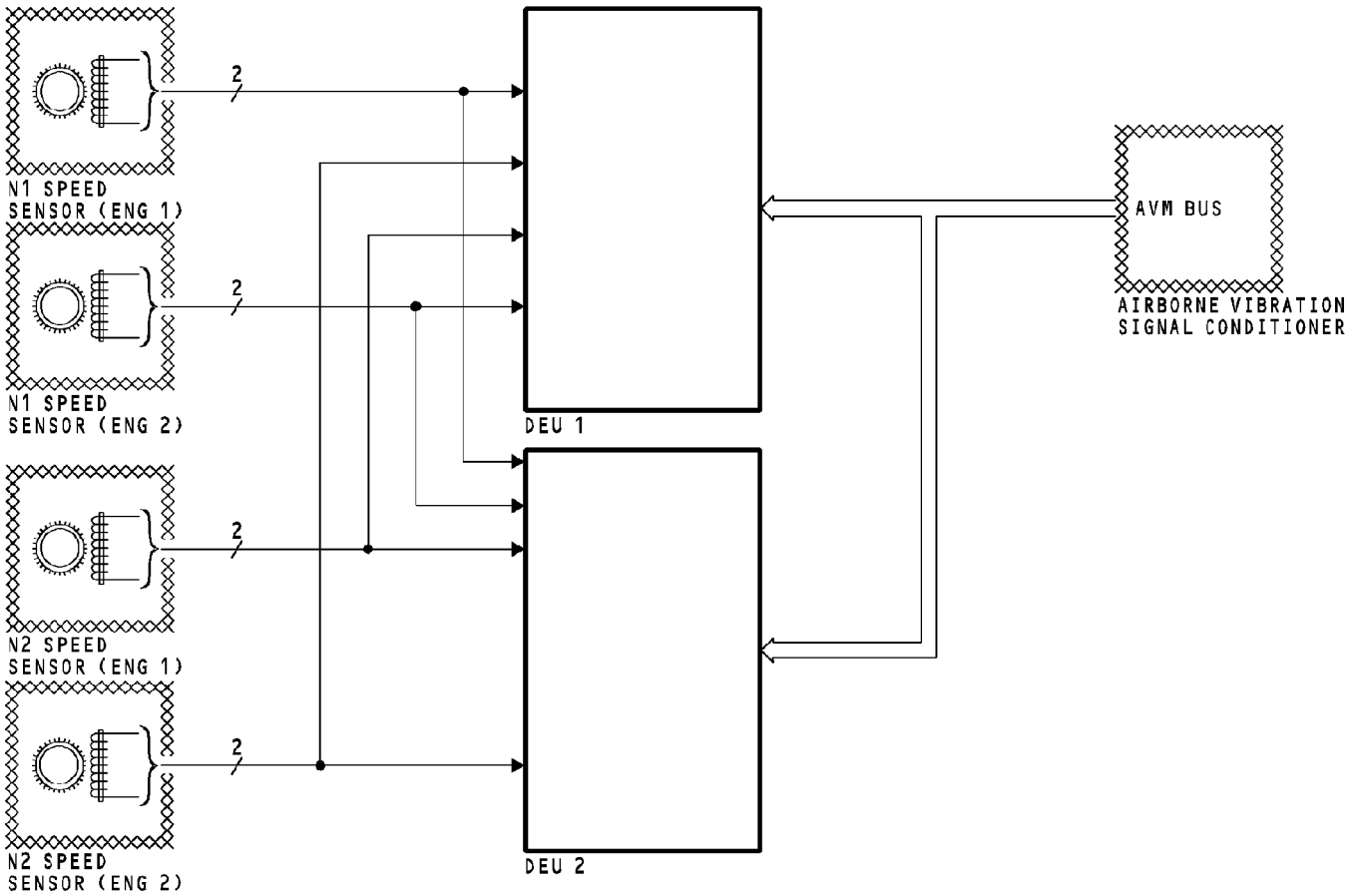
The engine speed sensors send analog frequency signals to both display electronic units (DEUs). N1 is low pressure rotor speed and N2 is high pressure rotor speed.

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.



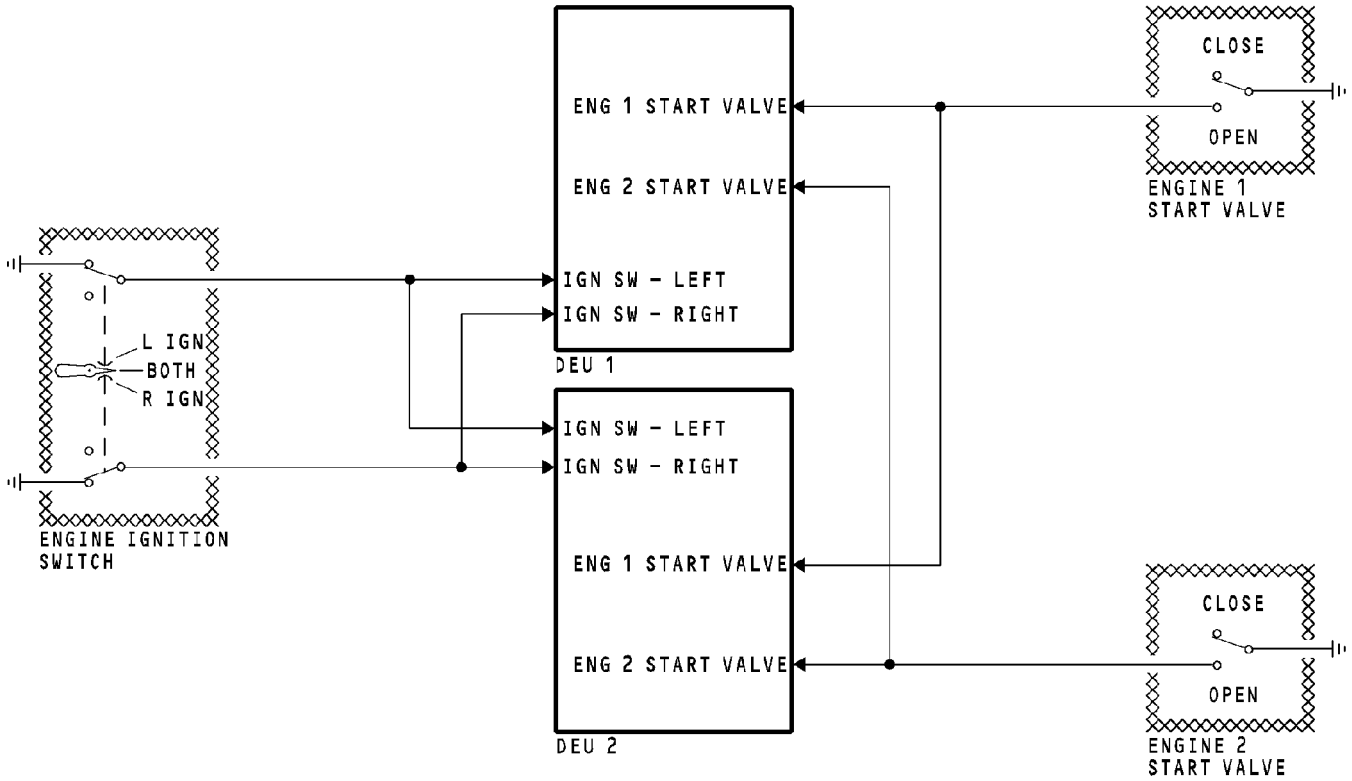
CDS - ENGINE INTERFACES - 4

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.



CDS - ENGINE INTERFACES - 5

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 (EECc).

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

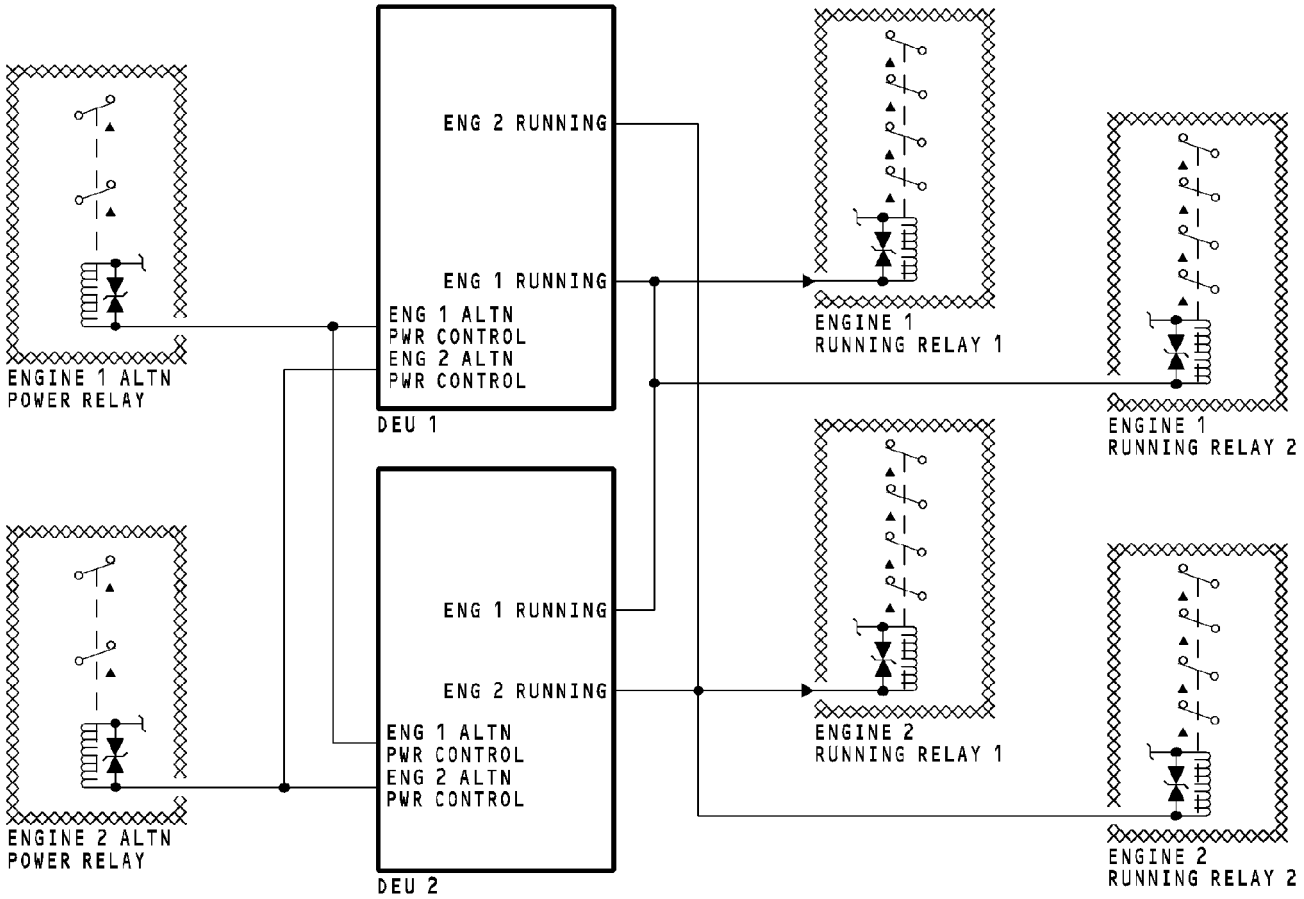
- Engine start lever is set to idle
- Engine start switch is set to GRD
- Engine start switch is set to CONT
- Control display unit (CDU) set to engine BITE.

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.

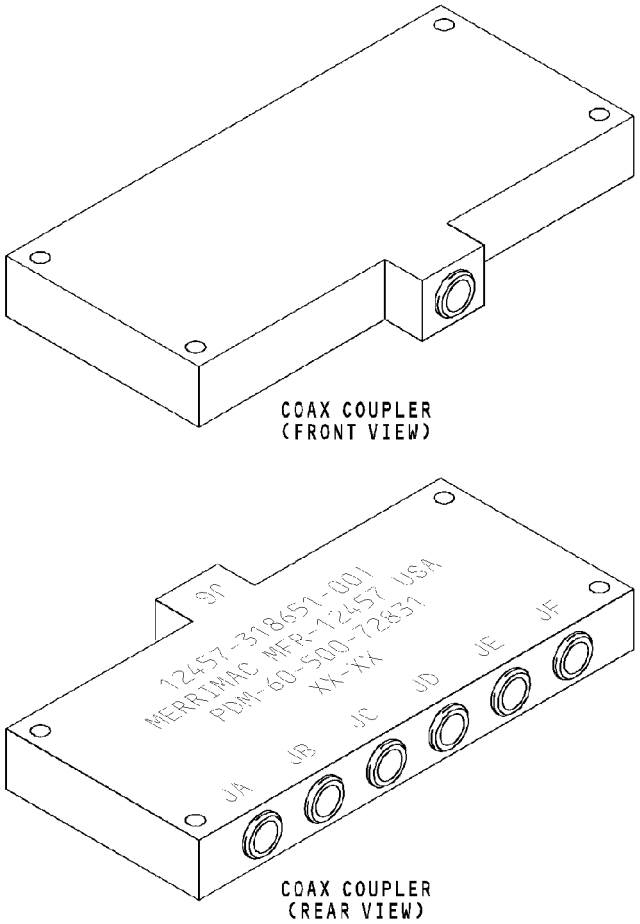


CDS - ENGINE INTERFACES - 6

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.



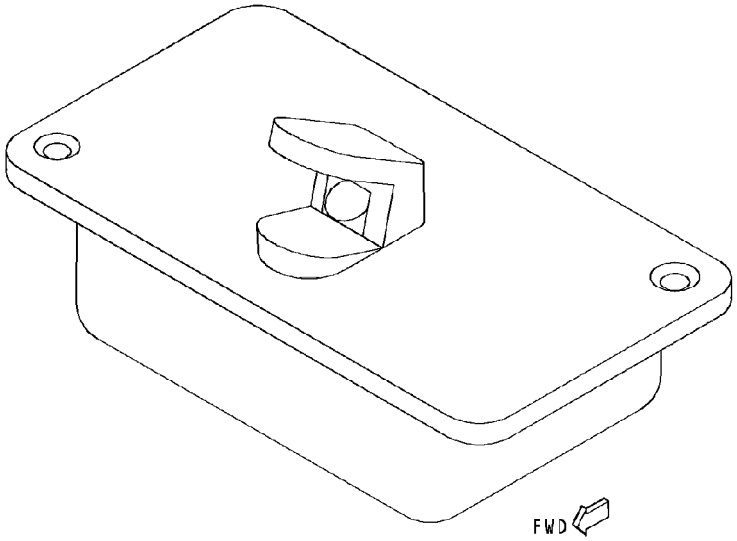
CDS - COAX COUPLER

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 that 1/2 pound. The RLS has a field of view of 70 degrees left, 70 degrees right, 40 degrees up and 15 degrees down.



CDS - REMOTE LIGHT SENSOR

EFFECTIVITY
HAP ALL

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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.

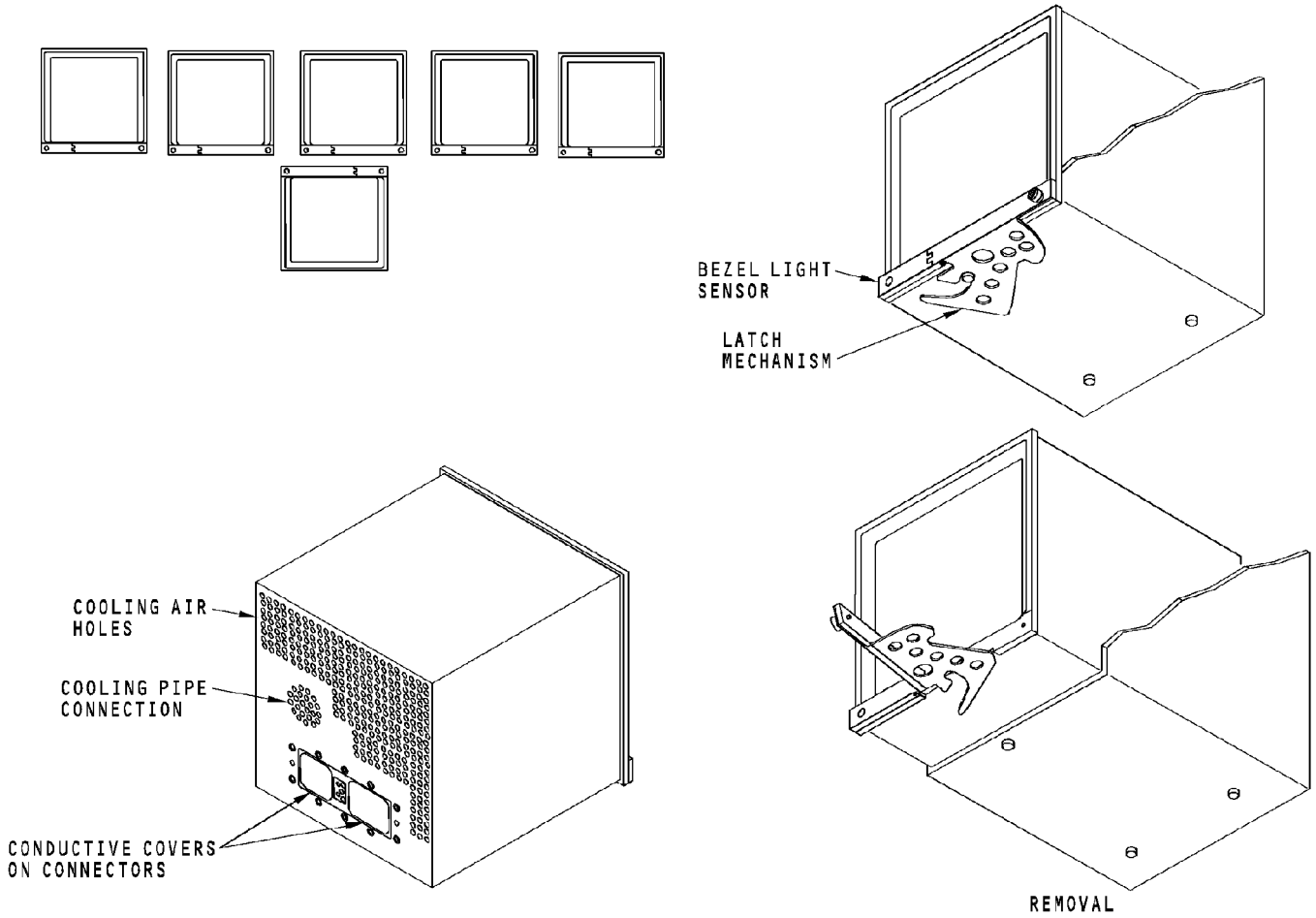
Training Information Point

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.



CDS - DISPLAY UNIT

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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.

LCD Interface

The LCD interface changes image data to digital voltages.

Voltage Reference

The voltage reference changes the digital voltage values from the LCD interface to analog voltage reference (VREF) voltages. The VREF voltage is a voltage that the LCD drivers use to control the image element on the LCD for different intensities.

LCD Drivers

The LCD drivers control the 1152 X 1152 color dots that make up the display.

Backlight Driver Assembly

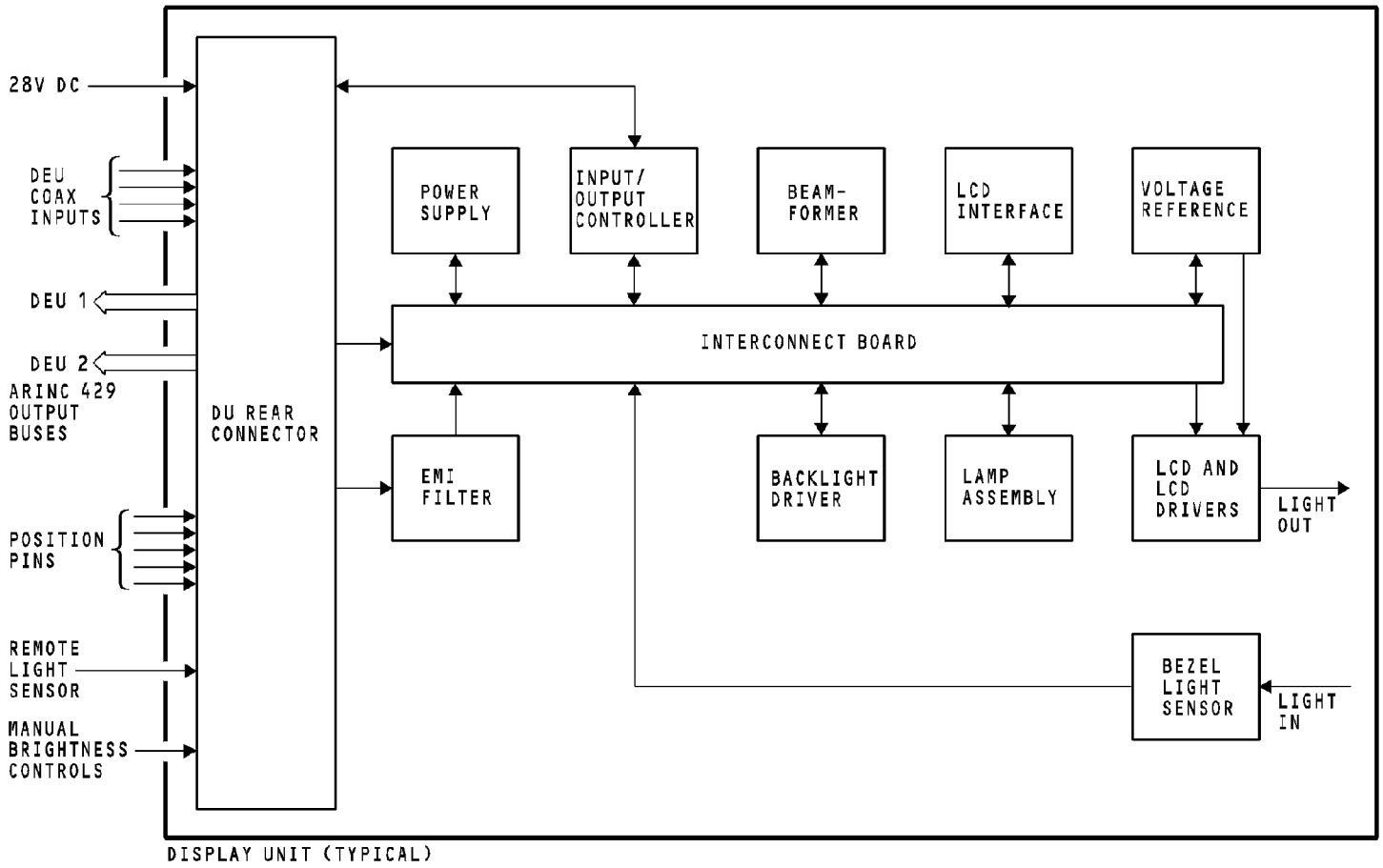
The backlight driver assembly controls a single fluorescent lamp. It also controls the lamp and LCD heater circuits. The backlight driver assembly keeps the lamp temperature at 60C. And the backlight driver assembly keeps the temperature for the LCD above 25C.

Lamp Assembly

The lamp assembly has a back surface to reflect the fluorescent lamp to increase the light output. It also has temperature sensors. When the lamp and LCD temperature are out of range, the backlight driver assembly adjusts the temperature.

Bezel Light Sensor

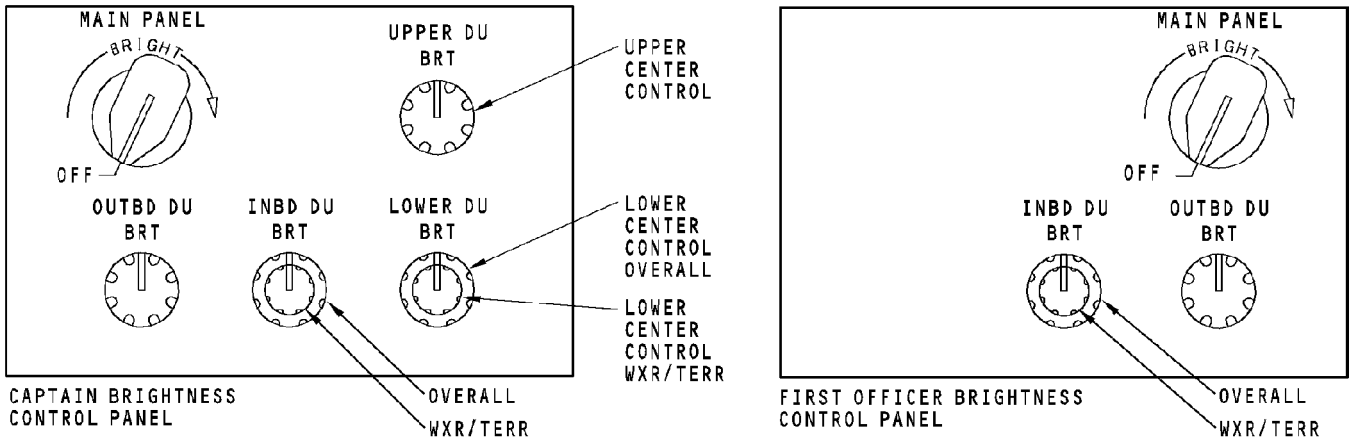
The bezel light sensor (BLS) senses incident light. The interconnect board changes the BLS signal to a digital value. This value goes on the ARINC 429 buses back to the DEU for light intensity control.



CDS - DU - FUNCTIONAL DESCRIPTION

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.



CDS - BRIGHTNESS CONTROLS

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.

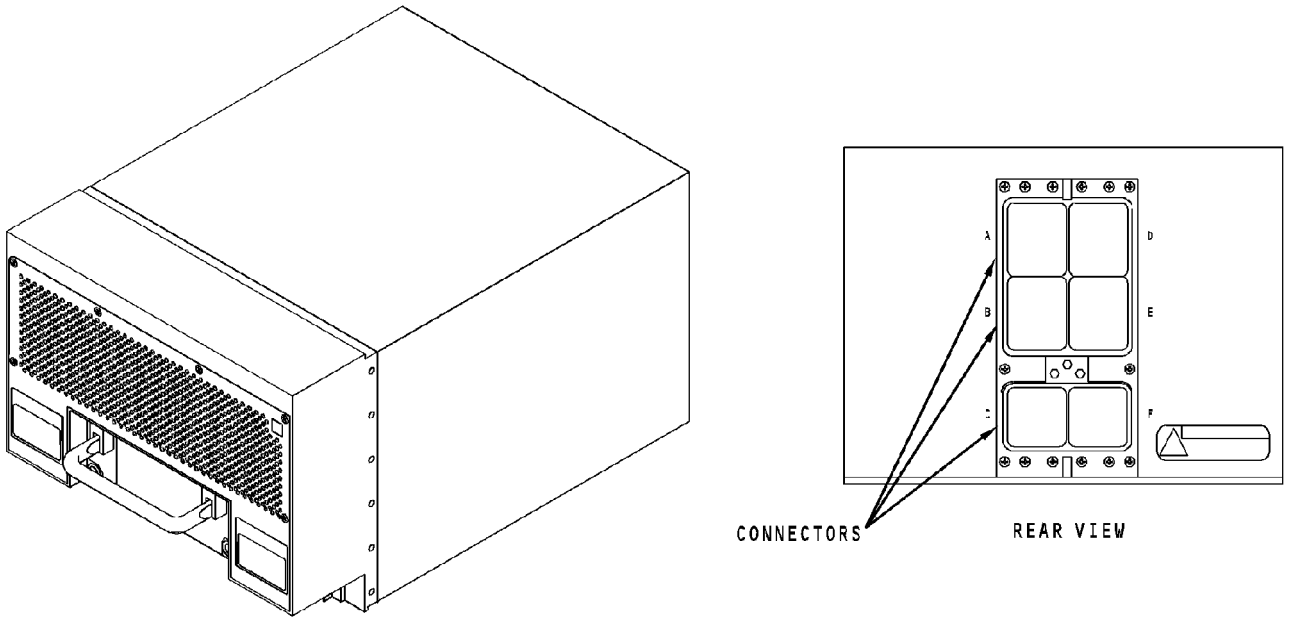
Physical Description

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.



CDS - DISPLAY ELECTRONICS UNIT

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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 (CP) bus.

Graphic Generator

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

Power Supply

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

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.

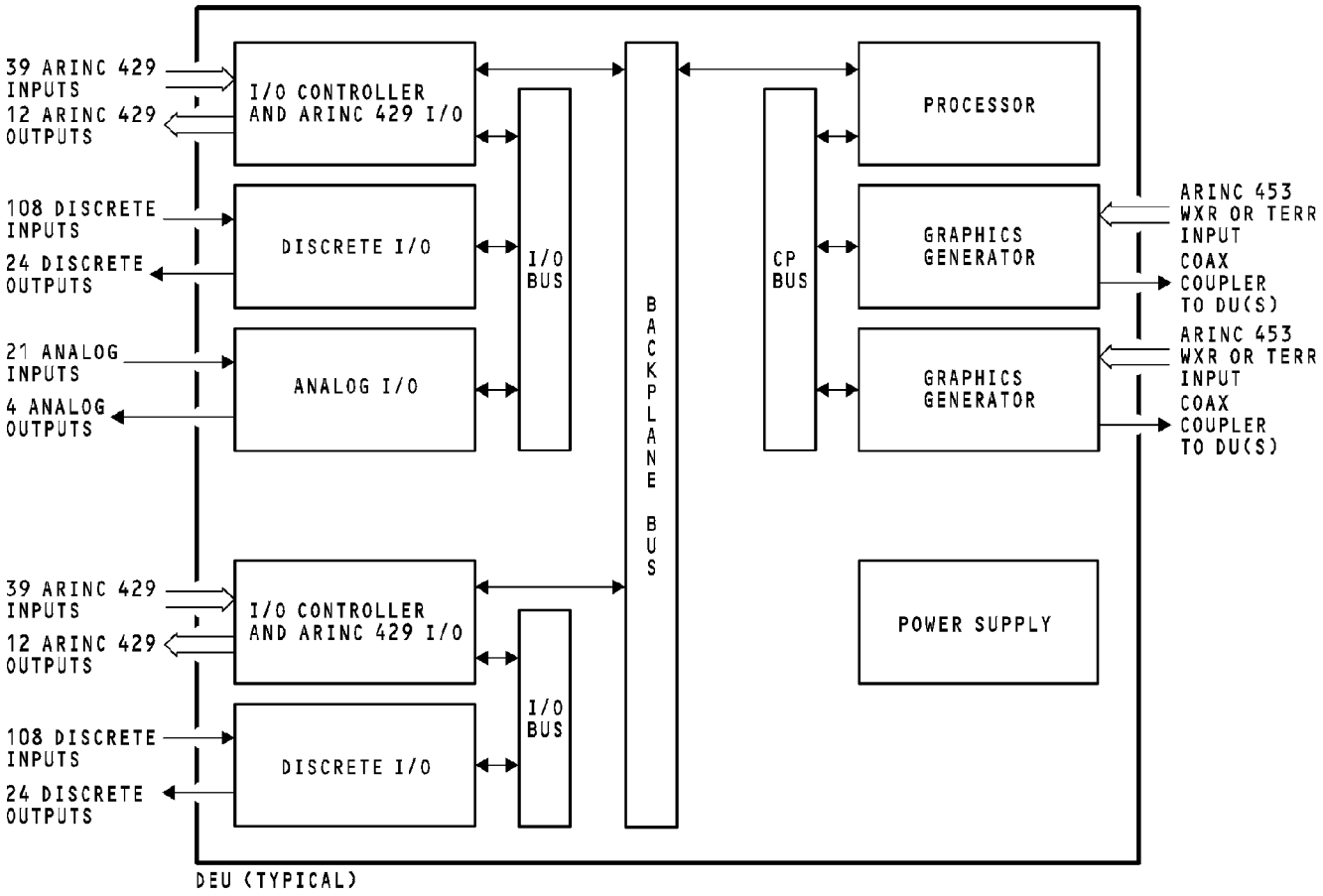
The message CDS FAULT shows if two or more of these cards fail in a DEU or one fails in each DEU:

- Graphic generator
- 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.

EFFECTIVITY

HAP ALL



CDS - DEU - FUNCTIONAL DESCRIPTION

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.

HAP 001-005, 021-026, 028-054, 101-999

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

HAP 006-013, 015-020

The minimum altitude selection is radio when the minimums reference selector is set to "BARO" or "RADIO".

HAP ALL

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.

EFFECTIVITY

HAP ALL

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.

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

HAP 001-013, 015-026, 028-030 PRE SB 737-31-1246 AND PRE SB 737-31-1295

- DATA, for altitude and ETA of route waypoints

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

- DATA, for selection of vertical situation display and for a range setting of 160 nm or greater, altitude and ETA of route waypoints

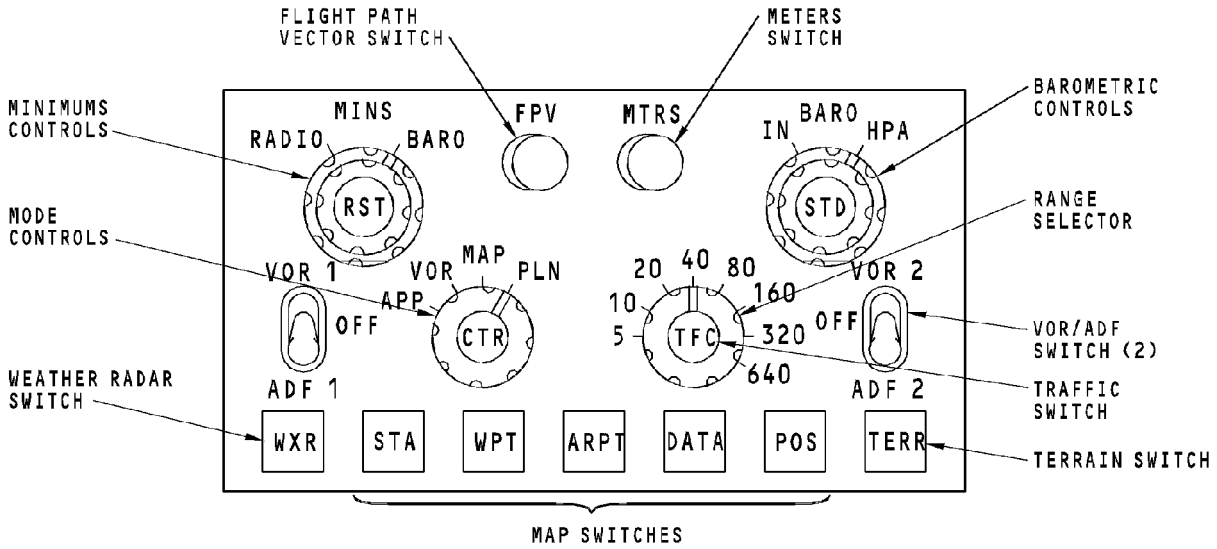
HAP ALL

- 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).



NOTE: SOME SWITCHES MAY BE MARKED INOP

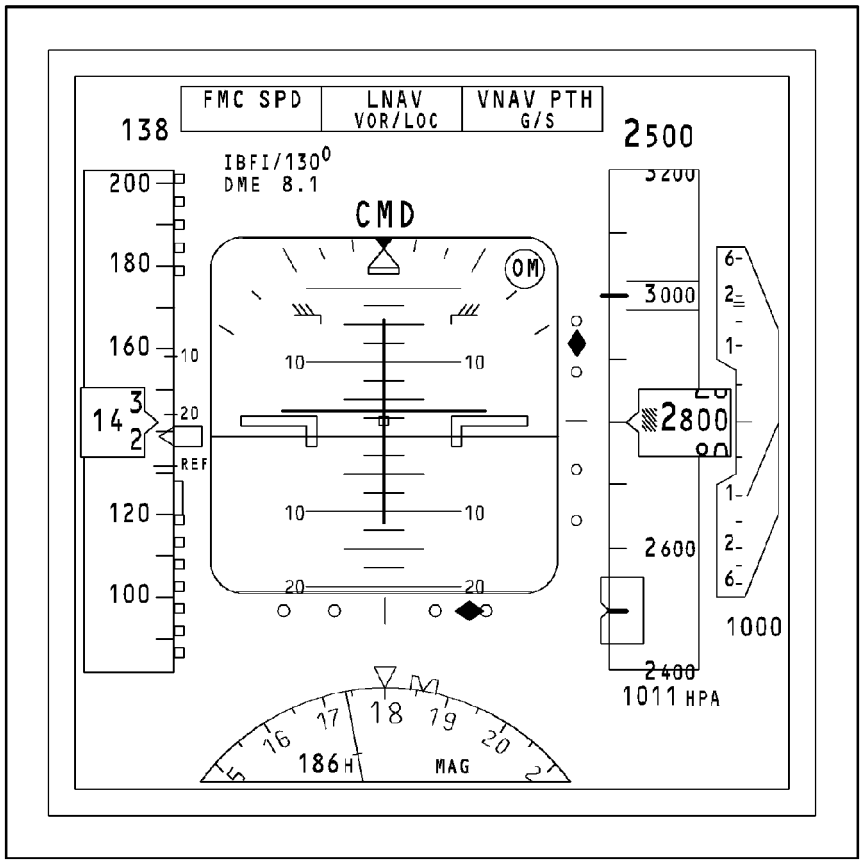
CDS - EFIS CONTROL PANEL

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.



CDS - PRIMARY FLIGHT DISPLAY OVERVIEW

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

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 PRE SB 737-31-1246 OR POST SB 737-31-1295

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

HAP 031-054; HAP 001-013, 015-026, 028-030 (POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295

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

HAP ALL

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

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 PRE SB 737-31-1246 OR POST SB 737-31-1295

The DEU calculates Vref + 15.

HAP 031-054; HAP 001-013, 015-026, 028-030 (POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295

The DEU calculates Vref + 20.

HAP ALL

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.

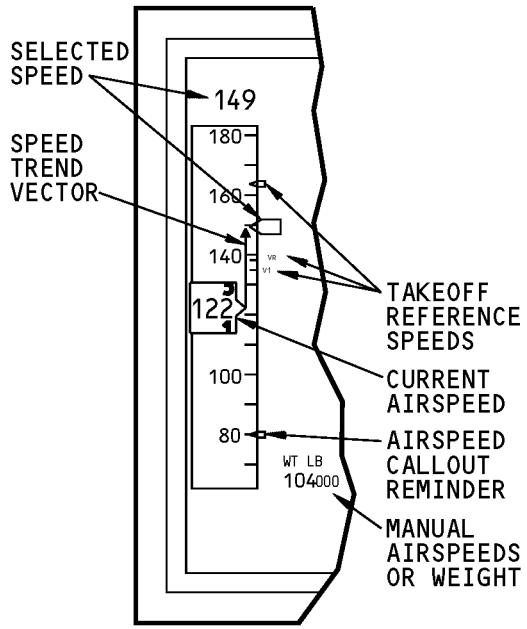
See the flight management computer system section for more information on flap maneuver speeds. (SECTION 34-61)

HAP 031-054, 101-999

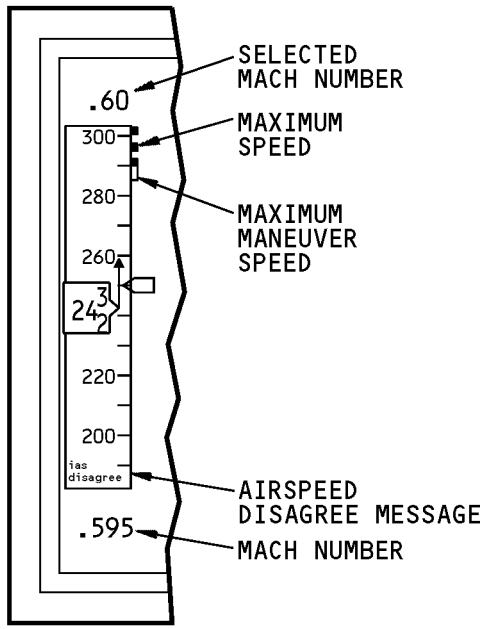
Vref Flap/Speed Annunciation

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.

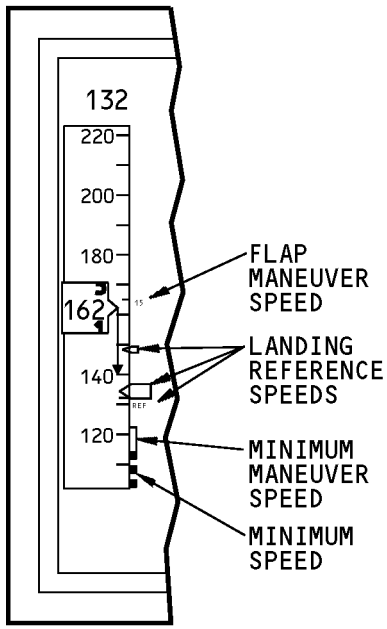
HAP ALL



AIRSPEED TAPE
TAKEOFF

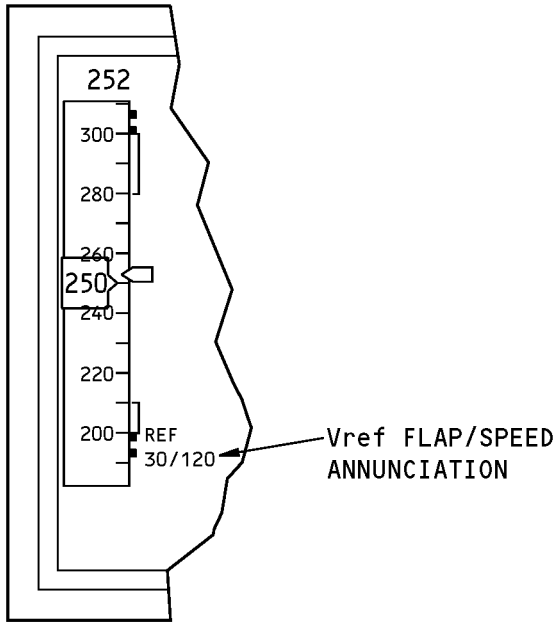


AIRSPEED TAPE
CRUISE OR CLIMB



AIRSPEED TAPE
LANDING

CDS - PFD - AIRSPEED INDICATIONS



CDS - PFD - Airspeed Indications - Vref Flap/Speed

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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

HAP 031-036, 041, 047-050, 053, 054, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370

- Horizon Line Heading Scale

HAP 044-054, 102-999

- Navigation Performance Scales (NPS)

HAP ALL

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.

The pitch limit indication shows when flaps are lowered.

HAP 001-007, 028-054, 101-999

When the flaps are up, the pitch limit indication shows if the airspeed gets to the stall speed.

HAP ALL

Flight Path Vector Indication

The flight path vector indication shows when you select FPV on the EFIS control panel. The indication shows the vector of motion of the airplane relative to the horizon and the airplane heading.

EFFECTIVITY

HAP ALL

Comparator Function Annunciations

The comparator function annunciations are PITCH and ROLL. These annunciations show if the CDS calculates a difference of more than five degrees between the captain and first officer pitch or roll display values.

If the PITCH or ROLL annunciation shows, the annunciation flashes for the first 10 seconds. After 10 seconds, the display is steady.

HAP 031-036, 041, 047-050, 053, 054, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370

Horizon Line Heading Scale

The PFD shows the airplane's heading against a compass rose. The heading scale in the attitude indications shows a section of the compass rose on the horizon line.

The heading you set on the MCP also shows on the heading scale. If the set heading value is more than the scale, the indicator is parked at one end of the scale.

The heading scale on the attitude horizon line does not show during these conditions:

- The FPV is not set
- The absolute pitch angle is more than 20 degrees
- The absolute bank angle is more than 50 degrees.

HAP 044-054, 102-999

Navigation Performance Scales (NPS)

The Navigation Performance Scales (NPS) show the airplane position in the lateral and vertical path specified by the FMC. The NPS show when LNAV is in the engaged FD or autopilot mode. The NPS indications do not show if the FMC does not send an RNP value to the DEU.

The NPS show in four parts:

- LNAV/VNAV deviation scales and pointers
- Deviation scale identifier
- ANP/RNP bars
- Anticipation cues

LNAV/VNAV Deviation Scales and Pointers

The LNAV deviation scale and pointer show below the ADI. The pointer shows the lateral direction that the plane must go to get back to the FMC specified path.

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:

EFFECTIVITY
HAP ALL

HAP 044-054, 102-999 (Continued)

- 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.

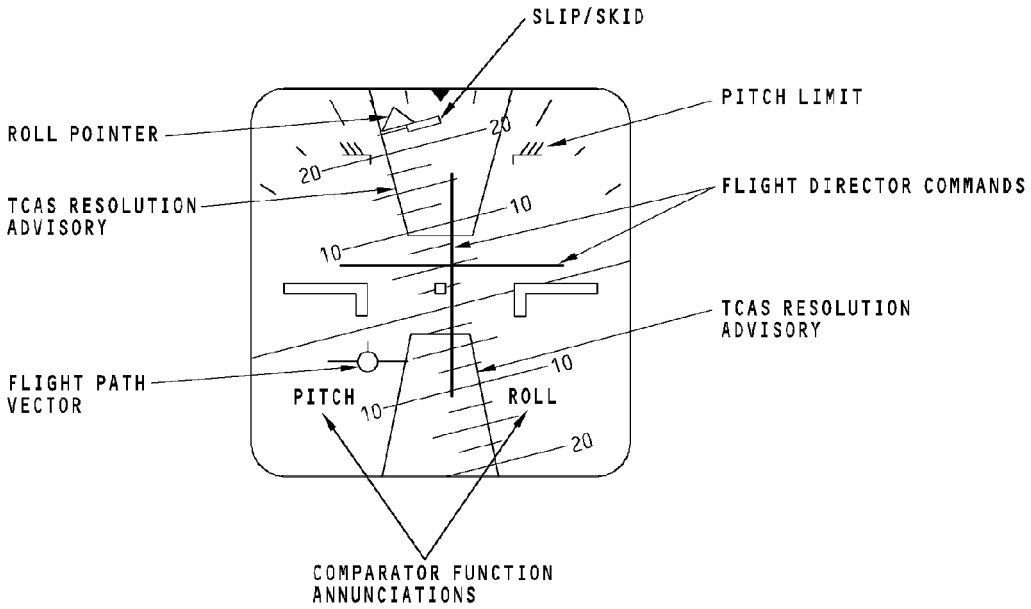
The outer scale marks on the deviation scales show the RNP values in nautical miles. The ANP/RNP bars show at the ends of the deviation scales. The bars show the ANP value in nautical miles. The space between the ends of the bars shows the quantity of the flight technical error.

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.

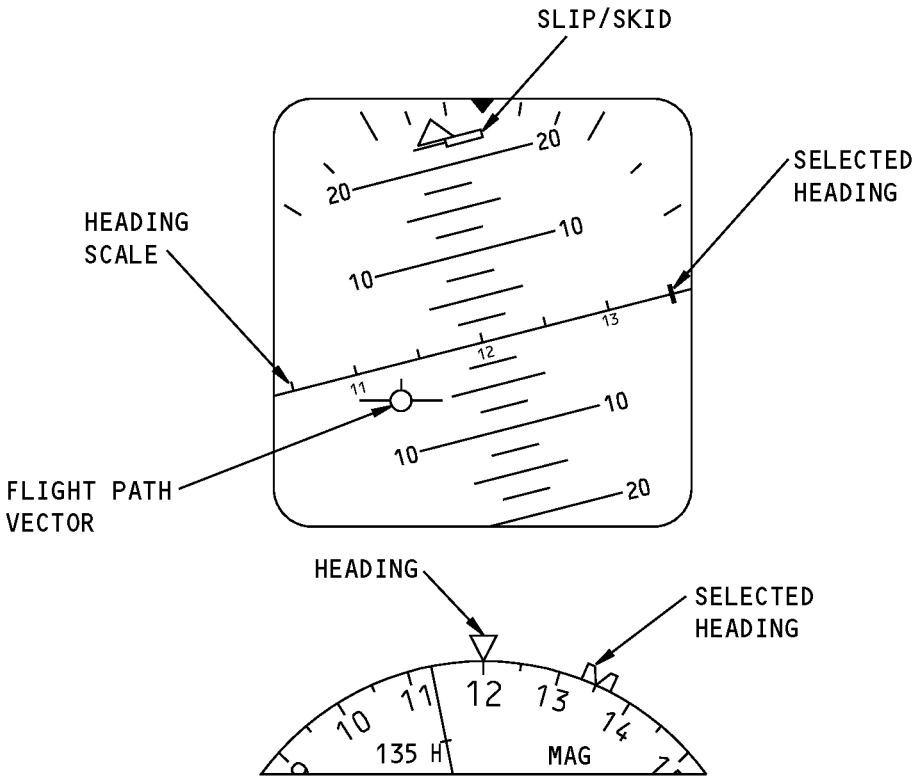
Anticipation cues

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.

HAP ALL



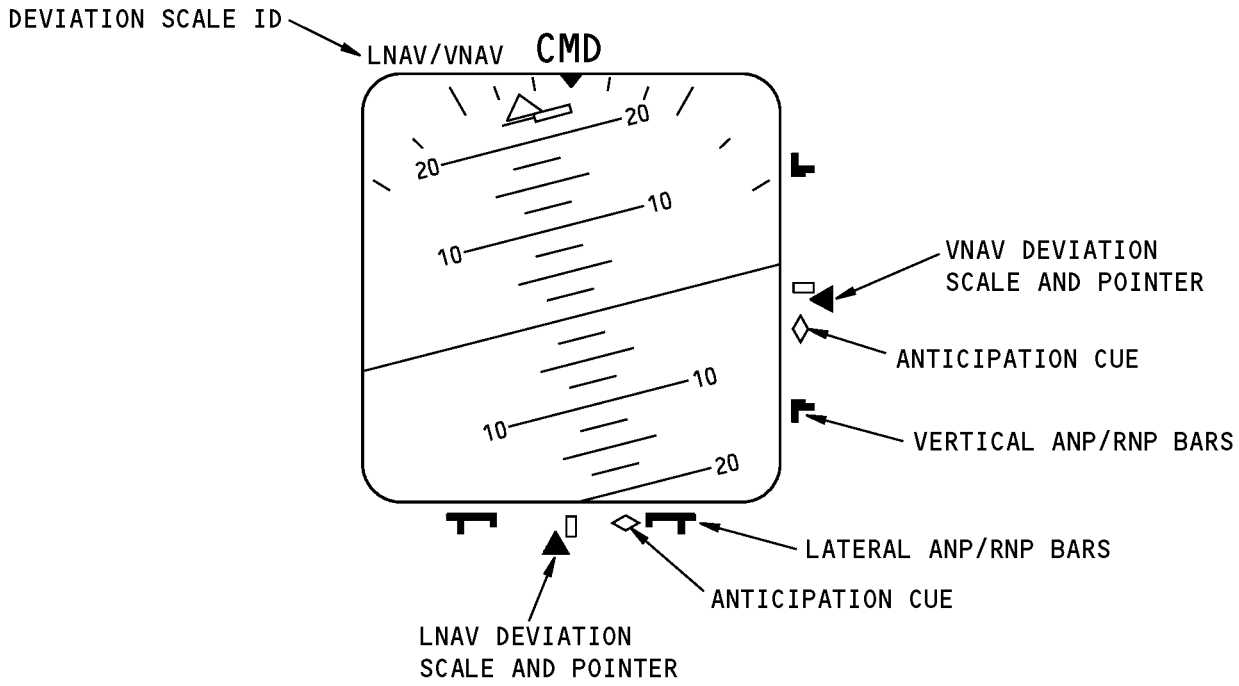
CDS - PFD - ATTITUDE INDICATIONS



CDS - PFD - Attitude Indications - Horizon Line Heading Scale

EFFECTIVITY

HAP 031-036, 041, 047-050, 053, 054, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370



CDS - PFD - Attitude Indications - NPS

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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.

A landing altitude reference bar shows the height above touchdown. From 0 to 500 feet above landing altitude, the bar is amber. From 500 to 1000 feet, the bar is white.

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.

Barometric Reference

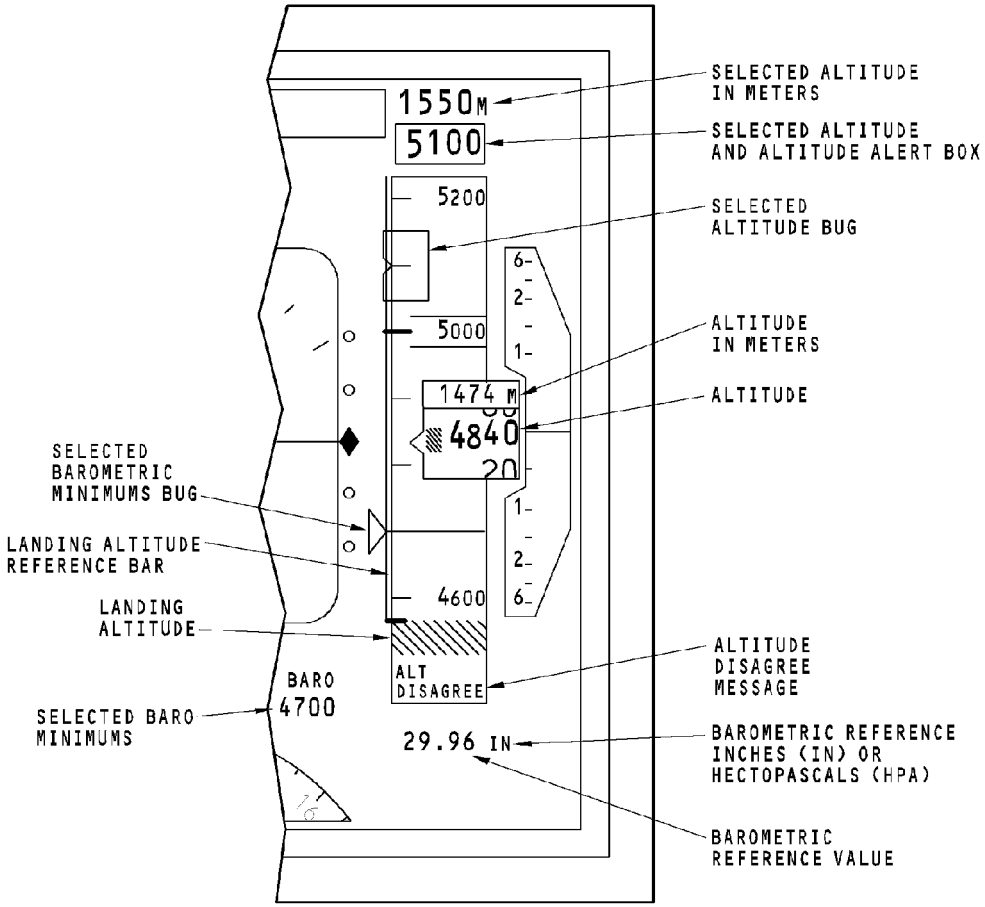
You select the barometric reference from the EFIS control panel, and it shows below the altitude tape. If you select the barometric reference in inches, IN shows next to the digital barometric reference value. If you select the barometric reference in hectopascals, HPA shows next to the digital barometric reference value. If you select the standard barometric reference, STD shows.

HAP 031-054, 101-999

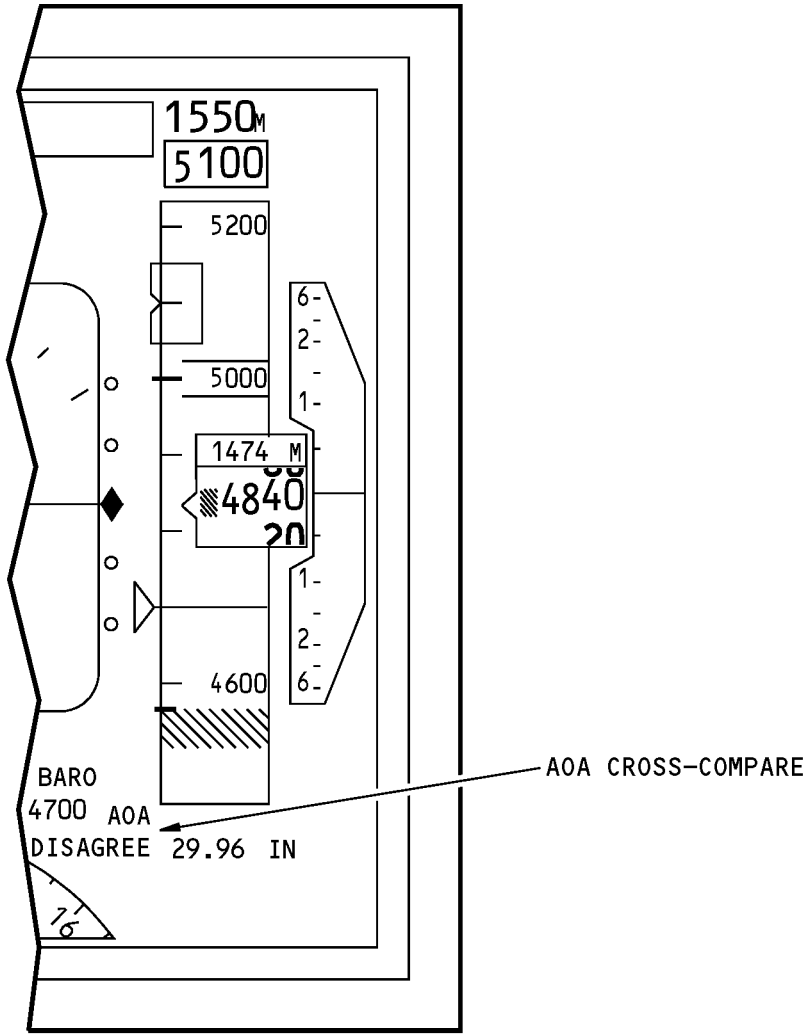
AOA DISAGREE Annunciation

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.

HAP ALL



CDS - PFD - ALTITUDE INDICATIONS



CDS - PFD - ALTITUDE INDICATIONS - AOA DISAGREE

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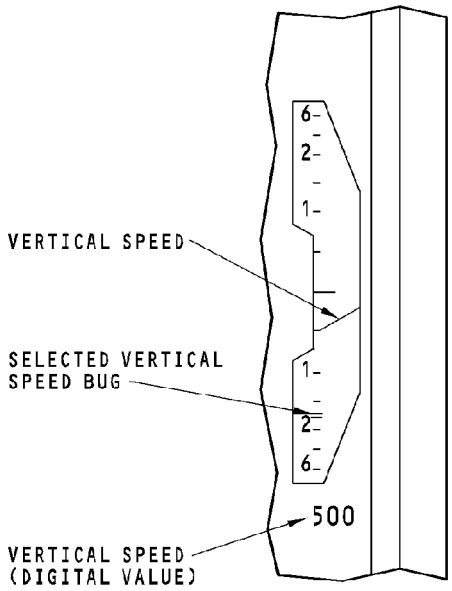
Vertical Speed Indications

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.

See the Air Data Inertial Reference System section for more information on vertical speed information. (SECTION 34-21)



CDS - PFD - VERTICAL SPEED INDICATIONS

Heading Indications

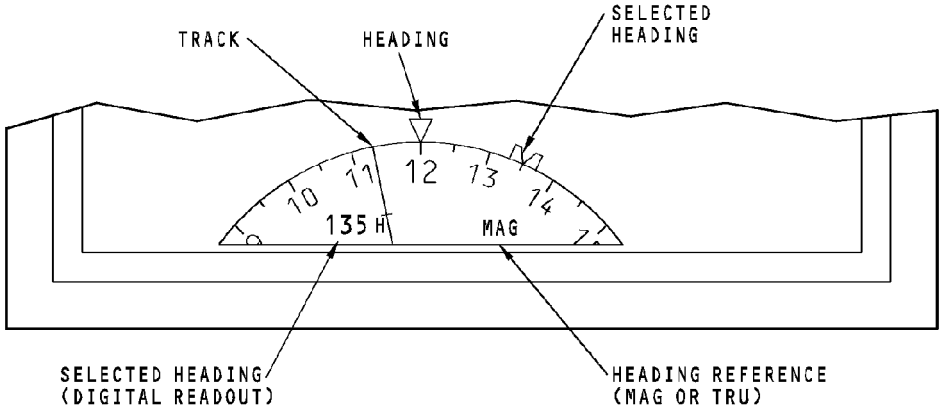
The heading indication shows on a partial compass rose at the bottom of the primary flight display (PFD).

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.



CDS - PFD - HEADING INDICATION

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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)

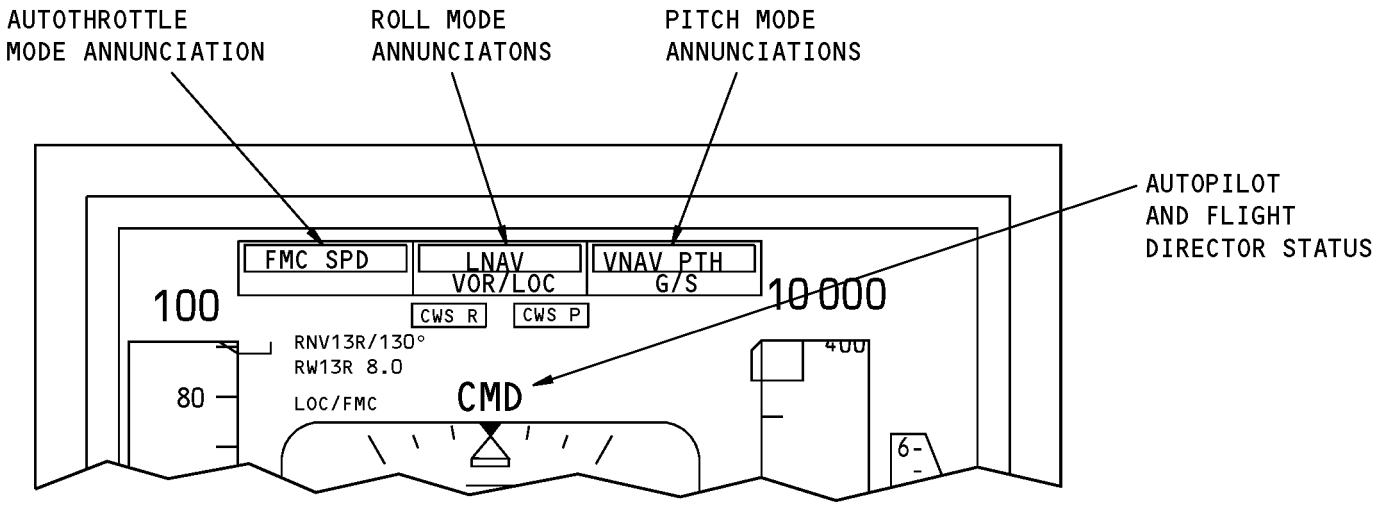
Autopilot and Flight Director Status

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)



NOTE: THE DATA SHOWN ON THE DISPLAY IS ONLY AN EXAMPLE.

CDS - PFD - FLIGHT MODE ANNUNCIATIONS

Landing Indications

These are the landing indications:

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 (POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295
- Approach scale identifier

HAP ALL
- Approach deviation indications
- Approach reference data

HAP 037-054, 101-999
- Rising runway indications

HAP ALL
- Marker beacon indications.

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 (POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295

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.

HAP 037

"GLS" shows for a GLS approach. If the CDS receives no data from the MMR, the "GLS" indicator is removed.

HAP ALL

Approach Deviation Indications

The approach deviation scales and pointers show lateral and vertical deviation from the approach path.

HAP 001-013, 015-019, 031-054, 101-999

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.

HAP ALL

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.

EFFECTIVITY

HAP ALL

HAP 031-054, 101-999

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.

HAP 021-026, 028-054, 101-999

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 is not received.

HAP ALL

See the ILS section for more information. (SECTION 34-31)

HAP 037

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 is not received.

See the ILS section for more information. (SECTION 34-31)

HAP ALL

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.

HAP 037

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.

HAP ALL

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.

HAP 037

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.

HAP ALL

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.

HAP 037

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.

HAP 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.

HAP 037-054, 101-999

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.

HAP ALL

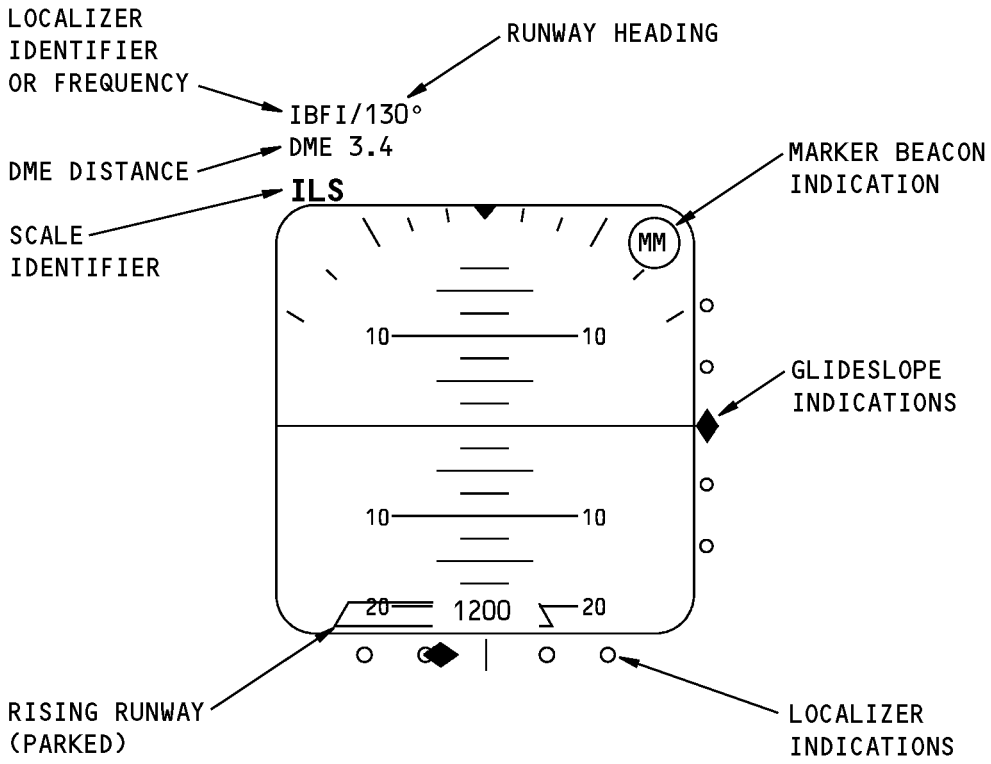
Marker Beacon Indications

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.

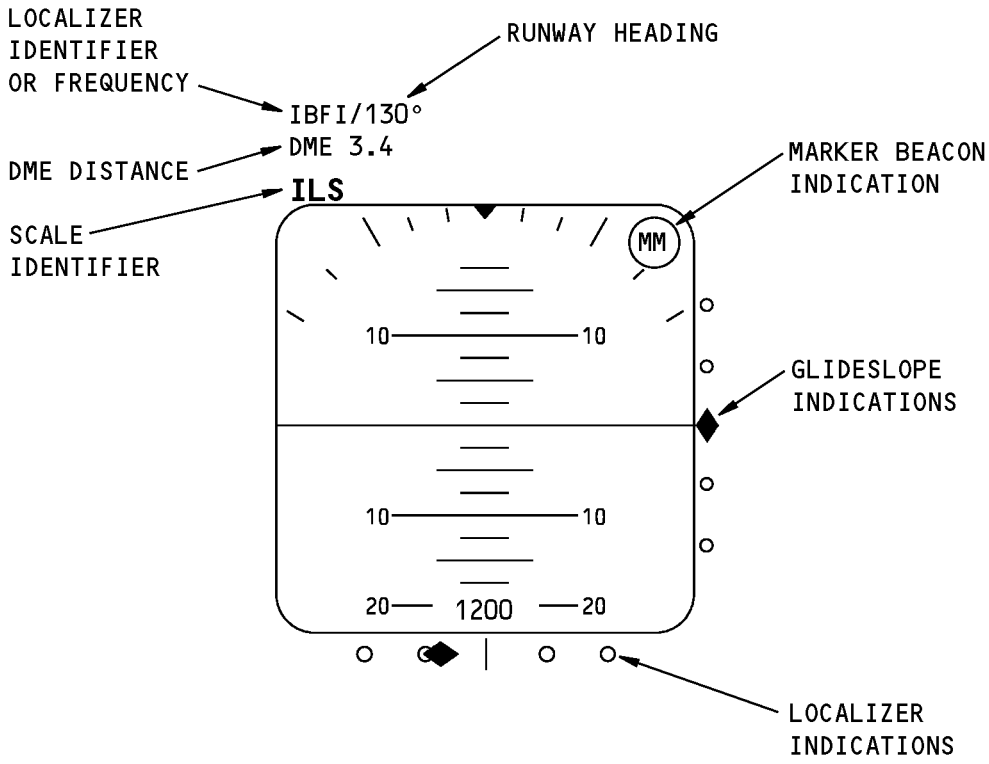
See the marker beacon system section for more information. (SECTION 34-32)

EFFECTIVITY

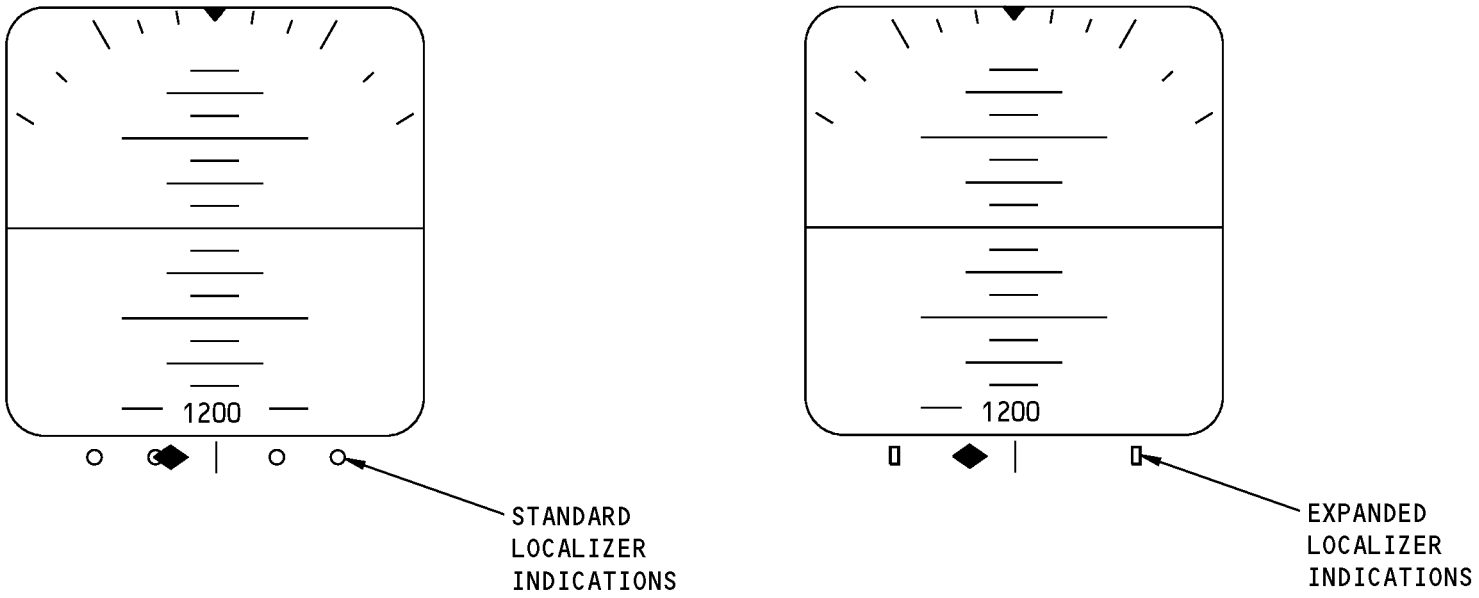
HAP ALL



CDS - PFD - LANDING INDICATIONS



CDS - PFD - LANDING INDICATIONS



CDS - PFD - STANDARD AND EXPANDED LOCALIZER DEVIATION SCALE

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General

The radio altitude indication shows radio altitude from the radio altimeter. The indication shows below 2500 feet radio altitude.

Radio Altitude

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 PRE SB 737-31-1246 AND PRE SB 737-31-1295

The radio altitude shows as a digital value.

HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

The radio altitude shows as a digital value from 1000 feet to 2500 feet. Below 1000 feet, an analog display replaces the digital display. On the ground, below 50 knots, radio altitude shows as a digital display again.

HAP ALL

Radio Minimums

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 PRE SB 737-31-1246 AND PRE SB 737-31-1295

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 remain amber until reset.

HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

When the airplane is above 1000 feet radio altitude, the radio minimum altitude that you select shows as a digital value.

Below 1000 feet, the radio minimum altitude that you select shows as a green triangular bug on the radio altitude dial. During descent when the radio altitude is equal to the radio minimum altitude, the radio altitude dial, radio altitude value, and the radio minimum altitude bug turn amber and flash for 3 seconds. After 3 seconds the displays remain amber until reset.

HAP ALL

You can reset the radio minimums alert by doing one of the following:

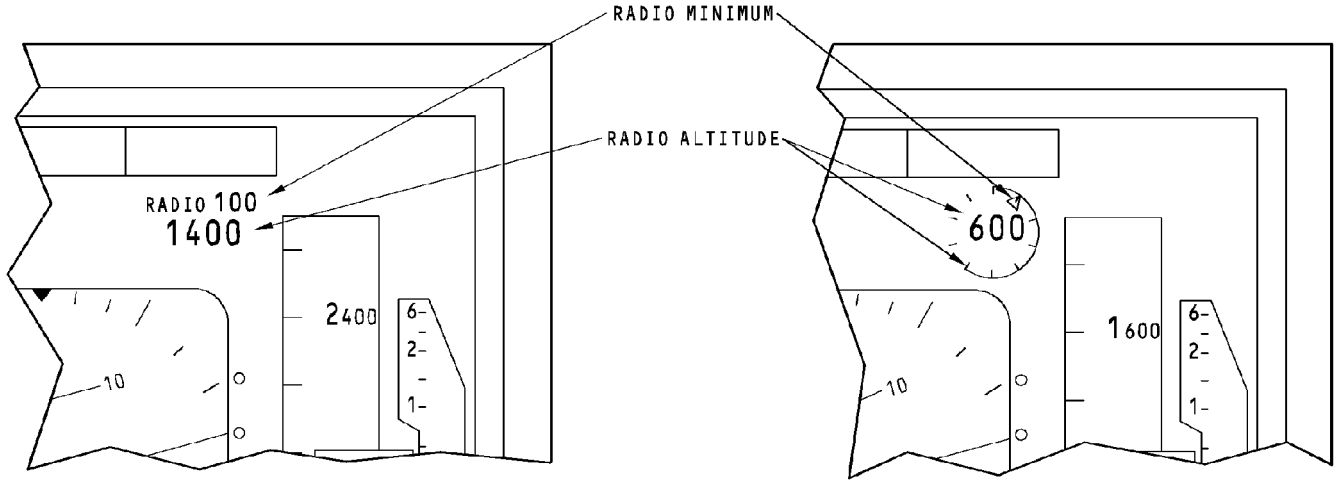
- Push the RST (reset) button on the EFIS control panel
- Climb above the radio minimums value
- Land.

You can make the radio mimimums 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.

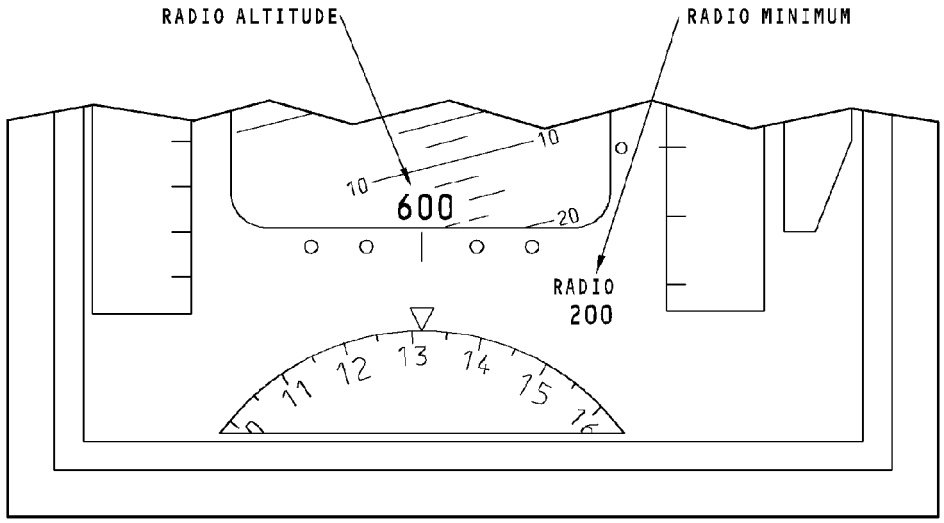
If the radio minimums display is blank, the radio minimums alert display does not occur.



PRIMARY FLIGHT DISPLAY
(RADIO ALTITUDE MORE THAN 1000 FEET)

PRIMARY FLIGHT DISPLAY
(RADIO ALTITUDE LESS THAN 1000 FEET)

CDS - PFD - RADIO ALTITUDE AND RADIO MINIMUMS INDICATIONS



CDS - PFD - RADIO ALTITUDE AND RADIO MINIMUMS INDICATIONS

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Ground Proximity Warning System Time Critical Annunciations

The ground proximity warning system (GPWS) time critical annunciations show below the attitude indication. Only one GPWS annunciations shows at a time. These are the GPWS annunciations:

- WINDSHEAR warning
- PULL UP warning.

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

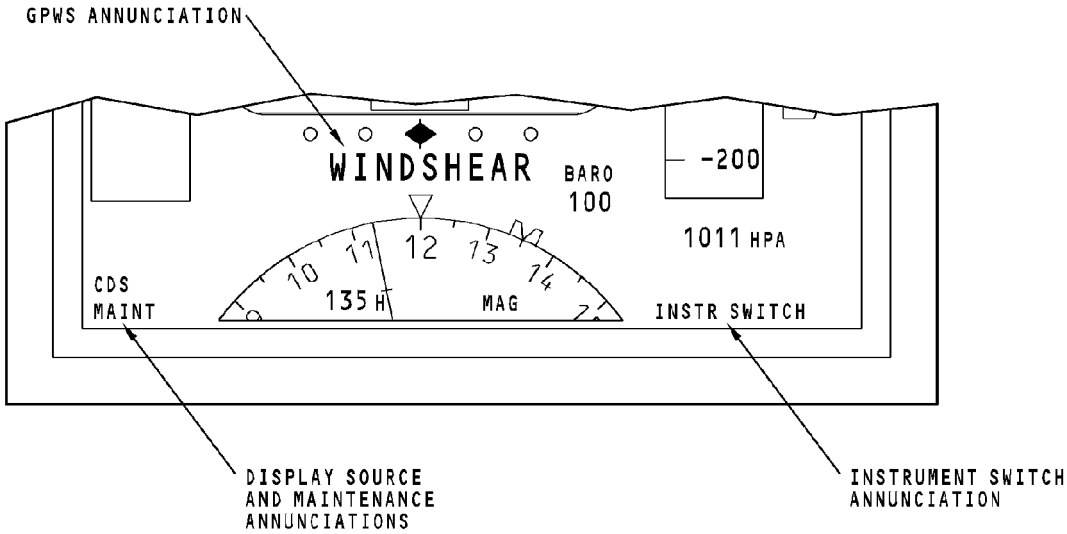
The DSPLY (display) source annunciation shows in the air for CDS faults. The annunciation shows on the ground or in the air if the display source switch is in the ALL ON 1 or ALL ON 2 position.

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.



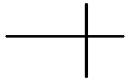
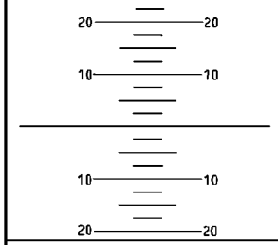
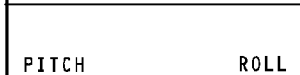
CDS - PFD - TIME CRITICAL ANNUNCIATIONS

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.

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 ACCELLERATION 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 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

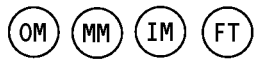
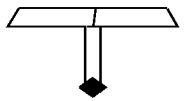
CDS - PFD - SYMBOLOGY - 1

Primary Flight Display Symbology

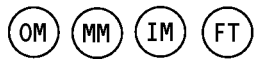
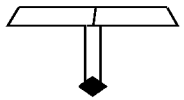
Additional symbology shows in these tables.

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 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
ILS	APPROACH SCALE IDENTIFIER (W)	ILS IS ILS LOCALIZER AND GLIDESLOPE. SOURCE: SCALE LOGIC – DEU

CDS - PFD - SYMBOLOGY - 2

SYMBOL	NAME	REMARKS
	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	APPROACH SCALE IDENTIFIER (W)	ILS IS ILS LOCALIZER AND GLIDESLOPE. SOURCE: SCALE LOGIC – DEU

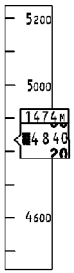
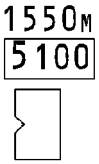
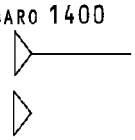
CDS - PFD - SYMBOLOGY - 2

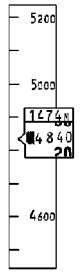
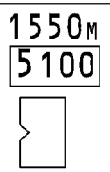
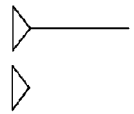
SYMBOL	NAME	REMARKS
	MARKER BEACON DISPLAYS OM (C) MM (A) IM (W) FT (W)	OM IS OUTER MARKER. MM IS MIDDLE MARKER. IM IS INNER MARKER, BACKCOURSE MARKER, OR AIRWAYS MARKER. FT IS FUNCTIONAL TEST. SOURCE:VOR/MB 1
	LOCALIZER DEVIATION SCALE (W) WARNING (A) LOCALIZER DEVIATION POINTER (M)	POINTER SHOWS LOCALIZER 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

CDS - PFD - SYMBOLOGY - 2

Primary Flight Display Symbology

Additional symbology shows in these tables.

SYMBOL	NAME	REMARKS
	RADIO ALTITUDE DIAL (W) ALERT (A) RADIO ALTITUDE (W) RADIO MINIMUMS BUG (G) ALERT (A)	DIAL SHOWS IN THE AIR BELOW 1000 FEET. GREEN BUG SHOWS RADIO MINIMUMS. DIGITAL DISPLAYS SHOW ON THE GROUND AND ABOVE 1000 FEET. ALERT SHOWS ON DESCENT IF VISIBLE. TO REMOVE RADIO MINIMUMS ALERT PUSH RST ON EFIS CONTROL PANEL. TO REMOVE RADIO MINS DISPLAY PUSH RST WHILE NOT IN ALERT CONDITION OR SELECT RA MINS BELOW ZERO. SOURCES: ALTITUDE - RA; MINS - EFIS CP; ALERT - DEU
	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
	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. SOURCES: SELECTED ALTITUDE METERS - DEU; SELECTED ALTITUDE - MCP; ALTITUDE BUG - DEU
	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

SYMBOL	NAME	REMARKS
RADIO 200 -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
	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
	SELECTED ALTITUDE IN 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
	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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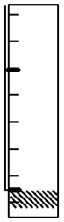
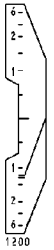
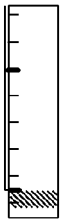
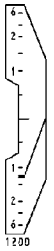
Primary Flight Display Symbology

Additional symbology shows in these tables.

SYMBOL	NAME	REMARKS
	ALTITUDE TAPE WITH LANDING ALTITUDE ALERT/CAUTION BAR UPPER - ALERT (W) LOWER - CAUTION (A) AND LANDING ALTITUDE REFERENCE (A)	LANDING BAR SHOWS ALTITUDE ABOVE TOUCHDOWN. THE UPPER AREA IS FROM 1000 FEET TO 500 FEET ABOVE TOUCHDOWN. LOWER AREA IS FROM TOUCHDOWN TO 500 FEET. SOURCE: DEU LANDING ALTITUDE REFERENCE SHOWS FMC ROUTE LANDING ALTITUDE. SOURCE: FMC
	VERTICAL SPEED TAPE 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. 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. SOURCES: 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) PULL UP ANNUNCIATION (R)	WINDSHEAR OR PULL UP SHOWS AS APPROPRIATE. SOURCE: GPWS

SYMBOL	NAME	REMARKS
	ALTITUDE TAPE WITH LANDING ALTITUDE ALERT/CAUTION BAR UPPER - ALERT (W) LOWER - CAUTION (A) AND LANDING ALTITUDE REFERENCE (A)	LANDING BAR SHOWS ALTITUDE ABOVE TOUCHDOWN. THE UPPER AREA IS FROM 1000 FEET TO 500 FEET ABOVE TOUCHDOWN. LOWER AREA IS FROM TOUCHDOWN TO 500 FEET. SOURCE: DEU LANDING ALTITUDE REFERENCE SHOWS FMC ROUTE LANDING ALTITUDE. SOURCE: FMC
	VERTICAL SPEED TAPE 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. 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. SOURCES: 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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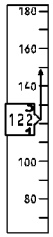
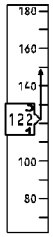
Primary Flight Display Symbology

Additional symbology shows in these tables.

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/BLACK) HIGH SPEED BUFFET (A) MINIMUM MANUVER SPEED (A) STICK SHAKER SPEED (R/BLACK)	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

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	MACH (W) HIGHLIGHT (W)	MACH SHOWS FOR MACH GREATER THAN 0.4. HIGHLIGHT SHOWS FOR 10 SECONDS WHEN DISPLAY CHANGES. SOURCES: MACH - 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/BLACK) HIGH SPEED BUFFET (A) MINIMUM MANUVER SPEED (A) STICK SHAKER SPEED (R/BLACK)	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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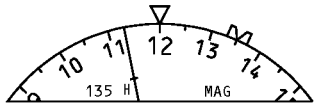
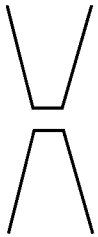
Primary Flight Display Symbology

Additional symbology shows in these tables.

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)	AUTHROTTLE 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 RESLOUTION ADVISORY (R)	SOURCES: TCAS, DEU

Primary Flight Display Symbology

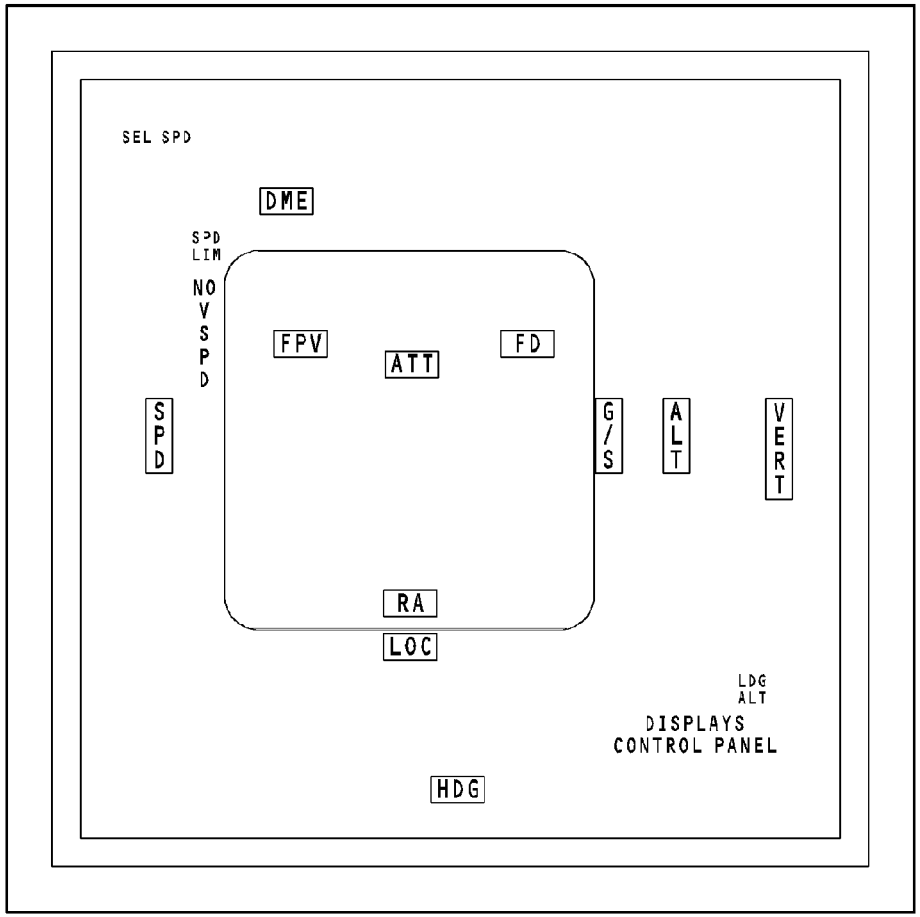
Additional symbology shows in these tables.

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).

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.



CDS - PFD - FAULT INDICATIONS

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.

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

- Vertical Situation Display mode.

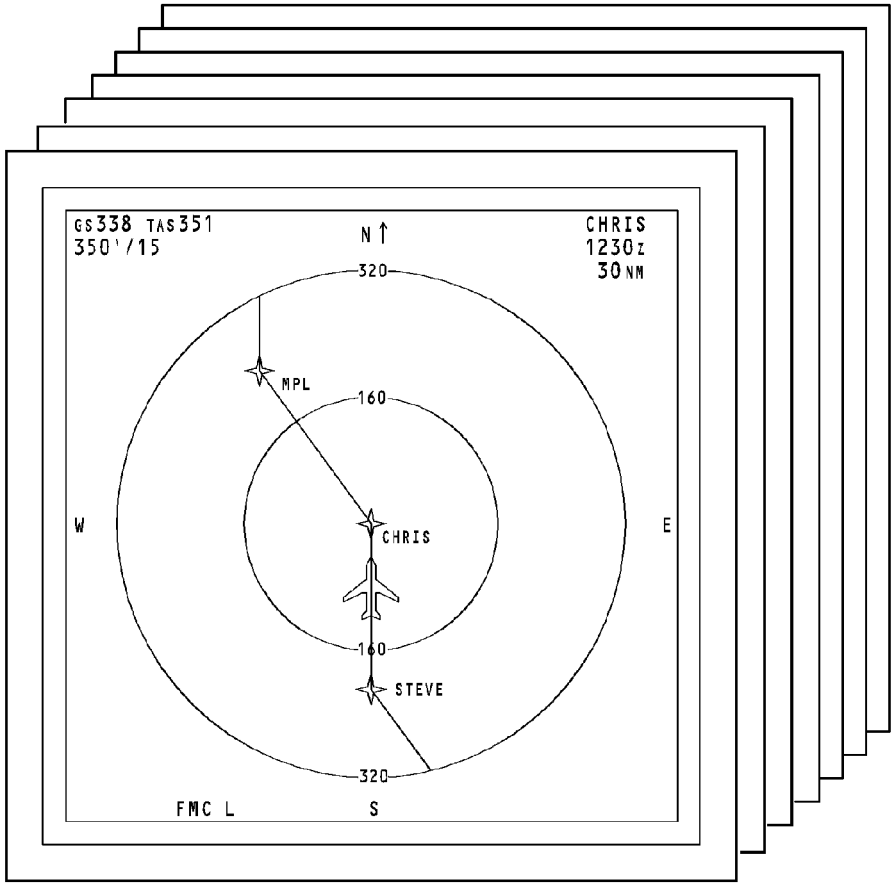
HAP ALL

These are some of the indications that show on the ND:

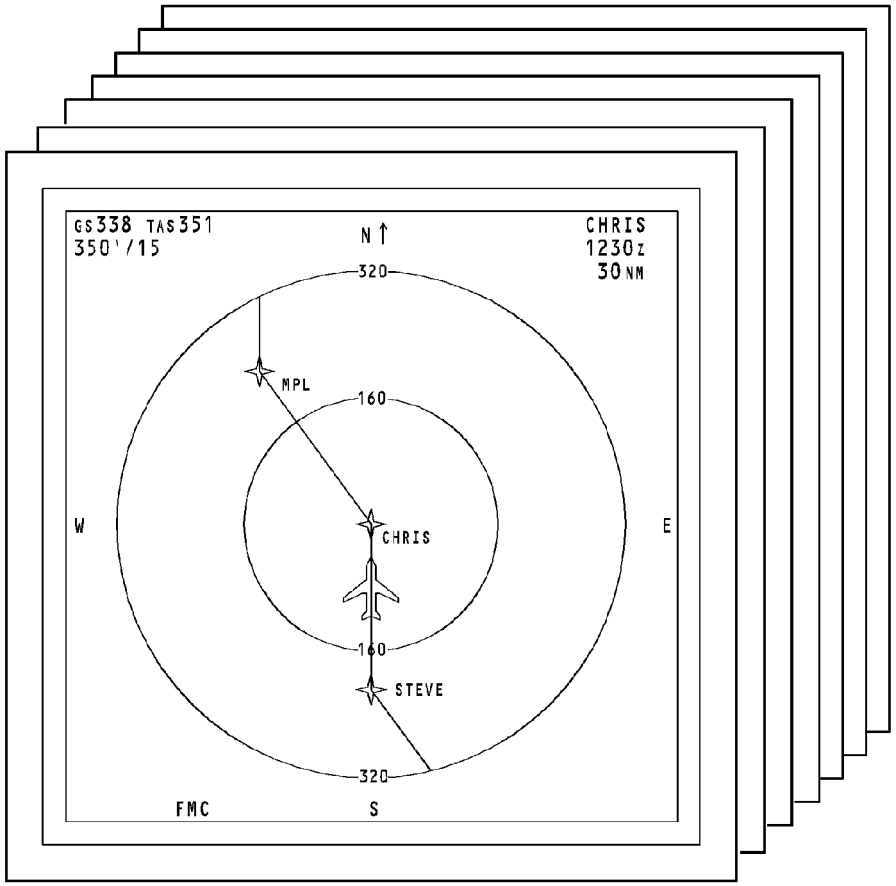
- Heading
- Track
- Ground speed
- True airspeed
- Wind
- Route
- Weather Radar
- TCAS data

HAP

- Enhanced GPWS data
- VOR/ADF pointers
- VOR deviation
- LOC and G/S deviations.



CDS - NAVIGATION DISPLAY OVERVIEW



CDS - NAVIGATION DISPLAY OVERVIEW

EFFECTIVITY

HAP 001-013, 015-026, 028-036

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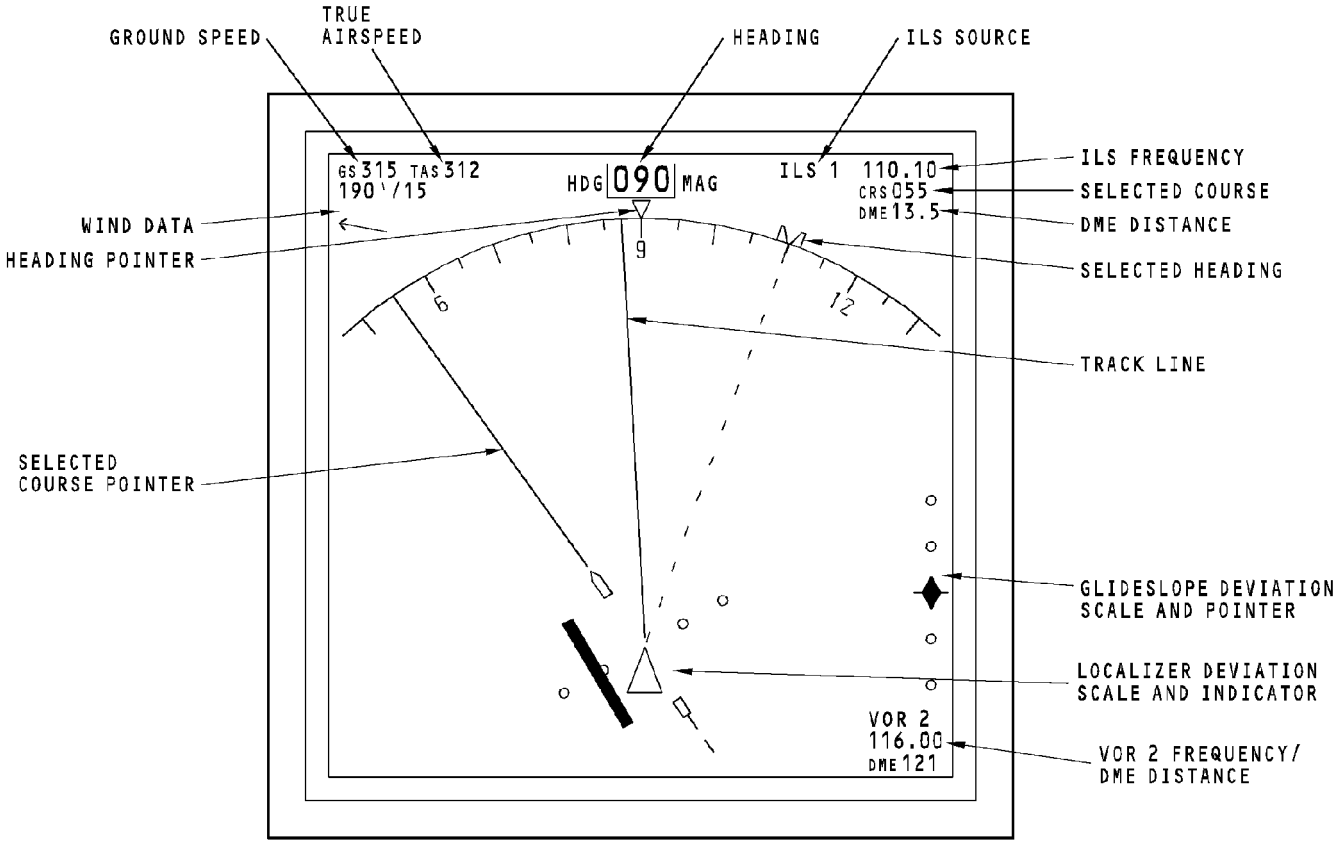
Approach

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.

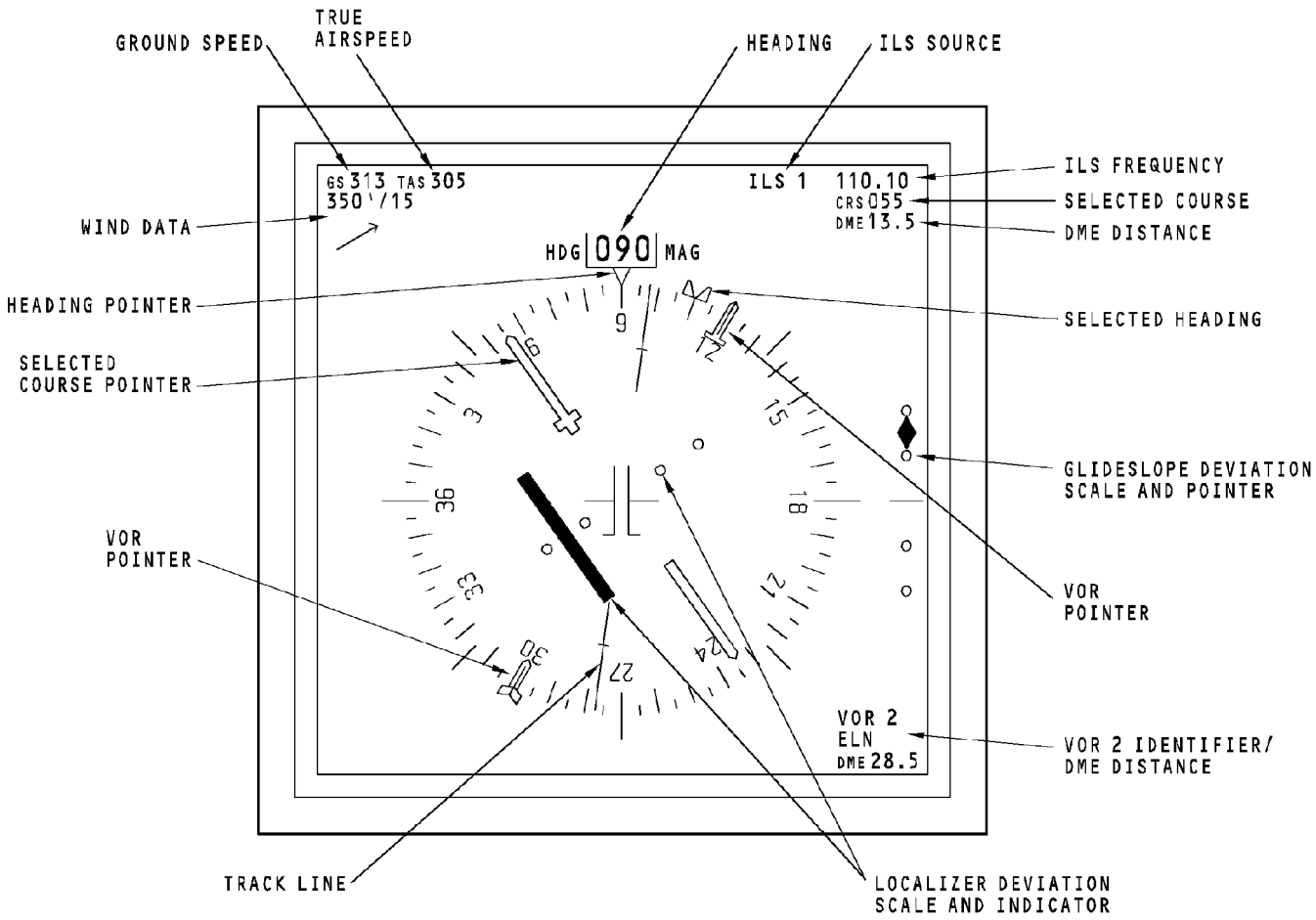


CDS - ND - EXPANDED APPROACH

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.

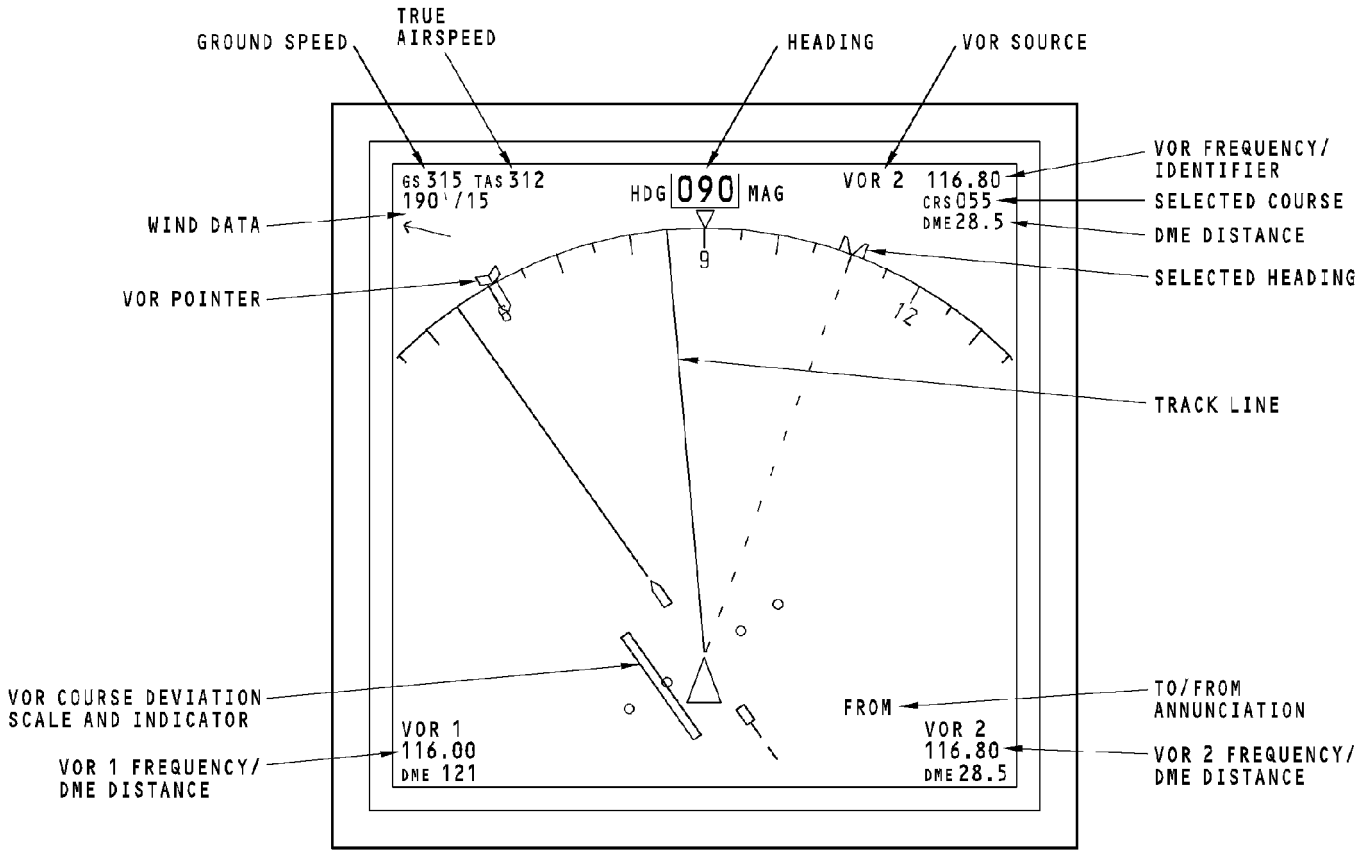


CDS - ND - CENTERED APPROACH

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.

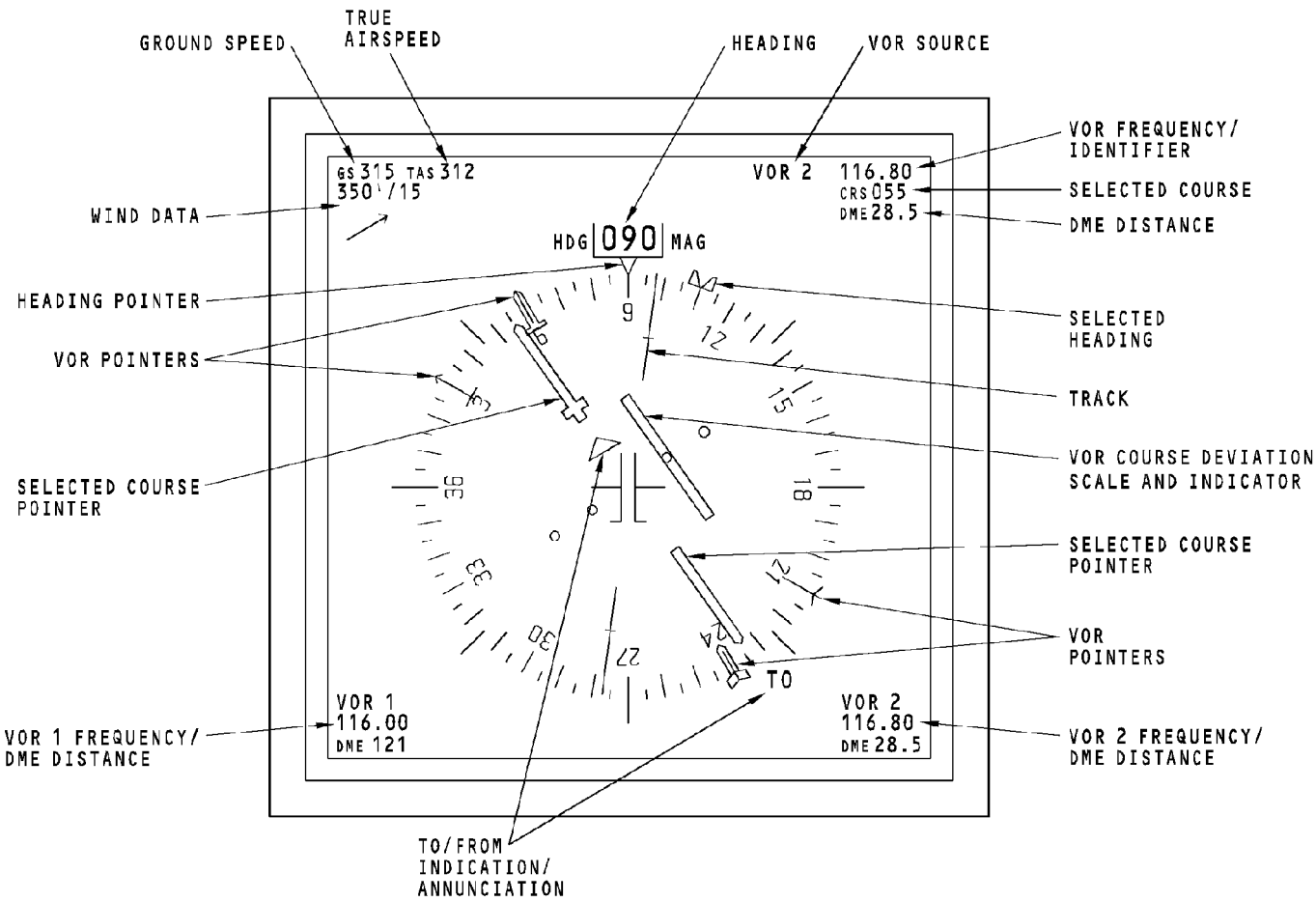


CDS - ND - EXPANDED VOR

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.

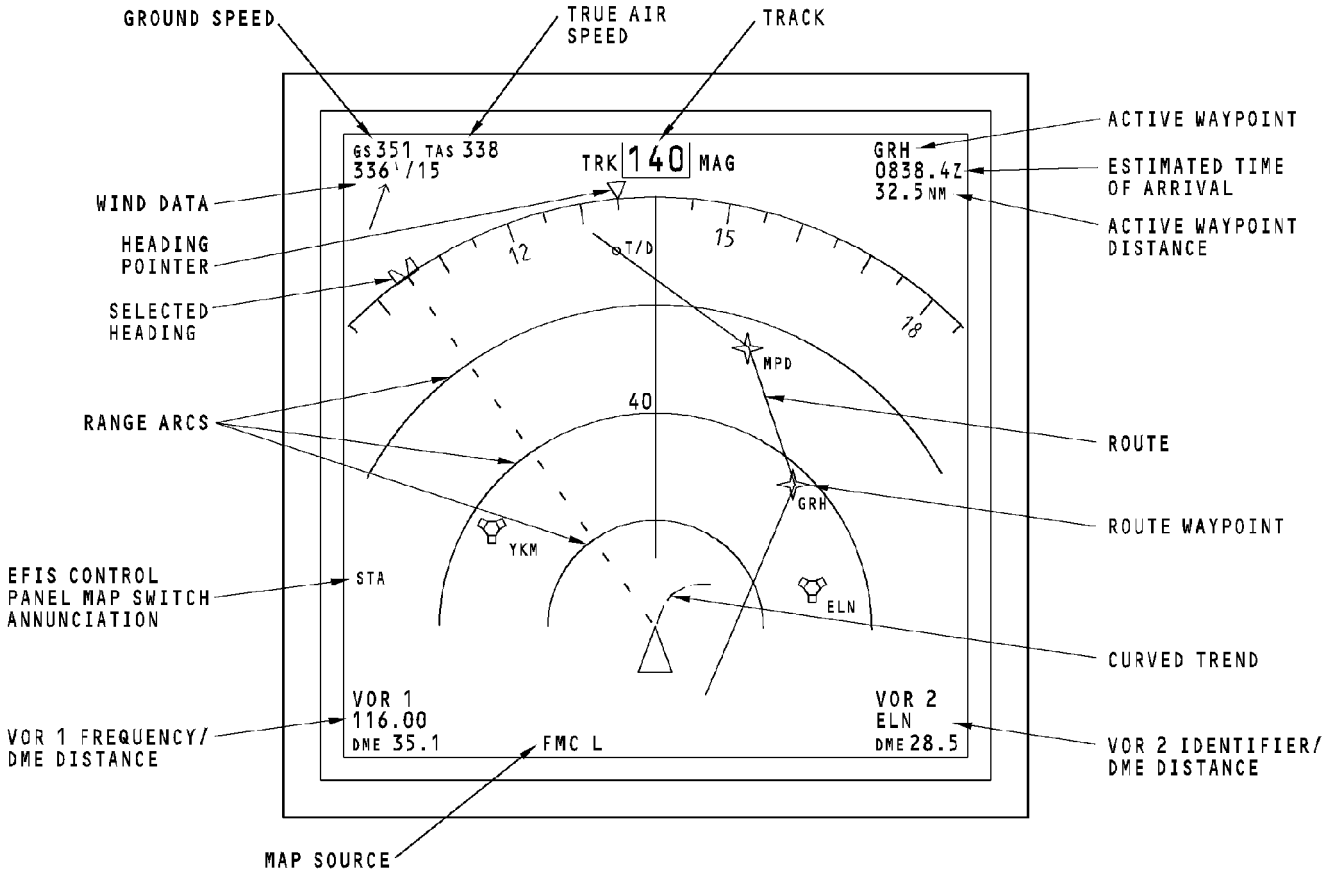


CDS - ND - CENTERED VOR

Expanded Map Mode

To show the expanded map display, select the map position on the EFIS control panel.

The map display show the flight plan and other navigation data. To see additional map data, use the map switches on the EFIS control panel.

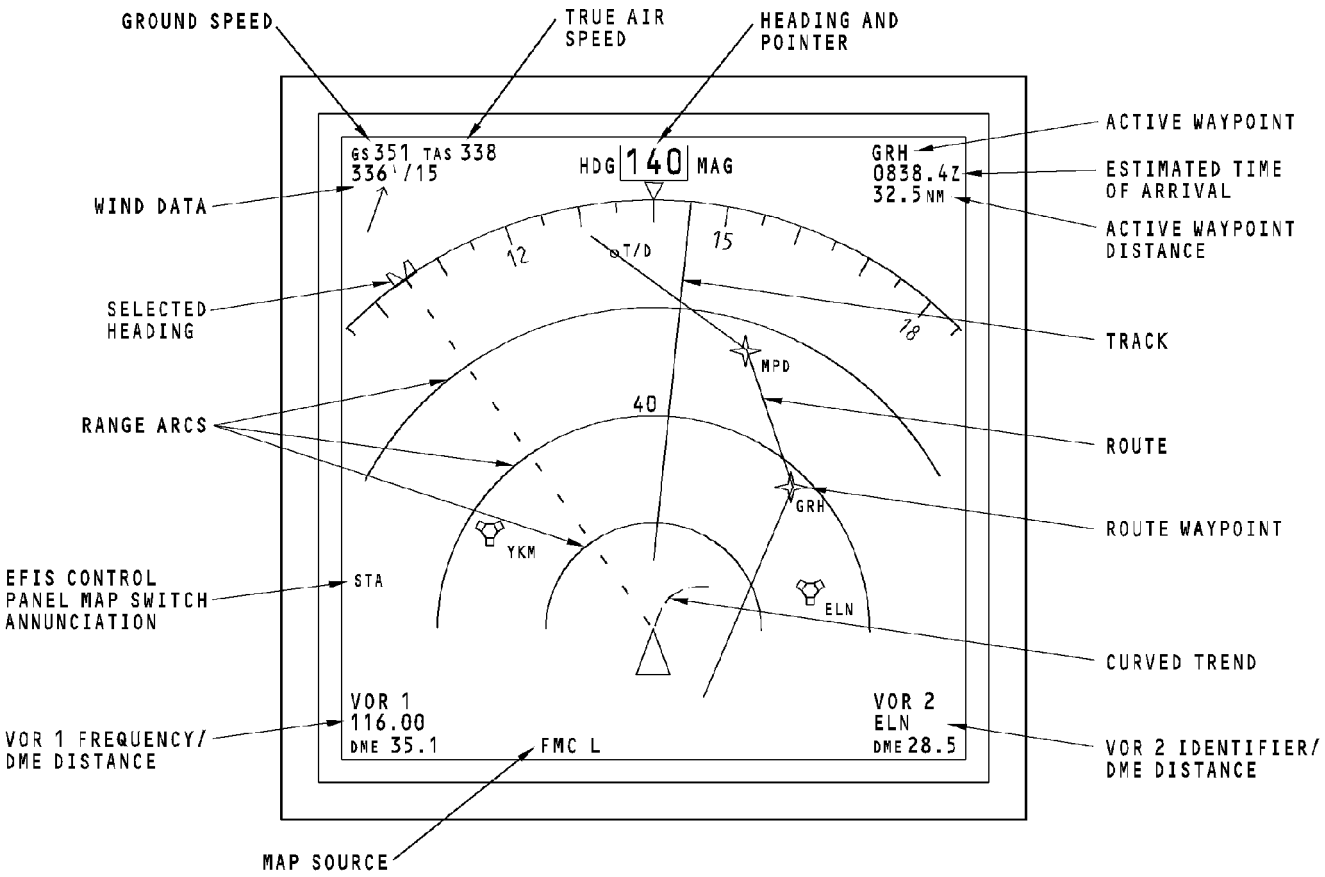


CDS - ND - EXPANDED MAP MODE

EFFECTIVITY

HAP 038, 042-046, 050-053; HAP 037, 039, 040 POST SB 737-31-1370

31-62-00-315

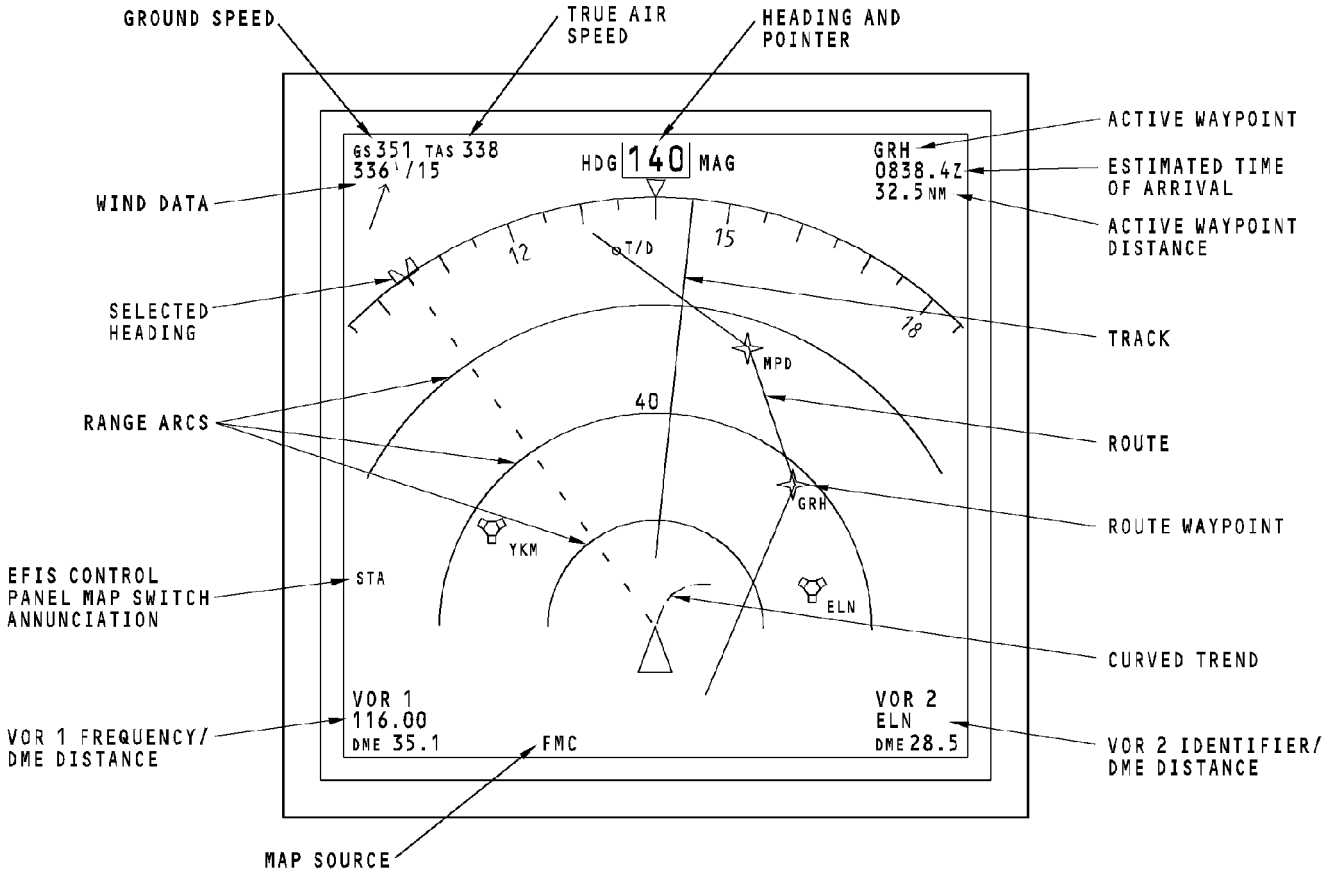


CDS - ND - EXPANDED MAP MODE

EFFECTIVITY

HAP 041, 047-049, 054, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370

31-62-00-315

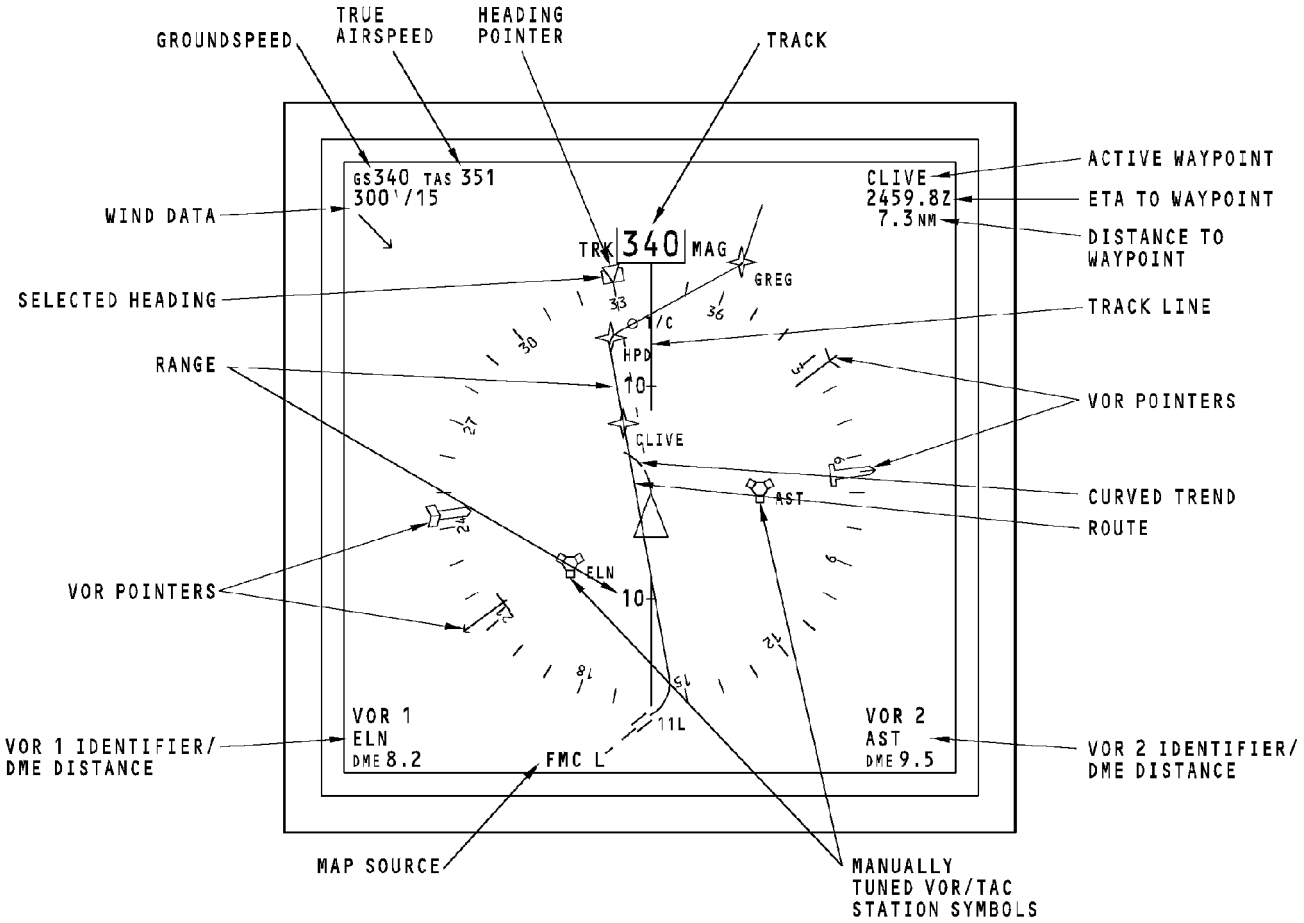


CDS - ND - EXPANDED MAP MODE

Centered Map Mode

To show the centered map display, select the map mode on the EFIS control panel and push the CTR switch.

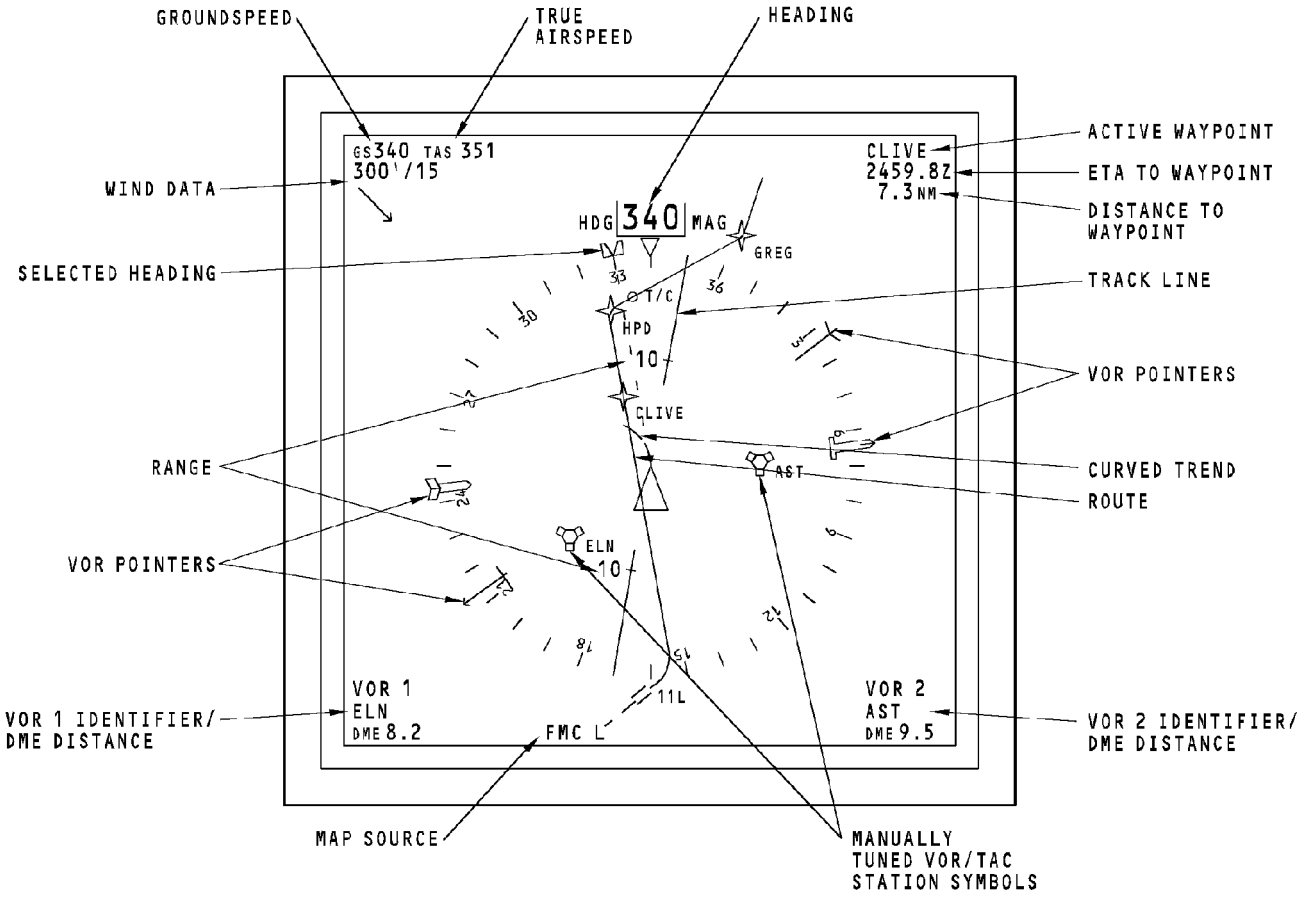
The map display show the flight plan and other navigation data. To see additional map data, use the map switches on the EFIS control panel.



CDS - ND - CENTERED MAP

EFFECTIVITY

HAP 038, 042-046, 050-053; HAP 037, 039, 040 POST SB 737-31-1370

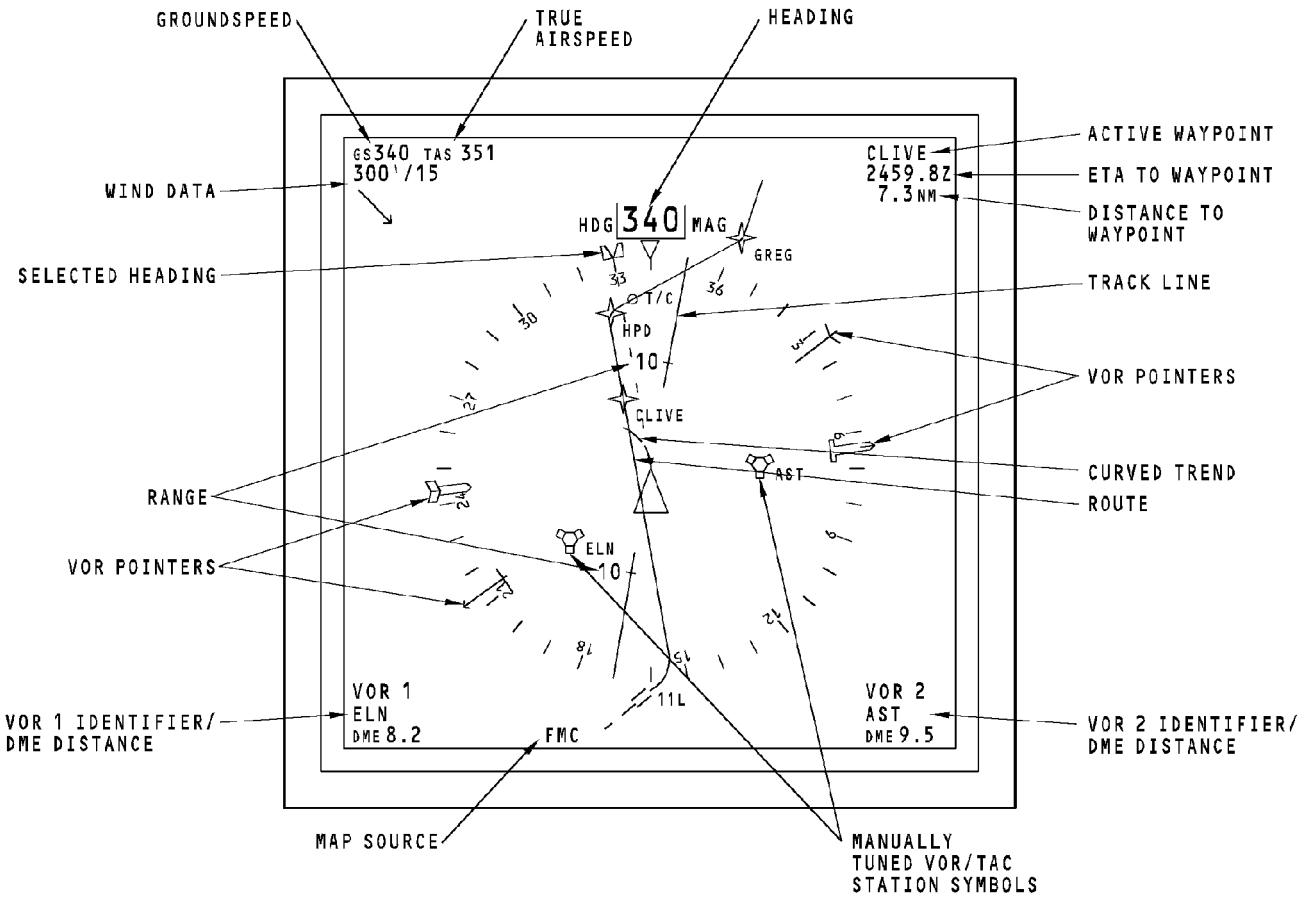


CDS - ND - CENTERED MAP

EFFECTIVITY

HAP 041, 047-049, 054, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370

31-62-00



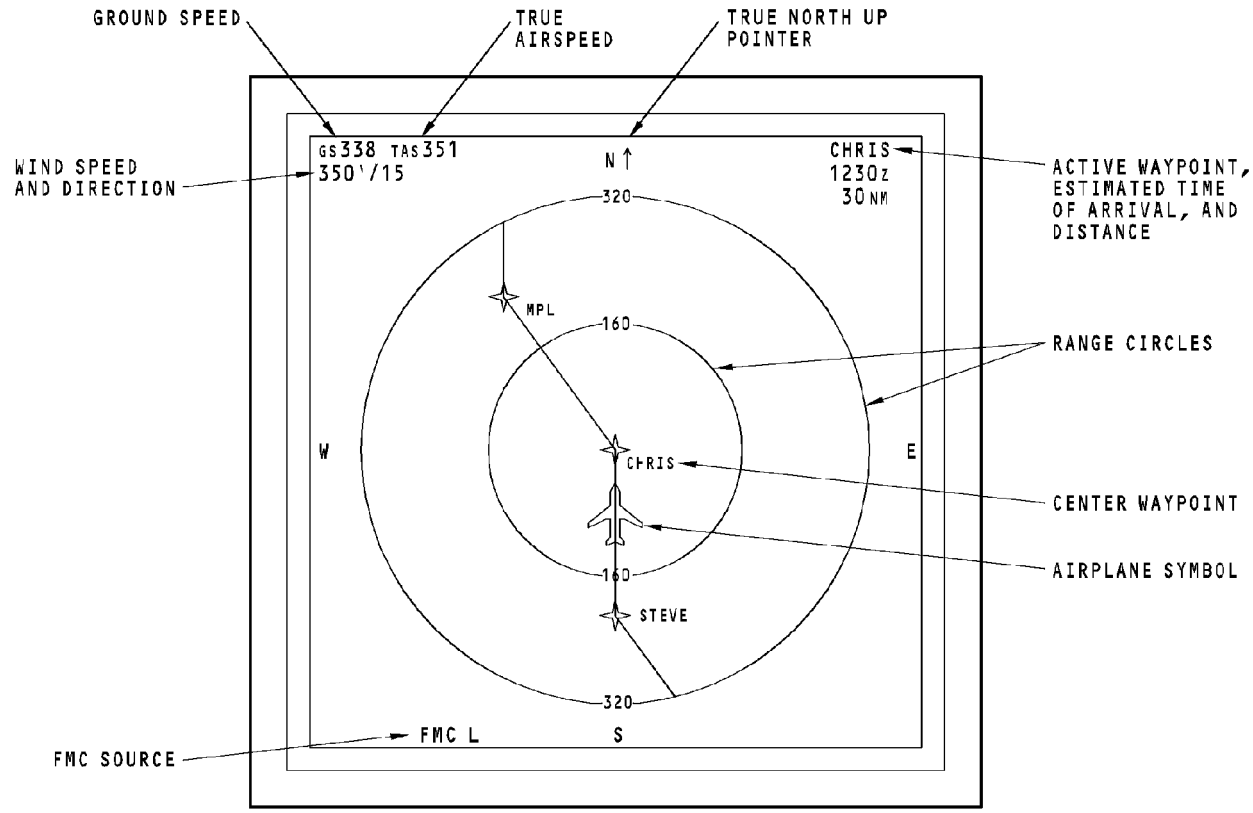
CDS - ND - CENTERED MAP

Plan

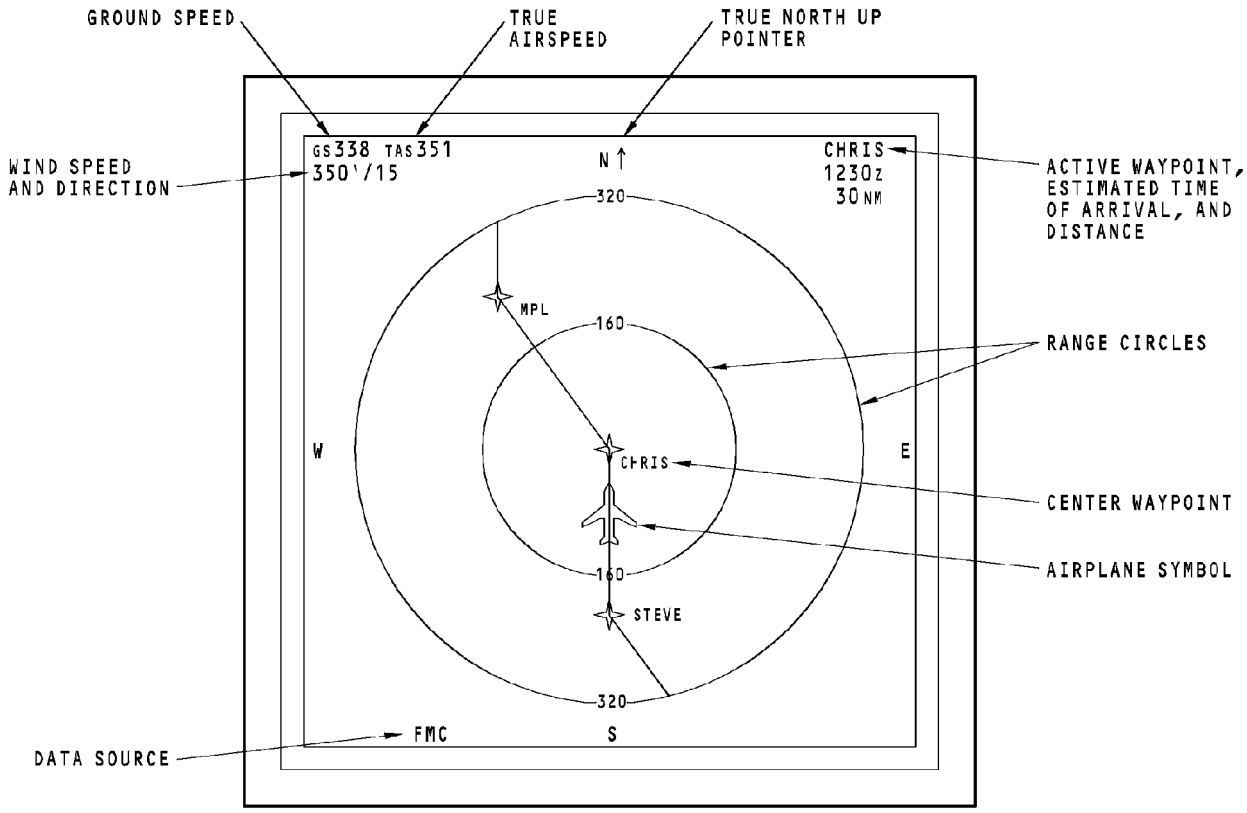
To show the plan display, select the plan mode on the EFIS control panel.

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.



CDS - ND - PLAN MODE



CDS - ND - PLAN MODE

EFFECTIVITY

HAP 001-013, 015-026, 028-036

31-62-00

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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.

HAP 001-013, 015-026, 028-030 ((POST SB 737-31-1205 AND PRE SB 737-31-1246) OR PRE SB 737-31-1295) AND (POST SB 737-31-1246 OR POST SB 737-31-1295)

- To show the VSD, set the map mode on the EFIS control panel to MAP, then push the DATA switch.

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 ((POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295) AND (POST SB 737-31-1246 OR POST SB 737-31-1295)

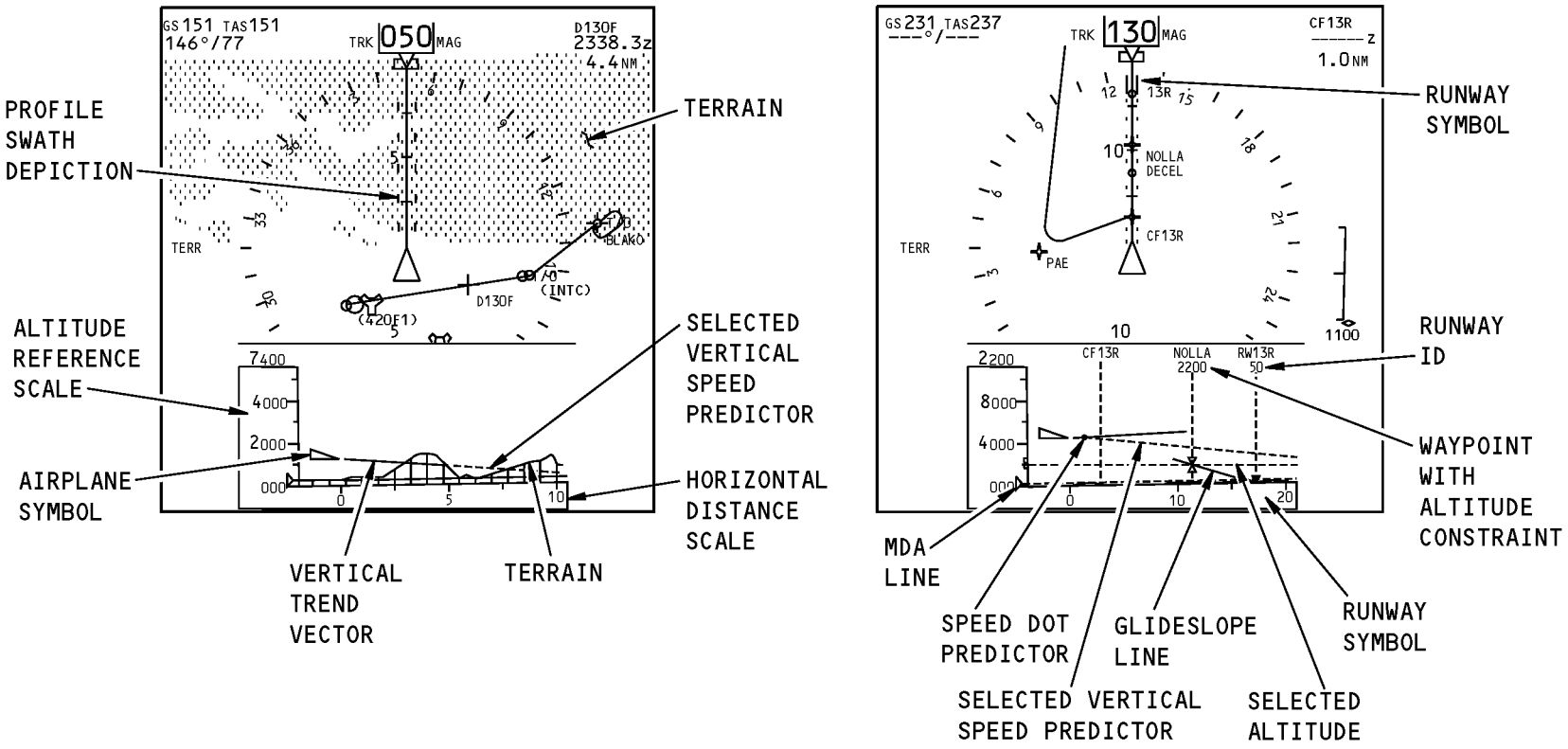
- To show the VSD, set the map mode on the EFIS control panel, then push the CTR switch two times. To change from the Expanded Map to the Centered Map, push the CTR switch on the EFIS control panel. To change from the Centered Map to the Centered Map with VSD, push the CTR switch again. To change from the Centered Map with VSD to the Expanded Map, push the CTR switch again.

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

See the GPWS - VSD section for more information. (34-46-00)

EFFECTIVITY

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295



CDS - ND - Vertical Situation Display

EFFECTIVITY

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

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.

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	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. MEDIMUM 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

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	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. MEDIMUM 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.
TERRAIN	TERRAIN ANNUNCIATION (R) (A)	VOR, APP, MAP, MAP CTR	RED TERRAIN ALERT OR AMBER TERRAIN CAUTION SOURCE: GPWS

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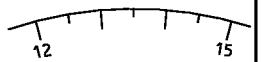
Navigation Display Symbology

Additional symbology shows in these tables.

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 1 FMC L 2 FMC R 2	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.

1 AIRPLANES WITH SINGLE FMC

2 AIRPLANES WITH DUAL FMC

1700488 S0000310527_V2

CDS - ND - Symbology - 2

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
○ irs 1 2 ○ gps 1 2 3 ○ 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

CDS - ND - Symbology - 2

EFFECTIVITY

HAP ALL

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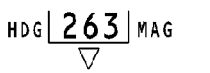
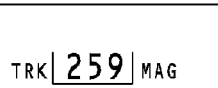
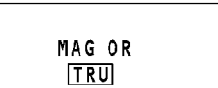
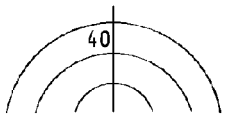
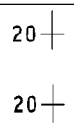
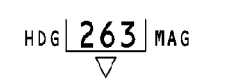
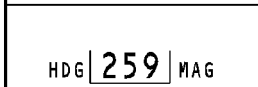
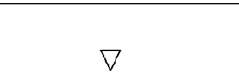
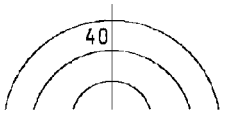
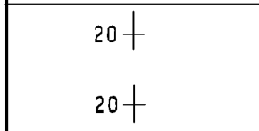
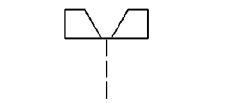
Navigation Display Symbology

Additional symbology shows in these tables.

SYMBOL	NAME	MODE(S)	REMARKS
	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.
	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.
	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.
	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.

SYMBOL	NAME	MODE(S)	REMARKS
	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.
	HEADING: REFERENCE (G) READOUT (W) ORIENTATION (G)	MAP, MAP CTR	BOX SHOWS HEADING.
	HEADING POINTER (W)	MAP, MAP CTR	POINTER SHOWS HEADING ON THE COMPASS ROSE.
	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.
	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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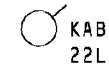
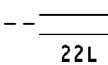
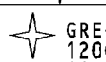
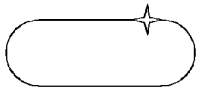
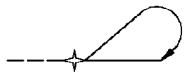
Navigation Display Symbology

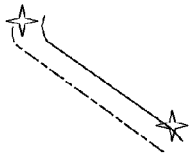
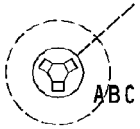
Additional symbology shows in these tables.

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.

CDS - ND - SYMBOLOGY - 4

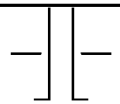
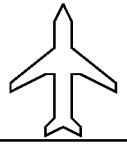
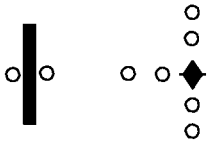
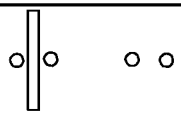
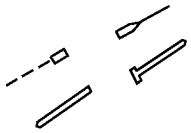
Navigation Display Symbology

Additional symbology shows in these tables.

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.
	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

Navigation Display Symbology

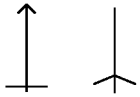
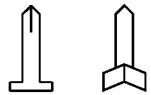
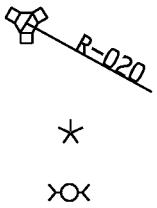
Additional symbology shows in these tables.

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 HAN 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

CDS - ND - SYMBOLOGY - 6

Navigation Display Symbology

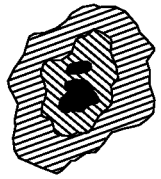
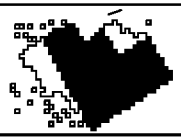
Additional symbology shows in these tables.

SYMBOL	NAME	MODE(S)	REMARKS
DECEL	DECELERATION 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		
	TUNED NAVAIDS (G)	MAP, MAP CTR	SHOWS THE TUNED NAVAIDS. SOURCE: DEU
	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

Navigation Display Symbology

Additional symbology shows in these tables.

SYMBOL	NAME	MODE(S)	REMARKS
 WINDSHEAR	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: • 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 EXTENT FROM ARCS. SOURCE: WXR
 TERR	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

SYMBOL	NAME	MODE(S)	REMARKS
	WEATHER RADAR RETURNS (M, R, A, AND G)	MAP, MAP CTR, VOR, APP	WEATHER RADAR RETURNS AND WINDSHEAR SHOW WHEN THE WXR SWITCH IS ON. RETURNS SHOW AS: • TURBULENCE (M) • INTENSE RETURNS (R) • MEDIUM INTENSITY (A) • LOW INTENSITY (G). 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
■ ↑ −03	TCAS RESOLUTION ADVISORY (RA) (R)	MAP, MAP CTR, APP, VOR	THE TCAS SYMBOL SHOWS THE RELATIVE POSITION OF THE INTRUDER AIRPLANE. THE VERTICAL SPEED ARROW SHOWS IF THE AIRPLANE IS ASCENDING OR DESCENDING AT A SPEED GREATER THAN 500 FEET PER MINUTE. THE NUMERIC ALTITUDE SHOWS AS RELATIVE ALTITUDE TO YOUR AIRPLANE WITH A PLUS OR MINUS SIGN TO SHOW IF THE INTRUDER AIRPLANE IS ABOVE OR BELOW YOUR AIRPLANE. IF THERE IS NO SIGN BEFORE THE NUMERIC ALTITUDE, THE ALTITUDE IS THE ALTITUDE OF THE INTRUDER AIRPLANE. SOURCE: TCAS, DEU
+02 ● ↓	TCAS TRAFFIC ADVISORY TA (A)		
◆ ↓ −05	TCAS PROXIMATE TRAFFIC (W) RELATIVE ALTITUDE		
+09 ◇	TCAS OTHER TRAFFIC (W) RELATIVE ALTITUDE		
● ↑ 128	TCAS TA ABSOLUTE ALTITUDE		
TA 8.9 −12↑	TCAS NO BEARING MESSAGE (RA−R, TA−A)		MESSAGE SHOWS TRAFFIC TYPE, RANGE IN NMS, ALTITUDE, AND VERTICAL DIRECTION. SOURCE: TCAS, DEU

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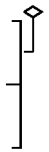
Navigation Display Symbology

Additional symbology shows in these tables.

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

Navigation Display Symbology

Additional symbology shows in these tables.

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.

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.

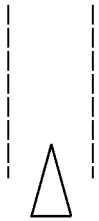
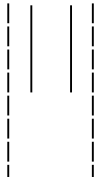
The top part of the display in the VSD mode is the lateral map. More symbols show in the lateral map to show the relation between the map and the VSD.

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.

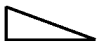
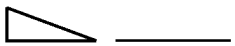
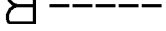
EFFECTIVITY

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

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.

VSD Symbology

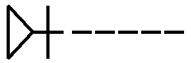
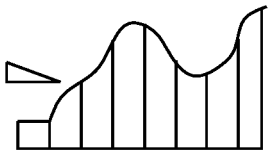
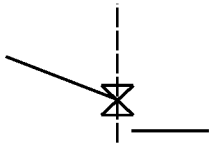
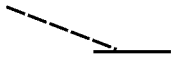
Additional symbology shows in this table.

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)	

CDS - VSD - Symbology - 2

VSD Symbology

Additional symbology shows in this table.

SYMBOL	NAME (COLOR)	REMARKS
	MINIMUM DECENT ALTITUDE (MDA) BUG AND VECTOR (G/A)	BUG AND VECTOR CHANGE FROM GREEN TO AMBER WHEN THE AIRPLANE DECENDS 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.

VSD Symbology

Additional symbology shows in this table.

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	

EFFECTIVITY

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

VSD Symbology

Additional symbology shows in this table.

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	

EFFECTIVITY

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

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:

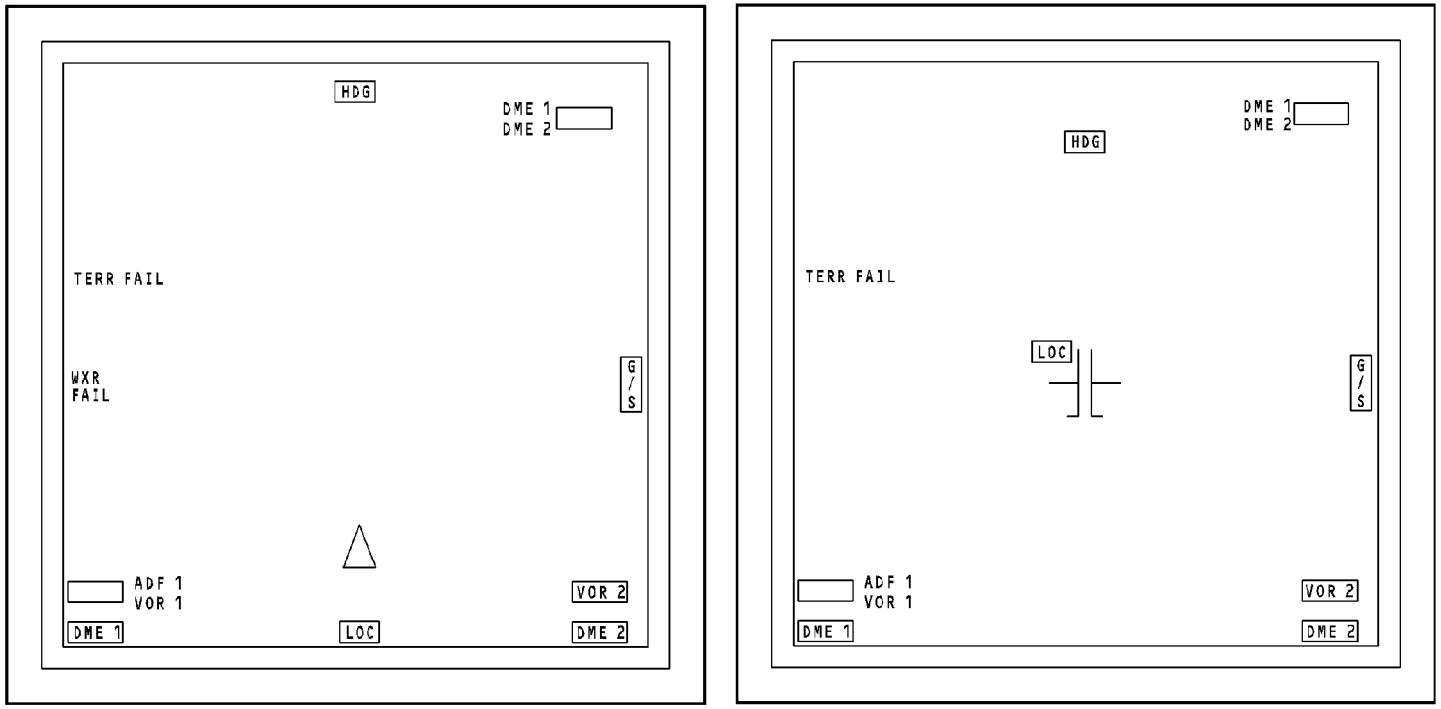
- HDG - ADIRU
- WXR FAIL - WXR failed

HAP 008-013, 015-026, 028-054, 101-999

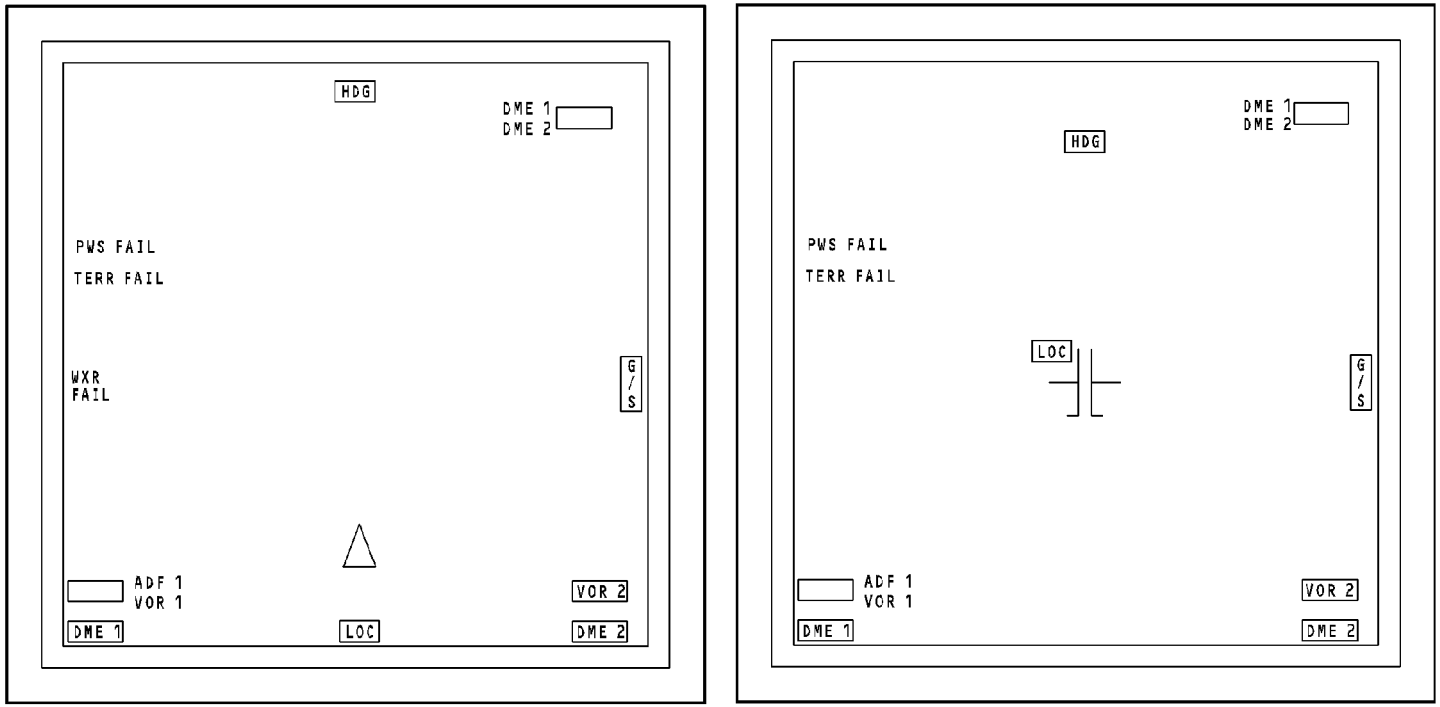
- PWS FAIL - WXR R/T predictive windshear fail

HAP ALL

- TERR FAIL - GPWS terrain function fail
- DME 1/2 - DME interrogator (DME station collocated with ILS or VOR station)
- ADF 1 - ADF receiver (select ADF on EFIS control panel)
- VOR 1/2 - VOR receiver (select VOR on EFIS control panel).



CDS - ND - APPROACH MODE FAILURE FLAGS



CDS - ND - APPROACH MODE FAILURE FLAGS

EFFECTIVITY

HAP 008-013, 015-026, 028-054, 101-999

31-62-00

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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:

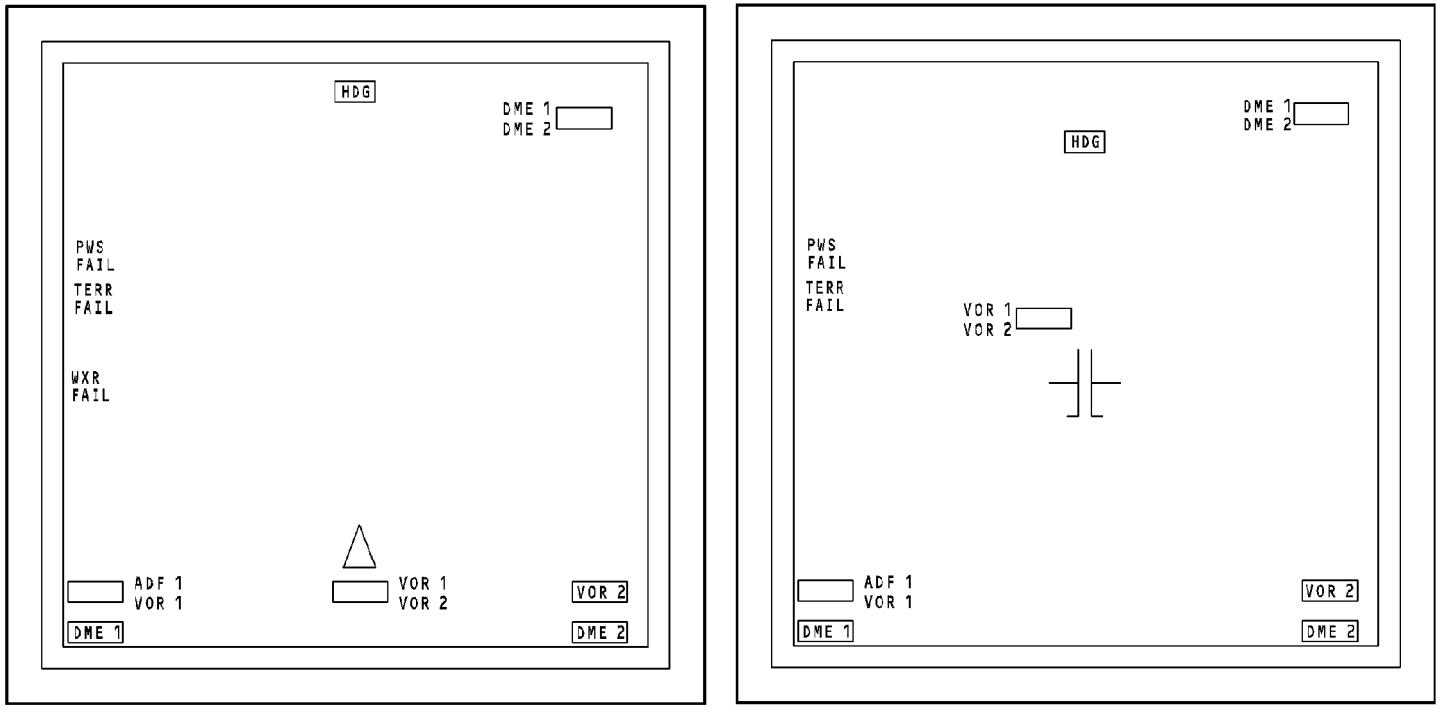
- HDG - ADIRU
- VOR 1/2 - VOR receiver (tuned)
- DME 1/2 - DME interrogator (DME station collocated with VOR station)
- WXR FAIL - WXR failed

HAP 008-013, 015-026, 028-054, 101-999

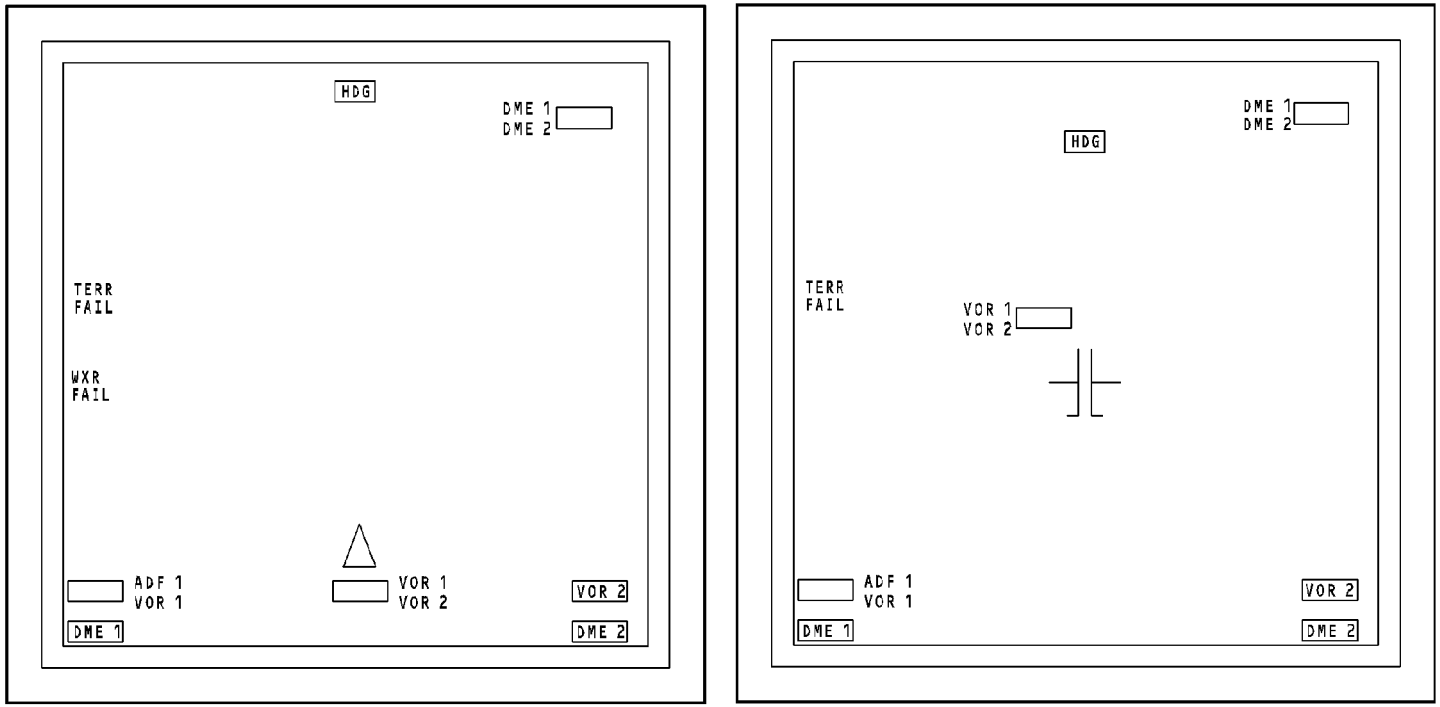
- PWS FAIL - WXR R/T predictive windshear fail

HAP ALL

- TERR FAIL - GPWS terrain function fail
- ADF 1 - ADF receiver (select ADF on EFIS control panel)
- VOR 1/2 - VOR receiver (select VOR on EFIS control panel).



CDS - ND - VOR MODE FAILURE FLAGS



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:

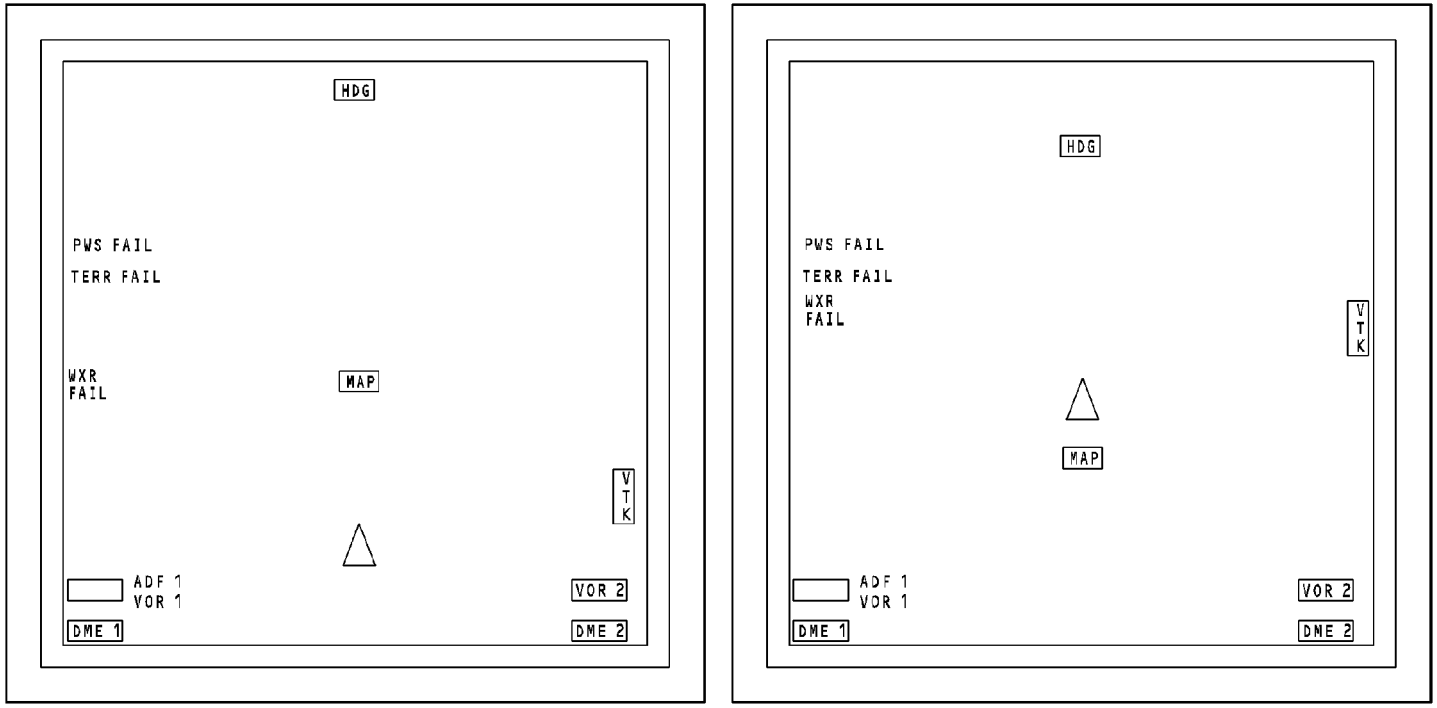
HAP 001-013, 015-026, 028-036, 041, 047-049, 054, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370
- HDG - ADIRU

HAP 038, 042-046, 050-053; HAP 037, 039, 040 POST SB 737-31-1370
- TRK - FMC and ADIRU

HAP ALL
- MAP - FMC
- VTK - FMC
- WXR FAIL - WXR failed

HAP 008-013, 015-026, 028-054, 101-999
- PWS FAIL - WXR R/T predictive windshear fail

HAP ALL
- TERR FAIL - GPWS terrain function fail
- DME 1/2 - DME interrogator (DME station collocated with VOR station)
- ADF 1 - ADF receiver (select ADF 1 on EFIS control panel)
- VOR 1/2 - VOR receiver (select VOR on EFIS control panel).



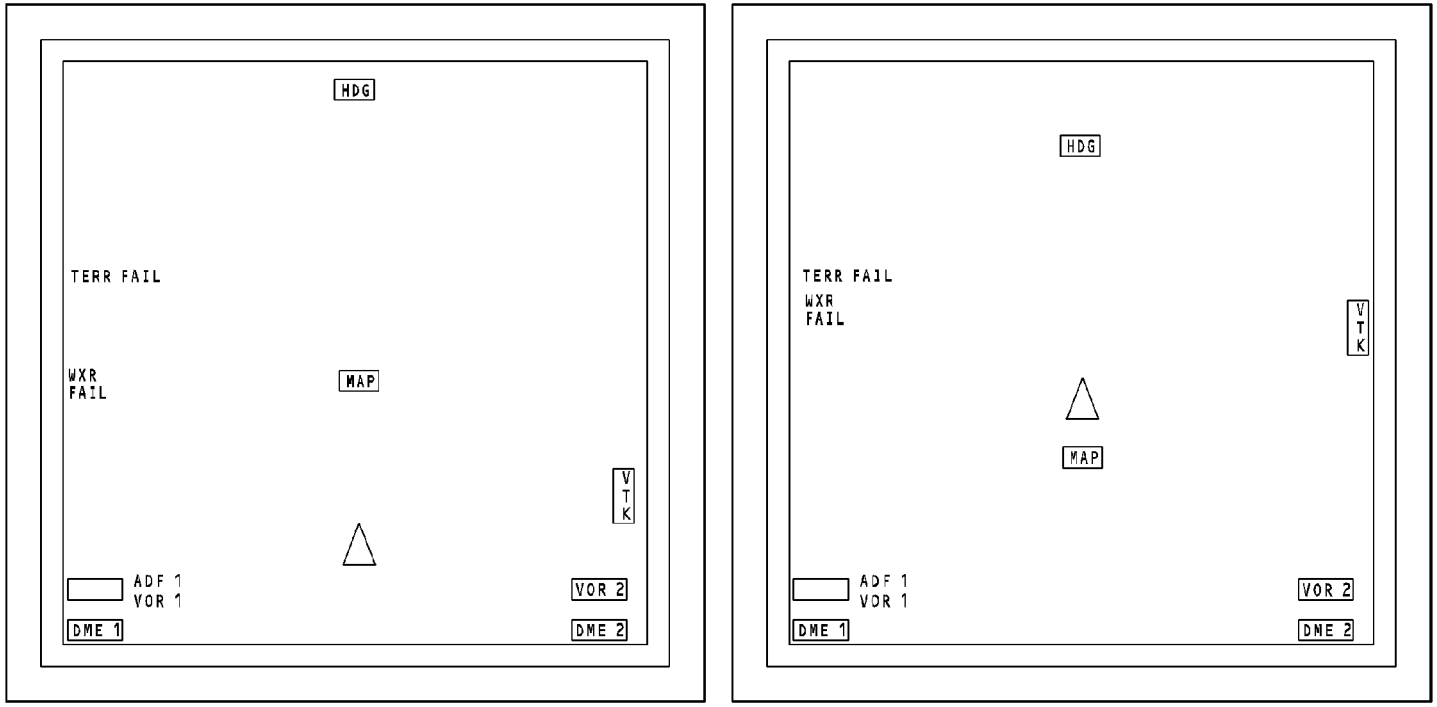
MAP

MAP CENTER

CDS - ND - MAP MODE FAILURE FLAGS

EFFECTIVITY

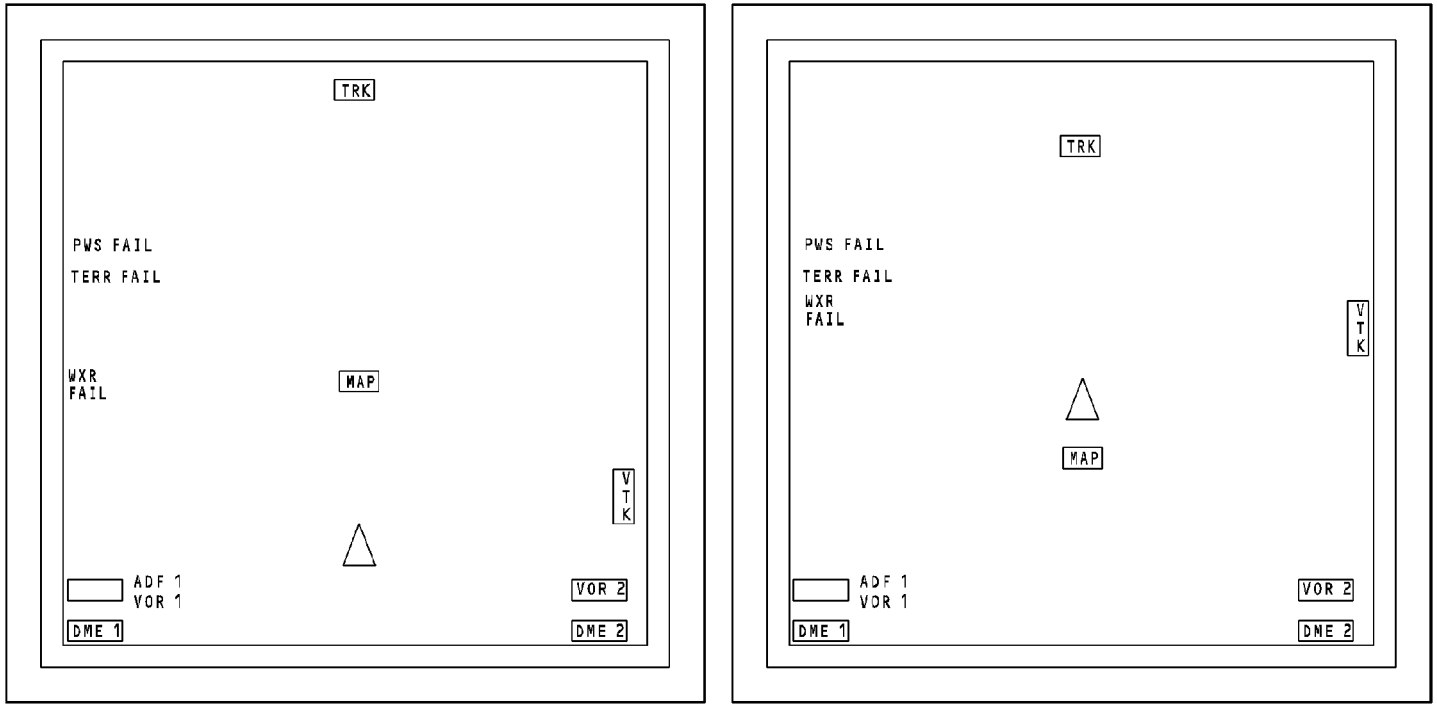
HAP 008-013, 015-026, 028-036, 041, 047-049, 054, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370



MAP

MAP CENTER

CDS - ND - MAP MODE FAILURE FLAGS



MAP

MAP CENTER

CDS - ND - MAP MODE FAILURE FLAGS

EFFECTIVITY

HAP 038, 042-046, 050-053; HAP 037, 039, 040 POST SB 737-31-1370

31-62-00-329

CDS - ND - PLAN MODE FAILURE FLAGS

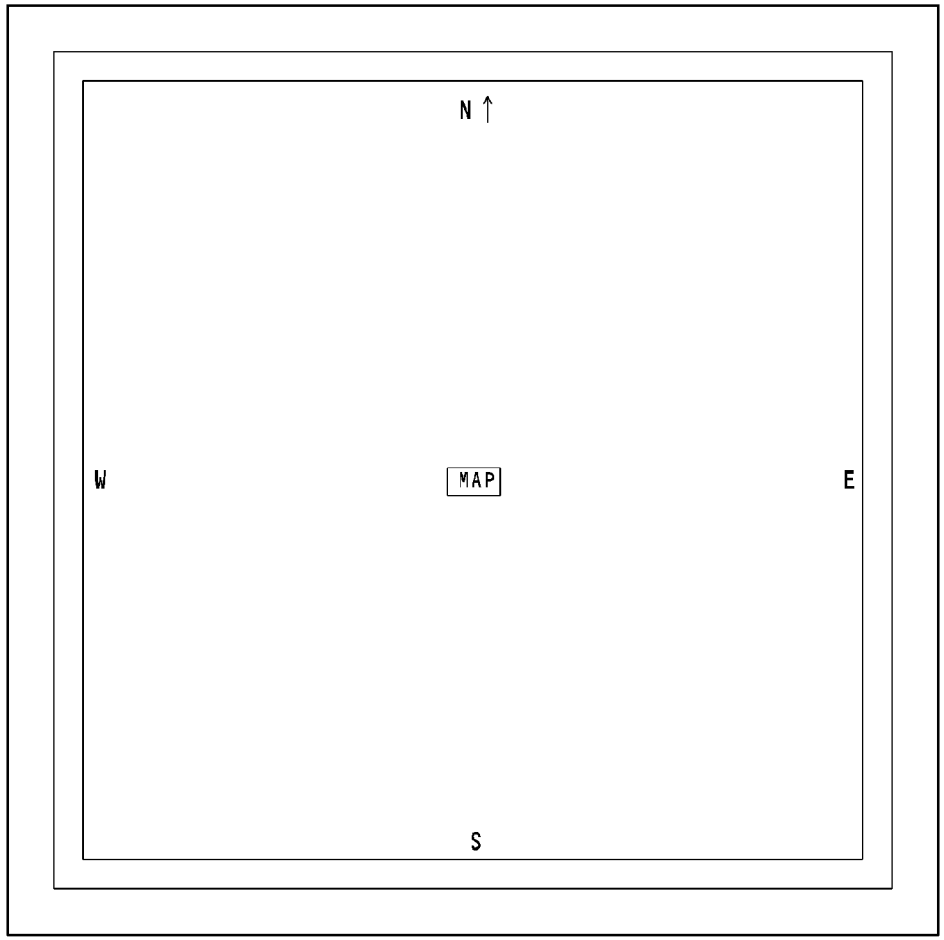
General

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.



CDS - ND - PLAN MODE FAILURE FLAGS

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

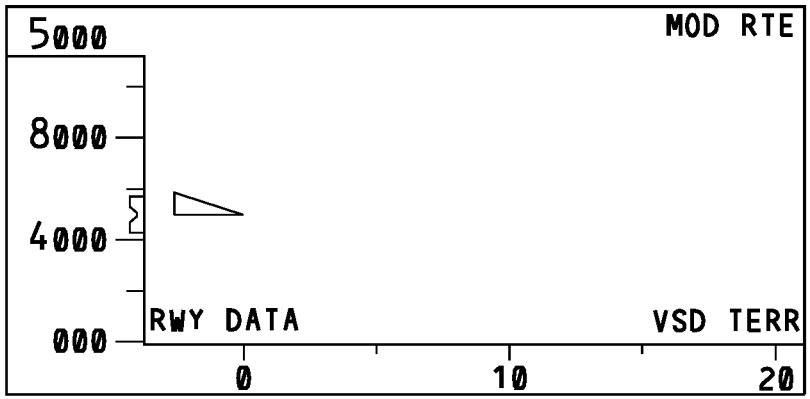
Failure Flags

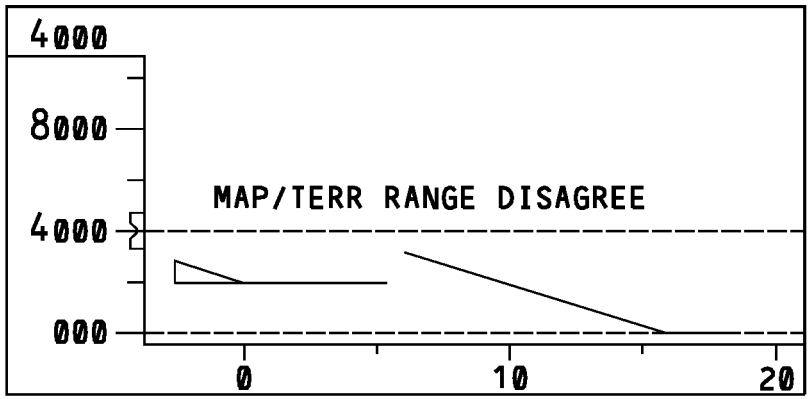
If the DEU does not receive input data for the VSD, failure flags replace the display data. These flags are amber:

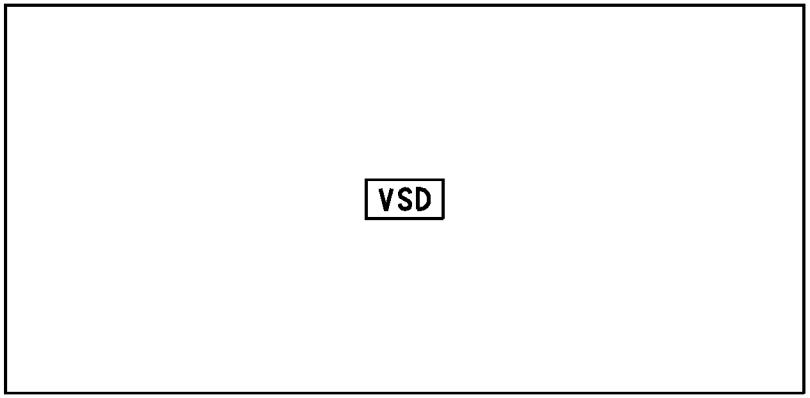
- VSD TERR - EGPWC fail
- VSD - invalid altimeter data

EFFECTIVITY

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295







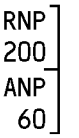
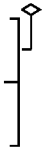
CDS - ND - Vertical Situation Display Failure Flags

EFFECTIVITY

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

Navigation Display Symbology

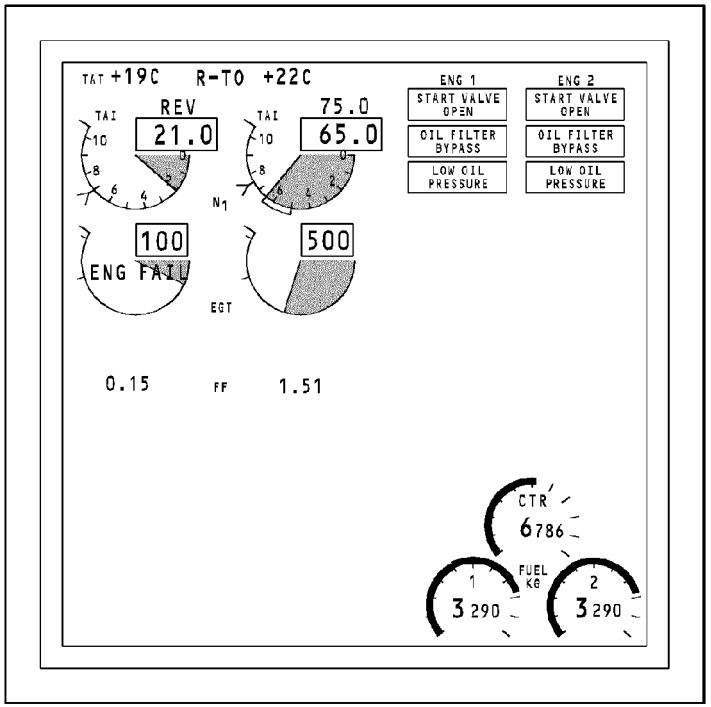
Additional symbology shows in these tables.

SYMBOL	NAME	MODE(S)	REMARKS
	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.
	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.

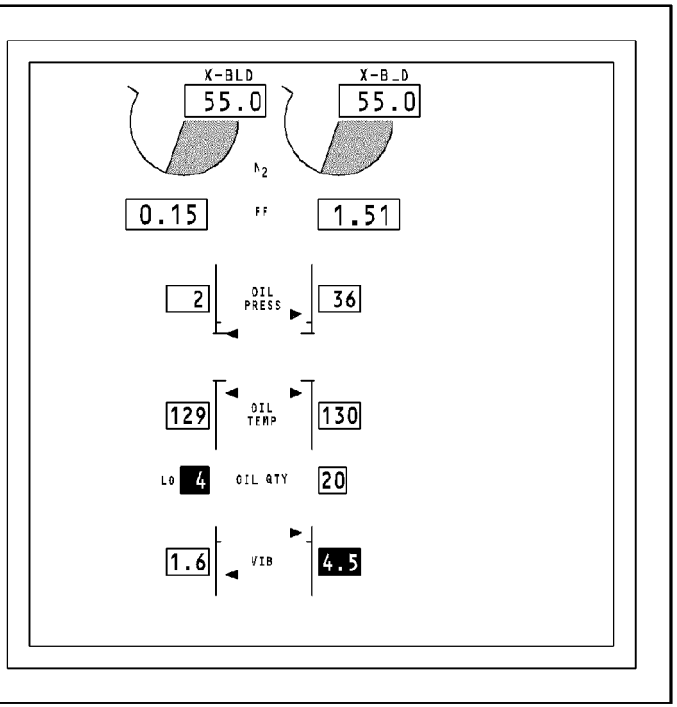
Engine Display

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.



PRIMARY ENGINE DISPLAY



SECONDARY ENGINE DISPLAY

CDS - ENGINE DISPLAY - INTRODUCTION

EFFECTIVITY

HAP ALL

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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.

Exceedence Indications

Secondary engine data that goes above or below tolerance limits shows on the compacted engine display in a box. The color of the box aligns with the red and amber limit bands that show in the secondary engine display. When the exceedance occurs, the box shows and flashes for 10 seconds. After 10 seconds, the box shows but does not flash.

Automatic Selection of the Compacted Engine Display

If one of the center DUs fails, the data shows on the other center DU. The display changes automatically as shown in the table below.

Center DUs	Data shown before failure	Failure	Data shown after failure
Upper --- Lower	Primary Engine --- blank	Upper	blank --- Primary Engine
Upper --- Lower	Primary Engine --- Secondary Engine	Upper	blank --- Compacted Engine
Upper --- Lower	Primary Engine --- blank	Lower	Primary Engine --- blank
Upper --- Lower	Primary Engine --- Secondary Engine	Lower	Compacted Engine --- blank
Upper --- Lower	Primary Engine --- System Data	Upper	blank --- Primary Engine
Upper --- Lower	Primary Engine --- System Data	Lower	Primary Engine --- 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.

HAP 031-054, 101-999

Manual Selection of the Compacted Engine Display

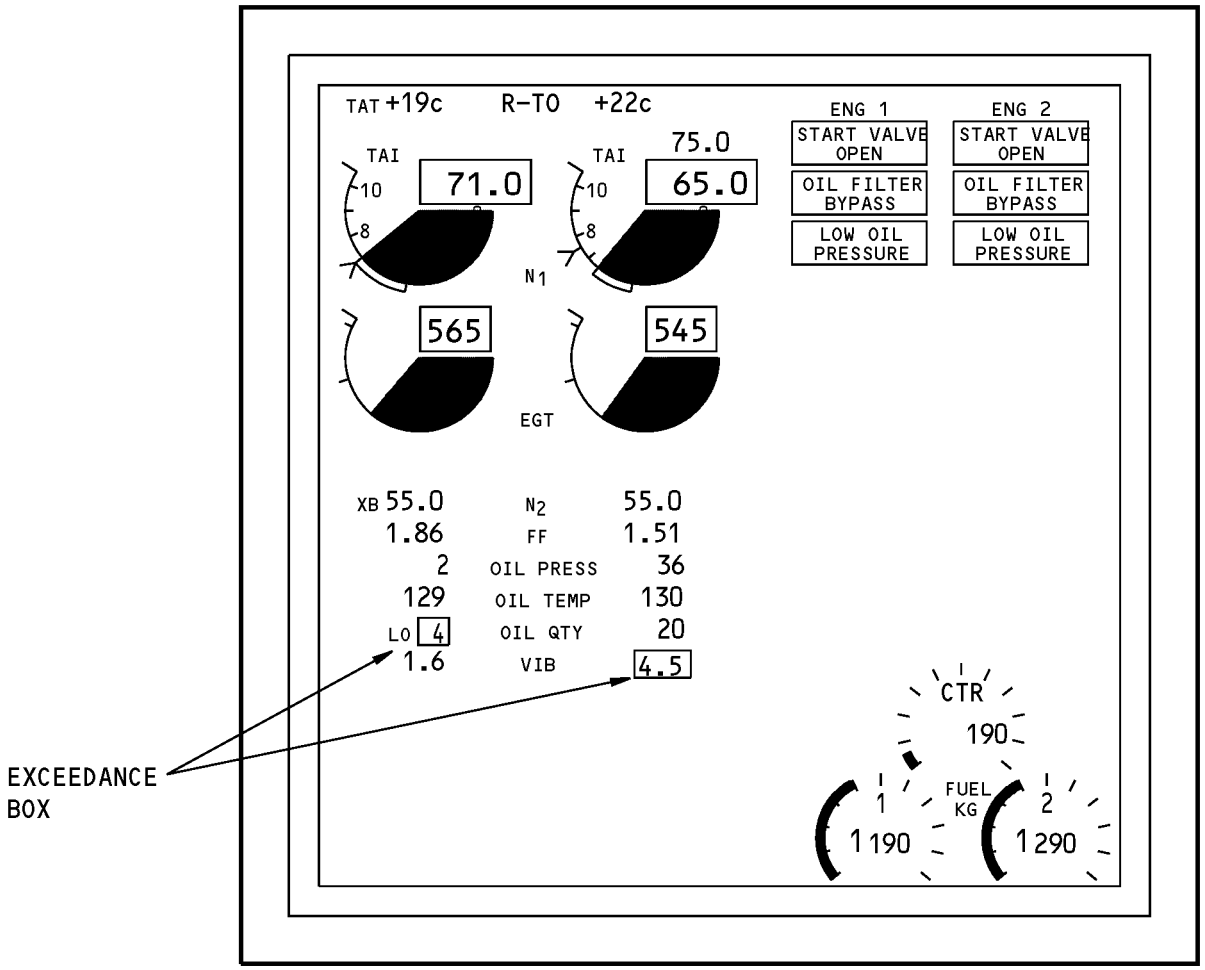
You can manually control the data that shows on the center DUs. Use the MFD keys on the engine display control panel as shown in the table below.

Center DUs	Data shown before action	MFD key	Data shown after action
Upper --- Lower	Primary Engine --- blank	ENG	Primary Engine --- Secondary Engine
Upper --- Lower	Primary Engine --- Secondary Engine	ENG	Compacted Engine --- blank
Upper --- Lower	Compacted Engine --- blank	ENG	Primary Engine --- blank
Upper --- Lower	Primary Engine --- blank	SYS	Primary Engine --- System Data
Upper --- Lower	Primary Engine --- System Data	SYS	Primary Engine --- blank
Upper --- Lower	Compacted Engine --- blank	SYS	Compacted Engine --- System Data
Upper --- Lower	Primary Engine --- System Data	ENG	Primary Engine --- Secondary Engine
Upper --- Lower	Compacted Engine --- System Data	ENG	Primary Engine --- System Data

HAP ALL

EFFECTIVITY

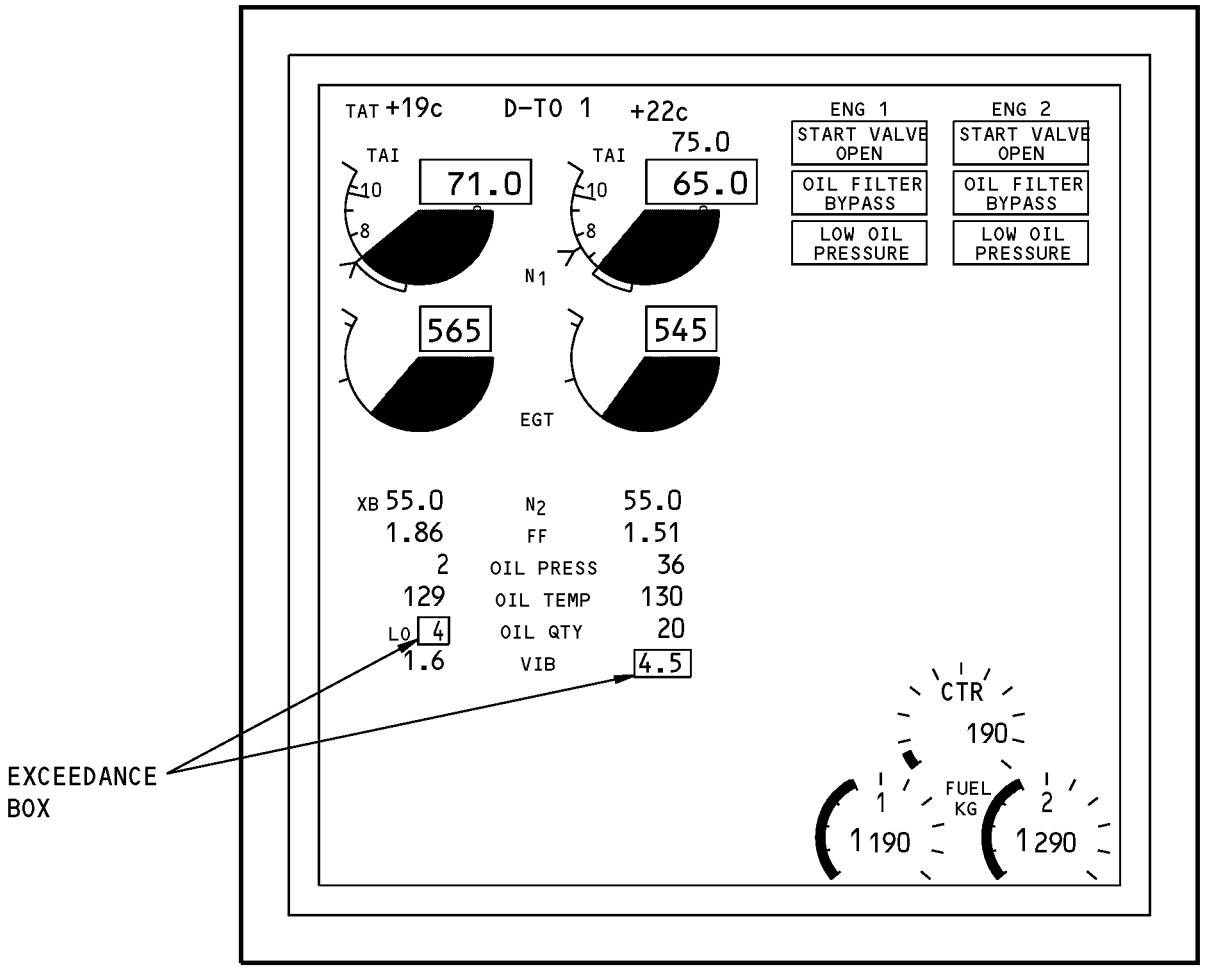
HAP ALL



CDS - ENGINE DISPLAY - COMPACTED ENGINE DISPLAY

EFFECTIVITY

HAP 001-013, 015-026, 028-036, 048, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370



CDS - ENGINE DISPLAY - COMPACTED ENGINE DISPLAY

EFFECTIVITY

HAP 038, 041-047, 049-054; HAP 037, 039, 040 POST SB 737-31-1370

31-62-00

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Autothrottle Limit Message

HAP 001-013, 015-026, 028-030

The autothrottle limit message (A/T LIM) shows when the autothrottle computer sets the N1 reference.

HAP 031-054, 101-999

The autothrottle limit message (A/T LIM) shows when the FCC-A sets the N1 reference.

HAP ALL

Thrust Modes

These are the thrust modes that can show:

- TO
- CLB
- CON
- CRZ
- G/A

HAP 001-013, 015-026, 028-036, 048, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370

- R-TO
- R-CLB

HAP 038, 041-047, 049-054; HAP 037, 039, 040 POST SB 737-31-1370

- TO 1
- TO 2
- D-TO
- D-TO 1
- D-TO 2
- CLB 1
- CLB 2

HAP ALL

- MAN

The thrust mode does not show if the autothrottle (A/T) limit shows.

Total Air Temperature

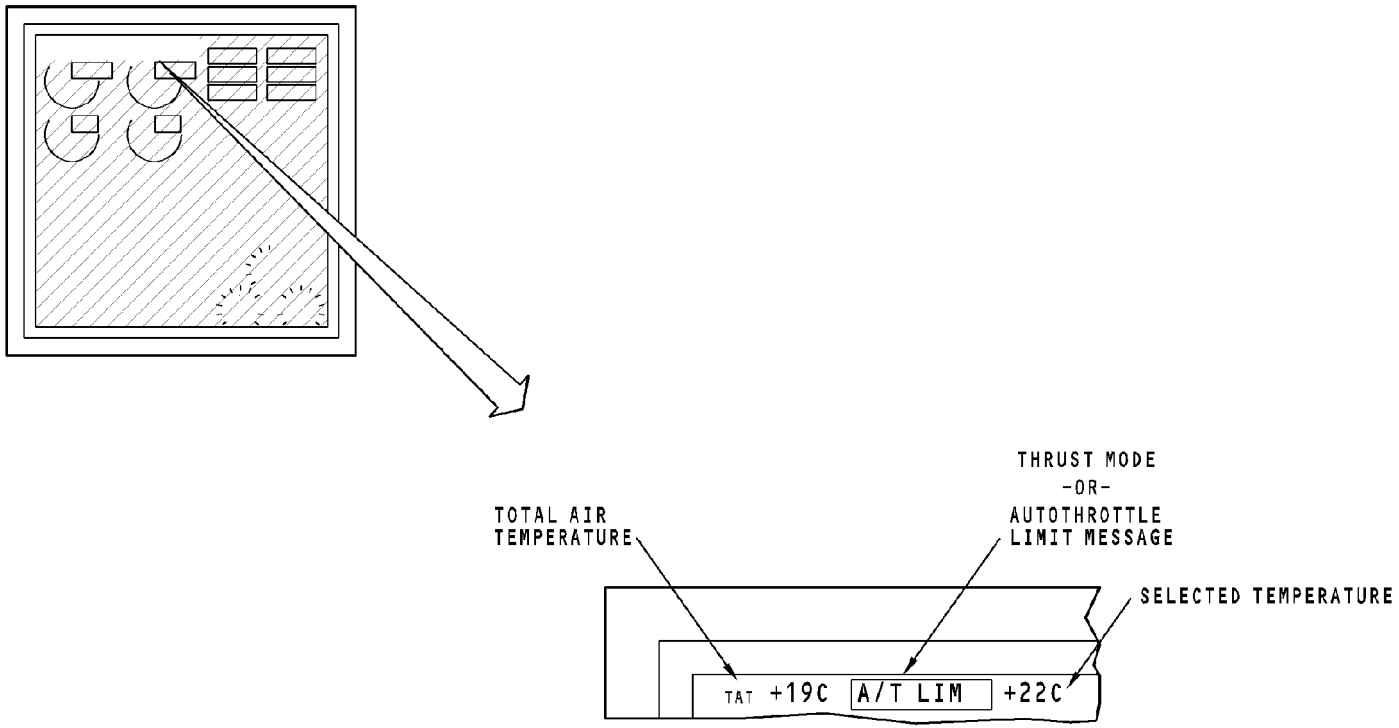
The total air temperature (TAT) shows as a digital indication.

Selected Temperature

The selected temperature shows the selected temperature that you set on the FMC CDU takeoff reference page.

EFFECTIVITY

HAP ALL



CDS - ENGINE DISPLAY - MISCELLANEOUS INDICATIONS

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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)

HAP 031-040, 042-045, 047-049, 051-053, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

COMM Messages

These are the COMM messages:

HAP 031-040, 042-045, 047-049, 051-053, 101-999; HAP 001-013, 015-026, 028-030 ((POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295) AND (POST SB 737-31-1246 OR POST SB 737-31-1295)

- ACARS (medium level)
- ACARS (low level)

HAP 031-040, 042-045, 047-049, 051-053, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

- 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.

HAP 031-040, 042-045, 047-049, 051-053, 101-999; HAP 001-013, 015-026, 028-030 ((POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295) AND (POST SB 737-31-1246 OR POST SB 737-31-1295)

The .ACARS message shows when the ACARS receives a DISPLAYABLE ACARS uplink.

When the medium level .ACARS message shows, the Aural Warning System makes a Hi-Low chime sound.

The low level .ACARS message does not make the Hi-Low chime sound. Also, the low level .ACARS message always shows on the bottom of the list of COMM messages. The low level .ACARS message shows one space to the right of the other types of messages.

EFFECTIVITY
HAP ALL

HAP 031-040, 042-045, 047-049, 051-053, 101-999; HAP 001-013, 015-026, 028-030 ((POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295) AND (POST SB 737-31-1246 OR POST SB 737-31-1295) (Continued)

HAP 038, 042-046, 048, 051-053, 104-999

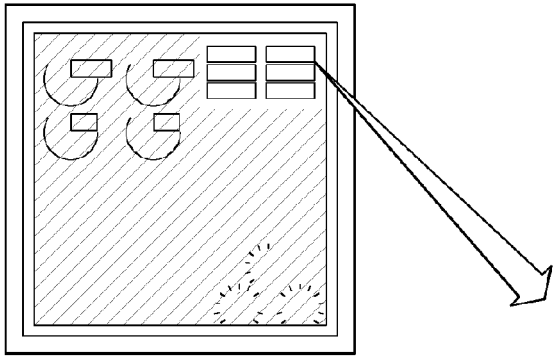
Cat IIIb Messages

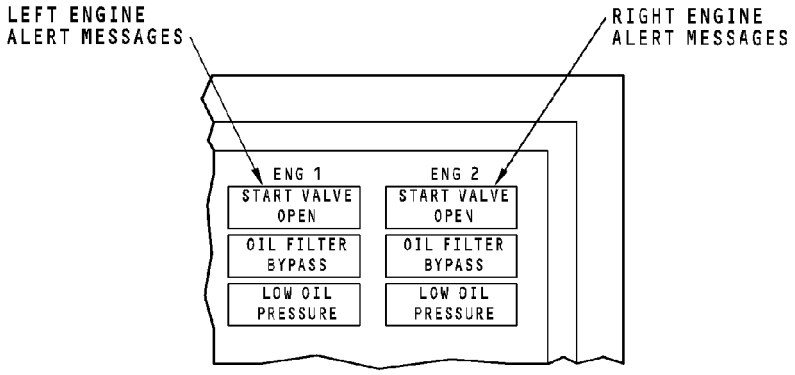
Cat IIIb messages show below the crew alert messages. If you push the Cancel/Recall button (C/R) on the Engine Control Panel, the messages are removed. After you cancel a message, the Recall Cue shows. While the Recall Cue shows, you can push the Cancel/Recall button (C/R) to make the cancelled messages show again.

These are the Cat IIIb messages that can show:

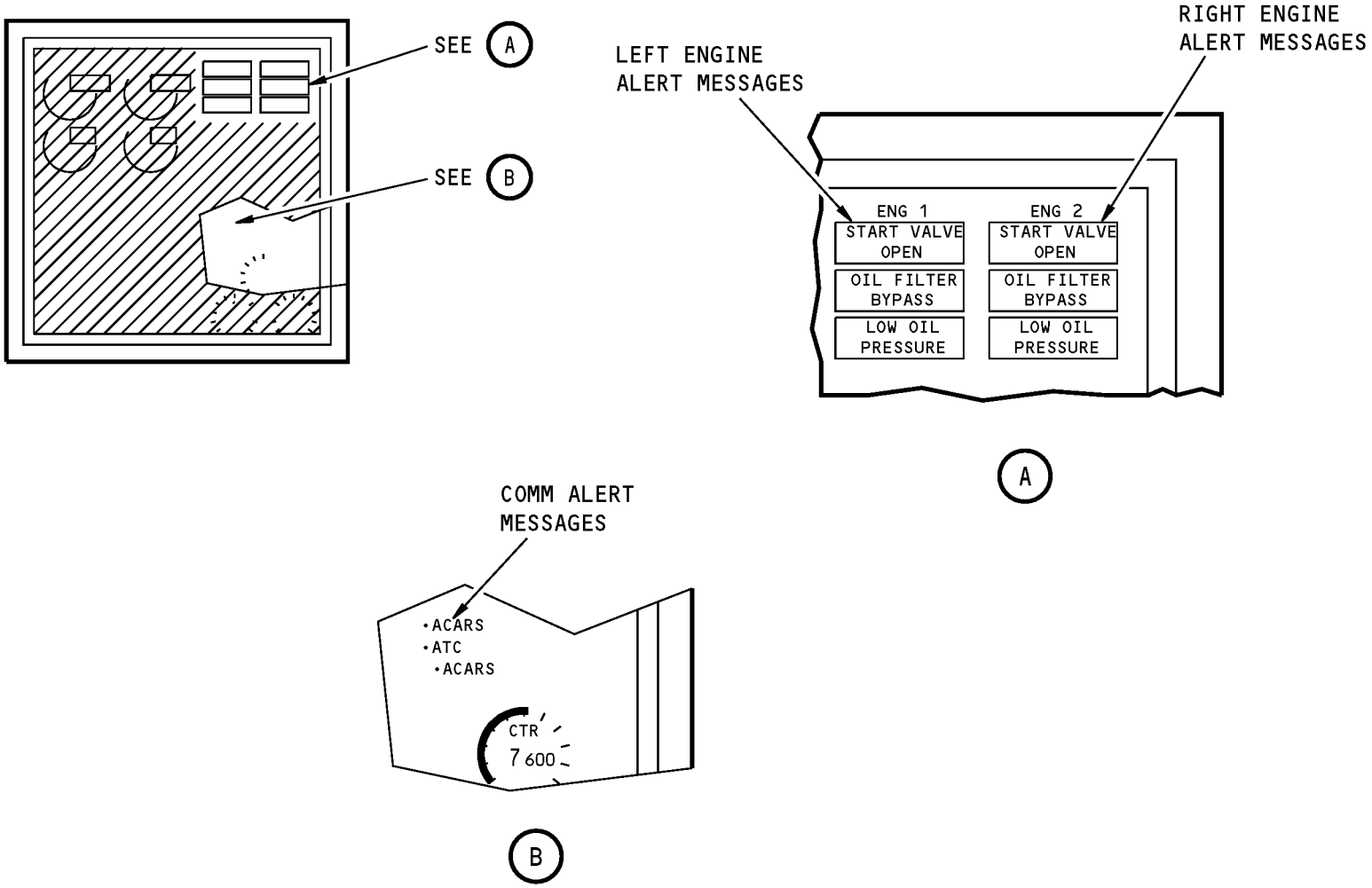
- NO AUTOLAND
- NO LAND 3
- NO ILS AUTOLAND
- NO ILS LAND 3

HAP ALL





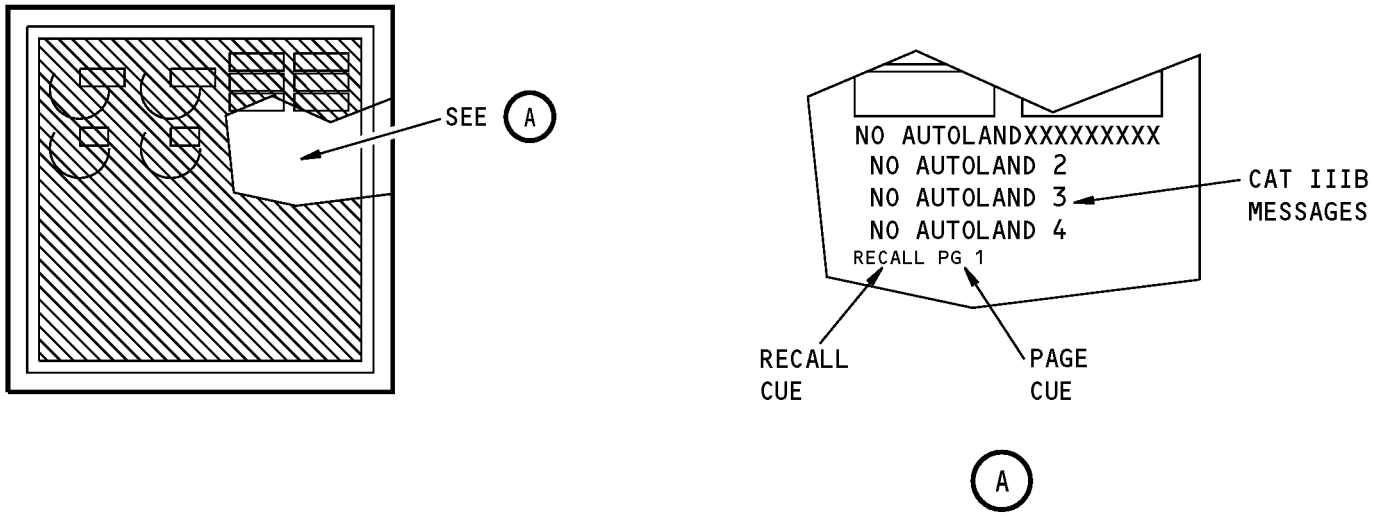
CDS - ENGINE DISPLAY - CREW ALERT MESSAGES



CDS - Engine Display - Crew Alert Messages

EFFECTIVITY

HAP 031-040, 042-045, 047-049, 051-053, 101-999; HAP 001-013, 015-026, 028-030 (POST SB 737-31-1246 OR POST SB 737-31-1295) AND ((POST SB 737-31-1246 AND PRE SB 737-31-1295) OR POST SB 737-31-1295)



CDS - Engine Display - CAT IIIb Messages

EFFECTIVITY

HAP 038, 042-046, 048, 051-053, 104-999

31-62-00

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)

HAP 038, 041-047, 049-054; HAP 037, 039, 040 POST SB 737-31-1370

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)

HAP ALL

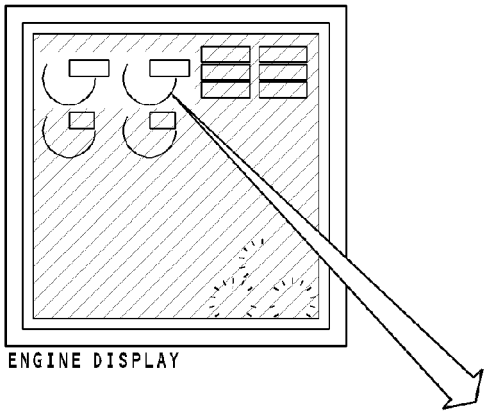
Thrust Reverser Message

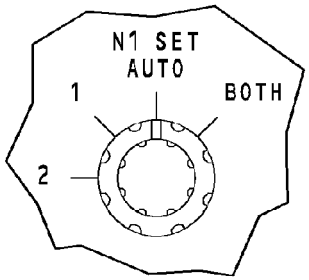
The thrust reverser message shows when the thrust reverse operates. If the thrust reverser message shows, it replaces the reference N1 readout for that engine.

Thermal Anti-Ice Indication

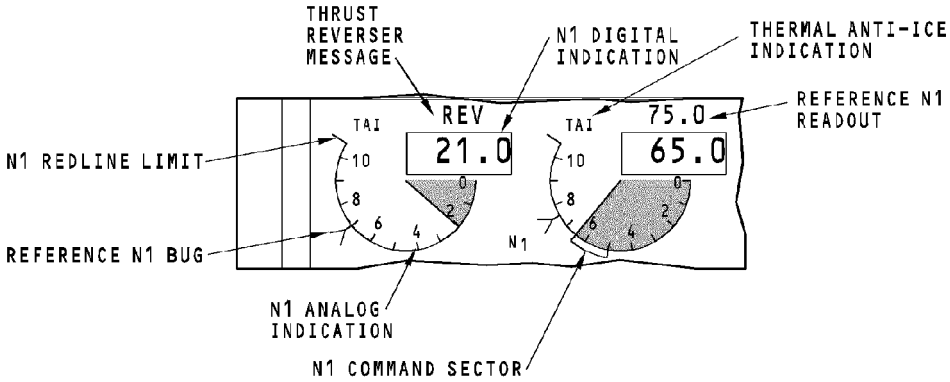
If the thermal anti-ice (TAI) system is on, the TAI indication shows.

See the air intakes section for more information on TAI indication. (SECTION 30-20)





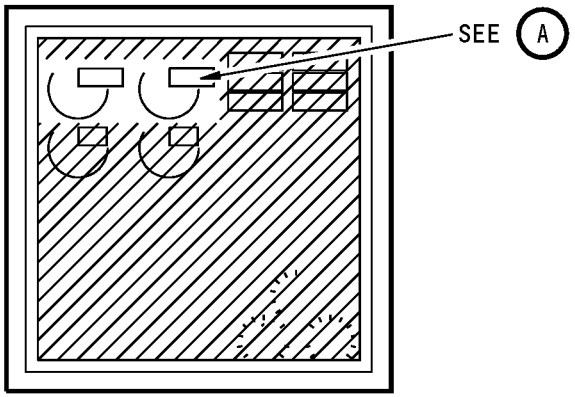
N1 SET CONTROLS



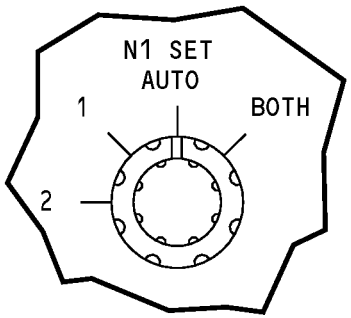
CDS - ENGINE DISPLAY - N1 INDICATION

EFFECTIVITY

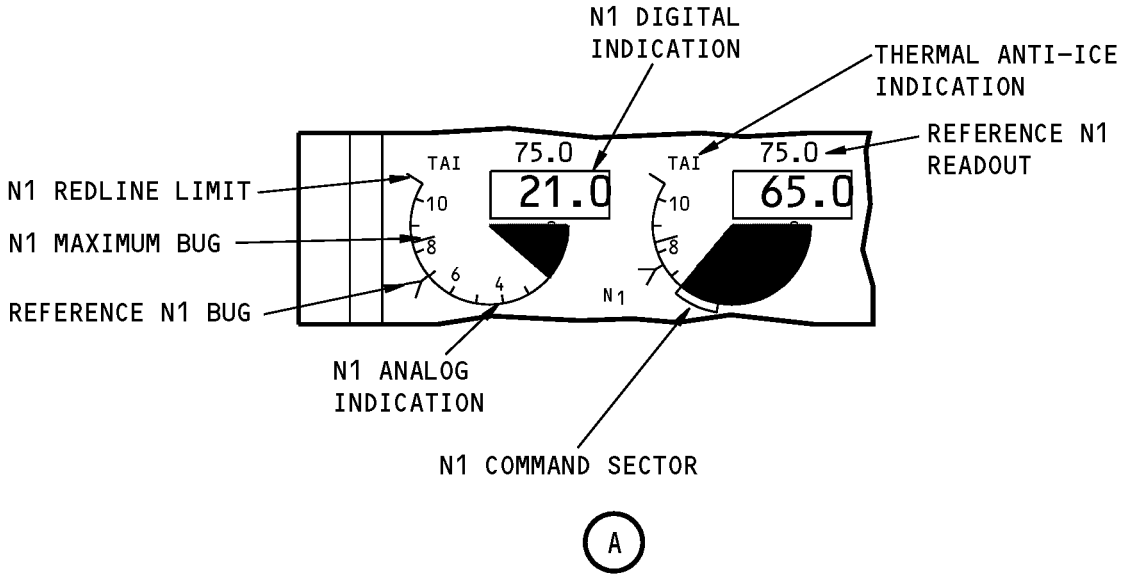
HAP 001-013, 015-026, 028-036, 048, 101-999; HAP 037, 039, 040 PRE SB 737-31-1370



ENGINE DISPLAY



N1 SET CONTROLS



CDS - ENGINE DISPLAY - N1 INDICATIONS

EFFECTIVITY

HAP 038, 041-047, 049-054; HAP 037, 039, 040 POST SB 737-31-1370

31-62-00

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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:

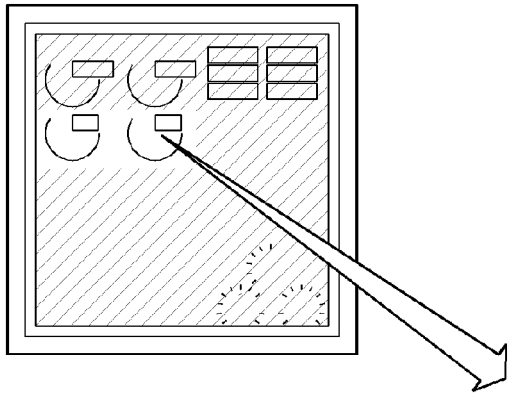
- Airplane is on the ground
- Engines are off
- Fire switch is not on.

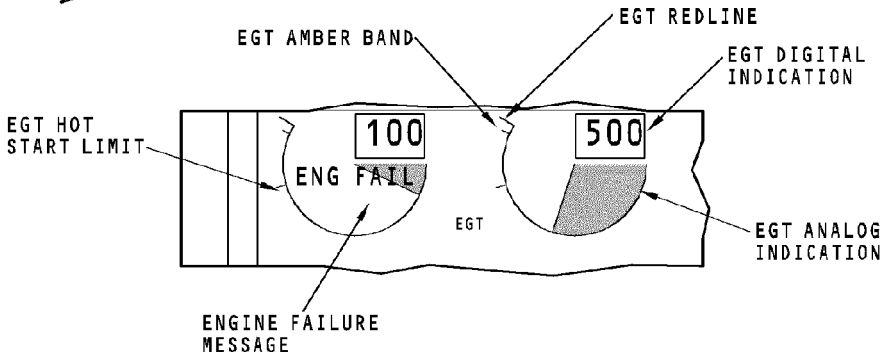
See the EGT indicating system section for more information. (SECTION 77-21)

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)





CDS - ENGINE DISPLAY - EGT INDICATION

N2

The N2 value shows as a digital indication and an analog indication.

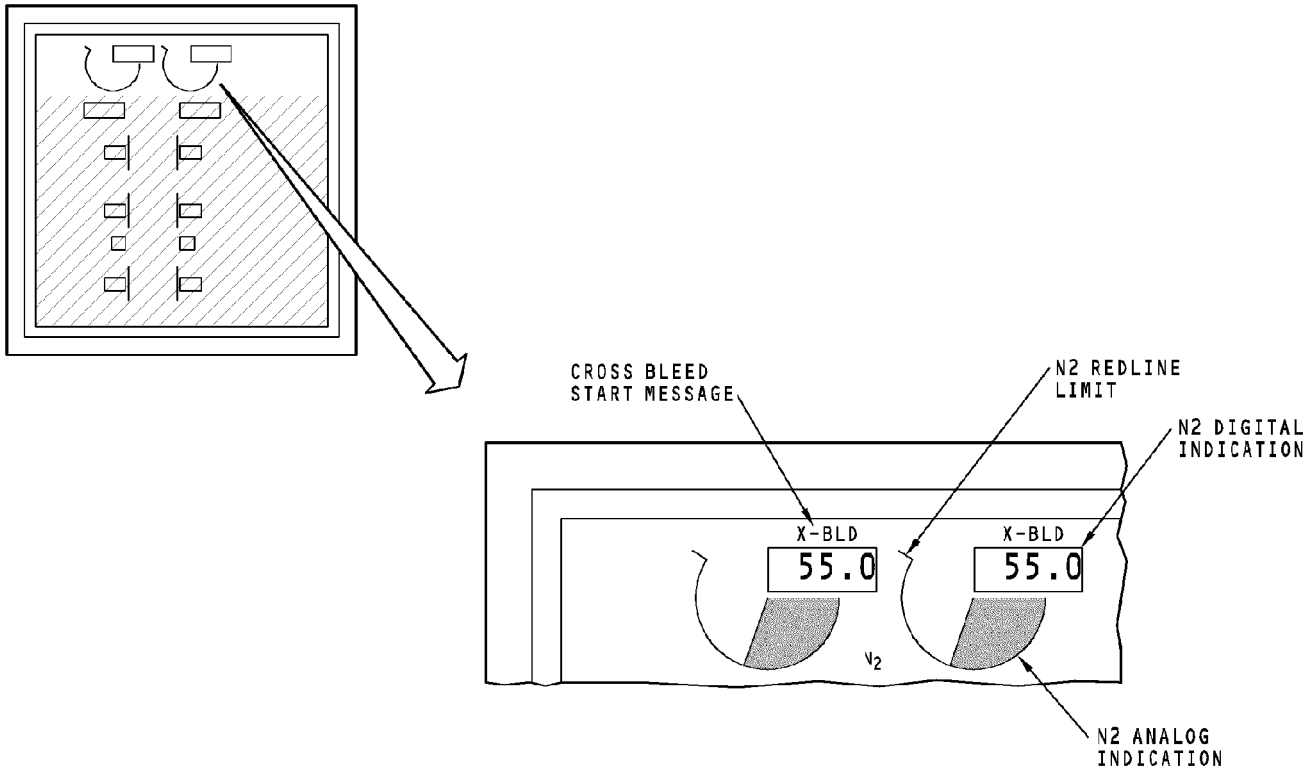
In the normal operation range, the digital and analog indication are white. If the N2 value gets to the redline limit, the digital and analog indication are red.

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)



CDS - ENGINE DISPLAY - N2 INDICATION

Fuel Indications

These are the fuel indications:

- Fuel quantity
- Fuel flow/fuel used

Fuel Quantity

HAP 001-013, 015-026, 028-030 PRE SB 737-31-1246 AND PRE SB 737-31-1295

The fuel quantity shows as an analog and digital indication.

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295

The fuel quantity shows as a digital indication for each tank, plus a sum total.

HAP ALL

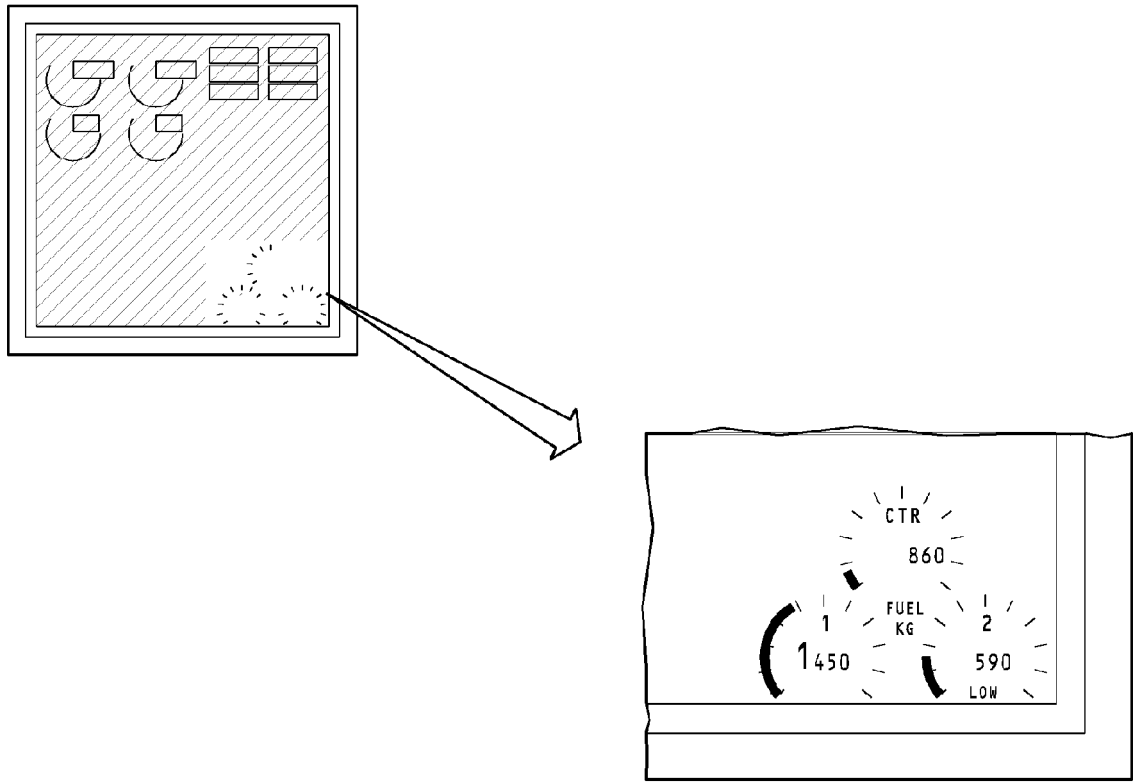
See the fuel chapter for more information on the fuel quantity indications. (CHAPTER 28)

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)

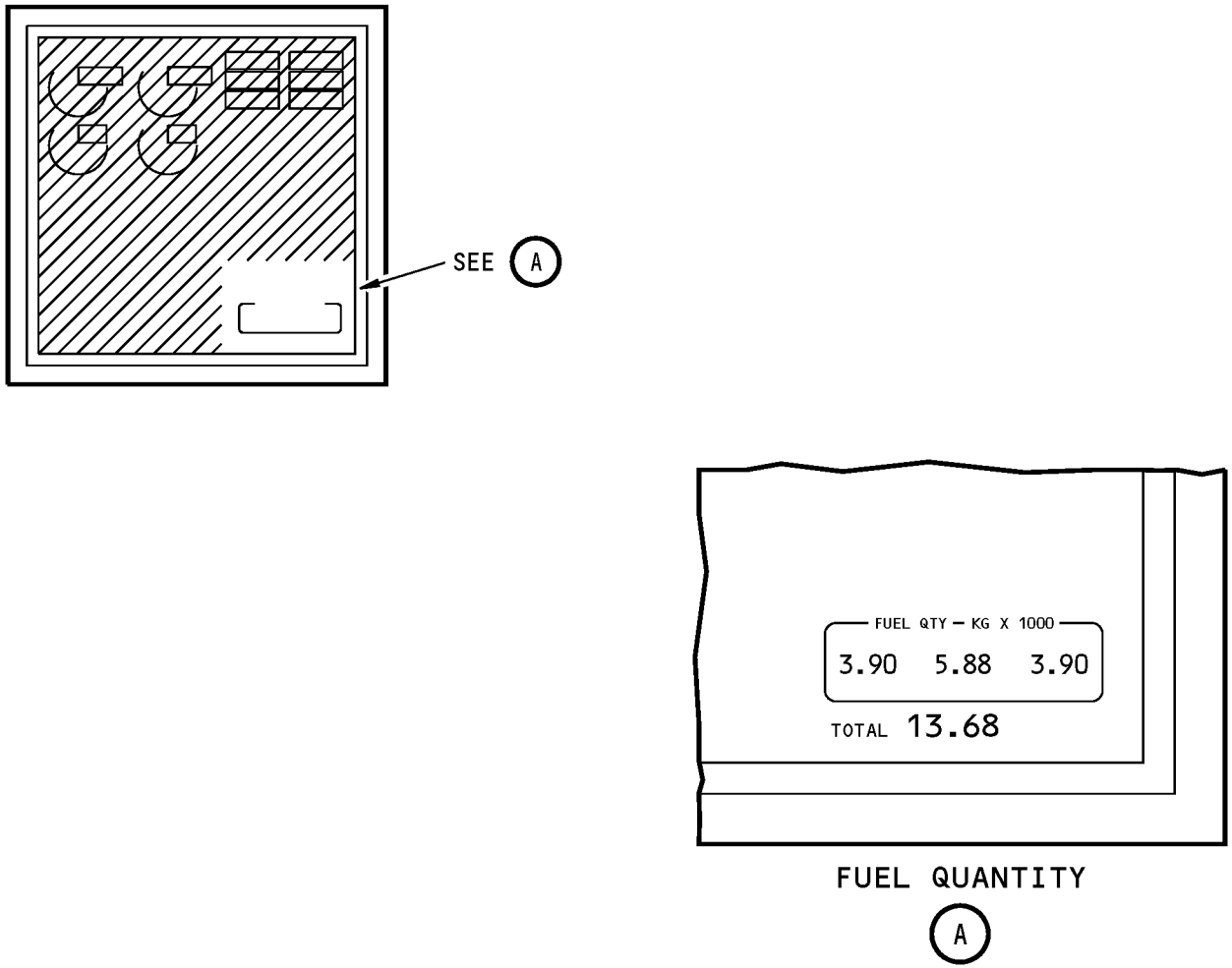


FUEL QUANTITY

CDS - ENGINE DISPLAY - FUEL INDICATIONS

EFFECTIVITY

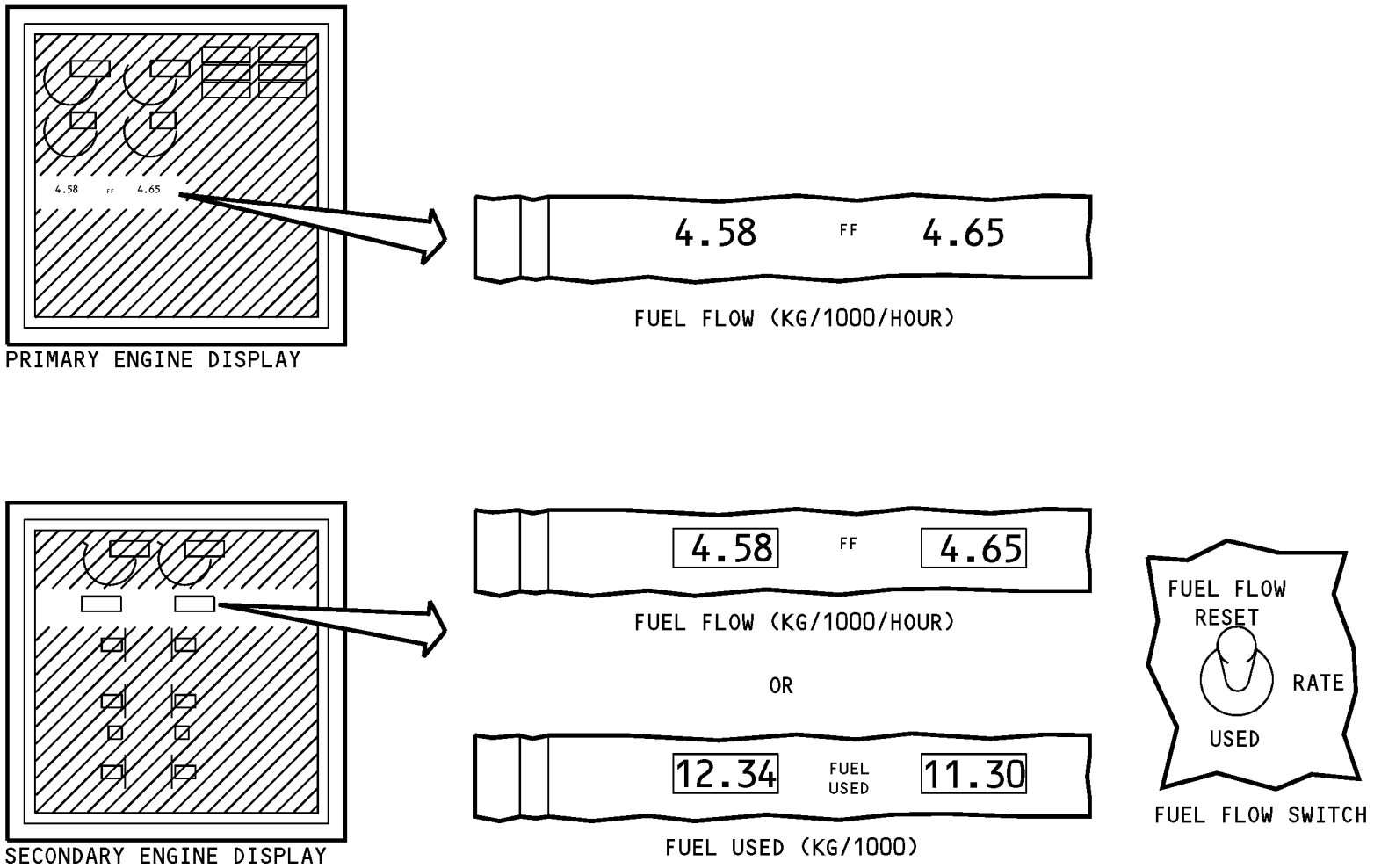
HAP 001-013, 015-026, 028-030 PRE SB 737-31-1246 AND PRE SB 737-31-1295



CDS - ENGINE DISPLAY - FUEL INDICATIONS

EFFECTIVITY

HAP 031-054, 101-999; HAP 001-013, 015-026, 028-030 POST SB 737-31-1246 OR POST SB 737-31-1295



CDS - ENGINE DISPLAY - FUEL 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

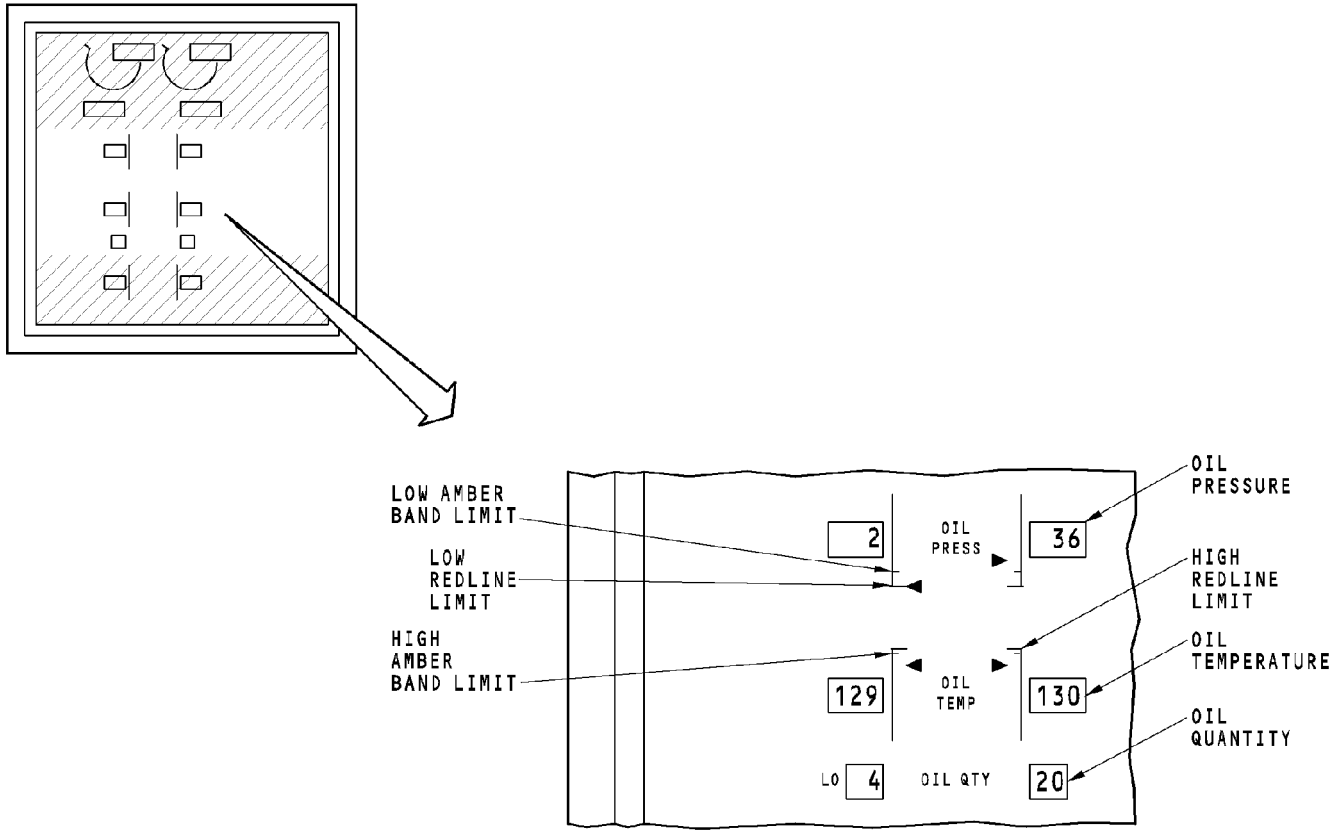
The oil pressure shows as an analog and digital indication. In the normal operation range, the scale, the pointer, and the digital display are white. When the oil pressure is in the low amber band limit, the scale, the pointer, and the digital display are amber. When the oil pressure is in the low redline 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.

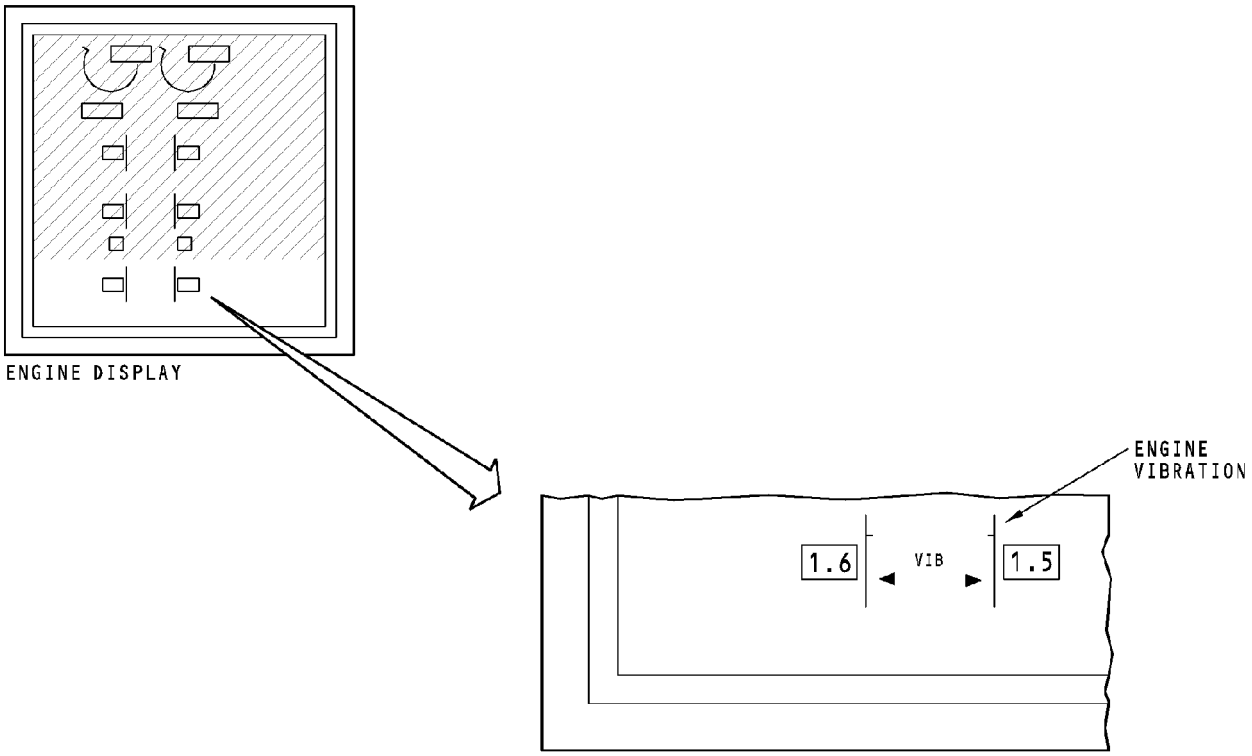


CDS - ENGINE DISPLAY - OIL INDICATIONS

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)



CDS - ENGINE DISPLAY - ENGINE VIBRATION INDICATIONS

General

HAP 001-013, 015-026, 028-037, 039-041, 047-050, 053, 054, 101-999

The systems display shows these indications:

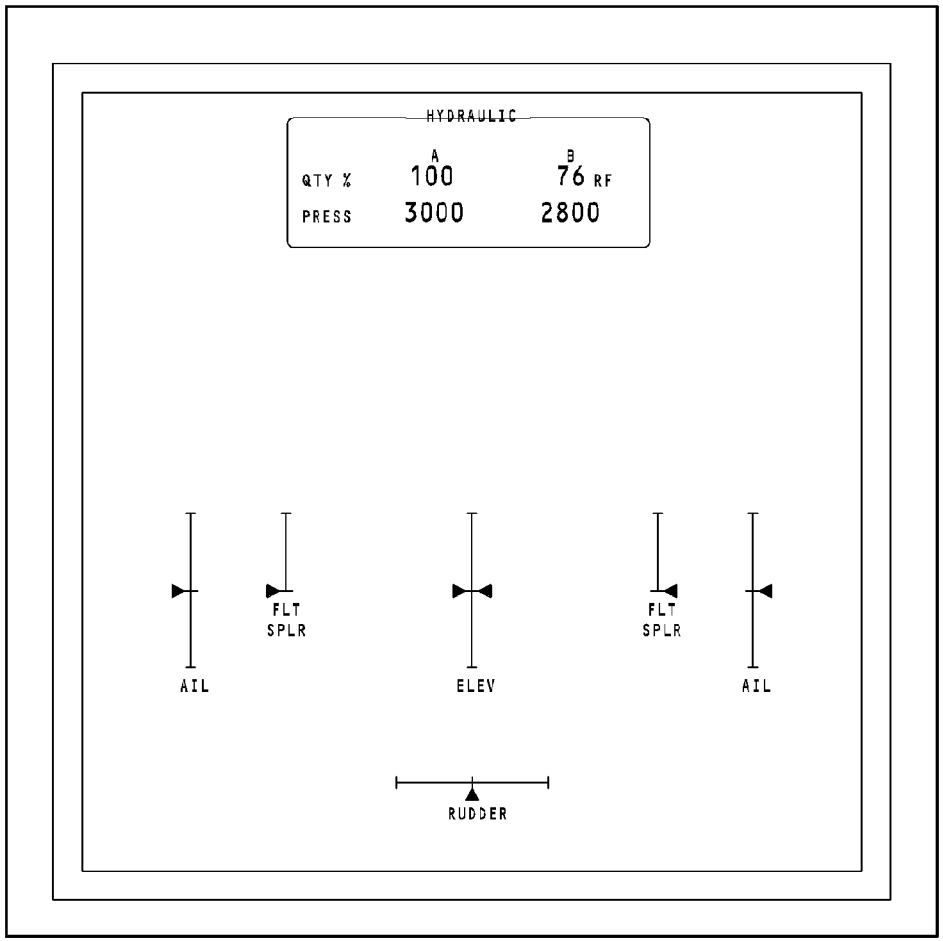
- Hydraulic quantity
- Hydraulic pressure
- Flight control surface positions.

HAP 038, 042-046, 051, 052

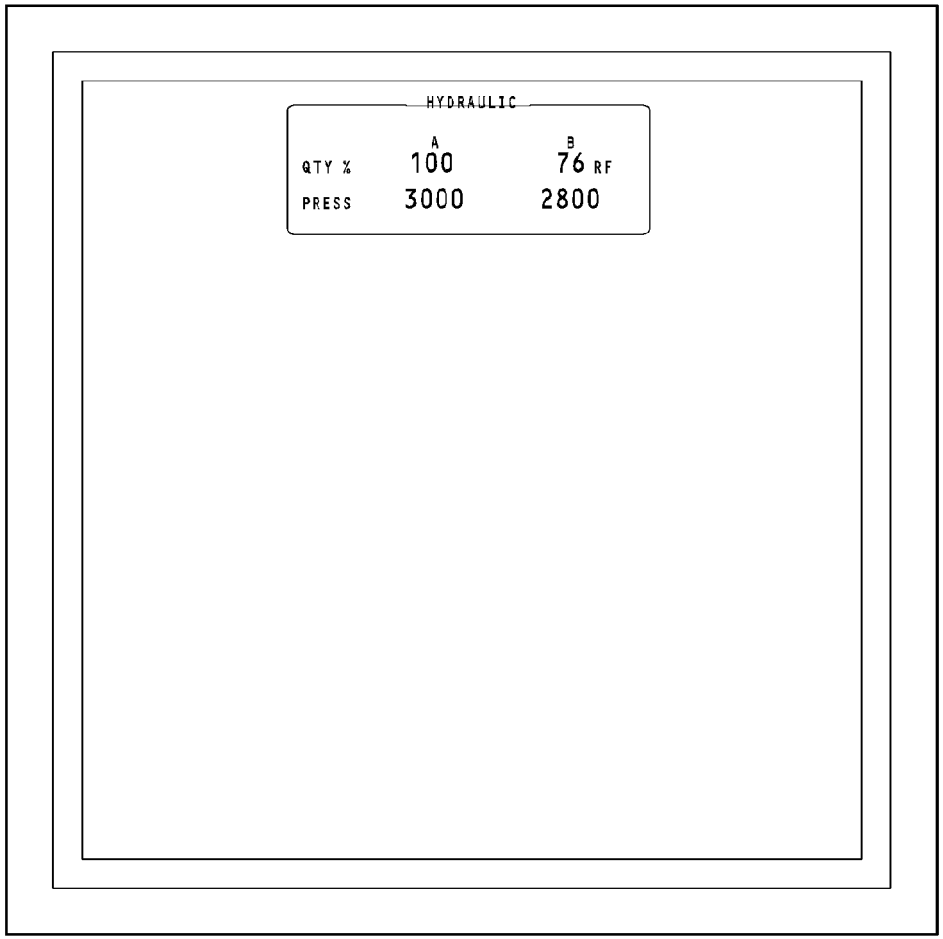
The systems display shows these indications:

- Hydraulic quantity
- Hydraulic pressure.

HAP ALL



CDS - SYSTEMS DISPLAY - INTRODUCTION



CDS - SYSTEMS DISPLAY - INTRODUCTION

EFFECTIVITY
HAP 038, 042-046, 051, 052

31-62-00

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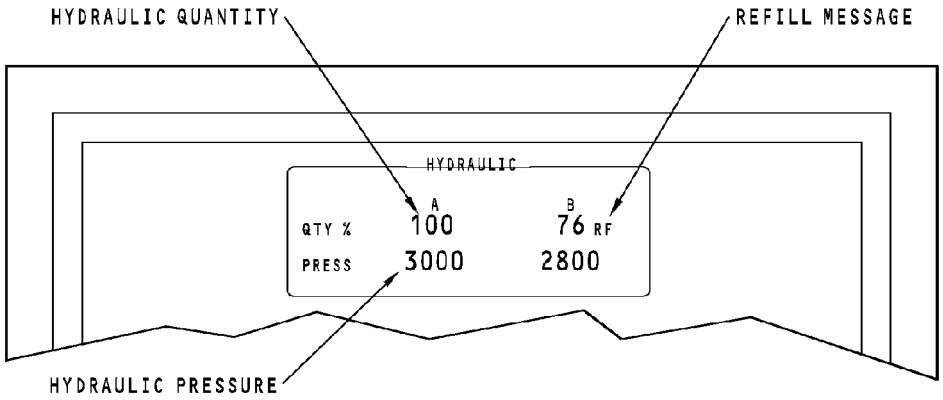
General

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.

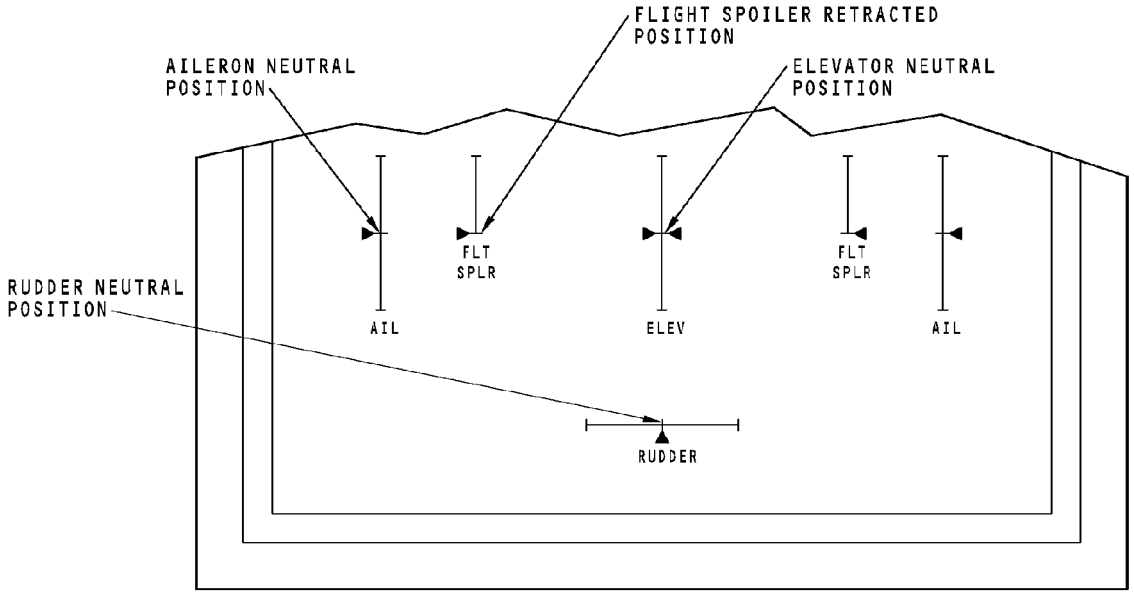
Hydraulic pressure shows in units of pounds per square inch (PSI).



CDS - SYSTEMS DISPLAY - HYDRAULIC 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.



CDS - SYSTEMS DISPLAY - FLIGHT CONTROL SURFACE POSITIONS INDICATIONS

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

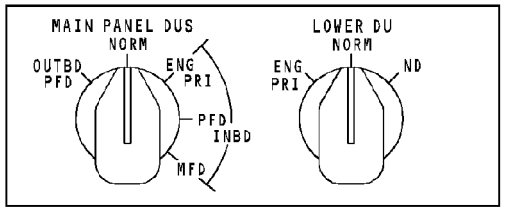
The NORM selections on the Display Select Panels shows this data on the display units:

- 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

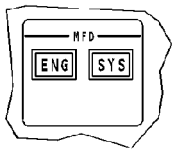
Power-up

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.

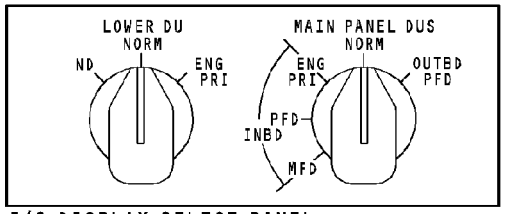
At power-up, the lower center display unit shows the secondary engine display. After power-up, with the display select panel lower DU selector in the NORM position, you can use the ENG switch or the SYS switch to control the format that shows on the lower center display unit.



CAPTAIN DISPLAY SELECT PANEL

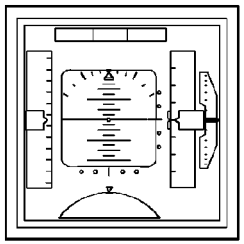


ENGINE DISPLAY CONTROL PANEL



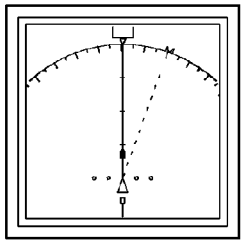
F/O DISPLAY SELECT PANEL

PRIMARY FLIGHT DISPLAY



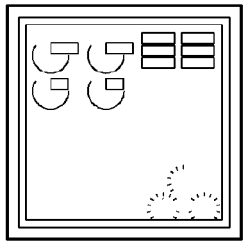
LEFT OUTBOARD DU

NAVIGATION DISPLAY



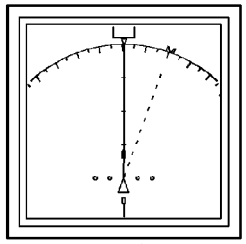
LEFT INBOARD DU

PRIMARY ENGINE DISPLAY



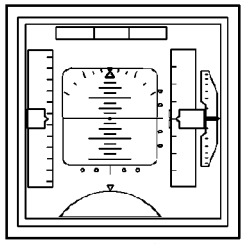
UPPER CENTER DU

NAVIGATION DISPLAY



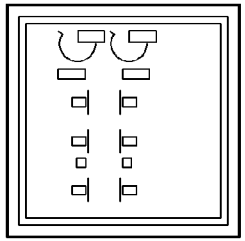
RIGHT INBOARD DU

PRIMARY FLIGHT DISPLAY



RIGHT OUTBOARD DU

SECONDARY ENGINE DISPLAY



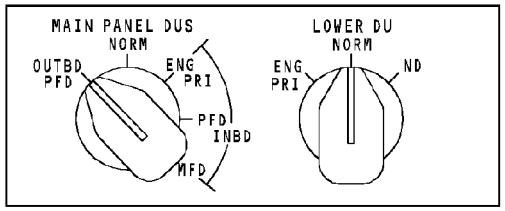
LOWER CENTER DU

CDS - OPERATION - SWITCHING - NORM POSITION

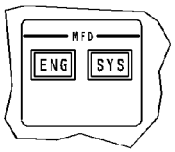
CDS - OPERATION - SWITCHING - OUTBD PFD POSITION

OUTBD PFD

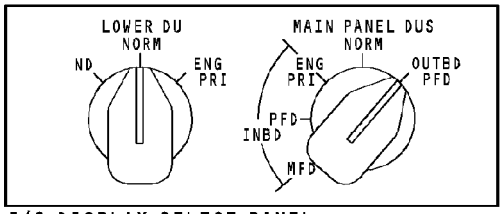
When you set the Main Panel DU switch on the Display Select Panel to OUTBD PFD, the primary flight display shows on the outboard display unit. The inboard display unit does not show data.



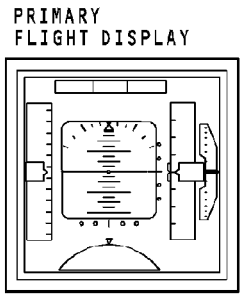
CAPTAIN DISPLAY SELECT PANEL



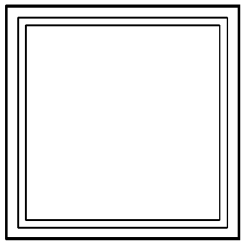
ENGINE DISPLAY CONTROL PANEL



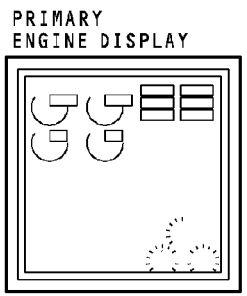
F/O DISPLAY SELECT PANEL



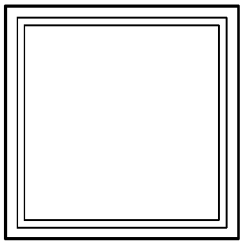
LEFT OUTBOARD DU



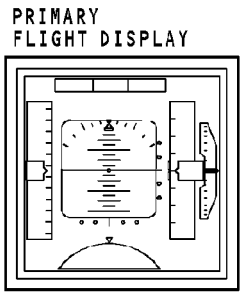
LEFT INBOARD DU



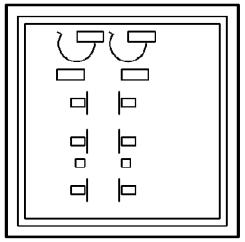
UPPER CENTER DU



RIGHT INBOARD DU



RIGHT OUTBOARD DU

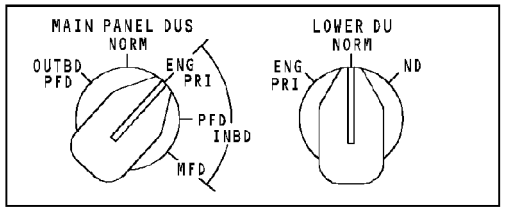


LOWER CENTER DU

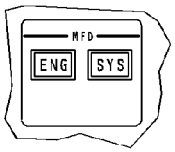
CDS - OPERATION - SWITCHING - OUTBD PFD POSITION

INBD ENGINE PRI

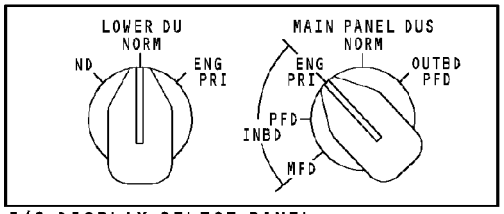
When you set the Main Panel DUs switch on the Display Select Panel to INBD ENGINE PRI, the primary engine display shows on the inboard display unit. The navigation display does not show and the upper center display unit does not show display data.



CAPTAIN DISPLAY SELECT PANEL

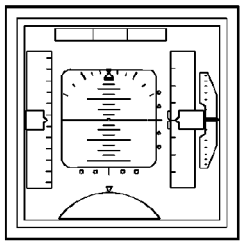


ENGINE DISPLAY CONTROL PANEL



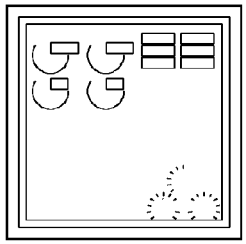
F/O DISPLAY SELECT PANEL

PRIMARY FLIGHT DISPLAY

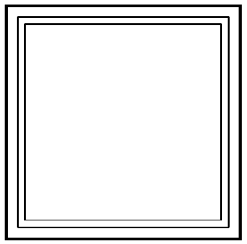


LEFT OUTBOARD DU

PRIMARY ENGINE DISPLAY

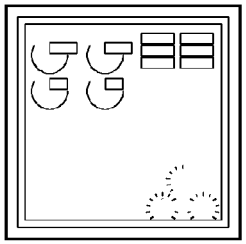


LEFT INBOARD DU



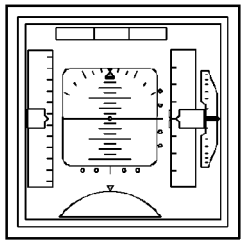
UPPER CENTER DU

PRIMARY ENGINE DISPLAY



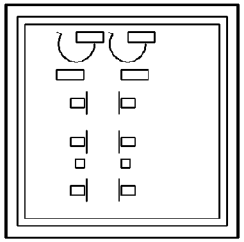
RIGHT INBOARD DU

PRIMARY FLIGHT DISPLAY



RIGHT OUTBOARD DU

SECONDARY ENGINE DISPLAY



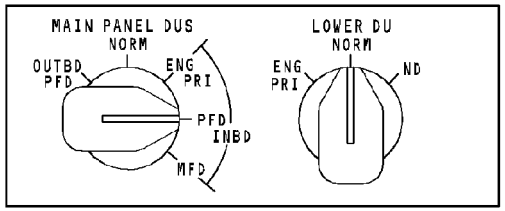
LOWER CENTER DU

CDS - OPERATION - SWITCHING - INBD ENG PRI POSITION

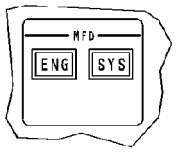
CDS - OPERATION - SWITCHING - INBD PFD POSITION

INBD PFD

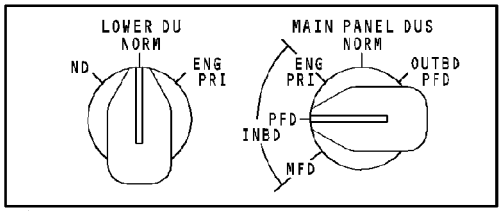
When you set the Main Panel DUs switch on the Display Select Panel to INBD PFD, the primary flight display shows on the inboard display unit. The outboard display unit does not show display data.



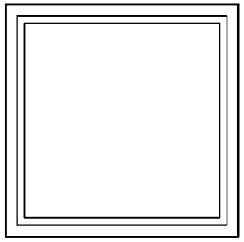
CAPTAIN DISPLAY SELECT PANEL



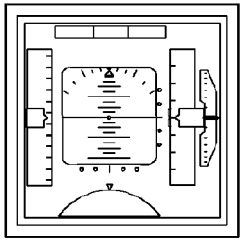
ENGINE DISPLAY CONTROL PANEL



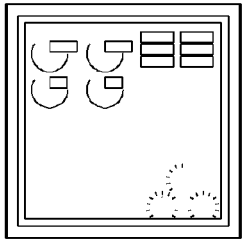
F/O DISPLAY SELECT PANEL


LEFT OUTBOARD DU

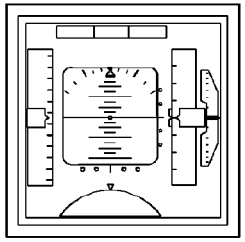
PRIMARY FLIGHT DISPLAY

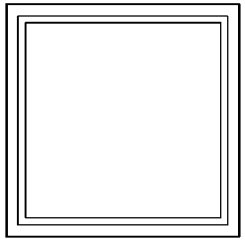

LEFT INBOARD DU

PRIMARY ENGINE DISPLAY

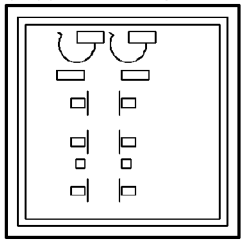

UPPER CENTER DU

PRIMARY FLIGHT DISPLAY


RIGHT INBOARD DU


RIGHT OUTBOARD DU

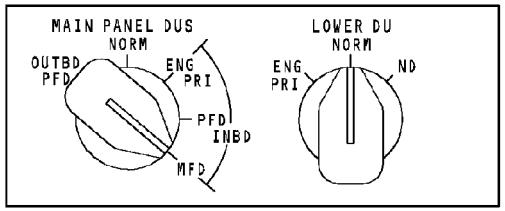
SECONDARY ENGINE DISPLAY


LOWER CENTER DU

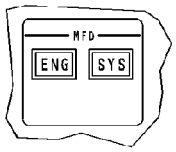
CDS - OPERATION - SWITCHING - INBD PFD POSITION

INBD MFD

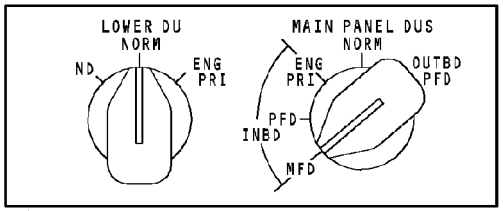
Set the Main Panel DUs switch on the Display Select Panel to INBD MFD to show the multi-function display (MFD) on the inboard display unit. Use the ENG and SYS keys on the engine display control panel to control the data that shows on the MFD. When you push the ENG key, the engine secondary display shows on the inboard display unit. When you push the SYS key, the systems display shows on the inboard display unit.



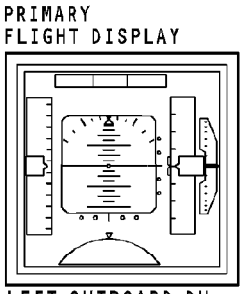
CAPTAIN DISPLAY SELECT PANEL



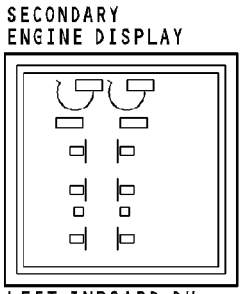
ENGINE DISPLAY CONTROL PANEL



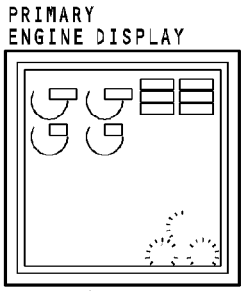
F/O DISPLAY SELECT PANEL



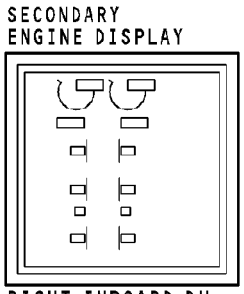
LEFT OUTBOARD DU



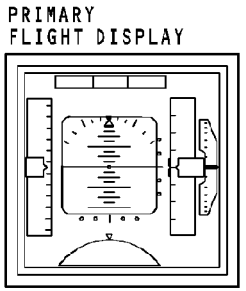
LEFT INBOARD DU



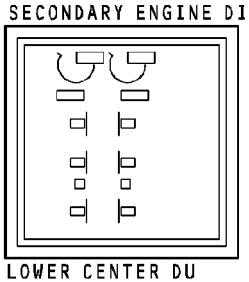
UPPER CENTER DU



RIGHT INBOARD DU



RIGHT OUTBOARD DU

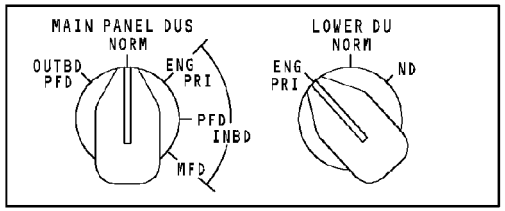


LOWER CENTER DU

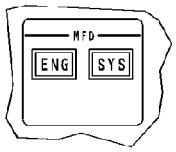
CDS - OPERATION - SWITCHING - INBD MFD POSITION

LOWER ENG

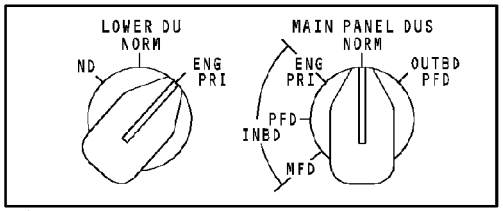
When you set the Lower DU switch on the Display Select Panel to ENG PRI, the primary engine display shows on the lower center display unit. The upper center display unit does not show data.



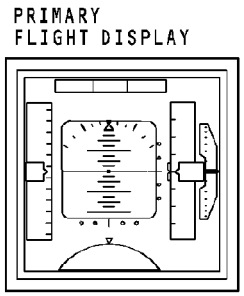
CAPTAIN DISPLAY SELECT PANEL



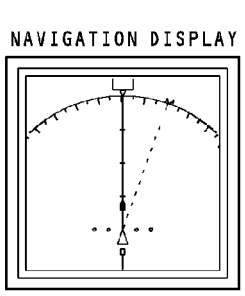
ENGINE DISPLAY CONTROL PANEL



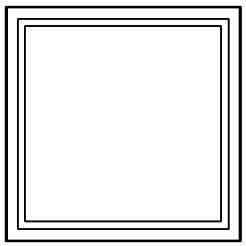
F/O DISPLAY SELECT PANEL



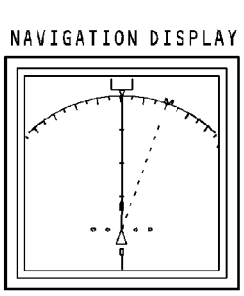
LEFT OUTBOARD DU



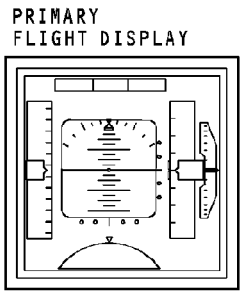
LEFT INBOARD DU



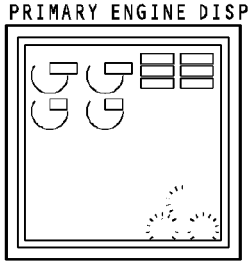
UPPER CENTER DU



RIGHT INBOARD DU



RIGHT OUTBOARD DU



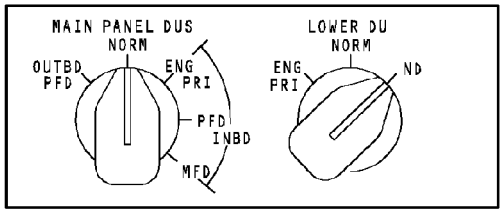
LOWER CENTER DU

CDS - OPERATION - SWITCHING - LOWER ENG POSITION

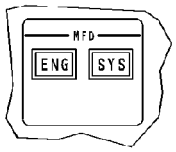
LOWER ND

If you set the Lower DU switch on the Display Select Panel to ND, the lower center display unit shows the navigation display.

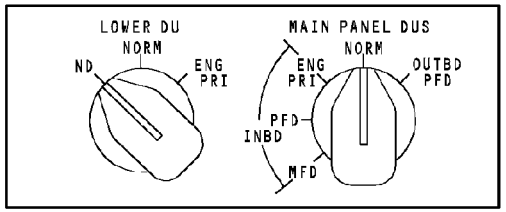
The captain and the first officer can each set the Lower DU switch on their Display Select Panels to ND. In that condition, the captain's navigation display shows on the lower center display unit.



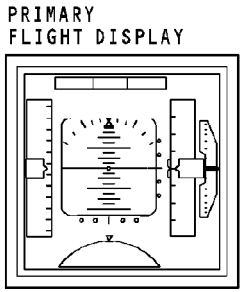
CAPTAIN DISPLAY SELECT PANEL



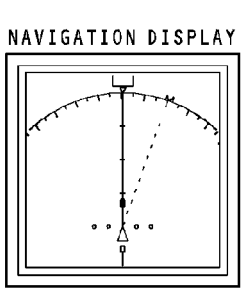
ENGINE DISPLAY CONTROL PANEL



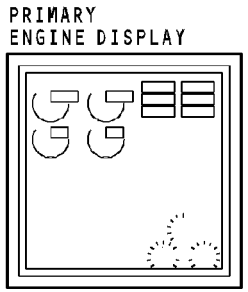
F/O DISPLAY SELECT PANEL



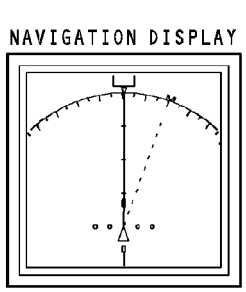
LEFT OUTBOARD DU



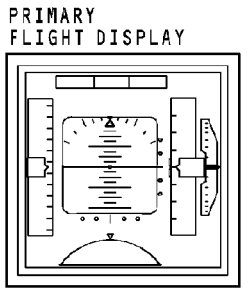
LEFT INBOARD DU



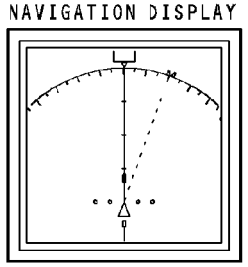
UPPER CENTER DU



RIGHT INBOARD DU



RIGHT OUTBOARD DU



LOWER CENTER DU

CDS - OPERATION - SWITCHING - LOWER ND POSITION

Inboard/Outboard Display Units

If the outboard display unit has a failure, the inboard display unit shows the primary flight display.

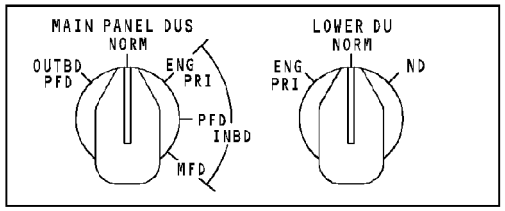
If the inboard display unit has a failure, the navigation display does not show.

Center Display Units

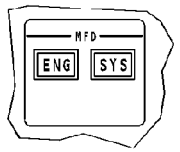
If the upper center display unit has a failure, the lower center display unit shows the primary engine display. If the secondary engine display already shows on the lower center display unit, the compacted engine display shows.

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.

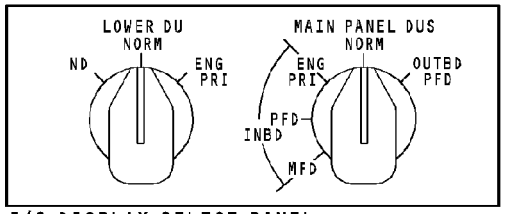
The lower center DU can show system data when the upper center DU shows the primary or compacted engine display. For this condition, if an exceedance occurs for secondary engine data, then the upper center display unit changes. The upper center display unit will show the compacted engine display with the exceedance data shown in a box.



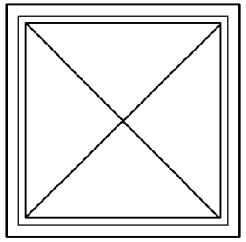
CAPTAIN DISPLAY SELECT PANEL



ENGINE DISPLAY CONTROL PANEL

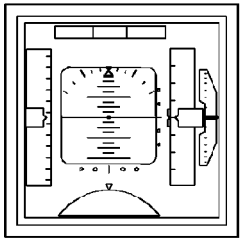


F/O DISPLAY SELECT PANEL

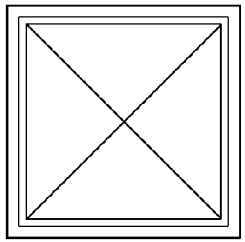


LEFT OUTBOARD DU

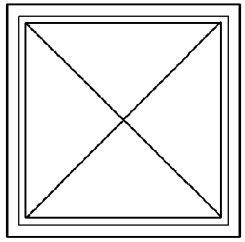
PRIMARY FLIGHT DISPLAY



LEFT INBOARD DU

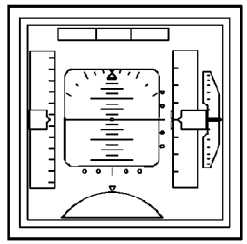


UPPER CENTER DU



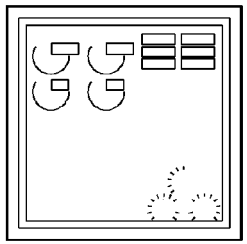
RIGHT INBOARD DU

PRIMARY FLIGHT DISPLAY



RIGHT OUTBOARD DU

PRIMARY ENGINE DISPLAY



LOWER CENTER DU

CDS - OPERATION - SWITCHING - AUTOMATIC

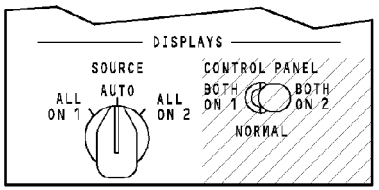
Display Source Selector

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.



SELECTOR POSITION / DU		LOB	LIB	UPPER C	LOWER C	RIB	ROB
AUTO	FAILURES NONE	DEU 1 GG A	DEU 1 GG A	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

CDS - OPERATION - DISPLAY SOURCE SELECTOR

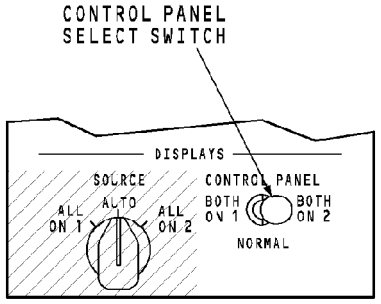
Control Panel Select Switch

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.



NAVIGATION/DISPLAYS SOURCE SELECT PANEL (P5)

DISPLAYS / SWITCH POSITION	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

CDS - OPERATION - CONTROL PANEL SELECT SWITCH

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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 engine 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.

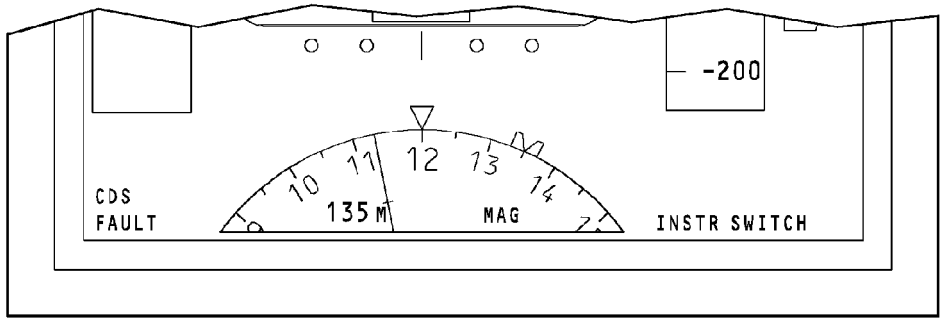
For these conditions, the CDS FAULT message shows and is removed when both engines start:

- 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.



INSTR SWITCH	INERTIAL REFERENCE DATA FROM SAME SOURCE
CDS MAINT	PARTIAL DEU FAILURE
CDS FAULT	DEU FAILURE OR BOTH DEU(S) HAVE A PARTIAL FAILURE OR INCOMPATIBLE S/W OR H/W OR MISCOMPARE OF CRITICAL DATA OR HOT BATTERY BUS NOT AVAILABLE OR DATA LOAD SWITCH IN DEU 1 OR DEU 2 POSITION (FOR HOT BATTERY BUS OR DATA LOAD SWITCH, CDS FAULT IS REMOVED WHEN BOTH ENGINES START.)
DSPLY SOURCE	SHOWS AFTER 2ND ENGINE STARTED FOR A CDS FAULT: DEU FAILURE, BOTH PARTIAL FAILURE, INCOMPATIBLE S/W OR H/W, OR CRITICAL DATA MISCOMPARE OR WHEN YOU SELECT ALL ON 1 (2).

CDS - TRAINING INFORMATION POINT - MAINTENANCE MESSAGES

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.

HAP 001-011 PRE SB 737-31-1136

Select the DEU position on the data loader control panel.

HAP 012, 013, 015-026, 028-054, 101-999; HAP 001-011 POST SB 737-31-1136

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.

HAP 031-054, 101-999

Put the diskette in the airborne data loader.

HAP 031-054, 101-999 (Continued)

HAP 001-013, 015-026, 028-030

Put the diskette in the portable data loader and connect the portable data loader to the data transfer unit receptacle.

HAP ALL

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.

HAP 031-054, 101-999

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.

HAP 001-011 PRE SB 737-31-1136

To download the BITE data, put the formatted diskette in the portable data loader. Select the DEU 1 or DEU 2 position 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.

HAP 012, 013, 015-026, 028-030; HAP 001-011 POST SB 737-31-1136

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.

HAP 012, 013, 015-026, 028-030; HAP 001-011 POST SB 737-31-1136 (Continued)
HAP 001-011 PRE SB 737-31-1136

Training Information Point

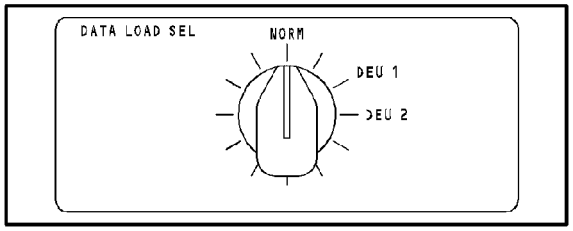
When you select DEU 1 or 2 on the data Load selector, that DEU does not drive any display units. The other DEU provides the data for all 6 DUs, and CDS FAULT shows.

HAP 012, 013, 015-026, 028-054, 101-999; HAP 001-011 POST SB 737-31-1136

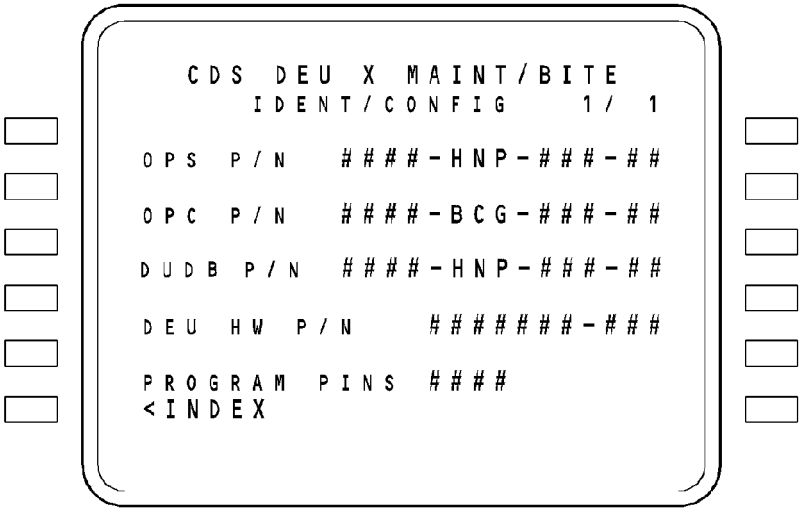
Training Information Point

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.

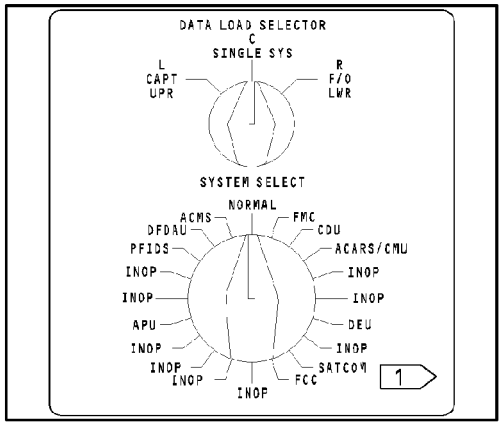
HAP ALL



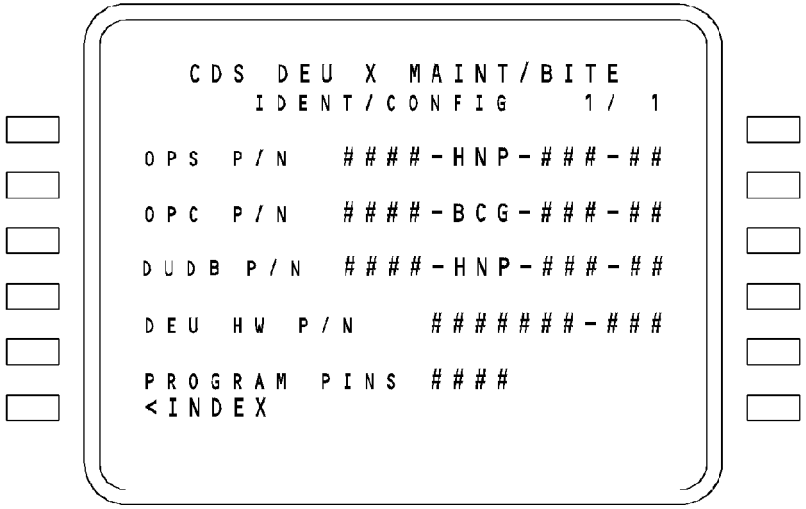
DATA LOADER CONTROL PANEL



CDU - CDS IDENT/CONFIGURATION PAGE



DATA LOADER CONTROL PANEL



CDU - CDS IDENT/CONFIGURATION PAGE

1 OPTIONAL SYSTEMS NOT ACTIVE ARE LABELED INOP.

CDS - TRAINING INFORMATION POINT - SOFTWARE LOADING

EFFECTIVITY

HAP 012, 013, 015-026, 028-054, 101-999; HAP 001-011 POST SB 737-31-1136

31-62-00

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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.

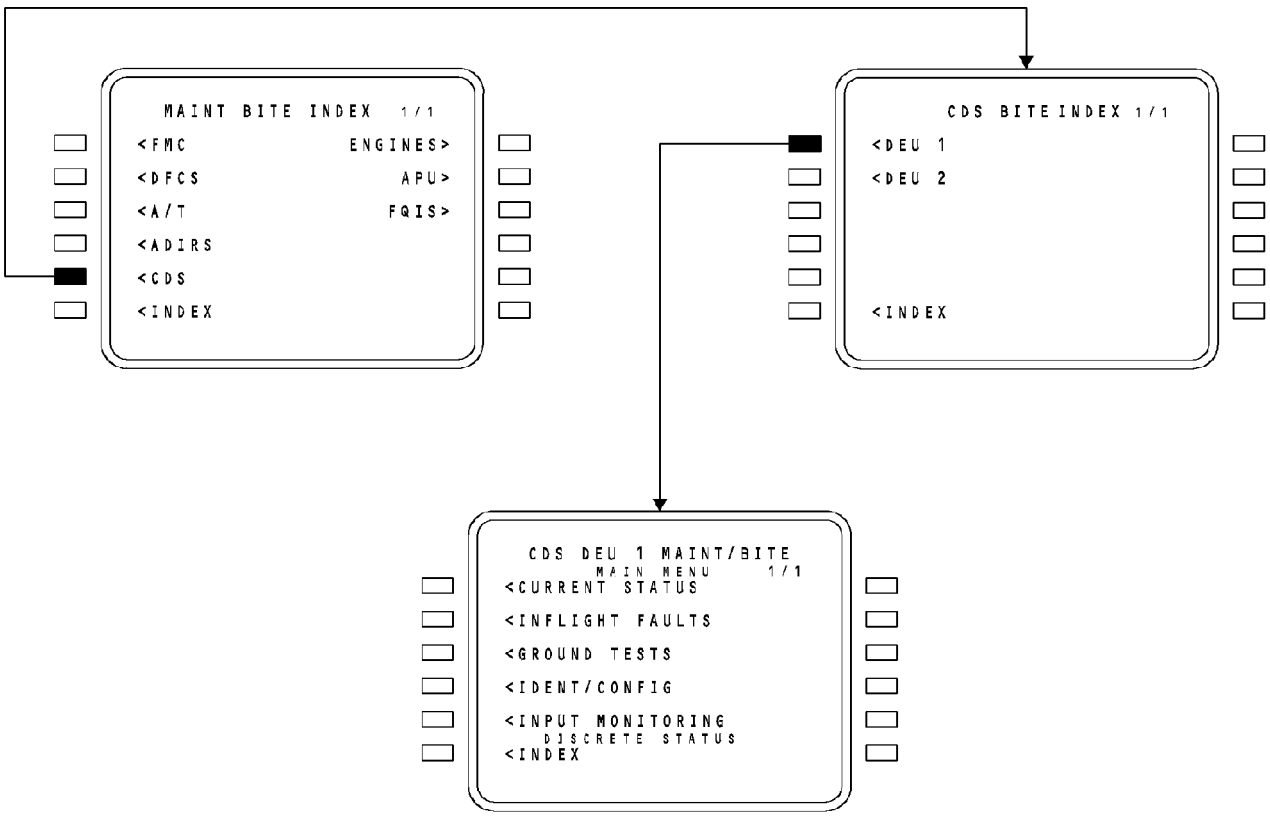
To do a check of the current status, select LSK 1L.

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.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - CDS BITE MAIN MENU

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:

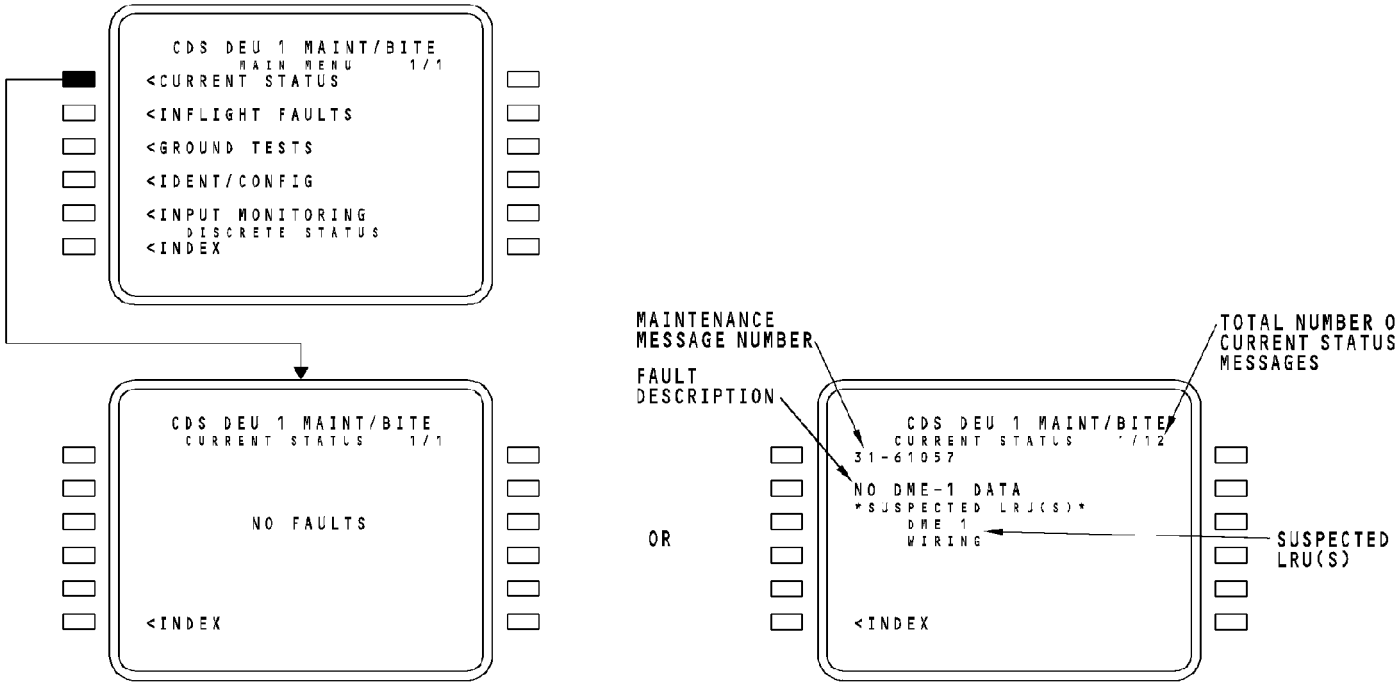
- Maintenance message number
- Fault description
- Suspected LRUs.

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.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - CURRENT STATUS

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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
- 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.

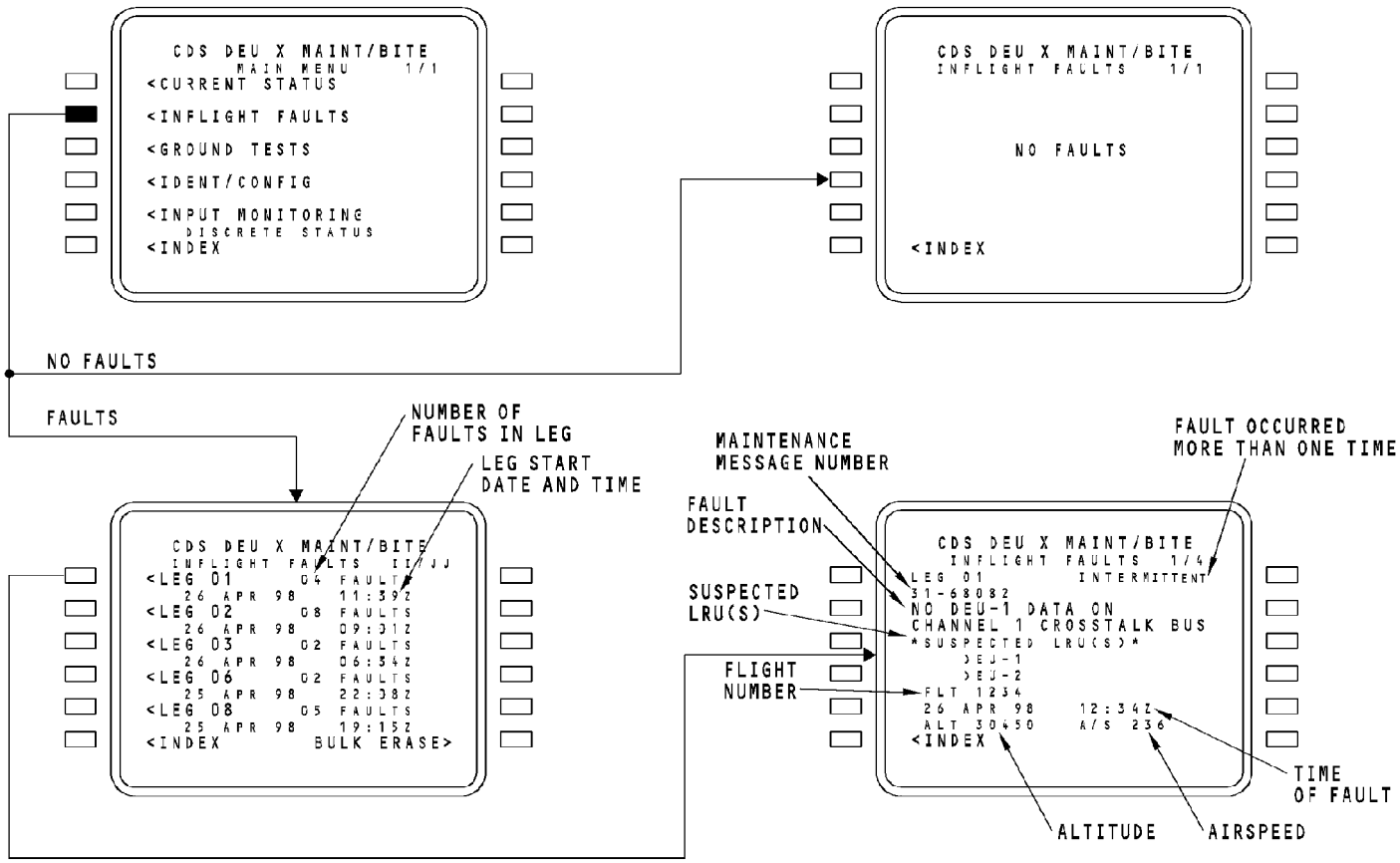
If the fault occurs more than once during the flight leg, you see the word INTERMITTENT near the top of the CDU page.

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.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS

CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS BULK ERASE

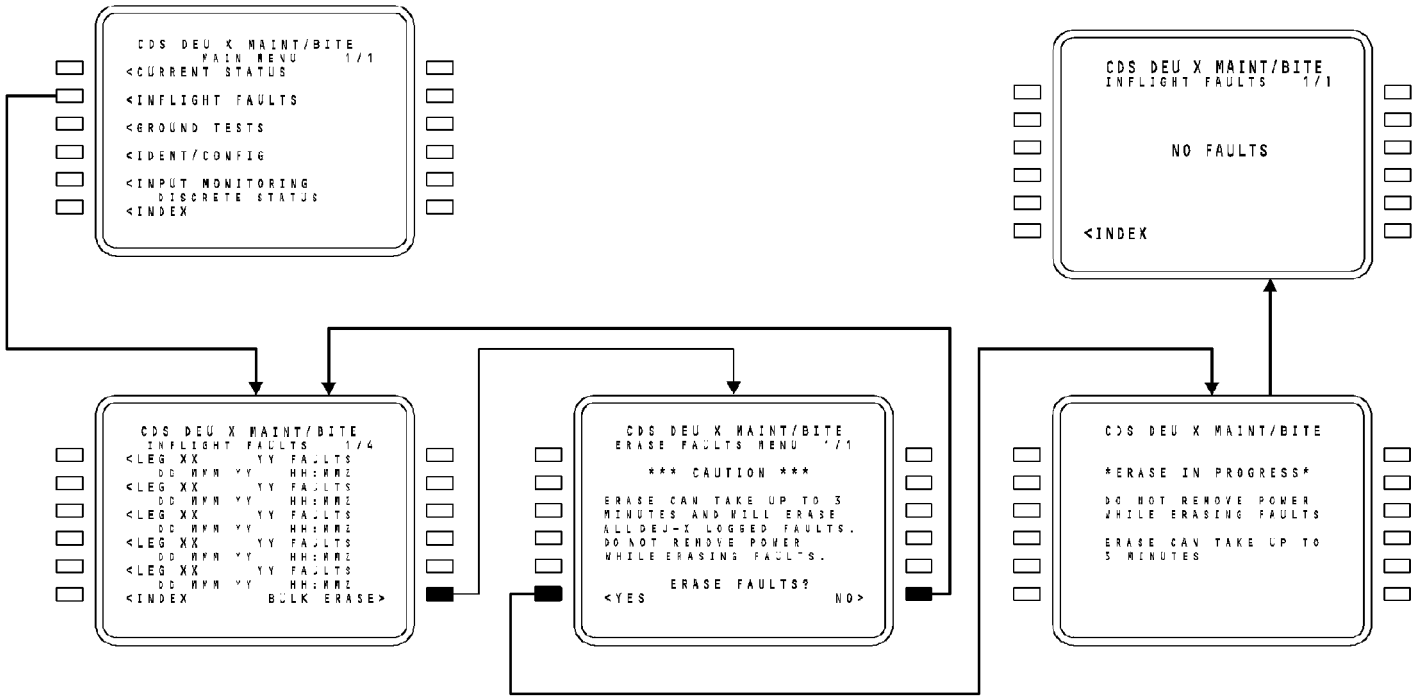
General

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.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INFLIGHT FAULTS BULK ERASE

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:

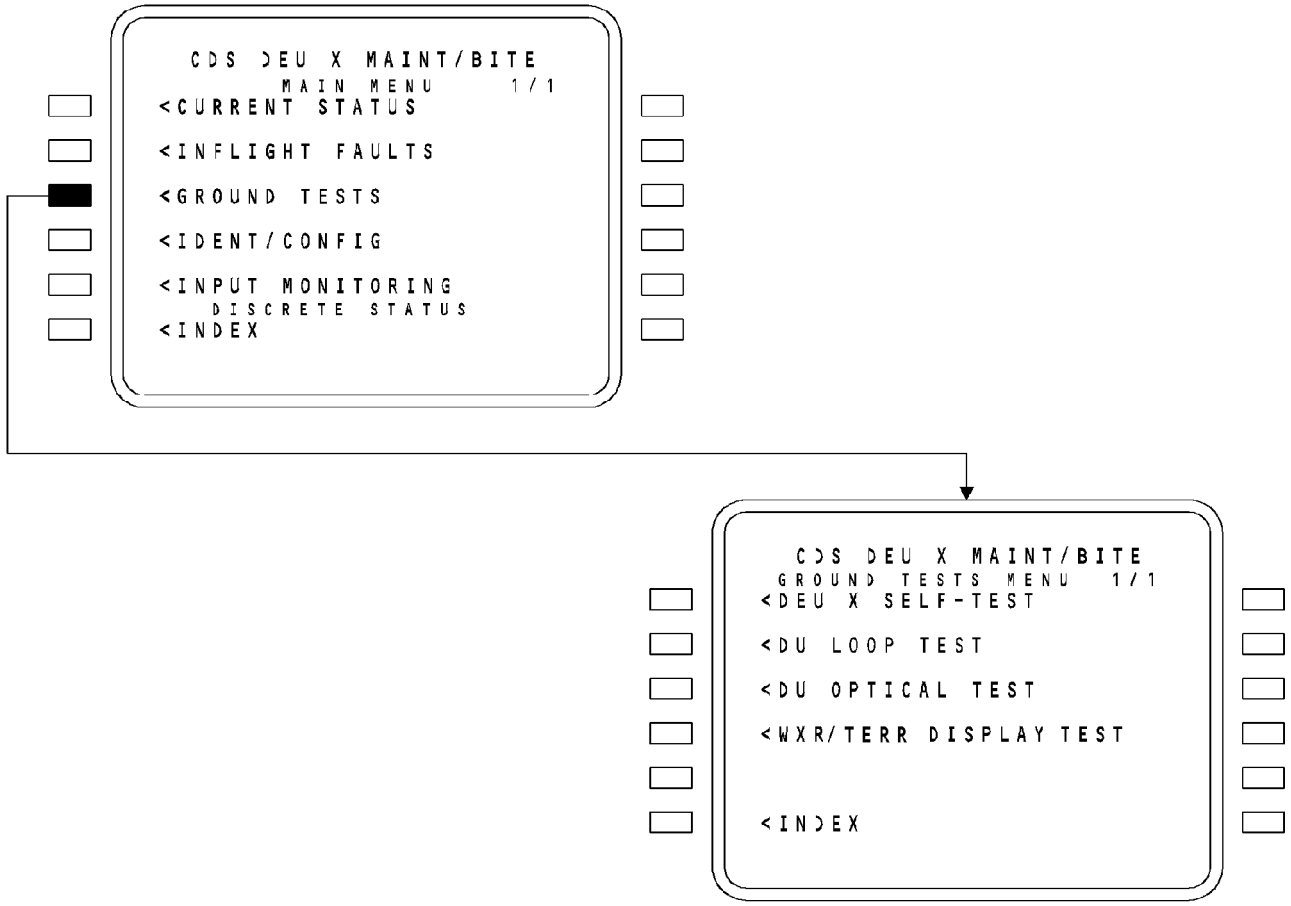
- DEU X self test
- DU loop test
- DU optical test
- WXR/TERR display test.

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.

HAP To operate the WXR/TERR display tests, select LSK 4L.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - GROUND TESTS MENU

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

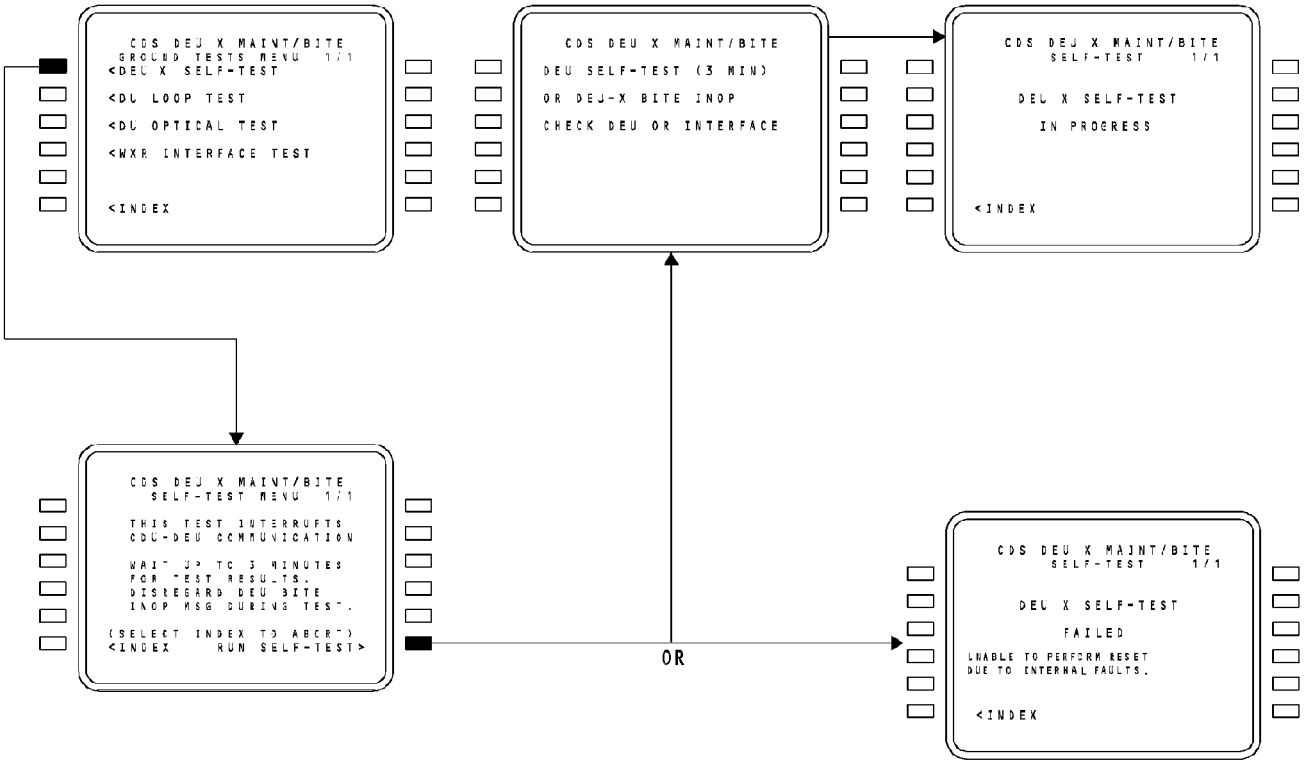
When the you select RUN on the SELF TEST MENU page, the core software takes 7 to 10 seconds to reset. The control screen shows DEU SELF-TEST during the DEU reset. If the reset cannot occur because of an internal DEU fault, the DEU SELF-TEST FAIL screen shows. If the DEU BITE is inoperative, the DEU SELF-TEST 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.

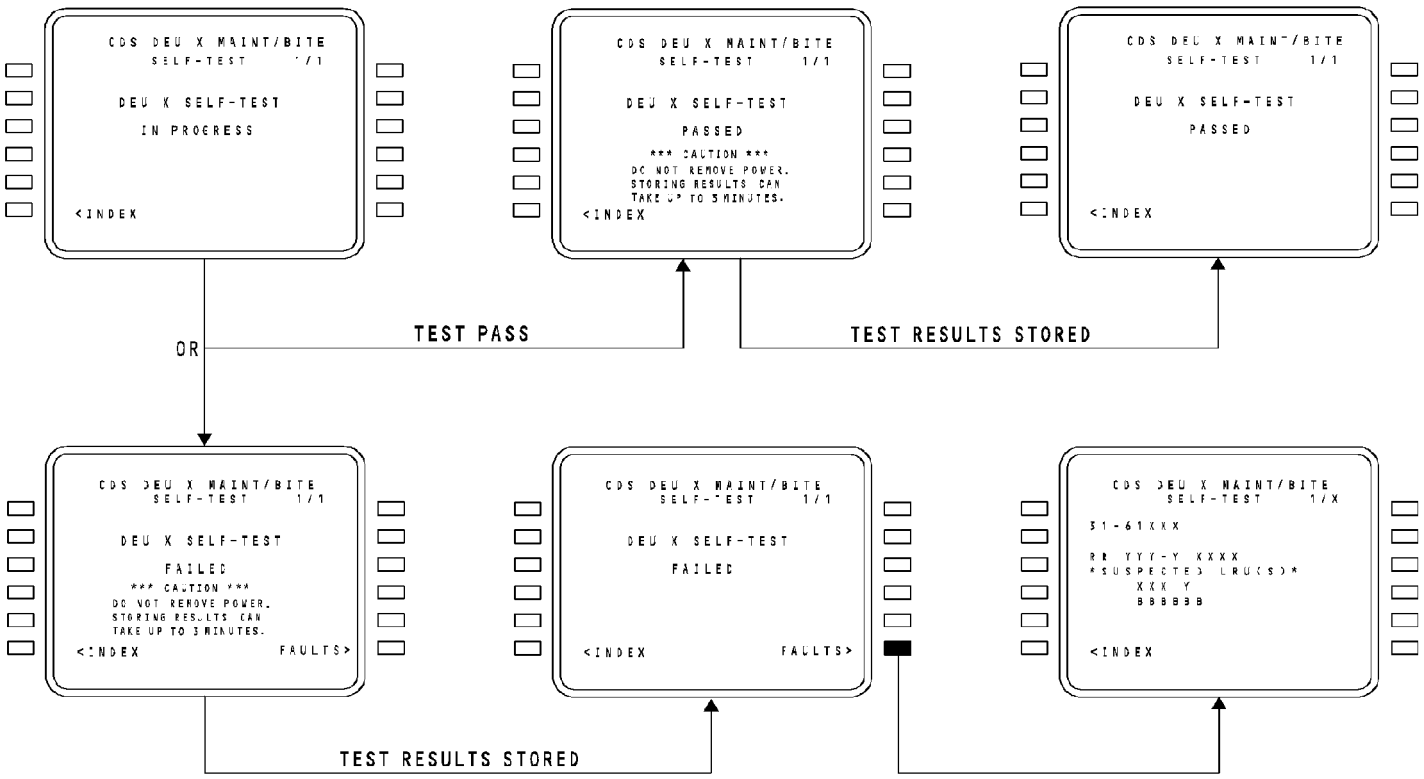


CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DEU SELF TEST 1

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.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DEU SELF-TEST 2

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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.

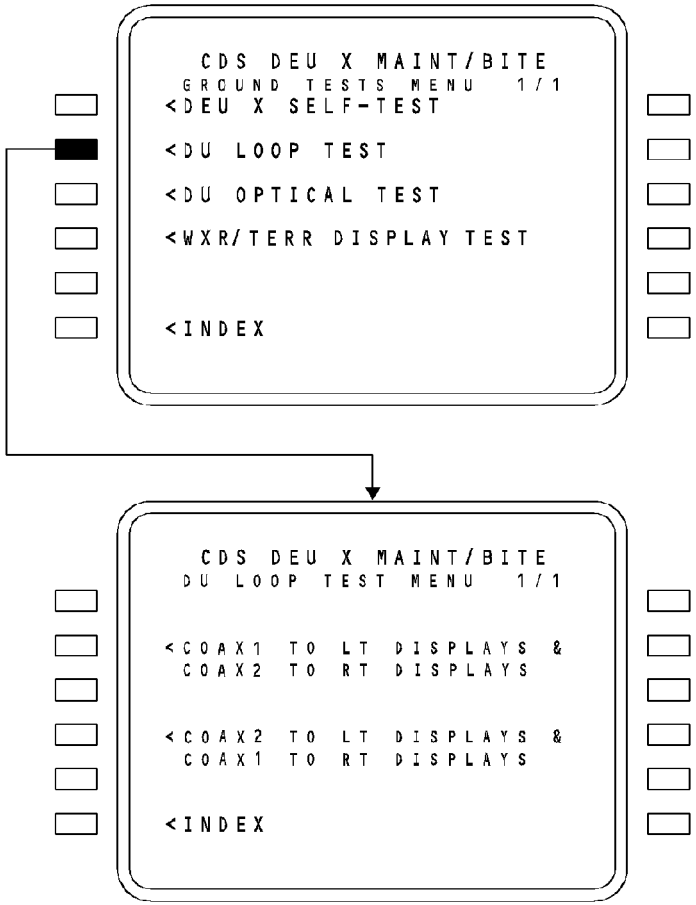
The coax cable input activity shows the status of the four coax cable inputs to the DU. A Y for yes and a N for no shows. A white highlight box shows around the specific coax cable input that currently transmits to the DU. From left to right the letters refer to these coaxial couplers:

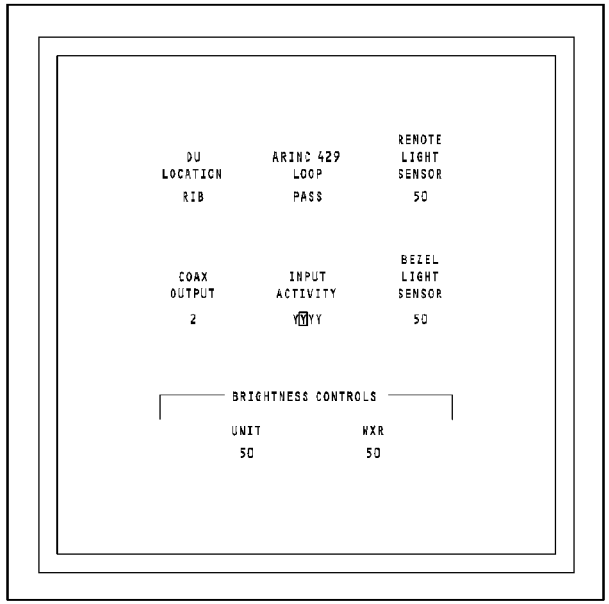
- First letter for coax coupler 1 from DEU 1, GG A
- Second letter for coax coupler 2 from DEU 1, GG B
- Third letter for coax coupler 4 from DEU 2, GG A
- Fourth letter for coax coupler 3 from DEU 2, GG B.

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.





DU - LOOP TEST

CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DU LOOP 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:

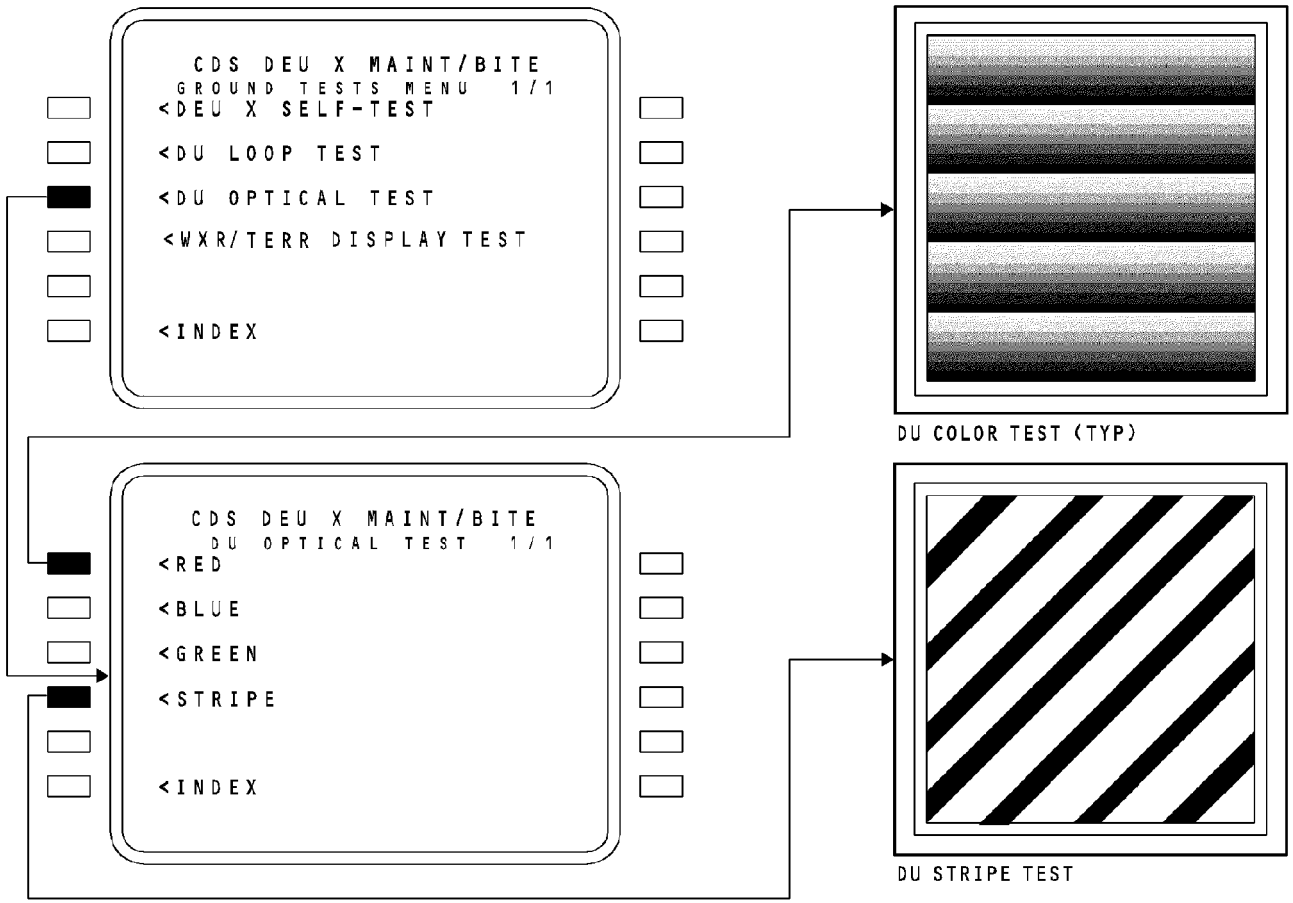
- RED
- BLUE
- GREEN
- STRIPE.

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.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - DU OPTICAL TEST

General

HAP 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.

HAP You do these tests to verify the weather radar and GPWS ARINC 453 interfaces to the DEUs.

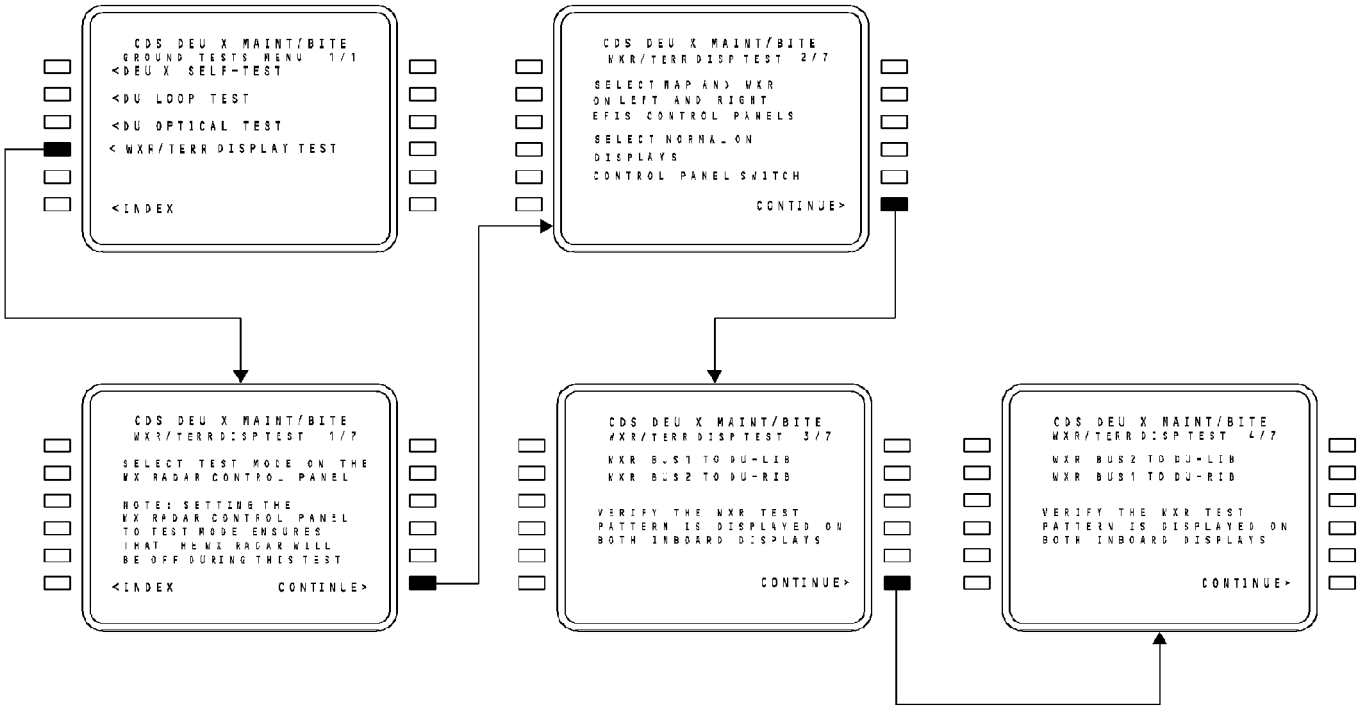
WXR/TERR DISPLAY TEST Page

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.

HAP Push LSK 6R, CONTINUE, to do a test of the terrain display.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - WXR/TERR DISPLAY TEST

HAP **General**

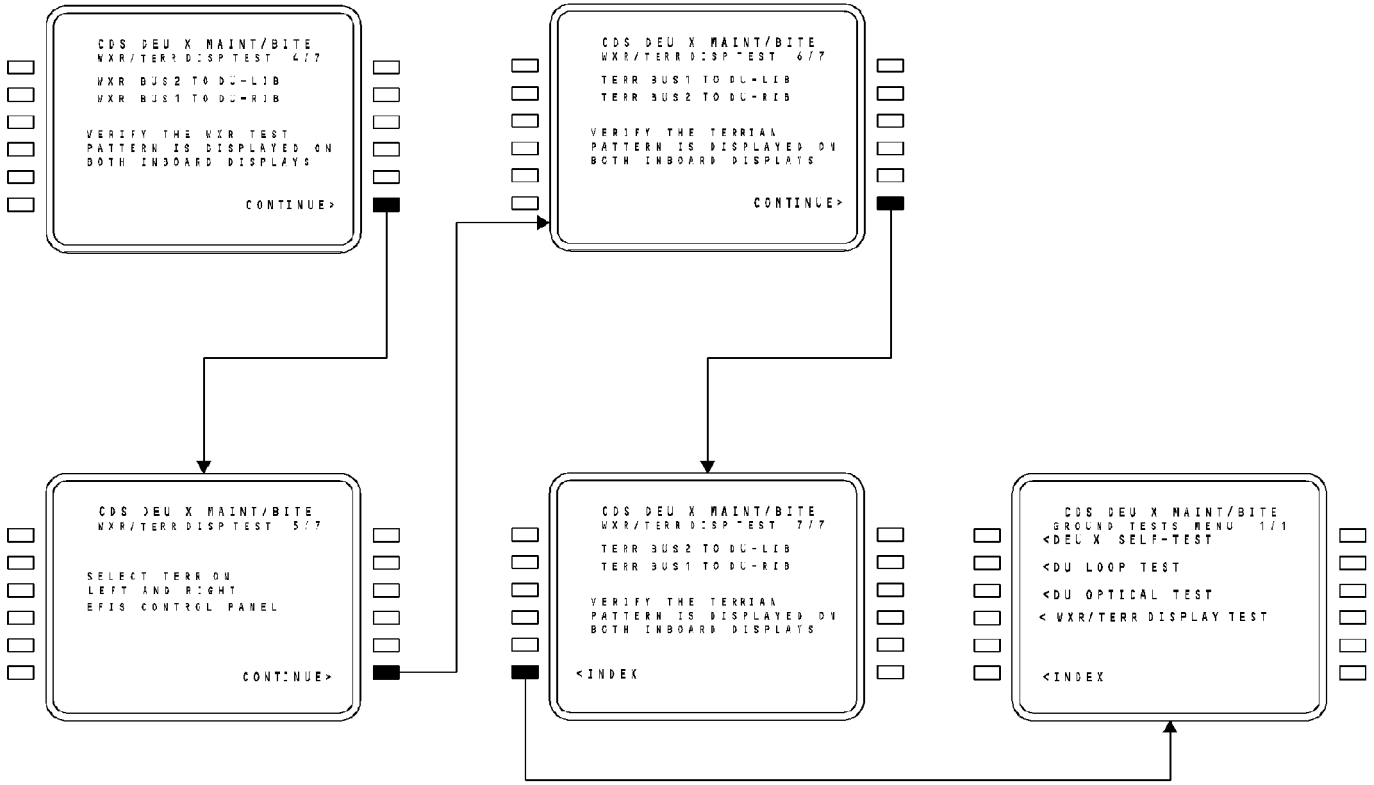
HAP You do this test to make sure the GPWS ARINC 453 interface to
HAP the DEUs is good.

HAP **WXR/TERR DISPLAY TEST Page 5**

HAP After the WXR display test is complete, you can do a test of the
HAP GPWS display. Follow the directions on the CDU page. Select
HAP TERR on both EFIS control panels. You should be in the correct
HAP mode on the navigation displays.

HAP If one of the terrain patterns does not show when you do the
HAP test, the ARINC 453 interface to the graphics generator is bad or
HAP the WXR/TERR relay is failed.

HAP To leave the test, push LSK 6R, CONTINUE. Then, push LSK 6L,
HAP INDEX.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - WXR/TERR DISPLAY TEST - TERR DISPLAY

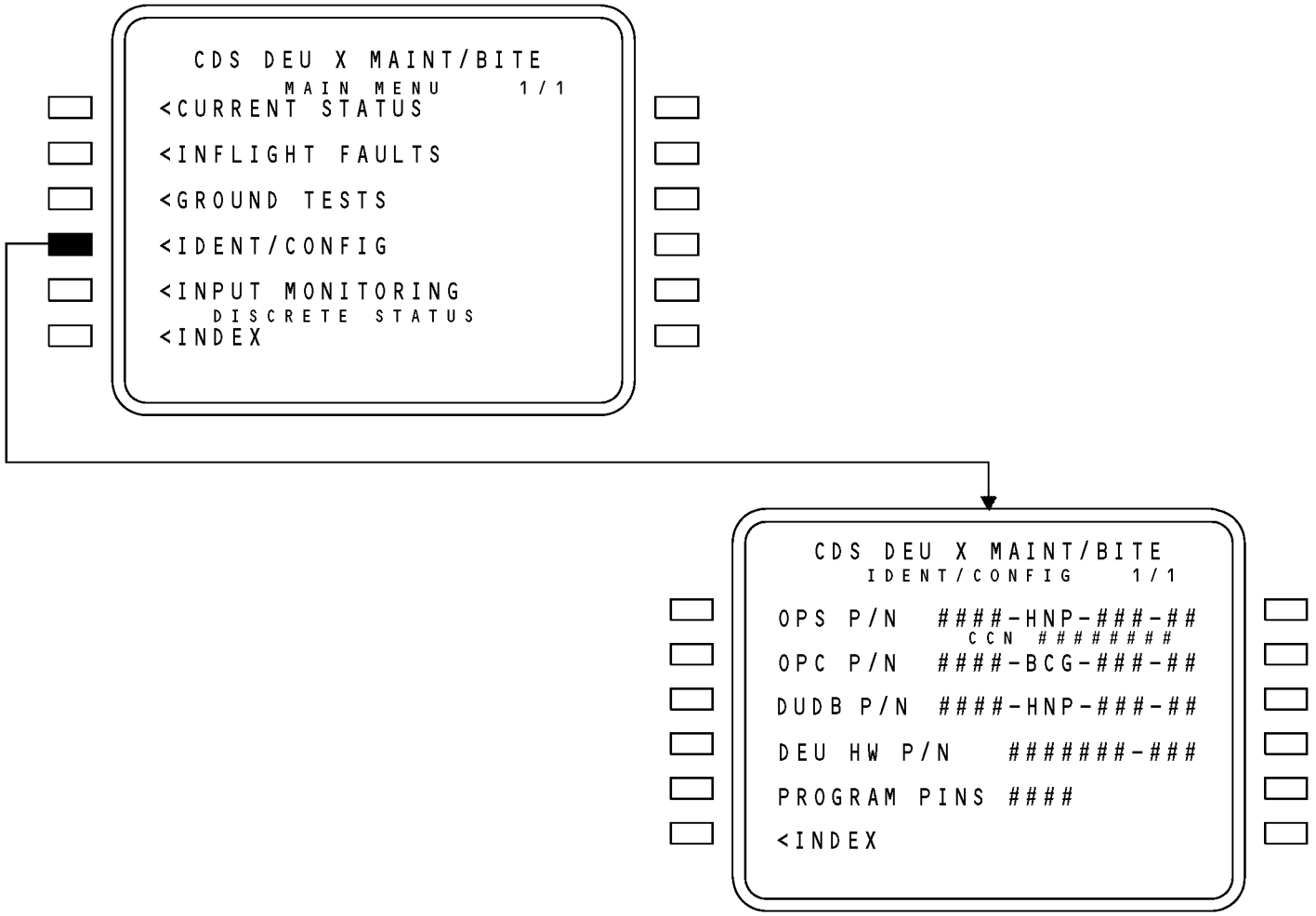
General

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.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - IDENT/CONFIG

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

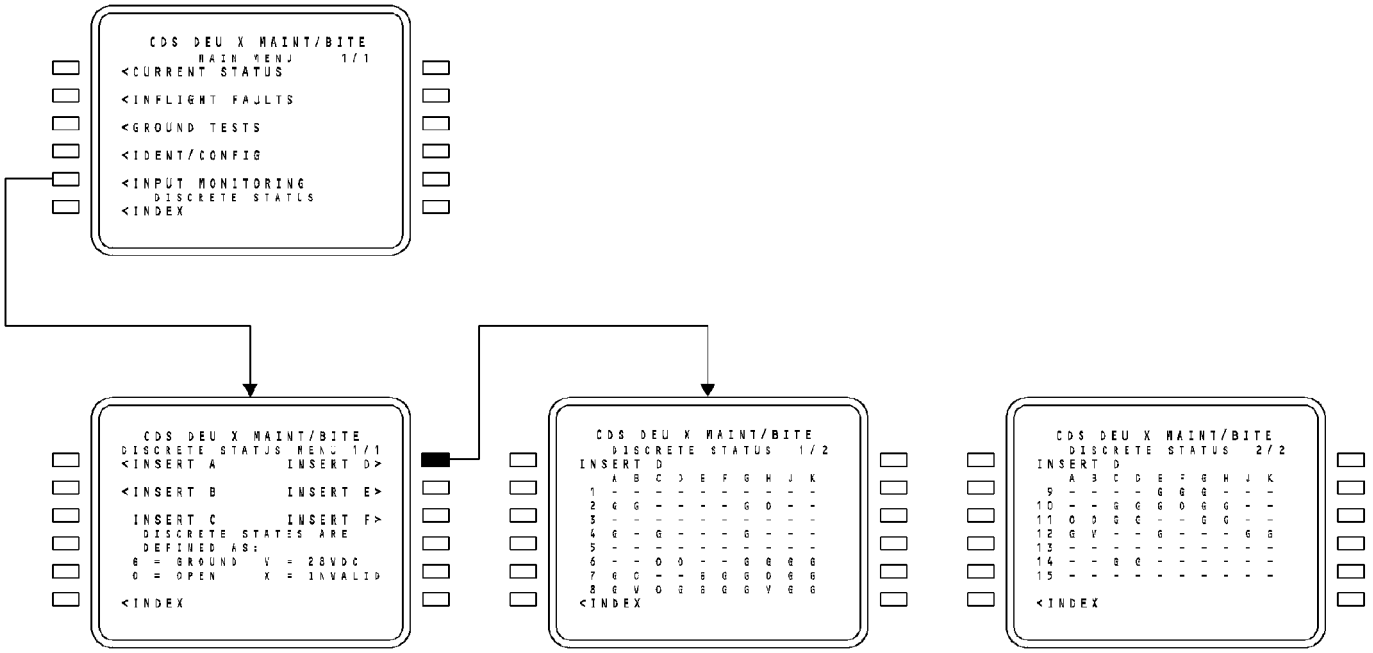
On the DISCRETE STATUS MENU page, you choose one of the five connectors. The connectors are A,B,D,E, and F.

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.

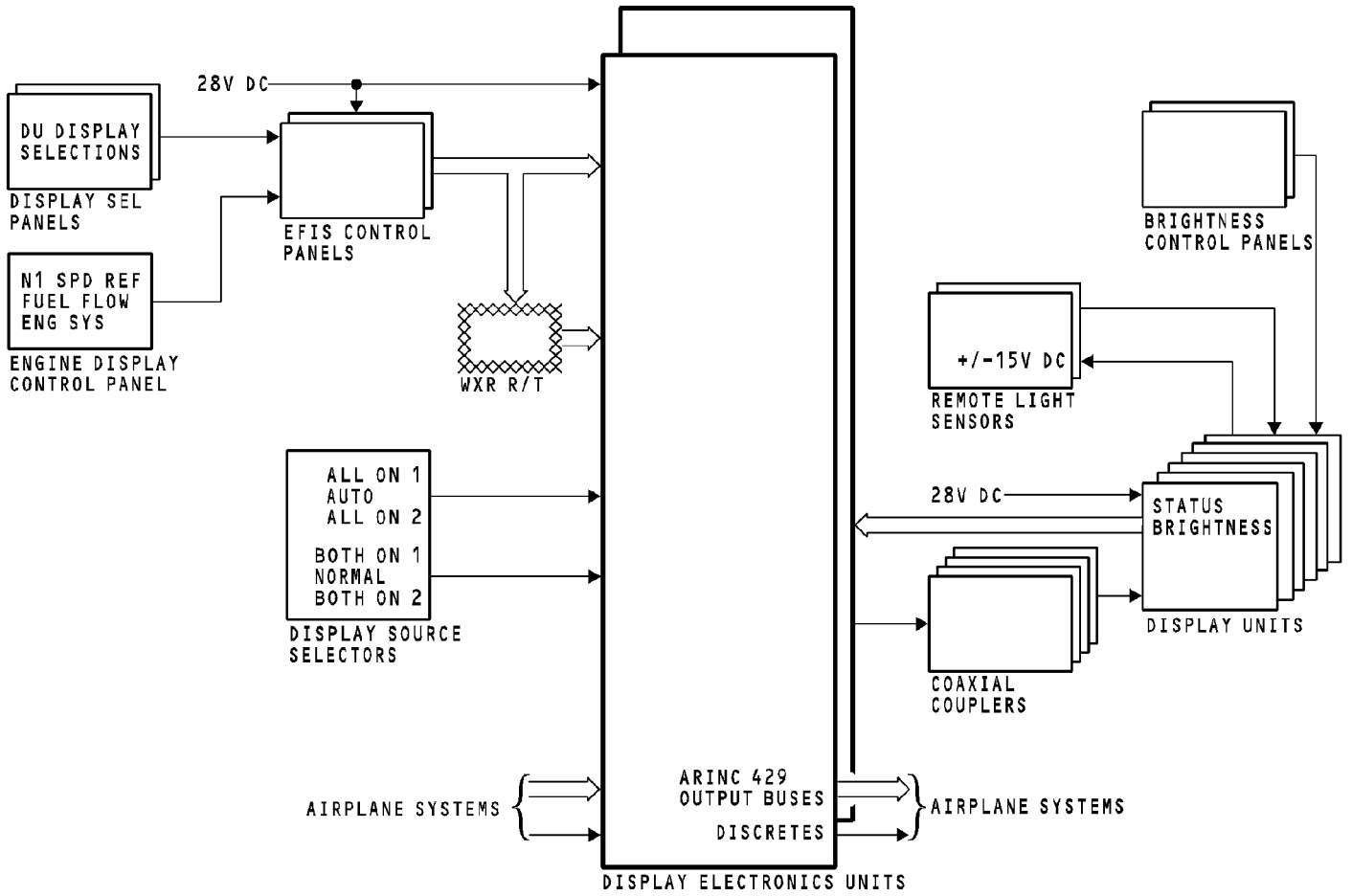
You can verify the status of a discrete input for detailed fault isolation procedures.



CDS - TRAINING INFORMATION POINT - CDU CDS BITE PAGES - INPUT MONITORING

General

This graphic is for reference purposes.



CDS - SYSTEM SUMMARY