

CHAPTER

31

Indicating and Recording Systems



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INDICATING AND RECORDING SYSTEMS

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3	May 05/2015		6	May 05/2015	
4	May 05/2015		7	May 05/2015	
5	May 05/2015		8	May 05/2015	
6	May 05/2015		9	May 05/2015	
7	May 05/2015		10	May 05/2015	
8	May 05/2015		11	May 05/2015	
9	May 05/2015		12	May 05/2015	
10	May 05/2015		13	May 05/2015	
11	May 05/2015		14	Sep 05/2016	
12	May 05/2015		15	May 05/2015	
13	May 05/2015		16	May 05/2015	
14	May 05/2015		17	Sep 05/2016	
15	May 05/2015		18	Sep 05/2016	
16	May 05/2015		19	Jan 05/2018	
17	May 05/2015		20	Jan 05/2018	
18	May 05/2015		21	Jan 05/2018	
19	May 05/2015		22	Jan 05/2018	
20	BLANK		23	Jan 05/2018	
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26	Jan 05/2018		20	BLANK	
27	Jan 05/2018		31-35-00		
28	BLANK		1	May 05/2015	
31-33-00			2	May 05/2015	
1	Jan 05/2016		3	May 05/2015	
2	May 05/2015		4	Jul 25/2018	
3	May 05/2017		5	Jul 25/2018	
4	May 05/2015		6	Jul 25/2018	
5	May 05/2017		7	Jul 25/2018	
6	May 05/2015		8	Jul 25/2018	
7	May 05/2015		9	Jul 25/2018	
8	May 05/2015		10	Jul 25/2018	
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10	May 05/2015		12	Jul 25/2018	
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12	May 05/2016		14	Jul 25/2018	
13	May 05/2016		15	Jul 25/2018	
14	May 05/2017		16	Jul 25/2018	
15	May 05/2017		17	Jul 25/2018	
16	Sep 05/2015		18	Jul 25/2018	
17	Sep 05/2015		19	Jul 25/2018	
18	Sep 05/2015		20	Jul 25/2018	

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O 22	Sep 05/2018		O 44	Sep 05/2018	
O 23	Sep 05/2018		O 45	Sep 05/2018	
O 24	Sep 05/2018		O 46	BLANK	
R 25	Sep 05/2018		D 47	Sep 05/2018	
O 26	Sep 05/2018		D 48	Sep 05/2018	
R 27	Sep 05/2018		D 49	Sep 05/2018	
O 28	Sep 05/2018		D 50	Sep 05/2018	
R 29	Sep 05/2018		D 51	Sep 05/2018	
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O 38	Sep 05/2018		D 60	Sep 05/2018	
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D 66	BLANK		22	May 05/2015	
31-41-00			23	May 05/2015	
1	May 05/2015		24	May 05/2015	
2	Jan 05/2018		25	May 05/2015	
3	Jan 05/2018		26	May 05/2015	
4	Jan 05/2018		27	May 05/2015	
5	May 05/2015		28	May 05/2015	
6	Jan 05/2018		29	May 05/2015	
7	Jan 05/2018		30	May 05/2015	
8	Jan 05/2018		31	Sep 05/2016	
9	May 05/2015		32	Sep 05/2016	
10	May 05/2015		33	Sep 05/2016	
11	May 05/2015		34	Sep 05/2016	
12	May 05/2015		35	May 05/2015	
13	May 05/2015		36	May 05/2015	
14	May 05/2015		37	Sep 05/2016	
15	May 05/2015		38	May 05/2015	
16	May 05/2015		39	May 05/2015	
17	May 05/2015		40	May 05/2015	
18	May 05/2015		41	May 05/2015	
19	May 05/2015		42	May 05/2015	
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44	May 05/2015		66	Jan 05/2018	
45	May 05/2015		67	Sep 05/2016	
46	May 05/2015		68	Sep 05/2016	
47	May 05/2015		69	Sep 05/2016	
48	May 05/2015		70	Sep 05/2016	
49	May 05/2015		71	Sep 05/2016	
50	Sep 05/2016		72	Sep 05/2016	
51	Sep 05/2016		73	Sep 05/2016	
52	Sep 05/2016		74	Sep 05/2016	
53	Sep 05/2016		75	Sep 05/2016	
54	Sep 05/2016		76	Sep 05/2016	
55	Sep 05/2016		77	Sep 05/2016	
56	Sep 05/2016		78	Sep 05/2016	
57	Sep 05/2016		79	May 05/2018	
58	Sep 05/2016		80	May 05/2018	
59	Sep 05/2016		81	Sep 05/2016	
60	Sep 05/2016		82	Sep 05/2016	
61	Sep 05/2016		83	Sep 05/2016	
62	Sep 05/2016		84	Sep 05/2016	
63	Sep 05/2016		85	Sep 05/2016	
64	Sep 05/2016		86	Sep 05/2016	

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88	Sep 05/2016		98.12	Jan 05/2018	
89	Sep 05/2016		98.13	Jan 05/2018	
90	Sep 05/2016		98.14	BLANK	
91	Jan 05/2018		31-51-00		
92	Sep 05/2017		1	May 05/2018	
93	Sep 05/2016		2	May 05/2018	
94	Jan 05/2018		3	May 05/2015	
95	Sep 05/2016		4	May 05/2018	
96	Jan 05/2018		5	May 05/2018	
97	Jan 05/2018		6	May 05/2018	
98	Jan 05/2018		7	May 05/2018	
98.1	Jan 05/2018		8	May 05/2016	
98.2	Jan 05/2018		9	May 05/2016	
98.3	Jan 05/2018		10	May 05/2016	
98.4	Jan 05/2018		11	May 05/2016	
98.5	Jan 05/2018		12	May 05/2016	
98.6	Jan 05/2018		13	May 05/2016	
98.7	Jan 05/2018		14	May 05/2016	
98.8	Jan 05/2018		15	May 05/2016	
98.9	Jan 05/2018		16	May 05/2018	
98.10	Jan 05/2018		17	May 05/2018	
			18	Jan 05/2018	

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21	May 05/2016		44	May 05/2018	
22	May 05/2016		45	May 05/2018	
23	May 05/2016		46	May 05/2016	
24	May 05/2016		47	May 05/2016	
25	May 05/2016		48	May 05/2016	
26	May 05/2016		49	May 05/2016	
27	May 05/2016		50	May 05/2016	
28	May 05/2016		51	May 05/2016	
29	May 05/2016		52	May 05/2016	
30	May 05/2016		53	May 05/2016	
31	May 05/2016		54	May 05/2016	
32	May 05/2016		55	May 05/2016	
33	May 05/2016		56	May 05/2016	
34	May 05/2016		57	May 05/2016	
35	May 05/2016		58	May 05/2016	
36	May 05/2016		59	May 05/2016	
37	May 05/2016		60	Jul 25/2018	
38	May 05/2016		61	May 05/2016	
39	May 05/2016		62	May 05/2016	
40	May 05/2016		63	May 05/2016	
41	May 05/2018		64	May 05/2016	

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67	May 05/2016		89	May 05/2016	
68	May 05/2016		90	May 05/2016	
69	May 05/2016		91	May 05/2016	
70	May 05/2016		92	May 05/2016	
71	May 05/2016		93	May 05/2016	
72	May 05/2016		94	May 05/2016	
73	May 05/2016		95	May 05/2016	
74	May 05/2016		96	May 05/2016	
75	May 05/2016		97	May 05/2016	
76	May 05/2016		98	May 05/2016	
77	May 05/2016		98.1	May 05/2016	
78	May 05/2016		98.2	May 05/2016	
79	May 05/2016		98.3	May 05/2016	
80	May 05/2016		98.4	May 05/2016	
81	May 05/2016		98.5	May 05/2016	
82	May 05/2016		98.6	May 05/2016	
83	May 05/2016		98.7	Sep 05/2016	
84	May 05/2016		98.8	Sep 05/2016	
85	May 05/2016		98.9	May 05/2016	
86	May 05/2016		98.10	May 05/2016	

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98.12	Sep 05/2017		9	May 05/2015	
98.13	May 05/2016		10	May 05/2015	
98.14	May 05/2016		11	May 05/2015	
98.15	May 05/2018		12	May 05/2015	
98.16	May 05/2018		13	May 05/2015	
98.17	May 05/2016		14	May 05/2015	
98.18	May 05/2016		15	May 05/2015	
98.19	May 05/2016		16	May 05/2015	
98.20	May 05/2016		17	May 05/2015	
98.21	May 05/2016		18	May 05/2015	
98.22	May 05/2016		19	May 05/2015	
98.23	May 05/2016		20	May 05/2015	
98.24	May 05/2016		21	May 05/2015	
98.25	May 05/2016		22	May 05/2015	
98.26	BLANK		23	May 05/2015	
31-61-00			24	May 05/2015	
1	May 05/2015		25	May 05/2015	
2	May 05/2015		26	May 05/2015	
3	May 05/2015		27	May 05/2015	
4	Jul 25/2018		28	May 05/2015	
5	May 05/2015		29	May 05/2015	
6	May 05/2015		30	May 05/2015	
7	Jan 05/2017				

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33	May 05/2015		55	May 05/2015	
34	May 05/2015		56	May 05/2015	
35	May 05/2015		57	May 05/2015	
36	May 05/2015		58	May 05/2015	
37	May 05/2015		59	May 05/2015	
38	May 05/2015		60	May 05/2015	
39	May 05/2015		61	May 05/2015	
40	May 05/2015		62	May 05/2015	
41	May 05/2015		63	May 05/2015	
42	Sep 05/2017		64	May 05/2015	
43	May 05/2015		65	May 05/2015	
44	May 05/2015		66	May 05/2015	
45	May 05/2017		67	May 05/2015	
46	May 05/2017		68	Sep 05/2016	
47	May 05/2017		69	Sep 05/2016	
48	May 05/2017		70	Sep 05/2016	
49	May 05/2017		71	May 05/2015	
50	May 05/2015		72	May 05/2015	
51	May 05/2015		73	May 05/2015	
52	May 05/2017		74	May 05/2015	

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76	May 05/2015		98	May 05/2015	
77	May 05/2015		98.1	May 05/2015	
78	May 05/2015		98.2	May 05/2015	
79	May 05/2015		98.3	May 05/2017	
80	May 05/2015		98.4	May 05/2017	
81	May 05/2015		98.5	May 05/2017	
82	May 05/2015		98.6	May 05/2015	
83	May 05/2015		98.7	May 05/2015	
84	May 05/2015		98.8	May 05/2015	
85	May 05/2015		98.9	May 05/2015	
86	May 05/2015		98.10	May 05/2015	
87	May 05/2015		98.11	May 05/2015	
88	May 05/2015		98.12	May 05/2015	
89	May 05/2015		98.13	May 05/2015	
90	May 05/2015		98.14	May 05/2015	
91	May 05/2015		98.15	May 05/2015	
92	May 05/2015		98.16	May 05/2015	
93	May 05/2015		98.17	May 05/2015	
94	May 05/2015		98.18	May 05/2015	
95	May 05/2015		98.19	May 05/2015	
96	May 05/2015		98.20	May 05/2015	

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98.22	May 05/2015		98.44	May 05/2015	
98.23	May 05/2018		98.45	May 05/2015	
98.24	May 05/2018		98.46	May 05/2015	
98.25	May 05/2015		98.47	May 05/2015	
98.26	May 05/2015		98.48	May 05/2015	
98.27	May 05/2015		98.49	May 05/2015	
98.28	May 05/2015		98.50	May 05/2015	
98.29	May 05/2015		98.51	May 05/2015	
98.30	May 05/2015		98.52	May 05/2015	
98.31	May 05/2015		98.53	Sep 05/2016	
98.32	May 05/2015		98.54	Sep 05/2016	
98.33	May 05/2015		98.55	May 05/2017	
98.34	May 05/2015		98.56	May 05/2017	
98.35	May 05/2015		98.57	May 05/2017	
98.36	May 05/2015		98.58	May 05/2015	
98.37	May 05/2015		98.59	May 05/2015	
98.38	May 05/2015		98.60	Sep 05/2016	
98.39	May 05/2015		98.61	Sep 05/2016	
98.40	May 05/2015		98.62	Sep 05/2016	
98.41	May 05/2015		98.63	May 05/2015	
98.42	May 05/2015		98.64	Sep 05/2016	
			98.65	May 05/2018	

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98.66	May 05/2018		98.89	Sep 05/2016	
98.67	May 05/2015		98.90	Sep 05/2016	
98.68	Sep 05/2016		98.91	Sep 05/2016	
98.69	Sep 05/2016		98.92	Sep 05/2016	
98.70	Sep 05/2016		98.93	Sep 05/2016	
98.71	Sep 05/2016		98.94	Sep 05/2016	
98.72	Sep 05/2016		98.95	Sep 05/2016	
98.73	Sep 05/2016		98.96	Sep 05/2016	
98.74	Sep 05/2016		98.97	Sep 05/2016	
98.75	Sep 05/2016		98.98	Sep 05/2016	
98.76	Sep 05/2016		98.99	Sep 05/2016	
98.77	Sep 05/2016		98.100	Sep 05/2016	
98.78	Sep 05/2016		98.101	Sep 05/2016	
98.79	Sep 05/2016		98.102	Sep 05/2016	
98.80	Sep 05/2016		98.103	Sep 05/2016	
98.81	Sep 05/2016		98.104	Jan 05/2018	
98.82	Sep 05/2016		98.105	Jan 05/2018	
98.83	Sep 05/2016		98.106	Jan 05/2018	
98.84	Sep 05/2016		98.107	Jan 05/2018	
98.85	Sep 05/2016		98.108	Jan 05/2018	
98.86	Sep 05/2016		98.109	Jan 05/2018	
98.87	Sep 05/2016		98.110	Jan 05/2018	
98.88	Sep 05/2016				

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98.113	Jan 05/2018		98.136	Jan 05/2018	
98.114	Jan 05/2018		98.137	Jan 05/2018	
98.115	Jan 05/2018		98.138	Jan 05/2018	
98.116	Jan 05/2018		98.139	Jan 05/2018	
98.117	Jan 05/2018		98.140	Jan 05/2018	
98.118	Jan 05/2018		98.141	Jan 05/2018	
98.119	Jan 05/2018		98.142	Jan 05/2018	
98.120	Jan 05/2018		98.143	Jan 05/2018	
98.121	Jan 05/2018		98.144	Jan 05/2018	
98.122	Jan 05/2018		98.145	Jan 05/2018	
98.123	Jan 05/2018		98.146	Jan 05/2018	
98.124	Jan 05/2018		98.147	Jan 05/2018	
98.125	Jan 05/2018		98.148	Jan 05/2018	
98.126	Jan 05/2018		98.149	Jan 05/2018	
98.127	Jan 05/2018		98.150	Jan 05/2018	
98.128	Jan 05/2018		98.151	Jan 05/2018	
98.129	Jan 05/2018		98.152	Jan 05/2018	
98.130	Jan 05/2018		98.153	Jan 05/2018	
98.131	Jan 05/2018		98.154	Jan 05/2018	
98.132	Jan 05/2018		98.155	Jan 05/2018	
98.133	Jan 05/2018		98.156	Jan 05/2018	

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98.157	Jan 05/2018		98.179	Jan 05/2018	
98.158	Jan 05/2018		98.180	Jan 05/2018	
98.159	Jan 05/2018		98.181	Jan 05/2018	
98.160	Jan 05/2018		98.182	Jan 05/2018	
98.161	Jan 05/2018		98.183	Jan 05/2018	
98.162	Jan 05/2018		98.184	Jan 05/2018	
98.163	Jan 05/2018		98.185	Jan 05/2018	
98.164	Jan 05/2018		98.186	Jan 05/2018	
98.165	Jan 05/2018		98.187	Jan 05/2018	
98.166	Jan 05/2018		98.188	Jan 05/2018	
98.167	May 05/2018		98.189	Jan 05/2018	
98.168	May 05/2018		98.190	Jan 05/2018	
98.169	Jan 05/2018		98.191	Jan 05/2018	
98.170	Jan 05/2018		98.192	Jan 05/2018	
98.171	Jan 05/2018		98.193	Jan 05/2018	
98.172	Jan 05/2018		98.194	Jan 05/2018	
98.173	Jan 05/2018		98.195	Jan 05/2018	
98.174	Jan 05/2018		98.196	Jan 05/2018	
98.175	Jan 05/2018		98.197	Jan 05/2018	
98.176	Jan 05/2018		98.198	Jan 05/2018	
98.177	Jan 05/2018		98.199	Jan 05/2018	
98.178	Jan 05/2018		98.200	Jan 05/2018	

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98.201	Jan 05/2018		98.223	Jan 05/2018	
98.202	Jan 05/2018		98.224	Jan 05/2018	
98.203	Jan 05/2018		98.225	Jan 05/2018	
98.204	Jan 05/2018		98.226	Jan 05/2018	
98.205	Jan 05/2018		98.227	Jan 05/2018	
98.206	Jan 05/2018		98.228	Jan 05/2018	
98.207	Jan 05/2018		98.229	Jan 05/2018	
98.208	Jan 05/2018		98.230	Jan 05/2018	
98.209	Jan 05/2018		98.231	Jan 05/2018	
98.210	Jan 05/2018		98.232	Jan 05/2018	
98.211	Jan 05/2018		98.233	Jan 05/2018	
98.212	Jan 05/2018		98.234	Jan 05/2018	
98.213	Jan 05/2018		98.235	Jan 05/2018	
98.214	Jan 05/2018		98.236	Jan 05/2018	
98.215	Jan 05/2018		98.237	Jan 05/2018	
98.216	Jan 05/2018		98.238	Jan 05/2018	
98.217	Jan 05/2018		98.239	Jan 05/2018	
98.218	Jan 05/2018		98.240	Jan 05/2018	
98.219	Jan 05/2018		98.241	Jan 05/2018	
98.220	Jan 05/2018		98.242	Jan 05/2018	
98.221	Jan 05/2018		98.243	Jan 05/2018	
98.222	Jan 05/2018		98.244	Jan 05/2018	

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98.245	Jan 05/2018				
98.246	Jan 05/2018				
98.247	Jan 05/2018				
98.248	Jan 05/2018				
98.249	Jan 05/2018				
98.250	Jan 05/2018				
98.251	Jan 05/2018				
98.252	BLANK				

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31-09-00	SYSTEMS CARD FILES - GENERAL DESCRIPTION	4	ARO ALL
31-09-00	SYSTEMS CARD FILES - COMPONENT LOCATION - MAIN EQUIPMENT CENTER	6	ARO ALL
31-09-00	SYSTEMS CARD FILES - COMPONENT LOCATION - LSCF CARDS	8	ARO ALL
31-09-00	SYSTEMS CARD FILES - COMPONENT LOCATION - RSCF CARDS	10	ARO ALL
31-09-00	SYSTEMS CARD FILES - POWER INTERFACES	12	ARO ALL
31-09-00	SYSTEMS CARD FILES - LSCF POWER INTERFACES	14	ARO ALL
31-09-00	SYSTEMS CARD FILES - RSCF POWER INTERFACES	16	ARO ALL
31-09-00	SYSTEMS CARD FILES - ARINC 429 AND 629 INTERFACES	18	ARO ALL
31-09-00	SYSTEMS CARD FILES	20	ARO ALL
31-09-00	SYSTEMS CARD FILES - ASG CARDS	22	ARO ALL
31-09-00	SYSTEMS CARD FILES - ASG CARD FUNCTIONAL DESCRIPTION	24	ARO ALL
31-25-00	CLOCKS - INTRODUCTION	2	ARO ALL
31-25-00	CLOCKS - GENERAL DESCRIPTION	4	ARO ALL
31-25-00	CLOCKS - COMPONENT LOCATIONS	6	ARO ALL
31-25-00	CLOCKS - INTERFACES	8	ARO ALL
31-25-00	CLOCKS - CLOCK	10	ARO ALL
31-25-00	CLOCKS - CLOCK SWITCH/PUSHBUTTON	12	ARO ALL
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31-25-00	CLOCKS - FUNCTIONAL DESCRIPTION	18	ARO ALL
31-31-00	FLIGHT DATA RECORDER SYSTEM - INTRODUCTION	2	ARO ALL
31-31-00	FDRS - GENERAL DESCRIPTION	4	ARO ALL
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31-31-00	FDRS - COMPONENT LOCATIONS - 2	8	ARO ALL
31-31-00	FDRS - SYSTEM INTERFACE	10	ARO ALL
31-31-00	FDRS - FLIGHT DATA RECORDER	12	ARO ALL
31-31-00	FDRS - UNDERWATER LOCATING DEVICE	14	ARO ALL
31-31-00	FDRS - DFDAF FUNCTIONAL DESCRIPTION	17	ARO ALL
31-31-00	FDRS - FDR FUNCTIONAL DESCRIPTION	20	ARO ALL
31-31-00	FDRS - SYSTEM TESTS	22	ARO ALL
31-31-00	FDRS - SPECIAL FUNCTIONS	24	ARO ALL
31-31-00	FDRS - SYSTEM SCHEMATIC	26	ARO ALL
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31-33-00	FLIGHT COMPARTMENT PRINTING SYSTEM - COMPONENT LOCATIONS - FLIGHT COMPARTMENT	4	ARO ALL
31-33-00	FLIGHT COMPARTMENT PRINTING SYSTEM - COMPONENT LOCATIONS - MEC	6	ARO ALL
31-33-00	FLIGHT COMPARTMENT PRINTING SYSTEM - INTERFACES	8	ARO ALL
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31-33-00	FLIGHT COMPARTMENT PRINTING SYSTEM- FUNCTIONAL DESCRIPTION	16	ARO ALL
31-33-00	FLIGHT COMPARTMENT PRINTING SYSTEM - OPERATIONAL GROUND TESTS	18	ARO ALL
31-35-00	AIRPLANE CONDITION MONITORING SYSTEM - INTRODUCTION	2	ARO ALL
31-35-00	ACMS - GENERAL DESCRIPTION	4	ARO ALL
31-35-00	ACMS - COMPONENT LOCATION	6	ARO ALL
31-35-00	ACMS - INTERFACES	8	ARO ALL
31-35-00	ACMS - QUICK ACCESS RECORDER	10	ARO ALL
31-35-00	ACMS - ACMF FUNCTIONAL DESCRIPTION	13	ARO ALL
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31-35-00	ACMS - OPERATION - ENGINE REPORTS MENU	20	ARO ALL
31-35-00	ACMS - OPERATION - OTHER REPORTS MENU	22	ARO ALL
31-35-00	ACMS - OPERATION - MAIN MENU	24	ARO ALL
31-35-00	ACMS - OPERATION - TITLE SCREEN	26	ARO ALL
31-35-00	ACMS - OPERATION - MNEMONICS	28	ARO ALL
31-35-00	ACMS - OPERATION - SIGNAL SOURCE DIALOG BOX	30	ARO ALL
31-35-00	ACMS - OPERATION - MODIFIABLE CONSTANTS	32	ARO ALL
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31-35-00	ACMS - OPERATION - TRACE LOG	42	ARO ALL
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31-41-00	AIRPLANE INFORMATION MANAGEMENT SYSTEM (AIMS)- INTRODUCTION	2	ARO ALL
31-41-00	AIMS - GENERAL DESCRIPTION - 1	6	ARO ALL
31-41-00	AIMS - GENERAL DESCRIPTION - 2	9	ARO ALL
31-41-00	AIMS - GENERAL DESCRIPTION - 3	12	ARO ALL
31-41-00	AIMS - FLIGHT DECK COMPONENT LOCATIONS - 1	14	ARO ALL
31-41-00	AIMS - FLIGHT DECK COMPONENT LOCATIONS - 2	16	ARO ALL
31-41-00	AIMS - MAIN EQUIPMENT CENTER COMPONENT LOCATIONS	18	ARO ALL
31-41-00	AIMS - MISCELLANEOUS RACKS COMPONENT LOCATIONS	20	ARO ALL
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31-41-00	AIMS - CONFIGURATION PIN INTERFACES	26	ARO ALL
31-41-00	AIMS - FLIGHT CONTROLS ARINC 629 BUSES INTERFACE	28	ARO ALL
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31-41-00	AIMS - INTERCABINET ETHERNET BUSES INTERFACES	36	ARO ALL
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31-41-00	AIMS - DATALINK ARINC INTERFACES	48	ARO ALL
31-41-00	AIMS - PLANENET LOCAL AREA NETWORK INTERFACES	50	ARO ALL
31-41-00	AIMS - DISPLAY UNITS VIDEO BUSES INTERFACES	54	ARO ALL
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31-41-00	AIMS - ANALOG DISCRETE OUTPUTS INTERFACES	58	ARO ALL
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31-41-00	AIMS - CABINET CHASSIS - 1	62	ARO ALL
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31-41-00	AIMS - CORE PROCESSOR MODULE/COMMUNICATIONS - FUNCTIONAL DESCRIPTION	91	ARO ALL
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31-41-00	AIMS - SOFTWARE - FUNCTIONAL DESCRIPTION	96	ARO ALL
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31-41-00	AIMS - UNIVERSAL TIME (COORDINATED) FUNCTION - FUNCTIONAL DESCRIPTION	98.4	ARO ALL
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**SYSTEMS CARD FILES - INTRODUCTION****Purpose**

The systems card files hold the ARINC 429 bus interface cards for essential systems.

They also hold the ARINC signal gateway (ASG) cards. The ASG cards change data formats between ARINC 429 and ARINC 629. They supply the interface between the interface cards and the systems ARINC 629 buses.

- WOW - weight-on-wheels
- xmtr - transmitter

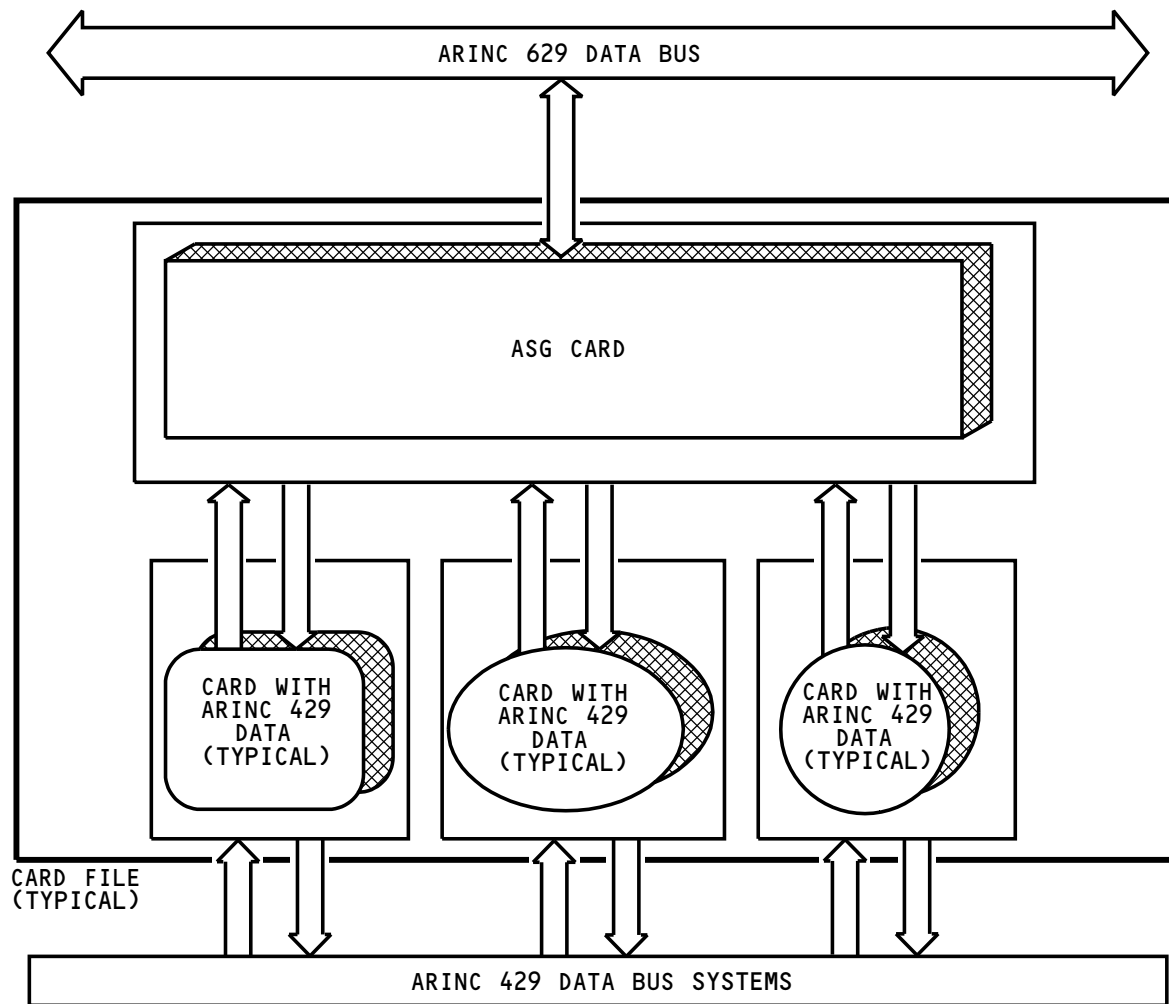
Abbreviations and Acronyms

- ACIPS - airfoil and cowl ice protection system
- APU - auxiliary power unit
- ARINC - Aeronautical Radio, Inc.
- ASG - ARINC 629 signal gateway
- CFPS - card file power supply
- CH - channel
- CSDS - cargo smoke detection system
- det - detection
- DLODS - duct leak and overheat detection system
- ECS - environmental control systems
- ESDS - electrostatic discharge sensitive
- FODC - fire/overheat detection card
- HYDIM - hydraulics interface module
- intfc - interface
- LH - left hand
- LRU - line replaceable unit
- LSCF - left systems card file
- ovht - overheat
- PSU - power supply unit
- rcvr - receiver
- RH - right hand
- RSCF - right systems card file

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SYSTEMS CARD FILES - INTRODUCTION

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SYSTEMS CARD FILES - GENERAL DESCRIPTION

General

The systems card files hold cards for ARINC 429 systems. These cards calculate data for their systems.

Data moves between the cards in the card files and the left and right ARINC 629 systems buses. Two ARINC signal gateway (ASG) cards in each card file supply the interface to and from the 629 data buses.

Components

There are two systems card files in the airplane, left and right. The system card files contain:

- Power supply cards (4 in each)
- ARINC signal gateway (ASG) cards (2 in each)
- ARINC 429 system cards (8 in Left)
- ARINC 429 system cards (9 in Right).

Interfaces

The eight ARINC 429 cards in the left system card file (LSCF) connect to their systems and to the ASG cards. The forward cargo smoke detector connects directly to the ASG cards in the LSCF.

The nine ARINC 429 cards in the right system card file (RSCF) connect to their systems and to the ASG cards. The aft cargo smoke detector connects directly to the ASG cards in the RSCF.

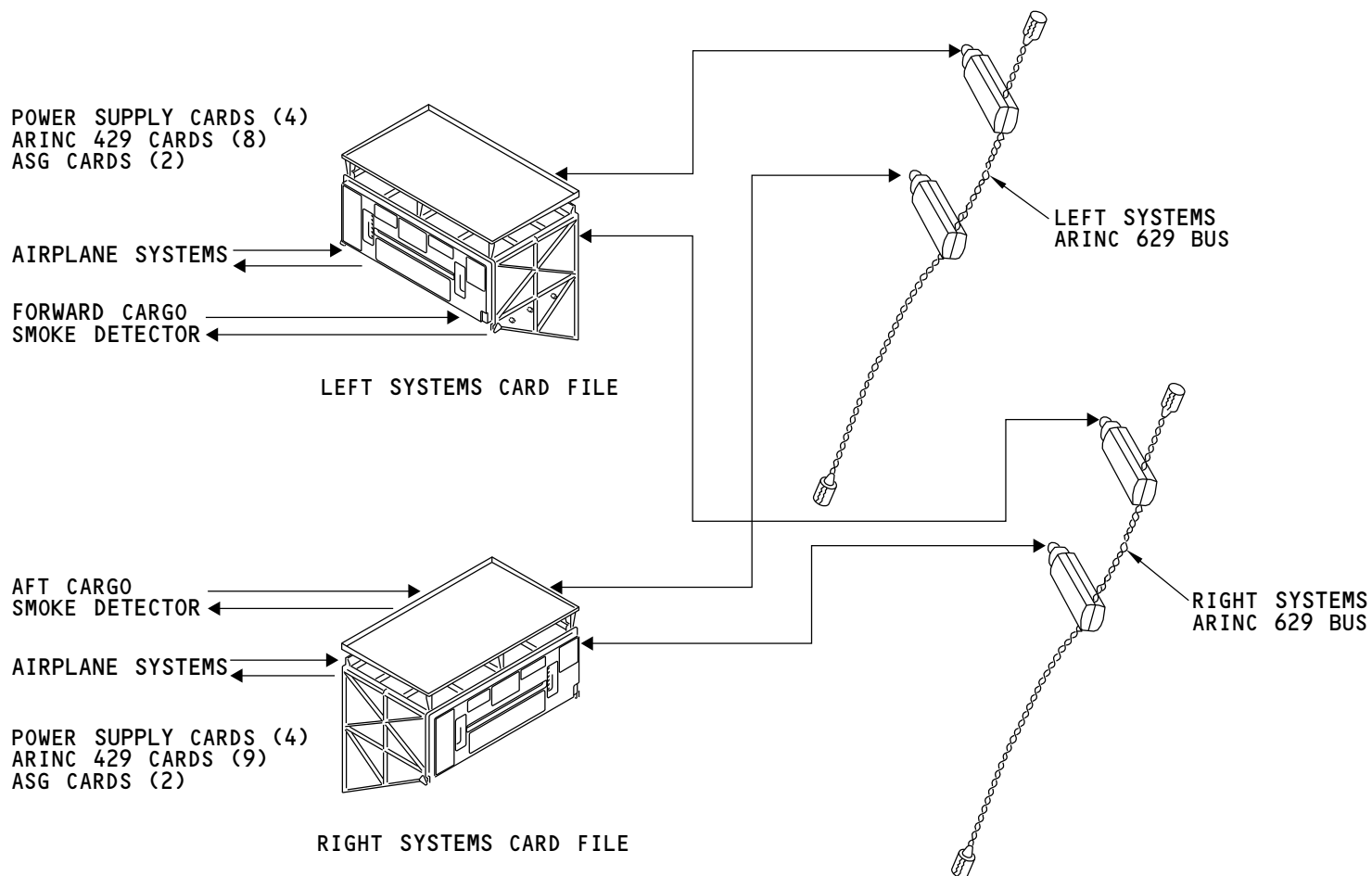
The left and right ASG cards in each card file connect to the left and right systems ARINC 629 buses.

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SYSTEMS CARD FILES - GENERAL DESCRIPTION

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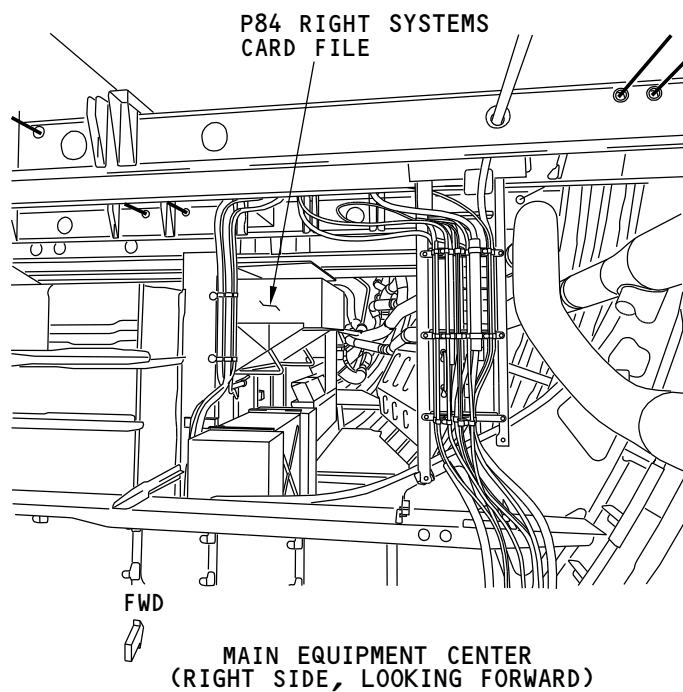
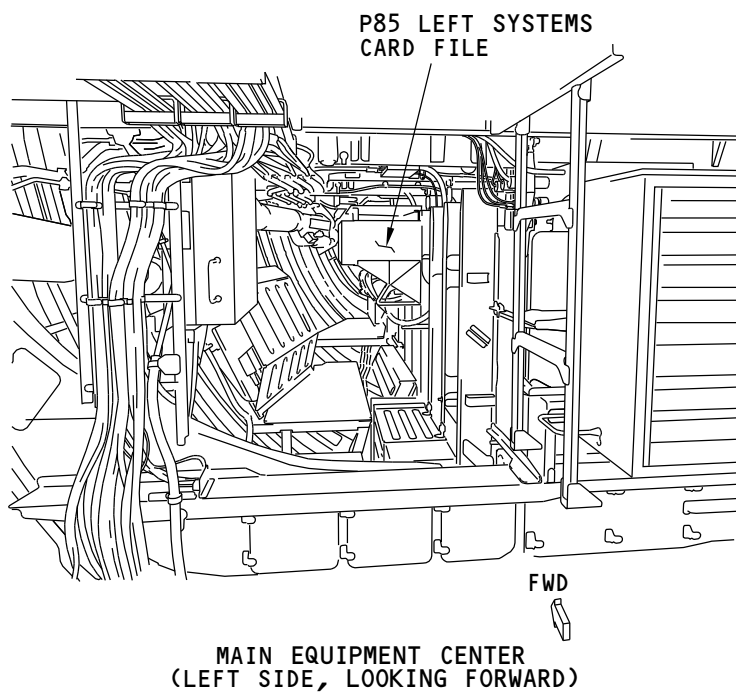
SYSTEMS CARD FILES - COMPONENT LOCATION - MAIN EQUIPMENT CENTER

General

These two systems card files are in the main equipment center:

- P85 Left systems card file (LSCF)
- P84 Right systems card file (RSCF).

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SYSTEMS CARD FILES - COMPONENT LOCATION - MAIN EQUIPMENT CENTER

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SYSTEMS CARD FILES - COMPONENT LOCATION - LSCF CARDS

General

The left systems card file (LSCF) in the P85 panel has 18 slots, A2 through A19. It contains the following interface cards:

- A2 - PSU - preregulator card
- A3 - PSU - linear/monitor card
- A4 - center HYDIM card CH2
- A5 - left DLODS card
- A6 - left ACIPS card
- A9 - APU fire/overheat detection card
- A10 - left engine fire/overheat detection card
- A12 - left ARINC 629 signal gateway card
- A14 - left ECS card
- A15 - right ARINC 629 signal gateway card
- A16 - left weight on wheels card
- A17 - left HYDIM card LH1
- A18 - PSU - Linear/monitor card
- A19 - PSU - Preregulator card.

A7, A8, A11 and A13 are empty slots.

A2	PSU - PREREGULATOR CARD
A3	PSU - LINEAR/MONITOR CARD
A4	CENTER HYDIM CARD CH2
A5	LEFT DLODS CARD
A6	LEFT ACIPS CARD
A7	SPARE
A8	SPARE
A9	APU FIRE/OVHT DET CARD
A10	LEFT ENGINE FIRE/OVHT DET CARD
A11	SPARE
A12	LEFT ARINC SIGNAL GATEWAY CARD
A13	SPARE
A14	LEFT ECS CARD
A15	RIGHT ARINC SIGNAL GATEWAY CARD
A16	LEFT WEIGHT ON WHEELS CARD
A17	LEFT HYDIM CARD LH1
A18	PSU - LINEAR/MONITOR CARD
A19	PSU - PREREGULATOR CARD

LEFT SYSTEMS CARD FILE (P85)

SYSTEMS CARD FILES - COMPONENT LOCATION - LSCF CARDS

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SYSTEMS CARD FILES - COMPONENT LOCATION - RSCF CARDS

General

The right systems card file (RSCF) in the P84 panel has 18 slots, A2 through A19. It contains the following interface cards:

- A2 - PSU - preregulator card
- A3 - PSU - linear/monitor card
- A4 - center HYDIM card CH1
- A5 - right DLODS card
- A6 - right ACIPS card
- A7 - center ACIPS card
- A8 - center DLODS card
- A10 - right engine fire/overheat detection card
- A12 - left ARINC 629 signal gateway card
- A14 - right ECS card
- A15 - right ARINC 629 signal gateway card
- A16 - right weight on wheels card
- A17 - right HYDIM card RH1
- A18 - PSU - linear/monitor card
- A19 - PSU - preregulator card.

A9, A11 and A13 are empty slots.

A2	PSU - PREREGULATOR CARD
A3	PSU - LINEAR/MONITOR CARD
A4	CENTER HYDIM CARD CH1
A5	RIGHT DLODS CARD
A6	RIGHT ACIPS CARD
A7	CENTER ACIPS CARD
A8	CENTER DLODS CARD
A9	SPARE
A10	RIGHT ENGINE FIRE/OVHT DET CARD
A11	SPARE
A12	LEFT ARINC SIGNAL GATEWAY CARD
A13	SPARE
A14	RIGHT ECS CARD
A15	RIGHT ARINC SIGNAL GATEWAY CARD
A16	RIGHT WEIGHT ON WHEELS CARD
A17	RIGHT HYDIM CARD RH1
A18	PSU - LINEAR/MONITOR CARD
A19	PSU - PREREGULATOR CARD

RIGHT SYSTEMS CARD FILE (P84)

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SYSTEMS CARD FILES - COMPONENT LOCATION - RSCF CARDS

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SYSTEMS CARD FILES - POWER INTERFACES

General

The LSCF PS1 circuit breaker in the P310 standby power management panel connects 28v dc to the preregulator 1 card in the LSCF. The LSCF PS2 circuit breaker connects 28v dc to the preregulator 2 card in the LSCF.

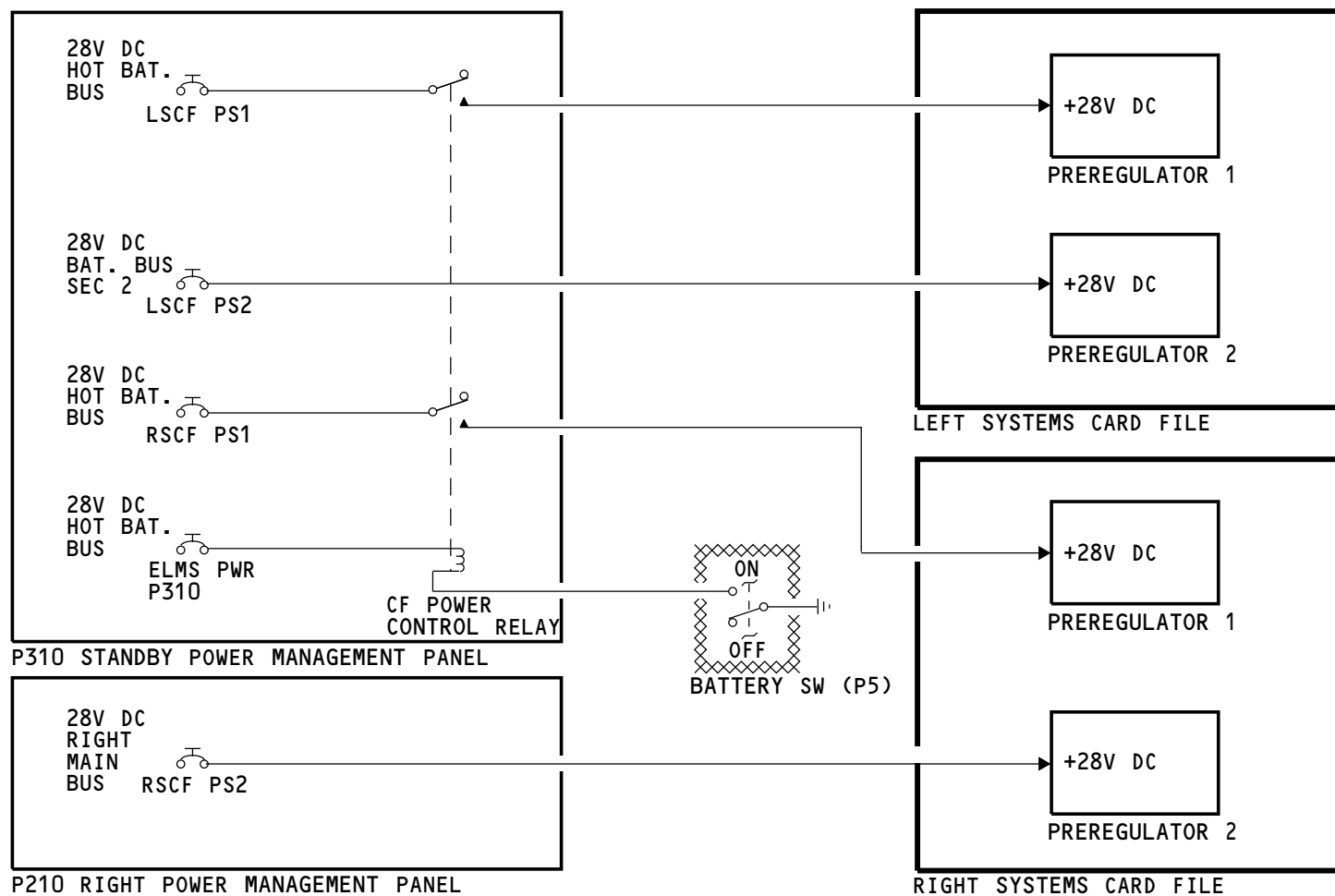
The RSCF PS1 circuit breaker in the P310 standby power management panel connects 28v dc to the preregulator 1 card in the RSCF.

The RSCF PS2 circuit breaker in the P210 left power management panel connects 28v dc to the preregulator 2 card in the RSCF.

The battery switch controls the 28v dc that goes to the PS1 power supplies in the left and right system card files.

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SYSTEMS CARD FILES - POWER INTERFACES

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SYSTEMS CARD FILES - LSCF POWER INTERFACES

General

The left system card file (LSCF) has two power supplies. Each power supply has these two cards:

- Preregulator
- linear monitor.

Preregulator Cards

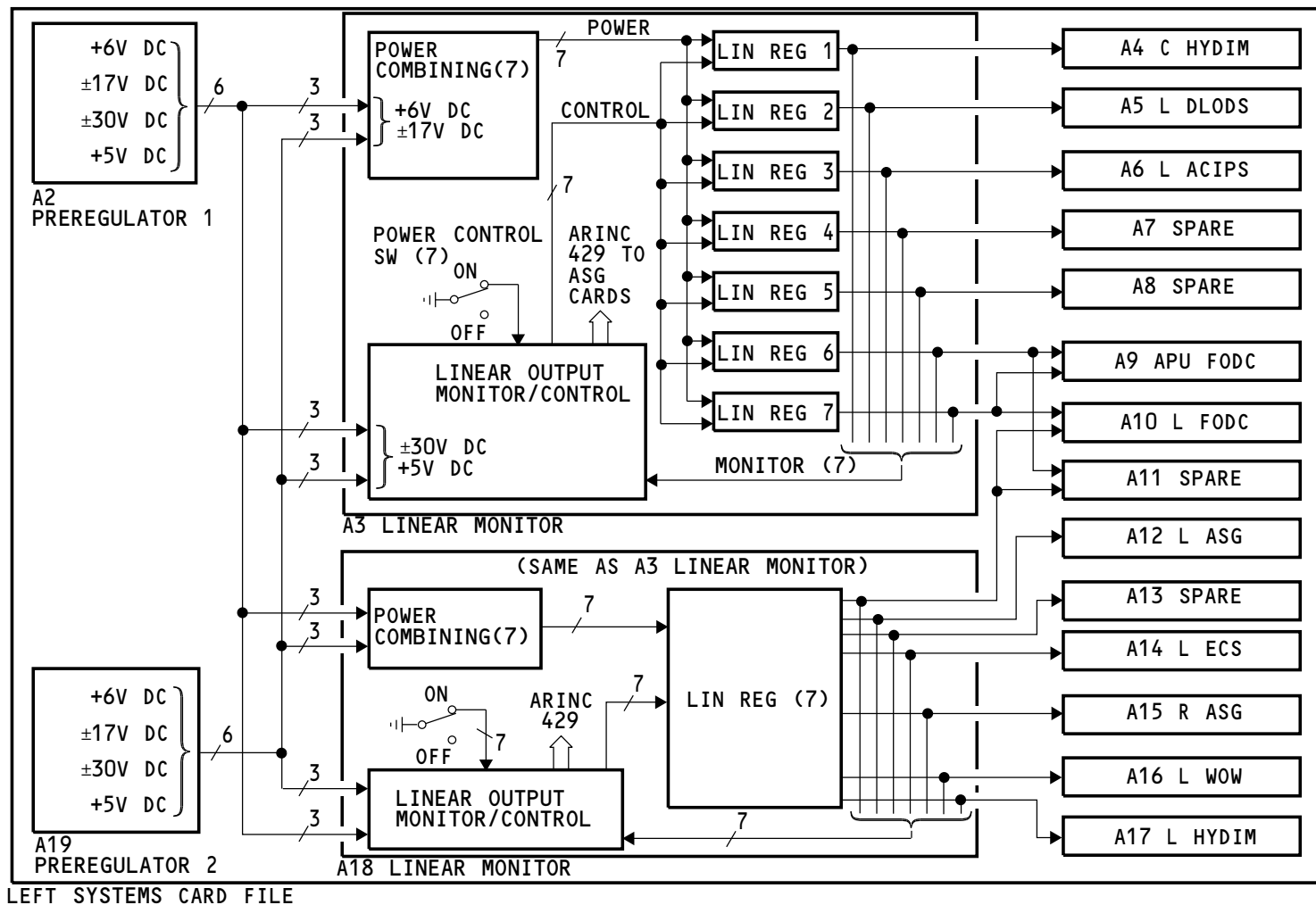
Each preregulator card supplies power to both linear monitor cards. Both linear monitor cards use the power from the preregulator 2 card. Preregulator 1 supplies backup power.

Linear Monitor Cards

Each linear monitor card sends power to seven linear regulators. The linear regulators are isolated from each other and send power to each member system card. The APU and left fire and overheat detection cards (FODC) receive two power inputs each.

The linear output monitor/control monitors the input and output power of the linear monitor. It sends power supply status to the ARINC signal gateway cards (ASG) on an ARINC 429 bus.

The linear output monitor/control also receives inputs from the power control switches. These switch inputs cause the linear regulators to be on or off.



LEFT SYSTEMS CARD FILE

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SYSTEMS CARD FILES - LSCF POWER INTERFACES

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**SYSTEMS CARD FILES - RSCF POWER INTERFACES****General**

The right system card file (RSCF) has two power supplies. Each power supply has these two cards:

- Preregulator
- linear monitor.

Preregulator Cards

Each preregulator card supplies power to both linear monitor cards. Both linear monitor cards use the power from the preregulator 2 card. Preregulator 1 supplies backup power.

Linear Monitor Cards

Each linear monitor card sends power to seven linear regulators. The linear regulators are isolated from each other and send power to each member system card. The right fire and overheat detection card (FODC) receives two power inputs.

The linear output monitor/control monitors the input and output power of the linear monitor. It sends power supply status to the ARINC signal gateway cards (ASG) on an ARINC 429 bus.

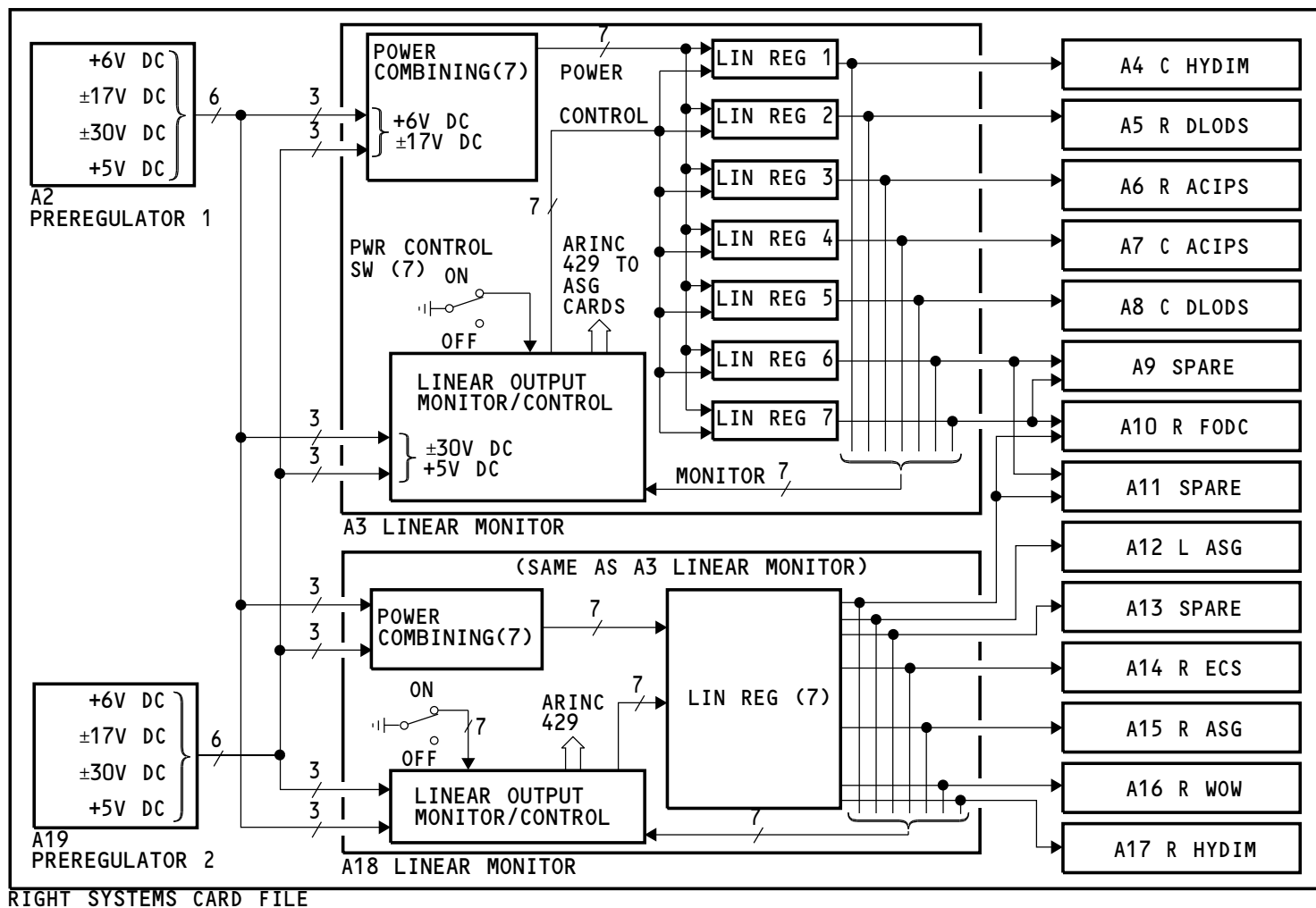
The linear output monitor/control also receives switch inputs from the card file front panel. These switch inputs cause the linear regulators to be on or off.

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SYSTEMS CARD FILES - RSCF POWER INTERFACES

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SYSTEMS CARD FILES - ARINC 429 AND 629 INTERFACES

General

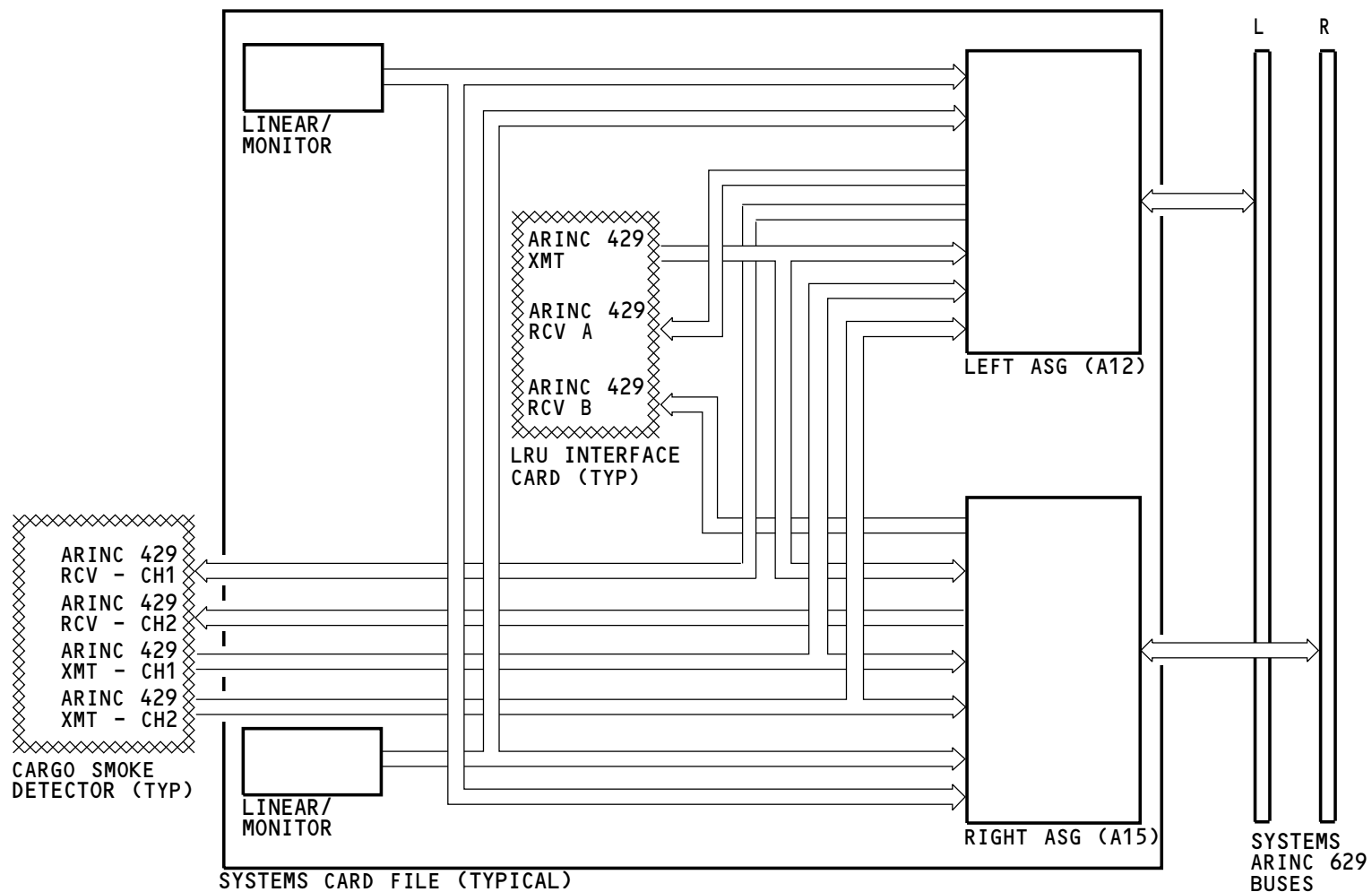
The interface cards in the system card files interface with their systems. They send and receive this type of information:

- ARINC 429 digital data
- Analog
- Analog discretes.

The interface cards also interface with other airplane systems. They send ARINC 429 data to and receive ARINC 429 data from the ASG cards.

The cargo smoke detectors also interface with other airplane systems. They send ARINC 429 data to and receive ARINC 429 data from the ASG cards. The cargo smoke detectors are not located in the system card files.

The ASG cards convert ARINC 429 data to ARINC 629 data and send it to the left and right systems ARINC 629 buses. They also receive ARINC 629 data from the left and right systems ARINC 629 buses. They convert this data to ARINC 429 data and send it to the interface cards and the cargo smoke detectors.



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SYSTEMS CARD FILES - ARINC 429 AND 629 INTERFACES

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**SYSTEMS CARD FILES****Purpose**

The left systems card file (LSCF) and right systems card file (RSCF) hold interface cards for the member systems LRUs. Each systems card file gives ARINC 429/629 and ARINC 629/429 communications and power supply connections.

Physical Description

The systems card files chassis have machined and sheetmetal parts.

A typical card file has these dimensions:

- Length 26.4 inches
- Height 17.85 inches
- Width 13.6 inches

Maximum weight of the systems cardfile chassis is 40 pounds.

There are eighteen positions for interface cards in each of the two systems card files. Centralized power takes four of these positions in each systems card file.

The power switches on the A3 and A18 linear/monitor cards extend through the card file cover.

Training Information Point

The RSCF chassis is the same as the LSCF chassis except that it holds right airplane electrical systems or one channel of a dual redundant system. The RSCF chassis has a different part number than the LSCF chassis and different member system LRU slot assignments.

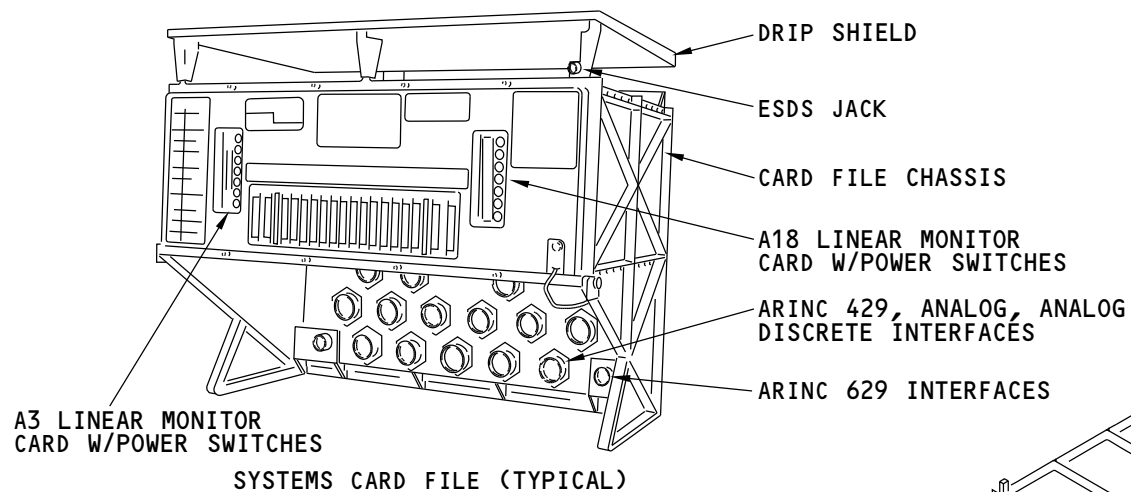
There is an ESDS jack located above each systems card file chassis.

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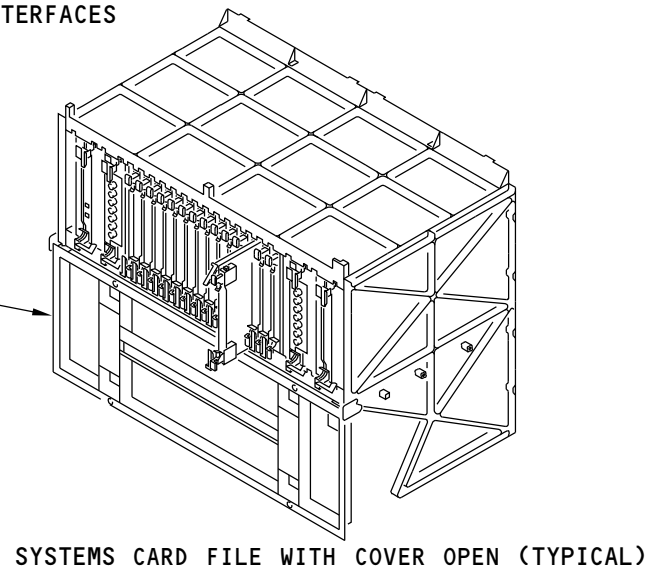
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CARD FILE COVER (SHOWN OPEN)



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SYSTEMS CARD FILES

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**SYSTEMS CARD FILES - ASG CARDS****Purpose**

ARINC 629 signal gateway (ASG) cards change data format between ARINC 429 and ARINC 629. The ASG cards move data between the LRU interface cards in the left and right systems card files and the left and right systems ARINC 629 buses. The ASG cards also move data between the forward and aft cargo smoke detectors and the left and right systems ARINC 629 buses.

Physical Description

A typical card has these dimensions:

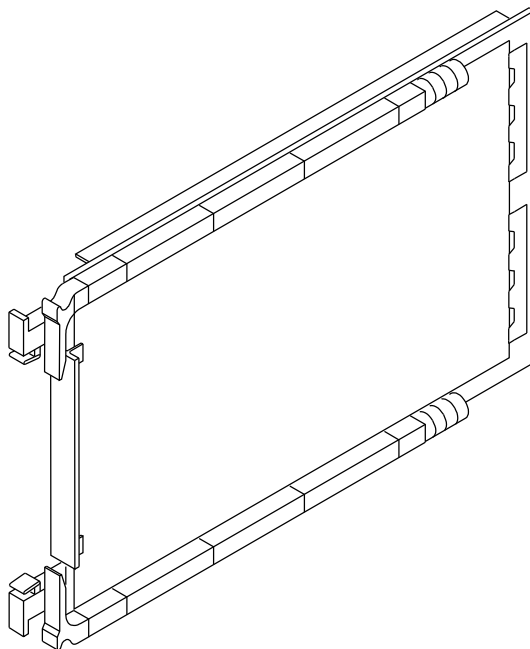
- Length 12 inches
- Height 7.43 inches
- Width 0.6 inch maximum with component protrusion

Maximum weight 1.9 pounds.

Training Information Point

The ASG cards are interchangeable.

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ARINC 629 SIGNAL GATEWAY (ASG) CARD (TYPICAL)

SYSTEMS CARD FILES - ASG CARDS

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SYSTEMS CARD FILES - ASG CARD FUNCTIONAL DESCRIPTION

General

An ARINC 629 signal gateway (ASG) card changes ARINC 429 data from LRU interface cards and cargo smoke detectors to ARINC 629 data. It sends this data to an ARINC 629 system bus.

The ASG card also gets data from an ARINC 629 system bus. It changes this data to ARINC 429 data and sends it to LRU interface cards and cargo smoke detectors.

Each ARINC 629 signal gateway (ASG) card has these components:

- ARINC 429 receiver
- ARINC 429 to ARINC 629 converter
- ARINC 629 terminal
- ARINC 629 to ARINC 429 converter
- ARINC 429 transmitter.

ARINC 429 Receiver

The ASG card receives ARINC 429 data at the ARINC 429 receiver from the LRU interface cards in the systems card files and the forward and aft cargo smoke detectors.

ARINC 429 to ARINC 629 Converter

The ARINC 429 to ARINC 629 converter in an ASG card changes the data from ARINC 429 to ARINC 629 format.

ARINC 629 Terminal

The ARINC 629 terminal transmits the data to an ARINC 629 systems bus.

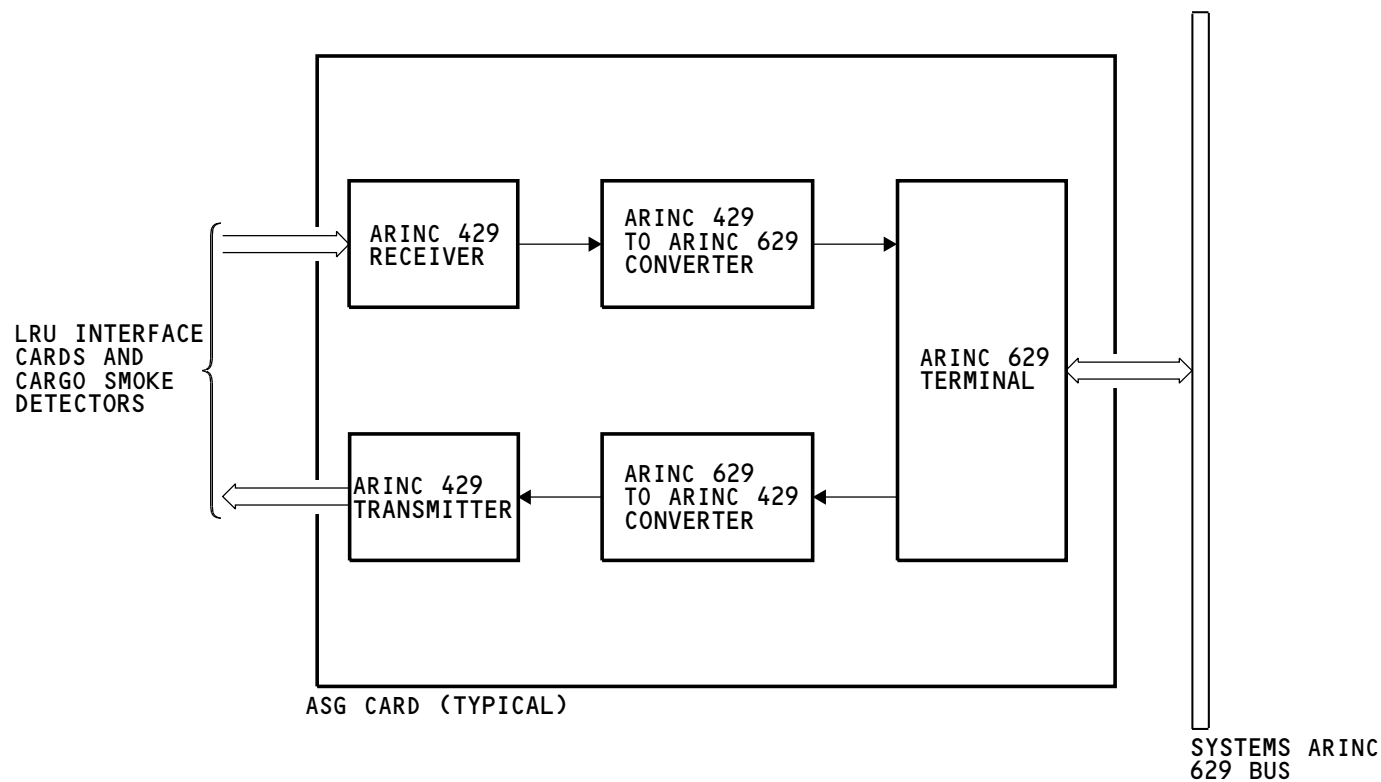
The ARINC 629 terminal receives data from an ARINC 629 systems bus.

ARINC 629 to ARINC 429 Converter

The ARINC 629 to ARINC 429 converter changes the data from the ARINC 629 systems bus to ARINC 429.

ARINC 429 Transmitter

The ARINC 429 transmitter sends the data to the LRU interface cards in the systems card files and the forward and aft smoke detectors.



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SYSTEMS CARD FILES - ASG CARD FUNCTIONAL DESCRIPTION

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CLOCKS - INTRODUCTION

General

The clocks give time reference to the flight crew.

Abbreviations and Acronyms

- AIMS - airplane information management system
- ARINC - Aeronautical Radio, Incorporated
- CDU - control display unit
- CHR - chronograph
- HD - hours/days
- HLDY - hold/year
- GPS - global positioning system
- GPSSU - global positioning system sensor unit
- LCD - liquid crystal display
- MAN - manual
- MM - minutes/months
- ND - navigation display
- UTC - universal time (coordinated)
- UTCF - universal time (coordinated) function

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**CLOCKS - GENERAL DESCRIPTION****General**

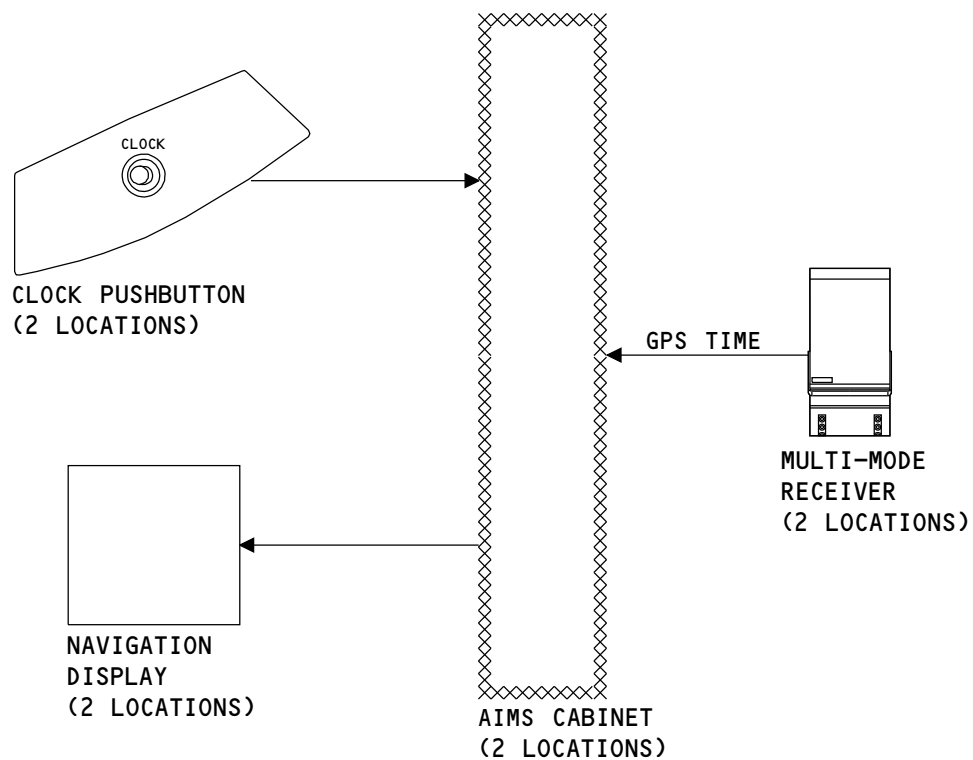
This is the data that the clocks show on the Navigation Display.

- Time and date from AIMS
- Universal time (controlled) (UTC) and date from the airplane information management system (AIMS)
- Digital counter

Use the clock pushbutton on the glareshield panel to control the clock display and digital counter function on the Navigation Displays..

The AIMS cabinets get UTC and date from the the multi-mode receivers (MMRs).

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CLOCKS - GENERAL DESCRIPTION

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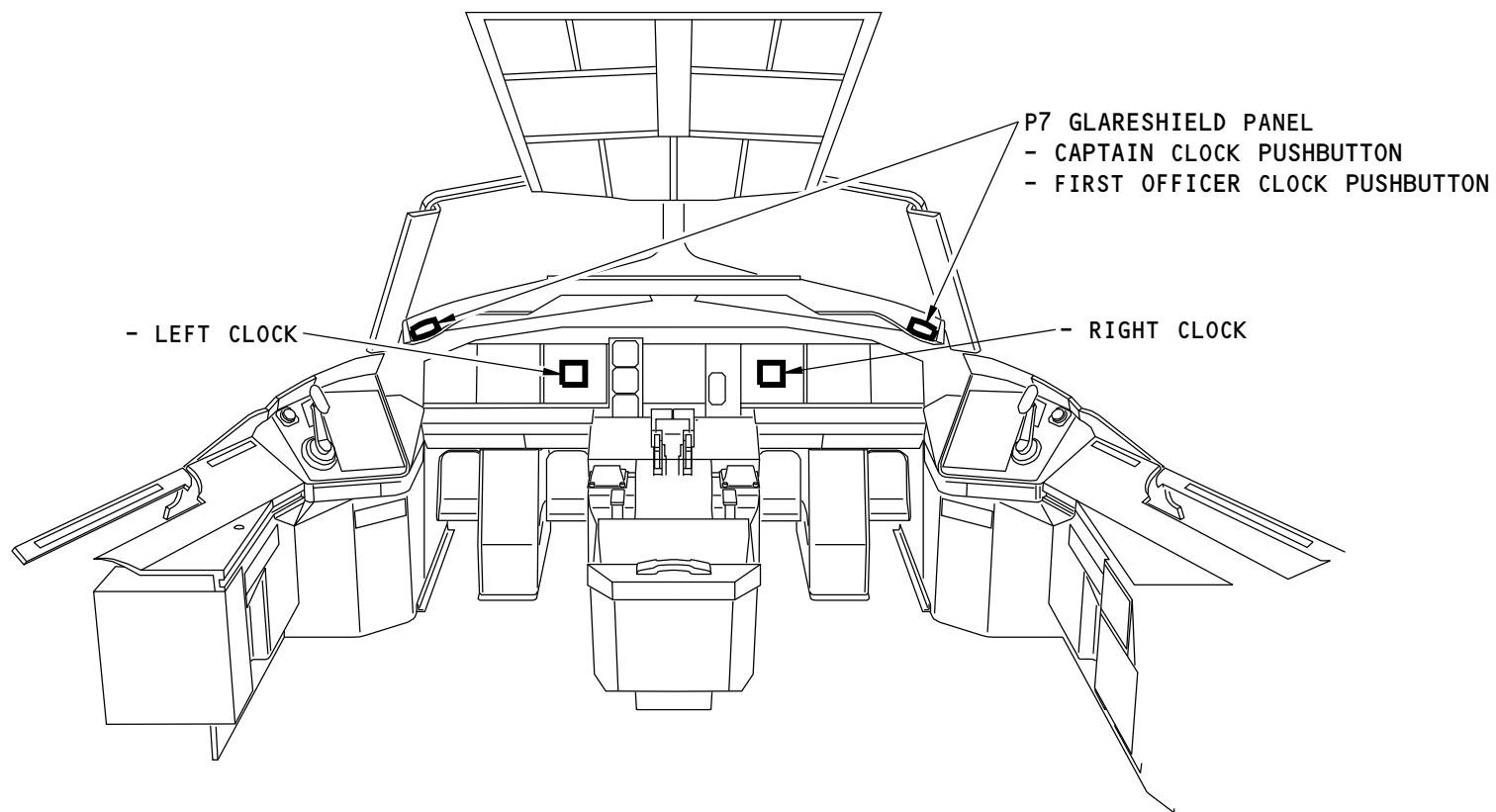
CLOCKS - COMPONENT LOCATIONS

General

These are the clock system components:

- Captain clock pushbutton
- First Officer clock pushbutton

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CLOCKS - COMPONENT LOCATIONS

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CLOCKS - INTERFACES

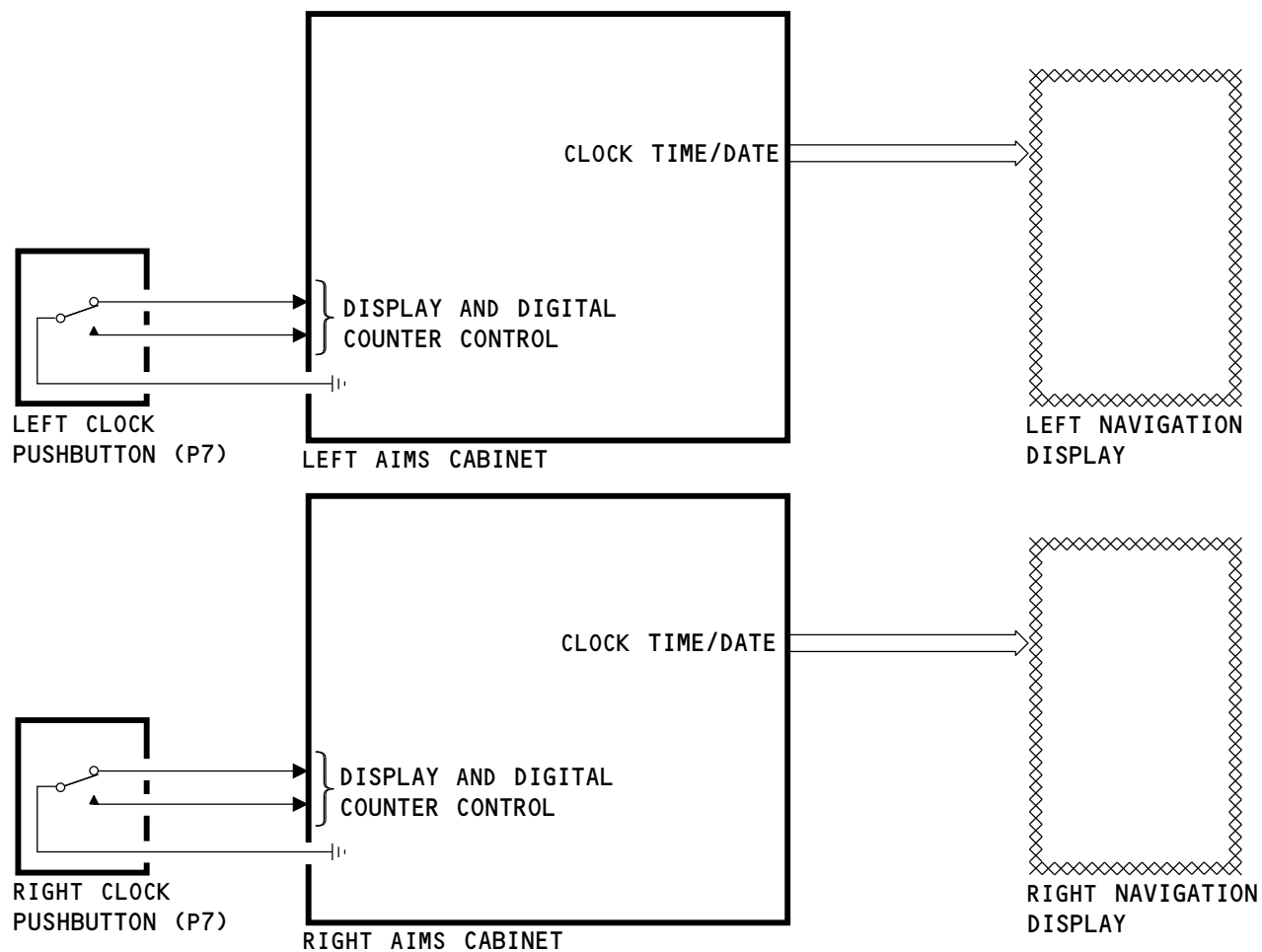
Clock Pushbuttons

Each clock gets a discrete signal from a clock pushbutton on the glareshield. These discrete signals control the clock function on the Navigation Display.

Digital Input

The left clock receives universal time (coordinated) (UTC) and date from the left AIMS cabinet. The right clock receives UTC and date from the right AIMS cabinet.

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CLOCK - INTERFACES

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CLOCKS - CLOCK

Displays

The clock is displayed on the Captain's and First Officer's Navigation Display.

Digital Counter

Use the Captain's and First Officer's clock pushbutton to start, stop, and reset the digital counter function.

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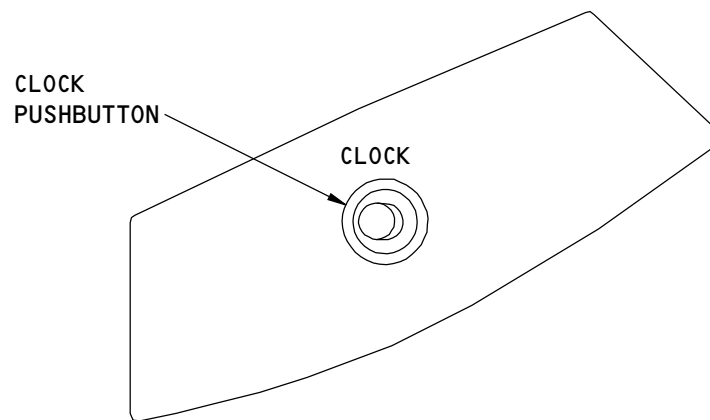
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**CLOCKS - CLOCK SWITCH/PUSHBUTTON****General**

You control the clock display and digital counter function on the Navigation Display from the clock pushbutton on the glareshield panel.

The captain's clock pushbutton controls the captain's clock digital counter function. The first officer's clock pushbutton controls the first officer's digital function.

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GLARESHIELD PANEL (P7)

CLOCKS - CLOCK PUSHBUTTON

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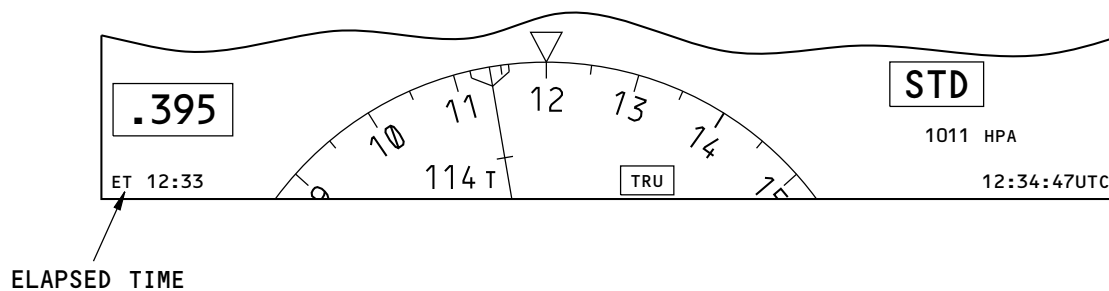
CLOCKS - ELAPSED TIME

General

Elapsed time shows on the lower left corner of the primary flight display.

Elapsed time begins incrementing at at takeoff, pauses at landing, and resets when both fuel cutoff switches transition from cutoff to run.

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CLOCKS - ELAPSED TIME

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CLOCKS - DIGITAL COUNTER

General

The digital counter shows on the Navigation Display.

Use the Captain's and First Officer's pushbutton on the glareshield to start, stop and reset the digital counter.

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**CLOCKS - FUNCTIONAL DESCRIPTION****Inputs**

The clock gets 28v dc for power.

The clock receives universal time (coordinated) UTC and date from the AIMS universal time (coordinated) function (UTCf).

A multiplexer senses the position of all the switches on the clock and also the clock switch on the glareshield panel P7.

Calculations and Outputs

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

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

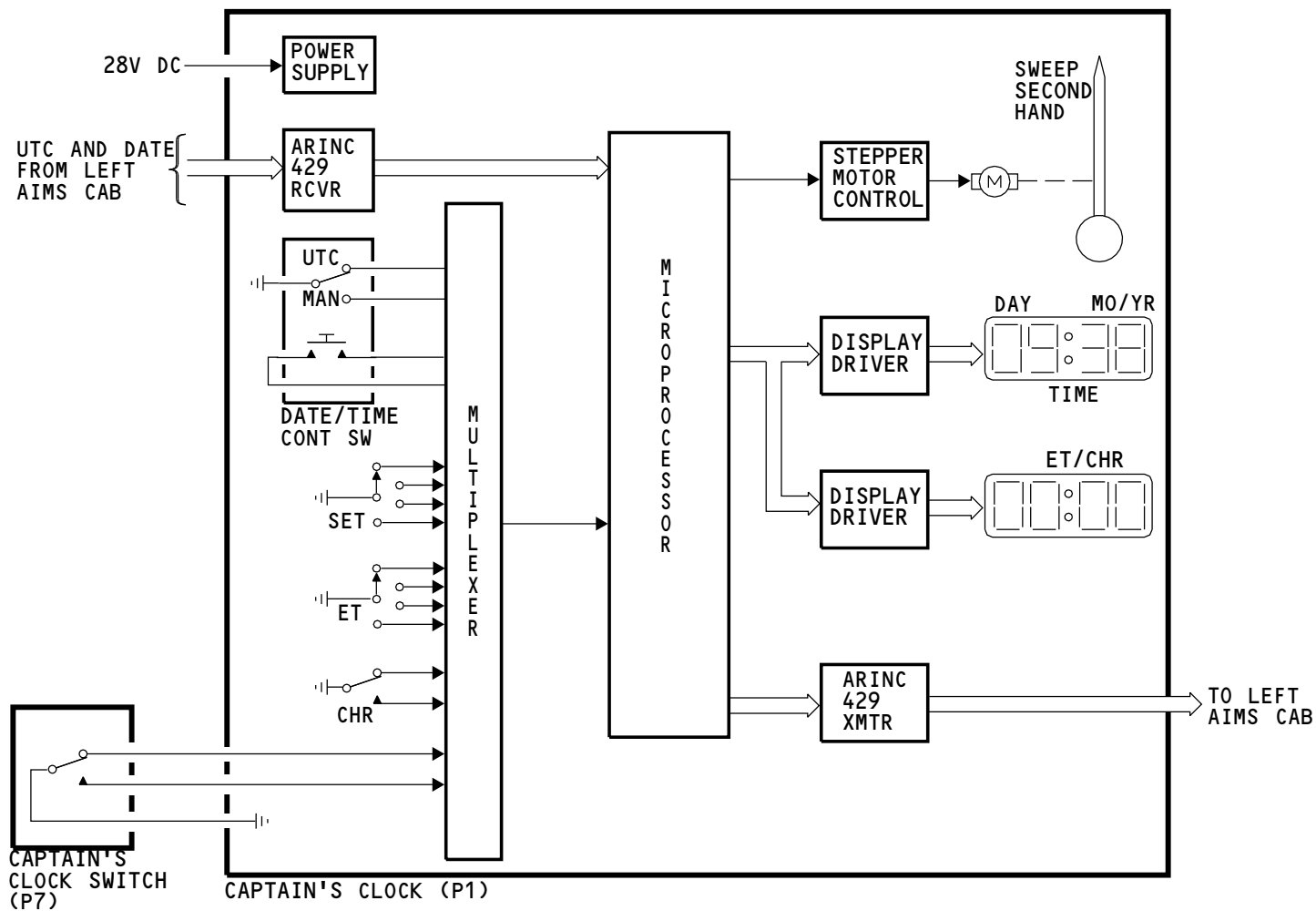
Display drivers supply display information to the clock displays.

ARINC 429 clock data goes to the AIMS cabinet.

Output to AIMS

The clock sends this data to the AIMS UTCf:

- Clock time
- Clock date
- AIMS UTC
- AIMS date
- Clock status data.



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CLOCKS - FUNCTIONAL DESCRIPTION

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FLIGHT DATA RECORDER SYSTEM - INTRODUCTION

Purpose

The flight data recorder system (FDRS) stores airplane parameters and system data in a protected solid state memory. These parameters provide data on flight conditions and airplane systems operation. Airline personnel use the data to analyze system performance during airplane maintenance.

Glossary

- ac - alternating current
- ACE - actuator control electronics
- AIMS - airplane information management system
- AOA - angle of attack
- ARINC - aeronautical radio, inc.
- ATE - automatic test equipment
- CMCF - central maintenance computing function
- CMM - communication management module
- comm - communication
- CPM - core processor module
- ctrl - control
- dc - direct current
- DFDAF - digital flight data acquisition function
- EEC - electronic engine control
- EICAS - engine indication and crew alerting system
- ELM - electrical load management
- FDR - flight data recorder
- FDRS - flight data recorder system
- flt - flight
- gnd - ground
- HF - high frequency
- IOM - input/output module
- L - left
- LAN - local area network
- lat - latitude
- long - longitude
- LRU - line replaceable unit
- maint - maintenance
- MAT - maintenance access terminal
- nav - navigation
- PDF - primary display function
- PMA - permanent magnet alternator
- pwr - power
- R - right
- rec - recorder
- rly - relay
- RPM - revolutions per minute
- rtn - return
- TAT - total air temperature
- ULD - underwater locating device
- V - volt
- VHF - very high frequency
- wps - words per second
- xdcr - transducer
- xfr - transfer
- xmtr - transmitter

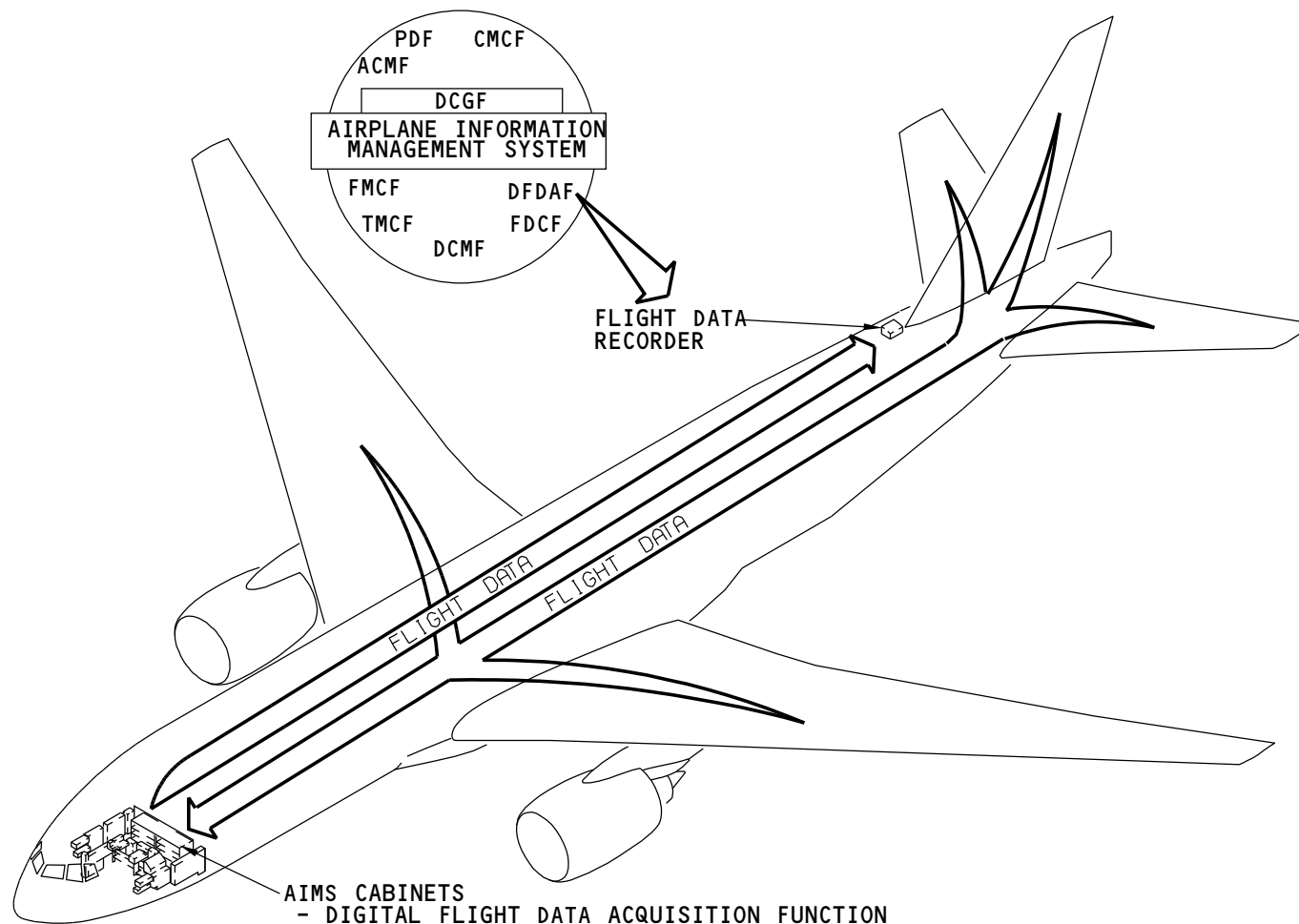
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FLIGHT DATA RECORDER SYSTEM - INTRODUCTION

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FDRS - GENERAL DESCRIPTION

General

The flight data recorder (FDR) receives and stores selected airplane parameters from various airplane systems and sensors in a crash-protected solid state memory. The digital flight data acquisition function (DFDAF) of the airplane information management system (AIMS) receives all the flight recorder data. The DFDAF then processes the data and sends it to the FDR, where it is stored. The DFDAF is in the CPM/Comm module of both AIMS cabinets.

The flight data recorder system (FDRS) operates during any engine start, while any engine is running, during test or when the airplane is in the air.

The FDR records the most recent 25 hours of flight.

In addition to the data recording function, the FDR also has monitor circuits which send fault data to the DFDAF within AIMS.

DFDAF

The DFDAF receives all flight parameters to record. The DFDAF converts these parameters to a digital format and sends them to the FDR.

Analog Signals and Analog Discretes

The DFDAF processes and the FDR stores analog signals and analog discretes.

The FDR sends discrete signals to the DFDAF. The discretes show fault status.

Data Bus Interfaces

AIMS gets power control data from several airplane systems. Power goes to the FDR when the logic is valid. The power control data includes:

- Engine start
- Engine running
- Air/ground logic
- Test.

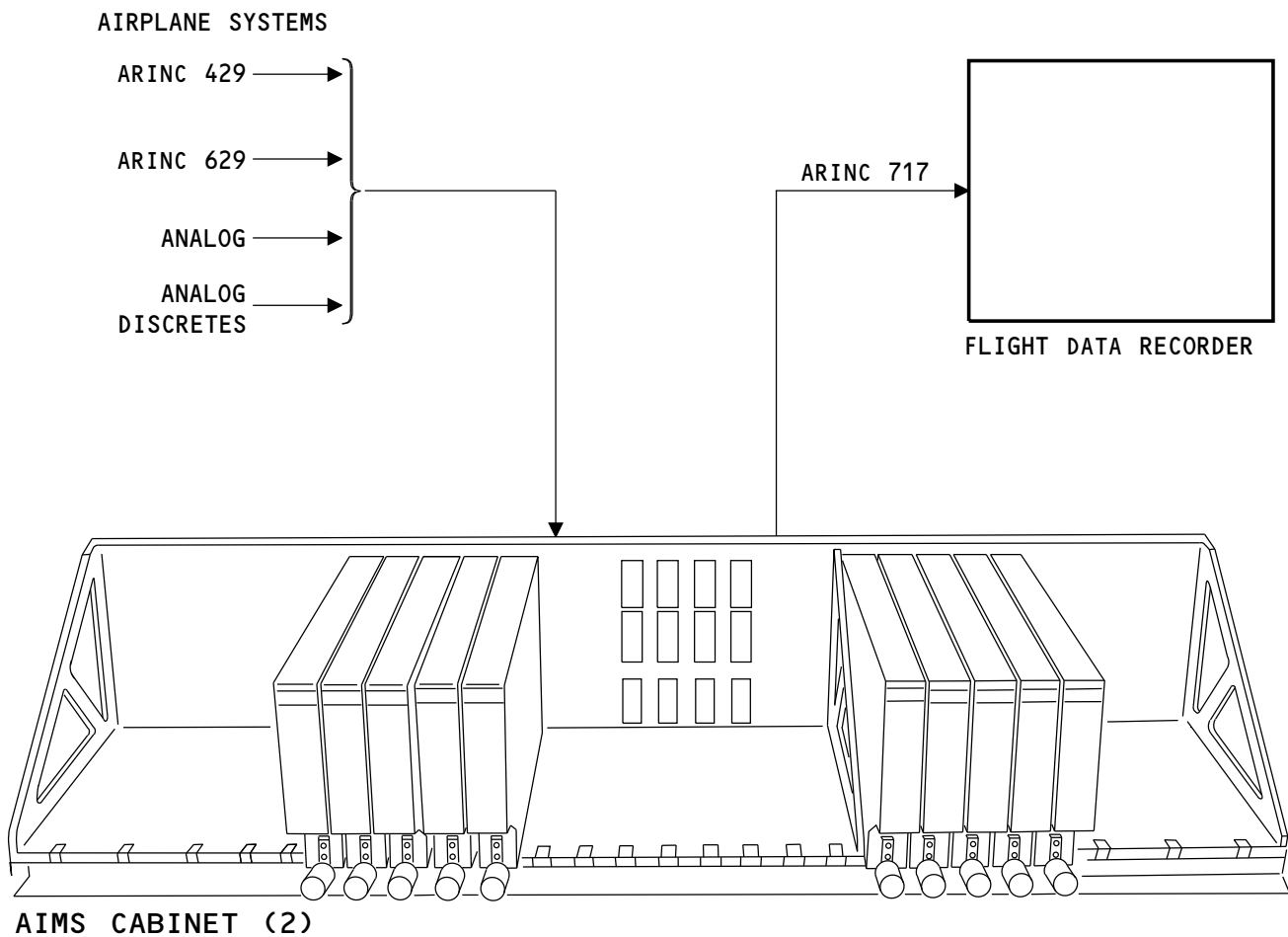
The FDR gets airplane parameters from the DFDAF in AIMS. Data goes on ARINC 717 buses. Each ARINC 717 bus has a shielded twisted pair of wires.

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FDRS - GENERAL DESCRIPTION

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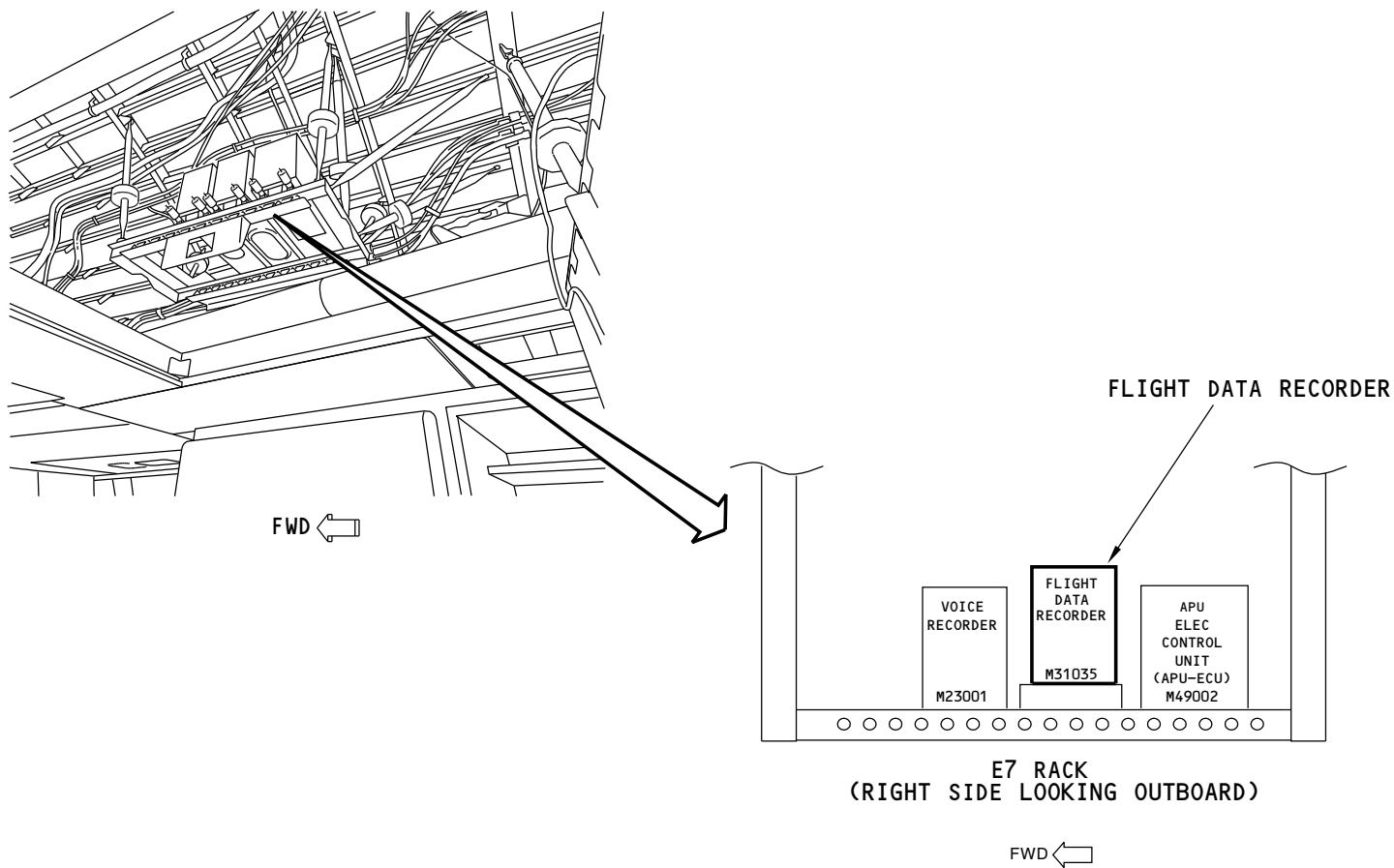


FDRS - COMPONENT LOCATIONS - 1

Aft Equipment Center

The flight data recorder (FDR) is in the E7 aft equipment rack. Access is through a ceiling panel that is forward of the aft galley.

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FDRS - COMPONENT LOCATIONS - 1

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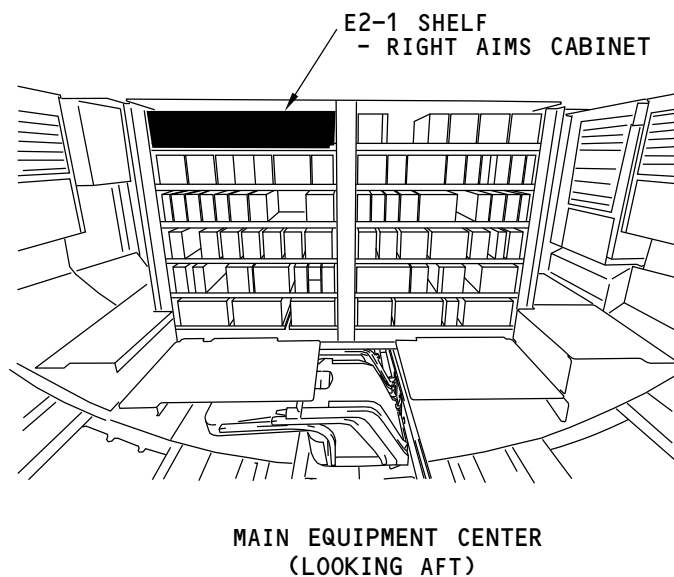
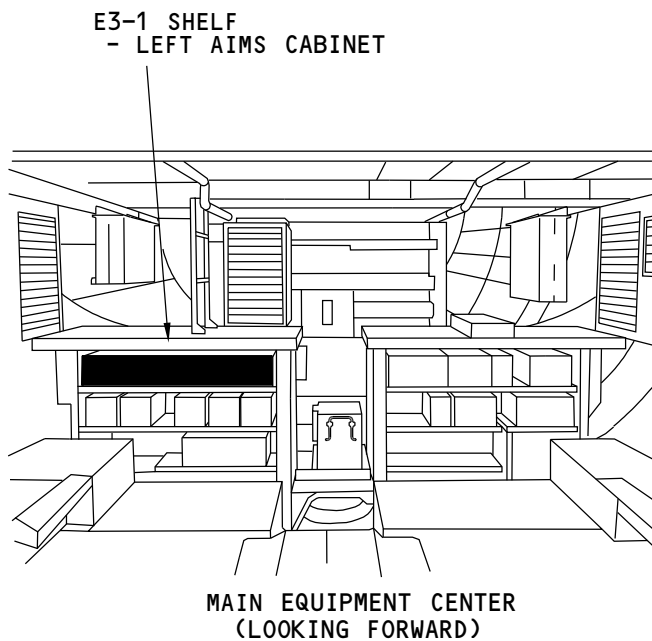


FDRS - COMPONENT LOCATIONS - 2

Main Equipment Center

The digital flight data acquisition function (DFDAF) is part of the airplane information management system (AIMS). The DFDAF is in the CPM/Comm LRM. The right AIMS cabinet is in the E2-1 shelf. The left AIMS cabinet is in the E3-1 shelf.

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FDRS - COMPONENT LOCATIONS - 2

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FDRS - SYSTEM INTERFACE

General

The flight data recorder system (FDRS) gets digital data and digital discrete data on ARINC 629 and ARINC 429 data buses. The FDRS also receives analog inputs from some of the airplane systems and sensors. The FDR receives power from the power management panel. The FDR sends analog data to the digital flight data acquisition functions (DFDAF) of AIMS.

The left AIMS cabinet sends DFDAF data on an ARINC 717 data bus to the FDR. If the left AIMS cabinet DFDAF fails, the right AIMS cabinet sends DFDAF data to the FDR. The DFDAF sends fault data, status and test result data to the CMCF and the display system functions within the AIMS cabinets.

Power

The FDR receives power from the P210 right power management panel. DFDAF uses engine, air/ground, and ground test logic to determine when to turn on the FDR.

Analog Data

The DFDAFs receive status and maintenance flag data from the FDR. The DFDAFs receive key events from the VHF and HF LRUs and variable analog data from TAT, AOA and engine RPM sensors.

Digital Data

The systems ARINC 629 buses provides engine, airframe data, and air/ground logic. This is the engine data:

- Engine parameters, normal and exceedances
- Commands
- Actual thrust.

This is the airframe data:

- Flight deck switch position
- Flight controls positions
- Mode selections on control panels in the flight deck.

The DFDRS receives status from the engine and airframe sensors. The DFDRS also receives data and status from the electrical power system.

The flight controls ARINC 629 buses provide flight data and navigation data. This is the flight data:

- Flight control position
- Commands
- Status.

This is the navigation data from the ADIRU and SAARU:

- Pitch, roll and yaw attitude
- Acceleration data
- Status.

ARINC 429 provides navigation (NAV) radio/NAV data and communication (COMM) radio data. This is the NAV radio data:

- Radio frequencies
- Mode
- Parameters
- Status.

NAV data is aircraft position (LAT/LONG) and sensor status. COMM data is radio control panel frequencies and sensor status.

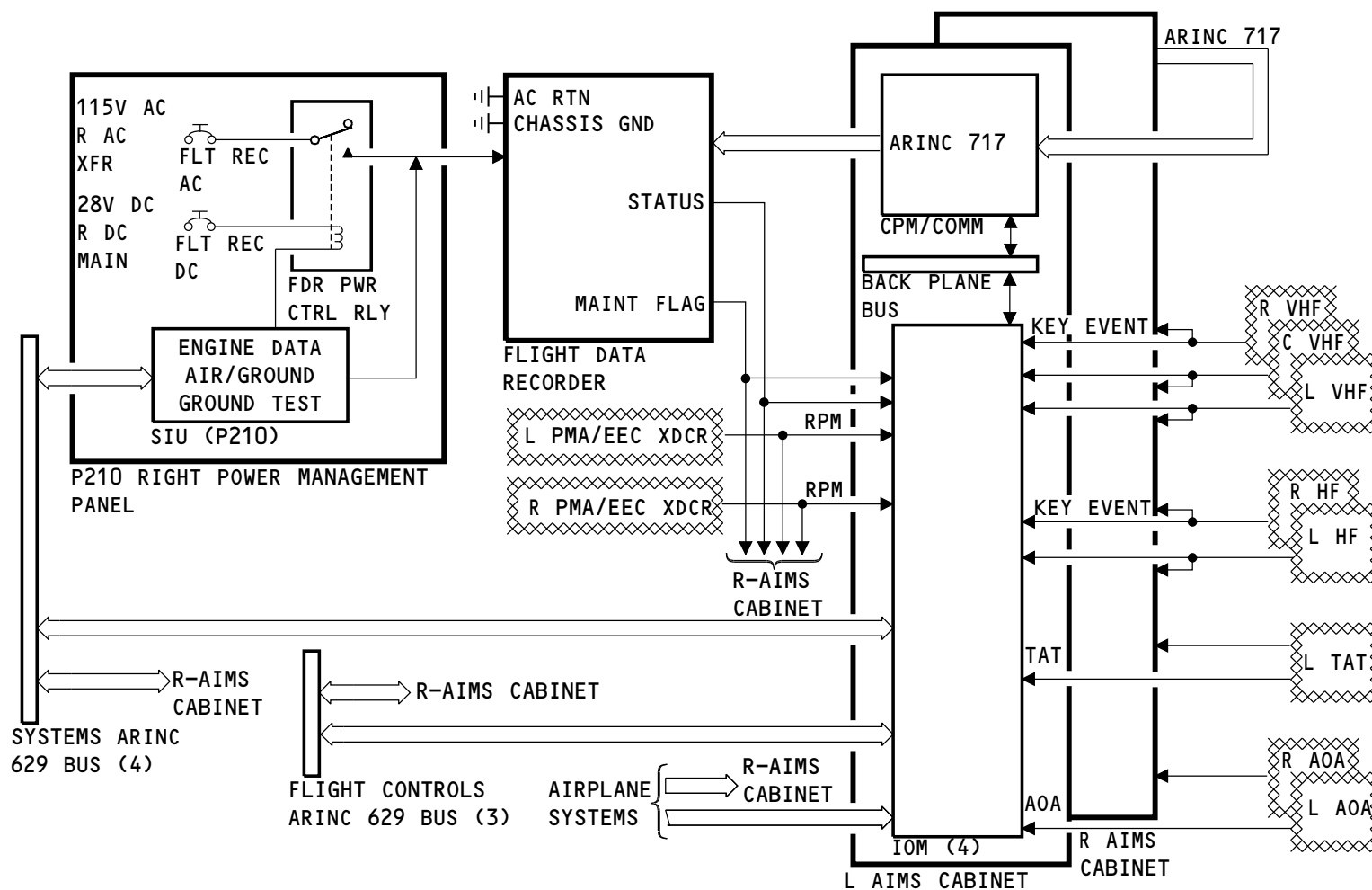
The left AIMS cabinet sends left or right DFDAF data on an ARINC 717 bus to the FDR.

The DFDAF sends fault data, status data and ground test results to the CMCF.

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FDRS - SYSTEM INTERFACE

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**FDRS - FLIGHT DATA RECORDER****Purpose**

The flight data recorder (FDR) records flight data in a protected solid-state memory.

Physical Description

The FDR is made of stainless steel. It weighs approximately 18 pounds. The memory storage assembly in the FDR is crush-proof up to 5000 pounds. The FDR case also supplies protection for up to 3400 g's of impact, deep sea pressures to 20,000 feet, and fire protection up to a temperature of 1100C for 1/2 hour.

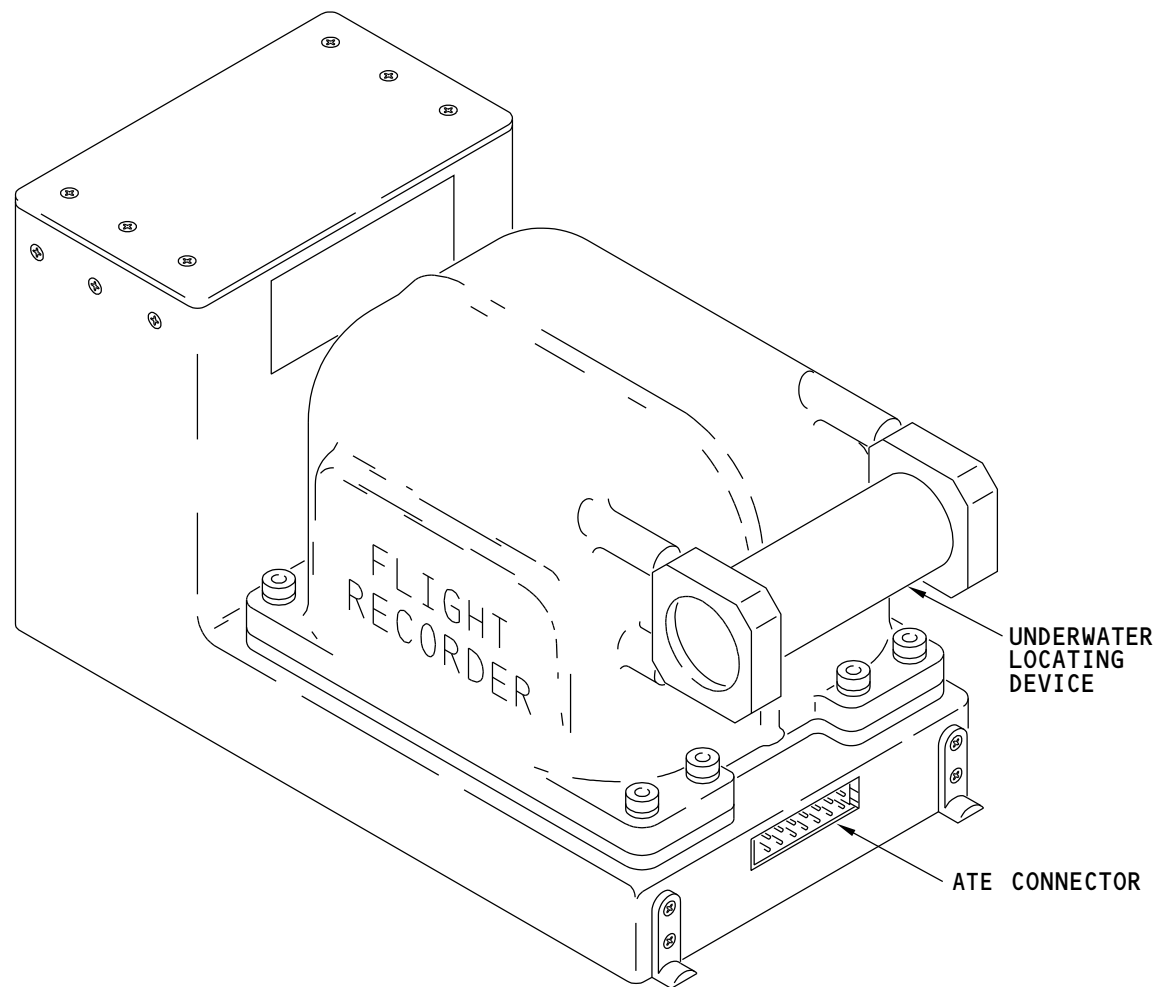
An underwater locating device (ULD) is on the front panel. An automatic test equipment (ATE) connector is on the front of the unit.

The FDR color is international orange with FLIGHT RECORDER in black letters on the left and right sides.

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FDRS - FLIGHT DATA RECORDER

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FDRS - UNDERWATER LOCATING DEVICE**Purpose**

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

Physical Description

The ULD is a line replaceable unit that is 1.3 inches in diameter and 4 inches long. It weighs less than 12 ounces.

Power

The ULD receives power from a 9.6 volt DUKANE model DK100 battery.

Functional Description

The ULD has these operational characteristics:

- Operates when it is put into water
- Operates to a maximum depth of 20,000 feet
- Has a detection range of 7,000 to 12,000 feet

ARO 001-014

- Has an operational life of 30 days underwater

ARO 015-999

- Has an operational life of 90 days underwater

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

Training Information Point

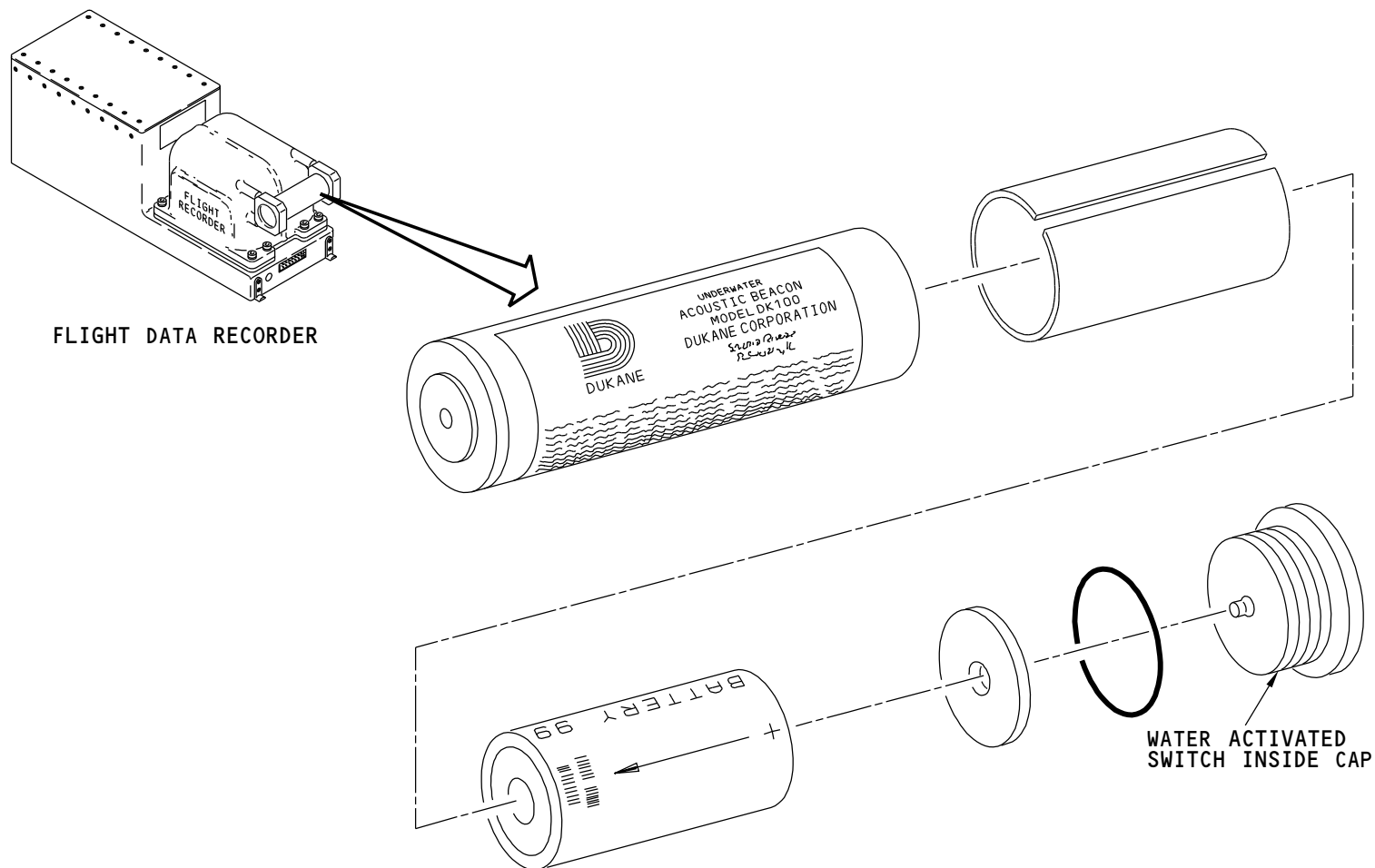
The DK100 ULD uses a lithium battery. If not activated, it has a life of six years. It is important to keep the water switch contacts clean. The battery is not a line replaceable unit.

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FDRS - UNDERWATER LOCATING DEVICE

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FDRS - DFDAF FUNCTIONAL DESCRIPTION

General

The digital flight data acquisition function (DFDAF) is software in each AIMS cabinet. The DFDAF collects data from:

- ARINC 629 buses
- ARINC 429 buses
- Analog discrete inputs
- Analog inputs.

The DFDAF reformats, organizes, and transmits this data to the FDR.

The DFDAF controls power to the FDR. The FDR records and monitors the fault status of the FDR system when it receives power. The FDR sends fault information to the central maintenance computing function (CMCF) and the primary display function (PDF) in AIMS.

ARINC 717 Interfaces

The AIMS core processor module/communication module (CPM/Comm) supplies ARINC 717 interfaces to the DFDAF. The AIMS DFDAF interfaces with the FDR via ARINC 717. Each of the AIMS cabinets has an ARINC 717 transmitter and a ARINC 717 bus for the FDR.

The output from the right AIMS cabinet goes to a source select relay in the left AIMS cabinet. The source select relay uses the output from the left or right DFDAF for the FDR. Software in the left AIMS cabinet controls the position of the source select relay. When the source select relay energizes, the left AIMS cabinet ARINC 717 output goes to the FDR.

DFDAF

Normal operation of the FDRS is automatic. The DFDAF is in both the left and right AIMS cabinets. The normal source of the data sent to the FDR is from the DFDAF in the left AIMS cabinet. If the left DFDAF fails, the DFDAF in the right AIMS cabinet automatically sends data to the FDR. In this case, the source select relay de-energizes. The DFDAF automatically collects, reformats and transmits data to the FDR shortly after the AIMS cabinets receive power.

The DFDAF continuously monitors airplane status to determine when to turn on the FDR and when to transmit data to the FDR. The DFDAF turns on the FDR when any one of these occur:

- Any engine is in start mode (starter air valve switch in START position or fuel cutoff lever not in CUTOFF position)
- Any engine is in the RUN mode (N1 RPM>20% or N2 RPM>20%)
- The airplane is airborne (from weight on wheels card in systems cardfile).

To supply power to the FDR, the DFDAF sends a digital discrete to the electrical load management system (ELMS) power management panel. The power management panel sends a ground to energize a relay in the panel and pass power to the FDR.

The DFDAF receives these two discrete inputs from the FDR:

- Maintenance flag
- System status flag.

The maintenance flag discrete shows a FDR internal failure. A system status flag shows a system level failure such as:

- No FDR power
- No data input to the FDR
- A power control relay failure in the power management panel.

The DFDAF reports system status to the CMCF within the AIMS cabinet.

CMCF

The DFDAF receives fault and status information from the FDR. DFDAF sends fault reports and status data to the CMCF. The CMCF determines pass/fail. For each fault message sent to the CMCF, the DFDAF records this information:

- Which message was sent
- The specified data
- Diagnostic data

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**FDRS - DFDAF FUNCTIONAL DESCRIPTION**

- Date, time, and flight number
- Software part number.

Use the MAT to request the DFDAF to start the FDRS ground test. The MAT interfaces with the CMCF which sends the test command to the DFDAF. The DFDAF transmits two frames of data to the FDR to verify the operational status of the FDRS and responds back to the CMCF with a pass/fail message. You see the test results and fault status on the MAT and the EICAS display format.

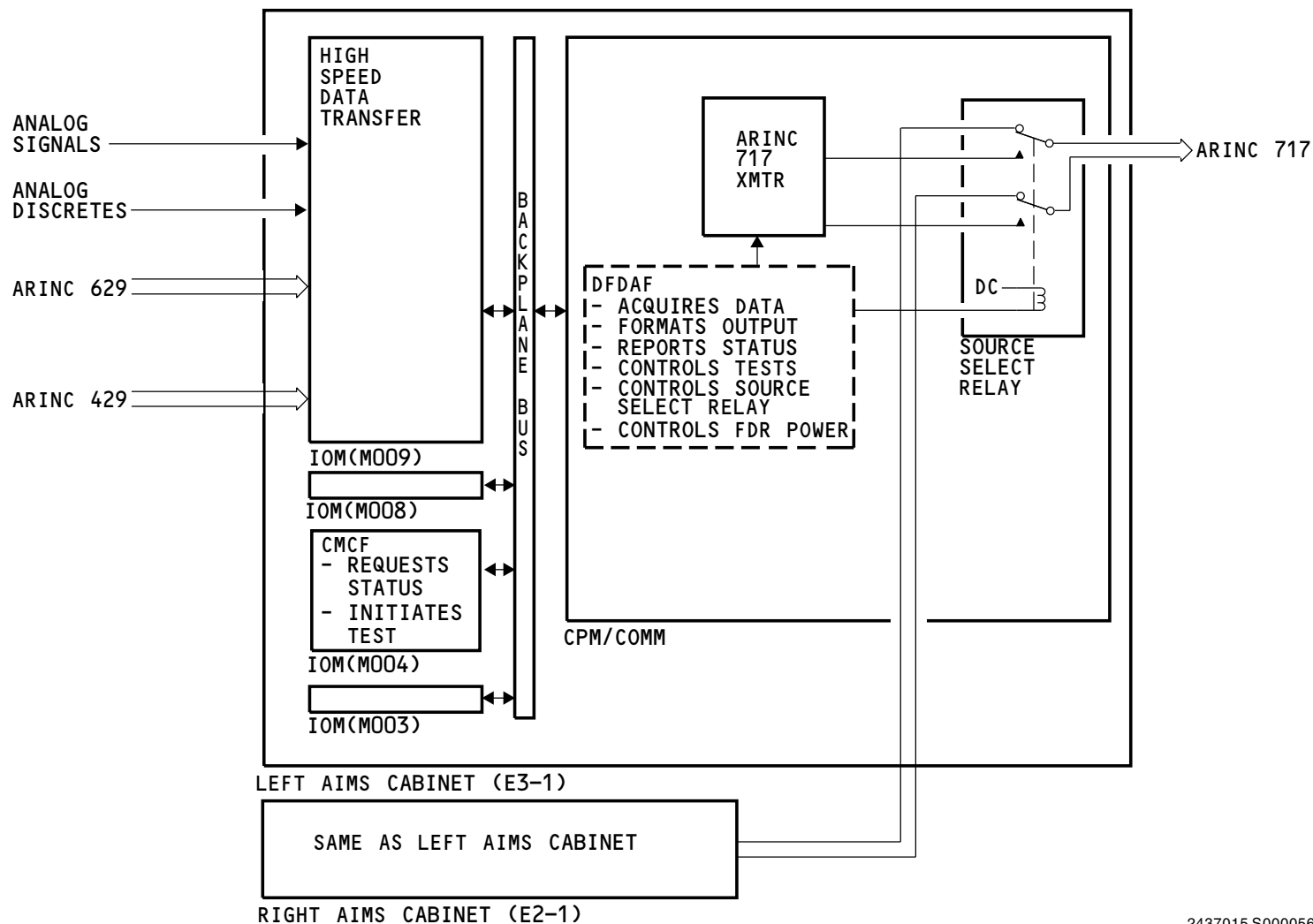
The DFDAF in the right AIMS cabinet sends data to the FDR first during the ground test. After the ground test for the DFDAF in the right AIMS cabinet, the DFDAF in the left AIMS cabinet sends data to the FDR to do the second half of the ground test.

A manual POWER ON command causes the FDR to transfer data to an ARINC 615 portable data loader. A manual POWER OFF command is available from the MAT to remove power to the FDR. The FDRS normal mode of operation inhibits the manual commands.

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RIGHT AIMS CABINET (E2-1)

FDRS - DFDAF FUNCTIONAL DESCRIPTION

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FDRS - FDR FUNCTIONAL DESCRIPTION

General

The flight data recorder (FDR) receives and records the last 25 hours of data. The FDR receives the data from the DFDAF. The FDR records the data in a solid-state memory. The memory is in a crash-proof, fire-resistant container. The FDR also monitors and sends fault data to the DFDAF.

Recording Data

The AIMS digital flight data acquisition function (DFDAF) sends data on a high speed data bus (ARINC 717) to the FDR. In the FDR, the receiver processes and sends the data to the microprocessor. The microprocessor receives, processes and stores the data in a crash survival solid-state memory.

Data Downloading

The front mounted automatic test equipment (ATE) connector on the FDR provides a connection for:

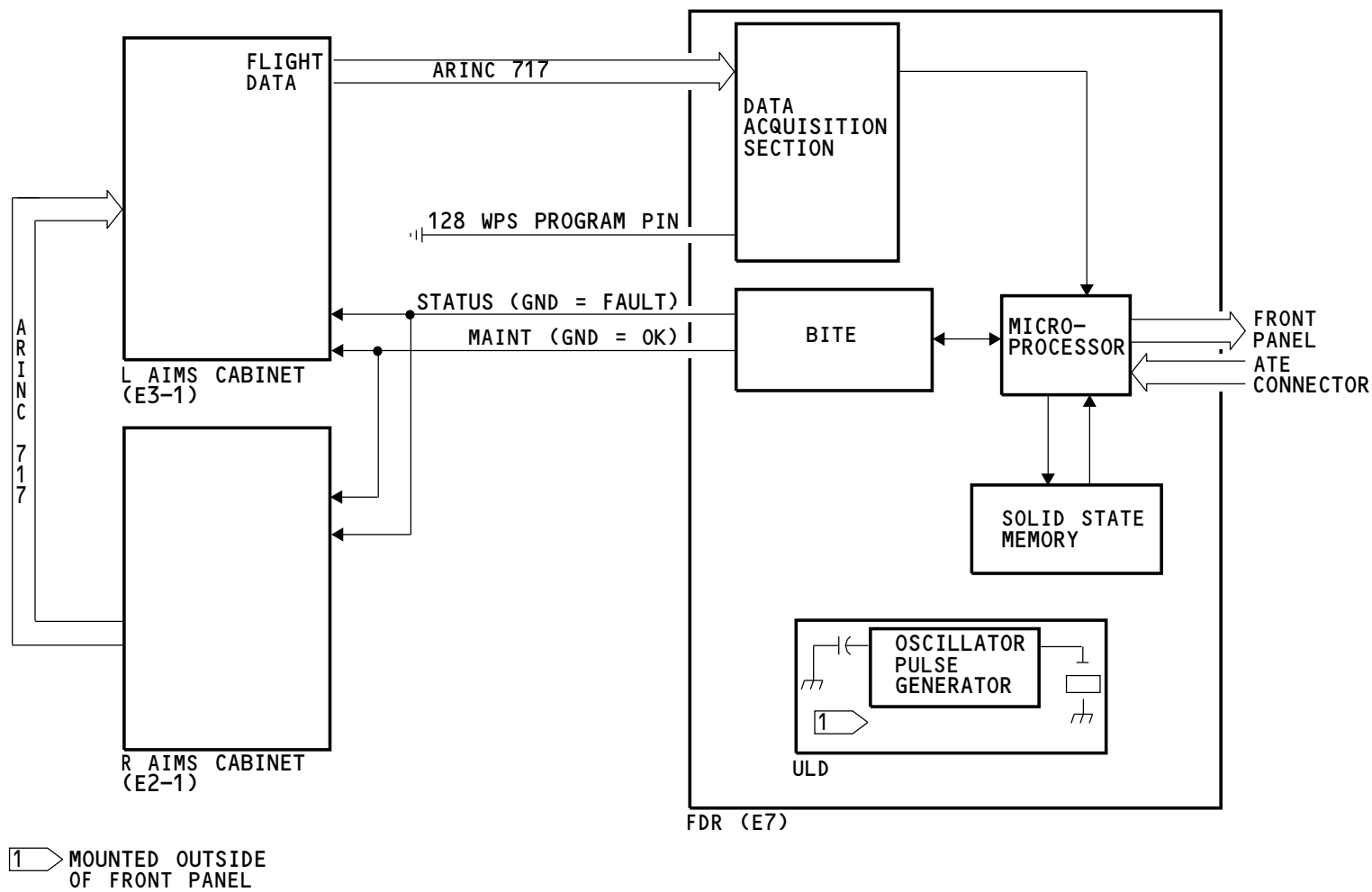
- ATE or ramp test equipment for recorder checkouts on or off the aircraft
- Data download to a portable data unit while on or off the airplane.

Non-normal Conditions

The FDR microprocessor sends these two discretes to the AIMS DFDAF:

- System status flag
- Maintenance flag.

The system status flag discrete causes a system level alert. A maintenance flag discrete causes a FDR internal failure. When a FDR fails, the FDR sends both discretes. When the AIMS DFDAF receives either discrete, EICAS (PDF) shows a FLT RCDR SYS status message. The AIMS DFDAF also sends the fault data to the AIMS CMCF.



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FDRS - FDR FUNCTIONAL DESCRIPTION

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FDRS - SYSTEM TESTS

General

You can do the FDRS system test to verify correct system interfaces and internal operation of the FDR. You do the test from the MAT.

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GROUND TESTS

SELECT ATA SYSTEM

(55)

30 PITOT AND STATIC ANTI-ICE SYSTEM

30 WINDOW HEAT CONTROL SYSTEM

31 AIMS - AIRPLANE CONDITION MONITORING SYSTEM

31 AIMS - DISPLAY SYSTEM

31 AIMS - AIMS - FLIGHT DATA RECORDER SYSTEM

31 AIMS - LEFT AIMS

31 AIMS - RIGHT AIMS

31 WARNING ELECTRONIC SYSTEM

32 AIR/GROUND SYSTEM

SELECT TEST TYPE

SYSTEM TEST

OPERATIONAL TEST

DOT

REPLACEMENT TEST

SELECT SYSTEM TEST

(1)

FLIGHT DATA RECORDER SYSTEM

CONTINUE

HELP

GO BACK

SELECT SYSTEM TEST

(1)

FLIGHT DATA RECORDER SYSTEM

M42011 S000617986_V1

FDRS - SYSTEM TESTS

31-31-00

31-31-00-010

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**FDRS - SPECIAL FUNCTIONS****General**

These are the special functions for the flight data recorder system:

- Flight Data Recorder Power Off
- Flight Data Recorder Power On.

Flight Data Recorder Power Off

A manual POWER OFF command is available from the MAT to remove power to the FDR. The FDRS normal mode of operation inhibits the manual commands.

Flight Data Recorder Power On

A manual POWER ON command causes the FDR to transfer data to an ARINC 615 portable data loader.

SPECIAL FUNCTIONS

SELECT ATA SYSTEM (55)

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

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31 AIMS - FLIGHT DATA RECORDER SYSTEM

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SELECT SPECIAL FUNCTION (2)

FLIGHT DATA RECORDER POWER OFF

FLIGHT DATA RECORDER POWER ON

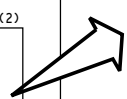
CONTINUE

HELP

GO BACK

SELECT SPECIAL FUNCTION (2)

FLIGHT DATA RECORDER POWER OFF
FLIGHT DATA RECORDER POWER ON



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FDRS - SPECIAL FUNCTIONS

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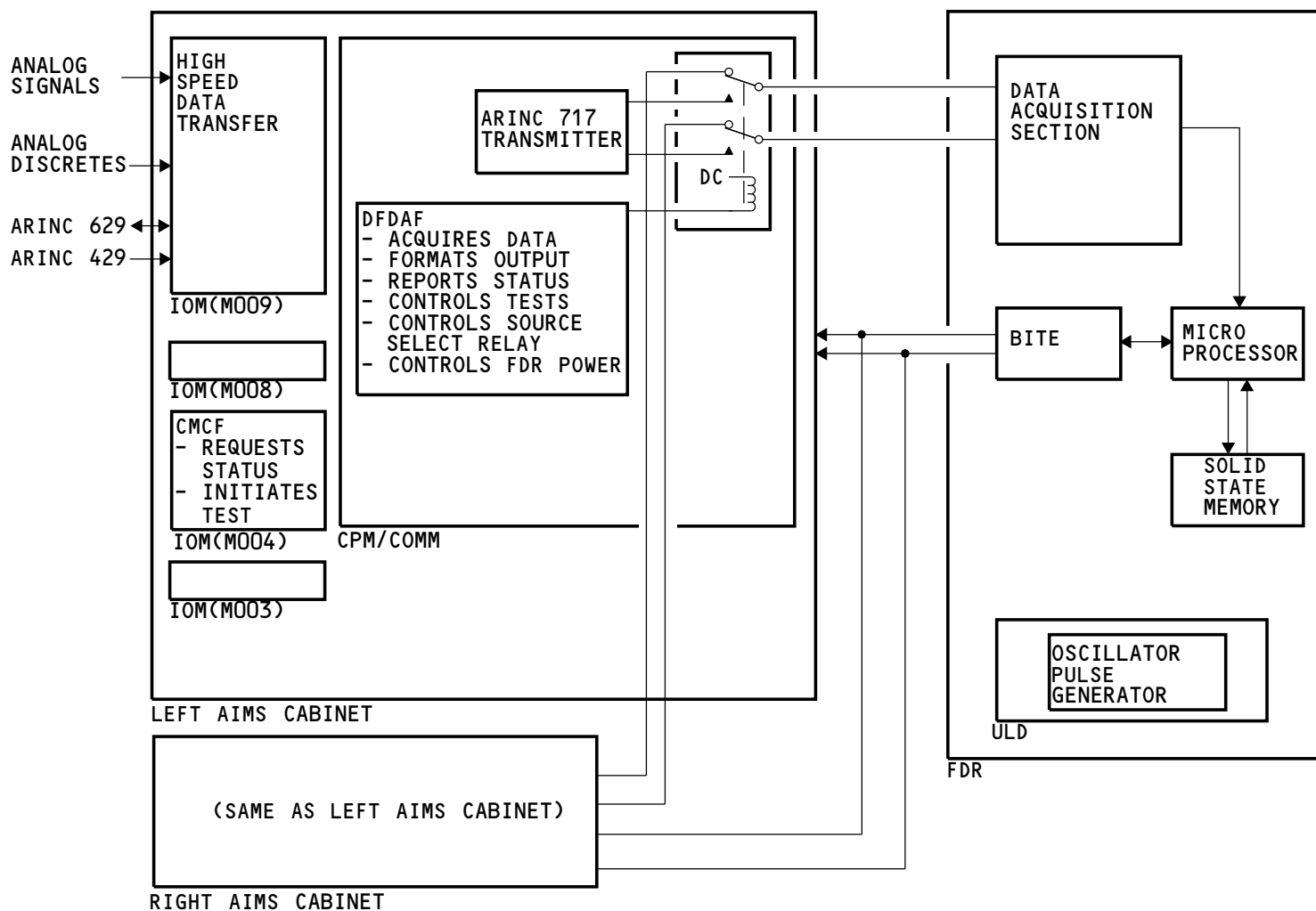


FDRS - SYSTEM SCHEMATIC

Schematic

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FDRS - SYSTEM SCHEMATIC

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**FLIGHT COMPARTMENT PRINTING SYSTEM - GENERAL DESCRIPTION****General**

The flight compartment printer supplies high-speed hard copy of text for these systems:

- Primary display system (PDS)
- Airplane condition monitoring system (ACMS)
- Central maintenance computing system (CMCS).

The flight compartment printer receives data from the print driver partition of the data communication management function (DCMF). The DCMF is part of the airplane information management system (AIMS). The printer sends status and error information back to the DCMF.

The DCMF prioritizes data sent to the printer in this order:

- Flight deck communication function (FDCF) of the DCMS
- Central maintenance computing function of the CMCS
- Airplane condition monitoring function of the ACMS
- Multifunction display (MFD).

Abbreviations and Acronyms

- ac - alternating current
- ACMS - airplane condition monitoring system
- AIMS - airplane information management system
- CMCS - central maintenance computing system
- CPM - core processor module
- DCMF - data communication management function
- DCMS - data communication management system
- FDCF - flight deck communication function
- LAN - local area network
- MFD - multifunction display
- OPC - operational program configuration file
- OPS - operational program software

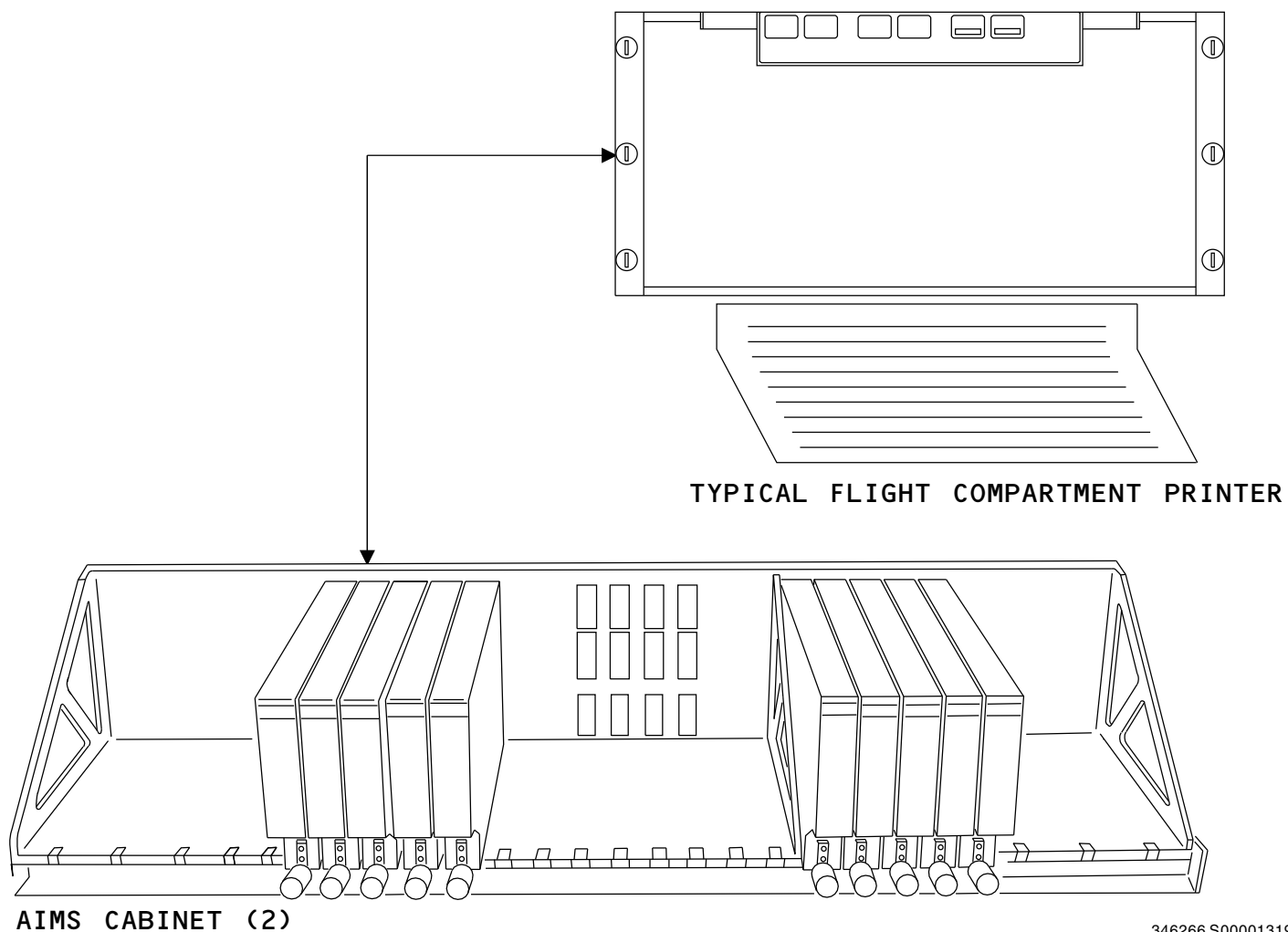
- PDF - primary display function
- PDS - primary display system

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AIMS CABINET (2)

TYPICAL FLIGHT COMPARTMENT PRINTER

346266 S0000131971_V2

FLIGHT COMPARTMENT PRINTING SYSTEM - GENERAL DESCRIPTION

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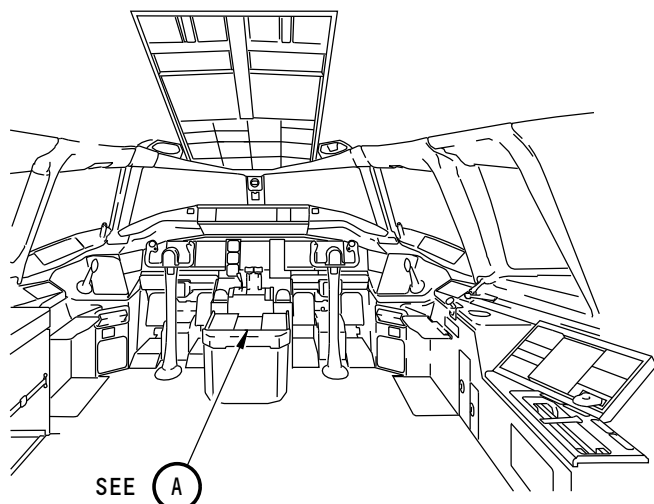


FLIGHT COMPARTMENT PRINTING SYSTEM - COMPONENT LOCATIONS - FLIGHT COMPARTMENT

Flight Compartment Component locations

The flight compartment printer is on the P8 aft aisle stand panel. It is in front of the cabin interphone handset.

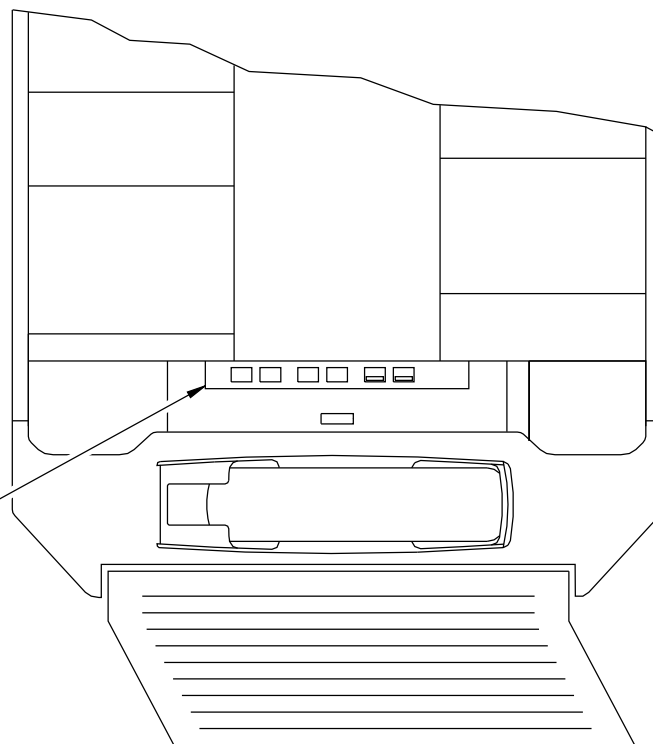
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SEE (A)

FLIGHT COMPARTMENT

AFT AISLE STAND PANEL, P8
• FLIGHT COMPARTMENT
PRINTER (TYPICAL)



(A)

M41598 S000617992_V2

FLIGHT COMPARTMENT PRINTING SYSTEM - COMPONENT LOCATIONS - FLIGHT COMPARTMENT

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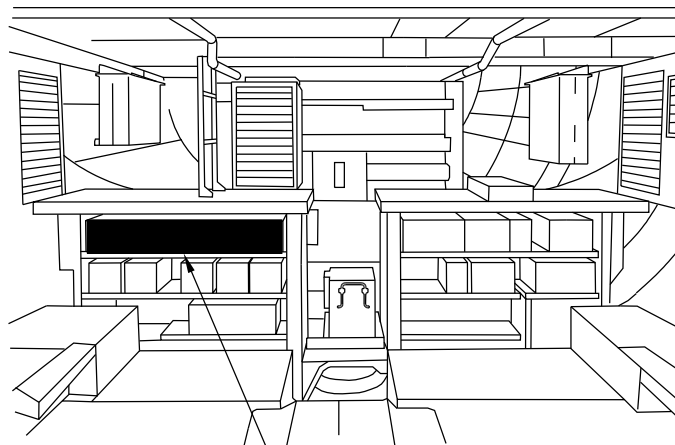
FLIGHT COMPARTMENT PRINTING SYSTEM - COMPONENT LOCATIONS - MEC

Other System Component Locations

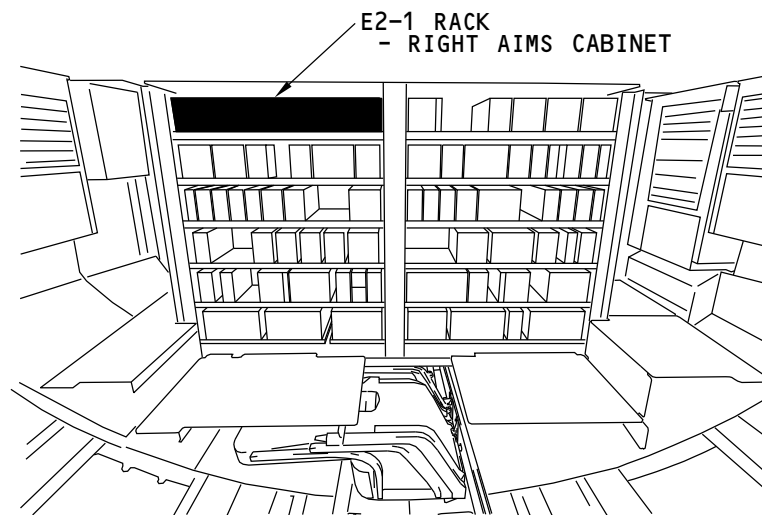
The print driver is a software partition in the data communication management function (DCMF). The DCMF is in the AIMS core processor module/communications (CPM/Comm) in both the left and right AIMS cabinets. Both AIMS cabinets are in the main equipment center.

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**E3-1 RACK
- LEFT AIMS CABINET**
(LOOKING FORWARD)



(LOOKING AFT)

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FLIGHT COMPARTMENT PRINTING SYSTEM - COMPONENT LOCATIONS - MEC

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FLIGHT COMPARTMENT PRINTING SYSTEM - INTERFACES

Power

The right main ac bus supplies power to the flight compartment printer.

Discretes

The left AIMS cabinet sends an enable discrete before it sends the printer data load.

ARINC 429

The flight compartment printer receives new operational program software (OPS) on the data load bus from the left AIMS cabinet.

The DCMF in both AIMS cabinets sends print data to the printer on the DCMF data bus.

The central maintenance computing system (CMCS) in the left AIMS cabinet sends test data to the printer on the CMCS bus. If the left AIMS cannot send CMCS information, it will send the information from the right AIMS cabinet.

The flight compartment printer sends status and error messages to the DCMS in both AIMS cabinets over the status bus.

Analog

The master dim and test module supplies the power for the indication lights on the front panel. The master dim and test module also sends a test input to the printer.

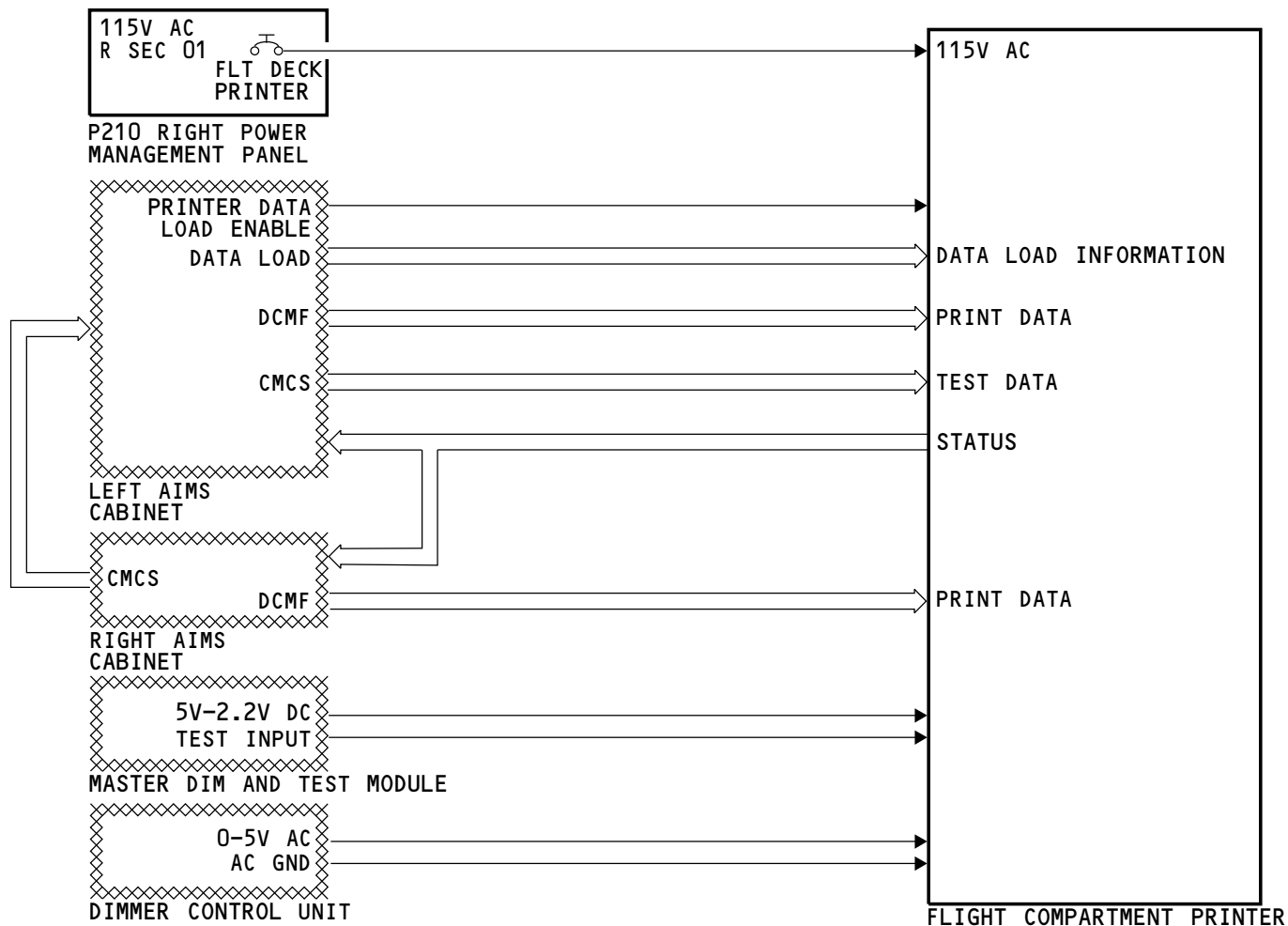
The dimmer control unit sends lighting control for the integral lighting for the printer.

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FLIGHT COMPARTMENT PRINTING SYSTEM - INTERFACES

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**FLIGHT COMPARTMENT PRINTING SYSTEM - FLIGHT COMPARTMENT PRINTER****General**

The printer can print an 8.5 inch page. The printer resolution is 300 dots per inch. You can load a full paper roll of 125 linear feet into the printer. The printer uses the U.S. standard 8.5 inch roll or the A4 European Air standard paper.

Physical Description

The printer weighs approximately 12.2 lbs without a paper roll.

These are the dimensions of the printer:

- 5 inches high
- 10.75 inches wide
- 10.25 inches deep.

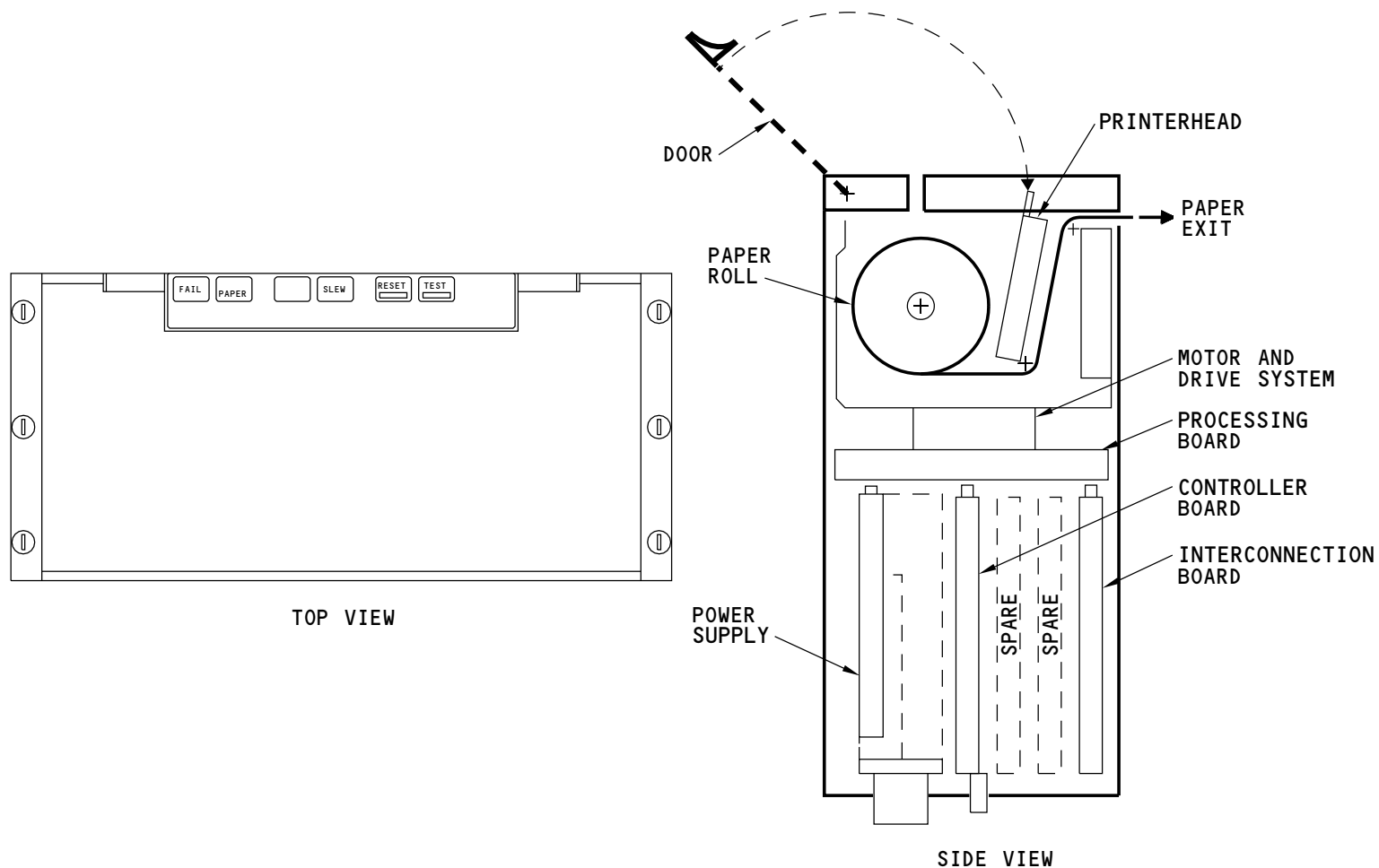
The printer contains all the mechanical components and electronics necessary for printer operation.

The mechanical components include:

- Printer head
- Rollers to move the paper
- Motor and drive system.

The electronic components include:

- Power supply
- Processor board
- Controller board
- Interconnection board
- 2 connectors.



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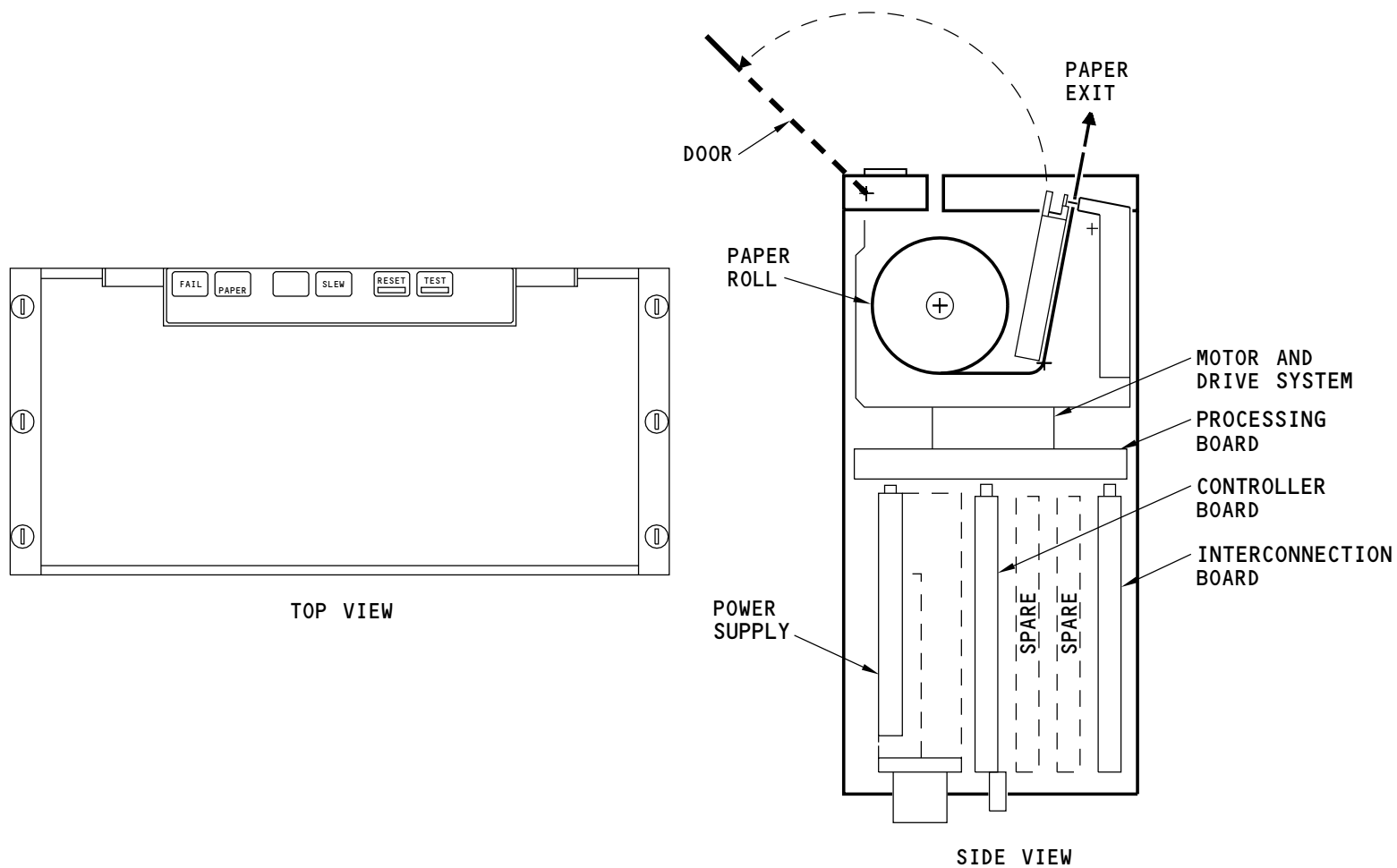
FLIGHT COMPARTMENT PRINTING SYSTEM - FLIGHT COMPARTMENT PRINTER

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FLIGHT COMPARTMENT PRINTING SYSTEM - FLIGHT COMPARTMENT PRINTER

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**FLIGHT COMPARTMENT PRINTING SYSTEM - OPERATION****General**

There are five functional buttons on the printer. Two of the push buttons show printer status. Three of the push buttons control the printer.

Indications

The amber FAIL light comes on when a failure occurs that you can not repair on the line.

The amber PAPER light comes on when the printer is out of paper or when there is a paper jam.

Controls

Push the SLEW switch to move the paper out of the printer. Release the SLEW switch to stop the paper.

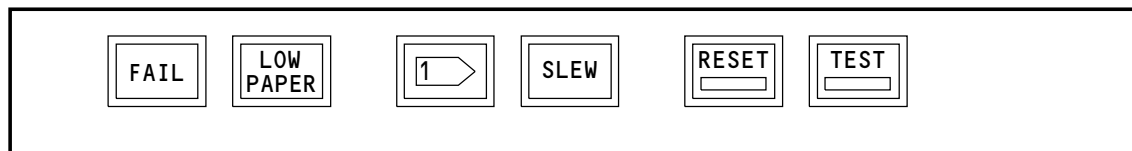
Push the RESET switch to cause a power-up reset of the electronic circuitry of the printer. Printing will stop. Messages in the printer memory are kept in memory. A green bar on the switch shows during the reset.

Push the TEST switch to do a test of the printer. During the test, a test pattern for text prints. The test pattern shows all the text characters the printer can print. A 300 dots per inch test pattern for graphics follows the test pattern for text. A green bar on the switch shows during the printer test.

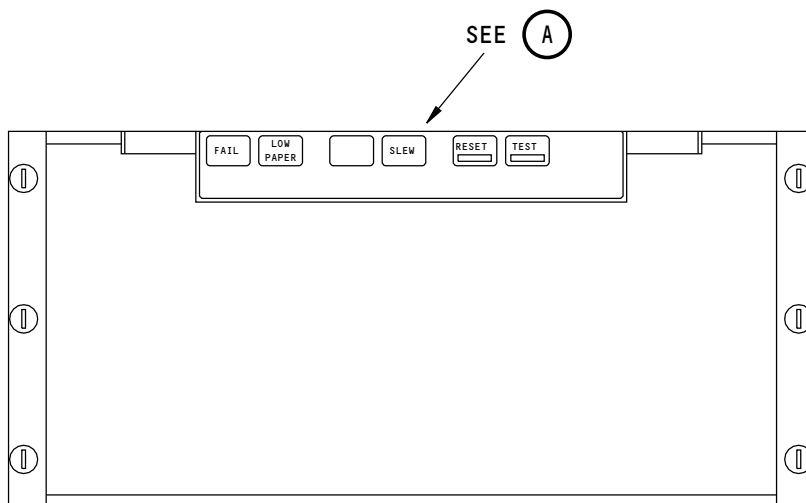
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A



1 THIS BUTTON NOT CONNECTED

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FLIGHT COMPARTMENT PRINTING SYSTEM - OPERATION

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FLIGHT COMPARTMENT PRINTING SYSTEM- FUNCTIONAL DESCRIPTION

General

There are three main electronics boards to control the printer. They are the:

- Controller board
- Processing board
- Interconnection board.

The door assembly unit detects when the door is open and sends a signal to the interconnection board. The interconnection board then sends a signal to turn on the fail indication on the front panel.

Controller Board

The controller board receives brightness controls from the dimmer control unit and the master dim and test module. These controls are to drive the lights on the front panel.

Processing Board

The processing board processes all inputs from the left and right AIMS cabinets. The processing board changes the data to signals to control the thermal print head.

Interconnection board

The interconnection board controls the flow of data between the processor board the controller board and the mechanical devices that print the paper.

The interconnection board controls the stepper motor and thermal print head to print on the paper. It also monitors the paper and door status. The interconnection board then turns on the lights on the front panel.

The stepper motor moves a roller system which controls the paper. A pulley/belt system control the speed of the motor output.

The interconnection board sends signals to the thermal print head to control what is printed. The thermal print head touches the sensitive side of the paper.

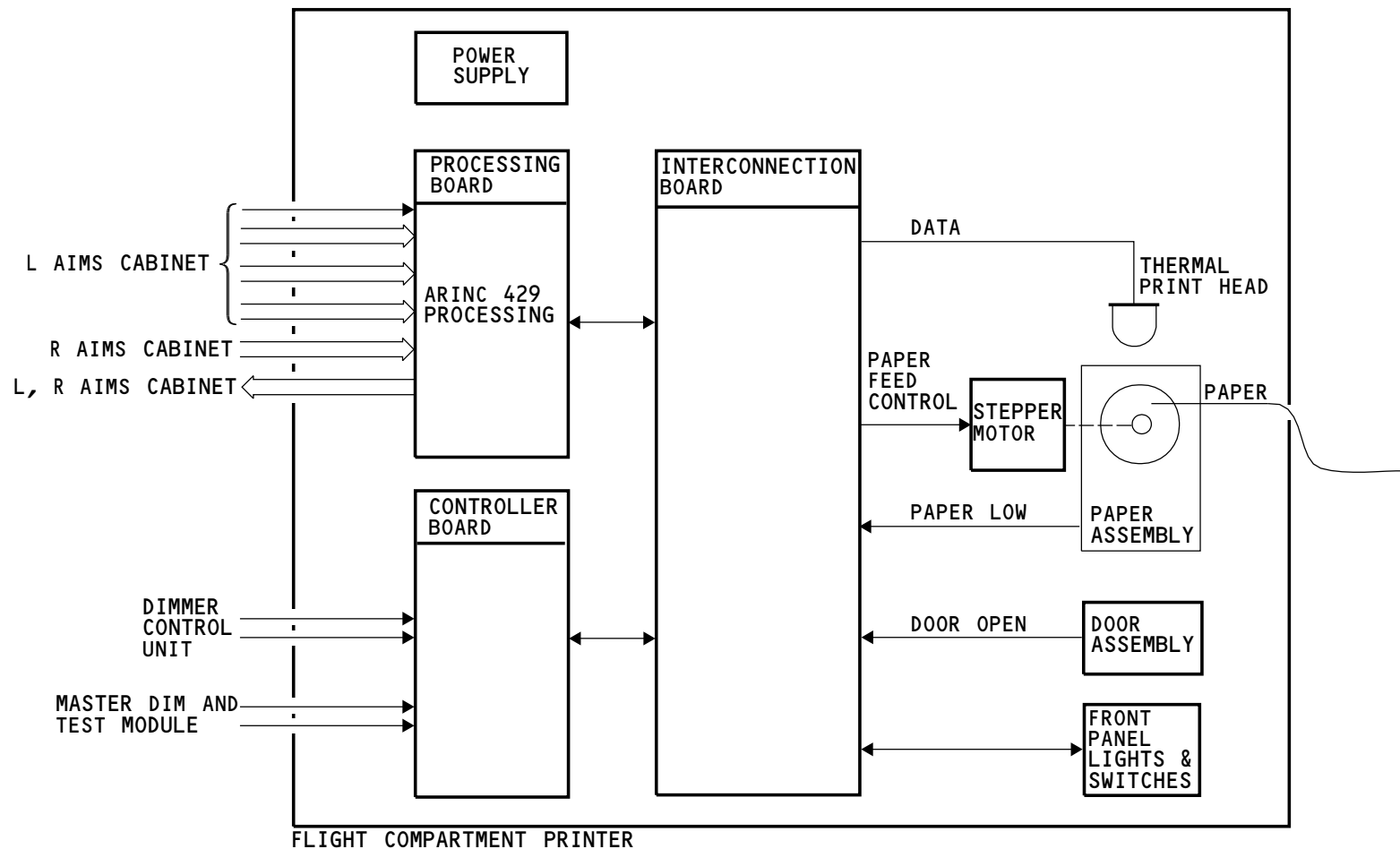
The paper assembly unit detects when paper is low or out and sends a signal to the interconnection board. The interconnection board then sends a signal to turn on the low paper indication on the front panel.

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FLIGHT COMPARTMENT PRINTING SYSTEM- FUNCTIONAL DESCRIPTION

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FLIGHT COMPARTMENT PRINTING SYSTEM - OPERATIONAL GROUND TESTS

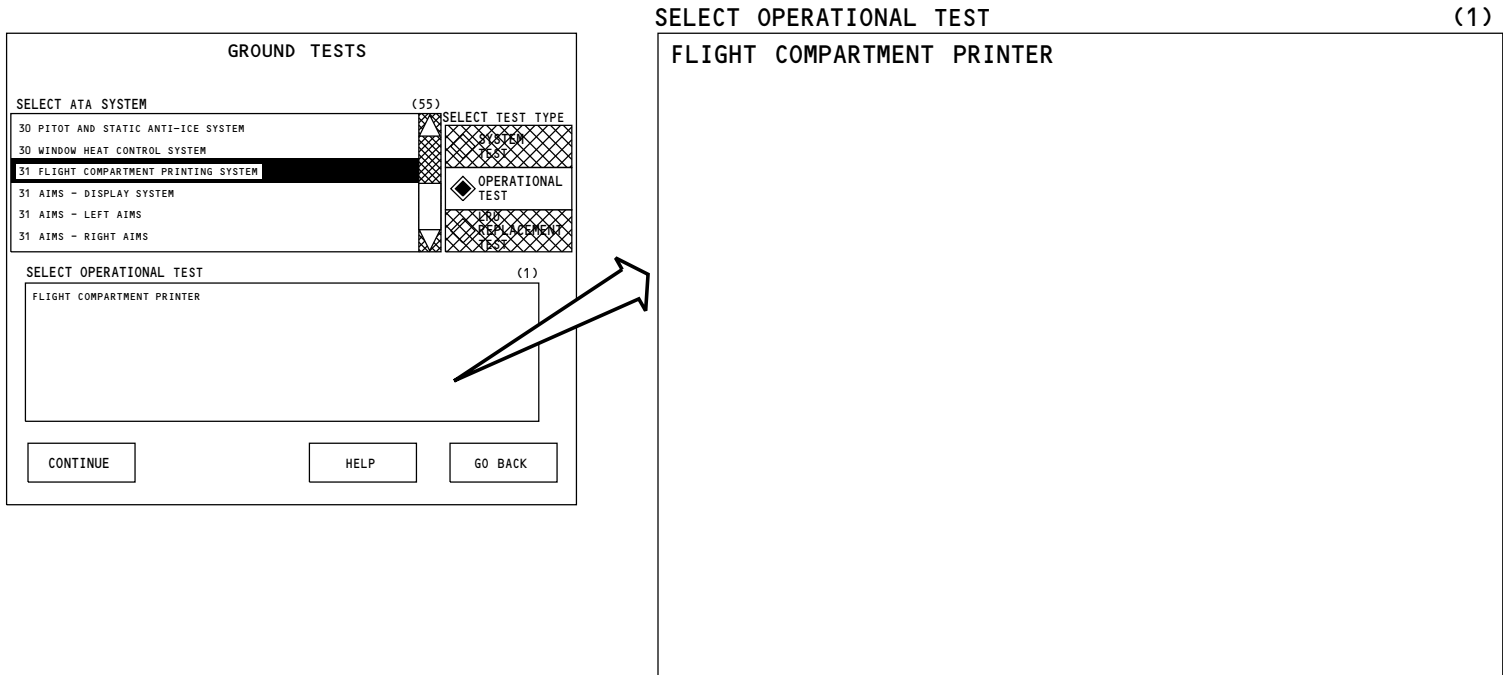
General

You can do a test of the flight compartment printer with the MAT. The MAT has one test for the printer, it is an operational ground test.

Flight Compartment Printer

During this test, the printer does an internal test. If the printer has no problem, it makes a printout of a page of characters. The lights on the printer come on during the test.

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FLIGHT COMPARTMENT PRINTING SYSTEM - OPERATIONAL GROUND TESTS

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AIRPLANE CONDITION MONITORING SYSTEM - INTRODUCTION

General

The airplane condition monitoring system (ACMS) collects, monitors, and records data from airplane systems. This data causes reports. The purpose of the reports are to:

- Analyze airplane performance
- Analyze trends
- Report significant events
- Troubleshoot faults.

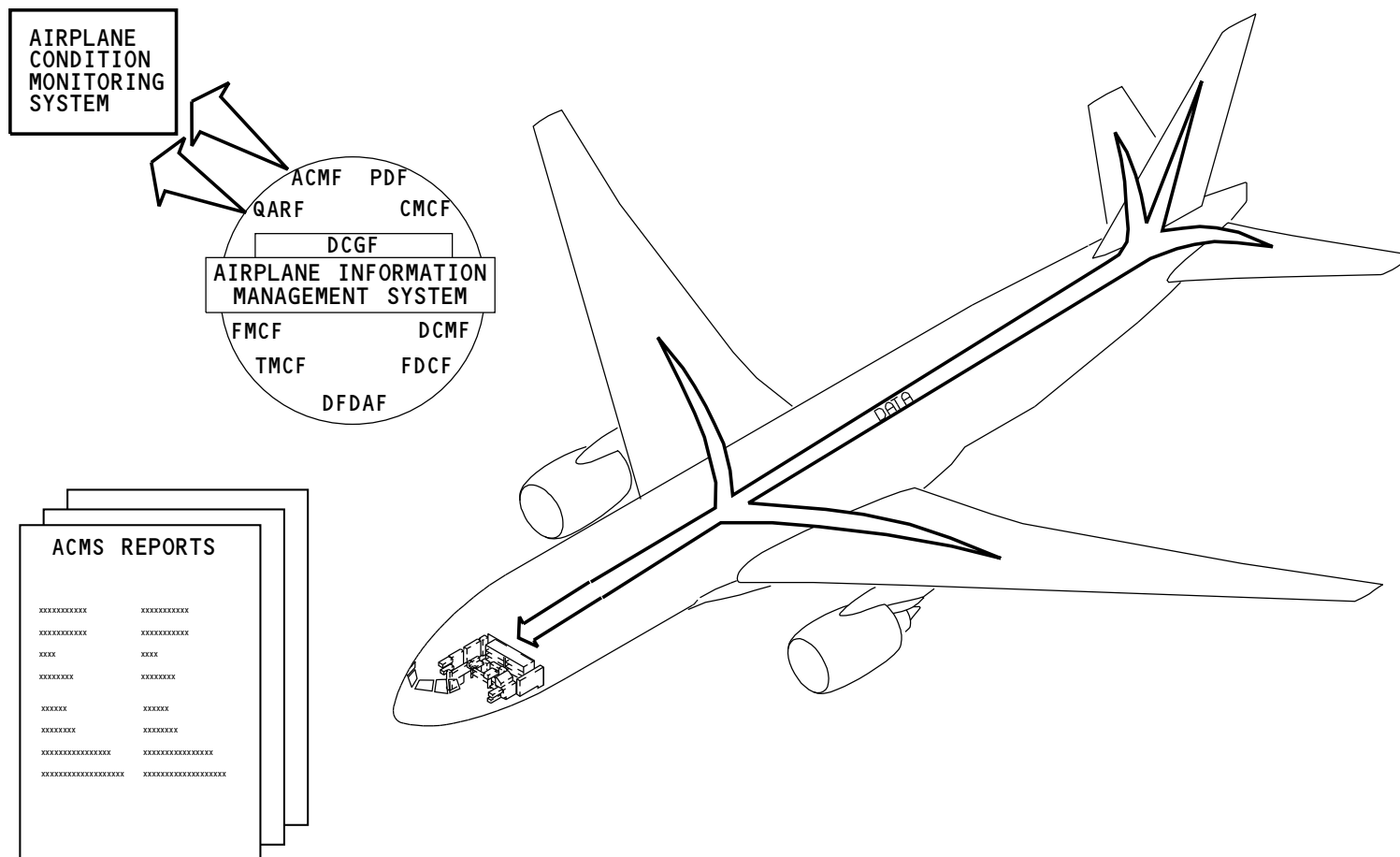
Abbreviations and Acronyms

- ACMF - airplane condition monitoring function
- ACMS - airplane condition monitoring system
- AIMS - airplane information management system
- AMI - airline modifiable information
- ARINC - Aeronautical Radio, Inc.
- ATE - automatic test equipment
- CPM/Comm - core processor module/communications
- CPM/STD - core processor module/standard
- CPU - central processing unit
- DCMF - data communication management function
- EEPROM - electrically erasable programmable read only memory
- GBST - ground based software tool
- IOM - input/output module
- MAT - maintenance access terminal
- OPC - operational program configuration
- OPS - operational program software
- QAR - quick access recorder
- SDU - satellite data unit
- SRAM - static random access memory
- VHF - very high frequency

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AIRPLANE CONDITION MONITORING SYSTEM - INTRODUCTION

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ACMS - GENERAL DESCRIPTION

General

The ACMS has the airplane condition monitoring function (ACMF) in the left and right AIMS cabinets.

ACMS user interface is through one of these display formats:

- On the maintenance access terminal (MAT), or
- On the portable maintenance access terminal (PMAT), or
- On the maintenance laptop (also known as laptop maintenance access terminal (LMAT)).

The ACMS has an interface with the QAR.

The airline uses a ground based software tool (GBST) to program the ACMS with custom features.

ACMF

The ACMF is in the left and right cabinets. The ACMF is a combination of standard and custom software. The software that the airline customizes sets these functions:

- Report format
- Report content
- Triggers.

Triggers are logic equations that detect conditions and cause data to record. An example of a trigger is an engine exceedance or a flight phase.

The ACMF-L sends the data to the:

- QAR
- MAT
- PMAT (if installed)
- MAT or PMAT disk drive to record on a diskette (if installed)
- Data communication management function (DCMF).

The ACMF-R sends the data to the:

- QAR
- Data communication management function (DCMF).

The DCMF controls the interface to:

- The printer
- The satellite data unit (SDU)
- The VHF transceivers.
- The HF transceivers.

MAT / LMAT

The ACMS main menu shows on the MAT, LMAT or PMAT. The standard ACMS menu lets the user do these:

- Modify constants
- Set triggers for manual reports
- See reports
- Set the destination for reports
- See real-time data.

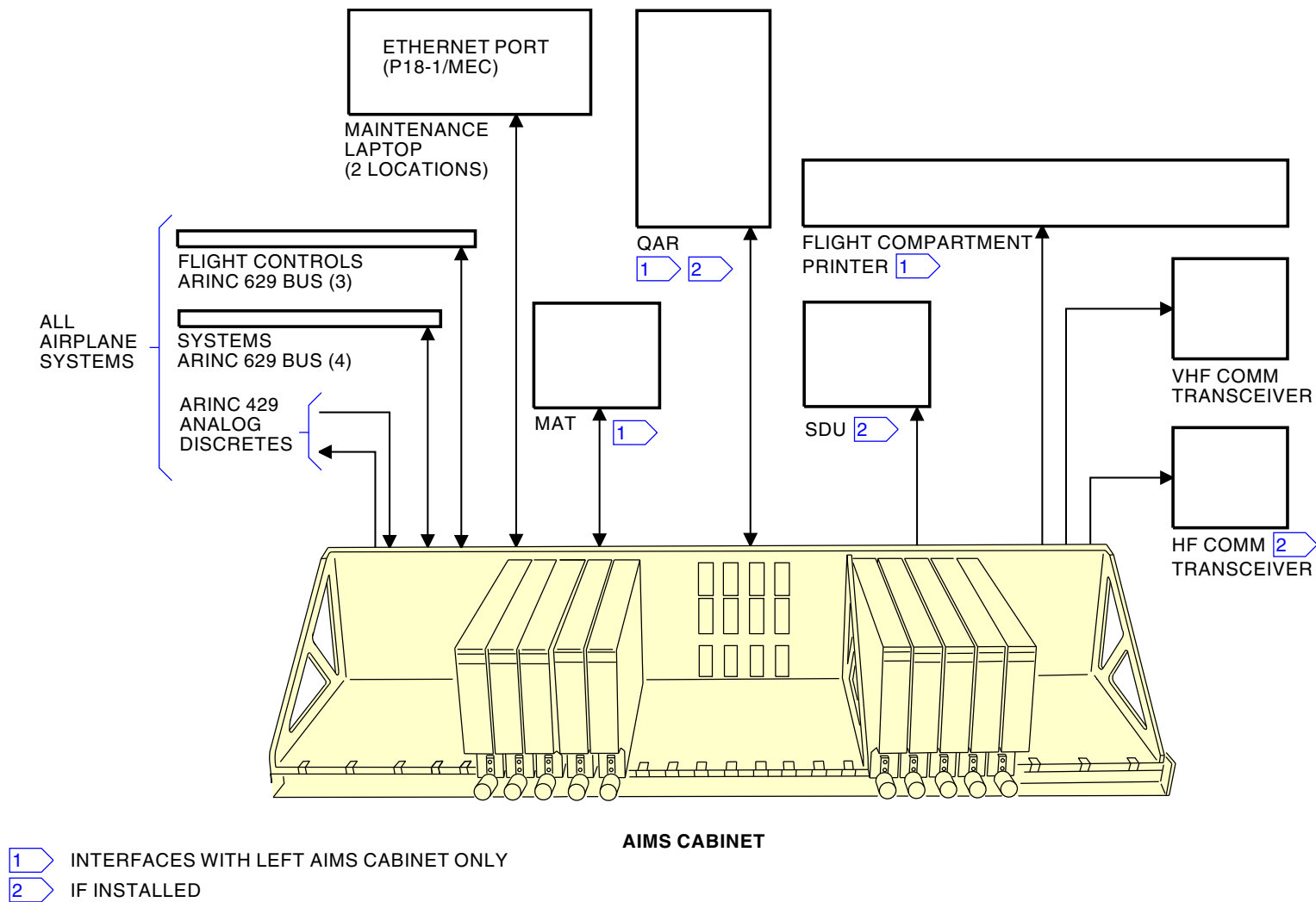
There are five ACMS menus that the airline can customize with the GBST.

Ground Based Software Tool

The airline uses the GBST to do these:

- Create custom MAT menus and displays
- Create specific reports
- Set triggers
- Set report types.

To load information from a diskette into the ACMF memory, use the disk drive on the MAT.



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ACMS - GENERAL DESCRIPTION

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**ACMS - COMPONENT LOCATION****ACMS Component Locations**

The airplane condition monitoring function (ACMF) is in the left and right AIMS cabinets.

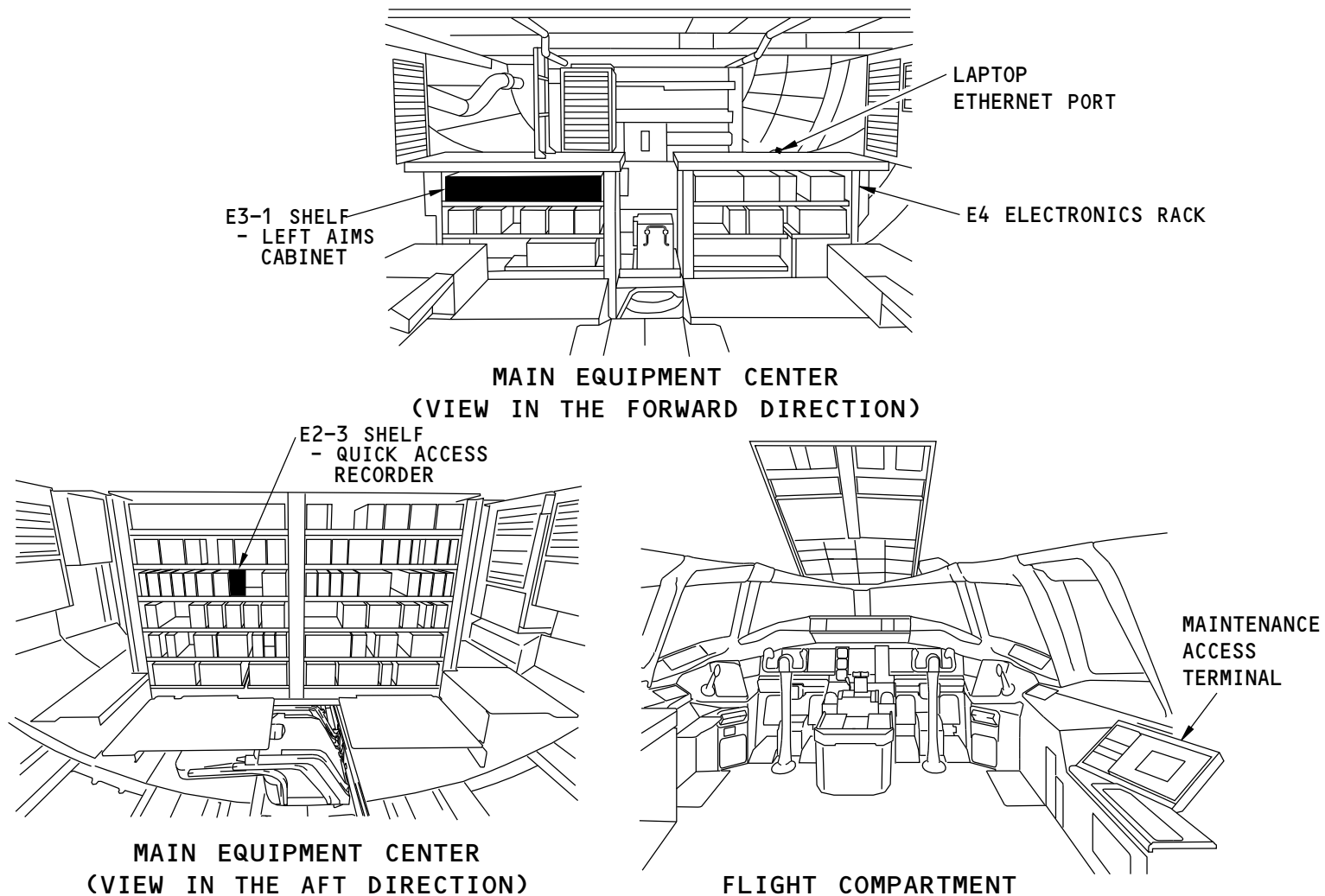
The QAR is on the E2 equipment rack.

Other System Component Locations

The user interface for the ACMS menus is through a maintenance access terminal (MAT) or portable maintenance access terminal (PMAT).

The user interface for the ACMS menus is through a maintenance access terminal (MAT), or the two laptop Ethernet ports (P18-1 panel and E-4 rack in main equipment center).

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ACMS - COMPONENT LOCATION

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ACMS - INTERFACES

General

The ACMS collects data to record and sends reports to many output devices. The MAT, LMAT or PMAT lets you see ACMS data and control ACMS functions.

Data Collection

Airplane systems send data into the left AIMS cabinet input/output modules (IOMs) on:

- Flight controls ARINC 629 buses
- Systems ARINC 629 buses
- ARINC 429 buses
- Analog inputs
- Discrete inputs.

Some airplane system data only goes to the right AIMS cabinet. The data comes from the:

- Right angle of attack vane
- Left total air temperature probe, element two.

The data conversion gateway function in the right AIMS cabinet converts this data to ARINC 629. It then transmits the data to the left AIMS cabinet over the right flight controls ARINC 629 bus.

QAR

The QAR sends two discretes to IOM (M003) and IOM (MOO4) in the left AIMS cabinet. The discretes are QAR recorder status and QAR tape low status.

The QAR recorder status discrete shows internal faults.

There are four digital data buses between the QAR and the CPM/Comm in the left AIMS cabinet.

The CPM/Comm sends a synch pulse to the QAR. This synch pulse is in ARINC 717 format.

The CPM/Comm sends ACMF data to the QAR. This ACMF data is in ARINC 717 format.

The CPM/Comm sends control data to the QAR. This control data is in RS422 format. The control data turns on the QAR.

The QAR sends data and status to the CPM/Comm in the left and/or right AIMS cabinets. The ACMF-L/ACMF-R monitors the data and status.

Control

The user requests information with the MAT, LMAT or PMAT. The MAT/LMAT/PMAT has ACMS menus and display formats. Also, ACMF airline modifiable information loads from the disk drive on the MAT, LMAT or PMAT.

Output

ACMS reports can go to these:

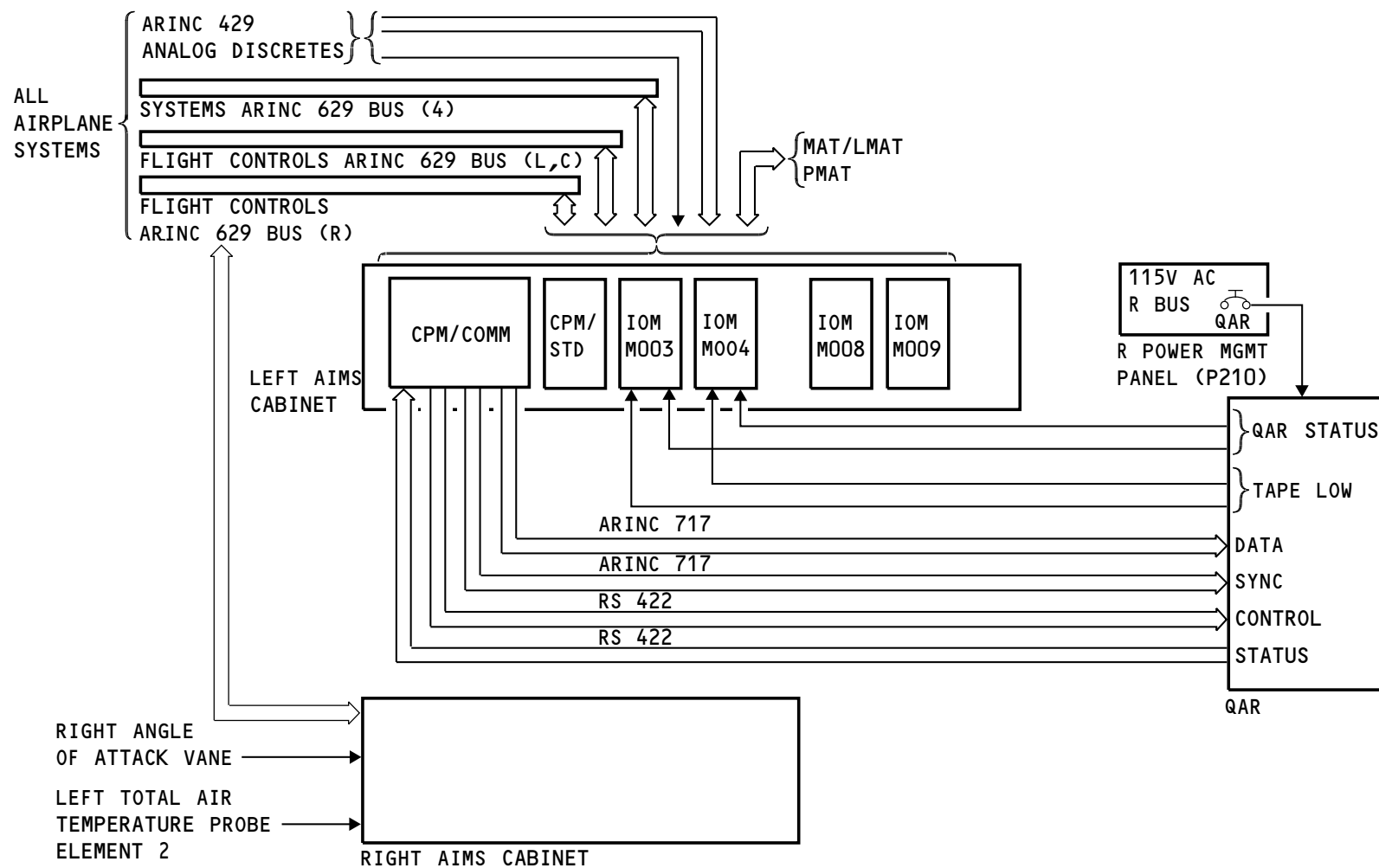
- QAR to record
- Data communication management system to transmit to a ground station
- Printer to print
- MAT, LMAT or PMAT to see on the display or to record on a floppy disk or a disk drive.

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ACMS - INTERFACES

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**ACMS - QUICK ACCESS RECORDER****General**

The wireless quick access recorder (WQAR) records, stores, and transmits (wireless) data sent from the ACMF. When configured with the wireless options, after aircraft landing, the recorded data is compressed and encrypted for secure transmission utilizing cellular/PCS phone technology integrated internally within the WQAR.

ARO 001-010; AIRPLANES WITH TELEDYNE 2243800-61/-73/-79/-81

The WQAR has a standard 128 MB - 2GB PCMCIA Card. PCMCIA Card is in a solid state FLASH media and can be accessed by removing the PC card via the access door in front of the unit.

ARO 011-999; AIRPLANES WITH TELEDYNE 2243800-362/-364

The WQAR has a standard 8GB Compact Flash (CF) recording media. CF recording media is a solid state FLASH media and can be accessed via the access door in front of the unit.

ARO ALL**Features**

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, recording media is not inserted and recording media memory is low or full.
- A manual eject button - allows the recording media to be ejected manually.
- An access door - protects and provides access to the recording media. Removal of the antenna might be required to open the wireless QAR access door.
- Internal card slot - provides internal storage and is not accessible to the user.
- Recording media slot - allows installation of the recording media.

- ATE Connector - provides connection of external Automatic Test Equipment (ATE).
- Cellular antenna mounting holes - provisions for front panel antenna installation.

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

When the wireless transmission mode is enabled and the airplane is on the ground, the 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.

A latched access door protects the recording media drive. The door must be opened to gain access to recording media slot. The alphanumeric display and fail indicator are both visible with the access door closed.

ARO 001-010; AIRPLANES WITH TELEDYNE 2243800-61/-73/-79/-81

The WQAR is configured with two PC Cards installed in the PC Card drive. The left side slot is configured with an Internal PC Card that provides internal memory storage for the WQAR software. The right side slot is configured with a Media PC Card that provides storage for recorded data.

ARO 011-999; AIRPLANES WITH TELEDYNE 2243800-362/-364

The WQAR is configured with a Removable SIM Module (RSM), the Compact Flash (CF) Recording Media, the RJ-45 port, and the RS-232 Console Port. The CF recording media contains encrypted backup flight data and system log file. The Removable SIM Module can hold up to four SIM cards, one for each of the four cellular radios inside the LRU.

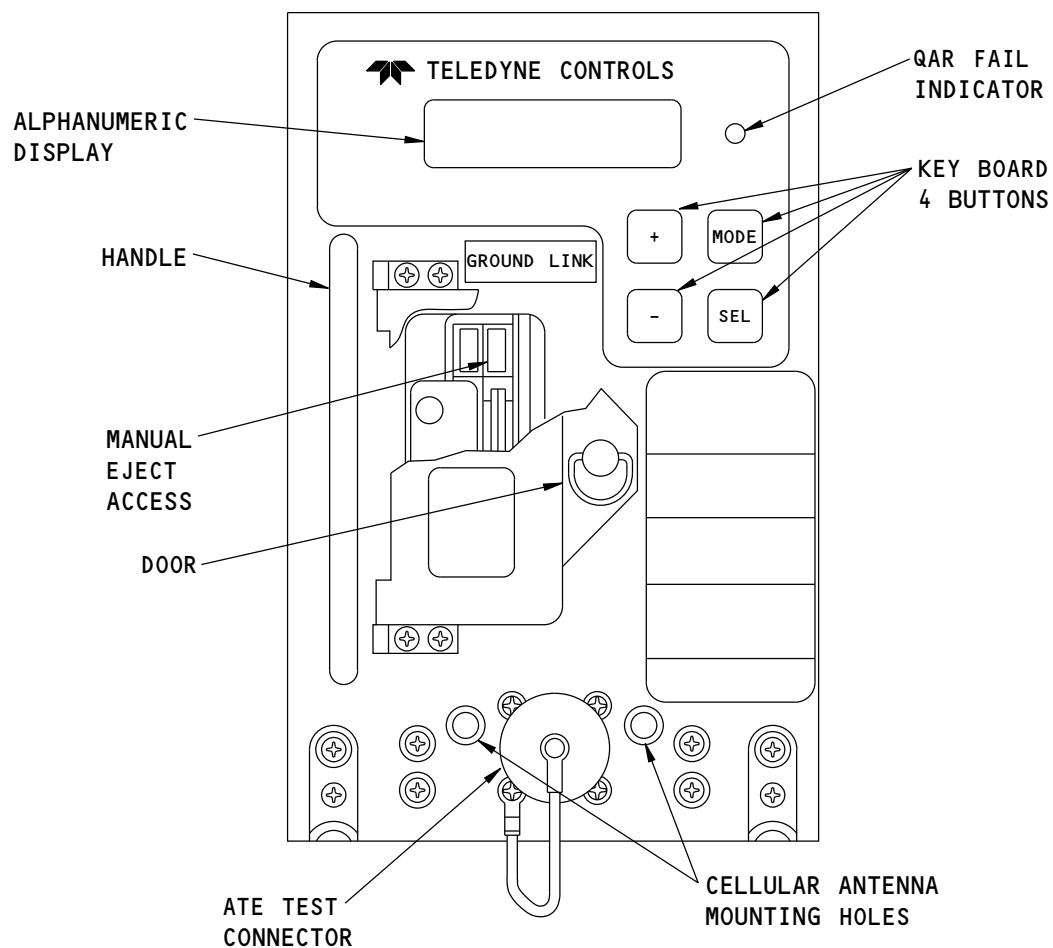
ARO ALL

The keyboard has four keys. You use these keys to select data, modes, and tests.

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ACMS - QUICK ACCESS RECORDER

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ACMS - ACMF FUNCTIONAL DESCRIPTION

General

The ACMF gets airplane system data, records the data, and creates reports.

Data Collection

The ACMF can process:

- ARINC 429 or ARINC 629 data received by the left AIMS cabinet
- ARINC 429 data received by only the right AIMS cabinet
- Analog and discrete input data to the left and right AIMS cabinets
- Data that communicates between the AIMS software partitions
- Data that goes from the left AIMS cabinet to ARINC 429 buses and ARINC 629 buses.

From the four IOMs or the other CPMs, this data transmits through the backplane bus to the ACMF.

CPM/STD

The left and right AIMS cabinets require the ACMF software.

There are different parts of the software. The parts include these:

- ACMF operational program software (OPS)
- AIMS operational program configuration file (OPC)
- ACMF airline modifiable information (AMI).

The ACMF operational program software is standard and the airlines can not customize it. It does these things:

- Evaluates the triggers
- Gets the data
- Compresses the data
- Prepares the reports.

The ACMF AMI sets the:

- Report formats

- Triggers to record data
- Customized menus, display formats, and MAT ACMS features.

The ACMF AMI also contains the onboard signal database. This database has all the available signals to the ACMF.

CPM/Comm

The ACMF sends data to these functions in the CPM/Comm:

- Data communication management function (DCMF)
- Quick access recording function (QARF)

The DCMF controls these interfaces:

- PlaneNet for MAT/LMAT/PMAT
- Printer
- Satellite communications system (SATCOM)
- VHF communication system.
- HF communication system.

The QARF controls the interface to the quick access recorder.

IOM

The ACMF sends data to these functions in the IOM:

- Central maintenance computing function (CMCF).

The CMCF records and shows the status of ACMS components. It also lets you load these software:

- The ACMF AMI
- The AIMS OPC
- The ACMF OPS.

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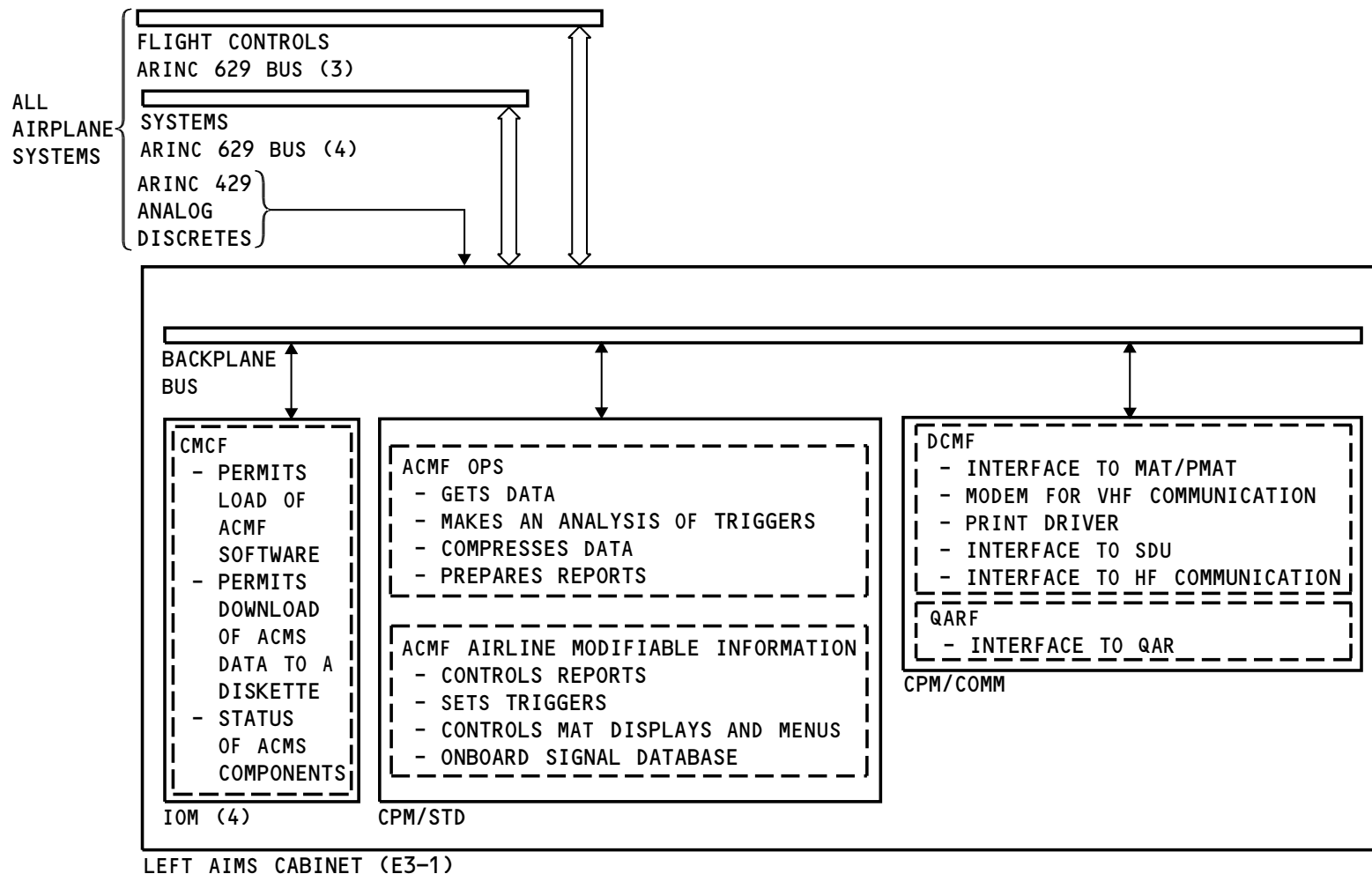
**ACMS - ACMF FUNCTIONAL DESCRIPTION****Training Information Point**

When you load a new OPS or AMI, the ACMS data that is stored in the CPM/STD memory goes away. If you need data for a report, be sure that you download the data to the flight compartment printer or to a diskette before you load the new OPS or AMI. When you load an OPC, the ACMS data that is stored in the CPM/STD memory does not go away.

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LEFT AIMS CABINET (E3-1)

ACMS - ACMF FUNCTIONAL DESCRIPTION

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**ACMS - AIRLINE MODIFIABLE INFORMATION****General**

The design of the 777 airplane lets the airlines customize certain functions in the airplane condition monitoring system (ACMS). You customize these functions through airline modifiable information (AMI). You use the ground based software tool (GBST) to make the modifications.

The ACMS system comes with a baseline AMI. This baseline AMI provides functionality to meet most airline requirements. The baseline AMI for the ACMS system has these types of reports and controls:

- Engine
- Airplane
- APU
- Environmental control system (ECS)
- Autoland
- Other report controls.

You use the GBST to modify:

- Report features
- ACMF features on the MAT
- Onboard parameter databases.

Engine Reports

The engine stable report collects data during stable cruise periods. It has these submenu items:

- REPORT SUMMARY
- MANNUALLY INITIATED.

The engine takeoff report collects key data for EGT parameters and takeoff derate data.

The engine climb report collects EGT data and climb derate data.

The normal engine start report collects key data during engine start. It has these submenu items:

- LEFT ENGINE
- RIGHT ENGINE.

The abnormal engine start report collects historical and real time data when an engine start is aborted or a fault condition occurs in the start sequence. It has these submenu items:

- LEFT ENGINE
- RIGHT ENGINE.

The engine oil monitoring report collects oil quantity during taxi in and taxi out. This report also computes oil consumption for each flight leg and keeps oil consumption information for the last ten flight legs.

The EGT divergence report computes EGT divergence between the left and right engine during stable cruise conditions and generates a report when the divergence exceeds a specified delta value.

The engine data report collects information during engine runup and engine operation. It has these submenu items:

- REPORT SUMMARY
- MANUALLY INITIATED.

The engine exceedance report collects historical and real time data during engine exceedances. It has these submenu items:

- LIMIT
- HISTORY-LEFT A
- HISTORY-LEFT B
- HISTORY-RIGHT A
- HISTORY-RIGHT B.

**ACMS - AIRLINE MODIFIABLE INFORMATION****Airplane Reports**

The airplane performance monitoring report collects airplane and engine data for the Boeing performance group for input into the Boeing supplied airplane performance analysis program. It has these submenu items:

- REPORT SUMMARY
- MANUALLY INITIATED.

APU Reports

The APU report collects airplane, engine, and APU data when an auto shutdown of the APU occurs. It also collects airplane, engine, and APU data at APU start, main engine start, defined duct pressure conditions, and at ECS demand limits. It has these submenu items:

- APU AUTO SHUTDOWN
- APU PERFORMANCE
- ALL APU REPORTS.

ECS Report

The ECS performance report collects airplane, engine, and ECS data at APU start, main engine start, defined duct pressure conditions, and at ECS demand limits.

Autoland Report

The autoland report collects aircraft systems data about an automatic landing sequence.

Other Report Controls

The other reports menu contains these other report controls:

- QAR RECORDING
- ALL REPORTS.

The QAR recording selection shows status of automatic QAR recording. It also lets you manually start the QAR recording.

The all reports selection gives you access to these items:

- BASELINE
- ENGINE
- CURRENT FLIGHT LEG.

Modifiable Parameters

You can use the GBST to change the control logic that defines data collection. You can also change the content and format of reports.

You can change the structure and display formats of the ACMS screens on the MAT. You can also add security features to control access to the ACMS functions on the MAT.

You can change the way the quick access recorder (QAR) records data.

You can also modify the onboard data bases in the ACMS memory.

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BASELINE AMI
ENGINE STABLE
ENGINE TAKEOFF
ENGINE CLIMB
NORMAL ENGINE START
ABNORMAL ENGINE START
ENGINE OIL MONITORING
EGT DIVERGENCE
ENGINE DATA
ENGINE EXCEEDANCE
AIRPLANE PERFORMANCE MONITORING
APU
ECS
AUTOLAND

MODIFIABLE FUNCTIONS
CONTROL LOGIC
REPORT SPECIFICATIONS
MAT MENU STRUCTURE
MAT DISPLAY FORMATS
SECURITY ACCESS
ON-BOARD PARAMETER DATABASE
QAR DATA MAPPING

ACMS - AIRLINE MODIFIABLE INFORMATION

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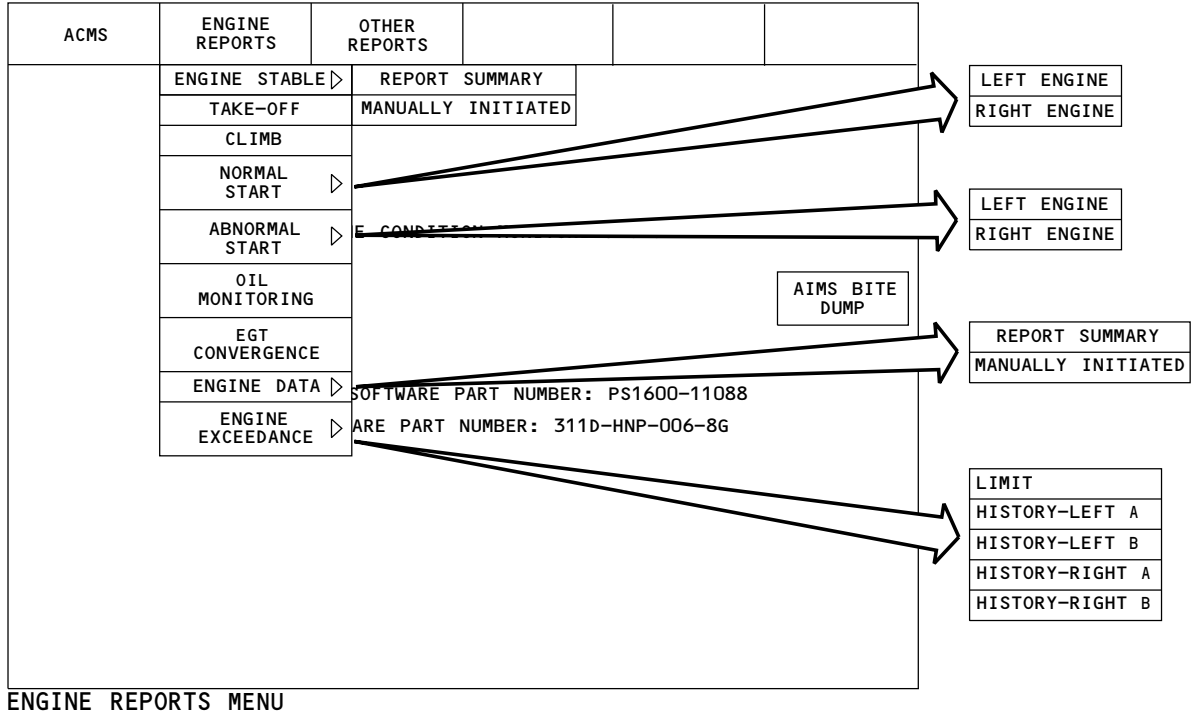
**ACMS - OPERATION - ENGINE REPORTS MENU****General**

You get access to the ACMS main menu through the MAT main menu.
Select ENGINE REPORTS to show the list of available engine reports.

Engine Reports Menu

The engine reports menu provides access to these menu items:

- ENGINE STABLE
- TAKE-OFF
- CLIMB
- NORMAL START
- ABNORMAL START
- OIL MONITORING
- EGT DIVERGENCE
- ENGINE DATA
- ENGINE EXCEEDANCE.



ACMS - OPERATION - ENGINE REPORTS MENU

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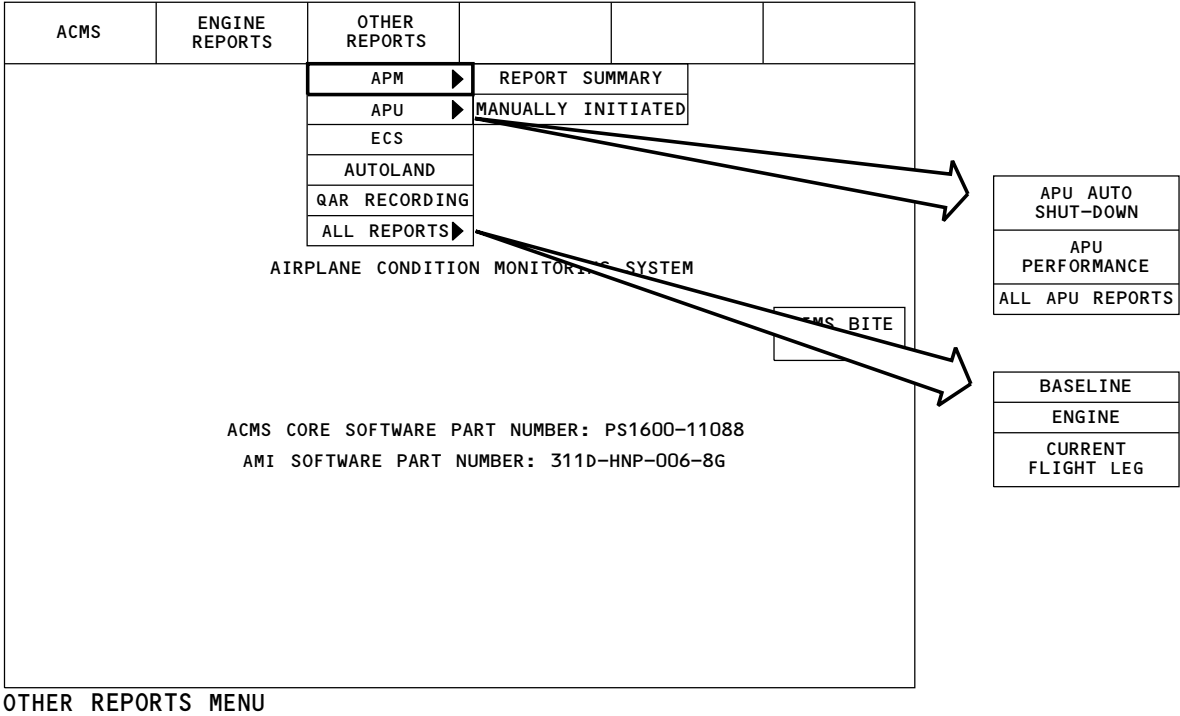
**ACMS - OPERATION - OTHER REPORTS MENU****General**

You get access to the ACMS main menu through the MAT main menu.
Select OTHER REPORTS to show the available reports.

Other Reports Menu

The OTHER REPORTS menu provides access to these menu items:

- APM
- APU
- ECS
- AUTOLAND
- QAR RECORDING
- ALL REPORTS.



ACMS - OPERATION - OTHER REPORTS MENU

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**ACMS - OPERATION - MAIN MENU****General**

You get access to the ACMS main menu through the MAT or LMAT main menu. Select ACMS to show the ACMS title display.

Menu Bar

The menu bar has the ACMS standard menu and five user defined menus. Airline modifiable information (AMI) software provides two of the user defined menus, engine reports and other reports. This manual does not describe the other three user-defined menus.

ACMS Standard Menu

The ACMS standard menu provides access to these menu items:

- PASSWORD
- TITLE SCREEN
- MNEMONIC DATA
- MODIFIABLE CONSTANTS
- PROGRAMMABLE REPORT 1
- PROGRAMMABLE REPORT 2
- PROGRAMMABLE REPORT 3
- QUICK REPORT
- TRACE LOG
- EXIT ACMS.

Programmable Reports

Each programmable report menu item supplies access to these cascaded menu options:

- SPECIFICATION
- RESULT.

Exit ACMS

The Exit ACMS menu item permits the user to return to the MAT or LMAT main menu.

ACMS	ENGINE REPORTS	OTHER REPORTS			
PASSWORD...	AIRPLANE CONDITION MONITORING SYSTEM PROGRAMMABLE REPORT 1> SPECIFICATION PROGRAMMABLE REPORT 2> RESULT PROGRAMMABLE REPORT 3> QUICK REPORT ACMS CORE SOFTWARE PART NUMBER: PS1600-11088 TRACE LOG AMI SOFTWARE PART NUMBER: 311D-HNP-006-8G EXIT ACMS				
TITLE SCREEN					
MNEMONIC DATA					
MODIFIABLE CONSTANTS					
PROGRAMMABLE REPORT 1>					
PROGRAMMABLE REPORT 2>					
PROGRAMMABLE REPORT 3>					
QUICK REPORT					
TRACE LOG					
EXIT ACMS					

AIMS BITE
DUMP

MAIN MENU

ACMS - OPERATION - MAIN MENU

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**ACMS - OPERATION - TITLE SCREEN****Title Screen**

The ACMS menu has a title screen menu item. You select this menu item to show the title screen page.

The title screen page shows the ACMS core and airline modifiable information (AMI) software part numbers.

Select AIMS BITE DUMP to download shop fault data for the airplane information management system (AIMS) to a diskette.

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ACMS	ENGINE REPORTS	OTHER REPORTS			
RESOURCES					
TITLE SCREEN					
MNEMONIC DATA					
MODIFIABLE CONSTANTS					
PROGRAMMABLE REPORT 1 ▸					
PROGRAMMABLE REPORT 2 ▸					
PROGRAMMABLE REPORT 3 ▸					
QUICK REPORT					
TRACE LOG					
EXIT ACMS					

MAIN MENU

ACMS	ENGINE REPORTS	OTHER REPORTS			
AIRPLANE CONDITION MONITORING SYSTEM AIMS BITE DUMP ACMS CORE SOFTWARE PART NUMBER: PS1600-11088 AMI SOFTWARE PART NUMBER: 311D-HNP-006-8G					

TITLE SCREEN PAGE

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ACMS - OPERATION - TITLE SCREEN

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**ACMS - OPERATION - MNEMONICS****General**

The mnemonic data page shows real time data. You use this page to monitor a specific signal parameter for troubleshooting.

The mnemonic data page shows this information for each mnemonic:

- Source LRU
- If applicable, left, center or right position
- Parameter value
- Engineering units of measure.

The mnemonic data page has command buttons at the bottom of the display.

Search Parameter

To show a parameter, select SEARCH PARAMETER and the parameter search dialog box shows.

Delete Parameter

To delete a parameter, select the parameter then select DELETE PARAMETER.

Start and Stop

Select START and the mnemonic data page updates the parameters at a 1Hz rate. Select STOP and the parameters do not update.

Clear List

Select CLEAR LIST and the mnemonic list on the mnemonic data page goes away.

Print

The PRINT selection causes the list to go to the printer.

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ACMS	ENGINE REPORTS	OTHER REPORTS			
PROGRAMMABLE REPORTS					
TITLE SCREEN					
MNEMONIC DATA					
MODIFIABLE CONSTANTS					
PROGRAMMABLE REPORT 1 ▶					
PROGRAMMABLE REPORT 2 ▶					
PROGRAMMABLE REPORT 3 ▶					
QUICK REPORT					
TRACE LOG					
EXIT ACMS					

MAIN MENU

ACMS	ENGINE REPORTS	OTHER REPORTS			
MNEMONIC DATA					
NAME _____ SOURCE _____ VALUE _____ UNITS _____ ALT_21ADIRU 21ADIRU 35 FT					START
					STOP
					SEARCH PARAMETER
					DELETE PARAMETER
					CLEAR LIST
					PRINT

MNEMONIC DATA PAGE

ACMS - OPERATION - MNEMONICS

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**ACMS - OPERATION - SIGNAL SOURCE DIALOG BOX****General**

The mnemonic data page uses the parameter search dialog box. The parameter search dialog box finds any signal in the ACMS database. You enter a signal name in the SIGNAL NAME field and/or enter an LRU in the SOURCE field. You can use an asterisk (*) as a wild card in the SIGNAL NAME field.

Select FIND SIGNAL to show a list of signals in the dialog box window.

Select the desired signal from the list and then select ADD SIGNAL.

Select DONE to close the parameter search dialog box. The selected signal then shows on the mnemonic data page.

Select ABORT SEARCH to stop a search.

The programmable report specification page also uses this dialog box.

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ACMS	ENGINE REPORTS	OTHER REPORTS			
PROGRAMMABLE					
TITLE SCREEN					
MNEMONIC DATA					
MODIFIABLE CONSTANTS					
PROGRAMMABLE REPORT 1 ▶					
PROGRAMMABLE REPORT 2 ▶					
PROGRAMMABLE REPORT 3 ▶					
QUICK REPORT					
TRACE LOG					
EXIT ACMS					

MAIN MENU

ACMS	ENGINE REPORTS	OTHER REPORTS																																																			
MNEMONIC DATA																																																					
PARAMETER SEARCH																																																					
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PARAMETER SEARCH DIALOG BOX

MNEMONIC DATA PAGE

ACMS - OPERATION - SIGNAL SOURCE DIALOG BOX

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**ACMS - OPERATION - MODIFIABLE CONSTANTS****General**

The modifiable constants function lets you change a constant with the MAT rather than with the GBST.

The modifiable constants show on the modifiable constants page. Scroll through the display to view all the modifiable constants.

For each modifiable constant, the page shows this information:

- Name
- Default value
- Current value.

Two command buttons show at the bottom of the display.

Modify Constant

To change a modifiable constant, select MODIFY CONSTANT and the modify value dialog box shows.

Print

Select PRINT, and a minimum of the last twenty modified constants show on the report. The printout contains these fields:

- Modified constant name
- Previous value
- New value
- Default value
- Time of change
- Date of change.



ACMS	ENGINE REPORTS	OTHER REPORTS			
PROGRAMS					
TITLE SCREEN					
MNEMONIC DATA					
MODIFIABLE CONSTANTS					
PROGRAMMABLE REPORT 1					
PROGRAMMABLE REPORT 2					
PROGRAMMABLE REPORT 3					
QUICK REPORT					
TRACE LOG					
EXIT ACMS					

MAIN MENU

ACMS	ENGINE REPORTS	OTHER REPORTS																																																																																																																					
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<table border="1"><thead><tr><th>NAME</th><th>DEFAULT</th><th>CURRENT</th></tr></thead><tbody><tr><td>ACHTFACTOR</td><td>EDTDIVRG</td><td>1.00 1.00</td></tr><tr><td>AOALMT_T2TAT</td><td></td><td>10.00 10.00</td></tr><tr><td>AUTOPTINT_ENGXCD</td><td>ENABLE</td><td>ENABLE</td></tr><tr><td>BPRISLMTL_ACMF</td><td>0.30</td><td>0.30</td></tr><tr><td>BPRISLMTR_ACMF</td><td>0.30</td><td>0.30</td></tr><tr><td>CASLMT_T2TAT</td><td>30.0</td><td>30.0</td></tr><tr><td>CAS_TAKEOFF</td><td>120.0</td><td>120.0</td></tr><tr><td>CLTIME_APUPERF</td><td>10.0</td><td>10.0</td></tr><tr><td>DELCDICE_T2TAT</td><td>2.5</td><td>2.5</td></tr><tr><td>DELCDICE_T2TAT</td><td>5.0</td><td>5.0</td></tr><tr><td>DELTDICE_T2TAT</td><td>30</td><td>30</td></tr><tr><td>DELTDICE_T2TAT</td><td>2</td><td>2</td></tr><tr><td>DOWNLINK_ABNESL</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_ABNESR</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_ALT</td><td>10000</td><td>10000</td></tr><tr><td>DOWNLINK_APM_A</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_APM_M</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_APUASDN</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_APUPERF</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_CLIMB</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_ECS</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_EGTDIVRG</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_ENGDATA</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_ENGICE</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_ENGXCD</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_NESL</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_NESR</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_OILMON</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_STABLE_A</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>DOWNLINK_STABLE_M</td><td>DISABLE</td><td>DISABLE</td></tr><tr><td>EPRDELTA_APM</td><td>0.030</td><td>0.030</td></tr><tr><td>EPRDELTA_STABLE</td><td>0.030</td><td>0.030</td></tr><tr><td>EXPONENT_EGTMARGIN</td><td>1.060</td><td>1.060</td></tr><tr><td>FLTPHASE_TEMP</td><td>0</td><td>0</td></tr><tr><td>FSOVTIME1_ABNESL</td><td>120</td><td>120</td></tr><tr><td>FSOVTIME1_ABNESR</td><td>120</td><td>120</td></tr><tr><td>IDLTIME_APUPERF</td><td>5</td><td>5</td></tr></tbody></table>						NAME	DEFAULT	CURRENT	ACHTFACTOR	EDTDIVRG	1.00 1.00	AOALMT_T2TAT		10.00 10.00	AUTOPTINT_ENGXCD	ENABLE	ENABLE	BPRISLMTL_ACMF	0.30	0.30	BPRISLMTR_ACMF	0.30	0.30	CASLMT_T2TAT	30.0	30.0	CAS_TAKEOFF	120.0	120.0	CLTIME_APUPERF	10.0	10.0	DELCDICE_T2TAT	2.5	2.5	DELCDICE_T2TAT	5.0	5.0	DELTDICE_T2TAT	30	30	DELTDICE_T2TAT	2	2	DOWNLINK_ABNESL	DISABLE	DISABLE	DOWNLINK_ABNESR	DISABLE	DISABLE	DOWNLINK_ALT	10000	10000	DOWNLINK_APM_A	DISABLE	DISABLE	DOWNLINK_APM_M	DISABLE	DISABLE	DOWNLINK_APUASDN	DISABLE	DISABLE	DOWNLINK_APUPERF	DISABLE	DISABLE	DOWNLINK_CLIMB	DISABLE	DISABLE	DOWNLINK_ECS	DISABLE	DISABLE	DOWNLINK_EGTDIVRG	DISABLE	DISABLE	DOWNLINK_ENGDATA	DISABLE	DISABLE	DOWNLINK_ENGICE	DISABLE	DISABLE	DOWNLINK_ENGXCD	DISABLE	DISABLE	DOWNLINK_NESL	DISABLE	DISABLE	DOWNLINK_NESR	DISABLE	DISABLE	DOWNLINK_OILMON	DISABLE	DISABLE	DOWNLINK_STABLE_A	DISABLE	DISABLE	DOWNLINK_STABLE_M	DISABLE	DISABLE	EPRDELTA_APM	0.030	0.030	EPRDELTA_STABLE	0.030	0.030	EXPONENT_EGTMARGIN	1.060	1.060	FLTPHASE_TEMP	0	0	FSOVTIME1_ABNESL	120	120	FSOVTIME1_ABNESR	120	120	IDLTIME_APUPERF	5	5
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MODIFIABLE CONSTANTS PAGE (TYPICAL)

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ACMS - OPERATION - MODIFIABLE CONSTANTS

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**ACMS - OPERATION - MODIFY VALUE DIALOG BOX****General**

The modifiable constants page uses the modify value dialog box. The modify value dialog box lets you enter a new value in the value field. Select ACCEPT to return to the modifiable constants page. The new value then shows on the modifiable constants page.

To change the enable or disable state of a modifiable constant, such as a report, use the MAT keyboard to enter a 1 for enable, or a 0 for disable. Select ACCEPT to return to the modifiable constants page. The new state then shows on the modifiable constants page.

The programmable reports specification page also uses this dialog box.

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MAIN MENU

MODIFIABLE CONSTANTS PAGE (TYPICAL)

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ACMS - OPERATION - MODIFY VALUE DIALOG BOX

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**ACMS - OPERATION - PROGRAMMABLE REPORT - SPECIFICATION****General**

The ACMS menu has three programmable report menu items. The programmable reports let you create a limited logic unit and record airplane parameters onboard the airplane. Each programmable report menu item cascades into two selections, SPECIFICATION or RESULT. Select SPECIFICATION to see the report specification page. Select RESULT to see the report results page.

Report Specification Page

The report specification page lets you select these:

- A report title
- The report trigger parameters
- The data collection specifications
- Automatic datalink
- QAR
- The report collection parameters.

You use text fields, selection boxes and cascading menu selections to define and control the report trigger parameters.

Select SEARCH PARAMETER and the parameter search dialog box shows. Use this to choose the collection parameters.

Select DELETE PARAMETER to remove a collection parameter from the list.

Select ARM to enable the report. The defined report trigger then causes collection of the report data. Select DISARM to disable the report.

Select DISPLAY RESULTS to see the report results page.

Select CLEAR REPORT to clear the current report specifications.

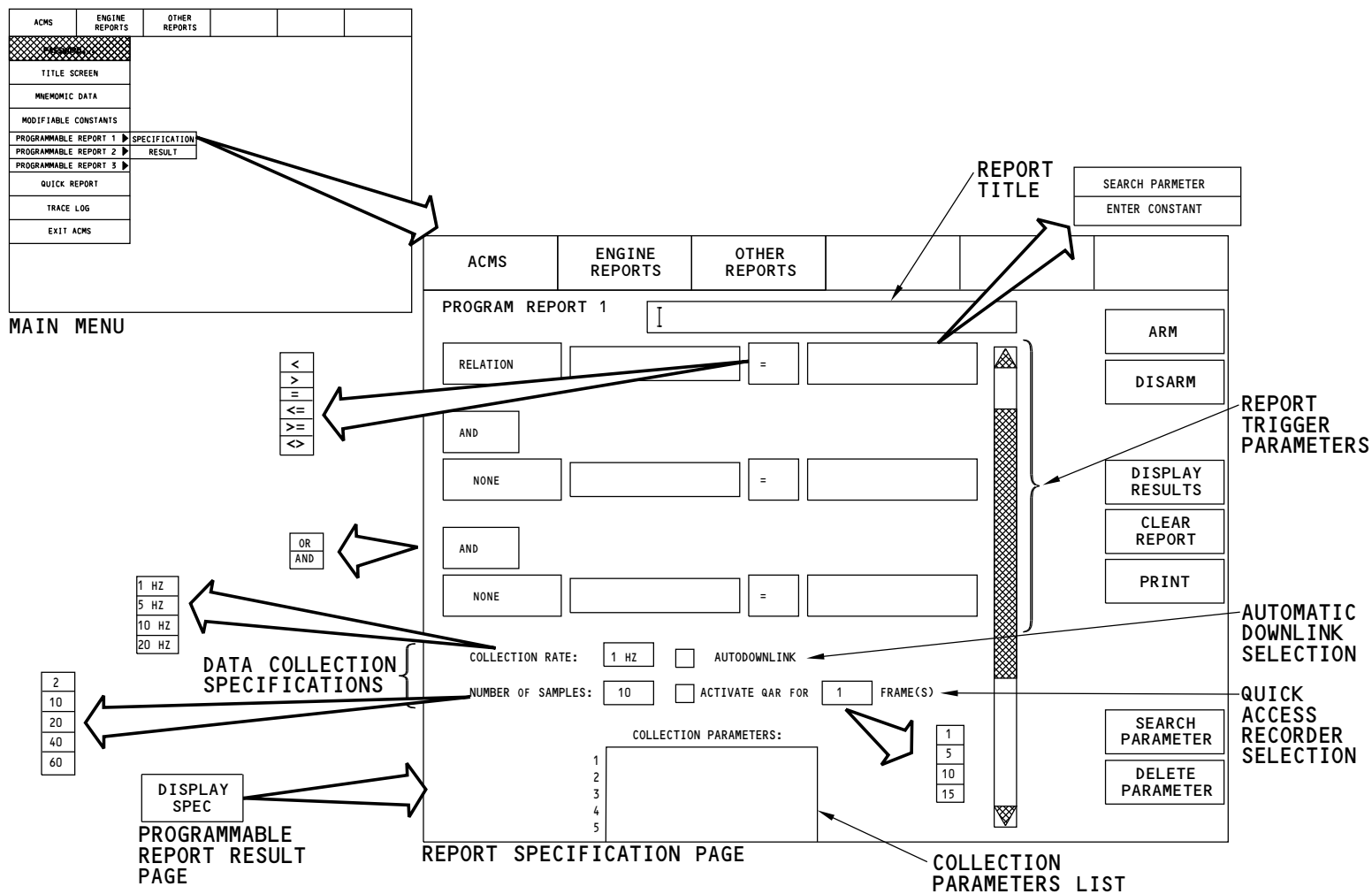
Select PRINT to print a copy of the programmable report specification page.

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ACMS - OPERATION - PROGRAMMABLE REPORT - SPECIFICATION

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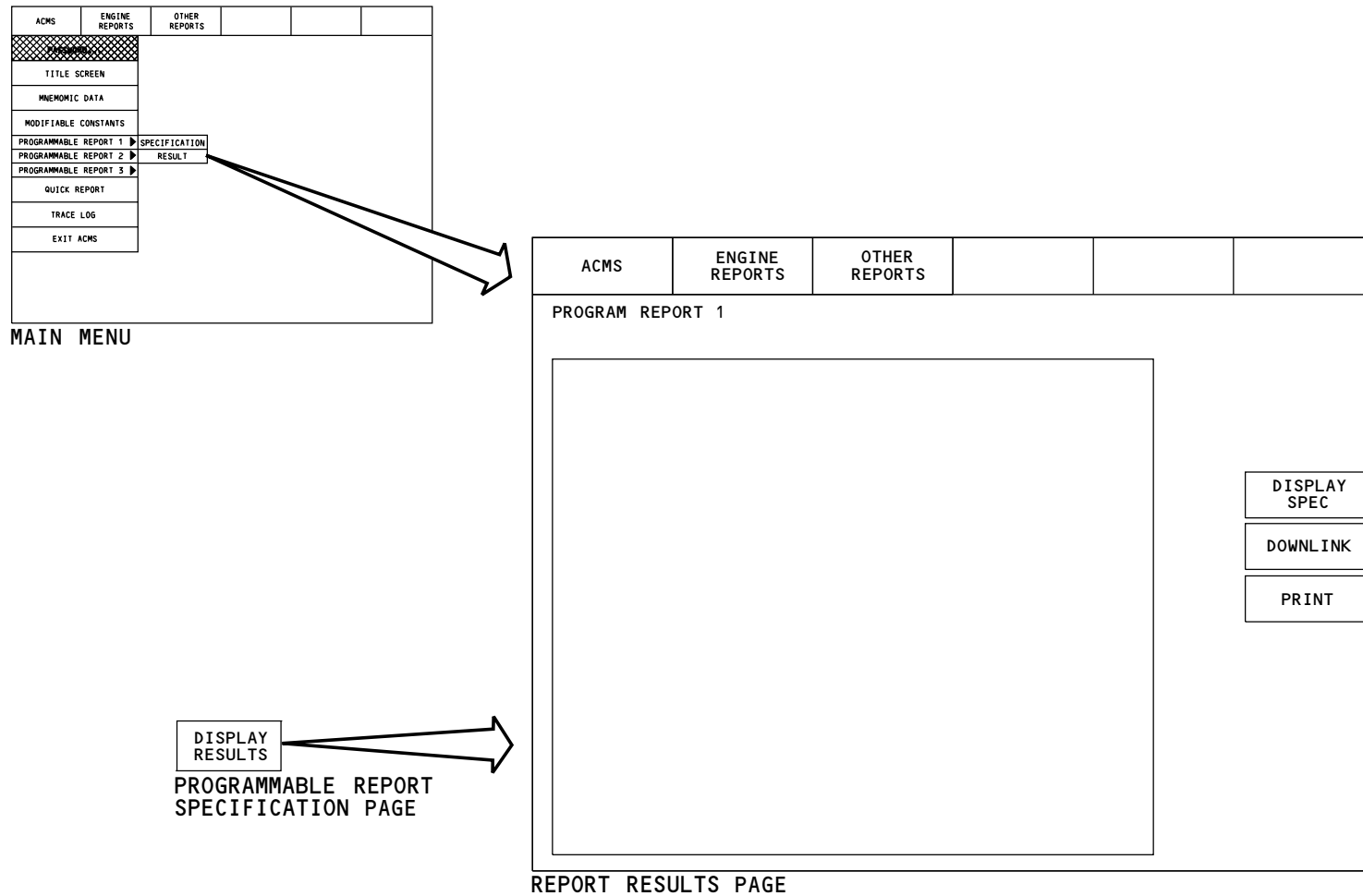
**ACMS - OPERATION - PROGRAMMABLE REPORT - RESULTS****General**

The programmable report result page shows the data for a report specification. Each report has header information that contains all the information captured in the report specification.

Select DISPLAY SPEC to return to the programmable report specification page.

Select DOWNLINK to transmit the report to a ground station.

Select PRINT to send the report to the flight compartment printer.



ACMS - OPERATION - PROGRAMMABLE REPORT - RESULTS

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**ACMS - OPERATION - QUICK REPORTS****General**

The quick report page gives you a time history for a group of signals. The quick report results show on the MAT during data collection.

You can select the:

- Report title
- Signal collection rate
- Collection signals.

You can identify up to seven collection signals for data collection.

The date and time will show when the report results are displayed.

Command buttons show at the bottom of the display.

Start and Stop

Select START to start the quick report data collection. The report collects and shows 60 values for each collection signal. Select STOP to stop the data collection before all 60 values are collected.

Search and Delete Parameters

Select SEARCH PARAMETER to add a collection signal to the list.

Select DELETE PARAMETER to delete a collection signal from the list.

Clear Report

Select CLEAR REPORT to clear the current quick report specifications.

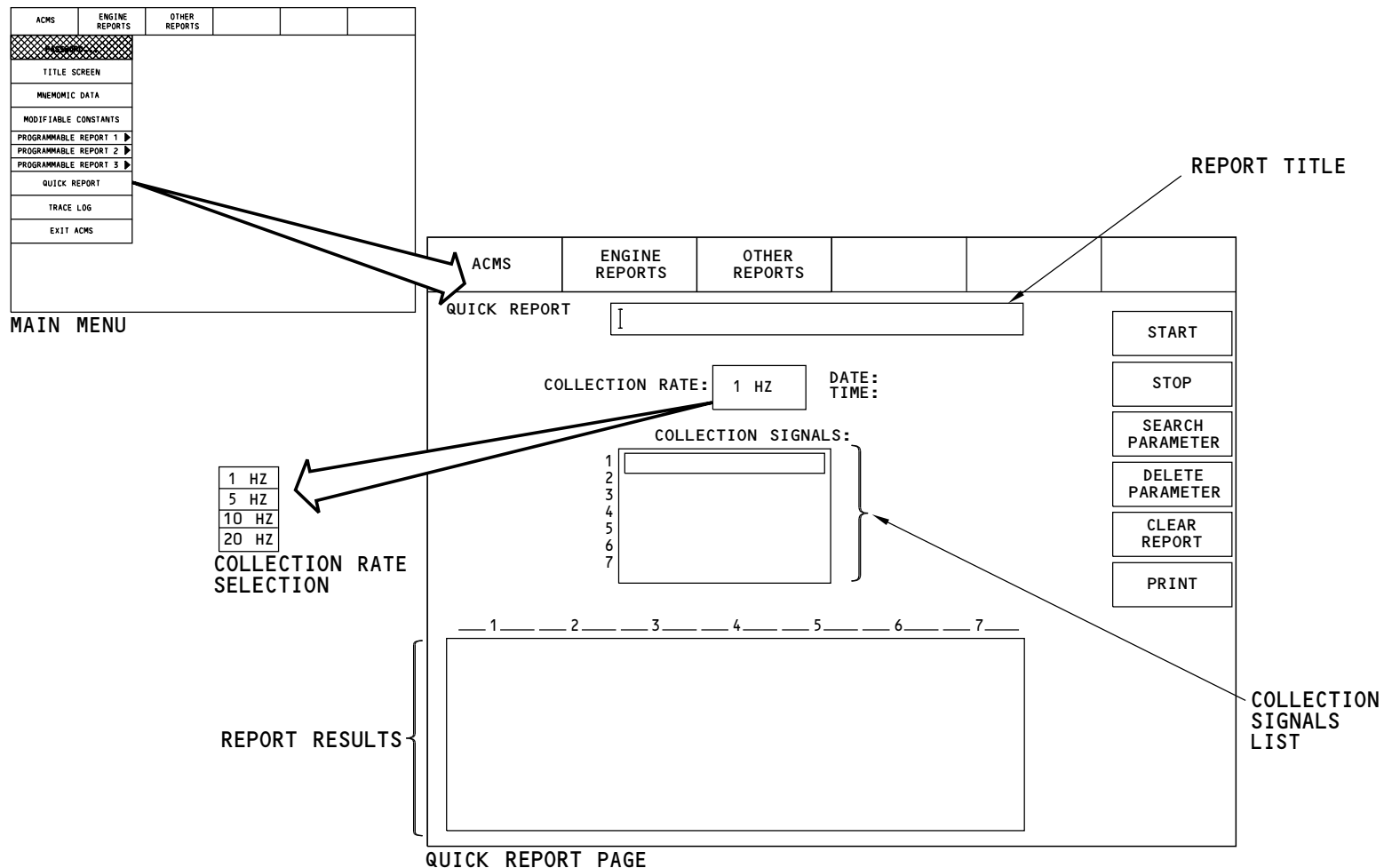
Print

Select PRINT to send the quick report to the flight compartment printer.

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ACMS - OPERATION - QUICK REPORTS

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ACMS - OPERATION - TRACE LOG

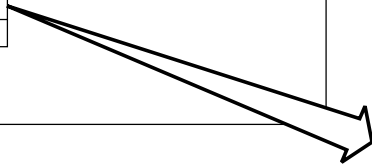
Trace Log

Software engineers use the trace log page to make sure the AMI software operates correctly.

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ACMS	ENGINE REPORTS	OTHER REPORTS			
PROGRAM TITLE SCREEN MNEMONIC DATA MODIFIABLE CONSTANTS PROGRAMMABLE REPORT 1 ▸ PROGRAMMABLE REPORT 2 ▸ PROGRAMMABLE REPORT 3 ▸ QUICK REPORT TRACE LOG EXIT ACMS					

MAIN MENU



ACMS	ENGINE REPORTS	OTHER REPORTS			
TRACE LOG					
					START
					STOP
					PRINT

TRACE LOG PAGE

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ACMS - OPERATION - TRACE LOG

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**ACMS - SYSTEM TEST****General**

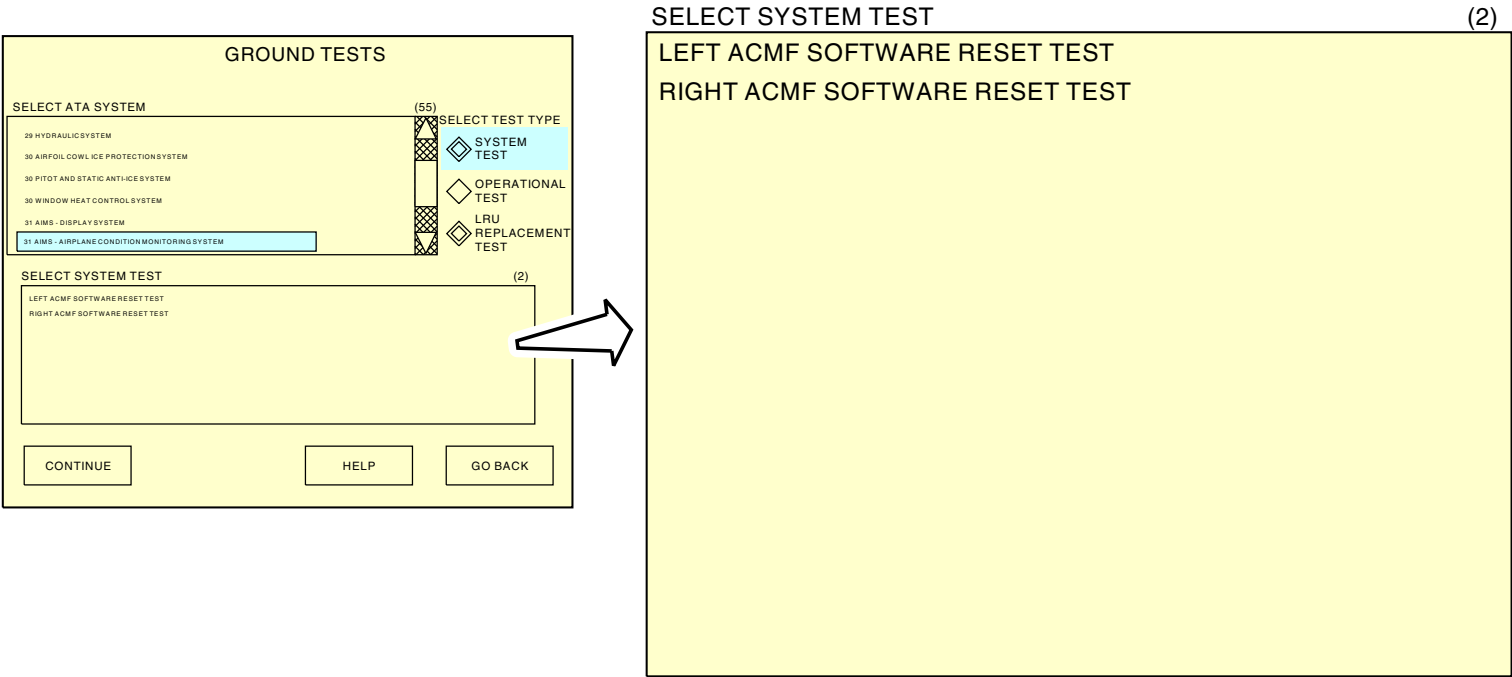
There is one system test for the ACMS. It is the left ACMF software reset test.

Left ACMF Software Reset Test

This test makes sure that the ACMF software in the left or right CPM/STD operates correctly. The test erases all ACMF reports. This test may reveal failures of fault tolerant components which may not impact airworthiness. EICAS message indications are the final determinant.

The test takes about one minute.

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ACMS - SYSTEM TEST

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AIRPLANE INFORMATION MANAGEMENT SYSTEM (AIMS)- INTRODUCTION

Purpose

The airplane information management system (AIMS) collects and calculates large quantities of data. The AIMS manages this data for several integrated avionics systems. These systems are the:

- Primary display system (PDS)
- Central maintenance computing system (CMCS)
- Airplane condition monitoring system (ACMS)
- Flight data recorder system (FDRS)
- Data communication management system (DCMS)
- Flight management computing system (FMCS)
- Thrust management computing system (TMCS).

The AIMS has software functions that do the calculation for each of these avionics systems.

The AIMS supplies one other software function that many airplane systems use. It is the data conversion gateway function (DCGF).

Abbreviations and Acronyms

NOTE: Not all the abbreviations and acronyms that follow are applicable for all airplanes. This data is for information only.

- ACARS - aircraft communications addressing and reporting system
- ACE - actuator control electronics
- ACMF - airplane condition monitoring function
- ACMS - airplane condition monitoring system
- ADF - automatic direction finder
- ADIRS - air data inertial reference system
- ADIRU - air data inertial reference unit
- ADM - air data module
- AFDC - autopilot flight director computer
- AFDS - autopilot flight director system
- AIMS - airplane information management system

- ALDB - airline loadable database
- AMI - airline modifiable information
- AMU - audio management unit
- APUC - auxiliary power unit controller
- ARINC - Aeronautical Radio, Inc.
- arpt - airport
- ASCPC - air supply cabin pressure controller
- ASG - ARINC 629 signal gateway
- ASM - autothrottle servo motor
- ATC - air traffic control
- BIPM - backplane interface/power monitor
- BPCU - bus power control unit
- BPFC - backup power frequency converter
- BSCU - brake system control unit
- BTMU - brake temperature monitor unit
- capt - captain
- CAS - calibrated airspeed
- CCA - circuit card assembly
- CCD - cursor control device
- CDU - control display unit
- CMCF - central maintenance computing function
- CMCS - central maintenance computing system
- comm - communication
- CPM - core processor module
- CPM/COMM - core processor module/communications
- CPM/GG - core processor module/graphics generator
- CPM/STD - core processor module/standard
- CSMU - cabin system management unit
- CTC - cabin temperature controller
- ctr - center

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AIRPLANE INFORMATION MANAGEMENT SYSTEM (AIMS)- INTRODUCTION

- ctrl - control
- DCGF - data conversion gateway function
- DCMF - data communication management function
- DCMS - data communication management system
- DFDAF - digital flight data acquisition function
- DH - decision height
- DLGF - data load gateway function
- DME - distance measuring equipment
- DSP - display select panel
- dspl - display
- DU - display unit
- ECS - environmental control system
- EDIU - engine data interface unit
- EEC - electronic engine control
- EEPROM - electrically erasable programmable read only memory
- EFIS CP - electronic flight instrument system control panel
- EICAS - engine indication and crew alerting system
- ELEC - electrical
- ELMS - electrical load management system
- eng - engine
- EPCS - electronic propulsion control system
- ESI - engine start inhibit
- FCPSA - flight control power supply assembly
- fctl - flight control
- FD - flight director
- F/D - flight director
- FDCF - flight deck communication function
- FDR - flight data recorder
- FDRS - flight data recorder system
- flt - flight
- FMCF - flight management computing function
- FMCS - flight management computing system
- F/O - first officer
- FQPU - fuel quantity processor unit
- freq - frequency
- FSEU - flap slat electronics unit
- GBST - ground based software tool
- GCU - generator control unit
- GPS - global positioning system
- GPWC - ground proximity warning computer
- GPWS - ground proximity warning system
- HF - high frequency
- IC - intercabin
- IDG - integrated drive generator
- ILS - instrument landing system
- IMM - intermodule memory
- I/O - input/output
- IOC - input/output controller
- IOM - input/output module
- IRS - inertial reference system
- ISSP - instrument source select panel
- LRM - line replaceable module
- LRU - line replaceable unit
- MAT - maintenance access terminal
- MB - marker beacon
- MCP - mode control panel
- MEC - main equipment center
- MFD - multi-function display
- MGSCU - main gear steering control unit
- MMR - multi-mode receiver

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AIRPLANE INFORMATION MANAGEMENT SYSTEM (AIMS)- INTRODUCTION

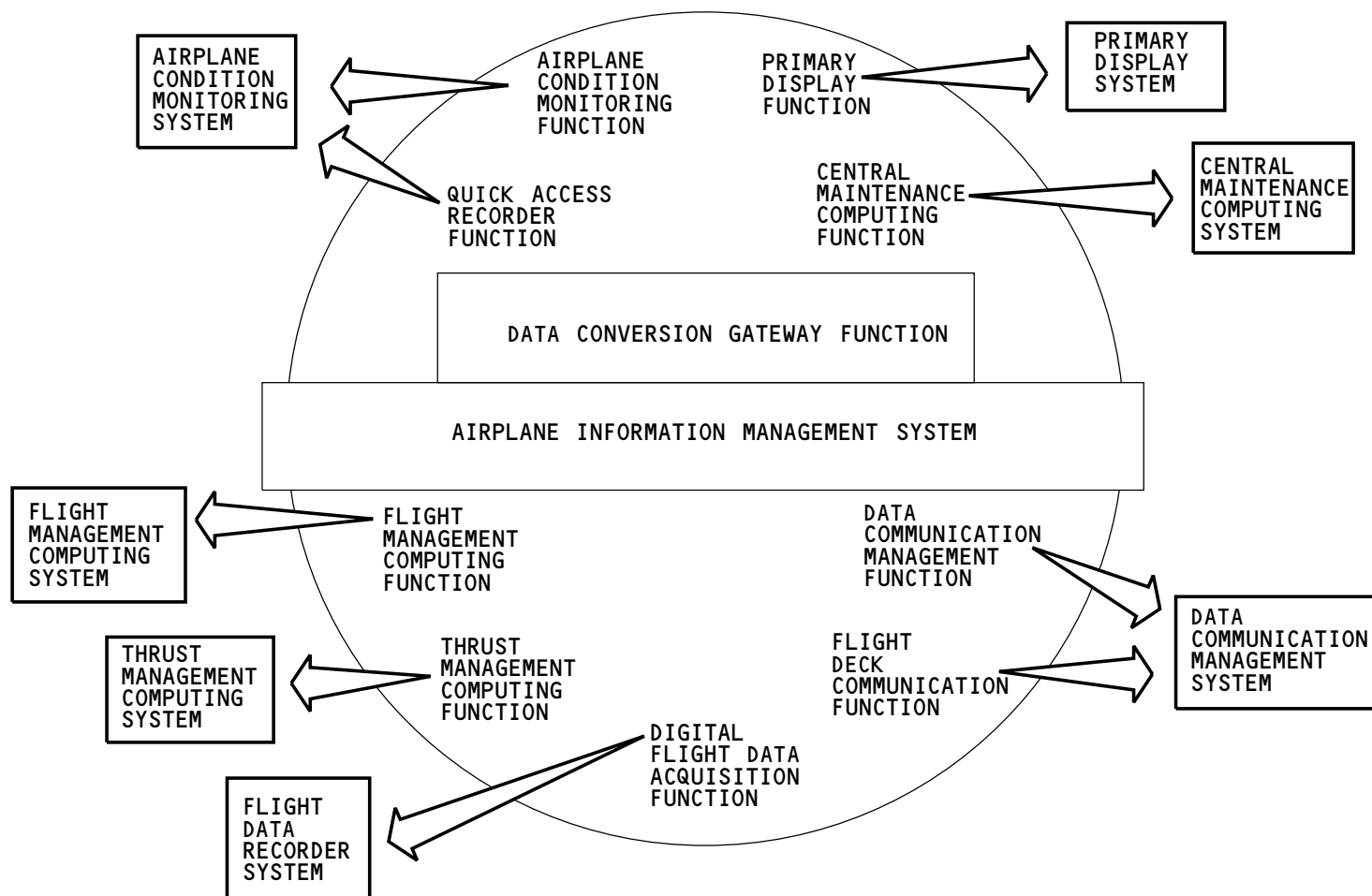
- MSD - mass storage device
- MTF - maintenance terminal function
- nav - navigation
- ND - navigation display
- NVM - non-volatile memory
- QAR - quick access recorder
- ONAT - onboard network access terminal
- ONS - onboard network system
- OPAS - overhead panel ARINC 629 system
- OPBC - overhead panel bus controller
- OPC - operational program configuration file
- OPS - operational program software
- PA/CI - passenger address/cabin interphone
- PCM - power conditioning module
- PDF - primary display function
- PDS - primary display system
- PFC - primary flight computer
- PFD - primary flight display
- PMAT - portable maintenance access terminal
- PMP - power management panel
- pos - position
- PSEU - proximity sensor electronics unit
- RA - radio altitude
- ref - reference
- RLS - remote light sensor
- RT - receiver-transmitter
- SAARU - secondary attitude air data reference unit
- SATCOM - satellite communications
- SDU - satellite data unit
- SELCAL - selective calling
- SPD - speed
- SRAM - static random access memory
- std - standard
- TAI - thermal anti-ice
- TAS - true airspeed
- TCAS - traffic alert and collision avoidance system
- temp - temperature
- TMCF - thrust management computing function
- TMCS - thrust management computing system
- TO/GA - takeoff/go-around
- UTC - universal time (coordinated)
- UTCF - universal time (coordinated) function
- VHF - very high frequency
- vib - vibration
- VOR - VHF omnidirectional ranging
- WAI - wing anti-ice
- WES - warning electronic system
- WEU - warning electronic unit
- WOW - weight-on-wheels
- WXR - weather radar
- xmsm - transmission
- xmtr - transmitter

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AIRPLANE INFORMATION MANAGEMENT SYSTEM - INTRODUCTION

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AIMS - GENERAL DESCRIPTION - 1

AIMS Cabinets

The AIMS has two cabinets which do the calculations for other avionic systems. To do these calculations, each AIMS cabinet has these:

- A cabinet chassis
- Four Input/output modules (IOM)
- Four Core processor modules (CPM)
- Two Power conditioning modules (PCM).

The IOMs, CPMs and PCMs are in the cabinet chassis. The chassis also has a backplane data bus and a backplane power bus to distribute data and power to the IOMs and CPMs.

The input/output module (IOM) transfers data between the software functions in the AIMS CPMs and external signal sources.

The CPMs supply the software and hardware to do the calculations for several avionic systems. The software is called functions. To keep a necessary separation between the functions, each function is partitioned. The partitions permit multiple functions to use the same hardware and be in the same CPM.

These are the three types of CPMs:

- CPM/Communication (CPM/COMM)
- CPM/Standard (CPM/STD)
- CPM/Graphics generator (CPM/GG).

The PCMs supply conditioned 28 volt power for the CPMs and IOMs. One PCM can supply all LRM power demands in the given cabinet. Two PCMs provide continued power distribution in case of a single PCM or aircraft busbar failure.

CPM Functions

These are the software functions in the CPM/COMM:

- Data conversion gateway function (DCGF)
- Data communication management function (DCMF)

- Flight deck communication function (FDCF)
- Quick access recorder function (QARF)
- Digital flight data acquisition function (DFDAF).

These are the software functions in the CPM/STD:

- Data conversion gateway function (DCGF)
- Flight management computing function (FMCF)
- Thrust management computing function (TMCF)
- Airplane condition monitoring function (ACMF).

These are the software functions in the CPM/GG:

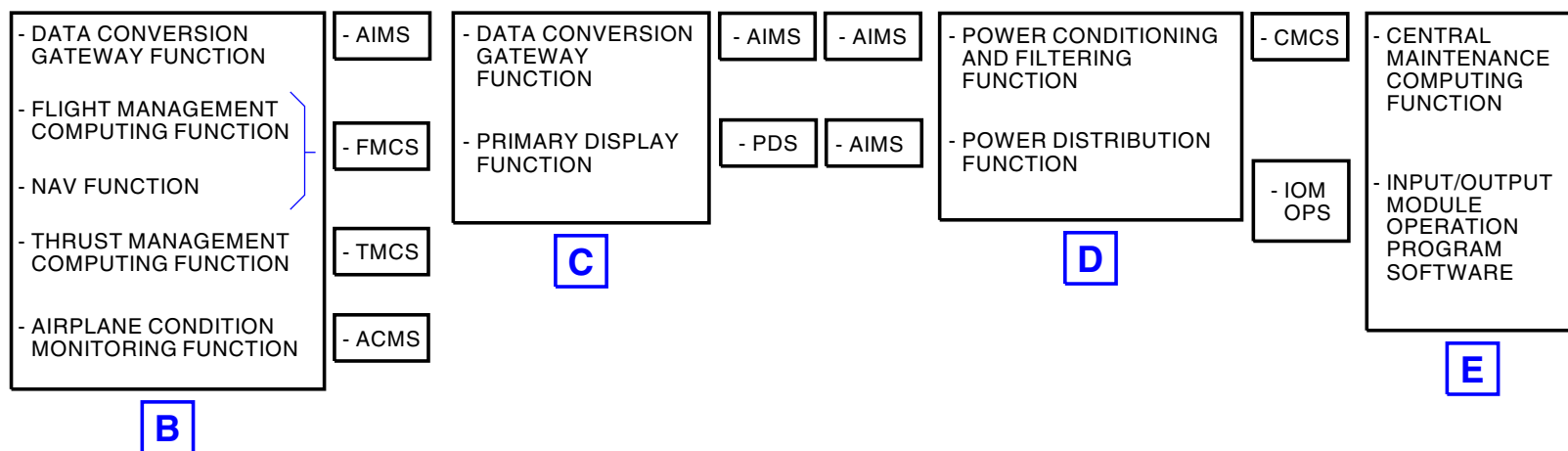
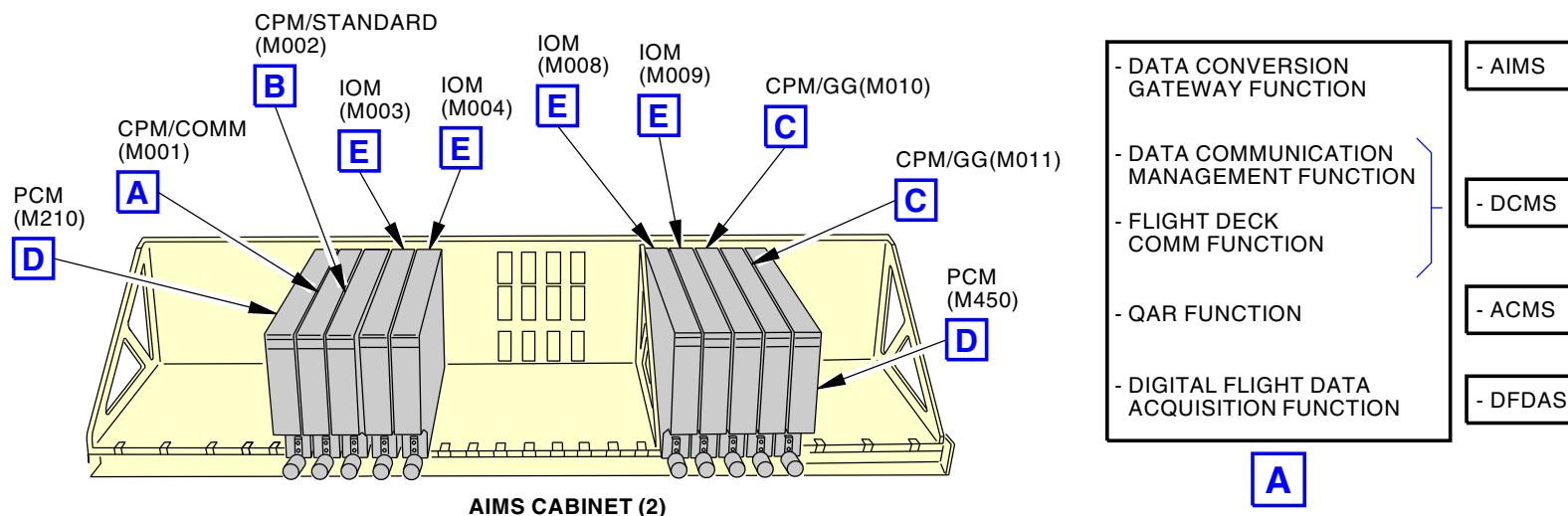
- Data conversion gateway function (DCGF)
- Primary display function (PDF).

These are the software functions in the IOM:

- Input/output module operational program software (IOM OPS)
- Central maintenance computing function (CMCF)

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AIMS - GENERAL DESCRIPTION - 1

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AIMS - GENERAL DESCRIPTION - 2**Avionics Systems Supported by AIMS**

The AIMS cabinets do the calculations for several avionic systems. Because the cabinets do the calculations for these systems the systems are considered to be integrated. The systems are:

- Primary display system (PDS)
- Central maintenance computing system (CMCS)
- Airplane condition monitoring system (ACMS)
- Digital flight data recorder system (DFDRS)
- Data communication management system (DCMS)
- Flight management computing system (FMCS)
- Thrust management computing system (TMCS).

The system includes the software function in the AIMS cabinets plus their components that have an interface.

Primary Display System

The components of the primary display system are:

- Primary display function (PDF)
- Display unit (DU) (6)
- Display select panel (DSP)
- Cursor control device (CCD) (2)
- Captain display switching panel
- First officer display switching panel
- Center display control panel
- Instrument source select panel (2)
- EFIS control panel (EFIS CP) (2)
- Remote light sensor (RLS) (2).

Central Maintenance Computing System

These are the components of the central maintenance computing system:

NOTE: Not all the components that follow are installed on all airplanes.

- Central maintenance computing function (CMCF)
- Maintenance access terminal (MAT) or Laptop MAT (LMAT)
- Portable maintenance access terminal (PMAT).

Airplane Condition Monitoring System

These are the components of the airplane condition monitoring system:

NOTE: Not all the components that follow are installed on all airplanes.

- Airplane condition monitoring function (ACMF)
- Quick access recorder (QAR)
- Quick access recorder function (QARF).

Flight Data Recorder System

These are the components of the flight data recorder system:

- Digital flight data acquisition function (DFDAF)
- Flight data recorder (FDR).

Data Communication Management System

These are the components of the data communication management system:

- Data communication management function (DCMF)
- Flight deck communication function (FDCF)
- Accept/Cancel/Reject switch (2).

**AIMS - GENERAL DESCRIPTION - 2****Flight Management Computing System**

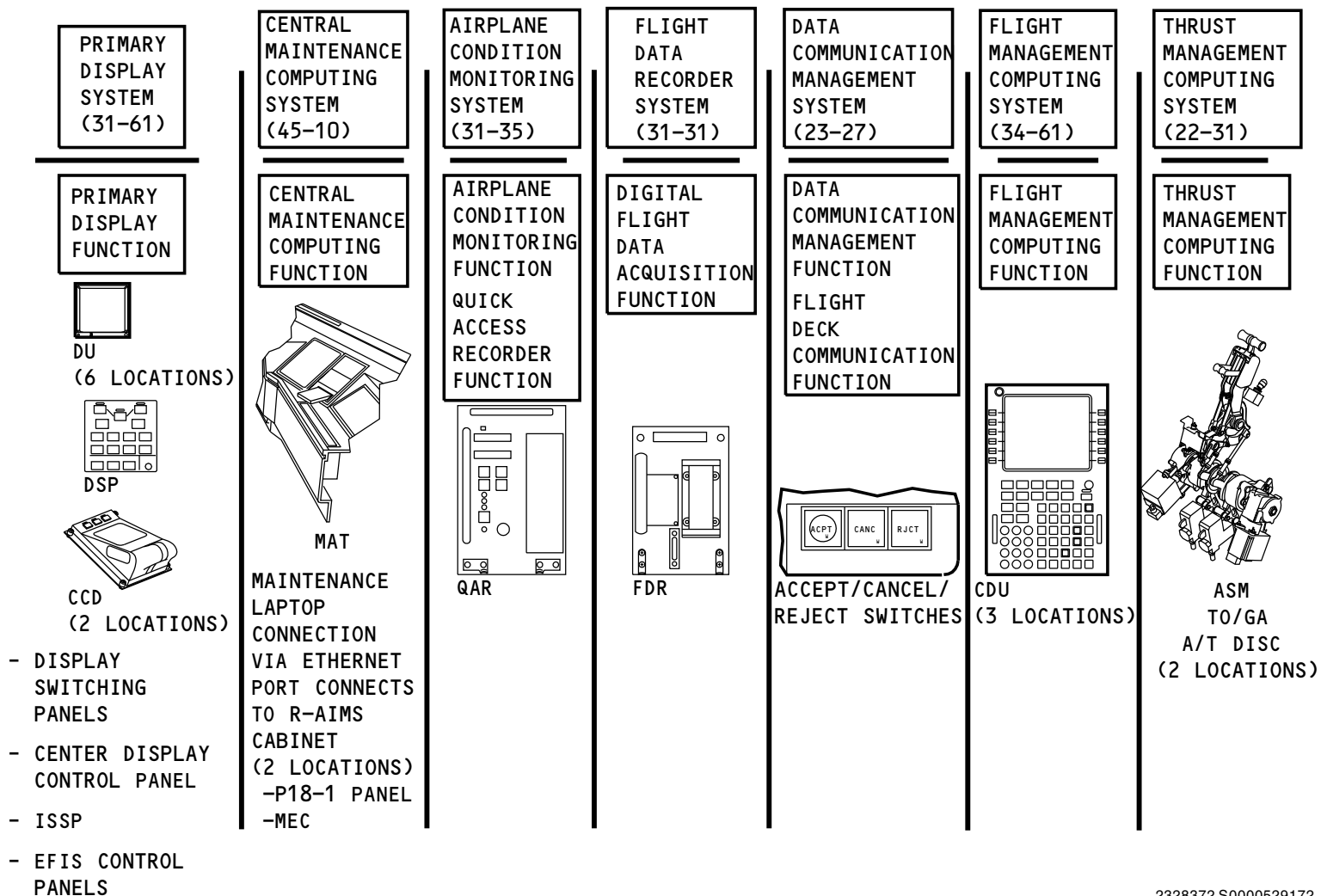
These are the components of the flight management computing system:

- Flight management computing function (FMCF)
- Control display unit (CDU) (3).

Thrust Management Computing System

These are the components of the thrust management computing system:

- Thrust management computing function (TMCF)
- Autothrottle servo motor (ASM) (2)
- TO/GA switch (2)
- Autothrottle disconnect switch (2).



AIMS - GENERAL DESCRIPTION - 2

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AIMS - GENERAL DESCRIPTION - 3**General Interfaces**

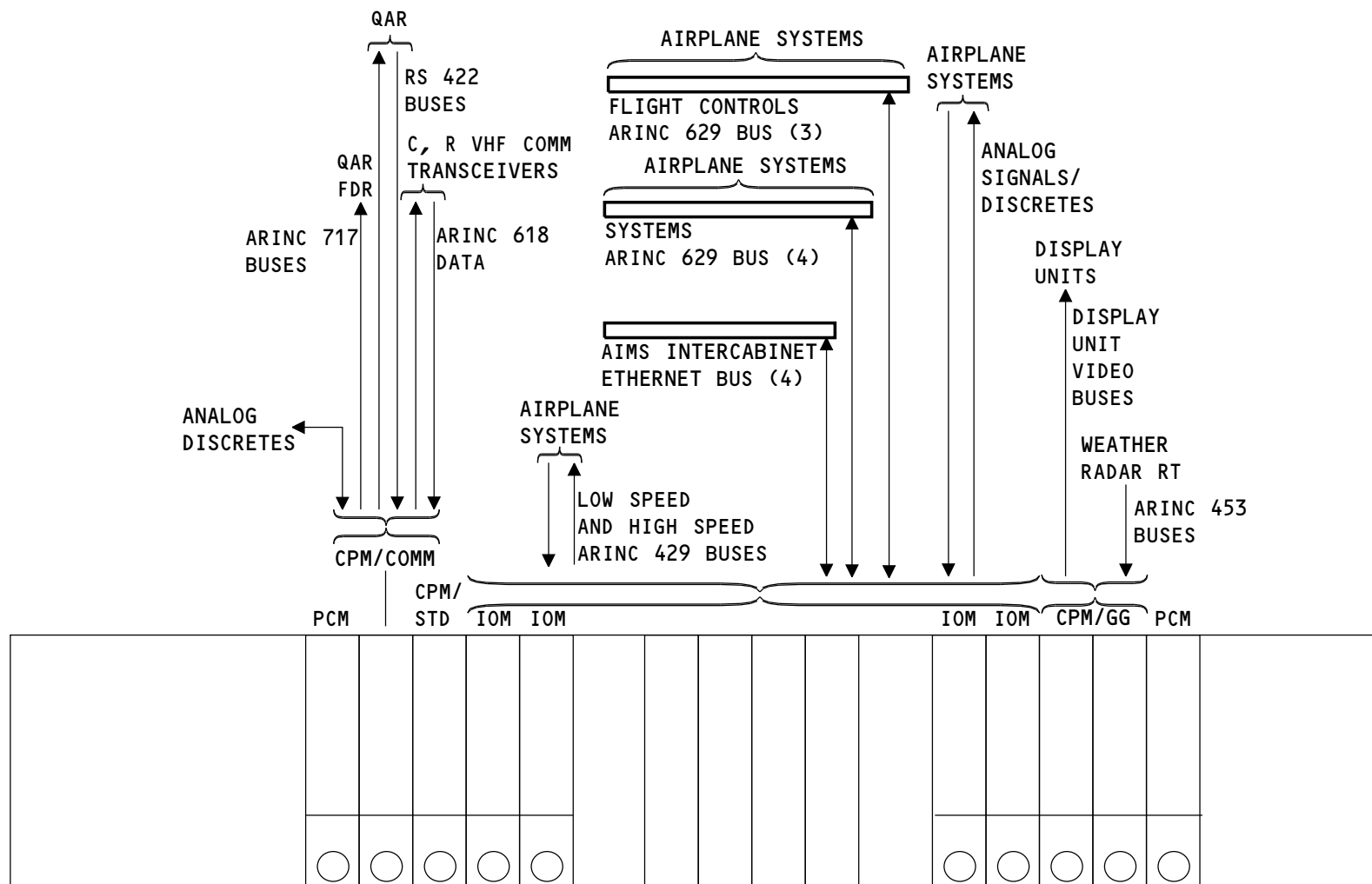
The AIMS has interface with all types of data communication formats. The two AIMS cabinets send data to and receive data from many of these:

- LRUs
- Sensors
- Switches
- Indicators.

These are the types of interfaces with the AIMS cabinets:

- Flight controls ARINC 629 buses (3)
- Systems ARINC 629 buses (4)
- AIMS intercabinet Ethernet buses (4)
- Low speed and high speed ARINC 429 data buses
- ARINC 453 buses
- RS 422 buses
- ARINC 717 buses
- ARINC 618 data
- Display units video buses
- Analog discretes
- Analog signals.

The large quantity of interfaces lets the AIMS integrate information from many of the airplane systems.



AIMS CABINET (2)

AIMS - GENERAL DESCRIPTION - 3

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AIMS - FLIGHT DECK COMPONENT LOCATIONS - 1

Integrated Systems Component Locations

These are the integrated systems that have components in the flight deck:

NOTE: Not all components are installed on all airplanes.

- Primary display system (PDS)
- Data Communication management system (DCMS)
- Flight management computing system (FMCS)
- Thrust management computing system (TMCS).

These PDS components are on the P1, P2, and P3 panels:

- Left instrument source select panel (ISSP)
- Left outboard display unit (DU)
- Left inboard DU
- Captain display switching panel
- Center upper DU
- Right inboard DU
- Right outboard DU
- Right instrument source select panel (ISSP)
- First officer display switching panel.

These PDS components are on the P55 and P7 panels:

- Left EFIS control panel (CP)
- Display select panel (DSP)
- Right EFIS CP
- Left Remote Light Sensor (RLS)
- Right RLS.

These PDS components are on the P9 and P10 panels:

- Lower center DU
- Center display control panel
- Left cursor control device (CCD)

- Right CCD.

The DCMS components on the P7 panel are the data uplink control switches. The DCMS controls the flight compartment printer on the P8 panel.

The DCMS components on the P5 panel are the cabin power control switches.

These FMCS and TMCS components are on the P8 and P10 panels:

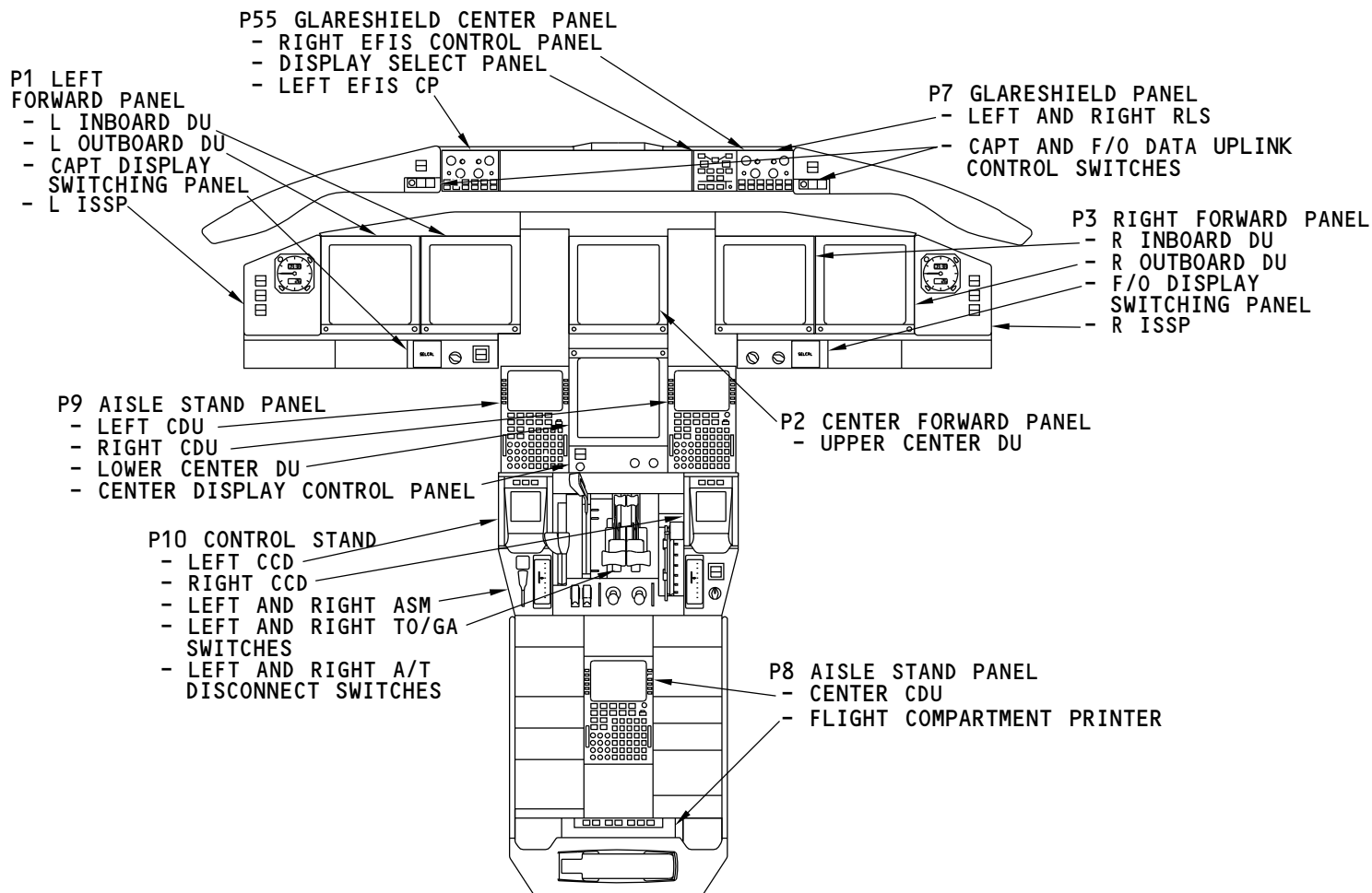
- Left control display unit (CDU)
- Right CDU
- Center CDU
- Left autothrottle servo motor (ASM)
- Right ASM
- Left TO/GA switch
- Right TO/GA switch
- Left autothrottle disconnect switch
- Right autothrottle disconnect switch.

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AIMS - FLIGHT DECK COMPONENT LOCATIONS - 1

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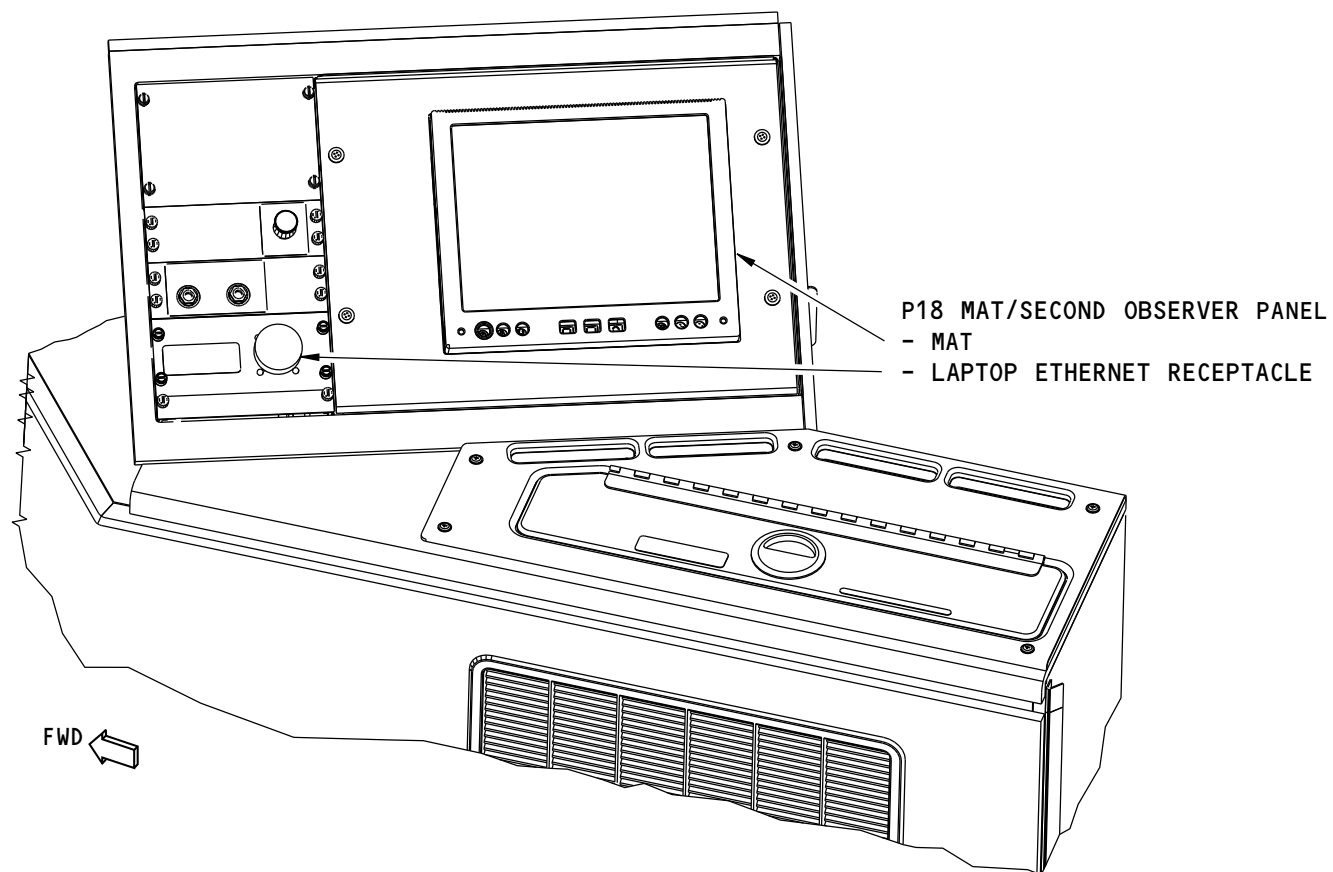


AIMS - FLIGHT DECK COMPONENT LOCATIONS - 2

Integrated System Component Locations

The CMCS maintenance access terminal (MAT) and a laptop Ethernet receptacle are on the P18 panel.

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AIMS - FLIGHT DECK COMPONENT LOCATIONS - 2

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**AIMS - MAIN EQUIPMENT CENTER COMPONENT LOCATIONS****AIMS Components Locations**

The AIMS components in the main equipment center (MEC) are the:

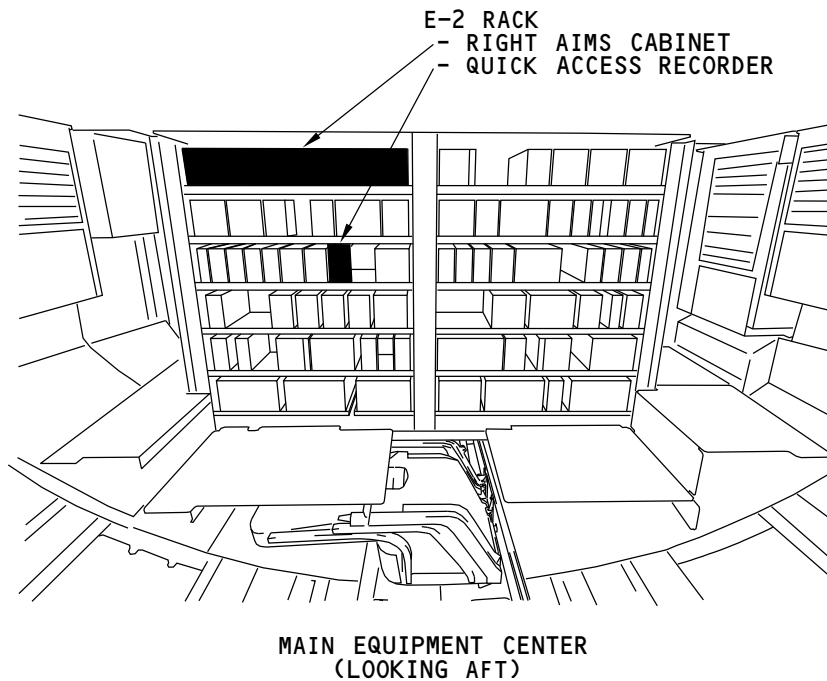
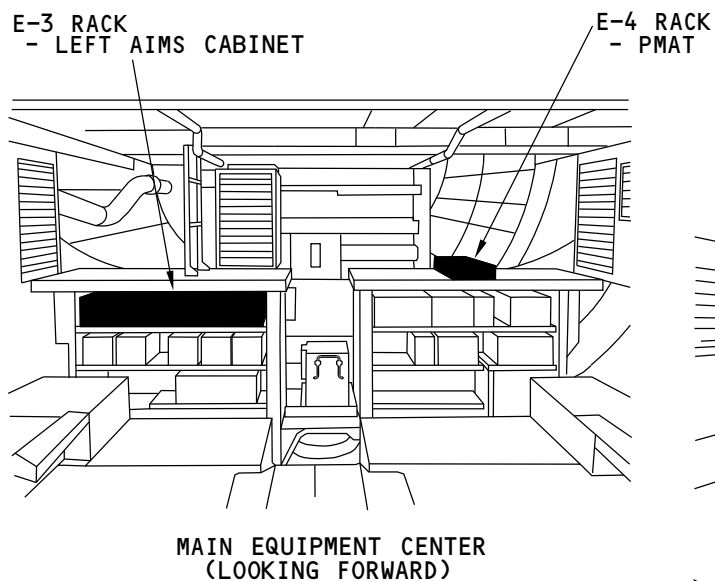
- Left AIMS cabinet
- Right AIMS cabinet.

Integrated Systems Components Locations

The CMCS component in the MEC is the portable maintenance access terminal (PMAT).

The ACMS component in the E2 rack is the quick access recorder.

NOTE: Not all equipment is installed on all airplanes.



AIMS - MAIN EQUIPMENT CENTER COMPONENT LOCATIONS

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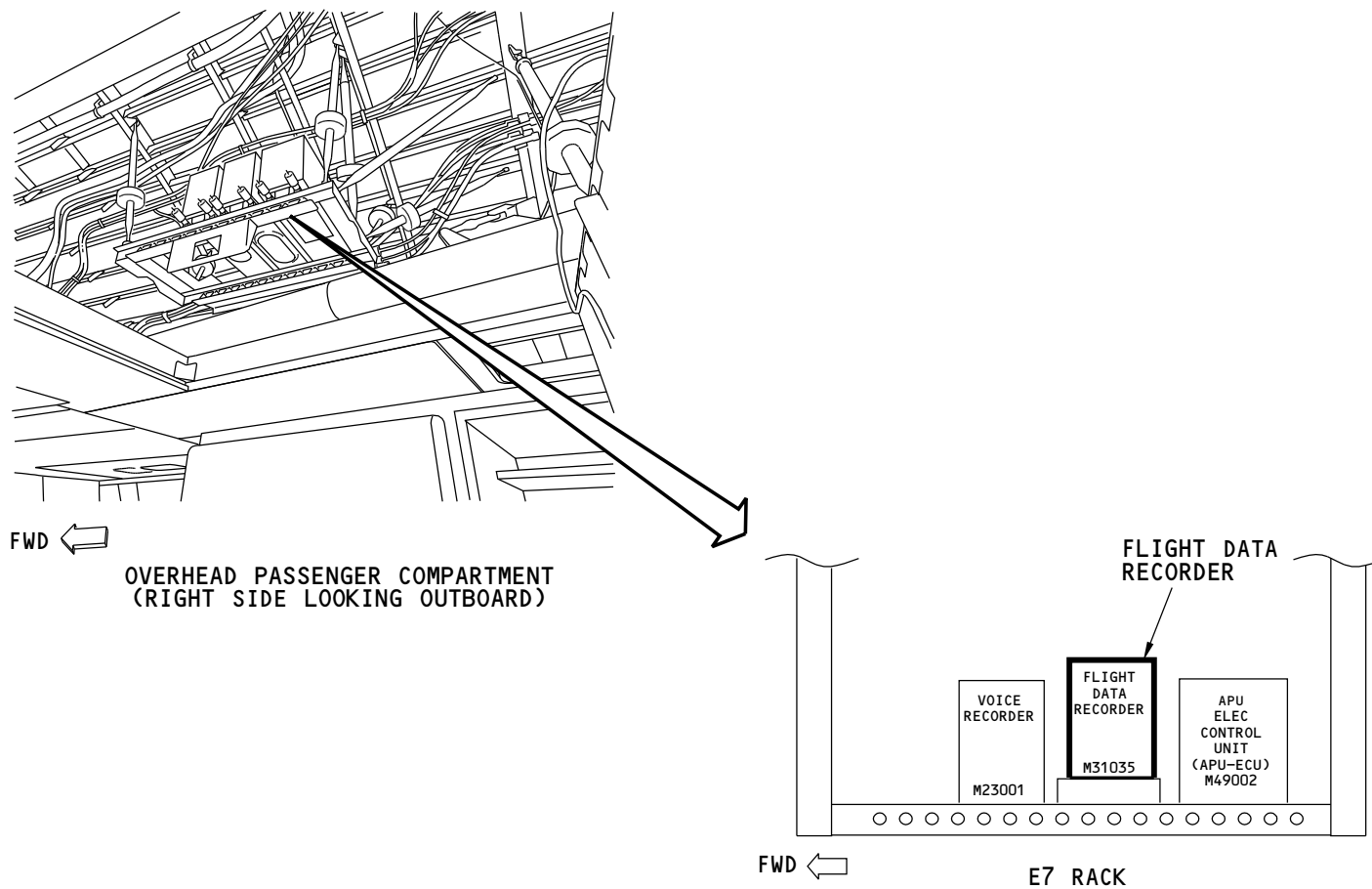


AIMS - MISCELLANEOUS RACKS COMPONENT LOCATIONS

Integrated System Component Locations

The FDRS component in the E7 rack is the flight data recorder (FDR).

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AIMS - MISCELLANEOUS RACKS COMPONENT LOCATIONS

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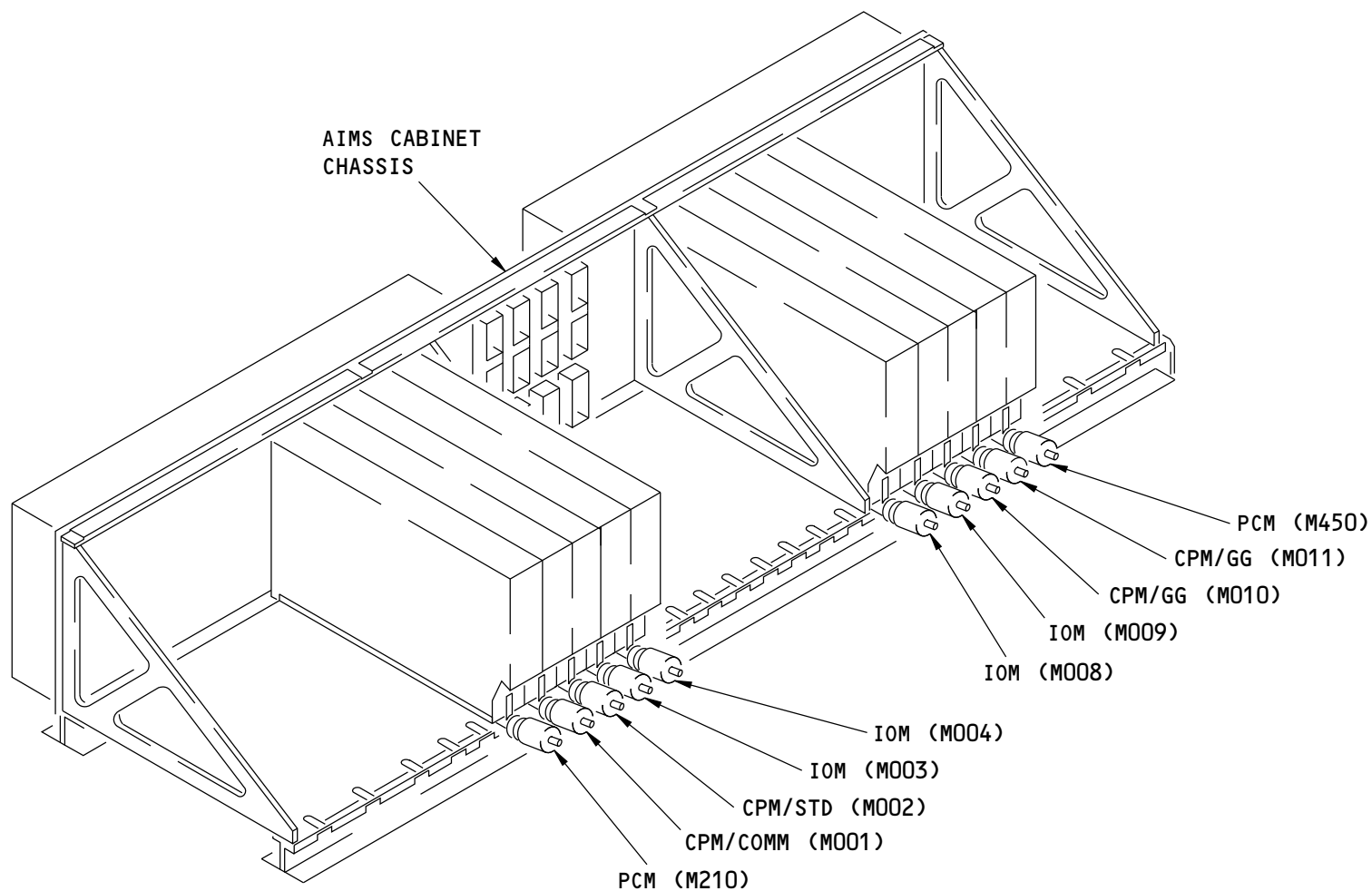
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**AIMS - AIMS CABINET COMPONENT LOCATIONS****AIMS Component Locations**

An AIMS cabinet includes ten LRMs and an AIMS cabinet chassis. The left AIMS cabinet components are:

- Cabinet chassis
- Core processor module/communication (CPM/COMM)
- CPM/standard (CPM/STD)
- CPM/graphics generator (CPM/GG) (2)
- Input/output module (IOM) (4)
- Power conditioning module (PCM) (2).

The right AIMS cabinet components are the same.



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AIMS - AIMS CABINET COMPONENT LOCATIONS

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AIMS - INPUT POWER INTERFACES

General

Each AIMS cabinet receives power through four circuit breakers in the overhead circuit breaker panel. Each AIMS cabinet also receives power through one hot battery bus circuit breaker in the standby power management panel.

The left AIMS cabinet gets electrical power from the 28 vdc captain's flight instrument bus, the 28 vdc first officer's flight instrument bus, and the hot battery bus. The right AIMS cabinet gets electrical power from the 28 vdc left main bus, the 28 vdc right main bus, and the hot battery bus.

The electrical power goes to the ARINC 659 backplane power bus of each AIMS cabinet and then to the two power conditioning modules (PCM) installed in each cabinet. Each PCM filters and conditions the input power. The PCMs then send power to the CPMs and IOMs in the AIMS cabinet.

NOTE: One PCM can supply all CPM and IOM power demands in the left or right AIMS cabinet.

The input power initial state (first tier) has the main, auxiliary, and hot battery power available. If the main bus input falls below 18.5 vdc, switches connect the auxiliary power input to the power bus. The system has now reached the second tier. If both the main and auxiliary inputs are lost, switches connect the hot battery bus to the internal power bus. The system has reached the third tier. The system can only stay in the third tier (hot battery bus, full power) for 200-400 msec. At time-out, battery switches to the input bus open and the system is in its final tier state, memory holdup. The battery bus input provides low power to the CPMs/IOMs for data retention. The power is limited to ensure battery drain does not exceed limits. An internal energy reserve supports each CPM and IOM module for 1 millisecond when power switches from main to auxiliary to battery.

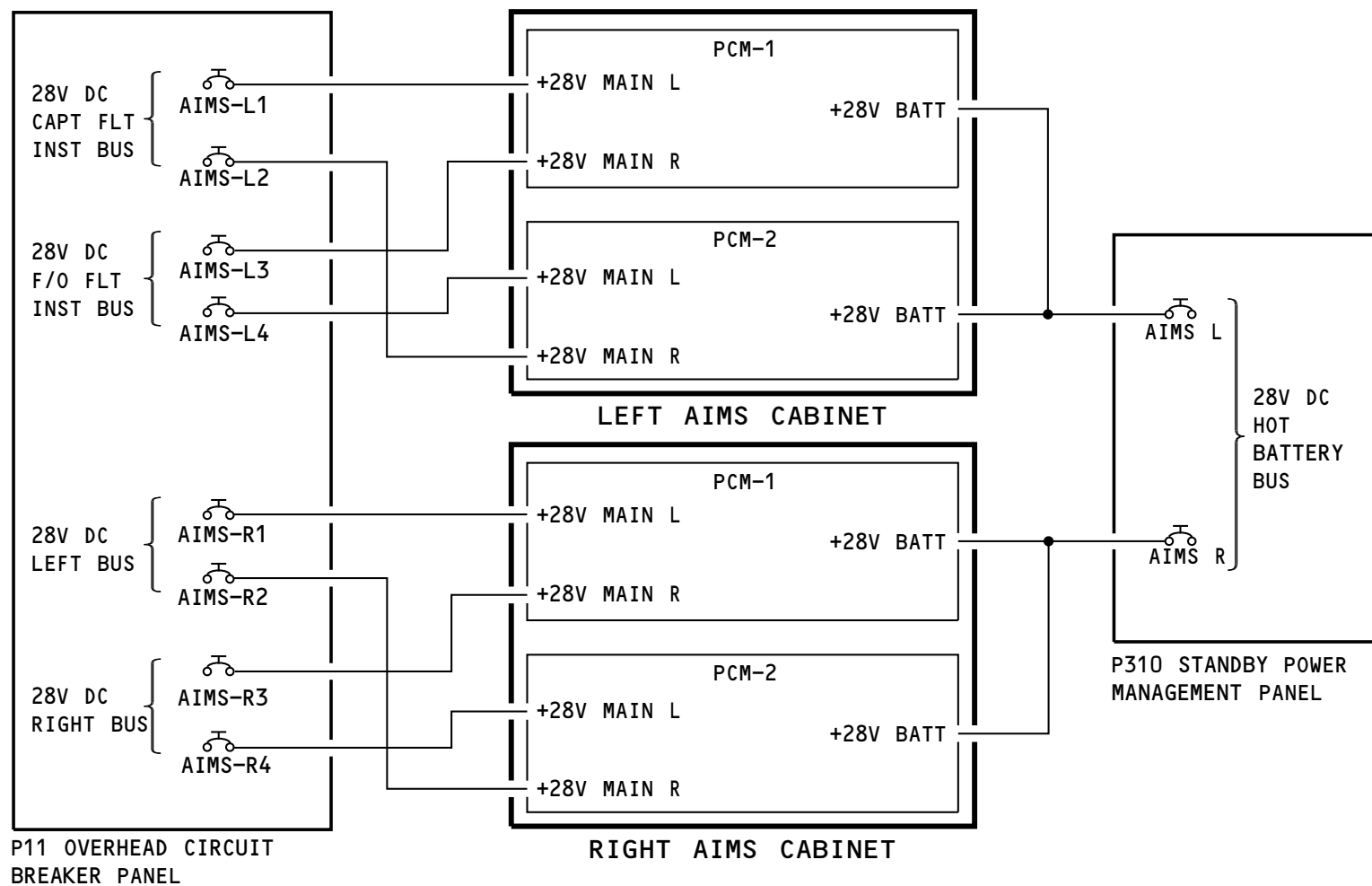
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AIMS - INPUT POWER INTERFACES

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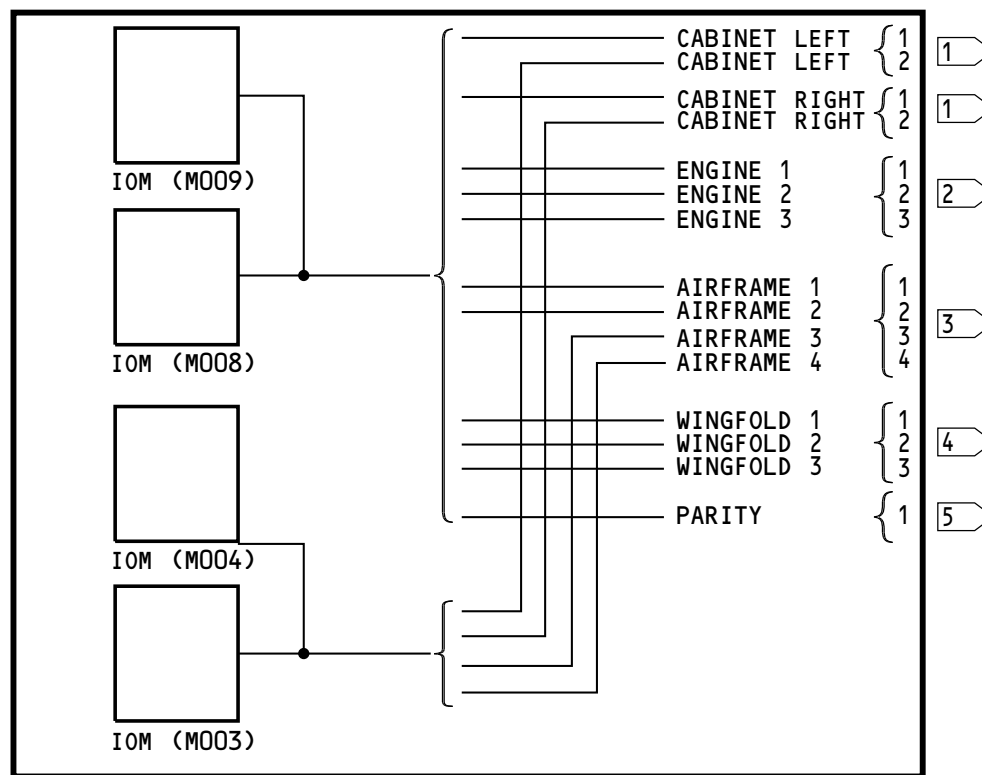
**AIMS - CONFIGURATION PIN INTERFACES****Configuration Pins**

The left and right AIMS cabinets have program pins that set the configuration of the:

- Cabinet position
- Engine manufacturer
- Airframe type
- Wingfold configuration
- Parity for the program pins.

The parity pin is grounded when an even number of program pins are grounded.

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LEFT AIMS CABINET

1 THESE PINS GROUNDED FOR THEIR RESPECTIVE CABINETS.

2 ENGINE TYPE DETERMINES WHICH PINS ARE GROUNDED

3 MODEL TYPE DETERMINES WHICH PINS ARE GROUNDED

4 WINGFOLD CONFIGURATION DETERMINES WHICH PINS ARE GROUNDED

5 THE PARITY PIN IS GROUNDED WHEN AN EVEN NUMBER OF PROGRAM PINS ARE GROUNDED

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AIMS - CONFIGURATION PIN INTERFACES

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AIMS - FLIGHT CONTROLS ARINC 629 BUSES INTERFACE**General**

The AIMS cabinets receive data on all three of the flight controls ARINC 629 buses and transmit data on the left and right buses. The AIMS cabinets also transmit data on the center flight controls ARINC 629 bus when the airplane is on the ground. The AIMS cabinets transmit data loading information and maintenance data on the center flight controls ARINC 629 bus.

The LRUs that have an interface with the AIMS cabinets on the flight controls ARINC 629 buses are the:

- Air data inertial reference unit (ADIRU)
- Secondary attitude air data reference unit (SAARU)
- Air data module (ADM), static (3)
- Air data module (ADM), pitot (3)
- Primary flight computer (PFC) (3)
- Actuator control electronics (ACE) (4)
- Flight control power supply assembly (FCPSA) (3).

The control display units (CDUs) and the autopilot flight director computers (AFDCs) connect to the flight controls ARINC 629 buses. However, the CDUs and AFDCs do not communicate with the AIMS cabinets on the flight controls ARINC 629 buses.

ADIRU

The AIMS cabinets receive inertial reference data and air data from the ADIRU on the left and right flight controls ARINC 629 buses. The AIMS cabinets transmit data to the ADIRU on the left and right flight controls ARINC 629 buses.

SAARU

The AIMS cabinets receive inertial reference data and air data from the SAARU on the center flight controls ARINC 629 bus. The AIMS cabinets transmit data to the SAARU on the left and right flight controls ARINC 629 buses.

ADM

The AIMS cabinets receive static pressure and total pressure data from the six ADMs on the three flight controls ARINC 629 data buses. The AIMS cabinets transmit data to the six ADMs on the left and right flight controls ARINC 629 data buses.

PFC

The AIMS cabinets receive flight control position data from the left, right and center PFCs on the left, center and right flight controls ARINC 629 buses. The AIMS cabinets transmit data to each PFC on the left and right flight controls ARINC 629 buses.

ACE

The AIMS cabinets receive power control unit data and position data from the four ACEs on the left, right, and center flight controls ARINC 629 buses. The AIMS cabinets do not transmit data to the ACEs. The AIMS cabinets receive ACE status data from the PFCs.

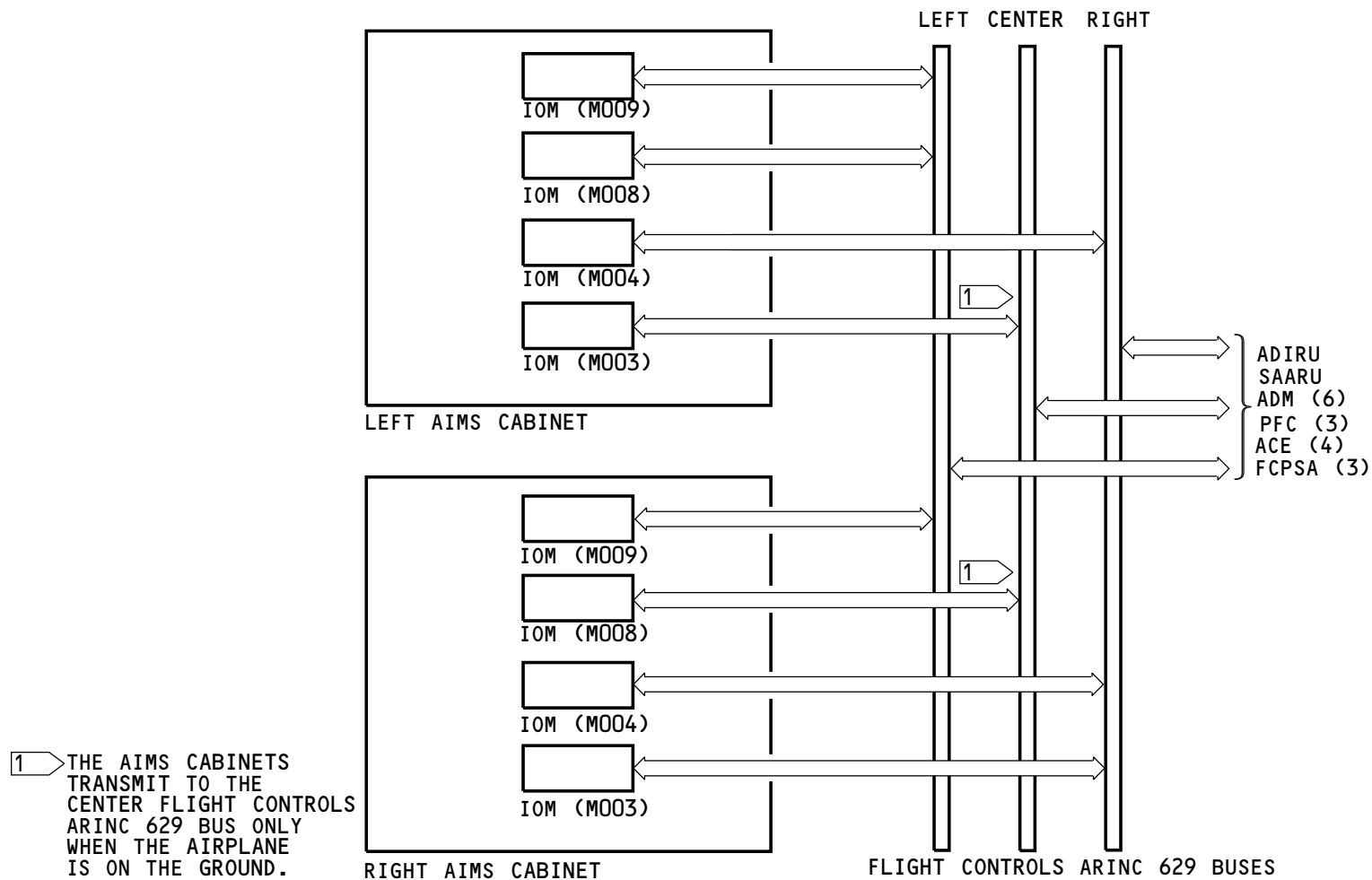
FCPSA

The AIMS cabinets receive voltage measurement data from the three FCPSAs on the three flight controls ARINC 629 buses. The AIMS cabinets transmit data to the FCPSAs on the left and right flight controls ARINC 629 buses.

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AIMS - FLIGHT CONTROLS ARINC 629 BUSES INTERFACES

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AIMS - SYSTEMS ARINC 629 BUSES INTERFACE

General

The AIMS cabinets receive and transmit data on all four of the systems ARINC 629 buses. These LRUs have an interface with the AIMS cabinets on the systems ARINC 629 buses:

- ARINC signal gateway card (ASG)
- Warning electronic unit (WEU)
- Backup generator converter (BU gen conv)
- Proximity sensor electronics unit (PSEU)
- Bus power control unit (BPCU)
- Generator control unit (GCU)
- ELMS power management panel (ELMS pwr mgmt pnl)
- Passenger address/cabin interphone controller (PA/CI CONT)
- Cabin system management unit (CSMU)
- Overhead panel bus controller (OPBC)
- Flap slat electronics unit (FSEU)
- Brake system control unit (BSCU)
- Brake temperature monitor unit (BTMU)
- Main gear steering control unit (MGSCU)
- Cabin temperature controller (CTC)
- Air supply-cabin pressure controller (ASPCP)
- Airborne vibration monitor signal conditioner (AVM signal conditioner)
- Engine data interface unit (EDIU)
- APU controller
- Fuel quantity processor unit (FQPU)
- Audio management unit (AMU)
- Control display unit (CDU)
- Autopilot flight director computer (AFDC).

ASG Card- System CardFile

A left and right system cardfile integrates many systems cards. The systems cardfiles have many data inputs and outputs. The left and right system cardfiles communicate on the left and right systems ARINC 629 buses.

Both systems cardfiles have two ARINC signal gateway (ASG) cards. One ASG card in each cardfile connects to the left ARINC 629 bus and one card in each cardfile connects to the right ARINC bus.

The other cards in the systems cardfiles are the:

- Engine fire detection card (2)
- Engine overheat detection card (2)
- APU fire detection card
- Airfoil and cowl ice protection system card (3)
- ECS card (2)
- HYDIM card (4)
- Weight on wheels (WOW) card (2)
- Duct leak overheat detection card (3)
- Cardfile power supply unit, monitor card (4).

The AIMS cabinets receive fire detection and fire handle position data from the:

- Left engine fire detection card
- Right engine fire detection card
- APU fire detection card.

The AIMS cabinets receive overheat detection data from the left engine overheat detection card and right engine overheat detection card.

The AIMS cabinets receive duct leak data from the left, right and center duct leak overheat detection cards.

The AIMS cabinets receive environmental system status data from the left and right ECS cards.

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**AIMS - SYSTEMS ARINC 629 BUSES INTERFACE**

The AIMS cabinets receive hydraulic system status data from the HYDIM cards in each cardfile.

The AIMS cabinets receive weight on wheels data from the left and right WOW cards.

The AIMS cabinets receive wing and cowl TAI data, and ice detector status from the left, right and center airfoil and cowl ice protection system cards.

The AIMS cabinets receive cardfile power-supply-unit cards status-data from the monitor card in each of the cardfile power supply units. There are 2 cardfile power supply units in each of the systems cardfiles.

WEU

The AIMS cabinets receive warning system data from the left and right WEUs on the left, right and center 1 systems ARINC 629 buses. The left WEU communicates on the left and center 1 buses and the right WEU communicates on the right and center 1 buses.

The AIMS cabinets transmit data to the WEUs on the left, right and center 1 systems ARINC 629 buses.

BU Generator Converter

The AIMS cabinets receive backup electrical power system data from the BU generator convertor on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the BU generator convertor on the left and right systems ARINC 629 buses.

PSEU

The AIMS cabinets receive proximity sensor data from the left and right PSEUs on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to each PSEU on the left and right systems ARINC 629 buses.

BPCU

The AIMS cabinets receive electrical power system data from the BPCU on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the BPCU on the left and right systems ARINC 629 buses.

GCU

The AIMS cabinets receive electrical power system data from the left GCU, right GCU and APU GCU on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the GCUs on the left and right systems ARINC 629 buses.

ELMS

The AIMS cabinets receive electrical power system data from the ELMS left power management panel, right power management panel, and standby power management panel on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the ELMS power management panels on the left and right systems ARINC 629 buses.

PA/CI CONT

The AIMS cabinets receive PA/CI CONT status data from the PA/CI CONT on the left systems ARINC 629 bus.

The AIMS cabinets transmit data to the PA/CI CONT on the left systems ARINC 629 bus.

CSMU

The AIMS cabinets receive cabin management system status data from the CSMU on the right systems ARINC 629 bus.

The AIMS cabinets transmit data to the CSMU on the right systems ARINC 629 bus.

OPBC

The AIMS cabinets receive switch position data from the overhead panel switches and other flight deck switches via the left and right OPBC on the left and right systems ARINC 629 buses.

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AIMS - SYSTEMS ARINC 629 BUSES INTERFACE

The AIMS cabinets transmit data to the OPBCs on the left and right systems ARINC 629 buses.

FSEU

The AIMS cabinets receive flap position data and slat position data from the left and right FSEU on the left, right and center 1 systems ARINC 629 buses.

The left FSEU has two interfaces on the left bus and two interfaces on the center 1 bus. The right FSEU has two interfaces on the right bus and two interfaces on the center 1 bus.

The AIMS cabinets transmit data to the left and right FSEU on the left, right and center 1 systems ARINC 629 buses.

BSCU

The AIMS cabinets receive brake system control data, from the BSCU on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the BSCU on the left and right systems ARINC 629 buses.

BTMU

The AIMS cabinets receive brake temperature data from the BTMU on the left systems ARINC 629 bus.

The AIMS cabinets transmit data to the BTMU on the left systems ARINC 629 bus.

MGSCU

The AIMS cabinets receive aft axle steering locked status from the MGSCU on the left systems ARINC 629 bus.

The AIMS cabinets transmit data to the MGSCU on the left systems ARINC 629 bus.

CTC

The AIMS cabinets receive air conditioning data and system status data from the left and right CTCs on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the CTCs on the left and right systems ARINC 629 buses.

ASCPC

The AIMS cabinets receive air supply data and cabin pressure data from the left and right ASCPCs on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the ASCPCs on the left and right systems ARINC 629 buses.

AVM Signal Conditioner

The AIMS cabinets receive engine vibration data and system status message data from the left and right AVM signal conditioners on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the AVM signal conditioners on the left and right systems ARINC 629 buses.

EDIU

The EDIUs receive ARINC 429 data from the A and B channels of the left and right electronic engine controls (EECs). The EDIUs convert the data to an ARINC 629 format. The left and right EDIUs transmit the ARINC 629 formatted data to the AIMS cabinets.

The AIMS cabinets receive engine data and system status message data from the channel A, the channel B, and the channel C EDIU interface cards in each EDIU. The EDIU channel interface cards and the systems ARINC 629 buses that connect to each are as follows:

- Channel A - left EDIU, left and C1 buses
- Channel B - left EDIU, left and C2 buses
- Channel C - left EDIU, C1 and C2 buses
- Channel A - right EDIU, right and C2 buses

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AIMS - SYSTEMS ARINC 629 BUSES INTERFACE

- Channel B - right EDIU, right and C1 buses
- Channel C - right EDIU, C1 and C2 buses.

The AIMS cabinets transmit data to the channel A, the channel B, and the channel C EDIU interface cards, in each EDIU.

The AIMS cabinets transmit data to the EDIUs on the same systems ARINC 629 buses that they receive data from. The EDIUs then transmit the data received from the AIMS cabinets to the left and right EECs.

APU Controller

The AIMS cabinets receive APU data from the APU controller on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the APU controller on the left and right systems ARINC 629 buses.

FQPU

The AIMS cabinets receive fuel data and system status data from the FQPU on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the FQPU on the left and right systems ARINC 629 buses.

AMU

The AIMS cabinets receive digital audio system status data from the AMU on the left systems ARINC 629 bus.

The AIMS cabinets transmit data to the AMU on the left systems ARINC 629 bus.

CDU

The AIMS cabinets receive keyboard selection data and map data from the left, right and center CDUs on the left and right systems ARINC 629 buses.

The AIMS cabinets transmit data to the CDUs on the left and right systems ARINC 629 buses.

AFDC

The AIMS cabinets receive autopilot status and guidance data from the left, right and center AFDCs on the left, right and center 1 systems ARINC 629 data buses.

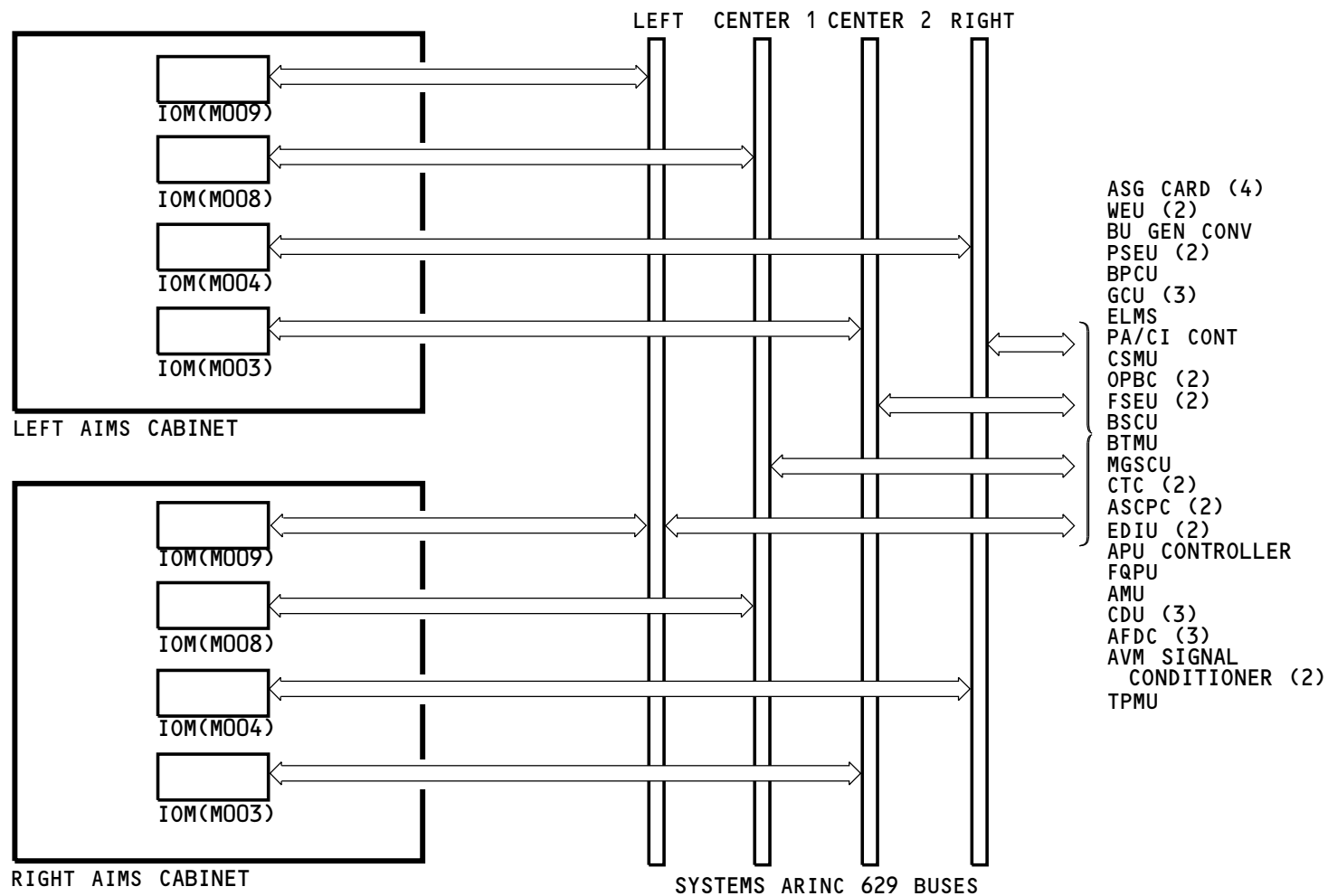
The AIMS cabinets transmit data to the AFDCs on the left, right and center 1 systems ARINC 629 buses.

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AIMS - SYSTEMS ARINC 629 BUSES INTERFACES

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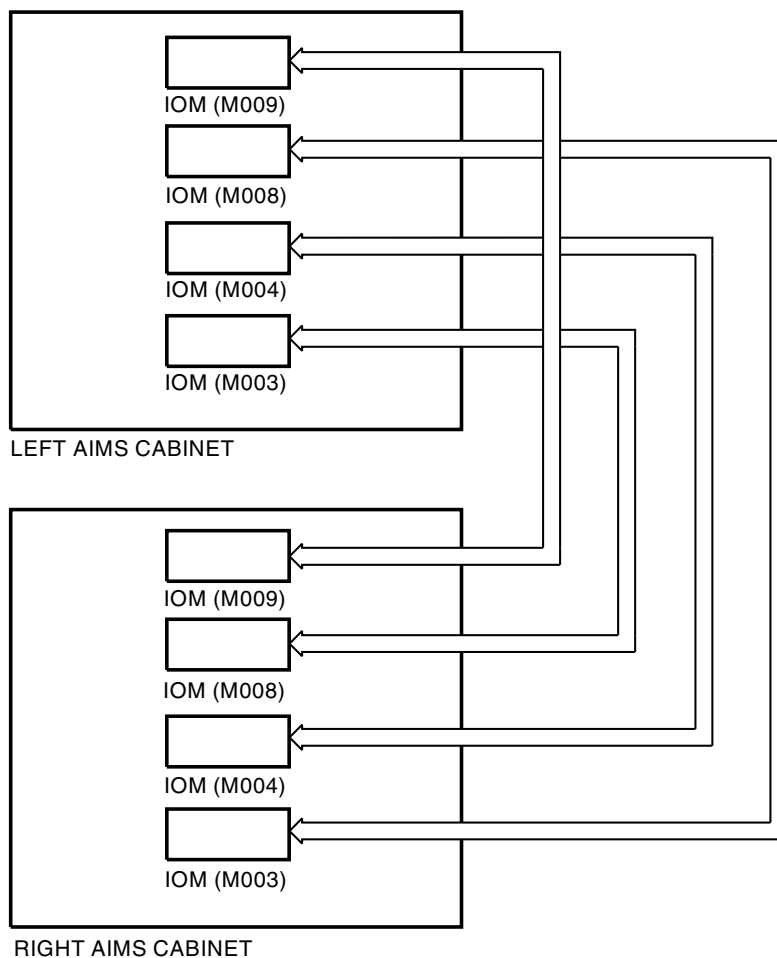
**AIMS - INTERCABINET ETHERNET BUSES INTERFACES****General**

The left and right AIMS cabinets transmit and receive data on all four of the AIMS intercabinet (IC) ethernet buses.

AIMS Cabinets

Data that goes between the two AIMS cabinets include intra-function active-nonactive data and inter-function communication data.

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AIMS INTERCABINET (IC) ETHERNET BUSES

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AIMS - INTERCABINET ETHERNET BUSES INTERFACES

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AIMS - ARINC 429 INPUTS INTERFACES

General

These are the four ways the ARINC 429 input buses go to the input/output modules:

- ARINC 429 bus goes directly to one IOM
- ARINC 429 bus goes to two IOMs in the same AIMS cabinet
- ARINC 429 bus goes to one IOM in each AIMS cabinet.
- ARINC 429 bus goes to two IOMs in each AIMS cabinets.

More critical systems usually send their data to more than one IOM.

The ARINC 429 buses may be either low speed or high speed buses.

ARINC 429 inputs

These LRUs send data to the AIMS cabinet on ARINC 429 buses:

- Autothrottle servo motors
- Mode control panel
- VHF communication transceivers
- HF communication transceivers
- Radio tuning panels
- Satellite data unit
- Clocks
- Cursor control devices (Capt and F/O)
- Display units
- EFIS control Panels
- Window heat control units
- Radio altimeter transceivers
- Weather radar receiver/transceivers
- TCAS computers
- ILS receivers
- VOR/MB receivers
- ADF receivers

- DME interrogators
- Global position system sensor units
- Cabin telecommunications unit
- Standby airspeed indication
- Standby altimeter
- Ground proximity warning computer
- Air traffic control mode S transponders.

Some of these LRUs have more than one ARINC 429 bus that go to the AIMS cabinet. Each bus sends different types of data.

Training Information Point

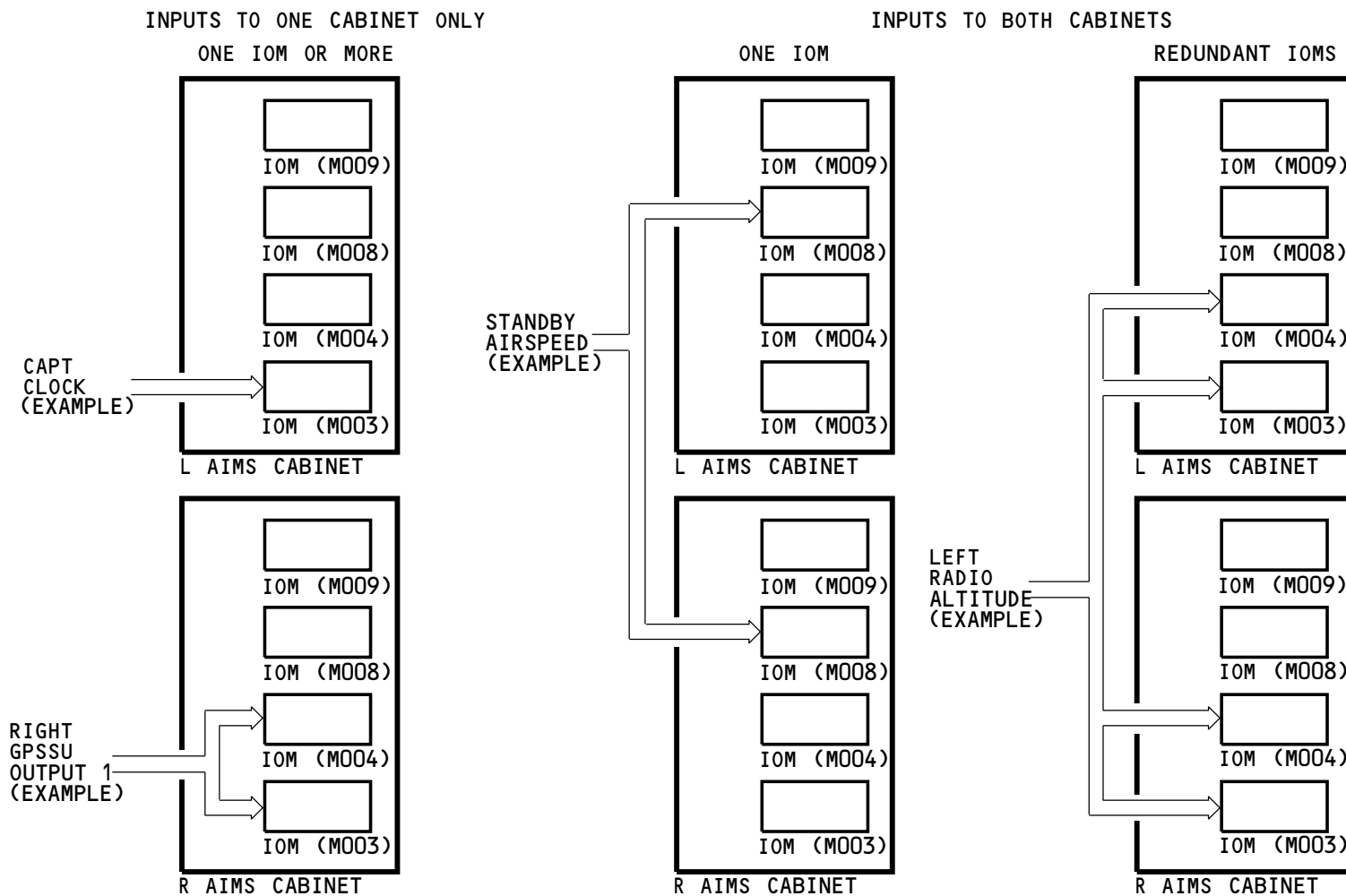
For details on the exact interfaces between the LRUs and the IOMs, refer to the wiring diagram manual.

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AIMS - ARINC 429 INPUTS INTERFACES

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AIMS - ARINC 429 OUTPUTS INTERFACES

General

The left and right AIMS cabinets transmit low speed and high speed ARINC 429 outputs in these three ways:

- There is a direct output
- There are two IOM sources in the same AIMS cabinet. A relay controls the output from one source.
- There is one IOM source in each AIMS cabinet. A relay controls the output from one source.

The different AIMS functions control the relays. For example, the FMCF controls the center nav tuning bus.

ARINC 429 outputs

There are eighteen 429 output buses. Each 429 bus transmits different types of data. These are the ARINC 429 output buses:

- Left general purpose bus #1
- Right general purpose bus #1
- Left general purpose bus #2
- Right general purpose bus #2
- Left general purpose bus #3
- Right general purpose bus #3
- Left DCMF data bus
- Right DCMF data bus
- Left inertial reference bus
- Right inertial reference bus
- Center nav tuning bus
- Left nav tuning bus
- Right nav tuning bus
- Center CMCF bus
- Left CMCF bus
- Right CMCF bus

- Left data load bus
- Right data load bus.

Training Information Point

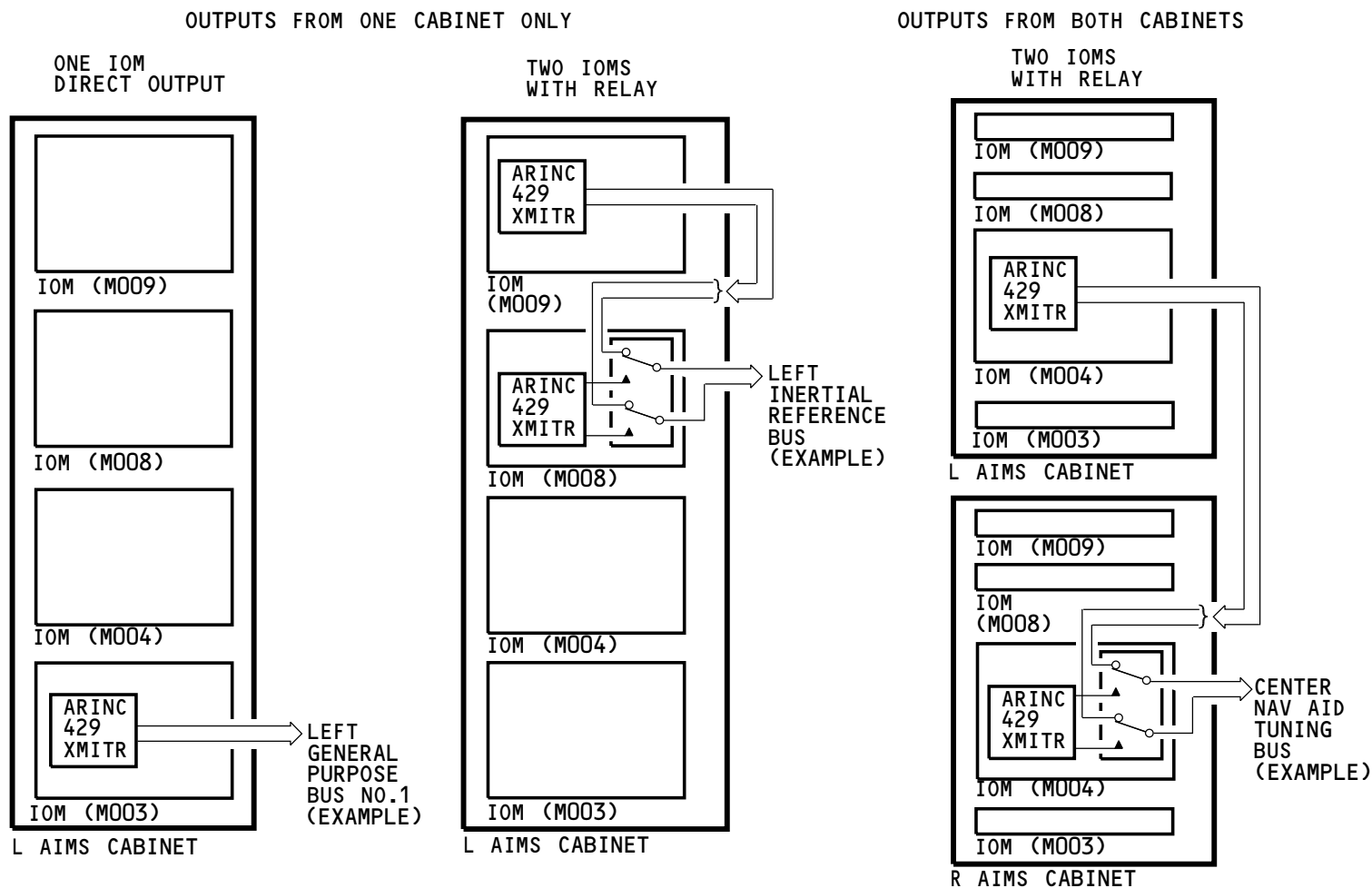
For details on the exact interfaces between the IOMs and the LRUs, refer to the wiring diagram manual.

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AIMS - ARINC 429 OUTPUTS INTERFACES

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**AIMS - ARINC 717 BUSES INTERFACES****General**

The CPM/COMM in the left and right AIMS cabinets supplies an ARINC 717 bus interface to the flight data recorder (FDR).

The CPM/COMM in the left AIMS cabinet supplies an ARINC 717 bus interface to the quick access recorder (QAR).

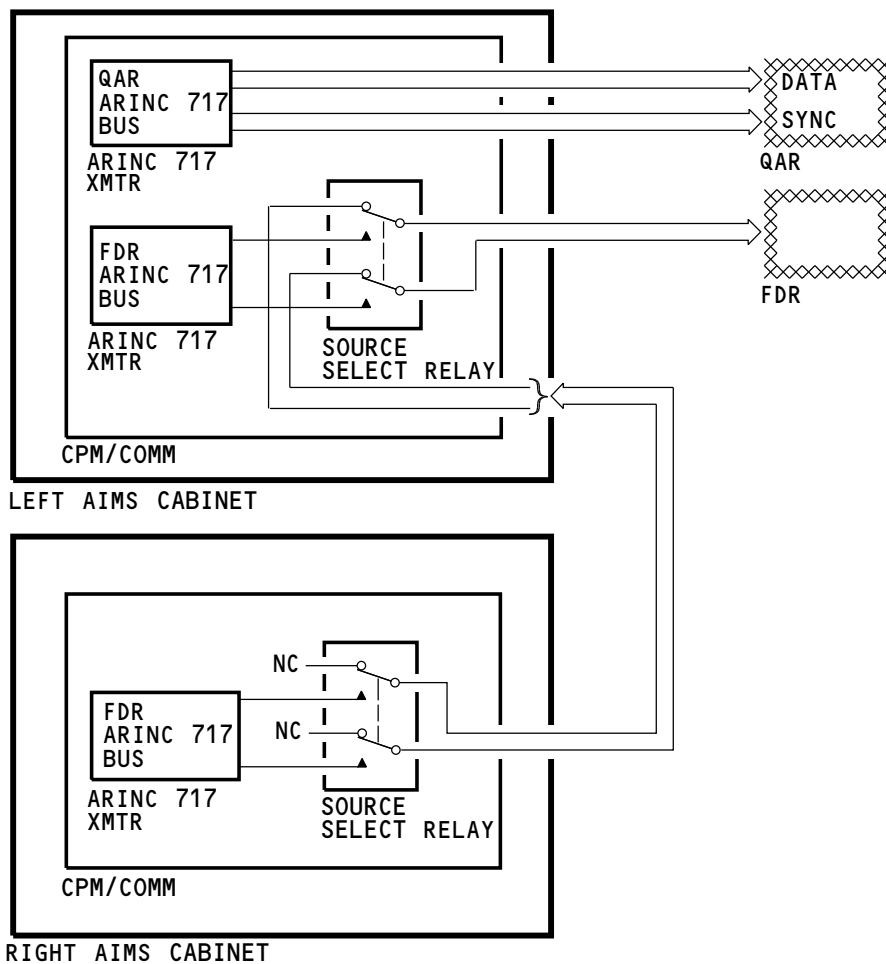
FDR ARINC 717 Buses

The CPM/COMM sends data to the flight data recorder (FDR) on an ARINC 717 bus. Each of the AIMS cabinets has an ARINC 717 transmitter and an ARINC 717 output bus for the FDR. The ARINC 717 transmitter receives data from the DFDAF and sends the data to the FDR.

The FDR ARINC 717 output from the right AIMS cabinet goes to a relay in the left AIMS cabinet. The relay sends the output from the left AIMS cabinet ARINC 717 transmitter or the right AIMS cabinet ARINC 717 transmitter to the FDR. The DFDAF in the left AIMS cabinet controls the state of the source select relay.

QAR ARINC 717 Buses

Two ARINC 717 buses connect the CPM/COMM with the QAR. The left AIMS cabinet has two ARINC 717 transmitters which transmit data to the QAR. The data is from the ACMF in the CPM/STD.



AIMS - ARINC 717 BUS INTERFACES

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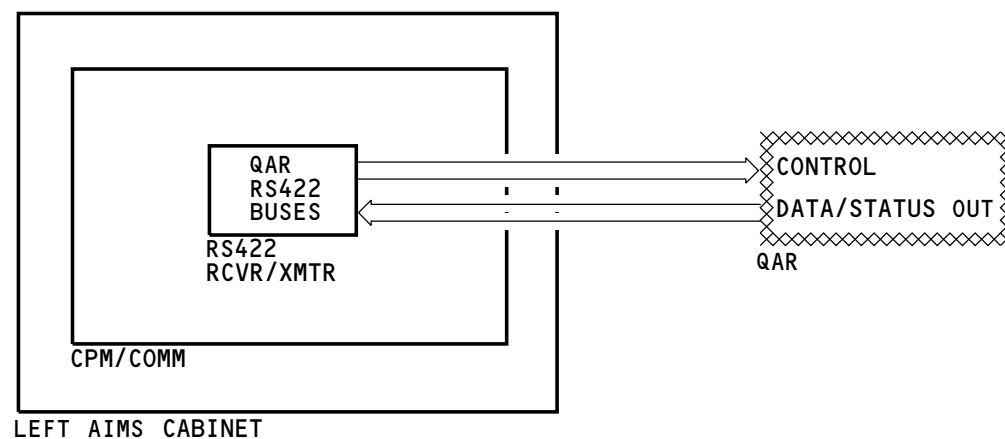
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**AIMS - RS422 BUS INTERFACES****QAR RS422 Buses**

The CPM/COMM in the left AIMS cabinet has an RS422 receiver and transmitter to connect to the QAR. A control RS422 bus and a data/status RS422 bus supply a two way communication between the CPM/COMM and the QAR. The CPM/COMM has the quick access recorder function (QARF) which controls the RS422 buses.

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AIMS - RS422 BUS INTERFACES

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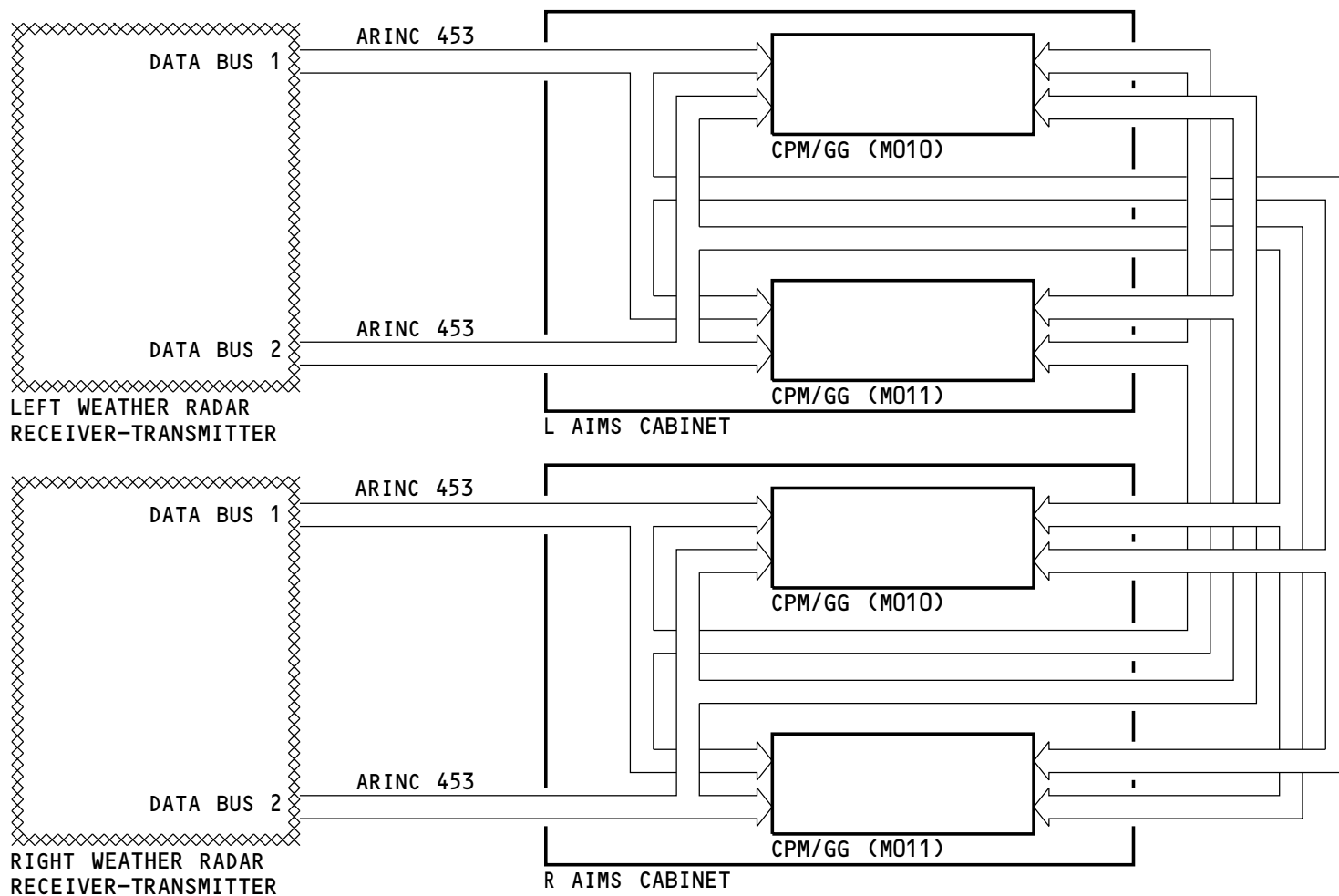
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**AIMS - WEATHER RADAR BUSES ARINC 453 INTERFACES****ARINC 453 Buses**

The left and right weather radar receiver-transmitters (WXR RT) send weather data to both AIMS cabinets on high speed ARINC 453 buses. Each WXR RT transmits the data over two ARINC 453 buses. Each AIMS cabinet also sends the ARINC 453 weather radar bus inputs to the other AIMS cabinet.

For the Captain's display, the primary selection is the Left WXR Transceiver's Data Bus 1 and the secondary selection is the Right WXR Transceiver's Data Bus 1. Similarly for the F/O's display, the primary selection is the Left WXR Transceiver's Data Bus 2 and the secondary selection is the Right WXR Transceiver's Data Bus 2.

Two load resistors terminate the ARINC 453 weather radar bus inputs at the rear connector in each AIMS cabinet.



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AIMS - WEATHER RADAR BUSES ARINC 453 INTERFACES

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**AIMS - DATALINK ARINC INTERFACES****ARINC DATALINK**

Each AIMS cabinet receives uplink ARINC 618 signals from its VHF communication transceiver.

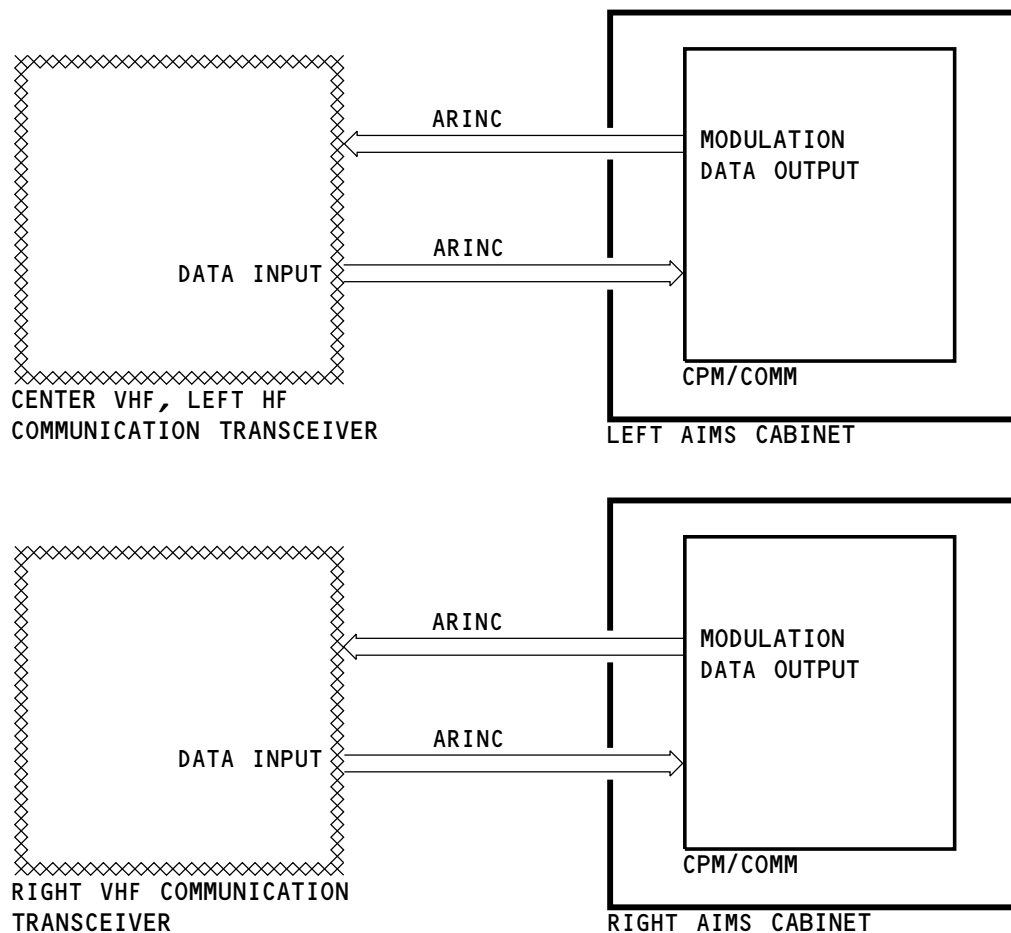
Each AIMS cabinet receives uplink ARINC signals from its HF communication transceiver.

Each AIMS cabinet transmits downlink ARINC 618 signals to its VHF communication transceiver.

Each AIMS cabinet transmits downlink ARINC signals to its HF communication transceiver.

The CPM/COMM in each AIMS cabinet has a modem interface to receive and transmit the signals.

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AIMS - DATALINK ARINC 618 INTERFACES

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**AIMS - PLANENET LOCAL AREA NETWORK INTERFACES****General**

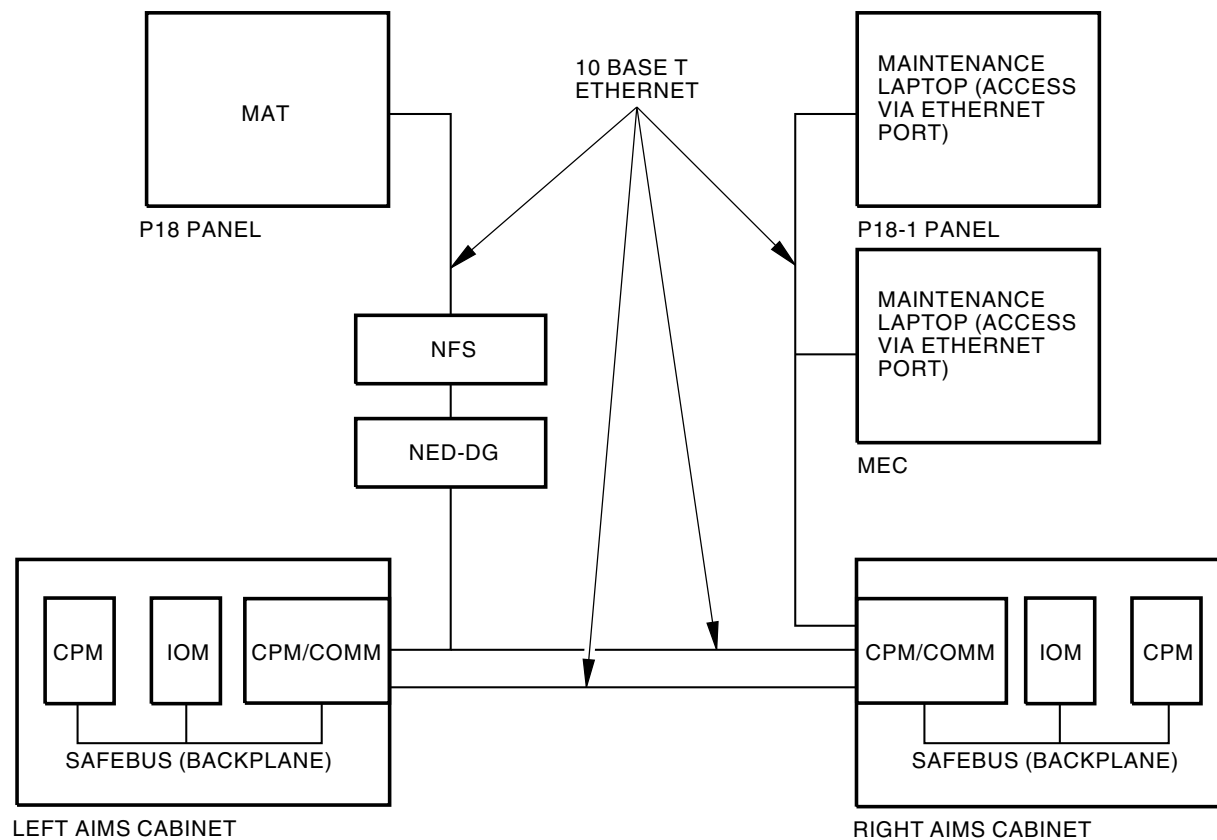
The PlaneNet local area network (LAN) is characterized as a point to point 10 Base T Ethernet network which provides connectivity between the various LRUs in PlaneNet. The 10 Base T Ethernet interface supports communication between AIMS and other LRUs on the PlaneNet. The PlaneNet LAN is used to transmit and receive block data between units connected to it. PlaneNet member systems use standard TCP/UDP/IP Ethernet protocols for data transfer and for software data loading applications.

PlaneNet provides a high-speed communications path to PlaneNet member systems primarily for transferring maintenance data for display. Additionally, the interface allows onboard software data loading or down loading of maintenance data.

The DCMF in the CPM/COMM has the communication protocols that permit the AIMS functions to communicate with the PlaneNet LAN. The CMCF and ACMF send their data to the DCMF to be formatted with the correct data format. The DCMF then transmits this data on the PlaneNet LAN.

Planenet Components

PlaneNet consists of 2 AIMS cabinets, one Maintenance Access terminal (MAT), located in the flight deck and two Portable Maintenance Access Terminal (PMAT) ports, one located in the flight deck and one in the EEbay. AIMS interfaces to the PlaneNet LAN through the AIMS Communications SLRM (CPM/COMM).



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AIMS - ETHERNET LOCAL AREA NETWORK INTERFACES

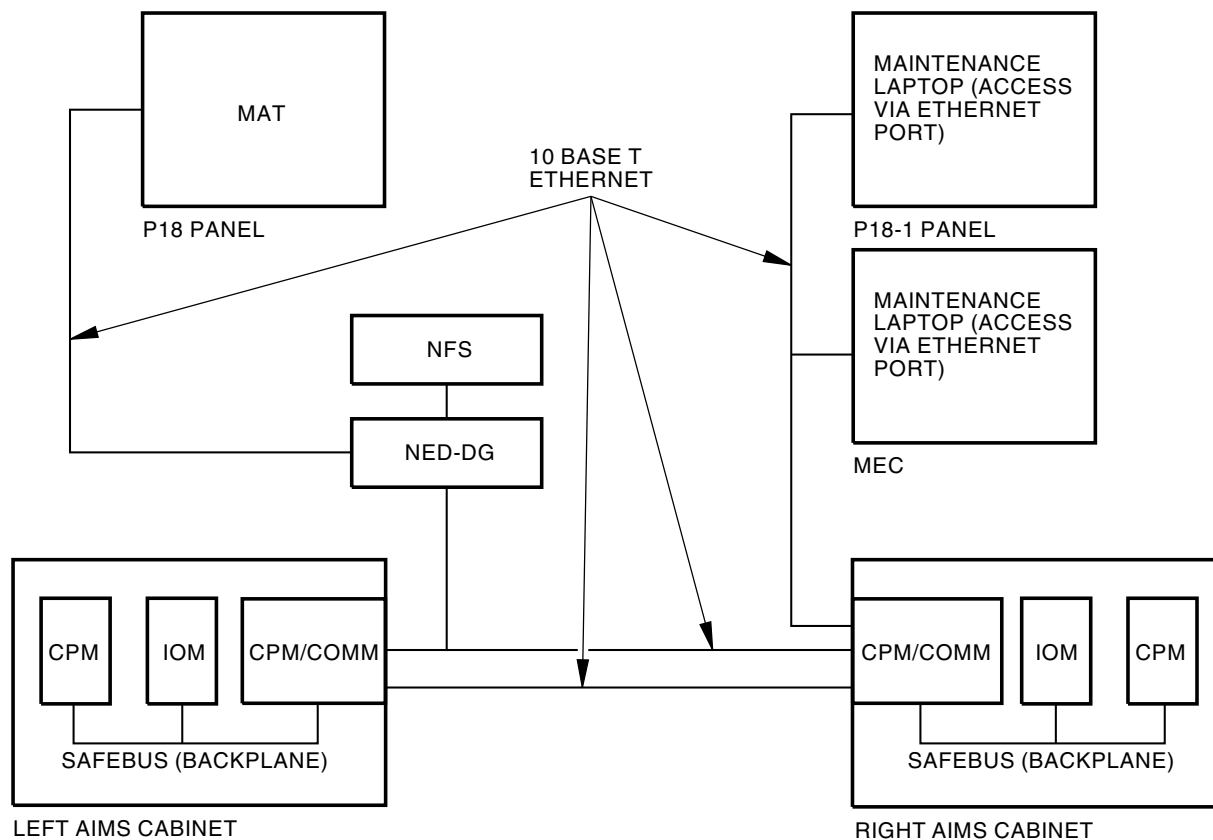
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AIMS - ETHERNET LOCAL AREA NETWORK INTERFACES

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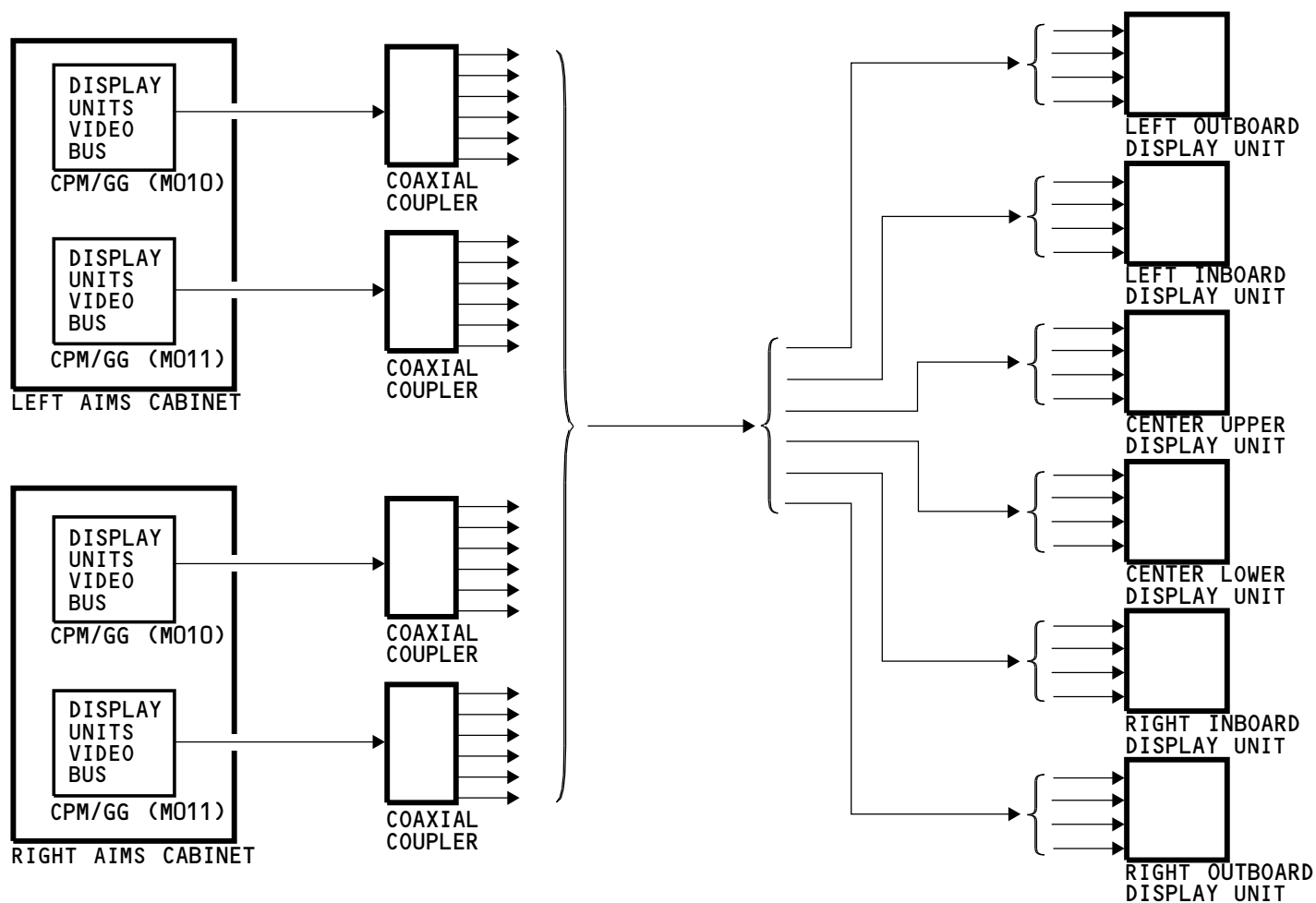
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**AIMS - DISPLAY UNITS VIDEO BUSES INTERFACES****Display Units Video Buses**

The two core processor module/graphics generators (CPM/GG) in both AIMS cabinets transmit video signals to the six display units. Each CPM/GG transmits on a dedicated display units video bus.

The display units video buses are coaxial cables that transfer high speed digitized compressed video signals. Each of the video buses is split by a coaxial coupler into six signals. The six signals then go to the six display units.



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AIMS - DISPLAY UNITS VIDEO BUSES INTERFACES

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AIMS - ANALOG DISCRETE INPUTS INTERFACES

General

There are two ways analog discrete inputs go to the input/output modules:

- The analog discrete input goes to two IOMs in the one AIMS cabinet
- The analog discrete input goes to two IOMs in both AIMS cabinets.

Analog Discrete Inputs

The AIMS cabinets receive these analog discrettes:

- Autothrottle disconnect
- Autothrottle disconnect reset
- Takeoff go around
- Master caution warning light reset
- Key event from the VHF radios
- Key event from the HF radios
- QAR tape low and status
- Program pins
- Air ground status from ELMS
- Maintenance/software load enable
- Trucks not tilted from the PSEU
- Flight data recorder status
- Flight data recorder maintenance status
- Fuel lever at cutoff position
- EEC GND test switch in ON position
- ACE in direct mode
- ACE power supply valid
- Alternate pitch trim - arm active
- Alternate pitch trim - arm down
- Alternate pitch trim - arm up
- Alternate pitch trim - control active
- Alternate pitch trim - control down

- Alternate pitch trim - control up
- Auto speed brake switch
- Thrust reverser interlock feedback
- Parking brake handle
- Parking brake valve close relay
- Brake source pressure indication
- APU fire alarm
- Left engine fire alarm
- Right engine fire alarm
- APU bottle pressure low
- Engine bottle pressure low
- ASCPC L/R bleed off message
- Cabin alert message
- Cabin call message
- Cabin ready message
- Cargo call message
- Ground call message
- Autopilot disconnect warning battery 2
- Girt bar armed - door X
- Left engine start continuous ignition
- Right engine start continuous ignition.

Training Information Point

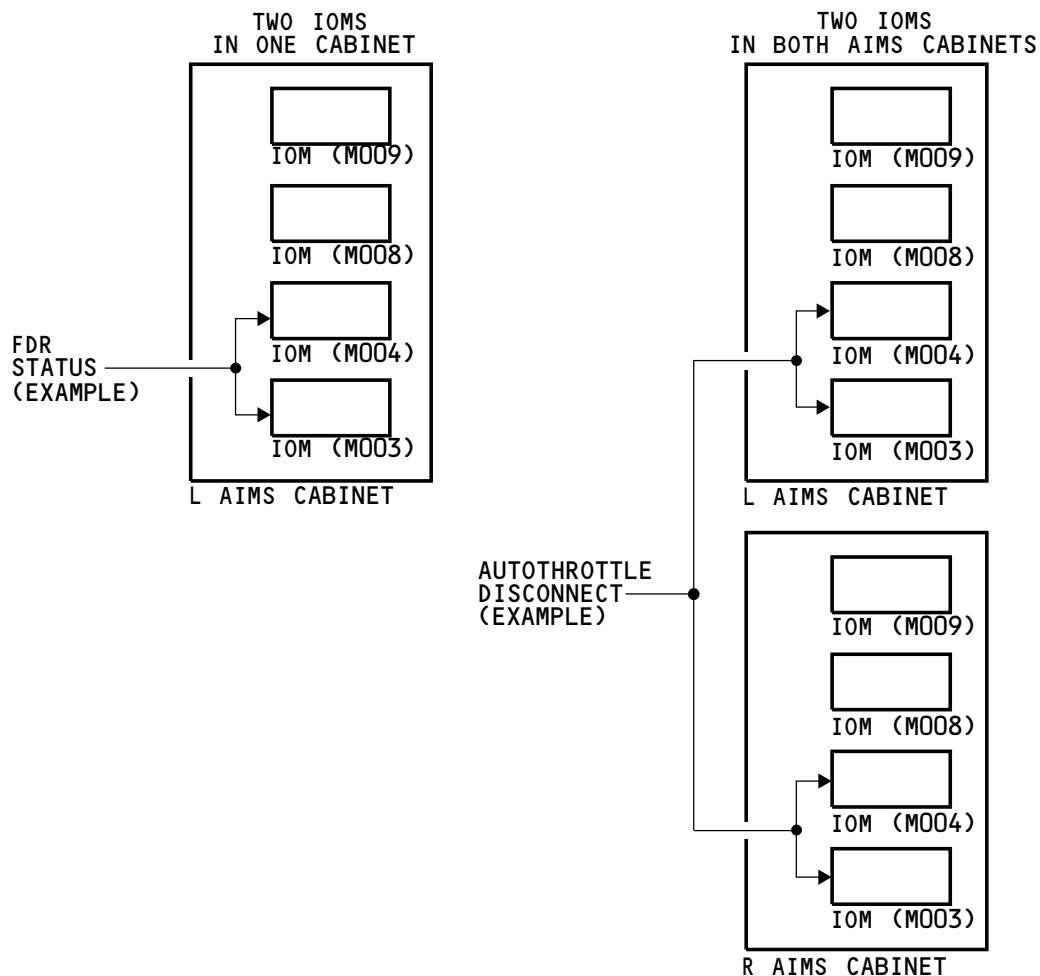
For details of the exact interfaces between the LRUs and the IOMs, refer to the wiring diagram manual.

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AIMS - ANALOG DISCRETE INPUTS INTERFACES

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AIMS - ANALOG DISCRETE OUTPUTS INTERFACES

General

The AIMS cabinets transmit analog discretes in these three ways:

- The analog discrete output comes from one IOM in one AIMS cabinet
- The analog discrete comes from the outputs of two IOMs in the same AIMS cabinet. The outputs are wired together in that AIMS cabinet
- The analog discrete comes from the outputs of two IOMs in both AIMS cabinets. The outputs are wired together in each AIMS cabinet and in the airplane wiring outside the cabinet.

The CPM/COMM also has analog discrete outputs. They are all direct outputs.

Analog Discrete Outputs

The IOMs send these analog discretes:

- Autothrottle servo inhibit
- Master caution lamp drive
- VHF voice data select
- VHF bite inhibit
- SDU data load enable
- Printer data load enable
- TCAS data load enable
- GPS data load enable
- ASCPC engine running
- Engine start solenoid
- PFC disconnect
- Radio altimeter test inhibit
- IRS 429 bus invalid
- WXR control on
- TCAS RA display status.

The CPM/COMM sends this analog discrete:

- VHF data keyline

Training Information Point

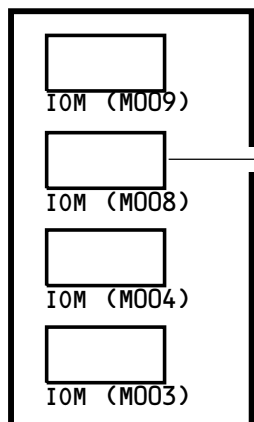
For details of the exact interfaces between the IOMs or CPMs and the LRUs, refer to the wiring diagram manual.

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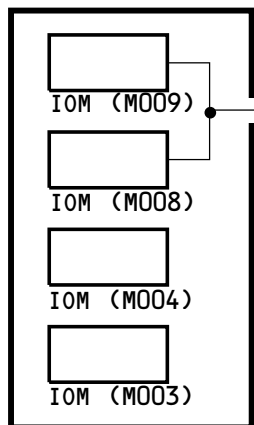
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DIRECT OUTPUT OR TWO IOM(S)
IN ONE AIMS CABINET


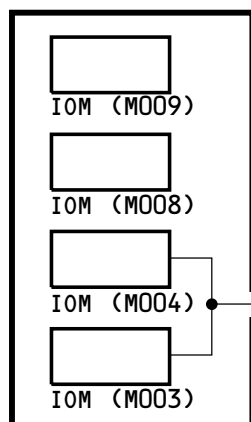
L AIMS CABINET



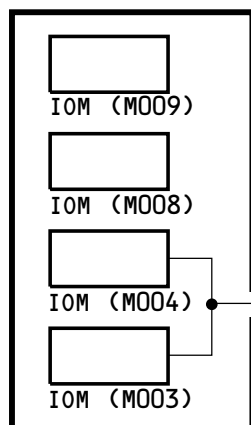
R AIMS CABINET

PRINTER
DATA LOAD
ENABLE
(EXAMPLE)

R VHF
VOICE/DATA
SELECT
(EXAMPLE)

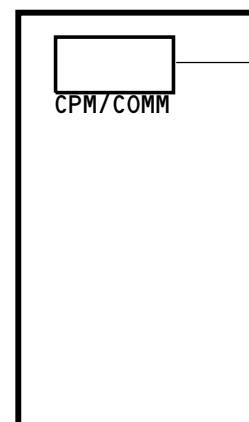
TWO IOMS IN BOTH AIMS
CABINETS


L AIMS CABINET



R AIMS CABINET

RADIO
ALTIMETER
TEST INHIBIT
(EXAMPLE)

CPM/COMM DIRECT
OUTPUTS


L AIMS CABINET

C VHF
KEYLINE
(EXAMPLE)

AIMS - ANALOG DISCRETES OUTPUTS INTERFACES

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AIMS - ANALOG INTERFACES

General

The input/output modules receive analog inputs in these three ways:

- The analog input goes to one IOM
- The analog input goes to two IOMs in the same AIMS cabinet
- The analog discrete input goes to two IOMs in each AIMS cabinets.

The input/output modules transmit analog outputs in these two ways:

- One IOM supplies the analog output
- One IOM in each AIMS cabinet supplies the analog output. The airplane wiring splices together the outputs.

Analog Inputs

The IOMs receive this analog data:

- Total air temperature
- Angle of attack
- Global positioning system time mark
- Crew oxygen pressure
- Passenger oxygen pressure
- Cabin pressure sensor
- N1 Tach
- N2 Tach
- Engine oil quantity sense.

Analog Outputs

IOMs send analog data to the engine oil quantity sensor. The AIMS cabinet sends a 6v dc oil quantity excitation voltage to the engine oil quantity sensor unit.

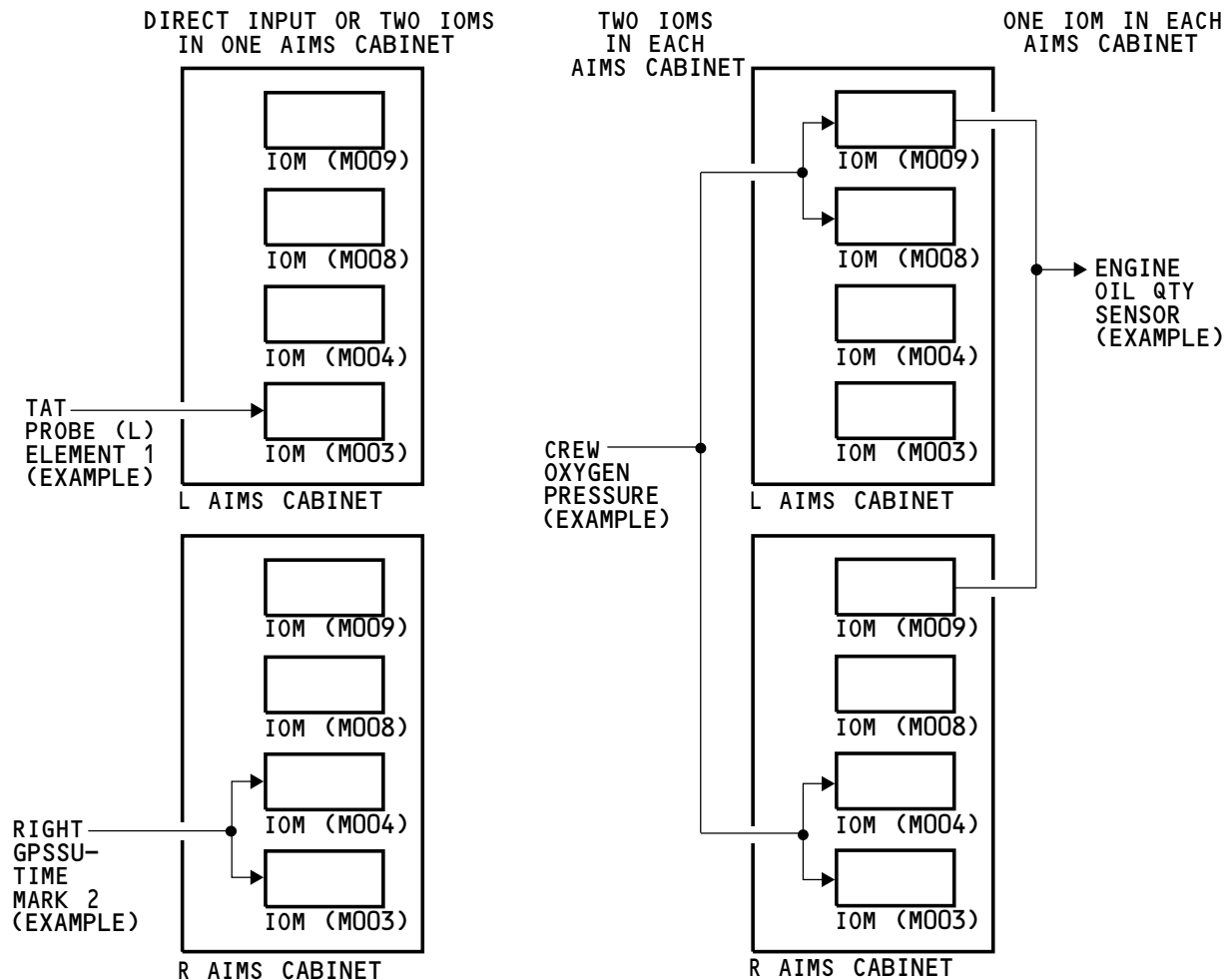
Training Information Point

For details of the exact interfaces between the IOMs and the LRUs, refer to the wiring diagram manual.

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AIMS - ANALOG INTERFACES

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AIMS - CABINET CHASSIS - 1**General**

Each cabinet chassis is a rack enclosure. Each cabinet chassis has ten slim line replaceable modules (SLRM) installed. Although there are slots for up to 26 SLRMs, only four of the 16 open positions are active spare, or populated, positions. They are considered populated because the connections are installed.

A printed wiring board called the backplane runs the width of the cabinet chassis. This backplane transfers the power and data to each SLRM.

Physical Description

The cabinet chassis has these dimensions:

- Width = 47 inches
- Depth = 19.5 inches
- Height = 9.85 inches.

The cabinet chassis weighs approximately 60 pounds.

With the 10 SLRMs installed, the AIMS cabinet weighs approximately 115 pounds.

The Back of the Cabinet Chassis

In the back of the cabinet chassis, there are three ARINC 650 connectors for each slot. The top two connectors, A and B, are for input and output data. The bottom connector C, is for the interface to the backplane.

In the empty slot, there are load plugs on the bottom connector.

Installation

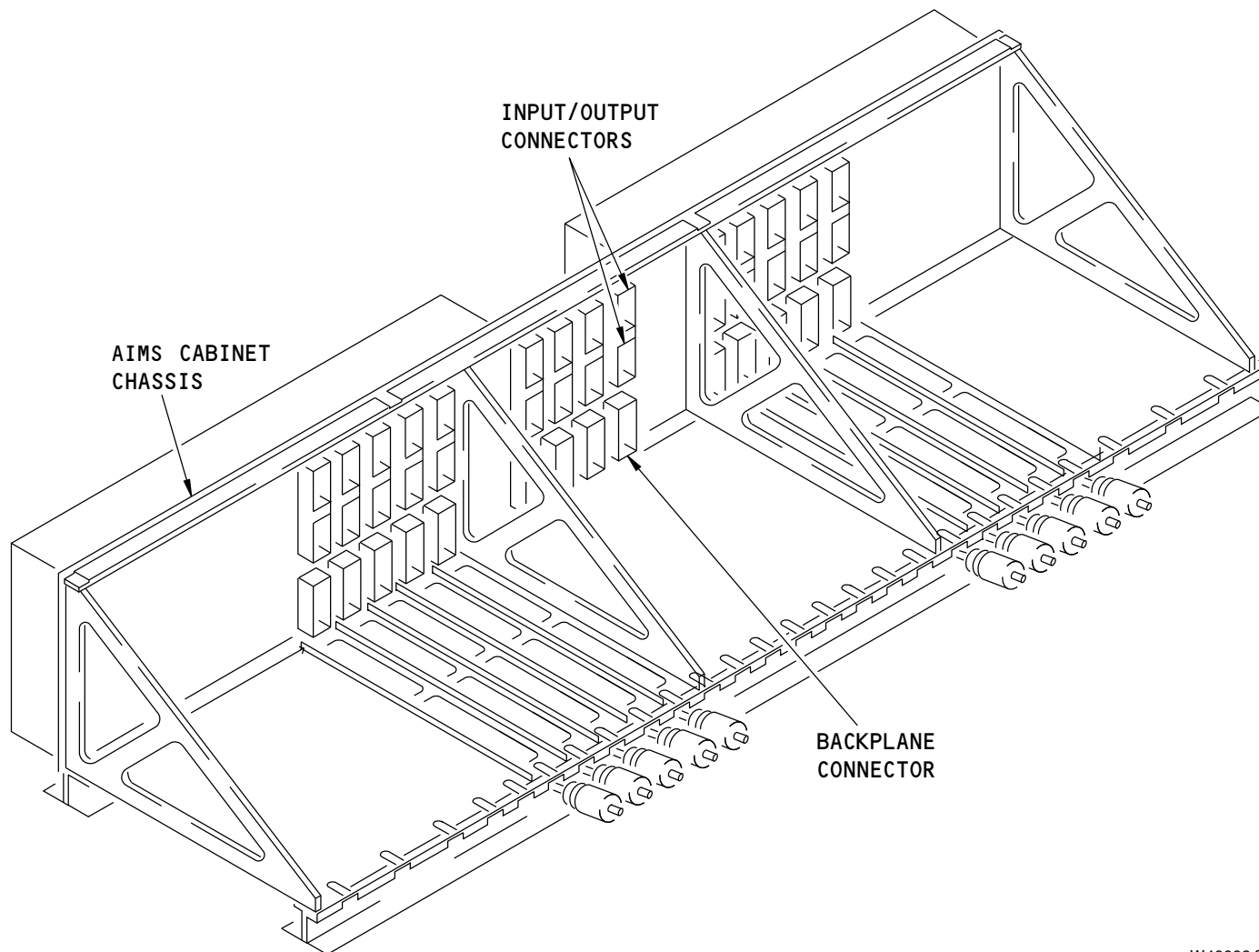
The cabinet has guide rails on the bottom surface and guide pins at the top and bottom of the rear connector to align the SLRMs.

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AIMS - CABINET CHASSIS - 1

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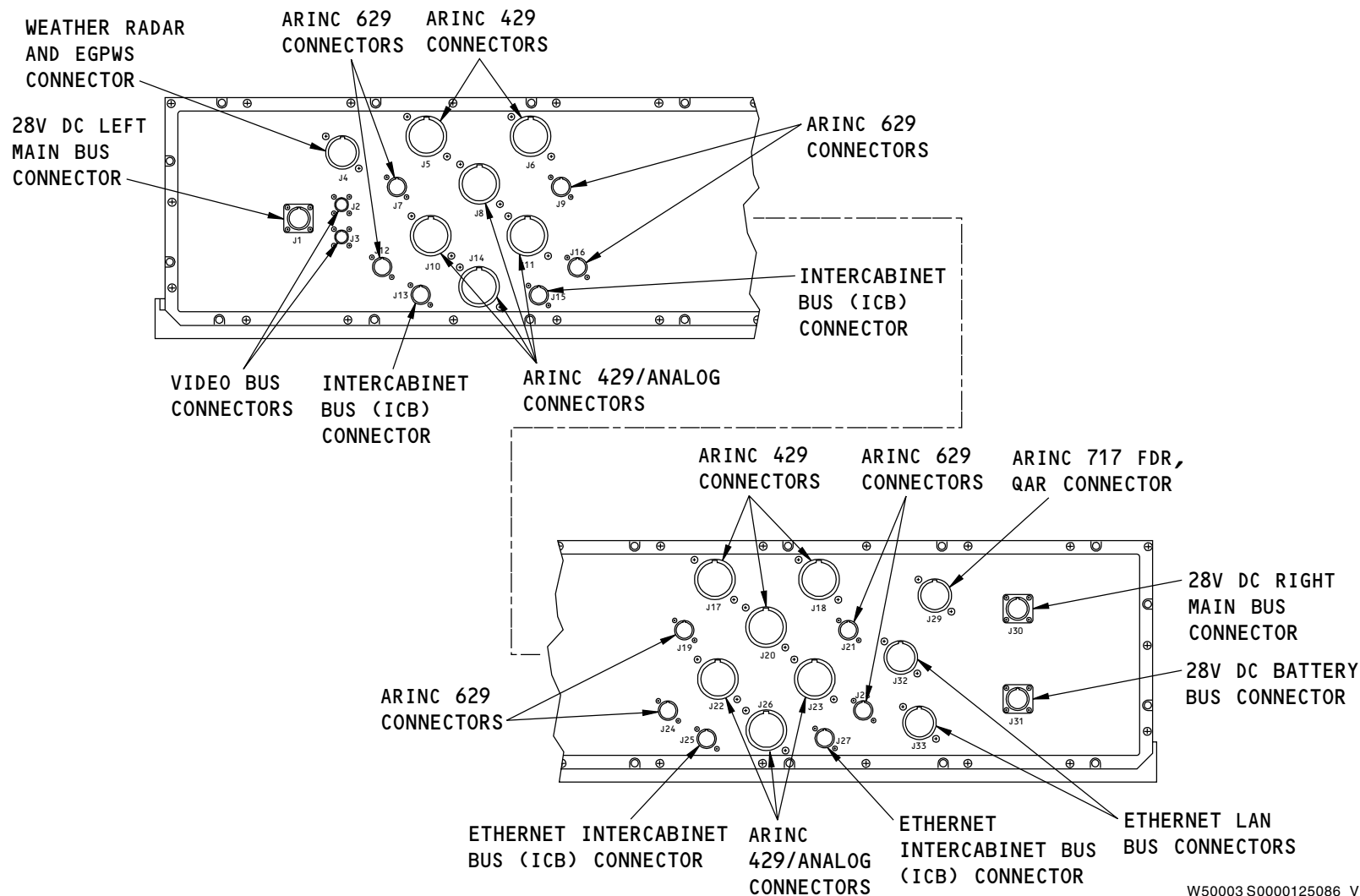
AIMS - CABINET CHASSIS - 2

The Rear of the Cabinet Chassis

These are the interface connectors on the rear of each cabinet:

- 8 connectors for ARINC 629 interface
- 2 connectors for video bus interface
- 12 connectors for ARINC 429, analog, and analog discrete interface
- 3 connectors for power interface
- 1 connector for ARINC 717 (QAR/FDR/VHF) interface
- 1 connector for ARINC 453 weather radar and EGPWS interface.
- 4 connectors for intercabinet bus interface
- 2 connectors for Ethernet local area network (LAN) interface.

The airplane power comes into the cabinet chassis through three power connectors. The power then goes to the two power conditioning modules (PCM) in each cabinet.



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AIMS - CABINET CHASSIS - 2

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AIMS - INPUT/OUTPUT MODULE

General

The input/output module (IOM) supplies the interface between the software functions in the AIMS cabinet and external signal sources. The four IOMs supply most of the standard and shared interfaces necessary to operate the CPMs. The CPM/COMM and the CPM/GG supply some unique input and output interfaces.

The IOM's primary duty is to move data with no delay or loss of data. The IOM does not verify the data, so the IOM is basically a high-speed data mover. The CMCF now performs processing in the IOM. The IOM transfers the data to/from the aircraft interfaces and the memory that is in the CPMs. Which piece of data and how it is transferred is a function of the applications, or software, that is programmed into AIMS.

The IOM is also responsible for maintaining other I/O system services such as low-level communications with system BITE, external input signal retrieval, background IOM BITE and IOM fault history log maintenance. In addition, the IOM performs initialization after reset, hardware and software configuration, initiated, power-up, and continuous BIT, and data load initiation.

Input/Output Modules

The IOM supplies these types of interfaces:

- Analog discrete inputs and outputs
- ARINC 429 data bus inputs and outputs
- ARINC 629 data buses
- Analog inputs and outputs
- Specialized inputs
- Ethernet Inter-Cabinet Bus (ICB).

The IOMs also interface with the backplane data bus and the backplane power bus to communicate with the software functions in the cabinet.

Physical Description

The IOM is a slim line replaceable module (SLRM). These are the dimensions of an IOM:

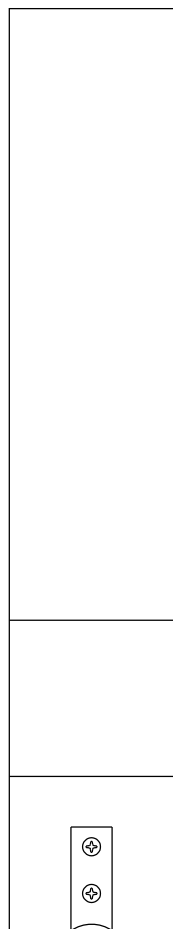
- 1.37 inches wide
- 15.36 inches deep
- 7.64 inches high.

The weight of an IOM is 6.5 pounds.

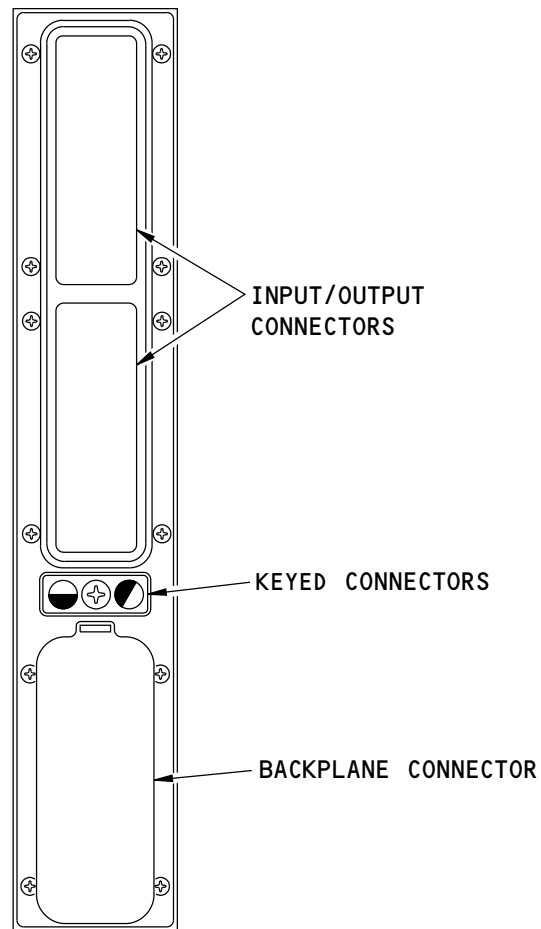
Installation

Each IOM has 2 pins that are shorter than the rest. This keeps 28 Vdc from reaching the IOM until positive contact occurs between the IOM ARINC 650 connector and the pin contacts in the backplane of the cabinet.

The four IOMs have the same keyed connectors. This makes the IOMs interchangeable.



INPUT/OUTPUT MODULE
(FRONT VIEW)



INPUT/OUTPUT MODULE
(REAR VIEW)

AIMS - INPUT/OUTPUT MODULE

W50264 S0000124961_V1

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AIMS - CORE PROCESSOR MODULES

General

The core processor modules (CPM) supply the hardware and software for the AIMS functions. These are the three different CPMs:

- CPM/Standard (CPM/STD)
- CPM/Communications (CPM/COMM)
- CPM/Graphics generator (CPM/GG)

Core Processor Modules

Each CPM has up to 2 circuit card assemblies (CCAs), a Processor CCA and client CCA. The Processor CCA contains the microprocessor, memory system, backplane interface, power conversion and monitoring, test interface, and debug support.

The CPM/STD contains only the processor CCA.

The CPM/GG is comprised of the STD CCA and a client CCA which provides specialized displays hardware with the following functions:

- Display graphics generation
- Weather radar

The CPM/COMM is comprised of the STD CCA and a client CCA which provides specialized communications interfaces with the following functions:

- ARINC 618 MODEM interface
- ARINC 717 QAR
- ARINC 717 FDR
- Ethernet

Physical Description

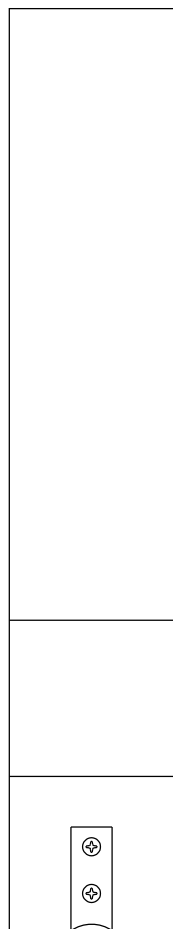
The three types of CPMs have these dimensions:

- 1.4 inches wide
- 15. inches deep
- 7.6 inches high.

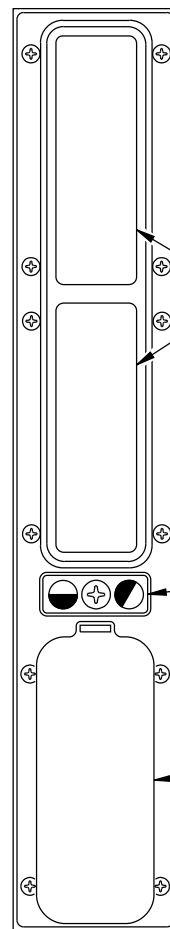
The weight of each CPM is approximately 6.5 pounds.

Installation

Each CPM has 2 pins that are shorter than the rest. This keeps +28 Vdc power from reaching the CPM until positive contact occurs between the CPM ARINC 650 connector and the pin contacts in the backplane of the cabinet.



CORE PROCESSOR MODULE
(FRONT VIEW)



CORE PROCESSOR MODULE
(REAR VIEW)

INPUT/OUTPUT
CONNECTORS

KEYED CONNECTORS

BACKPLANE CONNECTOR

AIMS - CORE PROCESSOR MODULES

W50272 S0000125219_V1

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D633W101-ARO

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AIMS - POWER CONDITIONING MODULE

General

There are two power power conditioning modules (PCM) installed in each AIMS cabinet. Each PCM filters and conditions the input power and then sends power to each CPM and IOM in the AIMS cabinet.

Electrical power goes to the ARINC 659 backplane power bus of each AIMS cabinet and then to the two PCMs.

Power Conditioning Modules

Each PCM is connected to two power buses and the hot battery bus. Aircraft power is first filtered to remove high frequency noise and protected from lightning upon entrance to the PCM. Two PCMs provide continued power distribution in case of a single PCM or aircraft busbar failure, but one PCM can supply all power demands in a cabinet. Each PCM provides power to each of the other SLRMs for normal functionality. Output to the CPMs and IOMs is current limited at 30 watts over the output voltage range. Power conditioning limits lower frequency surges before distribution, thus containing most dirty power within the PCM.

The PCMs supply conditioned 28 Volt power (~26V after conditioning) for the CPMs and IOMs. Each PCM also provides two (2) +5V VBATT signals for data retention.

Physical Description

The dimensions of the PCM are:

- 1.4 inches wide
- 15 inches deep
- 7.6 inches high.

The weight of each PCM is approximately 6.5 pounds.

Installation

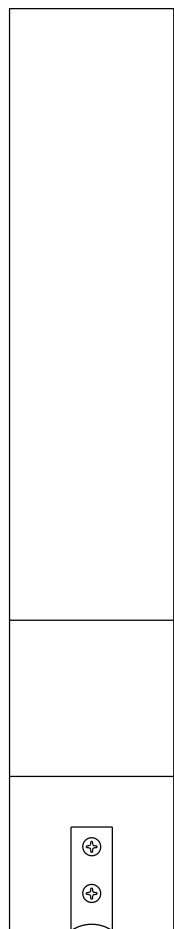
The PCM connectors have two pins shorter than the rest. This keeps 28v dc power from the PCM until it makes positive contact between the CPM ARINC 650 connector and the backplane pins of the cabinet.

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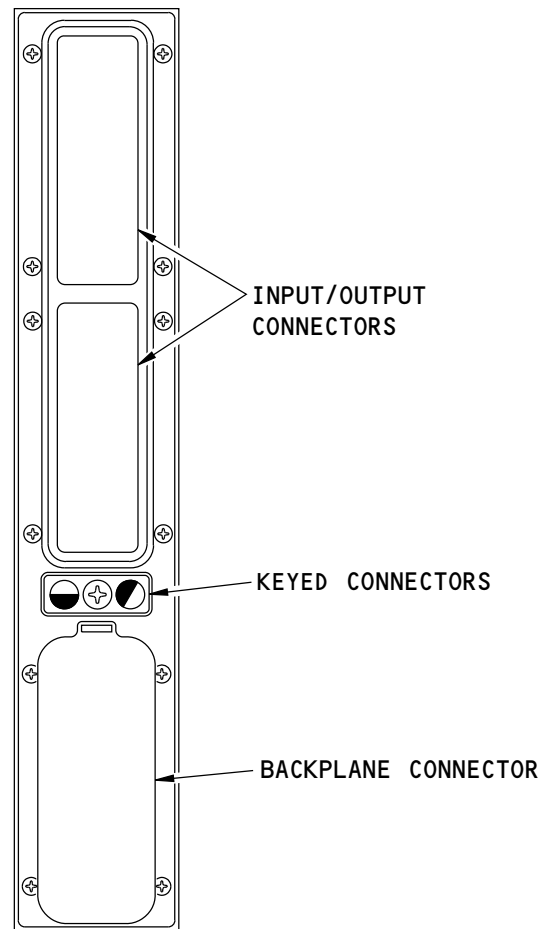
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POWER CONDITIONING MODULE
(FRONT VIEW)



POWER CONDITIONING MODULE
(REAR VIEW)

AIMS - POWER CONDITIONING MODULES

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AIMS - CABINET CHASSIS POWER DISTRIBUTION - FUNCTIONAL DESCRIPTION

General

Each AIMS cabinet receives power through four circuit breakers in the overhead circuit breaker panel. Each AIMS cabinet also receives power through one hot battery bus circuit breaker in the standby power management panel. Each AIMS cabinet receives 28 VDC power through four (4) circuit breakers in the overhead panel. The electrical power goes to the ARINC 659 backplane power bus of each AIMS cabinet and then to the two power conditioning modules (PCM) installed in each cabinet. Each PCM filters the input power for high frequency noise, electro-magnetic interference (EMI) and lightning. The power is current limited at 30 watts over the output voltage range. Also, the power conditioning limits lower frequency surges. Each PCM then sends power (approximately 26 VDC after conditioning) to each CPM and IOM in the AIMS cabinet.

Input Power

Each cabinet receives four 28 VDC inputs. The electrical power distribution system provides power to the Left AIMS cabinet with power from the CAPT FLT INST BUS (via 2 AIMS circuit breakers) and F/O FLT INST BUS (via 2 AIMS circuit breakers). The Right Cabinet gets power from the 28 VDC LEFT BUS (via 2 AIMS circuit breakers) and the 28 VDC RIGHT BUS (via 2 AIMS circuit breakers).

The input power initial state (first tier) has the main, auxiliary, and hot battery power available. If the main bus input falls below 18.5 VDC, switches connect the auxiliary power input to the power bus. The system has now reached the second tier. If both the main and auxiliary inputs are lost, switches connect the hot battery bus to the internal power bus. The system has reached the third tier. The system can only stay in the third tier (hot battery bus, full power) for 200-400 msec. At time-out, battery switches to the input bus open and the system is in its final tier state, memory holdup. The battery bus input provides low power to the CPMs/IOMs for data retention. The power is limited to ensure battery drain does not exceed limits. An internal energy reserve supports each CPM and IOM module for 1 millisecond when power switches from main to auxiliary to battery.

The four 28 VDC bus inputs are power 1 through power 4. Power 1 and power 2 enter the cabinet through a connector on the left side of the cabinet. Therefore, power 1 and power 2 are left power. Power 3 and power 4 enter the cabinet through a connector on the right side of the cabinet. Therefore, power 3 and power 4 are right power.

There are two power conditioning modules (PCMs) in each cabinet. The PCM does all of the conditioning and monitoring of the power before providing the power to the other modules. Each PCM consists of two channels (A and B), each of which provides independent power for up to 8 other SLRMs. Each Channel receives power from a left source and a right source. Channel A in each PCM is powered by sources 1 and 3 and Channel B is powered by sources 2 and 4. Each Channel in a PCM also provides status for each power source. Each PCM channel also receives 28VDC power from the hot battery bus. This input is conditioned and monitored and placed on the backplane power bus for use by up to eight SLRMs. A status line is also provided for the SLRMs to use to monitor the hot battery input on the backplane.

Each SLRM receives power from two PCMs. Each SLRM monitors the power status provided by the PCMs. Each SLRM must have at least one main power input to operate.

The loss of any one of the four power buses to the Cabinet has no effect on the function of any SLRMs in the cabinet. The loss of two power inputs from the same side of the cabinet, 1 and 2, or 3 and 4, has no effect on the function of the SLRMs. The loss of one power input from the left side and one power input from the right, 1 and 3, or 2 and 4, results in the loss of function in four SLRMs. The loss of three or four of the power buses to the cabinet chassis power backplane results in the loss of function of all the SLRMs.

Training Information Point

The status message AIMS shows when one or more of the power inputs has failed for one second. If only a single power bus has failed an AIMS CABINET BUS status message is displayed. If multiple power busses in a cabinet have failed, the AIMS status message is displayed.

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**AIMS - CABINET CHASSIS POWER DISTRIBUTION - FUNCTIONAL DESCRIPTION****Hot Battery Bus**

A connection to the Hot Battery bus is used to hold up AIMS internal memory, and to make AIMS less susceptible to faults due to power transients. The battery usage profile for the AIMS cabinet is as follows: 10 amps for 500ms, 400 mA for 30 seconds, then 45 mA indefinitely. Circuit protection is provided such that a maximum time of approximately 500 msec of battery power can be used before the AIMS will begin an orderly shut down, with just memory devices held up indefinitely. The connection to the hot battery bus keeps the SLRMs internal memories active.

Each SLRM receives two hot battery power inputs and status and one power input and status from one channel in each PCM.

Training Information Point

The hot battery bus holds the static random access memory (SRAM) with no other power on the airplane. If you remove the battery, you lose some data from the SLRMs. The data you lose includes:

- ACMF report data stored on the ACMF CCA
- Fault history data collected by the CMCF
- Individual SLRM fault history.

Power Distribution

Two PCMs are used per cabinet. The PCMs supply conditioned 28 volt power for CPMs and IOMs. The two PCMs provide continued power distribution in case of a single PCM or aircraft bus bar failure. Each PCM also provides power for the SAFEbus® lanes

The PCMs change the 28 VDC from the backplane power buses into:

- Voltages required by the SLRM
- 5 VDC transceiver voltage
- 2 VDC termination voltage.

Each SLRM sends a 5 VDC transceiver voltage to one of the four transceiver power backplanes. This power is used by the transceivers in the LRMs

Each SLRM sends a 2 VDC termination voltage to one of the four termination power backplanes. Terminators on the ends of the backplane data buses use the power from the 2V termination power backplanes

Training Information Point

Each SLRM has two short pins. The short pins make sure that the SLRM does not get power until it has positive contact between its connector pins and the backplane pins.

When you install an SLRM into the cabinet, this sequence occurs:

- Ground, battery, and signal pins in the connector make contact with the backplane ground, battery, and signal pins
- Short pins engage. This lets the power from the backplane go to the power in the SLRM.

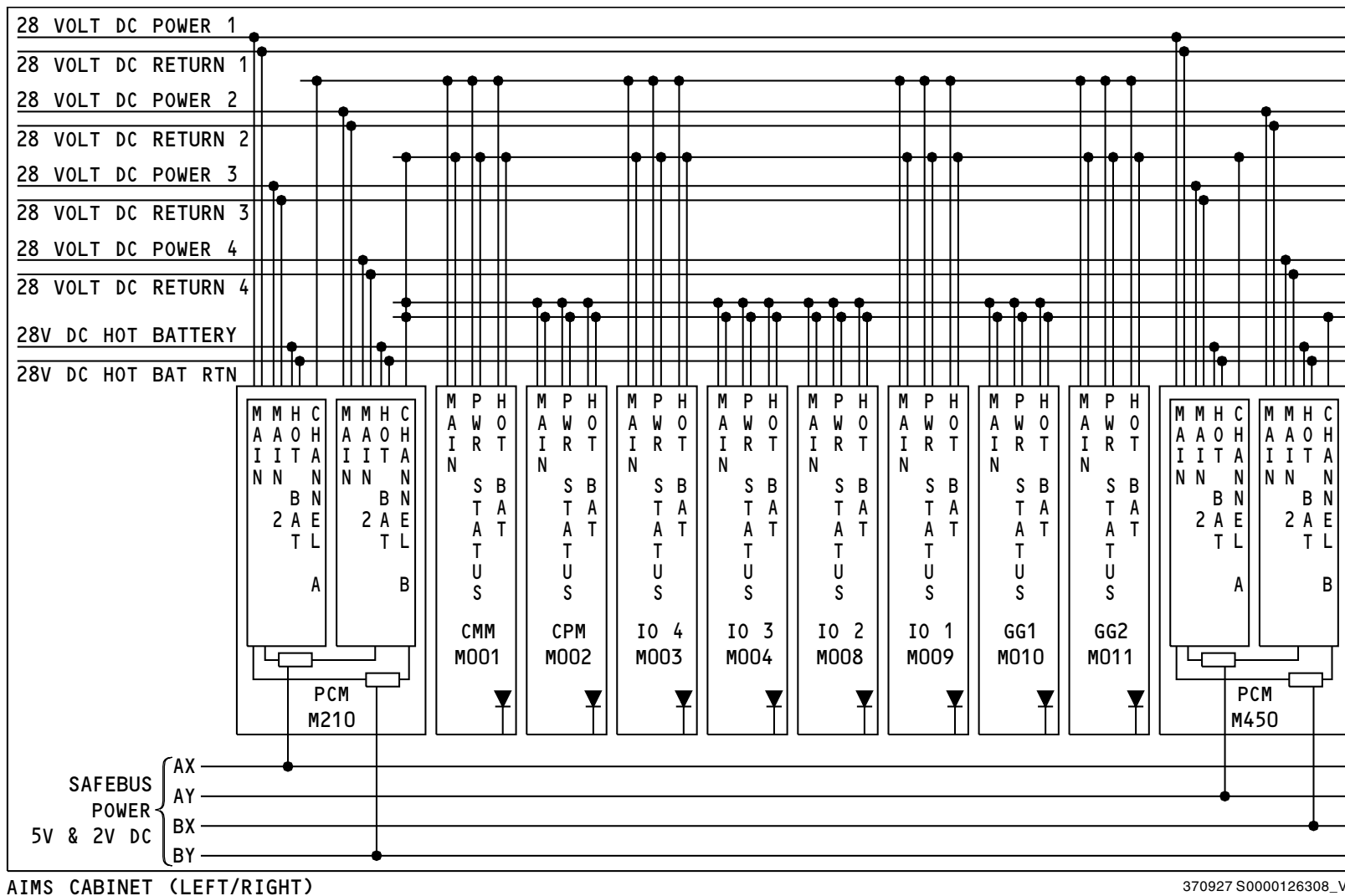
When you remove a SLRM from the cabinet, the reverse sequence occurs.

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AIMS - CABINET CHASSIS POWER DISTRIBUTION

**AIMS - CABINET CHASSIS BACKPLANE DATABUSES - FUNCTIONAL DESCRIPTION****General**

A signal distribution area goes along the entire width of the rear of the cabinet chassis. This area has four serial backplane data buses. These data buses distribute data between the SLRMs.

Data Distribution

The serial buses are AX, BX, AY and BY. The buses all transmit the same information. The two serial buses AX and BX come from the X bus interface in the SLRM, and are a bus pair. The two serial buses AY and BY come from the Y bus interface in the SLRM and are a bus pair. With the dual redundant buses, the SLRM can isolate failures in the module.

A serial bus consists of three signal lines. Two of the signal lines are data lines and the third signal line is a clock line. A terminator at each end of a serial bus terminates the three signal lines. The terminator gets power from the termination power backplane bus.

Transceivers in each SLRM transmit data to and receive data from the backplane data buses. The SLRM transmits data on all four of the serial buses at the same time. The transceivers get power from the transceiver power backplane bus.

The SLRM compares the data it transmits on serial buses AX and BX with the data it transmits on serial buses AY and BY.

The duplicate bus pairs supply bit-for-bit identical information. The duplication supplies error detection, isolation, and containment.

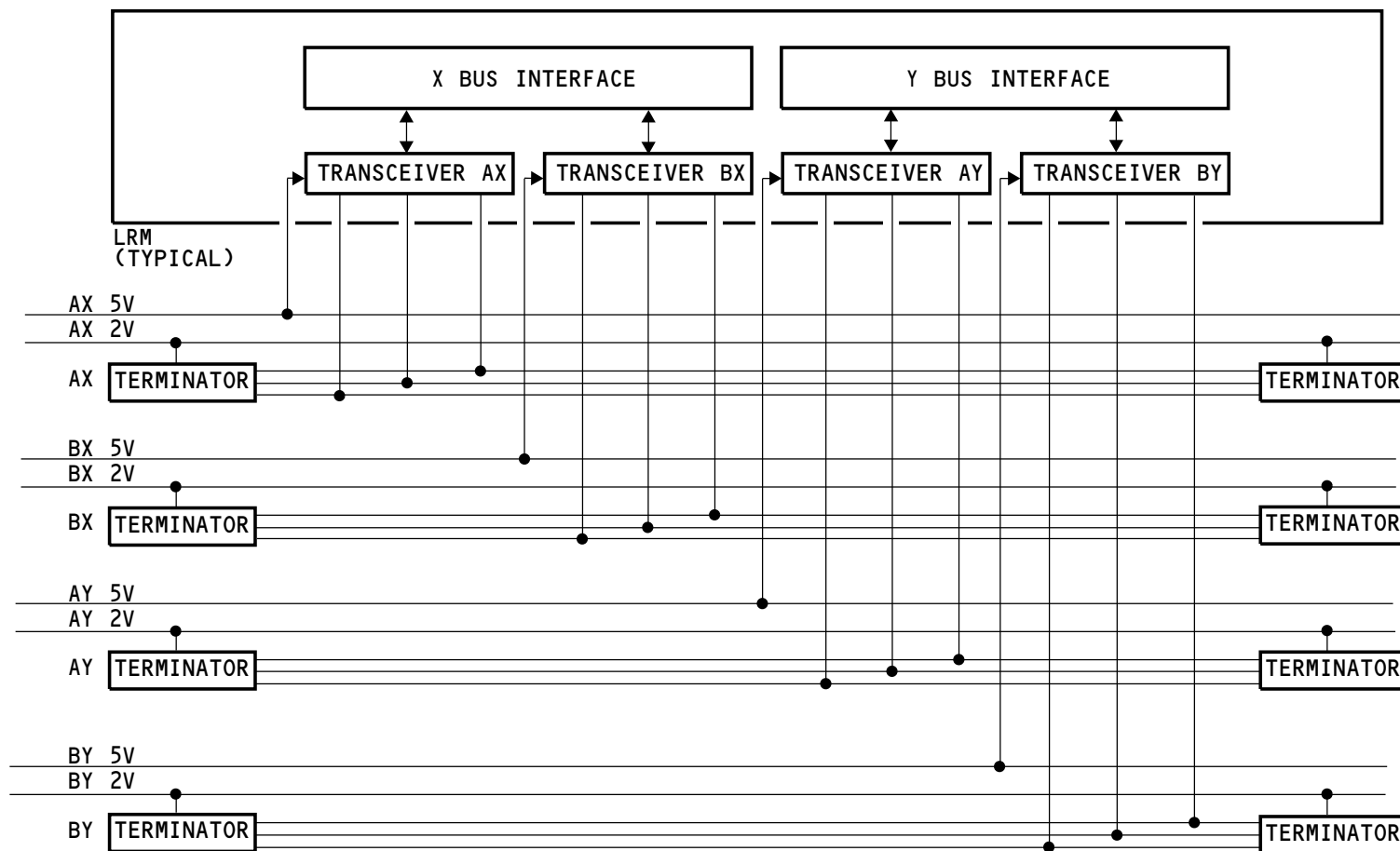
Training Information Point

The status message AIMS CABINET BUS shows when one of the four serial backplane data buses fails. This message shows a condition where the airplane can dispatch. The status message AIMS shows when two or more of the serial backplane data buses fails. This message shows a condition where the airplane cannot dispatch. All communication can be lost over a serial bus if a transceiver shorts out the serial bus or if power to the terminators fails.

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AIMS - CABINET CHASSIS BACKPLANE DATABUSES - FUNCTIONAL DESCRIPTION

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AIMS - INPUT/OUTPUT MODULE - FUNCTIONAL DESCRIPTION

General

The input/output module (IOM) supplies the interface between the software functions in the AIMS cabinet and external signal sources. The four IOMs in each AIMS cabinet supply most of the standard and shared input and output interfaces necessary to operate the CPMs.

The basic task of transferring data is the IOM's primary duty, and it must do so such that I/O data is neither lost nor subject to prolonged transport delays. The IOM does not monitor or interrogate any data that passes through it.

In addition to I/O transfer tasks, the IOM is responsible for maintaining other I/O system services such as low-level communications with Core BITE, external input signal retrieval, background IOM BITE and IOM fault history log maintenance.

Also, hardware and software monitors are incorporated into the IOM. These monitors validate the IOM operation during normal I/O processing. If a monitor detects a hard fault, IOM processing ensures that the failed resource is faulted (disabled) and the fault is reflected in the BITE History.

The IOM hosts the central maintenance computing function (CMCF).

IOM Hardware

The IOM consists of two circuit card assemblies (CCAs) within a mechanical chassis. The two CCAs are the:

- Core processor CCA
- Input/Output CCA

Core Processor CCA

The same Core Processor CCA in the CPM/STD is also used within the IOM. The processing functionality of the IOM is provided by a software I/O partition that runs on the Core Processor.

Input/Output CCA

The IO CCA contains all circuitry required for the external interfaces within the AIMS cabinet. The circuitry includes:

- A629 Tranceivers (2) - Provides Interface to Flight Controls Bus and Systems Bus
- Ethernet Transceivers (2) - Gives Interface to Inter-cabinet Bus, Backplane
- A429 Receivers (32) - Five of which are dedicated for monitoring transmitters
- A429 Transmitters (5) - Two transmitter outputs pass through relays to allow onside or offside source selection. Relays default to offside source.
- Analog Discrete Inputs (76) - Sixteen are dedicated for monitoring 28V Discrete Outputs and three are dedicated for intra-cabinet data, such as AIMS Cabinet ID and Weight on Wheels (WOW)
- Analog Discrete Outputs (16) - Analog discrete outputs to various systems
- DC Analog Inputs (5) - Engine Oil Quantity, Crew Oxygen Sensor, and Passenger Oxygen Sensor
- AC Analog Inputs (1) - Angle of Attack (AOA)
- Analog Outputs (2) - Engine Oil Quantity and Total Air Temperature (TAT) sensor excitation
- Specialized Inputs (5) - Three are for engine tachometer , one for Global Positioning System (GPS) and one is for TAT

The I/O CCA has:

- One single thread interface
- Two I/O controllers (IOC)
- Two backplane interface/power monitors (BIPM)
- Four transceivers.

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AIMS - INPUT/OUTPUT MODULE - FUNCTIONAL DESCRIPTION

The single thread interface receives data from the input and output interfaces and sends the data to the X IOC and the Y IOC. The single thread interface also receives data from the X IOC and sends the data to the input and output interfaces.

The I/O controllers (IOC) control the operation of the different IOM input and output interfaces. The IOCs receive data from the single thread interface and transmit the data to the BIPMs. Each IOC receives data from a BIPM and compares the data with the other IOC. If the data is the same, the X IOC sends the data to the single thread interface. The IOC also supplies the BITE for the IOM. The IOC BITE supplies an IOM BITE history log and an IOM fault history log. The IOC communicates with the four core processing modules to supply IOM BITE data. The functions in the CPMs use the BITE data to check for I/O interface faults. The IOCs operate in a dual, self-monitoring configuration. The IOCs are identical. The self-monitoring operation allows both IOCs to execute the same instructions on a clock-for-clock basis. The IOCs cross-compare all signals during normal operation. This is called lock-step operation. If the data in each IOC is the same, the X IOC sends the data to the single thread interface. If the data in each IOC is different, the IOCs will not send any more data to the I/O interfaces.

The X BIPM sends data to and receives data from the AX and BX transceivers. The X BIPM also sends data to and receives data from the X IOC. The Y BIPM sends data to and receives data from the AY and BY transceivers. The Y BIPM also sends data to and receives data from the Y IOC. The BIPM has an intermodule memory (IMM) array for data storage. The IMM array holds the data to be passed from one LRM to another LRM in the cabinet. The IMM array, in combination with the data bus interface, supplies an orderly flow of the data. For input and output data, the functions in the CPMs need to know what place in the array in the IMM to write to for output data and what place in the array IMM to read from for input data. The BIPMs also monitor power for the IOM. The BIPMs detect over voltage and under voltage conditions. The BIPMs prevent IOM operation during these conditions. The monitor circuits use a different power source than the rest of the IOM for operation.

The four transceivers supply the interface between the backplane data buses and the BIPM. The four transceivers receive 5v dc from the transceiver power backplane.

Function

Which piece of data and how it is transferred is a function of the applications programmed into the AIMS. In order for the IOM to know which data there is to move and when to move it, a table of commands or tasks to be performed is developed using the Interface Control Drawing/Data Capture Tool (IODE) and the SAFEbus® Tool Suite. The table of commands is contained in a list called the poll list, which is created using information from the SAFEbus® System Definition Language (SSDL) database. The poll list is then embedded in the IOM software. The IOM contains software routines programmed to carry out the commands in the poll list. The commands include: transmit commands, control commands, protocol service commands, and other special I/O commands. In addition, the IOM performs initialization after reset, hardware and software configuration, initiated, power-up, and continuous BIT, and data load initiation.

IOM Slot Position

The IOMs all have the same hardware and software. The IOM gets its slot identity from a ground that the cabinet supplies.

Training Information Point

At power up, the IOMs go through an initialization phase where they read their slot identity and configure themselves to the slot they are in. If you remove and install an IOM, when you reapply power to the cabinet, the IOM will go through the initialization phase.

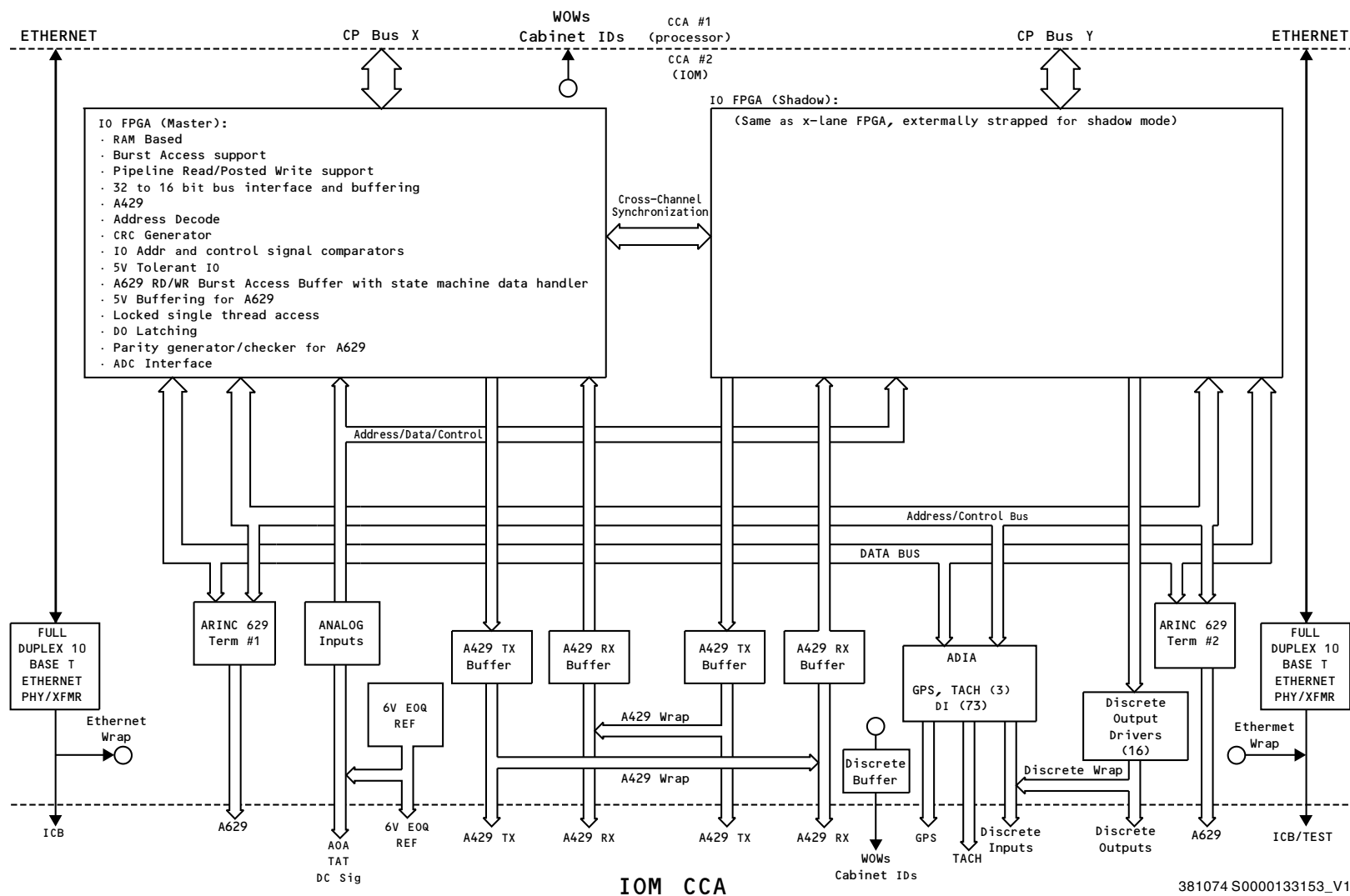
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AIMS - INPUT/OUTPUT MODULE - FUNCTIONAL DESCRIPTION

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AIMS - POWER CONDITIONING MODULE - FUNCTIONAL DESCRIPTION

General

Two PCMs are used per cabinet. Each PCM connects to two aircraft buses and an aircraft hot-battery bus. The PCMs supply conditioned 28 Volt power for CPMs and IOMs. The two PCMs provide continued power distribution in case of a single PCM or aircraft bus bar failure. Each PCM also provides power for two of the SAFEbus® lanes. All input connections are carefully segregated and electrically isolated so no PCM faults can affect multiple aircraft power sources.

Electrical power comes into the cabinet and then into the PCMs. Each PCM then filters the input power for high frequency noise, electro-magnetic interference (EMI) and lightning. The power is current limited at 30 watts over the output voltage range. Also, the power conditioning limits lower frequency surges. Each PCM then sends power (approximately 26 VDC after conditioning) to each CPM and IOM in the AIMS cabinet.

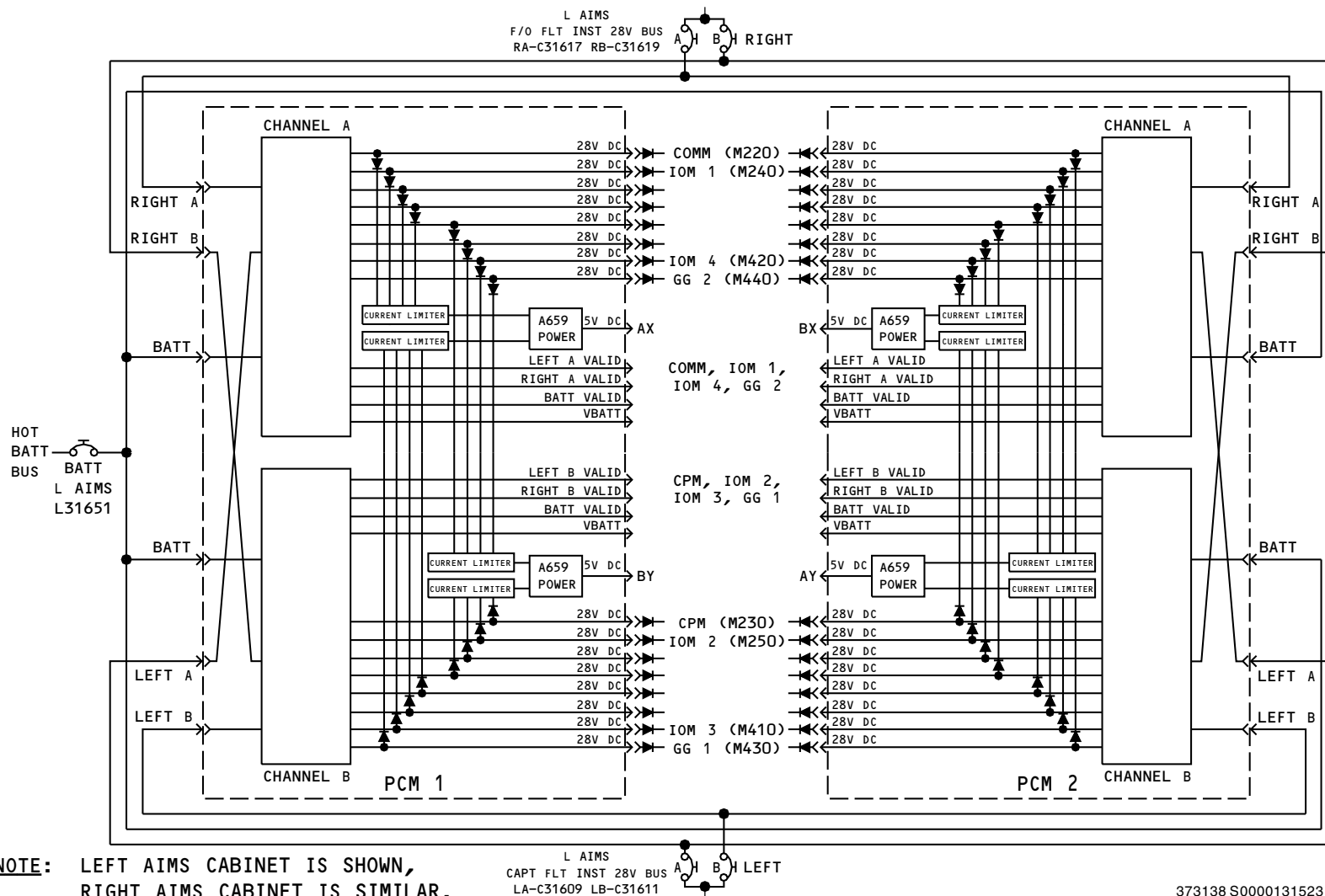
Outputs

The PCM is not a processor. It's primary functions are to provide power conditioning, EMI and lightning filtering of input power and input power monitoring and switching to the SLRMs. Each PCM also supplies +5VDC VBATT regulated power for RAM data retention for the applicable SLRMs. The PCM supplies the power monitoring discretes (MAIN 1 VALID, MAIN 2 VALID and BATT VALID). There is no fault reporting done by the PCMs. Any fault reporting for the PCMs are done by the SLRMs, which monitor the two main power inputs and two VBATT inputs (one main power and one VBATT from each PCM).

Dual, independent comparators in each PCM monitor power inputs, and if any input power is less than 18 VDC, switching begins.

Input Power Switching

The initial state (first tier) has the main, auxiliary, and hot battery power available. In this state, switches for the auxiliary and hot battery connections are open. The load is being driven from the main bus. When the main bus input falls below 18.5 VDC, two parallel switches connect the auxiliary input to the internal bus. The system has now reached the second tier and is fully powered by the auxiliary bus. If both the main and auxiliary inputs are lost, two switches in series connect the hot battery bus to the internal power bus. The system has reached the third tier. The system can only stay in the third tier (hot battery bus, full power) for the specified 200-400 msec duration. Upon time-out, the battery switches to the input bus bar are opened. The system is now in its final tier state, memory holdup. The battery bus input provides a low-drain power supply to the CPMs/IOMs for data retention. This supply will be internally limited using two limiting devices in series to ensure battery drain stays within allowable limits. This low-drain power is expected to be approximately 3-5 milliamperes per CPM or IOM module. It need only be attached to modules requiring sustained memory holdup. During the transitions of the switching from the main to auxiliary to battery, an internal energy reserve supports each CPM and IOM module for 1 millisecond.



POWER CONDITIONING MODULE - FUNCTIONAL DESCRIPTION

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**AIMS - CORE PROCESSOR MODULE/STANDARD - FUNCTIONAL DESCRIPTION****General**

The CPM/STD has one circuit card assembly. It is the core processor CCA. Other CPMs have the baseline core processor CCA, but they also have an additional CCA.

The CPM/STD does the calculations for these systems:

- Flight management computing system (FMC)
- Thrust management computing system (TMCF)
- Airplane condition monitoring system (ACMF)

CPM Hardware

The core processor modules have:

- lockstep processors
- Memory devices
- Application specific integrated circuits
- Support hardware.

All of this is mounted on the core processor CCA in the CPM.

Circuit Card Assembly

The CPM STD has one circuit card assembly (CCA). The CCA is the core processor CCA.

These are the five functions of the core processor CCA:

- Power supply
- Backplane interface/power monitor (BIPM)
- Processor
- Instruction Memory
- Data memory

Power Supply

The power supply receives 28v dc from the power backplane. The power supply supplies power for these functions:

- 5v dc transceiver power backplane
- 2v dc termination power backplane.

Backplane Interface/Power Monitor

The backplane interface/power monitor (BIPM) has two backplane interface/power monitors (BIPM) interface circuits and four transceivers.

The CPM uses the BIPMs for communication to the other CPMs and to the IOMs on the backplane data bus. The BIPM also monitors the CPM power.

The X BIPM sends data to and receives data from the AX and BX transceivers. The Y BIPM sends data to and receives data from the AY and BY transceivers. The X BIPM and Y BIPM also sends data to and receives data from the processor.

The BIPM has an intermodule memory (IMM) array for data storage. The IMM array holds the data to be passed from one LRM to another LRM in the cabinet. The IMM array, in combination with the bus interface, supplies an orderly flow of the data.

The BIPMs detect over voltage and under voltage conditions. The BIPMs prevent IOM operation during these conditions. The monitor circuits use a different power source than the rest of the CPM for operation.

The four transceivers supply the interface between the backplane buses and the backplane data bus/IMM interface circuits. The transceivers receive 5v dc from the transceiver power backplanes.

**AIMS - CORE PROCESSOR MODULE/STANDARD - FUNCTIONAL DESCRIPTION****Processor**

There are two identical microprocessors on the processor. The microprocessors do the same operations and use the same software from memory. The processor has bus comparison circuits to compare the data and control the buses of the two microprocessors. The bus comparison circuits check that the microprocessors generate and receive identical information. The bus comparison circuits report a fault to BITE if the data is not identical.

Instruction Memory and Data Memory

The microprocessors access instruction memory through the bus comparison circuits. The microprocessors also access data memory through the bus comparison circuits. Both memories are software loadable. The memories use electrically erasable programmable read only memory (EEPROM) devices and battery-backed dynamic random access memory (DRAM) devices.

The instruction memory stores operational (OPS) software. It includes this software:

- Core software
- BITE software
- Operational software for the AIMS functions.

Each microprocessor accesses this instruction software and does the instructions directly out of the instruction memory.

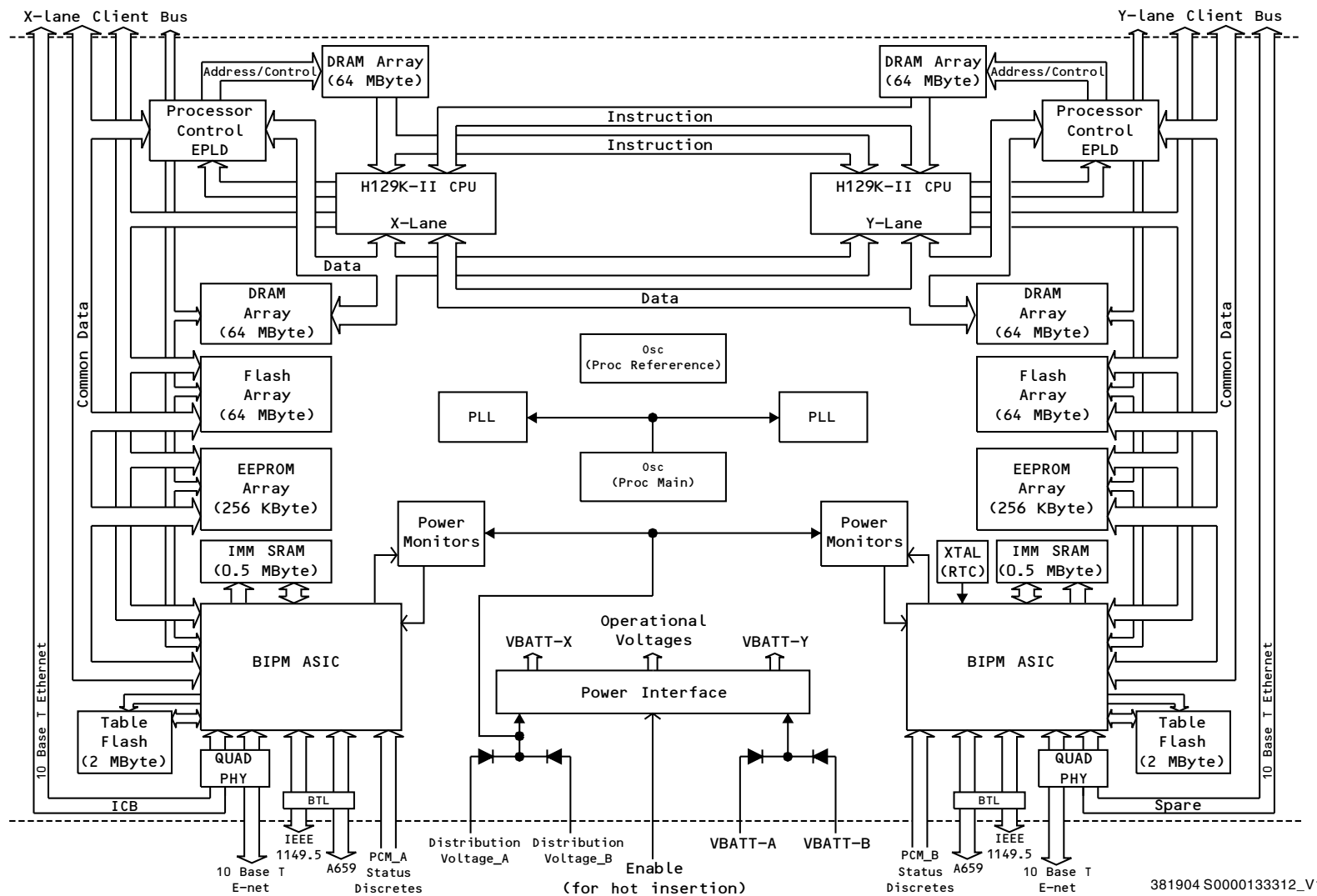
The data memory stores databases and program variables.

These are the databases:

- Navigation database (NDB) software
- Airline modifiable information (AMI) software
- Operational program configuration file (OPC) software
- BITE history data.

These are the program variables:

- FMCF CDU entered data
- CMCF existing faults
- CMCF fault histories.



AIMS - CPM/STD - FUNCTIONAL DESCRIPTION

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AIMS - CORE PROCESSOR MODULE/GRAPHICS GENERATOR - FUNCTIONAL DESCRIPTION**General**

The core processor module/graphics generator (CPM/GG) uses the same hardware as the CPM/STD and additional hardware to generate image data for the six display units.

The CPM/GGs do the calculations for the primary display system.

CPM/GG Hardware

In addition to the same core processor CCA as the CPM/STD, the CPM/GG has another CCA. This second CCA is the graphics generator (GG) CCA. The graphics generator CCA generates display formats and transmits this information to the display units.

GG CCA

The GG CCA includes these functions:

- Core processor bus interface
- Vector generation logic
- Weather radar logic
- Data compression/transmission.

The core processor bus interface communicates with the processor CCA. It supplies the protocol for the data transfers between the GG CCA and the processor CCA.

The vector generation logic creates these display functions:

- Lines
- Arcs
- Characters
- Background shading colors.

The vector generation logic receives graphics instructions from the core processor bus interface. The vector generation logic supplies the display format data to the data compression/transmission logic.

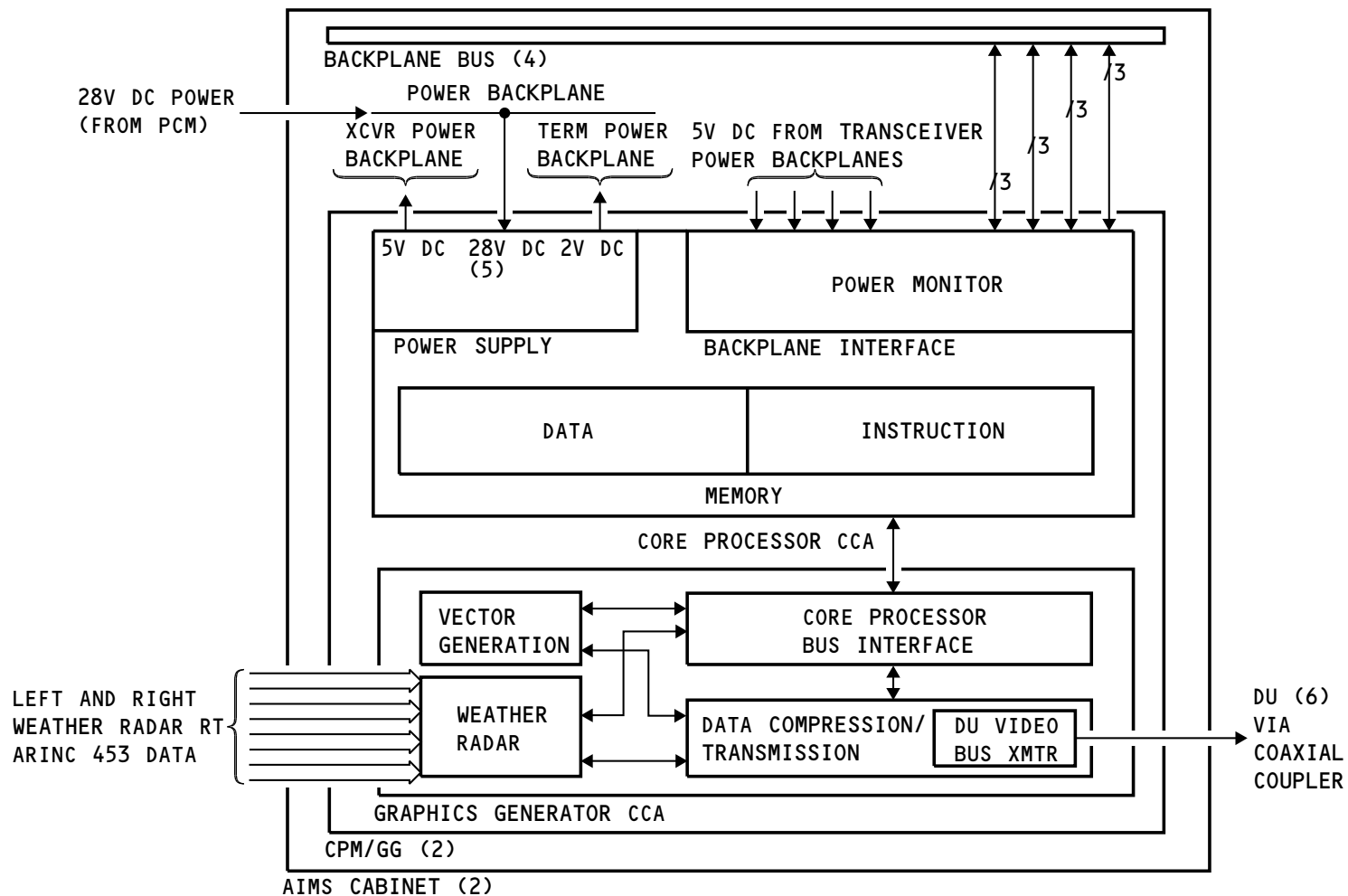
The weather radar logic does these functions:

- Receives weather radar ARINC 453 data from the left and right weather radar receiver-transmitters
- Creates raster type map image for display
- Calculates and adjusts the radar data to correct for airplane motion
- Supplies the weather radar data to the data compression/transmission logic.

The data compression/transmission logic:

- Combines data from the vector generation logic and the weather radar logic
- Compresses the data
- Transmits the data to the display units.

The data compression/transmission logic has a display unit video bus transmitter. The transmitter sends image data to the display units at a 125 Mbit per second rate. The data compression/transmission logic receives transmission instructions from the core processor bus interface.



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AIMS - CPM/GRAPHICS GENERATOR - FUNCTIONAL DESCRIPTION

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**AIMS - CORE PROCESSOR MODULE/COMMUNICATIONS - FUNCTIONAL DESCRIPTION****General**

The core processor module/communications (CPM/COMM) uses the same core processor CCA hardware as the CPM/STD. The CPM/COMM also has additional hardware: a COMM client CCA that provides various unique/specialized communications interfaces. Different functions use the communication client CCA. The DCMF function utilizes the COMM CCA to provide communication links to the ground via the ARINC 618 MODEM interface. The ACMF function utilizes the Quick Access Recorder (QAR) interface to allow data storage to the ARINC 717 QAR. The DFDAF function relies on the Digital Flight Data Recorder (FDR) to provide its link to the ARINC 717 FDR. The COMM CCA also contains a microprocessor that is used to support ARINC 615-A Dataloading using the Ethernet interface.

The CPM/Comm does the calculations for these systems:

- Flight data recorder system (FDRS)
- Data communication management system (DCMS).

Communications Client CCA

The Maintenance Terminal Function resides on the Node Processor on the CPM/COMM communications client card (CCA) and performs the Data Loader function when loading SLRMs in the AIMS Cabinet. The Communications Client CCA has these interfaces:

- Datalink ARINC interface
- FDR ARINC 717 interface
- QAR ARINC 717 interface
- QAR RS422 interface.

The datalink ARINC interface does these functions:

- Receives data modulated on tones from the center or right VHF communication transceiver
- Receives data modulated on tones from the left HF communication transceiver.
- Demodulates the tones and determines the message data

- Transmits the message data to the DCMF.

The datalink ARINC interface also does these functions:

- Receives message data from the DCMF
- Modulates audio tones with the message data
- Transmits the data modulated on the audio tones to the center or right VHF radio.

The datalink ARINC interface also transmits faults to the DCMF.

The center VHF communication transceiver interfaces with the CPM/COMM in the left AIMS cabinet. The right VHF communication transceiver interfaces with the CPM/COMM in the right AIMS cabinet.

The left HF communication transceiver interfaces with the CPM/COMM in the left AIMS cabinet. The right HF communication transceiver interfaces with the CPM/COMM in the right AIMS cabinet.

The FDR ARINC 717 interface receives data from the DFDAF software. The FDR ARINC 717 interface in the right AIMS cabinet transmits the data to a relay in the left AIMS cabinet. The DFDAF software in the left AIMS cabinet controls the relay and selects between the data received from the DFDAF in the left AIMS cabinet and the data received from the right AIMS cabinet. The FDR ARINC 717 interface in the left AIMS cabinet transmits the selected source of data from this relay to the FDR.

The FDR ARINC 717 interface also transmits faults to the DFDAF.

The QARF software in the CPM/Comm controls the QAR ARINC 717 and RS422 interface. Any fault detected in the ARINC 717 or RS422 interface goes to the ACMF. The QAR software transmits data to the QAR that it receives from the ACMF software in the CPM/ACMF.

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AIMS - CORE PROCESSOR MODULE/COMMUNICATIONS - FUNCTIONAL DESCRIPTION

Ethernet Interface**ARO 001-013**

The DCMF software in the CPM/COMM transfers data to and receives data from the PlaneNet via an Ethernet interface. Ethernet interface provides full-duplex point to point 10 base T connections, using Ethernet protocols (TFTP/UDP/IP, TCP/IP), for communication with LRUs on the PlaneNet. PlaneNet provides a high-speed communications path to PlaneNet member systems primarily for transferring maintenance data for display on the Maintenance Access Terminal (MAT), Laptop MAT (LMAT), or Portable MAT (PMAT). Additionally, the interface allows onboard LRU/LRM software data loading from the MAT/LMAT via the AIMS data loading function or down loading of maintenance data to a disk on the MAT/LMAT.

ARO 014-999

The DCMF software in the CPM/COMM transfers data to and receives data from the PlaneNet via an Ethernet interface. Ethernet interface provides full-duplex point to point 10 base T connections, using Ethernet protocols (TFTP/UDP/IP, TCP/IP), for communication with LRUs on the PlaneNet. PlaneNet provides a high-speed communications path to PlaneNet member systems primarily for transferring maintenance data for display on the Maintenance Access Terminal (MAT), Laptop MAT (LMAT), or Portable MAT (PMAT). Additionally, the interface allows onboard LRU/LRM software data loading from the MAT/LMAT or ONS MSD via the AIMS data loading function or down loading of maintenance data to a disk on the MAT/LMAT or to the ONS MSD.

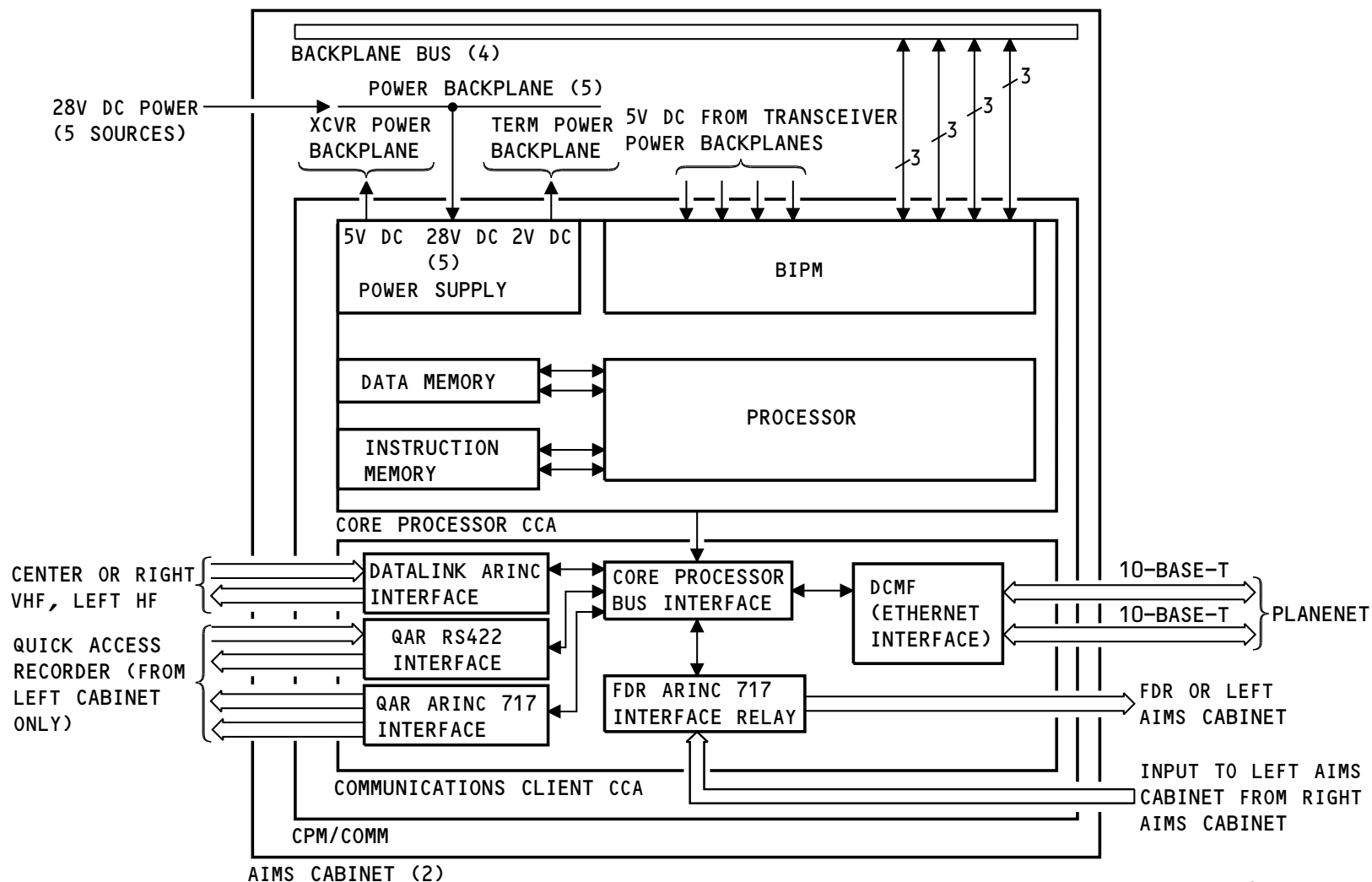
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AIMS - CPM/COMM - FUNCTIONAL DESCRIPTION

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AIMS - AIRLINE MODIFIABLE INFORMATION - OVERVIEW

General

The airplane information management system (AIMS) has several types of software loads. These are the types of software:

- Operational program software (OPS) in all CPMs and IOMs
- Operational configuration files (OPC) in all CPMs and IOMs
- Navigation Data Base (NDB) software for the FMCF function
- Airline modifiable information (AMI) software for related functions.

The design of the 777 airplane gives the option to permit airlines to customize the operation of some of the functions in AIMS. AMI software supplies this flexibility. Baseline AMI software and default values provide basic functionality for the related AIMS systems. If you make the decision to modify or customize the basic functionality, you use the ground based software tool (GBST) to develop the new AMI. There is currently a Sun workstation that operates the software for the GBST and in the future, a PC-based GBST is possible.

Baseline AMIs

Baseline AMIs supply an initial level of functionality for several AIMS functions. These are the functions that use baseline AMIs:

- Airplane condition monitoring function (ACMF)
- Flight deck communication function (FDCF)
- Electronic checklist (ECL) portion of the primary display function (PDF)
- Central maintenance computing function (CMCF).

You load baseline AMI software into the AIMS cabinet from a separate disk. This software is in addition to the other software for the core processor module (CPM) that has the related function. A new or modified AMI load will replace any existing AMI software for that particular function.

Default Values

Default values also supply an initial level of functionality for several AIMS functions. These are the functions that use default values:

- Data communication management function (DCMF)
- Flight management computer function (FMCF).

Default values are hardcoded (non-modifiable) values found in the operational software of the CPM for the related functions. To cause the function to operate with new values you must develop a customized AMI and load that software into the CPM from a new disk. These new values do not replace the default values but are used instead of the default values. If the AMI fails, the functions go back to the default values.

NOTE: Boeing initially installs a null AMI. A null AMI is a blank AMI that causes the related function to use the default values.

Training Information Point

The GBST updates with each blockpoint and the previous blockpoint's checklist (ECL) will not be the same as the new blockpoint software. For example, none of the EICAS messages would be the same because of the differences in the checklist builds from the GBST. If you would like to keep the same checklist, you can use the current blockpoint GBST to convert the previous blockpoint to a current checklist.

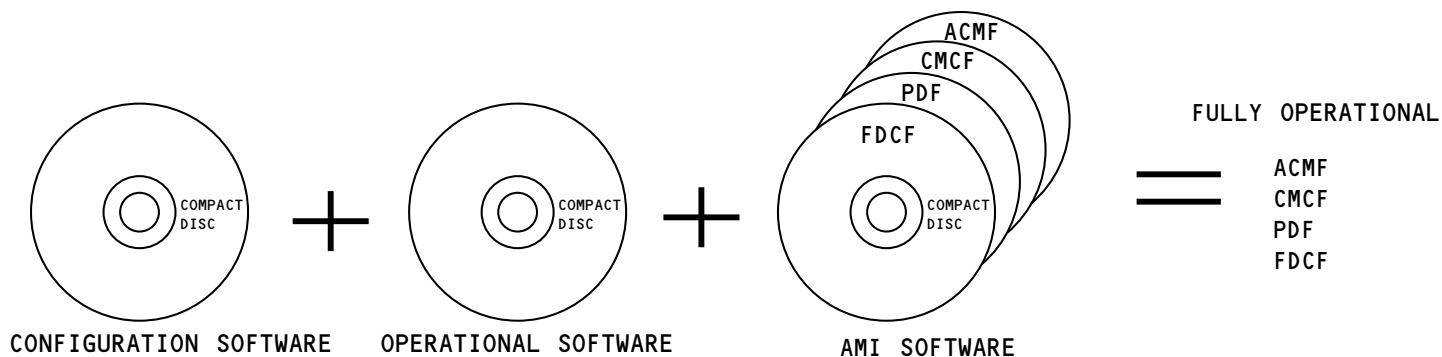
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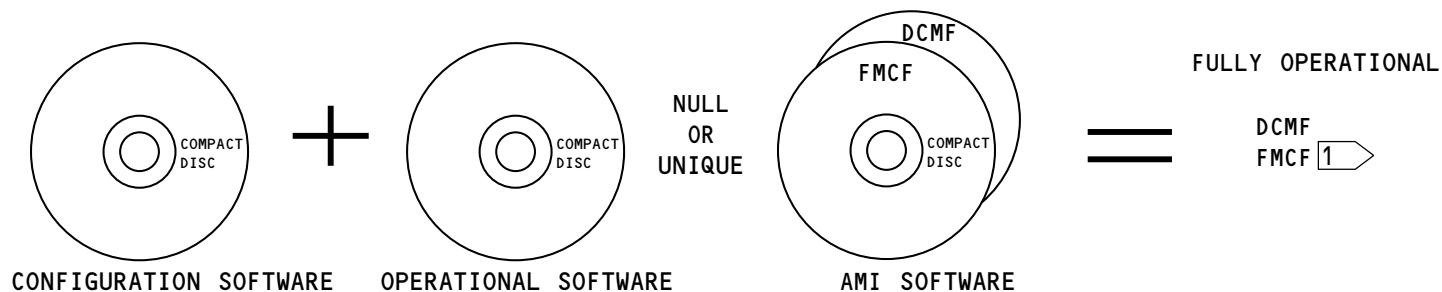
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SYSTEMS WITH BASELINE AMI



SYSTEMS WITH DEFAULT VALUES



1 ALSO REQUIRES NAVIGATION DATA BASE SOFTWARE

380683 S0000133281_V1

AIMS - AIRLINE MODIFIABLE INFORMATION OVERVIEW

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AIMS - SOFTWARE - FUNCTIONAL DESCRIPTION

General

These are the four different types of software in the AIMS cabinet:

- Operational program software (OPS)
- Operational configuration files (OPC)
- Airline modifiable information (AMI)
- Database.

These are the two different types of data stored by the SLRMs:

- Bite history data
- Run-time data.

These are the three different types of memory that the LRM use to store the software and the data:

- Flash which is nonvolatile
- EEPROM which is nonvolatile
- DRAM which is volatile.

Operational Program Software

The OPS is the core software and the application software for the avionic functions. There is a unique software part number for each type of SLRM. Modules that are the same, like all the IOMs and the two CPM/GGs, have the same part number.

The OPS is stored in flash memory which is nonvolatile memory. If you remove the module from the cabinet, you do not lose the OPS software. The OPS software can be loaded into the module either in the shop or when it is installed on the airplane.

Operational Program Configuration Files

The OPCs set the configuration of the airplane. The OPCs replace hardware program pins used on older model airplanes. There is only one OPC part number for the cabinet. This one part number includes the OPCs for several avionic functions.

The OPCs are in flash memory.

Training Information Point

There is only one OPC software part number for the cabinet. When you remove and replace one SLRM, you can load the OPC into that SLRM. When you load the OPC into the SLRM, it will do a check to make sure it is the same OPC software that is in the other SLRMs in the cabinet. This is to make sure that you can not load an OPC with a different part number into any SLRM.

If the OPC software part number changes, you need to load the new OPC into all the SLRMs in the cabinet. During a data load, you will get a dialog box that shows that the software is incompatible with the old OPC part number in the other SLRMs. You can override and force the software to load into the SLRM.

Airline Modifiable Information

The AMIs set the configuration of the airplane. This software, developed with the ground based software tool, gives the airlines more flexibility to define their configuration. Several avionic functions have an AMI. There is a separate software part number for each AMI.

The AMIs are in flash memory.

Database

There are several loadable databases in AIMS. The databases are in flash memory. The databases are:

- DU database
- Navigation database
- Checklist database
- Aero-engine database
- Loadable diagnostic information (LDI) database
- Flight Data Output/Software Allocation Table (FDO/SWAT) database

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AIMS - SOFTWARE - FUNCTIONAL DESCRIPTION

AIMS Cabinet Core Software Implementation

Core Software is a common function executing within each processor module (CPM & IOM) of the AIMS cabinet. The main function of Core Software is to provide an interface with the hardware and the environment for the application software to operate in.

Core Software fulfills several distinct roles:

- Provides the environment for applications to operate
- Determines the health status of the shared hardware resources
- Provides control of shared I/O resources
- Provides the ability to load program software and databases.

Portions of Core software reside on each processor module and are divided into the following pieces according to whether they are onboard loadable and the functions they perform:

- Resident Boot (not loadable)
- Common Monitor (not loadable)
- Non-resident Boot (on-board loadable)
- Non-resident operating system (on-board loadable)

Also included as part of the Core software on the CPM are several separate, on-board loadable, software partitions:

- BITE Monitor Partition (BMP)
- Data Conversion Gateway Function (DCGF)
- Flight Information and Data Output Function (FIDO)
- Dataload Partition (DLP)

On-board loadable Core software partitions on the IOMs include:

- Mini BITE Monitor Partition (mBMP)
- Mini Flight Information and Data Output Function (mFIDO)

BITE History Data

Each SLRM stores BITE history in EEPROM. EEPROM is nonvolatile memory. If you remove the SLRM, this BITE history is saved.

Run-Time Data

The run-time data is data that is generated by the operation of the cabinet. This run-time data is in DRAM. If you remove the module you will lose this data.

The battery bus power holds the data in DRAM, so that when you power down the airplane you do not lose this data.

Training Information Point

If you remove the SLRM or if you remove the battery without primary power, you lose data:

- ACMF report data
- Run time/Fault history data

Training Information Point

Under the system test function, do a cabinet reset test to make sure all run-time fault history data is stored into EEPROM before removing module or battery.

LRMs Software

This is the software loaded into the CPM/COMM:

- CPM/COMM OPS (includes core software and DCGF, DCMF, DFDAF, FDCF, QARF)
- Node Processor (NP) OPS
- AIMS OPC
- Flight Data Output/Software Allocation Table (FDO/SWAT) DB
- Air Traffic Control (ATC) DB
- AMI for DCMF

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**AIMS - SOFTWARE - FUNCTIONAL DESCRIPTION**

- AMI for FDCF.

This is the software loaded into the CPM/STD:

- CPM/STD OPS (includes core software and DCGF, ACMF, FMCF, TMCF, and performance database)
- AIMS OPC
- AMI for FMCF
- AMI for ACMF (left and right AIMS cabinet positions)
- Nav database
- FDO/SWAT DB
- Aero-engine DB
- MarVar DB

This is the software loaded into the CPM/GGs:

- CPM/GG OPS (includes core software, DCGF and PDF)
- AIMS OPC
- Checklst database
- DU database
- FDO/SWAT database

The software loaded into the IOMs:

- IOM OPS (includes core software and CMCF)
- AIMS OPC
- AMI for CMCF.
- Loadable Diagnostics Information (LDI) DB

Training Information Point

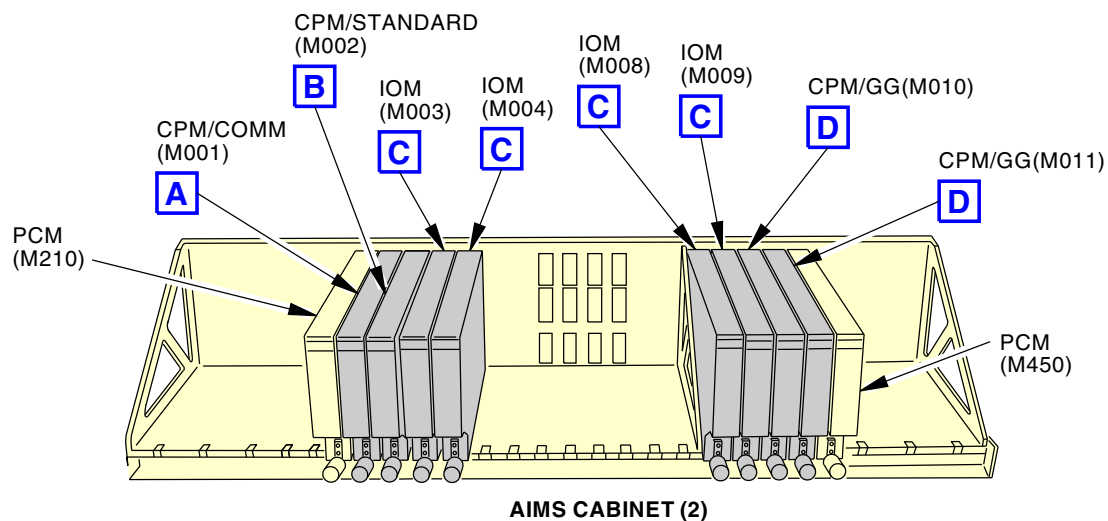
The status message AIMS shows when there is a difference between the OPCs or program pins of the left and right AIMS cabinets. This is monitored at power up or when this software is loaded.

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CPM/COMM

CPM/COMM OPS
AIMS OPC
AMI FOR DCMF
AMI FOR FDCF
NP OPS
FDO/SWAT DB
ATC DB

A

CPM/STD

CPM/STD OPS
AIMS OPC
AMI FOR FMCF
AMI FOR AMCF
NAV DATABASE
FDO/SWAT DB
AERO-ENGINE DB
MARVAR DB

B

IOM

IOM OPS
AMI FOR CMCF
AIMS OPC
LID DB

C

CPM/GG

CPM/GG OPS
AIMS OPC
CHECKLIST DB
DU DB
FDO/SWAT DB

D

AIMS - SOFTWARE - FUNCTION DESCRIPTION

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**AIMS - DATA CONVERSION GATEWAY FUNCTION - FUNCTIONAL DESCRIPTION****General**

The data conversion gateway function (DCGF) has these five primary purposes:

- Transfer data between the flight control ARINC 629 buses and analog, analog discrete and ARINC 429 buses
- Transfer data between the systems ARINC 629 buses and analog, analog discrete and ARINC 429 buses
- Transfer data between the systems ARINC 629 buses and the flight control ARINC 629 buses
- Isolate transfer of engine data between the flight control ARINC 629 buses and the systems ARINC 629 buses
- Isolate transfer of engine data between the systems ARINC 629 buses and analog, analog discrete and ARINC 429 buses.

All DCGF data transfers follow the same basic data flow. The IOMs receive the data. The data then moves to the CPMs over the backplane data bus. The CPMs reformat the data and send the data back to the IOMs. The IOMs then transmit the data.

DCGF Types

There are seven different types of data transfer.

DCGF Type 1: The AIMS cabinets receive ARINC 429, analog discrete signals, and analog signals and transmit the data to the flight controls ARINC 629 buses.

DCGF Type 2: The AIMS cabinets receive ARINC 429 and analog discrete signals and transmit the data to the systems ARINC 629 buses.

DCGF Type 3: The AIMS cabinets receive data from the flight controls ARINC 629 buses and transmit the data to the systems ARINC 629 buses.

DCGF Type 4: The AIMS cabinets receive data from the systems ARINC 629 buses and transmit the data to the flight controls ARINC 629 buses.

DCGF Type 5: The AIMS cabinets receive data from the flight controls ARINC 629 buses and transmit ARINC 429 data and analog discrete signals.

DCGF Type 6: The AIMS cabinets receive data from the systems ARINC 629 buses and transmit ARINC 429 data and analog discrete signals.

DCGF Type 7: The AIMS cabinets receive data from a systems ARINC 629 bus and transmit the data to another systems ARINC 629 bus.

DCGF Software

Each AIMS cabinet has two DCGFs. Each DCGF has a master and a shadow. The master is in control unless the CPM fails. Then the shadow takes over. DCGF1 is in the two CPM/GGs. CPM/GG M0010 is the master and CPM/GG M0011 is the shadow. DCGF2 is in the CPM/COMM and the CPM/STD. The CPM/STD is the master and the CPM/COMM is the shadow. DCGF1 and DCGF2 operate independently.

DCGF1 processes left engine data, data transfers and AOA and TAT calculations. DCGF2 processes right engine data and data transfers.

The engine data is data that goes to and from both engines for control and indication. This data goes to the EECs via the engine data interface units:

- ADIRU and SAARU data
- Autothrottle trim commands
- Condition of various engine related flight deck controls and switches.

Training Information Point

The status message AIMS shows when the DCGF fails in more than one of the CPMs or there is insufficient input/output resources for more than one second.

When only one of the DCGFs fail, a scheduled maintenance task (SMT) message AIMS CABINET LRM shows. It is a requirement that you do a check for this SMT message every 30 days. If the SMT message shows, you must do the corrective action for the DCGF. The SMT messages are on the maintenance task maintenance page.

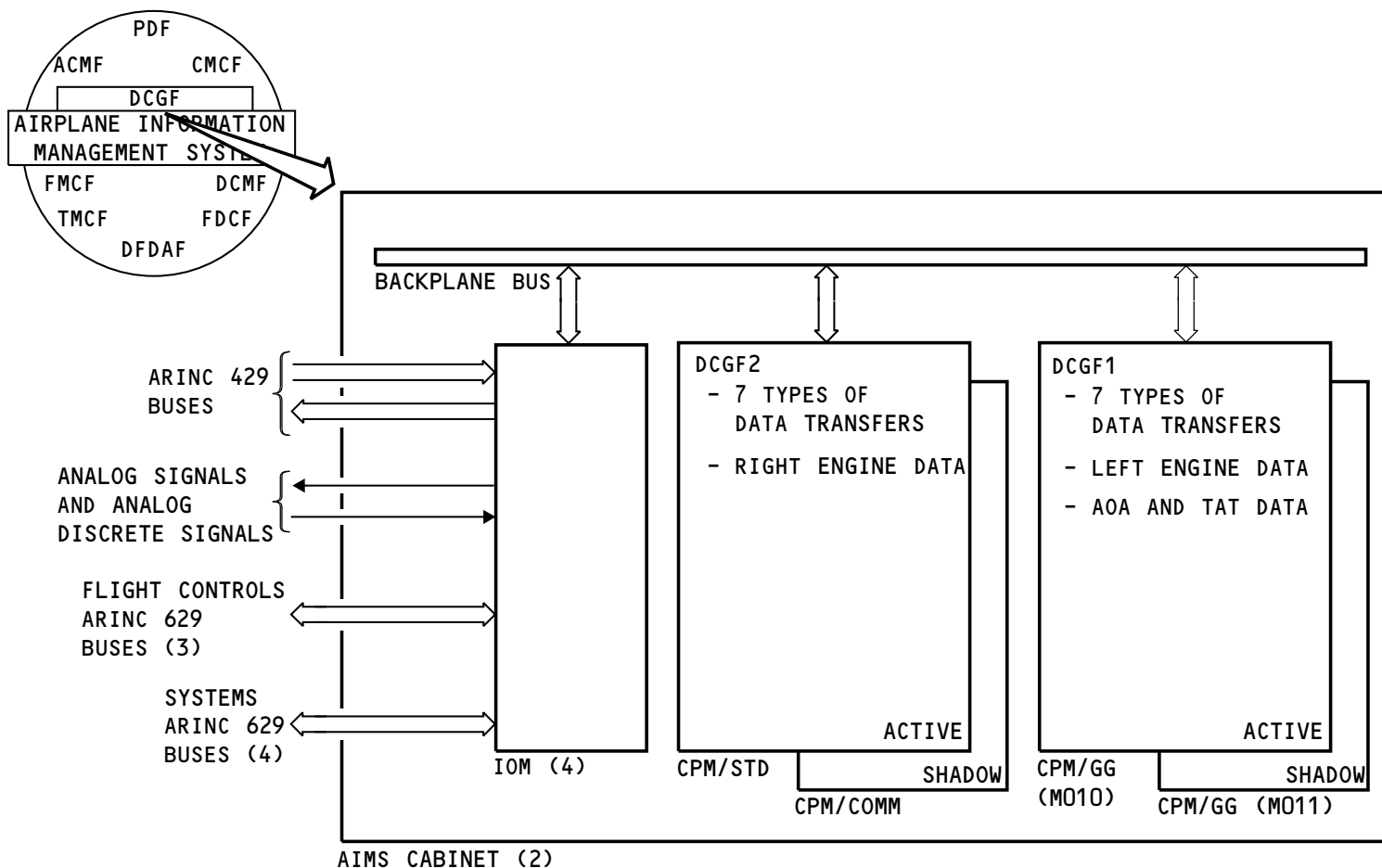
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AIMS - DATA CONVERSION GATEWAY FUNCTION - FUNCTIONAL DESCRIPTION

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**AIMS - UNIVERSAL TIME (COORDINATED) FUNCTION - FUNCTIONAL DESCRIPTION****General**

The core processor modules (CPMs) each perform the universal time (coordinated) function (UTCf) in addition to their other major functions.

Each CPM has a UTCf that supplies universal time (coordinated) (UTC) and date to all the functions in that CPM. One of the CPMs in each cabinet also sends UTC and date to the other airplane systems.

Time and Date Calculation

The AIMS cabinets receive time and date data from the multi-mode receivers (MMRs). The MMRs also send an analog time mark once per second. The UTCf uses the time mark signal and the time data to calculate the UTC.

CPM Interface

The UTCf in each CPM calculates the UTC and provides the UTC and date to the functions on that CPM. The UTCf uses the left MMR data if it is valid. Otherwise, the UTCf uses the right MMR data. If MMR data is not available, the UTCf maintains the UTC and the date. It does this based on the last valid data received from the MMR and its own internal clock.

The hot battery bus power lets the CPM clocks keep time when no other sources of power is available to the CPMs.

User System Interface

Each AIMS cabinet transmits UTC and date data to other airplane systems on these ARINC 429 data buses:

- General purpose #1 bus
- General purpose #2 bus
- Inertial reference bus
- Central maintenance buses (L/C/R).

Each AIMS cabinet transmits UTC and date data to other airplane systems on these ARINC 629 data buses:

- Flight controls buses

- Systems buses.

Only one of the four CPMs in a cabinet sends time and date data to other airplane systems. The priority for the CPM that sends the data is:

- CPM/Comm
- CPM/GG (M010)
- CPM/GG (M011)
- CPM/STD.

Training Information Point

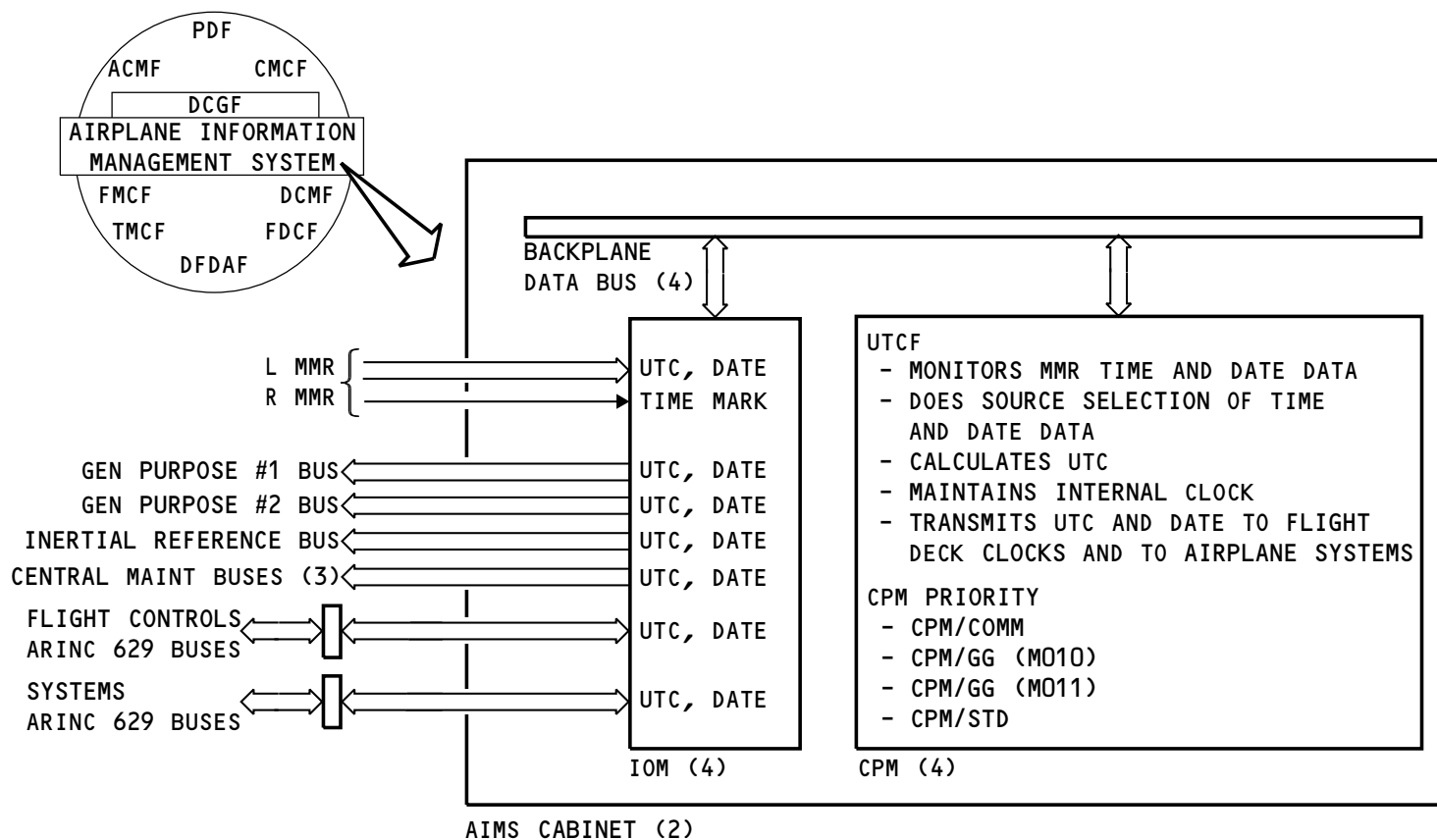
If the GPSSU-supplied or MMR-supplied external UTC source is lost and all power, including battery, is lost to the AIMS cabinets, the UTC will default to a date of 1994. When the external UTC source is restored, the UTC will update with the correct time and date.

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AIMS - UNIVERSAL TIME (COORDINATED) FUNCTIONAL DESCRIPTION

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**AIMS - SYSTEM GROUND TESTS****General**

You can do AIMS system ground tests from the MAT or maintenance laptop.

NOTE: The system ground tests cannot be performed from the MFD.

These are the two different types of system ground tests:

- IOM module reset test
- CPM reset test.

IOM Module Reset Test

Each of the four IOMs have an individual module reset test.

This test makes sure that the IOM operates correctly. The approximate time to run the test is less than one minute. After the test starts, you can not stop it.

This test may show failures of fault tolerant components which may not have an effect on airworthiness. Use EICAS messages with the proper documentation to find airworthiness.

CPM Module Reset Test

Each of the four CPMs have an individual module reset test.

This test makes sure that the CPM operates correctly. The approximate time to run the test is less than one minute. After the test starts, you can not stop it.

This test may show failures of fault tolerant components which may not have an effect on airworthiness. Use EICAS messages with the proper documentation to find airworthiness.

AIMS Cabinet Reset Test

Each of the two AIMS cabinets have an individual reset test.

This test makes sure that the AIMS cabinet operates correctly. The approximate time to run the test is less than one minute. After the test starts, you can not stop it.

This test may show failures of fault tolerant components which may not have an effect on airworthiness. Use EICAS messages with the proper documentation to find airworthiness.

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EFFECTIVITY	
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D633W101-ARO

GROUND TESTS

SELECT ATA SYSTEM (55)

30 WINDOW HEAT CONTROL SYSTEM
31 AIMS - FLIGHT DATA RECORDER SYSTEM
31 PRINTER
31 AIMS - AIRPLANE CONDITION MONITORING SYSTEM

31 AIMS - RIGHT AIMS
31 WARNING ELECTRONIC SYSTEM
32 PROXIMITY SENSOR SYSTEM (PSS)
32 AIR/GROUND SYSTEM

SELECT TEST TYPE

☒ SYSTEM TEST

☐ OPERATIONAL TEST

☐ LRU REPLACEMENT TEST

SELECT SYSTEM TEST (8)

CPM/COMM(M001) IN LEFT AIMS MODULE RESET
CPM/STD(M002) IN LEFT AIMS MODULE RESET
IOM(M003) IN LEFT AIMS MODULE RESET
IOM(M004) IN LEFT AIMS MODULE RESET
IOM(M008) IN LEFT AIMS MODULE RESET
IOM(M009) IN LEFT AIMS MODULE RESET
CPM/GG(M010) IN LEFT AIMS MODULE RESET
CPM/GG(M011) IN LEFT AIMS MODULE RESET

CONTINUE

HELP

GO BACK

SELECT SYSTEM TEST (8)

CPM/COMM(M001) IN LEFT AIMS MODULE RESET

CPM/STD(M002) IN LEFT AIMS MODULE RESET

IOM(M003) IN LEFT AIMS MODULE RESET

IOM(M004) IN LEFT AIMS MODULE RESET

IOM(M008) IN LEFT AIMS MODULE RESET

IOM(M009) IN LEFT AIMS MODULE RESET

CPM/GG(M010) IN LEFT AIMS MODULE RESET

CPM/GG(M011) IN LEFT AIMS MODULE RESET

LEFT AIMS CABINET RESET

RIGHT AIMS CABINET RESET

AIMS - SYSTEM GROUND TESTS

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Jan 05/2018

**AIMS - OPERATIONAL TESTS****General**

You can do AIMS operational tests from the MAT. Use the operational test to do a check of the ARINC 429 relays in each IOM.

NOTE: The operational tests cannot be performed from the MFD.

Operational Tests

Each of the four IOMs has an operational test.

This test makes sure that the ARINC 429 relays in the IOM operate correctly. The approximate time to run the test is less than one minute. After this test starts, you can not stop it.

This test may show failures of fault tolerant components which may not have an effect on airworthiness. Use EICAS messages and proper documentation to find airworthiness.

GROUND TESTS

SELECT ATA SYSTEM (55)

- 30 WINDOW HEAT CONTROL SYSTEM
- 31 AIMS - FLIGHT DATA RECORDER SYSTEM
- 31 PRINTER
- 31 AIMS - AIRPLANE CONDITION MONITORING SYSTEM
- 31 AIMS - LEFT AIMS
- 31 AIMS - RIGHT AIMS
- 31 WARNING ELECTRONIC SYSTEM
- 32 PROXIMITY SENSOR SYSTEM (PSS)
- 32 AIR/GROUND SYSTEM

SELECT TEST TYPE

- ☐ SYSTEM TEST
- ☒ OPERATIONAL TEST
- ☐ LRU REPLACEMENT TEST

SELECT OPERATIONAL TEST (4)

CONTINUE

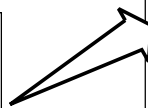
HELP

GO BACK

SELECT OPERATIONAL TEST

(4)

IOM(M003) IN LEFT AIMS ARINC 429 RELAYS
 IOM(M004) IN LEFT AIMS ARINC 429 RELAYS
 IOM(M008) IN LEFT AIMS ARINC 429 RELAYS
 IOM(M009) IN LEFT AIMS ARINC 429 RELAYS



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AIMS - OPERATIONAL TESTS

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AIMS - LRU REPLACEMENT TESTS

General

You can do AIMS LRU replacement tests from the MAT or maintenance laptop.

This test may show failures of fault tolerant components which may not have an effect on airworthiness. Use EICAS messages and proper documentation to find airworthiness.

NOTE: The LRU replacement tests cannot be performed from the MFD.

These are the two LRU replacement tests:

- IOM module reset test
- CPM reset test.

IOM Module Reset Test

Each of the four IOMs has an individual module reset test.

This test makes sure that the IOM operates correctly. The approximate time to run the test is less than one minute. After the test starts, you can not stop it.

This test may show failures of fault tolerant components which may not have an effect on airworthiness. Use EICAS messages and proper documentation to find airworthiness.

CPM Module Reset Test

Each of the four CPMs has an individual module reset test.

This test makes sure that the CPM operates correctly. The approximate time to run the test is less than one minute. After the test starts, you can not stop it.

This test may show failures of fault tolerant components which may not have an effect on airworthiness. Use EICAS messages and proper documentation to find airworthiness.

AIMS Cabinet Reset Test

Each of the two AIMS cabinets has an individual reset test.

This test makes sure that the AIMS cabinet operates correctly. The approximate time to run the test is less than one minute. After the test starts, you can not stop it.

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GROUND TESTS

SELECT ATA SYSTEM
(55)

30 WINDOW HEAT CONTROL SYSTEM
31 AIMS - FLIGHT DATA RECORDER SYSTEM
31 PRINTER
31 AIMS - AIRPLANE CONDITION MONITORING SYSTEM
31 AIMS - LEFT AIMS
31 AIMS - RIGHT AIMS
31 WARNING ELECTRONIC SYSTEM
32 PROXIMITY SENSOR SYSTEM (PSS)
32 AIR/GROUND SYSTEM

SELECT TEST TYPE

☐

SYSTEM
TEST

☐

OPERATIONAL
TEST

☒

LRU
REPLACEMENT
TEST

SELECT LRU REPLACEMENT TEST
(8)

CPM/COMM(M001) IN LEFT AIMS MODULE RESET
CPM/STD(M002) IN LEFT AIMS MODULE RESET
IOM(M003) IN LEFT AIMS MODULE RESET
IOM(M004) IN LEFT AIMS MODULE RESET
IOM(M008) IN LEFT AIMS MODULE RESET
IOM(M009) IN LEFT AIMS MODULE RESET
CPM/GG(M010) IN LEFT AIMS MODULE RESET
CPM/GG(M011) IN LEFT AIMS MODULE RESET

CONTINUE

HELP

GO BACK

SELECT LRU REPLACEMENT TEST

(8)

```

CPM/COMM(M001) IN LEFT AIMS MODULE RESET
CPM/STD(M002) IN LEFT AIMS MODULE RESET
IOM(M003) IN LEFT AIMS MODULE RESET
IOM(M004) IN LEFT AIMS MODULE RESET
IOM(M008) IN LEFT AIMS MODULE RESET
IOM(M009) IN LEFT AIMS MODULE RESET
CPM/GG(M010) IN LEFT AIMS MODULE RESET
CPM/GG(M011) IN LEFT AIMS MODULE RESET
LEFT AIMS CABINET RESET
RIGHT AIMS CABINET RESET
    
```

AIMS - LRU REPLACEMENT TESTS

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AIMS - BLOCKPOINT REFERENCES

General

The AIMS Blockpoint installed on an airplane can be determined by performing a configuration check on the Maintenance Access Terminal (MAT).

Blockpoint - Software Part Number

The following tables provide software part number which can uniquely identify the associated AIMS Blockpoint which is installed on the airplane:

AIMS1 Blockpoint Cross Reference

CPM/Comm OPS Part Number	CMP/GG OPS Part Number	AIMS Blockpoint
316F-HNP-002-09		1999
3167-HNP-002-10		2001
3166-HNP-002-11		2003
3164-HNP-002-13		2003C
	3164-HNP-003-12	2005A
	3165-HNP-003-13	2006
3163-HNP-002-14		V14
3162-HNP-002-15		V14A
3161-HNP-002-16		V16

AIMS2 Blockpoint Cross Reference

CPM/Comm OPS Part Number	BAT_LR Part Number	AIMS Blockpoint
	HNP59-AB03-1002	2003A
	HNP54-AB03-1003	2003B
	HNP55-AB03-1004	2005

CPM/Comm OPS Part Number	BAT_LR Part Number	AIMS Blockpoint
	HNP52-AB03-1005	2005A
	HNP51-AB03-1006	2006
	HNP51-AD07-1004	V14
HNP5D-AL02-1005		V15
HNP5E-AL02-1006		V15A
HNP5F-AL02-1007		V16
HNP58-AL02-1011		V17A

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WARNING ELECTRONIC SYSTEM - INTRODUCTION

General

The warning electronic system (WES) supplies indications of incorrect airplane system conditions to the flight crew.

Abbreviations and Acronyms

- ADIRU - air data inertial reference unit
- AFDC - autopilot flight director computer
- AGC - automatic gain control
- AIMS - airplane information management system
- AL - body longitudinal acceleration
- AN - body normal acceleration
- AOA - angle of attack
- AOAAS - autoslat trip point
- ARINC - Aeronautical Radio, Incorporated
- ASG - ARINC signal gateway
- BSCU - brake system control unit
- CG - center of gravity
- DB - data base
- FMCF - flight management computing function
- FSEU - flap/slat electronics unit
- GPWC - ground proximity warning computer
- GPSL - glideslope power level
- GW - gross weight
- HYDIM - hydraulic interface module
- MAT - maintenance access terminal
- MCP - mode control panel
- MGSCU - main gear steering control unit
- MLG - main landing gear
- MMO - maximum operating mach number
- MWL - master warning light

- NCD - no computed data
- NLG - nose landing gear
- OPBC - overhead panel bus controller
- OPC - operational program code
- OPS - operational program system
- PFC - primary flight computer
- PFCS - primary flight control system
- PFD - primary flight display
- PLI - pitch limit indication
- PSEU - proximity sensor electronics unit

ARO 001-013, 017-999

- PWS - predictive windshear

ARO ALL

- RA - radio altitude
- RA RT - radio altimeter receiver-transmitter
- SAARU - secondary attitude air data reference unit
- SBLP - speedbrake lever position
- SBPL - speedbrake power level
- STRIP - stick shaker trip point
- TBD - to be determined
- TCAS - traffic alert and collision avoidance system
- TLRA - thrust lever resolver angle
- V1 - decision speed
- VBFLO - initial buffet onset speed
- VCAS - computed airspeed
- VCMIN - active control minimum speed
- VFE - maximum flaps extended speed
- VLE - maximum gear extended speed
- VMAX - maximum speed limit
- VMIN - minimum speed limit

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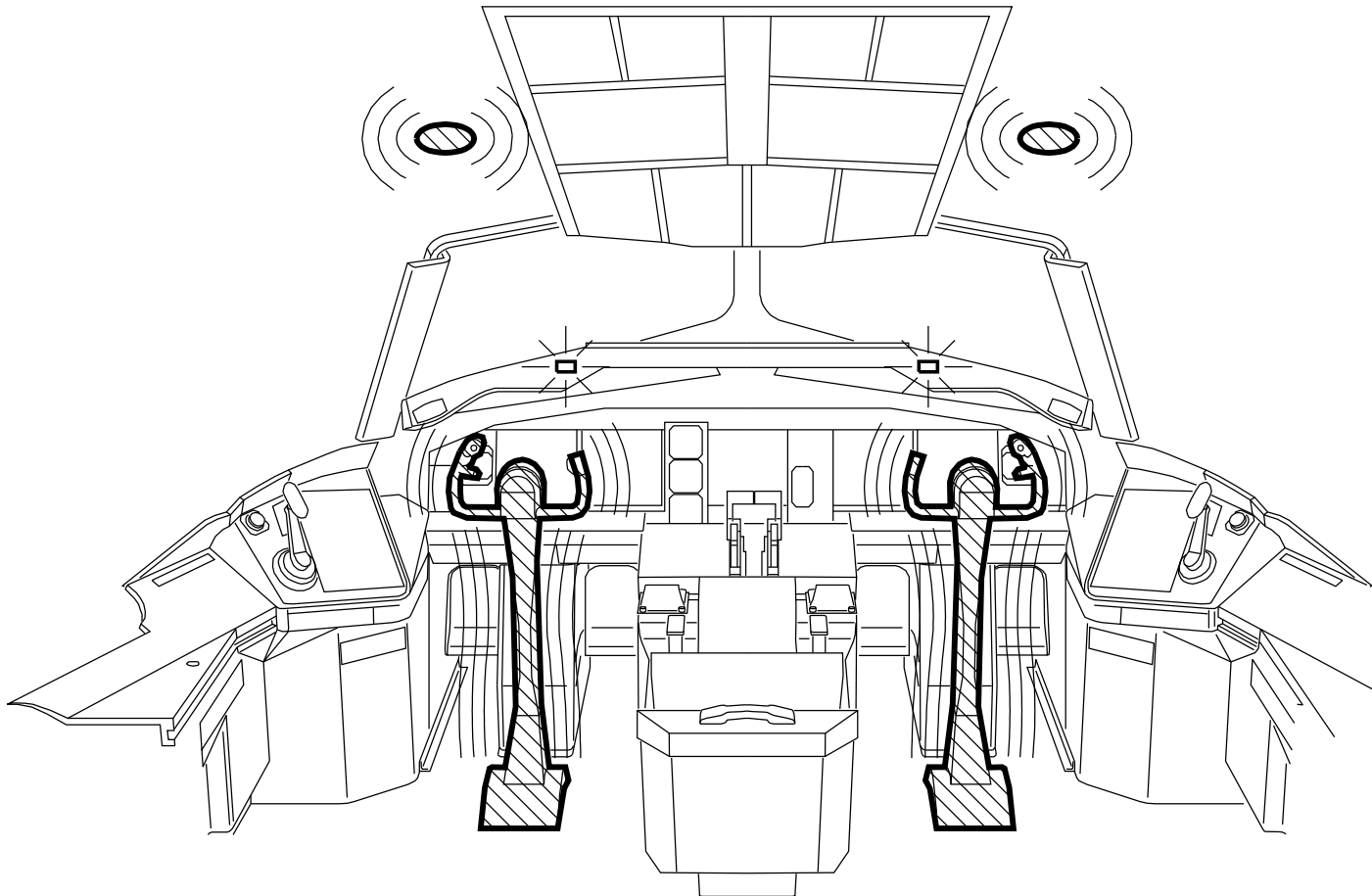
WARNING ELECTRONIC SYSTEM - INTRODUCTION

- VMO - maximum operating speed
- VSS - stick shaker speed
- VSSNG - maneuver margin above stick shaker speed
- WES - warning electronic system
- WEU - warning electronic unit

ARO 001-013, 017-999

- WXR - weather radar

ARO ALL



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WARNING ELECTRONIC SYSTEM - INTRODUCTION

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**WES - GENERAL DESCRIPTION****General**

The warning electronic system (WES) has two warning electronic units (WEUs). Each WEU has two internal channels which do the same functions. The WES receives inputs from sensors, airframe, and avionics systems. The systems ARINC 629 buses supply most of the data. Discrete inputs supply the rest of the data.

The WES does these functions:

- Master warning light control

ARO 014-016

- Alert aural control and amplification. This includes amplification of alert aural from the traffic alert and collision avoidance system (TCAS) computer and the ground proximity warning computer (GPWC)

ARO 001-013, 017-999

- Alert aural control and amplification. This includes amplification of alert aural from the traffic alert and collision avoidance system (TCAS) computer, the ground proximity warning computer (GPWC), and the predictive windshear (PWS) function of the weather radar (WXR).

ARO ALL

- Landing and takeoff configuration warning
- Speedbrake alert
- Stabilizer green band
- Altitude alert
- Stall warning
- Auto slat enable
- Speed tape parameter calculation. This includes maximum operating velocity (Vmo), and maximum operating mach (Mmo) indication.

Outputs go to these:

- Master warning lights
- Aural warning speakers
- Stick shaker actuators

ARO 001-013, 017-999

- Weather radar (WXR) system

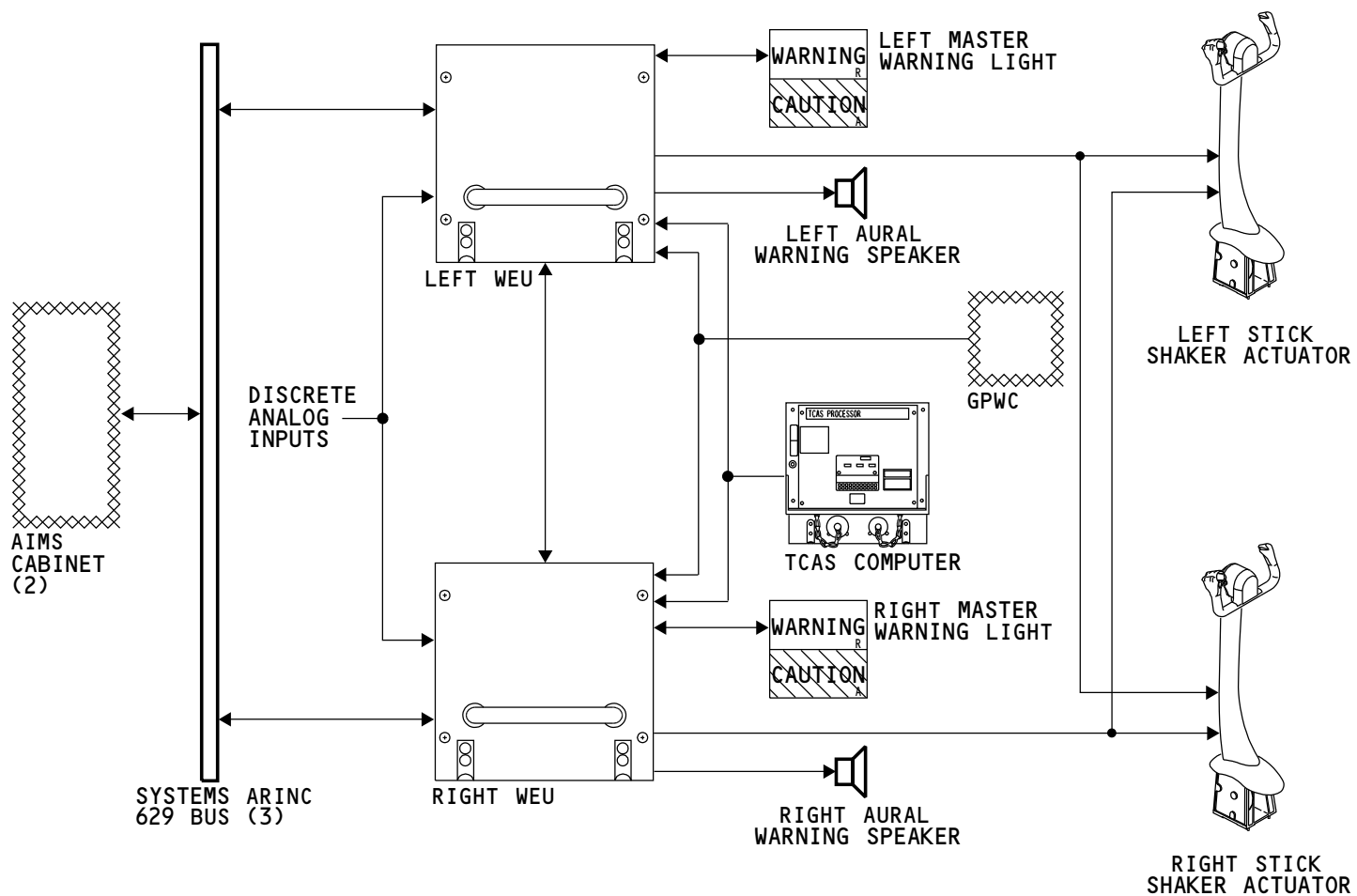
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- Airplane information management system (AIMS) for displays, maintenance functions, and data conversion.

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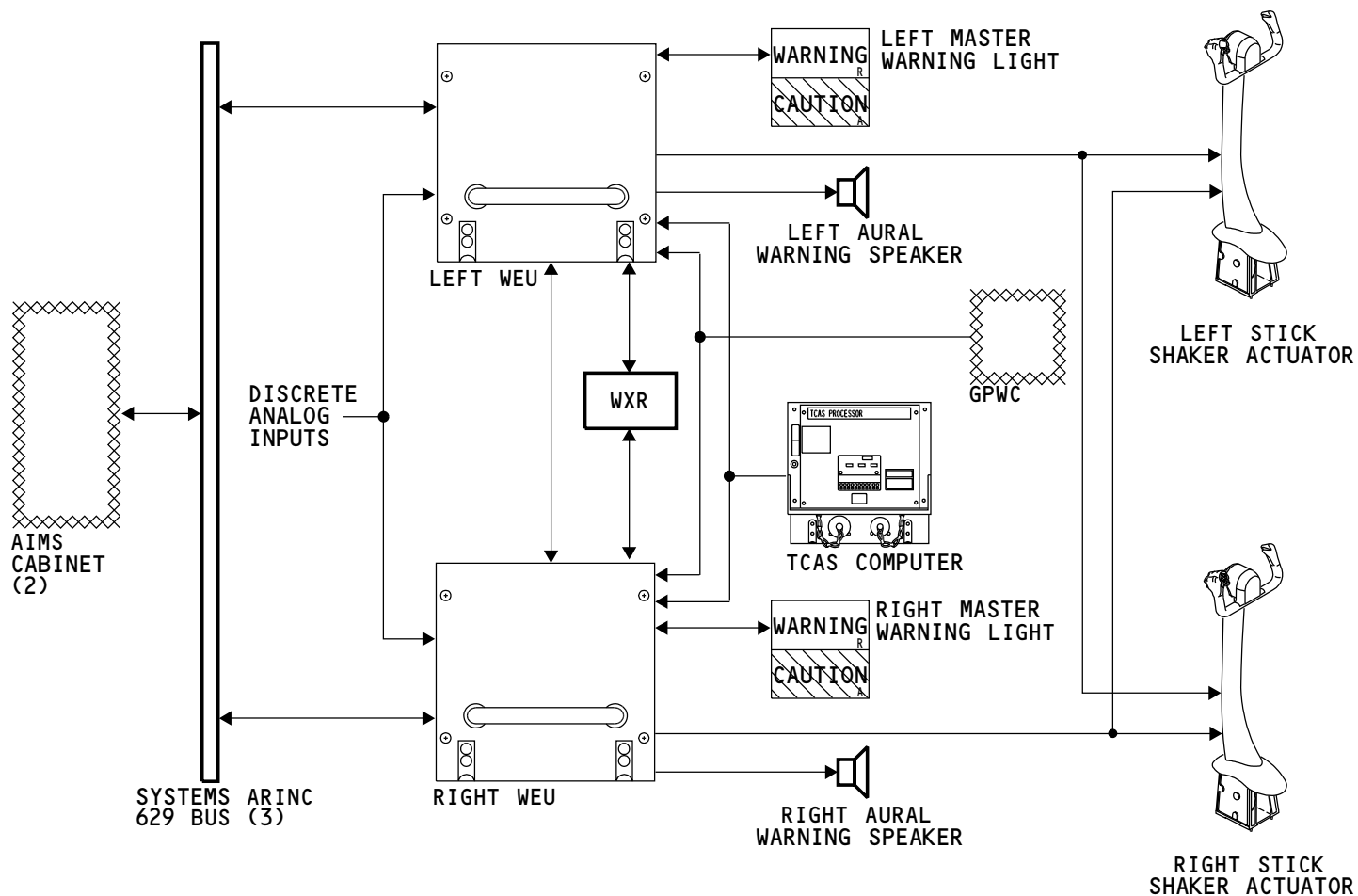
WES - GENERAL DESCRIPTION

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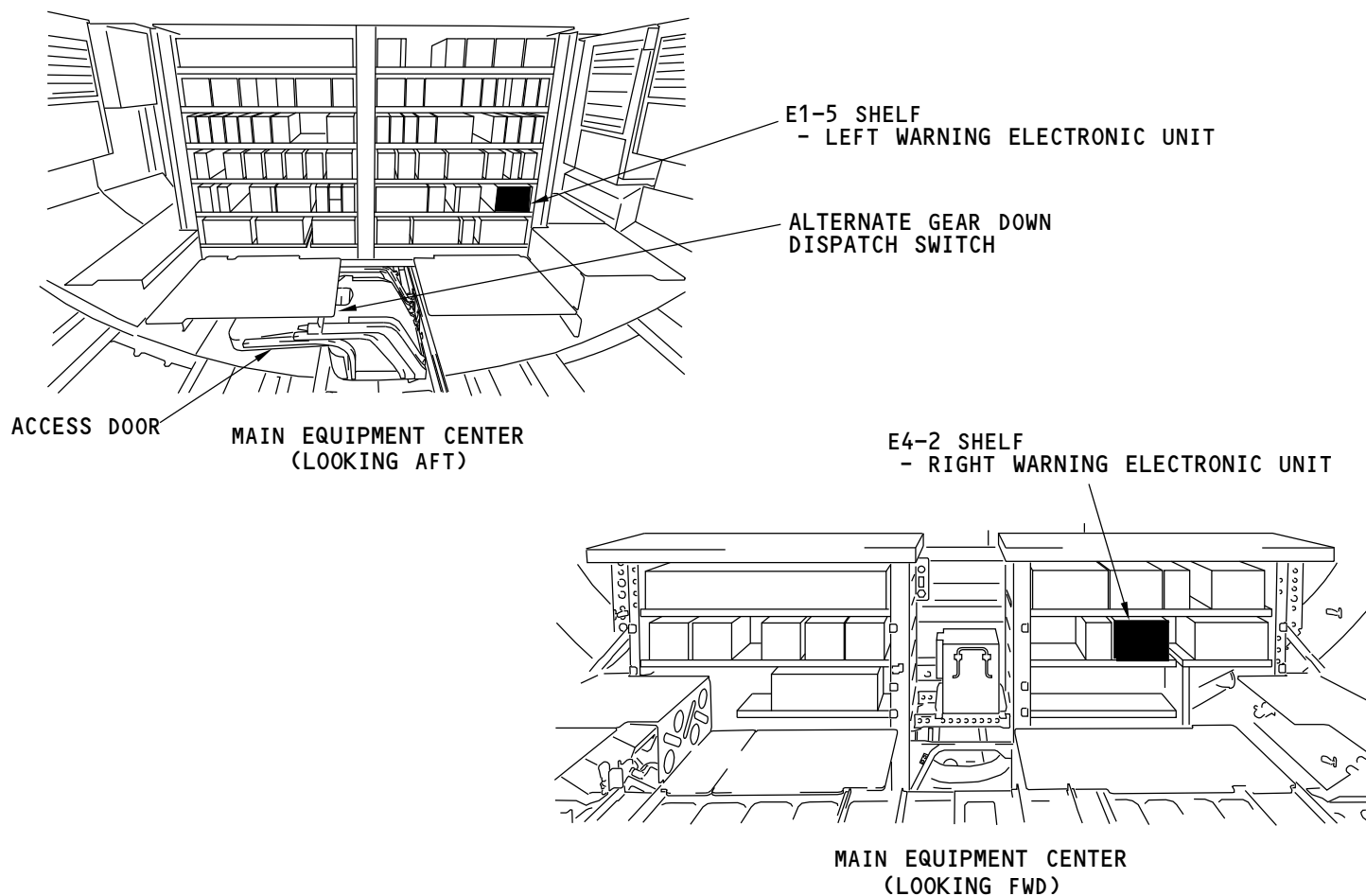
WES - COMPONENT LOCATIONS 1

General

The warning electronic units (WEUs) are in the main equipment center.

The alternate gear down dispatch switch is on the right side of the lower main equipment access hatch.

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WES - COMPONENT LOCATIONS 1

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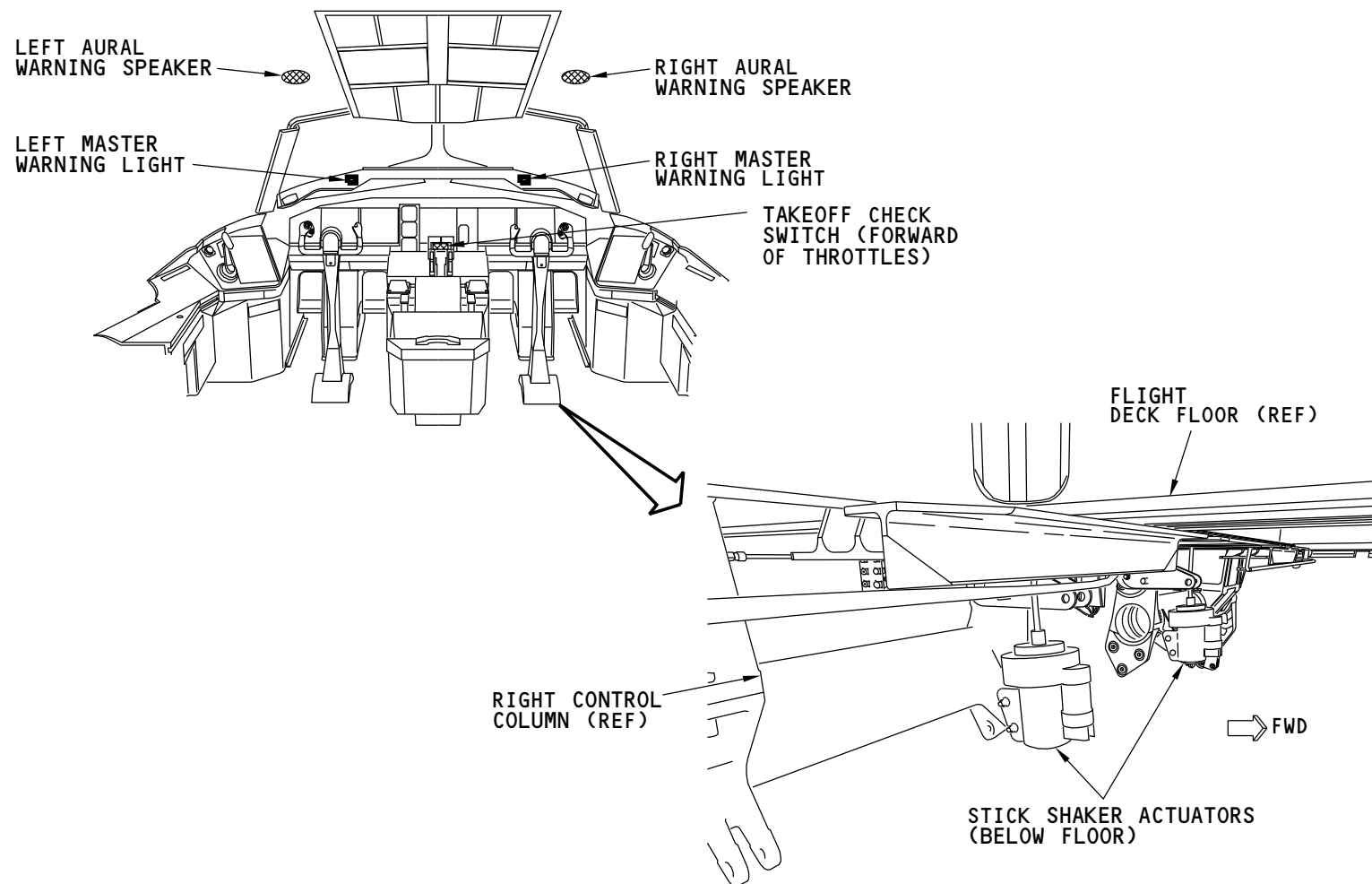


WES - COMPONENT LOCATIONS 2

General

The WES components in the flight deck, show on the graphic.

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WES - COMPONENT LOCATIONS 2

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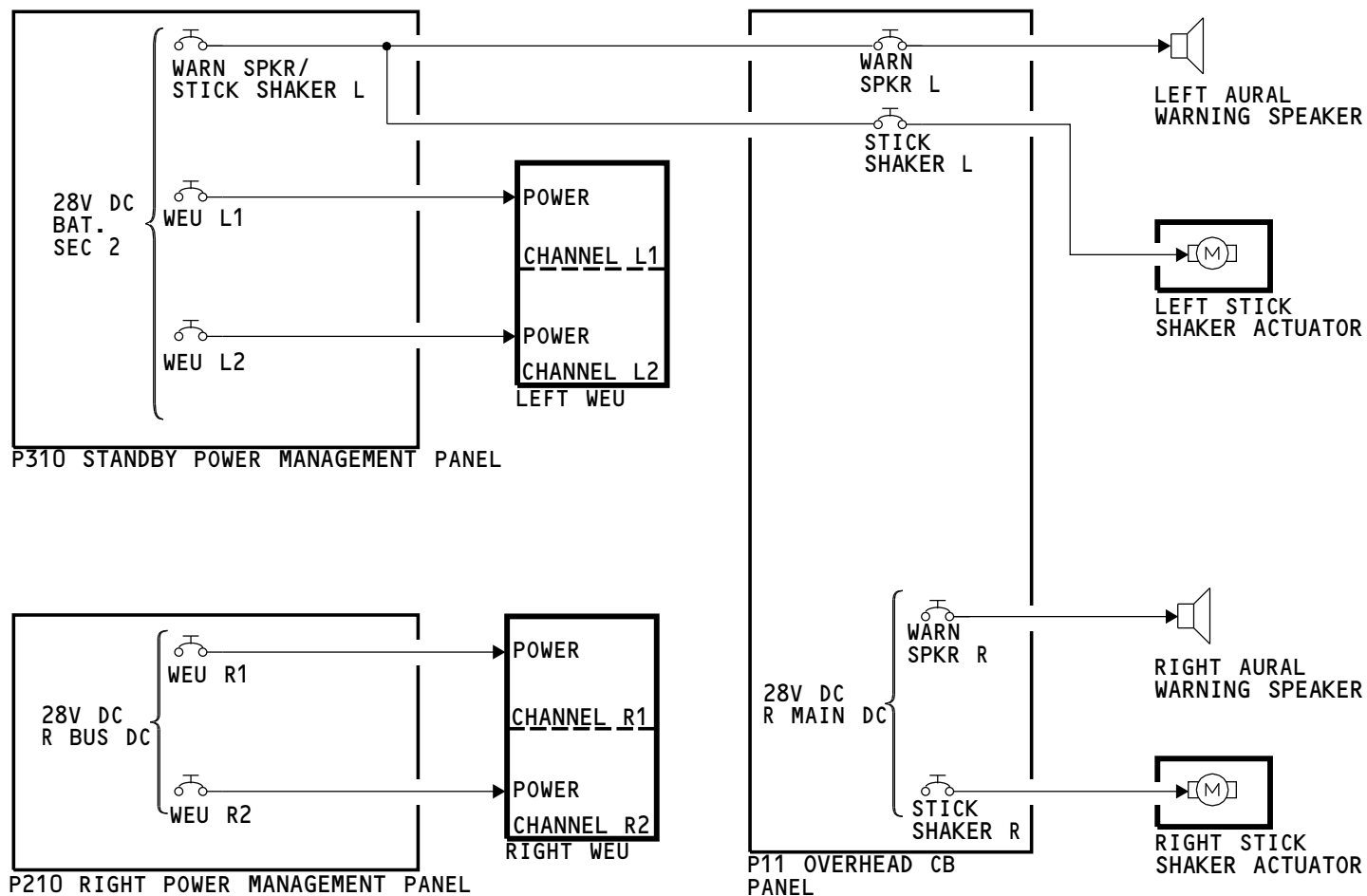
WES - POWER INPUTS

General

Each WEU receives two 28v dc inputs, one for each internal channel.

Each aural warning speaker and each stick shaker actuator receives 28v dc for operation.

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WES - POWER INPUTS

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**WES - DIGITAL INTERFACES****ARINC 629 Interface**

Each WEU channel connects to two system ARINC 629 buses.

Left WEU channel 1 (L1) transmits to and receives data from the left bus. Channel L1 only receives data from the center 1 bus.

Left WEU channel 2 (L2) transmits to and receives data from the center 1 bus. Channel L2 only receives data from the left bus.

Right WEU channel 1 (R1) transmits to and receives data from the right bus. Channel R1 only receives data from the center 1 bus.

Right WEU channel 2 right (R2) transmits to and receives data from the center 1 bus. Channel R2 only receives data from the right bus.

ARINC 629 Value Selection

One ARINC 629 data bus can have the same data value more than once. For example: radio altitude data from the left, center, and right radio altimeter transceivers is on the left system ARINC 629 bus.

Each WEU channel uses data from one ARINC 629 bus input.

Left WEU channel 1 (L1) uses data from the left bus. If a data value in the left bus fails, channel L1 uses the same data value from the center 1 bus.

Left WEU channel 2 (L2) uses data from the center 1 bus. If a data value in the center 1 bus data fails, channel L2 uses the same data value from the left bus.

Right WEU channel 1 (R1) uses data from the right bus. If a data value in the right bus fails, channel R1 uses the same data value from the center 1 bus.

Right WEU channel 2 (R2) uses the center 1 bus. If a data value in the center 1 bus fails, channel R2 uses the same data value from the right bus.

Proximity switch electronic unit (PSEU) data selection is also different from the previous explanation. If at least one PSEU supplies a good data value to the WEUs, the WEUs use that data value.

ARINC 429 Inter-Channel Buses

Each WEU channel receives data from the opposite WEU on an ARINC 429 bus. Each WEU channel transmits data to the opposite WEU on an ARINC 429 bus.

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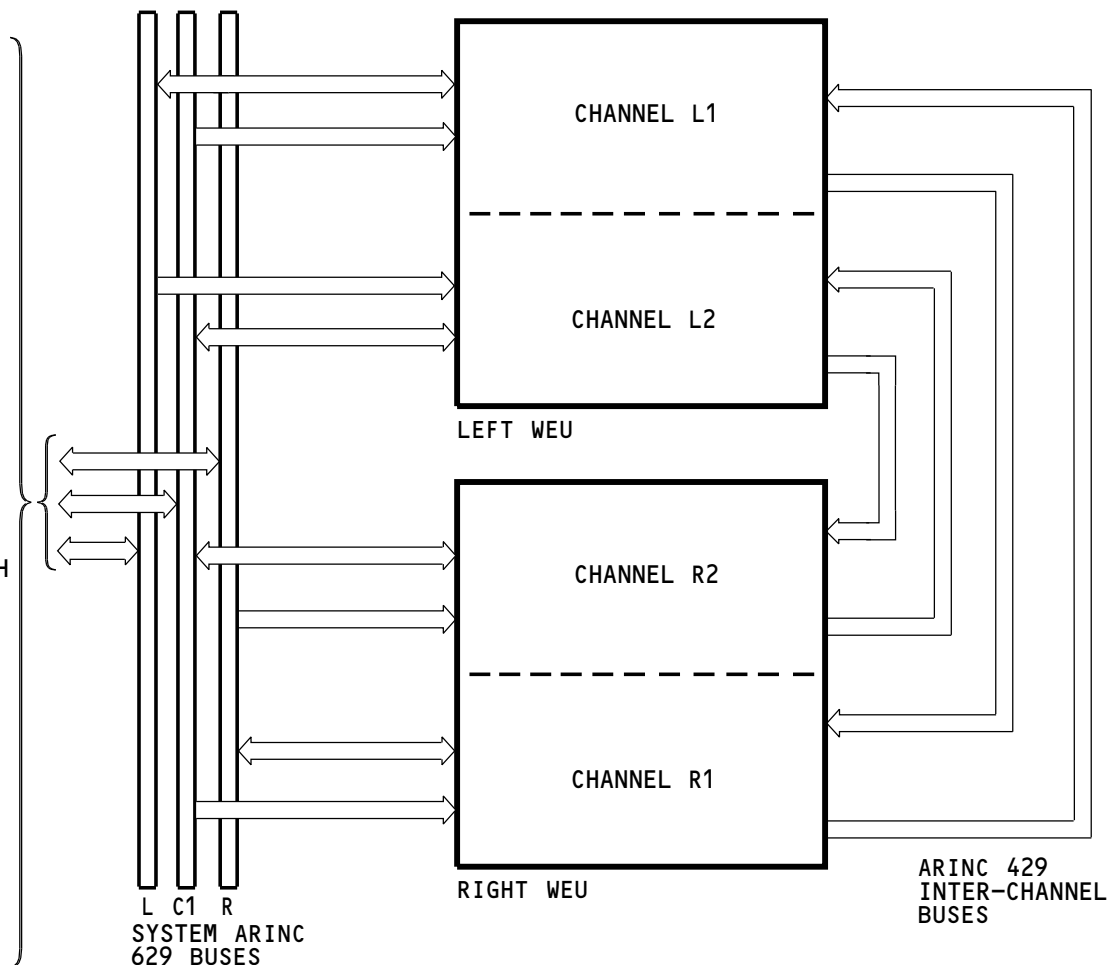
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FROM:

- ADIRU, SAARU
- AFDC L,R,C
- AIMS
- BSCU (THROUGH AIMS CABINETS)
- SYSTEM CARDFILES L,R
- FSEU L (L AND C1 BUSES ONLY)
- FSEU R (R AND C1 BUSES ONLY)
- GPWC (THROUGH AIMS CABINETS)
- MCP (THROUGH AIMS CABINETS)
- OPBC L,R (L AND R BUSES ONLY)
- PFC L,R,C (THROUGH AIMS CABINETS)
- PSEU 1,2 (L AND R BUSES ONLY)
- RA TRANSCEIVER L,C,R (THROUGH AIMS CABINETS)
- EEC L (L AND C1 BUSES ONLY)
- EEC R (R AND C1 BUSES ONLY)

TO:

- AIMS
- FSEU


ARINC 429
INTER-CHANNEL
BUSES

WES - DIGITAL INTERFACES

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WES - ANALOG INTERFACES - 1

Autopilot Disconnect

The three autopilot flight director computers (AFDCs) supply autopilot disconnect ground signals to the WEUs when the autopilot disconnects. The WEUs use these inputs to make the master warning lights come on and make a wailer aural.

Nose Gear Pressure Transducer

The nose gear pressure transducer supplies an aft or forward center of gravity (CG) signal to the WEUs. The WEUs use this input to verify stabilizer green band calculations.

Alternate Gear Down Dispatch Switch

The alternate gear down dispatch switch supplies three ground discrete signals to each WEU. When the switch is in the maximum operating speed (VMO) position, the WEUs use these signals to modify the maximum operating speed (VMO) and maximum operating mach (MMO).

Ground Proximity Gear Override Switch

The ground proximity gear override switch supplies an on/off signal to the WEUs. The WEUs use this input to inhibit the landing configuration warning siren.

Master Warning Light Interface

The left WEU makes the left master warning light come on. The right WEU makes the right master warning light come on. Each of the two channels in each WEU supplies a master warning arm signal to the opposite WEU. The master warning lights come on when at least two channels generate the master warning light on command.

Push either master warning light to send a reset ground discrete signal to the WEUs. The reset signal makes the master warning lights go out. The master warning lights also go out when the condition that made them come on goes away.

ARO 014-016

GPWC and TCAS Interface

The ground proximity warning computer (GPWC) and the traffic alert and collision avoidance system (TCAS) computer supply analog alert audio to the WEUs. The WEUs amplify and send this audio to the aural warning speakers.

ARO 001-013, 017-999

GPWC, TCAS, and PWS Interface

These systems supply analog alert audio to the WEU:

- Ground proximity warning system (GPWS)
- Traffic alert and collision avoidance system (TCAS)
- Weather radar (WXR) - For predictive windshear (PWS) alerts.

The WEUs amplify and send this audio to the aural warning speakers.

The WEUs also send a takeoff configuration arm signal to the weather radar. Weather radar uses this discrete in the logic that automatically turns on PWS during takeoff.

PWS Warning Discrete

The predictive windshear function in WXR sends a warning discrete to the WEUs. This discrete causes the master warning lights to come on when there is a PWS warning alert.

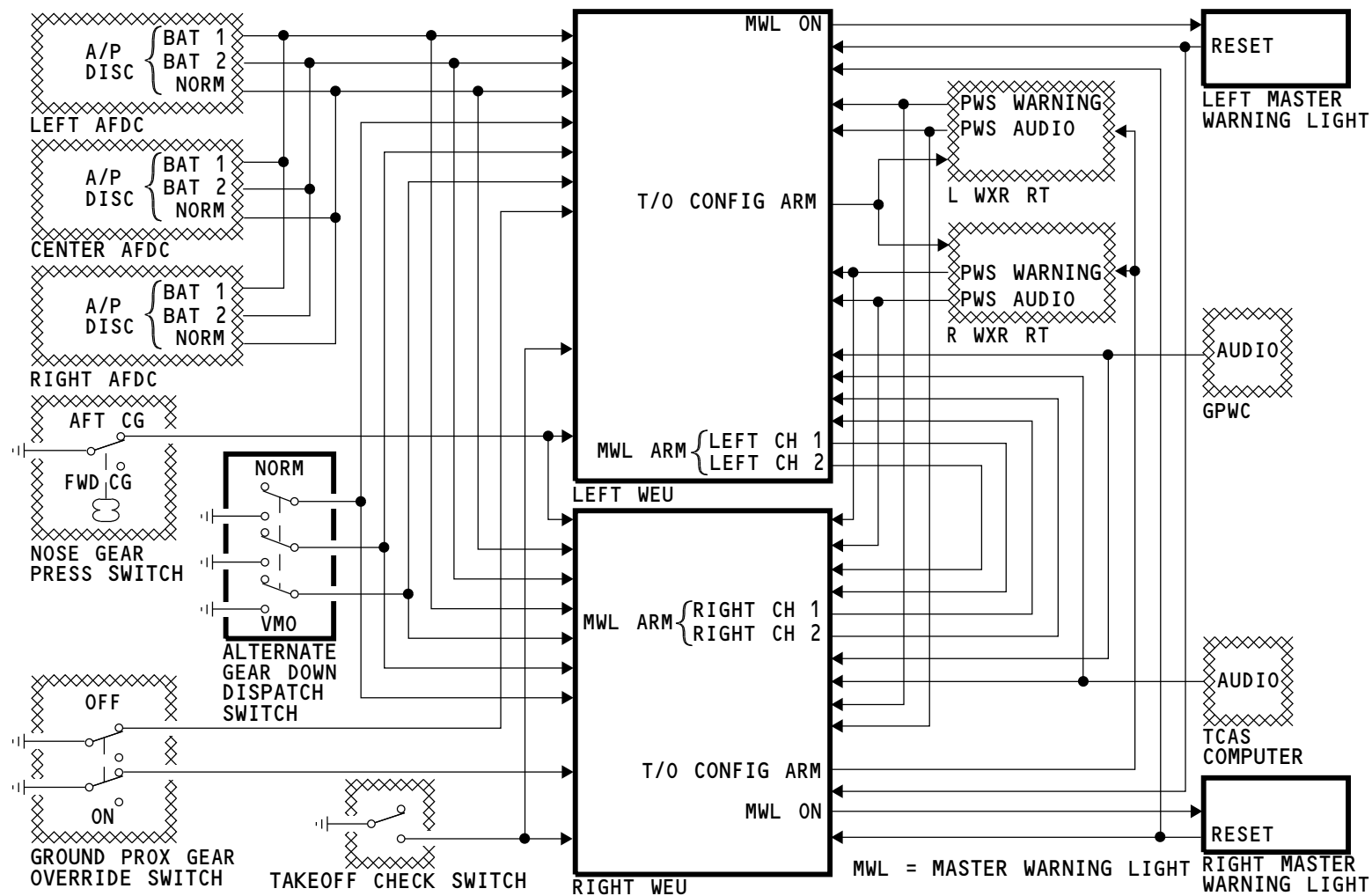
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WES - ANALOG INTERFACES - 1

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**WES - ANALOG INTERFACES - 2****Fire Warning Inputs**

The warning electronic units (WEUs) receive engine fire and APU fire signals from the engine and APU fire detection cards. The WEUs use these inputs to make a fire bell aural and to make the master warning lights come on.

Hydraulic Interface Modules Interface

The WEUs supply autoslat enable signals to the hydraulic interface modules (HYDIMs). The HYDIMs use these signals to increase available hydraulic flow for the slats.

Main Gear Steering Control Unit Interface

The main gear steering control unit (MGSCU) supplies main landing gear steering signals to the WEUs. The WEUs use these signals for takeoff configuration warning.

Stick Shaker Outputs

The stall warning function of the WEUs makes the stick shaker actuators come on when the airplane is near a stall.

Aural Warning Speaker Interface

The left WEU supplies alert aural to the left aural warning speaker. The right WEU supplies alert aural to the right aural warning speaker.

The two channels in each WEU supply an aural arm signal to the opposite WEU. An alert aural comes on when at least two channels generate the aural arm command.

The aural warning speakers send speaker monitor signals to the WEUs. The WEUs use these signals to check the speaker status.

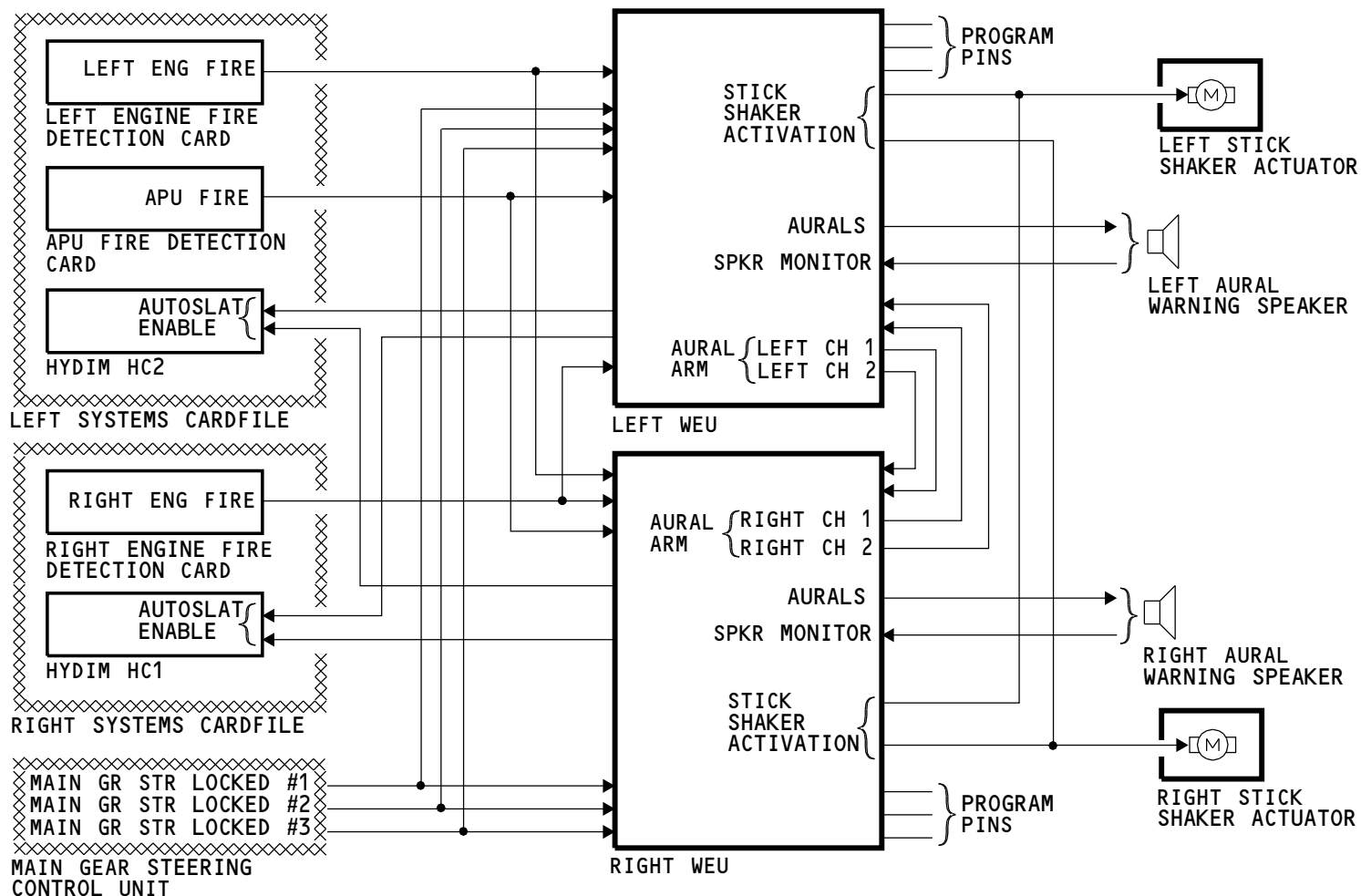
Program Pins

Each WEU has program pins. Some program pins identify each WEU (left or right). The WEUs have other program pins, but they are for flight test only.

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WES - ANALOG INTERFACES - 2

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**WES - WARNING ELECTRONIC UNIT****Purpose**

The warning electronic unit (WEU) receives inputs from various systems. The WEU uses these inputs to show warning and alert indications to the flight crew.

WEU Channels

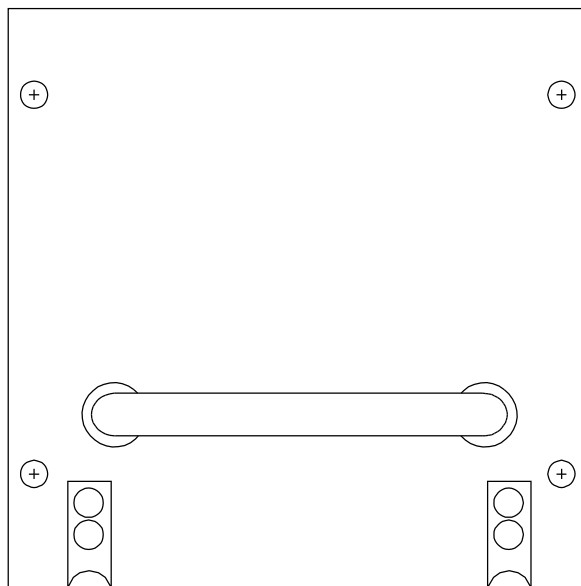
Each WEU has two channels that:

- Make alert aural
- Do airplane configuration warning
- Do stall warning computations
- Process crew alerting signals.

The WEUs send data to each other. The WEU supplies warning and alerting outputs only when at least two out of the four channels make an output.

Software Loading

The WEUs must have software loaded in them. You use the maintenance access terminal (MAT) to load software into the WEUs.



WES - WARNING ELECTRONIC UNIT

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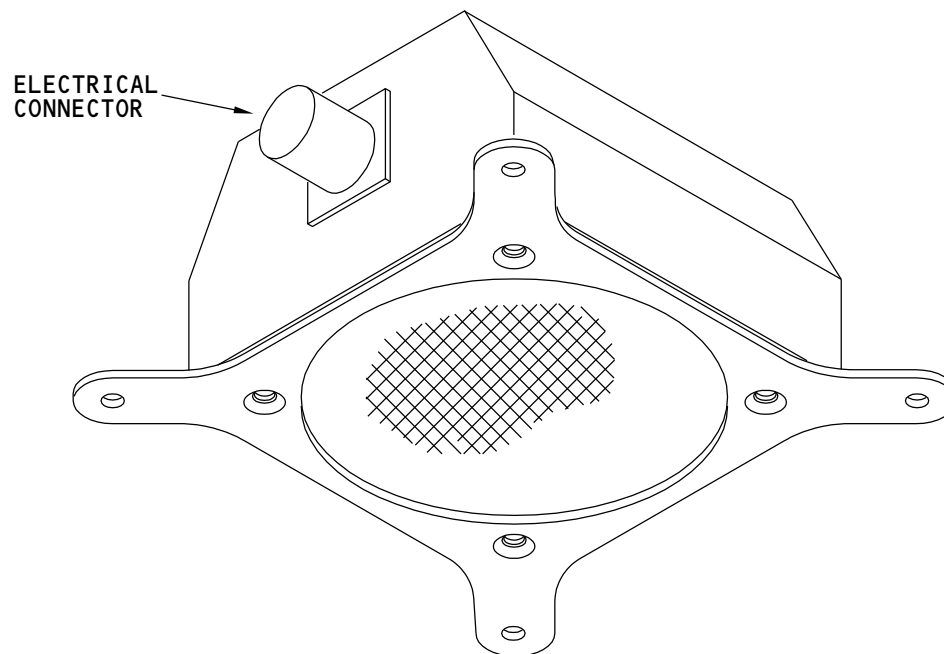
**WES - AURAL WARNING SPEAKER****General**

The aural warning speakers supply alert aural signals to the flight crew.

There are two aural warning speakers. Each speaker gets 28v dc. The 28v dc energizes an amplifier in the speaker.

Each aural warning speaker supplies a speaker monitor signal to its WEU.

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WES - AURAL WARNING SPEAKER

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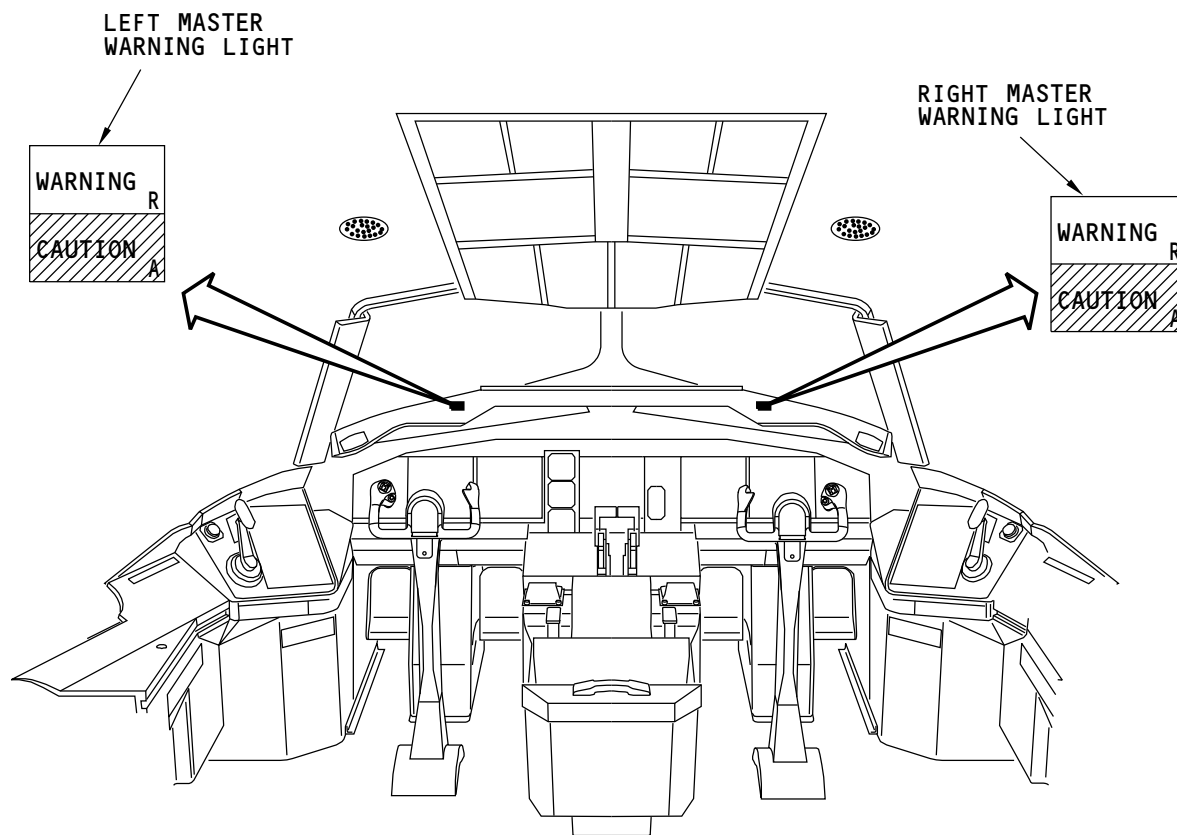
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**WES - MASTER WARNING LIGHTS****General**

The master warning lights come on when the WEU sends a ground signal.
The warning lights come on if there is a warning condition.

The master warning lights go out when the warning condition goes out, or
when the flight crew pushes the lights.



WES - MASTER WARNING LIGHTS

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**WES - SPEEDBRAKE LEVER, STABILIZER POSITION INDICATOR, FLAP LEVER****General**

The speedbrake lever, stabilizer position indicator, and flap lever are not WES components. However, they are critical for WES operation.

Speedbrake Lever

The speedbrake lever moves the speed brakes.

Stabilizer Position Indicator

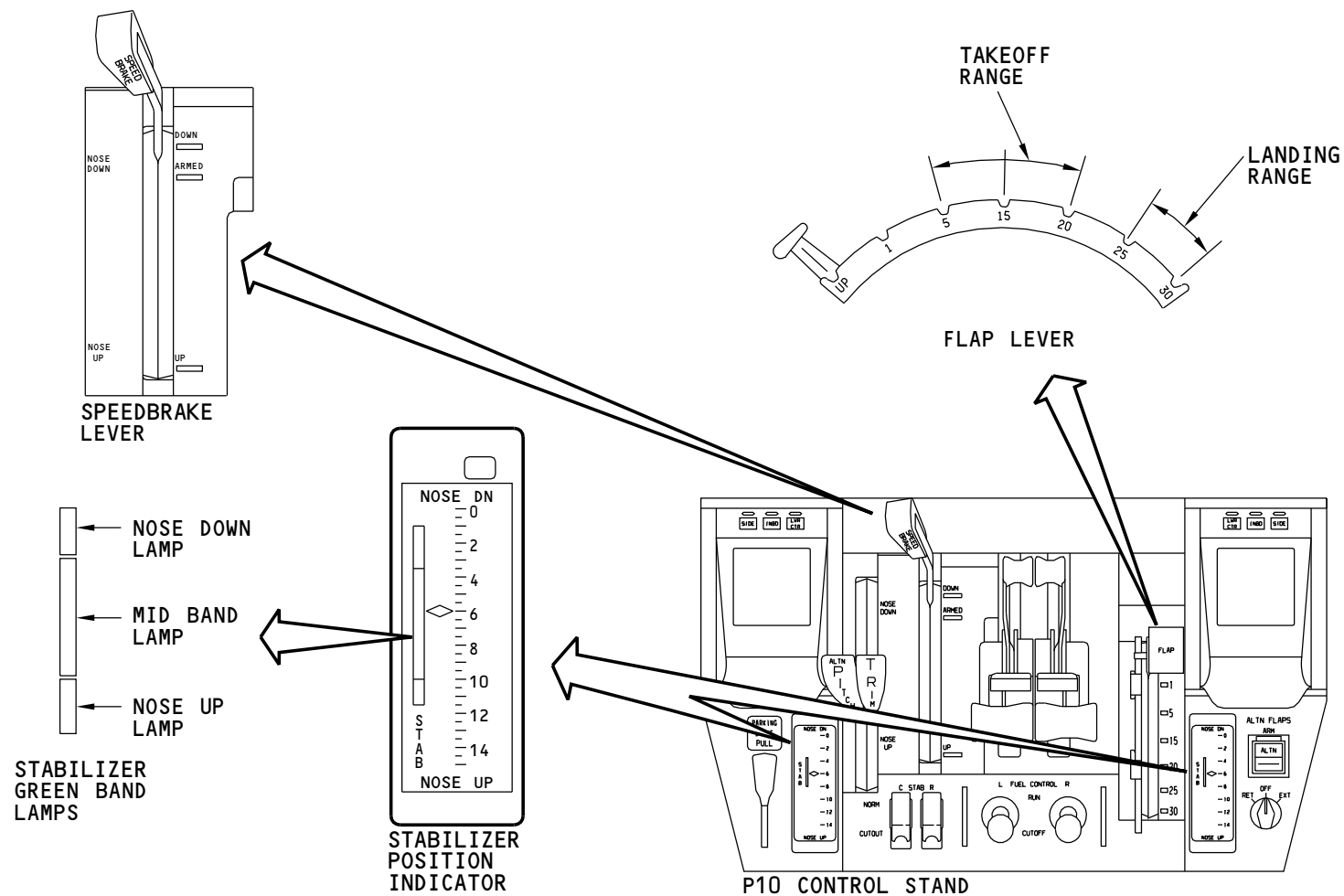
The stabilizer position indicators show the horizontal stabilizer position. Each indicator has three stabilizer green band lamps:

- Nose down
- Mid band
- Nose up.

The stabilizer green band lamps show the correct horizontal stabilizer position range for takeoff. The WEUs makes the stabilizer green band lamps come on.

Flap Lever

The flap lever sets the trailing edge and the leading edge devices position.



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WES - SPEEDBRAKE LEVER, STABILIZER POSITION INDICATOR, FLAP LEVER

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**WES - STICK SHAKER ACTUATOR****General**

The stick shaker actuators are dc motors that shake the control columns when the airplane is near a stall condition.

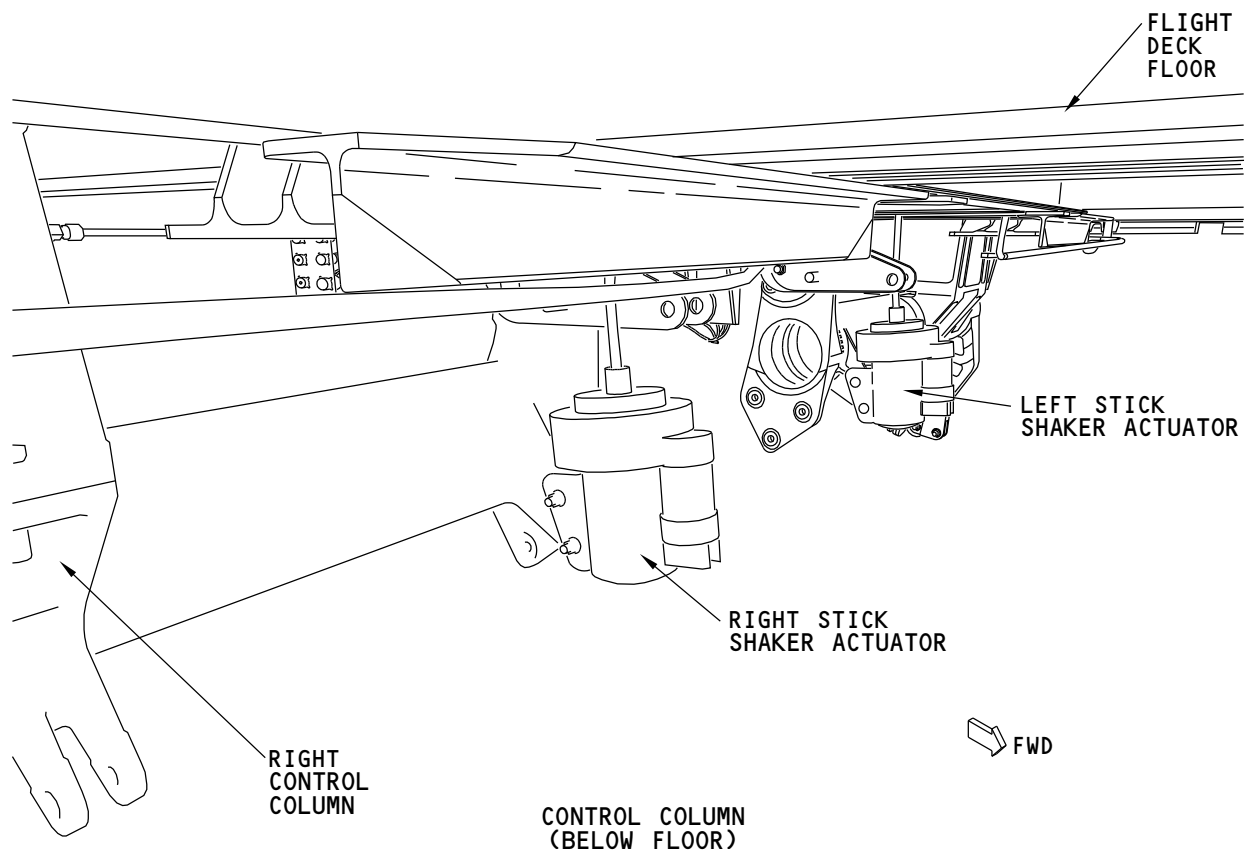
The WEUs control the stick shaker actuators.

There are two stick shaker actuators, one below each control column.

Access

Access to the stick shaker actuators is from the forward equipment center.

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WES - STICK SHAKER ACTUATOR

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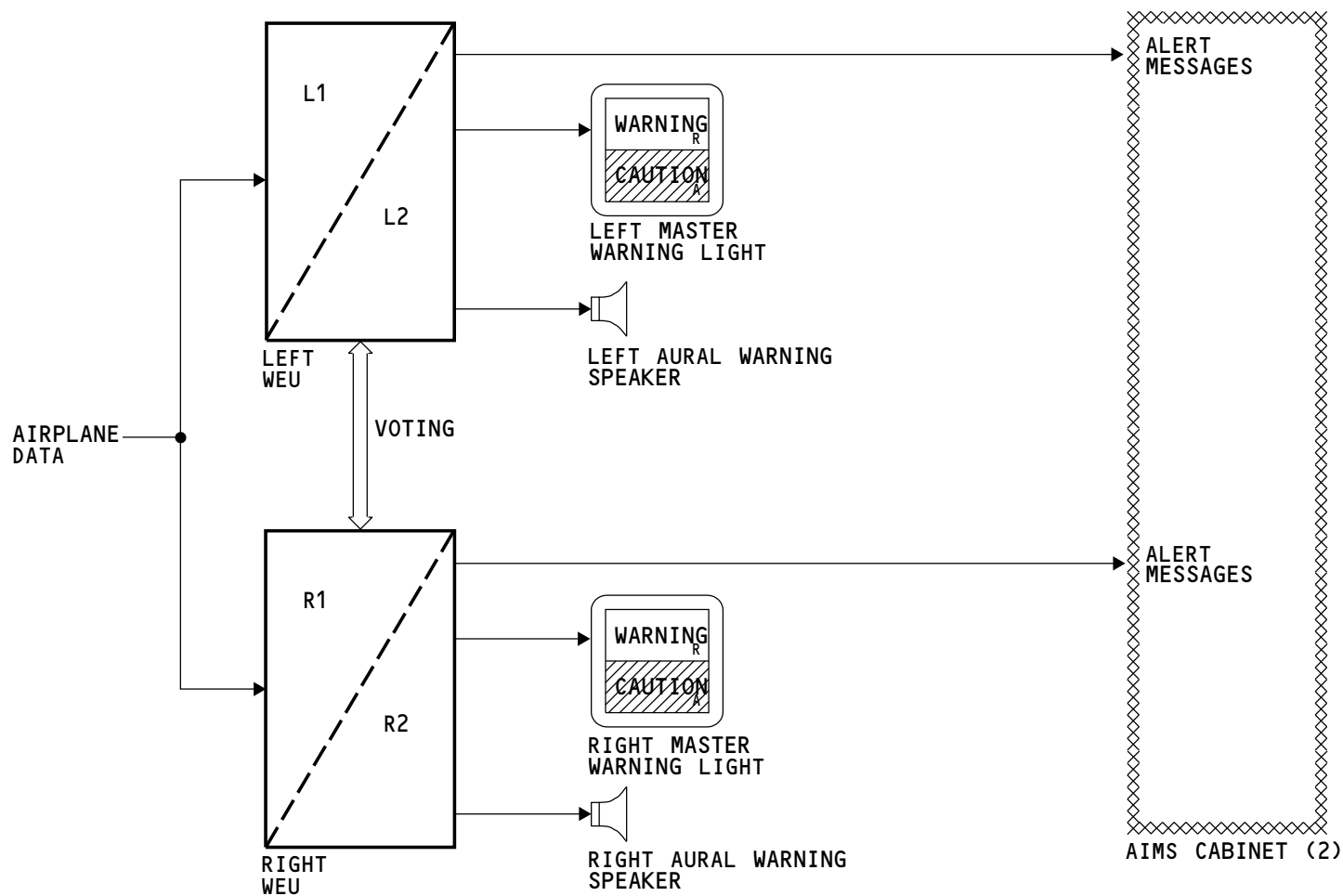
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**WES - INTERNALLY GENERATED WARNING AND ALERTS****Warning and Alerts**

The WEUs receive airplane data to internally calculate and generate warnings and alerts. The four WEU channels vote to produce an alert or a warning. When any 2 out of the 4 channels make the same calculation, the WEUs make a warning or an alert.

These are the indications for warnings and alerts:

- Alert message requests to the AIMS cabinets. The AIMS uses the requests to show alert messages
- Master warning lights on
- Alert aural.



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WES - INTERNALLY GENERATED WARNING AND ALERTS

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**WES - EXTERNALLY GENERATED WARNING AND ALERTS****Warning and Alerts**

The WEUs receive warning and alert requests from airplane systems. In this case, the WEUs do not calculate an alert or a warning. The four WEU channels only vote to produce the alert or warning. When any 2 out of the 4 channels sense the same request, the WEUs make a warning or an alert.

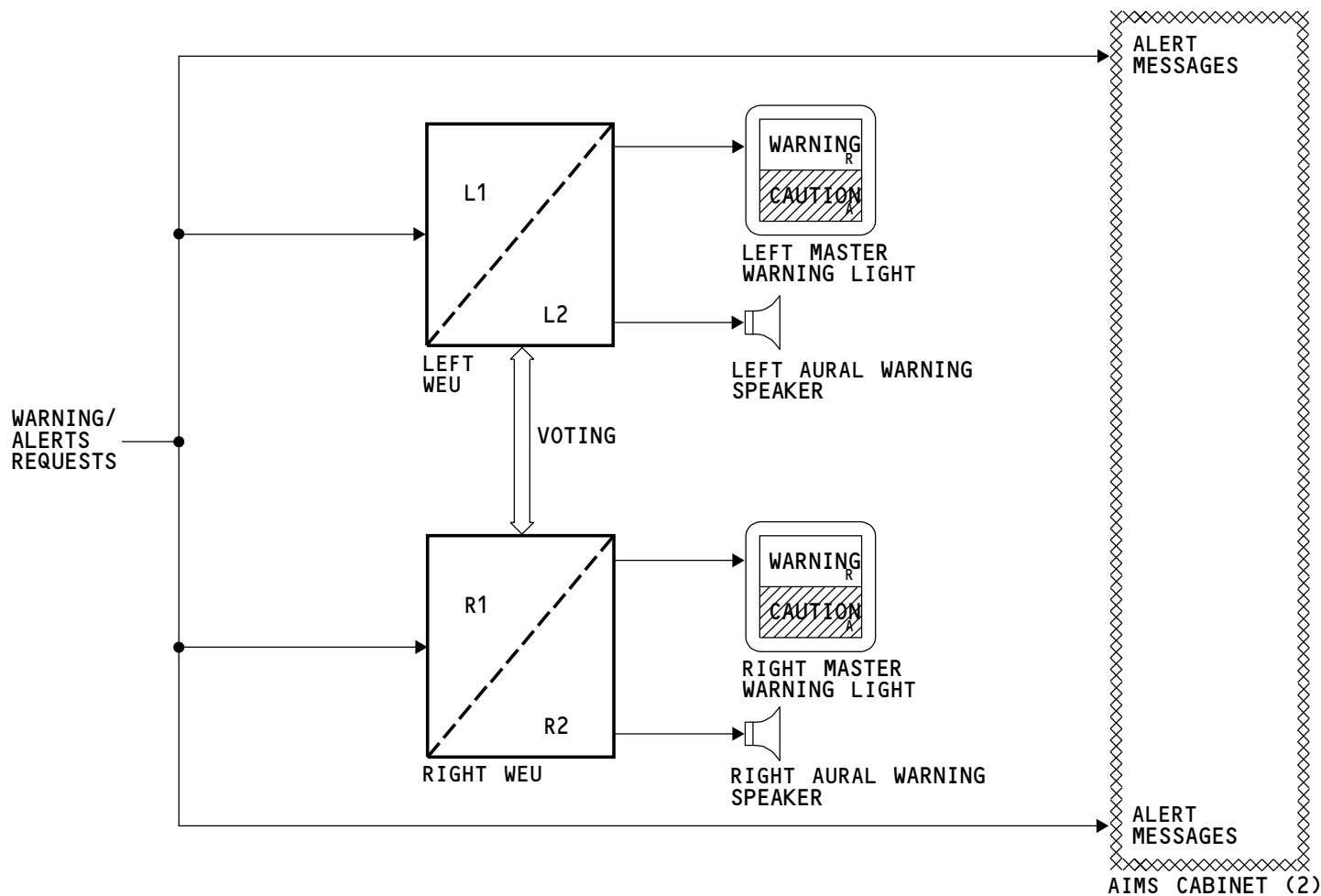
These are the indications for warnings and alerts:

- Master warning lights on
- Alert aural.

AIMS

The airplane systems also send warning and alert requests to the AIMS cabinets. The AIMS uses the requests to show alert messages.

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WES - EXTERNALLY GENERATED WARNING AND ALERTS

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WES - STICK SHAKER ACTUATION

General

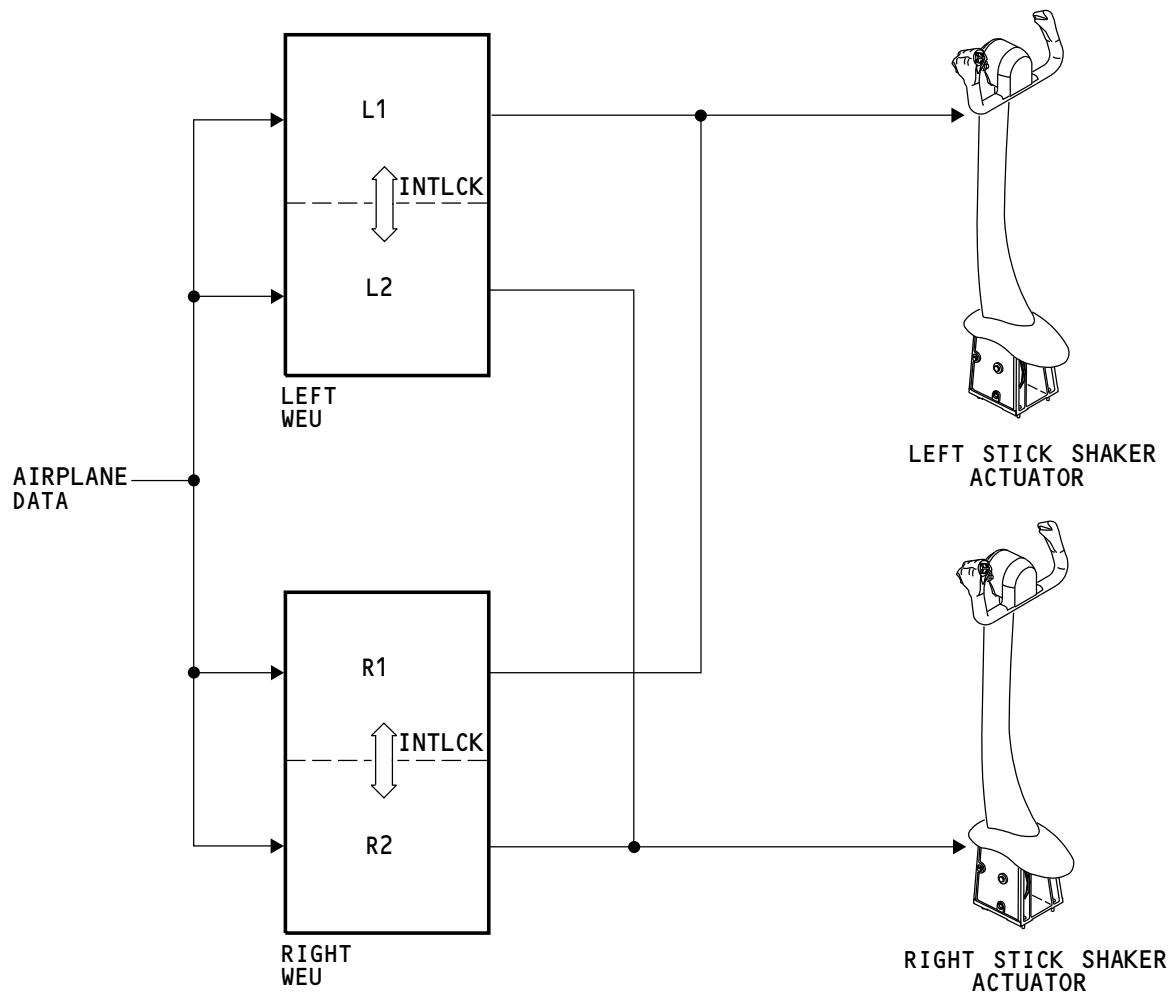
Each WEU channel independently calculates stick shaker actuator signals when the airplane is near a stall.

Interlocks

The stick shaker actuators come on only when the two channels inside a WEU produce a stick shaker actuation signal.

Any WEU can turn on both stick shaker actuators.

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WES - STICK SHAKER ACTUATION

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WES - TAKEOFF WARNING INHIBIT**Purpose and Operation**

The takeoff warning inhibit prevents flight crew distractions during takeoff. The takeoff warning inhibit prevents some warning indications and some alert indications.

All channels in each WEU calculate the takeoff warning inhibit.

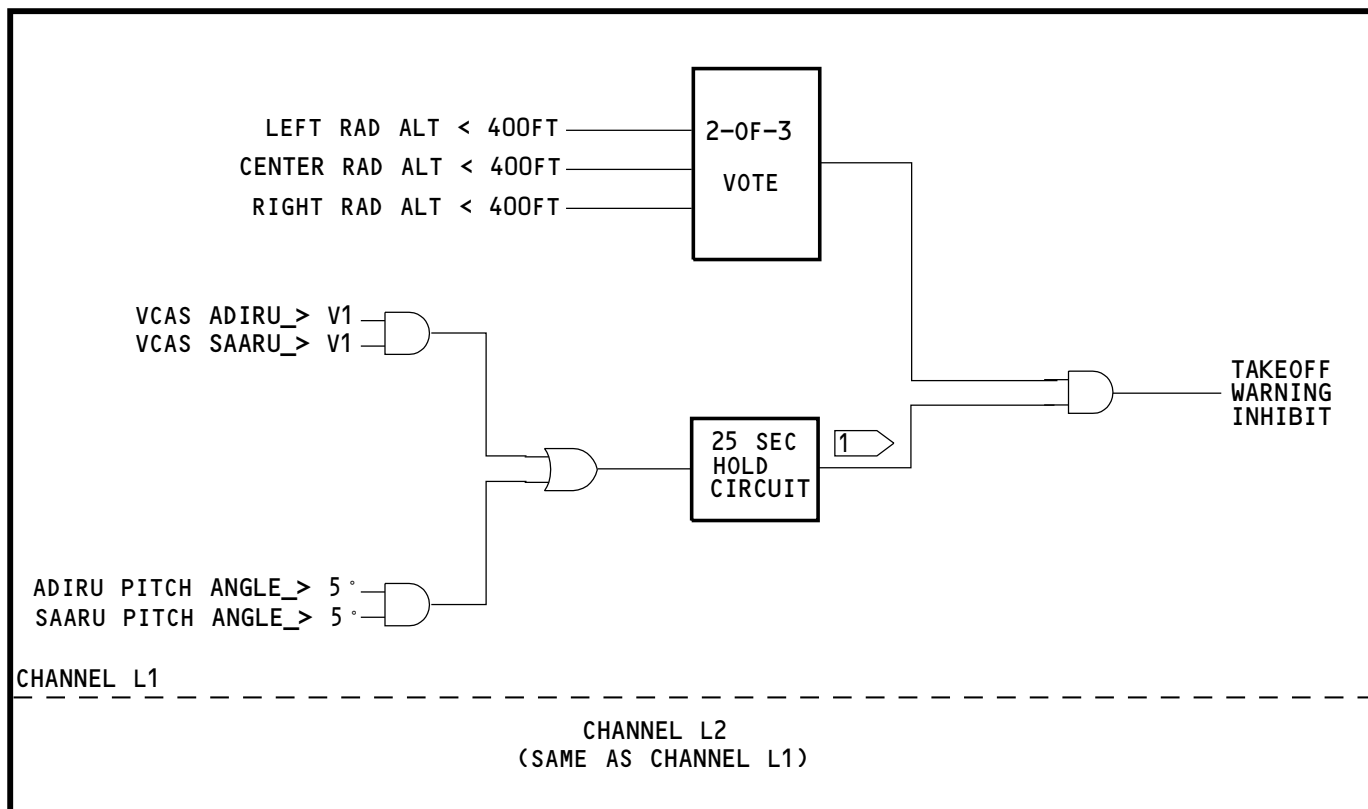
The takeoff warning inhibit starts when computed airspeed (VCAS) goes to the decision speed (V1), or pitch angle is 5 degrees or more.

The takeoff warning inhibit stops when the radio altitude goes above 400 feet, or 25 seconds after either the pitch angle was 5 degrees or the airplane reaches V1.

Warnings and Alerts Prevented

The takeoff warning inhibit prevents these warnings and alerts:

- Cabin pressure
- Fire warning
- Altitude alert
- Overspeed
- Crew alertness monitor



1

WHEN THE INPUT GOES FROM LOW TO HIGH,
THE OUTPUT GOES HIGH FOR 25 SECONDS.
THE OUTPUT THEN GOES LOW.

WES - TAKEOFF WARNING INHIBIT

M41756 S000618222_V1

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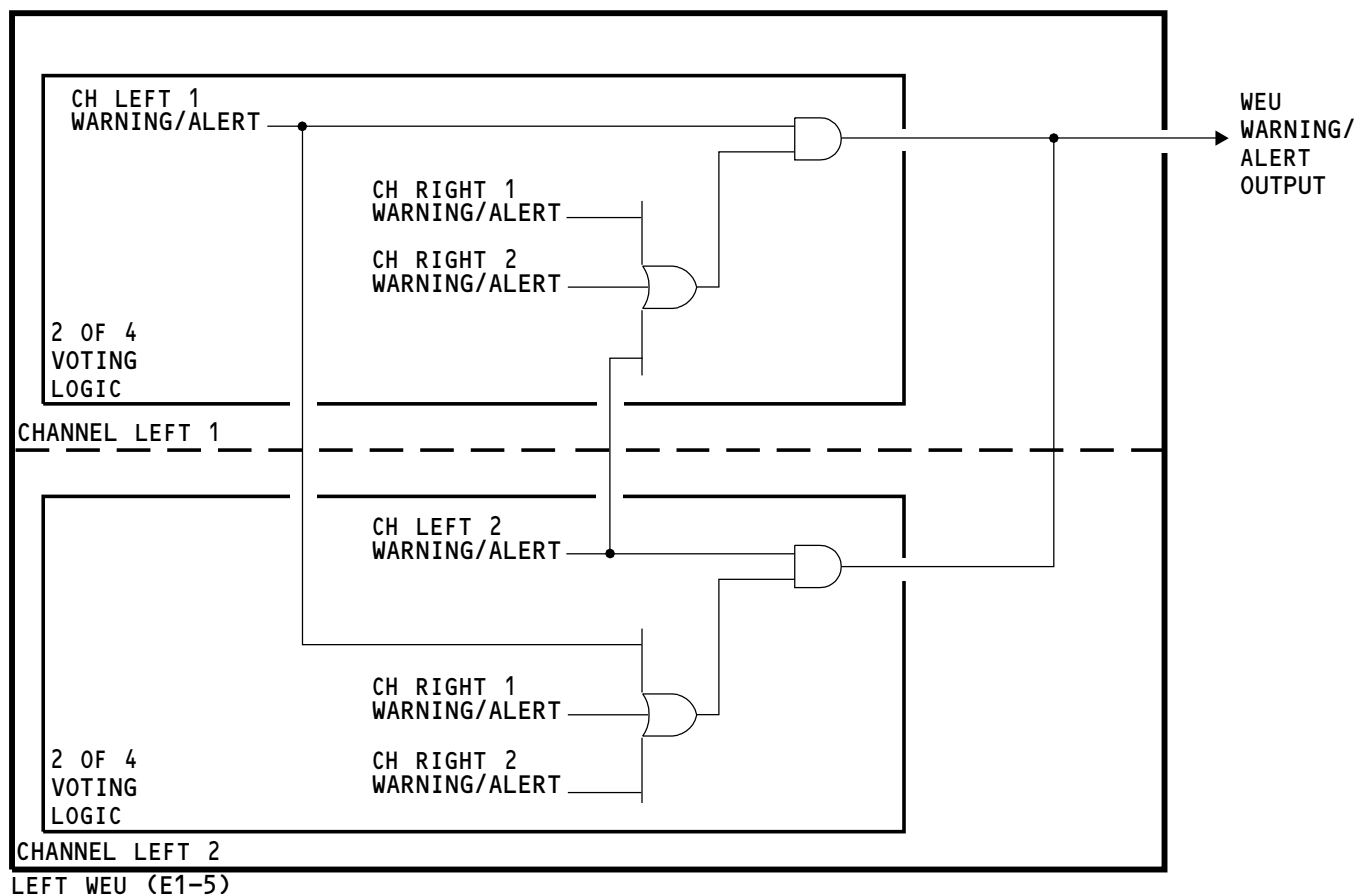
**WES - WARNING/ALERT VOTING LOGIC****General**

Each warning electronic unit (WEU) channel has 2 of 4 voting logic.

Before a WEU gives a warning or an alert output, the 2 of 4 voting logic makes sure that at least two channels give the same output. This prevents warning electronics system errors.

For example: If channel left 1 (L1) detects a fire warning condition, it will not make a warning alert output (master warning lights on and firebell aural on), until at least one other channel detects the same condition.

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WES - WARNING/ALERT VOTING LOGIC

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WES - ALERT AURAL GENERATION

Alert Aurals

The aural synthesizer control function of the WEU gives and amplifies alert aurals. The alert aurals are, in order of priority:

- Wailer
- Siren
- Fire bell
- Caution
- Chime
- C-chord.

Wailer

The WEUs give a wailer aural when the autopilot disconnects. The wailer is a sound that has a constant amplitude. Its frequency increases linearly from 125 Hz to 325 Hz with a period repetition of 400 msec.

Siren

For all EICAS warning messages, except fire and autopilot disconnect, the WEUs give the siren aural. The siren is a sound that alternates between 250 Hz and 950 Hz.

Fire Bell

The WEUs give the fire bell aural when there is a fire. The fire bell is a bell sound that is on for 1 second and off for 9.5 seconds plus or minus 0.5 seconds.

Caution

The WEUs give the caution aural when there is an EICAS caution message. The caution is four tones one after the other. Each tone is 160 msec long. Each tone has a constant amplitude and a frequency that varies from 20 Hz to 950 Hz.

Chime

The WEUs give a high/low chime when there is a call to the flight deck, or when a comm low or medium message shows. The high/low chime is two tones one after the other. The first tone is 1160 Hz with an amplitude that goes down with time. The second tone is 580 Hz with an amplitude that goes down with time.

C-Chord

The WEUs give a C-chord aural when the airplane approaches the autopilot mode control panel (MCP) selected altitude. The C-chord consists of three equal amplitude sine waves at the same time for 1.5 seconds. The frequencies of the sine waves are:

- 520 Hz
- 640 Hz
- 760 Hz.

ARO 014-016

GPWS and TCAS

The WEUs do not make the GPWS and the TCAS alert aurals. The GPWS and the TCAS supply analog alert aurals to the WEUs. The WEUs amplify the GPWS and TCAS alert aurals. The GPWS and TCAS alert aurals have no priority. They go on top of other WEU alert aurals.

**WES - ALERT AURAL GENERATION**

ARO 001-013, 017-999

GPWS, PWS and TCAS

The WEUs do not make the GPWS, PWS, and TCAS alert aural. The GPWS, PWS, and TCAS supply analog alert aural to the WEUs. The WEUs amplify these alert aural. The GPWS, PWS, and TCAS alert aural have no priority. They go on top of other WEU alert aural.

ARO ALL**Alert Aural Logic**

Each channel in each WEU makes the same alert aural.

The alert aural logic makes alert aural requests. The requests are part of the warning and alert conditions for the WEUs.

When the alert aural logic makes an alert aural request, it also makes an aural arm signal. This signal goes to the other three WEU channels. The aural arm signal also permits the WEU channel to make alert aural.

Alert Aural Priority Logic

The alert aural priority logic receives alert aural requests from the alert aural logic.

If there is more than one alert aural request at a time, the alert aural priority logic decides which alert aural has the higher priority.

Only the higher priority alert aural request goes through the alert aural priority logic.

Two of Four Vote

The alert aural requests go to the aural synthesizer only when at least one other WEU channel supplies an aural arm signal.

Aural Synthesizer

The aural synthesizer makes the alert aural. Gain control circuits set the aural synthesizer audio gain.

TCAS and GPWS Aural

Each WEU mixes traffic alert and collision avoidance system (TCAS) and ground proximity warning system (GPWS) alert aural with all other aural.

Opposite Channel Aural, and Aural Warning Speaker Interface

Only channel 1 on each WEU has a direct connection to the aural warning speakers. The left WEU connects to the left aural warning speaker, and the right WEU connects to the right aural warning speaker. Channel 2 on each WEU supplies alert aural to channel 1.

The aural warning speakers supply audio feedback signals to the WEUs. The WEUs use these signals to check speaker operation.

Test Tone

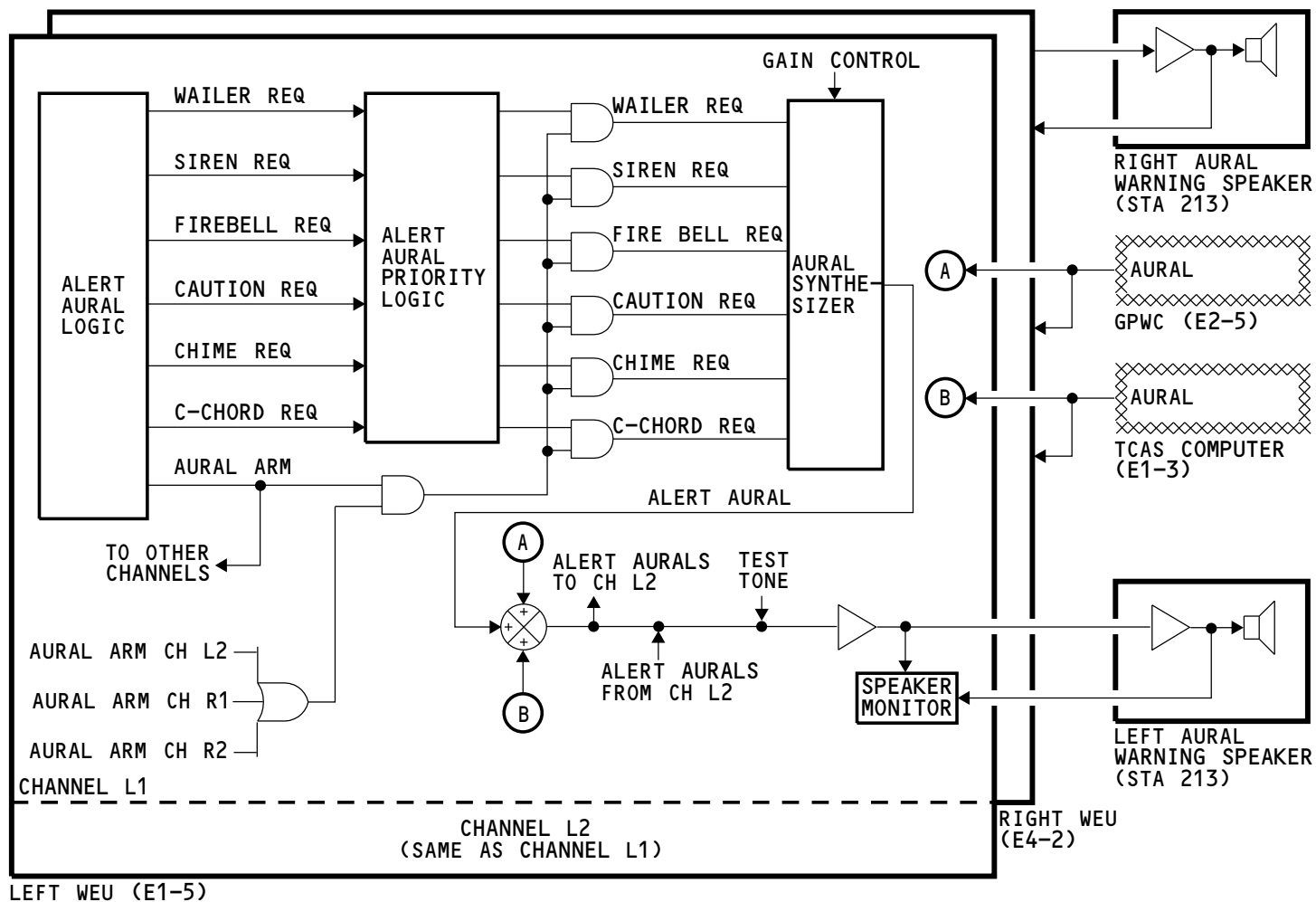
Each WEU channel makes a test tone during a WES system test.

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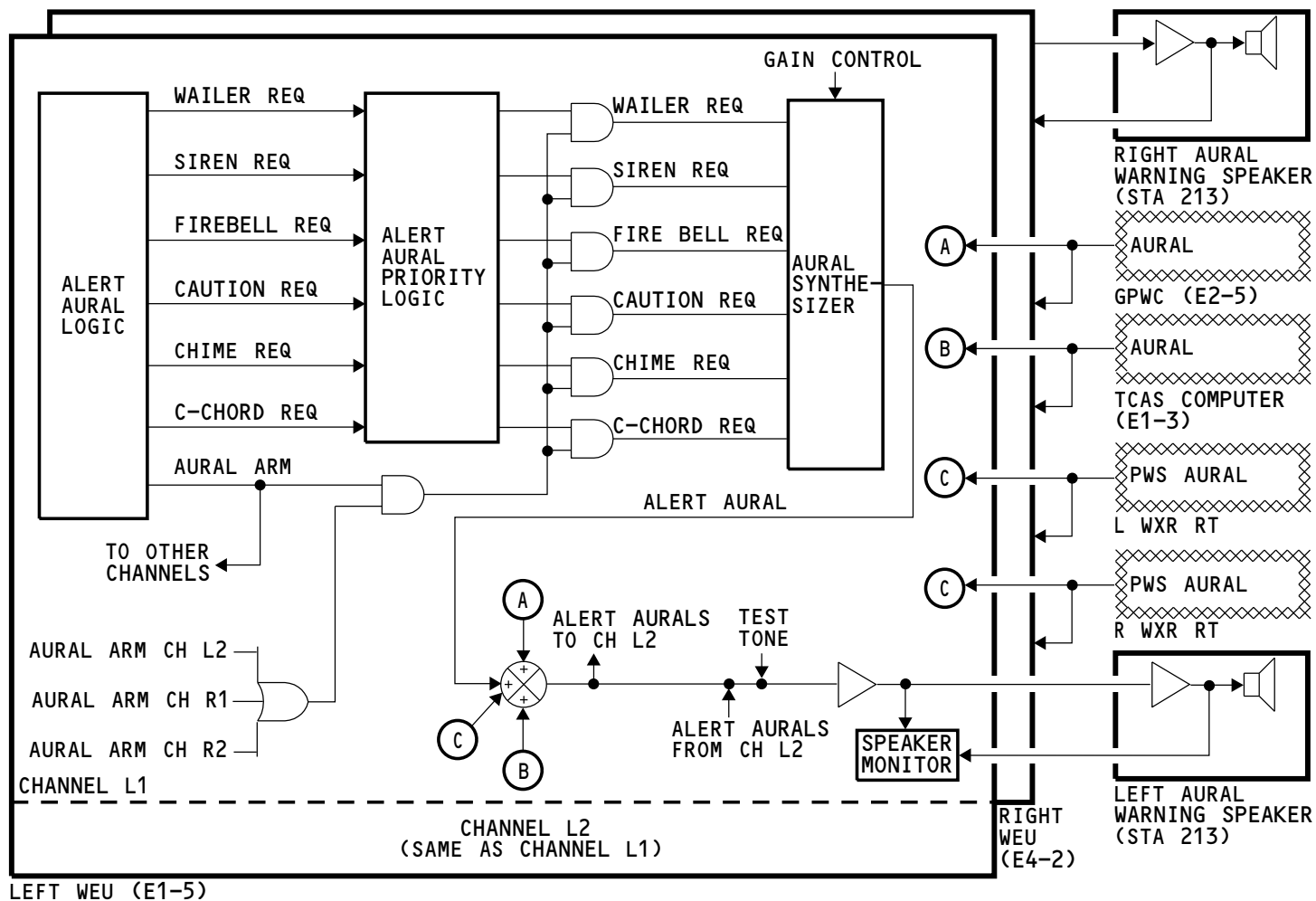
WES - ALERT AURAL GENERATION

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WES - ALERT AURAL GENERATION

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WES - AUDIO GAIN CONTROL**Audio Gain Levels**

The WEUs set the audio output gain automatically. The audio gain range is from -6dbr to +6dbr from the reference value of 0dbr. The Odbr value is different for the various aural sounds the WEUs make.

Automatic Gain Control (AGC)

The WEUs control the audio output gain based on:

- Flap and leading edge devices position
- Landing gear position
- Takeoff configuration warning enable. The WEUs make this enable signal when the conditions are good for a takeoff
- Takeoff warning inhibit
- Takeoff thrust
- Computed airspeed (Vcas)
- Landing mode. The WEUs make the landing mode signal when the flaps or leading edge devices are in landing position, the radio altitude is 800ft or less, and the computed airspeed is 80 knots or more
- Fuel control switch position
- Cabin pressure warning.

Manual Gain Control

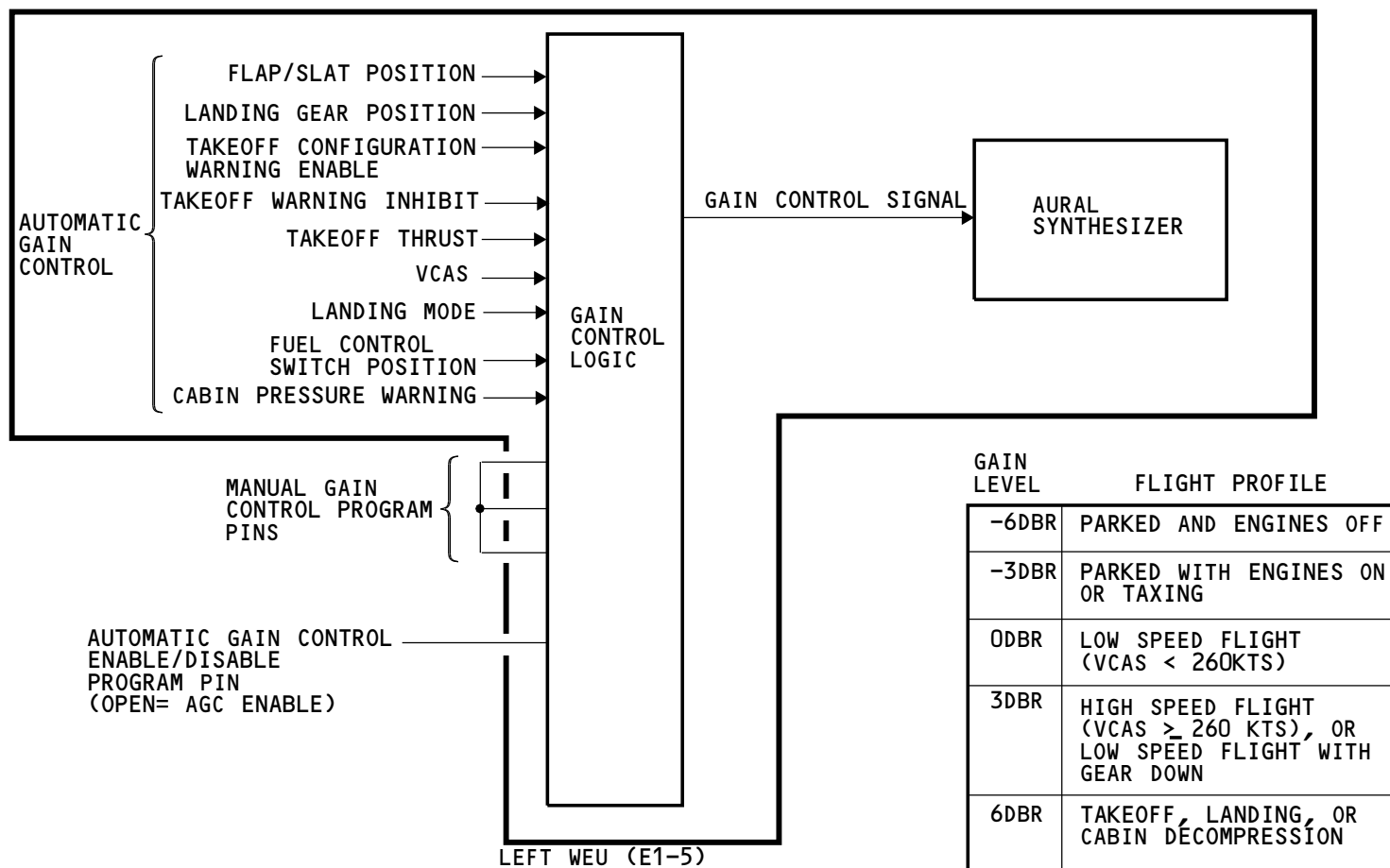
Shop personnel use the manual gain control program pins to set the audio output gain manually.

An AGC enable/disable program pin sets manual or automatic gain control for the WEUs. If you leave the pin open, the WEU uses AGC control. If you ground the pin the WEU uses manual gain control.

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WES - AUDIO GAIN CONTROL

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**WES - MASTER WARNING LIGHTS ACTIVATION****General**

The left WEU connects to the left master warning light (MWL). The right WEU connects to the right master warning light.

Each WEU channel makes a MWL arm signal. A WEU channel must receive at least one MWL arm signal from another WEU channel before it makes the MWL activation signal.

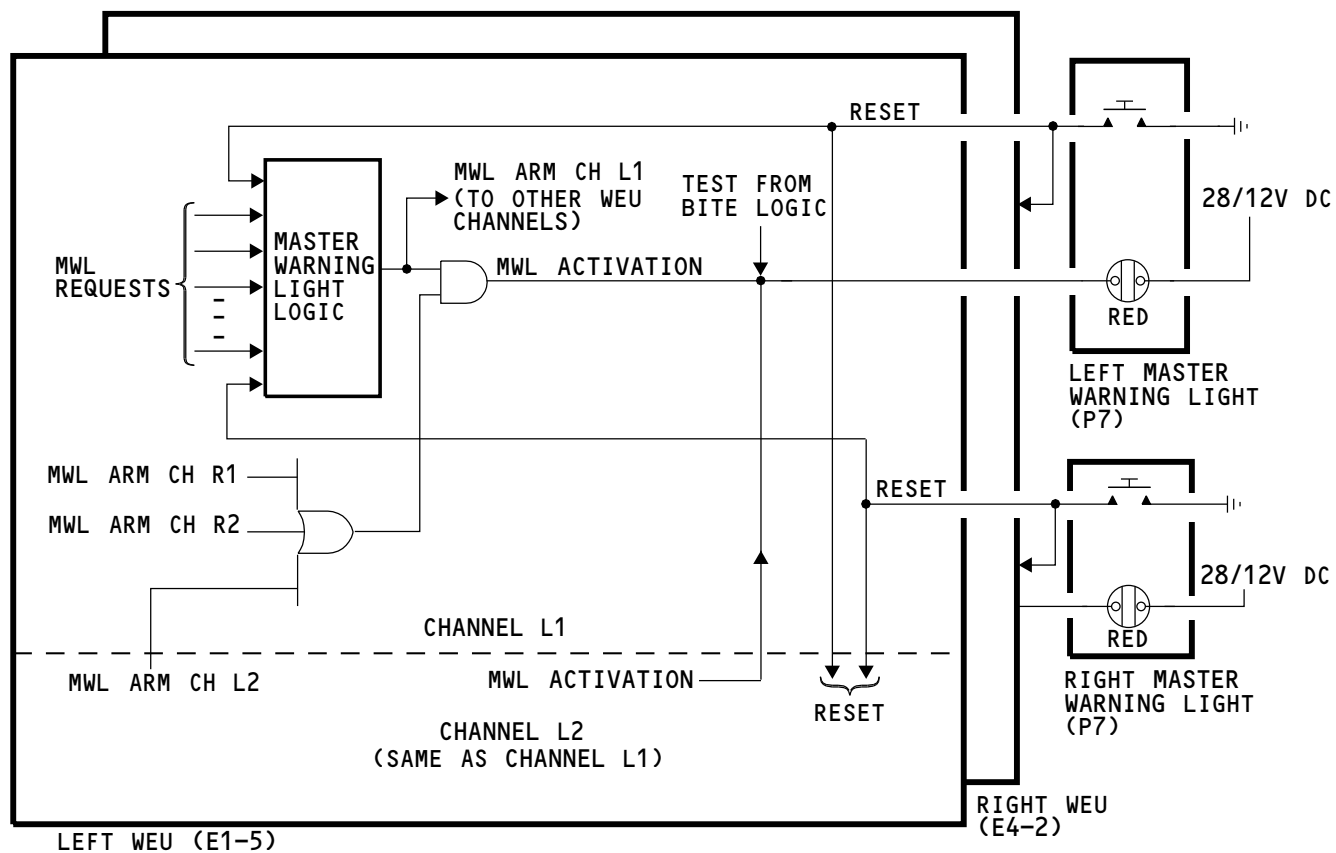
The MWL activation signal makes the master warning lights come on.

Push the master warning lights to supply a reset signal to the WEUs. The reset signals make the master warning lights go out. If there is another warning condition, the master warning lights come on again.

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MWL = MASTER WARNING LIGHT

WES - MASTER WARNING LIGHTS ACTIVATION

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WES - FIRE WARNING**Fire Warning Inputs**

The fire warning logic gets fire warning inputs from the system cardfiles. These cards supply fire warning inputs to the WEUs:

- Left engine fire detection card
- Right engine fire detection card
- APU fire detection card
- Left and right ARINC signal gateway (ASG) cards.

Each WEU channel inhibits fire warnings when the airplane is in takeoff.

The alert aural logic makes the fire bell alert aural. The master warning light logic makes the master warning lights (MWLs) come on.

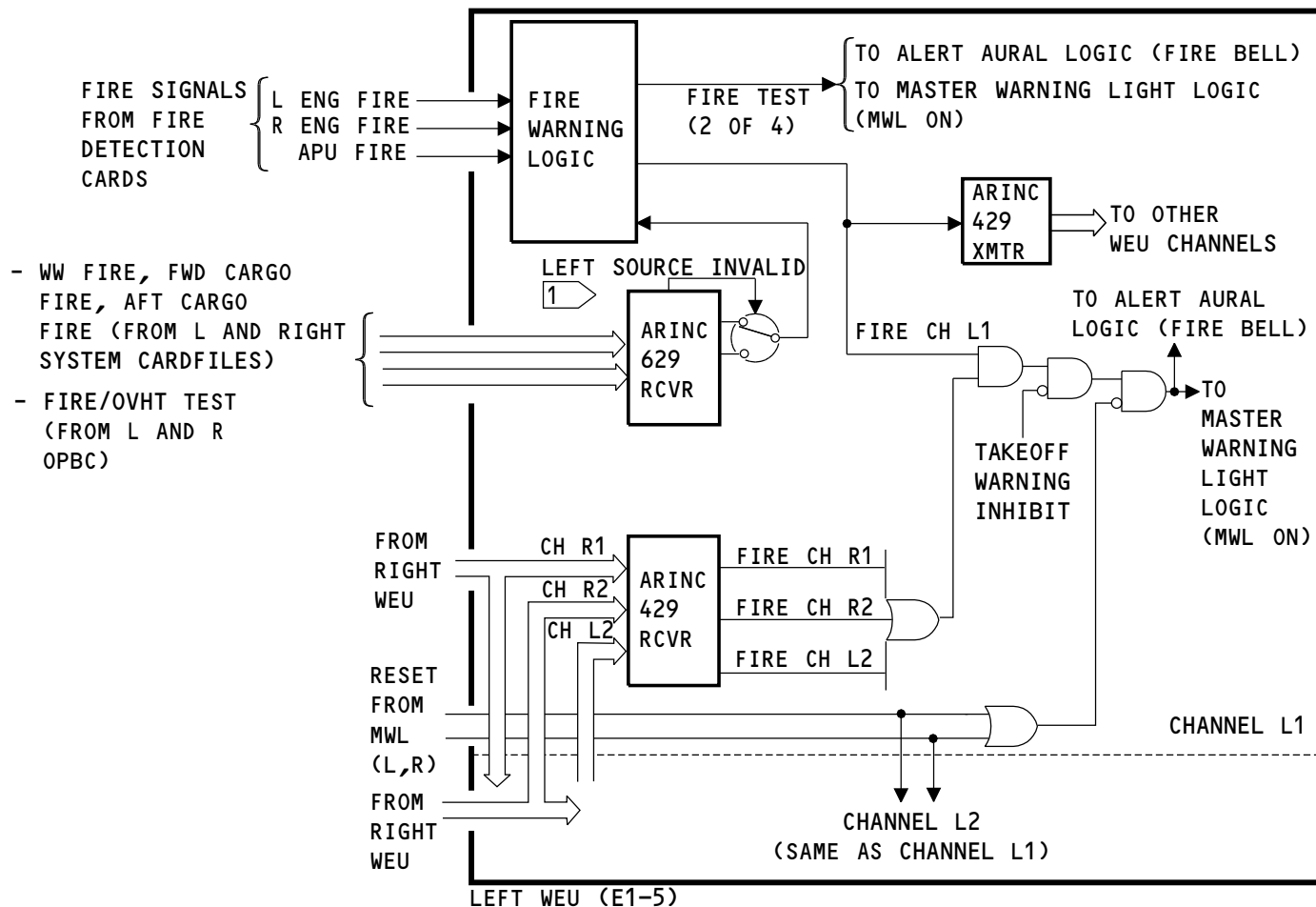
Push any master warning light to make the master warning lights and the fire bell go out.

Fire Test

When you do a fire warning test, the fire warning logic ignores fire warning inputs.

The fire warning logic makes a fire test signal. The fire warning logic makes the fire test signal only when at least one other WEU channel makes the same signal (2 of 4 vote).

The fire warning logic sends the fire test signal to the alert aural logic to make the fire bell and to the master warning light logic to make the master warning lights come on.



1 THE WEU PERFORMS THE DATA SOURCE SELECTION FROM TWO (2) ARINC 629 BUSES, IF THE DATA FROM THE LEFT SYSTEM SOURCE IS INVALID, THEN THE WEU WILL USE DATA FROM THE RIGHT SYSTEM SOURCE.

WES - FIRE WARNING

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**WES - AUTOPILOT DISCONNECT WARNING****General**

The autopilot flight director computers (AFDCs) supply autopilot disconnect discrete signals to the WEUs when the autopilot disconnects.

If at least two autopilot disconnect discrete signals show, the WEUs give an autopilot disconnect warning.

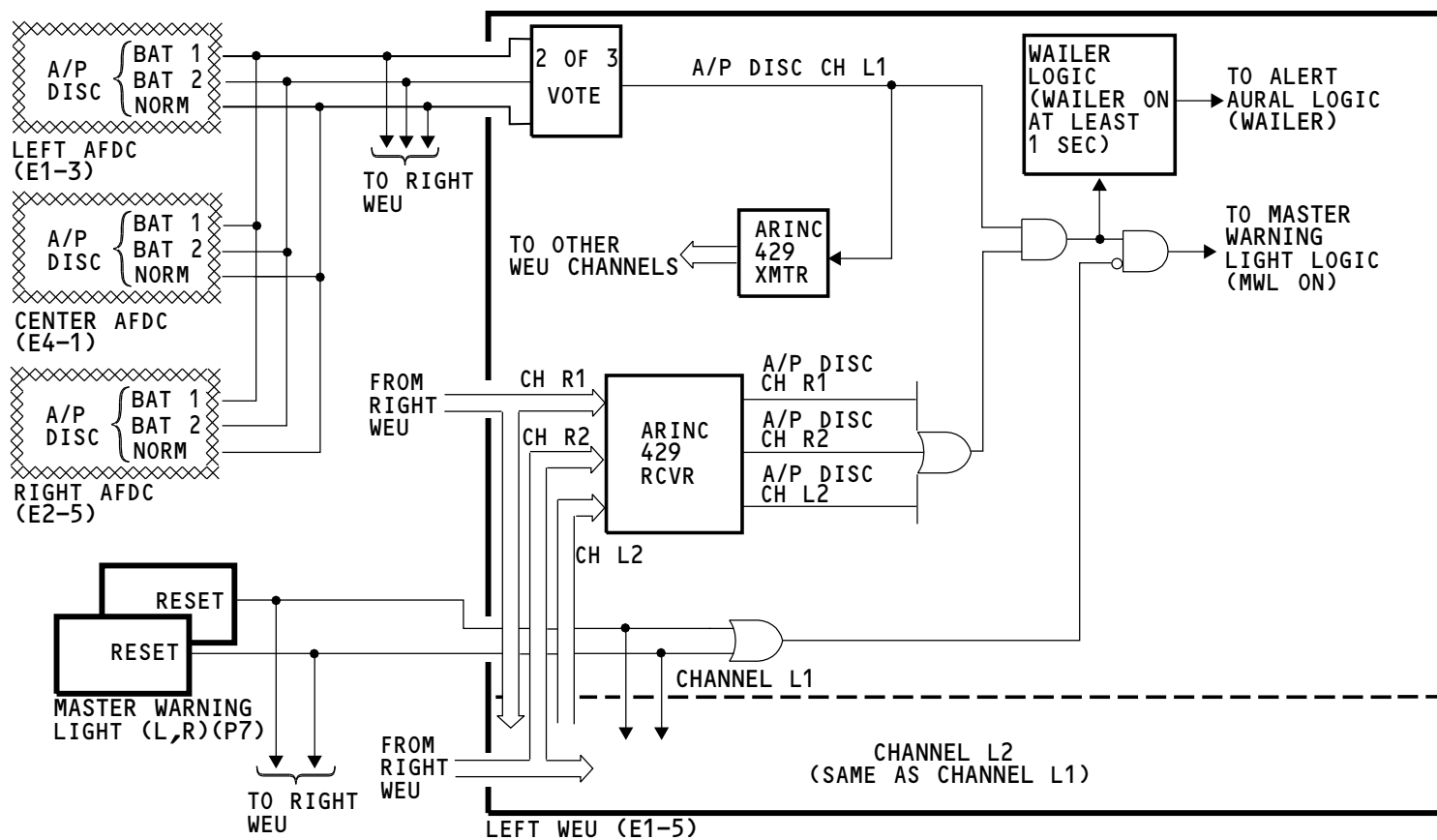
Before a WEU channel gives an autopilot disconnect warning, at least one other WEU channel must give the same warning.

The wailer logic sends a request to the aural alert logic. This is to make the wailer come on for at least one second anytime the autopilot disconnects. If the pilot pushes the autopilot disconnect switch twice before one second passes, the wailer still must continue for the remainder of the second. This is to let the pilot know the autopilot disconnected.

The aural alert logic gives the wailer alert aural. The master warning light logic makes the warning lights (MWLs) come on.

Push any master warning light to make the master warning lights go out. The wailer continues until the autopilot disconnect signals clear.

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WES - AUTOPILOT DISCONNECT WARNING

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**WES - OVERSPEED WARNING****General**

The stall warning function of the WEUs makes the overspeed warning signal.

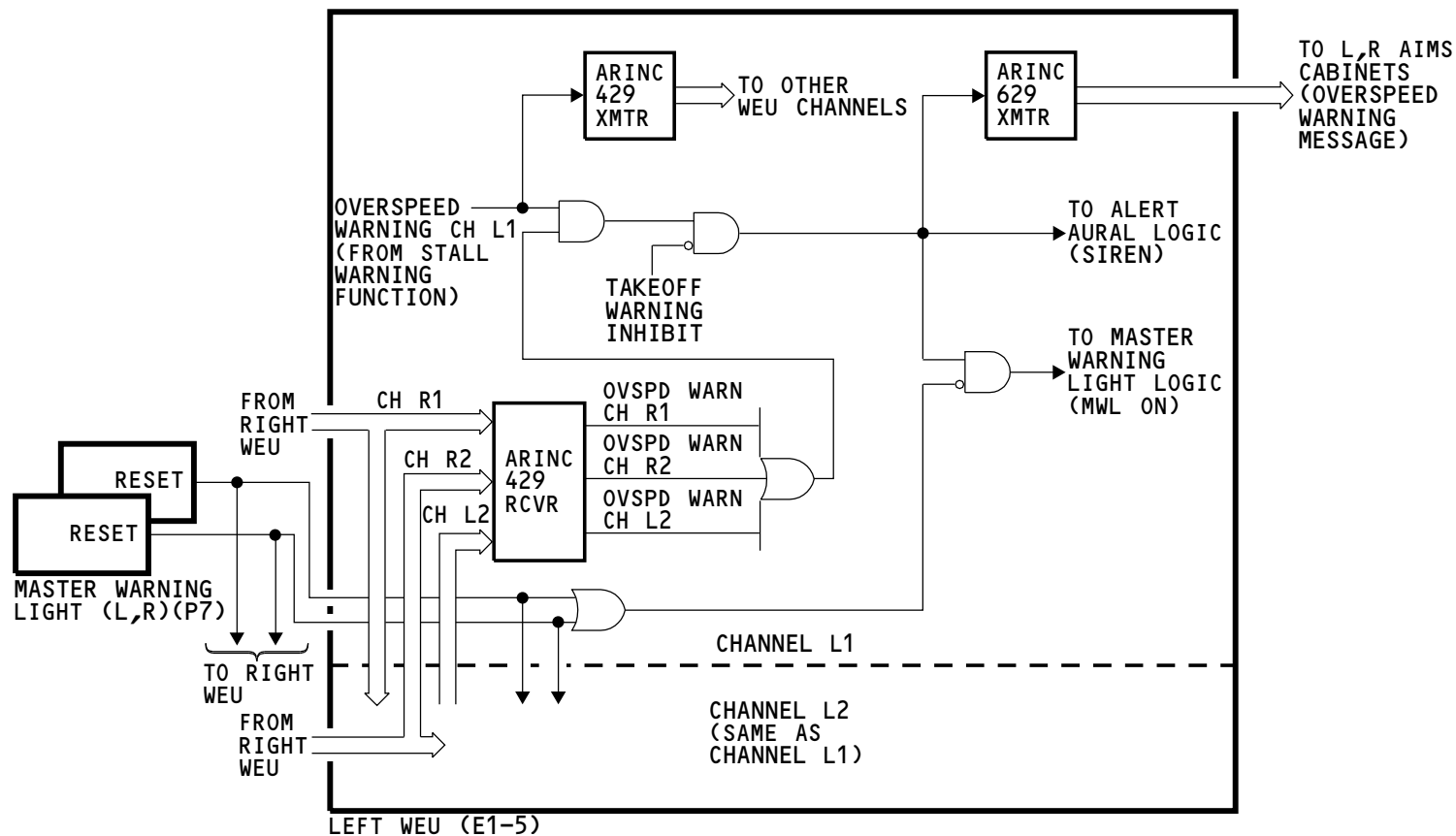
Before a WEU channel gives an overspeed warning, at least one other channel must give the same warning.

If there is a takeoff warning inhibit, the WEUs do not make the overspeed warning signal.

The overspeed warning threshold is 0.876 mach.

Push Overspeed Aural Reset Switch to make the master warning lights go out and stop the siren.

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M41772 S000618238_V1

WES - OVERSPEED WARNING

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**WES - CABIN PRESSURE WARNING****General**

The remote cabin pressure sensor senses cabin pressure. The cabin pressure signal goes to the standby power panel (P310). The standby power panel (P310) supplies the cabin pressure signal to the AIMS cabinets. The AIMS cabinets supply a digital signal for a cabin altitude greater than 10,000 feet to the WEUs.

Before a WEU channel makes a cabin altitude warning, at least another WEU channel must make the same warning.

Each WEU channel inhibits cabin altitude warnings when the airplane is in takeoff.

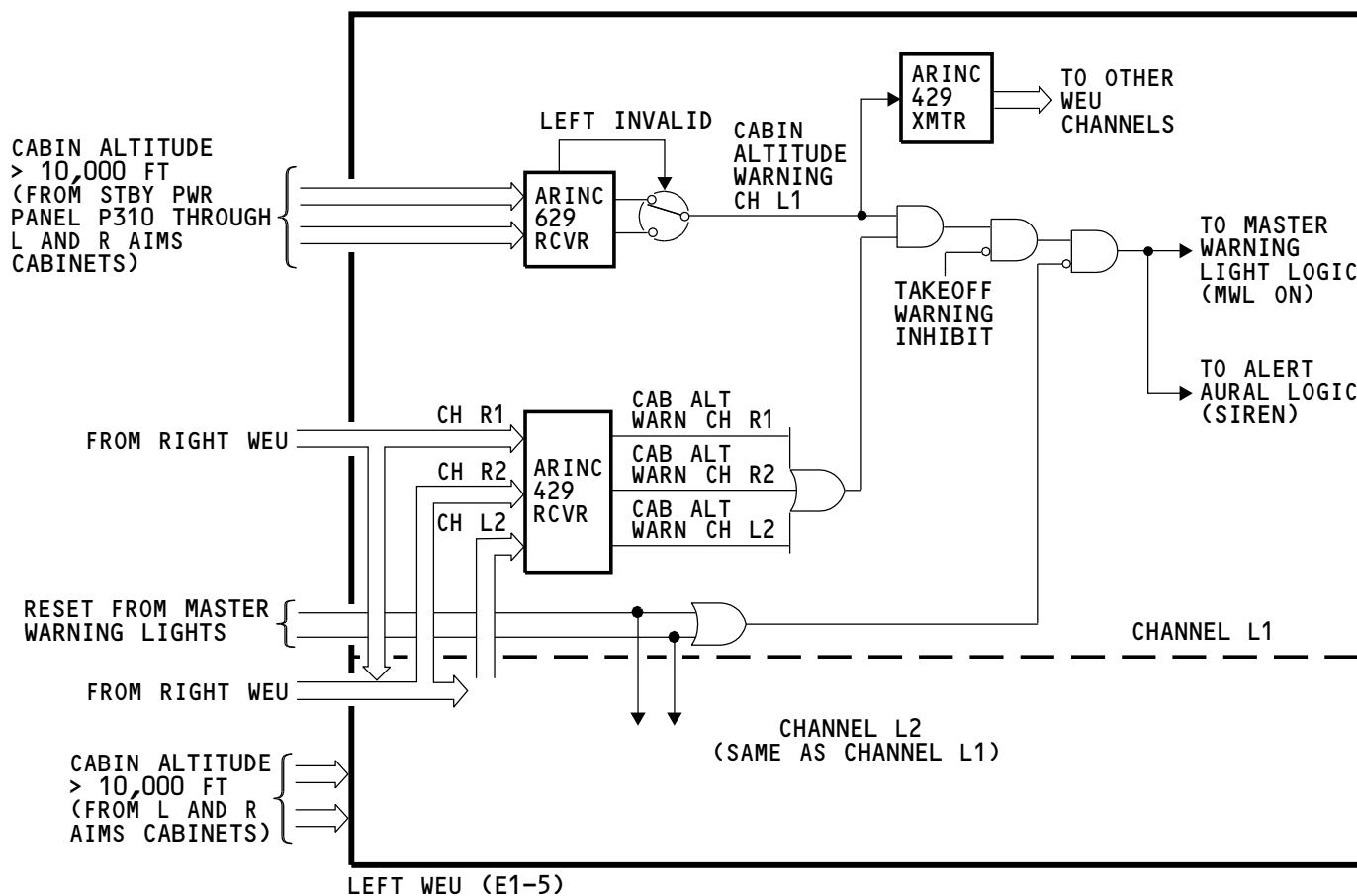
The master warning light logic makes the master warning lights (MWLs) come on. The alert aural logic makes the siren alert aural.

Push any master warning light to make the master warning lights and the siren go out.

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M41774 S000618240_V1

WES - CABIN PRESSURE WARNING

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**WES - UNSCHEDULED STABILIZER MOVEMENT WARNING****General**

The primary flight computers (PFCs) supply a digital signal for unscheduled stabilizer movement to the AIMS cabinets. The AIMS cabinets supply this signal to the WEUs.

Before a WEU channel makes an unscheduled stabilizer movement warning, at least one other WEU channel must make the same warning.

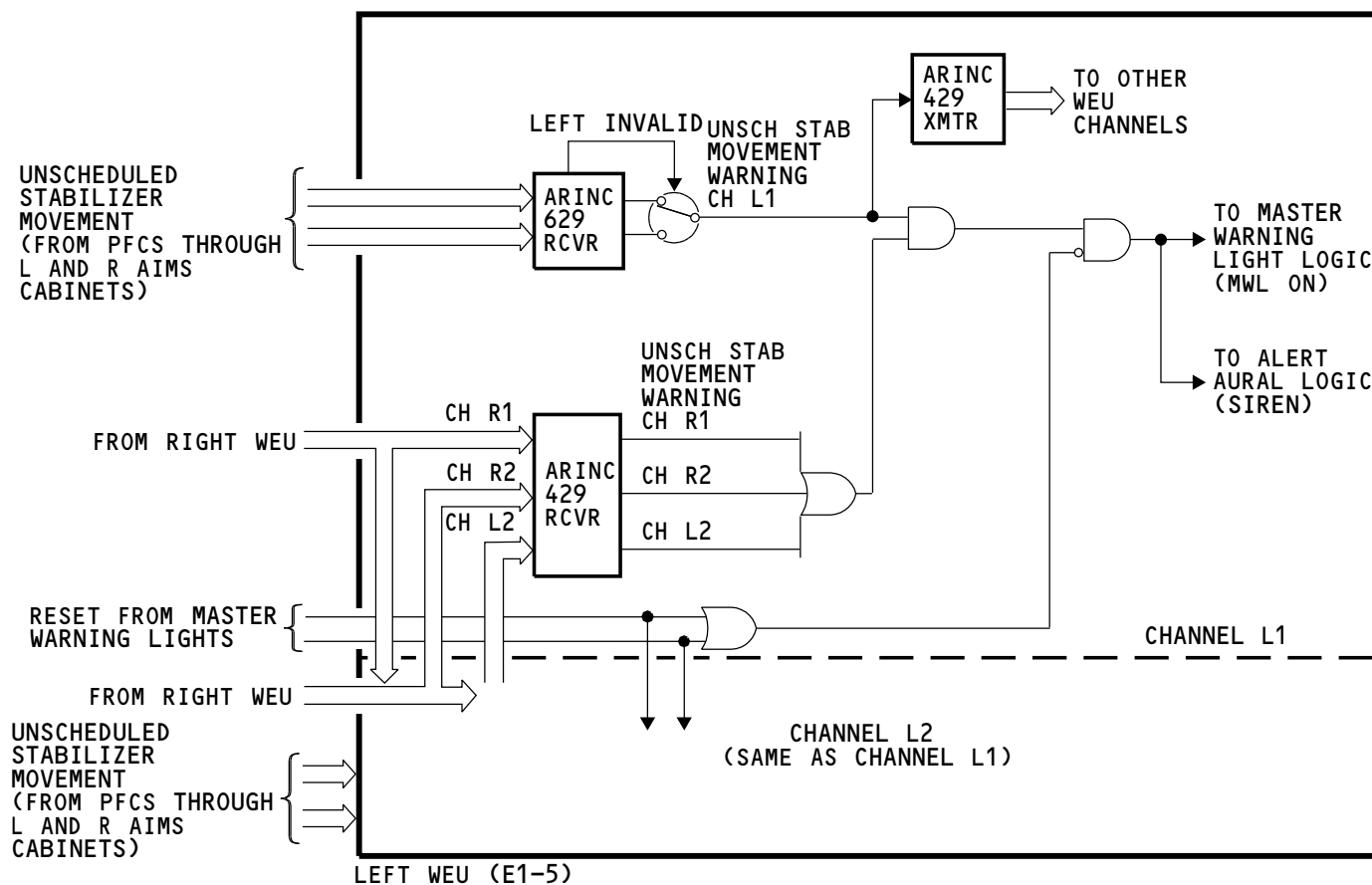
The alert aural logic makes the siren alert aural. The master warning light logic makes the master warning lights (MWLs) come on.

Push any master warning light to make the master warning lights and the siren go out.

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WES - UNSCHEDULED STABILIZER MOVEMENT WARNING

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**WES - ENGINE FAIL WARNING****Operation**

The AIMS cabinets supply a digital signal for engine fail warnings.

Before a WEU channel makes an engine fail warning, at least one other WEU channel must make the same warning.

The master warning light logic, makes the master warning lights (MWLs) come on.

Push any master warning light to make the master warning lights go out.

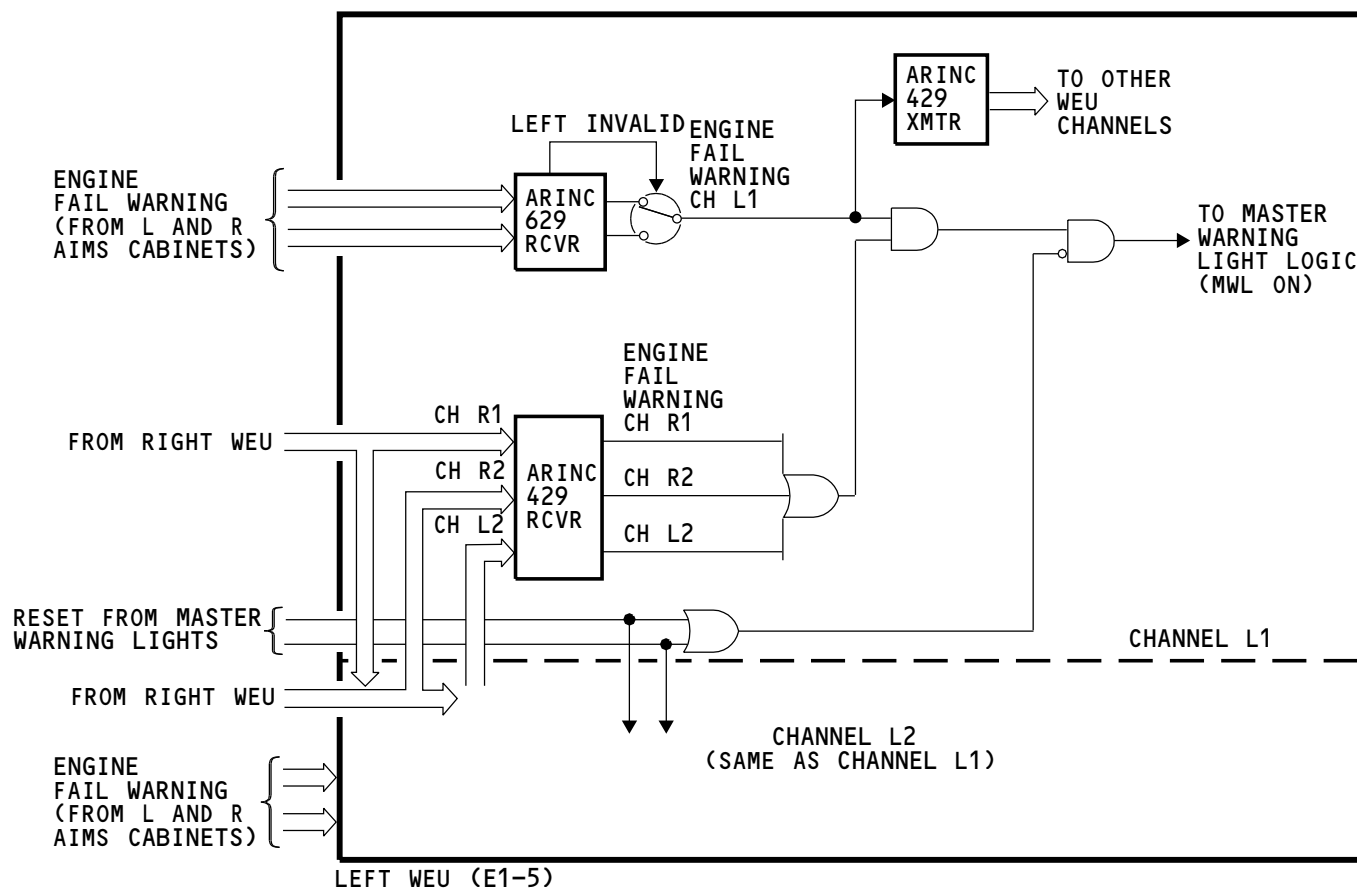
Training Information Point

A red ENG FAIL is displayed on the PFD, if actual thrust is less than commanded thrust during takeoff with airspeed between 65 knots and 6 knots prior to V1. Also, the master warning lights come on. The AIMS cabinets also send a digital request signal to the ground proximity warning computer (GPWC). The GPWC makes an engine fail aural.

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M41814 S000618286_V1

WES - ENGINE FAIL WARNING

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**WES - GPWS PULL UP AND WINDSHEAR WARNINGS****General**

The ground proximity warning computer (GPWC) supplies pull up and windshear digital discrete signals to the AIMS. The AIMS cabinets supply these signals to the WEUs.

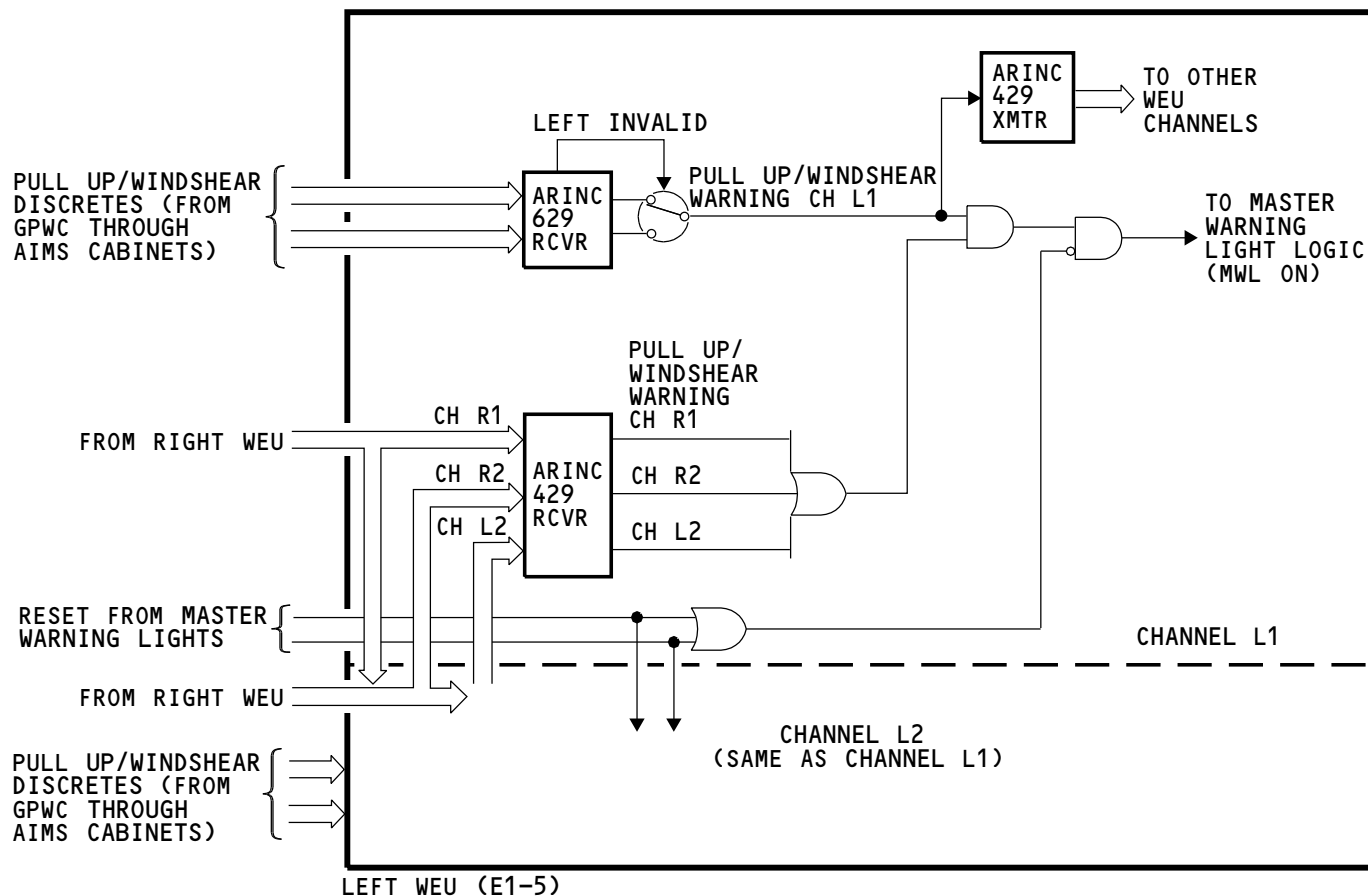
Before a WEU channel makes a pull up or a windshear warning, at least one other WEU channel must make the same warning.

The master warning light logic makes the master warning lights (MWLs) come on. Push any master warning light to make the master warning lights go out.

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WES - GPWS PULL UP AND WINDSHEAR WARNINGS

M41776 S000618243_V1

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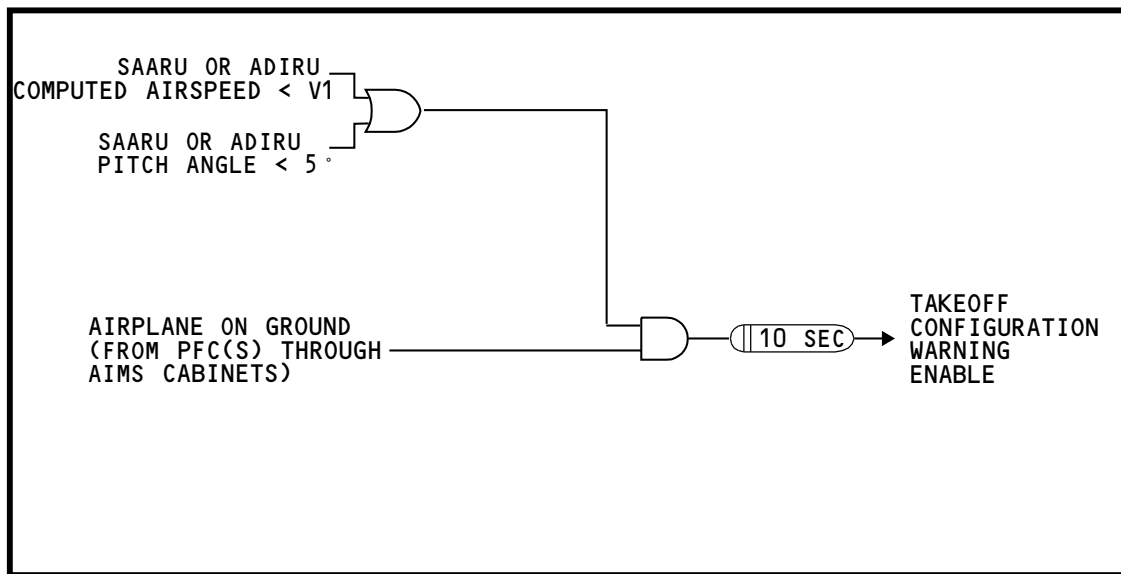
**WES - TAKEOFF CONFIGURATION WARNING ENABLE****General**

The WES makes a takeoff configuration warning when the airplane configuration is not safe for takeoff.

Each WEU has takeoff configuration warning enable logic. The takeoff configuration warning enable permits the WEUs to make takeoff configuration warnings only when it is possible to takeoff.

The WEUs use this data to make the takeoff configuration warning enable:

- Air data inertial reference unit (ADIRU) data
- Secondary attitude air data reference unit (SAARU) data
- Primary Flight Computer (PFC) data.



LEFT WEU (E1-5)

WES - TAKEOFF CONFIGURATION WARNING ENABLE

M41777 S000618244_V1

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WES - TAKEOFF ATTEMPT AND CONDITIONS MONITORED IN TAKEOFF**Takeoff Attempt**

The takeoff attempt signal enable permits the WEU to make a takeoff configuration warning.

The AIMS cabinets supply engine in takeoff thrust signals and the fuel control switch in run signals to the WEUs.

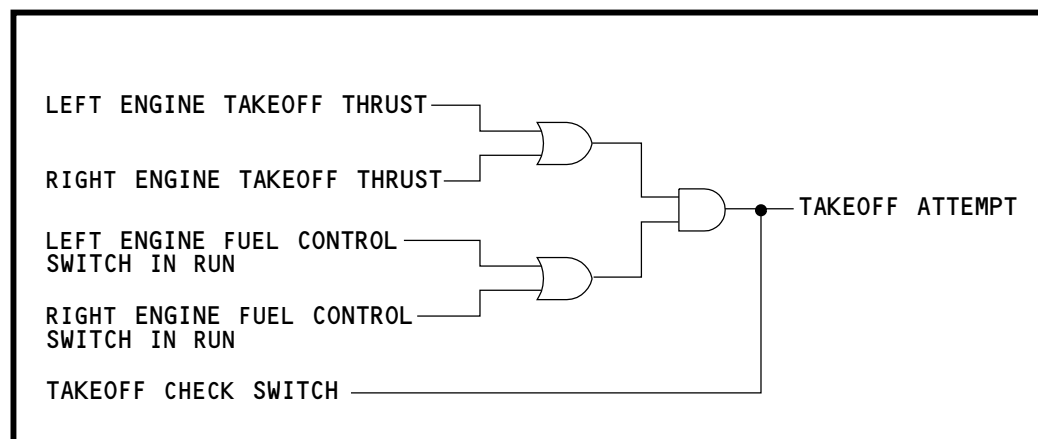
The WEUs make a takeoff attempt signal when a fuel control switch is in the run position and an engine gets to takeoff thrust.

Conditions Monitored in Takeoff

The takeoff configuration function of the WEUs monitors these conditions when the flight crew makes a takeoff attempt:

- Flaps and leading edge devices not in takeoff position
- Stabilizer not in takeoff position
- Parking brake set
- Main gear steering not locked
- Rudder not in takeoff trim
- Speed brake lever not down
- Passenger entry and cargo doors closed, latched, and locked.

If any of the above conditions occurs in takeoff, the WEUs supply a takeoff configuration warning to the flight crew.



LEFT WEU (E1-5)

M41778 S000618246_V1

WES - TAKEOFF ATTEMPT AND CONDITIONS MONITORED IN TAKEOFF

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WES - TAKEOFF CONFIGURATION WARNING FUNCTION INPUTS - 1

General

The flap slat electronic units (FSEUs) supply flaps and leading edge devices in takeoff position digital signals to the WEUs.

Each WEU channel gets inputs from the two FSEUs. Selection logic on each WEU channel uses one of the FSEUs to set a true output when the flaps or leading edge devices are in the takeoff position.

Each selection logic selects one FSEU input only. The selection priority depends on the WEU channel. This is the selection priority for channel L1:

- Left FSEU through the left bus
- Left FSEU through the center 1 bus
- Right FSEU through the center 1 bus.

This is the selection priority for Channel L2:

- Left FSEU through the center 1 bus
- Right FSEU through the center 1 bus
- Left FSEU through the left bus.

This is the selection priority for Channel R1:

- Right FSEU through the right bus
- Right FSEU through the center 1 bus
- Left FSEU through the center 1 bus.

This is the selection priority for Channel R2:

- Right FSEU through the center 1 bus
- Left FSEU through the center 1 bus
- Right FSEU through the right bus.

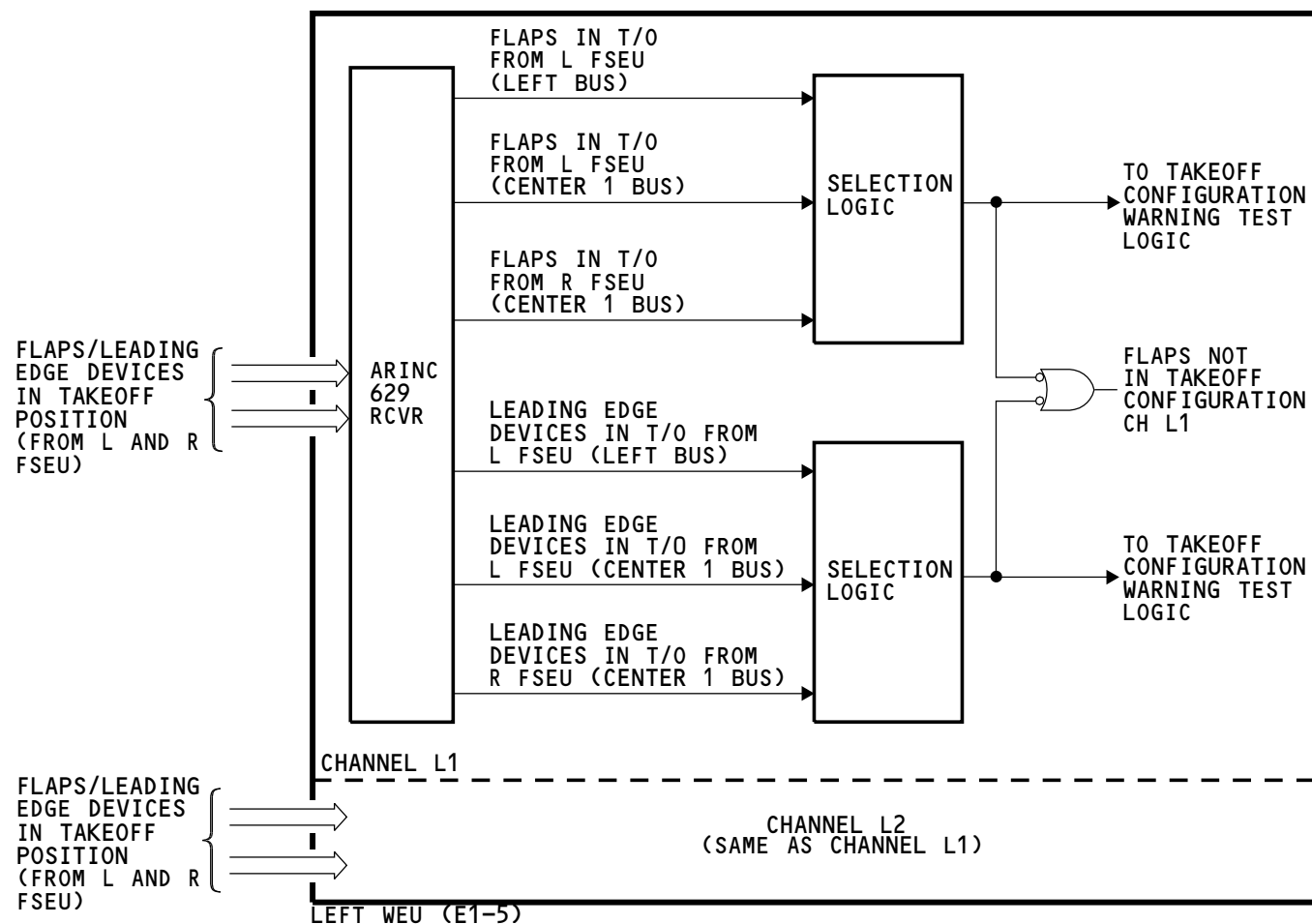
Takeoff Configuration Warning Test Logic Interface

Each WEU channel has a takeoff configuration warning test logic. When you do a takeoff configuration warning test, this logic verifies all inputs to the takeoff configuration warning function. The logic checks that all inputs are available and valid.

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M41780 S000618248_V1

WES - TAKEOFF CONFIGURATION WARNING FUNCTION INPUTS - 1

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WES - TAKEOFF CONFIGURATION WARNING FUNCTION INPUTS - 2**Stabilizer Not In Takeoff Position**

The primary flight computers (PFCs) supply stabilizer position signals to the AIMS cabinets. The AIMS cabinets supply the signals to the WEUs. The compare logic gets the stabilizer position signals.

The stabilizer green band function of the WEUs supplies stabilizer green band selection to the compare logic. The selection is one of these:

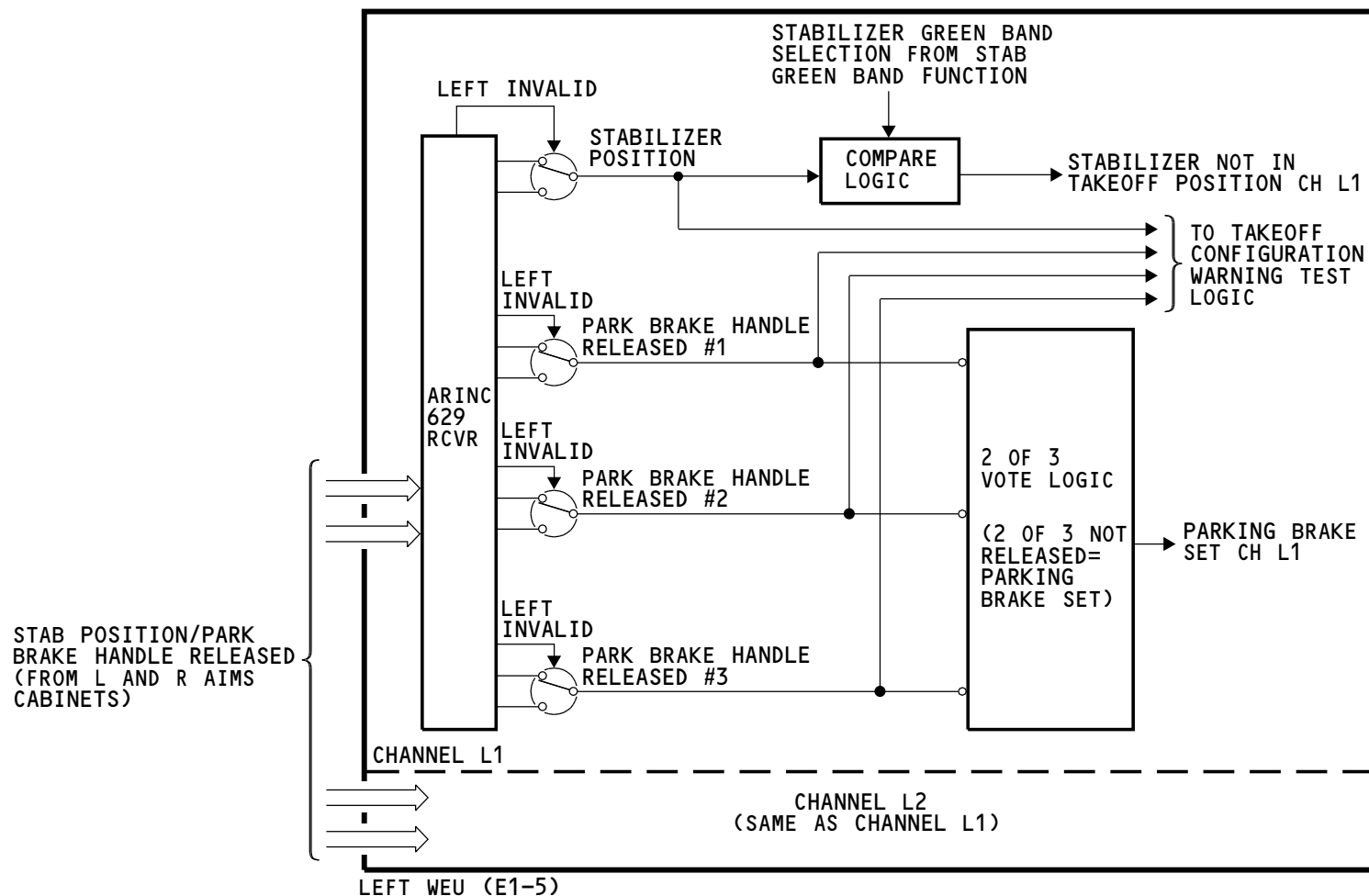
- Nose up band
- Mid band
- Nose down band.

The compare logic compares the stabilizer position and the stabilizer green band selection. If the stabilizer position is not in the green band, the compare logic makes a stabilizer not in takeoff signal.

Parking Brake Set

The parking brake handle has three switches. The switches supply parking brake handle released signals to the AIMS. The AIMS supplies the signals to the WEUs.

Each WEU channel supplies the signals from the three parking brake handle switches to a 2 of 3 vote logic. When at least two signals show the parking brake handle not released, the 2 of 3 vote logic makes a parking brake set signal.



M41781 S000618249_V1

WES - TAKEOFF CONFIGURATION WARNING FUNCTION INPUTS - 2

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**WES - TAKEOFF CONFIGURATION WARNING FUNCTION INPUTS - 3****Speed Brake Lever Not Down**

The primary flight computers (PFCs) supply the speed brake lever not down signal to the WEUs.

Rudder Position

The PFCs supply the rudder position signal to the WEUs.

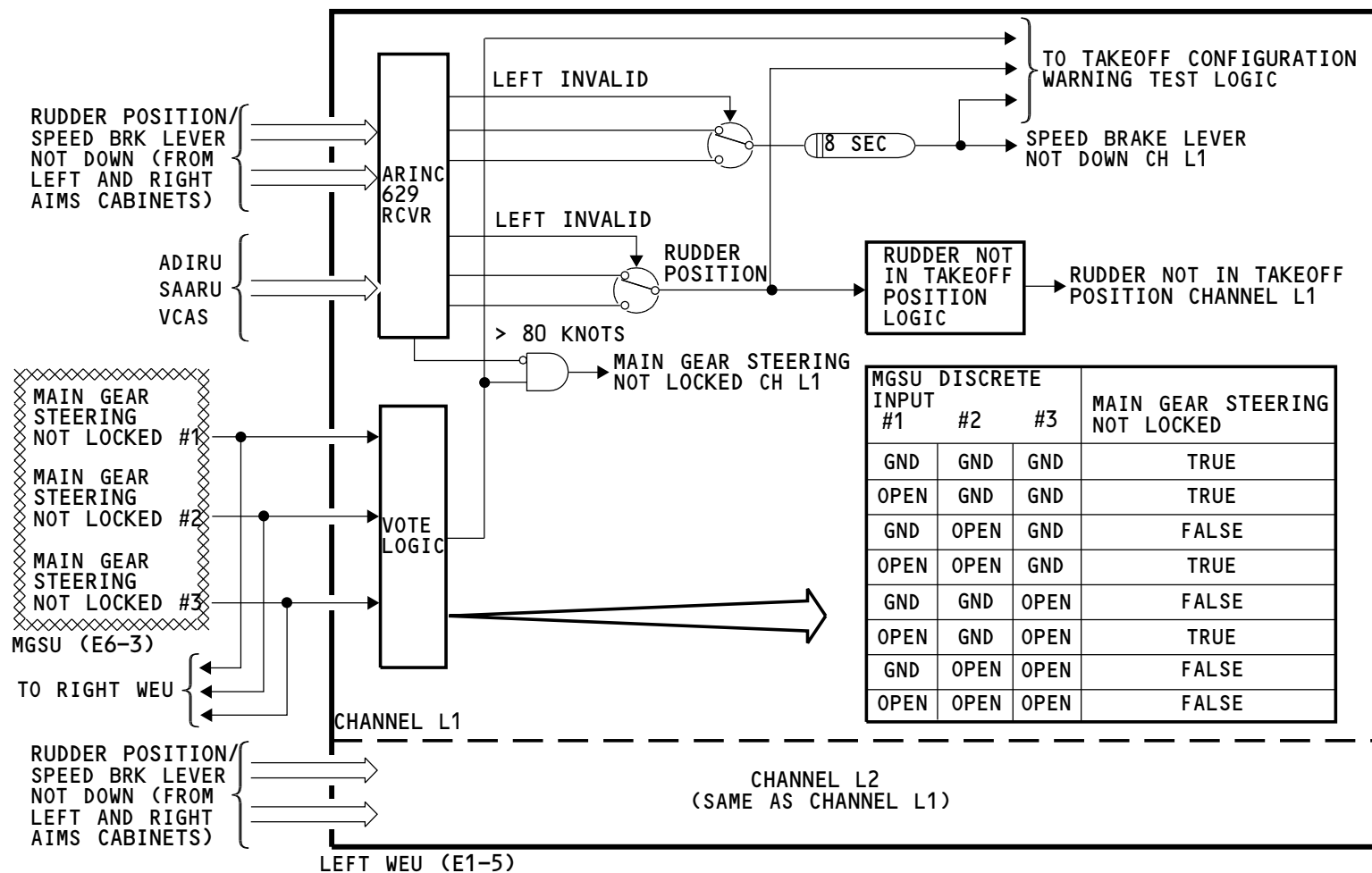
Each WEU channel has rudder not in takeoff position logic. This logic has the correct rudder position for takeoff. The logic compares the rudder position and the correct rudder position for takeoff. The rudder is in the correct position for takeoff when the trim value is 2 units or less.

If the rudder position is not in the correct takeoff position, the logic makes a rudder not in takeoff position signal.

Main Gear Steering Not Locked

The main gear steering unit (MGSU) supplies three discrete main gear steering not locked signals to the WEUs. Each WEU channel has vote logic. The vote logic makes the main gear steering not locked signal.

Each WEU channel also looks at the ADIRU and SAARU inputs to determine if VCAS is greater than 80 knots, the WEU will not output the T/O warning for the main gear steering.



M41782 S000618250_V2

WES - TAKEOFF CONFIGURATION WARNING FUNCTION INPUTS - 3

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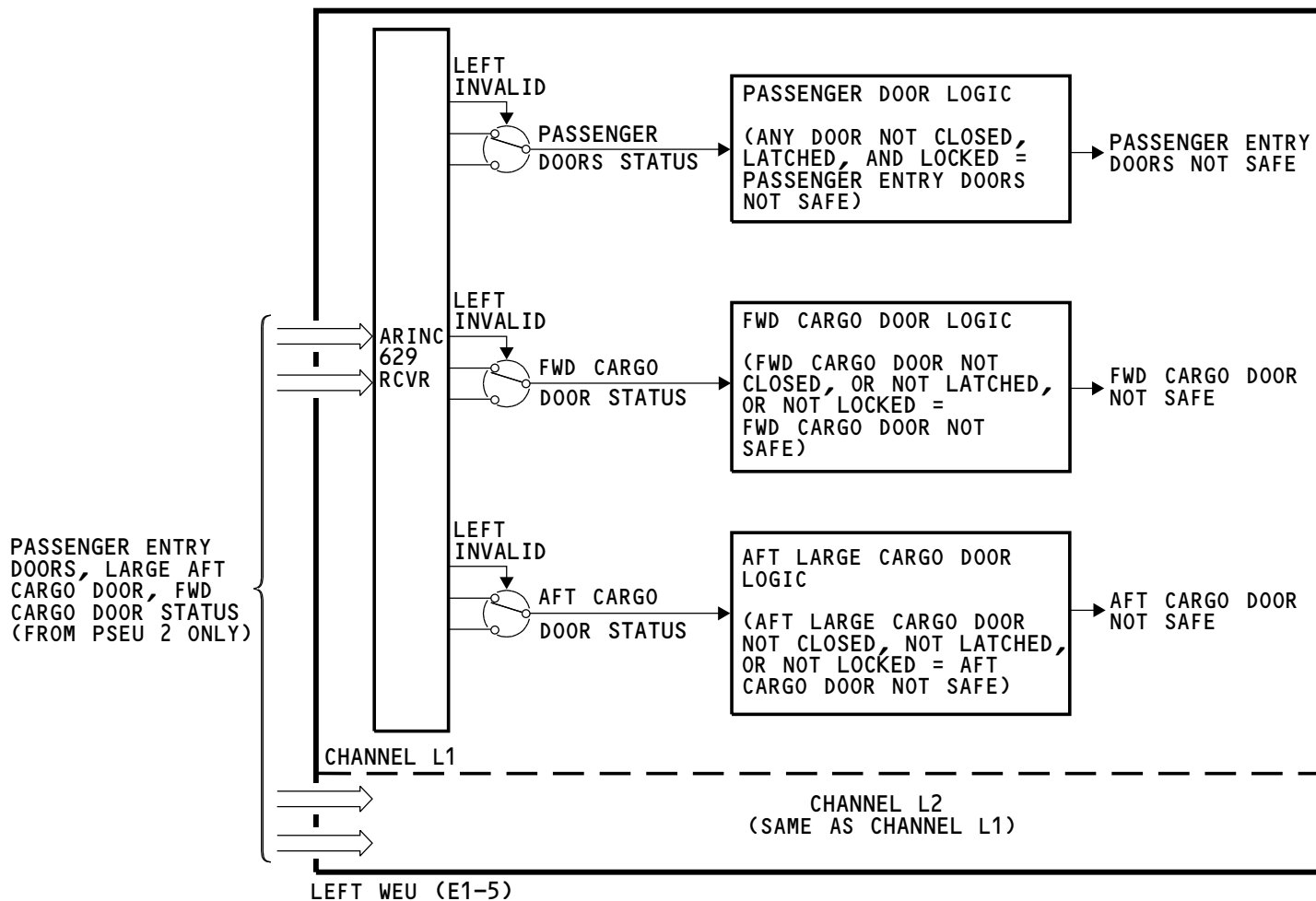
WES - TAKEOFF CONFIGURATION WARNING FUNCTION INPUTS - 4

Airplane Doors Status

The WEUs receive passenger entry and cargo doors status from the proximity switch electronic unit (PSEU) 2.

All doors must be closed, latched, and locked before takeoff.

In order to generate a CONFIG DOOR warning message, two or more sensors, for a particular door, will have a valid target "far" indication. The Small Cargo Door and Passenger Entry Door have 2 sensors (Closed, Locked/Latched). The Large Cargo Door has 3 sensors (Closed, Latched, Locked).



M41783 S000618251_V1

WES - TAKEOFF CONFIGURATION WARNING FUNCTION INPUTS - 4

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**WES - TAKEOFF CONFIGURATION WARNING FUNCTION OPERATION****Operation**

When the takeoff configuration warning enable is true, and the flight crew makes a takeoff attempt, the WEUs check for correct airplane takeoff configuration.

Before a WEU channel gives a takeoff configuration warning, at least one more channel must give the same warning.

EICAS Warning Messages

The WEUs supply an EICAS message request to the AIMS cabinets. The AIMS shows a warning EICAS message to the flight crew. Before a warning message shows, the AIMS must receive the same message request from at least two WEU channels at the same time.

The WEUs latch the digital signal to the AIMS cabinets for 10 seconds after the flight crew stops the takeoff attempt or after the takeoff warning inhibit starts. This is to make sure that the flight crew sees the EICAS message.

Master Warning Lights Reset

Push any master warning light to make the master warning lights go out. The siren continues until the takeoff configuration warning condition is clear.

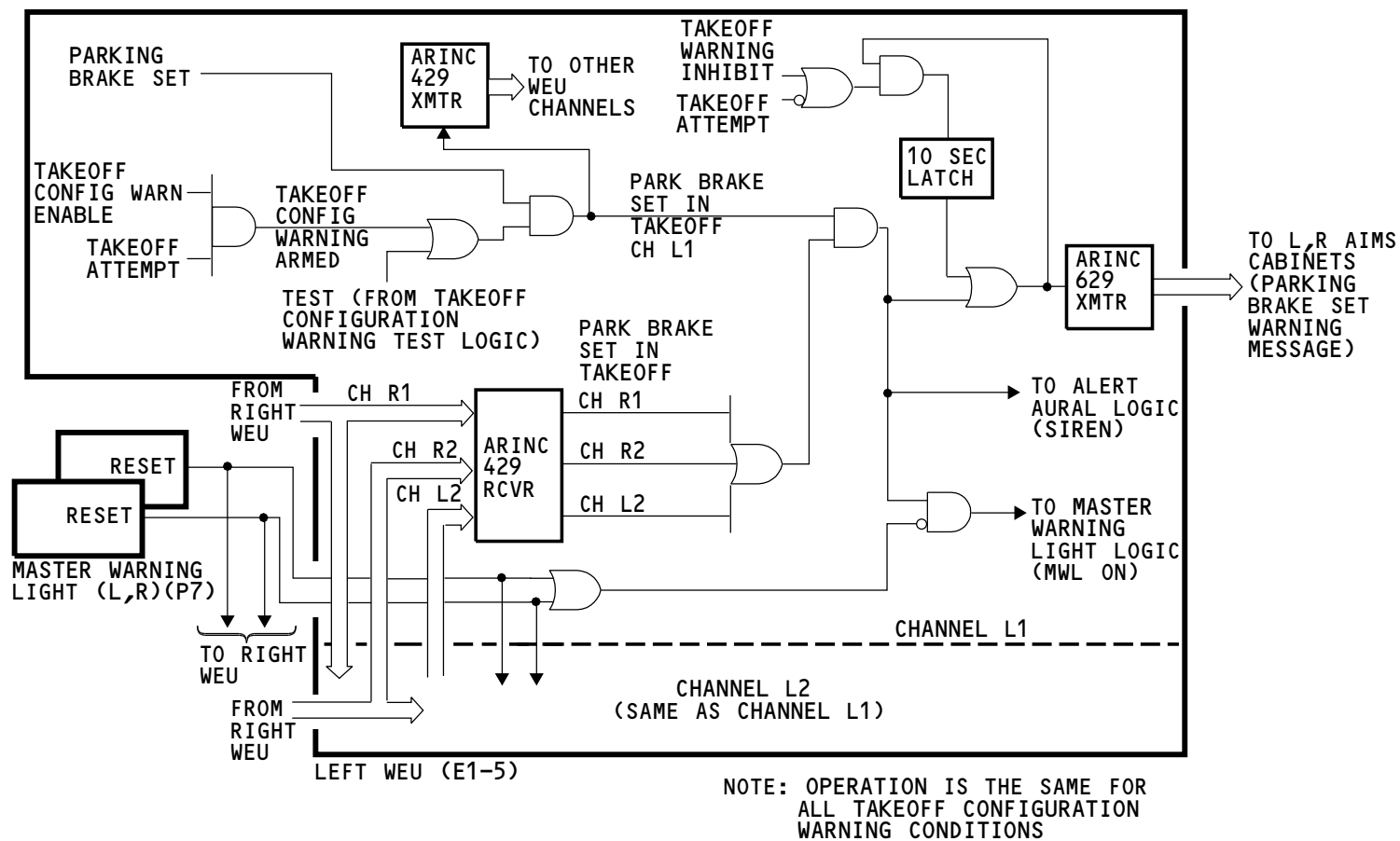
Test

A test signal comes from the takeoff configuration warning test logic. The test signal arms the takeoff configuration warning function. If the airplane is not in a good takeoff configuration, the WEUs make a takeoff configuration warning.

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WES - TAKEOFF CONFIGURATION WARNING FUNCTION OPERATION

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WES - STABILIZER GREEN BAND FUNCTION

Operation

The stabilizer green band function calculates the correct green band selections for takeoff. These are the three selections:

- Nose up
- Mid band
- Nose down.

The WEUs use this data from the flight management computing function (FMCf) of the AIMS to calculate the green band selection:

- Gross weight (GW)
- Airplane center of gravity (CG)
- Takeoff thrust rating.

The stabilizer green band selection goes to the takeoff configuration warning function.

Green Band Indications

The green band selection logic sends the stabilizer green band selection to the AIMS. The AIMS changes the green band selection into ARINC 429, and sends it to the stabilizer trim position indicators.

An airplane nose down selection makes the mid band lamp and the nose down lamp come on. An airplane nose up selection makes the mid band lamp and the nose up lamp come on. A mid band indication makes only the mid band lamp come on.

If the WEUs get a CG that is more than 44.0 or less than 14.0, the WEUs make all the stabilizer green band lamps go out. The WEUs also supply a STAB GREENBAND advisory EICAS message request to the AIMS.

The green band selection logic changes the stabilizer green band selection only when the takeoff configuration enable is true. When a takeoff attempt is true, the green band selection logic locks the selection in its present condition.

The green band selection logic turns off the green band lamps when the takeoff configuration warning enable is false.

Nose Gear Pressure Transducer

The WEUs use the nose gear pressure transducer input to do a check of the stabilizer green band selection.

If the WEUs calculate a nose up band, the transducer input must be forward CG (fly nose up condition). If the WEUs calculate a nose down band, the transducer position must be aft CG (fly nose down condition). If the WEUs calculate a mid band, the WEUs ignore the transducer input.

If the nose gear pressure transducer input does not agree with the green band calculation, the WEUs supply a STAB GREENBAND advisory EICAS message request to the AIMS.

Test

When you do a takeoff configuration warning test from the MAT, you do a test of the stabilizer green band function of the WEUs.

The takeoff configuration warning test logic supplies a test signal to the green band selection logic. The green band selection logic makes all three green band lamps come on each stabilizer trim indicator.

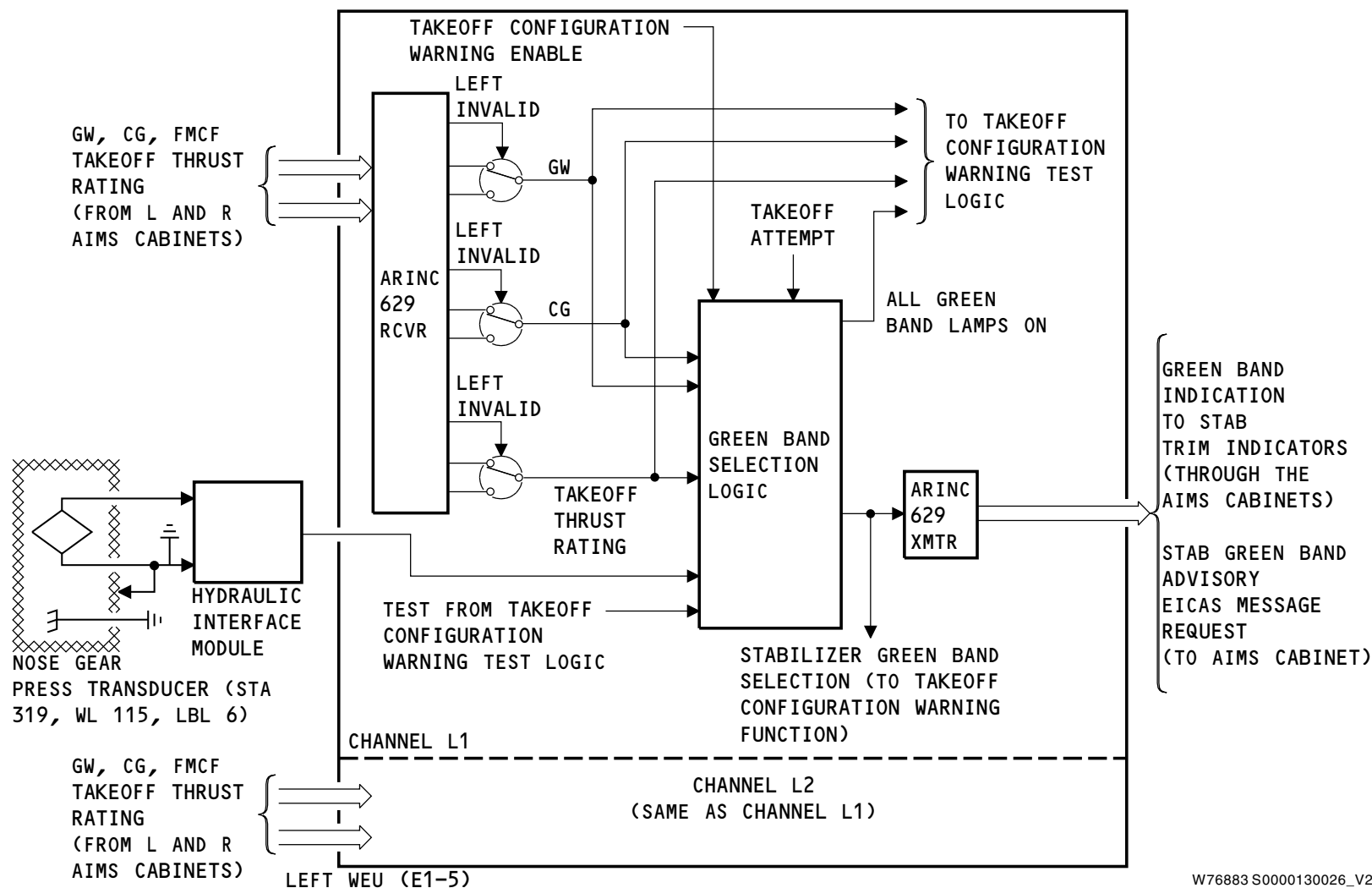
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WES - STABILIZER GREEN BAND FUNCTION

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WES - TAKEOFF CONFIGURATION WARNING TEST

General

You start a takeoff configuration warning test from the maintenance access terminal (MAT). When you do a takeoff configuration warning test, you also do a stabilizer green band function test.

The takeoff configuration warning test logic checks the condition of the takeoff configuration warning and stabilizer green band function inputs. If any input is not present or is invalid, the test fails.

Initiated Test Inhibit

A WEU channel must make an initiated test inhibit signal as false before a takeoff configuration test can start.

When the initiated test inhibit signal is true, the WEU channels cannot start any test.

The initiated test inhibit signal within a WEU channel is false (a test can start) only when all these conditions are true:

- Both engines are at less than takeoff thrust
- The airplane is on the ground
- The nose gear is compressed
- The ADIRU and the SAARU send incomplete pitot/static data (airplane not moving)
- Three or more WEU channels detect the same previous conditions.

Test Signal

The takeoff configuration warning test logic supplies a test signal that is on for five seconds and then it goes off. The test signal goes to the:

- Takeoff configuration warning function
- Stabilizer green band selection logic
- AIMS.

The test signal arms the takeoff configuration warning function. If the airplane is not in a good takeoff configuration, the WEUs make a takeoff configuration warning. If the airplane is in a good configuration for takeoff, the WEUs do not make a takeoff warning.

The stabilizer green band selection logic supplies an all green band lamps on signal to the takeoff configuration warning test logic. The test signal goes to the AIMS. The AIMS sends the test signal to the stabilizer trim indicators. The indicators make all three green band lamps come on.

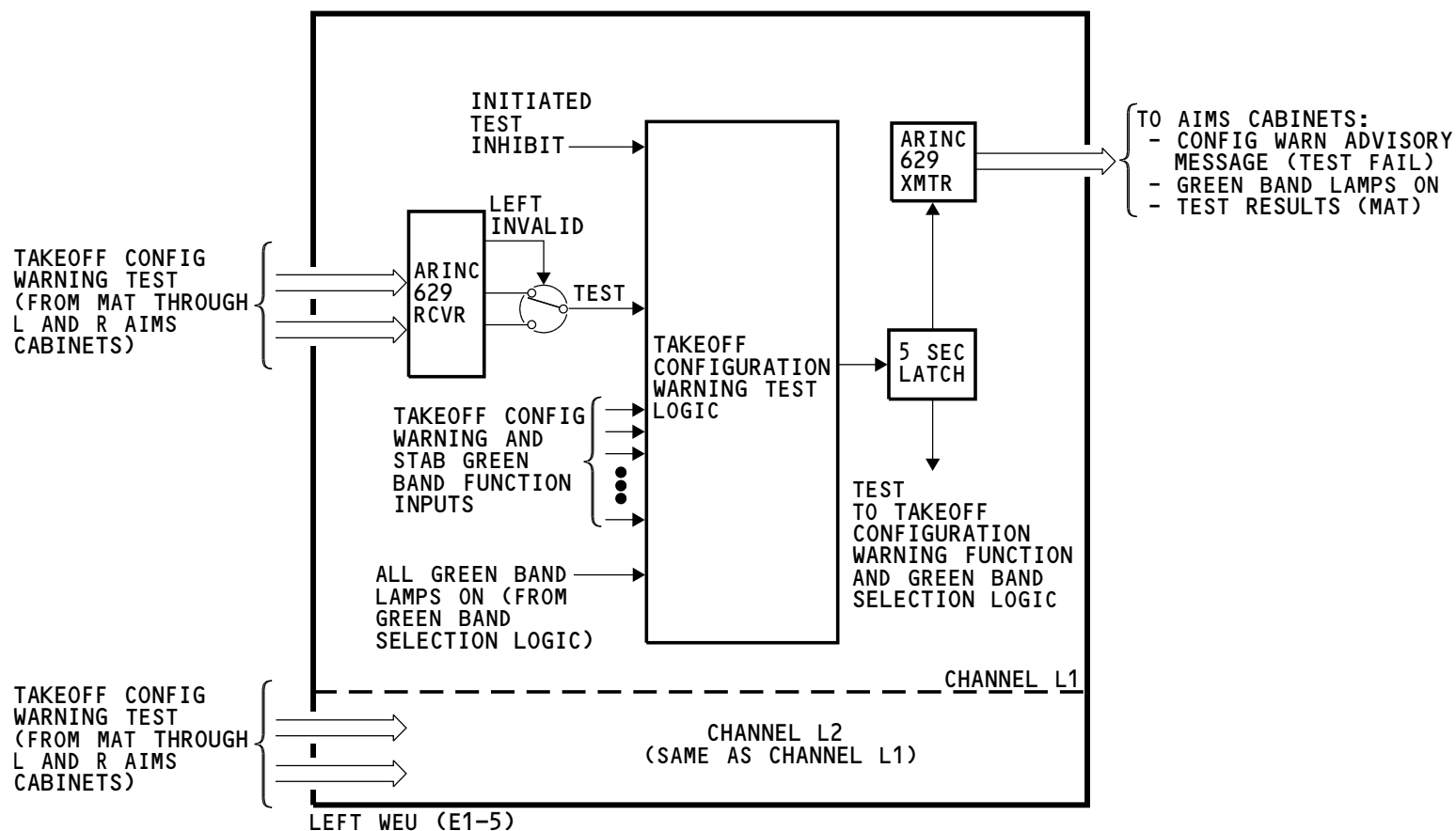
CONFIG WARN SYST Advisory Message

The AIMS shows the CONFIG WARN SYST EICAS advisory if the test fails. Each WEU channel latches the CONFIG WARN SYST message until you do another test or until you remove and reapply power to the WEUs.

The AIMS shows the CONFIG WARN SYST EICAS advisory message only when two or more channels supply a test fail signal.

MAT Display

The MAT shows a TAKEOFF CONFIGURATION TEST FAIL message or a TAKEOFF CONFIGURATION TEST COMPLETE message after the test ends.



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WES - TAKEOFF CONFIGURATION WARNING TEST

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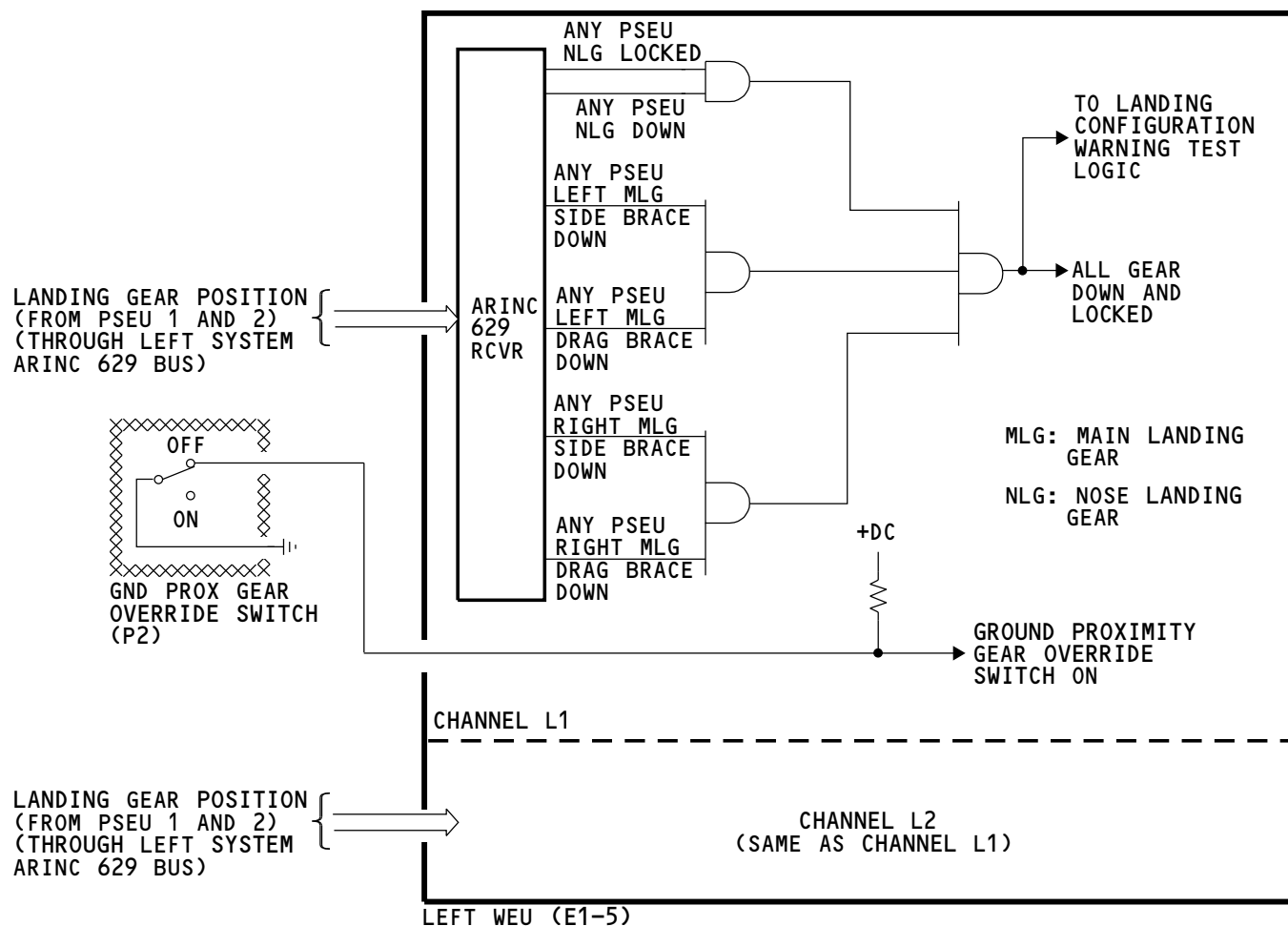
**WES - LANDING CONFIGURATION WARNING INPUTS - 1****PSEU Inputs**

The proximity switch electronic unit (PSEU) supplies landing gear position to the WEUs. The WEUs make an all gear down and locked signal.

Ground Proximity Gear Override Switch

The ground proximity gear override switch supplies an on signal to the WEUs.

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WES - LANDING CONFIGURATION WARNING INPUTS - 1

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WES - LANDING CONFIGURATION WARNING INPUTS - 2**Thrust Lever Resolver Angle Input**

The electronic engine controls (EECs) supply thrust lever resolver angle (TLRA) to the WEUs. Compare logic in the WEUs make a true output when the TLRA is less than the glideslope power level (GSPL). The WEUs have the GSPL value in memory.

The compare logic also supplies a true output to the speed brake alert logic when the TLRA is greater than the speedbrake power level (SBPL). The WEUs have the SBPL value in memory.

Radio Altitude Input

The AIMS supplies radio altitude to the WEUs. The left WEU uses radio altitude in this priority:

- Left
- Right
- Center.

The right WEU uses radio altitude in this priority:

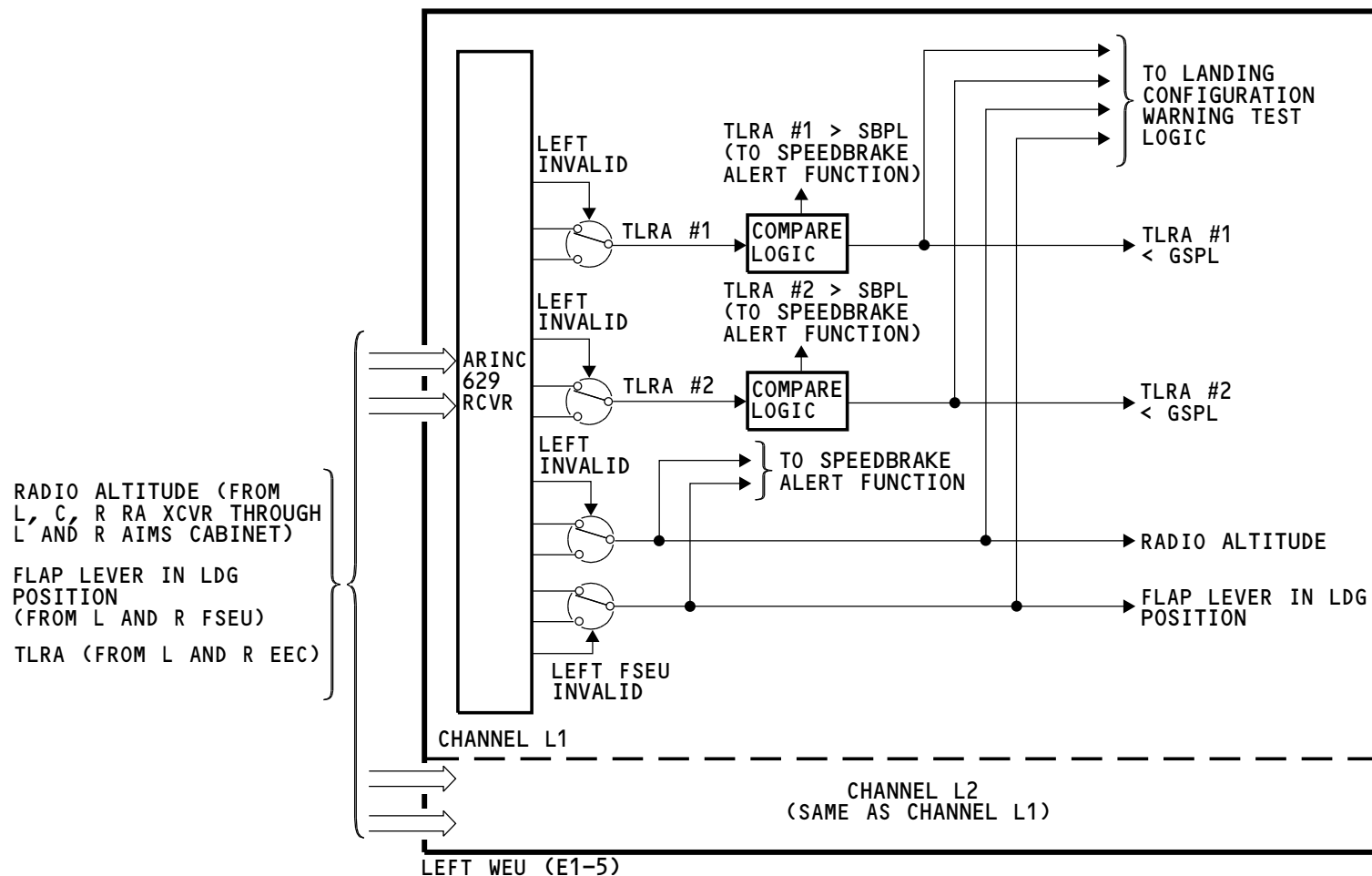
- Right
- left
- Center.

FSEU Inputs

The flap/slat electronic units (FSEUs) supply a flap lever in landing position digital discrete to the WEUs.

Landing Configuration Warning Test Logic Interface

All inputs that the WEUs use for landing configuration warning go to the landing configuration warning test logic.



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WES - LANDING CONFIGURATION WARNING INPUTS - 2

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WES - LANDING CONFIGURATION WARNING OPERATION**General**

The WEUs make a landing configuration warning when the airplane is on approach and the landing gear is not down and locked.

There are two types of landing configuration warnings: resetable and non-resetable. Both types of warnings show the same indications. The indications are:

- CONFIG GEAR level A message shows on the EICAS primary display.
- Siren aural comes on
- Master warning lights come on

Resetable Landing Configuration Warning

During a resetable landing configuration warning, the CONFIG GEAR warning message stays until you lower the landing gear. Push any master warning light to stop the siren aural and to make the warning lights go out. The siren also stops when the ground proximity gear override switch is on.

Non-resetable Landing Configuration Warning

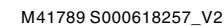
During a non-resetable landing configuration warning, the CONFIG GEAR warning message and the siren aural stay until you lower the landing gear. Push any master warning light to make the warning lights go out. The siren also stops when the ground proximity gear override switch is on.

Landing Configuration Warning Inhibit

The landing configuration warning inhibit prevents false resetable landing configuration warnings. The inhibit starts when the nose gear not compressed signal from the PSEU goes from false to true. The inhibit stops when the airplane goes above 800 feet of radio altitude, or 140 seconds after the nose gear not compressed signal was true.

Total Inhibit

The landing configuration warning function does not operate when the landing gear goes from all gear down and locked to all gears not down and locked (landing gear transition), and the radio altitude is below 800 feet. This is to prevent false warnings when the flight crew aborts a landing below 800 feet of radio altitude.



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WES - SPEEDBRAKE ALERT**General**

The speedbrake alert function tells the flight crew when it is not safe to extend the speedbrakes.

Conditions Monitored

The WEUs make a speedbrake alert when the speedbrake handle is past the arm position, and any of these conditions is present:

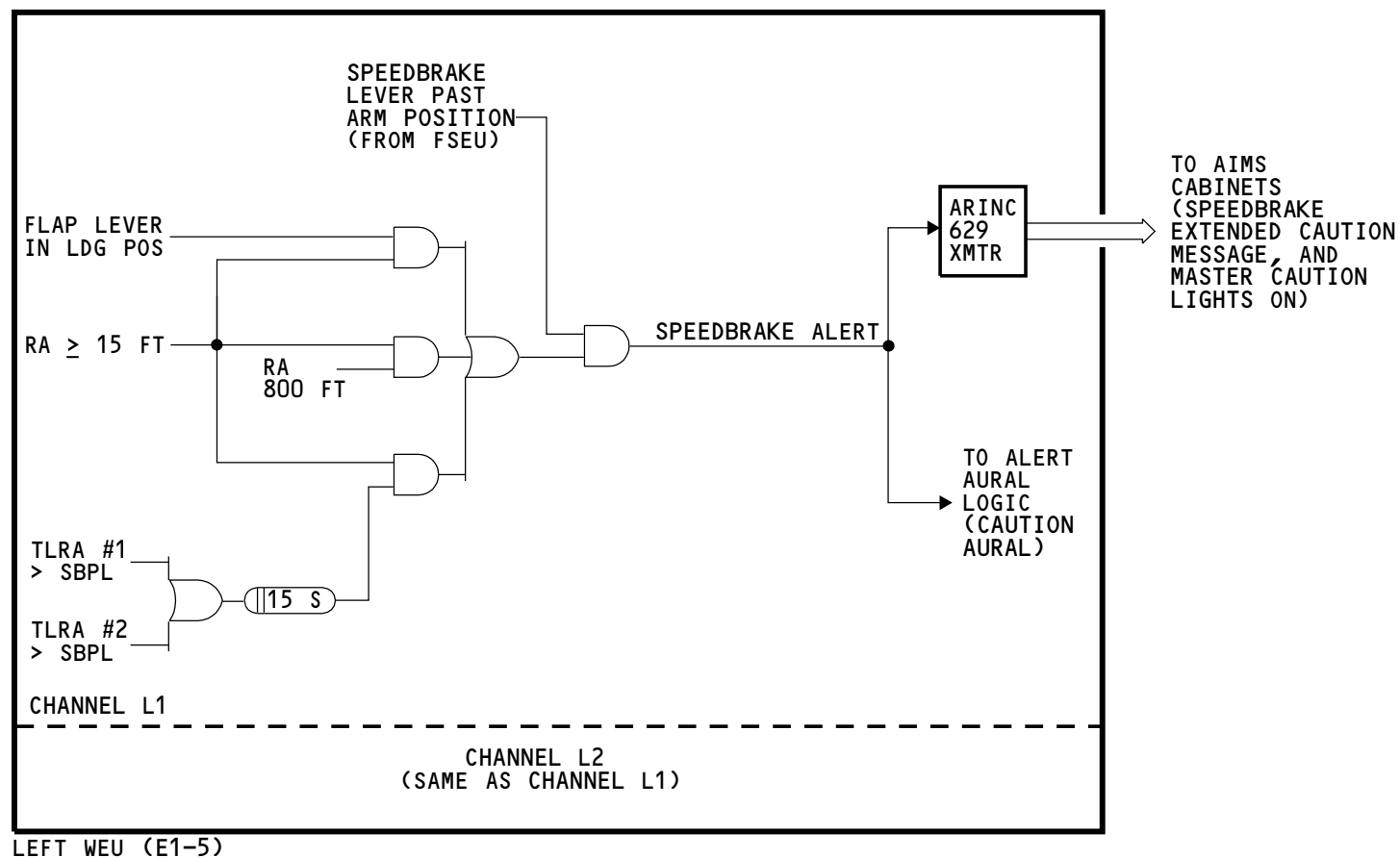
- Flaps lever in landing position with a radio altitude of 15 feet or more
- Radio altitude is between 15 and 800 feet
- 15 seconds after any thrust lever resolver angle (TLRA) is more than the speedbrake power level (SBPL) and the radio altitude is 15 feet or more.

Speedbrake Alert Indications

A speedbrake alert has these indications:

- A SPEEDBRAKE EXTENDED caution message shows on the EICAS display
- The master caution lights come on
- A caution aural comes on.

The AIMS shows the caution message and makes the master caution lights come on. The AIMS does this only when at least two WEU channels supply a speedbrake alert digital signal.



WES - SPEEDBRAKE ALERT

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WES - LANDING CONFIGURATION WARNING TEST

General

You start a landing configuration warning test from the maintenance access terminal (MAT). When you do a landing configuration warning test, you also do a test of the speedbrake alert function at the same time.

When the test passes, the WEUs make a landing configuration warning.

The landing configuration warning test logic checks the condition of the landing configuration warning and speedbrake alert function inputs. If any input is not present or is invalid, the test fails and you will not see a landing configuration warning.

Initiated Test Inhibit

A WEU channel must make an initiated test inhibit signal as false before a landing configuration warning test can start.

When the initiated test inhibit signal is true, the WEU channels cannot start any test.

The initiated test inhibit signal within a WEU channel is false (a test can start) only when all these conditions are true:

- Both engines are at less than takeoff thrust
- The airplane is on the ground
- The nose gear is compressed
- The ADIRU and the SAARU send incomplete pitot/static data (airplane not moving)
- Three or more WEU channels detect the same previous conditions.

Test Signal

The landing configuration warning test logic supplies a test signal that is on for 5 seconds and then it goes off. The test signal goes to the:

- Landing configuration warning function
- AIMS cabinets.

The landing configuration warning function makes a resetable landing configuration warning if all inputs to the landing configuration are valid.

CONFIG WARN SYST Advisory Message

The AIMS shows the CONFIG WARN SYST EICAS advisory if the test fails. Each WEU channel latches the CONFIG WARN SYST message until you do another test or until you remove and reapply power to the WEUs.

The AIMS shows the CONFIG WARN SYST EICAS advisory message only when two or more channels supply a test fail signal.

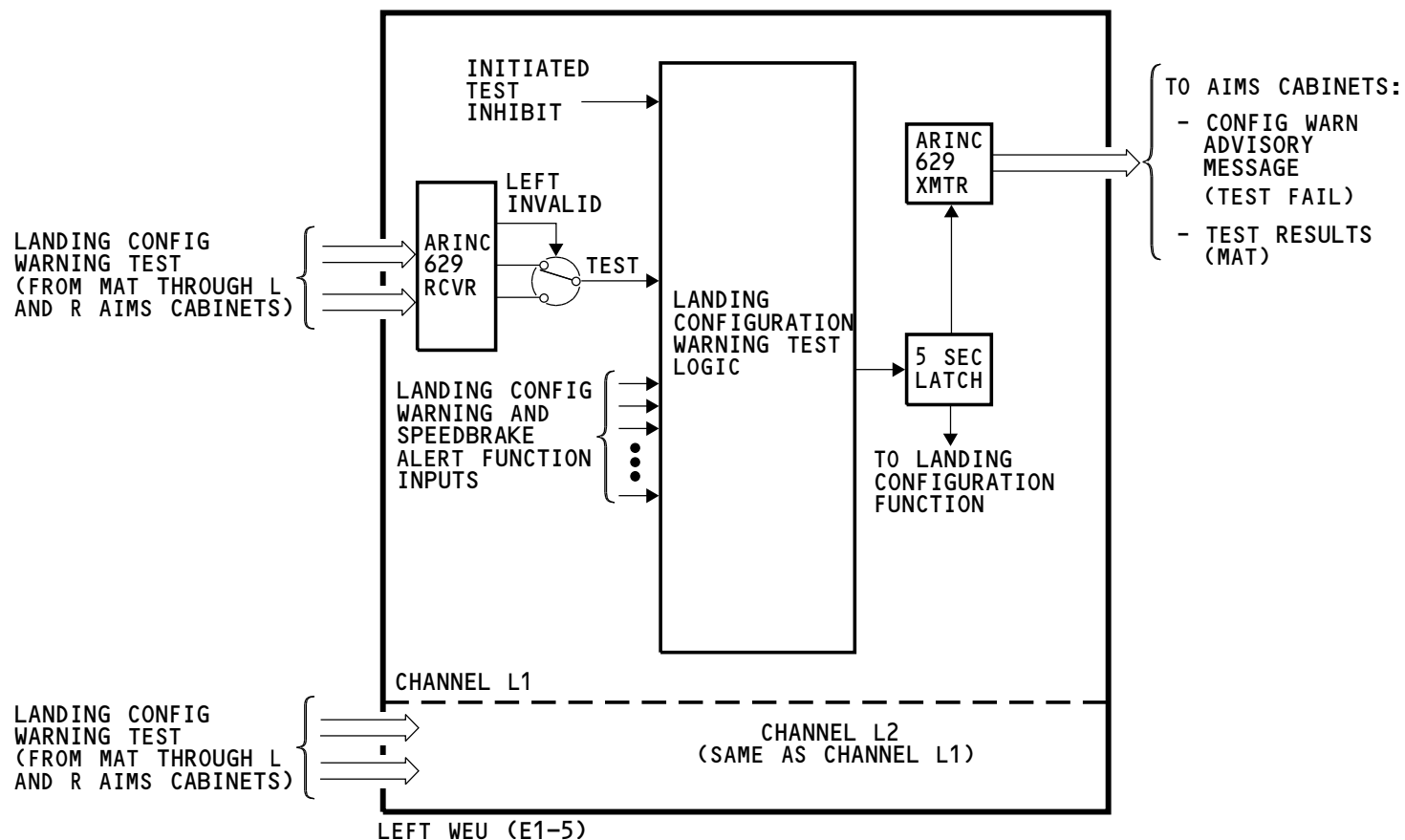
MAT Display

The MAT shows a LANDING CONFIGURATION TEST FAIL message or a LANDING CONFIGURATION TEST COMPLETE message after the test ends.

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WES - LANDING CONFIGURATION WARNING TEST

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WES - ALTITUDE ALERT FUNCTION**Purpose**

The altitude alert function of the WEUs tells the pilots when the airplane approaches or deviates from the mode control panel (MCP) selected altitude.

Altitude Approach Point

The altitude approach point is 900 feet from the selected altitude.

Altitude Approach

Altitude approach indications show on the PFD when the airplane is less than 900 feet and more than 200 feet from the selected altitude.

Altitude Capture Point

The altitude capture point is 200 feet from the selected altitude.

Altitude Alert

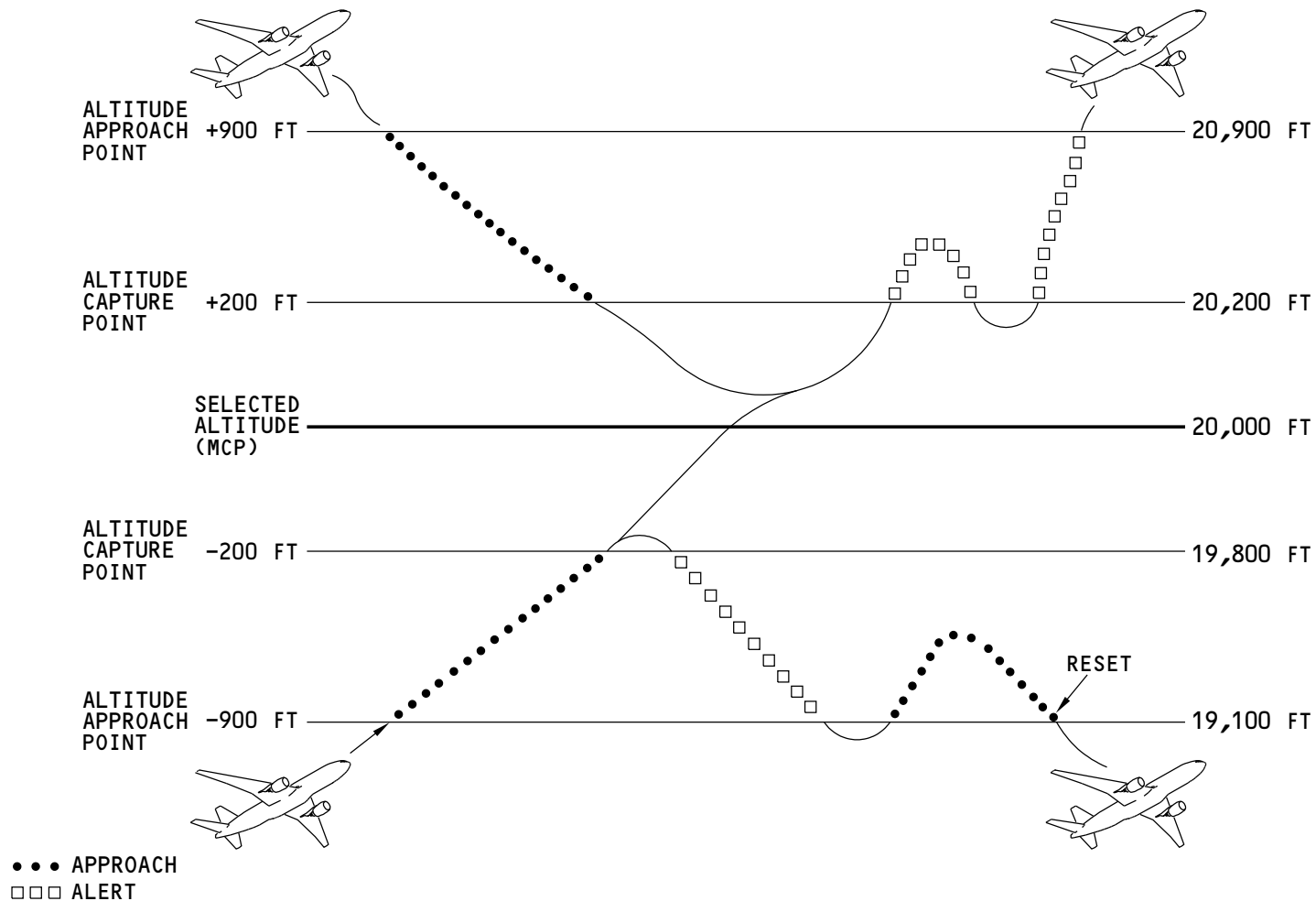
An altitude alert occurs when the airplane goes more than 200 feet away from the selected altitude.

Reset

An altitude alert reset occurs when one of these happens:

- The airplane goes 900 feet away from the selected altitude
- The flight crew changes the selected altitude on the mode control panel
- The airplane returns to within 200 feet of the selected altitude.

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WES - ALTITUDE ALERT FUNCTION

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**WES - ALTITUDE ALERT PFD INDICATIONS AND CONTROL****General**

The primary flight display (PFD) shows altitude alert indications.

Selected Altitude Display and Bug

The selected altitude from the mode control panel (MCP) shows above the altitude indication. The color of the selected altitude display is magenta.

The selected altitude bug is magenta. The bug points to the selected altitude when the selected altitude is on the PFD barometric altitude scale. If the selected altitude is not on the scale, the bug is at the top or bottom of the scale.

Selected Altitude Highlight Box

An altitude alert box is around the selected altitude when the airplane gets to the altitude capture point. This box stays when the airplane is less than 900 feet but more than 200 feet from the selected altitude (altitude approach).

Current Altitude Box

The box around the current altitude is usually white. The box is thicker when the airplane gets to the altitude capture point. The box stays thicker when the airplane is less than 900 feet but more than 200 feet from the selected altitude (altitude approach).

The box is yellow when the airplane goes more than 200 feet but less than 900 feet from the selected altitude (altitude alert).

MCP

The altitude selector is on the MCP. The selected altitude shows in the altitude window above the altitude selector.

Rotate the altitude selector to change the selected altitude.

C-chord

The WEUs make a C-chord aural when the airplane gets to the altitude capture point.

Caution Aural

The WEUs make a caution aural when an altitude alert occurs.

EICAS Message and Master Caution Lights

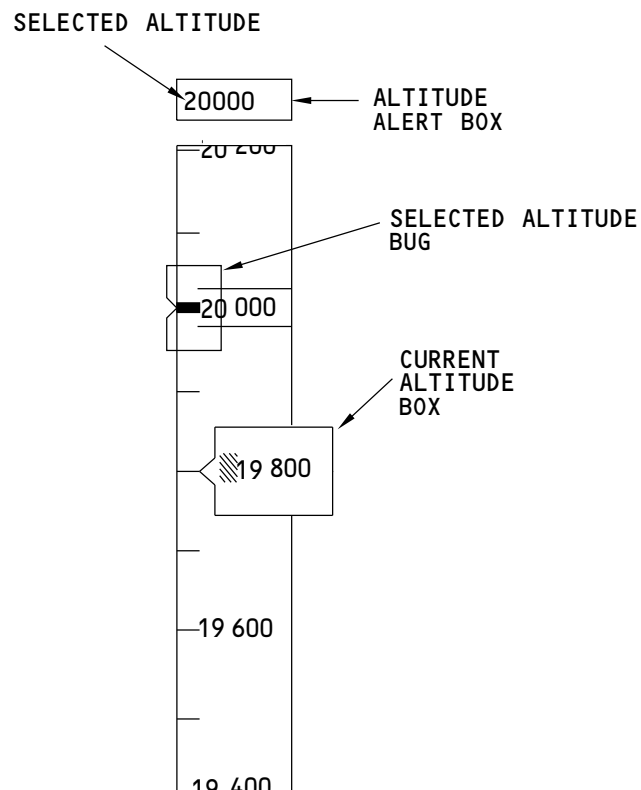
The WEUs send a digital signal to the AIMS cabinets when an altitude alert occurs. The AIMS shows an ALTITUDE ALERT EICAS caution message. The AIMS also makes the master caution lights come on.

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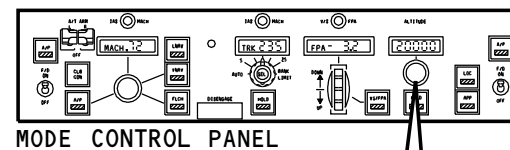
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ALTITUDE INDICATION
ON PFD



SELECTED ALTITUDE CONTROLS

WES - ALTITUDE ALERT PFD INDICATIONS AND CONTROL

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WES - ALTITUDE ALERT OPERATION

Altitude Comparator

The altitude comparator compares the selected altitude with the barometric altitude. The altitude comparator supplies these outputs:

- More than or equal to 200 feet from the selected altitude
- Less than or equal to 900 feet from the selected altitude
- Less than or equal to 200 feet from the selected altitude.

Alert/Approach Logic

The alert/approach logic calculates when the airplane approaches the selected altitude, or when it moves away from the selected altitude.

The alert/approach logic makes an altitude approach signal when the airplane is 200 feet or more, and 900 feet or less from the selected altitude. The altitude approach signal goes to the AIMS cabinets. The AIMS shows altitude approach indications on the primary flight displays (PFDs).

The alert/approach logic makes an altitude alert signal when the airplane goes 200 feet or more from the selected altitude. The altitude alert signals go to the aural alert logic and the AIMS cabinets.

The aural alert logic makes the caution aural.

The AIMS cabinets must receive an altitude alert signal from at least two WEU channels. The AIMS does these functions:

- Shows the ALTITUDE ALERT caution message
- Shows the altitude alert indications on the PFDs
- Makes the master caution lights come on.

Altitude Alert Inhibit

When the altitude alert inhibit signal is true, the altitude alert/approach logic does not make an alert. The WEUs use these signals in the altitude alert/approach inhibit logic:

- Glideslope (G/S) mode engaged
- All gear down and locked

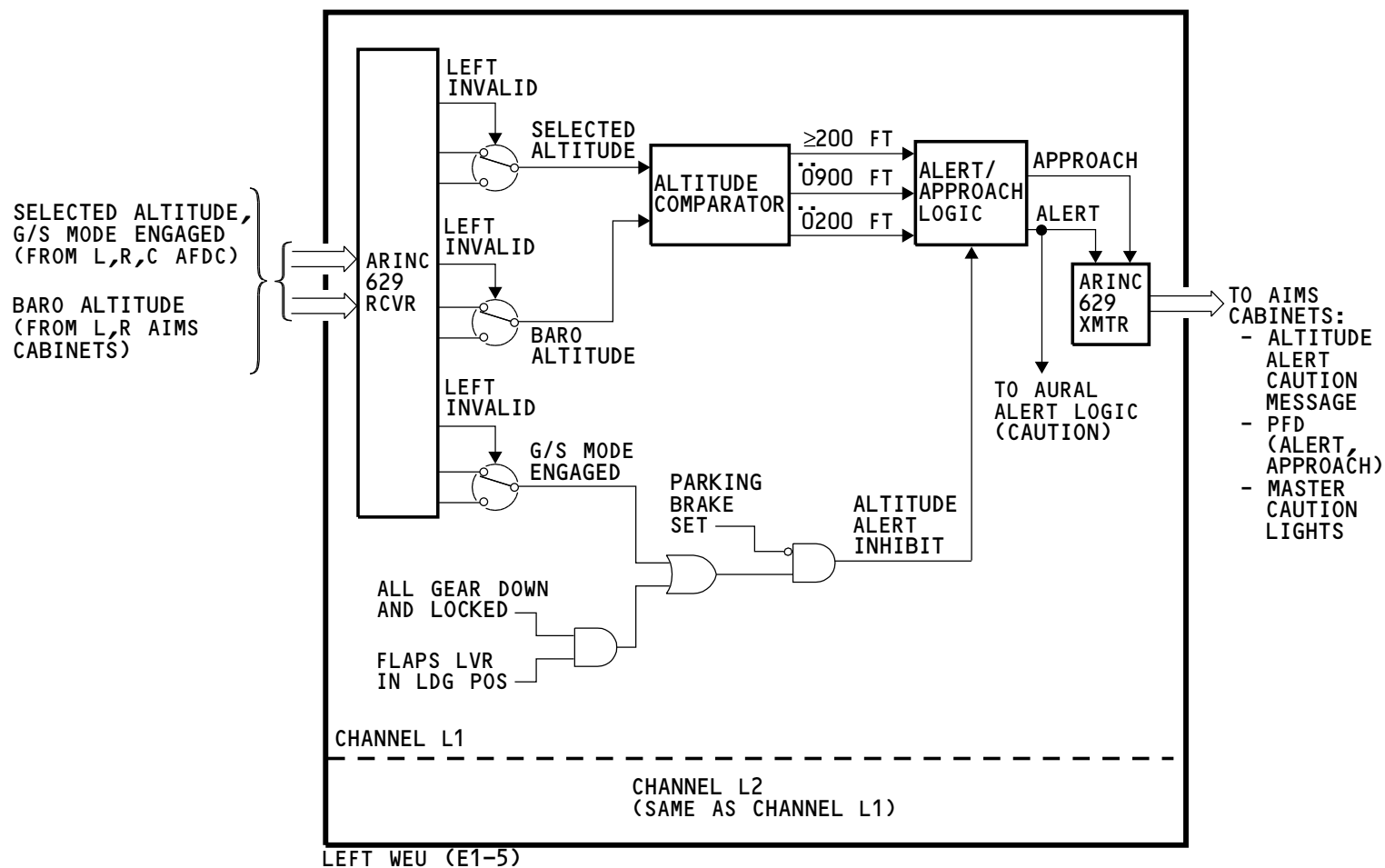
- Flaps in landing position.

Operational Check of the Altitude Alert Function

When the parking brake is set, the altitude alert inhibit signal is false. This permits an operational check of the altitude alert function on the ground.

Move the altitude selector on the mode control panel (MCP). You will see altitude approach indications when the difference between the selected altitude and the barometric altitude is 900 feet or less. After that, you will see altitude alert indications when the difference between selected altitude and barometric altitude is 200 feet or more.

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WES - ALTITUDE ALERT OPERATION

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WES - STALL WARNING FUNCTION

General

The stall warning function has these four functions:

- Stick shaker activation
- Pitch limit indication (PLI) calculation
- Speed tape parameter calculation
- Auto slat enable.

Stick Shaker Activation

The WEUs make the stick shaker actuators come on when the airplane has a corrected angle of attack (AOA) (alpha) that is too high.

The stick shaker trip point (AOA STRIP) logic calculates the AOA STRIP. The logic uses these inputs:

- Mach number from the air data inertial reference unit (ADIRU). Channels L1 and R1 use the ADIRU as the primary source and the SAARU as the secondary source. Channels L2 and R2 use the SAARU as the primary source and the ADIRU as the secondary source
- Nose gear down and locked from the proximity switch electronic unit (PSEU)
- Speedbrake lever position (SBLP) from the primary flight computers (PFCs)
- Flap and slat position from the flap/slat electronics units (FSEUs).

The WEUs compare the AOA STRIP and the AOA. If the AOA is equal to or higher than the AOA STRIP, each WEU channel makes a stick shaker actuator enable signal. This will happen only if the airplane is in the air.

The stick shaker actuators come on only when at least two channels in the same WEU make a stick shaker actuator enable signal.

Icing Correction

Selection of wing or engine anti-ice during flight will cause the stick shaker angle of attack schedule to be adjusted downward. The result is the stick shaker will activate at a higher speed.

Air Mode

The WEUs make the stick shaker actuators come on only when the air mode signal is true. The WEUs use these inputs to calculate the air mode signal:

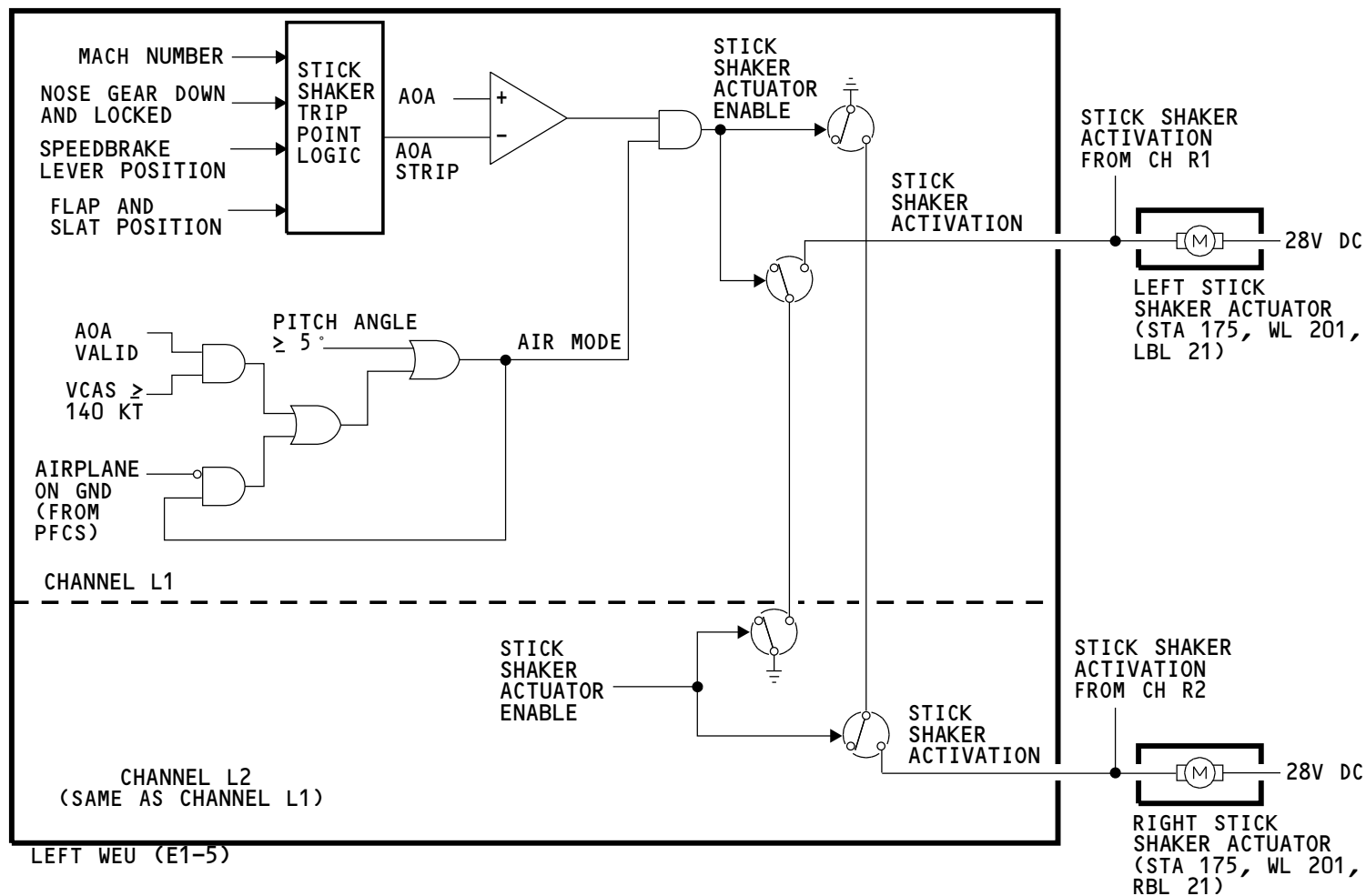
- Angle of attack (AOA)
- Computed airspeed
- Pitch angle.

All these signals come from the ADIRU. If the ADIRU fails, the WEUs use the SAARU.

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WES - STALL WARNING FUNCTION

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WES - PITCH LIMIT INDICATION

General

The WEUs calculate and show the flight crew the maximum pitch limit. The maximum pitch limit is the number of degrees the airplane can pitch up from the current pitch angle before the stick shaker actuators come on.

PLI Logic

The pitch limit indication (PLI) logic in each WEU channel uses these inputs to calculate the maximum pitch limit:

- Active control minimum speed (VCMIN) - VCMIN comes from the flight management computing function (FMC) of AIMS
- Stick shaker speed (VSS) - VSS comes from the VSS logic in each WEU
- Stick shaker trip point
- Corrected angle of attack (AOA)
- Air mode signal
- Computed airspeed (VCAS)
- Flaps up - This signal comes from the flap slat electronics units (FSEUs)
- Leading edge devices retracted - This signal comes from the FSEUs.

PLI Data

The PLI logic sends the PLI data to the AIMS cabinets. The AIMS cabinets send the data to the primary flight displays (PFDs). The PFDs show the pitch limit indicator symbol.

The WEUs send valid PLI data to the AIMS for both flaps not up and flaps up conditions.

For flaps not up conditions, the WEUs always send valid PLI data to the AIMS.

For flaps up conditions, the WEUs send valid PLI data to the AIMS only when any of these conditions is present:

- The flaps are up

- VCAS is less than the upper limit of the FMC minimum maneuver speed (amber band) on the PFD speed tape
- VCAS is less than 1.14 VSS.

At any other time, the data is no computed data (NCD).

The PLI goes out of view for any of these conditions:

- VCAS is 5 knots above the upper limit of the FMC minimum maneuver speed (amber band) for more than 15 seconds
- VCAS is above 1.14 VSS.

Pitch Limit Indications

When the airplane is on the ground and the flaps are not up, the pitch limit indicator shows 15 degrees pitch up attitude.

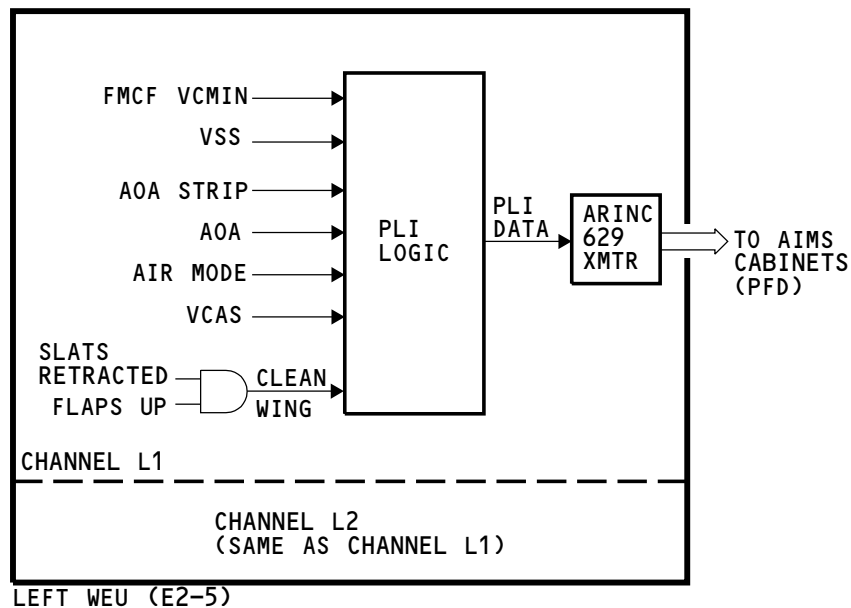
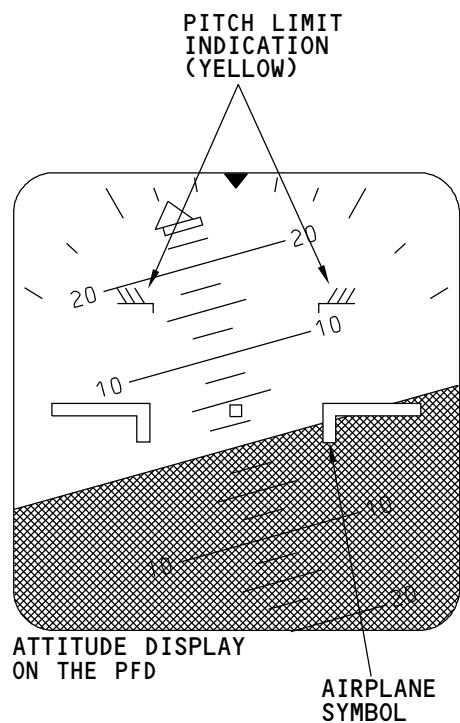
The maximum pitch limit indication at any time is 30 degrees minus the actual pitch angle.

The stick shaker actuators come on when the airplane symbol reaches the same pitch as the pitch limit indicator symbol.

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WES - PITCH LIMIT INDICATION

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WES - SPEED TAPE PARAMETER CALCULATION - 1

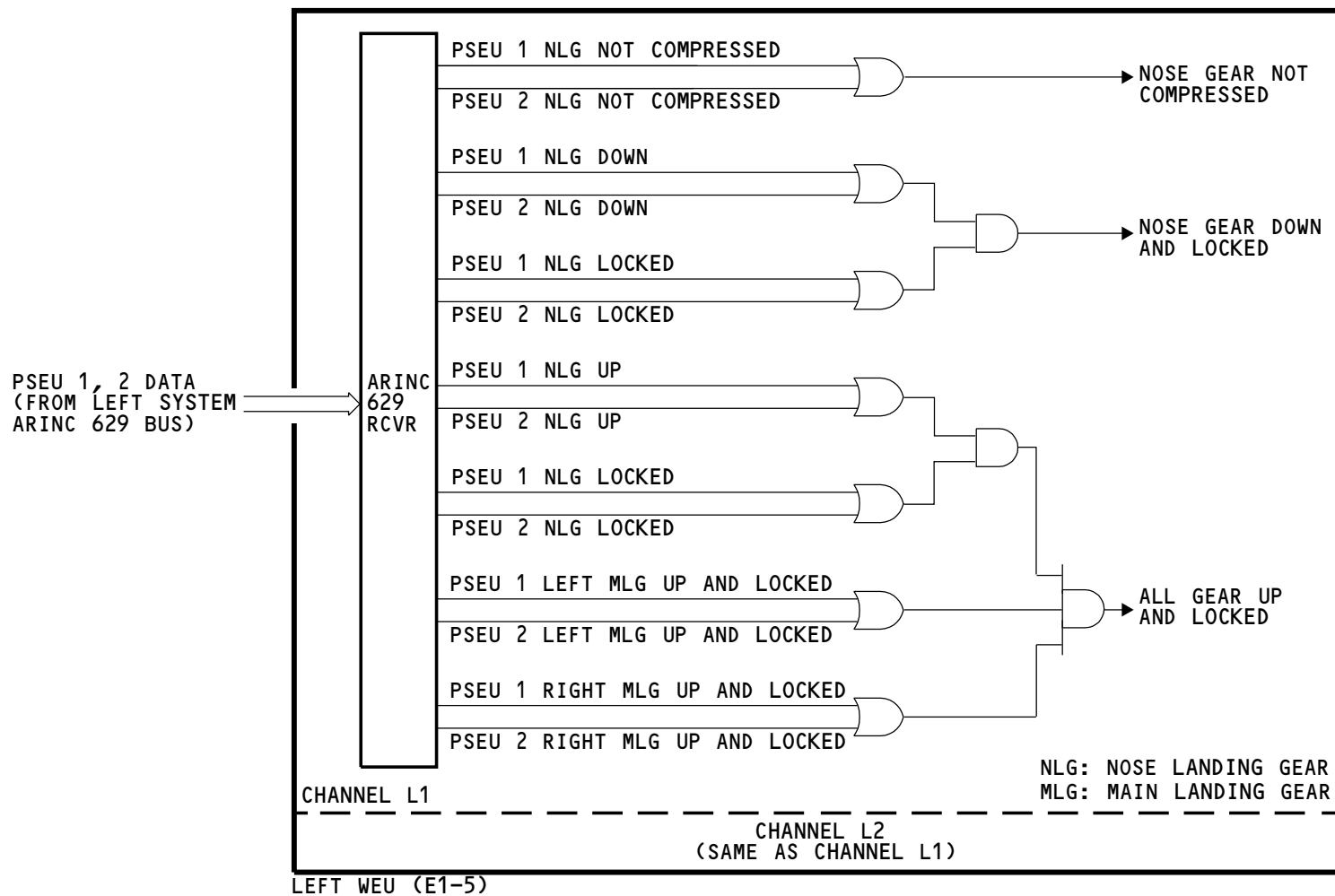
General

The WEUs use proximity switch electronic unit (PSEU) data to make these signals:

- All gear up and locked
- Nose gear not compressed signal
- Nose gear down and locked.

The WEUs use those signals to make speed tape parameters.

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WES - SPEED TAPE PARAMETER CALCULATION - 1

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WES - SPEED TAPE PARAMETER CALCULATION - 2

Speed Tape Parameters

The WEUs calculate these speed tape parameters:

- Maximum operating speed and the maximum operating mach number (VMO/MMO)
- Maximum flaps extended/maximum gear extended speed (VFE/VLE)
- Maximum speed (VMAX)
- Minimum speed (VMIN)
- Maneuver margin above stick shaker speed (VSSNG).

Inputs

The air data inertial reference unit (ADIRU) supplies these inputs for speed tape parameter calculation:

- Corrected angle of attack (AOA)
- Barometric altitude
- Body longitudinal acceleration (AL)
- Body normal acceleration (AN)
- Computed airspeed (VCAS)
- Mach number (MACH NO)
- Static pressure.

If the ADIRU fails, the secondary attitude air data reference unit (SAARU) supplies the same inputs.

The primary flight computers (PFCs) supply the PFCS in secondary or direct mode of operation signal, and speedbrake lever position (SBLP).

The proximity switch electronic units (PSEU) supply these inputs:

- All gear up and locked
- Nose gear down and locked
- Nose gear not compressed.

The flap slat electronic units (FSEUs) supply flap and slat position.

The alternate gear down dispatch switch supplies three identical ground signals when the switch is in the VMO position. When the alternate gear down dispatch switch is in the VMO position, the WEUs send a memo message request to the AIMS cabinets. The primary display function of the AIMS shows the memo message VMO GEAR DOWN.

Speed Tape

The primary flight display (PFD) shows the speed tape. The maximum speed (VMAX) and minimum speed (VMIN) show on the speed tape.

VMO/MMO Logic

The VMO/MMO logic calculates the maximum operating speed (VMO) and the maximum operating mach number (MMO).

The VMO and MMO are normally 330 knots and mach .87. When at least two of the three ground signals from the alternate gear down dispatch switch show the switch is in the VMO position, the VMO/MMO logic changes the VMO and MMO to 270 knots and mach .73.

The VMO/MMO goes to the maximum operating speed (VMAX) logic. When the computed airspeed (VCAS) or the mach number (MACH NO) is more than the limit calculated by the VMO/MMO logic, the VMO/MMO logic makes an overspeed warning.

VFE/VLE Logic

The VFE/VLE logic calculates VFE/VLE.

When the flaps and slats are up and the gear not clean signal is false, VFE/VLE is no computed data. When the flaps are not up, VFE/VLE is the same as VFE. When the flaps are up and the gear not clean signal is true, VFE/VLE is the same as VLE.

VFE/VLE goes to the VMAX logic. VFE/VLE also goes to the AIMS cabinets for FMCF calculations.

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**WES - SPEED TAPE PARAMETER CALCULATION - 2****VMAX Logic**

The VMAX logic calculates the VMAX. If the wing is clean and the gear not clean signal is false, VMAX is the same as the VMO/MMO. VMAX is the same as VFE/VLE for any other condition.

VMAX goes to the AIMS cabinets for display on the PFD and for FMCF calculations.

VSS Logic

The stick shaker speed (VSS) logic calculates VSS. VSS goes to the VMIN logic.

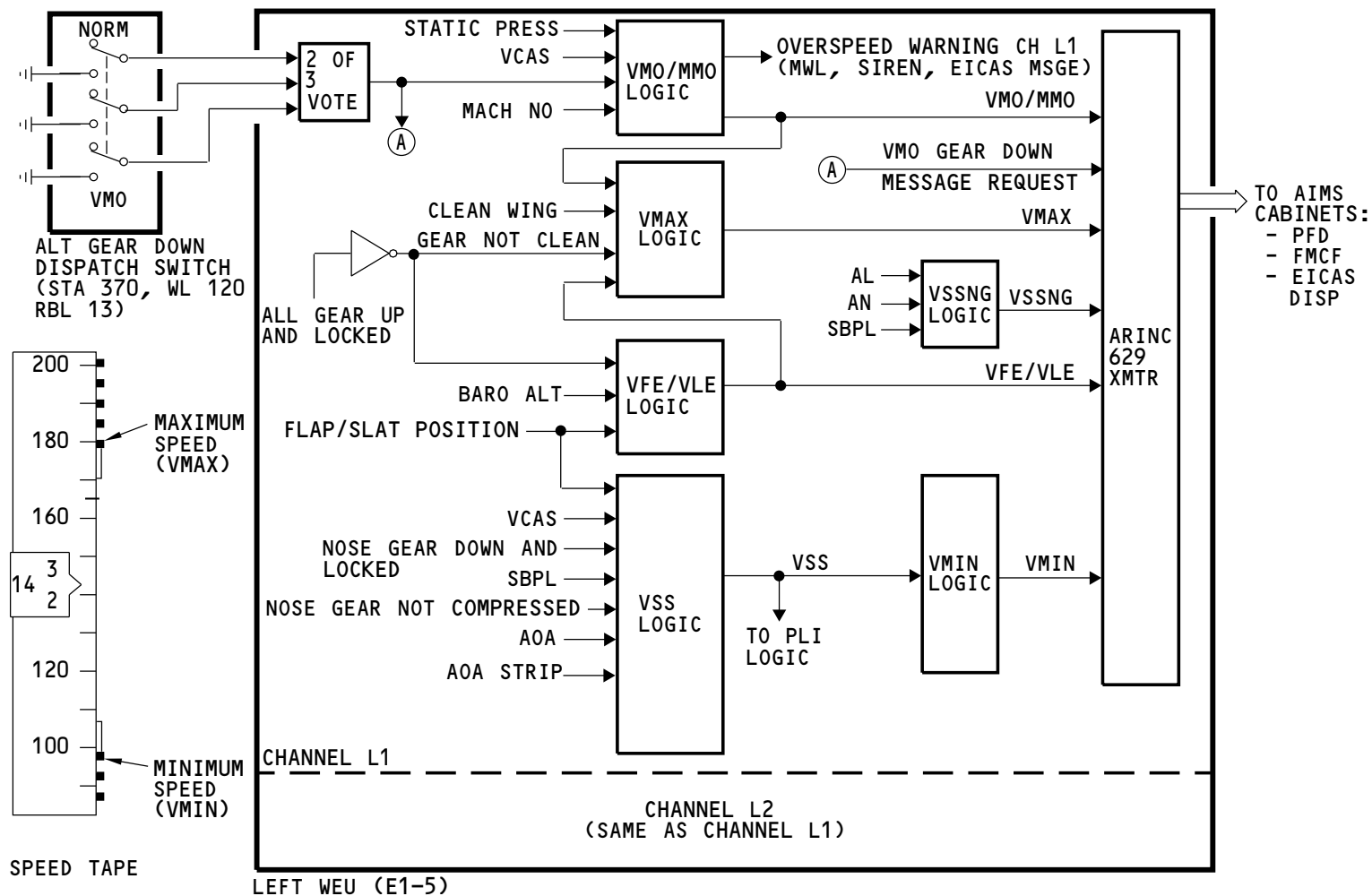
VMIN Logic

The VMIN logic calculates VMIN. VMIN is the same as VSS.

VMIN goes to the AIMS cabinets for display on the PFD and for FMCF calculations.

VSSNG Logic

The VSSNG logic calculates VSSNG. VSSNG goes to the AIMS cabinets for FMCF calculations.



WES - SPEED TAPE PARAMETER CALCULATION - 2

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**WES - AUTO SLAT ENABLE****General**

The auto slat enable function extends the leading edge slats automatically when the airplane is near a stall. The slats extend from the sealed position to the gapped position. This action gives more lift.

The auto slat enable function only operates when the flaps are 1 to 20 units, and the airplane is in the air.

Operation

If the corrected angle of attack (AOA) is more than the auto slat trip point (AOA AS), the WEUs make an auto slat enable signal.

The auto slat enable signal goes to the flap slat electronic units (FSEUs) and to the hydraulic interface modules (HYDIMs).

The FSEUs extend the slats from the sealed to the gapped position.

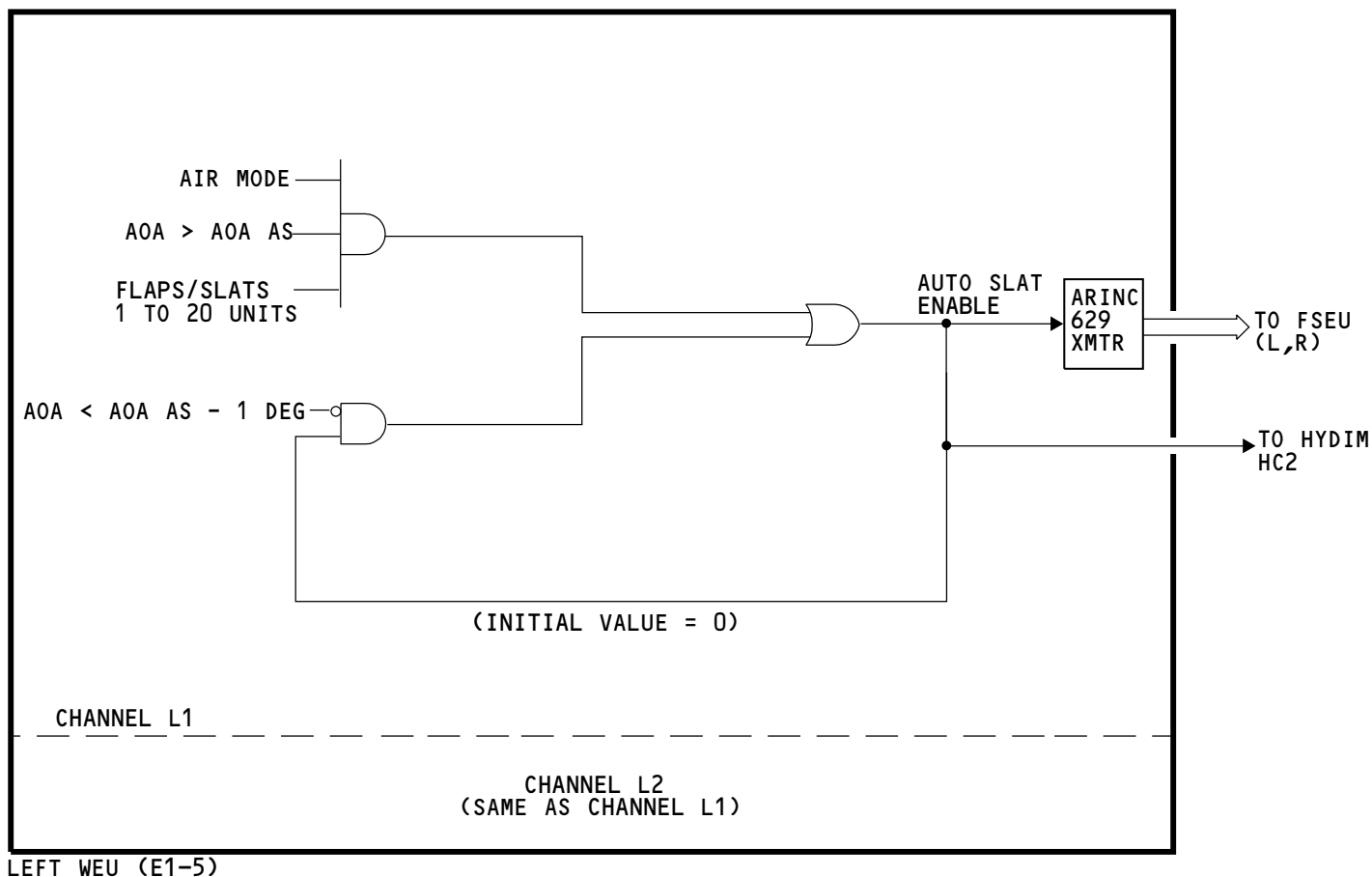
The HYDIMs increase available hydraulic flow for the slats. Because of the WEU signals to the HYDIMs, the slats move from the sealed position to the gapped position faster than normal.

When the auto slat enable signal is true, it stays true until the AOA is one degree below the AOA AS.

HYDIM Interfaces

Channels L1 and R1 auto slat enable signals go to HYDIM HC2. Channels L2 and R2 auto slat enable signals go to HYDIM HC1.

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WES - AUTO SLAT ENABLE

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WES - STALL WARNING FUNCTION TEST

General

Start a stall warning function test from the maintenance access terminal (MAT).

The stall warning function test does a check of the stall warning function in each WEU channel. The stall warning function test also verifies the condition of the stall warning function inputs. If any input is not present or is invalid, the test fails.

Initiated Test Inhibit

A WEU channel must make an initiated test inhibit signal as false before a stall warning function test can start.

When the initiated test inhibit signal is true, the WEU channels cannot start any test.

The initiated test inhibit signal within a WEU channel is false (a test can start) only when all these conditions are true:

- Both engines are at less than takeoff thrust
- The airplane is on the ground
- The nose gear is compressed
- The ADIRU and the SAARU send incomplete pitot/static data (airplane not moving)
- Three or more WEU channels detect the same previous conditions.

Stall Warning Function Test Logic

The stall warning function test logic receives the stall warning test signal from the AIMS cabinets. The stall warning function test logic supplies test signals that are on for 2 seconds and then go off. The stall warning function test logic does these functions:

- Makes the pitch limit indicators on the PFD go to 10 degrees
- The PFD speed tape shows a maximum operating speed (Vmo) of 50 knots, and a minimum speed limit of 30 knots
- Makes an auto slat enable signal that goes to a hydraulic interface module (HYDIM) and the flap slat electronic units (FSEUs)

- Makes the stick shaker actuators come on
- Verifies the condition of the stall warning function inputs
- Supplies test results to the MAT.



WARNING

IF THE FLAP LEVER IS AT 1,5,15, OR 20 AND HYDRAULIC POWER IS APPLIED TO THE AIRPLANE, THIS TEST WILL CAUSE THE LE SLATS TO MOVE FROM SEALED TO GAPPED. THIS LE SLAT MOVEMENT CAN BE PREVENTED BY SETTING BOTH THE C1 AND C2 AIR SWITCHES (P5 HYDRAULIC PANEL) TO THE OFF POSITIONS.

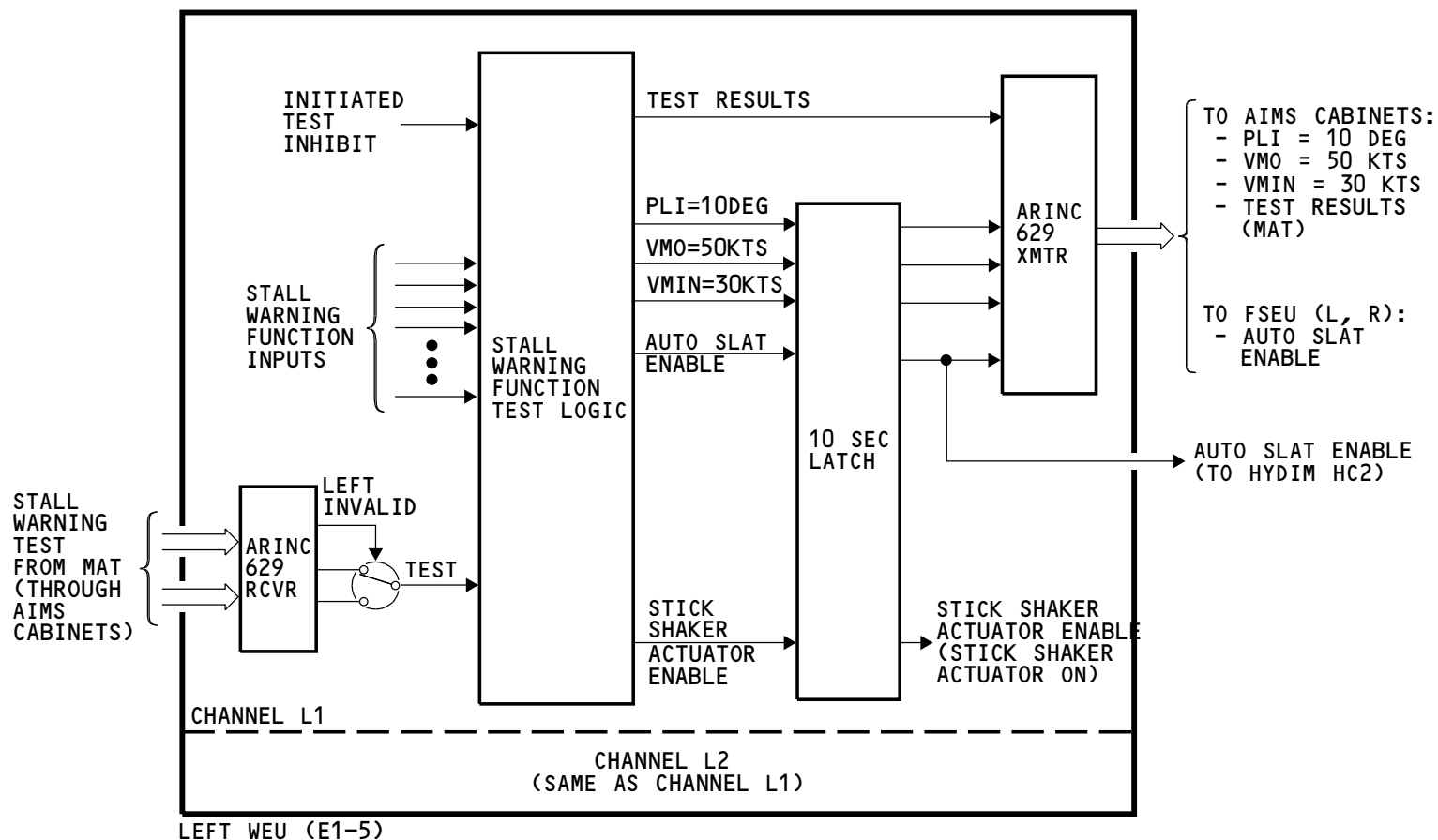
MAT Display

The MAT shows a STALL WARNING TEST FAIL message or a STALL WARNING TEST PASS message after the test ends.

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WES - STALL WARNING FUNCTION TEST

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WES - SYSTEM TEST

General

Use the MAT to start a WES system test. During the WES system test, each channel verifies:

- Its internal status
- The ARINC 629 inputs
- The ARINC 429 inputs
- All analog discrete inputs
- That all WEU channels have the same software
- Correct operation of the master warning lights and the aural warning speakers.

Each channel does the first five operations independent of each other. The four channels operate synchronously during the last operation.

The system test lasts approximately 20 seconds.

Initiated Test Inhibit

When the initiated test inhibit signal is true, the WEU channels cannot start any test.

These conditions must be true before you can do any WES test:

- Both engines are at less than takeoff thrust
- The airplane is on the ground
- The nose gear is compressed
- The ADIRU and the SAARU send incomplete pitot/static data (airplane not moving)
- Three or more WEU channels detect the same previous conditions.

Initiated Test Enable, WES System Test Enable

Each WEU channel must make an initiated test enable signal and a WES system test enable signal before a WES system test can start.

The initiated test enable signal within a WEU channel is true only when all these conditions are true:

- Both engines are at less than takeoff thrust
- The airplane is on the ground
- The nose gear is compressed
- The ADIRU and the SAARU send incomplete pitot/static data (airplane not moving).

The WES system test enable signal is true when all these conditions are present:

- Both engines fuel control switches are in the cut-off position (engines are not running)
- Initiated test enable signal is true.

Master Warning lights

Each WEU channel verifies its ability to make the master warning lights come on. Each WEU channel must receive at least one master warning light (MWL) arm signal from one other channel, before it makes a master warning light come on. Each WEU channel verifies all MWL arm combinations.

The master warning lights will come on and then go out as each of the 4 WEU channels verifies its master warning light. You will see the master warning lights flash 4 times during the WES system test.

Each WEU channel verifies the status of a master warning light. If current flow is not present when a channel makes the master warning light come on, or if current flow is present when a channel makes the master warning light go off, the channel considers the light failed.

A MWL-L or R status message shows when a master warning light fails.

WES - SYSTEM TEST

Aural Warning Speakers

Channel L1 does a test of the left aural warning speaker. Channel L1 must receive at least one aural arm signal from one other channel, before it sends a test tone for approximately 100 ms to the left aural warning speaker. Channel R1 does the same with the right aural warning speaker. You will hear a short test tone two times during the WES system test.

If a return voltage from the aural warning speaker is not present when a channel makes the test tone, or if a return voltage is present when a WEU channel makes the test tone, the channel considers the speaker failed.

A WARNING SPEAKER-L or R status message shows when an aural warning speaker fails.

Test Status

The MAT shows a WES SYSTEM TEST PASS message or a WES SYSTEM TEST FAIL after the WES system test ends.

Channel Failure

If a WEU channel fails during a system test, a WEU L1, L2, R1, or R2 EICAS status message shows.

Automatic WES System Test

The WEUs start a WES system test automatically when you apply power to the WEUs. However, the automatic test will start only if the WES system test enable signal is true.

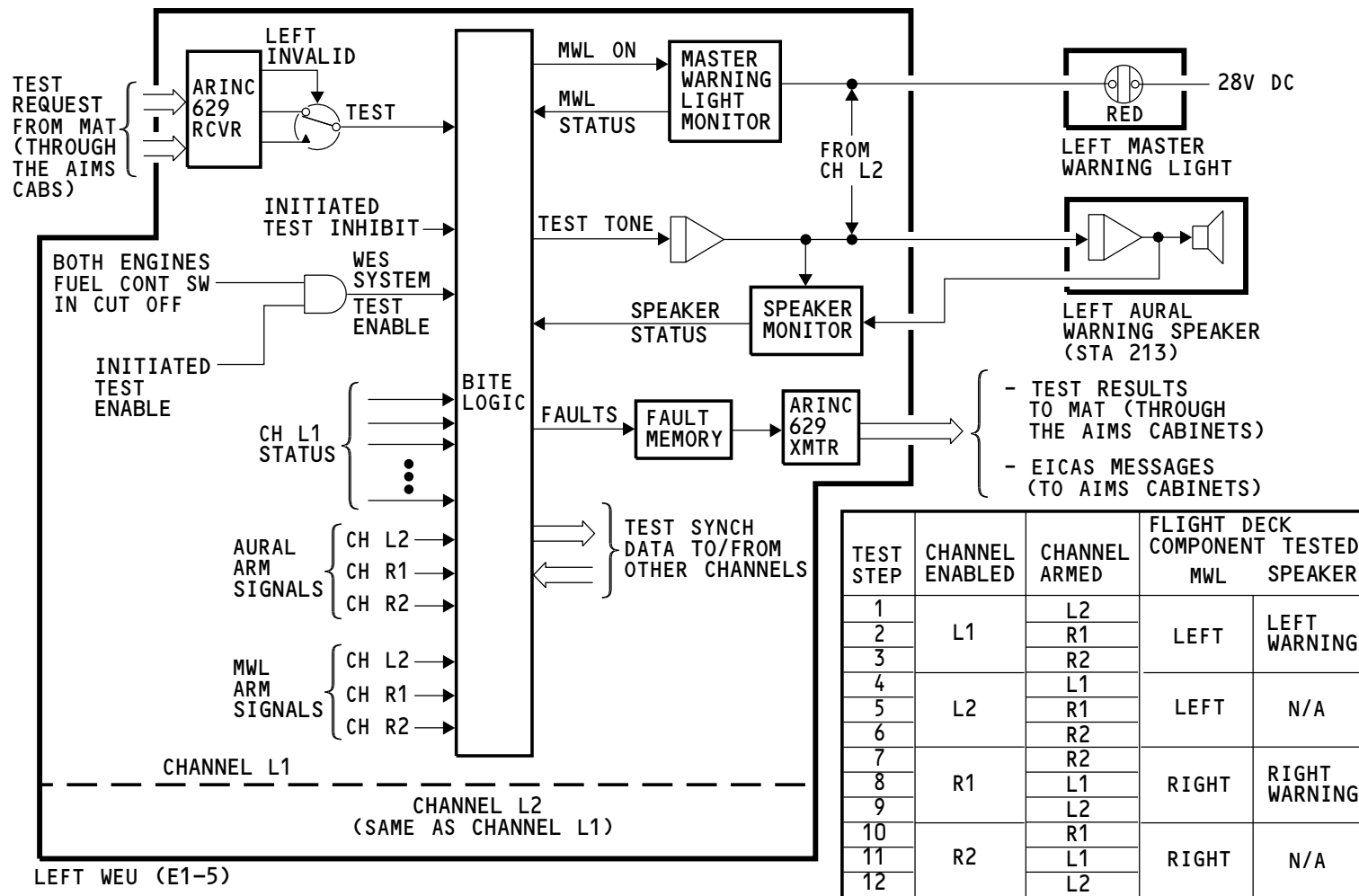
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WES - SYSTEM TEST

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WES - DATA LOAD**Software Loading**

It is necessary to load software into the WEUs. The WEU software files are:

- WEU OPC (operational program codes)
- WEU OPS (operational program system)
- WEU DB (data base).

The WEU OPC file supplies the warning electronics system (WES) customer options.

The WEU OPS file supplies the WEU operational software system.

The WEU DB file supplies the WEU data bases. Examples of the WEU data bases are stabilizer green band look-up tables, and stall warning function limits.

Software Interlock and ARINC 629 Input Port

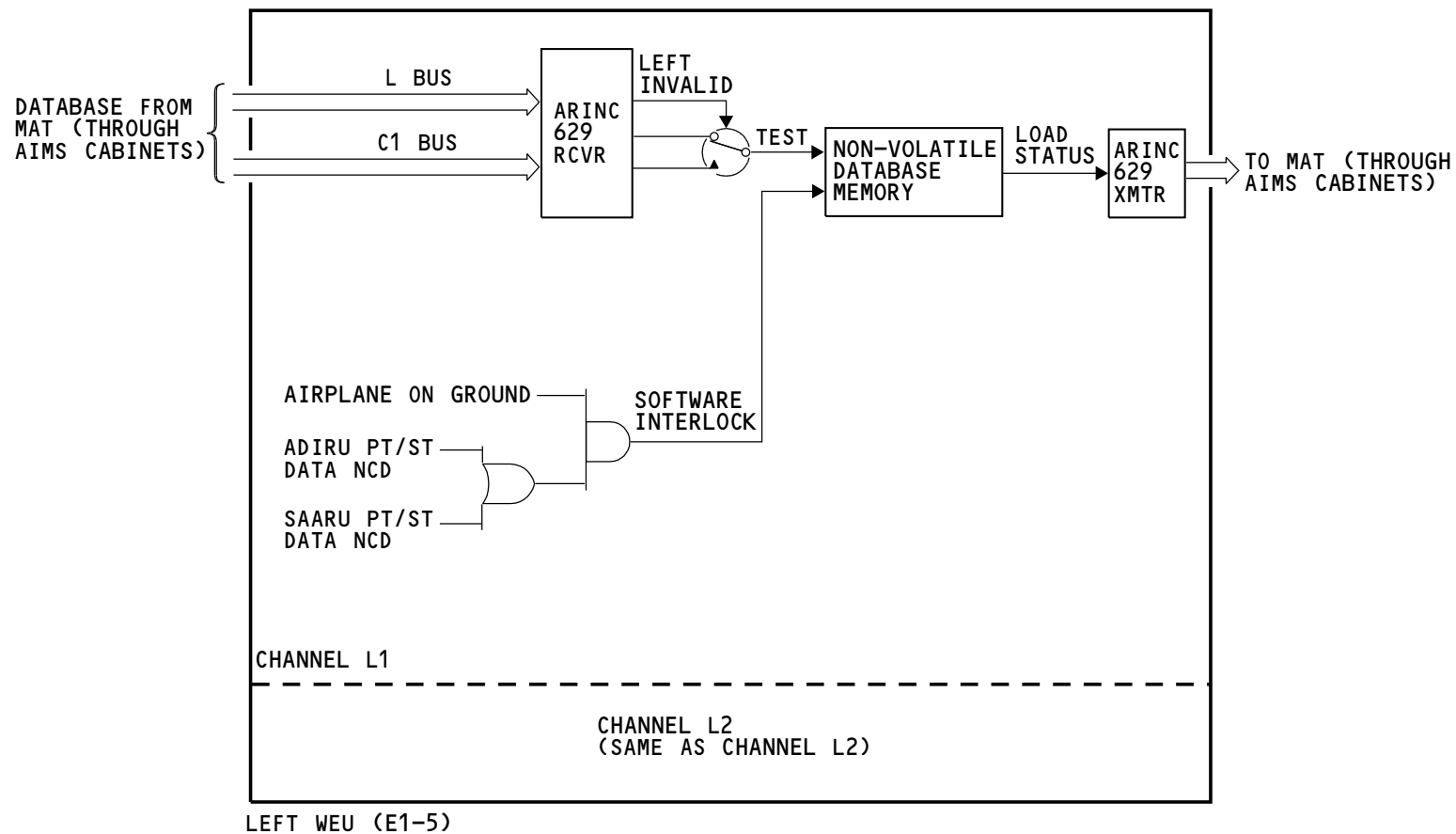
A software interlock must be present before a channel accepts a software data load.

Each channel accepts software data loads through only one ARINC 629 input port. If that input fails the channel switches to its other ARINC 629 input port.

Maintenance Practices

Each WEU must have software files. Use the MAT to make sure each WEU has software files loaded. All channels must have the same software.

If the WEUs do not have software files in them, use the MAT to load the WEU software files.



WES - DATA LOAD

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WES - GROUND TESTS - 1**General**

These are the WES tests you can do from the MAT:

- WES system test
- Takeoff configuration warning test
- Landing configuration warning test.

Landing Configuration Warning Test

The landing configuration warning test verifies the operation of the landing configuration warning function and the speedbrake alert function. You will notice a landing configuration warning when you do this test.

Takeoff Configuration Warning Test

The takeoff configuration warning test verifies the operation of the takeoff configuration warning function. This test simulates takeoff thrust and looks for proper takeoff configuration warning function response.

When you do a takeoff configuration warning test, you also do a stabilizer green band test. You will see the green band lamps on the stabilizer trim indicators come on.

Training Information Point

The takeoff configuration warning test will supply a takeoff configuration warning only if the airplane is not in the proper configuration for takeoff.

WES System Test

The WES system test verifies the status of each one of the WES channels. The test also verifies the operation of these:

- Master warning lights
- Aural warning speakers
- Stick shaker actuators.

GROUND TESTS

SELECT ATA SYSTEM (55)

31 AIMS - AIRPLANE CONDITION MONITORING SYSTEM	SELECT TEST TYPE ☒ SYSTEM TEST ☐ OPERATIONAL TEST ☐ LRU REPLACEMENT TEST
31 AIMS - LEFT AIMS	
31 AIMS - RIGHT AIMS	
31 WARNING ELECTRONIC SYSTEM	
31 AIMS - DISPLAY SYSTEM	
32 AIR/GROUND SYSTEM	
32 ANTISKID/AUTOBRAKE CONTROL SYSTEM	
32 BRAKE TEMPERATURE MONITOR SYSTEM	
32 PROXIMITY SENSOR SYSTEM (PSS)	

SELECT SYSTEM TEST (3)

LANDING CONFIGURATION WARNING
 TAKEOFF CONFIGURATION WARNING
 WARNING ELECTRONIC SYSTEM

CONTINUE

HELP

GO BACK

SELECT SYSTEM TEST (3)

LANDING CONFIGURATION WARNING
 TAKEOFF CONFIGURATION WARNING
 WARNING ELECTRONIC SYSTEM

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WES - GROUND TESTS - 1

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WES - GROUND TESTS - 2

General

You do the stall warning test from the MAT.

Training Information Point

The WES is in ATA chapter 31. However, you must select ATA System 27 Stall Warning Management to do a stall warning test.

Stall Warning Test

The stall warning test verifies the operation of the stall warning function. This test will activate the stick shaker actuators momentarily. You will also see some speed tape parameters on the PFD.

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GROUND TESTS

SELECT ATA SYSTEM

26 CARGO SMOKE DETECTION SYSTEM
26 FIRE EXTINGUISHING SYSTEM
27 PRIMARY FLIGHT CONTROL SYSTEM
27 STALL WARNING MANAGEMENT
27 HIGH LIFT SYSTEM
29 HYDRAULIC SYSTEM
30 AIRFOIL COWL ICE PROTECTION SYSTEM
30 AIR DATA SENSOR ANTI-ICE SYSTEM
30 WINDOW HEAT CONTROL SYSTEM

(55) SELECT TEST TYPE

☒ SYSTEM TEST
☐ OPERATIONAL TEST
☐ LRU REPLACEMENT TEST

SELECT SYSTEM TEST (1)

CONTINUE

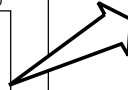
HELP

GO BACK

SELECT SYSTEM TEST

(1)

STALL WARNING



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WES - GROUND TESTS - 2

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**WES - TAKEOFF RUNWAY DISAGREE ALERT FUNCTION****General**

The Takeoff Runway Disagree function determines whether the aircraft is on the selected takeoff runway by comparing the aircraft's GPS position with the cross-track distance from the centerline of the origin runway entered in the active flight plan in the Control Display Unit (CDU).

A cross-track distance that exceeds 100 feet or GPS HIL (whichever is greater) will be the first logical element that will affect the alert comparing the aircraft's heading with the heading of the origin runway entered in the active flight plan in the CDU.

A heading difference of greater than 30 degrees will be the second logical element that will affect the alert. If either a position or a heading difference is detected, the alert will be triggered.

- Runway disagree function is only enabled when the aircraft is on the ground.
- The FMC Takeoff Runway Disagree function is inhibited when ground speed exceeds 80 knots.
- This option is contingent on this feature being included in the AIMS blockpoint 2003 or 2004 software update.
- This option is contingent on the installation of GPS.
- This option is contingent on acceptance of the retrofit proposal for activation of EICAS Caution-Level FMC RWY DISAGREE.

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PRIMARY DISPLAY SYSTEM - INTRODUCTION

General

The primary display system (PDS) is part of the airplane information management system (AIMS). The PDS shows information in many different formats on six display units (DUs) in the flight deck. The information includes:

- Airplane status
- Navigation data
- Flight plan data
- Engine indicating and crew alerting data
- Communication data
- Checklists
- Maintenance data.

Abbreviations and Acronyms

- ACARS - aircraft communications addressing and reporting system
- ACE - actuator control electronics
- acpt - accept
- ADIRS - air data inertial reference system
- ADIRU - air data inertial reference unit
- AFDS - autopilot flight director system
- ail - aileron
- AIMS - airplane information management system
- ALDB - airline loadable database
- alt - altitude
- altn - alternate
- ANP - Actual Navigation Performance
- app - approach
- ARINC - Aeronautical Radio, Inc.
- arpt - airport
- att - attitude

- baro - barometric
- BLS - bezel light sensor
- brks - brakes
- CAM - camera
- canc - cancel
- capt - captain
- CAS - calibrated airspeed
- CCD - cursor control device
- CDU - control display unit
- chkl - checklist
- CMCF - central maintenance computing function
- comm - communication
- CPM/GG - core processor module/graphics generator
- crz - cruise
- DH - decision height
- DSP - display select panel
- dspl - display
- DU - display unit
- EFIS CP - electronic flight instrument system control panel
- EGT - exhaust gas temperature
- EICAS - engine indication and crew alerting system
- elev - elevator
- eng - engine
- EPCS - electronic propulsion control system
- ESI - engine start inhibit
- excd - exceedance
- ext - external
- fctl - flight control
- F/D - flight director
- FDCF - flight deck communication function

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PRIMARY DISPLAY SYSTEM - INTRODUCTION

- FF - fuel flow
- flprn - flaperon
- flt - flight
- FMA - flight mode annunciation
- FMCF - flight management computing function
- FMCS - flight management computing system
- F/O - first officer
- FPV - flight path vector
- FPA - flight path angle
- FSEU - flap slat electronics unit
- fwd - forward
- GMCS - ground maneuver camera system
- GPWS - ground proximity warning system
- GS - glide slope
- G/S - ground speed
- hdg - heading
- hPa - hectopascal
- hyd - hydraulic
- IDG - integrated drive generator
- ILS - instrument landing system
- IM - inner marker
- inbd - inboard
- IOM - input/output module
- isln - isolation
- ISSP - instrument source select panel
- lim - limit
- LNAV - lateral navigation
- lo - low
- loc - localizer
- LRU - line replaceable unit
- LRM - line replaceable module
- LSK - line select key
- mag - magnetic
- MAT - maintenance access terminal
- MCP - mode control panel
- MDA - minimum descent altitude
- MFD - multi-function display
- MINS - minimums
- MLW - maximum landing weight
- MM - middle marker
- MMEL - master minimum equipment list
- MMO - maximum operating mach number
- MTRS - meters
- nav - navigation
- NCD - no computed data
- ND - navigation display
- NPS - Navigation Performance Scales
- NVM - nonvolatile memory
- N1 - low pressure rotor speed
- N2 - high pressure compressor RPM
- OF - overfull
- OM - outer marker
- OPAS - overhead panel ARINC 629 system
- outbd - outboard
- ovht - overheat
- PDS - primary display system
- PFD - primary flight display
- pln - plan
- pos - position
- QFE - altimeter setting to indicate height above reference airfield

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PRIMARY DISPLAY SYSTEM - INTRODUCTION

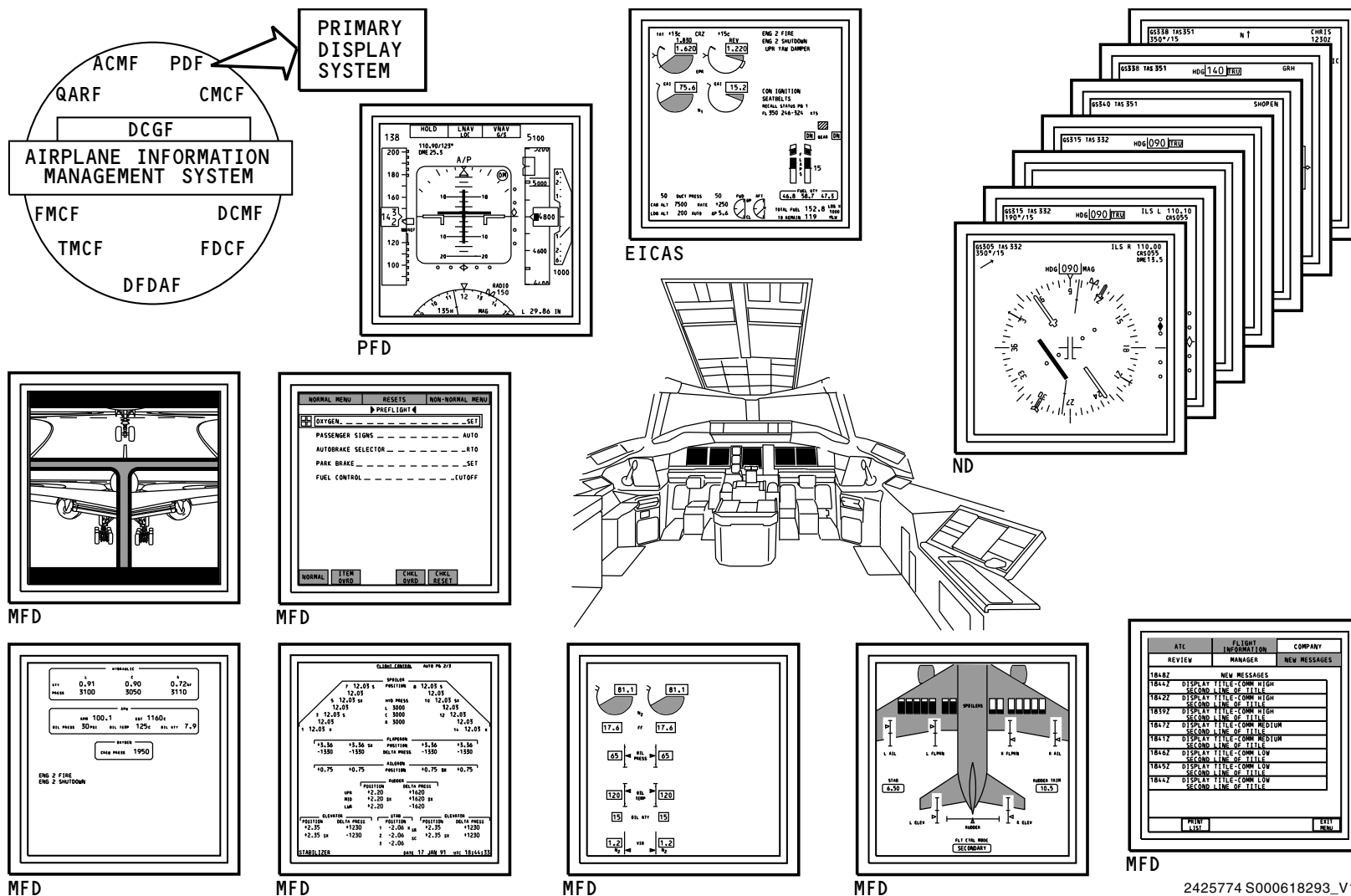
- QNH - altimeter setting to indicate height above mean sea level
- QRH - quick reference handbook
- RA - radio altitude
- RA - resolution advisory
- rcd - record
- rcl - recall
- ref - reference
- rev - reverser
- RF - refill
- rjct - reject
- RLS - remote light sensor
- RNP - Required Navigation Performance
- RTO - rejected takeoff
- SAI - system analysis item
- SATCOM - satellite communications
- SMT - scheduled maintenance task
- SPD - speed
- stat - status
- std - standard
- TA - traffic advisory
- TAI - thermal anti-ice
- TAS - true airspeed
- TCAS - traffic alert and collision avoidance system
- TCIU - taxi camera interface unit
- TCW - time critical warning
- temp - temperature
- tfc - traffic
- trk - track
- upr - upper
- UTC - universal time (coordinated)
- vert - vertical
- vib - vibration
- vlv - valve
- VMO - maximum operating limit speed
- VNAV - vertical navigation
- VR - rotation speed
- VREF - landing reference speed
- VSI - vertical speed indicator
- VS - stall speed
- VTK - vertical track
- VTO - volumetric topoff
- V1 - takeoff decision speed
- V2 - takeoff safety speed
- WAI - wing anti-ice
- WES - warning electronics system
- wpt - waypoint
- WXR - weather radar
- X-BLD - cross bleed

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PRIMARY DISPLAY SYSTEM - INTRODUCTION

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PRIMARY DISPLAY SYSTEM - GENERAL DESCRIPTION

General

The AIMS PDS provides dynamic and static information to the flight and ground crews. The PDS also provides crew interface with other avionics systems. These are the major components of the AIMS PDS:

- Six display units (DUs)
- Two EFIS control panels (EFIS CPs)
- Display select panel (DSP)
- Two cursor control devices (CCDs)
- Two remote light sensors (RLSs)
- Two instrument source select panels (ISSPs)
- Two display switching panels
- Center display control panel.
- NPS Deviation Scales and Points
- ANP Bars
- Anticipation Cues (Ghost Pointers)

Three control display units (CDU) give alternate EFIS CP functions and alternate DSP functions.

Overhead Panel ARINC 629 System (OPAS) Interface

These are the control panels that interface with the OPAS:

- DSP
- Two CCDs
- Two ISSPs
- Two display switching panels
- Center display control panel.

OPAS multiplexes the signals and sends the data to the systems ARINC 629 data buses.

OPAS also sends control information to each control panel.

AIMS Cabinet Interfaces

The AIMS cabinets get airplane information on the ARINC 629 flight controls and system buses and the ARINC 429 buses. The AIMS cabinets also get analog and analog discrete data.

The AIMS cabinets get control information from the two EFIS CPs and the two CCDs on ARINC 429 data buses. Additional control information comes from the three CDUs on the systems ARINC 629 buses.

The AIMS cabinets send information to the display units on high speed coax lines through four coax couplers.

Two remote light sensors supply inputs to the two outboard display units. Other flight deck controls supply additional brightness and contrast controls for the display units.

Each display unit sends information to the AIMS cabinets on ARINC 429 data buses. This data is for fault reporting and brightness controls.

DU Location and Formats

Location determines which types of display format shows. These are the display locations:

- Left outboard DU
- Left inboard DU
- Upper center DU
- Lower center DU
- Right inboard DU
- Right outboard DU.

The format that each DU shows depends on its location. DU status, location, and switch inputs determine the format a DU shows. These are the formats a DU can show:

- Primary flight display (PFD)
- Navigation display (ND)
- EICAS

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**PRIMARY DISPLAY SYSTEM - GENERAL DESCRIPTION**

- Multifunction display (MFD).

The left and right outboard DUs show only a PFD format.

The left and right inboard DUs normally show the ND format. They can show these formats:

- PFD
- EICAS
- MFD.

The upper center DU shows only the EICAS format. The lower center DU normally shows the MFD format. It can show these formats:

- EICAS
- ND
- MFD.

Each format has one or more modes. Flight deck control inputs and other system inputs determine which mode shows.

The PFD has only one mode.

The ND has these seven modes:

- Centered approach mode
- Expanded approach mode
- Centered VOR mode
- Expanded VOR mode
- Centered map mode
- Expanded map mode
- Plan mode.

The EICAS display can show the normal display or a compacted format.

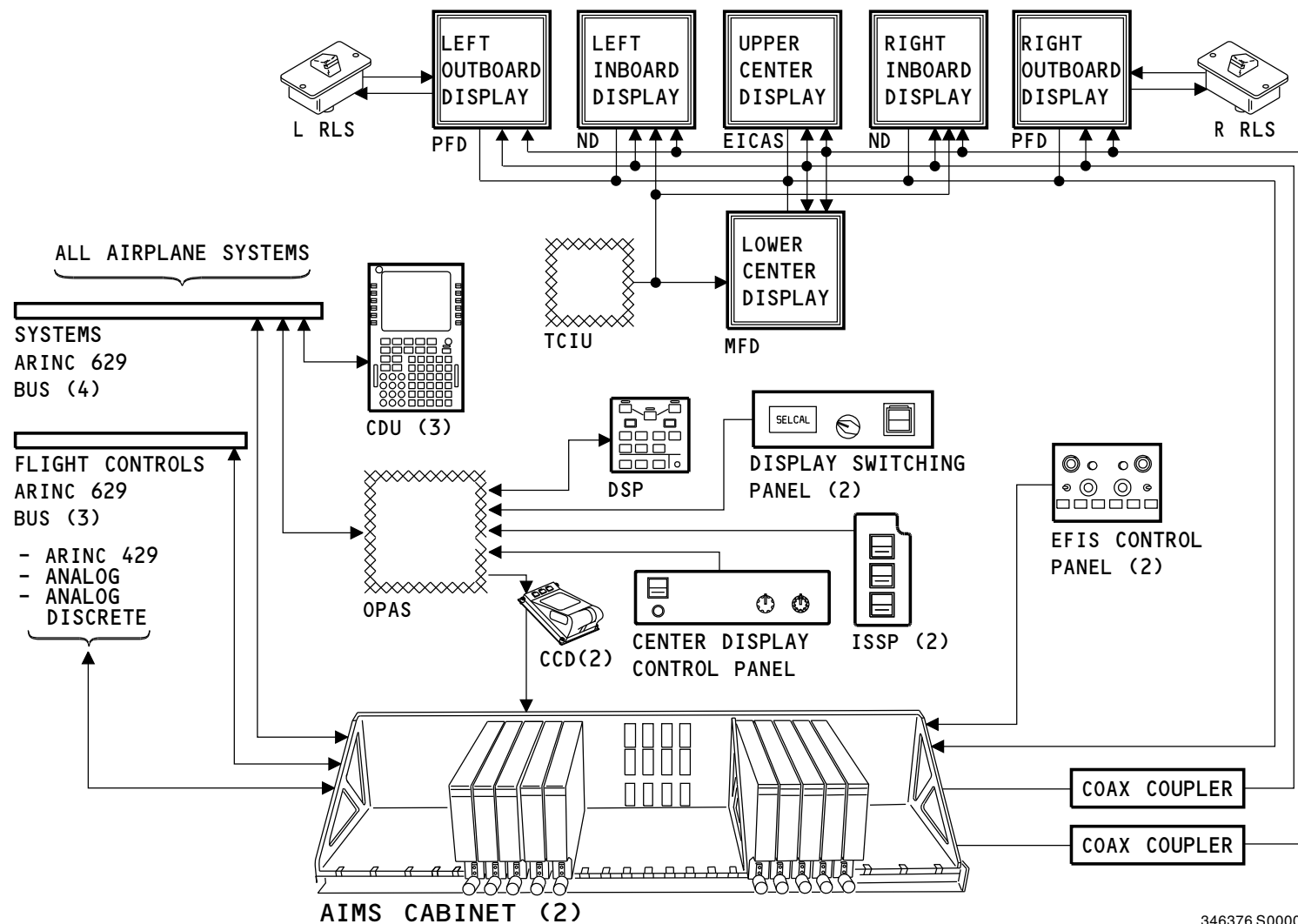
The MFD can show these formats:

- Secondary engine display
- Status display

- Synoptic display (7)
- Maintenance page (19)
- Checklists display
- Camera display
- Communication display.

The PFD, EICAS and secondary engine formats are critical formats. The ND and other MFD formats are essential formats.

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PRIMARY DISPLAY SYSTEM - GENERAL DESCRIPTION

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**PRIMARY DISPLAY SYSTEM - COMPONENT LOCATIONS - 1****Major Components**

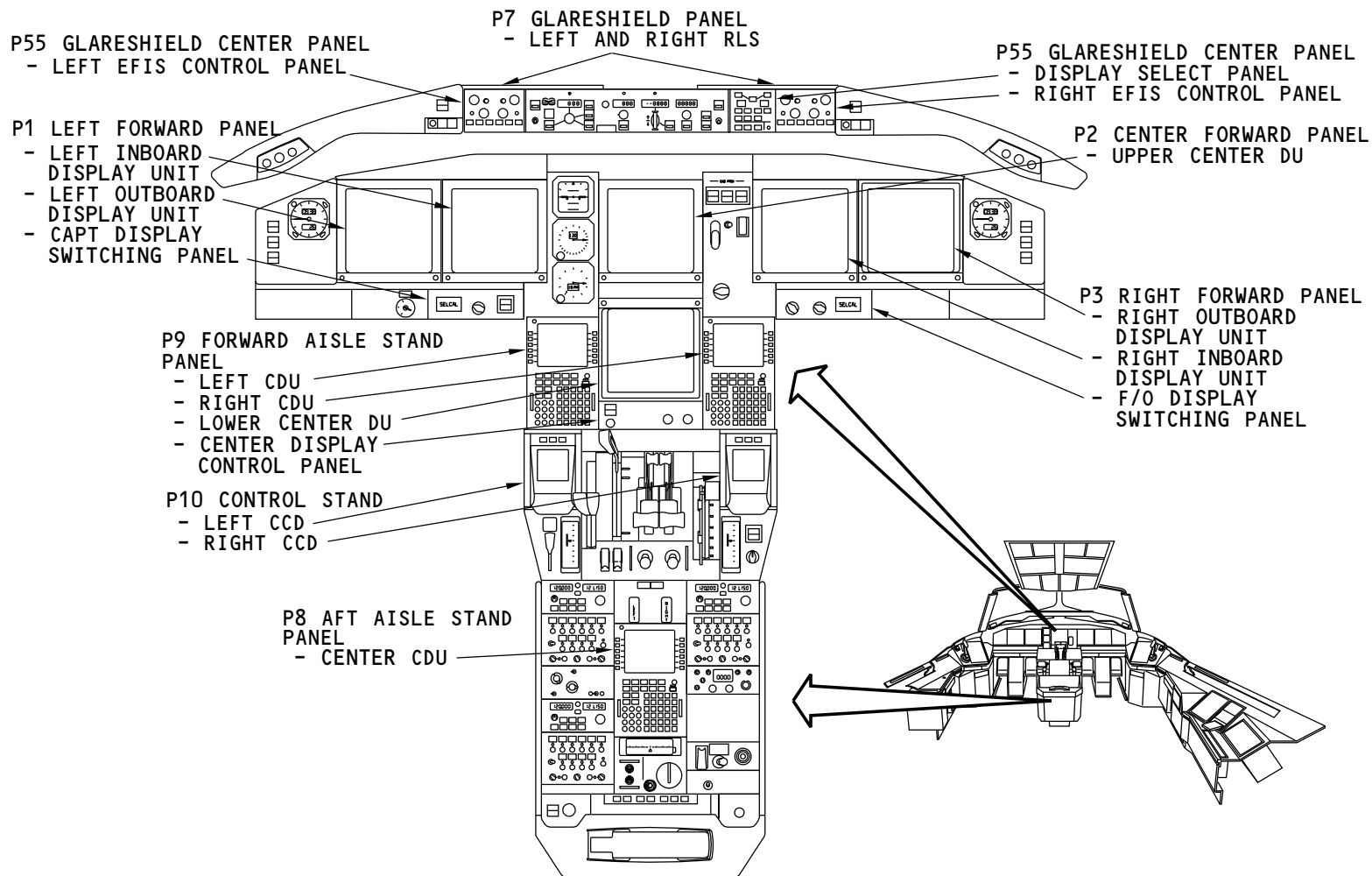
The primary display system major components in the flight deck are:

- Left outboard display unit (DU)
- Left inboard DU
- Right outboard DU
- Right inboard DU
- Upper center DU
- Lower center DU
- Left EFIS control panel (CP)
- Right EFIS CP
- Display select panel
- Left cursor control device (CCD)
- Right CCD
- Left Remote Light Sensor (RLS)
- Right RLS
- Captain's display switching panel
- F/O display switching panel
- Center display control panel.

Miscellaneous Components

Other controls and switches in the flight deck are:

- Left control display unit (CDU)
- Right CDU
- Center CDU.



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PRIMARY DISPLAY SYSTEM - COMPONENT LOCATIONS - 1

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**PRIMARY DISPLAY SYSTEM - COMPONENT LOCATIONS - 2****PDS Components**

The left AIMS cabinet is on the E3-1 shelf in the main equipment center.

The right AIMS cabinet is on the E2-1 shelf in the main equipment center.

Miscellaneous Components

There are these control panels and switches in the flight deck:

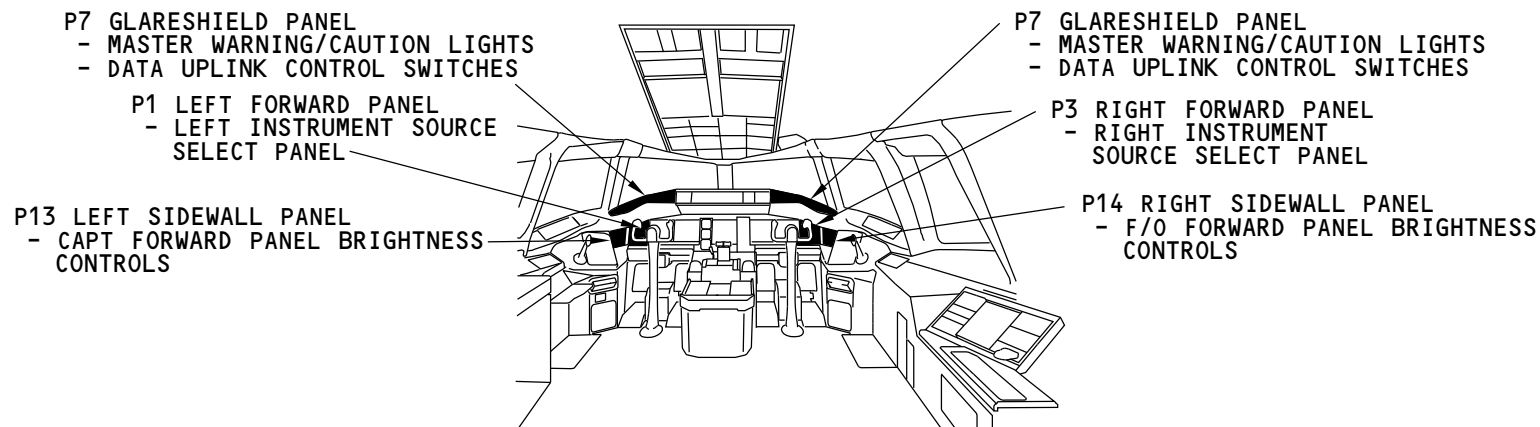
- Left instrument source select panel (ISSP)
- Right ISSP
- Captain data uplink control switches
- First officer data uplink control switches
- Captain master warning and caution light
- First officer master warning and caution light
- Captain forward panel brightness controls
- First officer forward panel brightness controls.

These are the data uplink control switches:

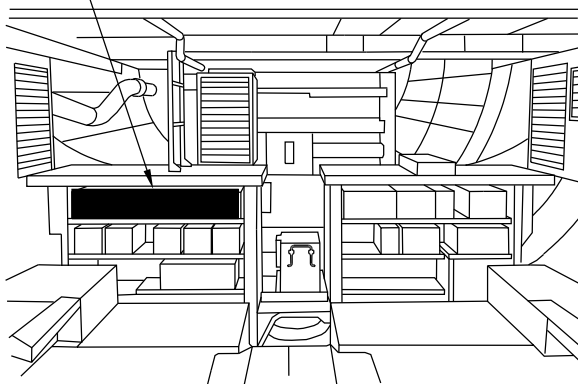
- Accept switch
- Cancel switch
- Reject switch.

These are the forward panel brightness controls:

- Outboard display brightness control
- Inboard display brightness control
- Inboard display weather radar brightness control.

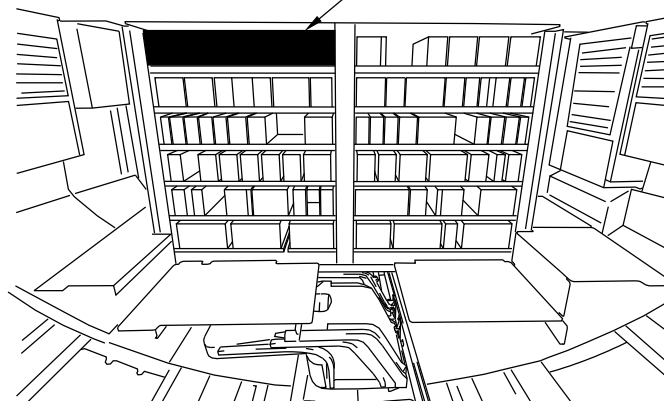


E3-1 SHELF
- LEFT AIMS CABINET



MAIN EQUIPMENT CENTER
(LOOKING FORWARD)

E2-1 SHELF
- RIGHT AIMS CABINET



MAIN EQUIPMENT CENTER
(LOOKING AFT)

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PRIMARY DISPLAY SYSTEM - COMPONENT LOCATIONS - 2

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PRIMARY DISPLAY SYSTEM - SYSTEM INTERFACE

OPAS Interface

The overhead panel ARINC 629 system (OPAS) receives control panel and switch input data from the flight deck. OPAS multiplexes the analog and discrete data and sends it to AIMS on the systems ARINC 629 bus. OPAS sends control signals to each of the control panels. These components interface with OPAS:

- Display select panel (DSP)
- Two cursor control devices (CCD)
- Two display switching panels
- Two instrument source select panels (ISSP)
- Center display control panel.

Each display unit sends information to the AIMS cabinets on ARINC 429 data buses. This data is for fault reporting.

Primary Display Function (PDF) of AIMS Interface

The PDF of AIMS gets control information from the two EFIS CPs and the two CCDs on ARINC 429 data buses and from the overhead panel ARINC system (OPAS) on the systems ARINC 629 data buses. Additional control information comes from the three CDUs on the systems ARINC 629 buses.

The PDF of AIMS gets airplane information on these buses for display:

- Flight controls ARINC 629 buses (3)
- Systems ARINC 629 buses (4)
- ARINC 429 buses.

The interface between the two AIMS cabinets is on four Ethernet Intercabinet buses for AIMS 2. The PDF of AIMS shares data for redundancy and configuration management.

Display Unit (DU) Interface

The AIMS cabinets send information to the DUs on high speed coaxial-lines through four coaxial couplers. Each coaxial coupler sends data to each DU.

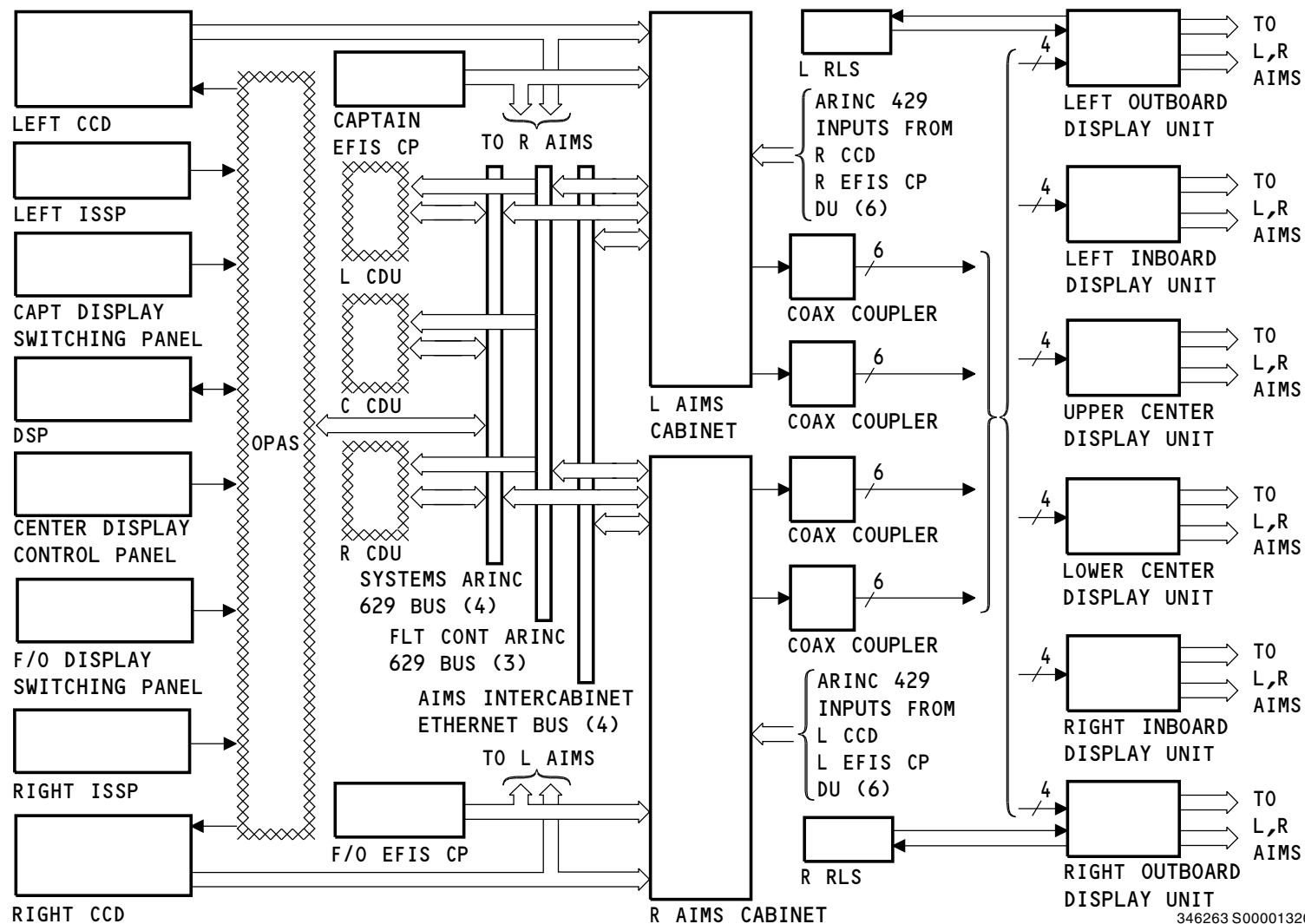
Two remote light sensors (RLS) supply inputs to the two outboard DUs, left RLS to left outboard DU and right RLS to right outboard DU. Other flight deck controls supply additional brightness and contrast controls for the display units.

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PRIMARY DISPLAY SYSTEM - SYSTEM INTERFACE

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PRIMARY DISPLAY SYSTEM - POWER INTERFACES**Power**

The captain's flight instrument 28v dc bus supplies power to these components:

- Left outboard display unit
- Left inboard display unit
- Upper center display unit
- Left cursor control device
- Left EFIS control panel.

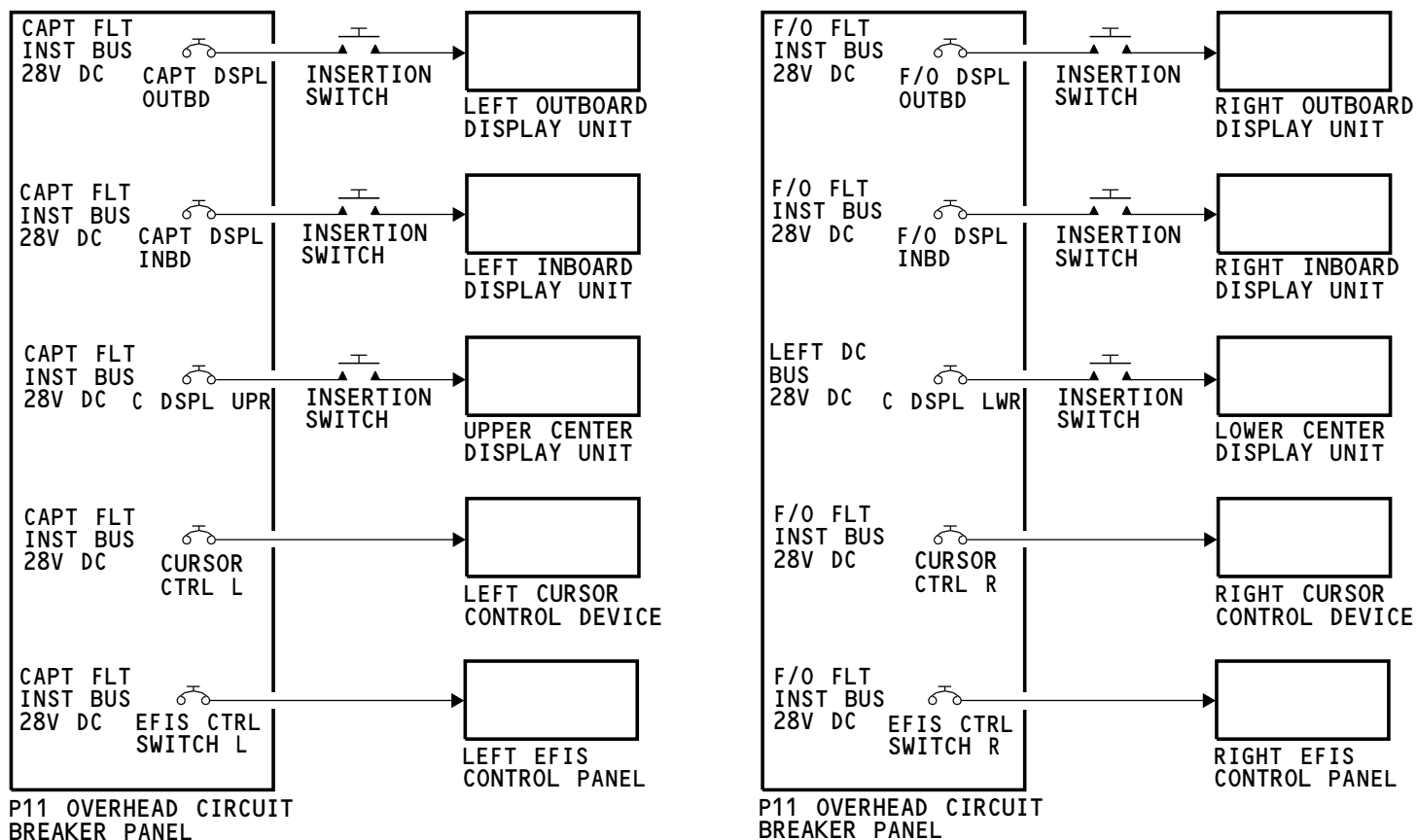
The first officers's flight instrument 28v dc bus supplies these components:

- Right outboard display unit
- Right inboard display unit
- Right cursor control device
- Right EFIS control panel.

The left dc bus supplies the lower center display unit with 28v dc.

Switches

An insertion switch is on the inside of each display unit (DU) rack. As the technician installs the DU, the switch closes and completes the circuit for the power input.



PRIMARY DISPLAY SYSTEM - POWER INTERFACES

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PRIMARY DISPLAY SYSTEM - BRIGHTNESS CONTROL INTERFACES

General

The display units (DUs) get brightness control inputs manually and automatically. Each display unit has a built-in bezel light sensor (BLS) for automatic brightness control. A remote light sensor (RLS) on the glareshield also supplies automatic brightness control to the onside outboard DU. The passenger sign module also sends automatic brightness control inputs to the outboard DUs.

Control panels in the flight deck have individual manual brightness controls for each display unit. Additional manual brightness controls are available for the display units (DUs) that show weather radar (WXR).

Automatic Brightness Control

Each display unit has a BLS on the front of the unit that measures ambient light. The automatic brightness control calculation uses two BLSs and an RLS input to adjust the DU brightness of the six DUs.

The brightness of a DU pair changes automatically based on the calculation of the brightest value the pair gets from their BLSs.

Each outboard DU sends an excitation voltage to its respective RLS. The RLS sends a signal back to its DU. The signal changes with the amount of light in the forward part of the flight deck.

Manual Brightness Control

The master brightness control on the passenger sign module sends a zone brightness input to the left and right outboard display units.

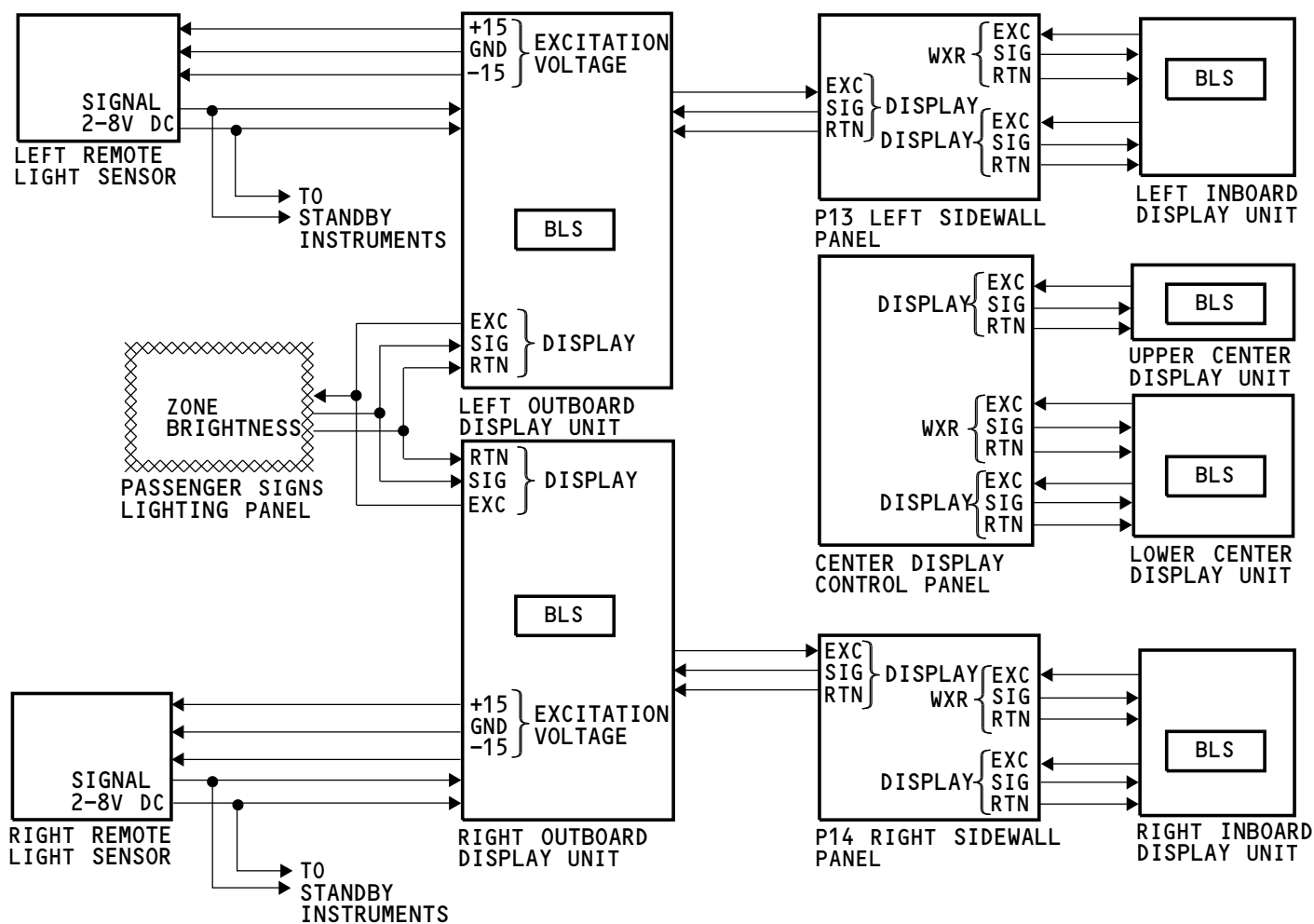
The captain's and first officer's forward panel brightness controls have controls for their outboard and inboard display units. These controls are on the sidewall panels. There is a single control for the outboard display units. There is a dual control knob for the inboard display units. The outer knob controls display brightness and the inner knob controls WXR brightness.

The center display control panel has a single knob to control the brightness of the upper center display unit. There is a dual control knob for the lower center display unit. The outer knob controls display brightness and the inner knob controls weather radar brightness when weather radar information shows on the lower center display unit.

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PRIMARY DISPLAY SYSTEM - BRIGHTNESS CONTROL INTERFACES

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**PRIMARY DISPLAY SYSTEM - ARINC 429 DATA BUS INTERFACES****General**

These components send data to the input/output modules (IOMs) in the two AIMS cabinets on ARINC 429 data buses:

- Six display units
- Two EFIS control panels
- Two cursor control devices (CCDs).

Display Unit Interface

The display units send:

- Fault monitoring data
- Brightness sensor values
- Remote light sensor values
- Manual brightness values.

EFIS Control Panel Interface

The EFIS control panels send switch position data to control the operation of the related primary flight display and navigation display.

Cursor Control Device Interface

The cursor control devices send:

- Cursor position data
- Display cursor position switch discretes
- Cursor activation switch discrete
- CCD status
- Program pin data
- CCD version number.

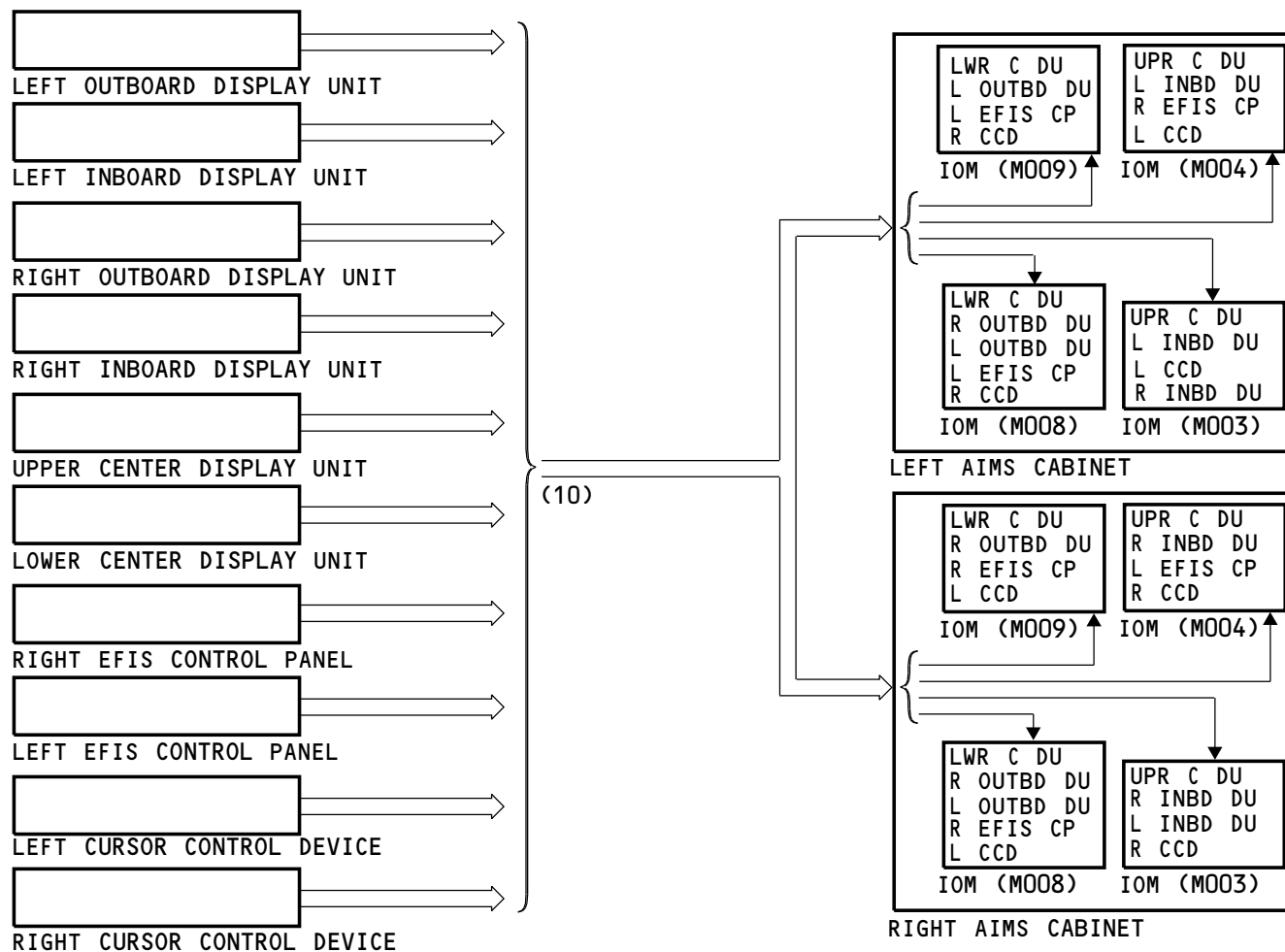
The inputs go to multiple IOMs in both cabinets. The multiple inputs provide for redundancy.

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PRIMARY DISPLAY SYSTEM - ARINC 429 DATA BUS INTERFACES

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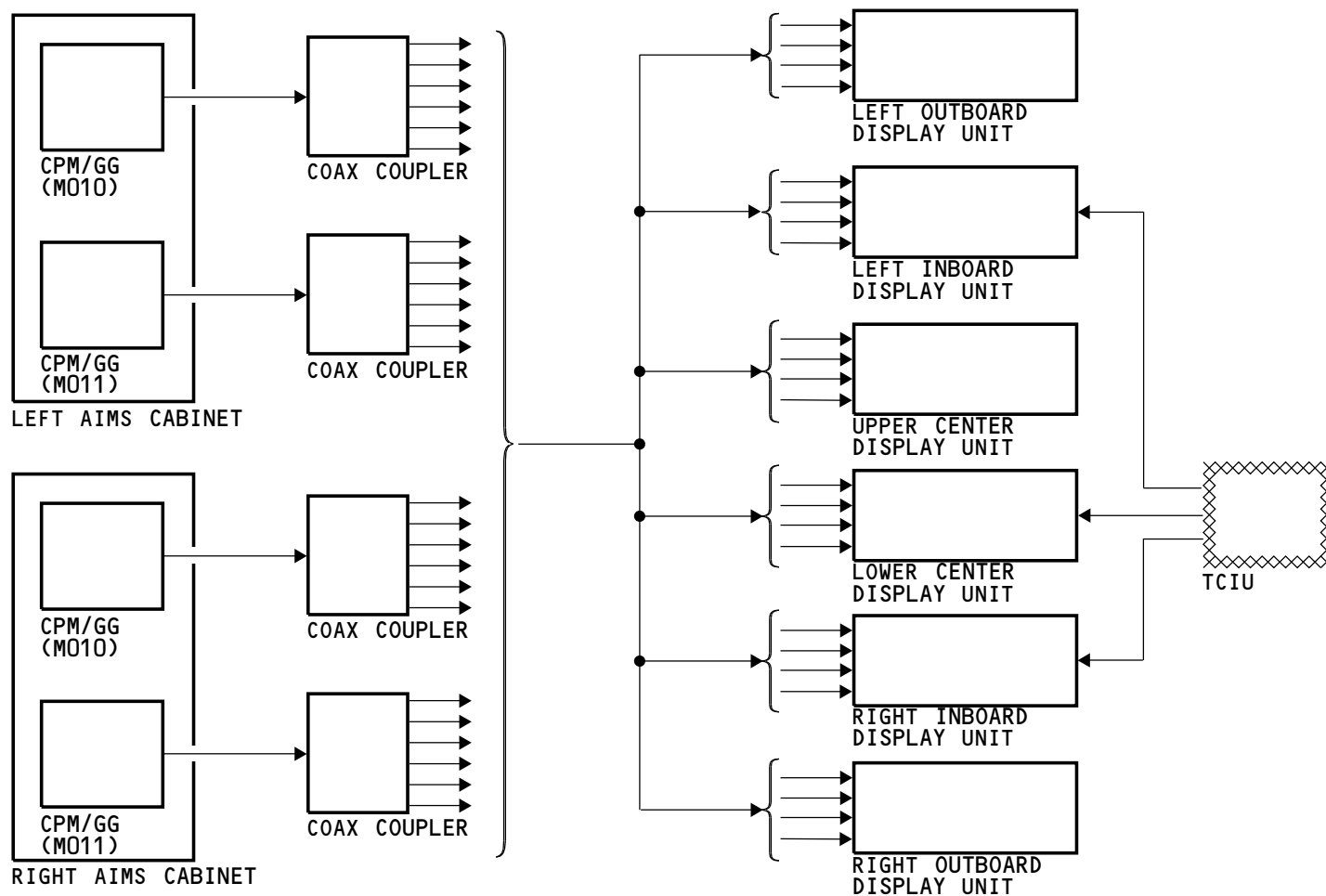
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**PRIMARY DISPLAY SYSTEM - DISPLAY UNIT COAX INTERFACES****General**

The display units get data from the AIMS graphic generators through coax buses. Each AIMS cabinet has two graphics generators, each with a bus output. Each bus output is split six ways and goes to each DU.

The data from the graphics generators contains instructions that make the symbols on the DUs.

The left inboard, right inboard, and lower center display units also receive a video input from the taxi camera interface unit (TCIU).



PRIMARY DISPLAY SYSTEM - DISPLAY UNIT COAX INTERFACES

M41828 S000618310_V1

**PRIMARY DISPLAY SYSTEM - OPAS INTERFACE****General**

The overhead panel ARINC 629 system (OPAS) continuously receives and monitors flight deck switches and lights, processes and formats the data, and transmits the data. OPAS uses the left and right systems ARINC 629 data buses. OPAS supplies two outputs to each of the primary display functions of AIMS.

Primary Display System OPAS Interface

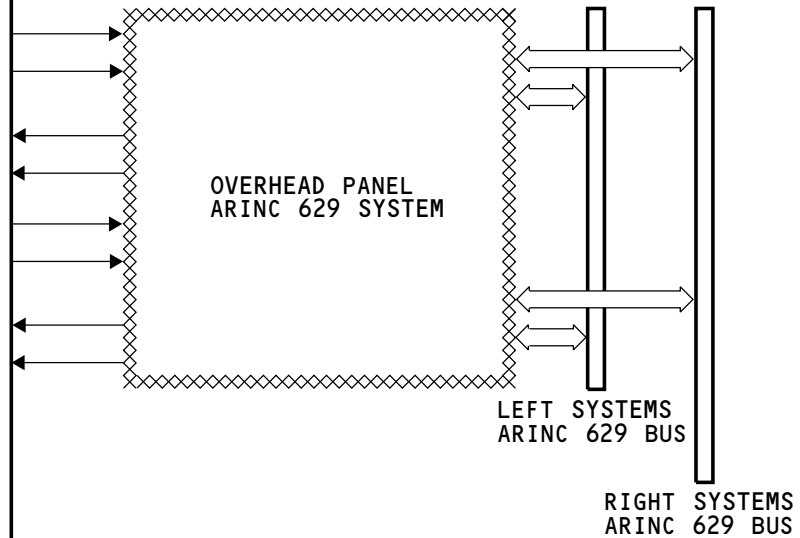
OPAS monitors these panels and switches of the primary display system. They include:

- All the switches on the CAPT and F/O instrument source select panels
- CAPT display switching panel
- F/O display switching panel
- CAPT and F/O accept/reject switches
- EICAS display select panel
- Center display control panel
- CCDs.

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PANEL	SWITCH	DISCRETE
CAPT & F/O INST SOURCE SELECT PANELS	NAV DISPL CONT AIR DATA/ATT	AUTO/CDU AUTO/ALTN AUTO/ALTN
CAPT DISPLAY SWITCH PANEL	HDG REF INBOARD DSPL	TRUE/NORM PFD/NORM/NAV MFD/EICAS
F/O DISPLAY SWITCH PANEL	INBOARD DSPL	EICAS/NORM/ NAV/MFD/PFD
CAPT & F/O ACCEPT/CANCEL/ REJECT SWITCHES	ACCEPT/CANCEL/ REJECT	ACCEPT/ REJECT/ CANCEL
DISPLAY SELECT PANEL	S1/S2/S3 ENG STAT ELEC HYD FUEL AIR DOOR GEAR FCTL CAM CHKL COMM NAV CANC RCL	LITES ON/OFF ENG STAT ELEC HYD FUEL AIR DOOR GEAR FCTL CAM CHKL COMM NAV CANC RCL
CENTER DISPLAY CONTROL PANEL	EVENT RECORD DISPL CONT	RECORD AUTO/ALTN
L & R CCD		LITE ON/OFF LWR CTR, INBD

PRIMARY DISPLAY SYSTEM FLIGHT DECK PANEL (TYPICAL)



PRIMARY DISPLAY SYSTEM - OPAS INTERFACE

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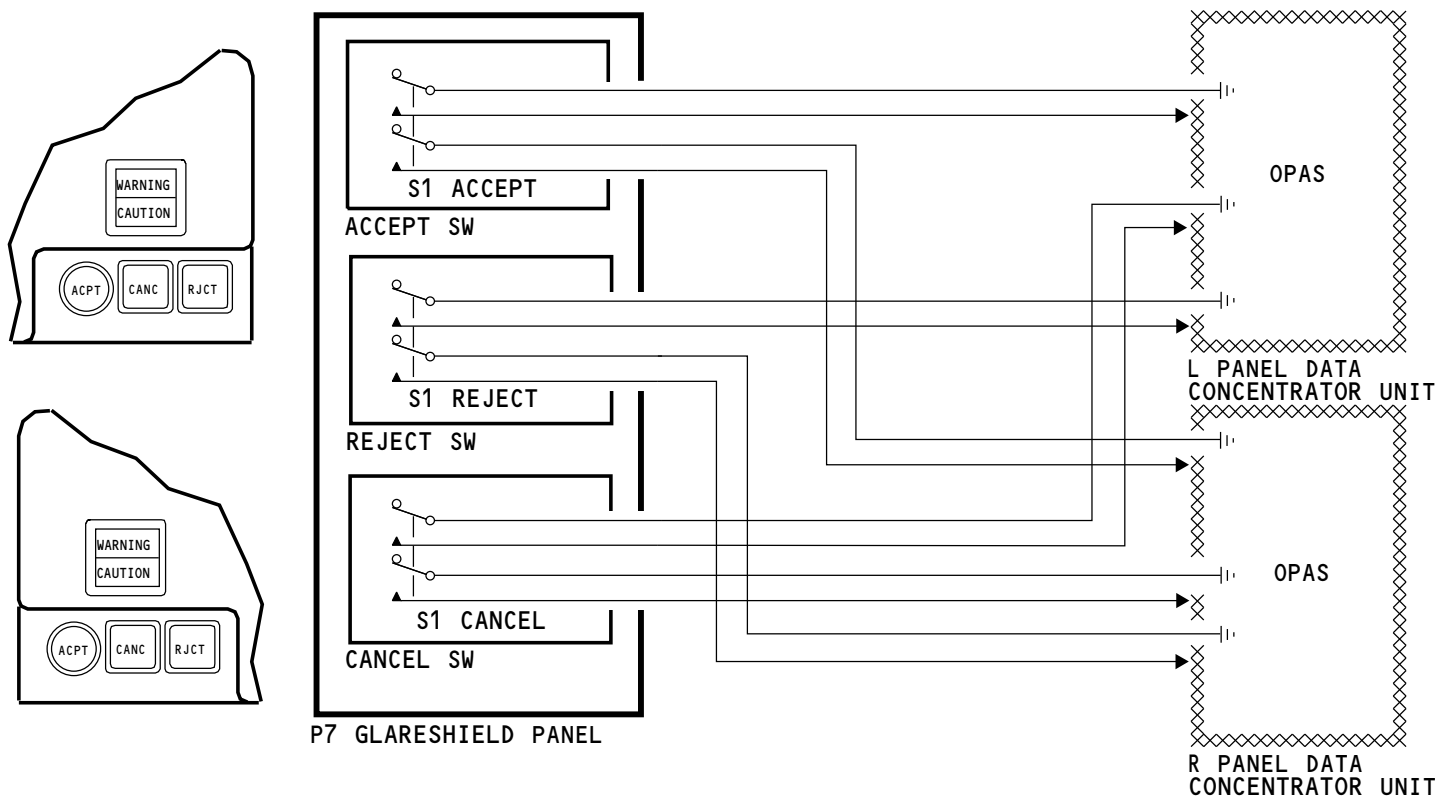


PRIMARY DISPLAY SYSTEM - ACCEPT, REJECT AND CANCEL SWITCH INTERFACE

General

The ACCEPT/REJECT/CANCEL switches on the captain's and first officer's glareshields give the flight crew control of uplink and downlink messages. The OPAS panel data concentrator units (PDCUs) receive requests as analog discretes and process them.

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M41835 S000618317_V1

PRIMARY DISPLAY SYSTEM - ACCEPT, REJECT AND CANCEL SWITCH INTERFACE

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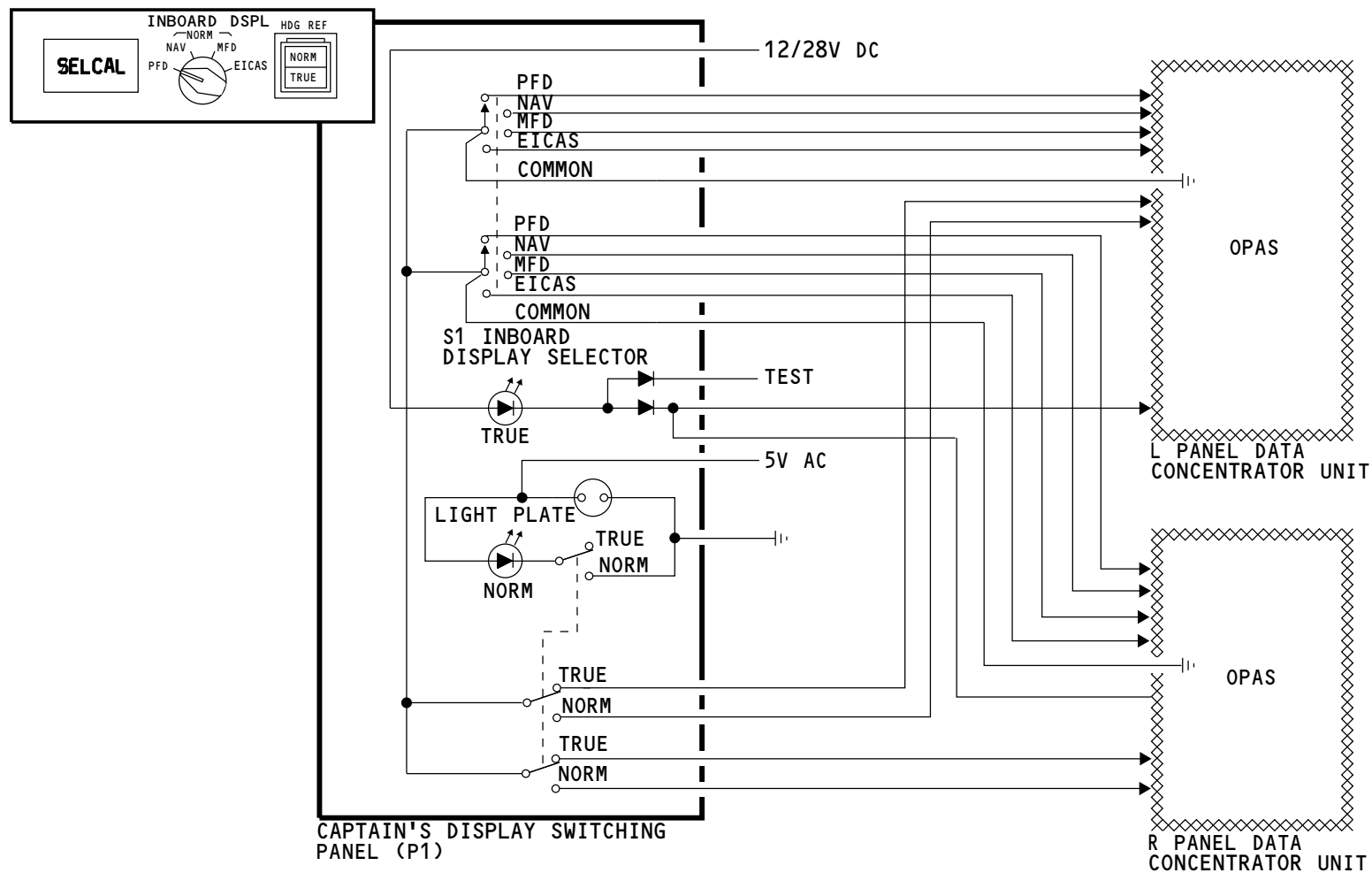
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PRIMARY DISPLAY SYSTEM - CAPTAIN DISPLAY SWITCHING PANEL INTERFACES

General

An inboard display (INBOARD DSPL) selector and a heading reference (HDG REF) switch send analog discretes to the OPAS panel data concentrator units (PDCUs). The inboard display selector gives the flight crew control of the inboard display format. The heading reference switch gives the flight crew control of the compass heading reference on both the captain's and first officer's displays.



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PRIMARY DISPLAY SYSTEM - CAPTAIN DISPLAY SWITCHING PANEL INTERFACES

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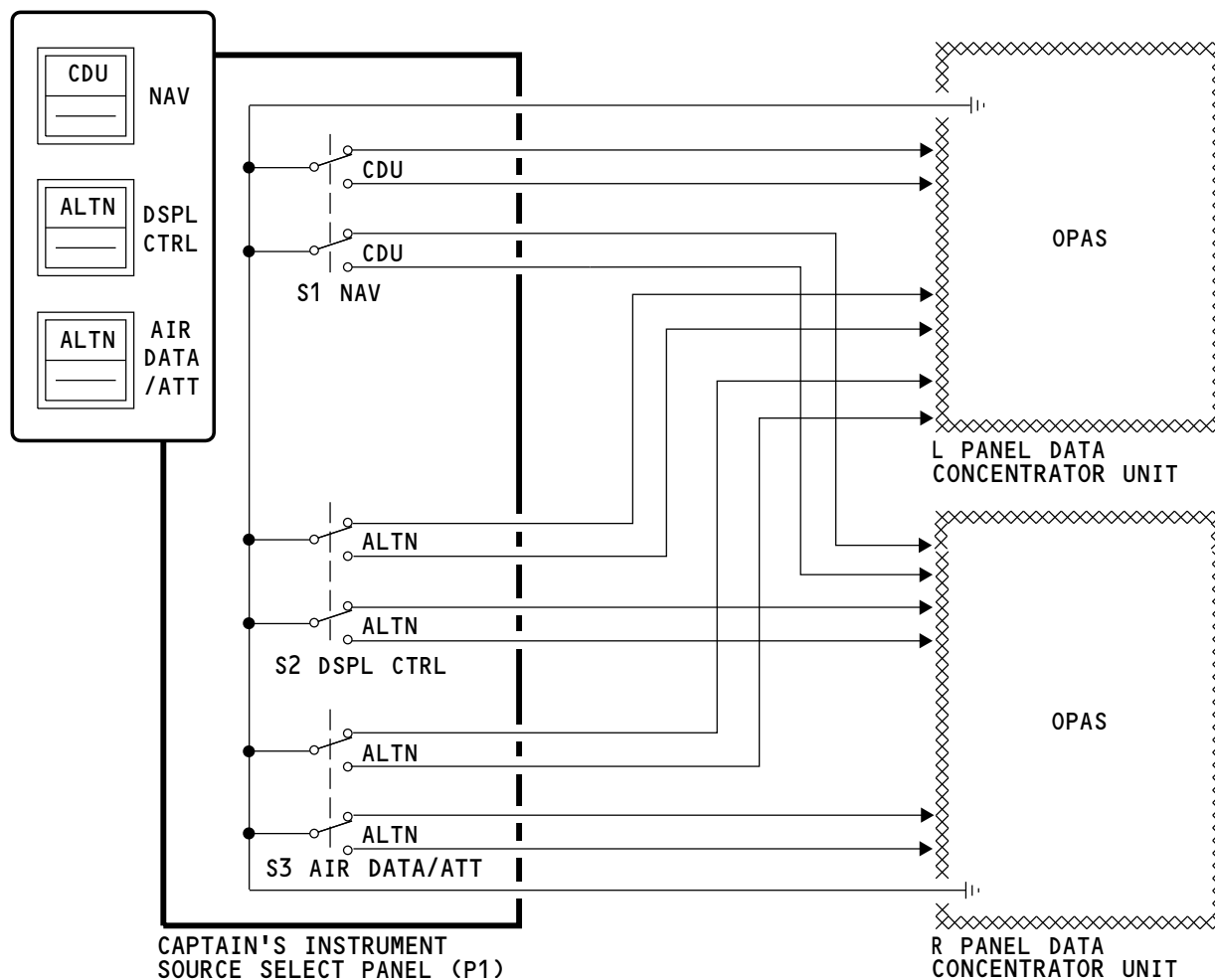
PRIMARY DISPLAY SYSTEM - INSTRUMENT SOURCE SELECT PANELS INTERFACE

General

The captain's and first officer's instrument source select panels (ISSPs) send analog discretes to the OPAS panel data concentrator units (PDCUs) to process. Each ISSP switch gives onside flight crew control for an alternate source display.

The PDS has automatic control when the ISSP switches are in the normal position.

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PRIMARY DISPLAY SYSTEM - INSTRUMENT SOURCE SELECT PANELS INTERFACE

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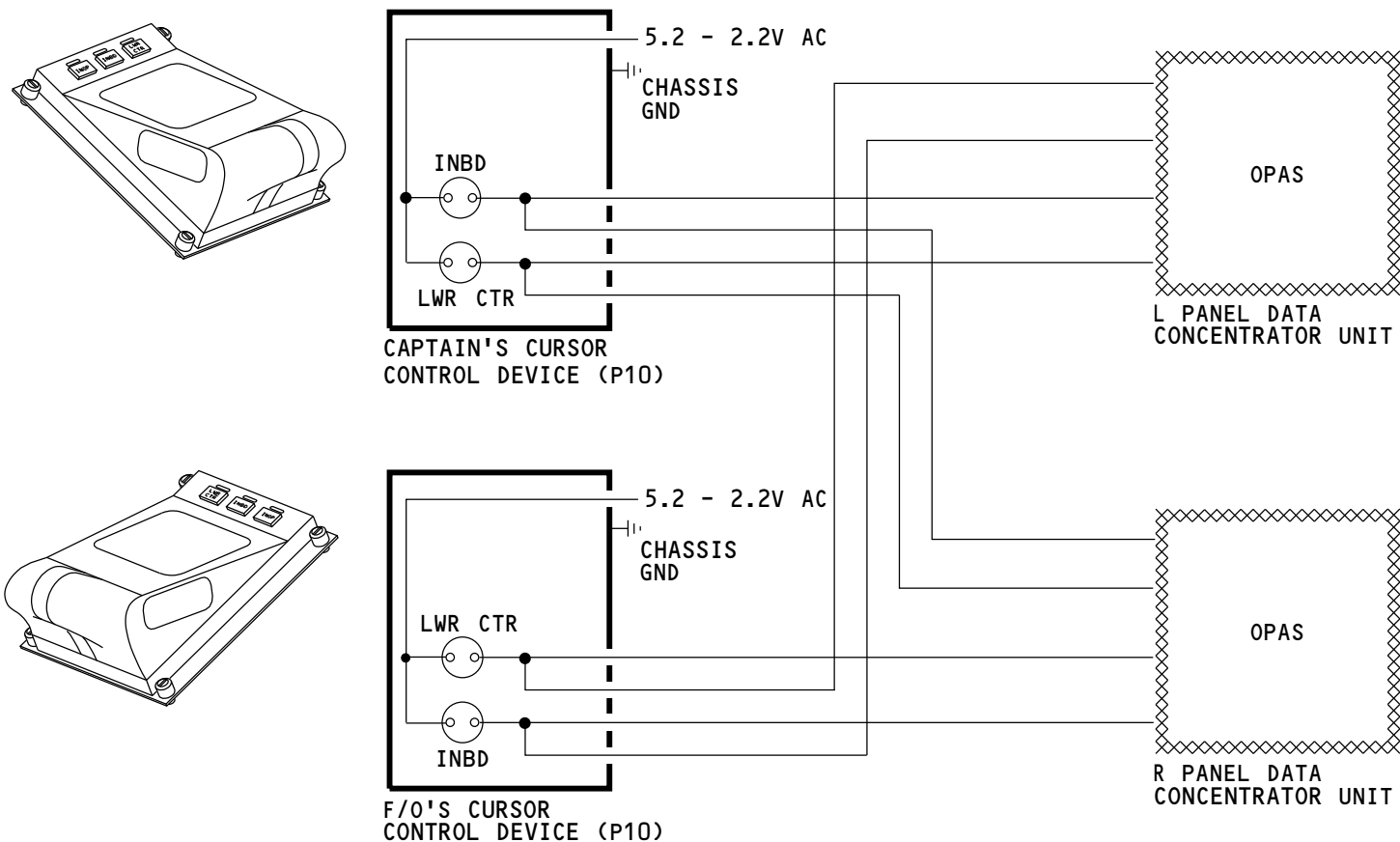


PRIMARY DISPLAY SYSTEM - CURSOR CONTROL DEVICE INTERFACES

General

The cursor control devise (CCD) gets grounds from the panel data concentrator units. The grounds turn on lights to indicate which display the operator selected.

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PRIMARY DISPLAY SYSTEM - CURSOR CONTROL DEVICE INTERFACES

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**PRIMARY DISPLAY SYSTEM - DISPLAY SELECT PANEL INTERFACES****General**

The display select panel (DSP) receives analog discrete data from the overhead panel ARINC 629 system (OPAS). The DSP sends analog discrete data to OPAS.

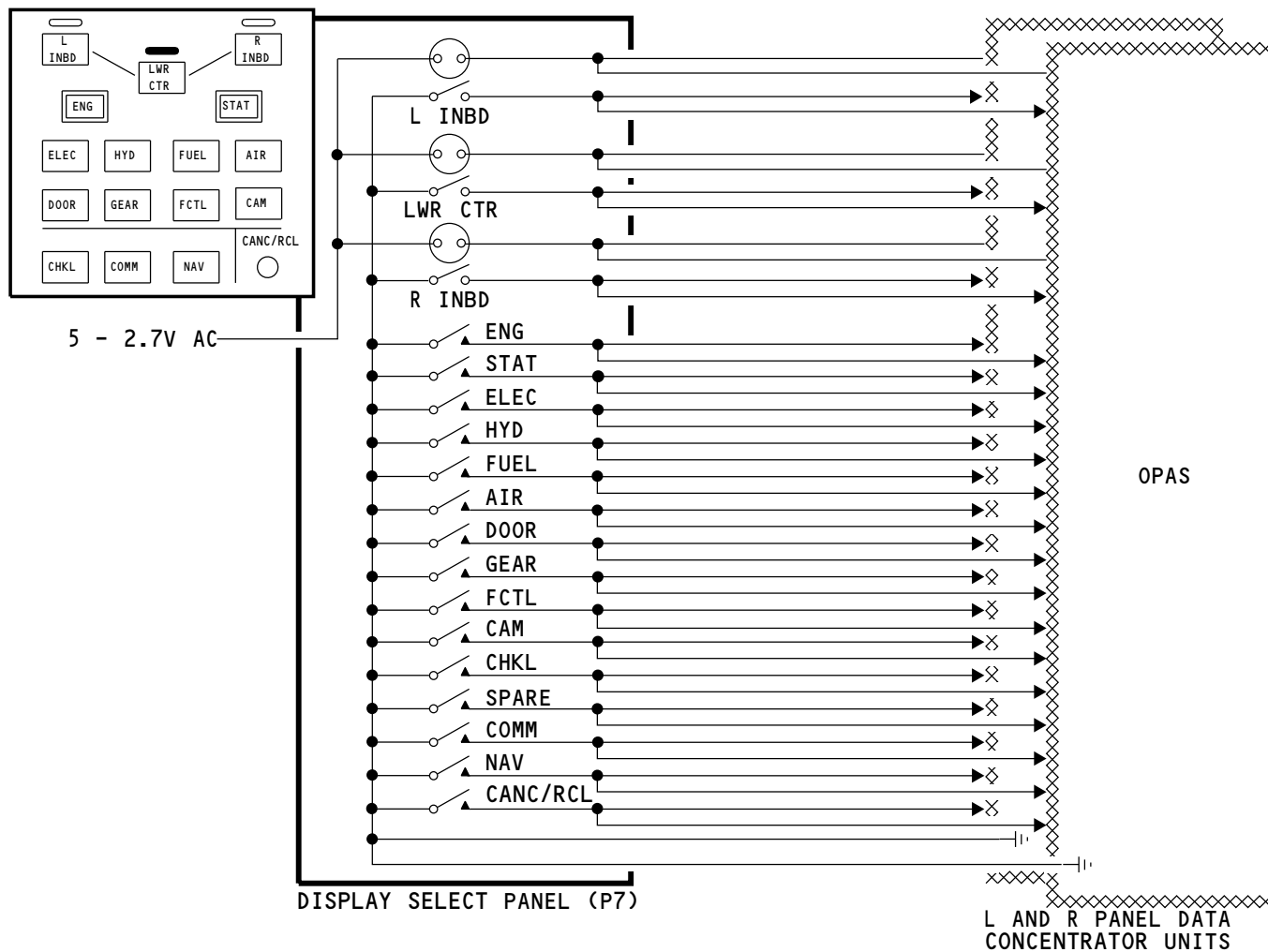
Inputs

The DSP receives a ground analog discrete from each OPAS panel data concentrator unit (PDCU). The DSP receives power from -2.7 to 5 vac.

Outputs

The DSP sends an analog discrete(s) to each OPAS PDCU when you make a mode and/or a display request.

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M41841 S000618323_V1

PRIMARY DISPLAY SYSTEM - DISPLAY SELECT PANEL INTERFACES

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PRIMARY DISPLAY SYSTEM - CENTER DISPLAY CONTROL PANEL INTERFACES

General

The center display control panel receives analog discretes from and sends analog discretes to OPAS.

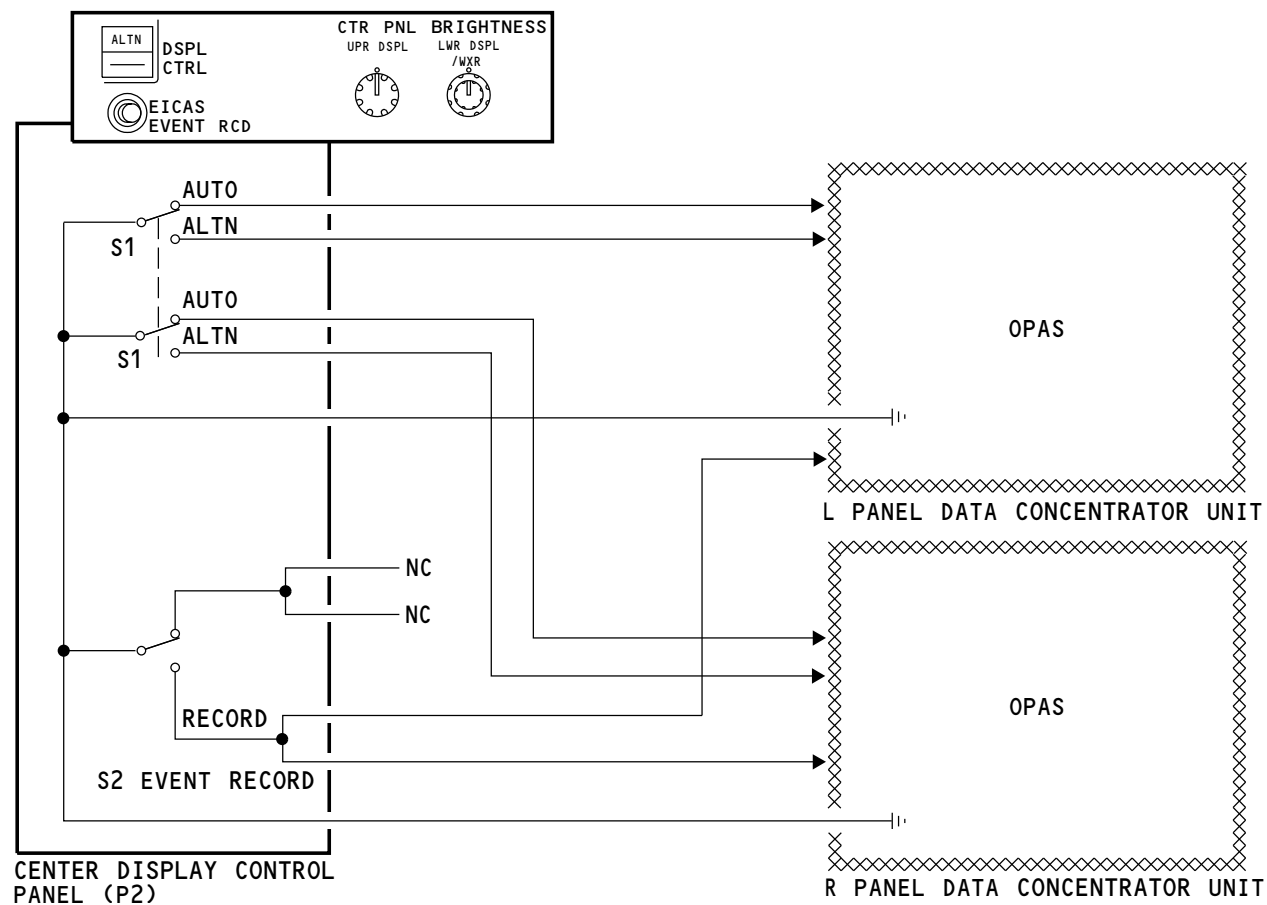
Inputs

OPAS sends two analog discrete grounds to the center display control panel.

Outputs

The center display control panel sends an analog discrete when the DSPL CTRL switch is in the AUTO and ALTN position to OPAS.

The center display control panel also sends an analog discrete to OPAS when the operator uses the event record switch.



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PRIMARY DISPLAY SYSTEM - CENTER DISPLAY CONTROL PANEL INTERFACES

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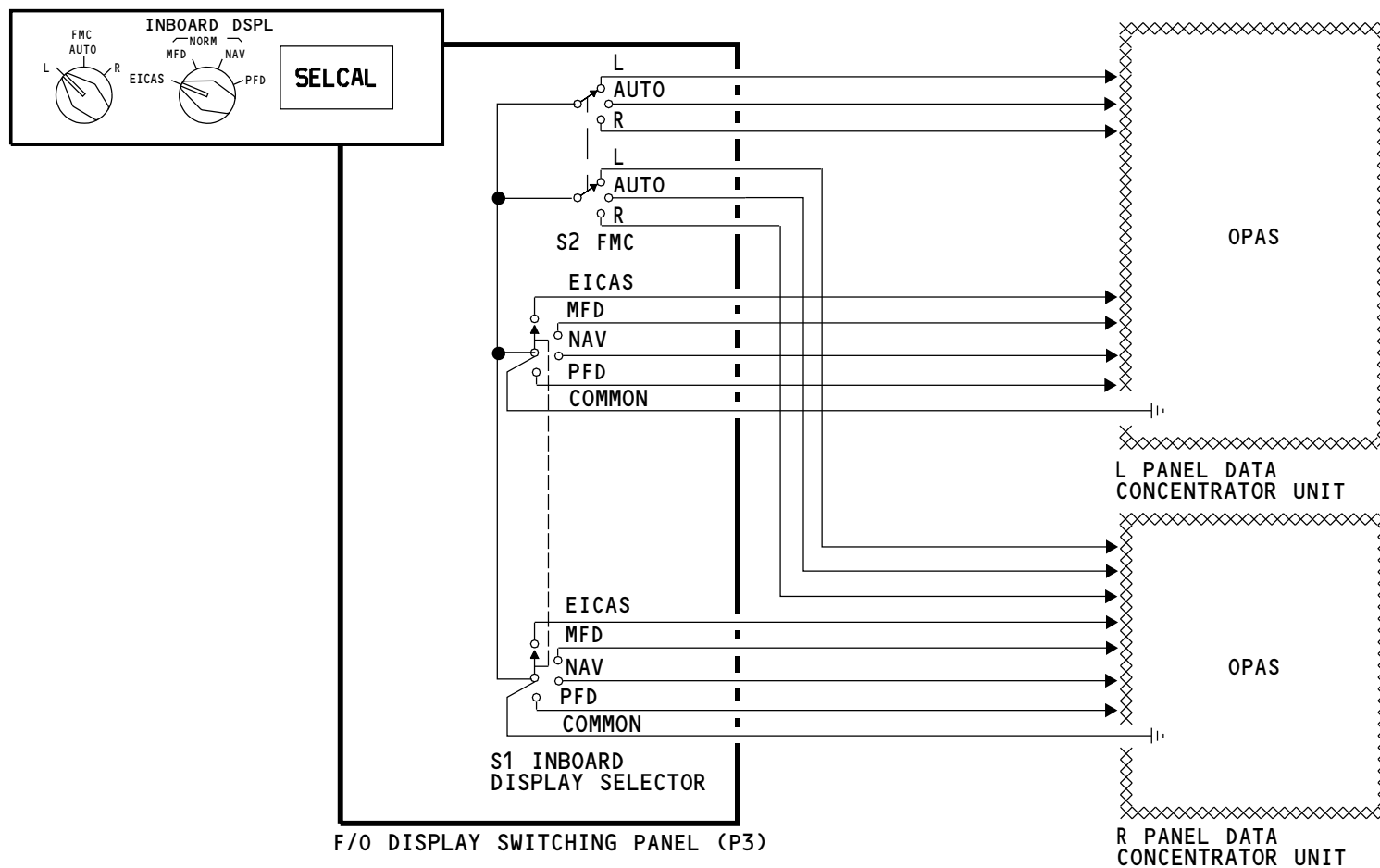


PRIMARY DISPLAY SYSTEM - F/O DISPLAY SWITCHING PANEL INTERFACES

General

An inboard display (INBOARD DSPL) selector and an FMC selector send analog discretes to the OPAS panel data concentrator units (PDCUs). The display selector gives the flight crew control of the inboard display format. The FMC selector gives the flight crew manual or automatic control of the FMCF source on both the captain and first officer's displays.

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PRIMARY DISPLAY SYSTEM - F/O DISPLAY SWITCHING PANEL INTERFACES

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PRIMARY DISPLAY SYSTEM - MASTER CAUTION LIGHTS INTERFACES

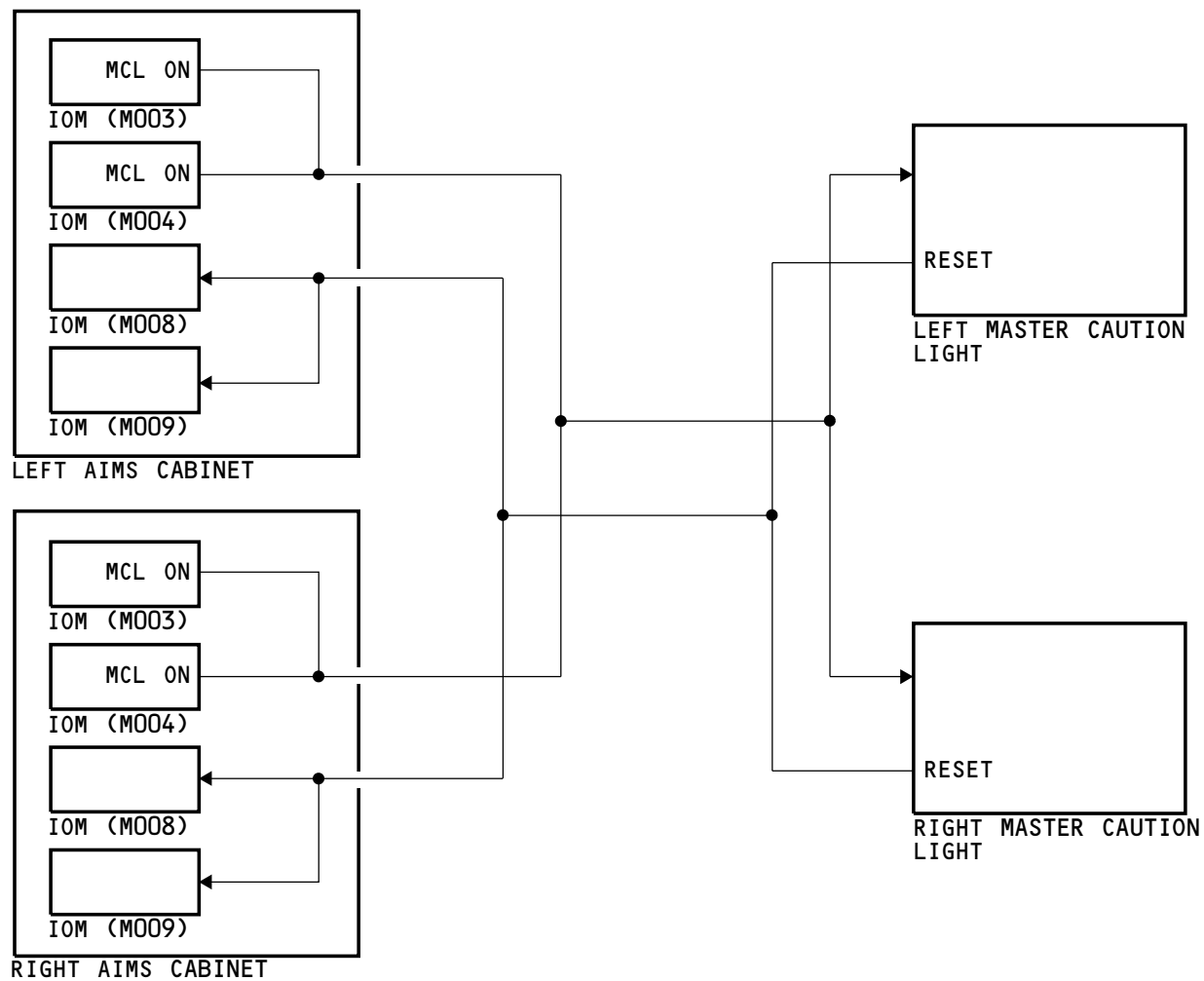
Master Caution Light On Signal

IOMs M004 and M003 in each AIMS cabinet supply a master caution light on signal to both master caution lights.

Reset

When you push a master caution light, IOMs M008 and M009 in each AIMS cabinet receive a master caution light reset signal. This makes both master caution lights go out.

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PRIMARY DISPLAY SYSTEM - MASTER CAUTION LIGHTS INTERFACES

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PRIMARY DISPLAY SYSTEM - DISPLAY UNIT

Purpose

The primary display system uses six identical ARINC D flat panel liquid crystal display (LCD) units. These display units (DUs) show:

- Primary flight information
- Navigation information
- Engine information
- Crew alerting information
- Airplane systems data.

Physical Description

The DUs are in a rack. The DUs are 8 inches by 8 inches and are 8.75 inches deep. Each DU weighs 18 pounds.

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

Operation

The DUs have two internal temperature detectors. The power supply has a detector that causes the DU to shutdown when the internal temperature reaches 110 degrees centigrade. The backlight assembly has a detector that causes the DU to shutdown when the internal temperature reaches 95 degrees centigrade. The detectors automatically turn the DUs off during an overtemperature condition. The DUs come on when the temperature returns to normal. The DUs use forced air cooling.

Training Information Point

The six DUs are interchangeable. Due to the viewing angle limitations of LCD technology, the installation of the lower center DU is 180 degrees (handle at the top) from the other DUs. For the lower center DU, the handle is opposite to the handle of the other DUs.

Training Information Point

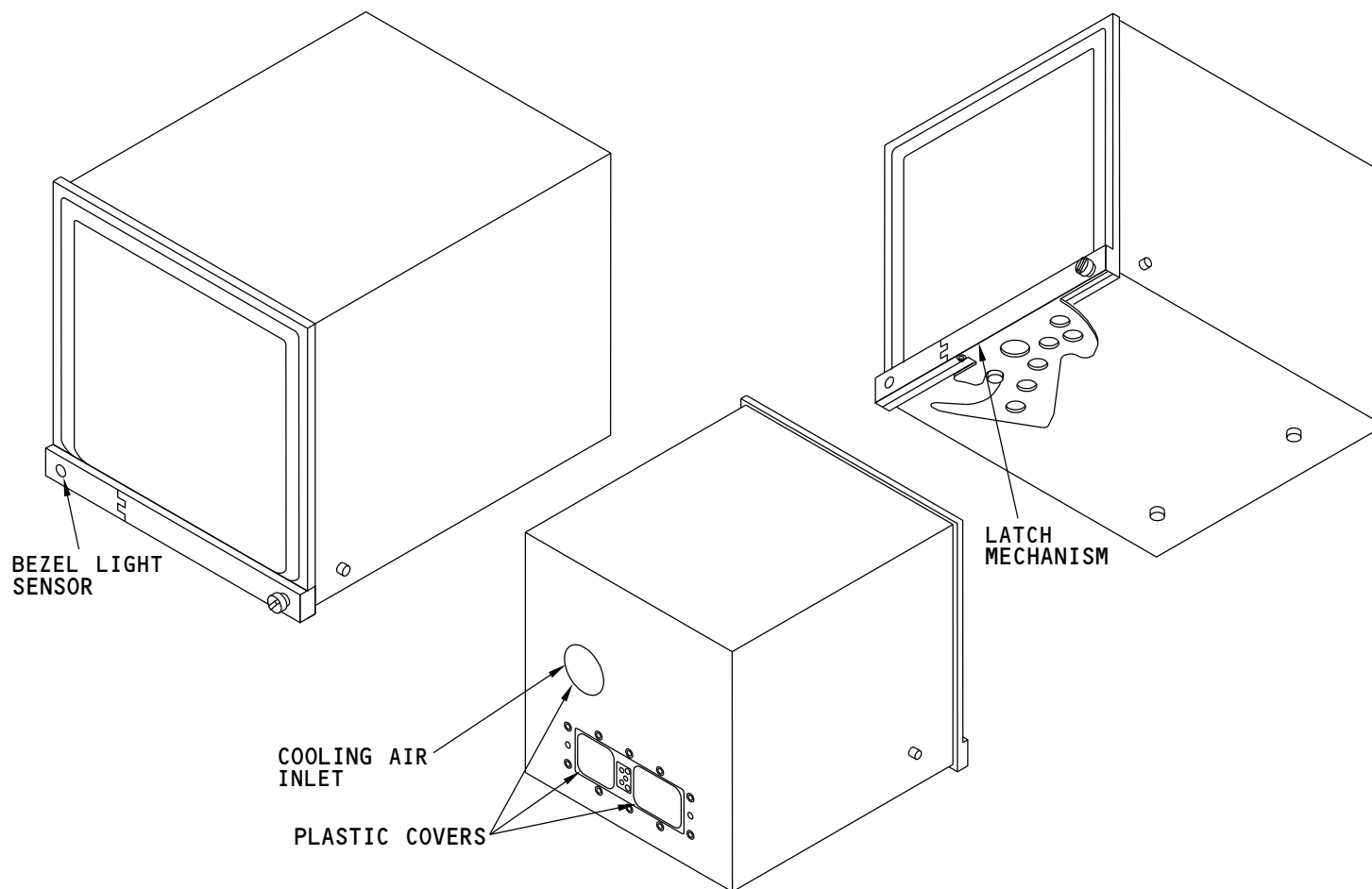
During the removal or installation of the inboard and outboard DUs, you must move the control column.


CAUTION

MOVEMENT OF THE CONTROL COLUMN MAY CAUSE FLIGHT SURFACE MOVEMENT.

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

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PRIMARY DISPLAY SYSTEM - DISPLAY UNIT

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PRIMARY DISPLAY SYSTEM - EFIS CONTROL PANEL

Purpose

Two identical EFIS control panels (EFIS CP) control data on the PFD and ND formats.

Description

The EFIS CP is 4.8 inches by 3.45 inches and 6 inches deep. The panel weighs approximately 4 pounds.

PFD Controls

Use these controls to manage data on the PFD:

- Minimums reference selector
- Flight path vector (FPV) switch
- Meters (MTRS) switch
- Barometric (BARO) reference selector.

The minimums reference selector selects and sets altitude minimums. The minimums reference outer selector selects either RADIO or BARO minimums. The inner selector sets the altitude. The reset (RST) push-button switch cancels the RADIO or BARO alert annunciation.

The FPV switch enables or disables the display of the FPV vector symbol.

The meters (MTRS) switch is an alternate action switch that controls the display of actual and selected altitude in meters. This is in addition to the display of these parameters in feet.

The barometric reference selector selects and sets the barometric reference. This selector has three controls, outer, middle, and inner. The baro reference outer selector selects either inches of mercury (IN) or hectopascals (hPa) as the barometric reference on the related PFD. The barometric middle selector sets the barometric correction. The inner push-button switch selects the standard baro setting 29.92 inches of Hg or 1013 hpa.

ND Controls

The ND mode selector enables either the approach (APP), VOR, MAP, or PLAN modes. Use the center (CTR) push-button to toggle between an expanded display that covers 90 degrees and a centered display that covers 360 degrees in all modes except PLAN.

The ND range selector controls the map range or display range in the MAP or PLAN mode. This selector also controls weather radar range and TCAS intruder symbol range in the expanded APP mode, expanded VOR mode and MAP modes.

The traffic switch selects or cancels TCAS traffic data.

The VOR/ADF switches show radio navigation aid data in all modes except PLAN. The OFF position causes the VOR and ADF information to go out of view. Bearing information shows on the compass rose when you set either switch to VOR or ADF. VOR/ADF identification or frequency data also shows in the lower corner of the display. Co-located DME distance shows when the switches are in the VOR position.

These ND map switches cause data to show on the NDs or cause data on the NDs to go out of view:

ARO 001-008 PRE SB 777-34-0232

- Terrain (TERR)

ARO ALL

- Weather radar (WXR)
- Station (STA)
- Waypoint (WPT)
- Airport (ARPT)
- DATA
- Position (POS)

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**PRIMARY DISPLAY SYSTEM - EFIS CONTROL PANEL****ARO 001-008 PRE SB 777-34-0232**

The terrain map switch causes ground proximity warning computer (GWPC) terrain data to show.

ARO ALL

The weather map switch causes weather radar (WXR) data to show.

The station map switch causes navigation aids not in the flight plan to show.

The waypoint map switch causes waypoints and ground reference points to show.

The airport map switch causes airports not in the flight plan to show.

The DATA map switch causes route data to show.

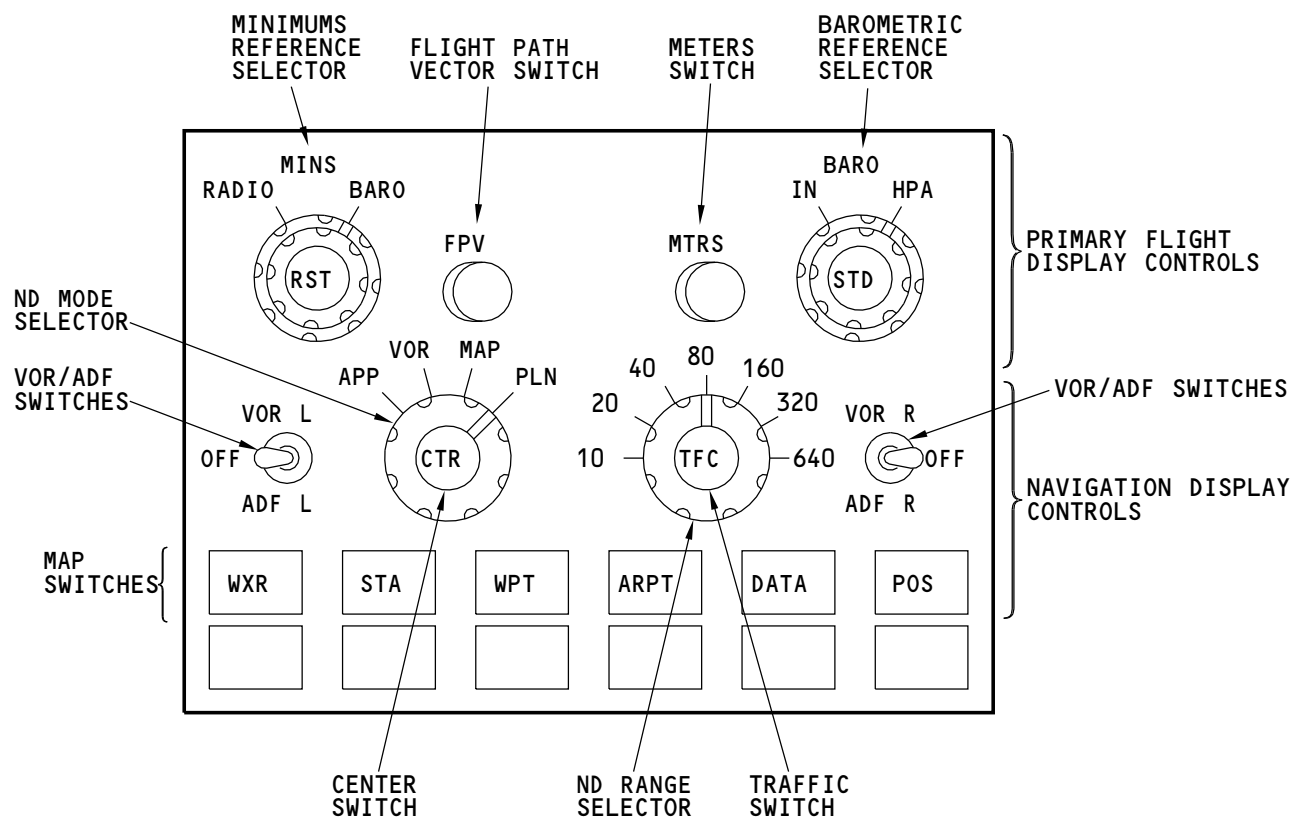
The STA, WPT, ARPT and DATA switches affect the map background display.

The position map switch causes VOR/DME and air data inertial reference system (ADIRS) position data to show on the map display.

Alternate Control Panel Functions

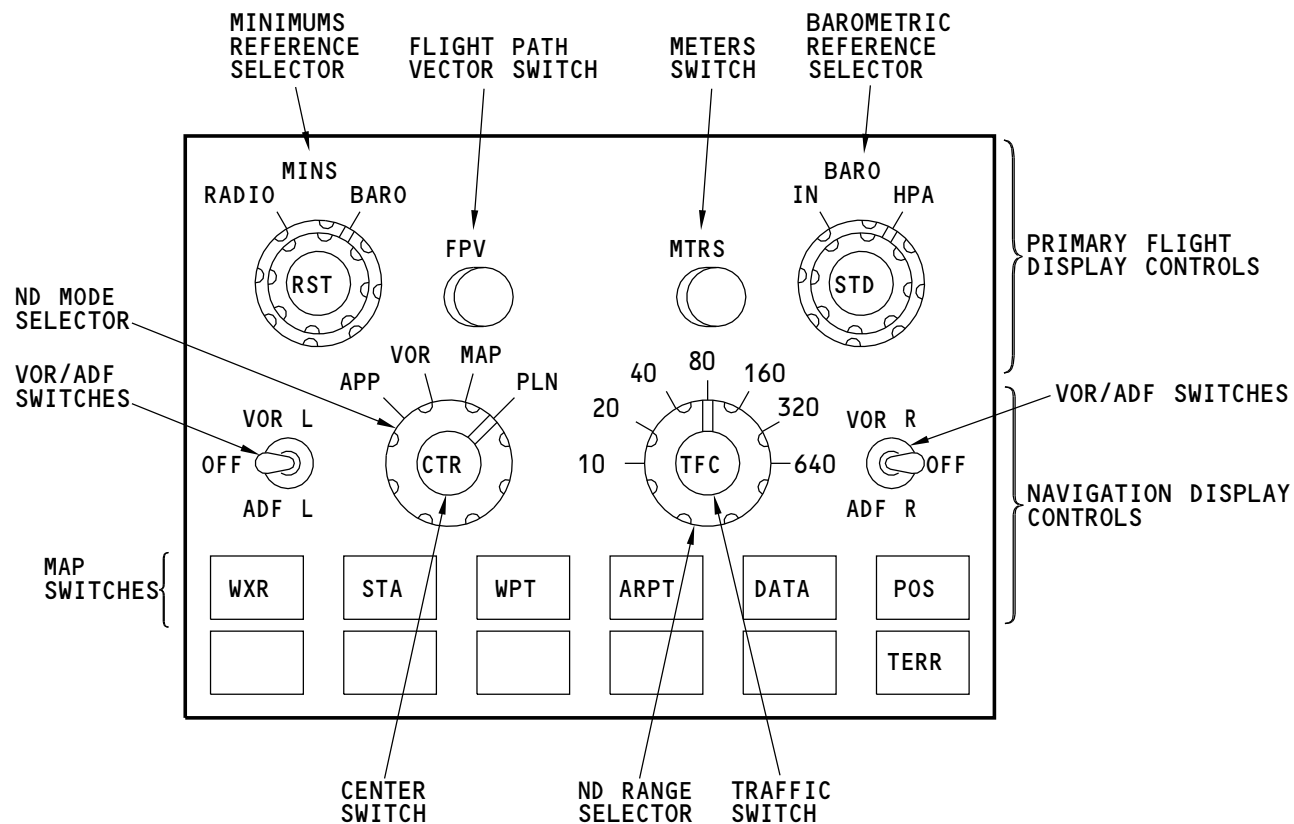
The left and right control display units (CDUs) provide alternative EFIS CP functions. CDU menu selections enable the alternate EFIS CP functions.

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PRIMARY DISPLAY SYSTEM - EFIS CONTROL PANEL

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PRIMARY DISPLAY SYSTEM - EFIS CONTROL PANEL

M41846 S000618328_V1

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PRIMARY DISPLAY SYSTEM - DISPLAY SELECT PANEL

Purpose

The display select panel (DSP) controls the formats on the two inboard and the center lower display units.

Physical Description

The DSP is 3.5 inches by 3.45 inches and 3 inches deep. It weighs 4 pounds.

DU Selection Controls

There are three switches at the top of the panel. The labels on the switches are L INBD, R INBD, and LWR CTR. Each switch has a light that comes on when you set the switch. The switches select which display unit (left inboard, right inboard, or lower center) responds to the mode select switches. The three select switches are latched electronically, only one switch is active at a time.

Mode Controls

The mode select switches are alternate action switches that control the display of these formats:

- ENG: Engine secondary
- STAT: Status page
- ELEC: Electrical synoptic
- HYD: Hydraulic synoptic
- FUEL: Fuel synoptic
- AIR: Air synoptic
- DOOR: Door synoptic
- GEAR: Gear synoptic
- FCTL: Flight controls synoptic
- CAM: Taxi camera system display
- CHKL: Checklists
- COMM: Communication function
- NAV: Navigation display.

On an inboard DU, if you select the same display that shows, the navigation display format will show. On the lower center DU, if you select the same display that shows, the DU blanks.

The status format is an exception. When the status format shows and you select the STAT switch, the next status page shows. When the last page shows and you select the STAT switch, the inboard DU shows the navigation display format and the lower center DU blanks.

The ENG, FUEL, and AIR switches also control information on the EICAS and compacted engine displays when EICAS is in the limited mode.

Cancel/Recall Switch

The cancel/recall (CANC/RCL) switch cancels and recalls EICAS caution and advisory messages.

When caution and advisory messages show, selection of this switch causes the first page of messages to go out of view and causes the next page of messages to show if additional pages exist. Warning, memo, and COMM messages remain. This switch also cancels red latched exceedance boxes.

You can recall caution and advisory messages when you select the CANC/RCL switch again. Previous messages return if the conditions that cause them to show still exist. Red exceedance boxes that you cancelled also show.

Alternate DSP Functions

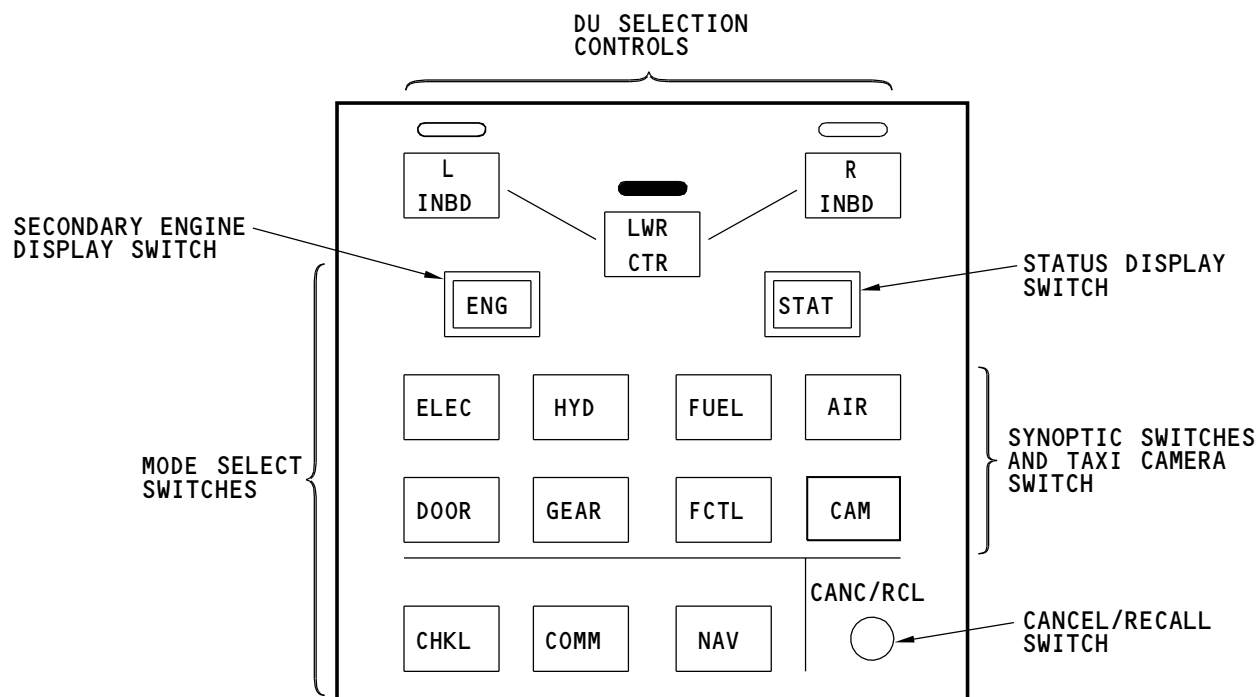
The three control display units (CDU) supply an alternate way to select the DSP functions. CDU menu selections enable the DSP functions.

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PRIMARY DISPLAY SYSTEM - DISPLAY SELECT PANEL

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PRIMARY DISPLAY SYSTEM - CONTROL DISPLAY UNIT MENUS

Purpose

The control display units (CDUs) provide menu selections for:

- Maintenance page selections
- Alternate EFIS control panel functions
- Alternate display select panel (DSP) functions

Maintenance Page Selection

Use Line select key (LSK) five right (5R) on the CDU MENU page to show the maintenance page menu on the selected display unit. Then use the cursor control device to make other selections.

The maintenance page selection is available on all three CDUs.

You can select and see maintenance pages any time the airplane is on the ground or any time the airplane is above ten thousand feet.

EFIS Control Panel Functions

The onside CDU provides a menu selection for the EFIS control panel. The selection of the EFIS function on a CDU disables the onside EFIS control panel.

The center CDU is a backup for the left or right CDU for the EFIS control panel functions. IF both CDUs fail, the center CDU is a backup for the CDU that fails first.

The CDU remembers the last valid settings of the EFIS CPs.

Use LSK 1R on the CDU MENU page, then LSK 2R to show the EFIS CONTROL page.

Use the OPTIONS key (LSK 6R) on the EFIS CONTROL page to show the EFIS OPTIONS page.

Use the CONTROL key (LSK 6R) on the EFIS OPTIONS page to show the EFIS CONTROL page.

These two pages supply most of the functions of the EFIS CP.

Display Select Panel Functions

The DSP menu selection is available on all three CDUs.

The CDU remembers the last valid DSP selection.

The selection of the DSP function on a CDU disables the DSP and the DSP lights go out. It also disables the DSP menu selections on the other two CDUs.

Use DSP CTL (LSK 3R), then DSP (LSK 4R) to show the DSP DISPLAY MODES page.

Use the SYNOPTICS key (LSK 6R) on the DISPLAY MODES page to show the DISPLAY SYNOPTICS page.

Use the MODES key (LSK 6R) on the DISPLAY SYNOPTICS page to show the DISPLAY MODES page.

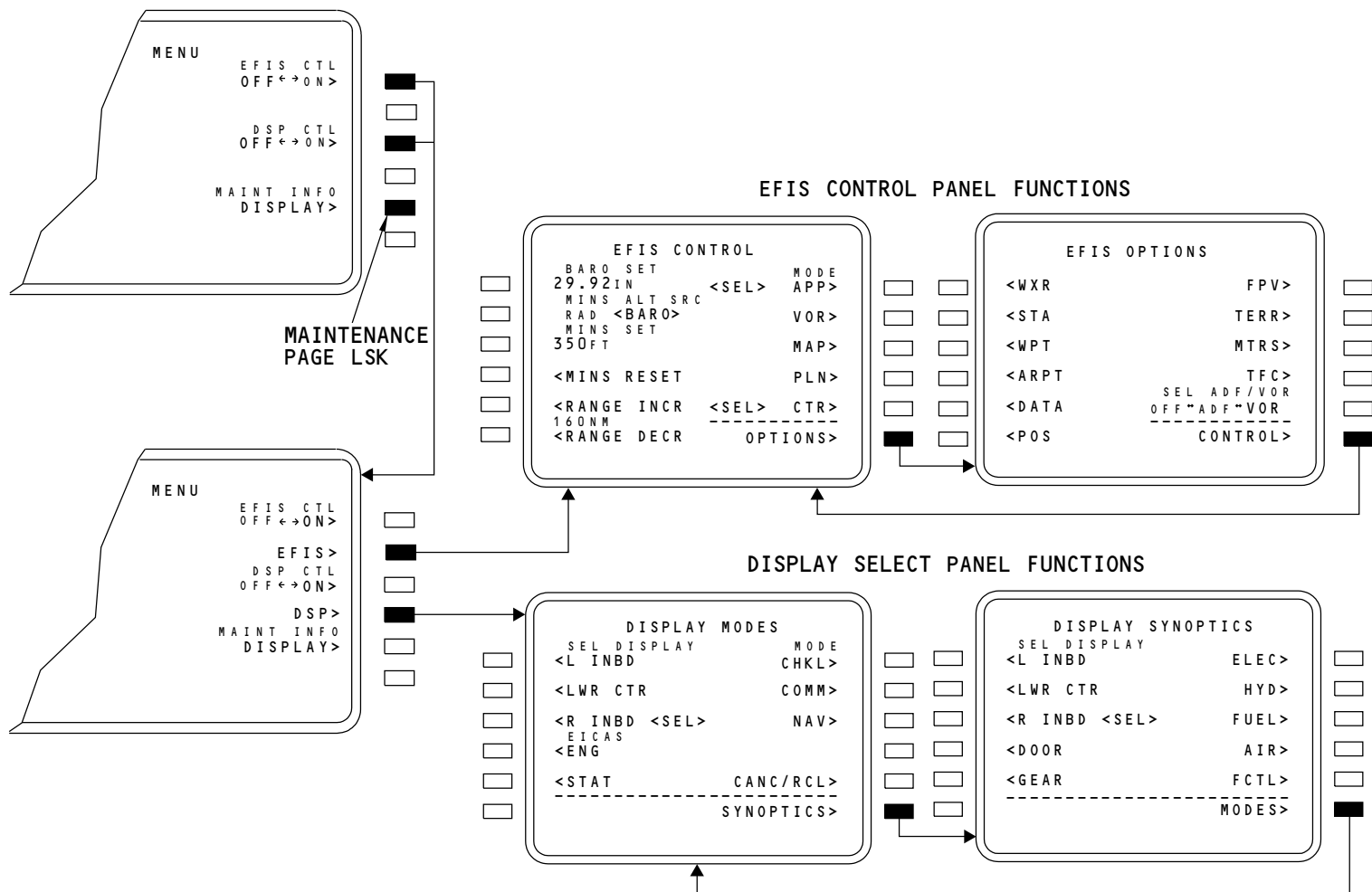
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Except for the CAM selection key, the CDU keys for the DSP functions operate the same as the switches on the DSP.

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PRIMARY DISPLAY SYSTEM - CONTROL DISPLAY UNIT MENUS

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**PRIMARY DISPLAY SYSTEM - CURSOR CONTROL DEVICES****Purpose**

Flight crews and maintenance personnel use the cursor control devices (CCD) for the data communication management function, to control the maintenance page format selections and to control selections on the side displays.

You also use the CCDs to control the electronic checklists.

Description

The CCD weighs four pounds. The CCD has its own power supply. The CCD has two electrical connectors, one for power and one for control. The CCD has four control switches and a touch pad.

Controls

The CCD has three momentary cursor location switches for display selection, one cursor select switch on the side for selection, and a touch pad.

The cursor location switches are:

- SIDE: This switch connects the CCD to the onside side display
- LWR CTR: This switch connects the CCD to the lower center display
- INBD: This switch connects the CCD to the inboard display.

Each cursor location switch has a cursor location light (green LED) that comes on when you select the switch.

Use the cursor select switch to make a selection when the cursor on the display is in an active area. You operate the switch with the thumb. This switch gives a tactile feedback.

Touch Pad

The cursor follows your finger on the display when you move a finger across the touch pad. Each touch pad has hot spots. These hot spots are at each corner of the touch pad. The cursor goes to the corner of the active display when you touch a corner of the touch pad. This gives the operator quick access to frequently used menu selections. In some instances, the cursor automatically moves to the next selection.

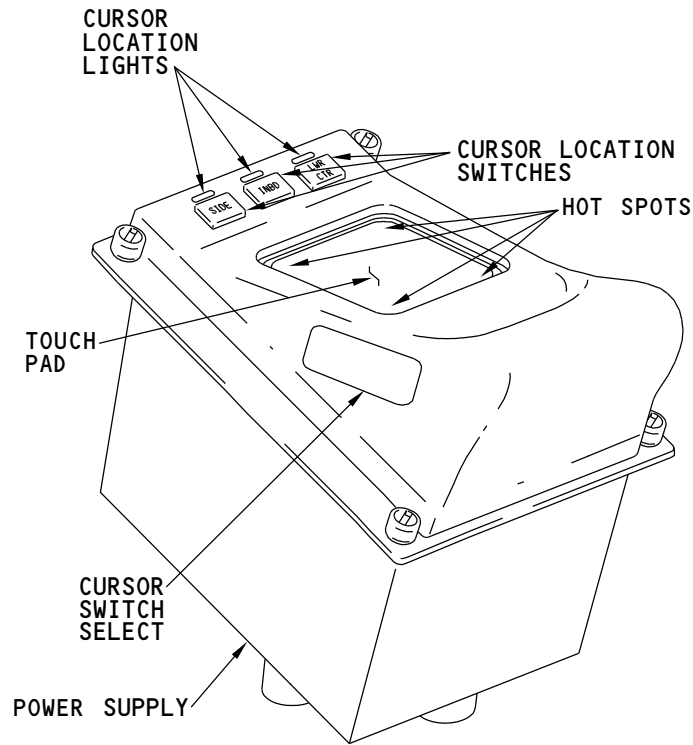
Training Information Point

The two CCDs are not interchangeable because the cursor select and cursor location switches are not in the same position.

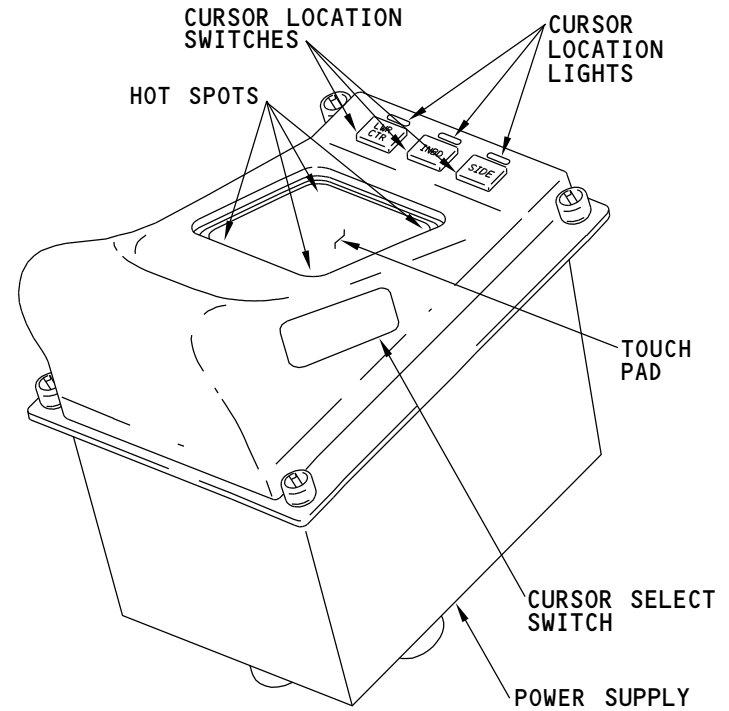
The manufacturer seals the CCD touch pad to prevent damage from liquid spills.

A glass faceplate over the touch pad prevents damage to the touch pad. The touch pads are impact resistant up to a force of 5 pounds.

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LEFT CCD



RIGHT CCD

PRIMARY DISPLAY SYSTEM - CURSOR CONTROL DEVICES

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**PRIMARY DISPLAY SYSTEM - REMOTE LIGHT SENSOR****Purpose**

Two remote light sensors (RLSs) are on the forward part of the glareshield. The sensors face forward. The RLSs measure ambient light with a photodiode sensor and supply an analog signal proportional to the ambient light. The left and right RLS sends data to the respective outboard display unit. The display units use the analog signals for automatic brightness control.

Description

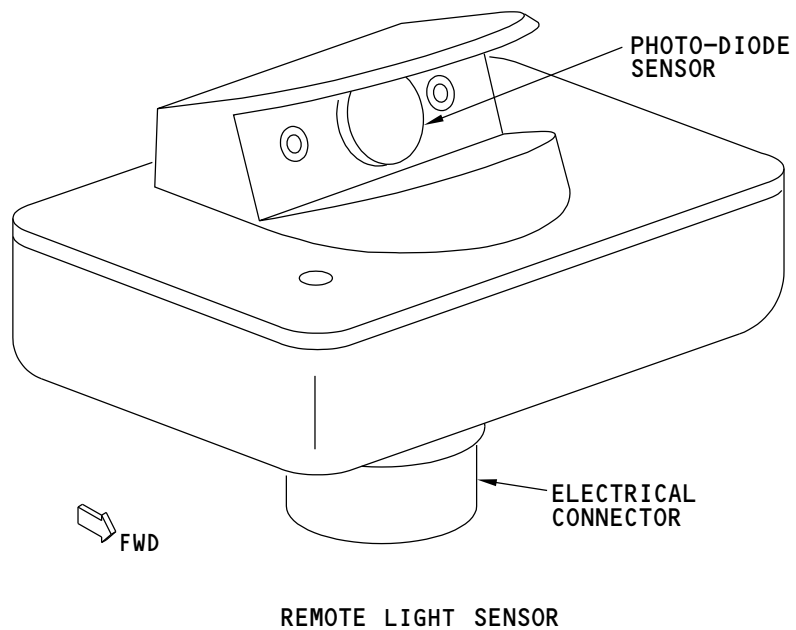
Each sensor weighs less than 1/2 pound. Each has a cable that has all the wires required for electrical power and signal interface. The cable is 84 inches long.

Each RLS has a field-of-view of 60 degrees left, 60 degrees right, 35 degrees up, and 35 degrees down.

Each RLS gets 15v dc from the onside display unit.

Training Information Point

The remote light sensors are interchangeable.



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PRIMARY DISPLAY SYSTEM - REMOTE LIGHT SENSOR

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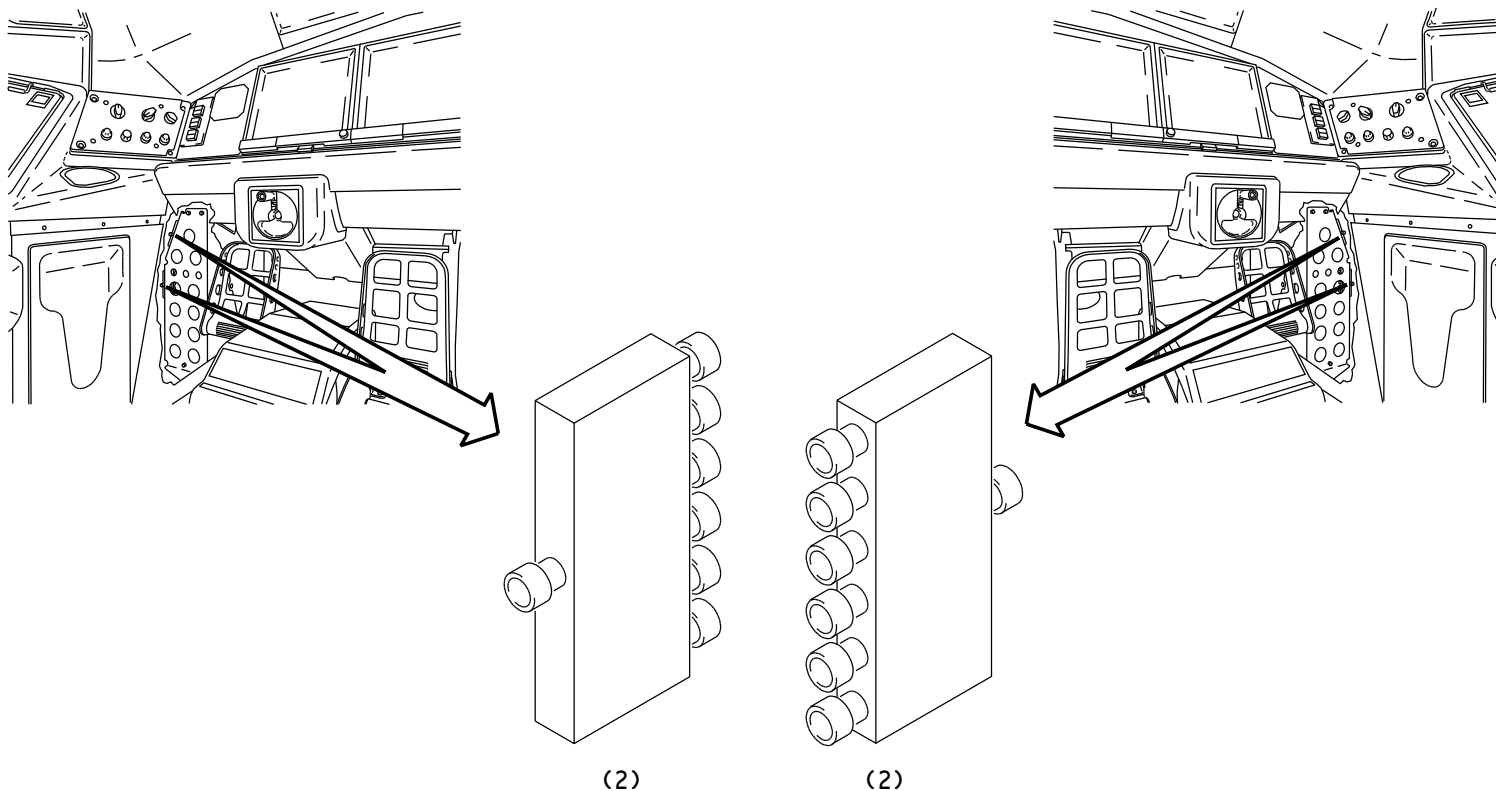
**PRIMARY DISPLAY SYSTEM - COAXIAL COUPLER****General**

There are four coaxial couplers on the airplane. Each graphics generator sends a video output to a coaxial coupler. The coaxial coupler splits the signal and sends an output to each of the six display units.

Location

The coaxial couplers are on disconnect brackets outboard of the captain's and first officer's outboard rudder pedals. There are two coaxial couplers on the outboard side of each disconnect bracket.

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PRIMARY DISPLAY SYSTEM - COAXIAL COUPLER

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**PRIMARY DISPLAY SYSTEM - BRIGHTNESS CONTROLS****Purpose**

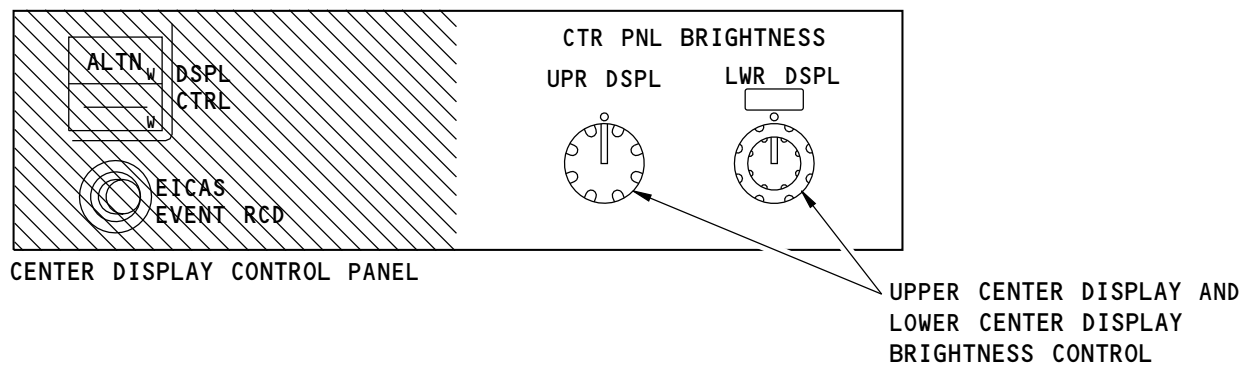
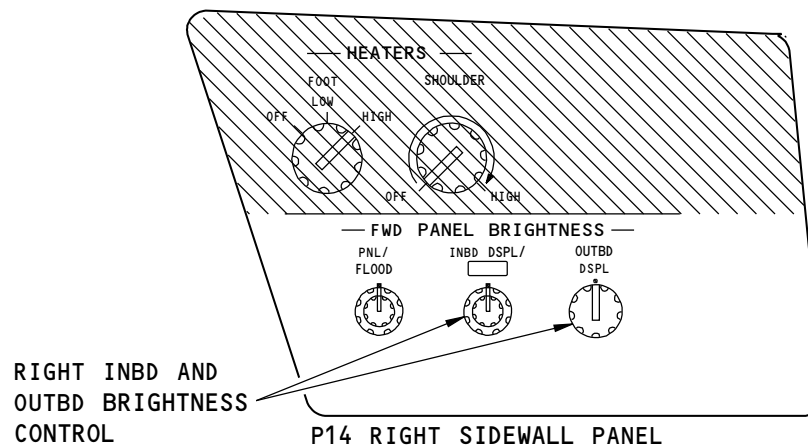
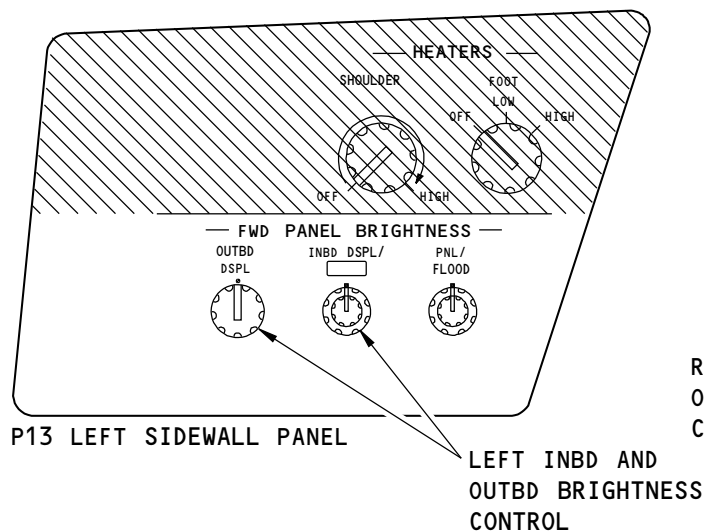
The brightness controls permit manual brightness control by the flight crew for the display units.

Forward Panel Brightness/Heater Controls

The flight crew forward panel brightness controls, control the brightness on the inboard and outboard DUs. There is a single control for the outboard display units. There are two controls for the inboard display units. The outer knob controls brightness and the inner knob controls the weather radar brightness.

Center Display Control Panel

The center display control panel has two brightness controls. The UPR DSPL control adjusts the brightness of the upper center display unit. The LWR DSPL has an outer knob and an inner knob. The outer knob adjusts the brightness of the center lower display. The inner knob adjusts the weather radar brightness.



PRIMARY DISPLAY SYSTEM - BRIGHTNESS CONTROLS

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**PRIMARY DISPLAY SYSTEM - DISPLAY SWITCHING PANELS****Purpose**

The display switching panels select the alternate positions for display formats.

Operation

There are two NORM positions. The MFD position causes the inboard DU to respond to the selections of the display select panel (DSP). The NAV position forces the inboard DU to show the ND format. In the NAV position, the inboard DU does not respond to DSP inputs.

The PFD position causes the inboard DU to show the PFD format.

The EICAS position causes the inboard DU to show the EICAS display format.

The INBD DSPL switch has no effect on the inboard display units (DUs) when the associated outboard DU finds a failure and the PFD switches automatically to the inboard DU. You cannot use the display selector for manual display selection.

Heading Reference Switch

The heading reference switch sets the reference for the PFD and ND formats. The NORM position sets the reference to magnetic heading and turns the NORM light on. The TRUE position sets the reference to true heading and turns the TRUE light on.

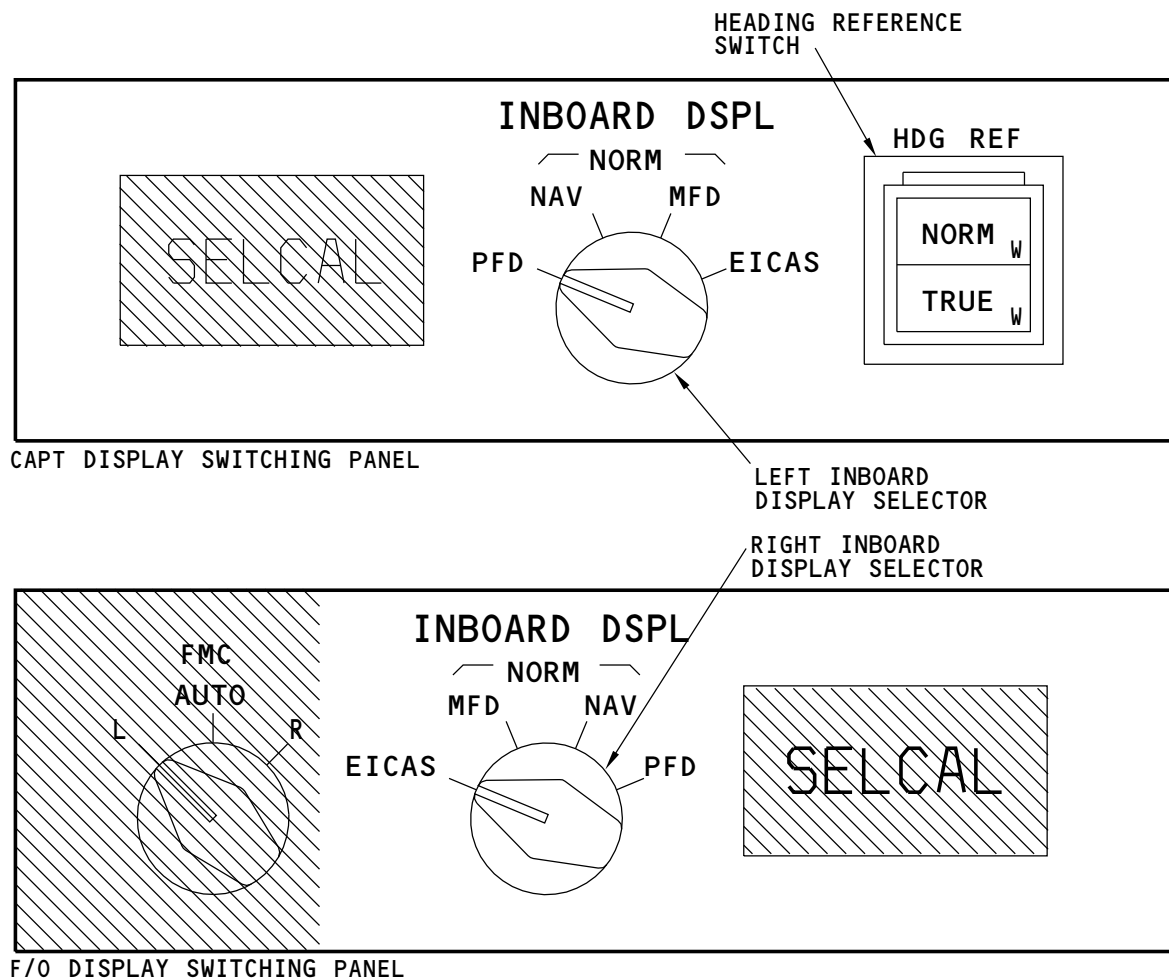
The switch has a plastic guard.

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PRIMARY DISPLAY SYSTEM - DISPLAY SWITCHING PANELS

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PRIMARY DISPLAY SYSTEM - MISCELLANEOUS CONTROLS - 1

General

The left and right instrument source select panels (ISSPs) and the center display control panel supply additional controls for the primary display system. Each source switch permits alternate display source for the flight crew member. These are the alternate source display control switches:

- Navigation source switch
- Display control source switch
- Air data/attitude source switch
- Center display control source switch
- Event record switch.

The three display source control (DSPL CTRL) switches in the flight deck supply manual control for the display channel outputs from the two graphics generators in each AIMS cabinet.

Instrument Source Select Panel (ISSP) Switches

The captain and first officer use the ISSP switches to select an alternate display source.

Use the navigation source switch (NAV) to select the CDU as an alternate map source.

Use the display control source switch (DSPL CTRL) on the ISSP to control the display channels source for the respective inboard and outboard display units. During normal operation, the captain's DUs use graphics generator M010 in the left AIMS cabinet and the first officer's DUs use graphics generator M011 in the right AIMS cabinet.

Use the air data/attitude source switch (AIR DATA/ATT) to select an alternate attitude and other ADIRU source inputs.

The center display control source switch (DSPL CTRL) is on the center display control panel. This switch controls the display source for the two center display units. During normal operation, these DUs use graphics generator M011 in the Left AIMS cabinet.

In the normal configuration, the switches are in the out position and no legend shows. A failure of a display channel causes the DUs to automatically switch to an alternate source. No legend shows in this case.

The selection of any of the switches, causes the display system to assume a failure and automatically change display channels. The NAV switch legend shows CDU when you select the NAV switch for alternate navigation source. In this case, the onside CDU or closest valid CDU. All other switches show ALTN when you select them.

If the display system has lost input sources, you can not cause the entire system to fail through the selection of manual overrides. The system ignores the switch(es) with only one display channel left.

EICAS Event Record Switch

The EICAS event record switch is an additional primary display system control on the center display control panel. Push the this switch to store a snapshot for each maintenance page.

Training Information Point

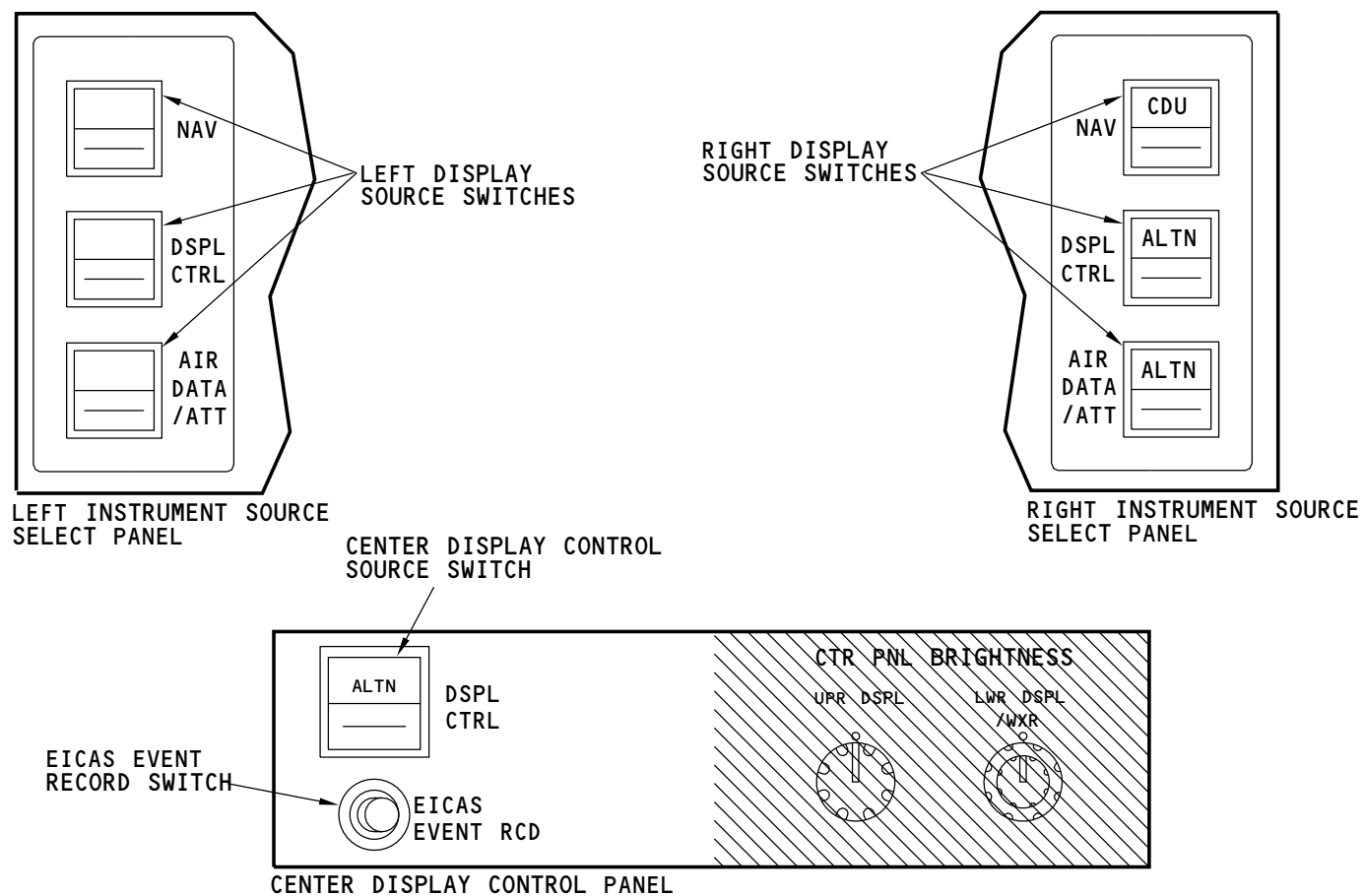
All display control source switches are line replaceable.

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PRIMARY DISPLAY SYSTEM - MISCELLANEOUS CONTROLS - 1

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**PRIMARY DISPLAY SYSTEM - MISCELLANEOUS CONTROLS - 2****Purpose**

The master caution lights alert the flight crew visually of a condition(s) that require crew awareness. You use the master warning/caution reset switch to reset the caution annunciation.

The master caution lights come on when a caution message shows on the EICAS display.

Training Information Point

When the master caution lights come on and there is a caution message on the EICAS display, you also hear a caution aural. The warning electronic system (WES) makes the caution aural. For all caution messages except ALTITUDE ALERT and SPEEDBRAKES EXT, AIMS sends a digital request to the WES to make the caution aural. WES makes the aural request for the caution messages ALTITUDE ALERT and SPEEDBRAKES EXT.

Master Caution Lights and Master Warning/Caution Reset Switch

The master caution lights come on whenever the system finds a new active caution message. The lights go out when you push the switch or when the condition that caused the message goes away. The master caution lights are amber.

Training Information Point

The master warning lights are part of the warning electronic system (WES). WES controls the master warning lights. The master warning lights are red. The master warning lights come on when there is a warning message on the EICAS display. The master warning lights also come on when there is a time critical warning (TCW) message on the PFD.

Accept (ACPT), Cancel (CANC), and Reject (RJCT) Switches

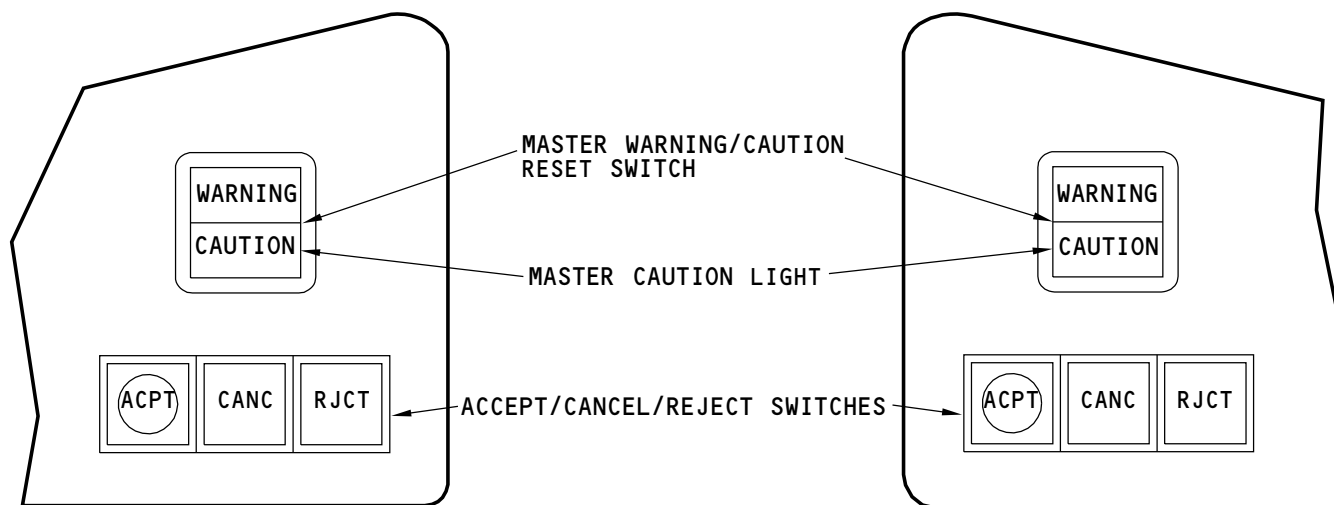
You use these switches with the flight deck communication function when you receive uplink messages.

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PRIMARY DISPLAY SYSTEM - MISCELLANEOUS CONTROLS - 2

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PRIMARY DISPLAY SYSTEM - PRIMARY FLIGHT DISPLAY OVERVIEW

Purpose

The primary flight display (PFD) gives the crew this information:

- Attitude
- Critical parameters cross comparison
- Airspeed
- Navigation Performance Scale and Pointers
- Actual Navigation Pointers Scales
- Anticipation Cues (Ghost Pointers)
- Altitude
- Marker beacon
- Vertical speed
- Heading
- Localizer and glide slope deviation
- Autopilot and autothrottle mode annunciations
- Autopilot status annunciations
- Radio altitude and decision height
- Time critical warning (TCW) messages.

Attitude

The attitude area supplies the flight crew with pitch and roll information from the air data inertial reference system (ADIRS). This data shows as sky/ground shading, a horizon line and a fixed airplane symbol. Additional information in this area includes this:

- Flight director (F/D) bars
- Flight path vector (FPV)
- Flight path angle (FPA)
- TCAS commands
- Slip/skid information
- Pitch limit indications.

Airspeed

The airspeed indication is to the left of the attitude area. Digital readouts show computed air speed (CAS) and MACH values. Reference speeds, maximum and minimum limit speeds, and speed trend data also show.

Navigation Performance Scale and Pointers

The Navigation Performance Scale (NPS) provides an indication of the actual airplane path with respect to the Lateral Navigation (LNAV) and Vertical Navigation (VNAV) path of the active Flight Management System (FMS) flight route.

Actual Navigation Pointers Scales

Actual Navigation Performance (ANP) scales provides an Indication of the lateral and vertical ANP with respect to lateral and vertical RNP.

Anticipation Cues (Ghost Pointers)

Anticipation cues (Ghost Pointers) depicts the lateral or Vertical path for the selected approach (Glide Slope, Localizer and Area Navigation (RNAV) paths).

Altitude

The barometric altitude indication shows as a digital readout and a moving tape to the right of the attitude area.

Marker Beacon

The marker beacon indication shows in the upper right area of the attitude display. Inner marker (IM) white, middle marker (MM) amber, or outer marker (OM) blue, show as the airplane flies over a marker beacon.

Vertical Speed

The vertical speed indication shows on a fixed scale with a pointer. It is to the right of the barometric altitude indication. TCAS advisory information shows on the vertical speed indication.

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PRIMARY DISPLAY SYSTEM - PRIMARY FLIGHT DISPLAY OVERVIEW

Heading

Heading and track data show on a partial compass rose at the bottom of the PFD.

ILS Data

ILS data shows when the ILS receiver tunes to a valid frequency. This data includes:

- localizer and glide slope deviation
- Rising runway
- ILS frequency
- ILS identifier
- DME distance and
- Selected runway course.

The identifier and selected runway course show at the upper left corner of the attitude area. Co-located DME distance shows just below the identifier.

Localizer and glide slope deviation show as pointers against fixed scales at the bottom and right sides of the attitude area. The scales go away when the ILS receivers are not tuned or invalid.

Localizer and glide slope deviation show as pointers against fixed scales at the bottom and right sides of the attitude area. The scales go away when the ILS receivers are not tuned or invalid. A rising runway moves with the localizer deviation pointer.

Flight Mode Annunciations

Autopilot and autothrottle flight mode annunciations show at the top of the PFD. The top lines show autothrottle, AFDS roll, and AFDS pitch active modes in large green letters. The lower line shows AFDS roll and pitch armed modes in the center and right areas in small white letters.

AFDS Status

The AFDS status shows at the top center of the attitude area. These annunciations show for a flight director (F/D) only or an autopilot and F/D engaged:

- FLT DIR - F/D only
- A/P - autopilot only or autopilot and F/D.

These are the autoland status annunciations:

- NO AUTOLAND
- >LAND 2<
- LAND 3.

Radio Altitude and Minimums

Radio altitude shows as a digital readout in the bottom center portion of the attitude area when the radio altitude is at or below 2500 feet. A highlight box shows for ten seconds as the altitude goes below 2500 feet.

Radio minimums (decision height-DH) shows as a digital readout near the lower left side of the altitude tape. The operator sets the RADIO value on the onside EFIS control panel. An amber alert shows as the radio altitude goes below the RADIO value.

The barometric minimums pointer shows on the PFD altitude tape when the "MINS" selector is in the "RADIO" position. This pointer is green if the flight crew set the barometric minimums altitude before the selection of the radio minimums. The green line across the altitude tape that shows on the selection of barometric minimums altitude does not show. The pointer color does not change when the airplane falls below the pointer altitude.

Time Critical Warning (TCW) Messages

There are three time-critical warning messages. The two ground proximity warning system (GPWS) and one engine messages show on the PFD at the bottom center of the attitude area. These messages are the highest priority messages in the flight deck. Immediate flight crew intervention must follow to keep the airplane in a safe operating environment.

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**PRIMARY DISPLAY SYSTEM - PRIMARY FLIGHT DISPLAY OVERVIEW**

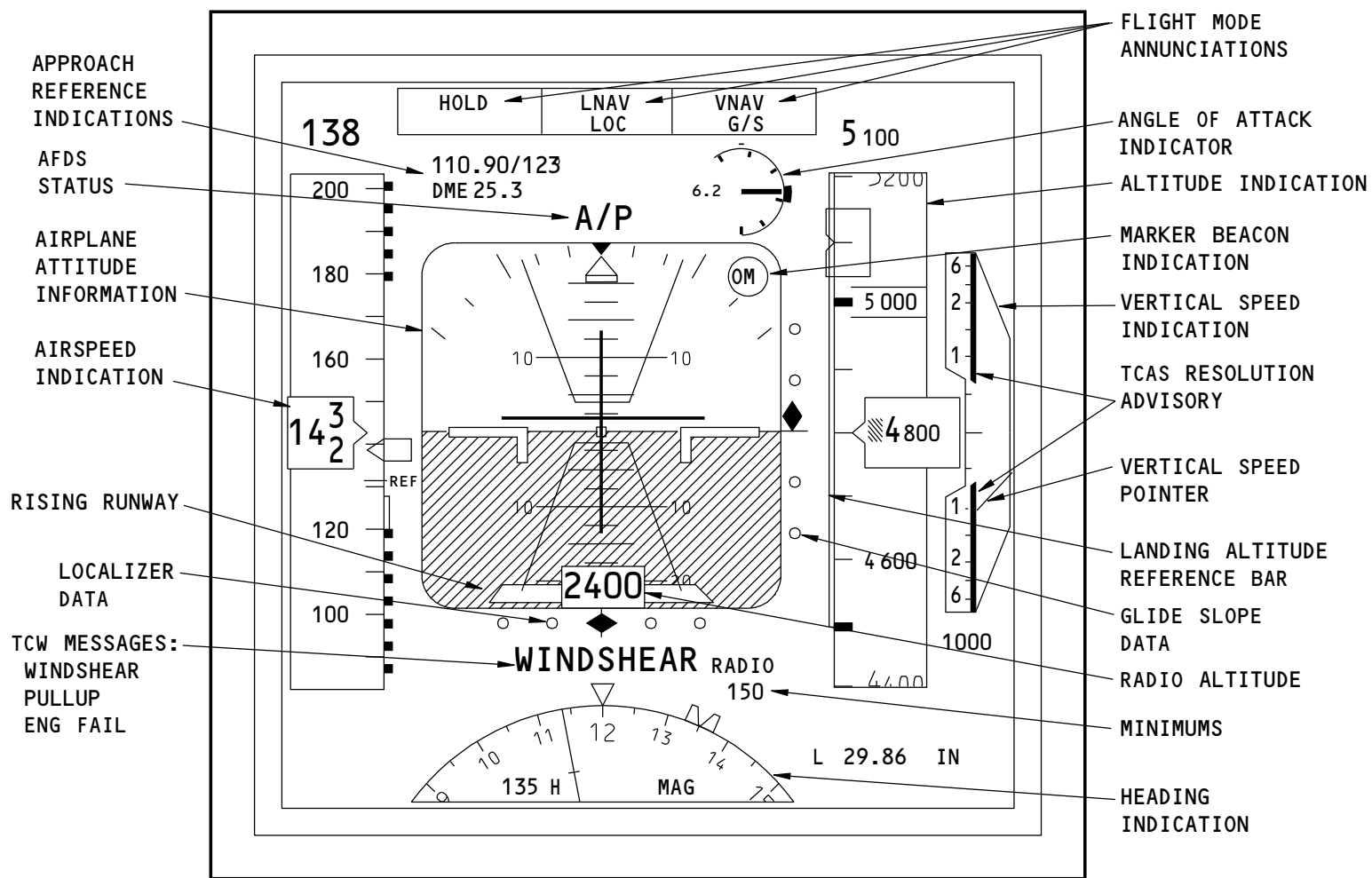
The GPWS message WINDSHEAR shows red during a windshear alert condition.

The GPWS message PULL UP shows red during a pull up alert condition.

The message ENG FAIL shows red during a failed engine condition.

If more than one condition exists, only one message shows in the priority above.

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PRIMARY DISPLAY SYSTEM - PRIMARY FLIGHT DISPLAY OVERVIEW

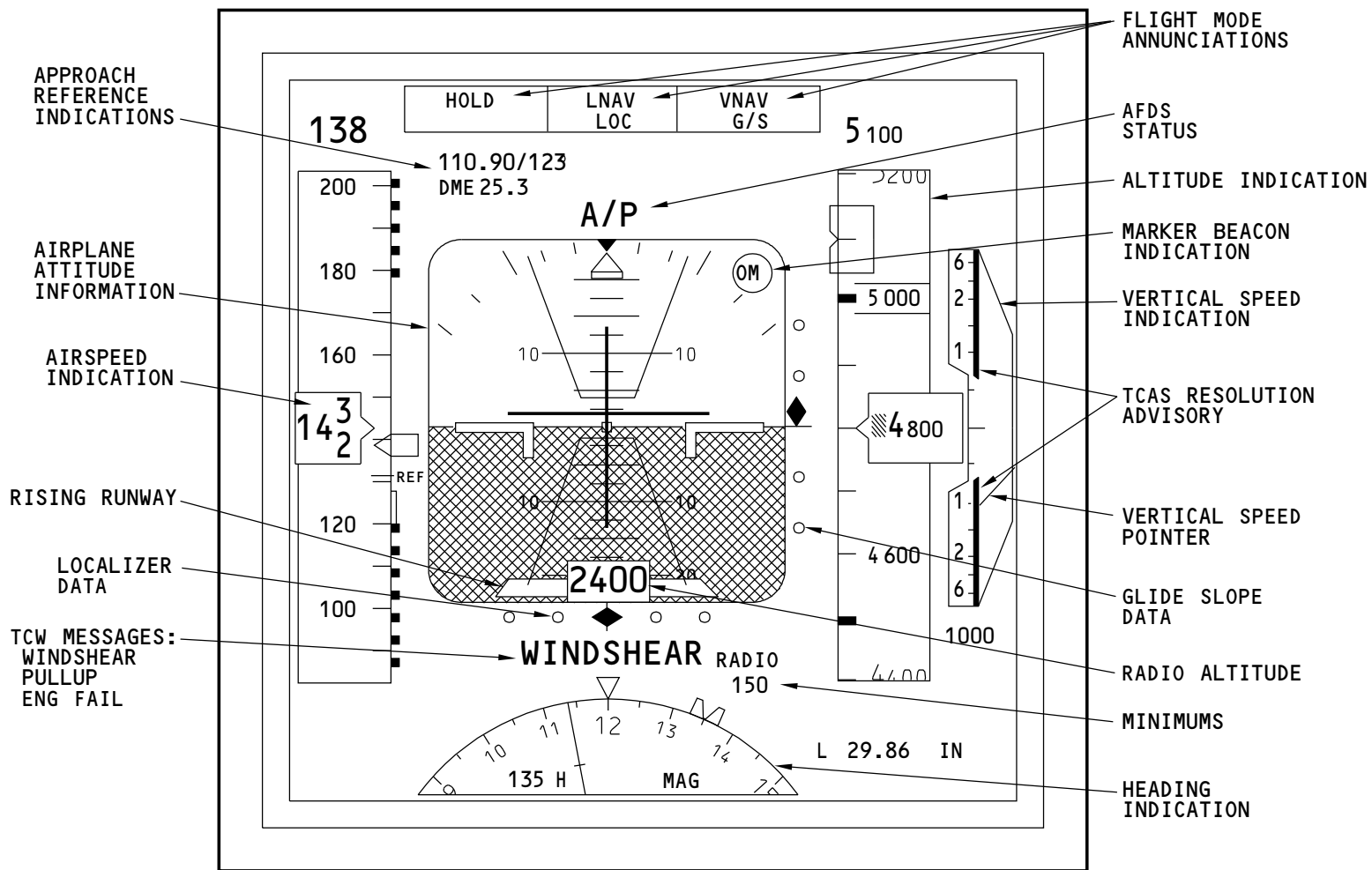
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PRIMARY DISPLAY SYSTEM - PRIMARY FLIGHT DISPLAY OVERVIEW

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**PRIMARY DISPLAY SYSTEM - PFD ATTITUDE AREA****General**

The attitude area has a pitch scale with a horizon line, bank pointer and scale, sky and ground shading, and a fixed airplane symbol. The dynamic symbols of the display move in response to the air data inertial reference system (ADIRS) pitch and roll outputs.

Roll Attitude

The bank pointer moves to show roll against the fixed bank scale. The bank scale shows ± 60 degrees of bank and the indices are at 10, 20, 30, 45, and 60 degrees. The bank pointer and slip/skid indicator turn amber when the bank is equal to or greater than ± 35 degrees.

Pitch Attitude

The pitch scale moves against the fixed airplane symbol. The pitch lines are every 2.5 degrees from -90 degrees to +90 degrees. The sky/ground shading shows airplane attitude at a quick glance.

Flight Director Bars

Flight director bars show in the sky/ground area as a cross-pointer. The pitch command is a horizontal magenta bar. The roll command is the vertical magenta bar. The two bars move independently.

Flight Path Vector (FPV) and Flight Path Angle (FPA)

The FPV symbol shows the flight path angle and drift angle. The FPA is relative to the horizon line. Drift angle is the difference between airplane track and airplane heading. You use the FPV switch on the outside EFIS control panel to show the symbol. The symbol shows when there are valid pitch and bank commands from the AFDS, and valid pitch and roll information from the ADIRS.

The selected flight path angle shows the FPA selected on the mode control panel (MCP).

Traffic Alert and Collision Avoidance System (TCAS) Resolution Advisory Commands

TCAS resolution advisory commands show on the attitude display as three red bands. This makes a symbol similar to a rising runway. Pilots must avoid this area(s) inside the lines during a traffic encounter.

Slip/Skid Indication

The slip/skid indication shows the lateral acceleration of the airplane by the displacement of the lower portion of the bank pointer. With no lateral acceleration, the pointer and rectangular section align.

Pitch Limit Indication

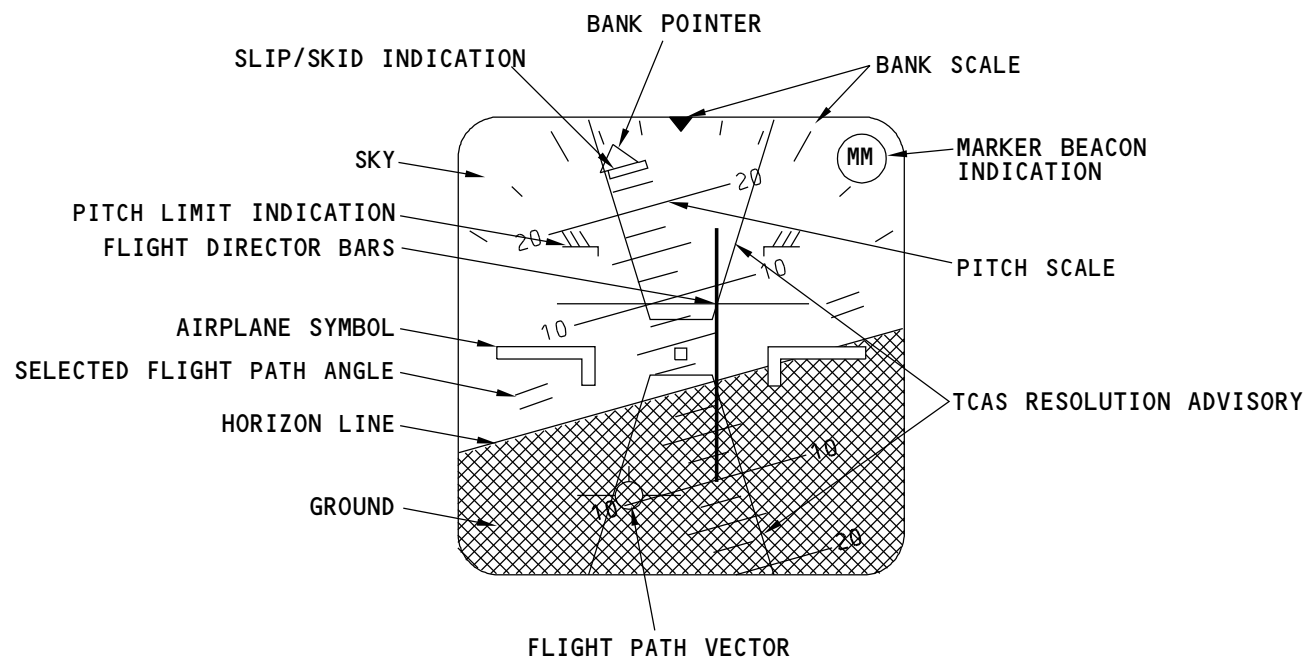
The pitch limit indication shows the remaining pitch angle to stick shaker activation for the current conditions. They show as amber eyelash symbols. They show during flap extension.

Marker Beacon Indication

The marker beacon indication shows in the upper right area of the attitude display. These are the indications that may show:

- IM (inner marker) white
- MM (middle marker) amber
- OM (outer marker) blue.

The indication shows as the airplane flies over a marker beacon. During a marker beacon functional test, the symbol FT shows. A circle encloses the symbols. The beacon displays flash at the rate normal for each beacon, IM-high, MM-medium, or OM-low.



PRIMARY DISPLAY SYSTEM - PFD ATTITUDE AREA

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PRIMARY DISPLAY SYSTEM - PFD NPS DEVIATION SCALES AND POINTERS AND RNP

General

The Navigation Performance Scale (NPS) and enhanced Required Navigation Performance (RNP) navigation capability are available via precise LNAV / VNAV path deviation guidance and display information. The NPS scales are presented when LNAV, VNAV or TOGA are active flight modes. Additionally, the scales will remain in view and operate even if other roll or pitch modes are selected while the airplane remains within RNP containment of the magenta path (on the ND).

NPS Deviation Scales and Points

The Deviation Scales and Pointers present a real time depiction of the location of the respective path in relation to airplane position. The respective lateral and vertical path displays are comprised of a scale (left / right or up / down, and center indices) and the deviation pointer. The extreme indices represent full scale path deviation.

Full scale is displayed as the current RNP. The deviation pointer represents a real time depiction of the respective path (LNAV and VNAV). Additionally, the pointer is directional. For example, should the LNAV pointer be left of center, the LNAV path is off the left wing and a left turn should be made to intercept the path and center the pointer on the center index. The pointers are filled magenta triangle-shaped symbols when not parked at the deflection limit. When at full scale and parked, the pointers are magenta and unfilled.

Actual Navigation Performance (ANP) Bars

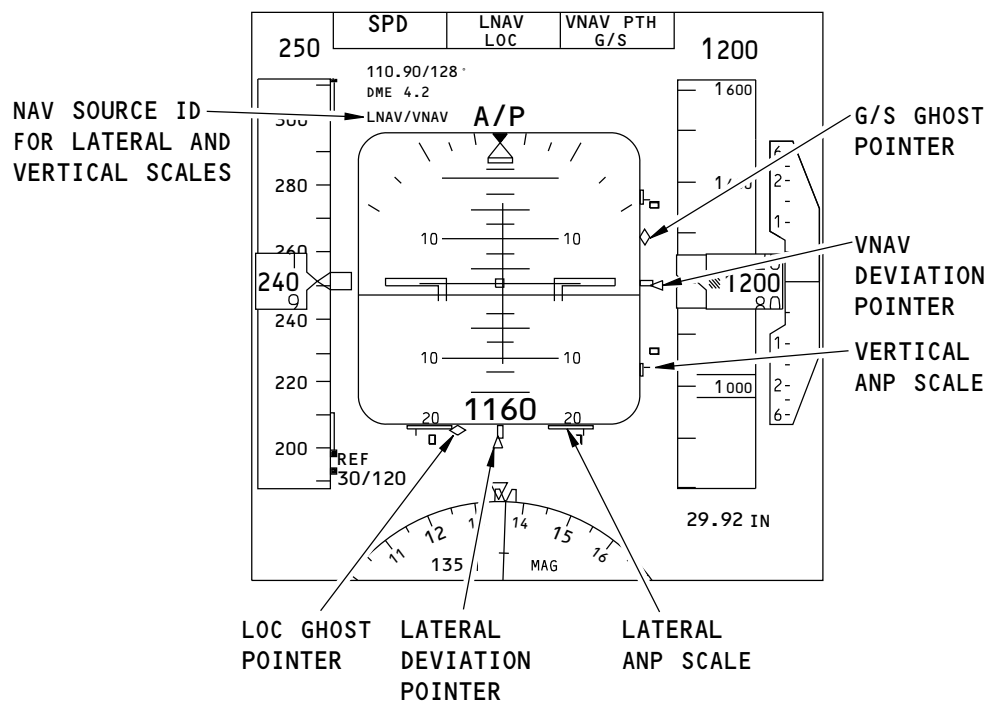
The ANP bars represent system performance (essentially the relationship between RNP and ANP) and move symmetrically from the outer scale when ANP increases. The bars initiate from the outer scale indices and expand inward as a function of decreasing navigation performance relative to RNP. The resulting gap between the ANP bars is described as Flight Technical Error and it is an area where the deviation pointer can migrate and still be assured that the airplane is remaining within the RNP airspace criteria.

Should the deviation pointer migrate into one of the ANP bars for 10 continuous seconds, the ANP bars will turn amber and the pointer will flash for 10 seconds to alert the pilot that a correction to path should be made promptly. Related to this deviation alert, the two bars will just touch at the center of the scale when ANP equals RNP. When the bars come together, system performance has degraded to a point where ANP equals RNP and RNP operations can no longer be assured. Subsequently, the alerting function turns the bars from white to amber, the deviation pointer will flash for 10 seconds, and the UNABLE RNP EICAS message is displayed.

Anticipation Cues (Ghost Pointers)

The ghost pointer is a white, unfilled diamond that represents the lateral or vertical path for the selected approach. The ghost pointer will show the location of the LNAV or VNAV path for an Area Navigation approach. The pointer moves along the lateral or vertical scale in similar fashion to the current ILS and G/S deviation pointers when ILS has been selected.

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PFD NPS DEVIATION SCALES AND POINTERS

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PRIMARY DISPLAY SYSTEM - PFD AIRSPEED INDICATION

General

The airspeed indication is a display that moves against a fixed pointer. The indication has a visible range of 121 knots. Lines show at 10 knot intervals from 30 knots to 990 knots. Numbers show every 20 knots from 40 knots to 980 knots. Airspeed indication limits cause the display to show 30 knots for computed airspeed inputs of 30 knots or less (airspeed NCD).

Airspeed and MACH Number

A digital readout in the center of the tape shows the current computed airspeed (CAS) from the ADIRS. As the value changes, the digits move to simulate a drum type readout. The tape moves so that the current CAS shows by the point of the readout box. Current MACH shows below the speed tape for MACH values greater than 0.4. The information goes away when MACH goes below 0.4 or when MACH fails.

Selected Speed

Selected speed or MACH show as a pointer against the speed tape. The pointer is magenta and is rectangular with a point on one end that shows the selected speed. A numeric readout of the selected speed or MACH shows above the airspeed indication.

Takeoff Reference Speeds

The takeoff reference speeds have of three symbols that show against the speed tape before and during takeoff roll. The bugs show as a green dash followed by V1, VR, or V2. V1 is the decision speed for takeoff abort. VR is the recommended rotation speed. V2 is the takeoff safety speed. The FMCF calculates these speeds. The pilots use the CDU to accept or change the speeds. V1 and VR go away after lift-off. V2 goes away after lift-off when the flaps begin to raise. VR changes to R when GS is less than four knots.

Landing reference speed shows as a green dash and the letters REF.

Flap Maneuver Speeds

Two flap maneuver speeds show. The speeds agree with the current flap selection and the next retracted flap selection. The speeds show as tick marks on the airspeed tape with labels for the flap selections.

The landing flaps setting and VREF shows in a digital format at the lower end of the airspeed tape on the right side, at the parked VREF position.

VNAV Speed Bands

The VNAV Speed Bands supply the crew with an indication of the permitted airspeed range during VNAV PTH descents. The bands show only when the flaps are up and the Selected Target Symbol is shown. The bands decrease if they could conceal other airspeed indications.

Limit Speeds

Maximum speed shows as a red and black barber pole that extends from the top of the speed tape. The barber pole extends to either VMO, MMO, flap placard or gear placard, whichever is smaller. The maneuver margin shows as a hollow amber bar that extends down from the bottom of the maximum speed barber pole. It represents the highest speed before the start of high speed buffet.

Minimum speed shows as a red and black barber pole that extends from the bottom of the speed tape to the Minimum speed.

The maneuver margin shows as a hollow amber bar above the minimum speed barber pole. It shows the minimum maneuvering speed of the aircraft. This speed depends on flap/slat settings.

Speed Trend Vector

The length and direction of the green speed trend vector shows the airspeed in ten second intervals based on current acceleration.

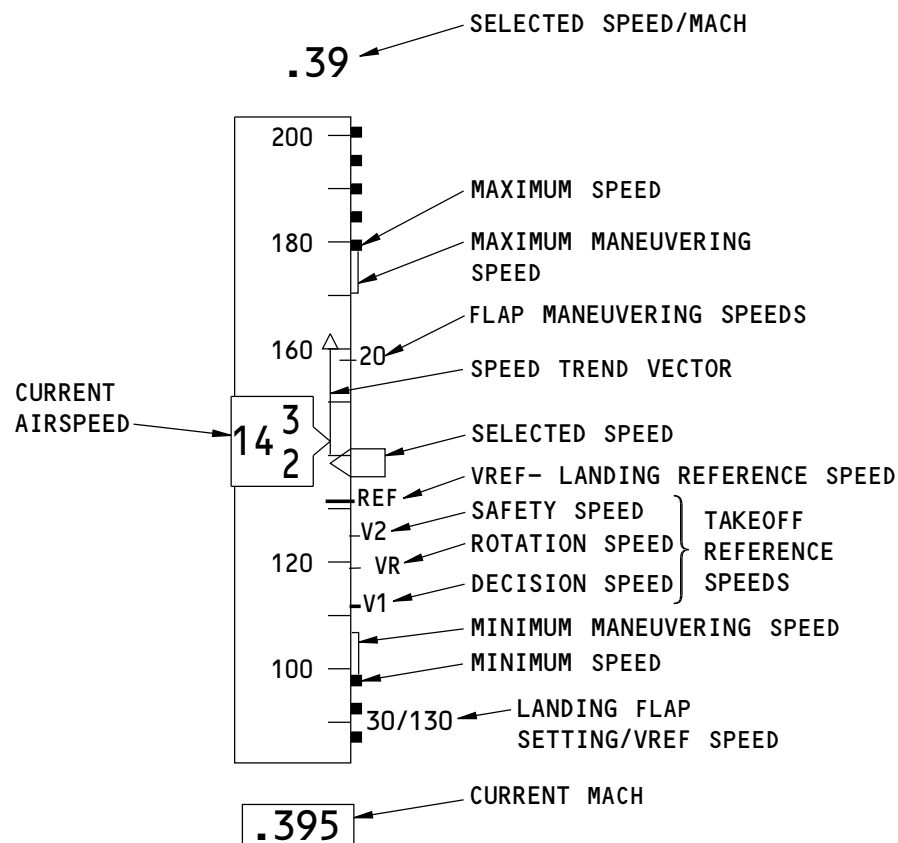
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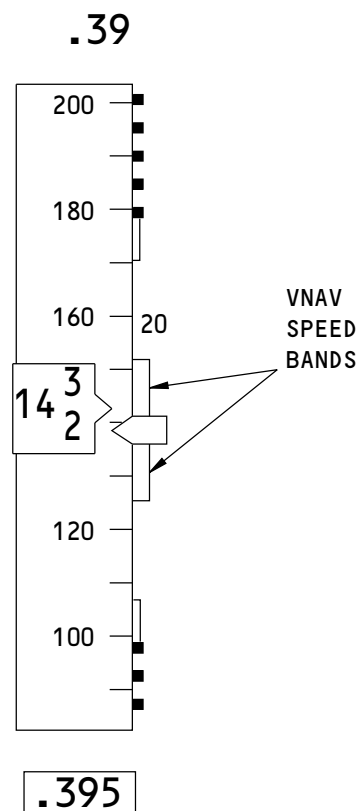
PRIMARY DISPLAY SYSTEM - PFD AIRSPEED INDICATION

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PRIMARY DISPLAY SYSTEM - PFD VNAV SPEED BAND

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PRIMARY DISPLAY SYSTEM - BAROMETRIC ALTITUDE AND VERTICAL SPEED

General

Barometric altitude shows as a digital readout on a moving tape. As altitude changes, the tape moves against a fixed readout box that contains a drum type readout. The baro altitude tape goes from a -9900 feet to 99900 feet. Lines show every 100 feet with numbers every 200 feet.

Selected Altitude

A selected altitude bug shows the selected altitude from the mode control panel (MCP). The bug rests at the top or the bottom of the scale with only half the bug visible when the selected/target altitude is off the scale. The meters (MTRS) switch on the onside EFIS control panel adds the actual altitude and selected altitude show in meters.

Baro Minimums (MDA)

The baro minimums show as a pointer and a digital readout. A knob on the EFIS CP lets the operator set the value. Baro minimums or MDA has a range that starts at -1000 feet. For values less than -1000 feet, the pointer and readout go away.

Barometric Reference

Barometric reference data includes:

- Actual barometric reference
- Barometric reference source (L or R)
- Preselected barometric reference
- Barometric correction reference (QNH or QFE).

An amber box shows around the reference readout for a barometric transfer warning.

Vertical Speed (V/S)

Vertical speed shows as a moving pointer against a fixed scale. The display range of the scale is ± 6000 feet/minute. The top half of the scale shows a positive V/S and the bottom half shows a negative V/S. A V/S in excess of 400 feet per minute causes a digital readout to show. With a positive rate of climb, a digital readout shows at the top of the VS scale. With a negative rate of climb, a digital readout shows at the bottom of the VS scale.

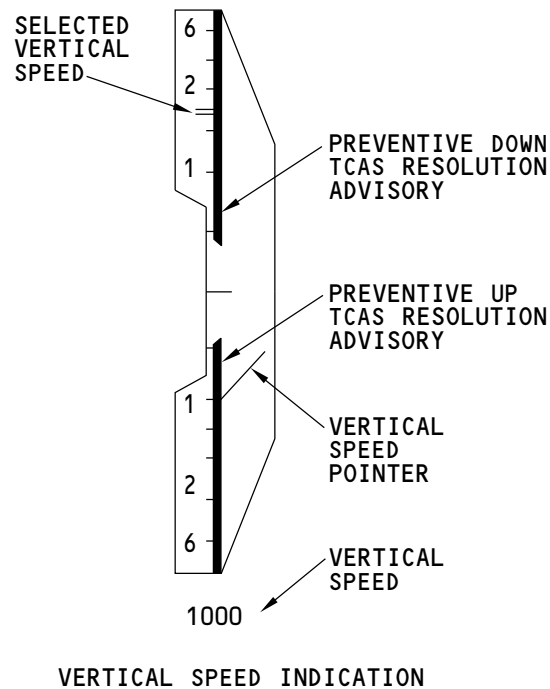
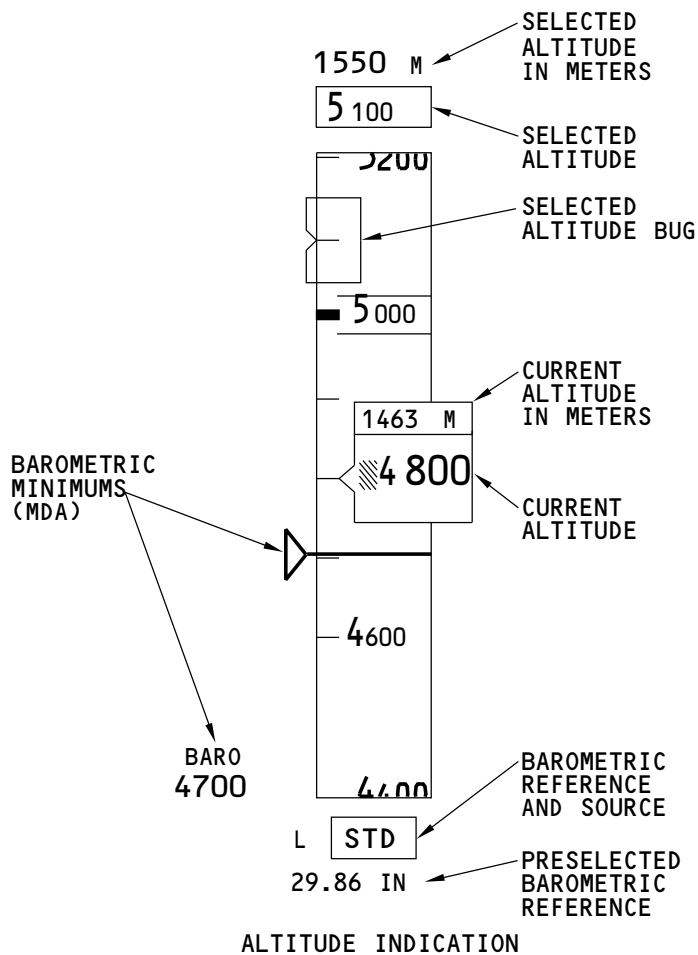
Selected V/S shows as a magenta double line against the numerical scale. You can select the V/S value from the MCP.

TCAS resolution advisories show as bars in the vertical speed area. The bars are red. These two advisories can show:

- Preventive up
- Preventive down.

Landing Altitude Reference Bar

Landing altitude reference bar is located along the inner edge of the altitude tape above the touchdown zone. A white bar displays when the airplane is between 1000 to 500 feet above the ground and an amber bar that extends upward 500 feet from the Landing Altitude. These bars advise the flight crew of the height above the touchdown zone.



PRIMARY DISPLAY SYSTEM - BAROMETRIC ALTITUDE AND VERTICAL SPEED

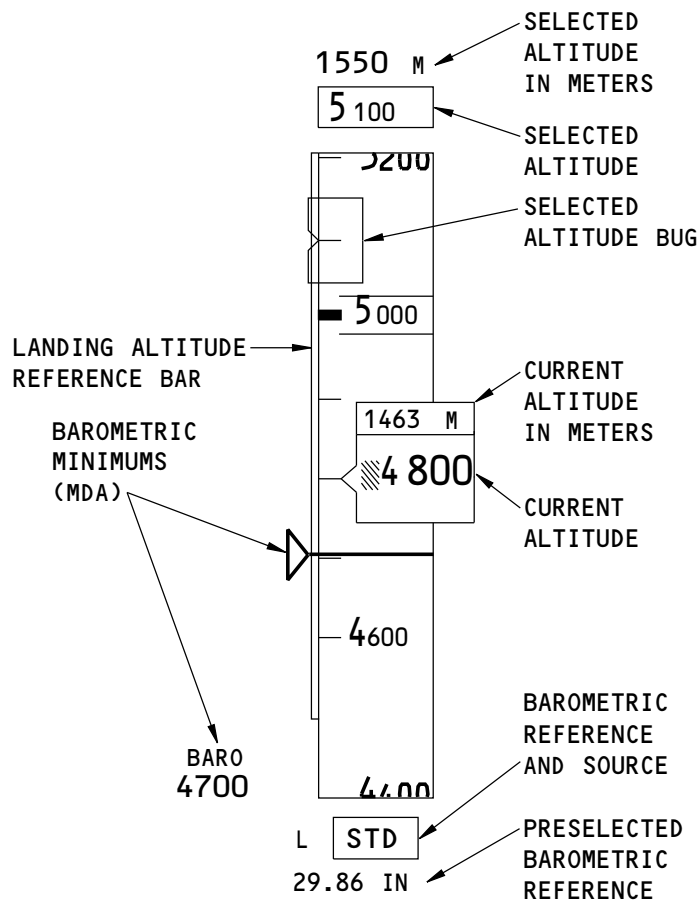
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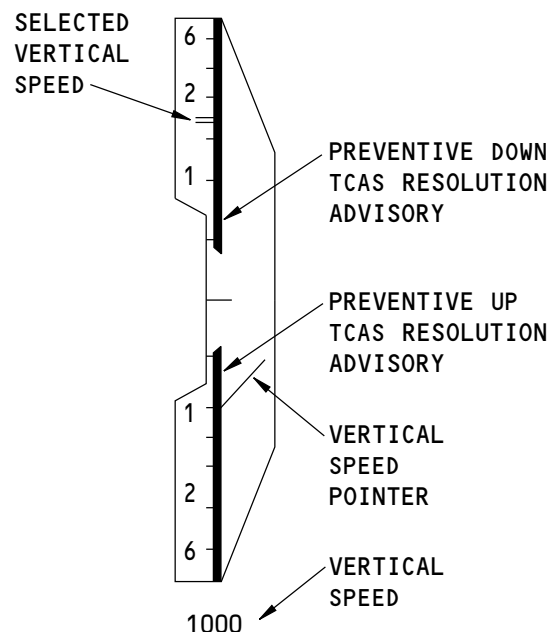
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ALTITUDE INDICATION



VERTICAL SPEED INDICATION

PRIMARY DISPLAY SYSTEM - BAROMETRIC ALTITUDE AND VERTICAL SPEED

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**PRIMARY DISPLAY SYSTEM - PFD HEADING AND TRACK****General**

A partial compass rose of approximately 80 degrees shows at the bottom of the PFD. The compass rose shows this data:

- Heading and track
- Heading reference
- Selected heading or track.

Heading and Track

The current heading shows as a white (W) triangular pointer above the compass rose. The track line shows as a white (W) line that extends up from the center of the compass rose (off screen) and moves in response to track data.

Heading Reference

The heading reference shows automatic or manual selections in the bottom right part of the compass rose. MAG in green (G) shows when the heading reference switch is in the NORM position. TRU (G) shows in a white box when the switch is in the TRUE position. When the reference switches from TRUE to MAG, a green highlight box appears around MAG for 10 seconds.

Selected Heading or Track

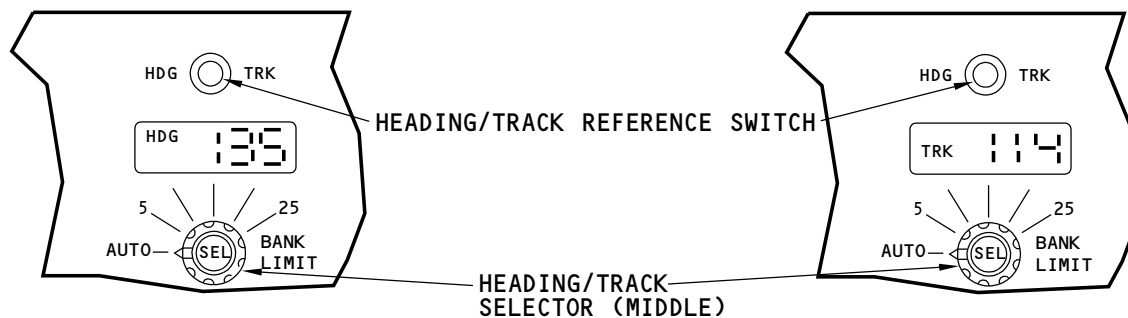
A selected heading or selected track shows magenta (M) both digitally and by a bug that shows the value on the compass rose. The digital readout shows in the lower portion just left of center. An H follows the value for selected heading and a T follows the value for selected track. The selected heading bug is in the shape of an M (bow tie). The bug is on the outer portion of the compass rose. The selected track bug is in the shape of a V and is in the inner portion of the compass rose. Use the heading/track selector on the mode control panel (MCP) to select a heading or track.

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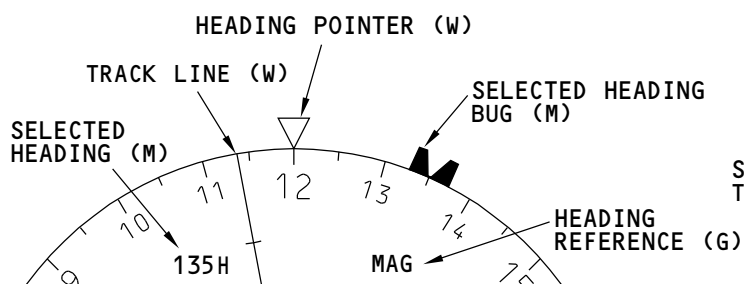
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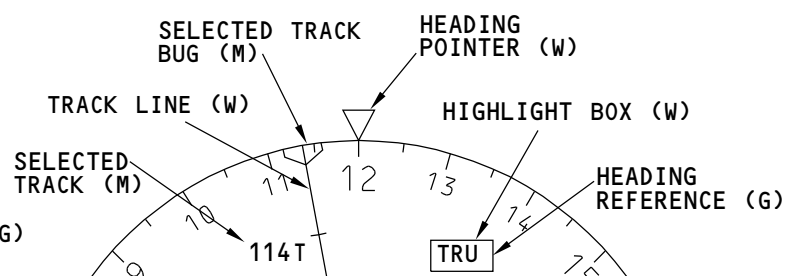


MODE CONTROL PANEL - HDG SELECTED

MODE CONTROL PANEL - TRK SELECTED



COMPASS ROSE WITH NORM SELECTED



COMPASS ROSE WITH TRU SELECTED

PRIMARY DISPLAY SYSTEM - PFD HEADING AND TRACK

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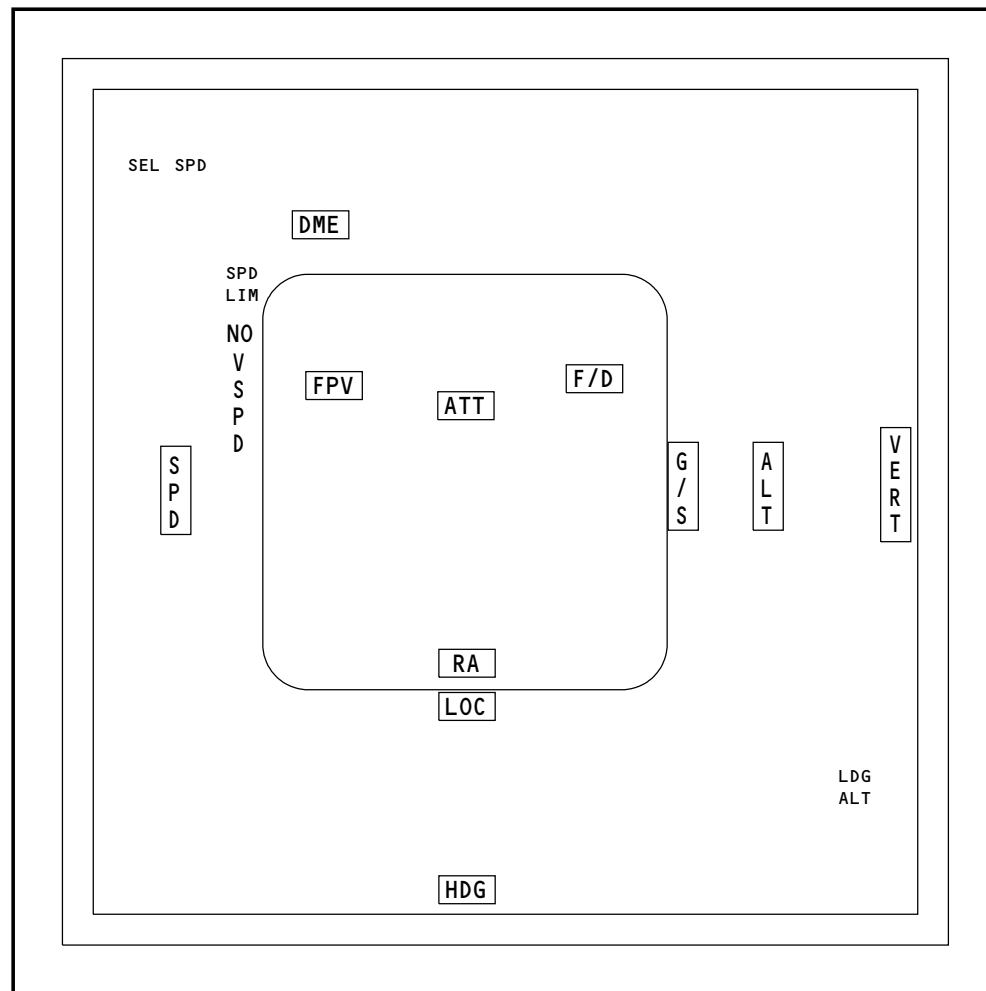
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PRIMARY DISPLAY SYSTEM - PFD FAULT ANNUNCIATIONS

General

The primary flight display shows data from many systems. The validity of the data determines what shows on the display. A no computed data (NCD) condition removes data from the display. An invalid condition removes the data and the display shows a failure flag.



PRIMARY DISPLAY SYSTEM - PFD FAULT ANNUNCIATIONS

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -1

General

The display function in the AIMS cabinets evaluates inputs from the airplane systems.

A no computed data (NCD) status causes information on the display to go away.

A fail status causes information on the display to go away and a fail flag to show.

NCD and Failed Conditions

The chart shows the conditions for:

- Instrument landing system (ILS)
- Co-located DME
- Radio altimeter (RA) system
- Decision height (DH)
- Flight mode annunciations (FMA).

ARO ALL	EFFECTIVITY

PARAMETER	CONDITION	RESULT	REMARKS
GLIDE SLOPE DEVIATION	NCD	GLIDE SLOPE POINTER GOES AWAY	NCD STATUS FROM ALL GLIDE SLOPE SOURCES INDEPENDENTLY OF LOCALIZER DATA
GLIDE SLOPE DEVIATION	FAIL	GLIDE SLOPE POINTER AND SCALE GO AWAY - AMBER G /	FAIL FROM ALL GLIDE SLOPE SOURCES INDEPENDENTLY OF LOCALIZER DATA
LOCALIZER DEVIATION	NCD	LOCALIZER POINTER GOES AWAY	NCD STATUS FROM ALL LOCALIZER SOURCES INDEPENDENTLY OF GLIDE SLOPE DATA
LOCALIZER DEVIATION	FAIL	LOCALIZER POINTER AND SCALE GO AWAY - AMBER LOC FLAG	FAIL STATUS FROM ALL LOCALIZER SOURCES INDEPENDENTLY OF GLIDE SLOPE DATA
DME DISTANCE	NCD	DME WITH DASHES SHOWS ----	ONside DME CO-LOCATED WITH ILS IS NCD
DME DISTANCE	FAIL	AN AMBER DME FLAG SHOWS	ONside DME CO-LOCATED WITH ILS FAILS
RADIO ALTITUDE	NCD	RA DATA GOES AWAY	NCD STATUS FROM ALL RA SOURCES
RADIO ALTITUDE	FAIL	RA DATA GOES AWAY, AMBER RA FLAG	FAIL STATUS FROM ALL RA SOURCES
DECISION HEIGHT	NCD	NUMERICS AND CHARACTERS GO AWAY	NCD STATUS FROM ONside EFIS CP
DECISION HEIGHT	FAIL	NUMERICS AND CHARACTERS GO AWAY	FAIL STATUS FROM ONside EFIS CP
FLIGHT MODE ANNUNCIATIONS	NCD	CHARACTERS GO AWAY	NCD STATUS FROM ONside AFDC
FLIGHT MODE ANNUNCIATIONS	FAIL	FMA SHOWS WITH AMBER LINE THROUGH CHARACTERS - ~~ENAV~~	FAIL STATUS FROM AFDC
LOCALIZE FREQUENCY	NCD	AMBER STRIKE THROUGH OF FREQUENCY	ONE OR TWO OF THE ILS RADIOS HAVE NCD STATUS ON THEIR TUNED FREQUENCY VALVE
LOCALIZE FREQUENCY	DISAGREEMENT	AMBER STRIKE THROUGH OF FREQUENCY	ALL 3 OF THE ILS RADIOS DO NOT HAVE THE SAME TUNING FREQUENCY

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -1

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -2

General

The display function in the AIMS cabinets evaluates inputs from the airplane systems.

A no computed data (NCD) status causes information on the display to go away.

A fail status causes information on the display to go away and a fail flag to show.

NCD and Failed Attitude Conditions

The chart shows the conditions for the attitude area on the PFD.

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PARAMETER	CONDITION	RESULT	REMARKS
ATTITUDE	NCD	HORIZON, PITCH LINES, ROLL POINTER, SKY/GROUND, SLIP/SKID INDICATORS GO AWAY	NCD PITCH AND/OR ROLL DATA FROM ADIRS OR PITCH EXCEEDS 90 DEGREES
ATTITUDE	FAIL	HORIZON, PITCH LINES, ROLL POINTER, SKY/GROUND, SLIP/SKID INDICATORS GO AWAY - AMBER ☐ ATT FLAG SHOWS	FAILED PITCH AND/OR ROLL DATA FROM ADIRS
FLIGHT DIRECTOR	NCD	FD BAR OR BARS REMOVED	NCD PITCH AND/OR ROLL FD COMMANDS FROM AFDC. PITCH AND ROLL BARS OPERATE INDEPENDENTLY.
FLIGHT DIRECTOR	FAIL	FD BARS REMOVED - AMBER ☐ FD FLAG SHOWS	FAILED PITCH AND/OR ROLL FD COMMANDS FROM AFDC
FLIGHT PATH VECTOR	NCD	FPV SYMBOL GOES AWAY	EFIS CP SWITCH ON AND ADIRS PITCH OR ROLL OR HEADING OR TRACK OR FPA IS NCD
FLIGHT PATH VECTOR	FAIL	FPV SYMBOL GOES AWAY - AMBER ☐ FPV FLAG SHOWS	EFIS CP SWITCH ON AND ADIRS PITCH OR ROLL OR HEADING OR TRACK OR FPA FAILS OR PITCH EXCEEDS 90 DEGREES

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -2

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -3

General

The display function in the AIMS cabinets evaluates inputs from the airplane systems.

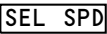
A no computed data (NCD) status causes information on the display to go away.

A fail status causes information on the display to go away and a fail flag to show.

NCD and Failed Airspeed Conditions

The chart shows the conditions for the airspeed indication.

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PARAMETER	CONDITION	RESULT	REMARKS
COMPUTED AIR SPEED	NCD	TAPE WITH POINTER AT 30 KNOTS SHOWS	NCD CAS FROM ADIRS
COMPUTED AIR SPEED	FAIL	ALL SPEED TAPE SYMBOLOGY GOES AWAY AND AMBER  FLAG SHOWS	FAILED CAS FROM ADIRS
SELECTED SPEED	NCD OR FAILED MCP SEL MACH OR SEL SPD	AMBER  FLAG SHOWS AND SELECTED SPEED BUG GOES AWAY	SELECTED MACH OR SELECTED AIRSPEED FROM THE MCP ARE NCD OR FAILED
SELECTED SPEED	FAIL	THREE DASHES - - - SHOW	FMC MACH TARGET, CAS TARGET OR VNAV PITCH COMMAND FAILED
V1, V2, VR	FAIL	BUGS AND READOUTS GO AWAY	FAILED ADIRS CAS
V1, V2, VR	FAIL	BUGS AND READOUTS GO AWAY AND AMBER NO V SPD SHOWS	CAS<50 KNOTS OR CAS NCD AND V1, OR V2, OR VR FAIL
V1, V2, VR	FAIL	V2 GOES AWAY, VR AND V1 STAY	V2 FAILS
SPEED LIMIT	NCD	BARBER POLE GOES AWAY	ADIRS CAS NCD OR CAS < 40 KNOTS AND STICK SHAKER SPEED NCD OR ADIRS CAS FAIL
SPEED LIMIT	FAIL	BARBER POLE GOES AWAY AND AMBER SPD LIM SHOWS	ADIRS FAIL AND WES MAX OP SPEED NCD OR FAIL OR STICK SHAKER SPEED NCD OR FAIL
MACH	MACH NCD OR FAIL	AREA BLANKS	MACH IS NCD OR LESS THAN.4 OR FAILED

M41872 S000618375_V1

PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -3

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -4

General

The display function in the AIMS cabinets evaluates inputs from the airplane systems.

A no computed data (NCD) status causes information on the display to go away.

A fail status causes information on the display to go away and a fail flag to show.

NCD and Failed Conditions

The charts shows the conditions for:

- Altitude indication
- Vertical speed indication
- Heading indication.

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PARAMETER	CONDITION	RESULT	REMARKS
BAROMETRIC ALTITUDE	FAIL	THE TAPE AND SYMBOLOGY GO AWAY AND AN AMBER ALT FLAG SHOWS	BARO CORRECTED ALTITUDE FROM THE ADIRS FAILS

BAROMETRIC ALTITUDE INDICATION

PARAMETER	CONDITION	RESULT	REMARKS
VERTICAL SPEED	NCD	POINTER AND DIGITAL READOUT GO AWAY	NCD ADIRS VERTICAL SPEED
VERTICAL SPEED	FAIL	SCALE, POINTER, AND DIGITAL READOUT GO AWAY AND AN AMBER VERT FLAG SHOWS	ADIRS VERTICAL SPEED FAILS

VERTICAL SPEED INDICATION

PARAMETER	CONDITION	RESULT	REMARKS
HEADING	NCD	TAPE NUMERICS GO AWAY	NCD MCP HEADING
HEADING	FAIL	TAPE NUMERICS, TICKS, AND HEADING INDEX GO AWAY. AN AMBER HDG FLAG SHOWS	FAILED MCP HEADING

HEADING INDICATION

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -4

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -5

General

The display function in the AIMS cabinets evaluates inputs from the airplane systems.

A no computed data (NCD) status causes information on the display to go away.

A fail status causes information on the display to go away and a fail flag to show.

NCD and Failed Conditions

The chart shows the conditions for:

- Actual Navigation Performance (ANP).

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PARAMETER	CONDITION	RESULT	REMARKS
ANP	FAIL	GAP BETWEEN ANP BARS.	FLIGHT TECHNICAL ERROR
ANP	FAIL	ANP EQUALS RNP, THE BARS TURN FROM WHITE TO AMBER.	SYSTEM PERFORMANCE DEGRADED

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PRIMARY DISPLAY SYSTEM - PFD NCD AND FAIL CONDITIONS -5

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PRIMARY DISPLAY SYSTEM - NAVIGATION DISPLAY OVERVIEW

General

The navigation display (ND) has seven modes of operation. The modes are:

- Expanded approach mode
- Centered approach mode
- Expanded VOR mode
- Centered VOR mode
- Expanded map mode
- Centered map mode
- Plan mode.

Flight planning, different flight phases, and flight changes require the use of the various modes.

The plan mode has a north-up orientation.

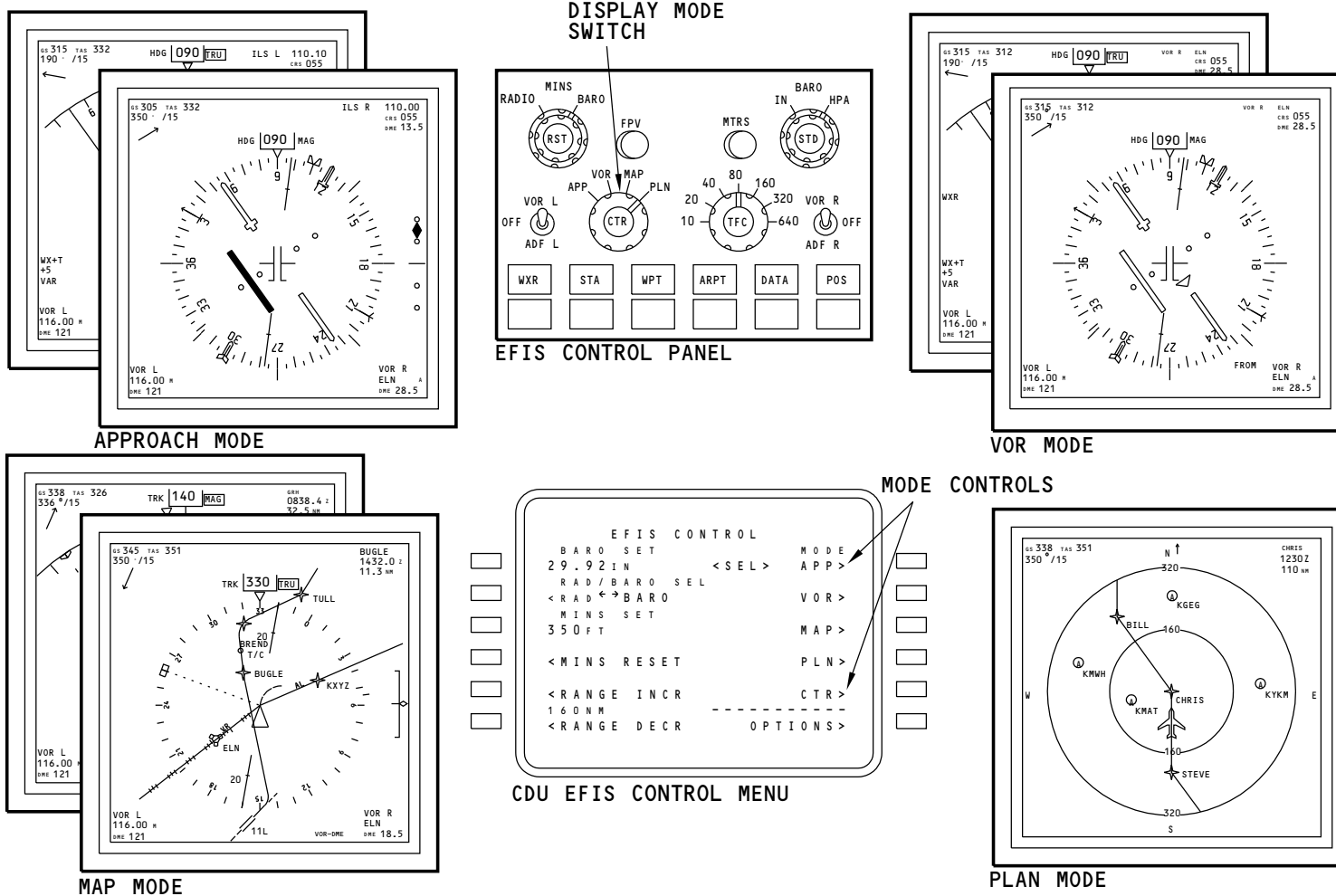
The centered modes show 360 degrees of the compass rose. The expanded modes show 90 degrees of the compass rose.

Use the EFIS control panel (CP) to change the modes of operation.

Controls

Use the outside EFIS CP or the outside CDU to control the mode of operation.

Use the CTR push-button on the EFIS CP or the CTR selection on the CDU EFIS page to toggle the ND between the centered and the expanded display in the approach, VOR and MAP modes.



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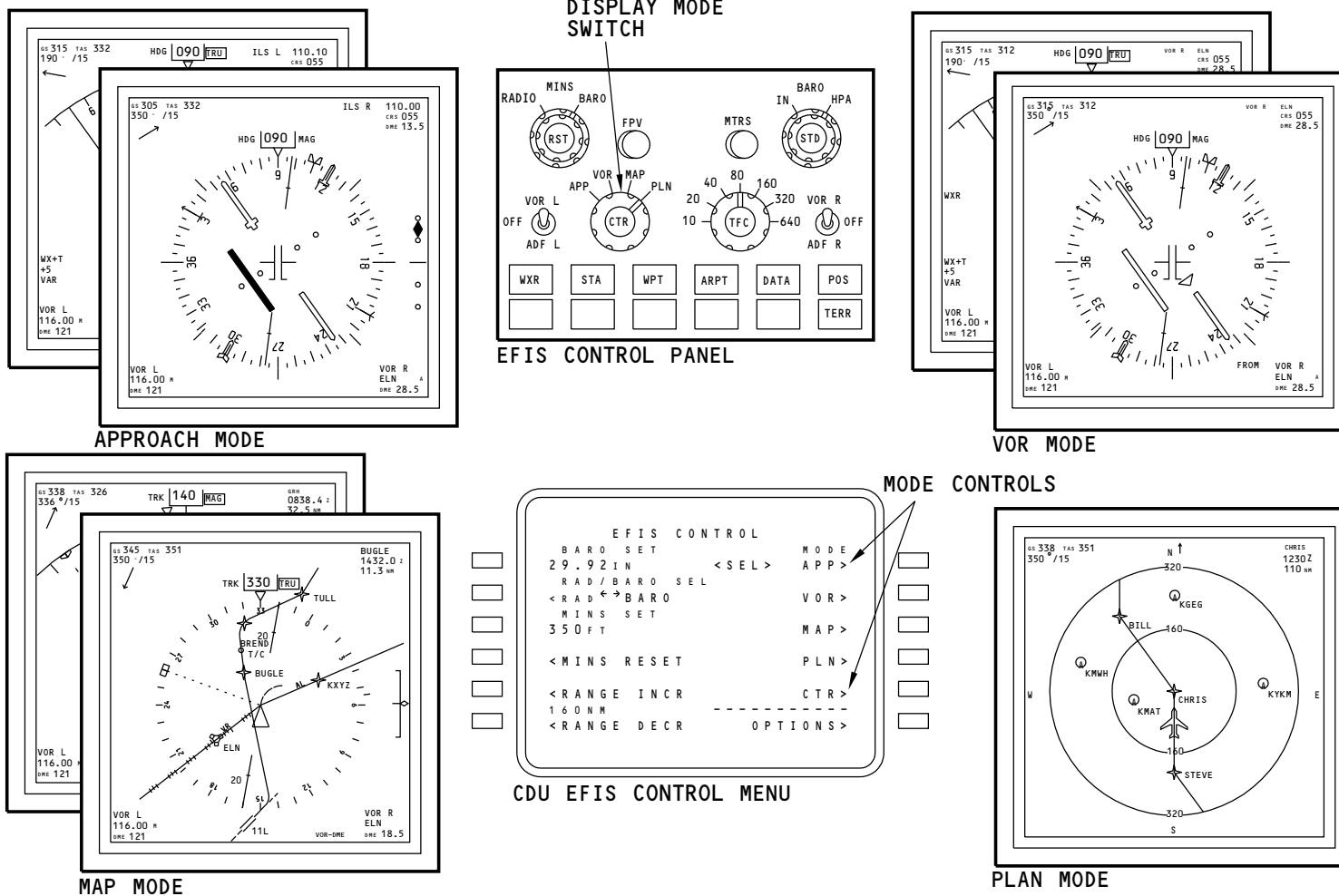
PRIMARY DISPLAY SYSTEM - NAVIGATION DISPLAY OVERVIEW

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PRIMARY DISPLAY SYSTEM - NAVIGATION DISPLAY OVERVIEW

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PRIMARY DISPLAY SYSTEM - CENTERED APPROACH MODE

General

The centered approach mode display shows ILS course deviation, and navigation information over a full 360 degree compass rose. The centered approach mode is a heading-up display. The airplane symbol in the center of the display shows the airplane position along the flight path.

Display Data

The heading box at the upper center of the display shows digital heading in 1 degree increments. The compass rose also rotates to show airplane heading. The digital heading readout is green. MAG or TRU annunciation shows in green to indicate the heading reference.

A white track pointer on the compass rose shows track angle.

Selected course shows as a magenta pointer that rotates around the fixed airplane symbol. The selected course also shows digitally in the upper right corner of the display.

The localizer deviation indication contains a deviation bar on a dot scale. The localizer deviation indicator rotates around the airplane symbol with the pointer.

Glide slope deviation shows as a deviation bar on a vertical dot scale on the right side of the display.

This data shows in the upper right corner for a tuned ILS station when the receiver gets a valid identifier from the ground station:

- Frequency
- Station (STA) identifier
- DME distance.

With no valid identifier, the tuned frequency shows. Below the frequency/identifier field is the selected course. DME distance to a co-located DME station shows below the selected course when available.

The ILS radio source shows at the upper right, near the frequency or STA identifier.

VOR or ADF bearing pointers show on the compass rose. VOR and ADF pointers move clockwise. The VOR pointer movement equals the difference between the received omni-bearing signal and the airplane heading. VOR pointers are green and ADF pointers are cyan. The left pointer is thin and the right pointer is thick for both radios. ADF pointer movement from the airplane heading is the received ADF bearing.

Use the VOR/ADF switches on the EFIS CP to show the applicable data in the lower left and/or right corners of the display. The switch position shows as well as the identifier/frequency of the tuned navigation aids. ADF data shows in cyan and VOR data shows in green. DME distance shows below the frequency/identifier for VOR stations with a co-located DME.

Selected heading shows as M shaped box on the outer edge of the compass rose. When selected heading and actual heading are equal, the box fits around the heading pointer. Selected track shows as a cursor on the inner edge of the compass rose.

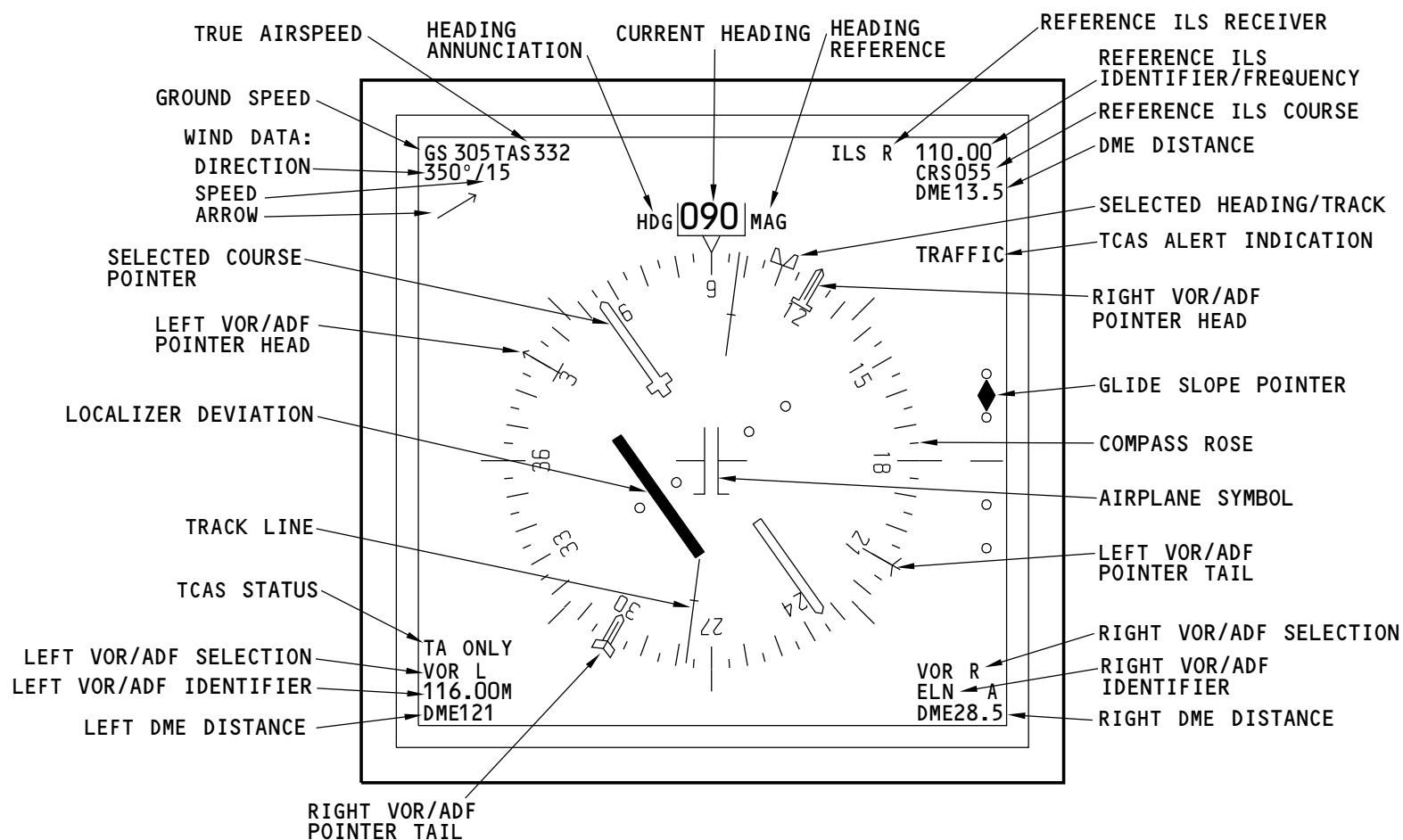
This data shows in the upper left corner:

- Ground speed
- True airspeed
- Wind data.

Ground speed and true airspeed shows as digital readouts. Wind data shows as digital readouts and a rotating arrow.

TCAS information shows as a message below the DME distance in the upper right corner.

TCAS status information shows below the WXR data field to indicate TCAS selection, TA ONLY (TCAS is not computing RAs) or TCAS TEST (TCAS is in the test mode).



PRIMARY DISPLAY SYSTEM - CENTERED APPROACH MODE

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PRIMARY DISPLAY SYSTEM - EXPANDED APPROACH MODE

General

The expanded approach mode shows ILS course and course deviation and navigation information. The display shows 90 degrees of the compass rose. The airplane symbol is at the bottom of the display and the point of the symbol represents the present position of the airplane along the flight path.

Display Data

The expanded approach mode shows data that does not show or is different on the full rose approach mode.

Heading and track, the airplane heading shows as digits on top of a 90 degree arc and is the same as the full approach mode. The track line extends from the tip of the airplane symbol to the compass rose.

Selected runway course shows as a magenta pointer.

Localizer and glide slope deviation scales and symbology are slightly different in appearance. The function is the same as the centered approach mode.

VOR/ADF bearing pointers head or the tail of the applicable pointer shows.

Selected heading or track show as a magenta dashed line that extends from the selected heading or track pointer to the apex of the airplane symbol.

TCAS information shows as messages in the right center of the display and as symbols.

TCAS status and mode information shows below the WXR data field to show this TCAS selection (TFC) and mode data:

- TA ONLY (TCAS is not computing RAs)
- TCAS TEST (TCAS is in the test mode)
- TCAS OFF
- TCAS FAIL (a fault exist in TCAS).

Data that does not change includes:

- Identifier, frequency and DME distance
- The radio source

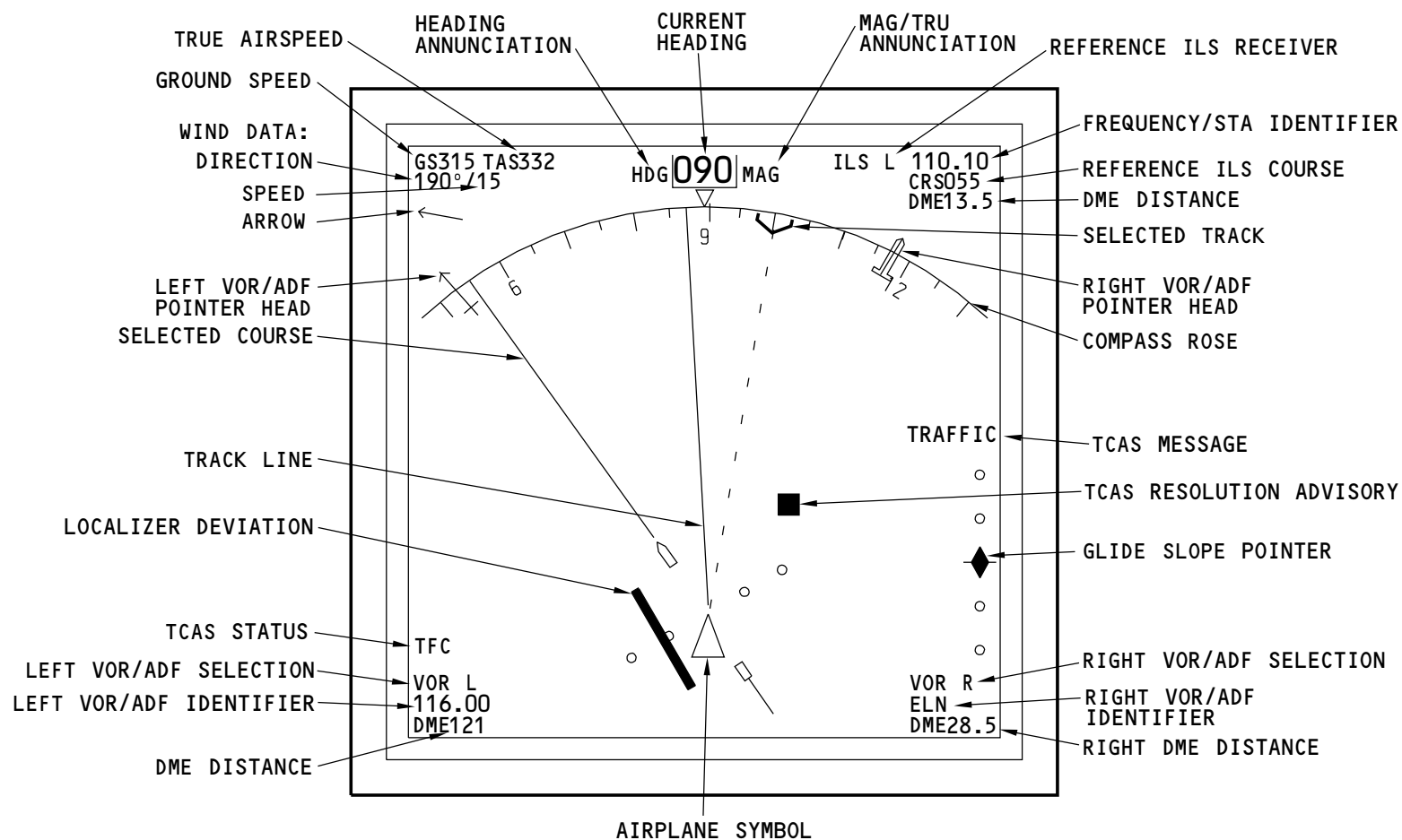
- ADF/VOR switch position, frequency and DME distance
- Ground speed, wind data and true airspeed.

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PRIMARY DISPLAY SYSTEM - EXPANDED APPROACH MODE

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**PRIMARY DISPLAY SYSTEM - APPROACH MODE FAILURE FLAGS****General**

Failures of input sources cause data to go away from the display and failure flags to show.

All the flags are amber.

The captain's and first officer's NDs operate independently.

Failure Flags

A heading (HDG) input failure to the ND causes HDG to show.

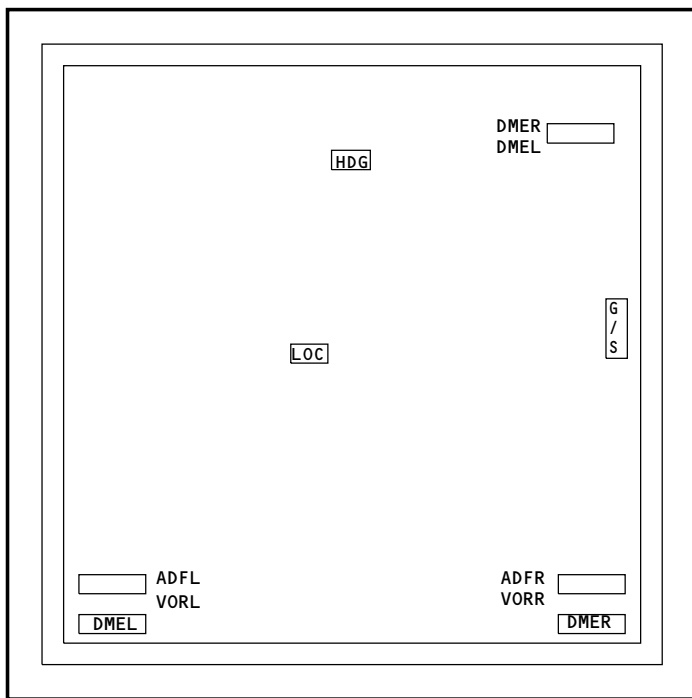
The DME co-located with the ILS, or left or right VOR failure causes DMEL or DMER to show on the ND. To see the flag for DMEs co-located with the VOR stations, put the applicable VOR switch on the EFIS CP in the VOR position.

The localizer (LOC) input failure causes the LOC to show on the ND. The localizer flag is independent of the glideslope flag.

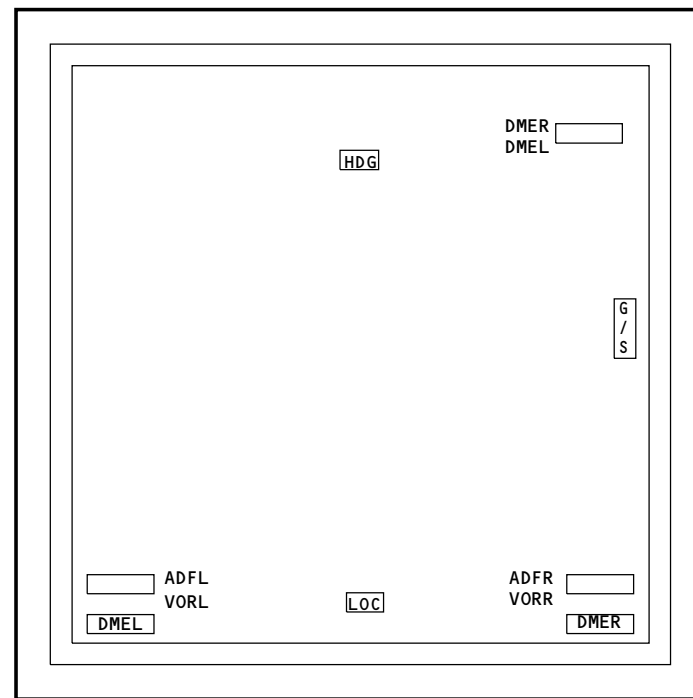
A glide slope (G/S) failure causes G/S to show on the ND. The glide slope flag is independent of the localizer flag.

A left or right ADF failure causes ADFL or ADFR to show on the ND. To see the flag, put the applicable switch on the EFIS control panel in the ADF position.

A left or right VOR failure causes VORL or VORR to show on the ND. To see the flag, put the applicable switch on the EFIS control panel in the VOR position.



CENTERED MODE



EXPANDED MODE

PRIMARY DISPLAY SYSTEM - APPROACH MODE FAILURE FLAGS

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**PRIMARY DISPLAY SYSTEM - APPROACH MODE NCD AND FAIL CONDITIONS****General**

The display function in the AIMS cabinets evaluates inputs from the airplane systems.

A no computed data (NCD) status causes information on the display to go away.

A fail status causes information on the display to go away and a fail flag to show.

Approach Mode NCD and Fail Conditions

The chart below shows the NCD and fail conditions for the approach mode.

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PARAMETER	CONDITION	RESULT	REMARKS
GLIDE SLOPE DEVIATION	NCD	GLIDE SLOPE POINTER GOES AWAY	NCD STATUS FOR ALL GLIDE SLOPE SOURCES INDEPENDENT OF LOCALIZER DATA
GLIDE SLOPE DEVIATION	FAIL	GLIDE SLOPE POINTER AND SCALE GO AWAY. AMBER G/S FLAG.	FAIL STATUS FOR ALL GLIDE SLOPE SOURCES INDEPENDENT OF LOCALIZER DATA
LOCALIZER DEVIATION	NCD	LOCALIZER POINTER GOES AWAY	NCD STATUS FOR ALL LOCALIZER SOURCES INDEPENDENT OF GLIDE SLOPE DATA
LOCALIZER DEVIATION	FAIL	LOCALIZER POINTER AND SCALE GO AWAY. AMBER LOC FLAG.	FAIL STATUS FOR ALL LOCALIZER SOURCES INDEPENDENT OF GLIDE SLOPE DATA
ADF FREQ/IDENT	NCD OR FAIL	IF IDENT INVALID, FREQ SHOWS. IF FREQ INVALID DISPLAY BLANKS	EFIS CP VOR/ADF SWITCHES ON
DME DISTANCE	NCD	DME WITH DASHES SHOWS - - - -	ON-SIDE DME CO-LOCATED WITH VOR IS NCD
DME DISTANCE	FAIL	AN AMBER DME FLAG SHOWS	ON-SIDE DME CO-LOCATED WITH VOR FAILS
HEADING	NCD	TAPE NUMERICS GO AWAY	NCD HEADING
HEADING	FAIL	TAPE NUMERICS, TICKS, AND HEADING INDEX GO AWAY. AN AMBER HDG FLAG SHOWS	FAILED HEADING

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PRIMARY DISPLAY SYSTEM - APPROACH MODE NCD AND FAIL CONDITIONS

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**PRIMARY DISPLAY SYSTEM - CENTERED VOR MODE****General**

The centered VOR mode shows selected VOR course and course deviation. The display shows the full 360 degrees of the compass rose. The centered VOR mode has a heading up display.

Display Data

There is some data that is the same as the data on the centered approach mode. Other data is unique to the VOR mode.

Heading and track is the same as the approach mode.

Selected VOR course shows as a magenta pointer that rotates around a fixed airplane symbol. The selected VOR course also shows digitally in the upper right corner.

VOR course deviation shows as a deviation bar on a dot scale. The dot scale rotates around the airplane symbol.

TO shows airplane direction to the tuned station. FROM shows airplane direction from the tuned station. A pointer and the TO or FROM indication shows this data.

The decoded VOR station identifier shows in the upper right corner for a tuned VOR station when the receiver gets a valid identifier from the ground station. With no valid identifier, the tuned frequency shows. Below the frequency/identifier field is the selected course. DME distance to the co-located DME station shows below the selected VOR course.

The radio source shows at the upper right between the heading readout and the frequency/identifier.

ADF/VOR bearing information is the same as the approach mode.

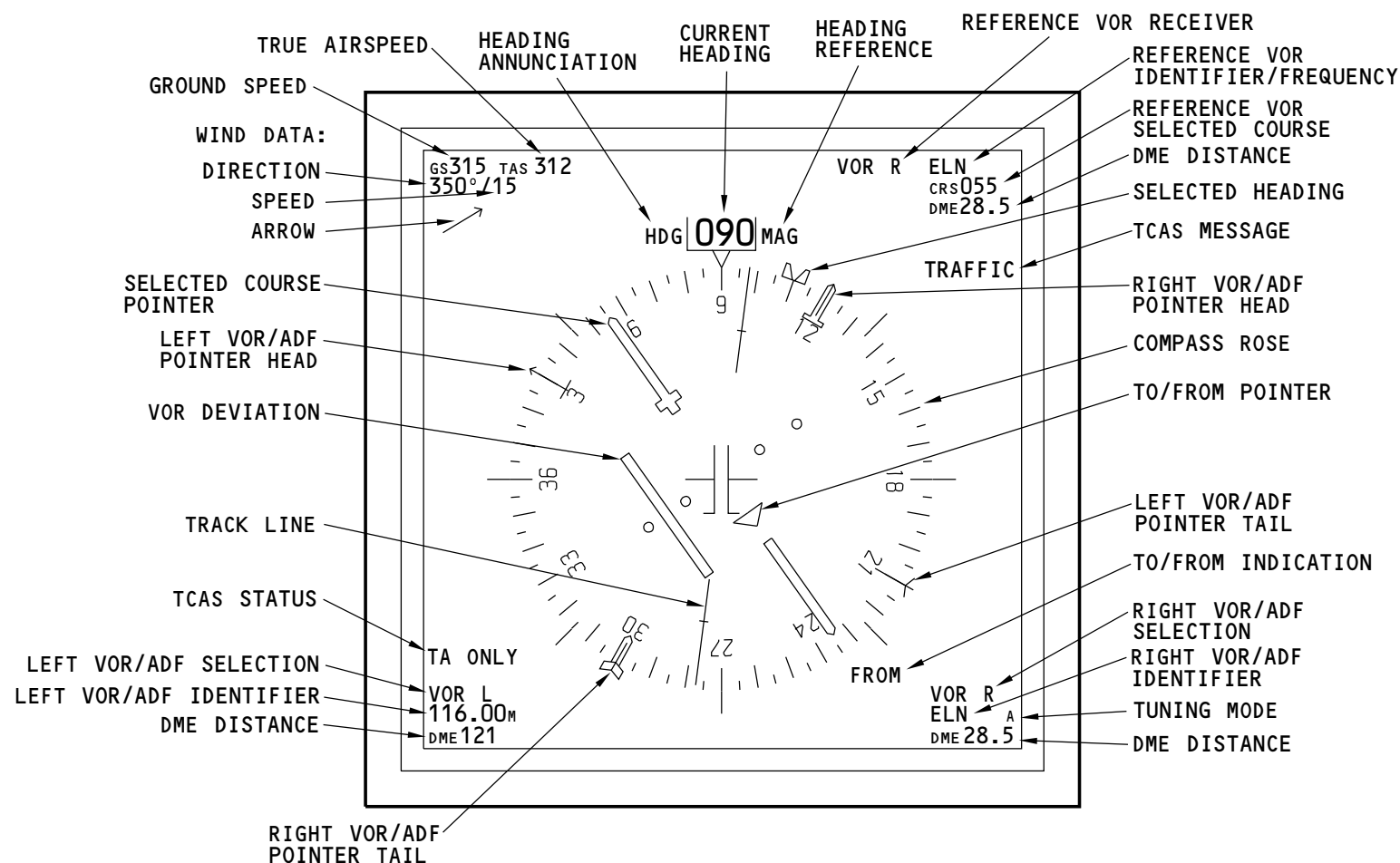
ADF/VOR switch position, frequency, and DME distance is the same as the approach mode.

Selected heading or track is the same as the approach mode.

Ground speed, wind data and true airspeed is the same as the approach mode.

TCAS information shows as a message below the DME distance in the upper right corner. Set the TFC switch on the EFIS CP to see the data.

TCAS status information shows below the WXR data field to indicate TCAS selection; TA ONLY (TCAS is not computing RA) or TCAS TEST (TCAS is in the test mode).



PRIMARY DISPLAY SYSTEM - CENTERED VOR MODE

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PRIMARY DISPLAY SYSTEM - EXPANDED VOR MODE**General**

The expanded VOR mode shows the selected VOR course and course deviation. The display shows 90 degrees of the compass rose. The airplane symbol is at the bottom of the display and the apex of the symbol represents the present position of the airplane.

Display Data

The expanded VOR mode shows data that does not show or is different on the centered VOR mode.

The airplane heading shows as digits on top of a 90 degree arc and is the same as the centered VOR mode. The track line extends from the tip of the airplane symbol to the compass rose.

Selected course shows as a magenta line.

VOR course deviation scales and symbols look slightly different. They function the same as the centered VOR mode.

Only the head or the tail of the VOR/ADF bearing pointers shows.

Selected heading or track shows as a magenta dashed line that extends from the apex of the airplane symbol to the selected heading or track pointer.

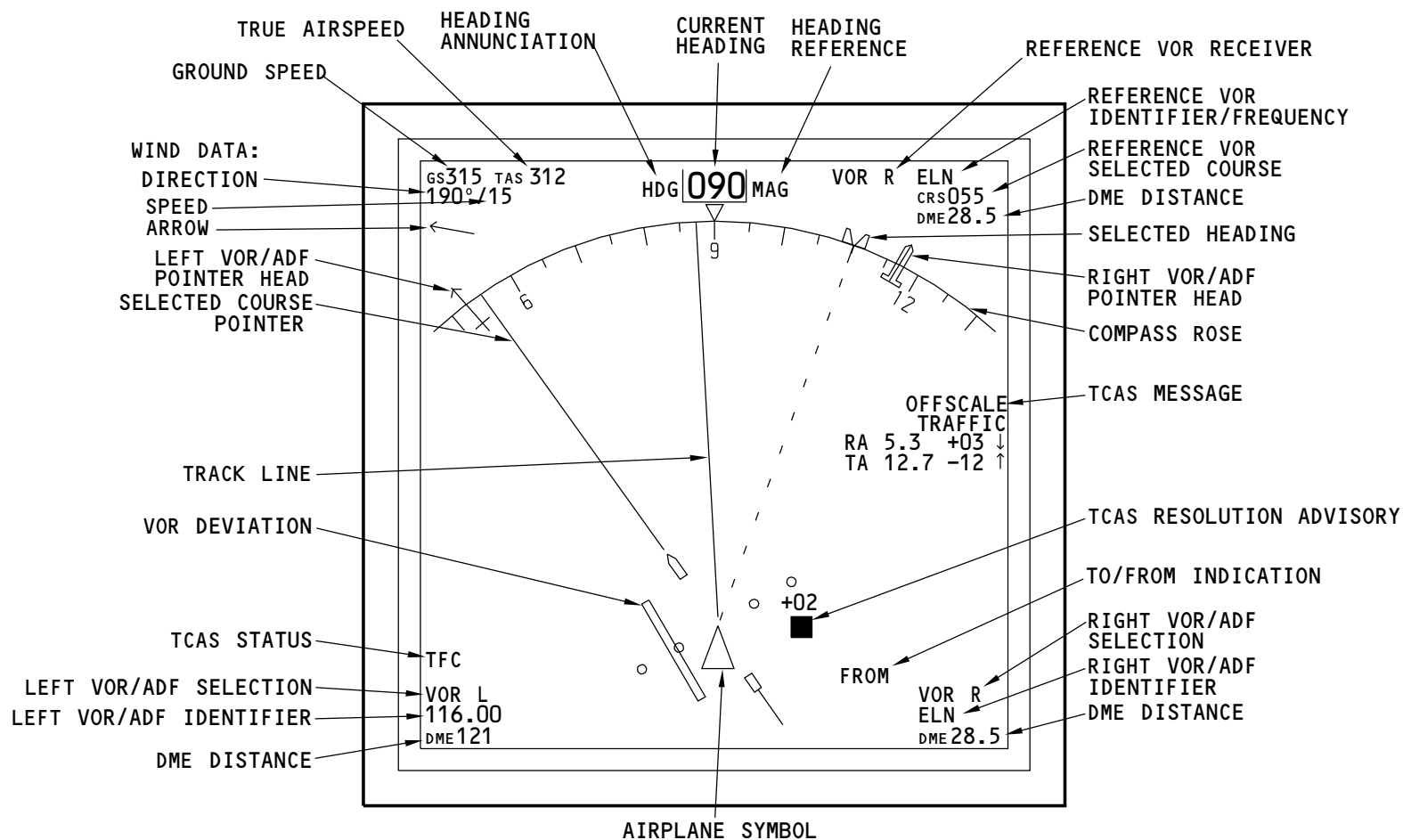
TCAS information shows as messages in the right center of the display and as symbols on the display. Set the TFC switch on the EFIS CP to see the information.

TCAS status and mode information shows below the WXR data field to show:

- TCAS selection
- TFC and mode data
- TA ONLY (TCAS is not computing RA)
- TCAS TEST (TCAS is in the test mode)
- TCAS OFF
- TCAS FAIL (a fault exist in TCAS).

Data that does not change includes:

- Identifier, frequency and DME distance
- The radio source
- ADF/VOR switch position, frequency and DME distance
- Ground speed, wind data and true airspeed.



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PRIMARY DISPLAY SYSTEM - EXPANDED VOR MODE

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PRIMARY DISPLAY SYSTEM - VOR MODE FAILURE FLAGS

General

Failures of input sources cause data to go away from the display and failure flags to show.

All the flags are amber in color.

The captain's and first officer's NDs operate independently.

Failure Flags

The heading (HDG) flag shows when the input to the applicable ND fails

DMEL or DMER (top corner information) flag shows when the DME co-located with the left or right VOR input fails to the ND

VORL or VORR (mode information) flag shows when the left or right VOR input fails to the ND

DMEL or DMER (bottom corner information) shows when the DME co-located with the left or right VOR input fails to the ND. To see the flag, put the applicable VOR switch on the EFIS CP in the VOR position.

VORL or VORR (bottom corner information) shows when the left or right VOR input fails to the ND. To see the flag, put the applicable switch on the EFIS control panel in the VOR position.

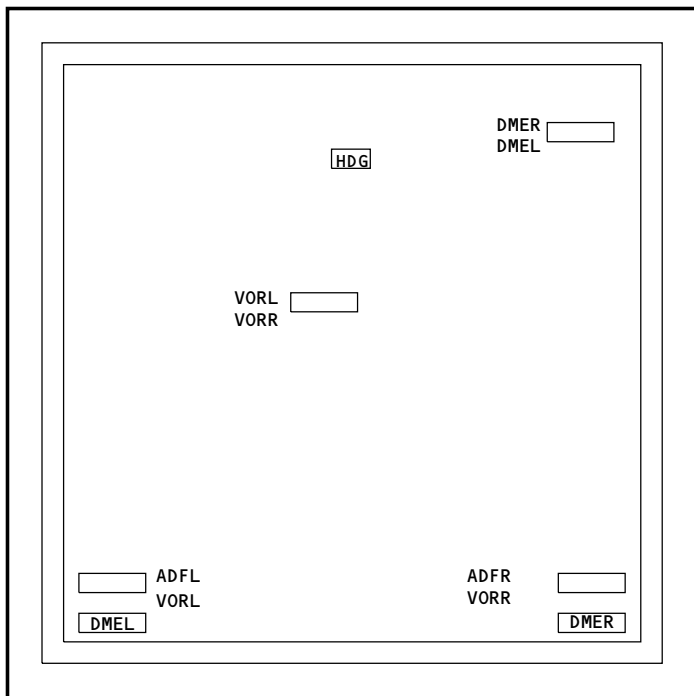
ADFL or ADFR shows when the left or right ADF input fails to the ND. To see the flag, put the applicable switch on the EFIS control panel in the ADF position.

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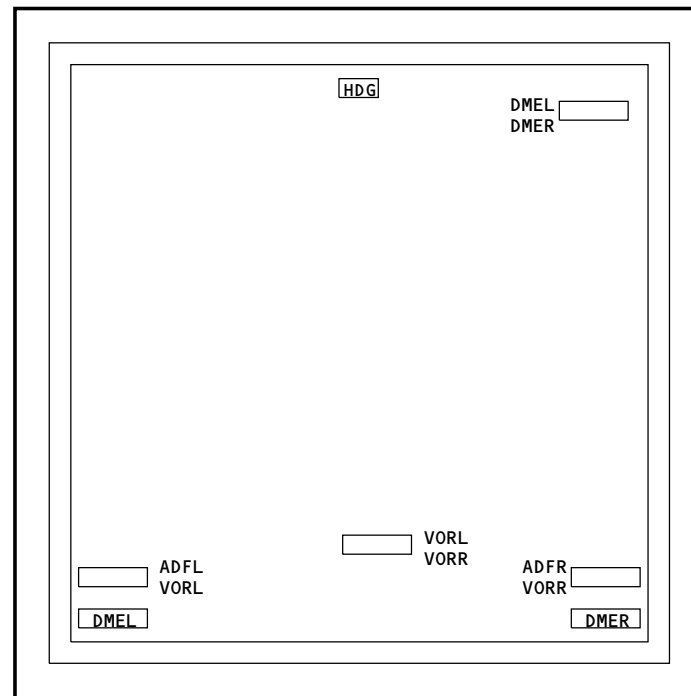
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CENTERED MODE



EXPANDED MODE

PRIMARY DISPLAY SYSTEM - VOR MODE FAILURE FLAGS

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**PRIMARY DISPLAY SYSTEM - VOR MODE NCD AND FAIL CONDITIONS****General**

The display function in the AIMS cabinets evaluates inputs from the airplane systems.

A no computed data (NCD) status causes information on the display to go away.

A fail status causes information on the display to go away and a fail flag to show.

VOR Mode NCD and Failure Conditions

The chart shows the NCD and fail conditions for the VOR mode and for the VOR, DME, and ADF data available through the VOR/ADF switches on the EFIS CPs.

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PARAMETER	CONDITION	RESULT	REMARKS
VOR FREQ/IDENT	NCD OR FAIL	IF IDENT INVALID, FREQ SHOWS. IF FREQ INVALID DASHES SHOW	CAPT AND F/O VOR
VOR COURSE	NCD	DEVIATION BAR GOES AWAY	CAPT AND F/O VOR
VOR COURSE	FAIL	SCALE AND BAR GO AWAY	CAPT AND F/O VOR
VOR OMNIBEARING	NCD	POINTERS GO AWAY	EFIS CP VOR/ADF SWITCHES ON
VOR OMNIBEARING	FAIL	ALL VOR SYMBOLOGY GOES AWAY. [VOR] FLAG SHOWS	CAPT AND F/O VOR
ADF FREQ/IDENT	NCD OR FAIL	IF IDENT INVALID, FREQ SHOWS. IF FREQ INVALID DISPLAY BLANKS	EFIS CP VOR/ADF SWITCHES ON
DME DISTANCE	NCD	DME WITH DASHES SHOWS - - - -	ON-SIDE DME CO-LOCATED WITH VOR IS NCD
DME DISTANCE	FAIL	AN AMBER [DME] FLAG SHOWS	ON-SIDE DME CO-LOCATED WITH VOR FAILS
HEADING	NCD	TAPE NUMERICS, TICKS, AND HEADING INDEX GO AWAY	NCD HEADING
HEADING	FAIL	TAPE NUMERICS, TICKS, AND HEADING INDEX GO AWAY. AN AMBER [HDG] FLAG SHOWS	FAILED HEADING

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PRIMARY DISPLAY SYSTEM - VOR MODE NCD AND FAIL CONDITIONS

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PRIMARY DISPLAY SYSTEM - CENTERED MAP MODE

General

The centered map mode shows the airplane flight plan on a full 360 degree display. The centered map mode has a track up reference. The point of the airplane symbol (a triangle) is the present position of the airplane.

The same basic data shows in both the centered and the expanded map modes.

Display Data

The current track value shows digitally in the readout box. The compass rose rotates and the readout changes in one degree increments. TRK shows on the left and MAG or TRU shows on the right. A track line shows from the bottom of the display through the tip of the airplane symbol to the readout box. Current heading shows as a triangular pointer on the outer edge of the compass rose.

Selected heading shows as a magenta (M) cursor (bow tie) on the outer edge of the compass rose. The selected heading cursor and the heading cursor (W) fit together when their values are equal. A dotted magenta vector shows full time except when the AFDS roll mode is LOC, ROLLOUT or LNAV. For these modes, the vector shows for ten seconds after selected heading changes, then goes away. Selected track shows as a magenta cursor on the inner edge of the compass rose. The vector is the same as the selected heading vector.

VOR/ADF bearing information is the same as approach and VOR modes.

VOR/ADF selection is the same as approach and VOR modes.

Ground speed, wind data, and true airspeed are the same as approach and VOR modes.

A curved position trend vector (W) shows from the tip of the airplane symbol. The vector shows the airplanes predicted position in 30, 60, or 90 second intervals. The map range controls the number of segments. The tip of each segment shows the future airplane position in 30 seconds. The ground speed determines the length of the line. Cross track acceleration from the ADIRU controls the curve.

This data shows in the upper right corner:

- Active waypoint identifier
- Estimated time of arrival (ETA) to the waypoint
- Distance to the waypoint.

The active (next) waypoint on the flight path is magenta.

The FMCF navigation mode shows in the lower right corner next to the navigation aid information. The update method shows as:

- VOR-DME
- DME-DME
- GPS
- LOC
- INERTIAL.

TCAS traffic messages and TCAS traffic symbols show in the centered map mode.

TCAS status and mode information shows below the WXR data field to indicate TCAS selection (TFC) and mode data; TA ONLY (TCAS is not computing RA), TCAS TEST (TCAS is in the test mode), TCAS OFF, or TCAS FAIL (a fault exist in TCAS).

Vertical deviation from the FMCF flight plan descent path shows on the VNAV path scale. The information shows when the descent phase becomes active. Deviation greater than 420 feet above the path causes a numerical readout to show above the vertical scale. Deviation greater than 420 feet below the path causes a numerical readout to show below the vertical scale.

Weather radar shows in this mode when the crew turns weather radar on.

Map background data contains many types of symbols and data. This data includes:

- Active, inactive and modified flight plans
- Flight plan waypoints
- Holding patterns

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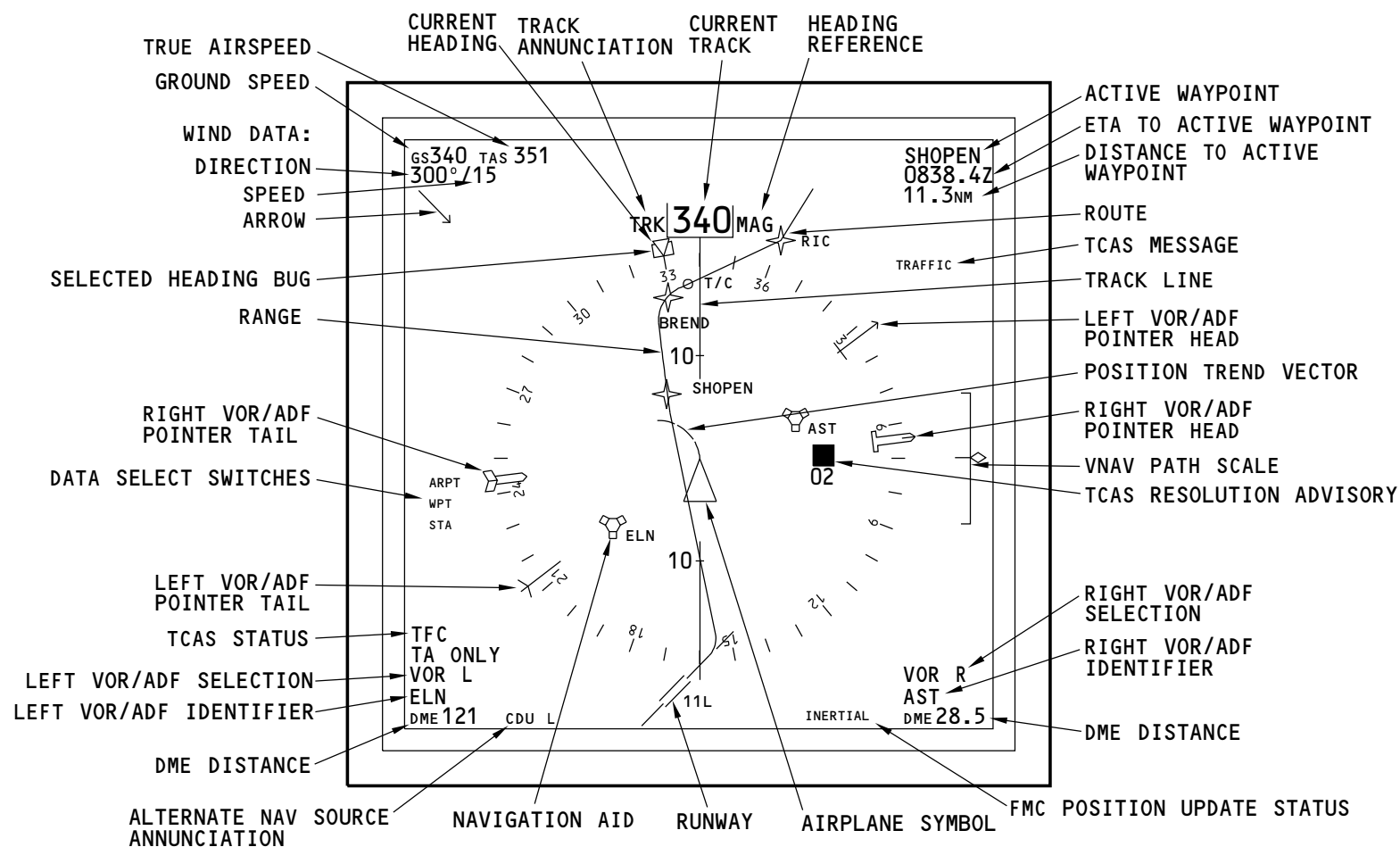


PRIMARY DISPLAY SYSTEM - CENTERED MAP MODE

- Airports
- Runways
- Navigation aids
- Airway segments
- Radio navigation aid raw data.

The ND data select switches on the EFIS control panels control much of the data.

The alternate navigation source shows if the FMCF fails in the lower left corner next to the navigation aid information. For CDU map changes, the CDU can only do straight or direct to calculations.



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PRIMARY DISPLAY SYSTEM - CENTERED MAP MODE

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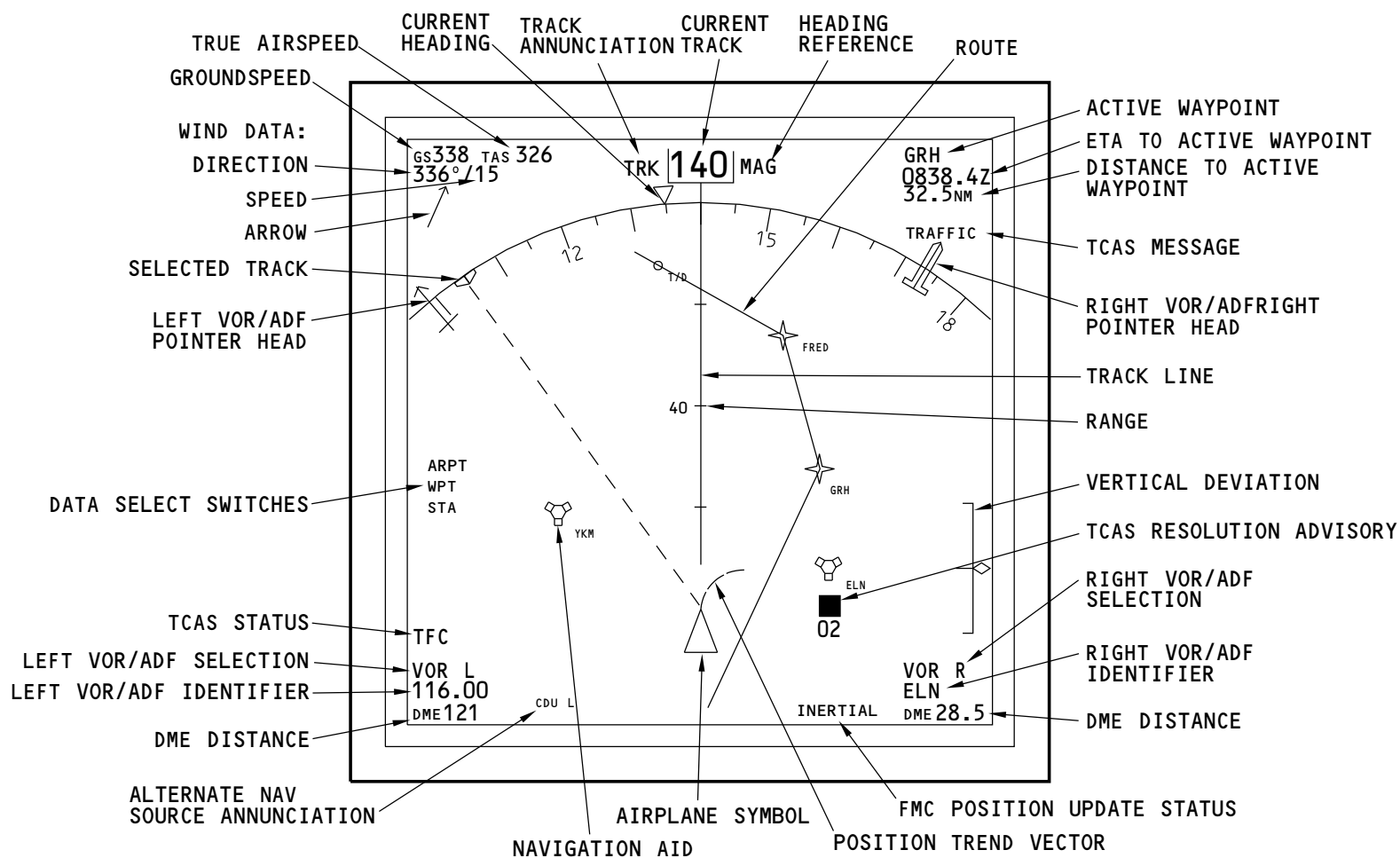


PRIMARY DISPLAY SYSTEM - EXPANDED MAP MODE

General

The expanded map mode shows the same basic data as the centered map mode. The airplane symbol is identical. The top of the symbol shows the present position of the airplane.

The single range numeric shows one half of the full scale map range from the range control on the EFIS control panel or the CDU.



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PRIMARY DISPLAY SYSTEM - EXPANDED MAP MODE

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PRIMARY DISPLAY SYSTEM - MAP MODE FAILURE FLAGS

General

Failures of input sources cause data to go away from the display and failure flags to show.

All the flags are amber in color.

The captain's and first officer's NDs operate independently.

Failure Flags

The TRK flag shows when the ADIRU track input fails.

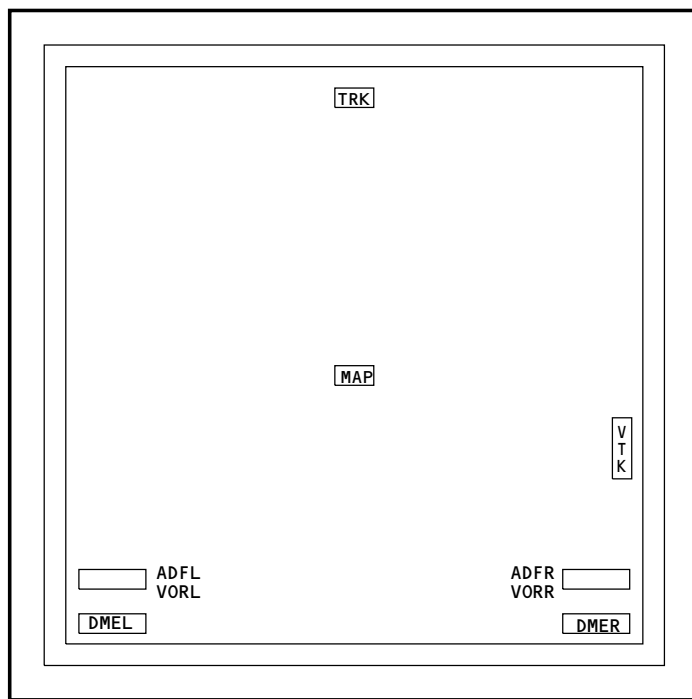
The MAP flag shows when the FMCF latitude or longitude is invalid or when the MAP dynamic or background data is invalid.

The VTK (vertical track) flag shows if the map dynamic or background data is invalid or the FMC altitude error rate is invalid.

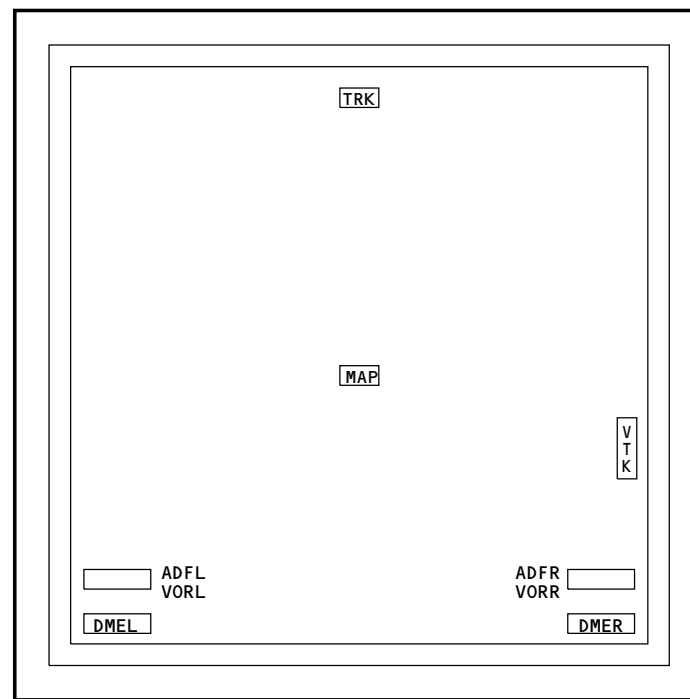
The VORL or VORR flag shows when the left or right VOR input fails. To see the flag, put the applicable switch on the EFIS control panel in the VOR position.

The ADFL or ADFR flag shows when the left or right ADF fails. To see the flag, put the applicable switch on the EFIS control panel in the ADF position.

The DMEL or DMER flag shows when the DME co-located with the ILS, or left or right VOR fails. To see the flag for DMEs co-located with the VOR stations, put the applicable VOR switch on the EFIS CP must in the VOR position.



CENTERED MODE



EXPANDED MODE

PRIMARY DISPLAY SYSTEM - MAP MODE FAILURE FLAGS

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**PRIMARY DISPLAY SYSTEM - MAP MODES NCD AND FAIL CONDITIONS****General**

The display function in the AIMS cabinets evaluates inputs from the airplane systems.

A no computed data (NCD) status causes information on the display to go away.

A fail status causes information on the display to go away and a fail flag to show.

MAP Modes NCD and Failure Conditions

The chart shows the NCD and fail conditions for the MAP modes.

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PARAMETER	CONDITION	RESULT	REMARKS
TRACK	NCD	TAPE NUMERICS GO AWAY, CURVED TREND VECTOR GOES AWAY	NCD TRACK
TRACK	FAIL	TAPE NUMERICS, TICKS, AND TRACK INDEX GO AWAY. CURVED TREND VECTOR GOES AWAY, AN AMBER [TRK] FLAG SHOWS	FAILED TRACK
MAP BACKGROUND	FAIL	ALL MAP DISPLAY DATA GOES AWAY AND AN AMBER [MAP] FLAG SHOWS	INVALID MAP DATA FROM FMCF
VERTICAL DEVIATION	FAIL	VERTICAL DEVIATION SCALE GOES AWAY. AMBER [VT K] SHOWS	MAP BACKGROUND NCD OR FMC ALTITUDE ERROR RATE NCD
VERTICAL DEVIATION	NCD	VERTICAL DEVIATION SCALE GOES AWAY	MAP BACKGROUND NCD OR FMC ALTITUDE ERROR RATE NCD
ILS	NCD	AMBER STRIKE THROUGH OF THE PDF ILS FREQUENCY	ONE OR TWO OF THE ILS RADIO HAS NCD STATUS
ILS	ILS TUNING DISAGREEMENT	AMBER STRIKE THROUGH OF THE PDF ILS FREQUENCY	ILS RADIOS DO NOT HAVE THE SAME TUNING FREQUENCY

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PRIMARY DISPLAY SYSTEM - MAP MODES NCD AND FAIL CONDITIONS

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 1

General

The ND map has dynamic and background data and may include a combination of the symbols or data in the chart. Dynamic data changes as a function of time. Background data is stationary data that does not move as a function of time.

The latitude and longitude of the symbol determines its location on the map display.

The EFIS control panel STA, WPT, ARPT, DATA and POS switches control some data.

The flight management computer function (FMCF) of AIMS supplies the map flight plan data.

The mode control panel (MCP) supplies selected heading (HDG) and track (TRK) data.

These symbology colors show on the ND:

- Green (G) - an engaged mode condition, dynamic conditions
- White (W) - present status, scales, armed flight mode displays
- Magenta (M) - command information, pointers, symbols, fly to condition
- Cyan (B) - nonactive or background information
- Red (R) - warnings
- Amber (A)- caution information, faults, flags.

SYMBOL	NAME	MODE(S)	REMARKS
1. GS 310	GROUND SPEED INDICATION (W)	ALL	CURRENT GROUND SPEED
2. TAS 312	TRUE AIRSPEED INDICATION (W)	ALL	CURRENT TRUE AIRSPEED SHOWS ABOVE 100 KTS
3. ⁰ 350 /15 ↙	WIND BEARING/SPEED (W) DIRECTION (W)	ALL	WIND DATA SHOWS IN RESPECT TO DISPLAY ORIENTATION AND HDG/TRK REFERENCE. ARROW DOES NOT SHOW IN THE PLAN MODE.
4. AAAAA	ACTIVE WAYPOINT IDENTIFIER	MAP, MAP CTR, AND PLAN	SHOWS THE GO TO WAYPOINT IN THE ACTIVE FLIGHT PLAN.
5. VOR L, R ILS L, C, R	RECEIVER REFERENCE (G)	VOR, VOR CTR, APP, APP CTR	SHOWS RECEIVER REFERENCE FOR THE DISPLAY.
6. 116.80 OR SEA	ILS (W)/VOR (G) FREQUENCY OR IDENTIFIER DISPLAY	VOR, VOR CTR APP, APP CTR	FREQUENCY SHOWS BEFORE THE IDENT IS DECODED. DECODED IDENT REPLACES THE FREQUENCY. MED FONT VOR, SMALL FONT DME ONLY.
7. 124 NM	DISTANCE DISPLAY (W)	MAP, MAP CTR, AND PLAN	SHOWS DISTANCE TO THE ACTIVE WAYPOINT.
8. DME 24.6	DME DISTANCE DISPLAY (W)	VOR, VOR CTR, APP, APP CTR	SHOWS DME DISTANCE TO THE REFERENCE NAVAID.
9. 0835.4_Z	ETA DISPLAY (W)	MAP, MAP CTR AND PLAN	SHOWS FMCF CALCULATED ETA FOR THE ACTIVE WAY POINT.
10. CRS 135	COURSE DISPLAY (W)	VOR, VOR CTR, APP, APP CTR	SHOWS VOR COURSE OR LOCALIZER COURSE.

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 1

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 2

General

Additional ND map symbology is shown in the graphic.

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SYMBOL	NAME	MODE(S)	REMARKS
11. 	EXPANDED COMPASS (W)	MAP, APP, VOR AND PLAN MAP CTR, VOR CTR, AND APP CTR	90 DEGREES SHOW IN THE EXPANDED MODE. 360 DEGREES SHOW WHEN THE CENTERED MODE IS SELECTED.
12. 	HEADING POINTER (W)	MAP, MAP CTR	SHOWS AIRPLANE HEADING ON THE COMPASS ROSE.
13. HDG 263 MAG 	HEADING: ORIENTATION (G) READOUT (W) REFERENCE (G) POINTER (W)	VOR, VOR CTR APP, APP CTR	BOX DISPLAYS CURRENT HEADING. POINTER SHOWS HEADING ON THE COMPASS ROSE.
14. 	TRACK POINTER WITH RANGE (W)	ALL EXCEPT PLAN	SHOWS AIRPLANE TRACK AND LOCATION ON THE COMPASS ROSE. RANGE SHOWS NEXT TO THE MIDDLE RANGE MARK.
15. MAG OR TRU	HEADING/TRACK REFERENCE (G) BOX (W) IN TRU	ALL EXCEPT PLAN	SHOWS HEADING/TRACK TO MAGNETIC NORTH OR TRUE NORTH. SWITCHING FROM TRU TO MAG SHOWS A BOX AROUND THE MAG FOR 10 SECONDS.
16. 	LEFT: VOR (G) OR ADF (B) BEARING	ALL EXCEPT PLAN	SHOWS BEARING TO (HEAD) OR FROM (TAIL) A TUNED STATION, IF A RADIO IS SELECTED ON THE EFIS CONTROL PANEL.
17. 	RIGHT: VOR (G) OR ADF (B) BEARING		
18. TRK 062 MAG	TRACK: ORIENTATION (G) READOUT (W) REFERENCE (G)	MAP, MAP CTR	BOX SHOWS CURRENT TRACK.

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 2

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 3

General

Additional ND map symbology is shown in the graphic.

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SYMBOL	NAME	MODE(S)	REMARKS
19.  KABC 22L	AIRPORT IDENTIFIER AND RUNWAY (W)	MAP, MAP CTR AND PLAN	THE ORIGIN OR AIRPORT SHOWS WHEN THE ND RANGE IS 80, 160, 320, OR 640 AND AN AIRPORT ENTRY.
20.  KTEB	AIRPORT (B)	MAP, MAP CTR	AIRPORTS WITHIN THE MAP AREA SHOW WITH A SELECTION OF THE ARPT SWITCH ON THE EFIS CONTROL PANEL.
21. 	AIRPORT AND RUNWAY (W)	MAP, MAP CTR AND PLAN	THE ORIGIN OR AIRPORT SHOWS WHEN THE ND RANGE IS 10, 20, OR 40 NM. RUNWAY DASHES EXTEND 14.2 NM.
22. 	WAYPOINT: ACTIVE (M) INACTIVE (W)	MAP, MAP CTR AND PLAN	ACTIVE - THE NEXT GO TO WAYPOINT. INACTIVE - OTHER WAYPOINTS ON THE ACVTIVE ROUTE.
23.  MLF	OFF ROUTE WAYPOINT (B)	MAP, MAP CTR	SHOWS WITH A SELECTION OF THE MAP SWITCH ON THE EFIS CONTROL PANEL AND ND RANGES OF 10, 20, OR 40.
24.  AMBOY KILMR PARBY	FLIGHT PLAN ROUTE: ACTIVE (M) MODIFIED (W) INACTIVE (B)	MAP, MAP CTR AND 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 (B) BETWEEN WAYPOINTS.
25.  KILMER 12000 0835Z	ROUTE DATA: ACTIVE WPT (M) INACTIVE WWPT (W)	MAP, MAP CTR	THE ENTERED OR PROCEDURAL ALTITUDE AND ETA FOR ROUTE WAYPOINTS SHOW WITH A SELECTION OF THE EFIS CONTROL PANEL DATA SWITH.
26. 	HOLDING PATTERN: ACTIVE ROUTE (M) MODIFIED ROUTE (W) INACTIVE ROUTE (B)	MAP, MAP CTR AND PLAN	A HOLDING PATTERN SHOWS WHEN IN THE FLIGHT PLAN. THE PATTERN INCREASES TO CORRECT SIZE FOR HOLDING.
27. 	PROCEDURE TURN: ACTIVE ROUTE (M) MODIFIED ROUTE (W) INACTIVE ROUTE (B)		A PROCEDURE TURN SHOWS WHEN IN THE FLIGHT PLAN. THE PATTERN INCREASES TO CORRECT SIZE FOR HOLDING.

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 3

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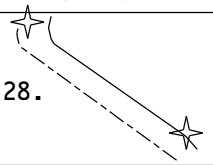
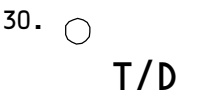
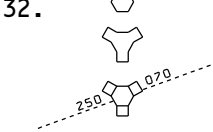
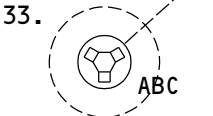
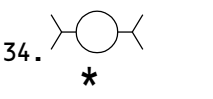


PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 4

General

Additional ND map symbology is shown in the graphic.

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SYMBOL	NAME	MODE(S)	REMARKS
28. 	OFFSET PATH AND IDENTIFIER: ACTIVE ROUTE (M) MODIFIED ROUTE (W)	MAP, MAP CTR AND 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.
29. 	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.
30. 	ALTITUDE PROFILE POINT AND IDENTIFIER (G)	MAP, MAP CTR	SHOWS THE FMCF CALCULATED T/C (TOP OF CLIMB), T/D (TOP OF DESCENT), S/C (STEP CLIMB), AND E/D (END OF DESCENT). DECELERATION AND PREDICTED ALTITUDE/ETA POINTS HAVE NO IDENTIFIER.
31. 	ENERGY MANAGEMENT CIRCLES (B, W)	MAP, MAP CTR	SHOWS CLEAN (B) AND SPEEDBRAKE (W) ENERGY MANAGEMENT CIRCLES AS DEFINED ON OFFPATH DES PAGE.
32. 	VOR (B, G), DME/TACAN (B, G) VORTAC (B, G)	MAP, MAP CTR	NAVAIDS (B) THAT RELATE TO STATIONS SHOW WHEN THE STA SWITCH ON THE EFIS CONTROL PANEL IS ON. TUNED NAVAIDS ALWAYS SHOW IN GREEN (G). A MANUALLY TUNED NAVAID SHOWS THE SELECTED COURSE AND ITS RECIPROCAL.
33. 	SELECTED REFERENCE POINT AND BEARING DISTANCE INFORMATION (G)	MAP, MAP CTR AND PLAN	SHOWS THE REFERENCE POINT SELECTED ON THE FMCS-CDU FIX PAGE. BEARING AND/OR DISTANCE FROM THE FIX SHOW WITH GREEN DASHES.
34. 	GPS POSITION (W) ADIRU POSITION (W)	MAP, MAP CTR	THE PRIMARY UPDATE MODE SHOWS WHEN THE POS SWITCH OF THE EFIS CONTROL PANEL IS SELECTED ON, INDICATES ADIRU/GPS POSITION RELATIVE TO THE FMCS POSITION.

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 4

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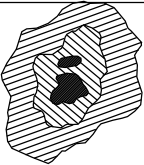
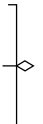
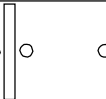
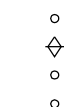


PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 5

General

Additional ND map symbology is shown in the graphic.

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SYMBOL	NAME	MODE(S)	REMARKS
35. 	WEATHER RADAR RETURNS (R, A, G, M)	MAP, MAP CTR VOR, APP	WEATHER RADAR RETURNS SHOW WHEN THE WXR SWITCH OF THE EFIS CONTROL PANEL IS ON. INTENSE WXR RETURNS SHOW IN RED (R). MEDIUM INTENSITY SHOW IN AMBER (A). LOW INTENSITY SHOW IN GREEN (G). TURBULENCE SHOWS IN MAGENTA.
36. 	AIRPLANE SYMBOL (W)	MAP, MAP CTR VOR, APP	CURRENT AIRPLANE POSITION IS AT THE POINT OF THE AIRPLANE SYMBOL.
37. 	AIRPLANE SYMBOL (W)	VOR CTR, APP CTR	CURRENT AIRPLANE POSITION IS AT THE TOP CENTER OF THE AIRPLANE SYMBOL.
38. 	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.
39. 	VERTICAL DEVIATION POINTER (M) AND SCALE (W)	MAP, MAP CTR	VERTICAL DEVIATION FROM THE CALCULATED VERTICAL PROFILE (POINTER) SHOWS AT THE TOP OF DESCENT (T/D) AND DURING DESCENT ONLY. SCALE INDICATES +/- 400 FEET DEVIATION. A DIGITAL READOUT SHOWS WHEN THE POINTER IS OVER +/- 400 FEET.
40. 	COURSE DEVIATION POINTER (M) AND SCALE (W)	VOR, VOR CTR APP, APP CTR	SHOWS VOR OR LOC DEVIATION. DEVIATION POINTER SHOWS THE DIRECTION OF THE VOR OR ILS (LOC) SELECTED COURSE FROM THE FMCS-CDU.
41. 	SELECTED COURSE POINTER (W) AND LINE (M)	VOR, VOR CTR APP, APP CTR	SHOWS VOR OR LOC SELECTED COURSE FROM THE FMCS-CDU.
42. 	GLIDE SLOPE DEVIATION POINTER (M) AND SCALE (W)	APP, APP CTR	SHOWS GLIDE SLOPE DEVIATION. DEVIATION POINTER SHOWS THE DIRECTION OF THE GLIDE SLOPE CENTERLINE.

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 5

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 6

General

Additional ND map symbology is shown in the graphic.

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SYMBOL	NAME	MODE(S)	REMARKS
43. 	TO/FROM INDICATOR (W)	VOR CTR	SHOWS NEAR AIRPLANE SYMBOL. SHOWS VOR TO/FROM INDICATION.
44. TO FROM	TO/FROM DISPLAY (W)	VOR, VOR CTR	SHOWS VOR TO/FROM INDICATION.
45. CDU L, C, OR R	MAP SOURCE ANNUNCIATION (G)	MAP, MAP CTR	SHOWS ND MAP SOURCE WHEN THE NAV SOURCE SWITCH IS THE CDU POSITION. THE NAV SOURCE SWITCH IN THE NORMAL POSITION SHOWS THE ND MAP SOURCE FOR A SELECTED FCMF OR FCMFS FAILURE.
46. 	SELECTED HEADING CURSOR (M)	ALL, EXCEPT PLAN	SHOWS THE HEADING SET ON THE MCP. A DASH LINE (M) EXTENDS FROM THE CURSOR TO THE POINT OR TOP OF THE AIRPLANE SYMBOL. THE MAGENTA (DASH) LINE GOES AWAY WHEN A ROLL MODE OTHER THAN HEADING IS ACTIVE.
47. 	SELECTED TRACK CURSOR(M)	ALL, EXCEPT PLAN	SHOWS THE TRACK SET ON THE MCP. A DASH LINE (M) EXTENDS FROM THE CURSOR TO THE POINT OR TOP OF THE AIRPLANE SYMBOL. THE MAGENTA (DASH) LINE GOES AWAY WHEN A ROLL MODE OTHER THAN HEADING IS ACTIVE.
48.  KGEK	FMC SELECTED ALTERNATE AIRPORTS (B)	MAP, MAP CTR PLAN	ND SHOWS FCMF SELECTED ENROUTE ALTERNATE AIRPORTS WHEN EFIS CP APRT SWITCH IS SELECTED. PLAN SHOWS FCMF ENROUTE ALTERNATE AIRPORTS AT ALL TIMES.
49. N ↑	NORTH POINTER (G)	PLAN	SHOWS MAP BACKGROUND IS ORIENTED AND REFERENCED TO TRUE NORTH.

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 6

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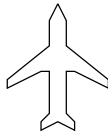


PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 7

General

Additional ND map symbology is shown in the graphic.

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SYMBOL		NAME	MODE(S)	REMARKS
50.		MINIATURE AIRPLANE (W)	PLAN	SHOWS ACTUAL POSITION AND TRACK ALONG ROUTE IN THE PLAN MODE ONLY.
51.	GPS	FMCf UPDATE STATUS (G)	MAP, MAP CTR	GLOBAL POSITIONING SYSTEM
	LOC			LOCALIZER
	DME-DME VOR-DME			RADIOS
	INERTIAL			INERTIAL ONLY
52.		TCAS RESOLUTION ADVISORY (RA) OR RELATIVE ALTITUDE (R)	MAP, MAP CTR APP, VOR	RA PITCH COMMANDS SHOW ON THE PFD. SEE NOTE BELOW.
53.		TCAS TRAFFIC ADVISORY OR TA (A) RELATIVE ALTITUDE		SEE NOTE BELOW. 
54.		TCAS PROXIMATE TRAFFIC (W) RELATIVE ALTITUDE		SEE NOTE BELOW. 
55.		TCAS OTHER TRAFFIC (W) RELATIVE ALTITUDE		SEE NOTE BELOW. 
56.		TCAS TA ABSOLUTE ALTITUDE		SEE NOTE BELOW. 
57.	RA 5.3 +03↑ TA 8.9 -12↑	TCAS NO BEARING MESSAGE (RA-R, TA-A)		MESSAGE SHOWS TRAFFIC TYPE, RANGE IN NMS, ALTITUDE AND VERTICAL DIRECTION.

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 8

General

Additional ND map symbology is shown in the graphic.

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SYMBOL	NAME	MODE(S)	REMARKS
58. TRAFFIC	TCAS TRAFFIC ALERT MESSAGE (RA-R, TA-A)	ALL	SHOWS TCAS RA OR TA IS ACTIVE WITH OR WITHOUT THE TFC SWITCH SELECTED.
59. 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 NEEDS TO BE ON.
60. TFC	TCAS MODE (B)		SHOWS TRAFFIC MODE IS ON.
61. TA ONLY	TCAS MODE (B)	ALL	SHOWS WHEN TCAS COMPUTER IS NOT COMPUTING RAS.
62. TCAS TEST			TCAS COMPUTER IS OPERATING IN THE TEST MODE. TFC IS ON (EFIS CP).
63. TCAS OFF	TCAS MODE (A)	MAP, MAP CTR APP, VOR	SHOWS A TCAS CONDITION EXISTS WHEN TFC IS ON FROM THE EFIS CP.
64. TCAS FAIL			SHOWS A FAULT IS PRESENT IN TCAS DATA WHEN TFC IS ON FROM THE EFIS CP.
1 THE TCAS SYMBOLS ABOVE THE ARROW SHOWS THAT THE TRAFFIC IS CLIMBING OR DESCENDING; NO ARROW INDICATES ALTITUDE OF TRAFFIC IN HUNDREDS OF FEET RELATIVE TO AIRPLANE POSITION. FOR ABSOLUTE ALTITUDE SYMBOLS, THE NUMERICS SHOW ALTITUDE OF TRAFFIC IN HUNDREDS AND THOUSANDS OF FEET. RELATIVE VERSUS ABSOLUTE ALTITUDE DISPLAY IS SELECTED BY A SWITCH ON THE TCAS CONTROL PANEL. FOR BOTH RELATIVE AND ABSOLUTE ALTITUDE, THE NUMERIC SHOWS BELOW THE TRAFFIC SYMBOL WHEN THE TRAFFIC IS BELOW THE AIRPLANE AND ABOVE THE TRAFFIC SYMBOL WHEN THE TRAFFIC IS ABOVE THE AIRPLANE. NO NUMERICS IN BOTH CASES SHOW ALTITUDE IS UNKNOWN. TCAS DATA SHOWS WHEN TRAFFIC (TFC) IS SELECTED ON THE EFIS CP.			

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 8

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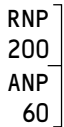
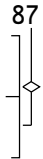


PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 9

General

Additional ND map symbology is shown in the graphic.

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SYMBOL	NAME	MODE(S)	REMARKS
	VERTICAL RNP/ANP VERTICAL ANP LABEL	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 LATERAL ANP LABEL	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 PATH DEVIATION BAND	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 PATH DEVIATION	MAP, MAP CTR	VERTICAL DEVIATION SCALE SHOWN FOR REFERENCE. SHOWS WHEN VERTICAL DEVIATION ERROR IS MORE THAN 420. THE VNAV PATH POINTER.

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PRIMARY DISPLAY SYSTEM - ND MAP SYMBOLOGY - 9

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PRIMARY DISPLAY SYSTEM - PLAN MODE**General**

The flight crew uses the plan mode for flight planning purposes.

The plan mode is a north-up presentation. The plan mode shows the entered route from the FMCS.

Range information shows as circles around the reference point in the middle of the display.

An airplane symbol shows current position and track, if the airplane is within the range and portion of the flight plan shown.

Display Data

Ground speed, wind data, and true airspeed is the same as approach, VOR and map modes except that the wind direction arrow does not show.

This data shows in the upper right corner:

- Active waypoint identifier
- Estimated time of arrival (ETA) to the waypoint
- Distance to the waypoint.

The active waypoint on the route is magenta.

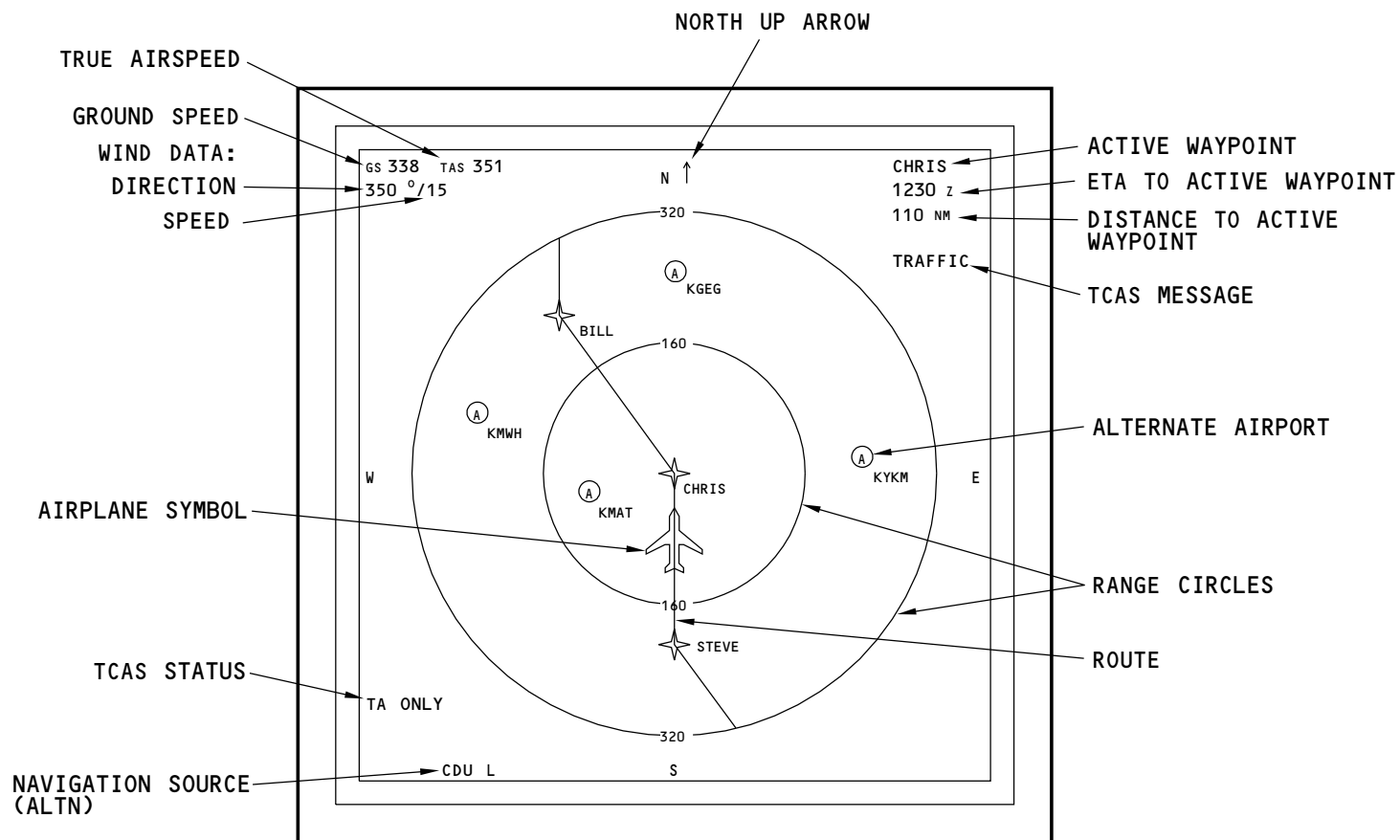
Only TCAS traffic data messages show in the plan mode.

TCAS status information shows below the WXR data field to indicate TCAS selection. Information is TA ONLY (TCAS is not computing RA) or TCAS TEST (TCAS is in the test mode).

The alternate navigation source, CDU L, CDU C, or CDU R shows if the active FMCF(s) fail(s) in the lower left corner next to the navigation aid information

Alternate airports for the origin and destination airports on the flight plan show as a circle around the letter A.

The MAP fail flag shows in the plan mode when the FMCS fails. TCAS status is the same as the map mode.



PRIMARY DISPLAY SYSTEM - PLAN MODE

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PRIMARY DISPLAY SYSTEM - PFD AND ND DISPLAY FUNCTIONAL DESCRIPTION

General

Each AIMS cabinet has four input/output modules (IOMs) and two core processor/graphic generators (CPM/GGs). Each graphic generator has an output to the display units (DUs). The PFD and ND functions in the CPM/GGs independently process their formats. The PFD function has these sub-functions:

- Display format processing
- Display resource management
- PFD display generator
- Graphics generator.

The ND function shares the display format processing and display resource management sub-function. The ND function has these sub-functions:

- ND generator
- Graphics generator.

Both functions send data to the graphic generator sub-function. The graphic generator reformats and sends this data to the DUs.

IOM

Each IOM does these functions:

- Presence and validity checks
- Source select and filtering.

The IOM modules do presence and validity checks on all display input parameters. Data updates ensure that the information the flight crew sees is current.

Each IOM removes bad data, replaces it with a good source, and filters the change from bad to a good data source. For critical data, the IOM sends messages to alert the flight crew of a failure. The IOMs send the valid and message data to the EICAS and MFD functions through the backplane bus.

CPM/GG

Each CPM/GG also has a PFD and ND function with sub-functions. Each AIMS cabinet has a redundant pair (CPM/GGs) for a total of four on the aircraft. Each CPM/GG can drive any three display units or three out of four display formats (PFD, ND, EICAS, or MFD). The EICAS and MFD functions configure and format the EICAS and MFD displays. The outboard DU location is for PFD display only. This redundant system supplies fail operational capability and allows deferred airplane maintenance.

The sub-functions in the CPM/GGs decode switch inputs and make the appropriate displays. Additional switch positions determine format location. If the outboard DU fails, the inboard DU automatically changes to the outboard format. The IOMs send display and switch input data to the display processing sub-function for the PFD and ND functions.

PFD/ND Function- Display Format Processing

The display format processing sub-function receives display and switch input data from the IOMs. It receives status data from the display system resource management sub-function for CPM/GG redundancy management. The display format processing sub-function formats the data and sends PFD and ND format data to the PFD and ND generator sub-functions. It also sends status data to the other CPM/GGs.

PFD/ND Function- PFD and ND Generators

The PFD and ND display generator sub-functions reformat the display data for the graphics generator.

PFD/ND Function- Graphics Generator

The graphics generator sub-functions use switch inputs and output device selection data to determine display location and correct format. The PFD has one format. The ND has these seven formats

- Approach (2)
- VOR (2)
- Map (2)
- Plan.

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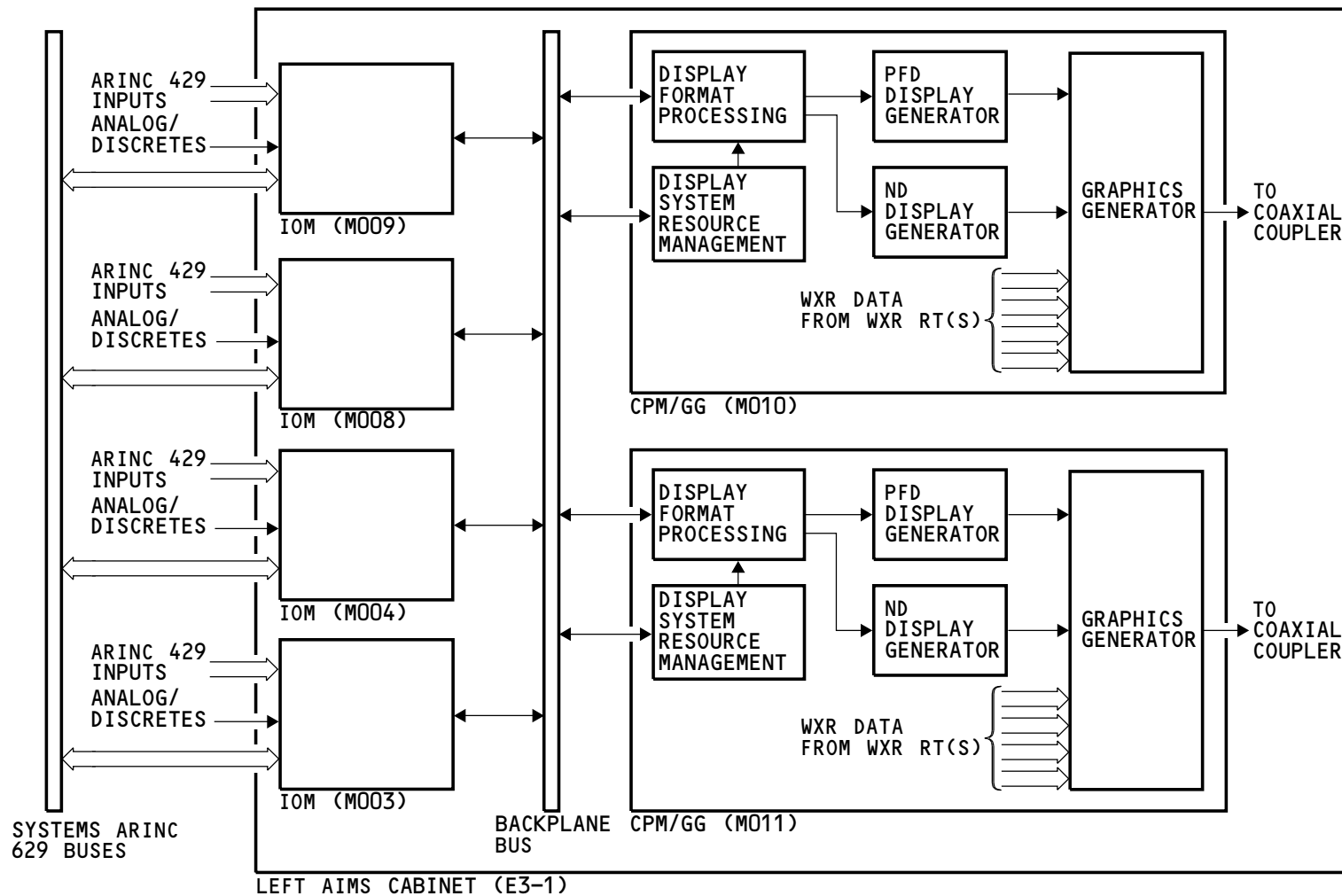
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**PRIMARY DISPLAY SYSTEM - PFD AND ND DISPLAY FUNCTIONAL DESCRIPTION**

The switch inputs permit automatic switch over of the PFD (outboard) to the ND (inboard) location in case of a PFD failure. The switch inputs also permit a ND in two locations.

The graphics generator receives the PFD and ND reformatted data from the PFD and ND generators. It converts this data to a video format and sends it to the DUs through a coaxial cable.



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PRIMARY DISPLAY SYSTEM - PFD AND ND DISPLAY FUNCTIONAL DESCRIPTION

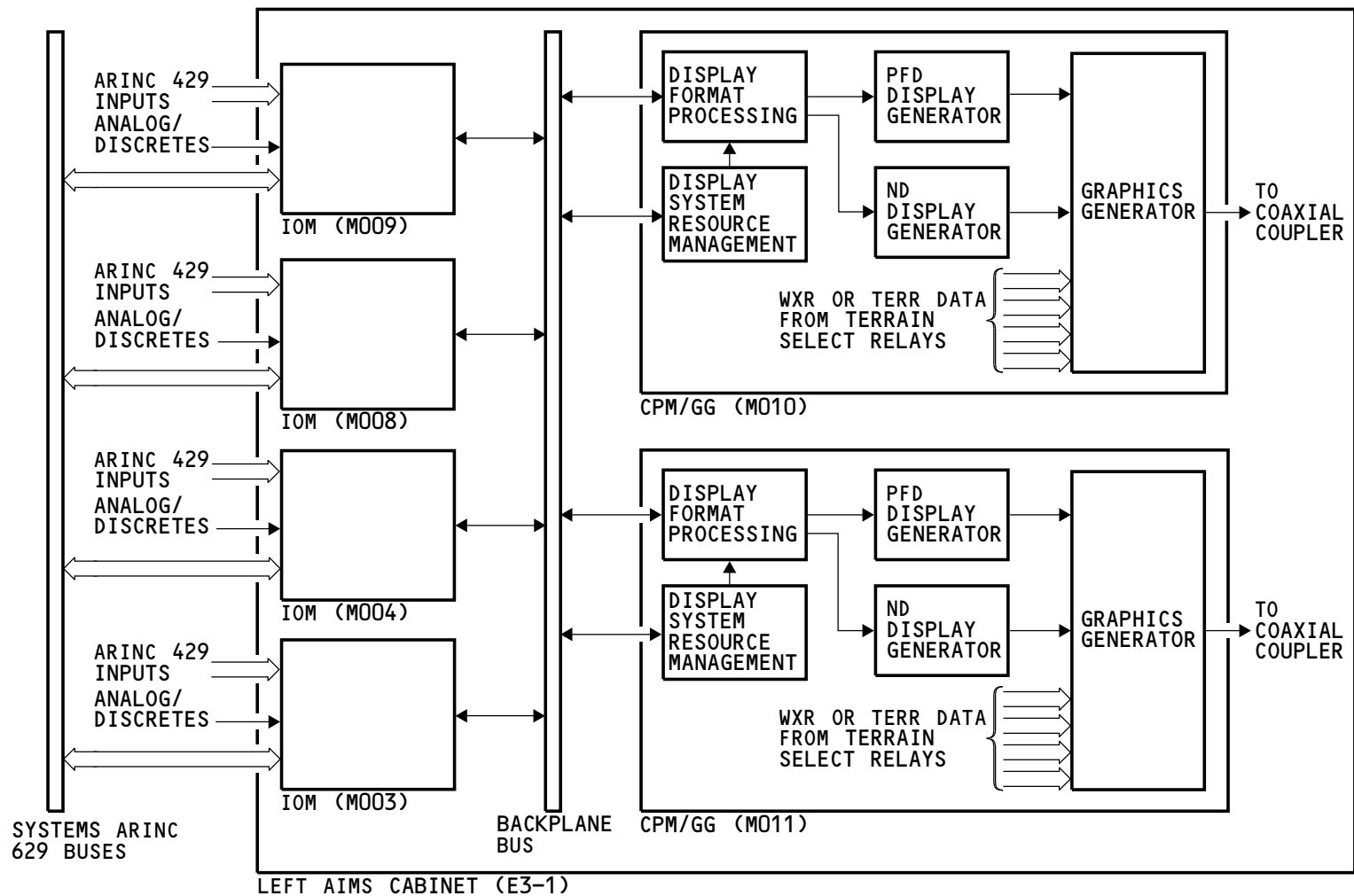
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PRIMARY DISPLAY SYSTEM - PFD AND ND DISPLAY FUNCTIONAL DESCRIPTION

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PRIMARY DISPLAY SYSTEM - DU FUNCTIONAL DESCRIPTION

General

Each display unit (DU) receives this from the AIMS cabinets:

- Graphics data
- Display format commands.

AIMS data goes to the DUs through coaxial cables. The DUs also receive brightness control data from internal and external sources. The DUs use this data to show flight information and status data to the flight crews during normal and non-normal conditions.

The input/output (I/O) controller also gets DU address information from five identification pins.

Input/Output Controller

The I/O controller receives, converts, and transmits data to the AIMS cabinet and the DU functions. The I/O controller sends graphics data to the beamformer and brightness control data to brightness control circuit. It sends command and BITE data to the DU controller.

A ground on an identification pin is a logic one. Address numbers on each DU set the standard configuration.

DU Controller

The DU controller uses a dedicated bus to receive and send data to the I/O controller. The DU controller is a programmable logic device. The DU controller has built in test (BITE) and fault logic circuits. BITE and fault circuits collect status data from the functions in the DU. The DU controller formats the data and sends it to the I/O controller. The DU controller also sends a DU reset signal and processes the DU identification (ID).

Beamformer

The beamformer receives the digital data and changes it to a CRT-like image. The beamformer splits the image data and sends it to the liquid crystal display (LCD). The beamformer also responds to BITE.

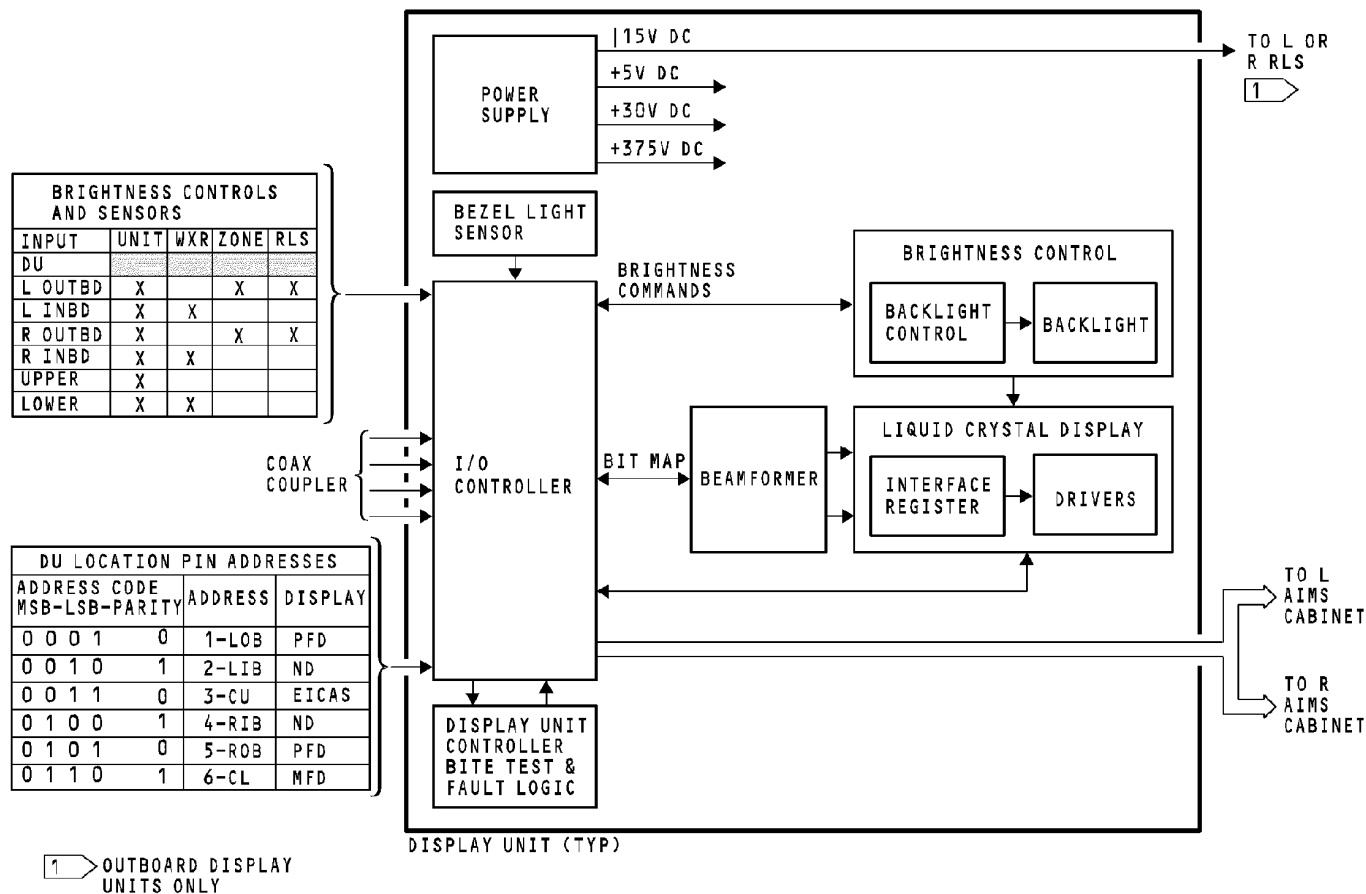
LCD Interface Register and LCD

The LCD interface register changes the two data images from the beamformer into a single image and loads the values into the LCD source drivers. The LCD interface register applies voltages to compensate for data that changes. This improves LCD response times. The interface also supplies timing and control signals to the LCD drivers. The LCD circuit responds to BITE.

Brightness Control

The brightness control circuit responds to the BITE. It uses a combination of these inputs to adjust the LCD brightness:

- Bezel light sensor (BLS), internal
- Paired DUs, WXR, and RLS from the brightness controls and sensors table, external.



PRIMARY DISPLAY SYSTEM - DU FUNCTIONAL DESCRIPTION

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PRIMARY DISPLAY SYSTEM - DISPLAY CONTROL FUNCTIONAL DESCRIPTION

General

There are four display channels in the primary display system. Each channel has a graphics generator, a coax coupler, and six coax cables.

Each AIMS cabinet has a left (M010) and a right (M011) graphics generator (GG). During normal operation, three of the GGs each send data to two DUs. The fourth GG is a spare. The GGs normally drive the displays at a 20 Hz rate.

Display control (DSPL CTRL) switches on the left instrument source select panel (L ISSP), center display control panel (CDCP), and right instrument source select panel (R ISSP) change the source of display data for the six display units (DUs).

Each switch has two positions, AUTO and alternate (ALTN). Normally, the switches are in the AUTO position. With the switches in the AUTO position, the AIMS cabinets automatically switch sources when a GG fails.

System software determines the switching sequence. For example, if the left GG in the left AIMS cabinet fails, the right GG in the left AIMS cabinet takes over.

Each graphics generator has the capability to drive a maximum of two critical formats and one essential format. The critical formats are the PFD, EICAS and secondary engine displays. The essential formats are the ND and the other MFD formats.

AUTO Position Operation

The AUTO position of the DSPL CTRL switch on the L ISSP causes the CPM/GG (M010) in the left AIMS cabinet to send data to the left outboard DU and left inboard DU.

The AUTO position of the DSPL CTRL switch on the CDCP causes the CPM/GG (M011) in the left AIMS cabinet to send data to the upper center DU and the lower center DU.

the AUTO position of the DSPL CTRL switch on the R ISSP causes the CPM/GG (M011) in the right AIMS cabinet to send data to the right outboard DU and right inboard DU.

The CPM/GG (M010) in the right AIMS cabinet is the spare.

ALTN Switch Operation or One Channel Failure

The ALTN position of the switches changes the source of display data.

With the display control switches in AUTO, failures also cause the source of display data to change.

When you put the DSPL CTRL switch on the L ISSP in the ALTN position, or the CPM/GG (M010) in the left AIMS cabinet fails, the CPM/GG (M011) in the left AIMS cabinet sends data to the captain DUs.

When you put the DSPL CTRL switch on the CDCP in the ALTN position, or CPM/GG M011 in the left AIMS cabinet fails, the CPM/GG (M010) in the right AIMS cabinet sends data to the upper center and lower center DUs.

When you put the DSPL CTRL switch on the R ISSP in the ALTN position, or the CPM/GG (M011) in the right AIMS cabinet fails, CPM/GG M010 in the right AIMS cabinet sends data to the first officer's DUs.

For any of the above conditions all display functions are available and there is no reduction in system capability and functionality. There are no flight deck effects set.

ALTN Switch Operation and One Channel Failure

Alternate switch operation and one channel failure together cause the display system to go to a limited format operation. The total display system has the capability to show four critical and two essential formats.

With all other conditions normal, the outboard display units will show PFDs. The inboard display units will show NDs. The upper center DU will show EICAS and the lower center DU will show the secondary engine display.

If the CPM/GG (M010) in the left AIMS cabinet hard fails and additionally the captain display control switch is in the alternate position causing an additional CPM/GG to be failed, CPM/GG (M010) in the right AIMS cabinet sends data to the left outboard (LOB), left inboard (LIB), and upper center DUs. CPM/GG (M011) in the right AIMS cabinet sends data to the right outboard (ROB), right inboard (RIB) and lower center DUs. This causes the display system to go to the limited format mode. For this condition only secondary Eng format can be displayed on the CL DU and there are no Display's related dispatch limitations.

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**PRIMARY DISPLAY SYSTEM - DISPLAY CONTROL FUNCTIONAL DESCRIPTION**

If the CPM/GG (M011) in the left AIMS cabinet hard fails additionally and the center display control switch is in the alternate position causing an additional CPM/GG to be failed, CPM/GG (M010) in the left AIMS cabinet sends data to the LOB, LIB, and upper center DUs. CPM/GG (M011) in the right AIMS cabinet sends data to the ROB, RIB and lower center DUs. This causes the display system to go to the limited format mode. For this condition only secondary Eng format can be displayed on the CL DU and there are no Display's related dispatch limitations.

If the CPM/GG (M010) in the right AIMS cabinet hard fails and additionally the first officer display control switch is in the alternate position causing an additional CPM/GG to be failed, CPM/GG (M010) in the left AIMS cabinet sends data to the LOB, LIB, and upper center DUs. CPM/GG (M011) in the left AIMS cabinet sends data to the ROB, RIB and lower center DUs. This causes the display system to go to the limited format mode. For this condition only secondary Eng format can be displayed on the CL DU and there are no Display's related dispatch limitations.

If the CPM/GG (M011) in the right AIMS cabinet hard fails and additionally the first officer display control switch is in the alternate position causing an additional CPM/GG to be failed, CPM/GG (M010) in the left AIMS cabinet sends data to the LOB, LIB, and upper center DUs. CPM/GG (M011) in the left AIMS cabinet sends data to the ROB, RIB and lower center DUs. This causes the display system to go to the limited format mode. For this condition only secondary Eng format can be displayed on the CL DU and there are no Display's related dispatch limitations.

Two Display Channel Failures

Two hard CPM/GG failures cause the display system to go into limited format mode. The total display system has the capability to show four critical and two essential formats.

NOTE: A "hard" CPM/GG failure is when AIMS can tell from the lack of input/output data that the (GG) is not reporting and that causes AIMS to trigger status messages.

With two hard failures, the system has the capability for:

- Separate captain and first officer PFDs.

- EICAS and secondary engine displays
- At least one ND to be controlled by either pilot
- Crew warnings, alerts, and cautions
- MFD availability on an inboard Display Unit in place of an ND (not required full time)
- Displays at a 10 Hz rate.

Two hard CPM/GG failures also cause the status message DISPLAY RESOURCES to show. There is no master minimum equipment list (MMEL) relief for this condition.

Three Display Channel Failures

If three failures occur, the last channel can fully support three display units.

This channel can send data to all display formats. In this condition, the GG sends data to three displays and then echoes or duplicates displays on other DUs.

After the third channel failure, the system has the capability for:

- Single PFD and single ND generation
- EICAS and secondary engine displays with warnings and alerts on EICAS (compacted EICAS)
- MFD availability in place of the ND.

This condition causes the status message DISPLAY PROCESSING and the caution message SGL SOURCE DISPLAYS to show. There is no MMEL relief for this condition.

Graphics Generator to Display Unit Interfaces Summary

There are many possible combinations of display channel failures and switch positions. The above text and chart that follows summarizes several of these conditions.

CONDITION	LOB DU	LIB DU	CU DU	CL DU	RIB DU	ROB DU
NORMAL GGs	L10	L10	L11	L11	R11	R11

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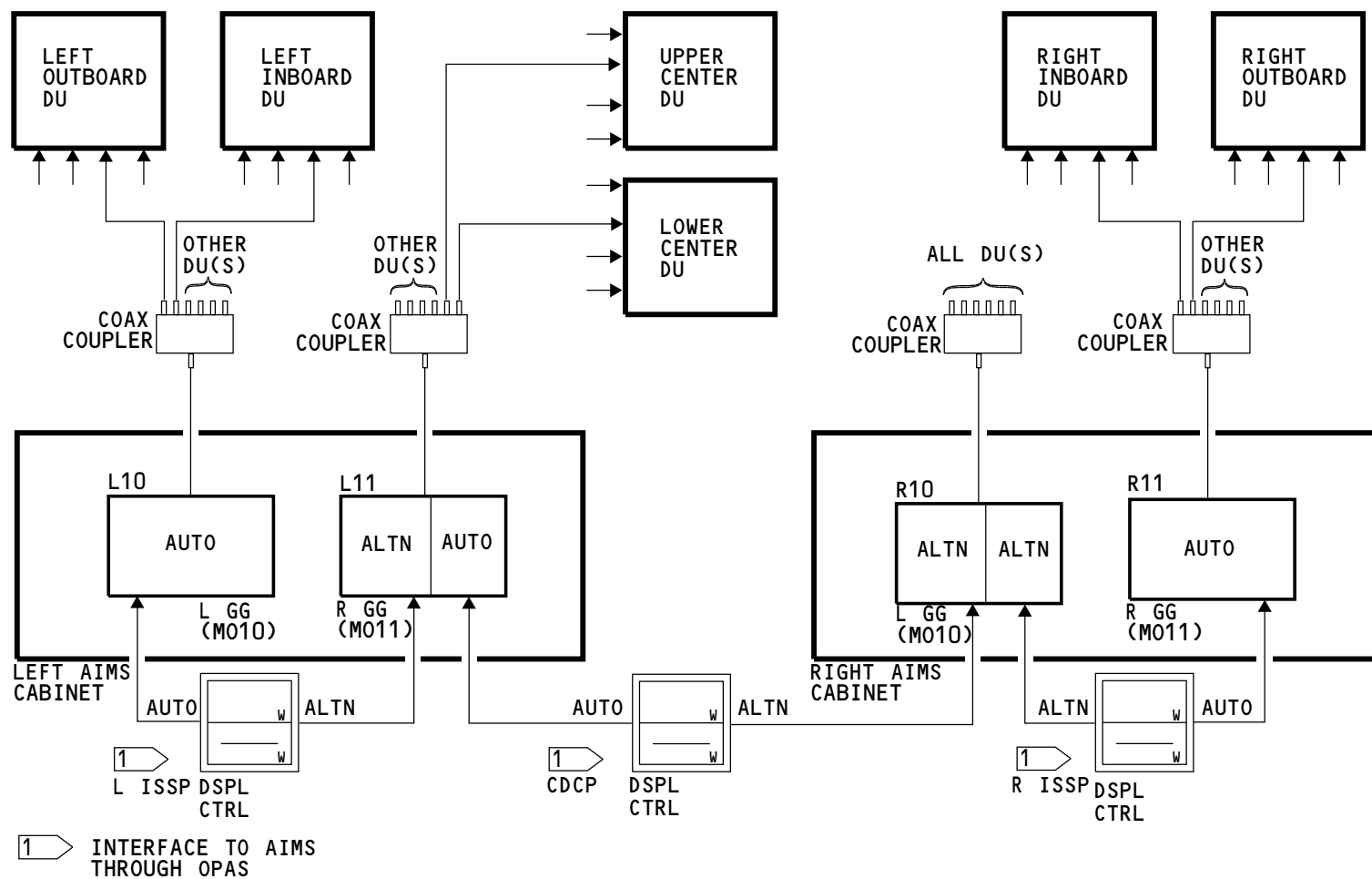
PRIMARY DISPLAY SYSTEM - DISPLAY CONTROL FUNCTIONAL DESCRIPTION

(Continued)

CONDITION	LOB DU	LIB DU	CU DU	CL DU	RIB DU	ROB DU
CAPT ALTN	L11	L11	L11	L11	R11	R11
CDCP ALTN	L10	L10	R10	R10	R11	R11
F/O ALTN	L10	L10	L11	L11	R10	R10
L 10 BAD	L11	L11	R10	R10	R11	R11
L 11 BAD	L10	L10	R10	R10	R11	R11
R 10 BAD	L10	L10	L11	L11	R11	R11
R 11 BAD	L10	L10	L11	L11	R10	R10
L10 BAD CAPT ALTN	R10	R10	R10	R11	R11	R11
L11 BAD CTR ALTN	L10	L10	L10	R11	R11	R11
R10 BAD F/O ALTN	L10	L10	L10	L11	L11	L11
R11 BAD F/O ALTN	L10	L10	L10	L11	L11	L11
L10L11 BAD	R10	R10	R10	R11	R11	R11
R10R11 BAD	L10	L10	L10	L11	L11	L11
L10R10 BAD	L11	L11	L11	R11	R11	R11
L10R11 BAD	L11	L11	L11	R10	R10	R10
L11R10 BAD	L10	L10	L10	R11	R11	R11
L11R11 BAD	L10	L10	L10	R10	R10	R10
ANY 3 FAIL	C PFD	C ND	EICAS	BLANK	C ND	C PFD
C = Captain						

Training Information Point

The AIMS has a 6 minute "Flop Monitor" that filters out intermittent DU blanking. The "Flop Monitor" is a software function in the AIMS Graphics Generator that monitors for an unacceptable number of DU "Unstable Events" in a finite time-frame. It is important to wait 6 minutes in case of DU blank trouble.



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PRIMARY DISPLAY SYSTEM - DISPLAY CONTROL FUNCTIONAL DESCRIPTION

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PRIMARY DISPLAY SYSTEM - EICAS DISPLAY FORMAT

General

The EICAS display normally shows on the upper center display unit (DU). When the upper center DU fails, the display automatically shows on the lower center DU. The display shows primary engine parameters and other data which require continuous display for flight safety. The EICAS display shows:

- Total air temperature (TAT) and assumed temperature
- Thrust reference mode
- Thrust reverser indication
- Primary engine parameters
- Anti-ice indication
- Pressurization indications
- Alerting and other annunciation messages
- Engine in-flight start envelope
- Gear position
- Flap position
- Fuel data.

TAT and Assumed Temperature

TAT shows above the N1 scales in white. Assumed temperature shows above the N1 scale in green when a request is made from the CDU thrust limit page. Assumed temperature is for reduced thrust takeoffs.

Thrust Limit Mode Annunciations

The thrust limit mode annunciation shows in green above and between the N1 scales.

Thrust Reverser Indication

REV shows above each engine N1 actual readout when the thrust reverser is in transit or the extended position. The indication temporarily overrides the primary thrust reference readout. The REV readout is amber when the thrust reverser is in transit and is green when the thrust reverser is fully extended.

Engine Parameters

The engine parameters show in a round dial format in a vertical column. N1 shows first, then EGT. Each parameter has a digital readout and an analog round dial.

N1

The N1 scale starts at an N1 minimum (3 o'clock position). N1 maximum shows at the 210 degree position. A pointer and the gray shading behind the pointer shows the actual N1. An amber bar at the upper end of the scale shows N1 maximum. Digital readouts for N1 show above the round dials. N1 command shows as a white sector that moves around the N1 scale. The reference N1 shows as a green digital readout above the actual N1 box.

Anti-Ice Indication

A green engine anti-ice (EAI) indication shows next to the N1 scale when the engine anti-ice valve is open. The wing anti-ice (WAI) indication shows near the bottom of the N1 scale when the wing anti-ice valve is open.

EGT

EGT also shows in a round dial format. A pointer and a gray scale show the actual values. Redline limits, amber band and amber band limits show on the scales. Digital readouts for EGT show above the analog dial.

When an engine exceedance occurs, this data changes from white to red or amber:

- Scale
- Digital readout
- Digital readout box
- Fill area.

For redline exceedances, the box around the digital readout stays red after the exceedance goes away.

The CANC/RCL switch removes or shows the exceedance indication.

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**PRIMARY DISPLAY SYSTEM - EICAS DISPLAY FORMAT**

The engine exceedance maintenance page shows the exceedance information and controls the data. Both N1 and EGT show exceedances when they occur.

ATC Datalink Message Field

An ATC message shows in the communication message field at the bottom left corner of EICAS when there is an ATC uplink.

If ECS information shows the ATC text shows above it.

If the EICAS display is not in the compacted format, ATC message text shows in the ATC datalink message field.

The ATC datalink message field has a maximum of 30 characters across. It also has:

- A maximum of 5 lines of text
- 1 line for accept, reject, cancel, and time information.

Pressurization Indications

Pressurization indications show below the EGT scales when an associated crew alert message shows or a parameter exceedance occurs. The data shows for the length of the condition when no AIR synoptic shows. The data includes:

- Duct pressure
- Cabin altitude
- Cabin rate
- Cabin differential pressure
- Outflow valves
- Landing altitude.

Any non-normal condition shows in red or amber.

Alerting and Other Annunciation Messages

These crew alerting and annunciation messages show on the right side of the display:

- Warning
- Caution
- Advisory
- Communication
- Memo.

The messages show by priority and in chronological order. The message field shows eleven messages. When more than eleven messages exist, a white page number shows.

A small box shows adjacent to these messages when there is a non-normal checklist with the message:

- Warning
- Caution
- Advisory.

The small box goes away when electronic checklists are on and the checklist for the message is complete.

STATUS Cue and RECALL Annunciation

The STATUS cue shows when the PDS makes a new status message and the status page is not showing. The STATUS cue goes away when the operator selects the status page or when the condition that causes the status message goes away. The STATUS cue is cyan.

The RECALL annunciation shows for one second each time the operator uses the recall switch. The RECALL annunciation is white.

In-flight Start Envelope

The range of airspeed for an in-flight start shows below the crew alerting message field. This occurs during flight if any engine is shut down and its fire switch is on.

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**PRIMARY DISPLAY SYSTEM - EICAS DISPLAY FORMAT**

The flight level shows in hundreds of feet and is to the nearest 1,000 feet of actual airplane altitude. If the airplane is above the maximum flight level for in-flight start, the maximum and current flight level show.

During fuel jettison, the fuel temperature readout changes to fuel-to-remain indication.

Gear Position Indication

A single landing gear indication shows the condition of the nose, left, and right main gear during normal operation. A white UP shows when all gear are up and locked. A green DOWN shows when all gear are down and locked. When the gear are in transit, a series of white diagonal lines show. The gear display goes blank after the gear UP shows for ten seconds.

During non-normal conditions, a multiple gear indication shows all individual gear positions.

Flap Position Indication

During normal flap operation, a single thermometer style indicator shows for all flap segments. The indicator shows the flap lever detents of 0, 1, 5, 10, 20, 25, and 30 degrees along the scale. Zero is at the top. A horizontal bar and a digital readout show the commanded flap position. The digital readout shows when the flap handle is in detent. The bar and readout are green when the flaps/slats are in the commanded position. Otherwise they are magenta.

The flap position indication goes blank ten seconds after the commanded flap position is 0 and both the flap handle and the flaps are in the 0 detent.

During non-normal conditions, a multiple flap indication shows. The multiple indication shows all individual flap/slat segments for each wing.

Fuel Data

Total fuel quantity and fuel temperature show as white numerical readouts in the lower right corner of the display. TOTAL FUEL and TEMP show in cyan.

During a fuel imbalance condition, a fuel quantity block shows to help the crew balance the fuel in the main tanks.

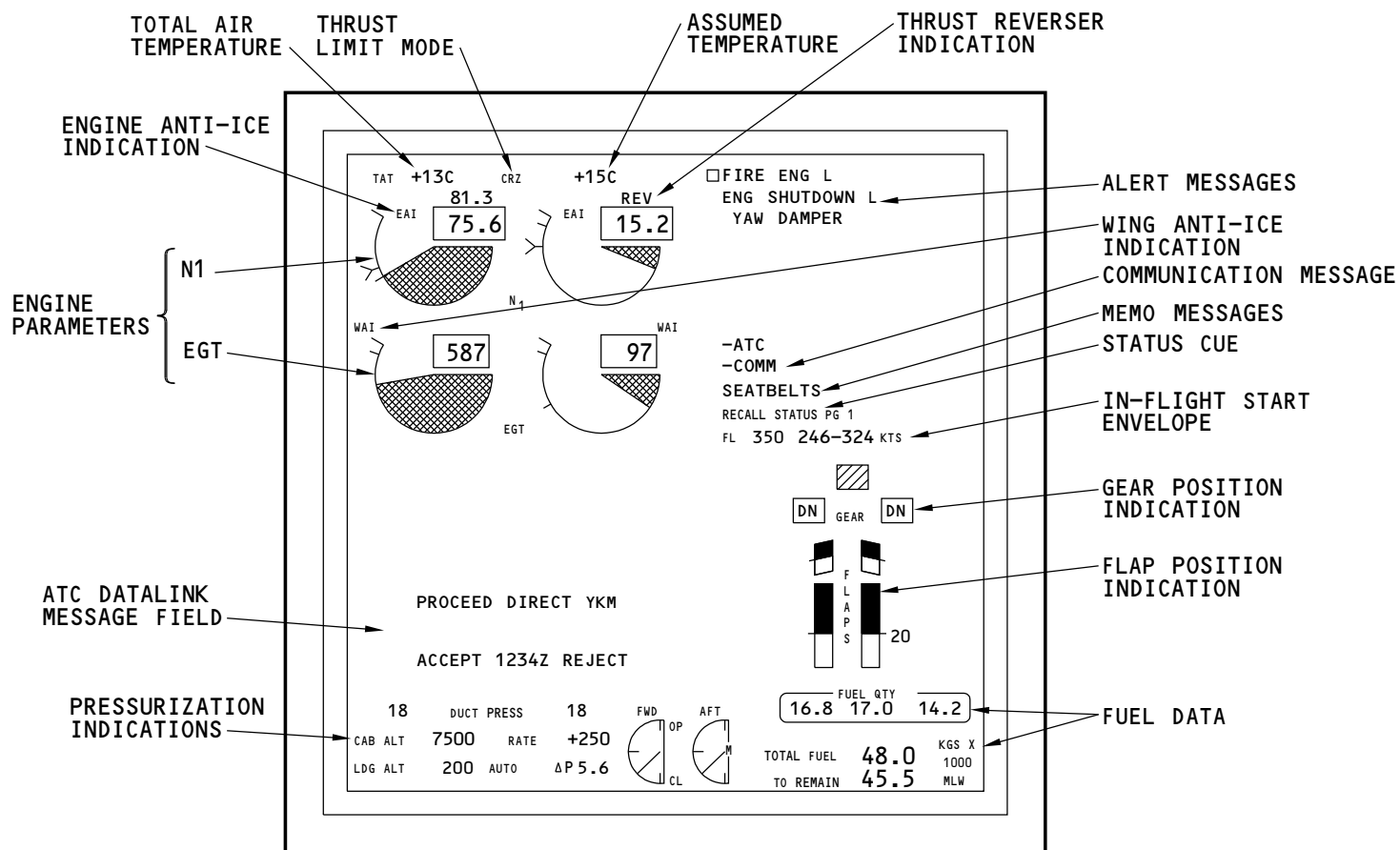
A low fuel temperature condition causes the fuel temperature readout to change to amber.

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PRIMARY DISPLAY SYSTEM - EICAS DISPLAY FORMAT

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PRIMARY DISPLAY SYSTEM - SECONDARY ENGINE DISPLAY FORMAT

General

The secondary engine display format shows on the center lower display unit (DU) at power-up. The format shows secondary engine parameters not required for continuous display. The ENG switch on the EICAS display select panel controls the display.

The display shows this information:

- High pressure rotor speed (N2)
- Fuel flow
- Oil pressure
- Oil temperature
- Oil quantity
- Engine vibration
- In-flight start data.

N2

N2 shows as a digital readout and a round analog scale. The display units are percent RPM. Red lines and color code for exceedance are the same as the N1 display on the EICAS display format.

Fuel Flow

A digital readout shows fuel flow in units of thousands of kilograms per hour for each engine just below the N2 scale. There are no exceedance indications for fuel flow.

Oil Pressure, Temperature, Quantity

Oil pressure shows as a digital readout and filled, moving pointers on a vertical analog scale. Oil pressure has a lower red line limit and an upper and lower amber band limit.

Oil temperature shows as a digital readout in degrees C and filled, moving pointers on a vertical analog scale. Oil temperature has an upper and lower red line limit and a high and low amber band limit.

For both oil pressure and oil temperature, these change colors (white to amber to red) as the parameter exceeds applicable high or low limits:

- Digital readouts
- Readout boxes
- Pointers.

Oil quantity shows as a digital readout in liters. For a low oil quantity condition, the digital readout changes to reverse video and a LO message shows next to the readout.

Engine Vibration

Engine vibration shows at the bottom of the page as a digital readout and a moving pointer on an analog scale. Vibration shows in normalized units from zero to five. The scale is white. A message shows below each digital readout. The message shows the rotor with the highest vibration level. The messages are N1, N2, or BB (broadband). During a high vibration condition, the vibration indication goes to reverse video.

In-Flight Start Data

During in-flight start conditions, if airspeed and altitude conditions require cross-bleed, then a X-BLD message shows. A fuel-on line shows the RPM level where the crew applies fuel. The message and indication are magenta. The fuel-on line shows when an engine shuts down in the air.

During an in-flight engine shutdown, the secondary engine display format automatically shows.

Duct Pressure

The duct pressure legend and readout show when one of the engines is not running and the fire handle is not pulled.

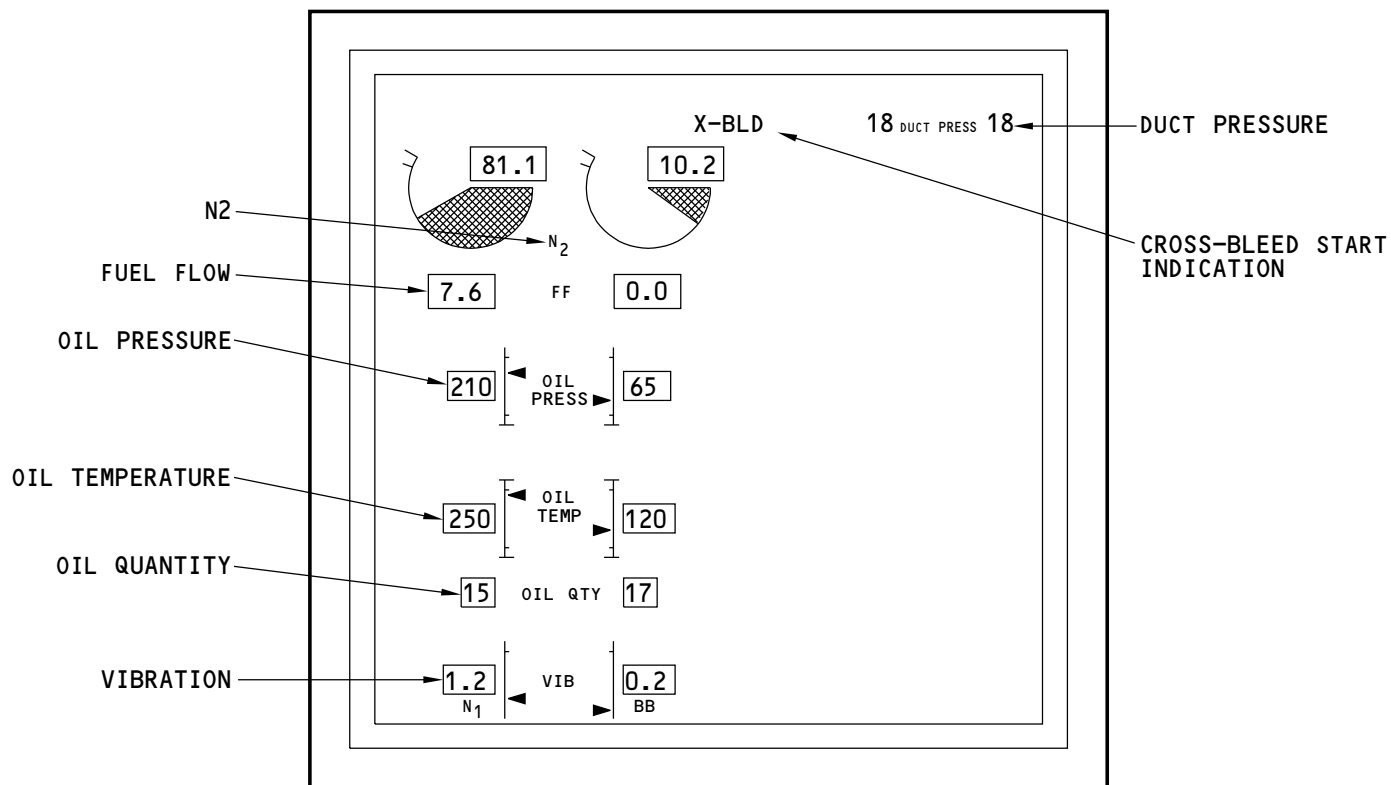
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PRIMARY DISPLAY SYSTEM - SECONDARY ENGINE DISPLAY FORMAT

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PRIMARY DISPLAY SYSTEM - EICAS ENGINE COMPACTED DISPLAY FORMAT**General**

When either the upper center or lower center is not available for engine data, engine parameters from the EICAS display and secondary engine display formats show in a compacted format. With only one DU available, EICAS is in the limited mode of operation.

When the above conditions exist, the ENG switch on the display select panel (DSP) controls the compacted format. The ENG switch changes the compacted format to the EICAS display format or the EICAS display format to the engine compacted format.

The FUEL switch controls the display of the fuel data block when EICAS is in the limited mode of operation.

The AIR switch controls the display of the ECS data block when EICAS is in the limited mode of operation.

The compacted format also shows when a maintenance page shows on the lower center DU.

Compacted Format Features

N1 and EGT are the same as the EICAS display format.

N2 shows as a numerical readout only. Cross-bleed (XB) shows next to N2.

Fuel flow and oil quantity are the same as the secondary engine display format except that the readout box goes away.

Oil pressure, oil temperature, and vibration show digitally only. The readout box and the analog scale go away.

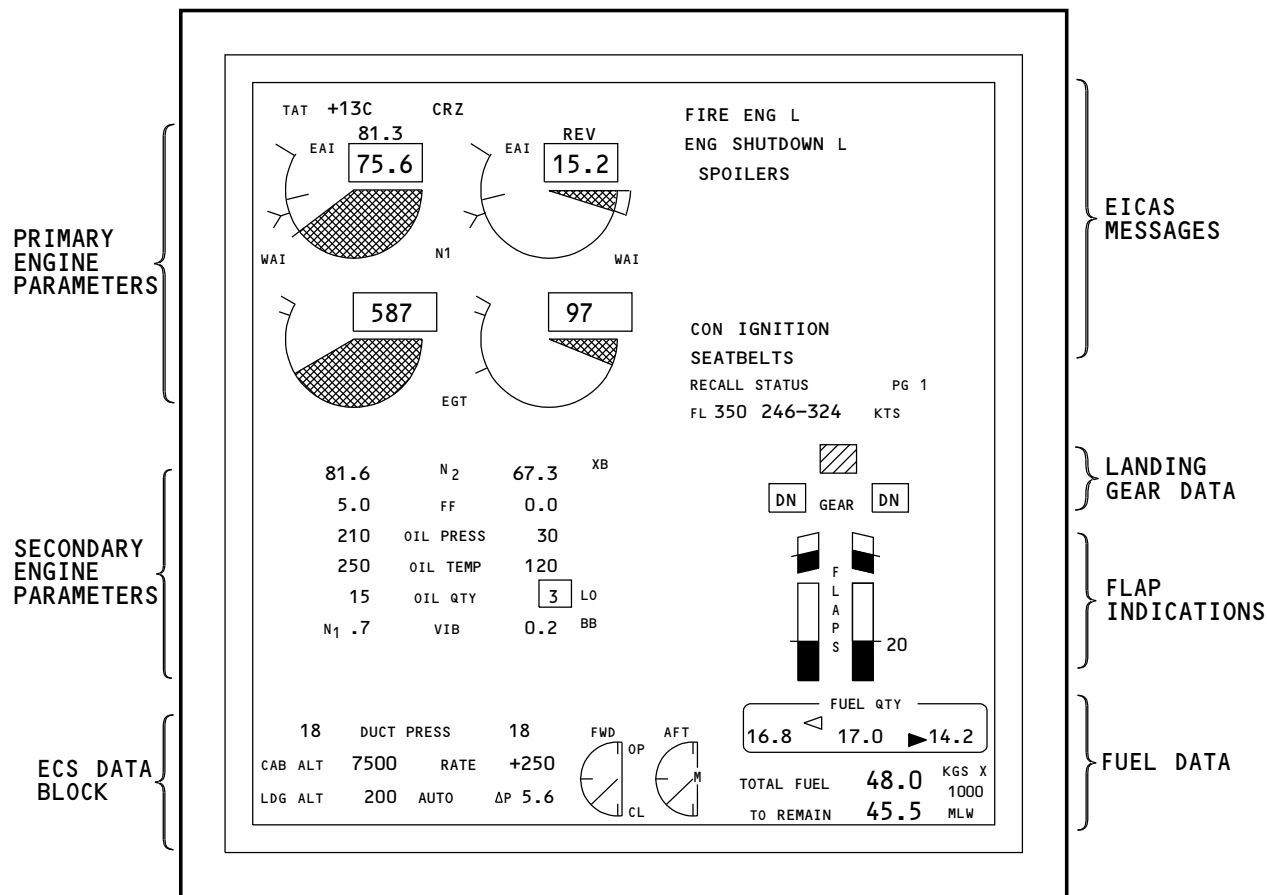
This data shows in the same way as the EICAS display format:

- Alert and annunciation messages
- Gear information
- Flap/slat information
- Cabin pressure data
- Fuel quantity and temperature.

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PRIMARY DISPLAY SYSTEM - EICAS ENGINE COMPACTED DISPLAY FORMAT

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PRIMARY DISPLAY SYSTEM - CREW ALERT MESSAGES

General

The EICAS display and engine compacted formats show these types of messages:

- Warnings
- Cautions
- Advisory
- Comm
- Memo
- In-flight start.

Warning, caution, and advisory messages are crew alerting messages. Comm messages tell the crew of communication requests. Memo messages are crew reminders of the current state of manually selected normal conditions.

The most important messages in sequence are:

- Warnings
- Cautions
- Advisory
- Comm and FMC medium
- Comm low
- Memo.

Warning, caution, advisory, comm and memo messages show from the top down with the most recent message at the top of its category.

There are eleven messages available on each page. The CANCEL/RECALL switch controls message paging when an overflow condition exists. A page number shows when an overflow condition exists. A bullet next to a message identifies a comm message.

Warning Messages

Warning messages have a relation to operational or airplane system conditions that require immediate crew action. Warning messages are red and have an associated aural and dedicated master warning lights.

The most recent warning message shows at the top of the message field. You cannot cancel warning messages with the cancel/recall switch.

The master warning light reset switch cancels aural and master warning light indications. The message stays on the display until the condition that caused the message goes away.

Warning messages are left justified and have a maximum of 20 characters.

Caution Messages

Caution messages have a relation to an operational or airplane condition that requires immediate crew awareness and possible action. Caution messages are amber and have an associated aural and dedicated master caution lights.

The most recent caution message shows at the top of the caution messages and below any existing warning messages.

The first push of the cancel/recall switch removes caution messages from the display. The second push returns the messages to the display if they are still active.

The master caution light reset switch cancels the master caution light and the caution aural. The message remains on the display until the condition that caused the message goes away.

Caution messages are left justified and have a maximum of 20 characters.

Advisory Messages

Advisory messages have a relation to an operational or airplane condition that requires crew awareness. Advisory messages are amber.

The most recent advisory message shows at the top of any advisory messages and below any existing warning or caution messages.

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PRIMARY DISPLAY SYSTEM - CREW ALERT MESSAGES

The first push of the cancel/recall switch removes advisory messages from the display. The second push returns the messages to the display if they are still active.

Advisory messages are left justified with the first space blank. They have a maximum of 19 characters.

Comm Messages

Comm messages alert the flight crew to new messages. The messages may affect the FMCS functions and advise the crew to check the CDU scratch pad. They may also affect the flight deck communication function (FDCF) and alert the crew to check the FDCF displays. Comm messages may also affect the cabin management system (CMS).

There are two levels of comm messages:

- Comm medium
- Comm low.

Comm medium messages identify an incoming communication request which requires immediate crew awareness and prompt crew acknowledgment. Comm medium messages are white and are associated with a hi-lo chime.

Comm medium messages are left justified, 20 characters long and the first character is a bullet.

Comm low messages identify an incoming communication request which requires timely crew awareness and timely crew acknowledgment. Comm low messages are white.

Comm low messages are left justified, 19 characters long and the first character is blank. The second character is a bullet.

To cancel a comm or FMC message, use the accept switch on the glareshield panel. Or use the appropriate datalink page of the CDU or MFD to accept the uplink.

Memo Messages

Memo messages remind the crew of certain manually selected normal conditions. Memo messages are white.

Memo messages are left justified and 20 characters long.

To cancel a memo message remove the condition to cause it to show.

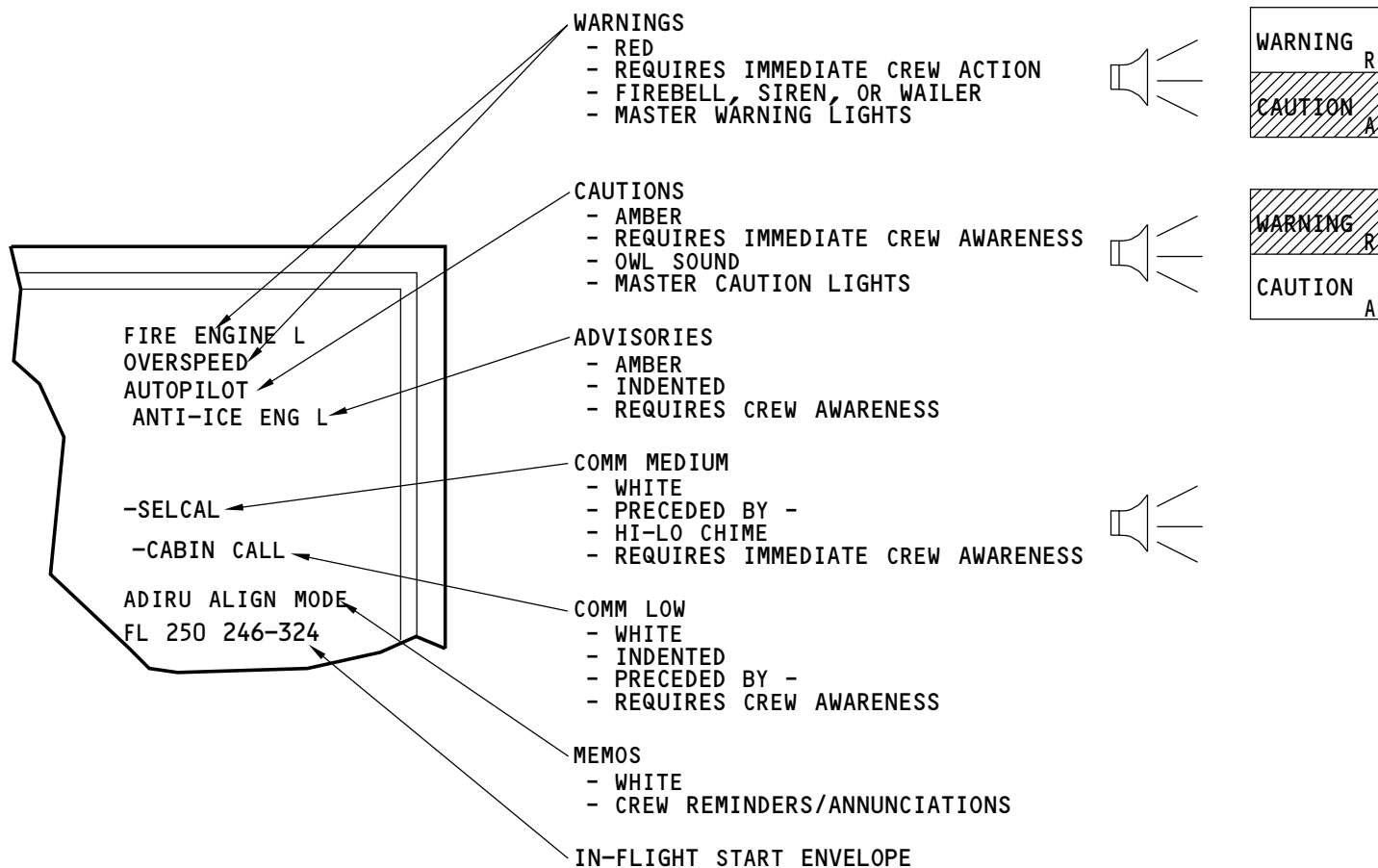
The most recent memo message shows at the top of any memo messages and below any existing comm messages.

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PRIMARY DISPLAY SYSTEM - CREW ALERT MESSAGES

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PRIMARY DISPLAY SYSTEM - EICAS INHIBITS SUMMARY

General

EICAS inhibits remove invalid messages and also remove the caution visuals and aural tones during the maintenance period and during certain airplane and flight conditions.

Message Inhibits

These are the six types of EICAS message and caution inhibits:

- Engine start inhibit (ESI)
- Starter cutout inhibit
- Message inhibit
- General inhibit
- Flight phase inhibits
- Master caution and caution aural tone inhibits.

Engine Start Inhibit

The engine start inhibit prevents some of these messages and alerts during an engine start sequence:

- Caution
- Advisory
- Memo
- Status.

The engine start inhibit prevents automatic electrical bus load shedding and bus transient annunciations that may occur due to generator switching during an engine start.

Starter Cutout Inhibit

When a starter cutout condition occurs, the STARTER CUTOUT caution message replaces these existing messages:

- Caution
- Advisory

- Comm
- Memo.

During the inhibit, message processing continues but the messages do not show.

The starter cutout inhibit stops when one of these happens:

- The starter cutout condition goes away
- A new caution message occurs that is not subject to ESI inhibits
- 20 seconds after it starts
- You push the CANCL/RCL switch.

Message Inhibit

Some messages cause other messages not to show. As an example, the caution message ENG R SHUTDOWN inhibits the advisory message ENG CONTROL R.

General Inhibit

Some airplane conditions cause certain messages not to show. As an example, airplane-on-the-ground inhibits the advisory message ICING WING.

Flight Phase Inhibits

There are several flight phase inhibits.

The advisory message takeoff inhibit prevents the display of all advisory messages during takeoff.

The comm message takeoff inhibit prevents the display of comm messages during takeoff except CABIN ALERT.

The status cue inhibit prevents the display from first engine start to top of climb or 30 minutes after liftoff.

The comm message landing inhibit prevents the display of comm messages during landing except CABIN ALERT.

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**PRIMARY DISPLAY SYSTEM - EICAS INHIBITS SUMMARY**

The caution/advisory landing inhibit prevents the display of caution and advisory messages during landing. These are the exceptions:

- AUTOPILOT
- NO AUTOLAND
- SPEEDBRAKE EXTENDED
- AUTOTHROTTLE DISC.

Master Caution Light and Caution Aural Tone Inhibits

There are two master caution lights and aural tone inhibits. They are the:

- Airplane takeoff inhibit
- All engine shutdown inhibit.

The airplane takeoff inhibit prevents the lights and tone during takeoff. The inhibit starts as the airplane accelerates through 80 knots and ends when one of these happens:

- The airplane reaches 400 feet of radio altitude
- 20 seconds after it starts
- The airplane slows to less than 75 knots.

The all engine shutdown inhibit prevents the lights and tones when the airplane is on the ground and both engines are shut down.

INHIBIT	RESULTS	CONDITIONS
ENGINE START INHIBIT	CERTAIN CAUTION, ADVISORY, MEMO, STATUS & ASSOCIATED ALERTS	EITHER ENGINE STARTER VALVE OPEN TO ENGINE IDLE RPM OR FUEL SWITCH IN CUTOFF
STARTER CUTOFF INHIBIT	CAUTION, ADVISORY, COMM, MEMO PROCESSED BUT DO NOT SHOW. REPLACES WITH STARTER CUTOFF CAUTION MESSAGE	AIRPLANE ON THE GROUND AND L OR R STARTER PROBLEM. ENDS WHEN ABOVE NOT TRUE OR 20 SECONDS OR NEW CAUTION OR CANCEL/RECALL PRESSED.
ADVISORY MESSAGE TAKEOFF INHIBIT	NO ADVISORY MESSAGES SHOW	STARTS WITH AIRPLANE ON GROUND AND TRANSITION FROM BELOW TO ABOVE 80 KNOTS. ENDS AT CLIMB THROUGH 400 FT RA OR 20 SECONDS OR ON GROUND AND TAKEOFF THRUST NOT SELECTED ON BOTH ENGINES.
COMM MESSAGE TAKEOFF INHIBIT	CERTAIN COMM MESSAGES DO NOT SHOW	STARTS WHEN T/O THRUST ON EITHER ENGINE AND AIRPLANE ON THE GROUND. ENDS AT CLIMB THROUGH 400 FT RA OR 20 SEC AFTER ROTATION OR T/O THRUST NOT SELECTED ON BOTH ENGINES
STATUS CUE INHIBIT	STATUS CUE DISPLAY DOES NOT SHOW	STARTS WITH FIRST ENGINE START. ENDS AT TOP OF CLIMB OR 30 MINUTES AFTER LIFTOFF.
COMM MESSAGE LANDING INHIBIT	CERTAIN COMM MESSAGES DO NOT SHOW	STARTS AT DESCENT THROUGH 800 FT RA. ENDS AT TRANSITION FROM AIR TO GROUND AND GS<80 KNOTS OR LOSS OF RA OR CLIMB THROUGH 800 FEET RA.
CAUTION/ADVISORY LANDING INHIBIT	CERTAIN CAUTION/ADVISORY MESSAGES NOT DISPLAYABLE. MASTER CAUTION LIGHT AND CAUTION AURAL TONE INHIBITED	STARTS AT DESCENT THROUGH 800 FT RA. ENDS AT TRANSITION FROM AIR TO GROUND AND GS<75 KNOTS OR 40 SEC OR ASCENT THROUGH 800 FEET RA.
AIRPLANE TAKEOFF INHIBIT	MASTER CAUTION LIGHT AND CAUTION AURAL TONE INHIBITED	STARTS WHEN CAS>80 KNOTS AND CAS NOT PREVIOUSLY >80 KNOTS. ENDS WHEN RA > 400 FT OR 20 SEC OR CAS<75 KNOTS
ALL ENGINE SHUTDOWN INHIBIT	MASTER CAUTION LIGHT AND CAUTION AURAL TONE INHIBITED	ENABLED WHEN AIRPLANE IS ON THE GROUND AND BOTH ENGINES SHUT DOWN

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PRIMARY DISPLAY SYSTEM - EICAS INHIBITS SUMMARY

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**PRIMARY DISPLAY SYSTEM - EICAS MESSAGE PROCESSING****General**

EICAS shows messages when certain conditions are met. Each type of message goes through several possible conditions before it shows on the display. Each message condition needs certain logic to be true.

Crew Alert Messages

Crew alert messages have these three possible conditions:

- ENABLED
- ACTIVE
- DISPLAYABLE.

A message is ENABLED when the logic is true and configuration requirements are true.

A message is ACTIVE when it is ENABLED and there are no inhibits.

A message is DISPLAYABLE when it is ACTIVE and it is not cancelled.

ACTIVE crew alerting messages that are inhibited by the starter cutout inhibit or that go away because of an overflow condition are DISPLAYABLE. Use the CNCL/RCL switch on the display select panel (DSP) to review the starter cutout inhibit messages. Also use the CNCL/RCL switch to go to the next page to review the overflow messages.

Status Messages

Status messages have these four possible conditions:

- ENABLED
- CURRENT
- ACTIVE
- DISPLAYABLE.

A message is ENABLED when the logic is true and configuration requirements are true.

A message is CURRENT when it is ENABLED and there are no inhibits. (ESI must be false or ESI became true after the message was ACTIVE.)

A message is ACTIVE when it becomes current or when it is latched.

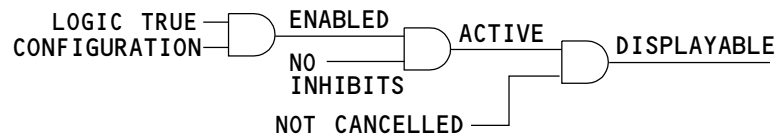
A message is DISPLAYABLE when it is ACTIVE and it is not cancelled.

ACTIVE status messages that go away because of an overflow condition are DISPLAYABLE. Use the STAT switch on the DSP to go to the next page of messages.

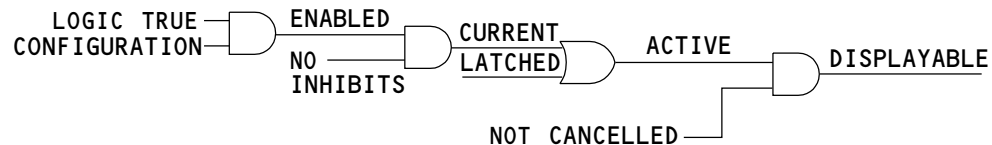
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CREW ALERT MESSAGE CONDITIONS



STATUS MESSAGE CONDITIONS

PRIMARY DISPLAY SYSTEM - EICAS MESSAGE PROCESSING

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**PRIMARY DISPLAY SYSTEM - STATUS PAGE FORMAT****General**

The status display shows information that helps the technician make a decision on the dispatch status of the airplane.

The status display shows:

- Hydraulic system information
- APU information
- Crew oxygen information
- Passenger oxygen information
- Status messages.

You use the status display switch on the display select panel (DSP) to select the status display on the multifunction display (MFD).

Hydraulic System Information

Digital display of hydraulic fluid quantity shows as a percentage; 1.00 equals full. Hydraulic fluid pressure shows for each of the three hydraulic systems.

These messages show next to the quantity readouts when the condition exists:

- LO (low)
- RF (refill)
- OF (overfill).

The LO message is amber and the RF and OF messages are white.

APU Information

APU information shows below the hydraulic information. The APU information includes:

- APU exhaust gas temperature (EGT), in centigrade
- APU rotor speed
- APU oil quantity
- APU oil pressure

- APU oil temperature.

Crew Oxygen

Crew oxygen status shows below the APU information.

Passenger Oxygen

Passenger oxygen status shows next to the crew oxygen status.

Status Messages

Status messages have a relation to conditions that affect dispatch. The technician uses applicable publications to make a decision on the dispatch status of the airplane.

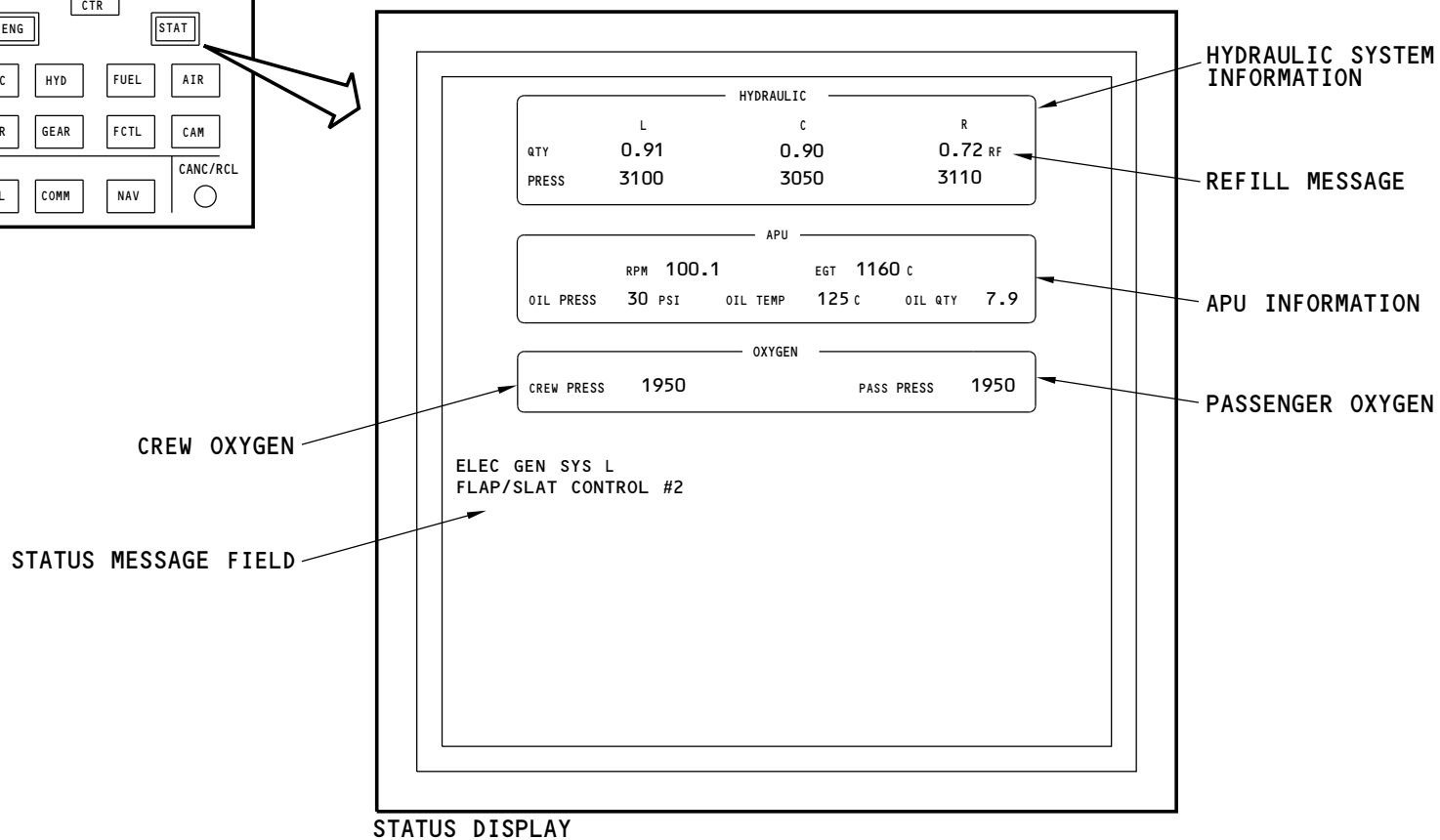
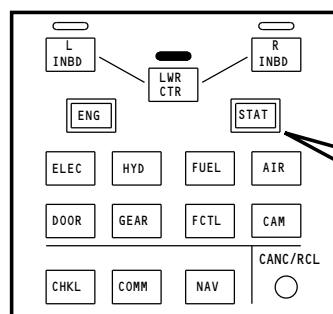
The status message field holds eleven messages on each page. Use the status display switch on the DSP to page through multiple pages of status messages. When the last page of status messages shows, a push of the status display switch causes the display to go away.

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PRIMARY DISPLAY SYSTEM - STATUS PAGE FORMAT

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PRIMARY DISPLAY SYSTEM - STATUS MESSAGE FIELD AND STATUS CUE

General

The status message field shows in the lower left corner on the status display (MFD). Status messages show the dispatch status of the airplane in the status message field. A status message is based on the requirements of the master minimum equipment list (MMEL). The most recent message shows at the top of the list.

The STATUS cue field shows on the EICAS display when the status display does not show and a new status message occurs. The STATUS cue shows below the memo message field.

These are the two types of status messages:

- Non-latched
- Latched.

Non-Latched

Non-latched status messages show on the status display when some malfunctions occur in the systems monitored by AIMS. The newest message shows first. When the condition that causes the message goes away, the message on the status page format goes away.

If more than eleven messages exist, they overflow to additional pages and a page number shows below the status message field. Use the status display switch on the display select panel (DSP) to page through multiple pages of status messages. When the last page of status messages shows, a push of the status display switch causes the display to go away.

Latched

Latched status messages also show on the status display when malfunctions occur in systems monitored by AIMS. They have the same priority as non-latched status messages. The most recent message of either type shows at the top of the list.

These are the three types of latched status messages:

- Ground only
- Air only

- Either air or ground.

AIMS stores latched status messages in memory. The messages go to the central maintenance computing function (CMCF) for flight deck effect correlation.

Latched messages allow the maintenance technicians to look at failures that occur in specific flight phases and may not be present or active all the time.

Latched status messages do not go away when the condition that causes the message goes away. Some latched status messages require the technician to do the necessary repair and then use the ERASE function on the MAINTENANCE TASK maintenance page to erase the messages. Other latched status messages require the technician to do the necessary repair and then do a ground test of the system to erase the message.

Status Cue

A STATUS cue shows on the EICAS display any time a new status message becomes current and the status page format does not show. The STATUS cue is cyan.

There is a fifteen second time delay before the STATUS cue shows. This prevents transient messages.

The STATUS cue goes away when one of these occurs:

- The status page format shows
- The condition that causes the status message goes away.

Status Cue Inhibit

A status cue inhibit does not let the STATUS cue show. During takeoff, the inhibit starts when both of these occur:

- The airplane is on the ground
- First engine start.

During landing, the inhibit starts when the airplane descends through 800 feet of altitude.

The inhibit stops 30 minutes after liftoff.

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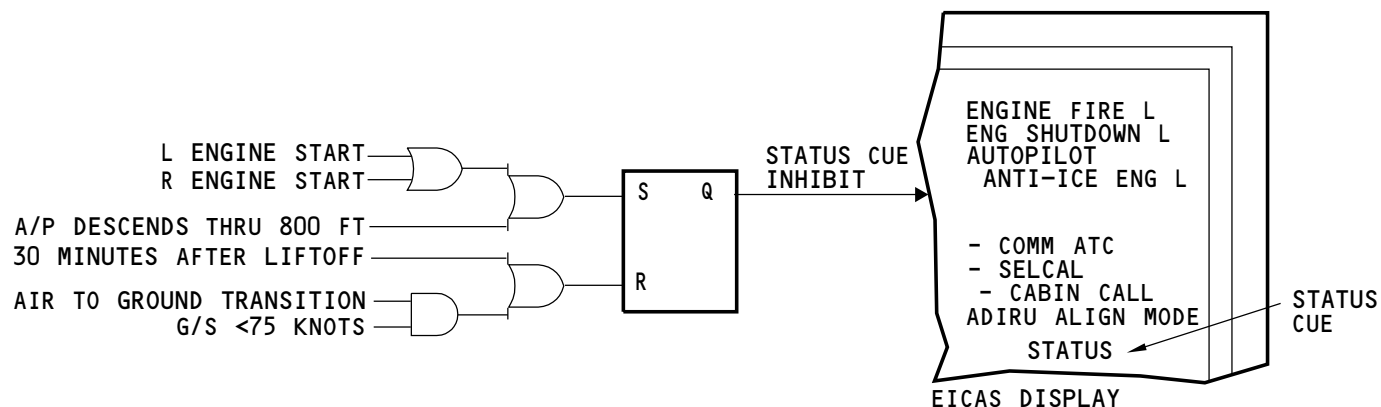
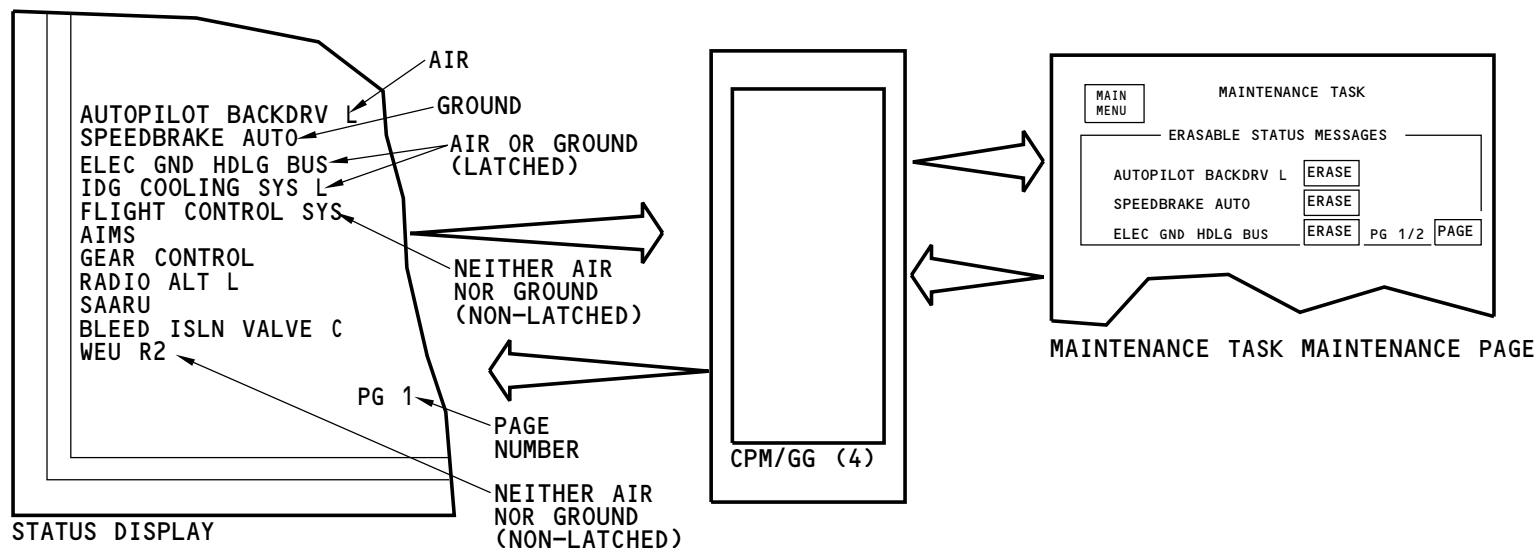
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**PRIMARY DISPLAY SYSTEM - STATUS MESSAGE FIELD AND STATUS CUE**

After landing, the inhibit stops when the airplane ground speed is less than 75 knots.

If a STATUS cue shows before the start of the inhibit, it continues to show.

If a status message becomes active during the inhibit and is still active when the inhibit ends, the STATUS cue shows.



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PRIMARY DISPLAY SYSTEM - STATUS MESSAGE FIELD AND STATUS CUE

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PRIMARY DISPLAY SYSTEM - SYNOPTIC FORMATS OVERVIEW

General

Synoptic formats give a graphic representation of airplane systems. The word SYNOPTIC combines the words synopsis (summary) and optic (visual). Synoptics are dynamic displays in color of real-time data. The synoptic displays are available for these systems:

- Flight controls (FCTL)
- Landing gear (GEAR)
- Doors (DOOR)
- Environmental control system (AIR)
- Fuel (FUEL)
- Hydraulic (HYD)
- Electrical (ELEC).

Push the applicable switch on the display select panel (DSP) to show a synoptic. Push the same switch a second time and the display goes away.

Synoptic formats can show as a multi functional display (MFD) on any or all of these DUs:

- Lower center DU
- Left inboard DU
- Right inboard DU.

Colors

Colors show on synoptic pages to help identify conditions and states. These colors show on the synoptic pages:

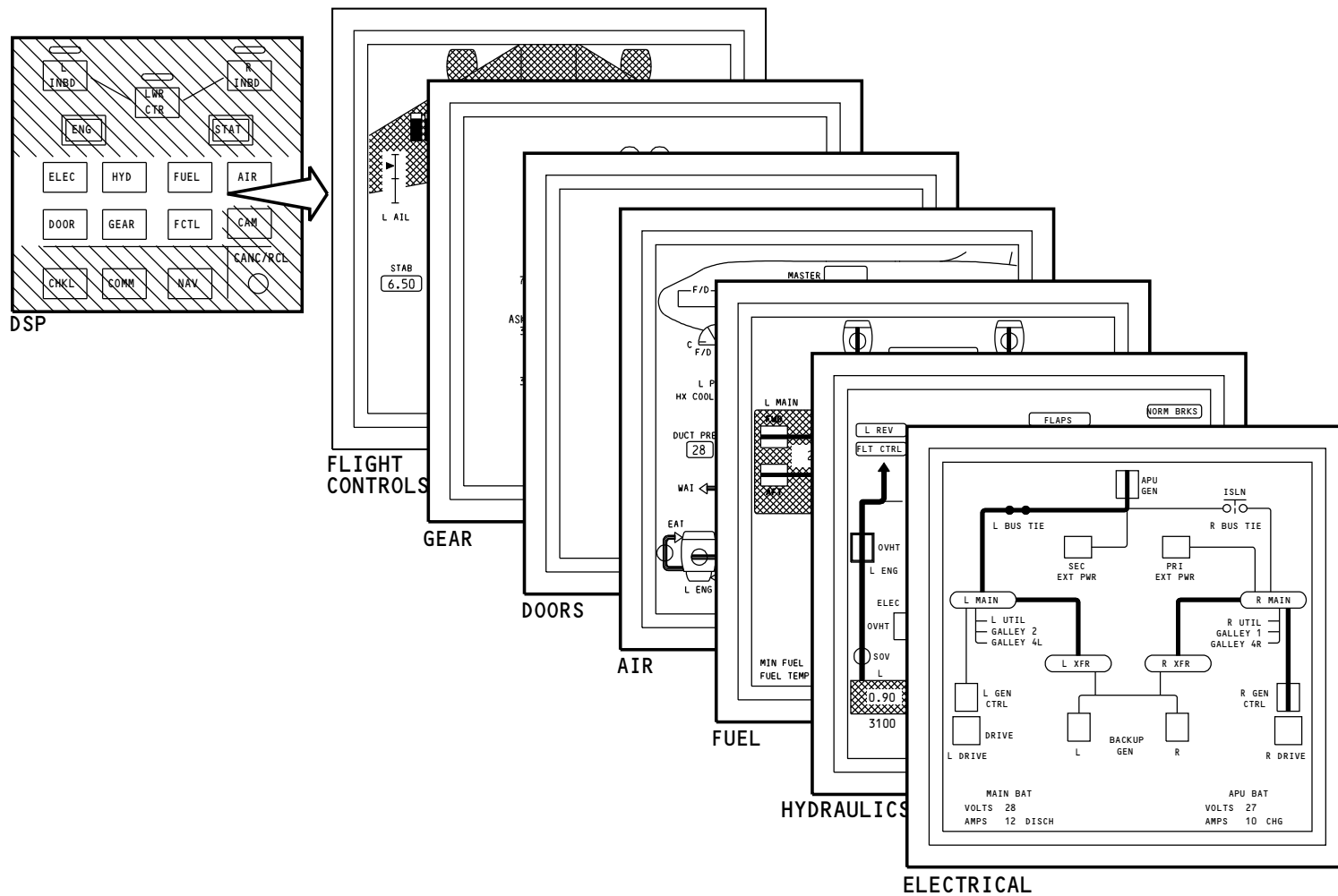
- Red, warning/limit/exceedance
- Amber, caution/limit/exceedance/failed
- Magenta, commands/targets
- Cyan, arm state
- Green, on/flow
- Grey, actual airplane condition
- White, off/invalid data.

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PRIMARY DISPLAY SYSTEM - SYNOPTIC FORMATS OVERVIEW

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PRIMARY DISPLAY SYSTEM - FLIGHT CONTROLS SYNOPTIC

General

The flight controls synoptic display shows the status of the external flight control surfaces on an airplane outline.

The synoptic shows this information:

- Spoiler position
- Flaperon position
- Aileron position
- Elevator position
- Stabilizer position
- Rudder trim position
- Rudder position
- Flight control mode
- Hydraulic system status
- Actuator control electronics (ACE) status.

Spoiler Position

Spoiler positions show as a thermometer. The full up position shows as a filled thermometer and the full down position has no fill. For invalid conditions the spoiler symbol goes away. For fail conditions an amber X shows.

Flaperon, Aileron, and Elevator Position

The flaperon, aileron and elevator surface position shows as a pointer that moves along a vertical scale. The ends of the scales show full range deflection and the tick mark at the center shows zero deflection. For invalid conditions, the triangular pointer goes away. For fail conditions, an amber X shows.

Stabilizer Position

Stabilizer position shows as a digital readout in units of trim. For invalid conditions, the digital readout goes away. For fail conditions, an amber X shows.

Rudder Trim Position

Rudder trim position shows as a digital readout in units of trim. The letters L or R show trim direction. For invalid conditions, the digital readout and the L and R goes away. For fail conditions, an amber X shows.

Rudder Position

The rudder position shows as a pointer that moves along a horizontal scale. The ends of the scales show full range deflection and the tick mark at the center shows zero deflection. For invalid conditions, the triangular pointer goes away. For fail conditions, an amber X shows.

Flight Control Mode

NORMAL, SECONDARY, or DIRECT shows for the applicable flight control mode. NORMAL is white and SECONDARY and DIRECT are amber. The box and message goes away when no data is available.

Hydraulic System Status

The hydraulic system status blocks show when there is low pressure in any of the three systems. L, C or R show for the applicable system. The system with low pressure shows as an amber letter and box. The normal systems show as green letters and boxes.

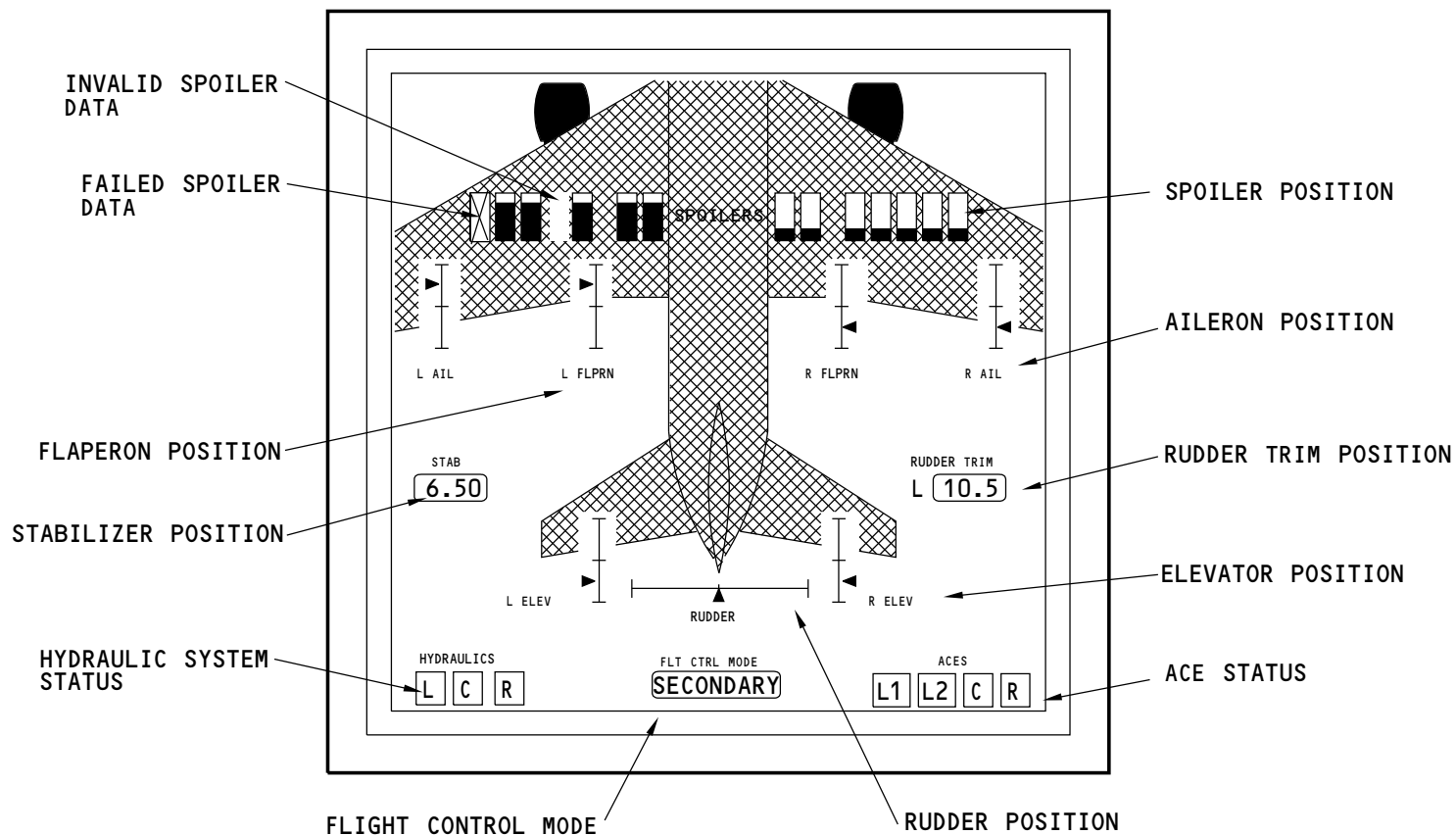
When all three systems are normal, the display goes away.

Actuator Control Electronics (ACE) Status

The ACE status blocks show when there is a failure. L1, L2, C, or R show for the applicable system. The box and label for the failed system shows in amber. The normal systems show as green letters and boxes.

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PRIMARY DISPLAY SYSTEM - FLIGHT CONTROLS SYNOPTIC

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PRIMARY DISPLAY SYSTEM - GEAR SYNOPTIC

General

The Gear synoptic shows this information:

- Gear door information
- Brake temperature
- Brake symbols
- Brake deactivation/antiskid status.

Gear Doors

The message CLOSED shows in the door symbol when the nose gear doors or the main landing gear doors close. When the doors are in transit, diagonal lines show in the door symbol. For invalid conditions, the door symbols go away.

Brake Temperature

Brake temperature shows as a digital readout next to the wheel symbol. Temperatures show as numbers on a scale that relates to actual brake temperatures. Normal temperatures are white readouts. Non-normal temperatures are amber readouts. Invalid brake temperature information shows blank.

Brake Status and Symbols

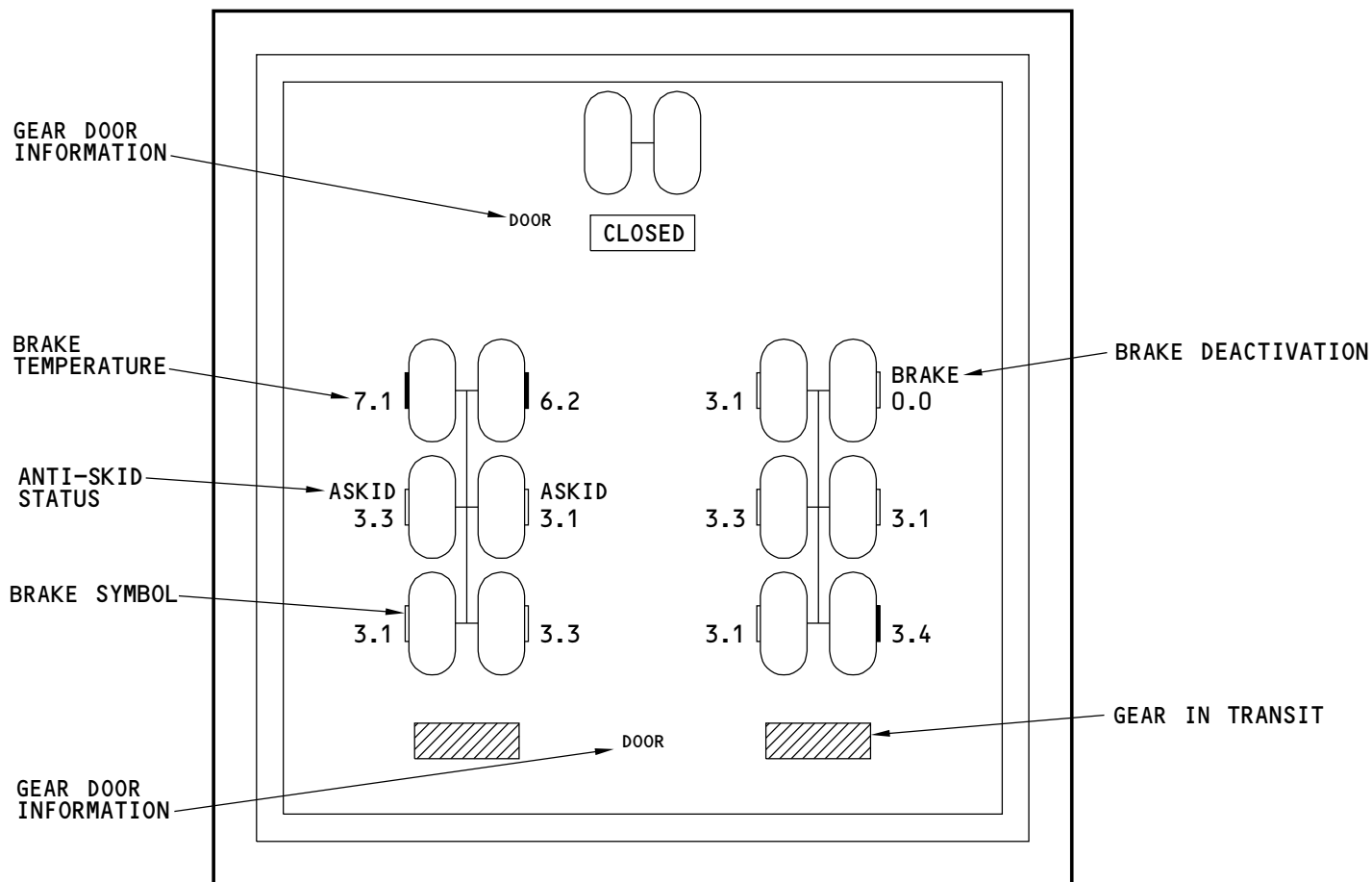
The brake symbol is a vertical bar next to the wheel symbol.

These are the four conditions and displays for the brakes:

- Brake invalid - a white symbol and blank digital temperature readout
- Brake normal - a white brake symbol and digital temperature readout
- Brake hottest - a solid white brake symbol shows on each truck for the hottest brake. The temperature readout remains white
- Brake overheat - the brake symbol and digital temperature readout change to amber. This cancels the brake hottest indication for that truck.

Brake Deactivation/Antiskid

The message BRAKE or ASKID shows next to the applicable wheel when there is a brake deactivation or an antiskid condition.



PRIMARY DISPLAY SYSTEM - GEAR SYNOPTIC

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PRIMARY DISPLAY SYSTEM - DOOR SYNOPTIC

General

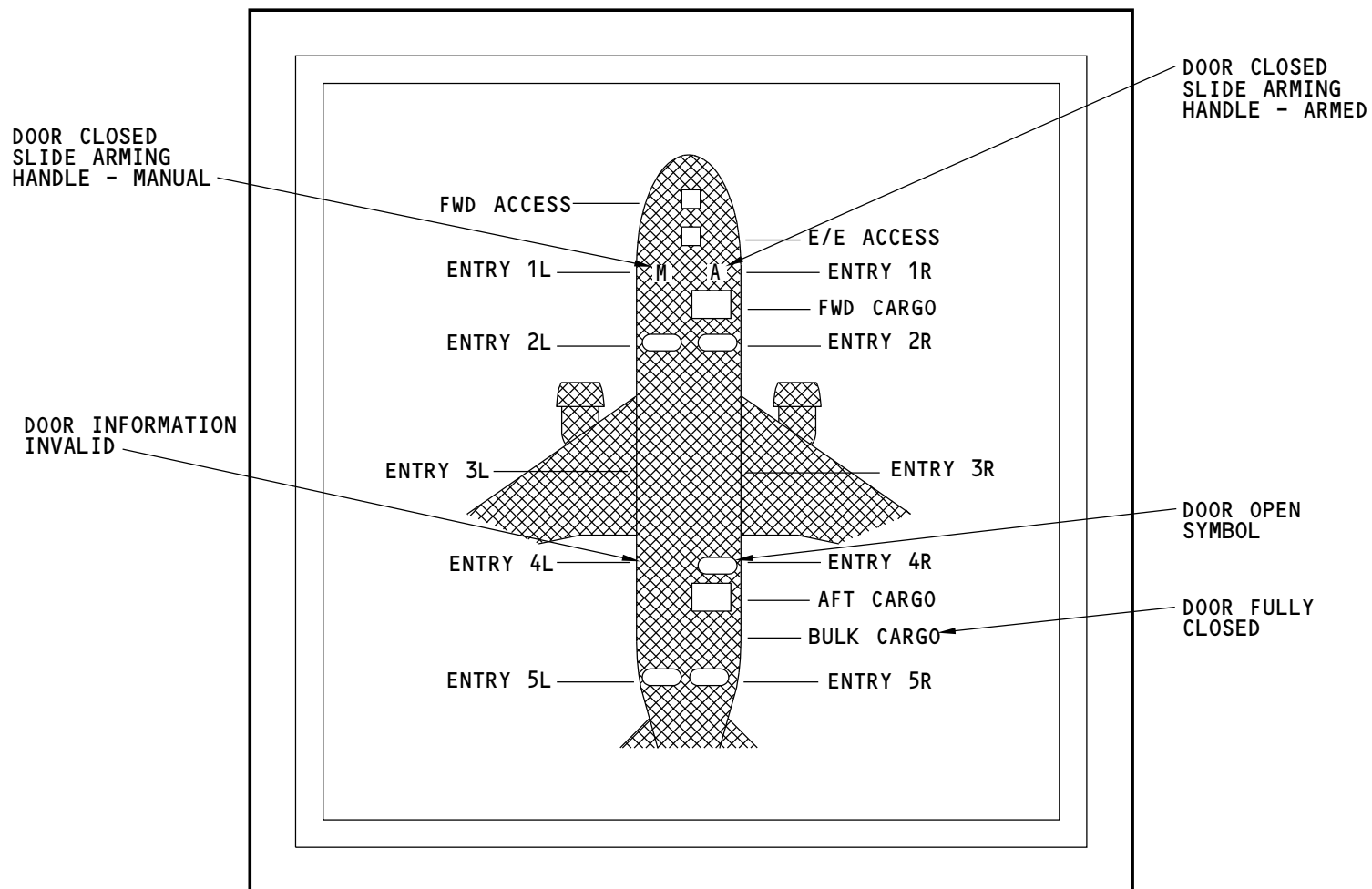
The door synoptic shows the status of these doors:

- Access doors
- Passenger entry doors
- Cargo doors.

The names of the doors always show. An amber symbol shows when a door is open or not completely closed. Cargo and access doors show nothing when they are fully closed. Invalid door information shows a white door symbol outline.

The slide arming handle position shows when the entry doors are fully closed. The symbol shows:

- A - for handle armed
- M - for handle in manual.



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PRIMARY DISPLAY SYSTEM - DOOR SYNOPTIC

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**PRIMARY DISPLAY SYSTEM - FUEL SYNOPSIS****General**

The fuel synopsis shows APU and ENG normal and non-normal pump status. The fuel synopsis also shows other ENG normal and non-normal fuel data. The fuel synopsis shows:

- APU pump status
- ENG pump status
- Total fuel
- Fuel quantity
- Fuel temperature and minimum fuel temperature
- Cross feed valve position
- Flow indications
- Fuel jettison.

APU Pump Status

The APU dc pump status shows as:

- Pump on (green)
- Pump off (white)
- Pump invalid (white).

ENG Pumps Status

The ENG ac pumps status show as:

- Pump on (green)
- Pump off (white)
- Pump invalid (white)
- Pump failed (amber with an X).

Total Fuel, Fuel Quantities, and Fuel Temperatures

The fuel synopsis shows this fuel information in the same way as the information on the EICAS display.

The legends are cyan and the readouts are white. For invalid or fail conditions, the readouts go away.

Fuel Balanced Message

A FUEL BALANCED message shows below total fuel when the left and right tanks disagree.

Cross Feed Valve Position

The valves show as one of these conditions:

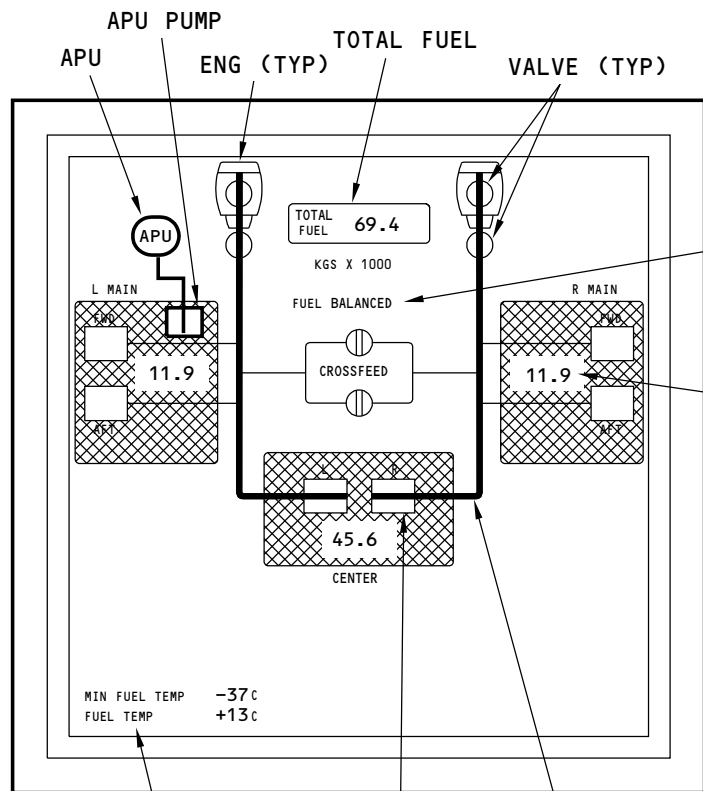
- Open
- Closed
- Failed open
- Failed closed
- Invalid.

Flow Indications

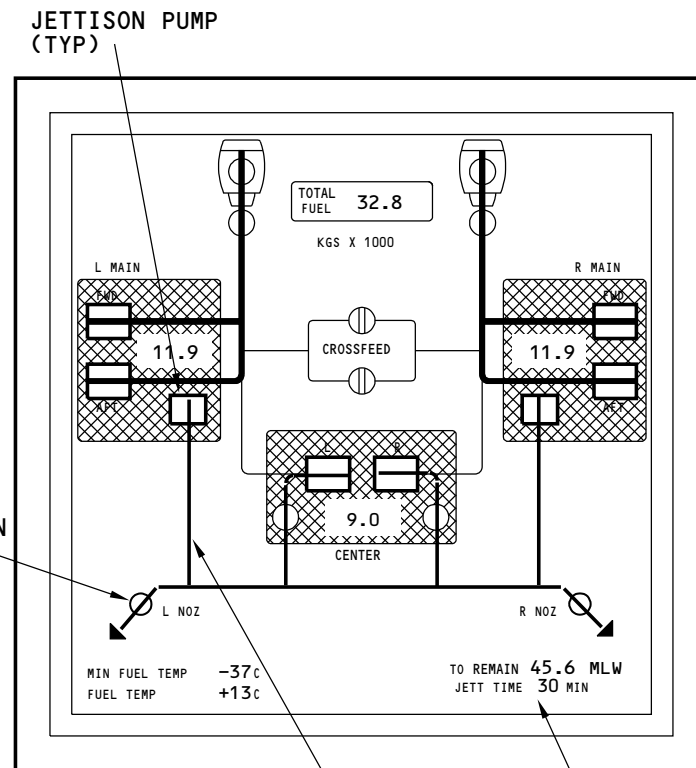
Automatic overrides and pressures cause fuel flow segments to show. Normal flow indications are green. When the engines use fuel with the pumps off, the flow indications are amber.

Fuel Jettison

During a fuel jettison condition, the fuel synopsis shows more information. The flow indications are magenta. The jettison pumps show. Fuel to remain and fuel jettison time also show.



NORMAL
FUEL TEMPERATURE
ENG PUMP (TYP)
FLOW INDICATIONS



FUEL JETTISON
FLOW INDICATIONS
FUEL TO REMAIN JETTISON TIME

PRIMARY DISPLAY SYSTEM - FUEL SYNOPTIC

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PRIMARY DISPLAY SYSTEM - AIR SYNOPTIC

General

The air synoptic shows this information:

- Master temperature
- Zone temperature
- Flight deck trim valve position
- Bleed isolation valve status
- Anti-ice valve positions
- APU isolation valve status
- Engine bleed valve status
- Engine start valve status
- Pack status
- Duct pressure and ground air supply
- APU running status
- Air flow indications.

Temperatures

The master temperature shows as a magenta digital readout. Zone temperatures, target and actual, also show as magenta and white digital readouts.

Target and actual zone temperatures show for these areas:

- Flight deck
- Zones A through F
- Aft cargo
- Bulk cargo.

The target temperature is magenta. The actual temperature is white.

Valves

The trim valves show in several possible conditions.

An open valve is green with a horizontal bar. A closed valve is white with a vertical bar.

A failed open valve is amber with an X. A failed closed valve is amber with an X.

Pack Status

Pack status shows as a symbol. The symbol is green for a pack on condition. The symbol is white for a pack off or invalid condition. The symbol is amber with an X for a failed pack condition.

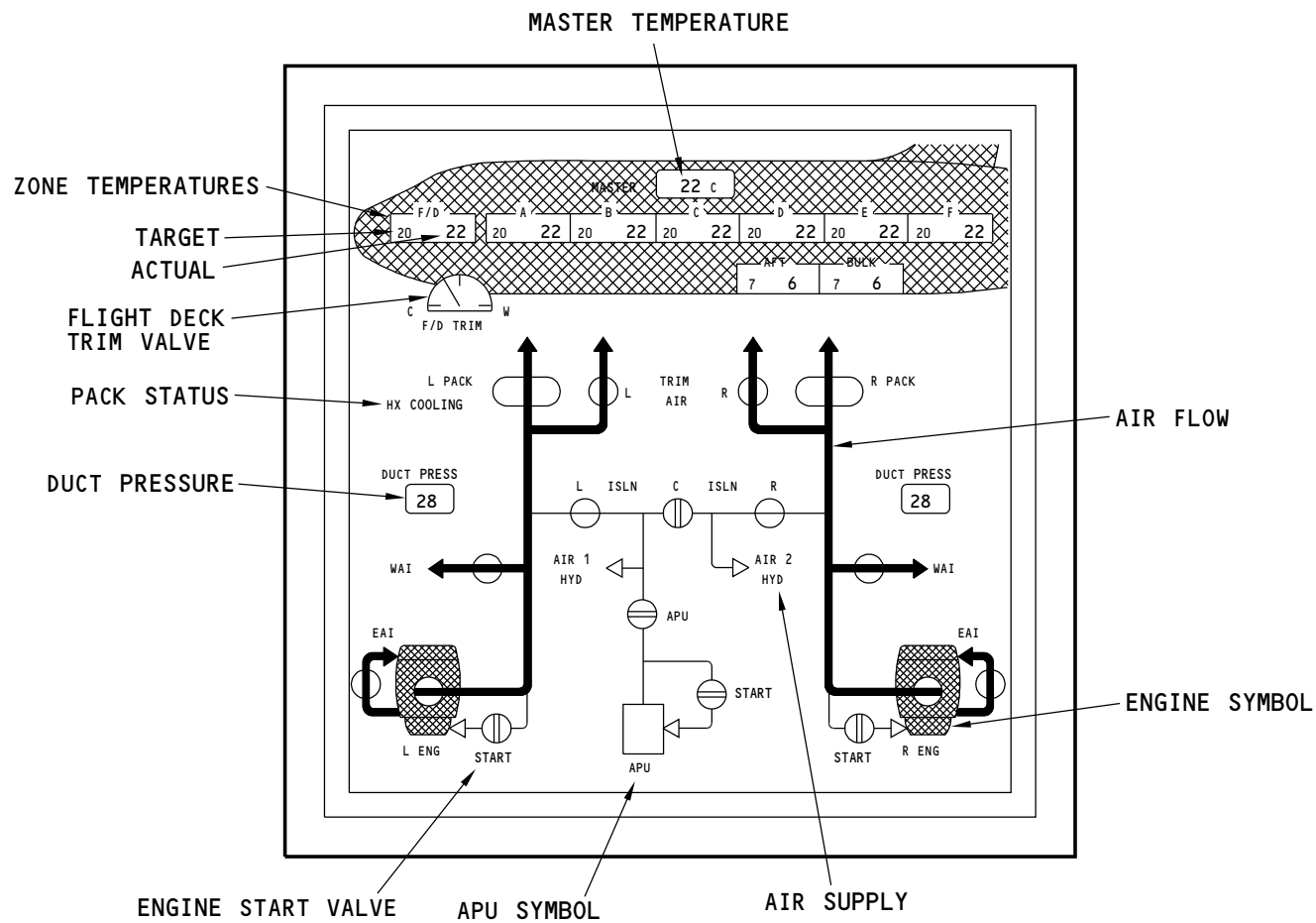
Duct Pressure and Ground Air Supply

Duct pressure shows as a digital readout.

The air source, either ground-air or an air-driven pump, shows as a cyan message.

APU Status

The APU symbol is green when the APU is running. The APU symbol is white when the APU is not running.



PRIMARY DISPLAY SYSTEM - AIR SYNOPTIC

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PRIMARY DISPLAY SYSTEM - HYDRAULIC SYNOPTIC**General**

The hydraulic synoptic shows this information:

- User systems
- Flow indications
- Pump status
- Valve information
- Reservoir quantity and status
- System pressure.

User Systems

The systems that use hydraulic power show at the top of the display.

Flow Segments

Flow segments are green. Pressure causes a segment to show.

Pump Status

A pump on symbol is green. A pump off symbol is white. A pump invalid symbol is white. A pump failed symbol is amber with an X.

An overheat message (OVHT) shows for the primary engine pump, primary electrical pump, demand electrical pump, and the demand air pump.

Valve Information

The shutoff valve and reserve supply valve have four possible conditions. A valve open symbol is green with a vertical line. A valve closed symbol is white with a horizontal line. A valve invalid symbol is white with no line. A valve failed symbol is amber with an X.

The reserve isolation valve has four possible conditions. A valve normal symbol is green with a horizontal line. A valve isolation symbol is white with a wedge shaped horizontal line. A valve invalid symbol is white with no line. A valve failed symbol is amber with an X.

The nose gear and steering isolation valve has four possible conditions. A valve normal symbol is green with a horizontal line. A valve isolation symbol is white with a horizontal line. A valve invalid symbol is white with no line. A valve failed symbol is amber with an X.

Reservoir Quantity and Status

Reservoir quantity for each tank shows as a digital readout. The readout values go from 0.0 to 1.20. A readout of 1.0 means the reservoir is full. When the airplane is on the ground, messages show for low quantity (LO), overfill (OF) or refill (RF). The quantity readout is normally white. The OF and RF messages are white. During a low condition, both the quantity readout and the LO message are amber.

System Pressure

System pressures show as digital readouts at the bottom the display.

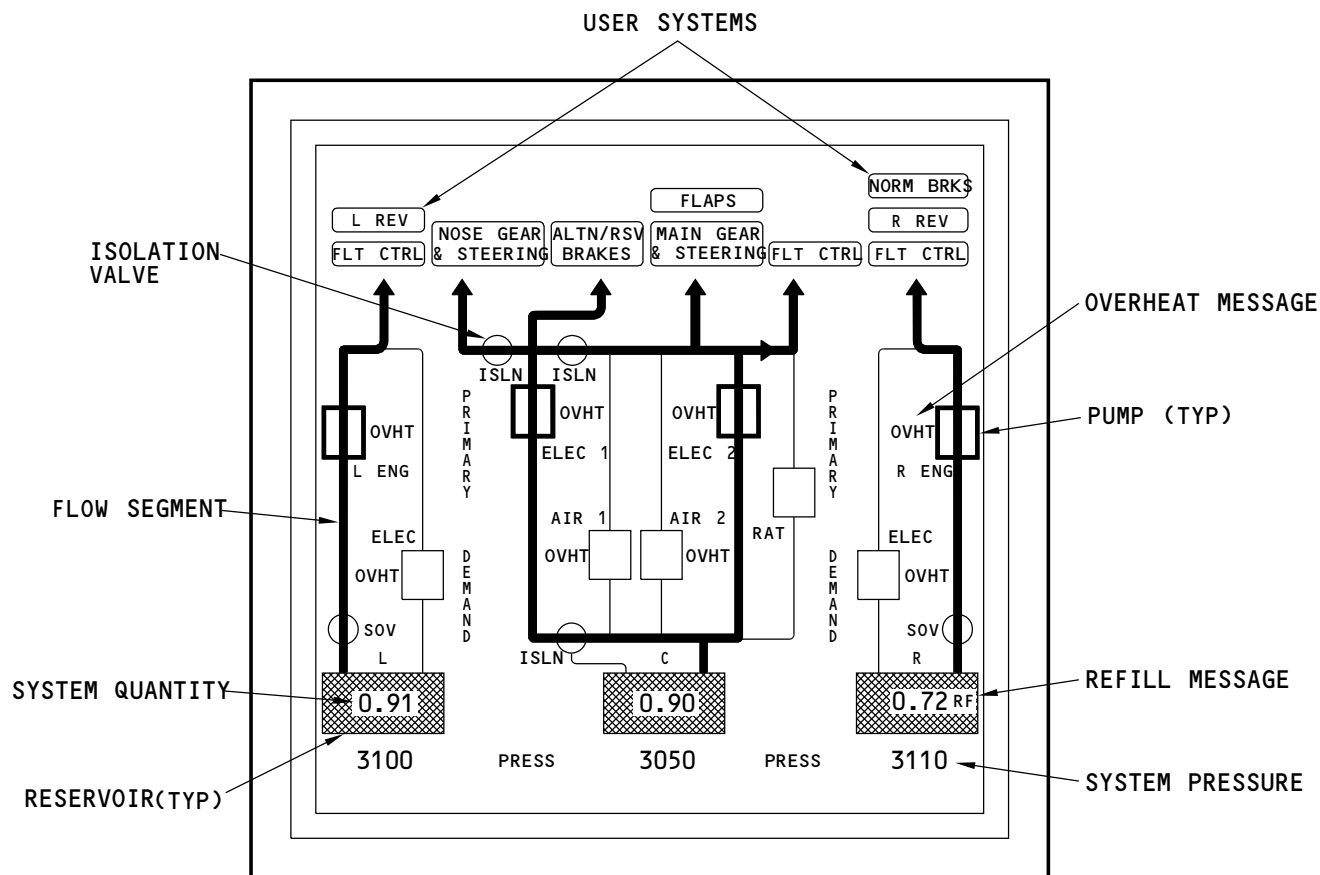
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PRIMARY DISPLAY SYSTEM - HYDRAULIC SYNOPTIC

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**PRIMARY DISPLAY SYSTEM - ELECTRICAL SYNOPTIC****General**

The electrical synoptic shows:

- Bus information
- Bus tie breakers position
- Power flow
- Generator drive status and control
- Backup generator status
- Battery information.

Bus information

Buses show as a legend in an oval symbol. For invalid conditions, the symbols and legends are white. For unpowered conditions, the symbols and legends are amber. With power applied, the symbols and legends are green.

Bus Tie Breakers

The bus tie breaker symbol is circuit breaker with two circular contacts. During normal operation the symbol is white when the breaker is open and green when the breaker is closed. When the breaker is isolated and the bus tie is commanded closed or tripped, the symbol is amber. During these conditions an amber isolation message (ISLN) shows also.

Power Flow

Power flow shows as green segments.

Power sources show as green boxes when power is available and as white boxes when power is not available. Logic equations determine which flow segments show.

Generator Drive and Control

The generator symbols have four conditions. The drive on symbol is a green box. The drive off and drive invalid symbols are white boxes. The drive failed symbol is an amber box with an X.

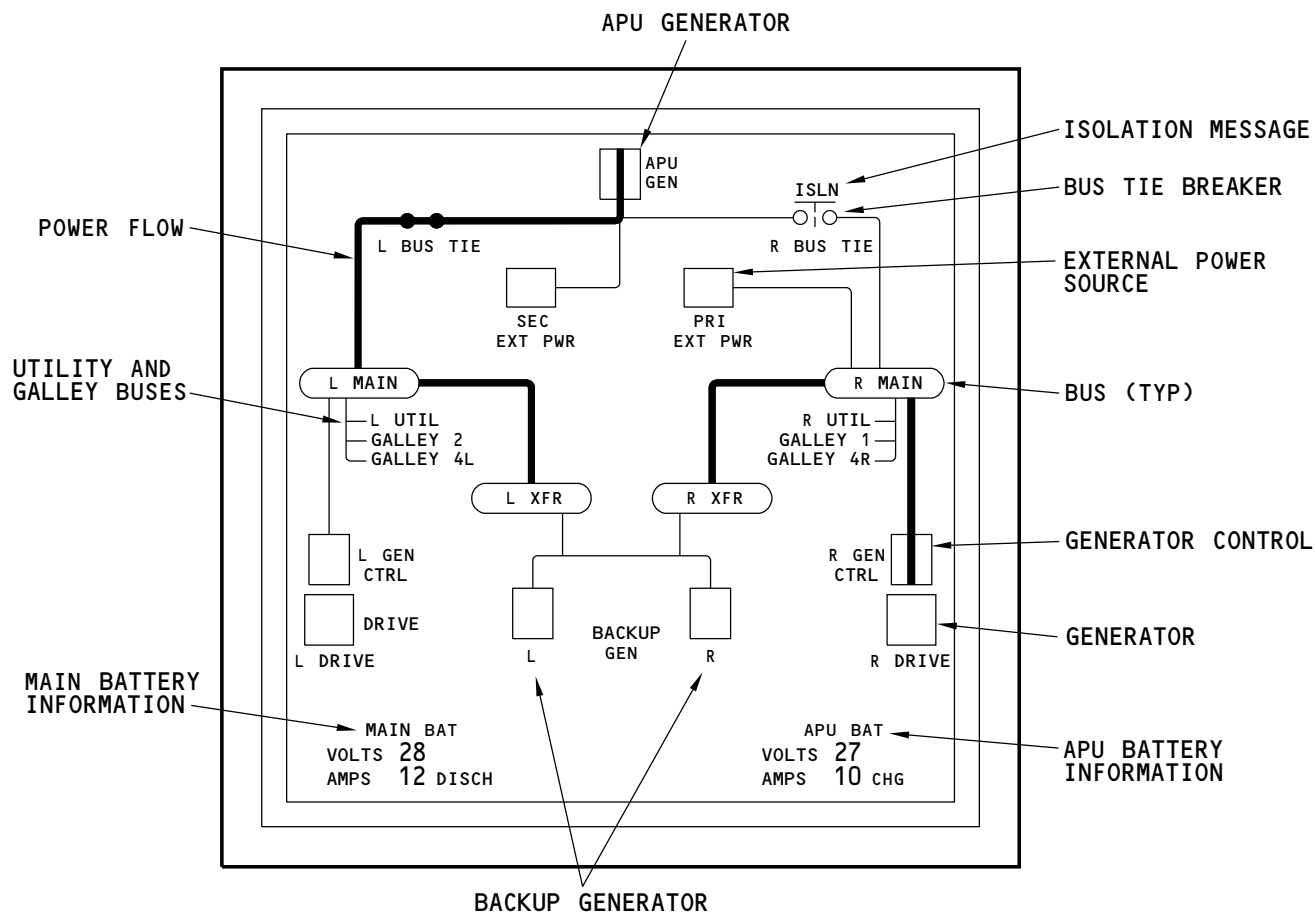
The generator control symbols have four conditions. The generator control breaker open and breaker invalid symbols are white boxes. The breaker closed symbol is a green box. The breaker failed symbol is an amber box with an X.

Backup Generator

The symbols for the backup generators are the same as the left and right generators.

Battery Information

Voltage, current, and battery charge status show for the main battery, and the APU battery.



PRIMARY DISPLAY SYSTEM - ELECTRICAL SYNOPTIC

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**PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGES OVERVIEW****General**

There are 18 system maintenance pages. The maintenance pages supply information that is useful in the analysis and repair of airplane systems.

You can select and see maintenance pages any time the airplane is on the ground or any time the airplane is above ten thousand feet.

The information shows in real time or as a snapshot (manual event or auto event). Snapshots occur automatically when individual systems exceed established parameters. The operator can print or downlink the maintenance pages to ground stations.

You can also take a manual snapshot of all the maintenance pages or of individual maintenance pages.

Maintenance Page Controls

The MAINT INFO prompt on the left, center, or right CDU gives access to the maintenance info display menu on the multifunction display (MFD). The MAINT DATA PGS menu option gives access to the maintenance pages on the MFD. You use the display select panel and the display switching panels to show the maintenance page display selection menu on the lower center, left inboard, or right inboard display units.

The EICAS event record switch on the center display control panel lets the operator take a manual snapshot of all the applicable maintenance pages at the same time. A snapshot is a picture of a maintenance page frozen in time.

You use the cursor control device to control more menu selections. Move your finger on the CCD touchpad to move the cursor symbol on the display. When the cursor is over the desired selection, use the cursor activation switch to make the selection. Each corner of the CCD touchpad has a "hot spot". This causes the cursor to go to the related corner of the display. This gives you quick access to frequently used menu selections.

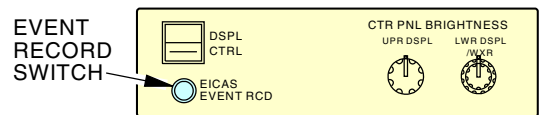
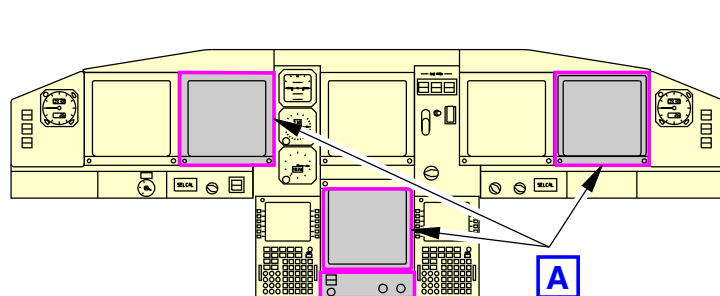
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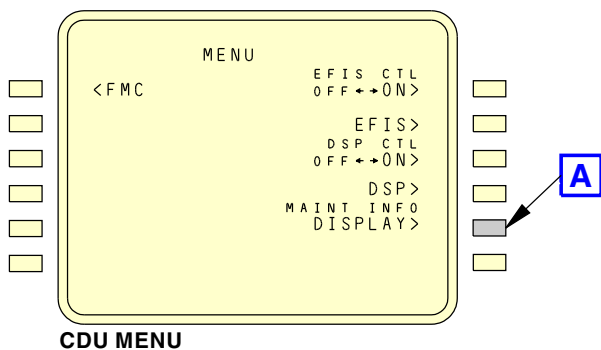
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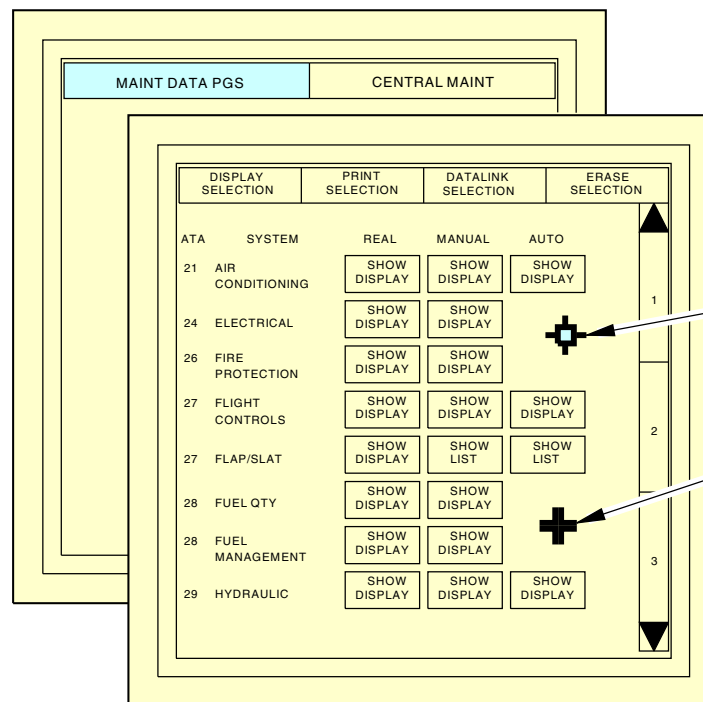
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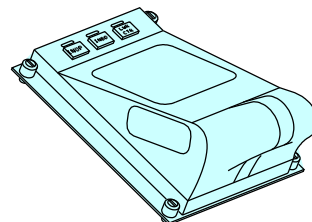
CENTER DISPLAY CONTROL PANEL



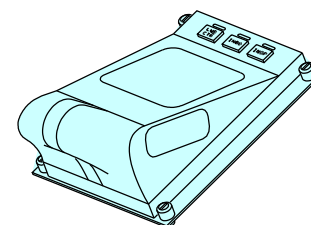
CDU MENU



MAINTENANCE PAGE DISPLAY MENU (MFD)



LEFT CURSOR CONTROL DEVICE



RIGHT CURSOR CONTROL DEVICE

2518772 S0000591590_V1

PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGES OVERVIEW

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE MAIN MENU BAR SELECTIONS

General

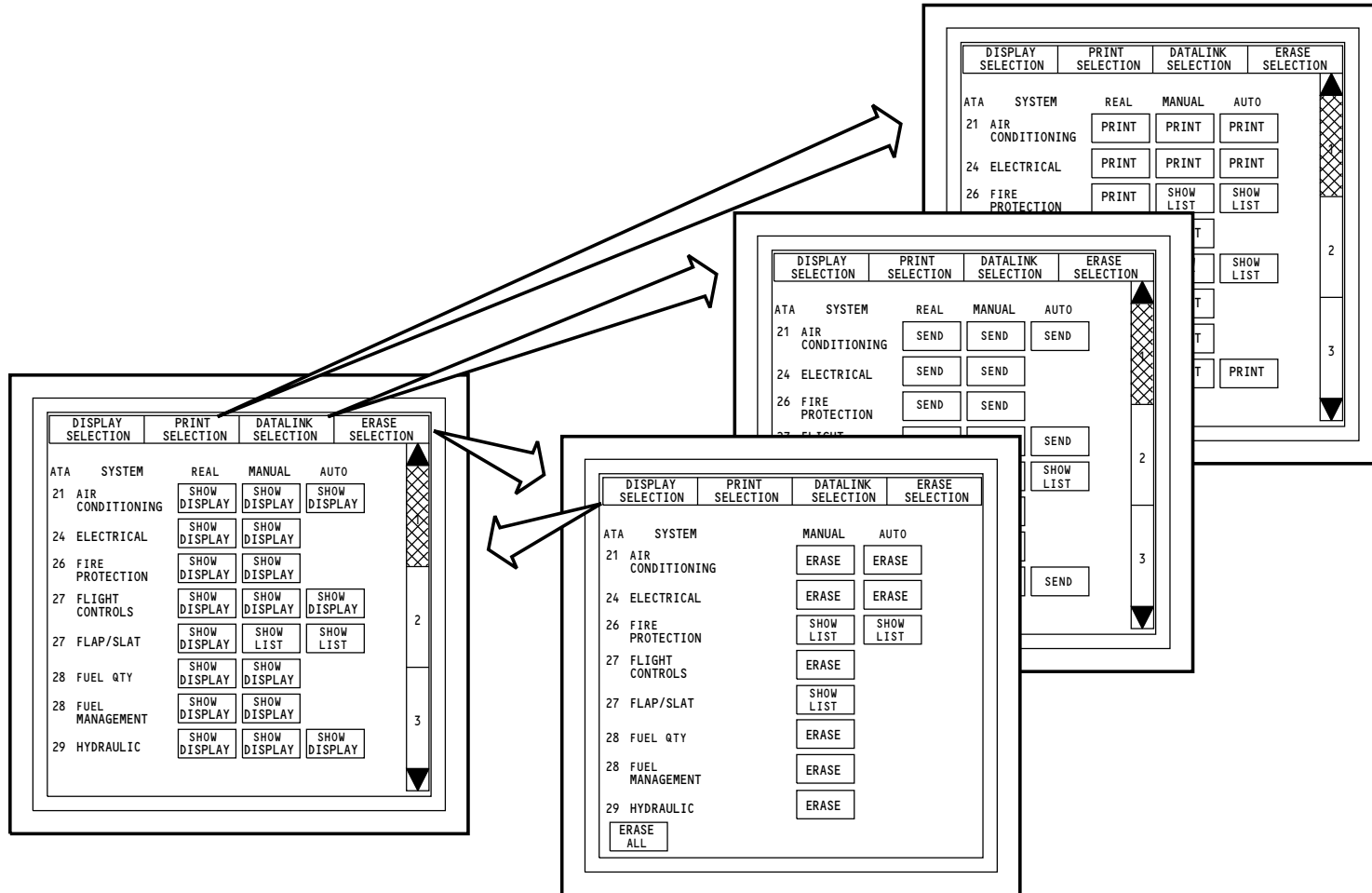
The main menu bar lets the operator choose a specific function and move from one function to another. The functions available are:

- DISPLAY SELECTION - This prompt lets the operator show real time or existing, manual snapshots, or auto snapshots of maintenance pages.
- PRINT SELECTION - This prompt lets the operator print real time or existing, manual snapshots, or auto snapshots of maintenance pages.
- DATA LINK SELECTION - This prompt lets the operator downlink real time or existing, manual snapshots, or auto snapshots of maintenance pages.
- ERASE SELECTION - This prompt lets the operator erase manual or auto snapshots of maintenance pages.

After a selection, the main menu function highlights.

The maintenance pages are in ATA sequence on all the menu pages. For the ERASE function, only those ATAs with manual or auto snapshots in memory show.

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE MAIN MENU BAR SELECTIONS



PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE DISPLAY SELECTION MENUS

General

The DISPLAY menu gives access when you select a maintenance page to real time information, auto snapshots, and manual snapshots. These are the display selections:

- SHOW DISPLAY - This selection shows the real time display of the maintenance page. It also shows a single auto or manual snapshot in memory
- SHOW LIST - This selection shows if there is more than one auto or manual snapshot in memory.

A blank area next to any selection means there are no selections for that maintenance page.

Maintenance Page Selections

There are three pages of maintenance page selections. They show in ATA sequence. A scroll bar at the right of the display lets the operator select the appropriate menu page. A highlight shows around the applicable page number. These are the selections:

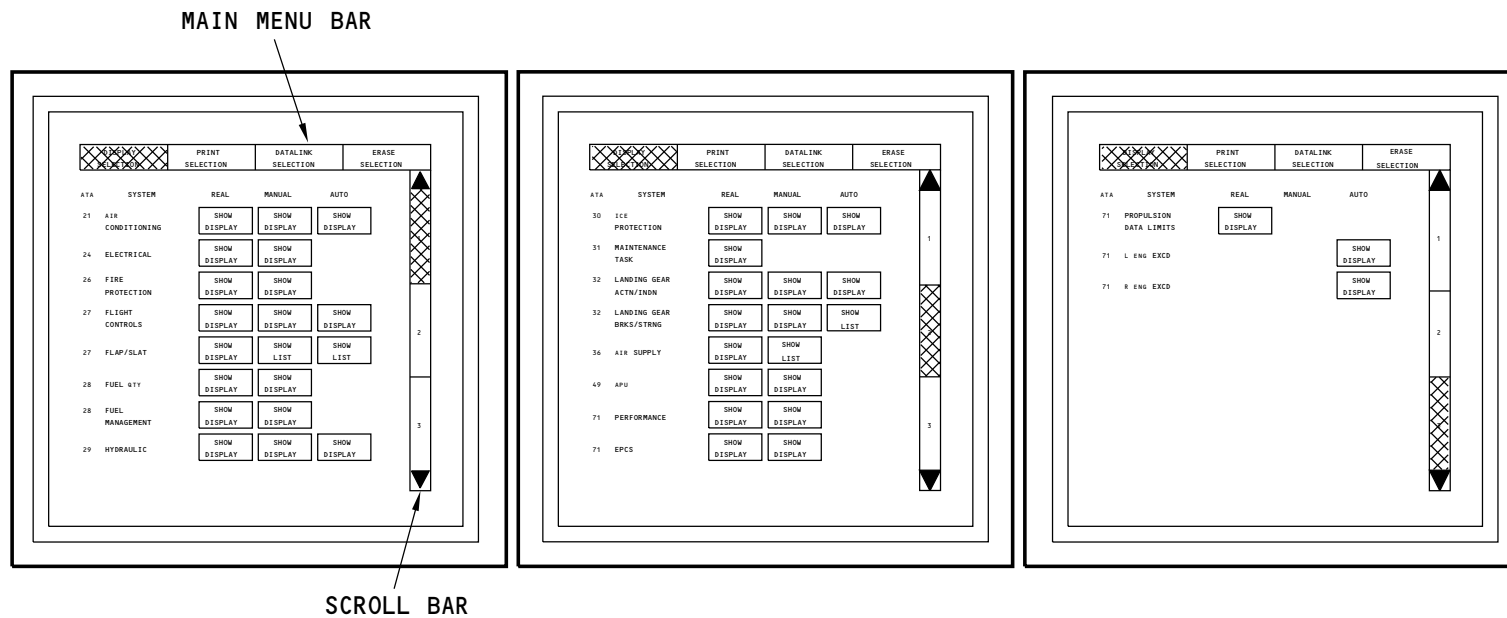
- 21 AIR CONDITIONING
- 24 ELECTRICAL
- 26 FIRE PROTECTION
- 27 FLIGHT CONTROLS
- 27 FLAP/SLAT
- 28 FUEL QUANTITY
- 28 FUEL MANAGEMENT
- 29 HYDRAULIC
- 30 ICE PROTECTION
- 31 MAINTENANCE TASK
- 32 LANDING GEAR ACTUATION/INDICATION
- 32 LANDING GEAR BRAKES/STEERING
- 36 AIR SUPPLY
- 49 APU

- 71 PERFORMANCE
- 71 EPCS
- 71 PROPULSION DATA LIMITS
- 71 LEFT ENGINE EXCEEDANCE
- 71 RIGHT ENGINE EXCEEDANCE.

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE DISPLAY SELECTION MENUS

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE AUTO AND MANUAL EVENT MENU PAGES

General

The SHOW DISPLAY prompt shows next to the maintenance page in the applicable column when one manual or auto snapshot is in memory.

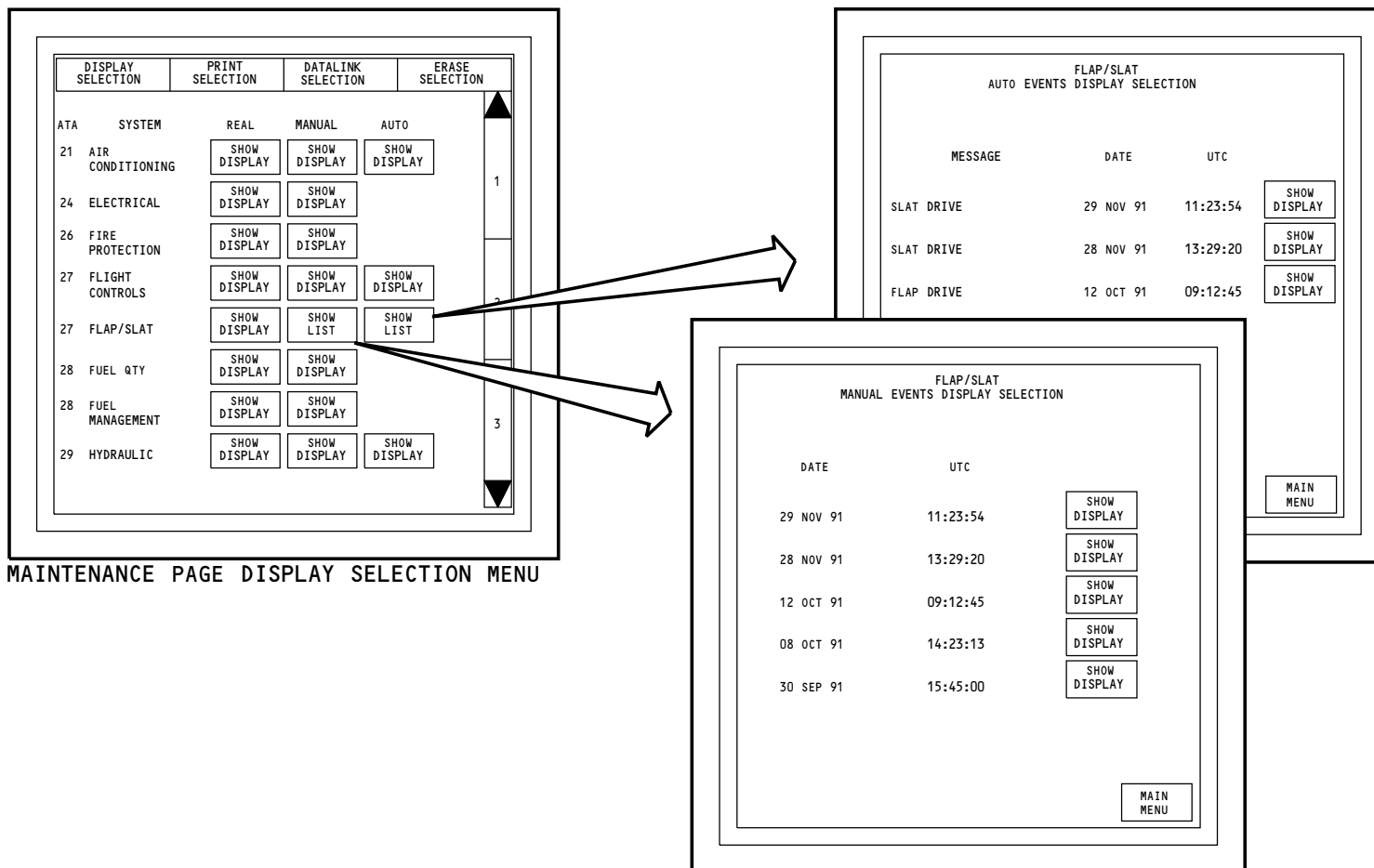
The SHOW LIST prompt shows next to the maintenance page when there is more than one manual or auto snapshots for that system.

The selection of the SHOW LIST prompt causes a menu to show that lists the snapshots that are in memory. AIMS stores up to five manual snapshots and five auto snapshots for each system. The menu page shows the maintenance page category at the top and the date and time of each snapshot. The auto event menu page also shows the associated auto event message.

The SHOW DISPLAY prompt causes the maintenance page in memory to show on the display unit.

The MAIN MENU prompt at the bottom-right returns the operator to the DISPLAY SELECTION menu.

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MAINTENANCE PAGE DISPLAY SELECTION MENU

PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE AUTO AND MANUAL EVENT MENU PAGES

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE PRINT MENUS

General

The PRINT SELECTION menu lets the operator print real time displays, manual snapshots, or auto snapshots of the maintenance pages.

A PRINT prompt shows for the real time displays. A PRINT prompt also shows for manual or auto snapshots when one snapshot is in memory.

A SHOW LIST prompt shows when more than one auto or manual snapshot is in memory.

Selection of the SHOW LIST prompt causes a menu page to show that lists the maintenance pages in memory. The PRINT prompt lets the operator print the individual pages.

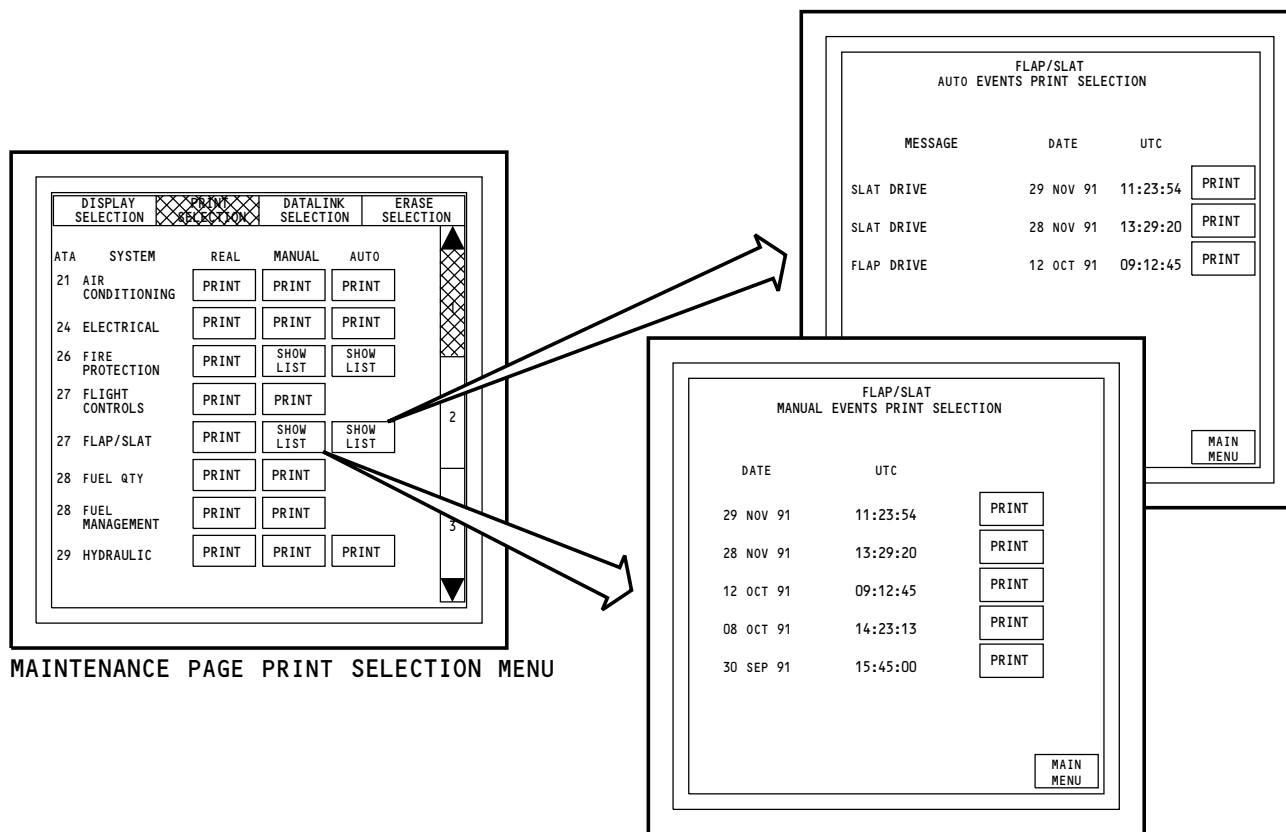
The MAIN MENU prompt returns the operator to the PRINT SELECTION menu page.

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MAINTENANCE PAGE PRINT SELECTION MENU

PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE PRINT MENUS

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE DATALINK MENUS

General

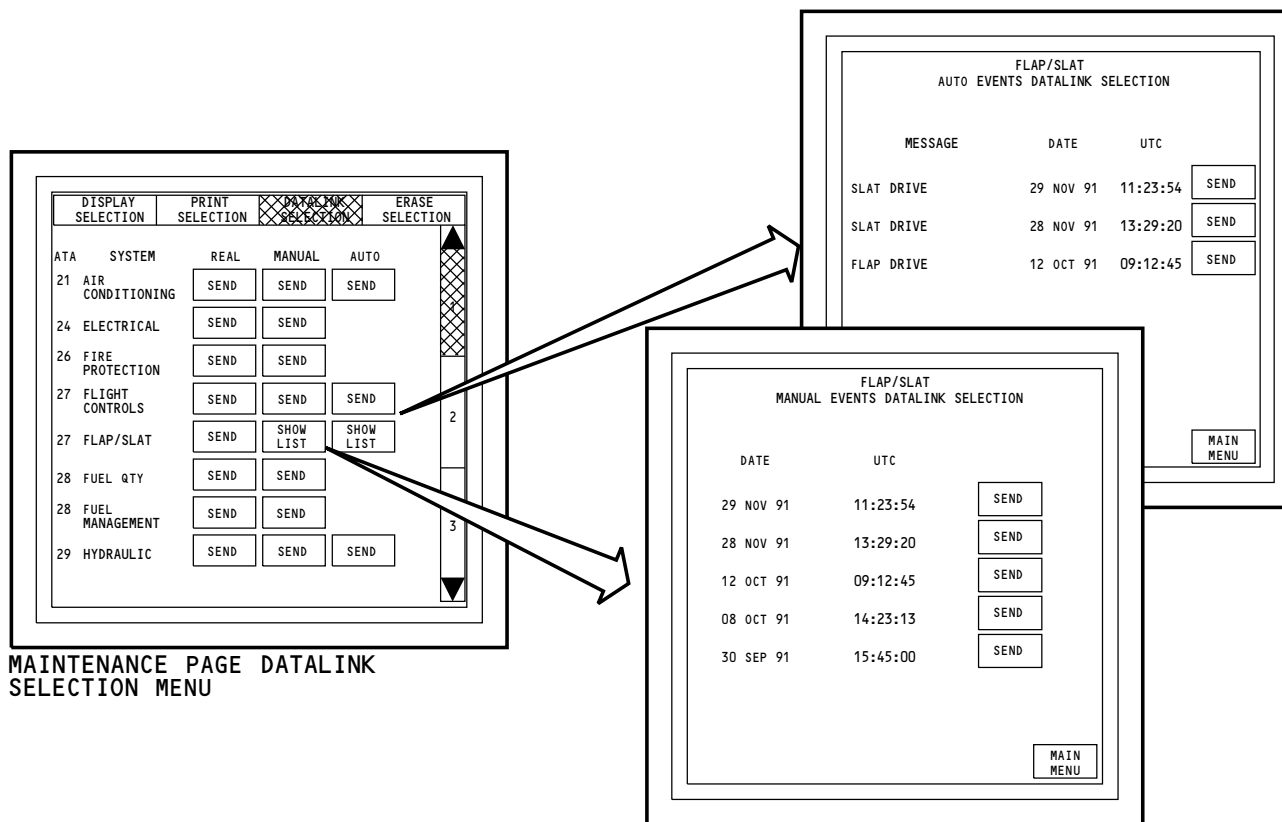
The DATALINK SELECTION menu lets the operator downlink real time displays, manual snapshots or auto snapshots of the maintenance pages.

A SEND prompt shows for the real time displays. A SEND prompt also shows for manual or auto snapshots when one snapshot is in memory.

A SHOW LIST prompt shows when more than one auto or manual snapshot is in memory.

Selection of the SHOW LIST prompt causes a menu page to show that lists the maintenance pages in memory. The SEND prompt lets the operator downlink the individual pages.

The MAIN MENU prompt returns the operator to the DATALINK SELECTION menu page.



MAINTENANCE PAGE DATALINK SELECTION MENU

PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE DATALINK MENUS

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE ERASE MENUS

General

The ERASE SELECTION menu lets the operator erase manual and auto snapshots of the maintenance pages. You cannot erase snapshots when the airplane is in the air.

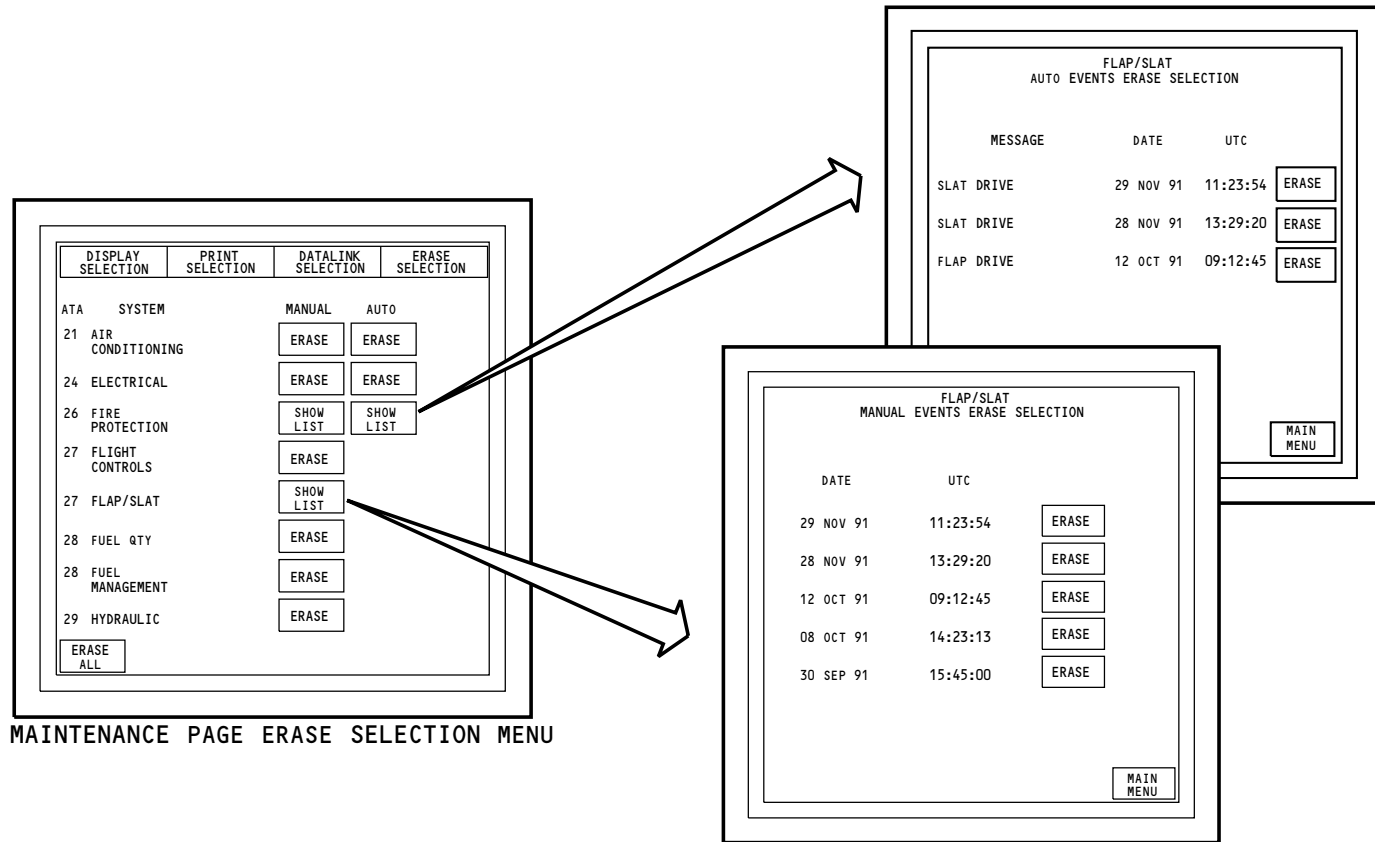
An ERASE prompt shows for maintenance pages when only one manual or one auto snapshot is in memory.

A SHOW LIST prompt shows when more than one auto or manual snapshot is in memory.

Selection of the ERASE ALL prompt erases all manual and auto events (snapshots) stored in non volatile memory.

Selection of the SHOW LIST prompt causes a menu page to show that lists the maintenance pages in memory. The ERASE prompt lets the operator erase the individual pages.

The MAIN MENU prompt returns the operator to the ERASE SELECTION menu page.



PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGE ERASE MENUS

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PRIMARY DISPLAY SYSTEM - INDIVIDUAL MAINTENANCE PAGE MENUS

General

Each maintenance page format except for the maintenance task maintenance page has several possible menu selections. The SHOW PG MENU or the CANCEL PAGE MENU shows in the top left corner of each maintenance page.

The SHOW PG MENU causes several menu selections to show across the bottom of the maintenance page and causes the CANCEL PAGE MENU selection to show at the top left of the display.

The CANCEL PAGE MENU causes the menu selections across the bottom of the maintenance page to go away and causes the SHOW PG MENU selection to show at the top left of the display.

The menu functions are available for real time, auto, or manual snapshot displays.

These are the commands that show across the bottom of the display:

- SEND - This selection lets the operator downlink the maintenance page that shows
- PRINT - This selection lets the operator print the maintenance page that shows
- ERASE - This selection lets the operator erase the manual or auto event for maintenance page that shows. This selection does not show for a real time format
- RECORD - This selection lets the operator take a manual snapshot of the maintenance page that shows (real time only)
- NEXT PAGE and PREV PAGE - This selection lets the operator page through a sequence of pages for systems that have more than one page format
- PREV MENU - This selection lets the operator return to MANUAL (AUTO) EVENT SELECTION page for the maintenance page that shows if they were accessed by the MANUAL (AUTO) EVENT SELECTION menu pages
- MAIN MENU - The selection lets the operator return to the DISPLAY SELECTION menu page. This selection is available on the maintenance task maintenance page.

Training Information Point

The ATA that shows can have more than one page. These command buttons will cause the selected action on all pages of the ATA:

- SEND
- PRINT
- ERASE
- RECORD.

EFFECTIVITY	
ARO ALL	

SHOW
PG MENU

ELECTRICAL PG 1/2

	L IDG	R IDG	APU GEN	PRI EXT PWR	SEC EXT PWR	BACKUP CONV	RAT GEN
AC-V	115	115	0	115	115	0	0
FREQ	400	400	0	400	400	0	0
LOAD	0.50	0.40	00.0	0.00	0.00	0.00	0.00

	MAIN BAT	L TRU	C1 TRU	C2 TRU	R TRU	APU/BAT
DC-V	27	29	29	29	29	27
DC-A	38 CHG	45	32	8	38	2 DIS

	L IDG	R IDG	L GEN	R GEN	CONV
OUT TEMP	92	93	0	0	70
RISE TEMP	10	12	0	0	--
OIL LEVEL	NORMAL	LOW	NORMAL	NORMAL	--
OIL FILTER	NORMAL	BLOCKED	BLOCKED	NORMAL	--

	L	FBW C	R
DC-V	28	28	28
DC-A	15	15	15

OVERTEMP IDG L
DATE 20 AUG 95 UTC 18:54:04

CANCEL PG MENU SELECTED

CANCEL
PG MENU

ELECTRICAL PG 1/2

	L IDG	R IDG	APU GEN	PRI EXT PWR	SEC EXT PWR	BACKUP CONV	RAT GEN
AC-V	115	115	0	115	115	0	0
FREQ	400	400	0	400	400	0	0
LOAD	0.50	0.40	00.0	0.00	0.00	0.00	0.00

	MAIN BAT	L TRU	C1 TRU	C2 TRU	R TRU	APU/BAT
DC-V	27	29	29	29	29	27
DC-A	38 CHG	45	32	8	38	2 DIS

	L IDG	R IDG	L GEN	R GEN	CONV
OUT TEMP	92	93	0	0	70
RISE TEMP	10	12	0	0	--
OIL LEVEL	NORMAL	LOW	NORMAL	NORMAL	--
OIL FILTER	NORMAL	BLOCKED	BLOCKED	NORMAL	--

	L	FBW C	R
DC-V	28	28	28

OVERTEMP IDG L
DATE 20 AUG 95 UTC 18:54:04

SEND

PRINT

ERASE

RECORD

NEXT
PAGE

MAIN
MENU

SHOW PG MENU SELECTED

PRIMARY DISPLAY SYSTEM - INDIVIDUAL MAINTENANCE PAGE MENUS

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PRIMARY DISPLAY SYSTEM - AIR CONDITIONING MAINTENANCE PAGE

General

The air conditioning maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The title shows the display mode. The title shows as:

- AIR CONDITIONING for the real time mode
- AIR CONDITIONING MAN for the manual event mode
- AIR CONDITIONING AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The air conditioning maintenance page shows environmental control system information. The information includes:

- Zone temperature

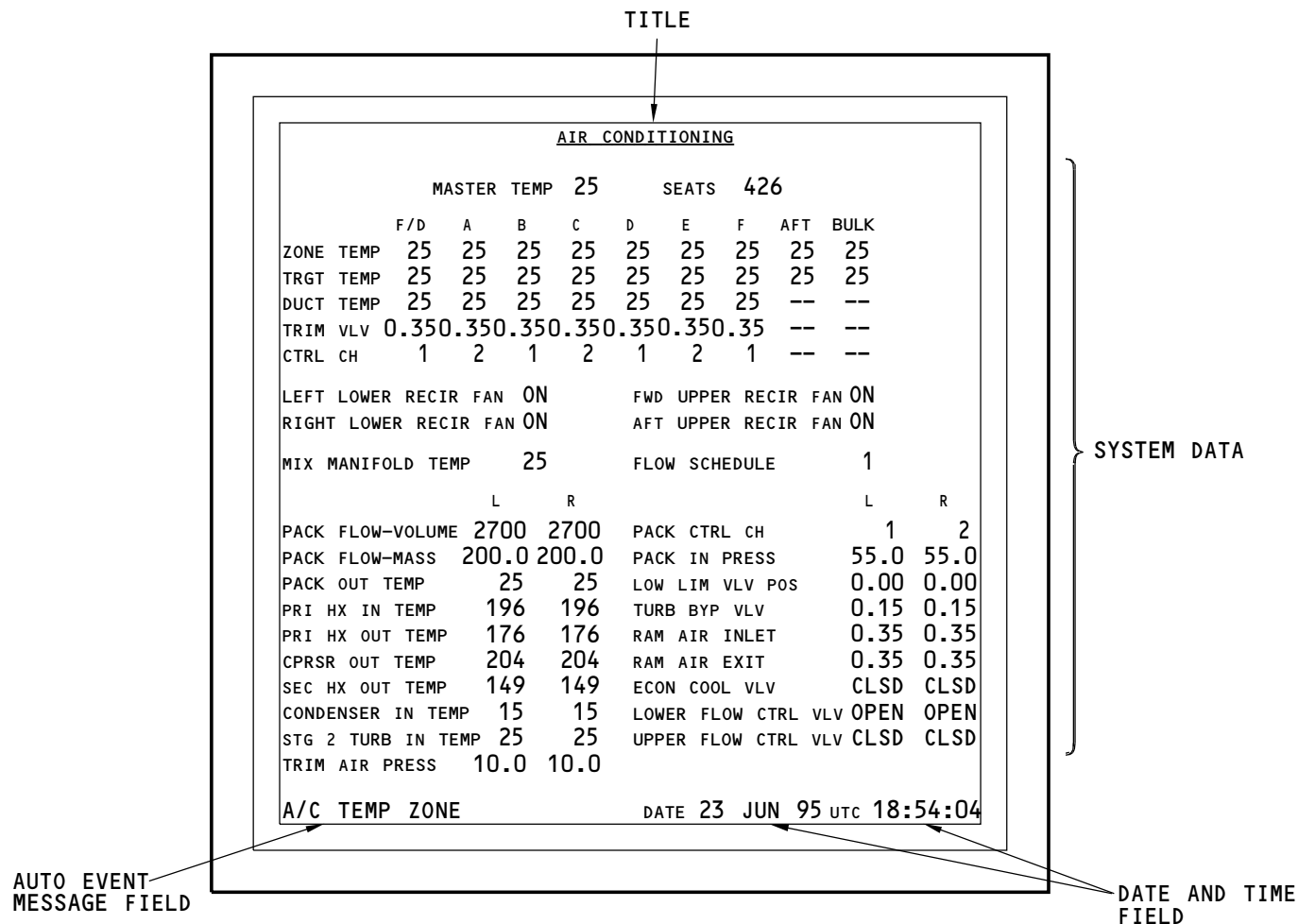
- Target temperature
- Duct temperature
- Trim valve position
- Recirculation fan status
- Trim air pressure
- Pack outlet temperature
- Pack flow
- Turbine bypass valve position
- Ram air inlet/exit positions
- Compressor outlet temperature
- Cabin temperature controller channel in control.

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PRIMARY DISPLAY SYSTEM - AIR CONDITIONING MAINTENANCE PAGE

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PRIMARY DISPLAY SYSTEM - ELECTRICAL MAINTENANCE PAGES

General

There are two electrical maintenance pages. They are available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The titles show the display mode and page number. The titles show as:

- ELECTRICAL PG 1/2 for the real time mode
- ELECTRICAL PG 2/2 for the real time mode
- ELECTRICAL MAN 1/2 for the manual event mode
- ELECTRICAL MAN 2/2 for the manual event mode
- ELECTRICAL AUTO 1/2 for the auto event mode
- ELECTRICAL AUTO 2/2 for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank. The message shows on both pages.

In the auto event mode, the message for the incident shows. The message shows on both pages.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

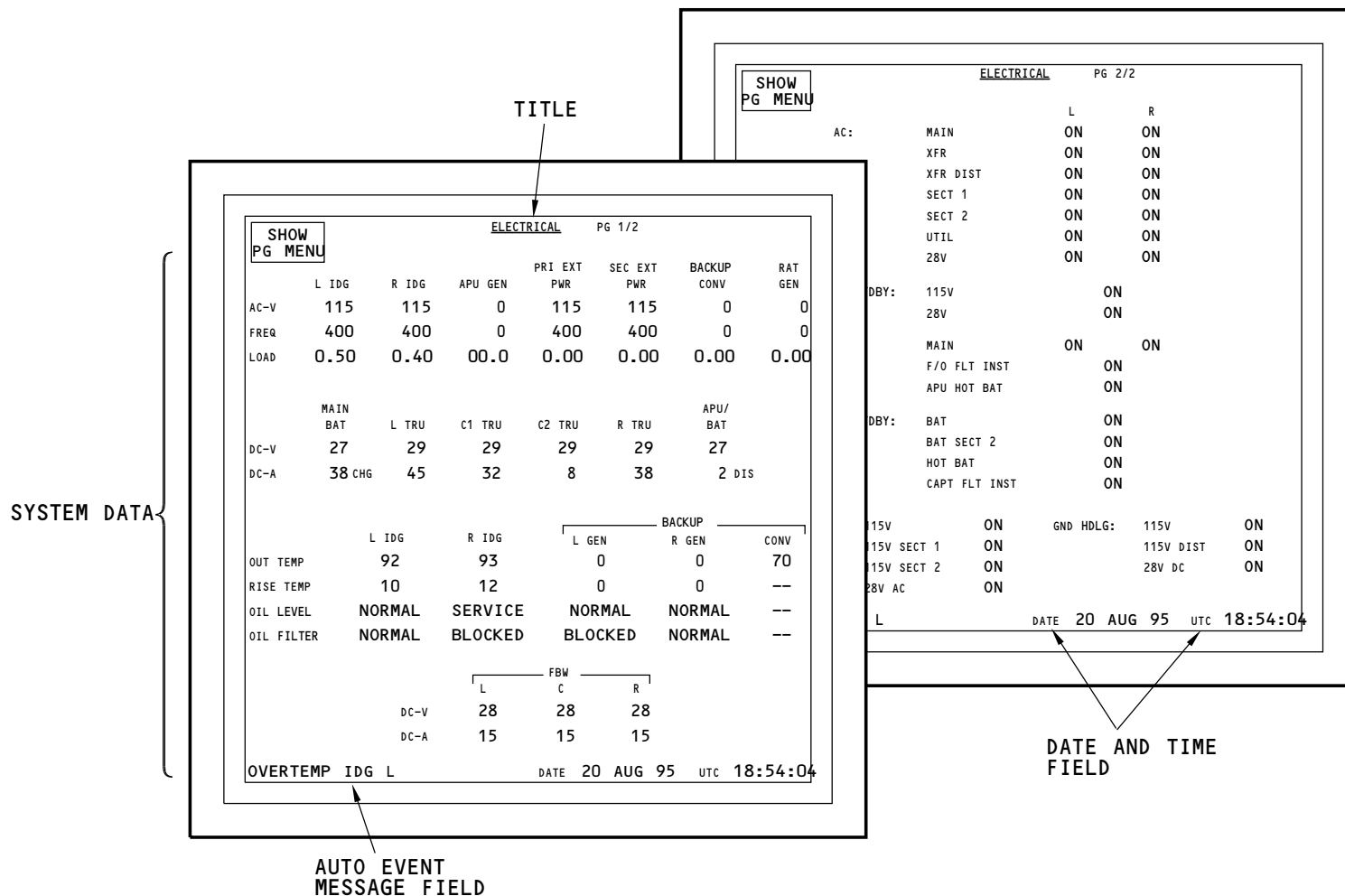
System Data

The information on electrical maintenance page 1/2 includes:

- AC voltage
- AC frequency
- AC load
- DC voltage
- DC amperage
- IDG outlet/rise temperature
- IDG oil and oil filter information
- Fly by wire (FBW) DC system information.

The electrical maintenance page 2/2 has bus status information for the:

- AC buses
- AC standby bus
- DC buses
- DC standby bus
- Ground service bus
- Ground handling bus.



PRIMARY DISPLAY SYSTEM - ELECTRICAL MAINTENANCE PAGES

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PRIMARY DISPLAY SYSTEM - FIRE PROTECTION MAINTENANCE PAGE

General

The fire protection maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The title shows the display mode. The title shows as:

- FIRE PROTECTION for the real time mode
- FIRE PROTECTION MAN for the manual event mode
- FIRE PROTECTION AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

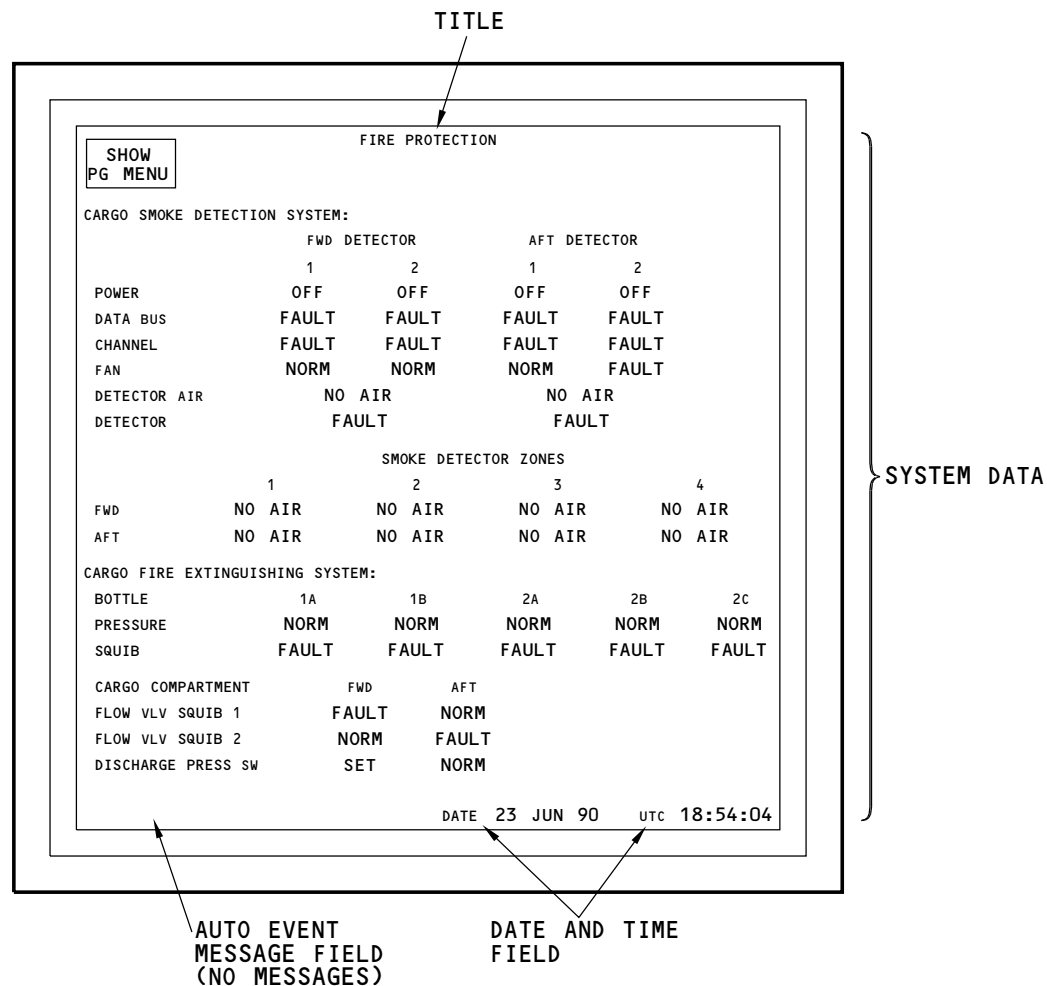
System Data

The fire protection maintenance page shows cargo smoke detection and fire system information. The information includes:

- Forward cargo smoke detection system information

- Aft cargo smoke detection system information
- Smoke detector zones
- Cargo fire system information.

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PRIMARY DISPLAY SYSTEM - FIRE PROTECTION MAINTENANCE PAGE

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PRIMARY DISPLAY SYSTEM - FLIGHT CONTROLS MAINTENANCE PAGES

General

There are three flight control maintenance pages. They are available in three display modes. They are:

- Real time
- Manual event
- Auto event.

Title

The titles show the display mode and page number. The titles show as:

- FLIGHT CONTROL PG 1/3 for the real time mode
- FLIGHT CONTROL PG 2/3 for the real time mode
- FLIGHT CONTROL PG 3/3 for the real time mode
- FLIGHT CONTROL MAN PG 1/3 for the manual event mode
- FLIGHT CONTROL MAN PG 2/3 for the manual event mode
- FLIGHT CONTROL MAN PG 3/3 for the manual event mode
- FLIGHT CONTROL AUTO 1/3 for the auto event mode
- FLIGHT CONTROL AUTO 2/3 for the auto event mode
- FLIGHT CONTROL AUTO 3/3 for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank. The message shows on all pages.

In the auto event mode, the message for the incident shows. The message shows on all pages.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The information on the flight controls maintenance page 1/3 includes:

- Airplane state information (roll, pitch, yaw etc.)
- Column information
- Wheel information
- Pedal information
- Speed brake handle information
- Rudder trim position data
- Column feel data
- Gust suppression data
- Flight mode information.

The information on the flight controls maintenance page 2/3 includes:

- Spoiler position data
- Hydraulic pressure data
- Flaperon position data
- Aileron position data
- Rudder position data
- Elevator position data
- Stab position data.

The information on the flight controls maintenance page 3/3 includes:

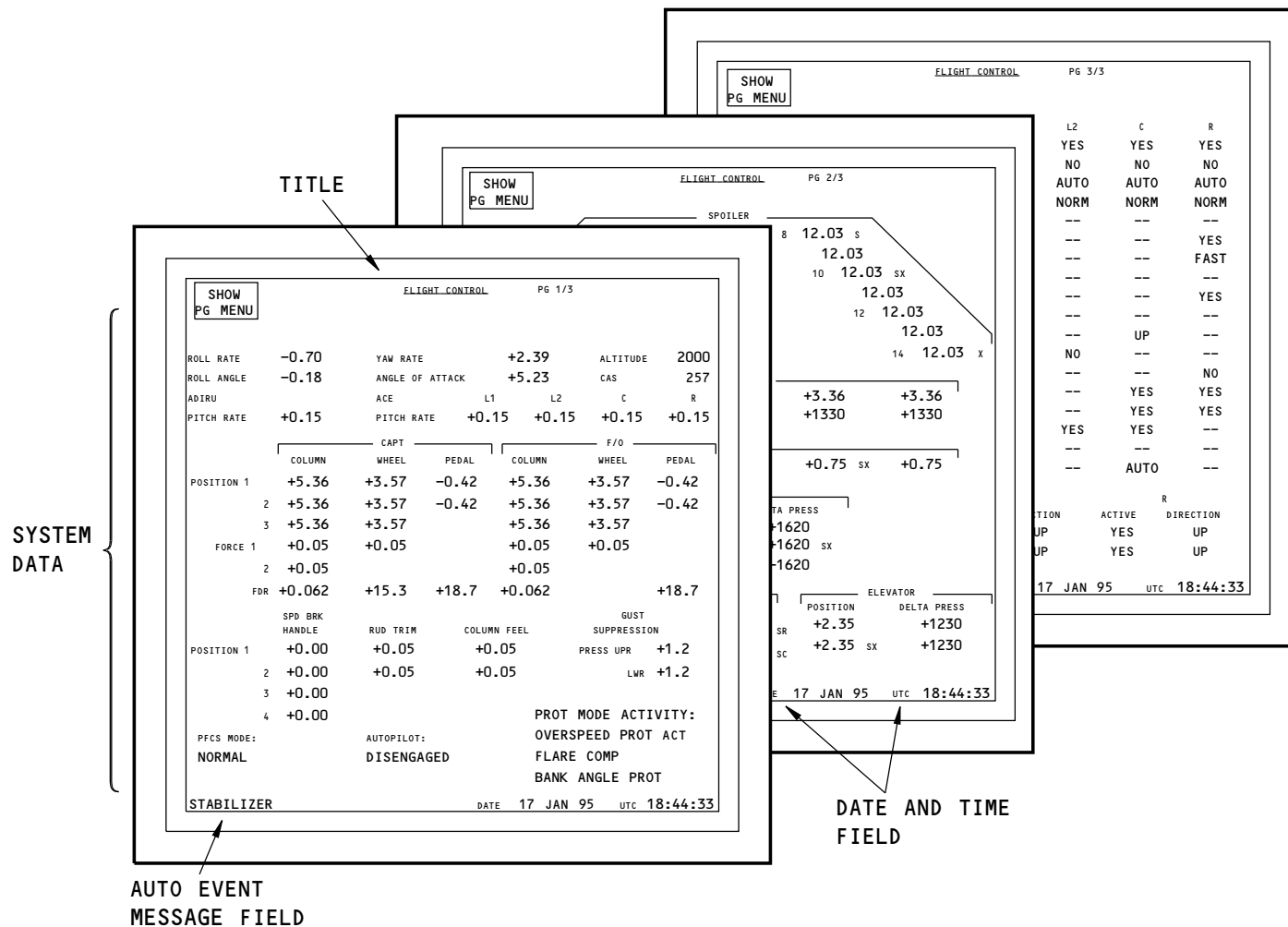
- ACE analog discrete data
- AIMS analog discrete data.

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PRIMARY DISPLAY SYSTEM - FLIGHT CONTROLS MAINTENANCE PAGES

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**PRIMARY DISPLAY SYSTEM - FLAP/SLAT MAINTENANCE PAGE****General**

The flap/slat maintenance page is available in three display modes. They are:

- Real time
- Manual event
- Auto event.

- Flap lever position
- Slat position
- Flap position
- Slat mode and command data
- Flap/slat skew data.

Title

The title shows the display mode. The title shows as:

- FLAP/SLAT for the real time mode
- FLAP/SLAT MAN for the manual event mode
- FLAP/SLAT AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The flap/slat maintenance page shows flight control system information. The information includes:

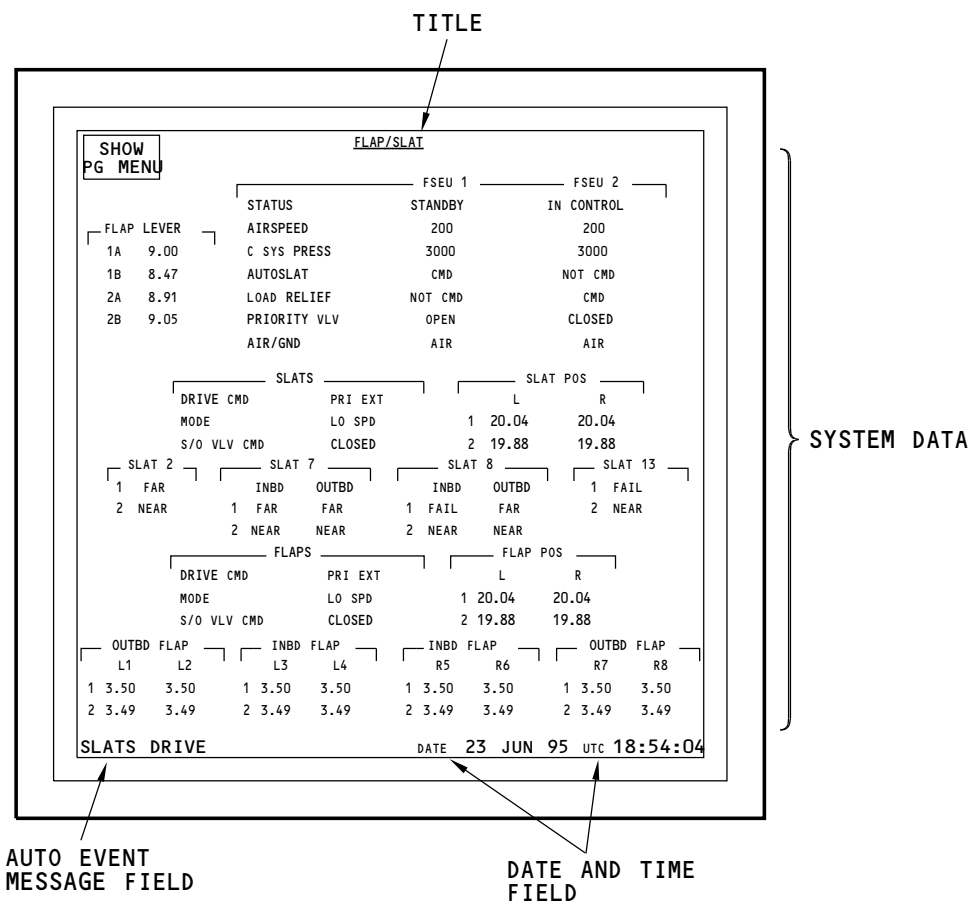
- FSEU status information

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PRIMARY DISPLAY SYSTEM - FLAP/SLAT MAINTENANCE PAGE

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PRIMARY DISPLAY SYSTEM - FUEL QUANTITY MAINTENANCE PAGES

General

There are three fuel quantity maintenance pages. They are available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The titles show the display mode and page number. The titles show as:

- FUEL QTY PG 1/3 for the real time mode
- FUEL QTY PG 2/3 for the real time mode
- FUEL QTY PG 3/3 for the real time mode
- FUEL QTY MAN 1/3 for the manual event mode
- FUEL QTY MAN 2/3 for the manual event mode
- FUEL QTY MAN 3/3 for the manual event mode
- FUEL QTY AUTO 1/3 for the auto event mode
- FUEL QTY AUTO 2/3 for the auto event mode
- FUEL QTY AUTO 3/3 for the auto event mode

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank. The message shows on both pages.

In the auto event mode, the message for the incident shows. The message shows on both pages.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The information on fuel quantity maintenance page 1/3 includes:

- Total fuel data
- Main tank probe data

The information on fuel quantity maintenance page 2/3 includes:

- Total fuel data
- Tank fuel data
- Center tank probe data
- Center tank water data
- Center tank volume top-off data

The information on fuel quantity maintenance page 3/3 includes:

- Total fuel data
- Tank fuel data
- Model check active data
- Max-vol active data
- Pitch and roll data
- Main tank volume top-off data
- Main tank water data

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TITLE

SYSTEM DATA

AUTO EVENT MESSAGE FIELD

FUEL QTY AUTO										PG 1/3	
TOTAL FUEL 210.5										UPLIFT QUANTITY 200.6	
TEMP +20C										UPLIFT DENSITY 6.600	
U.S. STANDARD UNITS											
L MAIN						R MAIN					
HEIGHT	VOS	HEIGHT	VOS	HEIGHT	VOS	HEIGHT	VOS	HEIGHT	VOS	HEIGHT	VOS
1 48.4	4300	15 25.2	4300	1 48.4	4300	15 25.2	4300	1 48.4	4300	15 25.2	4300
2 45.9	4300	16 19.8	4300	2 45.9	4300	16 19.8	4300	2 45.9	4300	16 19.8	4300
3 31.5	4300	17 18.4	4300	3 31.5	4300	17 18.4	4300	3 31.5	4300	17 18.4	4300
4 38.9	4300	18 17.9	4300	4 38.9	4300	18 17.9	4300	4 38.9	4300	18 17.9	4300
5 31.3	4300	19 16.0	4300	5 31.3	4300	19 16.0	4300	5 31.3	4300	19 16.0	4300
6 34.6	4300	20 16.0	4300	6 34.6	4300	20 16.0	4300	6 34.6	4300	20 16.0	4300
7 31.3	4300	21 15.9	4300	7 31.3	4300	21 15.9	4300	7 31.3	4300	21 15.9	4300
8 27.9	4300	22 15.7	4300	8 27.9	4300	22 15.7	4300	8 27.9	4300	22 15.7	4300
9 25.0	4300	23 14.9	4300	9 25.0	4300	23 14.9	4300	9 25.0	4300	23 14.9	4300
10 23.8	4300	24 13.5	4300	10 23.8	4300	24 13.5	4300	10 23.8	4300	24 13.5	4300
11 48.4	4300	25 25.2	4300	11 48.4	4300	25 25.2	4300	11 48.4	4300	25 25.2	4300
12 45.9	4300	26 19.8	4300	12 45.9	4300	26 19.8	4300	12 45.9	4300	26 19.8	4300
13 31.5	4300	27 18.4	4300	13 31.5	4300	27 18.4	4300	13 31.5	4300	27 18.4	4300
14 38.9	4300	28 17.9	4300	14 38.9	4300	28 17.9	4300	14 38.9	4300	28 17.9	4300
LOW FUEL										DATE 23 JUN 90 UTC 18:54:04	

U78534 S0000217729_V1

PRIMARY DISPLAY SYSTEM - FUEL QUANTITY MAINTENANCE PAGES

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FUEL QTY AUTO PG 2/3

TOTAL FUEL 210.5
TEMP +20C

UPLIFT QUANTITY 200.6
UPLIFT DENSITY 6.600

US STANDARD UNITS

		L MAIN		CTR	R MAIN	
QUANTITY		66.3		71.5		66.3
DENSITY		6.600		6.600		6.600

CENTER L

	HEIGHT	VOS		HEIGHT	VOS
1	48.4	4300	6	25.2	4300
2	45.9	4300	7	19.8	4300
3	31.5	4300	8	18.4	4300
4	38.9	4300	9	17.9	4300
5	31.3	4300	10	16.0	4300

CENTER R

	HEIGHT	VOS		HEIGHT	VOS
1	48.4	4300	6	25.2	4300
2	45.9	4300	7	19.8	4300
3	31.5	4300	8	18.4	4300
4	38.9	4300	9	17.9	4300
5	31.3	4300	10	16.0	4300

CENTER TANK WATER L
CENTER TANK VTO SET 26640

CENTER TANK WATER R

LOW FUEL

DATE 23 JUN 90

UTC 18:54:04

DATE AND
TIME FIELD

PRIMARY DISPLAY SYSTEM - FUEL QUANTITY MAINTENANCE PAGES

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FUEL QTY		AUTO		PG 3/3	
TOTAL FUEL		210.5		UPLIFT QUANTITY 200.6	
TEMP +20c				UPLIFT DENSITY 6.600	
US STANDARD UNITS					
	L MAIN	CTR	R MAIN		
QUANTITY	66.3	71.5	66.3		
DENSITY	6.600	6.600	6.600		
MODEL CHECK ACTIVE		1000			
MAX-VOL ACTIVE		10			
PITCH		-4.0			
ROLL		+7.0			
L MAIN VTO SET		9290		R MAIN VTO SET 9290	
L MAIN WATER				R MAIN WATER	
LOW FUEL		DATE 23 JUN 90		UTC 18:54:04	

DATE AND
TIME FIELD

PRIMARY DISPLAY SYSTEM - FUEL QUANTITY MAINTENANCE PAGES

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**PRIMARY DISPLAY SYSTEM - FUEL MANAGEMENT MAINTENANCE PAGE****General**

The fuel management maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The title shows the display mode. The title shows as:

- FUEL MANAGEMENT for the real time mode
- FUEL MANAGEMENT MAN for the manual event mode
- FUEL MANAGEMENT AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The fuel management maintenance page shows fuel system information. The information includes:

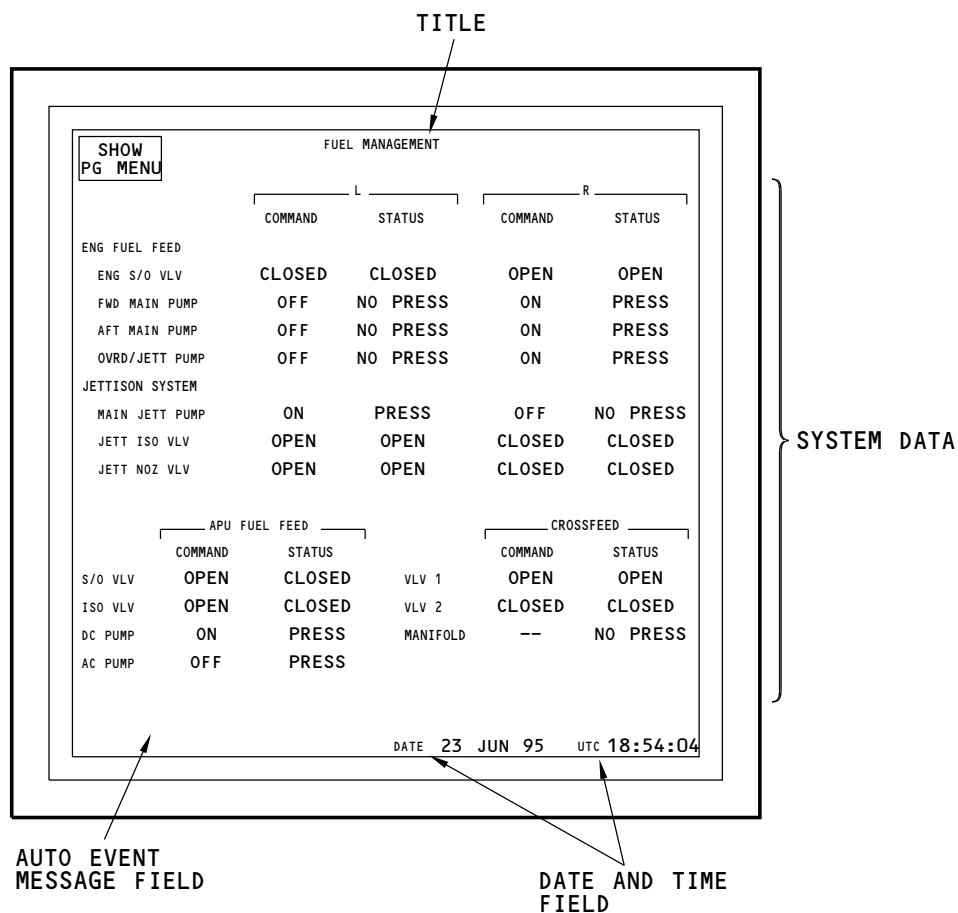
- Actual and commanded positions for engine fuel feed components

- Actual and commanded positions for jettison system components
- Actual and commanded positions for APU fuel feed components
- Actual and commanded positions for crossfeed components.

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PRIMARY DISPLAY SYSTEM - FUEL MANAGEMENT MAINTENANCE PAGE

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**PRIMARY DISPLAY SYSTEM - HYDRAULIC MAINTENANCE PAGE****General**

The hydraulic maintenance page is available in these three display modes:

- Real time
 - Manual event
 - Auto event.
- Demand pump pressure, temperature, and status
 - Rat pump pressure, temperature, and status
 - Isolation valve position.

Title

The title shows the display mode. The title shows as:

- HYDRAULIC for the real time mode
- HYDRAULIC MAN for the manual event mode
- HYDRAULIC AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The hydraulic maintenance page includes:

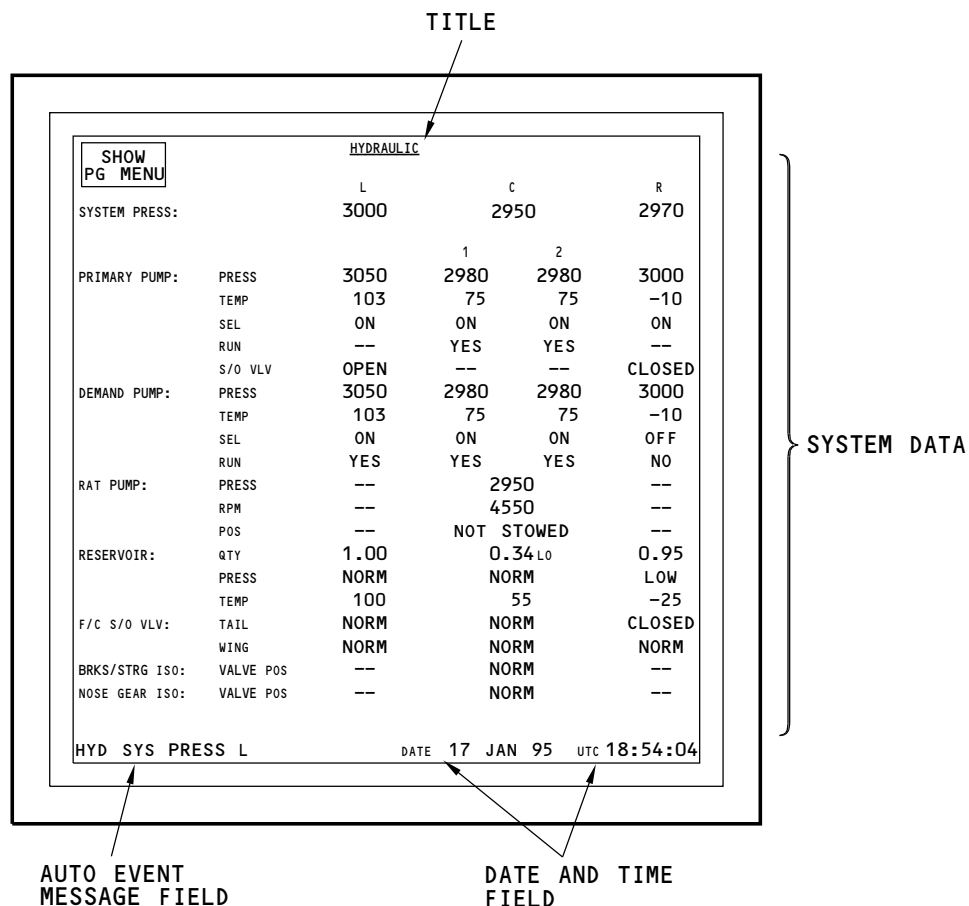
- Hydraulic system quantity
- Hydraulic system pressure
- Primary pump pressure, temperature, and status

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PRIMARY DISPLAY SYSTEM - HYDRAULIC MAINTENANCE PAGE

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PRIMARY DISPLAY SYSTEM - ICE PROTECTION MAINTENANCE PAGE

General

The ice protection maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The title shows the display mode. These are the titles:

- ICE PROTECTION for the real time mode
- ICE PROTECTION MAN for the manual event mode
- ICE PROTECTION AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

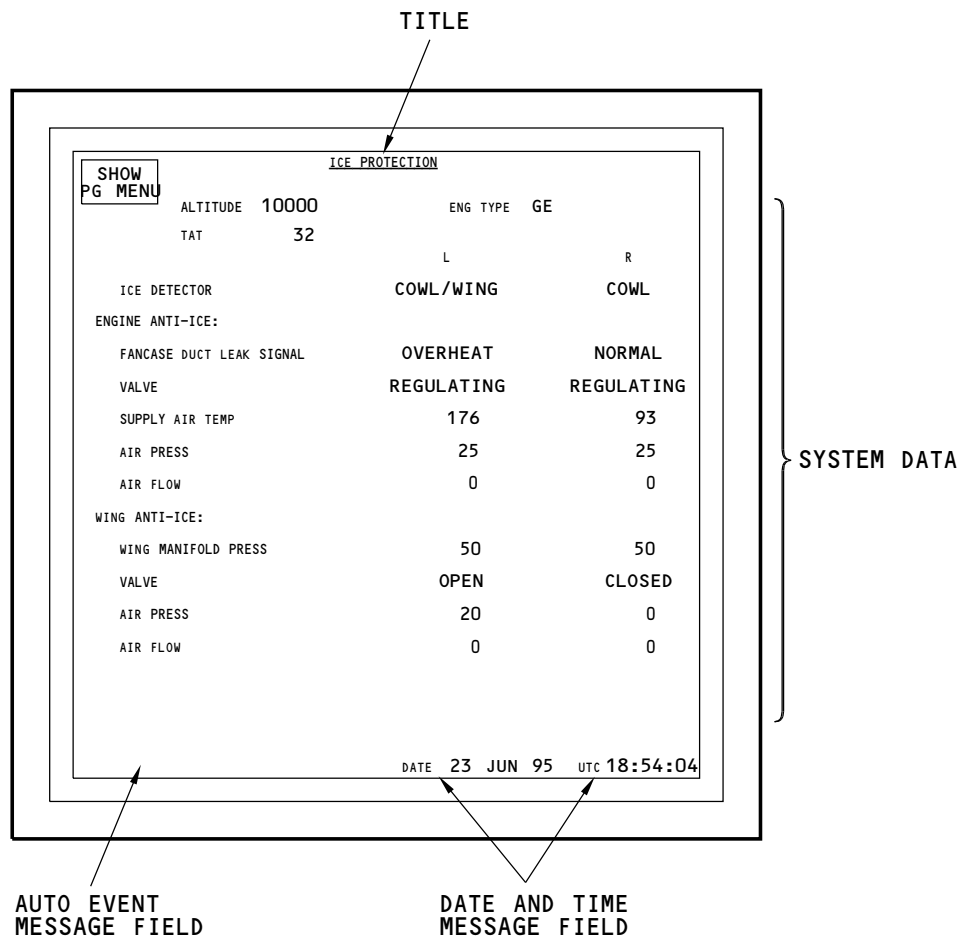
The ice protection maintenance page shows this engine and wing anti-ice system information:

- Airplane altitude

- Total air temperature
- Engine type
- Engine anti-ice system valve positions, pressure, and flow
- Wing anti-ice system valve positions, pressure, and flow.

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PRIMARY DISPLAY SYSTEM - ICE PROTECTION MAINTENANCE PAGE

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**PRIMARY DISPLAY SYSTEM - MAINTENANCE TASK MAINTENANCE PAGE****General**

The maintenance task maintenance page is unique. The page has these functions:

- Erase latched status messages
- View and erase scheduled maintenance task (SMT) messages
- Control the electronic checklist.

Use the cursor control device to clear, enable or disable any of the functions.

The MAIN MENU command at the top left causes the maintenance page DISPLAY SELECTION menu to show.

Erasable Latched Status Messages

This window shows status messages whose activation conditions are no longer true but are latched in AIMS nonvolatile memory (NVM). The messages show in the order in which they were latched in NVM. The window shows a maximum of three messages. When three messages or less show, the page number shows 1/1. When more than one page of messages exist, the PAGE command shows. The page number then shows the total number of pages. Use the PAGE command to get to the other pages of messages. The messages page in a circular way. When you return to the first page of messages from the last pages of messages, the messages update and the page number updates. The initial selection of this maintenance page always causes the first page of messages to show.

The ERASE command clears the message from NVM and removes the message from the display.

The ERASE function does not operate when the airplane is in the air.

SMT Message Functions

This window shows the active SMT messages whose activation conditions are true or are latched in NVM. The messages show in the order they were latched in NVM. The window shows a maximum of three messages. Use the PAGE command when more than three messages exist. (PAGE operation identical to latched status message function).

The ERASE command shows to the right of messages latched in NVM. Activation of the command clears the message from NVM and removes the message from the display. Not all SMT messages latch in NVM.

The ERASE function does not operate when the airplane is in the air.

Checklist Function

Each selection of the ENABLE/DISABLE button causes the message to toggle between [ENABLE] and [DISABLE]. This selection enables or disables the electronic checklist function. The current checklist condition shows next to the STATUS prompt. The system stores the message in non-volatile memory so that the condition remains when you put power back on the airplane.

The initial software load in the graphics generators cause the function to be ENABLED.

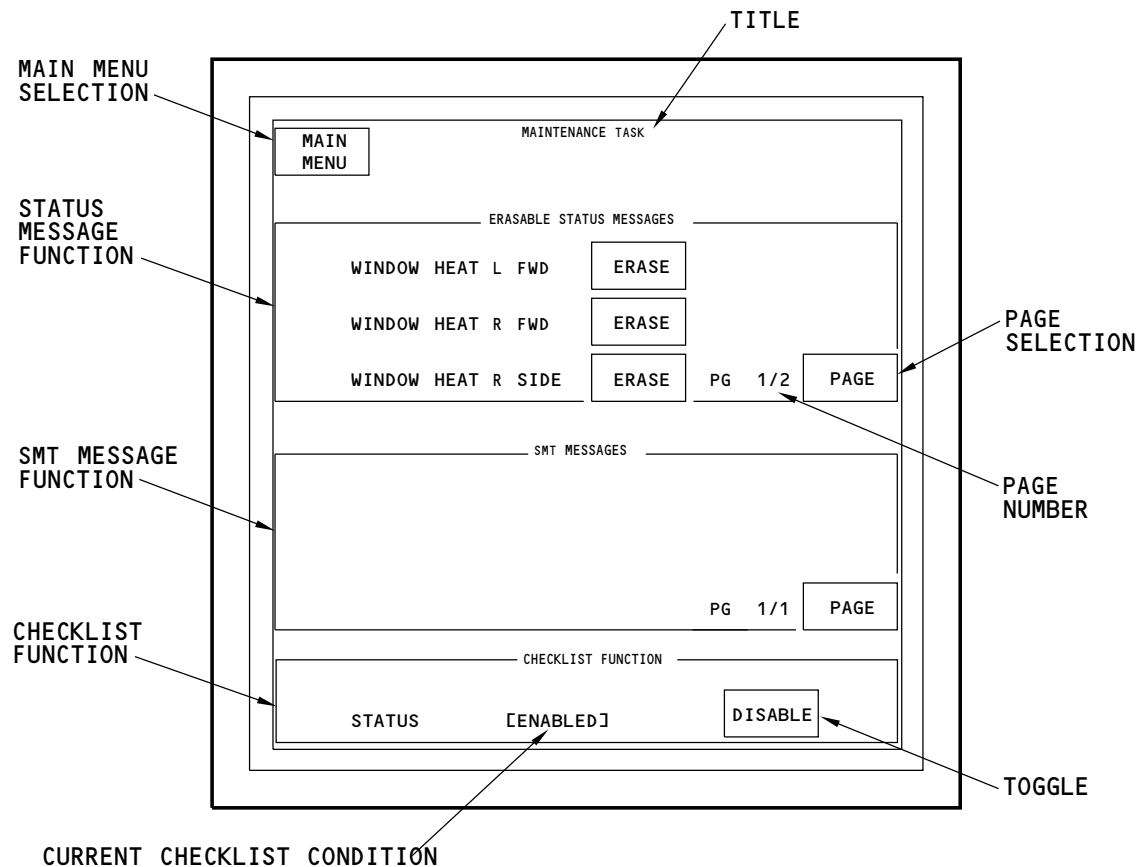
The toggle does not operate when the airplane is in the air.

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PRIMARY DISPLAY SYSTEM - MAINTENANCE TASK MAINTENANCE PAGE

M41944 S000618490_V1



PRIMARY DISPLAY SYSTEM - LANDING GEAR ACTUATION MAINTENANCE PAGE

General

The landing gear actuation maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The title shows the display mode. The title shows as:

- LANDING GEAR ACTN/INDN for the real time mode
- LANDING GEAR ACTN/INDN MAN for the manual event mode
- LANDING GEAR ACTN/INDN AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The landing gear actuation maintenance page shows:

- Tailstrike, alternate extend command, and gear lever data
- Nose gear data

- Main gear data
- Hydraulic and flap/slat data
- Hydraulic pressure data
- Air/ground data.
- Semi-levered gear data.

ARO 001-014 POST SB 777-31-0266

- Landing Condition Limits Exceeded from hard landings data

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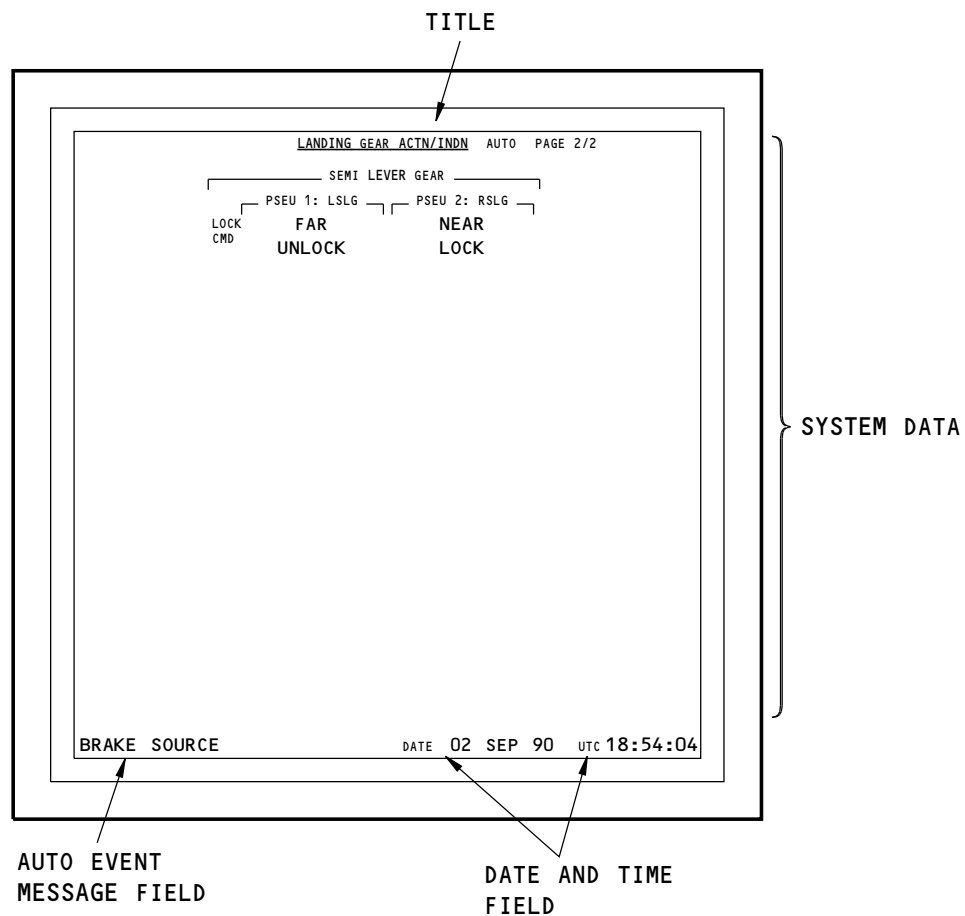
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PRIMARY DISPLAY SYSTEM - LANDING GEAR ACTUATION MAINTENANCE PAGE

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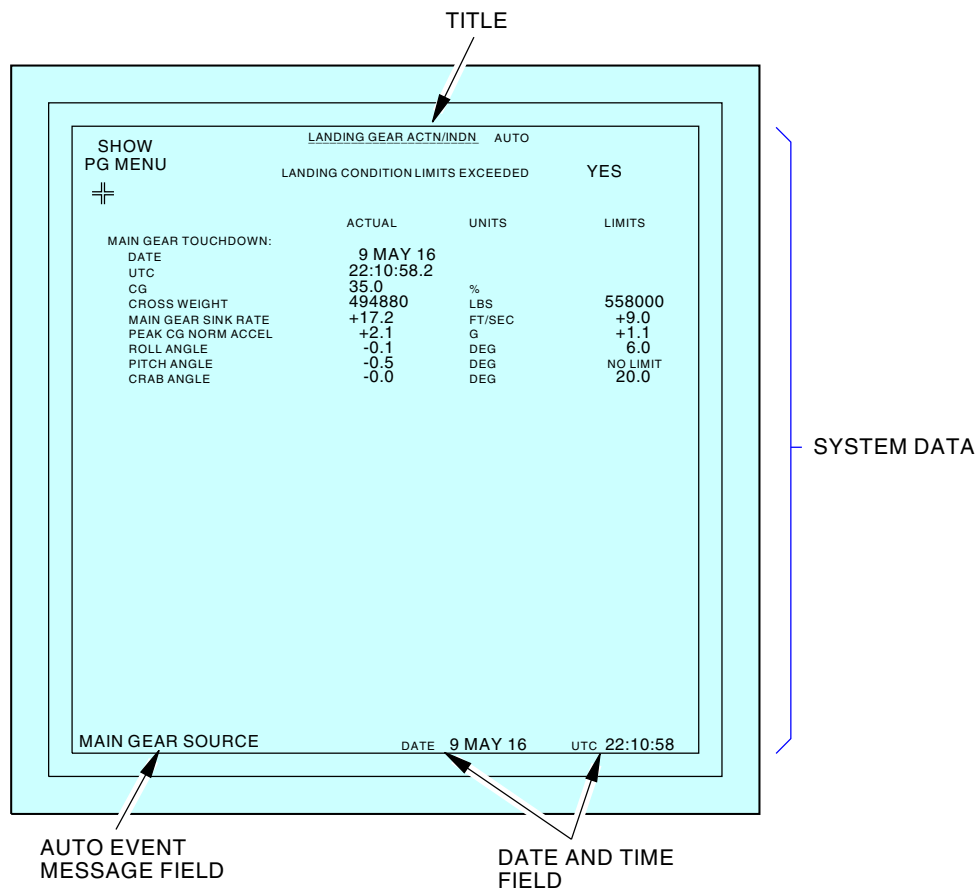
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PRIMARY DISPLAY SYSTEM - LANDING GEAR ACTUATION MAINTENANCE PAGE

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PRIMARY DISPLAY SYSTEM - LANDING GEAR BRAKE/STEERING MAINTENANCE PAGE

General

The landing gear brake/steering maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.

- Main gear brake data
- Brake temperature
- Brake metered pressure.

Title

The title shows the display mode. The title shows as:

- LANDING GEAR BRKS/STRNG for the real time mode
- LANDING GEAR BRKS/STRNG MAN for the manual event mode
- LANDING GEAR BRKS/STRNG AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

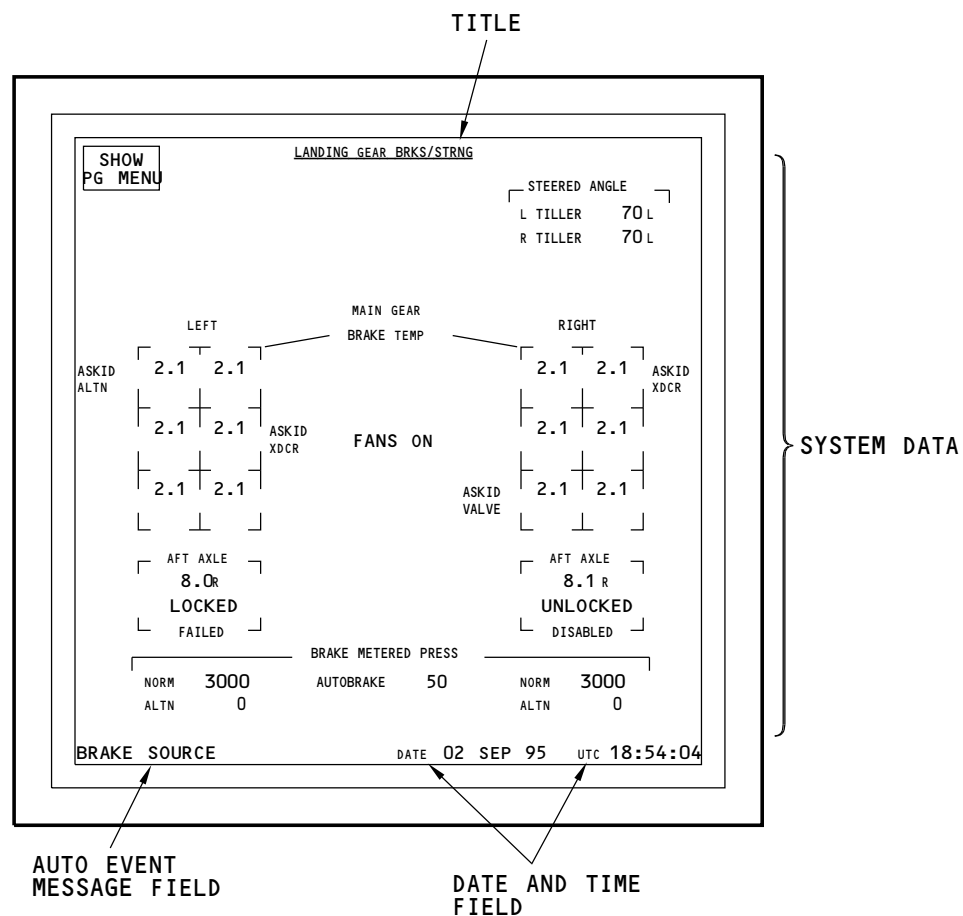
System Data

The landing gear brake/steering maintenance page shows:

- Nose gear data
- Main gear steering data

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PRIMARY DISPLAY SYSTEM - LANDING GEAR BRAKE/STEERING MAINTENANCE PAGE

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**PRIMARY DISPLAY SYSTEM - AIR SUPPLY MAINTENANCE PAGE****General**

The air supply maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.
- Flight phase
- Cabin pressure system data
- Outflow valve data
- Cabin pressure controller channel in control.

Title

The title shows the display mode. The title shows as:

- AIR SUPPLY for the real time mode
- AIR SUPPLY MAN for the manual event mode
- AIR SUPPLY AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The air supply maintenance page shows environmental control system information. The information includes:

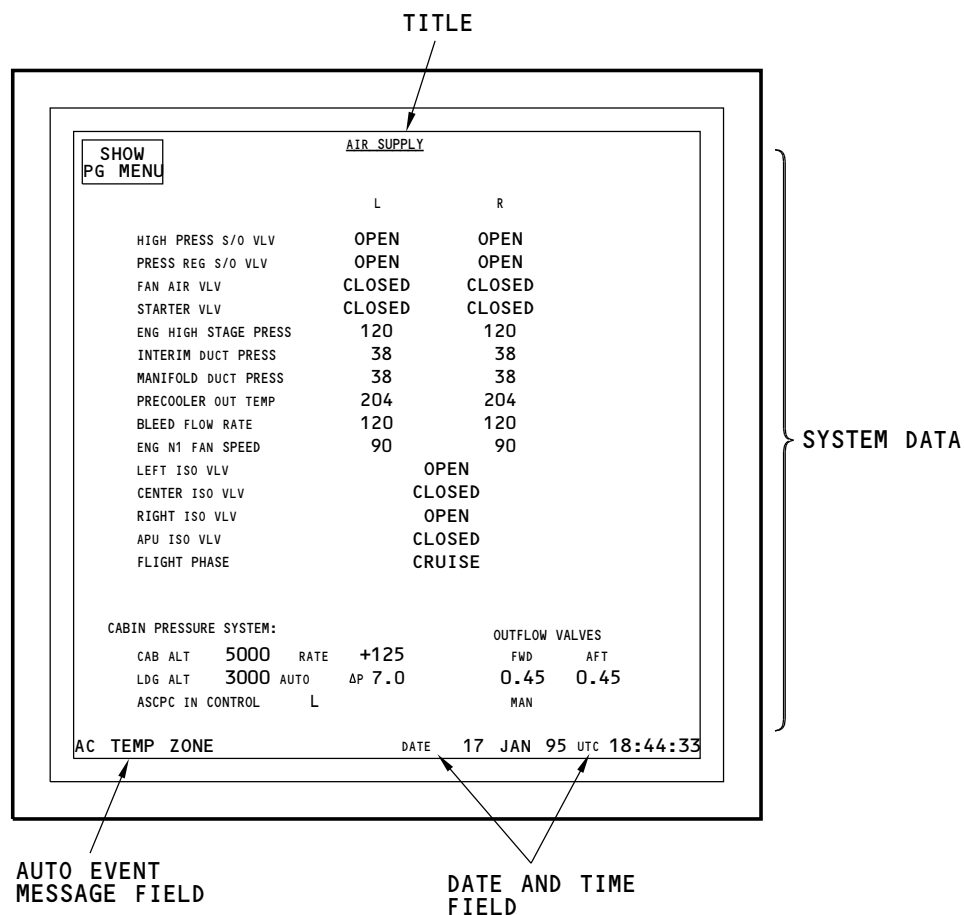
- Air supply valve positions
- Air supply miscellaneous data

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PRIMARY DISPLAY SYSTEM - AIR SUPPLY MAINTENANCE PAGE

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PRIMARY DISPLAY SYSTEM - APU MAINTENANCE PAGE

General

The APU maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The title shows the display mode. The title shows as:

- APU for the real time mode
- APU MAN for the manual event mode
- APU AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The APU maintenance page shows:

- APU mode
- Rotor speed
- EGT

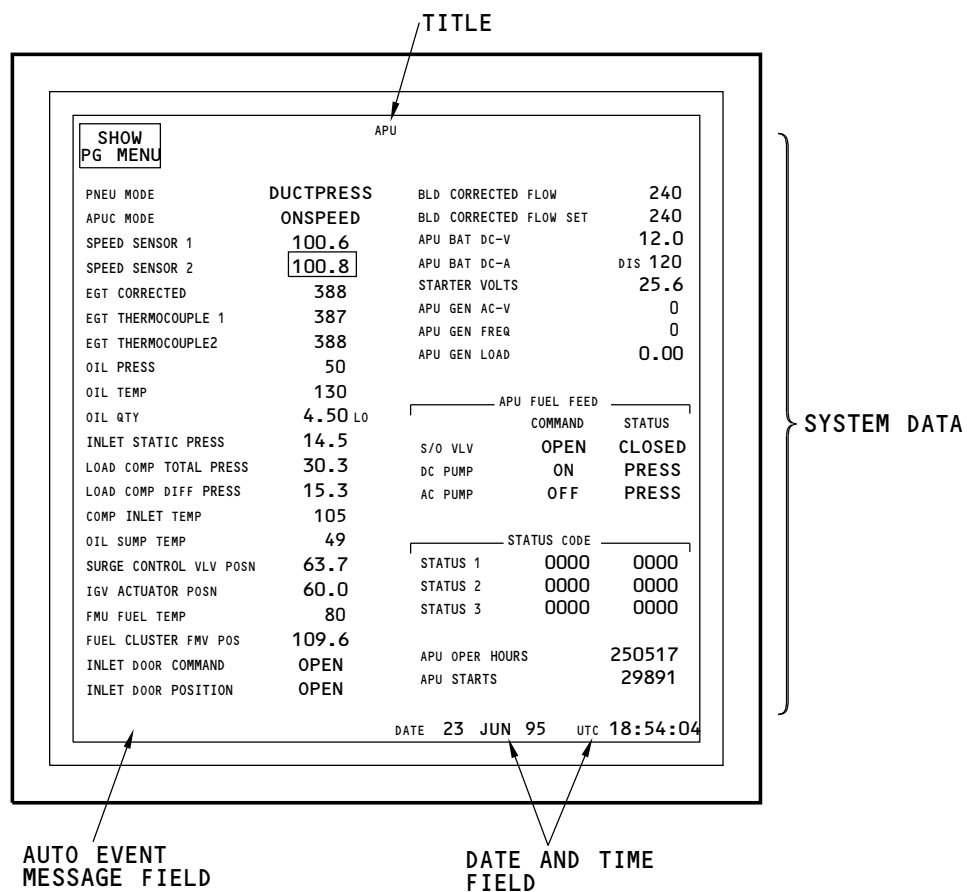
- Oil information
- Starter voltage
- Pressure data
- Valve positions
- Door positions
- Battery, starter, and generator status
- Status code, APU unique maintenance codes (six maximum), hexadecimal
- APU operating hours and starts
- Other APU status data.

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PRIMARY DISPLAY SYSTEM - APU MAINTENANCE PAGE

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PRIMARY DISPLAY SYSTEM - PERFORMANCE MAINTENANCE PAGE

General

The performance maintenance page is available in these three display modes:

- Real time
- Manual event
- Auto event.

- Engine vibration
- Engine oil parameters.

Title

The title shows the display mode. The title shows as:

- PERFORMANCE for the real time mode
- PERFORMANCE MAN for the manual event mode
- PERFORMANCE AUTO for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank.

In the auto event mode, the message for the incident shows.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

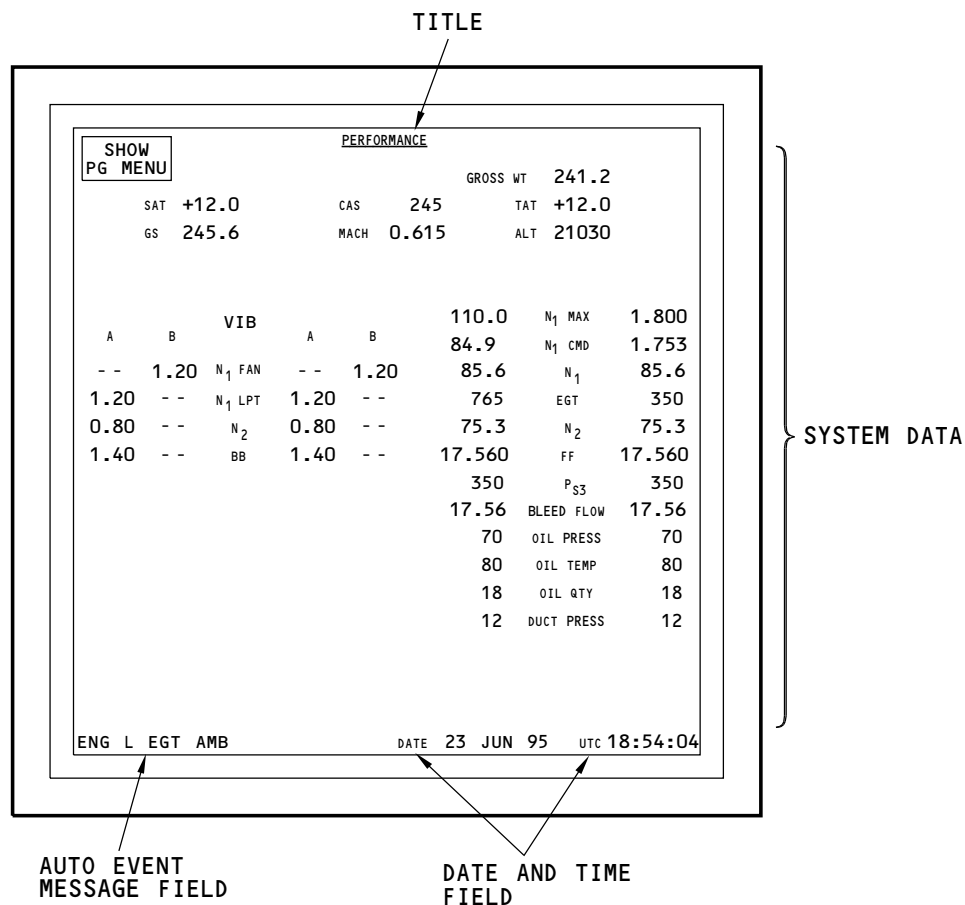
System Data

The performance maintenance page shows:

- Airplane state data
- Engine parameters

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PRIMARY DISPLAY SYSTEM - PERFORMANCE MAINTENANCE PAGE

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PRIMARY DISPLAY SYSTEM - EPCS MAINTENANCE PAGES

General

There are two electronic propulsion control system (EPCS) maintenance pages. They are available in these three display modes:

- Real time
- Manual event
- Auto event.

Title

The titles show the display mode and page number. The titles show as:

- EPCS PG 1/2 for the real time mode
- EPCS PG 2/2 for the real time mode
- EPCS MAN 1/2 for the manual event mode
- EPCS MAN 2/2 for the manual event mode
- EPCS AUTO 1/2 for the auto event mode
- EPCS AUTO 2/2 for the auto event mode.

Auto Event Message

In the real time mode, the auto event message shows for the most recent auto event in memory. If there are no auto events in memory, the message field is blank. The message shows on both pages.

In the auto event mode, the message for the incident shows. The message shows on both pages.

There is no message in the manual event mode.

Date and Time

In the real time mode, the date field shows the current date and universal coordinated time (UTC).

In the manual event mode and the auto event mode, the date field shows the date and UTC of the incident.

System Data

The information on EPCS maintenance page 1/2 includes:

- Channel in control
- Rotor speed information
- Thrust reverser information
- Engine temperature and pressure data.

The information on EPCS maintenance page 2/2 includes:

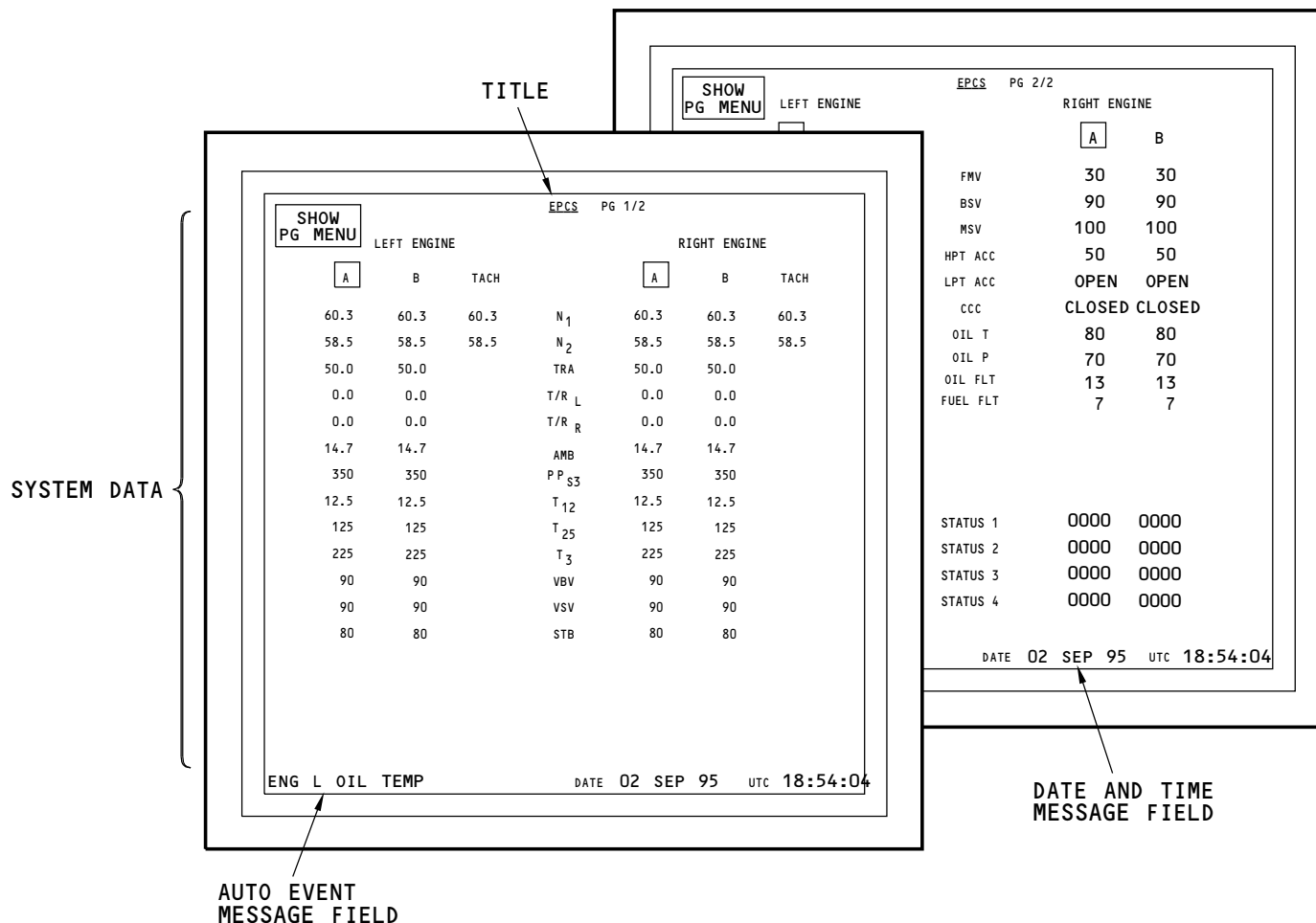
- Channel in control
- Oil pressure and temperature
- Status message codes (hexadecimal).

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PRIMARY DISPLAY SYSTEM - EPCS MAINTENANCE PAGES

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PRIMARY DISPLAY SYSTEM - PROPULSION DATA LIMITS MAINTENANCE PAGES

General

- APU data limits.

There are two maintenance pages for propulsion data limits. They are available in the real time display mode only.

Title

The title shows the page. The titles show as:

- PROPULSION DATA LIMITS PG 1/2
- PROPULSION DATA LIMITS PG 2/2.

System Data

The propulsion data limits maintenance pages show engine red-line and amber-line exceedance limits. The information shows on two pages.

The information on the limits maintenance page 1/2 for propulsion data includes:

- Rotor speeds
- EGT
- Oil pressure
- Oil temperature
- Oil pressure data points.

The information on the limits maintenance page 2/2 for propulsion data includes:

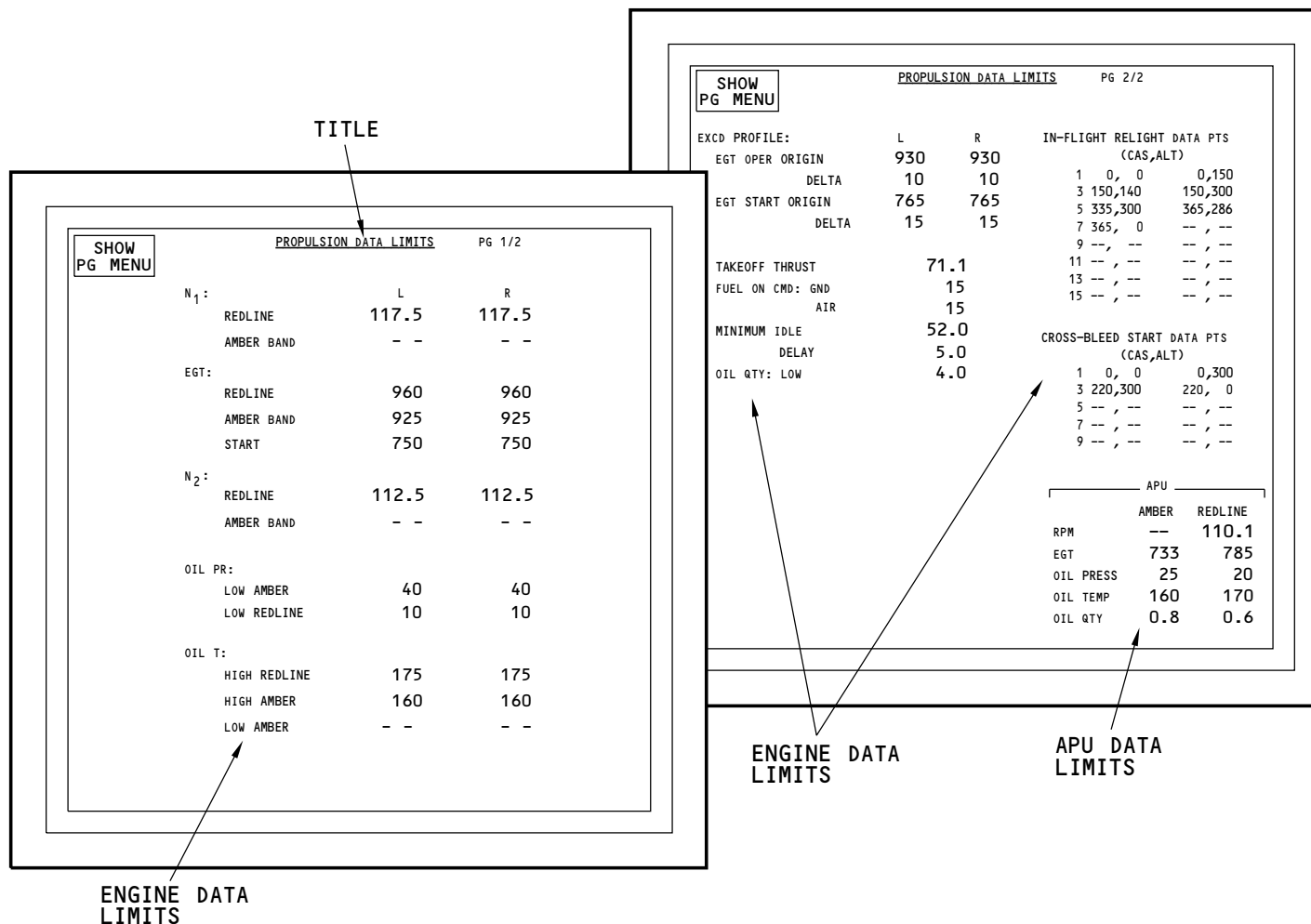
- Takeoff thrust
- Fuel on command
- Minimum idle
- Oil quantity
- Engine vibration
- Exceedance profile
- In-flight relight data points
- Cross-bleed start data points

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PRIMARY DISPLAY SYSTEM - PROPULSION DATA LIMITS MAINTENANCE PAGES

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PRIMARY DISPLAY SYSTEM - ENGINE EXCEEDANCE MAINTENANCE PAGES

General

There are two separate engine exceedance maintenance pages, one for the left engine and one for the right engine. They are available in the auto event display mode only.

Title

The title shows the engine. The titles show as:

- L ENG EXCD
- R ENG EXCD.

System Data

The engine exceedance maintenance pages show engine red line and amber line exceedance profiles. Profiles show for:

- N1 amber band/red line exceedance mini-profile
- N2 amber band/red line exceedance mini-profile
- EGT start limit exceedance profile
- EGT amber band/red line exceedance profile.

Each profile area stores up to four exceedances in nonvolatile memory (NVM). The date and time of each exceedance shows at the top of the profile. The parameter message follows the date. The profile data follows the message.

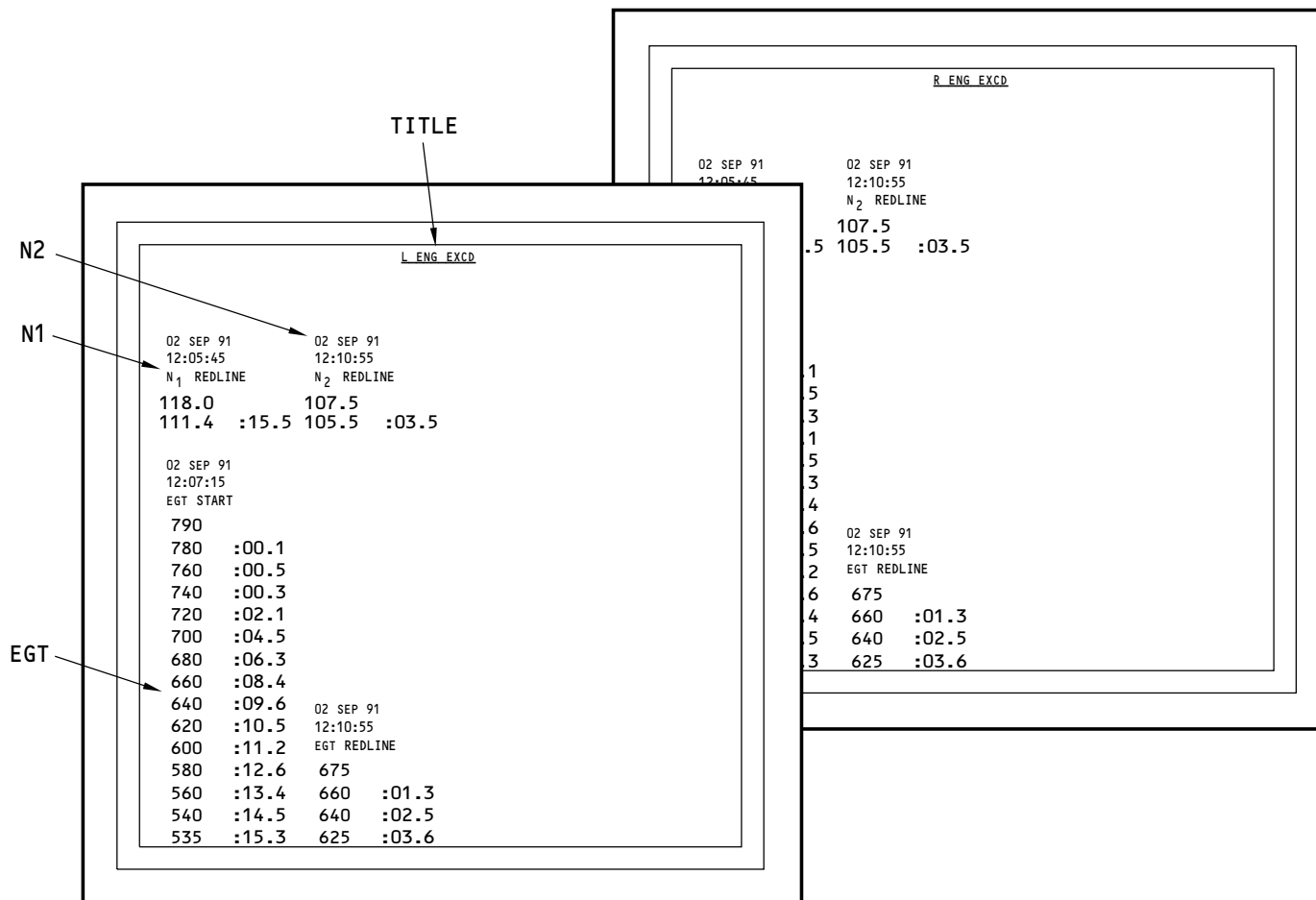
The exceedances show in order of occurrence with the most recent exceedance in the right hand column.

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PRIMARY DISPLAY SYSTEM - ENGINE EXCEEDANCE MAINTENANCE PAGES

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGES SUMMARY

General

These are the four main selection pages:

- Display selection page
- Print selection page
- Datalink selection page
- Erase selection page.

These are the eight sub-page selections:

- Manual events display selection sub-page
- Auto events display selection sub-page
- Manual events print selection sub-page
- Auto events print selection sub-page
- Manual events datalink selection sub-page
- Auto events datalink selection sub-page
- Manual events erase selection sub-page
- Auto events erase selection sub-page.

Also, individual menu selections show on each maintenance page.

Each maintenance page shows the available menu selections.

These menu selections for the maintenance pages show in the summary chart:

- Real time
- Manual event
- Auto event
- Number of pages.

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ATA	TITLE	REAL TIME	MANUAL EVENT	AUTO EVENT	NUMBER OF PAGES
21	AIR CONDITIONING	YES	YES	YES	1
24	ELECTRICAL	YES	YES	YES	2
26	FIRE PROTECTION	YES	YES	YES	1
27	FLIGHT CONTROLS	YES	YES	YES	3
27	FLAP/SLAT	YES	YES	YES	1
28	FUEL QUANTITY	YES	YES	YES	1
28	FUEL MANAGEMENT	YES	YES	YES	1
29	HYDRAULIC	YES	YES	YES	1
30	ICE PROTECTION	YES	YES	YES	1
31	MAINTENANCE TASK	YES	NO	NO	1
32	LANDING GEAR ACTUATION/INDICATION	YES	YES	YES	1
32	LANDING GEAR BRAKES/STEERING	YES	YES	YES	1
36	AIR SUPPLY	YES	YES	YES	1
49	APU	YES	YES	YES	1
71	PERFORMANCE	YES	YES	YES	1
71	EPCS	YES	YES	YES	2
71	PROPULSION DATA LIMITS	YES	NO	NO	2
71	LEFT ENGINE EXCEEDANCE	NO	NO	YES	1
71	RIGHT ENGINE EXCEEDANCE	NO	NO	YES	1

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PRIMARY DISPLAY SYSTEM - MAINTENANCE PAGES SUMMARY

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**PRIMARY DISPLAY SYSTEM - ELECTRONIC CHECKLIST OVERVIEW****General**

Checklists contain data necessary for the flight crew to operate the airplane in normal conditions and to help with non-normal conditions.

The flight crew completes the electronic checklist item by item on a READ and DO basis. These are the three types of checklists:

- Normal checklists (for example, PREFLIGHT and BEFORE START)
- Non-normal checklists related to an EICAS message (for example, ENG FAIL L and FIRE APU)
- Non-normal checklists not related to an EICAS message (for example, GEAR LEVER LOCKED DN and VOLCANIC ASH).

Normal checklist are organized by phase of flight. The flight crew uses them to verify that important procedural steps have been done.

Non-normal checklists contain steps to correct a condition. A square box shows in front of an EICAS message when the message is related to a non-normal checklist and the checklist is not complete. There are also non-normal checklists not related to an EICAS message. These are called unannunciated checklists.

Electronic Checklist Operation

Normal and non-normal electronic checklists show on any multifunction display (MFD). Push the CHKL switch on the display select panel (DSP) to show a checklist.

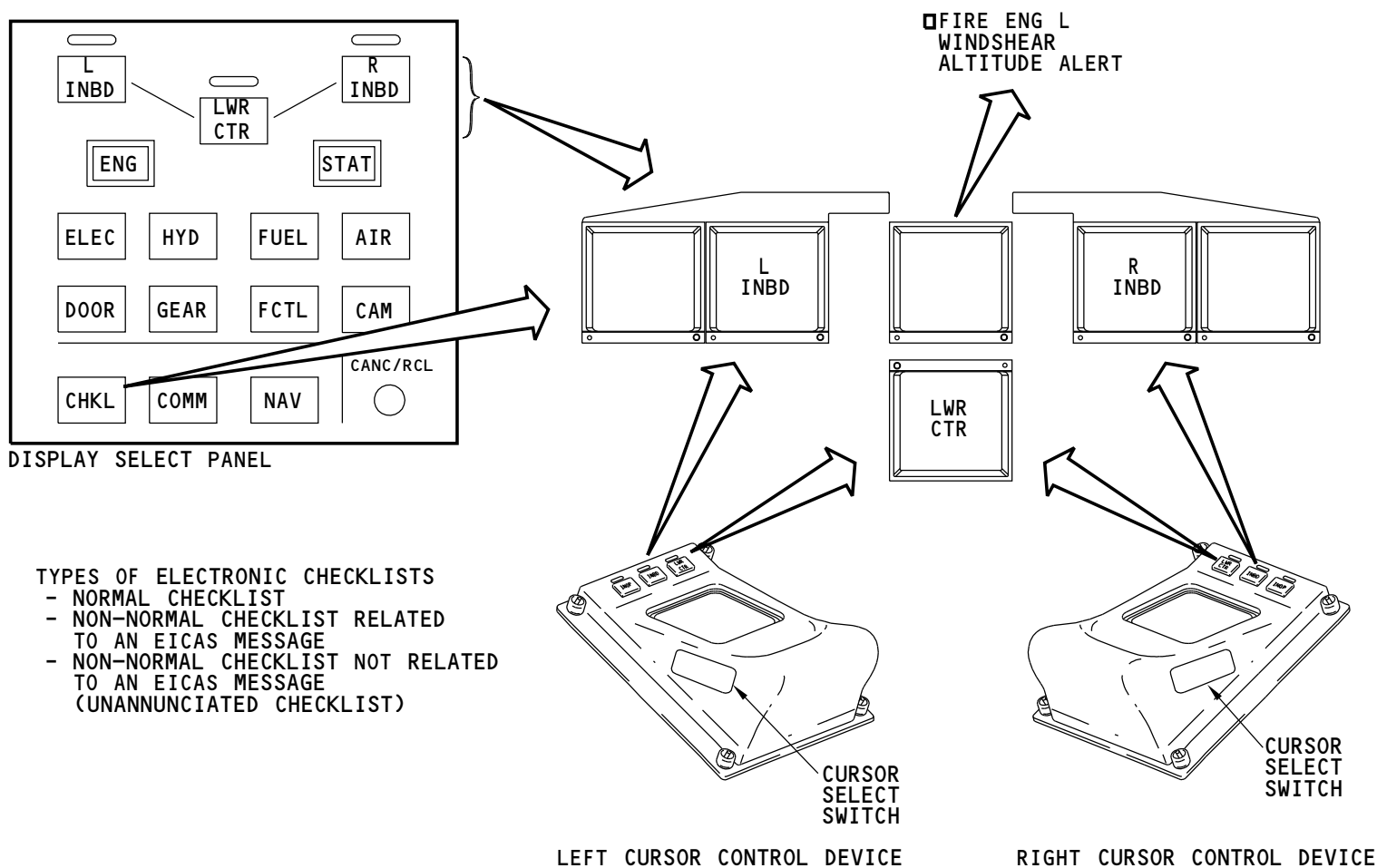
Only one checklist shows at a time. This checklist can show on more than one display unit, but only one cursor control device (CCD) can control the checklist.

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PRIMARY DISPLAY SYSTEM - ELECTRONIC CHECKLIST OVERVIEW

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**PRIMARY DISPLAY SYSTEM - CHECKLIST DISPLAY PRIORITY****Automatic Display of Checklists**

Push the CHKL switch on the display select panel (DSP) to show a checklist on the selected MFD. The primary display system monitors the air/ground phase and EICAS message level and makes an automatic checklist selection.

When the airplane is in the ground phase (on the ground and engines off), this is the checklist priority:

- Warning message checklist (not completed or not accessed)
- Normal checklist (not completed or not accessed)
- Caution message checklist (not completed or not accessed)
- Advisory message checklist (not completed or not accessed)
- Unannunciated checklist (not completed).

When the airplane is in the air phase (engines running), this is the priority:

- Warning message checklist (not completed or not accessed)
- Caution message checklist (not completed or not accessed)
- Advisory message checklist (not completed or not accessed)
- Unannunciated checklist (not completed)
- Normal checklist (not completed or not accessed).

Manual Display of Checklists

Push the CHKL switch on the DSP to show a checklist. If the primary display system makes a decision that no checklists needs to show (all checklists are complete), only the menu bar at the top of the display shows. This permits selection of the normal and non-normal menus. These menus show a list of all the normal and non-normal checklists available for manual selection.

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NORMAL	RESET	NON-NORMAL	RESET
PREFLIGHT			
☒	OXYGEN	SET	
☒	PASSENGER SIGNS	SET	
☒	FLIGHT INSTRUMENTS	SET	
	AUTOBRAKE	RTO	
	PARKING BRAKE	SET	
	FUEL CONTROL SWITCHES	CUTOFF	

NORMAL CHECKLIST

NORMAL	RESET	NON-NORMAL	RESET
FIRE ENG L			
☒	AUTOTHROTTLE ARM SWITCH	OFF	
	THRUST LEVER L	CLOSE	
	FUEL CONTROL SWITCH L	CUTOFF	
	ENGINE FIRE SWITCH L	PULL	
IF FIRE ENG L MESSAGE REMAINS DISPLAYED:			
	ENGINE FIRE SWITCH L	ROTATE	
ROTATE TO THE STOP AND HOLD FOR			
ONE SECOND.			
CONTINUED			

NON-NORMAL CHECKLIST CONNECTED TO AN EICAS MESSAGE

DISPLAY PRIORITY - GROUND PHASE

- WARNING MESSAGE CHECKLISTS
- NORMAL CHECKLISTS
- CAUTION MESSAGE CHECKLISTS
- ADVISORY MESSAGE CHECKLISTS
- UNANNUNCIATED CHECKLISTS

NORMAL	RESET	NON-NORMAL	RESET
GEAR LEVER LOCKED DN			
☒	LEVER LOCK OVERRIDE SWITCH	PUSH AND HOLD	
	LANDING GEAR LEVER	UP	

NON-NORMAL CHECKLIST NOT CONNECTED TO AN EICAS MESSAGE

DISPLAY PRIORITY - AIR PHASE

- WARNING MESSAGE CHECKLISTS
- CAUTION MESSAGE CHECKLISTS
- ADVISORY MESSAGE CHECKLISTS
- UNANNUNCIATED CHECKLISTS
- NORMAL CHECKLISTS

PRIMARY DISPLAY SYSTEM - CHECKLIST DISPLAY PRIORITY

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PRIMARY DISPLAY SYSTEM - CHECKLIST CONTROL

General

Use the active cursor control device (CCD) to control the checklist.

Checklist Menu Bar

Use the NORMAL and NON-NORMAL menu selection on the checklist menu bar to show a list of all normal or non-normal checklists.

Use the RESETS menu selection to show a list of checklist reset options and the airline modifiable information (AMI) software part numbers.

Command Keys

These are the six command keys that control the checklists:

- NORMAL shows the next normal checklist
- ITEM OVRD overrides the highlighted checklist item. An overridden item changes color to cyan
- NOTES key shows if the checklist has more information for the flight crew
- CHKL OVRD allows the flight crew to override the current checklist so they can go on to the next one
- CHKL RESET resets the current checklist
- NON-NORMAL shows the next non-normal checklist.

Closed Loop and Open Loop Items

The checklist function monitors the position of switches, controls and other data in the flight deck. Checklist items that are monitored by the checklist function are called closed loop items. Checklist items that are not monitored are called open loop items.

Closed loop (monitored) items are checklist items that automatically show complete when the boolean state of the applicable line item goes true. Closed loop items show as checkmarks with no gray checkboxes.

Open loop (not monitored) items show as a gray checkbox. Use the CCD cursor activation switch to set open loop items complete.

Line Item and Active Area Highlight Boxes

After the flight crew makes a checklist selection, a line item highlight box shows on the first line item that is not complete. The line item highlight box has a thin line width which goes around the text of the checklist line item. When the cursor is on a line item, an active area highlight box goes around the line item highlight box and open loop check box. When line items are marked complete, the cursor and the line item highlight box move to the next line item.

Cursor Movement

The flight crew moves the cursor as necessary. When all checklist items on a page are complete, the cursor moves to the next page selection on the scroll bar (the scroll bar shows if the checklist has more than one page).

Completed Line Items and Checklists

Checklist line items show in white and change color to green when the flight crew does the required action. When the flight crew completes all items (green) or overrides all items (cyan), one of these messages show at the bottom of the checklist:

- CHECKLIST COMPLETE
- CHECKLIST COMPLETE EXCEPT DEFERRED ITEMS
- CHECKLIST OVERRIDDEN.

If the flight crew does not complete one checklist before they go to another, the NORMAL or NON-NORMAL command key changes color to amber to show that one or more checklists are not complete. Selection of the amber command key returns the system to the first line item not complete in the first incomplete checklist.

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PRIMARY DISPLAY SYSTEM - CHECKLIST CONTROL

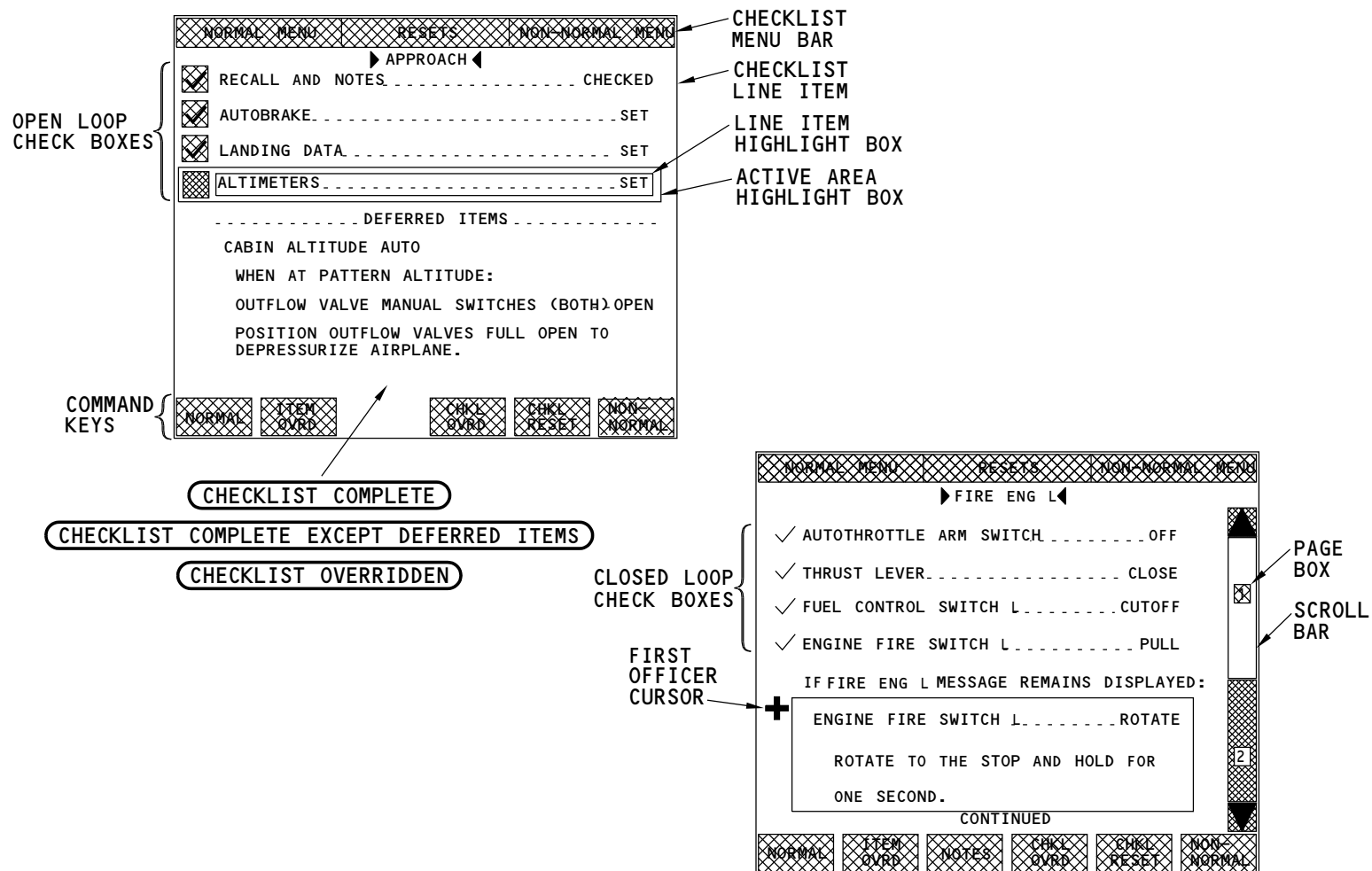
Scroll Bar

Checklists with more than one page have a scroll bar to give access to different pages. A page box and highlight indicates the page that shows on the display unit. Each page box shows the status of that page:

- White - At least one line item is not complete, or the page has not been accessed
- Green - All line items on the page are complete.

A page indicator shows a maximum of nine page numbers. Selection of a page number shows that page. A down arrow symbol replaces page number nine if the checklist is larger than nine pages. Selection of this arrow shows a page indicator that starts with an up arrow. Immediately below the up arrow is the selection of page nine and subsequent pages. This allows for a maximum of 99 pages in a checklist.

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PRIMARY DISPLAY SYSTEM - CHECKLIST CONTROL

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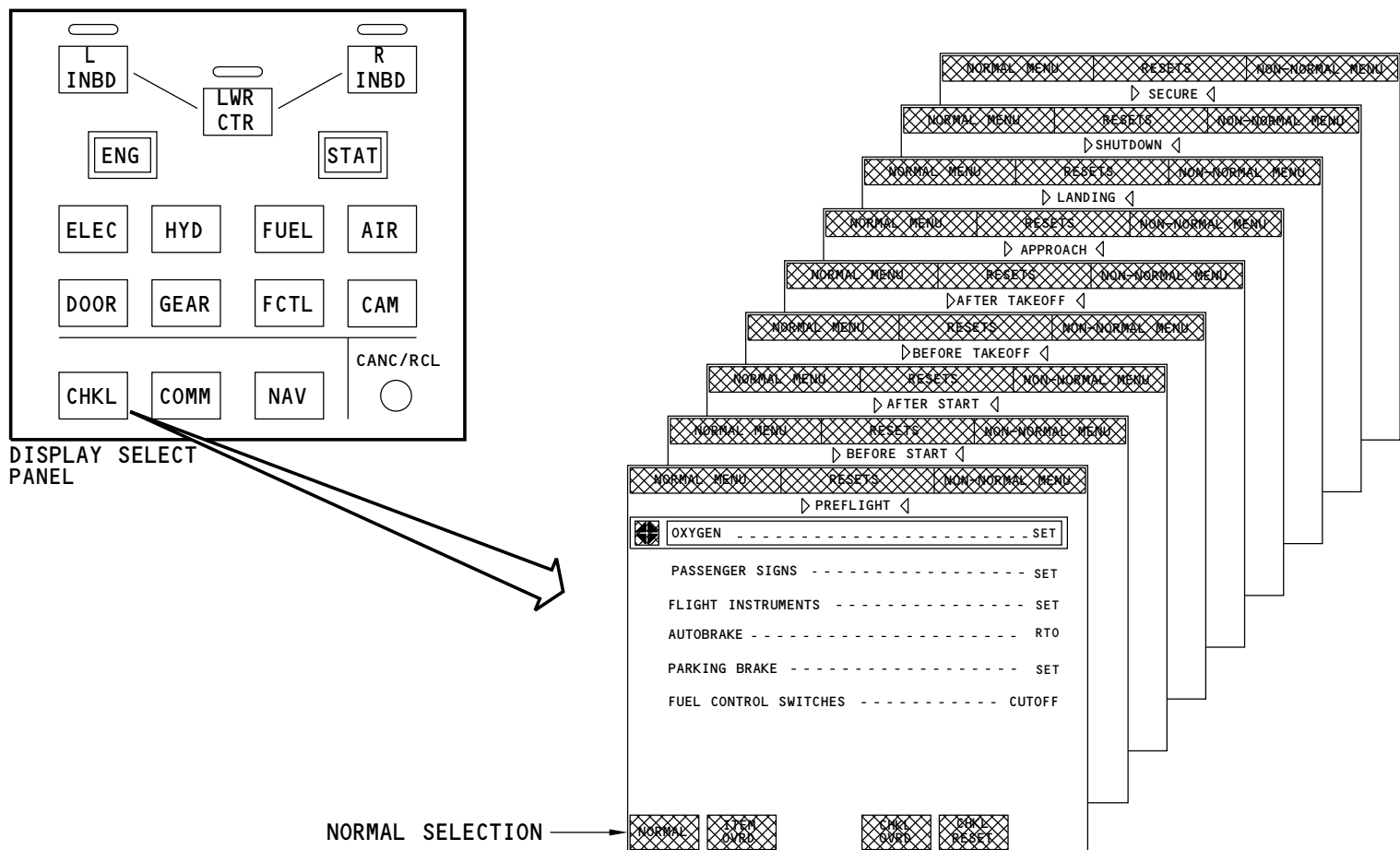
**PRIMARY DISPLAY SYSTEM - NORMAL CHECKLIST OPERATION****Checklist Access**

To show a normal checklist, push the CHKL button on the display select panel (DSP). The first normal checklist that is not complete shows (unless a checklist with a higher priority exists). The normal checklist order directly relates to the different flight phases. The checklist changes after each flight phase. At the end of each normal checklist, select CHKL on the DSP or NORMAL in the lower left corner of the display to show the next checklist in order.

This is the order of the normal checklists:

- PREFLIGHT
- BEFORE START
- AFTER START
- BEFORE TAKEOFF
- AFTER TAKEOFF
- APPROACH
- LANDING
- SHUTDOWN
- SECURE.

To remove the checklist from the display unit (after all checklists are complete), push CHKL on the DSP a second time.



PRIMARY DISPLAY SYSTEM - NORMAL CHECKLIST OPERATION

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**PRIMARY DISPLAY SYSTEM - NON-NORMAL CHECKLIST OPERATION****Checklist Access**

To show a non-normal checklist, push the CHKL button on the display select panel (DSP). The first non-normal checklist that is not complete shows (unless a checklist with a higher priority exists).

If an EICAS message shows with a white empty box next to it, select CHKL to access the non-normal checklist for that condition. If more than one EICAS message shows, a CHKL selection causes a list box of non-normal checklists to show.

List Box

The list box shows non-normal checklists in this order:

- Warning message checklists
- Caution message checklists
- Advisory message checklists
- Unannunciated checklists.

The list box contains a list of incomplete checklists that have a relation to an EICAS message. Use the cursor control device to select a checklist from the list box. When the checklist is complete, the checklist title goes away from the list box. If there are more than nine non-normal checklists, a scroll bar shows adjacent to the list box.

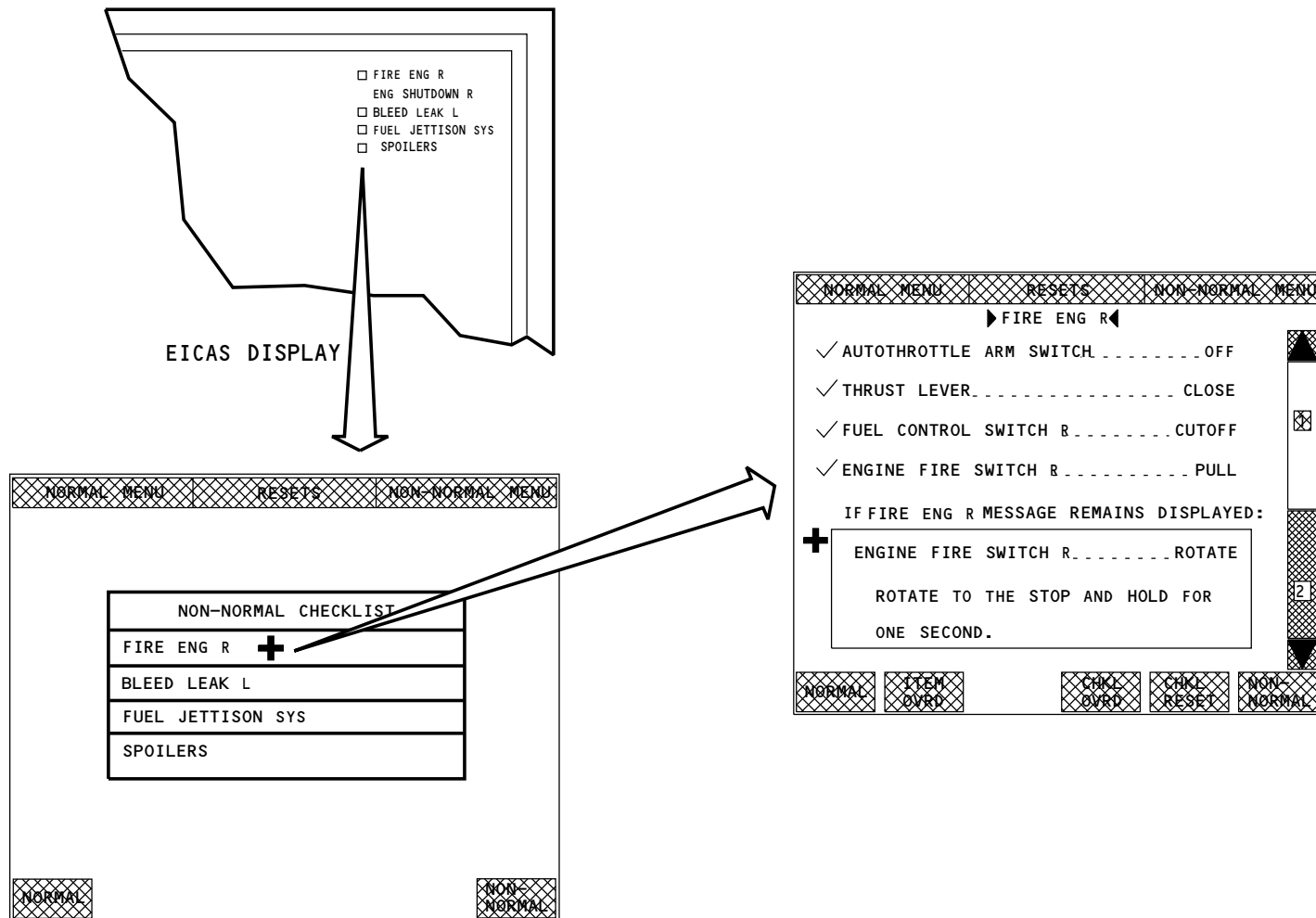
Un-annunciated Non-normal Checklists

Non-normal checklists that do not have a relation with an EICAS message are called unannunciated checklists. Select the NON-NORMAL MENU to show the non-normal checklist menu. Unannunciated checklists are the first sub-menu under the non-normal menu.

Non-normal Checklist Status Indicator

The condition of a non-normal checklist that has a relation to an EICAS message shows on the display unit (engine primary format) as a box adjacent to the related EICAS message. The checklist status shows as one of these:

- White empty box - The checklist for the message has not been accessed or the checklist has been accessed but not complete
- No box - The checklist for the message is complete or no checklist procedure exists for the message.



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PRIMARY DISPLAY SYSTEM - NON-NORMAL CHECKLIST OPERATION

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PRIMARY DISPLAY SYSTEM - CHECKLIST OPERATIONAL NOTES

General

Operational notes give information about the effects of failures that occur during the flight. Operational notes include:

- Inoperative equipment
- Limitations
- Notes.

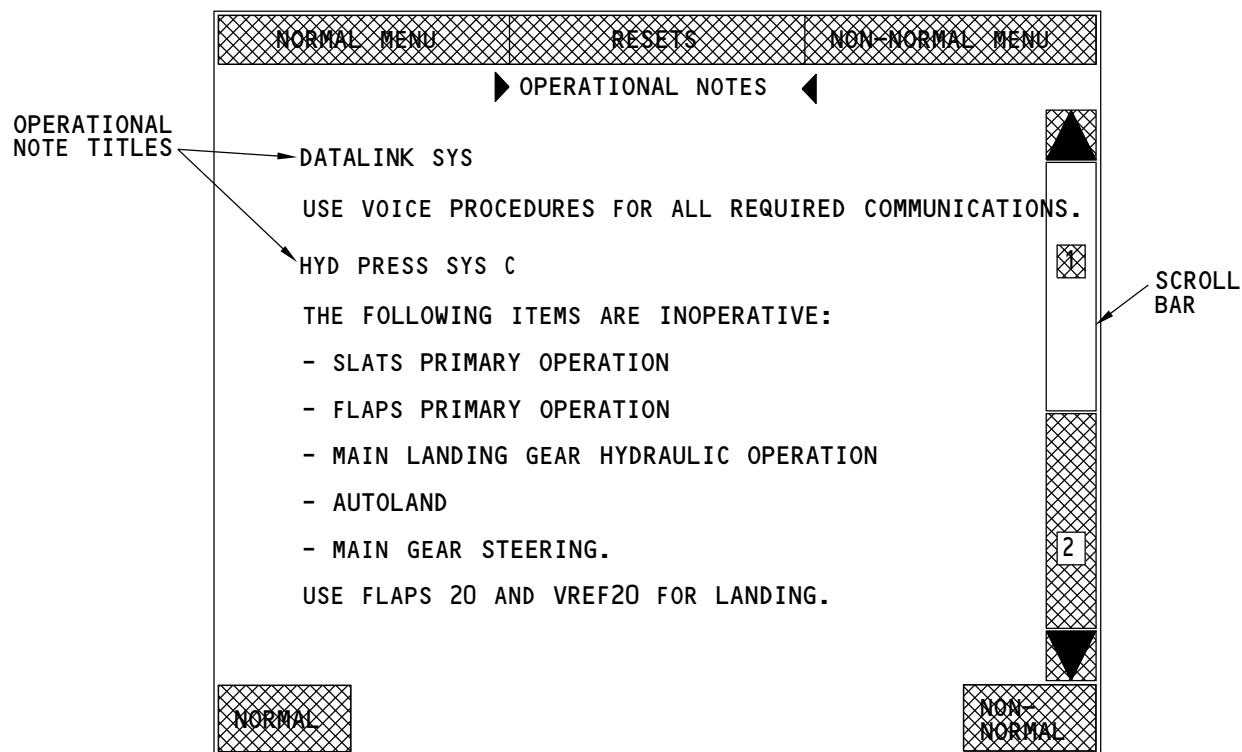
To access operational notes, select the NOTES command key. The NOTES selection shows on the lower part of the display unit when information that has a relation to a non-normal condition is important. Operational notes are available throughout the rest of that flight.

Each operational note includes a title which is the same as the EICAS message.

A paging panel shows if the operational notes have more than one page.

Operational notes latch to the state of the non-normal condition. When the condition and EICAS message goes away, the operational note goes away.

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PRIMARY DISPLAY SYSTEM - CHECKLIST OPERATIONAL NOTES

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**PRIMARY DISPLAY SYSTEM - CHECKLIST LANDING PREPARATION FEATURE****Landing Preparation Functions**

Many non-normal checklists contain landing preparation line items also known as deferred line items. These items have a relation to the approach and landing phases of flight. The landing preparation information includes:

- Inoperative equipment
- Limitations
- Landing preparation procedures
- Conditional statements
- Notes.

If a non-normal checklist has deferred items, they show on a subsequent normal checklist.

A non-normal checklist that contains deferred items is complete when all line items before the deferred items are complete. The message CHECKLIST COMPLETE EXCEPT DEFERRED ITEMS shows on the bottom of the checklist.

On the normal checklists, each set of deferred items refers to the EICAS message that caused the original non-normal checklist. A line makes a separation of the deferred items from both the originating non-normal checklist and the approach or landing normal checklist.

If a non-normal condition occurs after the normal checklist is complete, the non-normal checklist is not complete until all items including the deferred items are complete.

NORMAL MENU		RESETS	NON-NORMAL MENU	
▶ APPROACH ◀				
☒	RECALL AND NOTES		CHECKED	
☒	AUTOBRAKE		SET	
☒	LANDING DATA		SET	
☒	ALTIMETERS		SET	
..... DEFERRED ITEMS				
CABIN ALTITUDE AUTO				
WHEN AT PATTERN ALTITUDE:				
☒	OUTFLOW VALVE MANUAL SWITCHES (BOTH)	...	OPEN	
POSITION OUTFLOW VALVES FULL OPEN TO DEPRESSURIZE AIRPLANE.				
CHECKLIST COMPLETE				
NORMAL	ITEM OVRD	CHKL RESET	NON-NORMAL	

LINE SEPARATION FOR DEFERRED LINE ITEMS

EICAS MESSAGE THAT CAUSED ORIGINATING NON-NORMAL CHECKLIST

DEFERRED LINE ITEMS FROM ORIGINATING NON-NORMAL CHECKLIST

CHECKLIST COMPLETE

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PRIMARY DISPLAY SYSTEM - CHECKLIST LANDING PREPARATION FEATURE

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**PRIMARY DISPLAY SYSTEM - NON-NORMAL CHECKLIST CONDITIONAL STATEMENTS****General**

These are the two different types of conditional statements for non-normal checklists:

- Closed loop (automatic switch and system input)
- Open loop (manual input from the pilot).

Conditional statements have an IF-THEN structure.

Open Loop If Statement

Open loop IF statements include the selections YES and NO. Use the CCD to place the cursor adjacent to the YES/NO line and make a selection to answer the statement. If the answer to the IF statement is yes, the cursor moves to the first line item within the IF statement to be completed. If the answer to the IF statement is no, the line item turns cyan to show that the item is not applicable.

Closed Loop If Statement

Closed loop IF statements are similar to open loop IF statements with one difference. In closed loop IF statements, the YES and NO decision is made automatically by the checklist function which monitors airplane system status. If the condition is yes, the cursor moves to the first line item within the IF statement to be completed. If the condition is no, the IF statement is satisfied and turns cyan to show that the item is not applicable.

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NORMAL MENU	RESETS	NON-NORMAL MENU
▶ SMOKE REMOVAL ◀		
☒ OXYGEN MASK AND SMOKE GOGGLES ON		
☒ CREW COMMUNICATION ESTABLISH		
☒ FLIGHT DECK DOOR CLOSE		
☒ RECIRCULATION FANS SWITCHES (BOTH) OFF		
IF SMOKE IS IN THE FLIGHT DECK:		
+ ☐ YES ☒ NO		
EQUIPMENT COOLING SWITCH OFF		
CONTINUED		
NORMAL	ITEM OVRD	CHKL OVRD RESET NON-NORMAL

OPEN LOOP IF STATEMENT

NORMAL MENU	RESETS	NON-NORMAL MENU
▶ FIRE ENG L ◀		
☒ AUTOTHROTTLE ARM SWITCH OFF		
☒ THRUST LEVER CLOSE		
☒ FUEL CONTROL SWITCH L CUTOFF		
☒ ENGINE FIRE SWITCH L PULL		
IF FIRE ENG L MESSAGE REMAINS DISPLAYED:		
+ ENGINE FIRE SWITCH L ROTATE		
ROTATE TO THE STOP AND HOLD FOR ONE SECOND.		
CONTINUED		
NORMAL	ITEM OVRD	CHKL OVRD RESET NON-NORMAL

CLOSED LOOP IF STATEMENT

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PRIMARY DISPLAY SYSTEM - NON-NORMAL CHECKLIST CONDITIONAL STATEMENTS

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**PRIMARY DISPLAY SYSTEM - CHECKLIST OVERRIDE FUNCTION/CHECKLIST TIMERS****General**

These are the two types of override functions:

- Checklist item overrides
- Checklist overrides.

Checklist Item Override

The ITEM OVRD selection is available on all checklists. Selection of the ITEM OVRD command key turns the highlighted step to cyan. This shows that the step has been overridden. Both closed loop and open loop steps can be overridden.

A checklist is complete if all steps, except landing preparation steps, are green or cyan.

Conditional statements (both closed and open loop) cannot be overridden. Steps within conditional statements can be overridden.

Checklist Override

Full checklists can be overridden. Select the CHKL OVRD command key to override a checklist. The checklist turns cyan when it is overridden. All related operational notes and landing preparation items go away and conditional statements cancel. The message CHECKLIST OVERRIDDEN shows at the bottom of the page.

Checklist Timers

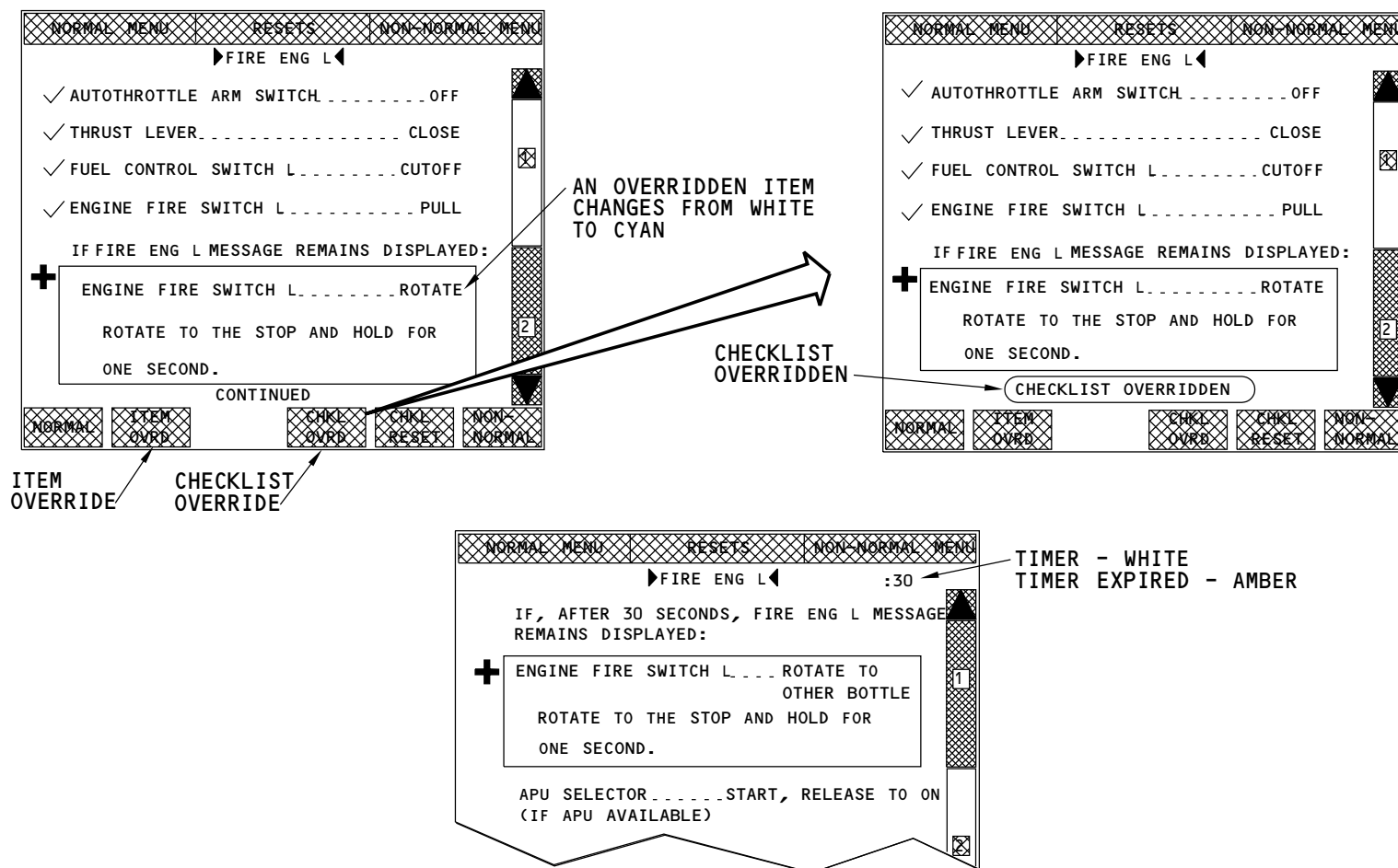
Where necessary, an automatic timer shows in the upper right corner of the checklist. This helps complete checklist items where time delays are necessary. Maximum time is 99 minutes and 59 seconds. All timers are countdown timers. Timers usually go with conditional IF statements. When the line item highlight box shows on a line item, the timer starts to count down.

Timers continue to operate when the checklist does not show. This lets the flight crew do other tasks and then return to the checklist. Timers show in white. An expired timer shows :00 and the color is amber. As soon as the operator completes the next line item, the expired timer goes away.

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PRIMARY DISPLAY SYSTEM - CHECKLIST OVERRIDE FUNCTION/CHECKLIST TIMERS

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PRIMARY DISPLAY SYSTEM - CHECKLIST RESETS

General

When a checklist is complete, to do the checklist again, the checklist must be reset. Some conditions require resets to prepare the checklist for the next phase of flight.

There are manual resets and automatic resets.

The resets menu page also has the software part numbers for the checklist databases.

Normal Checklist - Manual Reset Conditions

These are the normal manual checklist reset conditions:

- **RESETS FUNCTION.** The flight crew selects the RESETS function from the menu bar and then selects RESET NORMAL. This resets all normal checklists. If the flight crew selects RESET ALL, then all normal and non-normal checklists are reset.
- **INDIVIDUAL CHECKLIST RESET.** Select the CHKL RESET command key to reset any displayed checklist.

Normal Checklist - Automatic Reset Conditions

These are the automatic normal checklist reset conditions:

- **GO-AROUND.** If the airplane is in the air, the landing gear is not up, and TO/GA is selected, or takeoff thrust is set on either engine, then all specified normal checklists automatically reset.
- **TOUCH AND GO.** If the airplane changes from air to ground, and takeoff thrust is set with groundspeed greater than 80 KIAS, and the thrust reversers not deployed, then all specified normal checklists are reset.
- **RESET ALL.** The airplane changes from air to ground, and both engines are shut down, and at least one passenger door is open (conditions must be set for 10 minutes). All normal checklists are reset.
- If a completed checklist is selected from the menu, it is automatically reset.

Non-Normal Checklist Manual Reset Conditions

These are the non-normal manual checklist reset conditions:

- **RESETS FUNCTION.** During preflight, the flight crew selects the RESETS menu and then selects RESET NON-NORMAL. This resets all non-normal checklists. If the flight crew selects RESET ALL, then all normal and non-normal checklists are reset.
- **INDIVIDUAL CHECKLIST RESET.** Select the CHKL RESET command key to reset any displayed checklist.

Non-Normal Checklist - Automatic Reset Conditions

These are the automatic non-normal checklist reset conditions:

- The non-normal conditions no longer exist.
- **RESET ALL.** The airplane changes from air to ground, and both engines are shut down, and at least one passenger door is open (conditions must be set for 10 minutes). All checklists are reset.

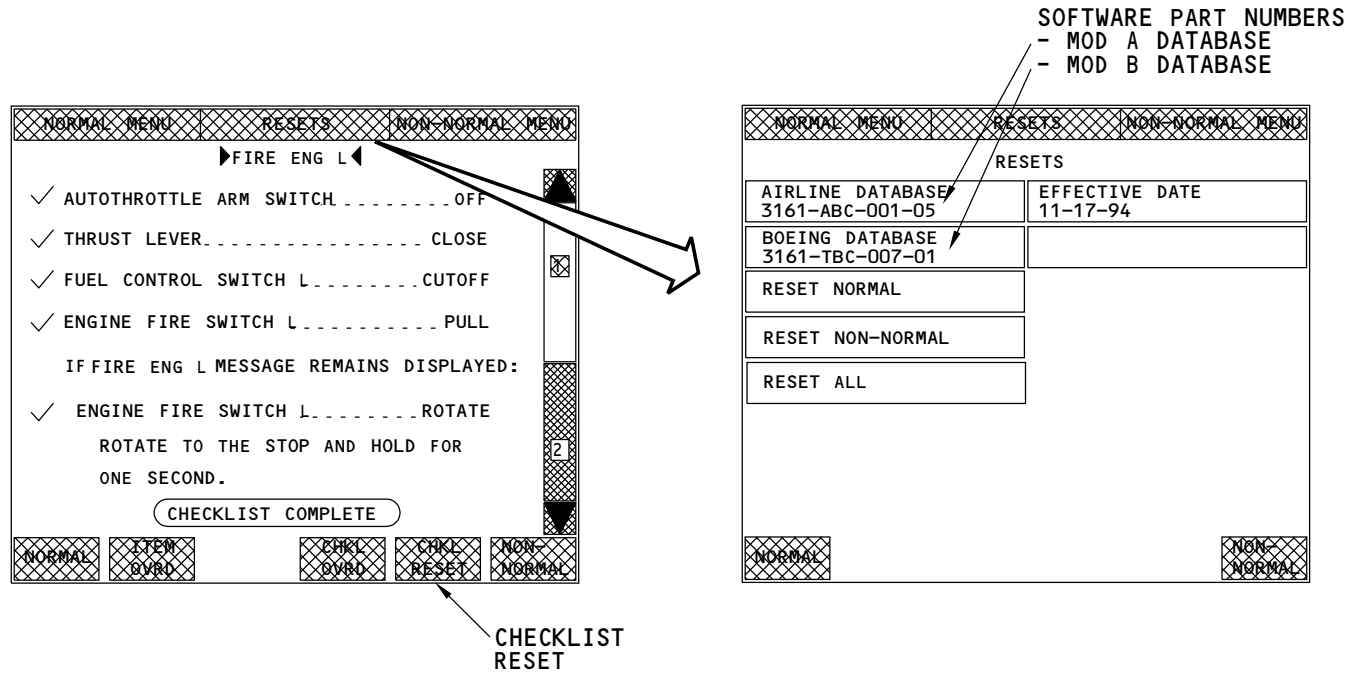
Checklist Databases

The checklist database has two parts, the MOD B database and the MOD A database.

The MOD B database has the Boeing baseline checklist and the specific rules and global rule flags for the particular airplane configuration.

The MOD A database has the Boeing baseline checklist (without the specific rules) and all the airline modifications (AMI).

Together, the two databases make an operational checklist.



PRIMARY DISPLAY SYSTEM - CHECKLIST RESETS

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PRIMARY DISPLAY SYSTEM - AIRLINE MODIFIABLE INFORMATION

General

Boeing provides an initial customized normal and non-normal checklist for each airline.

Boeing will also provide electronic checklist revision information along with operations manual updates.

The airline may use the ground based software tool to make any other desired changes to the baseline AMI.

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BASELINE AMI

CUSTOMIZED NORMAL AND NON-NORMAL
CHECKLIST

MODIFIABLE INFORMATION

ANY ELEMENT OF THE CHECKLIST THAT THE
AIRLINE FINDS TO BE NECESSARY

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PRIMARY DISPLAY SYSTEM - AIRLINE MODIFIABLE INFORMATION

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PRIMARY DISPLAY SYSTEM - EICAS AND MFD FUNCTIONAL DESCRIPTION

General

Each AIMS cabinet has four input/output modules (IOMs) and two core processor/graphic generators (CPM/GGs). Each graphic generator has an output to the display units (DUs). The EICAS and MFD functions in the CPM/GGs independently process their formats. The EICAS function has these sub-functions:

- Solution logic
- EICAS display generator.

The MFD function has these sub-functions:

- System fault reports
- Determine dispatch status
- MFD display generator.

Both functions send data to the graphic generator sub-function. The graphic generator reformats and sends this data to the DUs.

IOMs

Each IOM does these functions:

- Presence and validity checks
- Source select and filtering.

The IOM modules do presence and validity checks on all display input parameters. Data updates at specified frequencies make sure that the information the flight crews see is current.

Each IOM removes bad data, replaces it with a good source, and filters the change from bad to a good data source. The IOM sends, in critical cases, messages to alert the flight crew of a failure. The IOMs send the valid and message data to the EICAS and MFD functions through the backplane bus.

CPM/GGs

Each CPM/GG also has an EICAS and MFD function with sub-functions. Each AIMS cabinet has two CPM/GGs for a total of four on the aircraft. Each CPM/GG can drive any three display units or three out of four display formats (EICAS, MFD, PFD, or ND). The PFD and ND functions configure and format the PFD and ND displays. The outboard DU location is for PFD display only. This redundant system supplies fail operational capability and allows deferred airplane maintenance.

The sub-functions in the CPM/GGs decode switch inputs and make the appropriate displays. Additional switch positions determine format location. If the upper center DU fails, the lower center DU changes to the upper center DU format.

EICAS Function- Solution logic

The solution logic sub-function receives display and switch input data from the IOMs. The solution logic sub-function determines which of these formats to select:

- EICAS display
- Compacted engine
- Secondary engine.

The solution logic use the DSP DU and ENGINE push-button selection along with DU failure status to change between the EICAS display and compacted engine formats. A second push of the DSP ENGINE switch causes the MFD to show the secondary engine format.

The solution logic sub-function sends the display data to the EICAS display function. A failure of the lower DU also causes the solution logic to send compacted engine set logic along with display outputs to the EICAS display sub-function.

EICAS Function- EICAS Display

The EICAS display sub-function use the solution logic inputs and display data to select the correct format(s) and display data. The EICAS and/or secondary formats go to the EICAS display generation block.

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**PRIMARY DISPLAY SYSTEM - EICAS AND MFD FUNCTIONAL DESCRIPTION****EICAS Function- EICAS Display Generation**

The EICAS display generation sub-function reformats the display data for the graphics generator.

EICAS/ Function - MFD Graphics Generator

The graphics generator sub-function changes the EICAS display data to graphics on a vector format and sends it to the displays through a coaxial-cable. DU switch inputs from the display switching panels determine when an EICAS display shows in more than one location.

MFD Function - System Fault Reports

The system fault reports sub-function receive faults, sort and order the faults by time of occurrence. It sends this data to the determine dispatch status sub-function.

MFD Function - Determine Dispatch Status

The determine dispatch status sub-function use the fault report data and an airworthiness table to determine the airplane dispatch status. It sends this data to the MFD display generator.

MFD Function - MFD Display Generator

The MFD display generator sub-function use the airplane status data, display selection, and real time status inputs to properly format displays. The display generator use this data along with the maintenance page control and output device selection inputs for proper page display and correct DU location. These inputs permit the MFD display to show synoptics and maintenance formats.

It also use the switch data for automatic lower DU selection to an EICAS format in case the upper DU fails.

The graphics generator sub-function changes the display data to a video format and sends it to the DUs through a coaxial-cable. DU switch inputs from the display switching panels determine when a MFD display shows in more than one location.

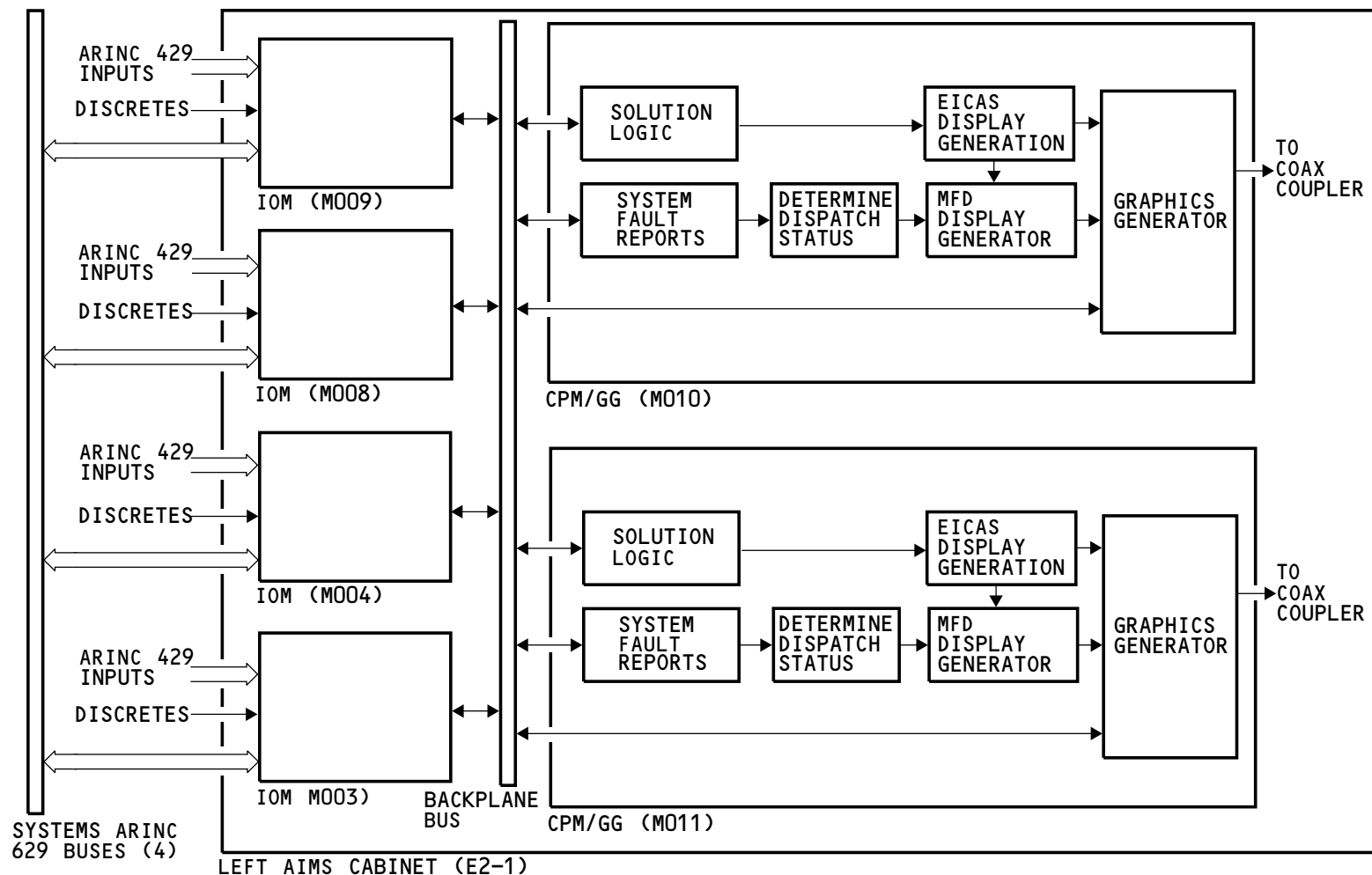
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PRIMARY DISPLAY SYSTEM - EICAS AND MFD FUNCTIONAL DESCRIPTION

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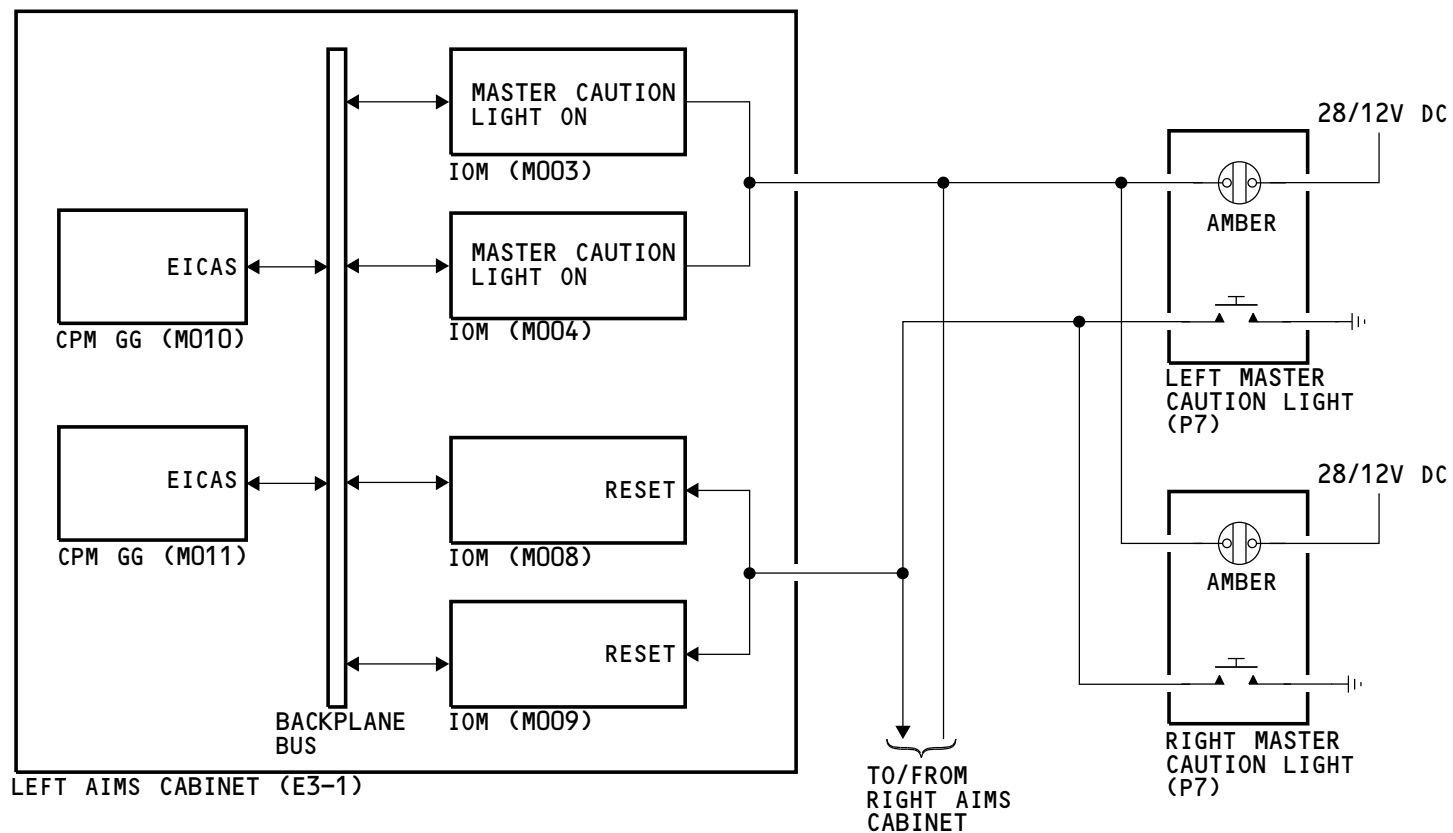
PRIMARY DISPLAY SYSTEM - MASTER CAUTION LIGHTS FUNCTIONAL DESCRIPTION

General

When a caution message shows on the EICAS display, the EICAS function in the CPM GGs make master caution light on signals. The IOMs supply the master caution light on signals to the master caution lights. The master caution lights come on.

When you push the master caution lights, a momentary reset signal goes to the IOMs. The IOMs send the reset signal to the EICAS function in the CPM GGs. The EICAS function then makes the master caution lights go out.

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PRIMARY DISPLAY SYSTEM - MASTER CAUTION LIGHTS FUNCTIONAL DESCRIPTION

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PRIMARY DISPLAY SYSTEM - DISPLAY FORMAT ALLOCATIONS - 1

General

Hardware position pins for display units (DU) determine normal display configuration. A position number identifies each DU location and its normal format. These are the position numbers, normal display format, and location:

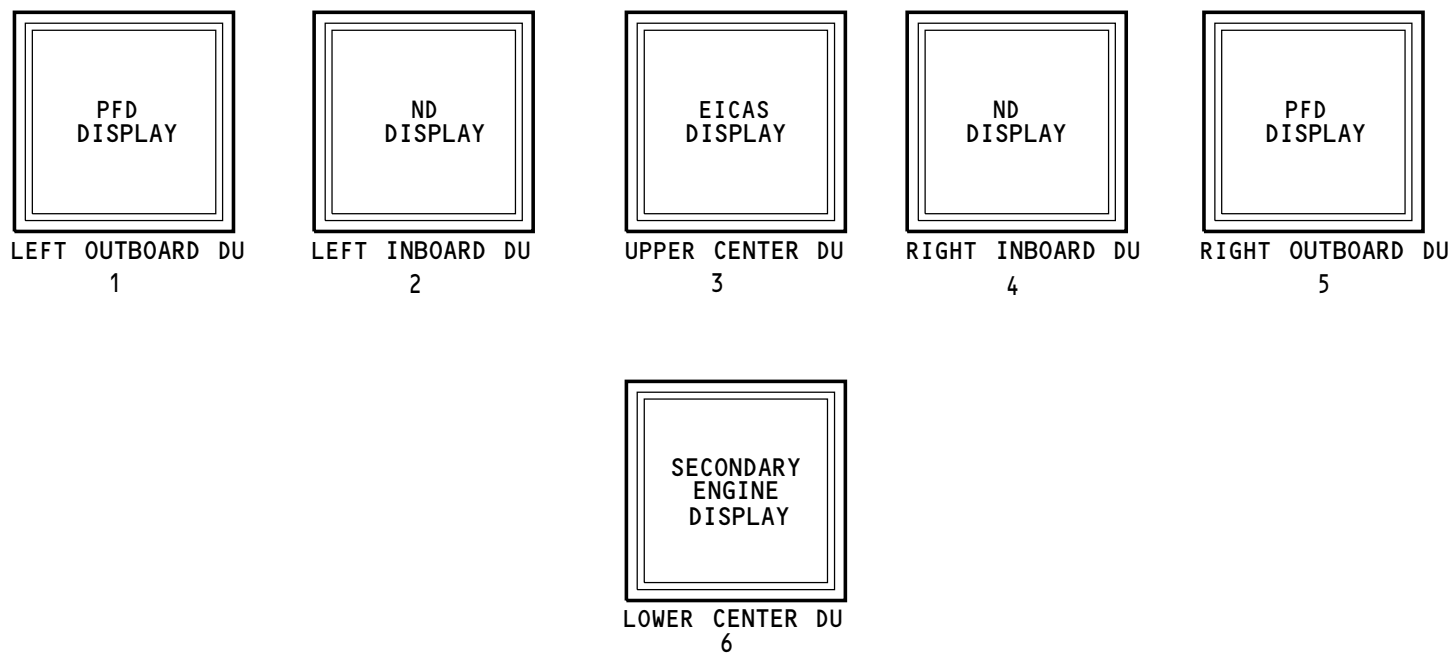
- Position 1 - Captain's PFD (left outboard)
- Position 2 - Captain's ND (left inboard)
- Position 3 - EICAS display (upper center)
- Position 4 - First officer's ND (right inboard)
- Position 5 - First officer's PFD (right outboard)
- Position 6 - Secondary engine (lower center).

Each DU reports its operational status at power-up on the ground or at power-up after a long term power interrupt (5 seconds). The display function latches the configuration in memory. Subsequent in-flight failures of a position pin configuration does not cause format changes or failure indications.

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PRIMARY DISPLAY SYSTEM - DISPLAY FORMAT ALLOCATIONS - 1

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PRIMARY DISPLAY SYSTEM - DISPLAY FORMAT ALLOCATIONS - 2

General

Display unit failures or unique requirements cause the need to move displays to alternate DU locations. Some displays move automatically. Controls on the display select panel and the display switching panels enable the operator to move displays manually.

Display Unit Display Format Allocations

Each DU location has the capability to show specific formats.

The left outboard DU shows the captain PFD format only.

The right outboard DU shows the first officer PFD format only.

The center upper DU shows the EICAS display or compacted engine formats.

The left inboard DU shows these displays:

- Captain ND
- Captain PFD
- EICAS display
- Compacted engine display
- MFD formats.

The right inboard DU shows these displays:

- First officer ND
- First officer PFD
- EICAS display
- MFD formats.

The center lower DU shows these displays:

- MFD formats
- EICAS display
- Captain ND display
- First officer ND display.

The left, right inboard and lower center DUs can show the MFD formats. The MFD formats are:

- Secondary engine display
- Status display
- Synoptic displays
- Maintenance pages
- Checklists
- Camera system display
- Communication displays.

Inboard Display Selectors

The inboard display selectors control onside movement of display formats to and from the inboard DUs.

The NORM position of the selector has two settings. The ND position causes the inboard DU to show the ND format. The MFD position works with the display select panel (DSP) L or R INBD switch and the other DSP display switches to show one of these displays on an inboard DU:

- Secondary engine display
- Status display
- Synoptic displays
- Camera system display
- Flight deck communication function display.

The L or R INBD switch on the DSP and the MFD position of the selector cause maintenance pages to show on an inboard DU after selection on a CDU.

PFD position causes the PFD display to show on the inboard DU.

The EICAS position causes the EICAS display to show in the normal mode or the compacted engine display to show in the limited mode. The limited mode exists when only one DU is available for EICAS display and secondary engine display.

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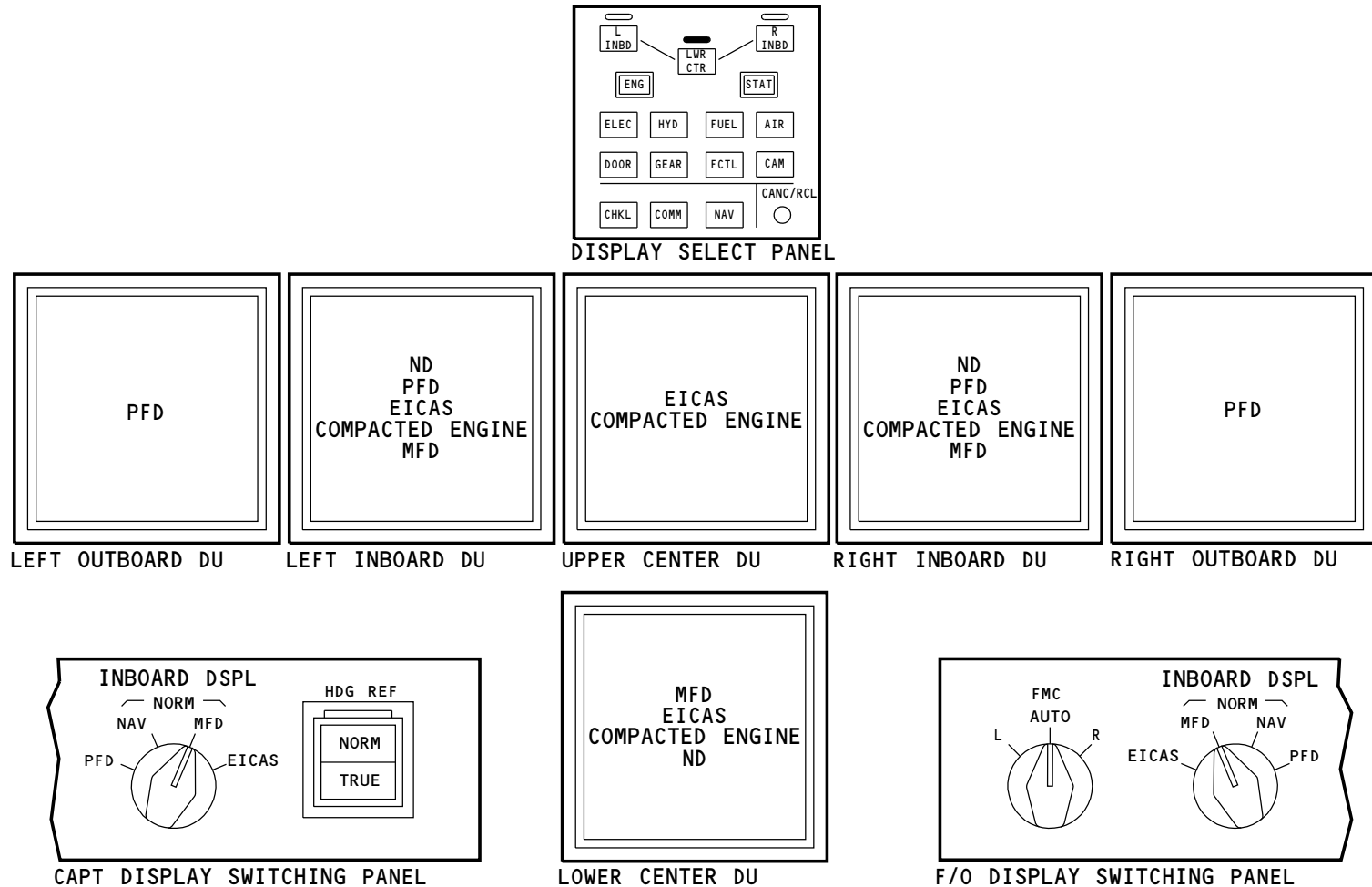
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**PRIMARY DISPLAY SYSTEM - DISPLAY FORMAT ALLOCATIONS - 2**

Movement of the inboard display selector from the PFD position or from the EICAS position to the NORM position (ND or MFD) causes the ND format to show on the inboard DU.

A failure of the inboard display selector causes the display format that shows to latch.



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PRIMARY DISPLAY SYSTEM - DISPLAY FORMAT ALLOCATIONS - 2

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**PRIMARY DISPLAY SYSTEM - AUTOMATIC DISPLAY SWITCHING****General**

The PFD display on the outboard DUs and the EICAS display on the upper center DU automatically move to alternate locations when a DU failure occurs.

When only one DU shows the EICAS display, EICAS is in the limited mode. In the limited mode, only these three switches on the DSP have a function:

- ENG switch
- AIR switch
- FUEL switch.

Outboard DU Failures

The PFD display automatically moves to the inside inboard location when a detected failure of the outboard DU occurs.

After the PFD display moves automatically, the inboard display selector on the display switching panel has no effect on the inboard DU.

Upper Center DU failures

The EICAS display automatically moves to the lower center DU when a detected failure of the center upper DU occurs. The lower DU then shows the compacted engine display.

The ENG switch on the DSP causes the display to change between EICAS display and compacted engine display.

The AIR switch controls the ECS data block.

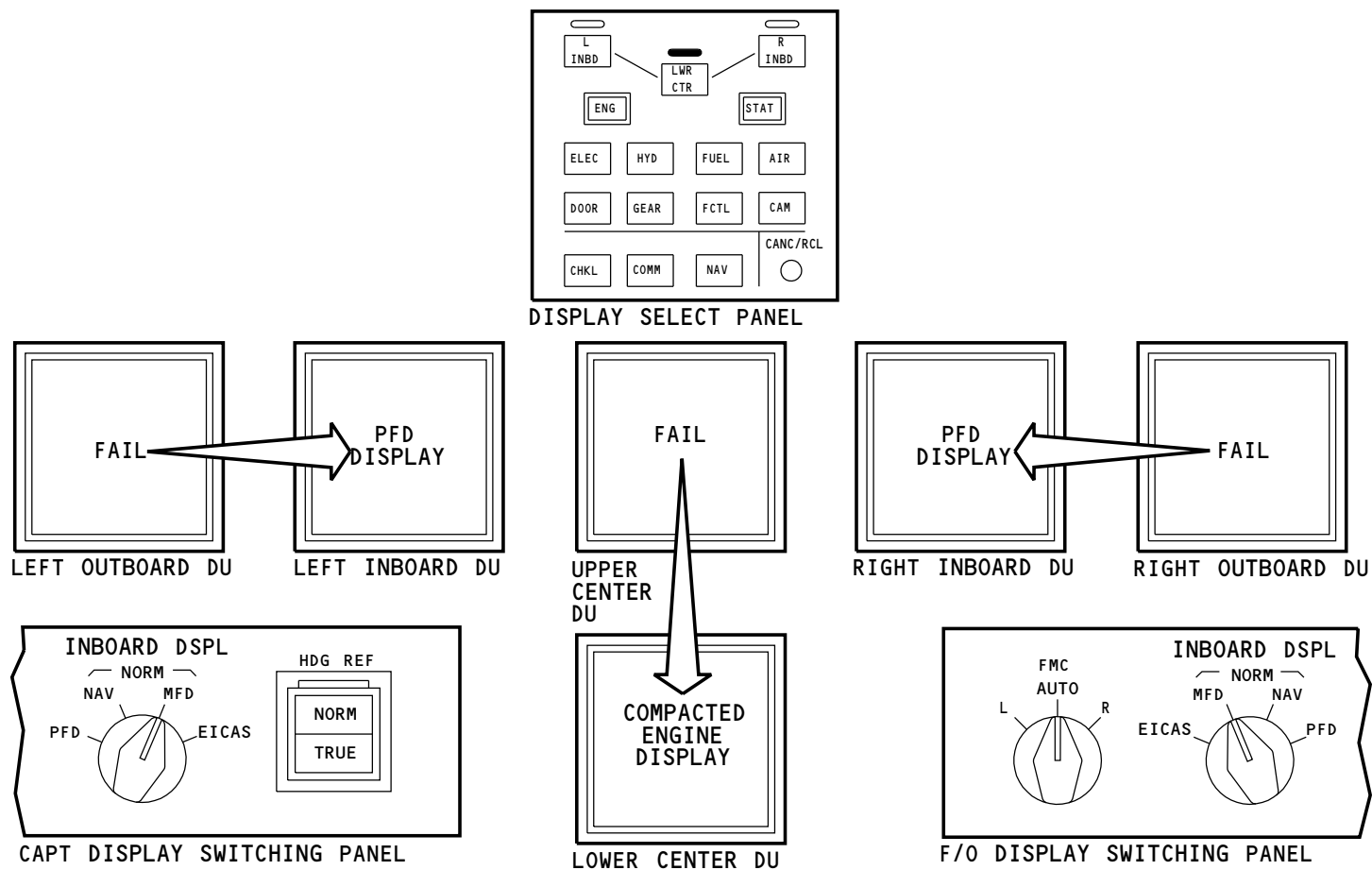
The FUEL switch controls the fuel quantity and fuel imbalance display.

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PRIMARY DISPLAY SYSTEM - AUTOMATIC DISPLAY SWITCHING

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PRIMARY DISPLAY SYSTEM - PFD MANUAL SWITCHING

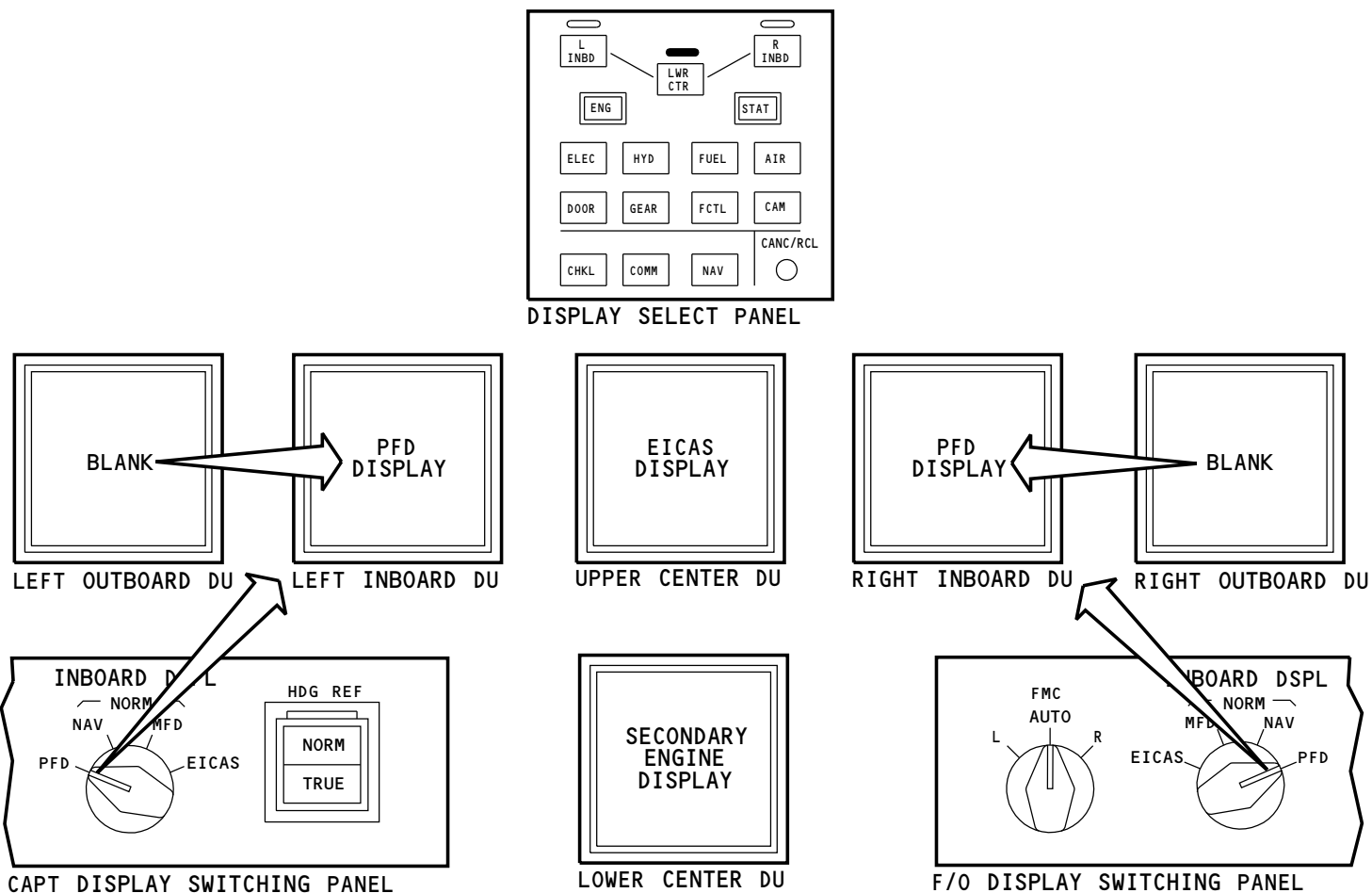
General

The PFD position of the inboard display selector on the display switching panel lets the operator move the PFD format to the inboard DU.

The outboard DU blanks when the selector is in the PFD position.

Return the inboard display selector to NORM (ND or MFD) to cause the PFD to show on the outboard DU and to cause the ND format to show on the inboard DU.

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M41973 S000618519_V1

PRIMARY DISPLAY SYSTEM - PFD MANUAL SWITCHING

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PRIMARY DISPLAY SYSTEM - MANUAL EICAS SWITCHING

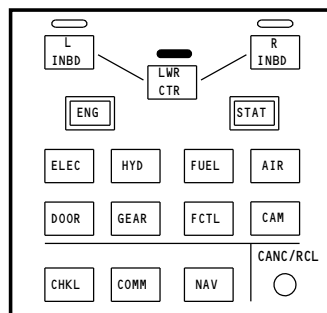
General

The EICAS position of the inboard display selector on the display switching panel lets the operator move the EICAS display format to the inboard DU.

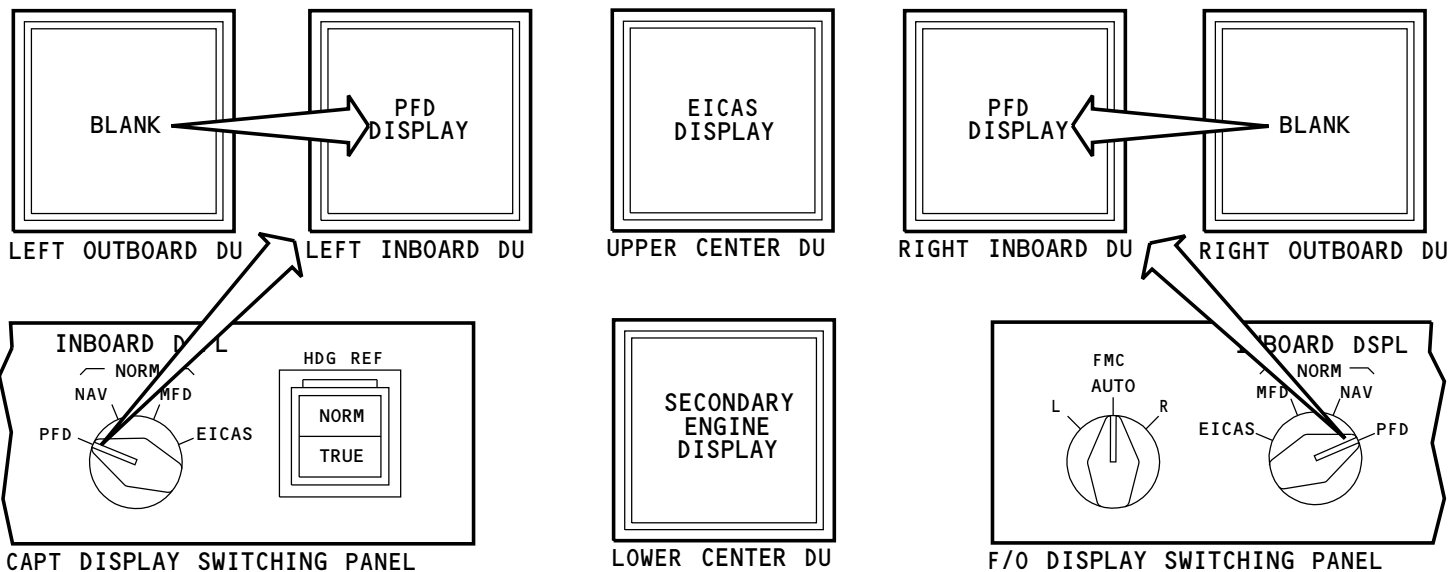
Both inboard DUs can show the EICAS display format at the same time. Both displays will be identical. One DU cannot show EICAS display and the other show compacted engine.

The upper center DU blanks when the inboard display selector is in the EICAS position.

Return the inboard display selector to NORM (ND or MFD) to cause the engine EICAS display to show on the upper center DU and to cause the ND format to show on the inboard DU.



DISPLAY SELECT PANEL



M41975 S000618521_V1

PRIMARY DISPLAY SYSTEM - MANUAL EICAS SWITCHING

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PRIMARY DISPLAY SYSTEM - MULTIPLE DU FAILURES

General

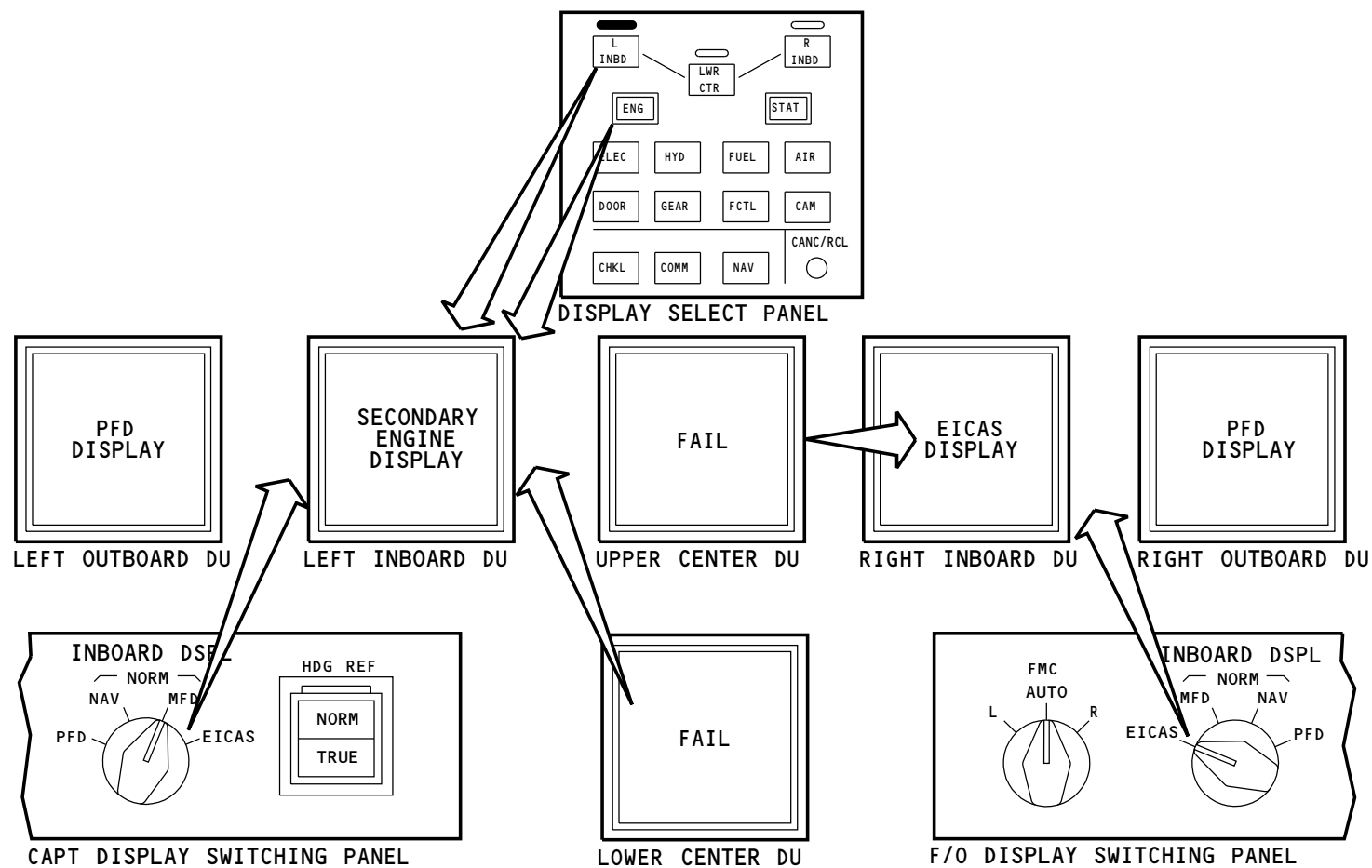
The display select panel (DSP) switches and the inboard display selectors on the display switching panel provide system redundancy when multiple DU failures occur.

The EICAS position of the inboard display selector causes the EICAS display format to show on an inboard DU.

The L INBD or R INBD switch on the DSP causes other EICAS formats to show on an inboard DU. The inboard display selector must be in the MFD position before the DSP L INBD or R INBD switch will have effect.

The L INBD or R INBD switch also has no effect if an outboard DU fails and the PFD automatically switches to an inboard DU.

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M41977 S000618523_V1

PRIMARY DISPLAY SYSTEM - MULTIPLE DU FAILURES

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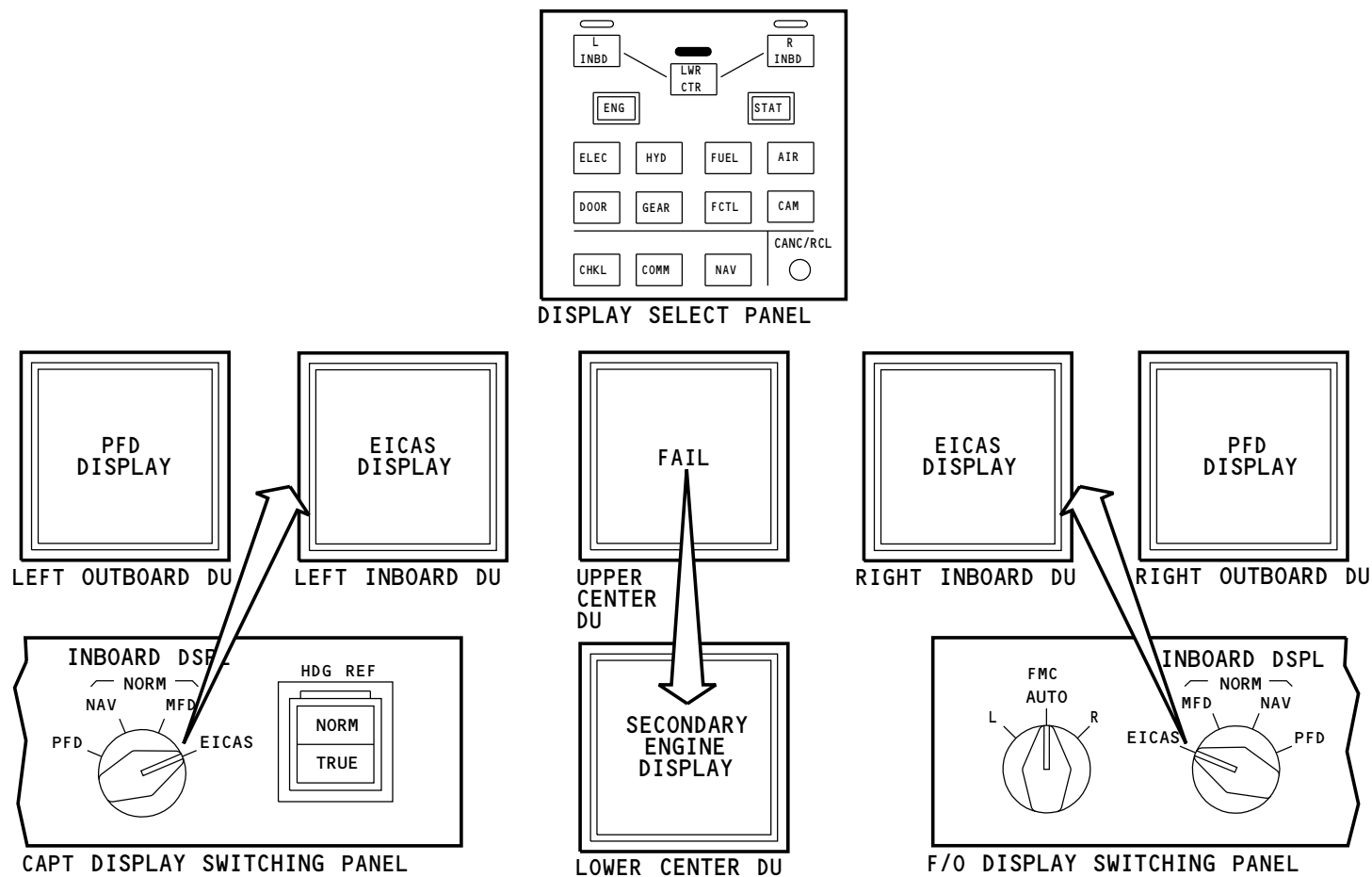


PRIMARY DISPLAY SYSTEM - EICAS LIMITED MODE RECOVERY

General

After the EICAS display automatically switches, the selection of EICAS on either inboard display selector causes the lower center DU to show the secondary engine format. The EICAS display shows on the inboard DU.

The EICAS display shows on both inboard DUs when the inboard display selectors are in the EICAS position.



M41979 S000618525_V1

PRIMARY DISPLAY SYSTEM - EICAS LIMITED MODE RECOVERY

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**PRIMARY DISPLAY SYSTEM - MULTIPLE DISPLAY FORMATS****General**

The primary display system has the capability to show multiple formats at the same time. To do this, the DSP works with the inboard display selectors on the display switching panels. The system has the capability to show any combination of display formats.

As an example, to show the AIR synoptic on the F/O's inboard DU, do this:

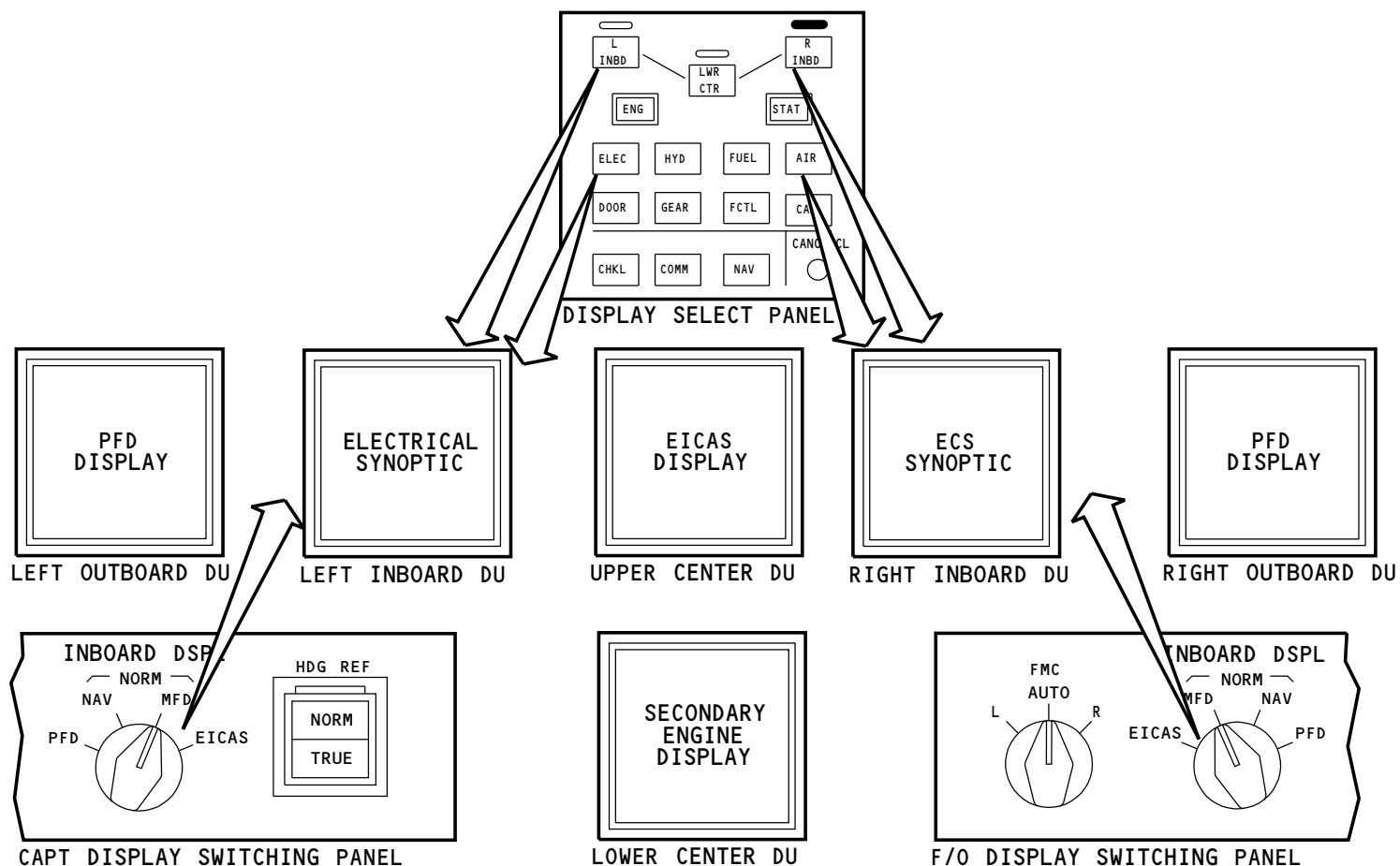
- Put the right inboard display selector in the MFD position
- Select R INBD on the DSP
- Select AIR on the DSP.

To show the electrical synoptic on the captain's inboard DU, do this:

- Put the left inboard display selector in the MFD position
- Select L INBD on the DSP
- Select ELEC on the DSP.

The inboard DUs return to the ND display when you select the inboard display selector on the Captain's Display Switching Panel to the ND position or when you select the NAV switch on the DSP.

The inboard DU also returns to the ND display when you select the NAV switch or re-select the Synoptic switch on the DSP if the DU is showing the synoptic page.



M41981 S000618527_V1

PRIMARY DISPLAY SYSTEM - MULTIPLE DISPLAY FORMATS

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**PRIMARY DISPLAY SYSTEM - NAVIGATION DISPLAY PRIORITIES****Center Lower DU**

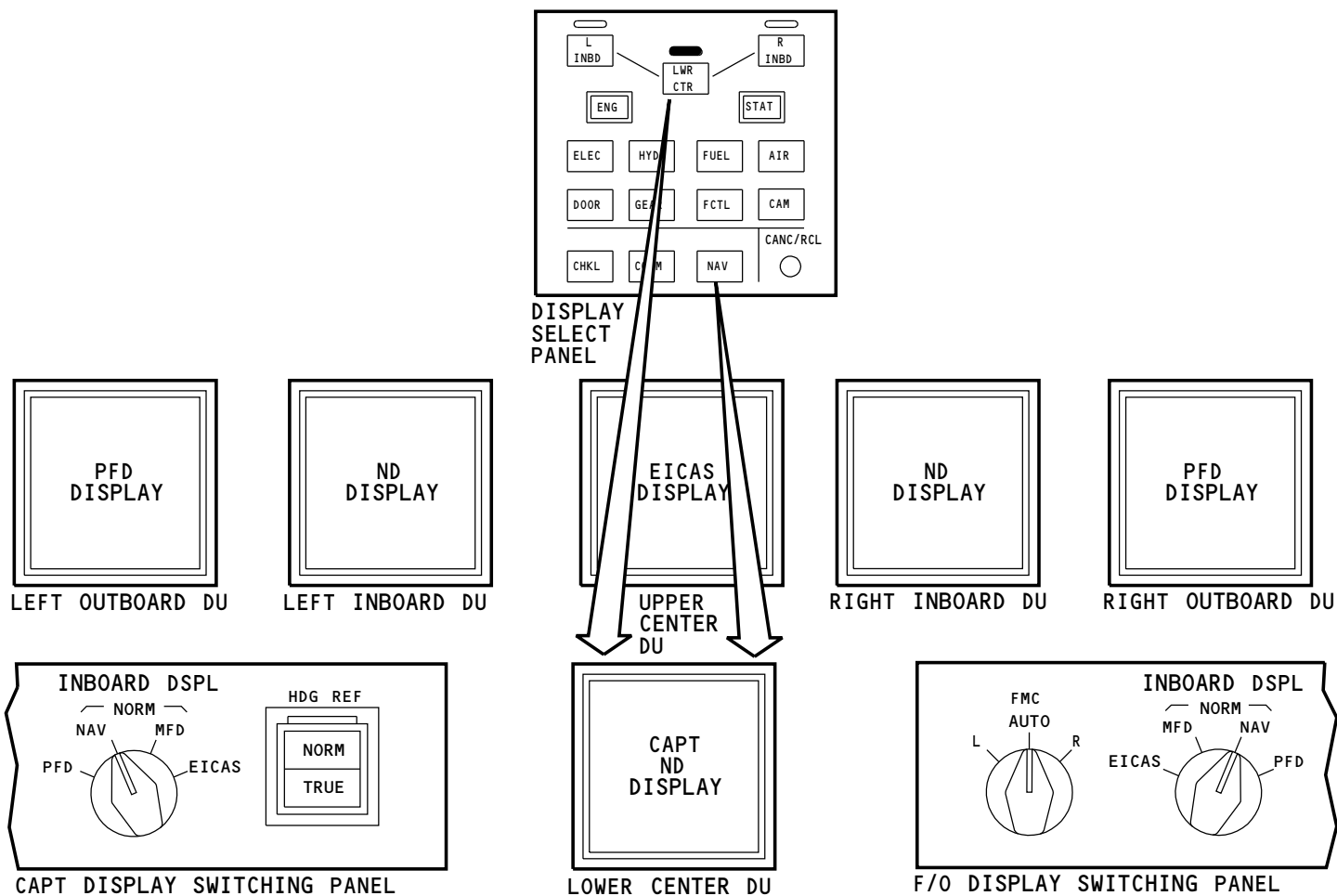
Select the NAV switch and the LWR CRT switch on the DSP to cause an ND display to show on the lower center DU.

If only one ND (capt or F/O) shows on an inboard DU, the other ND (capt or F/O) shows on the lower center DU.

If both the captain's and the F/O's inboard DUs show the ND display or neither show the ND display, the lower center DU shows the captain's ND.

Inboard DU

If the left or right inboard display selector on the display switching panels is in the MFD position and the NAV switch on the DSP is set, then the left or right inboard DU will show the associated captain's or first officer's ND display. If the inboard DU is showing a synoptic page, re-selecting the synoptic switch on the DSP will also turn the DU to the ND display.



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PRIMARY DISPLAY SYSTEM - NAVIGATION DISPLAY PRIORITIES

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**PRIMARY DISPLAY SYSTEM - SECONDARY ENGINE EXCEEDANCE****General**

The EICAS display format and MFD show different formats when a secondary exceedance latches or an exceedance clear occurs. This occurs during normal and limited operation.

Secondary Engine Exceedance Latches

When a secondary engine exceedance latches in memory, the upper center DU and lower center DU change formats. The new formats depend on the formats that show before the exceedance occurs.

During normal operation one of these will occur:

- If the lower center DU is blank, then it shows the secondary engine format and the upper center DU shows the EICAS display format.
- If the lower center DU shows the secondary engine format, it remains the same and the upper center DU shows the EICAS display format.
- If the lower center DU shows a maintenance page while the airplane is on the ground, it remains the same and the upper center DU shows the compacted engine format.
- If the lower center DU shows a status page format, a synoptic, flight deck communication function format, checklist format or a navigation display, it remains the same and the upper center DU shows the compacted engine format.

During limited operation, if the upper center DU is blank and the lower center DU shows the EICAS display format, the lower center DU shows the compacted engine format.

Secondary Engine Exceedance Clears

During normal operation, when the secondary engine exceedance clears, the upper center DU shows the EICAS display format for all conditions except when the lower center DU shows a maintenance page while the airplane is on the ground, then the upper center DU shows the compacted engine format. The center lower DU remains the same.

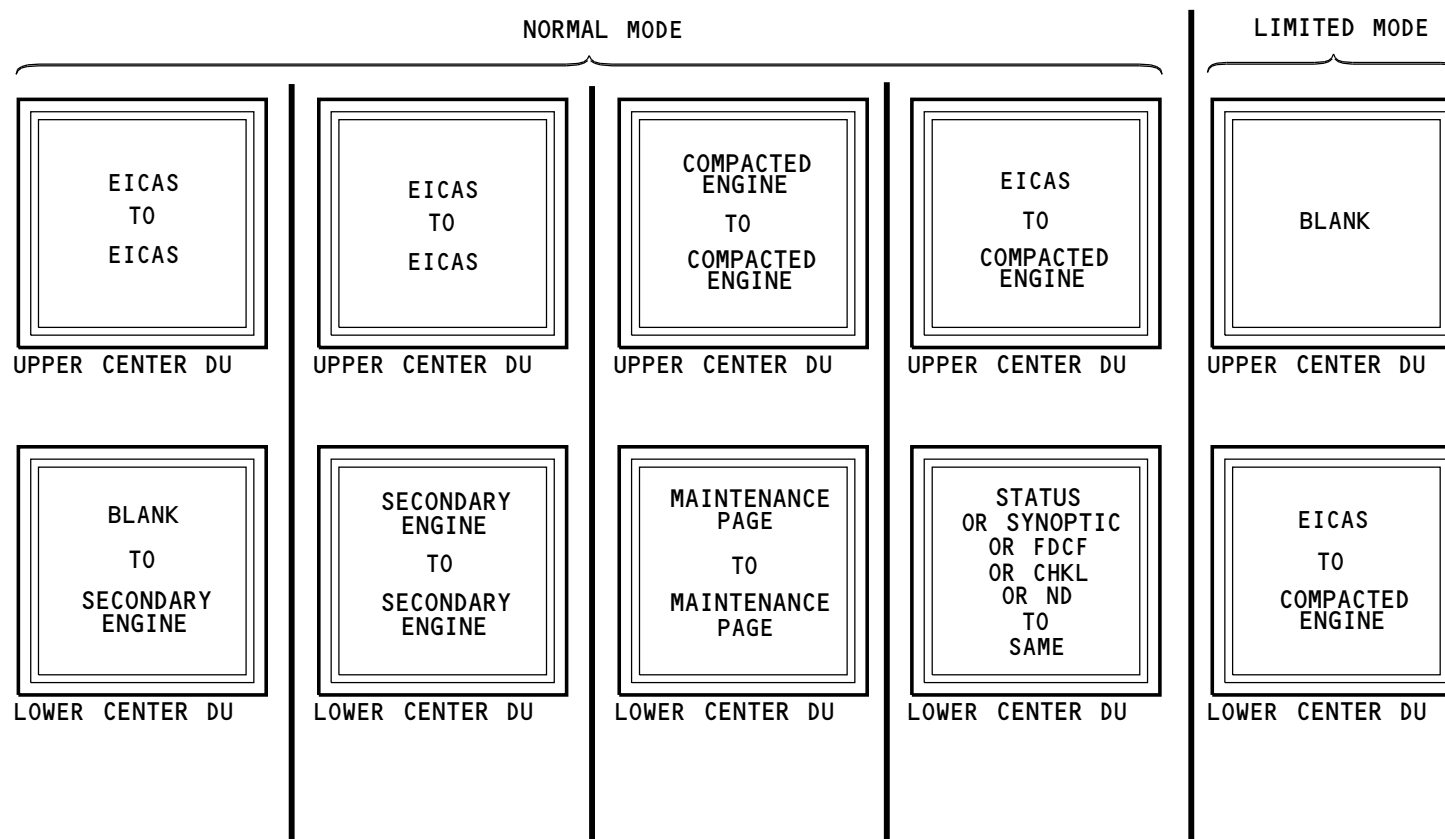
During limited operation, when the exceedance clears, the lower center DU remains the same.

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PRIMARY DISPLAY SYSTEM - SECONDARY ENGINE EXCEEDANCE

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PRIMARY DISPLAY SYSTEM - SPECIAL FUNCTIONS

General

The AIMS primary display system (PDS) special functions make sure the interfaces of the displays to their hardware are correct. PDS hardware includes:

- CPM/GGs
- Display units (DU)
- Coaxial couplers
- Control panels and switches
- Remote light sensors
- Cursor control devices (CCD).

These are the special functions for PDS hardware:

- Display Switches
- Display screens (5)
- CPM/GG to WXR interface checks (4)
- Brightness control and display units
- CPM/GG to DU interface checks (4).

NOTE: The PDS special functions cannot be operated through the multi-function display (MFD).

Display Switches

The display unit special functions supports functional testing of interfaces and verifies correct operation. The DUs show a test format to do this.

Display Screens (5)

Select the display screen special functions on the MAT. Examine the DU liquid crystal display (LCD). The DU BITE circuits do not monitor the DU LCD and electronic driver circuits. These are the failures to look for:

- Line defects
- Element defects

- Full-field gray scale characteristics.

For the full red screen test (the red, blue, and green screen tests are similar), all six DUs show a solid red screen. Use the MAT to cycle through the seven red gray scales. All six DUs show the same red gray scale level. This occurs with the brightness controls on all six DUs set to maximum and all six DUs should appear equal. A DU with a weak backlight or electronic driver failure stands out from the other DUs at one or more of the gray scale levels.

For the full white/black screen test, all DUs show a solid white screen. Use the MAT to cycle through the seven gray scales plus black. This test detects intermittent dot failures and hard failures. A DU with a weak backlight or electronic driver failure stands out from the other DUs at one or more of the gray scale levels.

For the striped pattern test, all six DUs show a screen with diagonal white and black stripes. This format allows detection of electrically floating line failures. These lines may not be visible on a solid color screen.

CPM/GG to WXR Interface Check (4)

The CPM/GG to WXR interface check verifies the validity to the WXR ARINC 453 inputs to the GGs in each AIMS cabinet.

Brightness Control and Display Units

This special function supports functional tests of hardware interfaces and makes sure operation is correct. The six DUs show a test display to do this.

CPM/GG to DU Interface Checks (4)

The graphic generator special functions supports functional tests of airplane interfaces and verifies correct interface of the CPM/GGs to the DUs. The CPM/GGs do a test one at a time. The DUs are grouped in two sets of three for this test. All four combinations of CPM/GG to DU groups are tested. The DUs show the test format to make sure that each DU receives each CPM/GG input.

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SPECIAL FUNCTIONS

SELECT ATA SYSTEM (21)

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31 AIMS - DISPLAY SYSTEM

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SELECT FUNCTION (15)

BLUE SCREEN.

CPM/GG (M010-L AND M011-R) TO DU INTERFACE CHECK

CPM/GG (M010-R AND M011-L) TO DU INTERFACE CHECK

CPM/GG (M011-L AND M010-R) TO DU INTERFACE CHECK

CPM/GG (M011-R AND M010-L) TO DU INTERFACE CHECK

CPM/GG (M010) IN L-AIMS WXR INTERFACE CHECK

CPM/GG (M011) IN L-AIMS WXR INTERFACE CHECK

CPM/GG (M010) IN R-AIMS WXR INTERFACE CHECK

CPM/GG (M011) IN R-AIMS WXR INTERFACE CHECK

CONTINUE

HELP

GO BACK

SELECT FUNCTION

(15)

BLUE SCREEN
 BRIGHTNESS CONTROLS AND DISPLAY UNITS
 CPM/GG (M010) IN L-AIMS WXR INTERFACE CHECK
 CPM/GG (M011) IN L-AIMS WXR INTERFACE CHECK
 CPM/GG (M010) IN R-AIMS WXR INTERFACE CHECK
 CPM/GG (M011) IN R-AIMS WXR INTERFACE CHECK
 CPM/GG (M010-L AND M011-R) TO DU INTERFACE CHECK
 CPM/GG (M010-R AND M011-L) TO DU INTERFACE CHECK
 CPM/GG (M011-L AND M010-R) TO DU INTERFACE CHECK
 CPM/GG (M011-R AND M010-L) TO DU INTERFACE CHECK
 DISPLAY SWITCHES
 GREEN SCREEN
 RED SCREEN
 STRIPE SCREEN
 WHITE SCREEN

PRIMARY DISPLAY SYSTEM - SPECIAL FUNCTIONS

M42112 S000618532_V1



PRIMARY DISPLAY SYSTEM - BRIGHTNESS CONTROLS AND DISPLAY UNITS TEST DISPLAY

General

The brightness controls and display units test is a special purpose test that does a test of the primary display system hardware. You use the MAT, LMAT or PMAT to start the test and the test display shows on all six DUs.

The test display shows these:

- DU location
- ARINC 429 loop
- Graphic generator (GG) source
- DU input activity
- Status of brightness inputs.

The background of the test format is black. Text titles are cyan. Test values are white except for FAIL, N (for no) and BAD which are red. PASS and Y (for yes) are green.

DU Location

The DU location information shows the location ID pins of the DU that the GG is addressing. The readouts show as:

- RIB - right inboard DU
- ROB - right outboard DU
- CU - center upper DU
- CL - center lower DU
- LIB - left inboard DU
- LOB - left outboard DU.

An invalid DU location ID shows as BAD.

ARINC 429 Loop

The ARINC 429 loop shows the status of the ARINC 429 bus from the DUs to the AIMS cabinets.

A PASS or FAIL indication shows on the DU.

GG Source

The GG source shows the GG that is driving the display. The readouts show as:

- L10 for the left GG in the left AIMS cabinet
- L11 for the right GG in the Left AIMS cabinet
- R10 for the left GG in the right AIMS cabinet
- R11 for the right GG in the right AIMS cabinet.

Input Activity

The input activity area shows the status of the four DU coaxial cable inputs. The specific input for each DU shows with a white highlight box.

A Y or N shows for each of the four coaxial inputs.

Brightness Inputs

The value of both automatic and manual brightness control inputs show as a percentage of maximum value.

The range of each of the inputs is from 0 to 100. BAD shows if the input is bad. These are the inputs for automatic brightness controls:

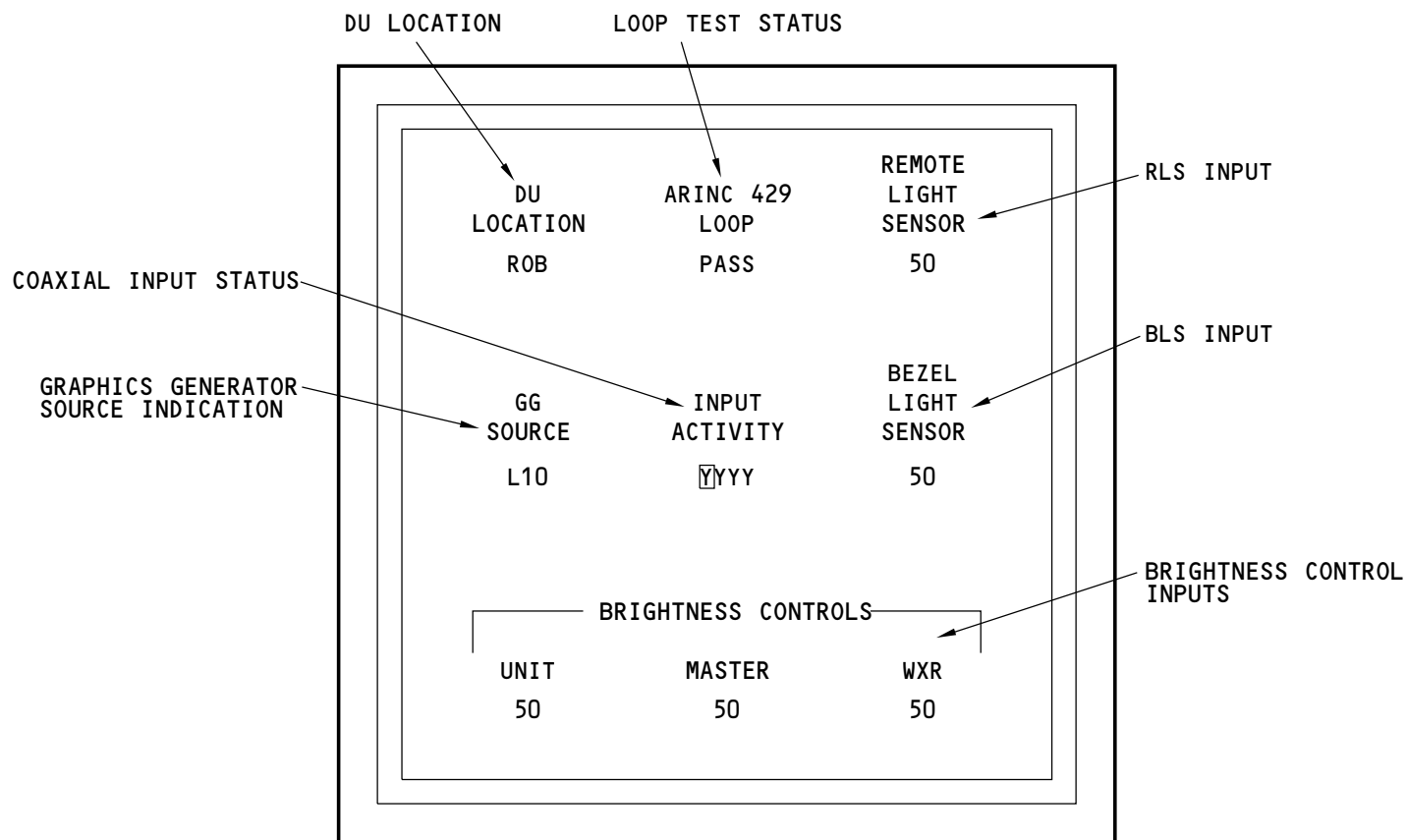
- Remote light sensor (RLS)
- Bezel light sensor (BLS).

During the test, automatic brightness control of the DUs is disabled.

These are the manual inputs:

- Unit brightness from the individual brightness control knob
- Master brightness from the zone brightness control
- WXR from the shading brightness control knob.

As you adjust a knob, the value on the DU should change.



M41986 S000618533_V1

PRIMARY DISPLAY SYSTEM - BRIGHTNESS CONTROLS AND DISPLAY UNITS TEST DISPLAY

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PRIMARY DISPLAY SYSTEM - DISPLAY SWITCHES TEST DISPLAY**General**

The display switches test display is a special purpose test that shows the status of switches that effect the primary display system. You use the MAT, LMAT or PMAT to select the test and a test display shows on all six DUs. As you change the position of any of the switches, the display changes.

The display shows the condition of these switches:

- Display select panel (DSP) switches
- Accept (ACPT), cancel (CANC), reject (RJCT) switches.

The display also shows the position of switches and selectors on the:

- Instrument source select panels (ISSPs)
- Display switching panels
- CDCP.

DSP Switches

There is an indication for all the switches on the DSP. A filled white box shows when you select a switch. The fill goes away when you deselect the switch.

Accept, Cancel, Reject Switches

A filled white box shows when you select a switch. The fill goes away when you deselect the switch.

ISSPs

The position of each of the switches on the captain's and first officer's ISSPs show.

The display control (DSPL CTRL) switch positions show as AUTO or ALT.

The navigation source switch positions show as AUTO or CDU.

The air data/attitude source switch positions show as NORM or ALT.

Display Switching Panels

The captain's and first officer's inboard display selector positions show as PFD, ND, MFD or EICAS.

The heading reference switch position shows as NORM or MAG.

CDCP

The display control (DSPL CTRL) switch position shows as AUTO or ALT.

The event record switch shows a white box shows when you select the switch. The white box goes away when you deselect the switch.

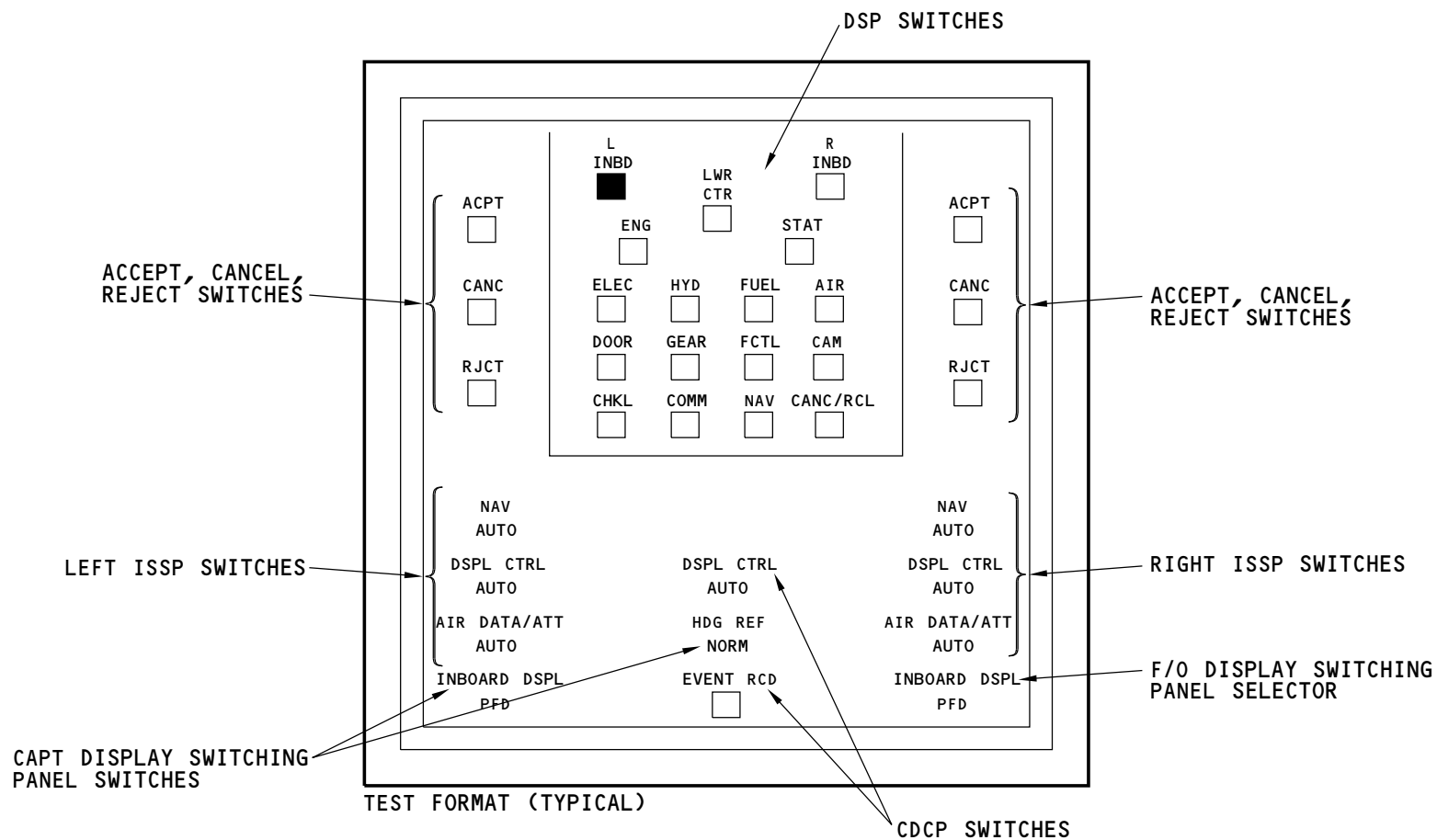
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PRIMARY DISPLAY SYSTEM - DISPLAY SWITCHES TEST DISPLAY

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GROUND MANEUVER CAMERA SYSTEM - INTRODUCTION

General

The ground maneuver camera system (GMCS) lets the flight crew see the main and the nose landing gear. The views help the flight crew during ground maneuvers of the 777-300.

ARO 016-999

The ground maneuver camera system also supplies the view from the nose landing gear taxi camera to the in-flight entertainment (IFE) system.

ARO ALL**Abbreviations and Acronyms**

- AIMS - airplane information management system
- CAM - camera
- CCD - charge coupled device
- CDU - control display unit
- CMCS - central maintenance computing system
- DSP - display select panel
- DU - display unit
- ELMS - electrical load management system
- GMCS - ground maneuver camera system

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- IFE - in-flight entertainment

ARO ALL

- MAT - maintenance access terminal
- MCU - modular concept unit
- MGMT - management
- MFD - multi-function display
- NTSC - national television system committee
- PMAT - portable maintenance access terminal
- TCIU - taxi camera interface unit

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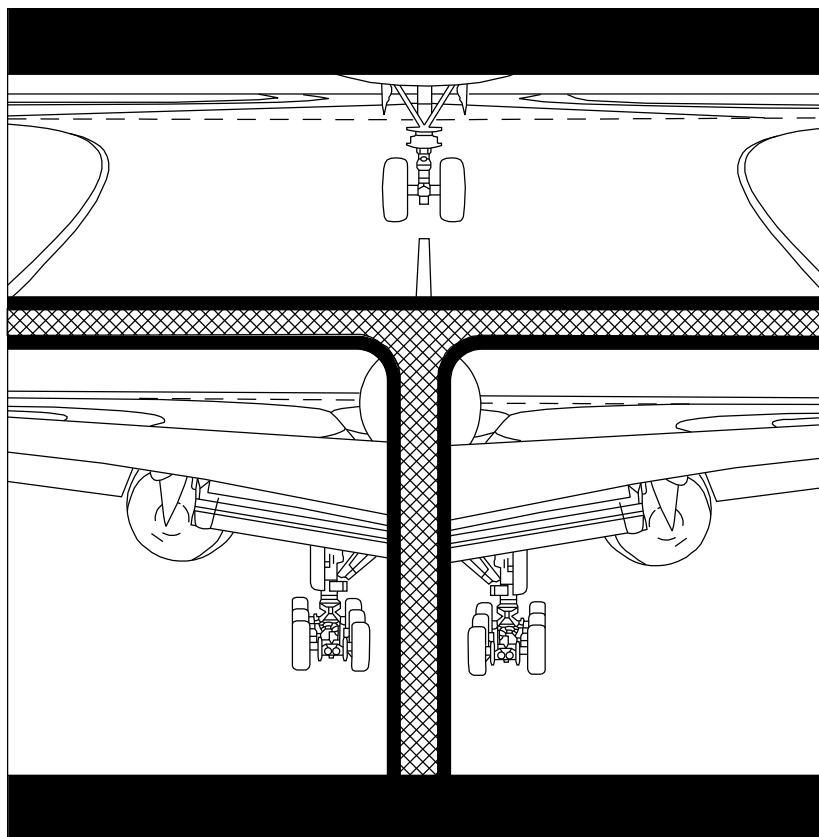
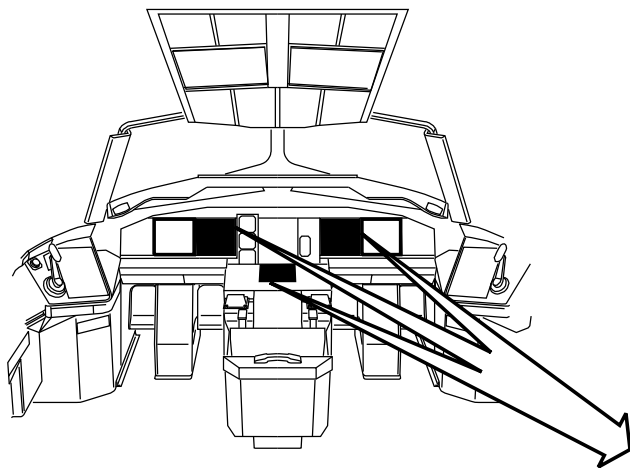
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M42123 S000618556_V1

GROUND MANEUVER CAMERA SYSTEM - INTRODUCTION

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**GMCS - GENERAL DESCRIPTION****General**

The ground maneuver camera system (GMCS) has a taxi camera interface unit (TCIU) and three taxi cameras.

Description

The taxi cameras send national television system committee (NTSC) video to the TCIU. The TCIU combines the three video signals into a 3-way split screen video format. The TCIU sends the 3-way split screen video format to these display units:

- Left inboard
- Right inboard
- Lower center.

The pilots select the GMCS video on the display select panel (DSP) or the control display units (CDUs).

Also, the TCIU has these other functions:

- Supply power to the taxi cameras

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- Supply nose landing gear taxi camera video to the in-flight entertainment (IFE) system

ARO ALL

- Automatic electronic pan of the main landing gear taxi cameras to compensate for horizontal stabilizer position (the main landing gear cameras are in the horizontal stabilizer)
- Supply manual boresight functions for maintenance personnel to align the taxi cameras views after replacement of a taxi camera or the TCIU.

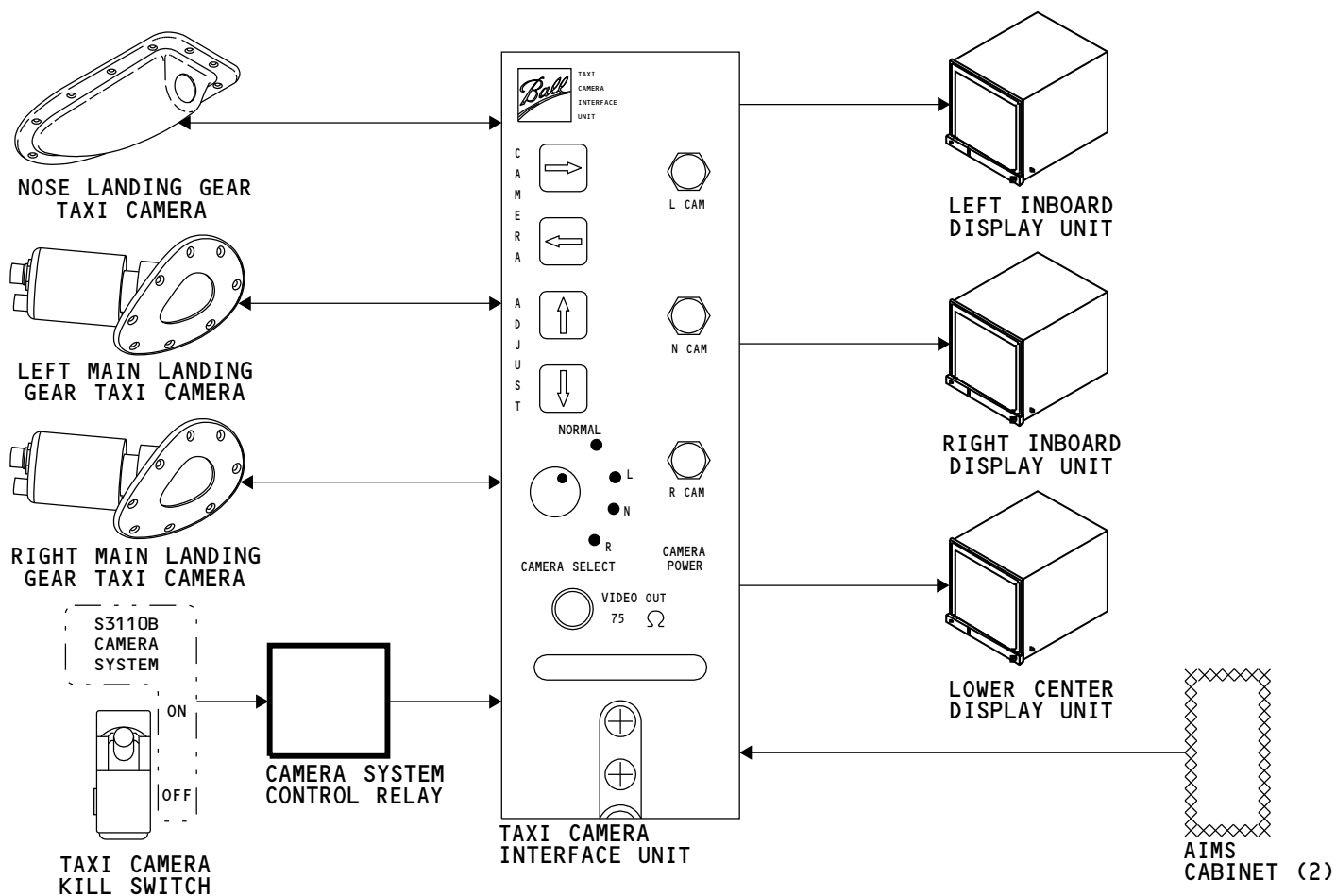
The camera system kill switch controls the power to the GMCS.

Stabilizer position data comes from the AIMS cabinets.

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GMCS - GENERAL DESCRIPTION

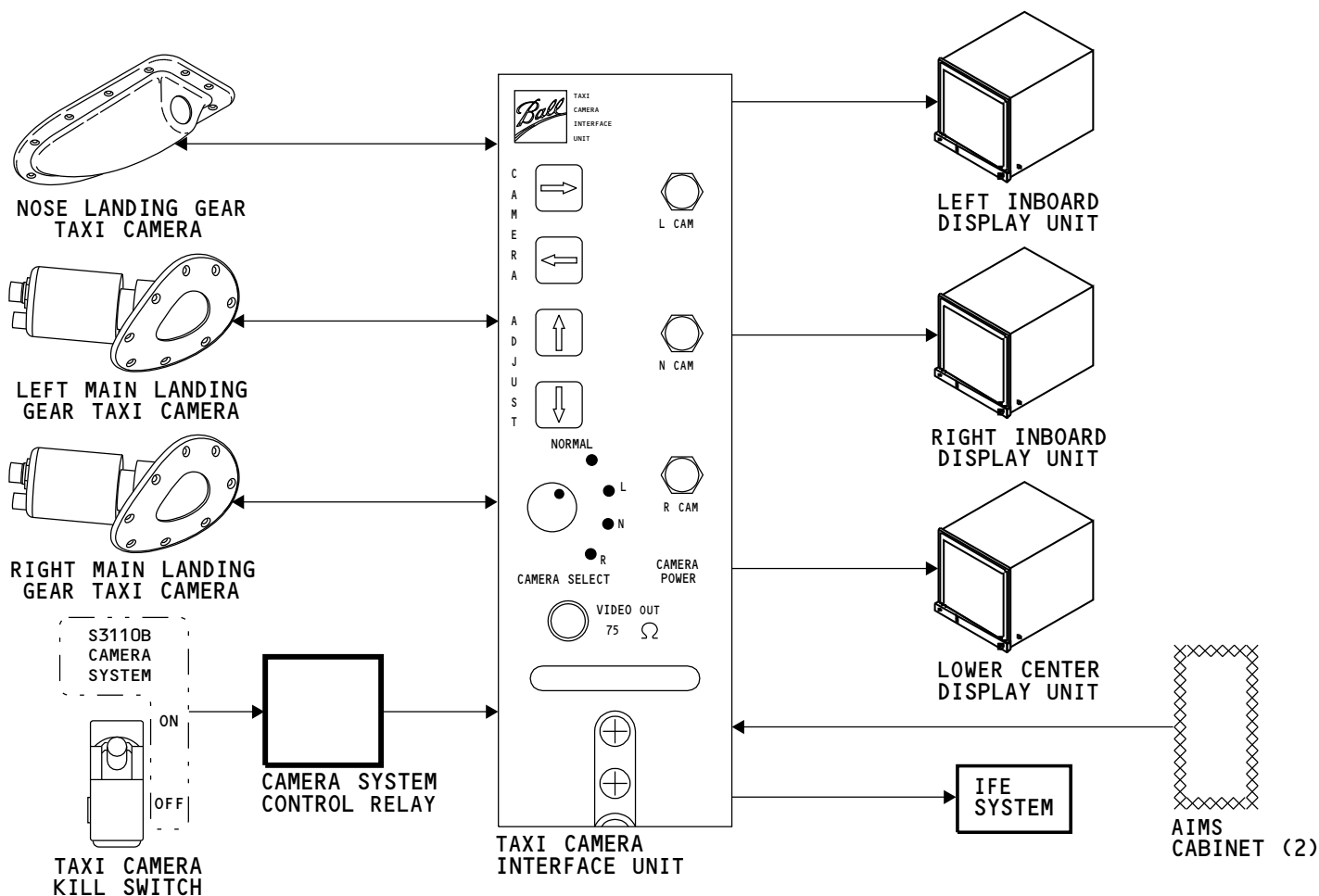
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GMCS - GENERAL DESCRIPTION

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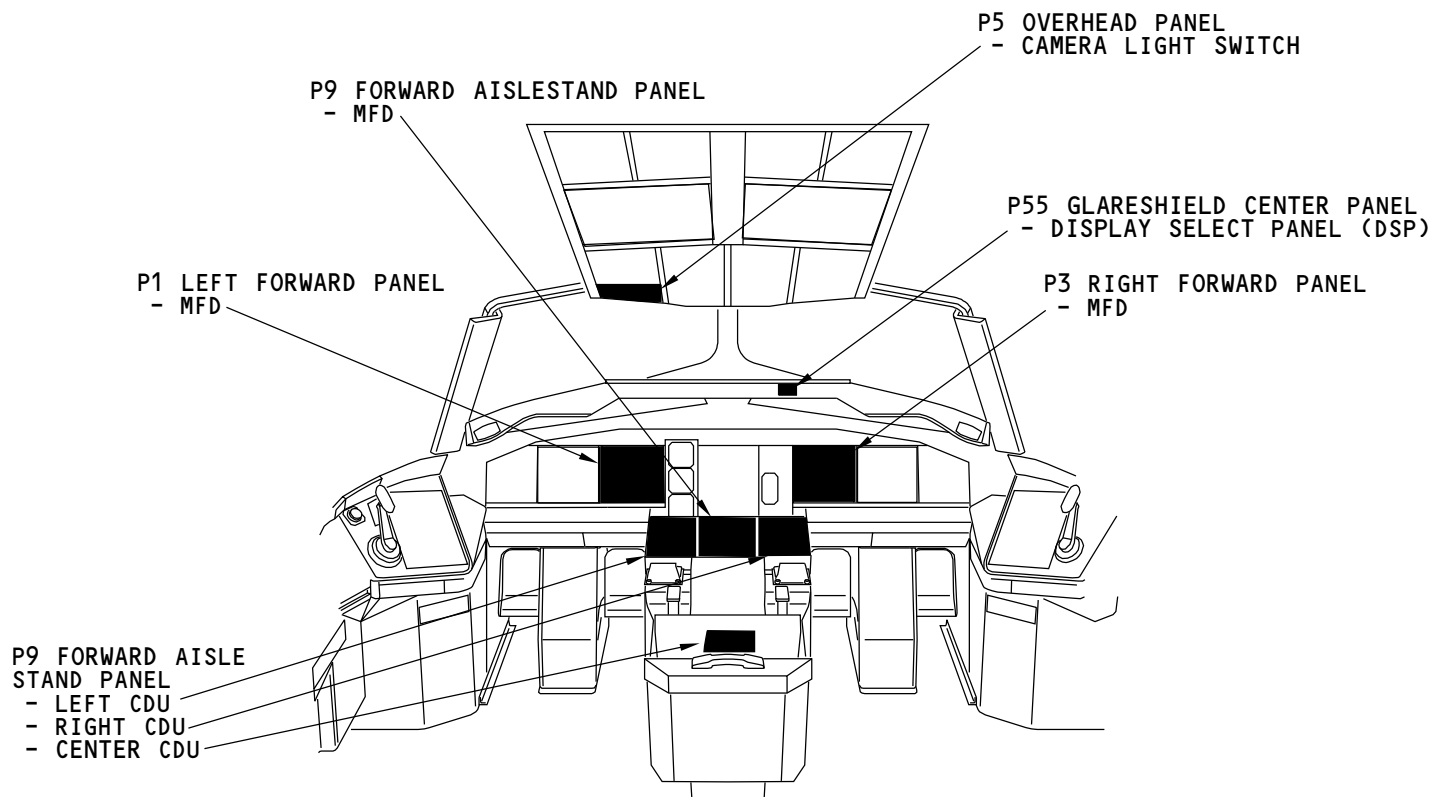
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**GMCS - FLIGHT DECK COMPONENT LOCATIONS****General**

These are the components in the flight deck that interface with the GMCS:

- Camera light switch
- Display select panel (DSP)
- Multi-function displays (MFDs)
- Left, right, and center CDUs.



GMCS - FLIGHT DECK COMPONENT LOCATIONS

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**GMCS - MAIN EQUIPMENT CENTER AND FUSELAGE COMPONENT LOCATIONS****Equipment Center**

The taxi camera interface unit is in the main equipment center on the E1-5 shelf.

Fuselage

The nose landing gear taxi camera is on the lower side of the fuselage. It is aft of the bottom TCAS antenna and in front of the center transmit radio altimeter antenna.

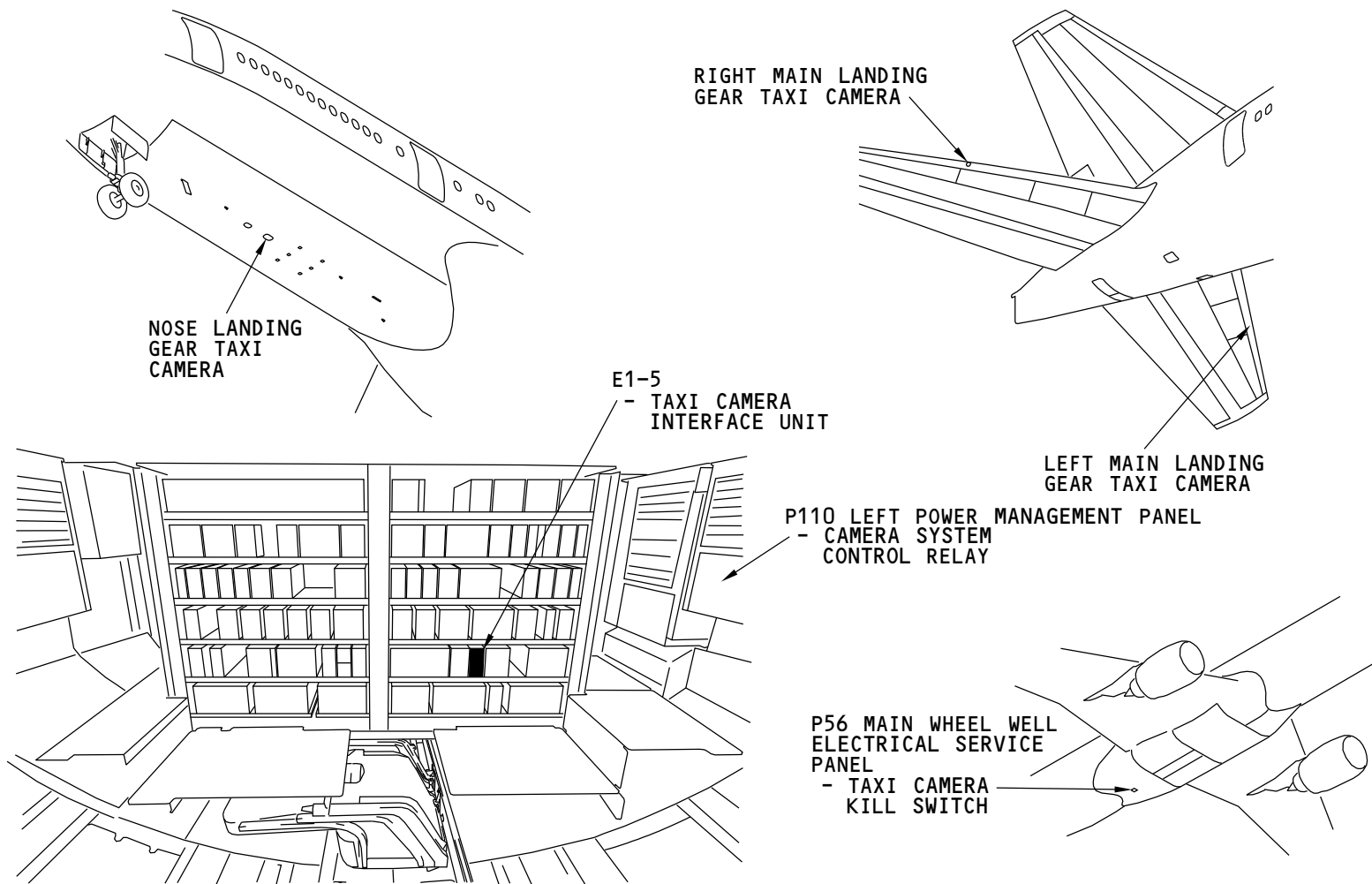
The left main landing gear taxi camera is in the leading edge of the left horizontal stabilizer.

The right main landing gear taxi camera is in the leading edge of the right horizontal stabilizer.

The taxi camera kill switch is on the P56 main wheel well electrical service panel.

The camera system control relay is on the P110 left power management panel.

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GMCS - MAIN EQUIPMENT CENTER AND FUSELAGE COMPONENT LOCATIONS

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**GMCS - POWER AND TAXI CAMERAS INTERFACE****Taxi Camera Interface Unit Power Inputs**

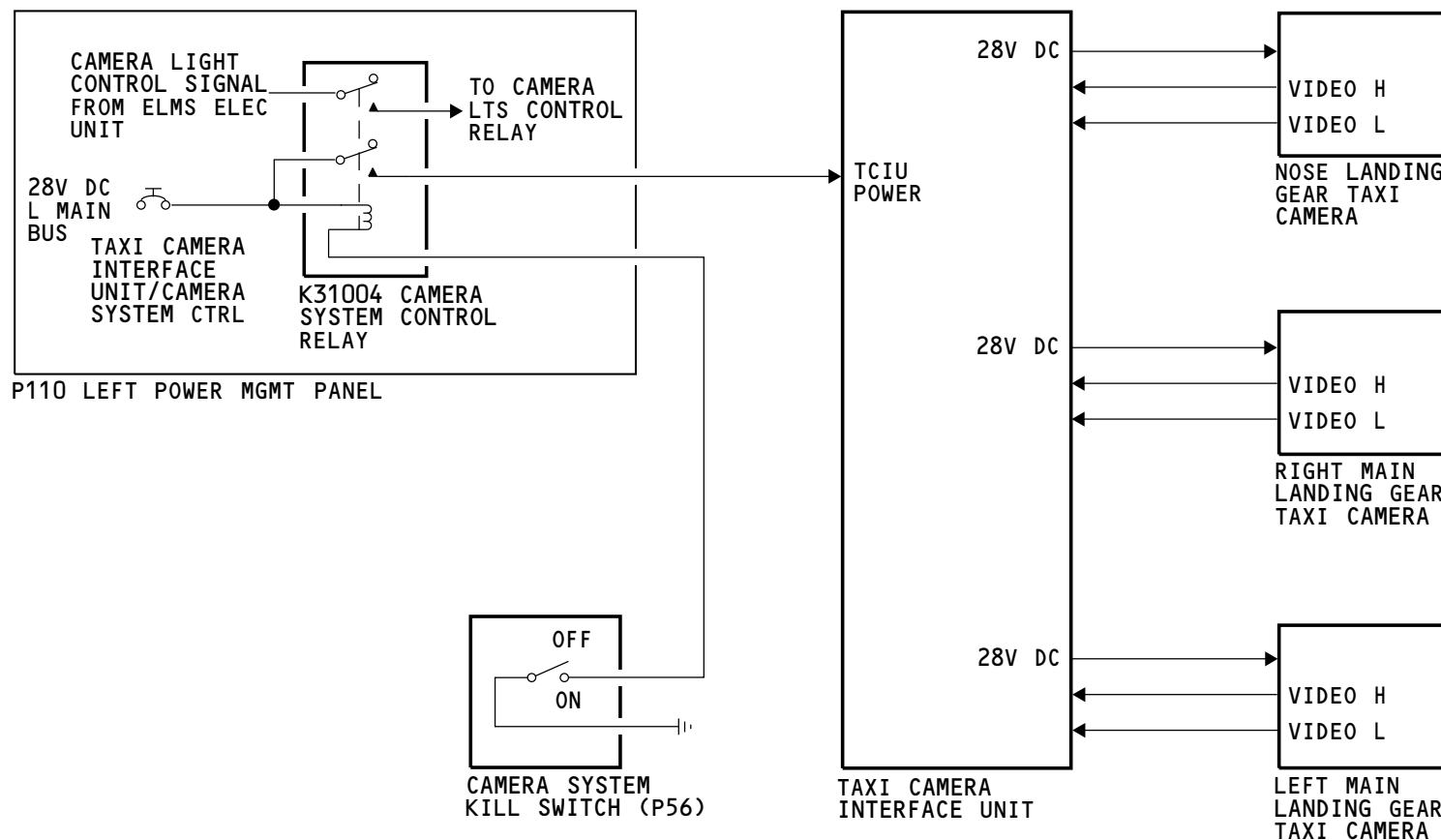
The camera kill switch on the P56 main wheel well electrical service panel controls the power to the TCIU and the camera lights. When the camera kill switch is in the ON position, a ground energizes the camera system control relay. When the camera system control relay is energized, 28v dc goes to the TCIU and the electrical load management system (ELMS) electronic unit can send a taxi camera light control signal to the camera lights control relay to allow the camera lights to come on. The camera lights come on when the flight crew selects the taxi camera lights on.

See the taxi camera lights section for more information about the taxi camera lights (SECTION 33-47).

When the camera kill switch is in the OFF position, the TCIU and the camera lights do not come on. This disables the ground maneuver camera system (GMCS).

Taxi Cameras Power and Video Interface

The TCIU sends 28v dc to each taxi camera. The taxi cameras supply a national television system committee (NTSC) color video signal to the TCIU.



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GMCS - POWER AND TAXI CAMERAS INTERFACE

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**GMCS - TCIU INTERFACE****TCIU Horizontal Stabilizer Position Input**

The TCIU receives horizontal stabilizer position from the AIMS cabinets. The TCIU uses this input for electronic panning of the main landing gear taxi cameras to compensate for stabilizer position changes.

TCIU Video Output

The taxi camera interface unit (TCIU) supplies a 3-way split NTSC color video signal from the three taxi cameras directly to the display units (DUs).

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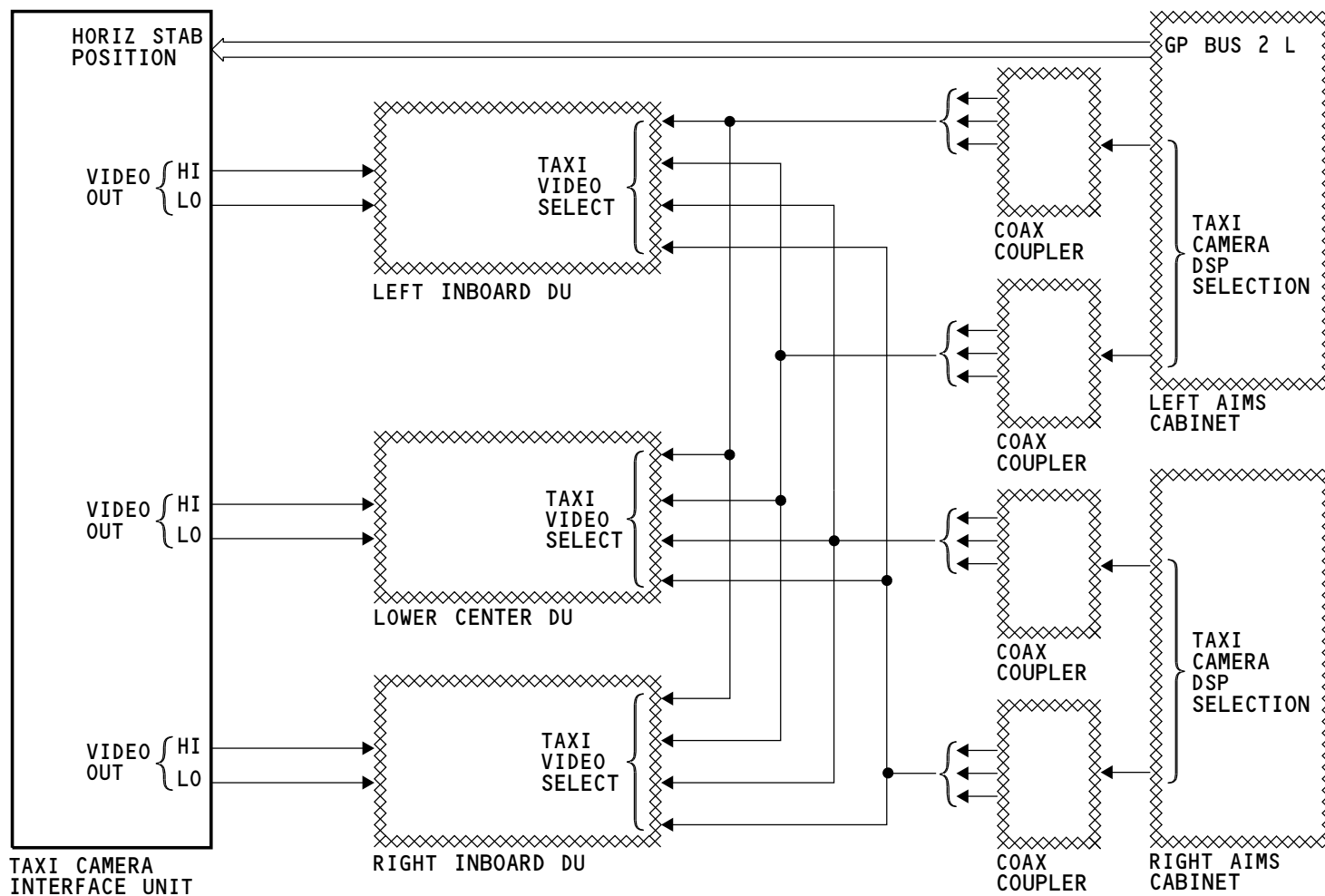
The TCIU also supplies an NTSC color video signal from the nose landing gear camera to the in-flight entertainment (IFE) system.

ARO ALL**DU Video Interface**

The flight crew uses the DSP to select the taxi cameras video for the multi-function display (MFD). The AIMS cabinets send the taxi camera selection to these units:

- Left inboard DU
- Lower center DU
- Right inboard DU.

The DUs use this signal to select the TCIU video input for display.



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GMCS - TCIU INTERFACE

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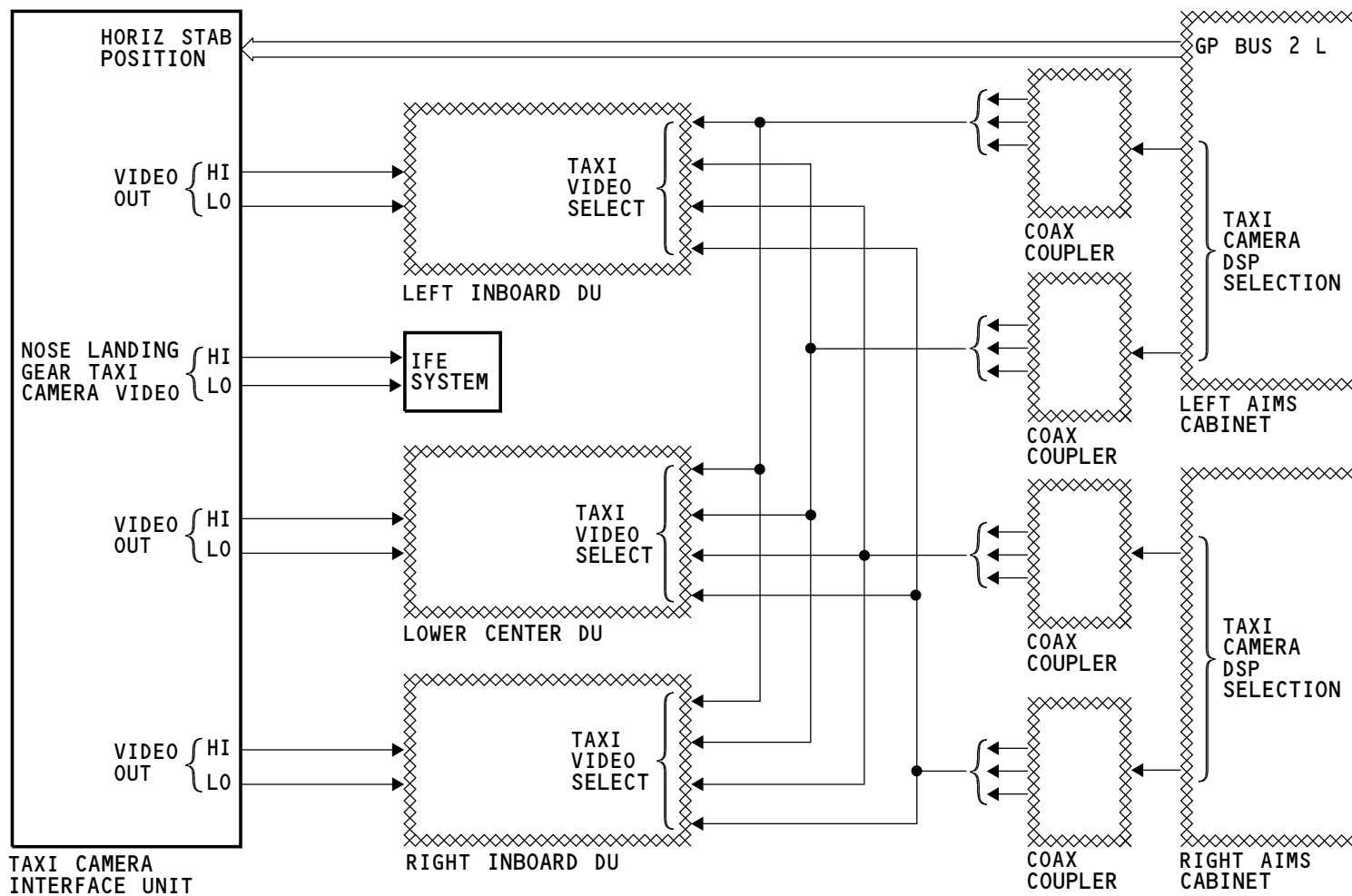
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GMCS - TCIU INTERFACE

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GMCS - TAXI CAMERA INTERFACE UNIT**Purpose**

The taxi camera interface unit (TCIU) does these functions:

- Supplies a 3-way split NTSC color video signal of the three taxi cameras to the multi-function displays (MFDs)
- Supplies power to the taxi cameras
- Supplies electronic panning of the main landing gear taxi cameras to compensate for the horizontal stabilizer position
- Lets maintenance personnel do a manual boresight of the three taxi cameras after replacement of a camera or the TCIU.

Physical Description

The TCIU is an ARINC 600 2 MCU box. Forced air supplies cooling for the TCIU. The TCIU is a line replaceable unit.

TCIU Circuit Breakers

The TCIU has three circuit breakers on its front panel. The circuit breakers supply power to the taxi cameras. Each taxi camera has a circuit breaker.

Camera Select Selector and Camera Adjust Buttons

You use the camera selector and the camera adjust buttons when you do a manual boresight of a taxi camera.

Use the camera selector to select the camera you want to use for a boresight procedure. In the L, N, and R (left, nose, right) positions, an overlay display alignment mark shows on the MFD over the video from the selected taxi camera.

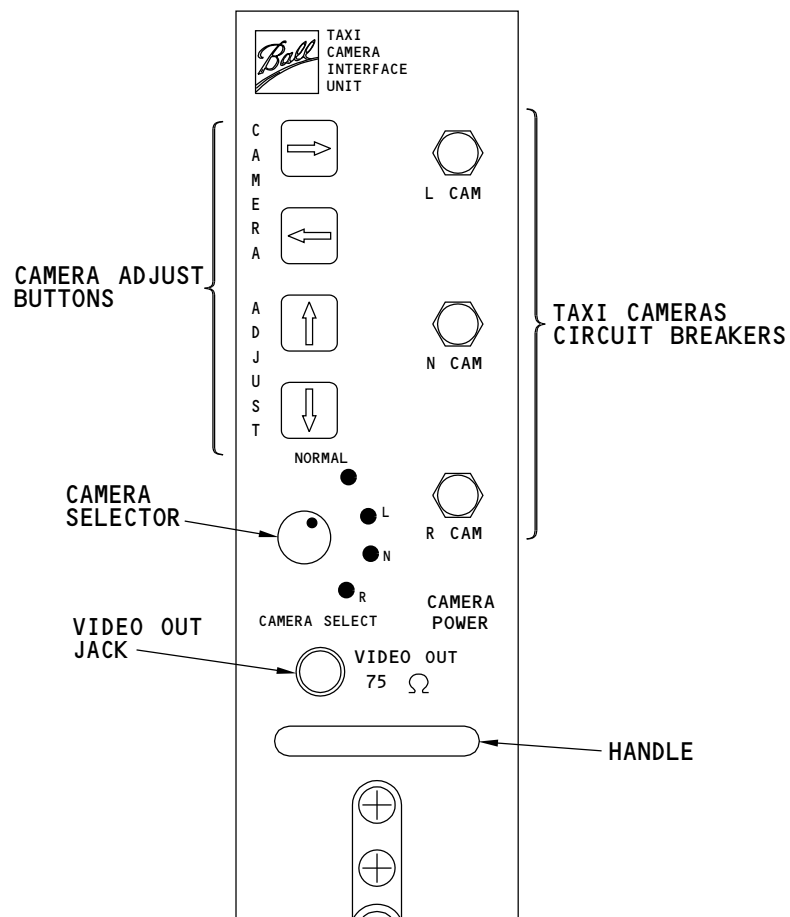
Use the camera adjust buttons to electronically pan the selected camera picture on the MFD up, down, right, or left. You pan the camera picture until the selected landing gear picture aligns with the overlay alignment mark on the MFD.

Video Out Jack

The video out jack supplies a color NTSC video signal output. The video signal at the video out jack is the same as the video signal that goes to the MFD. The video out jack accepts a BNC type plug.

Training Information Point

The TCIU does not send maintenance data to the CMCS. There are no CMCS tests you can do from the MAT or a PMAT.



GMCS - TAXI CAMERA INTERFACE UNIT

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**GMCS - TAXI CAMERAS****Purpose**

The taxi cameras supply an NTSC color video image to the taxi camera interface unit (TCIU).

Description

The taxi cameras are in sealed, pressurized housings. Only shop personnel can pressurize and seal the taxi camera housings.

The camera points through a window in the camera housing. The windows are made from crystal sapphire. The camera housing windows have window heat to prevent ice, frost, or condensation that could cause blockage of the camera view. Window heat occurs automatically when the cameras have power.

Nose Landing Gear Taxi Camera

The nose landing gear taxi camera has a 2.8 mm lens. The horizontal field of view of the nose landing gear taxi camera is approximately 94 degrees. The vertical field of view is approximately 30 degrees.

The weight of the nose landing gear taxi camera and its housing is approximately 2.5 lbs (1.1kg).

The nose landing gear taxi camera is not interchangeable with the main landing gear taxi cameras.

Main Landing Gear Taxi Cameras

The main landing gear taxi cameras are in the leading edge of the horizontal stabilizer. The left main landing gear taxi camera and the right main landing gear taxi camera are interchangeable. The airframe adaptors that mount the main landing gear taxi cameras are different for the left and right camera.

The main landing gear taxi cameras have an 8 mm lens. The horizontal field of view of the main landing gear taxi cameras is approximately 18 degrees. The vertical field of view is approximately 20 degrees.

The weight of each main landing gear taxi camera and its housing is approximately 2.2 lbs (1 kg).

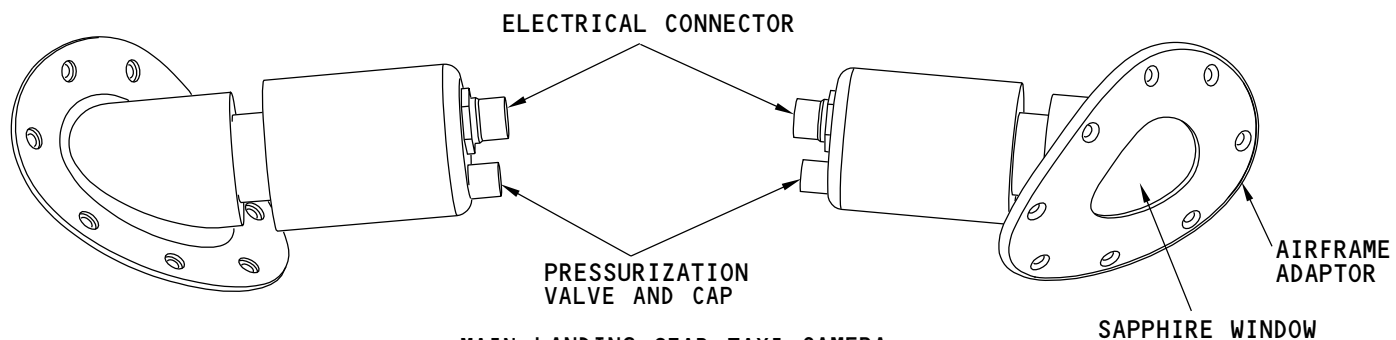
Training Information Point

Line personnel can only remove and replace the camera housings with the cameras in them. Shop personnel remove the cameras from their housings for repair.

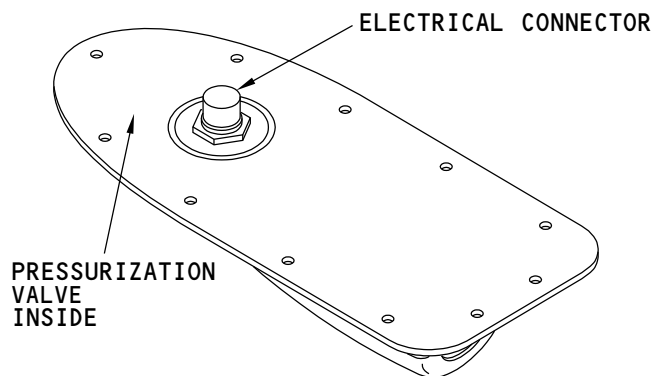
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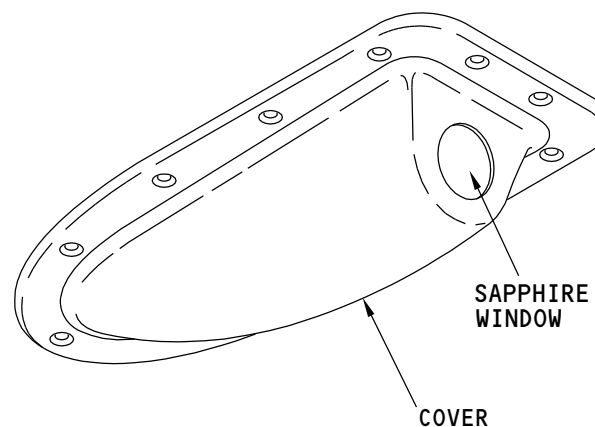
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MAIN LANDING GEAR TAXI CAMERA
(RIGHT CAMERA SHOWN, LEFT CAMERA
IS THE SAME EXCEPT FOR THE AIRFRAME ADAPTOR)



NOSE LANDING GEAR TAXI CAMERA



GMCS - TAXI CAMERAS

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**GMCS - TAXI CAMERA KILL SWITCH****Purpose**

The taxi camera kill switch controls the power to these units:

- TCIU
- Taxi cameras
- Camera lights.

Operation

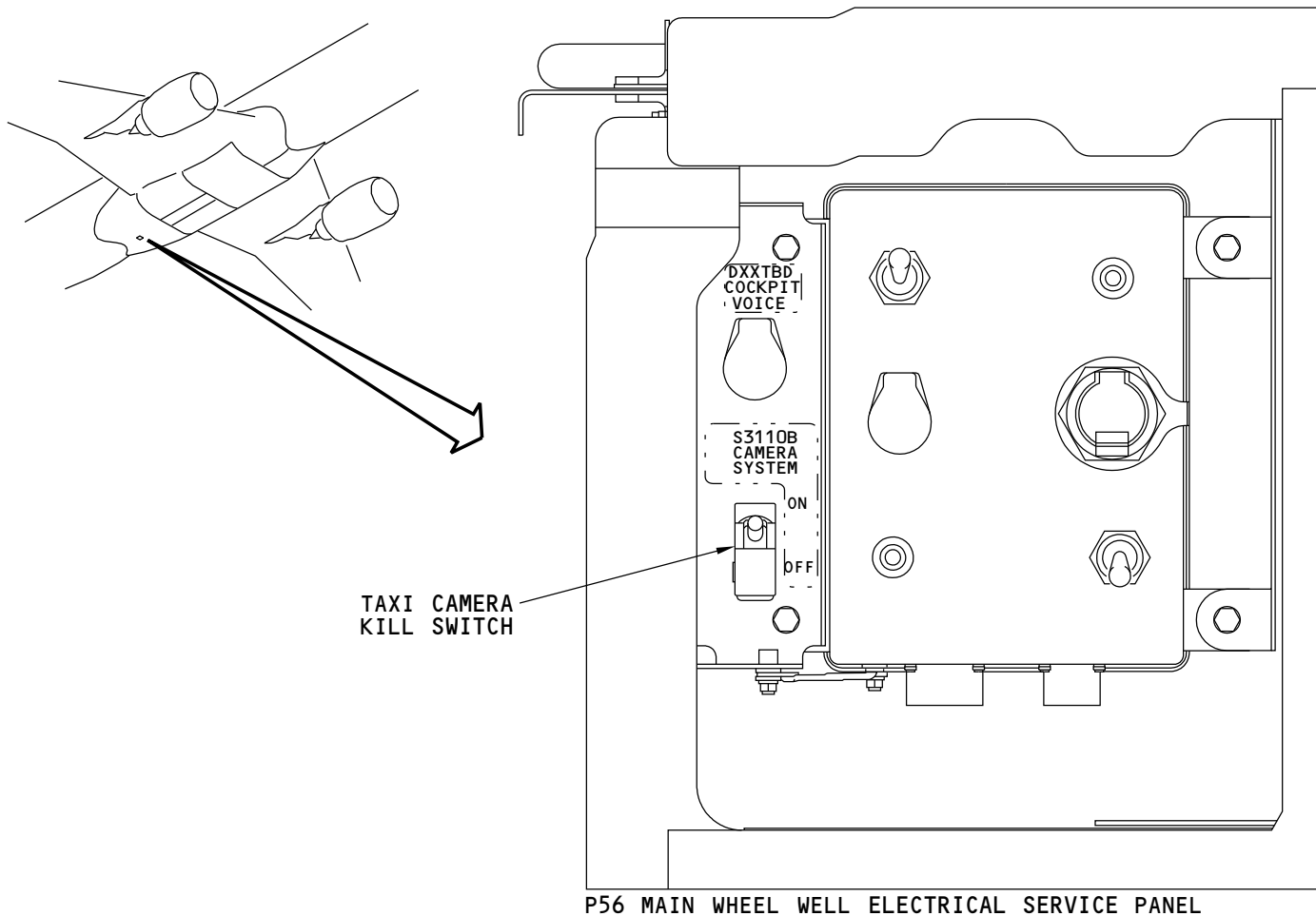
When the taxi camera kill switch is in the OFF position, the TCIU, taxi cameras, and camera lights do not operate.

When the taxi camera kill switch is in the ON position, the TCIU and the cameras have power. Also, the camera lights can come on when the flight crew selects them.

Description

The taxi camera kill switch is a guarded switch. The switch is guarded to the on position.

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TAXI CAMERA
KILL SWITCH

P56 MAIN WHEEL WELL ELECTRICAL SERVICE PANEL

GMCS - TAXI CAMERA KILL SWITCH

M42007 S000618566_V1

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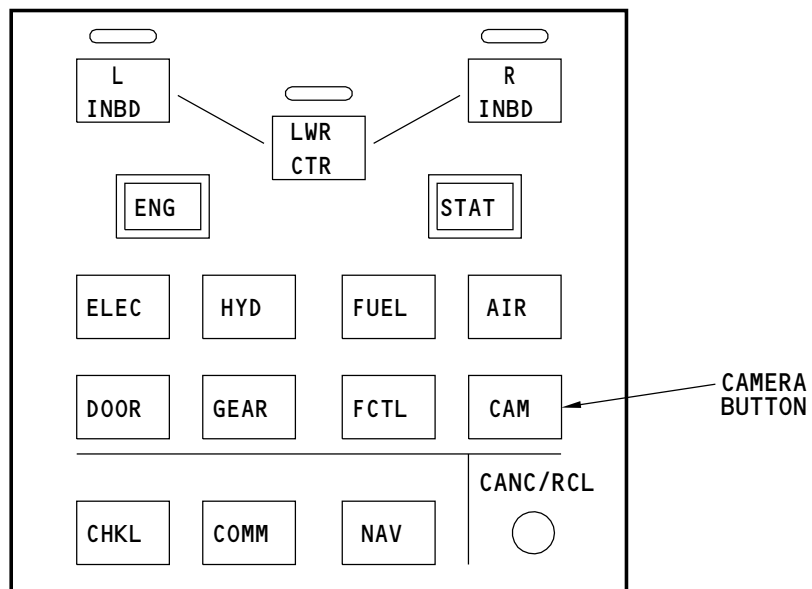
**GMCS - DISPLAY SELECT PANEL****GMCS Video Selection**

Use the CAM (camera) button on the EFIS display select panel (DSP) to see the GMCS video from the three taxi cameras on the multi-function display (MFD).

Training Information Point

If the taxi camera kill switch is in the OFF position, the MFD goes blank when you select the camera button on the DSP.

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GMCS - DISPLAY SELECT PANEL

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**GMCS - FUNCTIONAL DESCRIPTION****General**

The taxi camera interface unit (TCIU) receives video signals from the three taxi cameras. The TCIU makes a 3-way split video signal from the three taxi cameras. The 3-way split video signal goes to three display units (DUs) in the flight compartment.

Power

The TCIU gets 28v dc for power. The TCIU sends 28v dc to each camera through dedicated circuit breakers.

Camera Inputs

Each taxi camera gets 28v dc from the TCIU. The 28v dc is for camera power and for camera lens window heat.

Camera Outputs

The charge-coupled device (CCD) gets light through the lens. The CCD changes the light to electrical signals. The main control/timing controls the operation and timing in the camera. The video signal processor and the video signal encoder change the electrical signals into national television standards committee (NTSC) video signals. The cameras send the video signals to the TCIU.

TCIU

The TCIU receives the video signals from the three taxi cameras. The video signals go through a sync detector. If the sync detector senses a video signal, the video goes to the video signal mixer.

The video signal mixer receives horizontal stabilizer position through the general purpose bus of the AIMS. The video signal mixer uses this data to electronically pan the main landing gear taxi cameras. This corrects the main landing gear view on the MFD regardless of the horizontal stabilizer position.

The video signal mixer also receives overlay display video from the overlay generator. The overlay generator sends overlay video only when the camera select selector is in the L, N, or R positions.

The video signal mixer monitors the status of the camera adjust buttons. You use these buttons to manually pan the camera view left, right, up, or down when you do a boresight procedure.

The video signal mixer sends a 3-way split video signal from the three taxi cameras to three DUs. The 3-way split video signal also goes to the video out jack on the TCIU front panel.

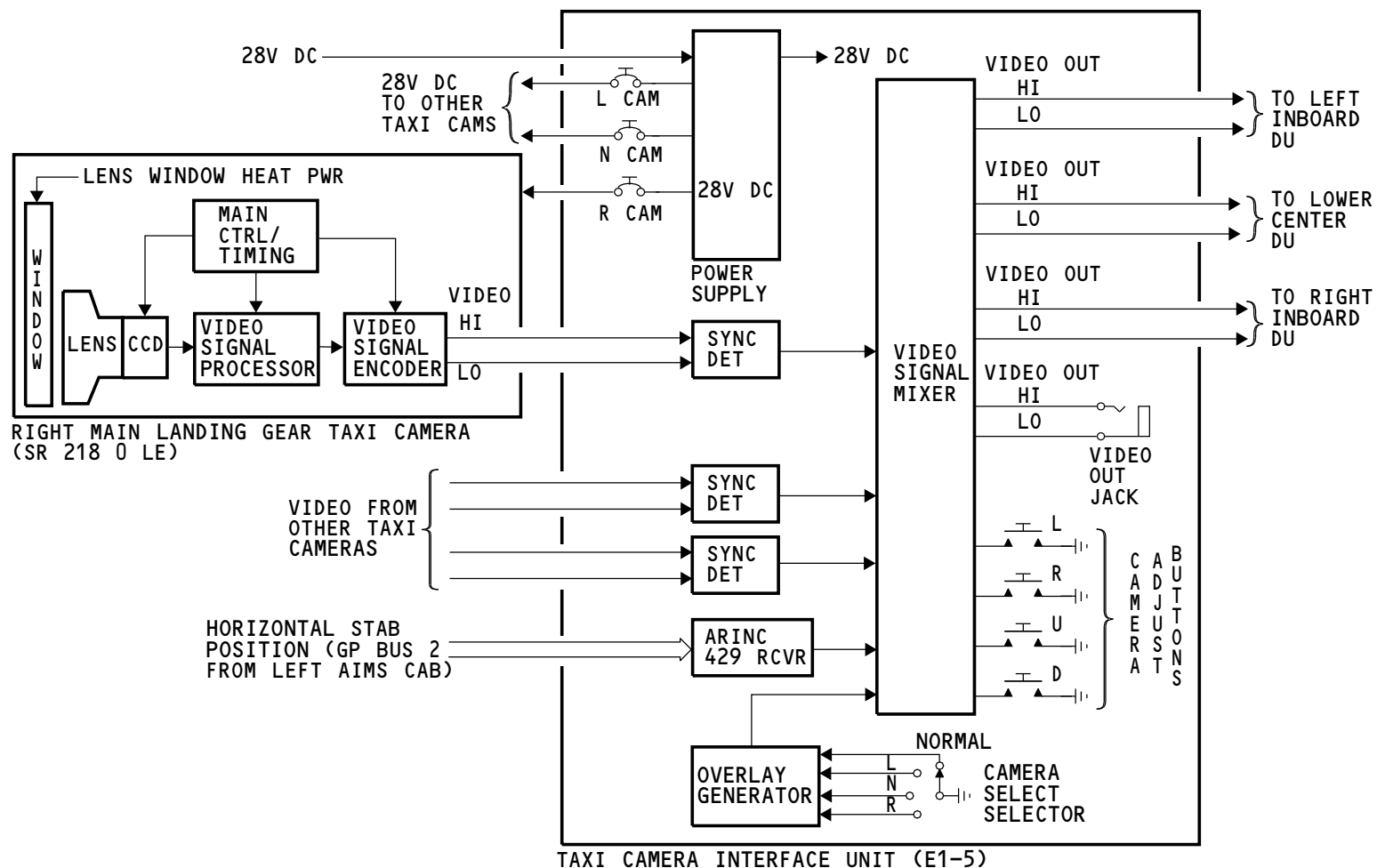
ARO 016-999

The video signal mixer also sends the video signal from the nose landing gear taxi camera to the in-flight entertainment (IFE) system.

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GMCS - FUNCTIONAL DESCRIPTION

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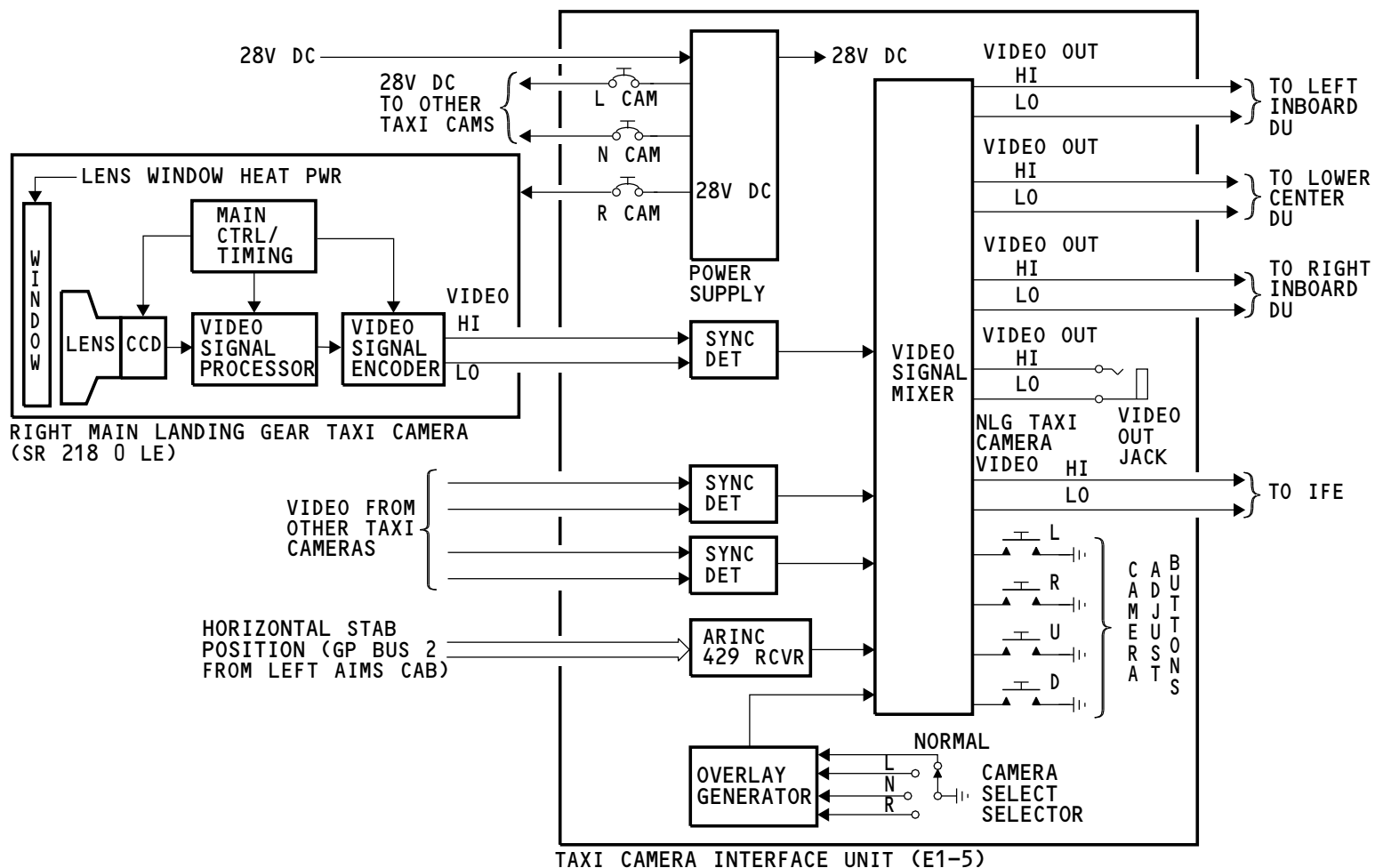
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GMCS - FUNCTIONAL DESCRIPTION

M42009 S000618568_V1

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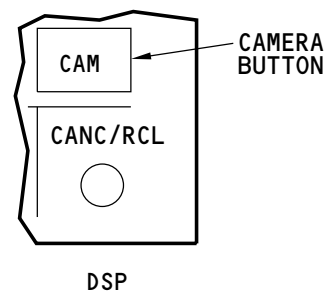
**GMCS - DISPLAYS****General**

Use the camera button on the display select panel (DSP) to show the GMCS display.

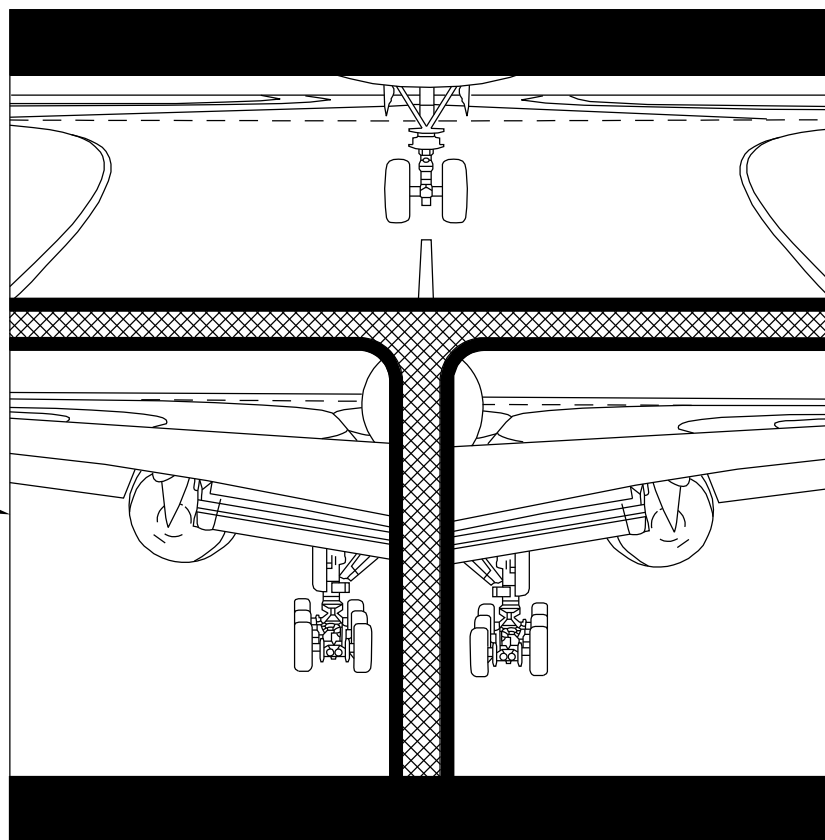
The nose landing gear taxi camera video shows on the upper section of the MFD.

The left main landing gear taxi camera video shows on the lower left section of the MFD.

The right main landing gear taxi camera video shows on the lower right section of the MFD.



LEFT MAIN LANDING
GEAR TAXI
CAMERA VIEW



NOSE LANDING
GEAR TAXI CAMERA
VIEW

RIGHT MAIN LANDING
GEAR TAXI CAMERA
VIEW

MFD

GMCS - DISPLAYS

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**GMCS - BORESIGHT FUNCTION****General**

The boresight function of the ground maneuver camera system (GMCS) lets you align the camera views. This makes sure that the taxi camera views are correct. You normally do a boresight procedure after you replace a taxi camera or the taxi camera interface unit (TCIU).

Operation

You can only boresight one camera at a time. You use the camera selector on the TCIU to select the camera you want to boresight.

A camera alignment mark shows on the MFD after you select a camera with the camera selector. The alignment mark shows only for the selected camera.

You use the camera adjust buttons on the TCIU to electronically pan the selected camera view until the landing gear aligns with the alignment mark.

Training Information Point

You can use any self-powered NTSC portable video monitor connected to the video out jack when you do a boresight of a taxi camera. This lets one person do the boresight procedure.

If you do not have a self-powered NTSC portable video monitor, you will need two people to do the boresight procedure. One in the flight compartment to look at the MFD and direct the boresight procedure. Another person must be in the MEC to get the instructions from the flight compartment to select the desired camera and to push the correct camera adjust buttons.

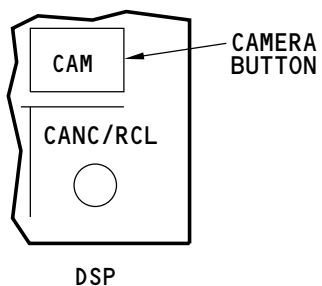
Before you do a boresight for the nose landing gear taxi camera, make sure the nose landing gear is at zero degrees of steering. This lets you put the landing gear picture correctly over the alignment mark.

Before you do a boresight for the left or right main landing gear camera, make sure the horizontal stabilizer position is 8.5 degrees (within the green band). This lets you put the landing gear pictures correctly over the alignment marks.

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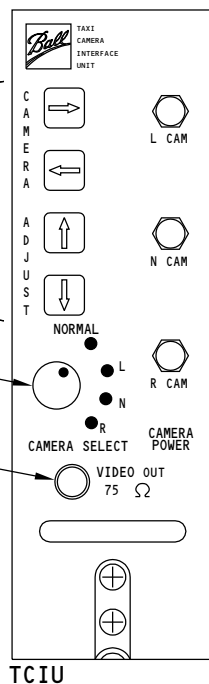
D633W101-ARO



CAMERA ADJUST
BUTTONS

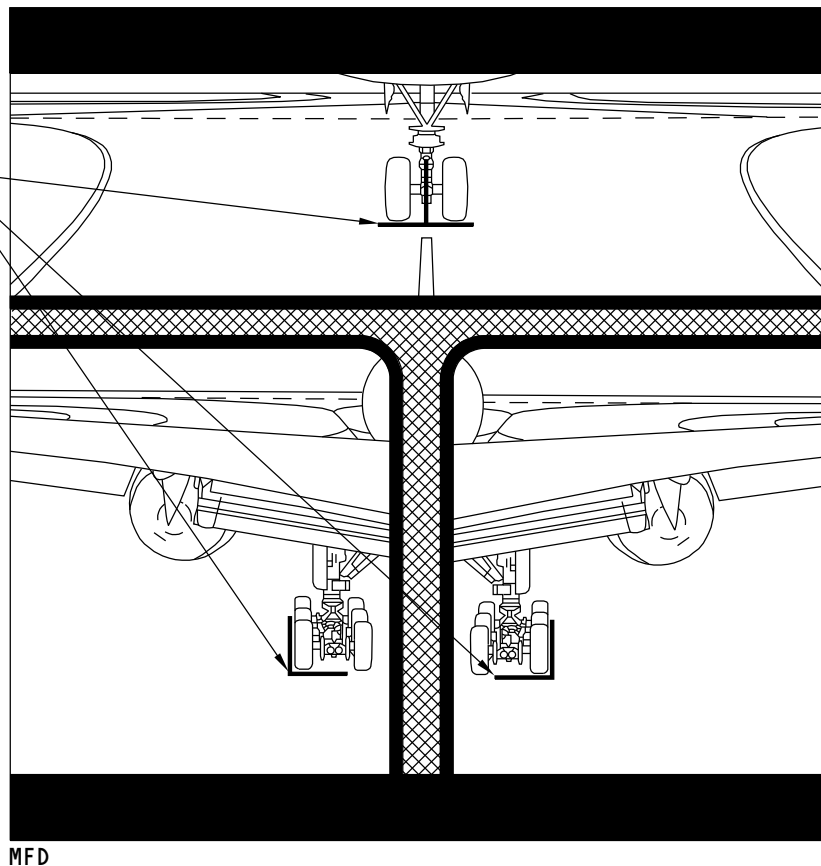
CAMERA
SELECTOR

VIDEO OUT
JACK



ALIGNMENT MARKS

1



1 ONLY ONE ALIGNMENT MARK
SHOWS AT A TIME

GMCS - BORESIGHT FUNCTION

M42125 S000618571_V1

31-61-00

ARO ALL EFFECTIVITY

D633W101-ARO

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