

EICAS SYSTEM

General

The EICAS (Engine Indications and Crew Alert System) includes the following components: One dual channel Data Concentrator Unit (DCU) concentrates input signals from the aircraft and engine systems and provides two redundant, high speed ARINC 429 buses to the EICAS display(s) and the MFD's. Each DCU channel also provides a low speed ARINC 429 bus to the IAPS (Integrated Avionics Processor System). This bus is used to route DCU BITE and aircraft system maintenance data to the MDC (Maintenance Diagnostic Computer).

An ARINC low speed output bus is provided from each display to the IAPS. This bus is used to implement an on-line monitoring technique for verifying the correct operation of the displays and to provide BITE data to the MDC.

There are four quadrants in the IAPS (LA, LB, RA, RB), which house four IOC's respectively. Each IOC provides a high speed ARINC 429 bus to the DCU to route display monitoring data to the DCU's as part of the in-line monitor. The A quadrants are routed to one channel of the DCU and the B quadrants are routed to the other channel.

No probable single fault in the EICAS, other than sensor faults, results in the loss of any engine or aircraft systems data. A combination of any two EICAS failures, other than sensor faults, does not result in the loss of critical engine data. However, manual display reversion is necessary in the event of a display failure. Reversion source selection is automatic in the EFD and DCU. The EFD and DCU chooses the source that provides valid data for a defined set of critical data.

Gulfstream G200 - EICAS

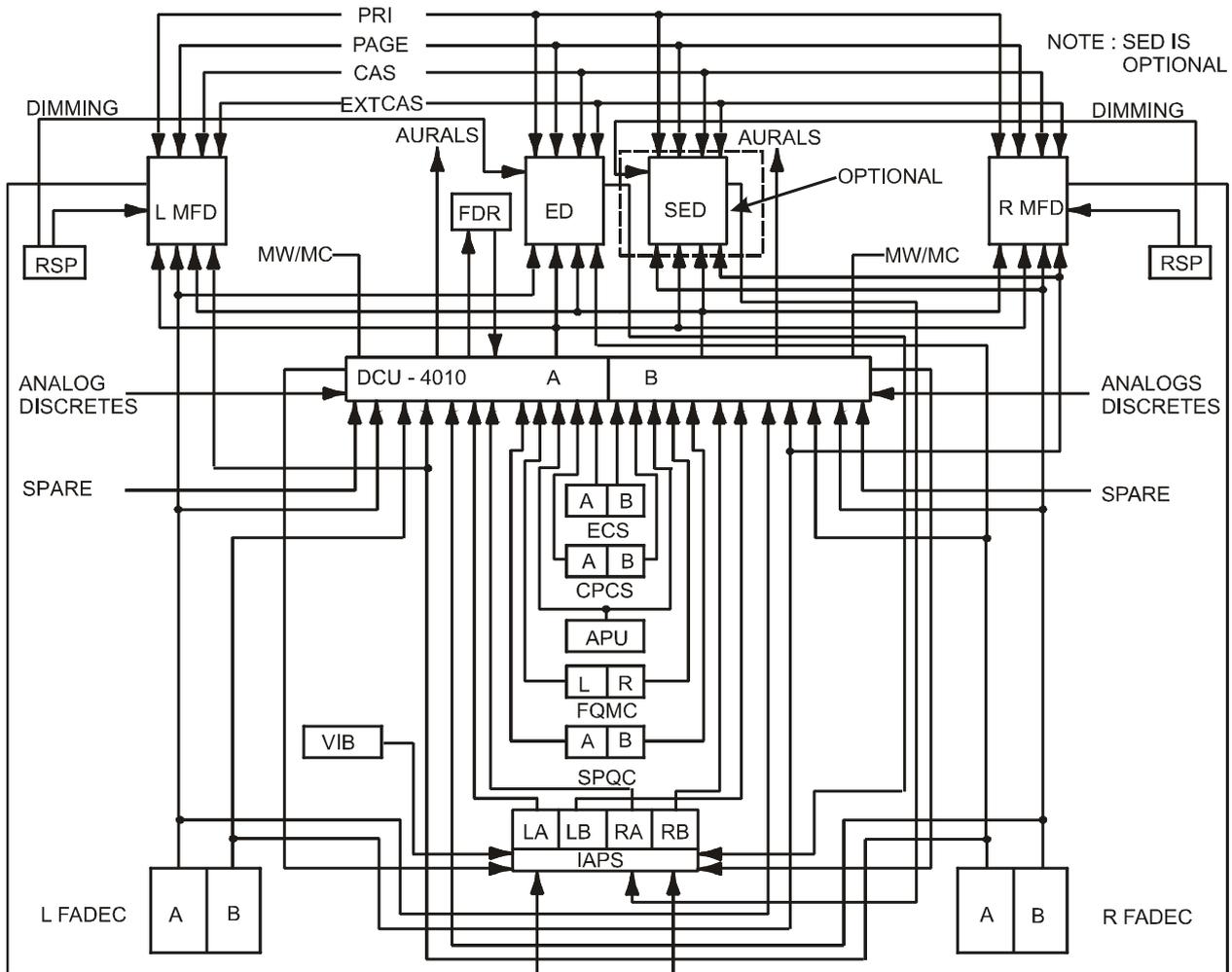


Figure 5-62. EICAS Block Diagram

EICAS Redundancy

The following table summarizes EICAS redundancy in architecture. Redundant buses are listed in pairs.

Redundant Bus Pair	Redundant Data Type	Connecting LRU's	
		From:	To:
LA_FADEC LB_FADEC	L_ENG L_ENG	L_FADEC_A L_FADEC_B	L_MFD/ED/A_DCU/B_DCU R_MFD/SED/A_DCU/B_DCU
RA_FADEC RB_FADEC	R_ENG R_ENG	R_FADEC_A R_FADEC_B	L_MFD/ED/A_DCU/B_DCU R_MFD/SED/A_DCU/B_DCU
LA_GP5 LB_GP5	MONITOR MONITOR	L_IAPS_A L_IAPS_B	A_DCU B_DCU
RA_GP5 RB_GP5	MONITOR MONITOR	R_IAPS_A R_IAPS_B	A_DCU B_DCU
A_DCU_2	ENG	A_DCU	L_MFD/R_MFD/ED/SED
B_DCU_2	ENG	B_DCU	L_MFD/R_MFD/ED/SED
A_DCU_1	AIRCRAFT	A_DCU	LA/LB IOC's
B_DCU_1	AIRCRAFT	B_DCU	RA/RB IOC's
ED_1	MAINTENANCE	ED	LA/LB IOC's (+ RA/RB if SED not present)
SED_1	MAINTENANCE	SED	RA/RB IOC's
L_MFD_1	MAINTENANCE	L_MFD	LA/LB IOC's
R_MFD_1	MAINTENANCE	R_MFD	RA/RB IOC's

The EICAS uses the following components:

Four EFD-4077 (EFIS) CRT display units

One DCU-4010 Dual channel data concentrator unit

Two RSP-4000 Reversionary switch panels

The center EFD-4077 display is configured as the EICAS Display (ED), and the two inboard displays are MFD's. The MFD's can be switched to PFD's, MFD's, or ED's through the RSP. If an MFD is selected to be an ED while the center display is still operable, the reverted MFD automatically displays the EICAS secondary page. The EICAS page button pages only the reverted MFD(s) while the center EICAS display remains on the primary page format. If only a single display is functioning as an ED, the page button causes the ED to page between the primary engine format and the two other pages.

A secondary EICAS display (SED) is optional. If installed, the SED functions as a permanently reverted MFD. The EICAS subsystem functions with or without the SED installed.

The ED, optional SED, and the two outboard PFD's cannot be switched to any other function. The displays cannot be switched off except by using circuit breakers with the exception of the two outboard PFD's which are switched off when its adjoining MFD is reconfigured to a PFD.

COMPONENTS DESCRIPTION

EFD-4077 EICAS Display

The EFD displaying the EICAS information uses three formats or pages:

Primary page for engine indications, crew alert (annunciators) messages, and some aircraft system indications, secondary page for additional aircraft systems indications; and an electrical page.

A red exceedance condition (N_1 N_2 & ITT only), a warning message or aircraft configuration change causes the EICAS display to automatically revert to the primary page, when on a page other than the primary page. Reversion to the primary page also occurs after 30 seconds whenever landing gear is down and locked.

Primary Page

The primary page, shown in Figure 5-65 contains the following information:

Data	Type
N_1	Analog and Digital
ITT	Analog and Digital
N_2	Digital
L Engine Vibration	Analog
R Engine Vibration	Analog
Fuel Flow	Digital
Total Fuel Quantity	Digital
Wing Tank Quantities	Digital
Engine Oil Temperature	Analog and Digital
Engine Oil Pressure	Analog and Digital
Cabin Altitude	Digital
Cabin Differential	Digital
Cabin Rate	Digital

APU RPM	Digital
APU EGT	Digital
APR Armed/On	Annunciation
N ₁ Power Setting	Bug
N ₁ /N ₂ Sync Pointer	Annunciation
T/R	Annunciation
Crew Alerting List	Messages
Landing Gear	Annunciation
Stabilizer Trim Position	Analog and Digital
Aileron Trim Position	Analog
Rudder Trim Position	Analog and Digital
Flap Position	Analog and Digital
Slat Position	Analog
Krueger Position	Annunciation
Hydraulic Pressure	Analog and Digital

When N₁ and ITT reach redline, the digital readout and pointer turn red and flash for four seconds. Variable red lines for N₁ and ITT are supplied on the FADEC bus by the FADEC manufacturer. When N₂ reaches redline, the digital readout shall turn red and flash for four seconds. The variable redline for N₂ shall also be supplied on the FADEC bus.

Gear and flap information is displayed whenever the gear is not all up and locked or whenever flaps/slats/kruegers are not at 0°. They are removed from the display 30 seconds after the gear is all up and locked, and the flaps, slats, and kruegers are at 0°.

When a gear is up and locked, the readout is a white UP. When the gear is in transition, the readout is amber rectangles. When the gear is down and locked, the readout is a green DN.

Figure 5-63 shows the primary page data presentation during engine

start on the ground. During this phase, oil temperature and pressure are displayed as digital readout and analog gages. APU data is displayed whenever the APU master switch is ON. Trim positions are not displayed until after the engine start phase.

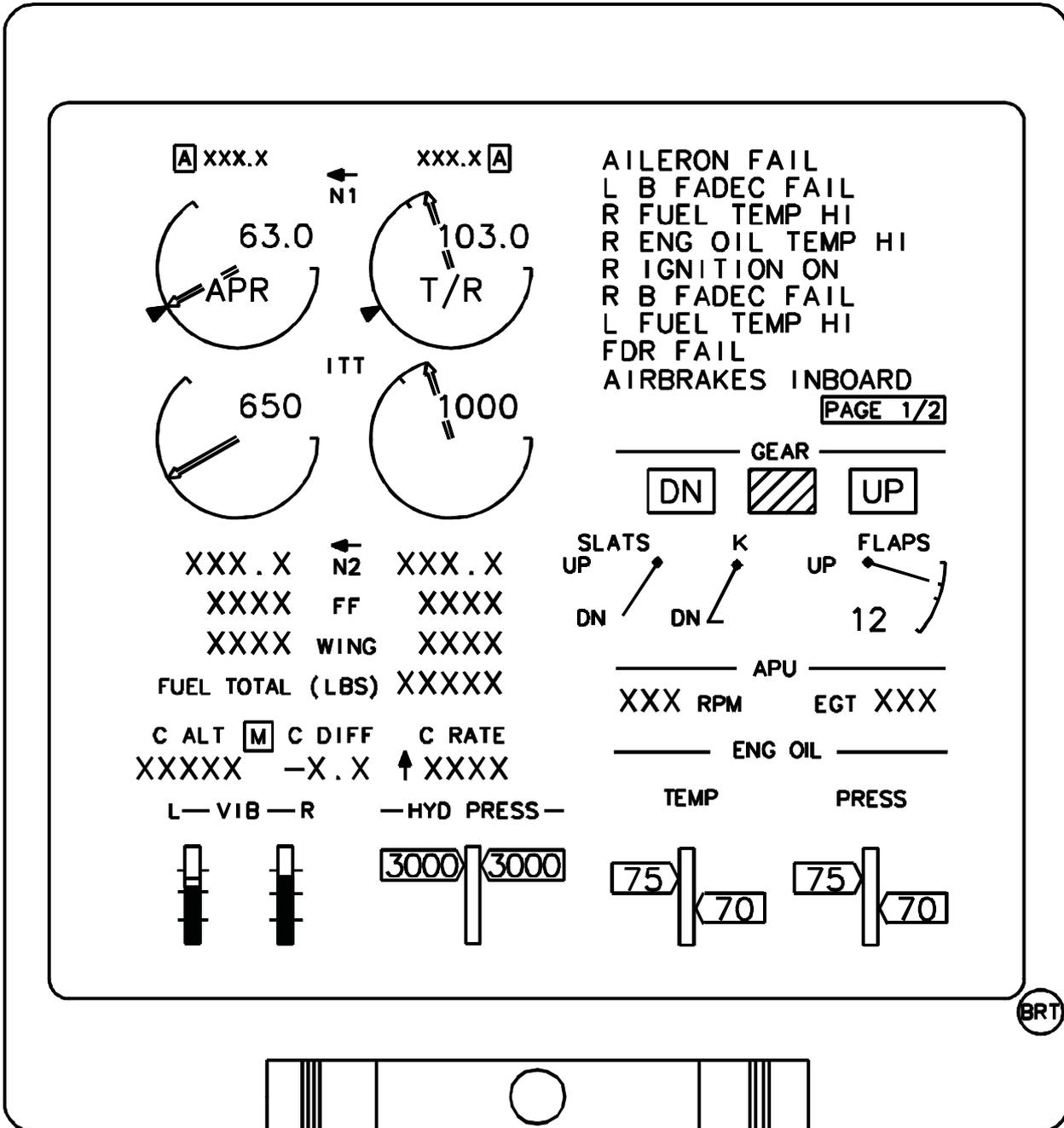


Figure 5-63. EICAS Engine Start Primary Page

Figure 5-64 shows the primary page data presentation during cruise conditions. The oil temperature and pressure digital readouts are removed. Trim indications are displayed. Kruegers, slats, and flaps are 0°, and gear is up and locked, and thus are not displayed. All messages have been cancelled. The APU is not ON and, therefore, not displayed.

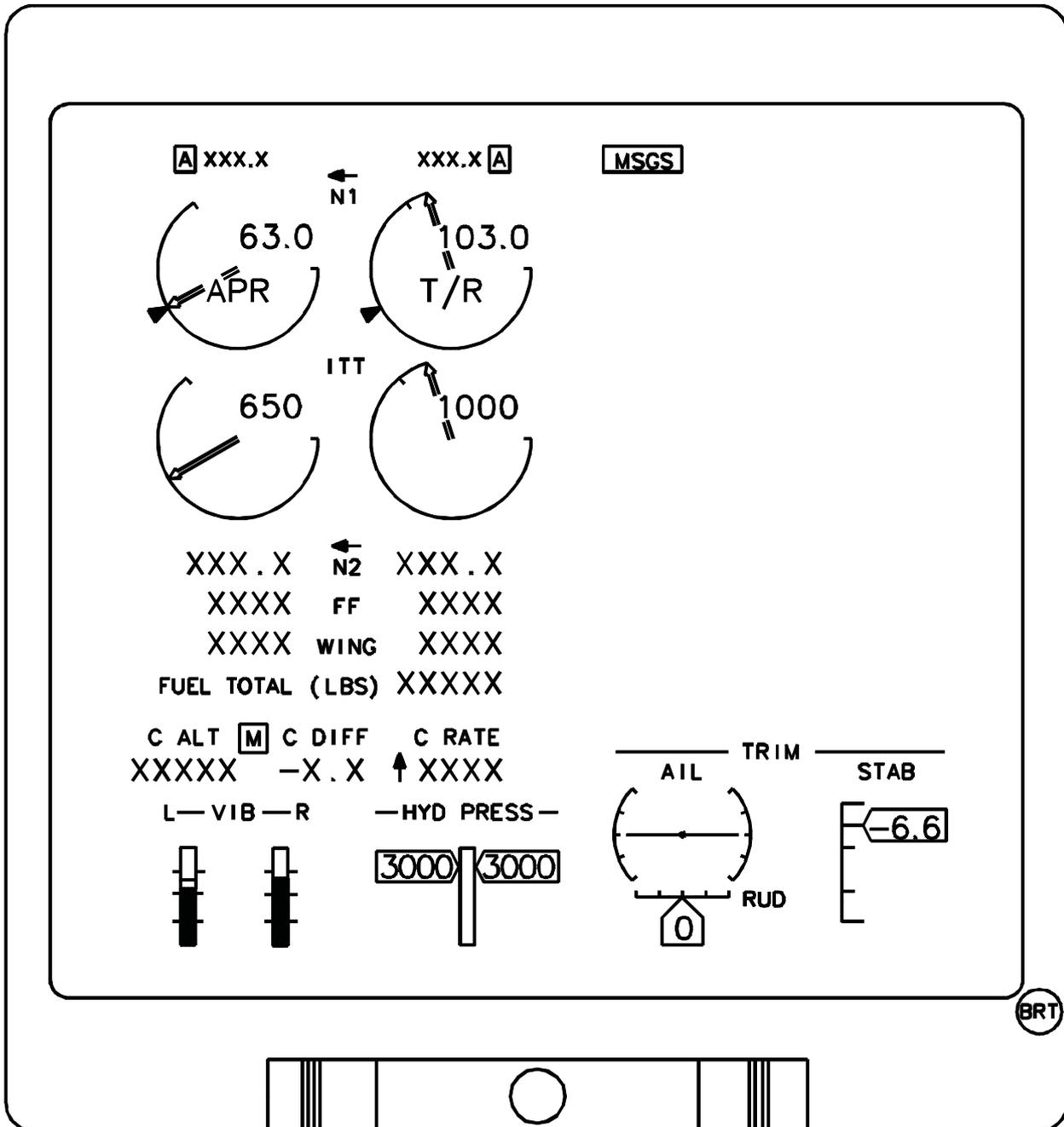


Figure 5-64. EICAS Cruise Condition Primary Page

Figure 5-65 shows the complete primary page data presentation. In this case the APU is on (reason for being displayed), trim indications are displayed. The landing gear is not up, and krueger flaps, flaps, and slats are not at zero.

Landing gear, slats, krueger flaps and flaps are always displayed simultaneously; 30 seconds after these systems are retracted (cruise condition), they are not displayed.

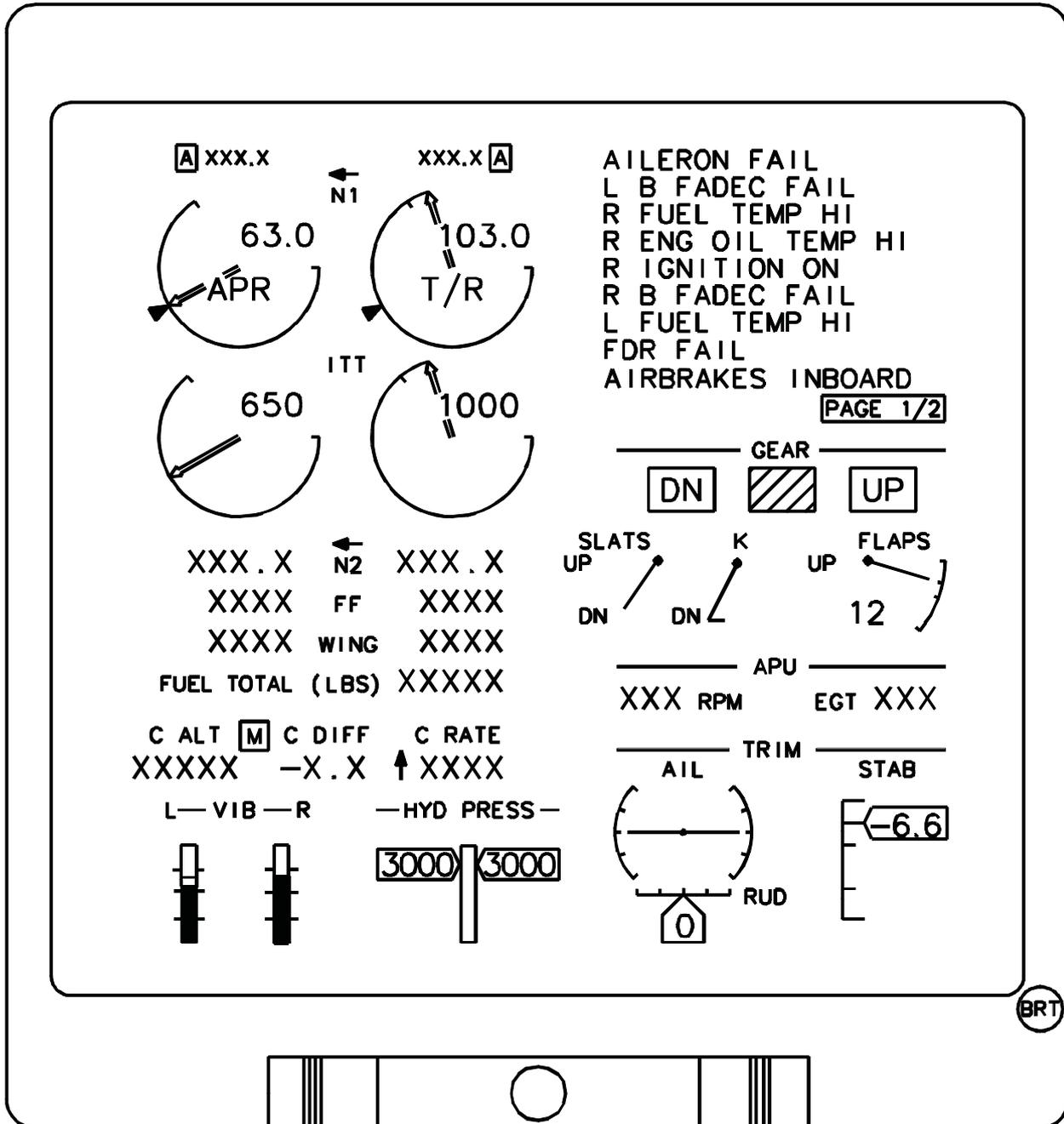


Figure 5-65. EICAS Primary Page

CREW ADVISORY SYSTEM (CAS) PAGING

There are four categories of messages: warning, caution, advisory, and status. Warning messages are always displayed and not paged. If the number of warnings messages to be displayed exceeds the available display area, the most recent warning messages fill the display area. Caution, advisory, and status messages can be cancelled, and can be paged if there are more messages than display area available.

When there is more than one page of messages asserted, a page box is displayed at the bottom of the message list. The page box indicates the page currently being displayed and the total number of message pages. For example, **PAGE 1/2** indicates that currently page one is being displayed and there is a total of two message pages. CAS page button is used to page from one page to the next. When the last page of messages is displayed, a subsequent CAS page command removes all the caution, advisory, and status messages that are currently displayed. No messages are displayed at this point (unless there are currently warning messages asserted). **MSGs** box annunciation is displayed to indicate that the cancelled messages exist. Any subsequent CAS page command recalls the active message list. If new messages occur while the blank page is displayed, they are displayed while the cancelled messages remain cancelled.

Secondary Page

The secondary page, Figure 5-66, contains the following information:

Data	Type
Total Fuel Quantity	Digital
Fuel Used	Digital
Fuel Temp	Digital
Left/Right Wing Fuel Quantity	Digital
Forward Fuselage Fuel Quantity	Digital
Fuselage Fuel Quantity	Digital
Center Tank Fuel Quantity	Digital
Left and Right Feed Tank Fuel Quantity	Digital
Basic Operating Weight	Digital
Payload	Digital
Gross Weight	Digital
Eng Oil Temp	Digital
Eng Oil Press	Digital
Eng Oil Quantity	Annunciator
Left and Right Hydraulic Quantity	Digital
Landing Field Elevation	Digital
Cabin Temperature	Digital
Cockpit Temperature	Digital
Oxygen Pressure	Digital
Left and right hydraulic temperature	Digital

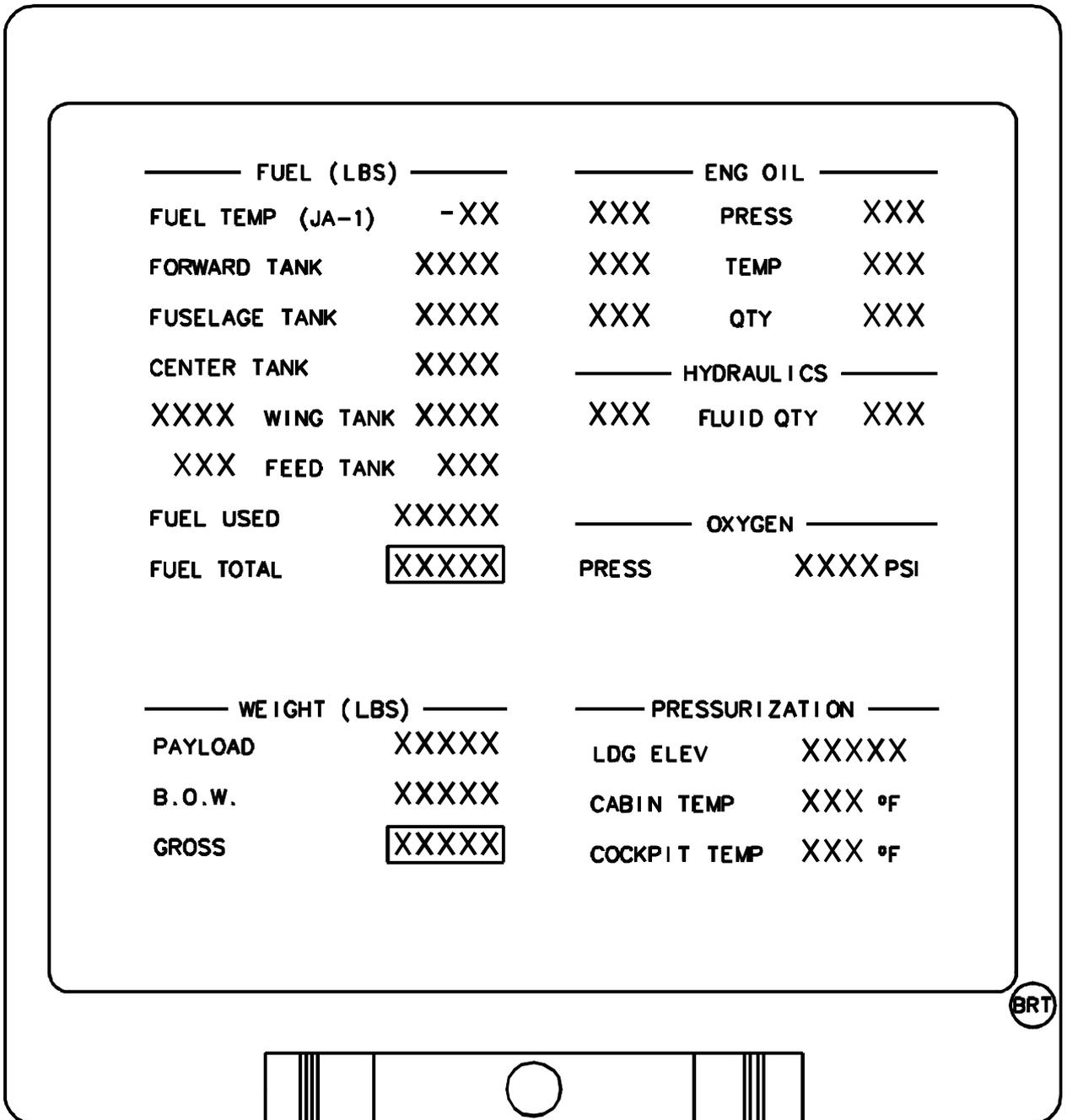


Figure 5-66. EICAS Secondary Page

ELECTRICAL PAGE

The electrical page is shown in Figure 5-67 and contains the following information:

Data	Type
Generator Voltage	Digital
Generator Amps	Digital
Battery Voltages	Digital
Battery Temperature	Digital
APU Generator Voltage	Digital
APU Generator Amps	Digital

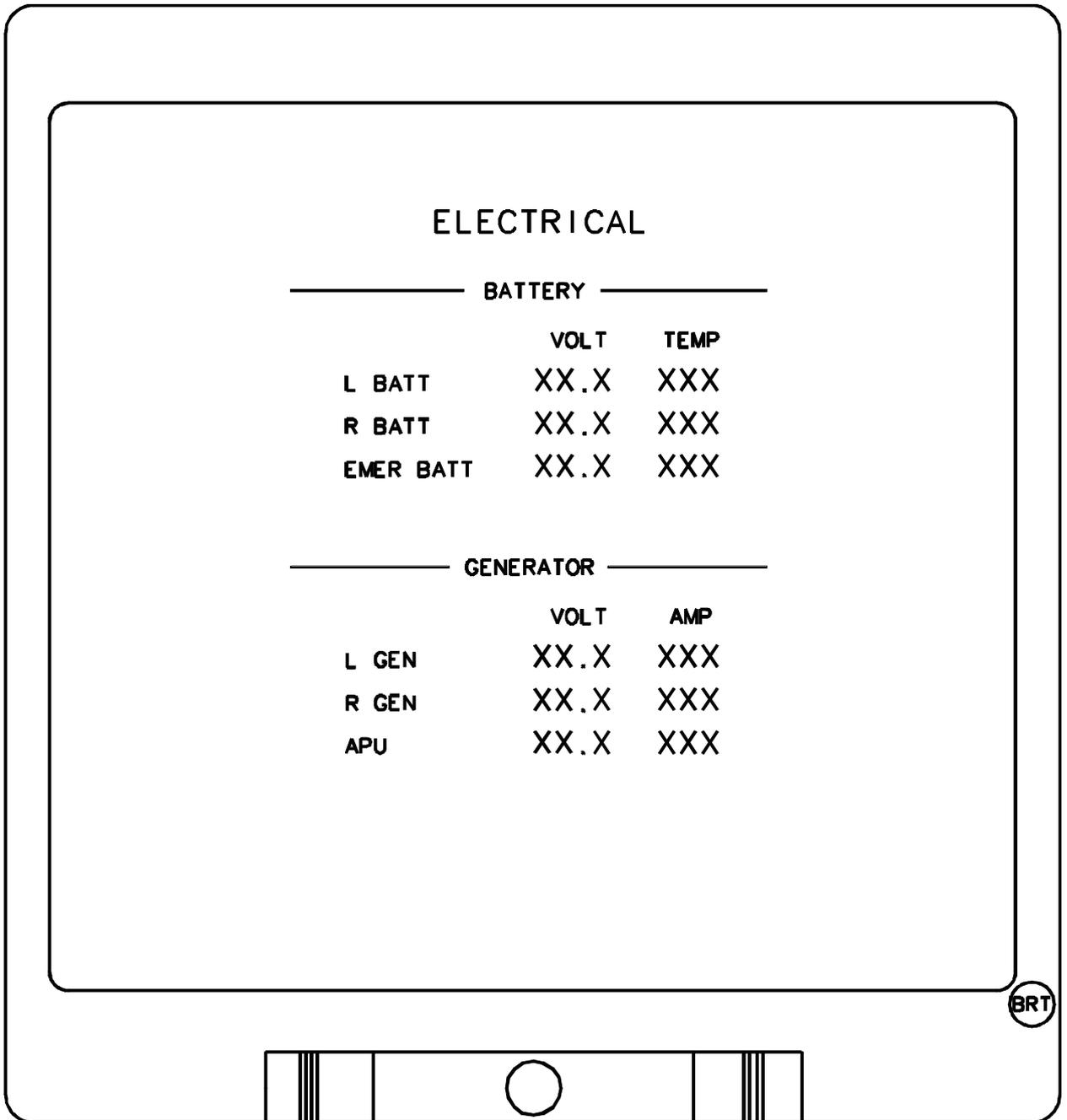


Figure 5-67. EICAS Electrical Page

AURAL TONES

EICAS supplies aural tones. The DCU generates the following tones, in the following order (DCU A or B), when test is performed:

- 1 Stall Warbler
- 2 Take Off Warning / Landing Gear Horn
- 3 Autopilot Cavalry Charge
- 4 Fire Bell
- 5 Altitude "C" Chord
- 6 Overspeed Clacker
- 7 Trim tone
- 8 Double Chime - SELCAL
- 9 Triple Chime - Warning
- 10 Single Chime - Caution

MAINTENANCE COMPUTER DATA

The DCU collects and sends information to the Maintenance Diagnostics Computer (MDC). This information includes engine exceedances, engine trend, life cycle counters, system exceedances, and maintenance messages.

Engine trend recordings can be taken once a flight (generally 10 to 30 seconds after take-off). A recording of specific parameters is taken by the DCU and logged in the MDC. A maximum of 16 parameters can be recorded and include N_1 , N_2 , ITT, engine vibration, oil pressure and temperature, and fuel flow for each engine. A record of the engine operating time, since the last recording, can be kept for each engine.

The life cycle recording can be a record of the number of engine cycles that have accrued on each engine, the total operating time accrued on each engine, and the total number of thrust reverser deployments accrued on each engine if this feature is utilized.

Engine exceedance recordings can be made for each instance of an engine exceedance condition. Exceedance values can be assigned for up to 16 parameters (8 parameters per engine). Parameters recorded include N_1 , N_2 , ITT, engine vibration, oil pressure and temperature for each engine. When the value of a parameter exceeds the assigned exceedance value, a recording can be taken of the parameter, the exceedance value, the elapsed time above the exceedance value, the maximum value attained, the date and time the exceedance occurred, and the flight leg.

System exceedances are similar to the engine exceedances, but are recording of non engine parameters.

Up to 180 different messages can be sent to the MDC. Maintenance messages are messages meant for maintenance crews and may or may not be the same as the crew alert messages.

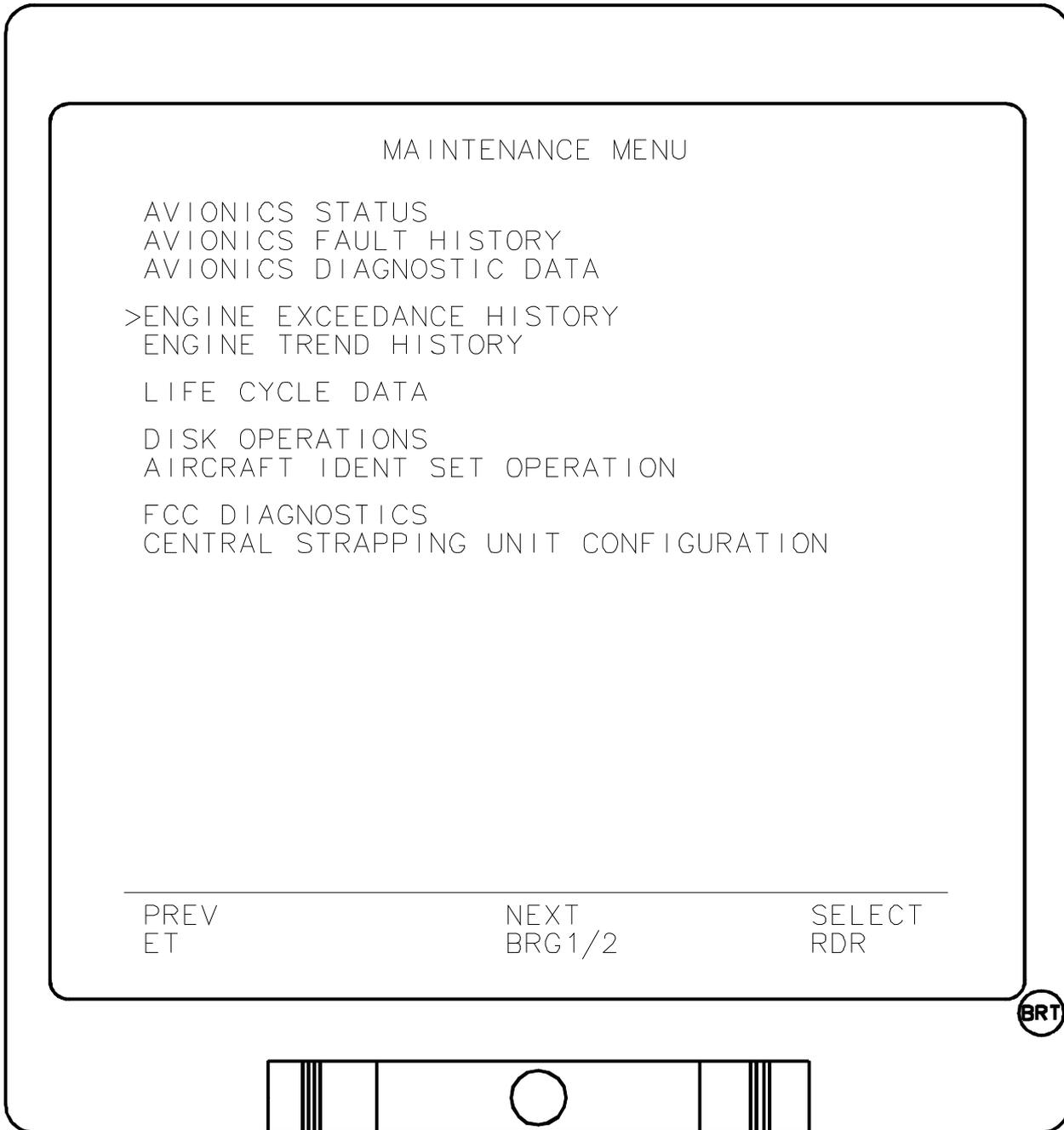


Figure 5-68. EICAS Avionics Status Maintenance Page

EICAS CONTROLS AND MESSAGES

CAS pushbutton - causes paging of the message list on the primary page. After all messages are displayed, next press causes **MSGs** to be displayed at bottom of the page and the message lines are empty

PRIME pushbutton - used to switch to the primary page of data

PAGE pushbutton - pages the display through the primary page, secondary page, and the electrical page.

PAYLOAD knob - has three positions as follows:

INC - increases payload weight

OFF - no change to payload

DEC - decreases payload weight

MASTER WARNING / CAUTION pushbutton - reset switches that extinguish the flashing warning and/or caution annunciator and cancel the associated aural warning if the aural warning is cancellable

IND TEST switch - has two positions as follows:

DCU A & LTS - initiates all lamps test and DCU-A aural messages

DCU B - initiates DCU-B aural messages

NORM/EXTENDED CAS mode switch - This two position switch places the EICAS display and the EFD (if they are displaying EICAS) respectively, into one of two states. In NORM position, the displays perform normal EICAS operations. In the EXTENDED CAS position, if the aircraft is on the ground and the primary page is being displayed, the gear, flap, and TRIM (if APU is not running) information is removed and the message list extended

(Continued)

Caution Messages

EICAS COMPRTR FAIL - EICAS comparator system malfunction

EICAS MISCOMPARE - N_1 , N_2 , ITT, warning/caution messages and aural warning data difference between DCU-A and DCU-B

NOTE

All caution, advisory, and status messages are automatically inhibited from 80 knots on takeoff roll until the aircraft is 200 feet above the ground.

Status Messages

AURAL DISABLE (A/B) - Aural warning of the respective DCU is inoperative

DCU ANALOG INPUT (A/B) - One of analog sensors (slats/flaps position, engine vibration and various pressure sensors) is disconnected from DCU-A or DCU-B

DCU FAULT (A/B) - Data concentrator unit malfunction. Affects EICAS operation

IOC FAULT - One or more of EFIS I/O concentrators has failed

MAINTENANCE DATA - New maintenance information available in maintenance page

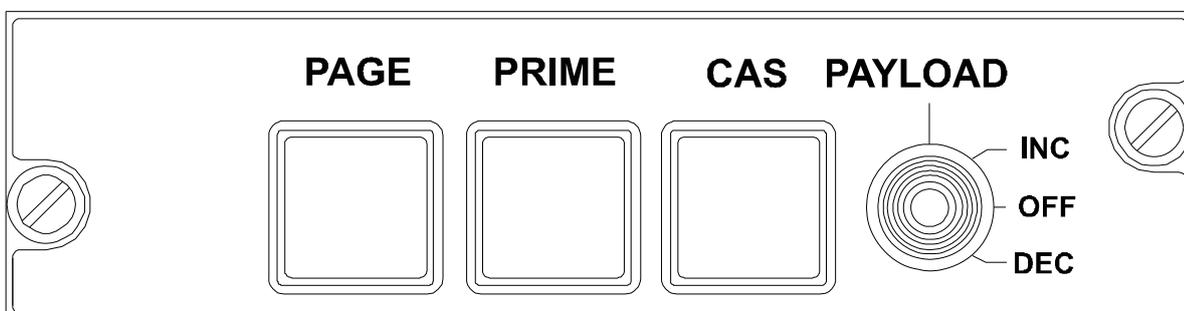


Figure 5-69. EICAS Panel