INDICATING / RECORDING SYSTEMS

GENERAL

The aircraft displays, instruments and controls are installed and adjusted for use in such a manner as to be accessible and visible to the crew. The instruments are readable during daylight and lit with white natural lights for night use. All placards have the same units as the instruments.

INSTRUMENTS AND CONTROL PANELS

Control panels are installed in the cockpit and include all controls, indicators and displays required to operate the aircraft.

Pilot Instrument Panel

Adaptive flight display (AFD) (2)
Clock
Avionics illuminated switching pushbuttons
Instrument light dimming control
Compass slave/DG control
Compass left/right slew Control
Landing gear control

Copilot Instrument Panel

Adaptive flight display (AFD) (2))
Clock
Compass slave/DG control
Compass left/right slew Control
Instrument light dimming control
Avionics illuminated switching pushbuttons

Central Instrument Panel

Standby (3-in-1) display: attitude, airspeed and altitude
Engine fire indication and extinguishing control

Pedestal

FMS CDU (2)
Throttle quadrant
Flaps/slats selector and slat bypass
Trim controls (horizontal, aileron & rudder)
ECS (Environmental control system and pressurization)
Gust lock lever
Emergency landing gear down control
Emergency brake/parking lever
Aux hydraulic pump control
Thrust reversers arm control
Ground airbrake control
Flight airbrake control
Engine sync control
Engine data recording control

Pedestal Maintenance Panel

AHRS normal/compensation switch
AHRS normal/leveling switch
Standby gyro cb
Flaps/slats test
EICAS maintenance control
CAS extended data switch

Pedestal Extension

CCP (cursor control panel) (2)
RSP (reversion switch panel)
Airborne radiotelephone handset (optional)
Interior switching panel (optional)

(Continued)

Pilot Side Console

Audio control panel
Audio switching panel
Nosewheel steering control
Inertial navigation mode selector (MSU) (optional)
Ashtray and cup holder
Cockpit voice recorder (CVR) control panel
Oxygen mask
Hour meter
Display Control Grip (DCG)

Co-Pilot Side Console

Audio control panel
Audio switching panel
Oxygen shutoff valve
Cockpit voice recorder microphone
Passenger oxygen control panel
Database unit (DBU)
Display Control Grip (DCG)

Glareshield Panel

Flight guidance panel (FGP)
Master warning - pilot
Master warning - copilot
Anti skid switch
Display control panel (DCP) (2)

Glareshield

Two ice detection lights

(Continued)

Overhead Panel

Circuit breaker panels
Fuel system controls
De-ice/anti-ice controls
Windshield heat controls
Engine control switches
Lighting controls
APU controls
APU fire control
System/warning test switches
Electric power controls

Signaling and Warning Devices Testing

Indicator lights located in the cockpit are tested simultaneously. Light test is done by DCU/A pushbutton

Crew Alert System

Signals from different aircraft systems are presented on EICAS display messages area. Some signals also cause the illumination master caution lights.

Dimming

All warning and advisory lights (except fire warning) are controlled by a day/night switch.

AOA and Stall Warning System

The AOA and stall warning system enables the pilot to retain a sufficient margin from stall during flight maneuvers and provides stall warning signal and auto-slats extension when necessary.

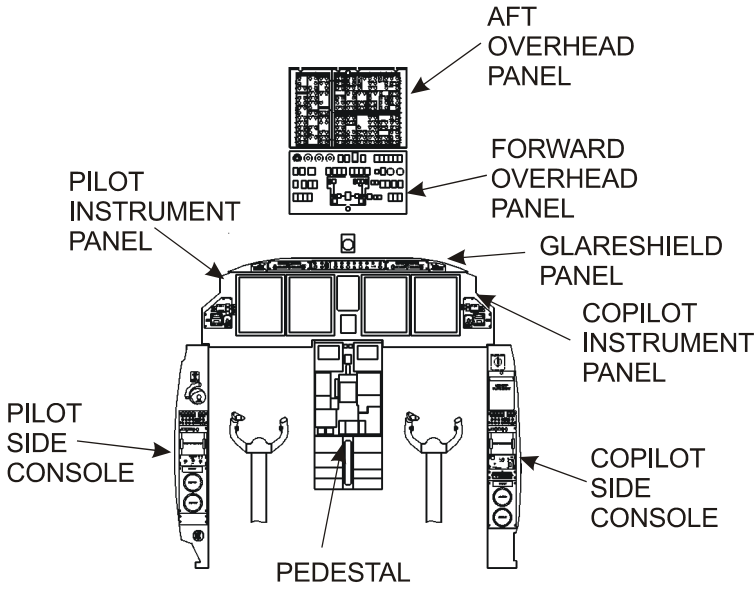

Figure 7-31-1. Cockpit Layout

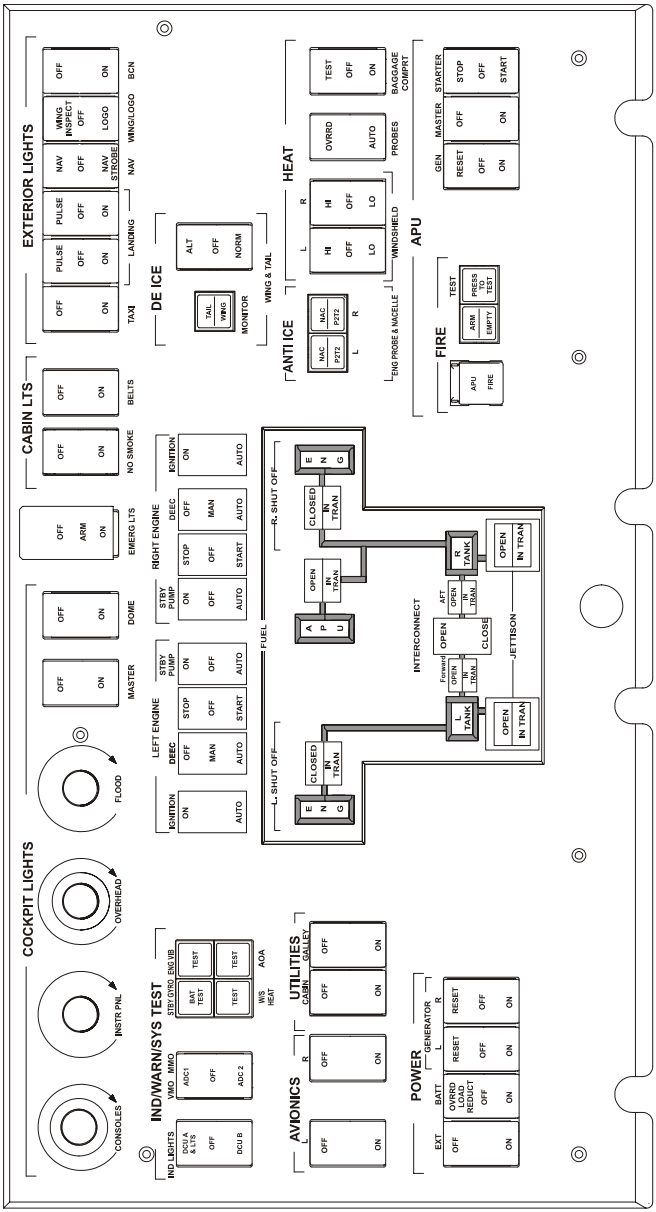

Figure 7-31-2. Front Overhead Panel

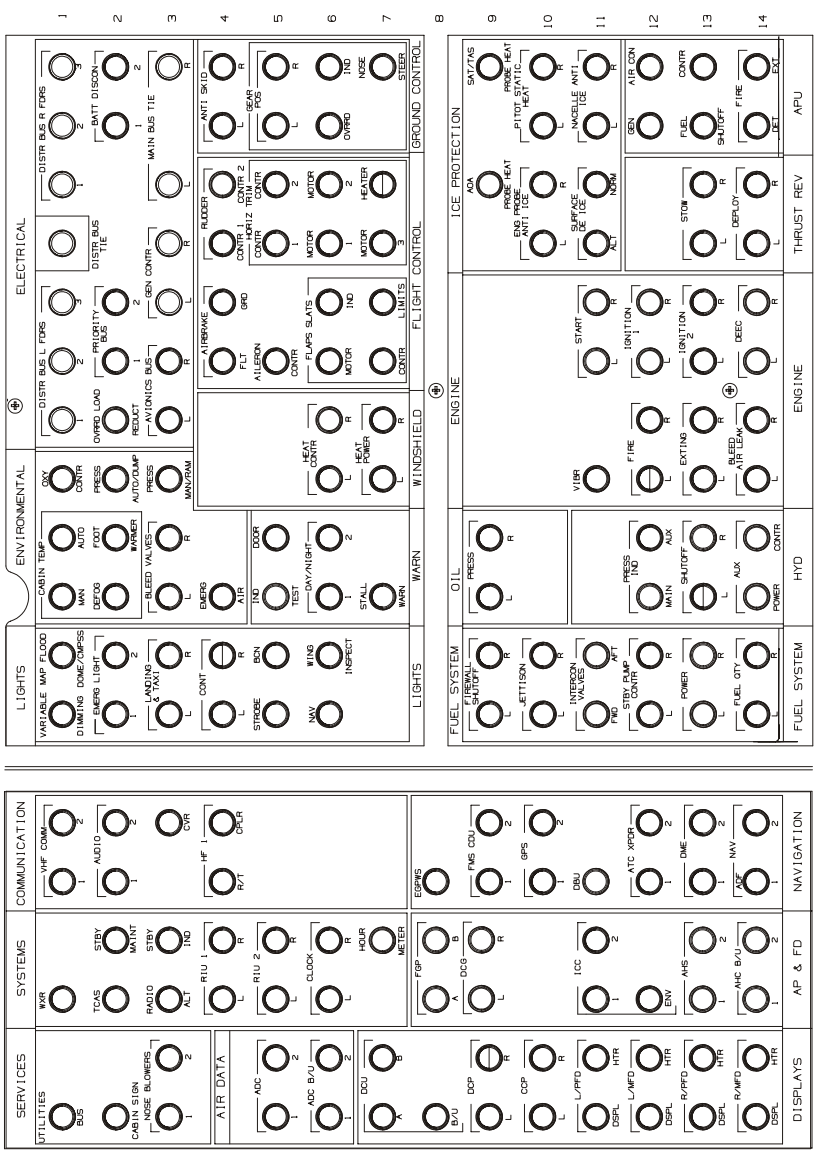

Figure 7-31-3. Aft Overhead Panel

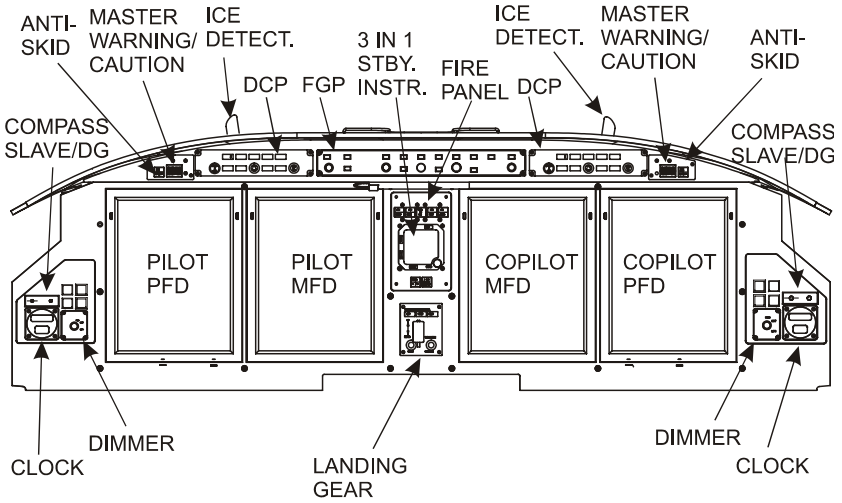

Figure 7-31-4. Instrument Panel

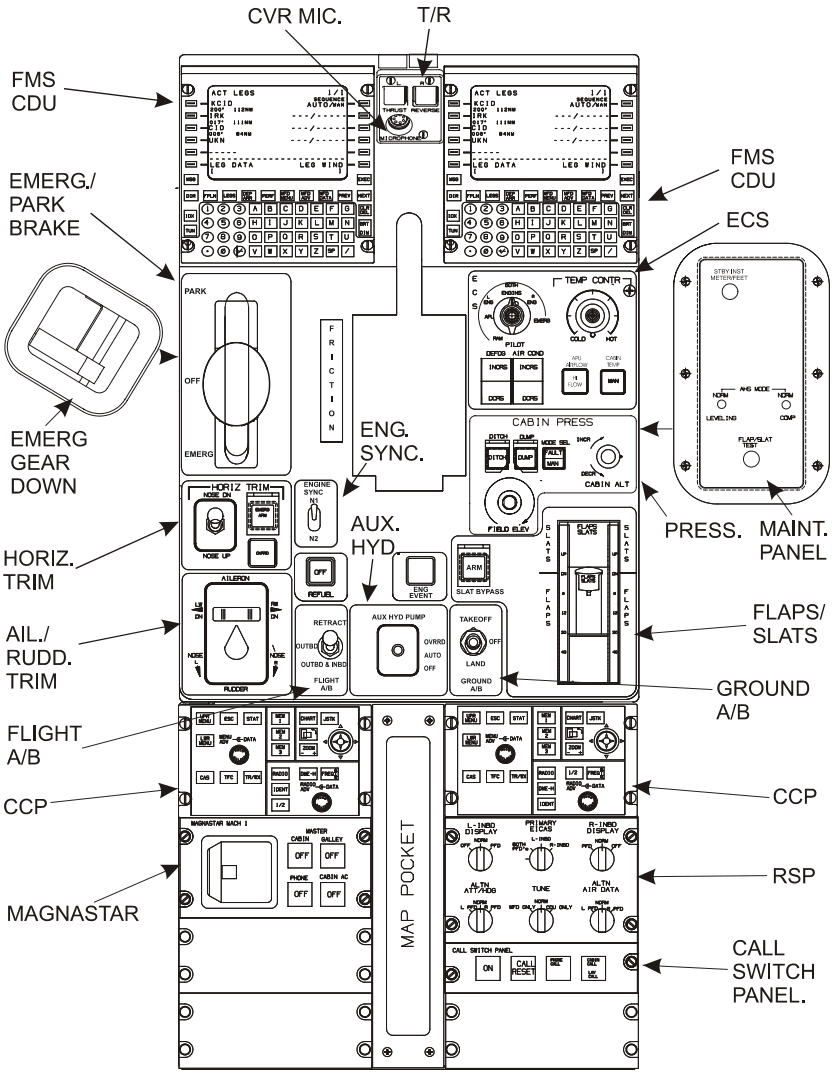

Figure 7-31-5. Pedestal

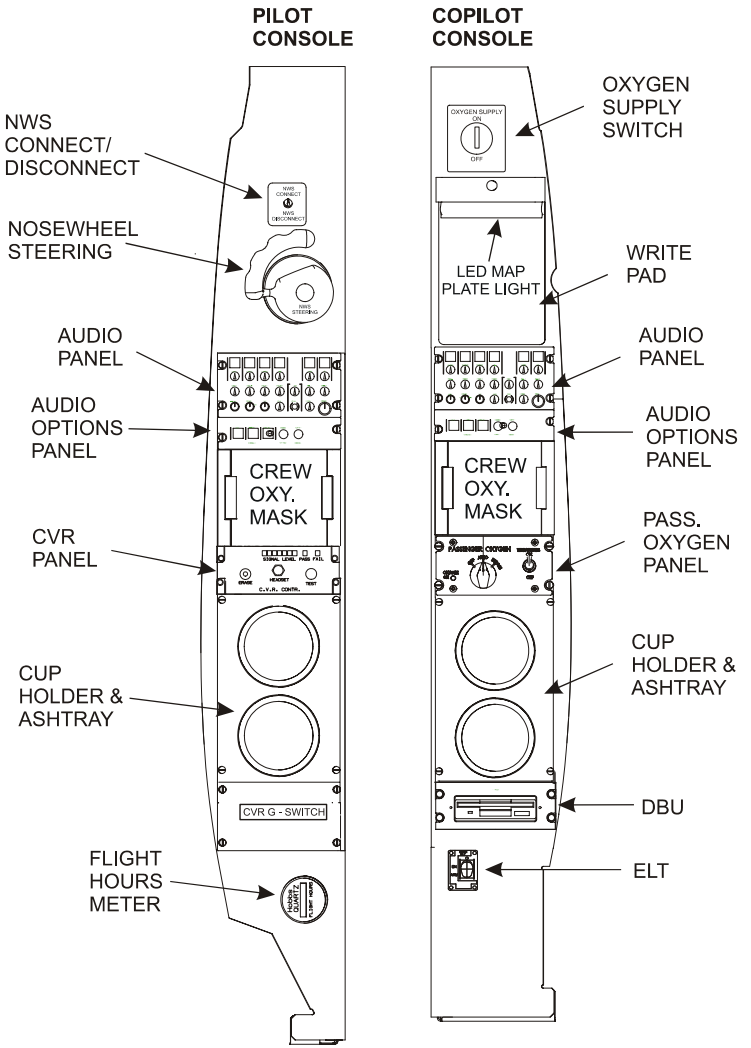

Figure 7-31-6. Pilot / Copilot Side Consoles

ELECTRONIC FLIGHT INSTRUMENTS SYSTEM (EFIS)

The EFIS consists of the following:

- Four adaptive flight displays (AFD)
- Two display control panels (DCP)
- Two cursor control panels (CCP)
- One reversionary switching panel (RSP)

The EFIS system includes four 10" X 12" LCD displays (AFD) for pilot and copilot, to display primary flight and navigation information, weather radar, checklist (optional), systems information and messages.

Each AFD uses an 1200 x 1000 pixel, active matrix, color liquid crystal display. Two AFD's are installed on each pilot instrument panel. The DCP is located above the displays. The outboard displays serve as primary flight display (PFD) and the inboard displays serve as multifunction display (MFD). Each display is capable of presenting all required information and data for the safe operation of the aircraft.

The DCP is the primary pilot interface to control the PFD. A combination of direct control functions and display menus controls the display.

The CCP is the primary pilot interface to control the MFD. The CCP enables MFD radio tuning, menu, and external data overlay control as well as quick access keys. The CCP external data overlay control include: chart display, orientation, zoom and joystick. The display format options are controlled using on screen menus. The CCP also controls the crew alert system (CAS).

The RSP provides display and sensor reversion as well as EICAS display selection for the associated pilots PFD and MFD.

(Continued)

The AFD receives data directly from the following sensors:

- AHRS
- ADC
- On-side VOR/LOC receiver
- TCAS
- DCU
- Digital electronic engine control (DEEC)
- Weather Radar
- Electronic ground proximity warning system (EGPWS)

EFIS DISPLAY PARAMETERS

PFD Format

Altitude:

- Barometric pressure setting either in-hg or hPa
- Barometric rolling digital display and analog moving vertical tape
- Minimum descent barometric reference altitude
- Preselected altitude
- Analog radio altitude

Airspeed:

- Rolling digital display and moving vertical tape
- Take-off speeds (V_1, V_R, V_2, V_{FTO})
- FGS reference speed
- Approach reference speed (V_{REF})
- Airspeed trend vector
- Overspeed cues
- Low airspeed awareness
- Flap extension speed reference

Angle of attack:

- Analog angle of attack display
- Digital angle of attack display

Vertical Speed:

- Analog scale - permanent
- Digital display under dynamic conditions
- FGS reference vertical speed bug

(Continued)

Height:
- Radio altitude digital display below 2500 feet
- Minimum radio altitude reference altitude

Attitude:
- Pitch
- Roll
- Excessive attitude indication

Lateral Acceleration (slip/skid)

Flight guidance lateral deviation
- FMS:
- Localizer
- VOR
- GLS (growth option)

Flight guidance vertical deviation:
- FMS
- Glideslope
- GLS (growth option)

TCAS II Resolution Advisory

Distance:
- FMS
- DME

Annunciations:
- Minimums
- Autopilot mistrim (pitch, roll, yaw)
- Pitch trim fail
- Marker beacons
- FGS (AP, YD, modes)
- Navigation source
- Bearing source
- Preset Navigation source
- FMS messages
- TAWS annunciation

(Continued)

Compass rose display:
- Heading
- Course
- Selected heading
- Track angle (from FMS)
- To/from indicator
- Lateral deviation

Present position map / extended present position map overlay:
- Map symbology

Radar symbology
TCAS 2 traffic symbology
Bearing
- FMS
- VOR
- ADF

Lightning sensor overlay (option)
TAWS Symbology (map overlay)
Temperature:
- SAT
- ISA deviation display
- TAT

TAS
Ground speed
Wind speed and direction
Elapsed time
EICAS display (pilot selectable and in reversion)
Display menus
Gross weight (from FMS)
Fuel remaining (from FMS)
Fuel temperature

MFD format

MAP display:
- Heading up (aircraft centered)
- 3D map (option)
- North up
- Map display text window

TCAS only display
Radio management display
Radar symbology (map overlay)
TAS
Ground speed
Wind speed and direction
TCAS II traffic symbology (overlay)
Lightning sensor (overlay)
TAWS symbology (map overlay)
Maintenance information
Checklist (optional)
Graphical weather (optional)
Electronic charts (optional)
Enhanced map overlays (optional)
2D terrain (future growth)
Video (future growth)
EICAS information

Figure 7-31-7. PFD - Uncompressed Format

Figure 7-31-8. PFD - Compressed Format

Figure 7-31-9. MFD Format

EICAS MESSAGES INHIBIT

EICAS messages are inhibited during take-off when:

1. Both engines thrust is more than 70% and airspeed is more than 80 kias on ground
2. Aircraft is airborne for less than 30 seconds
3. Radio altitude is less than 400 ft

EICAS messages are inhibited during landing when:

1. Any landing gear is down and locked and radio altitude is less than 400 ft
2. Aircraft on ground for less than 30 seconds
3. Both left and right airspeed is more than 40 kias

DISPLAY DIMMER PANEL

The display dimmer panel on pilot / copilot panels controls the respective side displays brightness as follows:

PFD outer ring - Adjusts the PFD display brightness.

MFD knob - Adjusts the MFD display brightness.

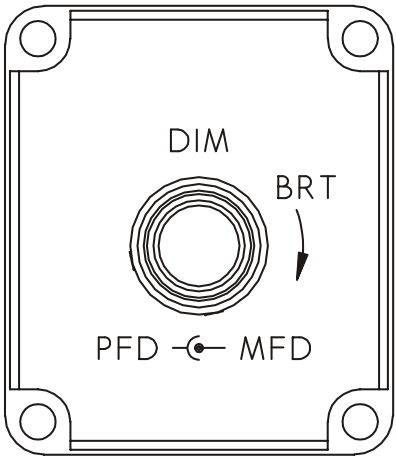

Figure 7-31-10. Display Dimmer Panel

INTEGRATED AVIONICS PROCESSOR SYSTEM (IAPS)

The integrated avionics processor system (IAPS) is a physical collection of several functional modules combined into an efficient mechanical package to minimize size, weight, installation cost and aircraft wiring. It consists of the following modules:

- Integrated card cage (ICC)
- IAPS environmental controller (IEC)
- Two configuration strapping Units (CSU)
- Two options control modules (OCM) - installed on CSU
- Two input/output concentrators (IOC)
- Two power supplies (PWR)
- Two flight guidance computers (FGC)
- Two flight management computers (FMC)
- One maintenance diagnostics computer (MDC)

The ICC provides integral high intensity radio frequency (HIRF) and lightning protection for all installed modules. The ICC provides physical and electrical segregation between left and right side signals. This segregation is maintained through the ICC's backplane.

The PWR’s provide the necessary power requirements for all installed modules.

The CSU’s provide switches and a plug in configuration module to enable selection and activation of the required optional configurations.

The IOC’s perform data concentration for the avionics system. The IOC’s concentrate essential and non-essential data. Each IOC provides the I/O capability of low/high speed ARINC 429 input and output ports.

DISPLAY CONTROL PANEL

The display control panel (DCP) is located on the glareshield. The DCP controls the PFD display configuration and controls as follows.

NAV button - Press to set the navigation source. When the NAV SOURCE list on the PFD is not in view, the first press selects the list and changes the NAV source to the next available NAV source on the list. The list is a closed loop. The currently active NAV source is displayed in larger cyan text. Other available NAV sources are displayed in smaller white text.

MENU button - Press to move the focus indicator through the active menus. The focus indicator is displayed on the PFD or MFD following the active menu. Turn the MENU knob clockwise or counterclockwise to move the focus indicator right and down or left and up, respectively.

ESC button - Press to step up one level out of a selected menu.

TFC button - Press to display the TCAS traffic map on the PFD. If the rose format is active, the rose/TCAS format is selected. Hold the TFC button for more than 1 second selects the rose/TCAS format with the range set to 10 miles (5 mile half range ring displayed).

RANGE knob - Turn to select the displayed range. Clockwise to increase and counterclockwise to decrease. The available range settings are: 5, 10, 25, 50, 100, 200, 300 and 600.

(Continued)

AUTO TILT button - Press to select the weather radar auto tilt feature to maintain the picture in the same area of the display.

TILT knob - Turn to adjust the weather radar antenna vertical tilt angle. The selected angle (-15° to +15°) is displayed with the letter T on the MFD.

SELECT button - Press to select / deselects new value set with the DATA knob.

FRMT button - Press to display the display format list and select the next available format. The format can be ROSE, PPOS (present position), or SUMMARY (compressed PFD only). The currently active format is displayed in larger cyan text. Other available formats are displayed in smaller white text.

RADAR button - Press to display the RADAR CONTROL menu on the PFD. Use the MENU knob to position the focus indicator around the MODE menu or the desired control function. The available control functions are mode, target arm, sector scan, ground clutter suppression, and auto tilt. Use the DATA knob or the SELECT button to change the mode/control function surrounded by the focus indicator.

DATA knob - Turn to change the value located in the focus indicator window.

MENU ADV knob - Turn to move the focus indicator to allow activation of different display items on the PFD.

(Continued)

REFS button - Press to select the reference menus on the PFD. On ground used to move through the REFS menu. In flight, the 2/3 page is the first selection. REFS menu displays the settings for V_1, V_R, V_2, V_{FTO}, V_{REF}, MIN ALERT, BARO MIN, and RA MIN.

ET button - Press to display the elapsed time on the PFD. The first press of the ET button sets the ET to 00:00, displays the ET on the PFD and the timer starts. The second press of the ET button stops the timer. The third press of the ET button removes the ET from the display.

TR/WX button - When WX is selected, the format and range change automatically to be compatible, if required. The TR/WX/LX legend indicates which overlay is selected. The selected overlay abbreviation(s) (TR, WX, LX) is displayed larger and in cyan. Press and hold the TR/WX button for 1 second to automatically set the terrain overlay on the present position map with a 10 nm range.

STD button - Press the to exchange the BARO set value with the standard (STD) pressure.

BARO knob - Turn to control the PFD BARO set readout.

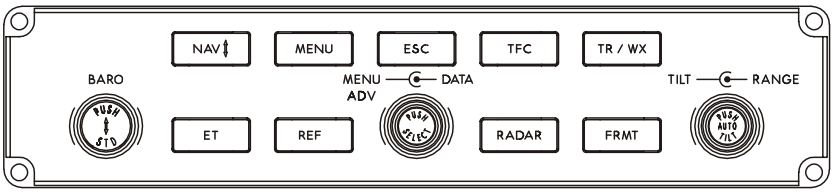

Figure 7-31-11. Display Control Panel

CURSOR CONTROL PANEL

The cursor control panel (CCP) provides for MFD display control. The CCP calls up main menus and associated submenus to control the current MFD display. The CCP provides control of all crew alert system (CAS) displays, including on the PFD when the PFD is in compressed format. Pressing a button for an optional function that is not enabled (e.g. CHART) displays a SELECTION INACTIVE message on the MFD.

Display Controls

TR/WX button - Selects / deselects the terrain, weather, and lightning (if installed) overlays on the PFD. When weather is selected, the format and range change automatically to be compatible, if required. The only MFD display format that is compatible with the radar format is PPOS (present position) map. Plan map, TCAS only, FMS text only, and aircraft systems synoptics are not compatible with weather radar display. If weather is in view and an incompatible format is selected, the weather overlay is removed. Holding the TR/WX button for 1 second automatically selects the PPOS map with the weather overlay.

(Continued)

TFC button - Selects / deselects the TCAS traffic overlay on the current MFD format (if compatible). If the current MFD format is not compatible with the traffic overlay, the MFD display changes to the TCAS only format with last selected TCAS range. When the TCAS only format is displayed, a TCAS full range ring and a TCAS Half Range ring are added to the display. When TCAS only is active, weather radar or optional terrain information, is removed. Selection of radar or terrain deselects the TCAS only mode. The TCAS only display is only available on the MFD. Holding the TFC button for more than 1 second selects the TCAS only format with 10-mile range.

CAS button - Shows the CAS (crew alert system) message list on the MFD. When the PFD is in compressed format, the CAS message list is displayed on the PFD. If there is more than one page of CAS messages, second press of the CAS button displays the next page. When the last CAS message page is in view, pressing the CAS button hides all non-warning CAS messages.

MENU ADV DATA knob - Tuning frequency increases / decreases when the RADIO MENU ADV/DATA knobs are turned in a clockwise / counterclockwise direction, respectively.

MENU ADV knob - Moves the focus indicator among the menu items. Allows upper and lower menu selections.

MENU ADV PUSH SELECT button - Turns on the radio frequency tune mode when the focus indicator is around a VHF COM or NAV frequency. Turns on the radio frequency single digit tuning mode when the focus indicator is around a HF channel or FLIGHT ID Code.

(Continued)

LWR MENU button - Displays the MFD lower menu when in split format. Press ESC button when any second level menu is in view to return to the lower main menu.

UPR MENU - Displays the MFD upper menu when no menus are in view, the split window format is in view and the EICAS is not locked on the MFD. Press ESC button when any second level menu is in view to return to the Upper main menu.

ESC button - Pressed to return to any previous menu.

STAT button - Selects / deselects the status window on the MFD. The status window provides access to the following MDC (maintenance diagnostic computer) functions: MAINTENANCE, FCS DIAGNOSTICS and optional SUBSCRIPTIONS, DATABASE EFFECTIVITY, and FILE SERVER CONFIG pages when a file server is installed.

Memory Controls

MEM1, MEM 2, MEM 3 buttons (Quick Access Keys) - Memorize configurations of the upper and lower MFD windows. Momentary press selects the desired combination. Press and hold the key for more than 3 seconds to store the current upper and lower MFD window configuration and selections for future recall.

(Continued)

Chart / Checklist Controls

CHART button - Selects / deselects the chart display on the MFD. Removes the previously displayed upper and lower window when EICAS information is not displayed A Second press removes the chart and returns to the previous upper and lower window displays.

Orientation button - Used to rotate a chart by 90°.

Joystick - Used to page through checklists and position the FMS PPOS map pilot created waypoint. With a checklist page in view, up or down joystick movement highlights a menu or an item. Right or left joystick movement moves to the next or previous checklist. With the FMS PPOS map displayed, the joystick positions the cursor to the desired point on the map. Pressing the FMS ENTER button transfers the geographic coordinates to the FMS CDU scratchpad.

JSTK button - Selects the joystick function in the upper or lower MFD window.

ZOOM button - Increases / decreases the size of a displayed chart. Pressing ZOOM + increases the size of the chart that displays the area previously highlighted by the cursor window. Pressing ZOOM - returns the chart to its normal size.

(Continued)

Radio Controls

RADIO button - Selects and deselects the sub menu for the selected radio system on the MFD, the tuning control sub-menu of the radio associated with the current position of the displayed tuning control. Pressing the RADIO button when another menu is displayed closes the menu and returns the tune box to it's default position (COM). All sub-menus automatically close.

RADIO ADV/DATA/ knobs - Used for MFD radio tuning and radio menu control. The larger and smaller knobs change the frequency respectively.

IDENT button - Selects transponder ident for the active transponder.

DME-H button - Selects/deselects the DME Hold function. When selected, DME Hold holds the current DME frequency while allowing independent tuning of the VOR receiver.

1/2 button - Selects/deselects the cross-side radio menu on the MFD. When a radio sub-menu is in view, the equivalent cross-side radio (e.g., #2) sub-menu is selected/deselected.

FREQ button - Swaps the active and preset frequency for the selected radio system.

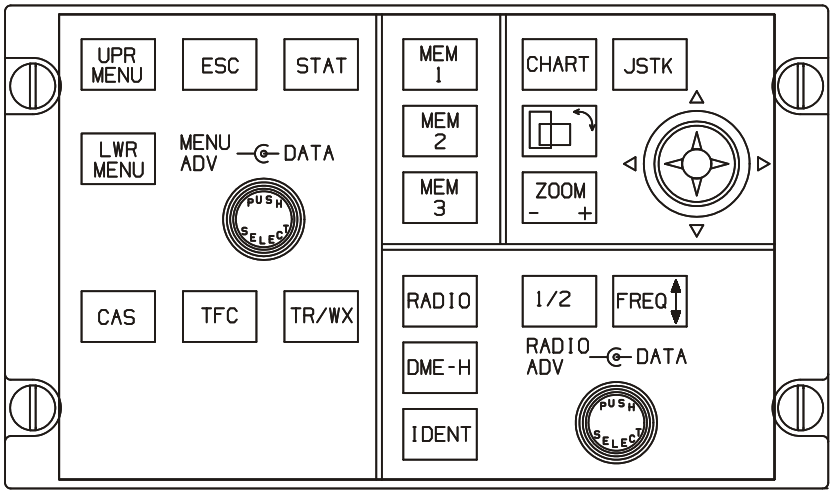

Figure 7-31-12. Cursor Control Panel

REVERSION SWITCH PANEL

The reversion switch panel (RSP) enables reversion control of sensors and displays as follows:

L INBD DISPLAY knob - Has three positions:

NORM - Selects the left inboard display as a MFD and the left outboard display as a PFD.

PFD - Selects the left inboard display as a PFD and the left outboard display off.

OFF - the left inboard display is off. The right MFD tunes both sets of radios. The radio controls on the left CCP are inoperative.

PRIMARY EICAS knob - Has three positions:

L INBD - Displays EICAS on the left inboard display. If this display is acting as an MFD, the MFD is locked into a split window configuration with EICAS shown in the upper window. The MFD does not display the upper window menus. If this display is acting as a PFD, the PFD displays a compressed EICAS presentation.

R INBD - Displays EICAS on the right inboard display. If this display is acting as an MFD, the MFD is locked into a split window configuration with EICAS shown in the upper window. The MFD does not display the upper window menus. If this display is acting as a PFD, the PFD displays a compressed EICAS presentation.

BOTH PFDS - Displays a compressed EICAS presentation on any AFD acting as a PFD.

(Continued)

R INBD DISPLAY knob - Has three positions:

NORM - Selects the right inboard display as a MFD and the right outboard display as a PFD.

PFD - Selects the right inboard display as a PFD and the right outboard display off.

OFF - The right inboard display is turned off. The left MFD tunes both sets of radios. The radio controls on the right CCP are inoperative.

ALTN AIR DATA knob - Has three positions:

NORM - Pilot / copilot PFD's and MFD's use the onside ADC as the air data source.

L PFD - Selects ADC-2 as the air data source for both pilot / copilot PFD's and MFD's. Yellow ADC 1 alert comes on the PFD's.

R PFD - Selects ADC-1 as the air data source for both pilot / copilot PFD's and MFD's. Yellow ADC 2 alert comes on the PFD's.

TUNE - Has three positions:

NORM - Normal position. Tuning and control of all radios is available from either the MFD's and FMS CDU's for both onside and cross-side radios.

MFD ONLY - Selects the MFD's as the master tuner. The FMS CDU's TUNE page is blank.

CDU ONLY - Selects the FMS CDU's as the master tuner. The MFD radio menu is blanked.

(Continued)

ALTN ATT/HDG knob - Has three positions:

NORM - Normal position. Allows each side PFD and MFD to use the onside AHS as the attitude heading source.

L PFD - Selects AHS-2 as the attitude heading source for onside displays. Yellow AHS 2 alert comes on the PFD's.

R PFD - Selects AHS-1 as the attitude heading source for onside displays. Yellow AHS 1 alert comes on the PFD's.

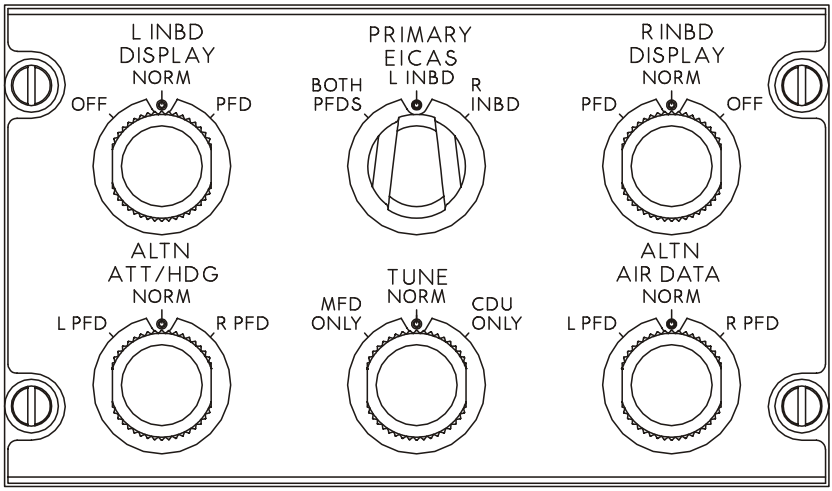

Figure 7-31-13. Reversion Switch Panel

INTEGRATED ELECTRONIC STANDBY INSTRUMENT

The integrated electronic standby instrument (IESI or 3-in-1) enables display of the three main functions: attitude, altitude and airspeed. The instrument is used if main flight instruments fail. It is located on the center instrument panel to used by both pilots. The IESI has the following display and control capabilities with all corrections, calculations and displays generated internally:

- Attitude
- Altitude
- Airspeed
- Mach number
- Barometric pressure setting in Mbar and in-Hg

Figure 7-31-14. Integrated Electronic Standby Instrument (IESI)

DISPLAYS CONTROLS

Caution Messages

DCU FAULT - Data concentrator unit malfunction. EICAS operation not affected
EFIS COMPARE INOP - EFIS comparator system malfunction
EFIS MISCOMPARE - EFIS data difference (heading, attitude, LOC, G/S etc.)
EGPW SYSTEM FAIL - EGPWS system failure. Ground proximity, windshear and terrain warnings unavailable
FDR INOP - Flight data recorder has failed

Status Messages

CAS MISCOMPARE - Difference in crew alert system channels data
AUX HEADSET CONN - Maintenance headset connected
CABIN CALL - Cabin call pushbutton pressed
DCU FAN FAIL - DCU fan failure
MAINTENANCE - New maintenance information available in MDC
MDC DATA ERROR - MDC data error

(Continued)

Aural Alerts (🔊)

Alert	Description	Triple Chime
STALL	Voice – stall	No
TAWS Audio	Voice/aural from TAWS system	No
TCAS Audio	Voice/aural from TCAS	No
ENGINE FIRE	Voice – engine fire	Yes
ENGINE OVERHEAT	Voice – engine overheat	Yes
APU FIRE	Voice – APU fire	Yes
CONFIGURATION	Voice – configuration warning non-mutable	Yes
CONFIGURATION	Voice – configuration warning mutable	Yes
OVERSPEED	Aural – aircraft overspeed	No
TRIM TONE	Aural – trim operating	No
AUTOPILOT DISCONNECT	Aural – cavalry charge	No
CABIN ALTITUDE	Voice – cabin altitude exceeded	Yes
GEAR	Voice – gear warning non-mutable	Yes
GEAR	Voice – gear warning mutable	Yes
WARNING ATTENSON	Aural – triple chime	No
ALTITUDE ALERT	Aural – C chord	No
CAUTION ATTENSON	Aural – single chime	No
VERTICAL TRACK ALERT	Aural – FMS VNAV alert	No
SELCAL	Voice – selcal received	No
CABIN CALL	Aural – Two Tone Double Chime, cabin or phone	No

DISPLAY CONTROL GRIP (DCG)

The DCG is a duplicate means of controlling the functions controlled by the display control panel (DCP) and cursor control panel (CCP).

The DCG's are mounted on the cockpit sidewalls, above pilot and copilot consoles. Both DCG's are identical, one shaped to mirror the other.

The following functions are controlled by the DCG's:

- All PFD menus
- MFD upper/lower menus
- PFD/MFD hotspots for: TFC, terrain & weather overlays
- Preselect NAV source/course
- Radar tilt control
- Range control
- EICAS CAS paging
- Radio transmission (PTT)
- Checklist
- 3D FMS
- Optional charts, zoom in/out GWX, scroll 3D map

DCG Controls

Display Select buttons (2) - Controls various display functions according to the selected display mode.
Menu / Escape (ESC) button - Selects / deselects a menu.
Cursor Control - Moves the cursor left, right, up and down.
Multifunction wheel - Scrolls up or down a menu or a list.
Enter Trigger - Executes the selected menu item / command.
Press-to-Talk (PTT) button - Enables radio transmission.

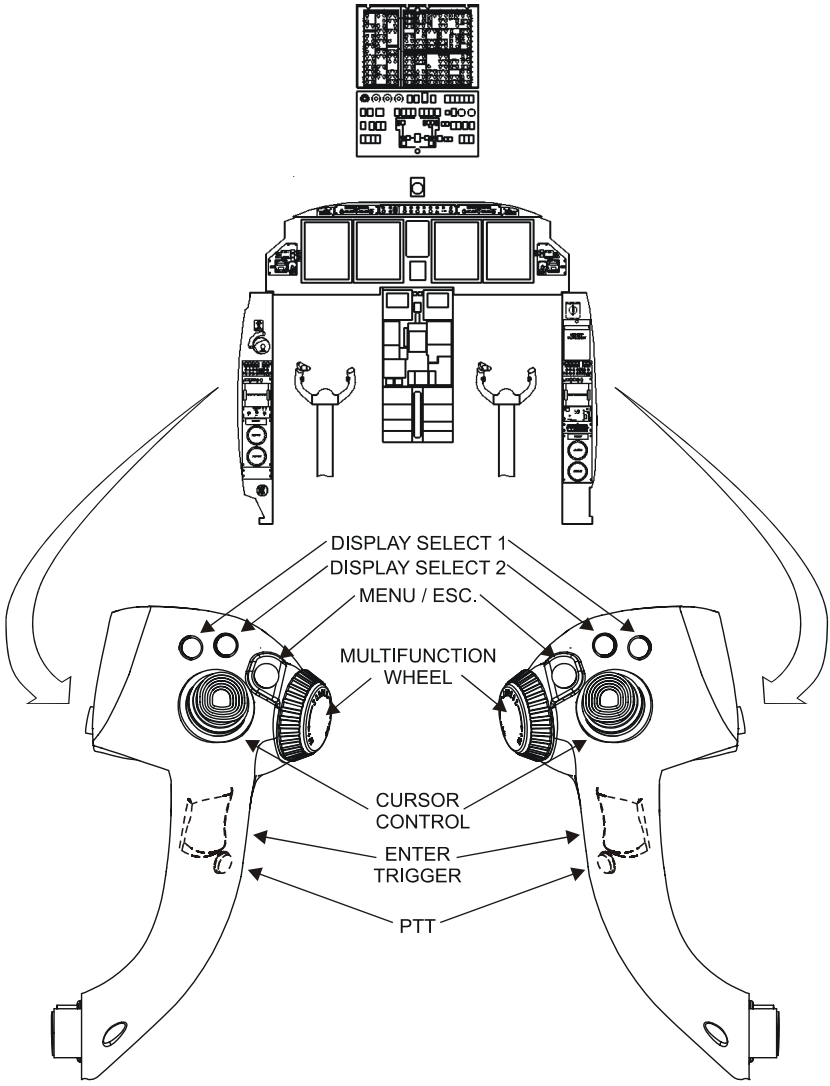

Figure 7-31-15. Display Control Grip (DCG)