

DC-10
FLIGHT CREW OPERATING MANUAL

CHAPTER 10
FLIGHT INSTRUMENTS

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FLIGHT INSTRUMENTS

GENERAL

The flight instruments chapter includes the pitot static system, the air data system, and those basic flight instruments, standby instruments, and related components which provide altitude, airspeed, Mach, vertical speed, true airspeed, overspeed warning, attitude, and air temperature data to the flight crew.

Sensors provide inputs to three central air data computers where temperature and instrument position corrective factors are applied as appropriate. The flight recorder maintains a history of time-related flight parameters.

DESCRIPTION

PITOT/STATIC SYSTEM

During normal operation, the pitot/static system inputs variable pressure values to the central air data computers which provide computed outputs for readout of airspeed, vertical speed, and altitude. Two parallel static systems (the Captain's and First Officer's) provide inputs to the central air data computers, while a third system provides raw inputs (uncorrected barometric) to the standby altimeter, the standby airspeed indicator, and provides input to the third central air data computer. A fourth (alternate static) system provides raw inputs to the cabin pressure controller and the cabin differential pressure indicator.

PRIMARY FLIGHT INSTRUMENTS

The primary Mach/AS indicators, true airspeed indicators, vertical speed indicators, altimeters, and the overspeed warning system derive their inputs from the central air data computers which receive and process (correct for

temperature and position error) raw data from the pitot static system. The overspeed warning sensor will activate an aural warning device when limiting airspeeds are reached.

DIRECTIONAL INDICATING SYSTEMS

There are two independent compass systems. Each compass system is stabilized by the associated directional gyro or inertial navigation system (INS) platform (if installed). The compass system can operate in the slaved (normal) mode or DG (unslaved) mode. The mode is selected by the COMPASS switch on the overhead panel. In the slaved mode the compass is synchronized with a flux valve and provides magnetic heading. The synchronization indicator is on the overhead panel. In the DG mode the compass heading is controlled by the SET HDG knob on the overhead panel. The compass heading is displayed on the radio magnetic indicators (RMI) at all times, and on the horizontal situation indicator (HSI) compass card when the HSI switch is in the RAD position. The number 1 compass system normally drives the Captain's HSI and the First Officer's RMI. The number two compass system normally drives the First Officer's HSI and the Captain's RMI. When the COMP Selector on the overhead panel is placed in the BOTH ON 2 (or BOTH ON 1) position, the number two (or one) compass system drives all compass cards. The adjacent annunciator light will be on. On aircraft with INS installed, when the HSI switch is in INS, the HSI compass card will display true heading derived from the associated INS. A standby magnetic compass provides a heading reference in relation to magnetic north.

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ATTITUDE DIRECTOR INDICATOR

For the purpose of this chapter, the Attitude Director Indicator (ADI) is considered as a basic attitude display and not for the broader role it performs as the command focal point in the flight director and flight guidance subsystems. These diverse aspects are described in the navigation and flight guidance chapters.

Two remote vertical gyros or inertial platforms (if installed) provide basic attitude information to the Captain's and First Officer's ADI's. The ATT COMP STAB selector permits selection of the third vertical gyro or the third inertial platform (if installed) for input to either the Captain's or First Officer's indicators. An ATT warning flag on the ADI indicates attitude data are unusable. The ADI has

a test button which, when pushed, tests the attitude, flight director, and rising runway functions.

DIGITAL FLIGHT DATA RECORDER

A digital flight data recorder (DFDR) records data from aircraft subsystems, sensors and flight data entry panel inputs.

CONTROLS AND INDICATORS

The controls, indicators, and annunciator lights are on the Captains and First Officers instrument panels, Center instrument panel, Overhead panel, and Flight Engineers Upper No. 2 and 3 panels. Illustrations of the panels are in Chapter 1. Individual controls and indicators are illustrated and described in this chapter.

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FLIGHT INSTRUMENTS - Controls and Indicators

Altitude Advisory Light
Works in conjunction with altitude advisory system. Provides steady on signal (in conjunction with aural tone) when aircraft is at the altitude advisory threshold (minimum of 750 feet from selected altitude) and goes off when within 250 feet of selected altitude. Advisory light flashes (in conjunction with aural tone) when aircraft deviates 250 feet or more from previously selected and acquired altitude. Pushing the altitude advisory RESET button will turn off the flashing advisory light.
The steady light can be turned off any time in flight by rotating the ALT pre-select knob to set in new altitude.

100 Foot Pointer
The pointer will make a full circle for each 1000 ft. of altitude gained or lost. Negative altitudes are read on the dial as 900 feet for a -100 foot altitude, et cetera. Pointer will remain in last position with power failure.

BARO Set Knob
Push-to-turn BARO knob is rotated to change barometric pressure values as read in the MB/IN HG readouts.

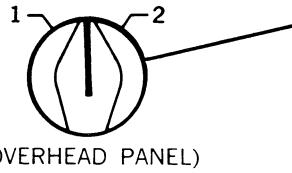
OFF Flag
Appears to indicate mach data are unusable.

VMO Pointer
Reads maximum permissible airspeed as related to altitude. Failure of the Vmo advisory system will drive the Vmo pointer to 257.5 kts. Normal static sea level indication is 350 knots.

Airspeed Pointer
Reads indicated airspeed. Failure of airspeed indicating system will cause pointer to remain in the last position.

Airspeed Command Bug
This bug reflects airspeed set in flight guidance SPD readout.

MAX SPD WARN TEST Selector



(OVERHEAD PANEL)

MAX SPD WARN TEST Selector

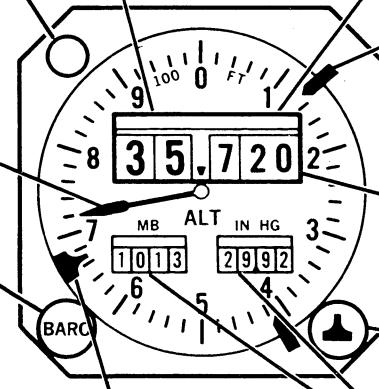
- 1—Rotating and holding switch momentarily will test Max Speed Warning System 1. An aural warning will sound.
- 2—Rotating and holding switch momentarily will test Max Speed Warning System 2. An aural warning will sound.

Altitude Warnings

The digital readout also displays an OFF failure flag which is associated with either a loss of input power, invalid computer input, no input for 2 ± 0.5 seconds or more, internal power supply failure or other internal failures.

OFF

FAILURE FLAG



Digital Readout

Indicates altitude from 0 to 50,000 feet. The right-hand two-digit drum is numbered in 20-foot increments. The "0" position of the left-hand ten-thousands drum is green for alert indication of altitudes of less than 10,000 feet.

Altitude Reference Bugs (2)

Movable pointer used to alert pilot to specified altitudes.



NEG Flag

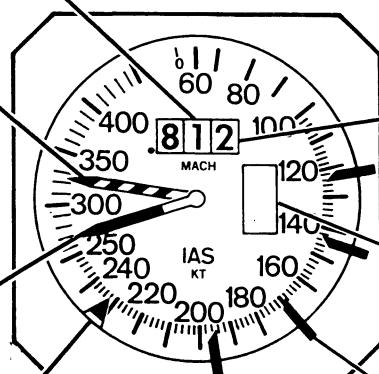
A negative altitude shutter obscures the digital readout to announce altitudes below sea level.

Reference Index Knob

Used to set the altitude reference index as desired.

MB / IN HG Readout

Indicates the selected barometric pressure as expressed in millibars and inches of mercury.



MACH Readout

Indicates mach number. The minimum mach readout is .150.



A/S Flag

Appears when airspeed data are unusable.

MACH/AS INDICATOR
CAPTAIN'S AND COPILOT'S
INSTRUMENT PANELS

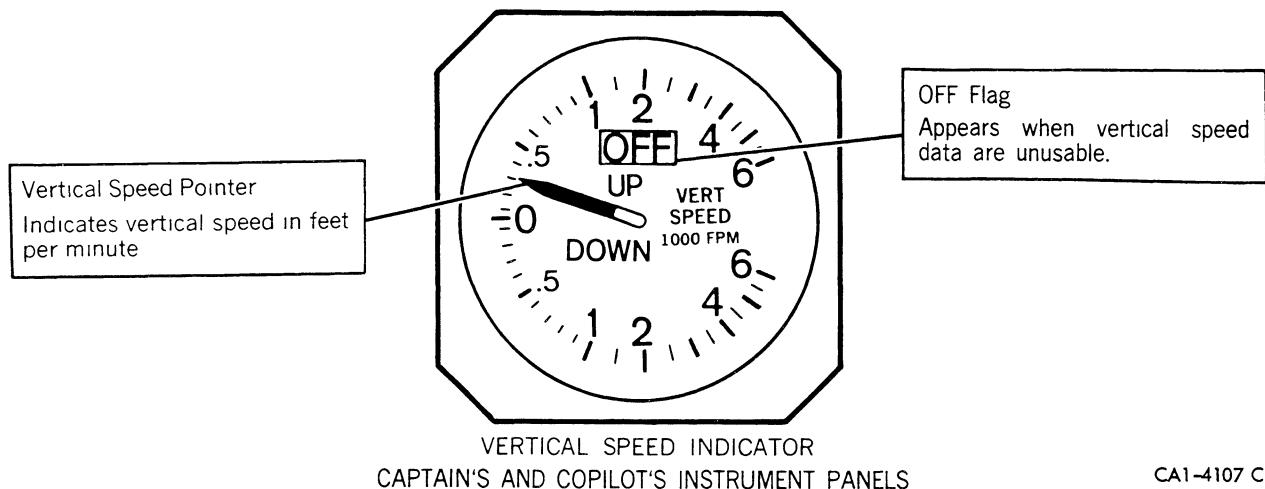
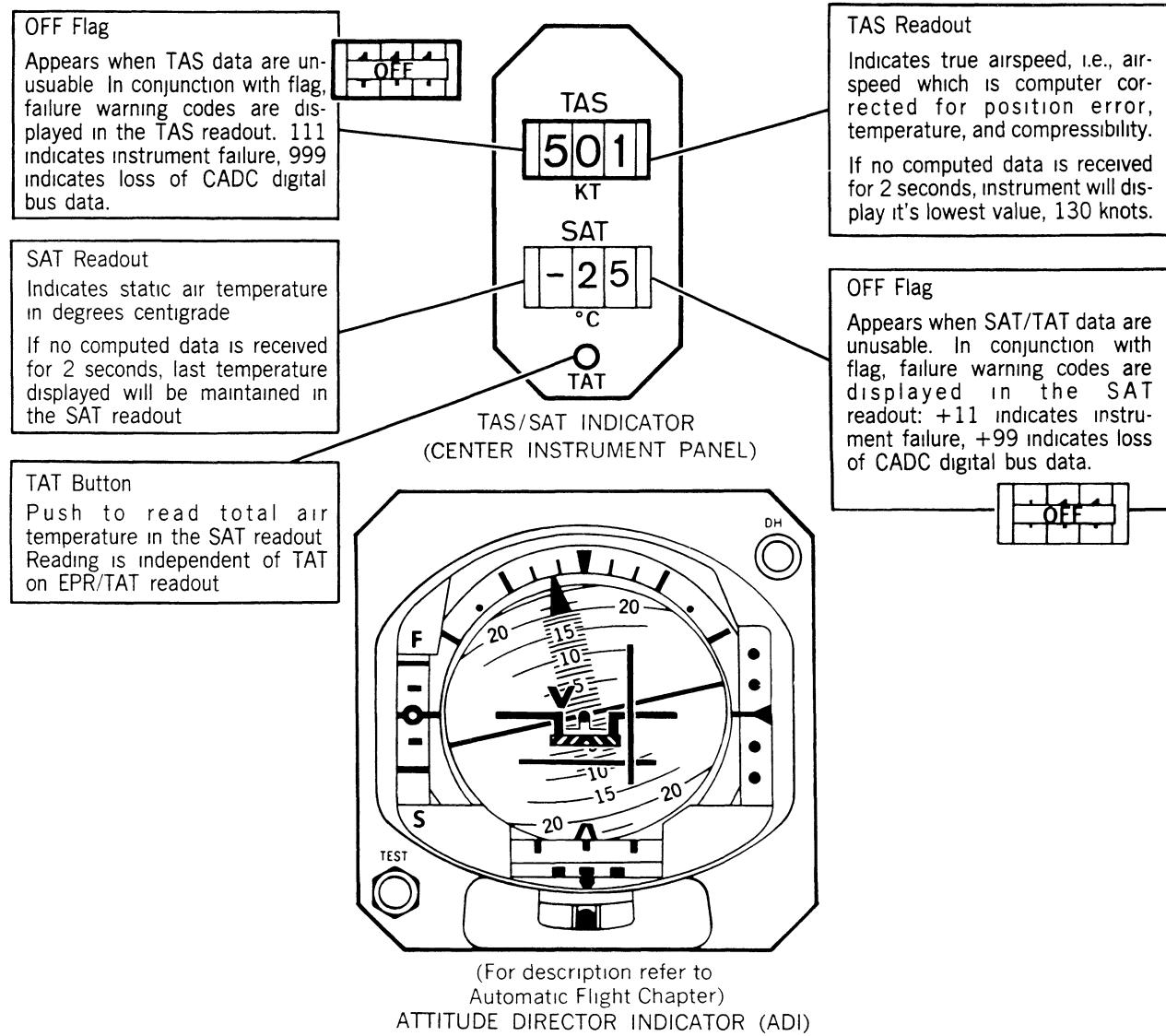
Airspeed Reference Bugs (4)

Movable pointers normally used to alert the pilot to specified airspeeds.

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FLIGHT INSTRUMENTS - Controls and Indicators

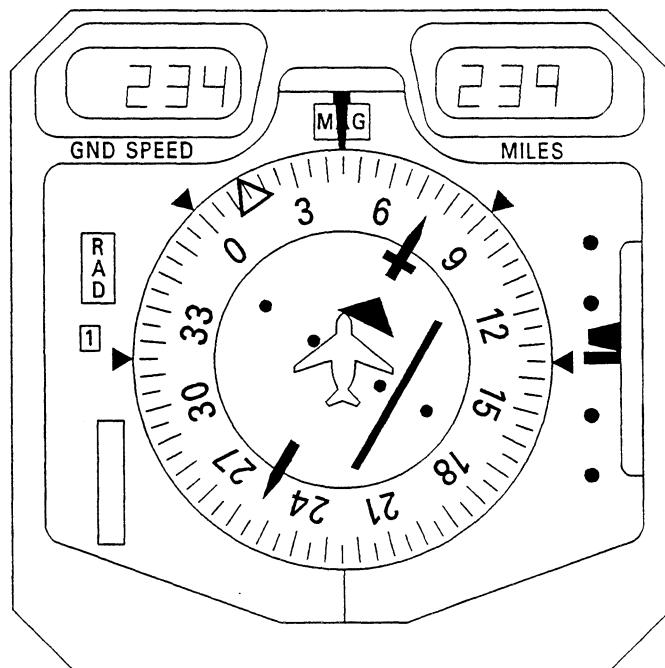


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FLIGHT INSTRUMENTS – Controls and Indicators



(For description, refer to Navigation System Chapter)

HORIZONTAL SITUATION INDICATOR (HSI)

CAPTAIN'S AND COPILOT'S INSTRUMENT PANELS

CA1-9368B

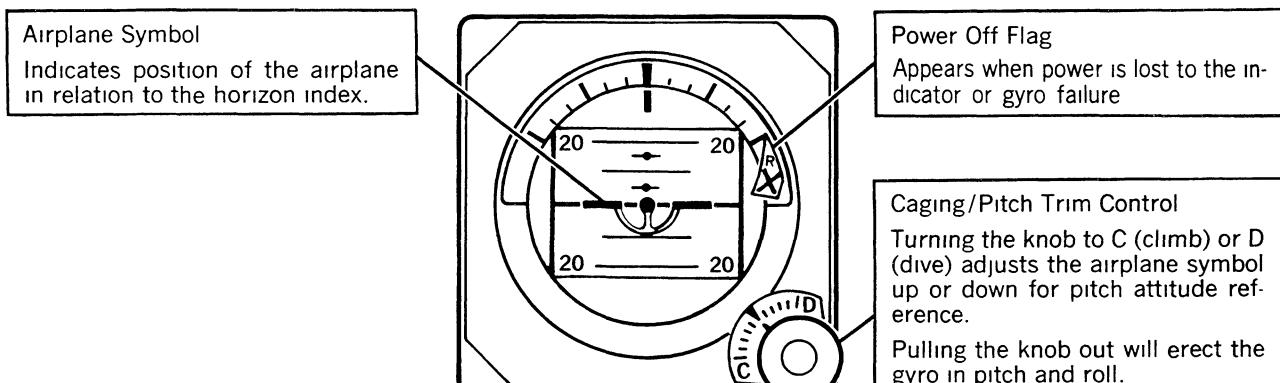
JL
Jun 1/96

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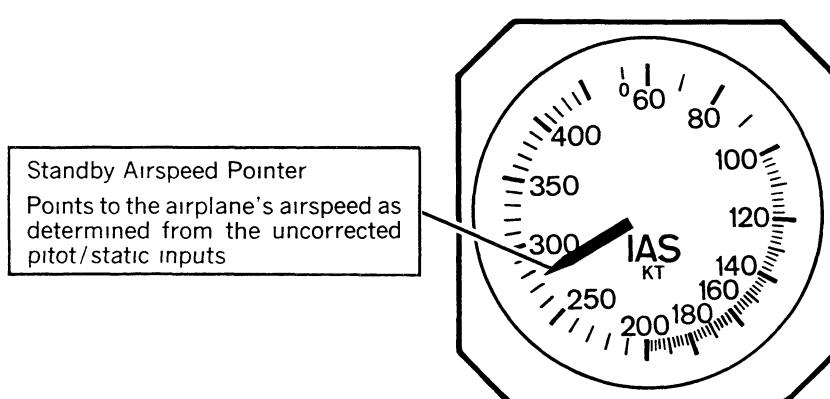
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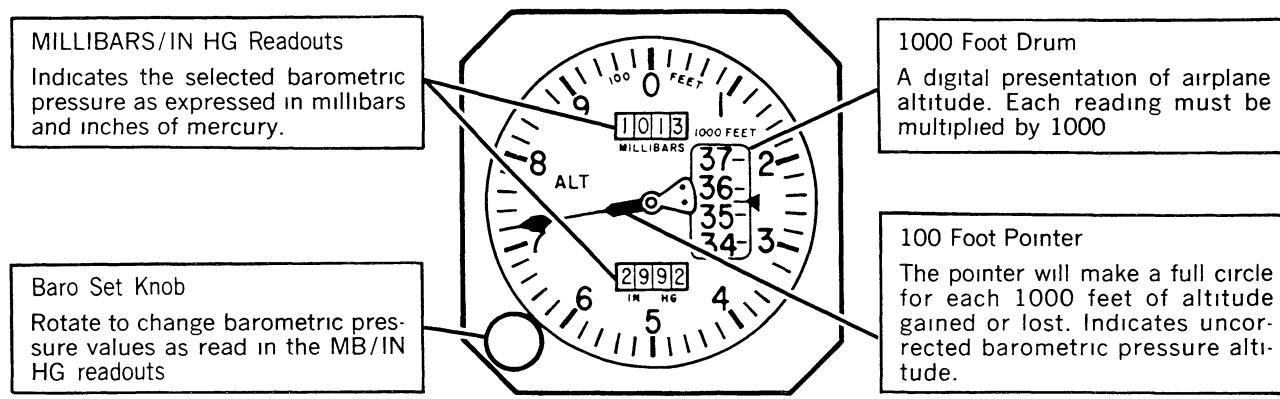
FLIGHT INSTRUMENTS - Controls and Indicators



STANDBY ATTITUDE INDICATOR



STANDBY IAS INDICATOR

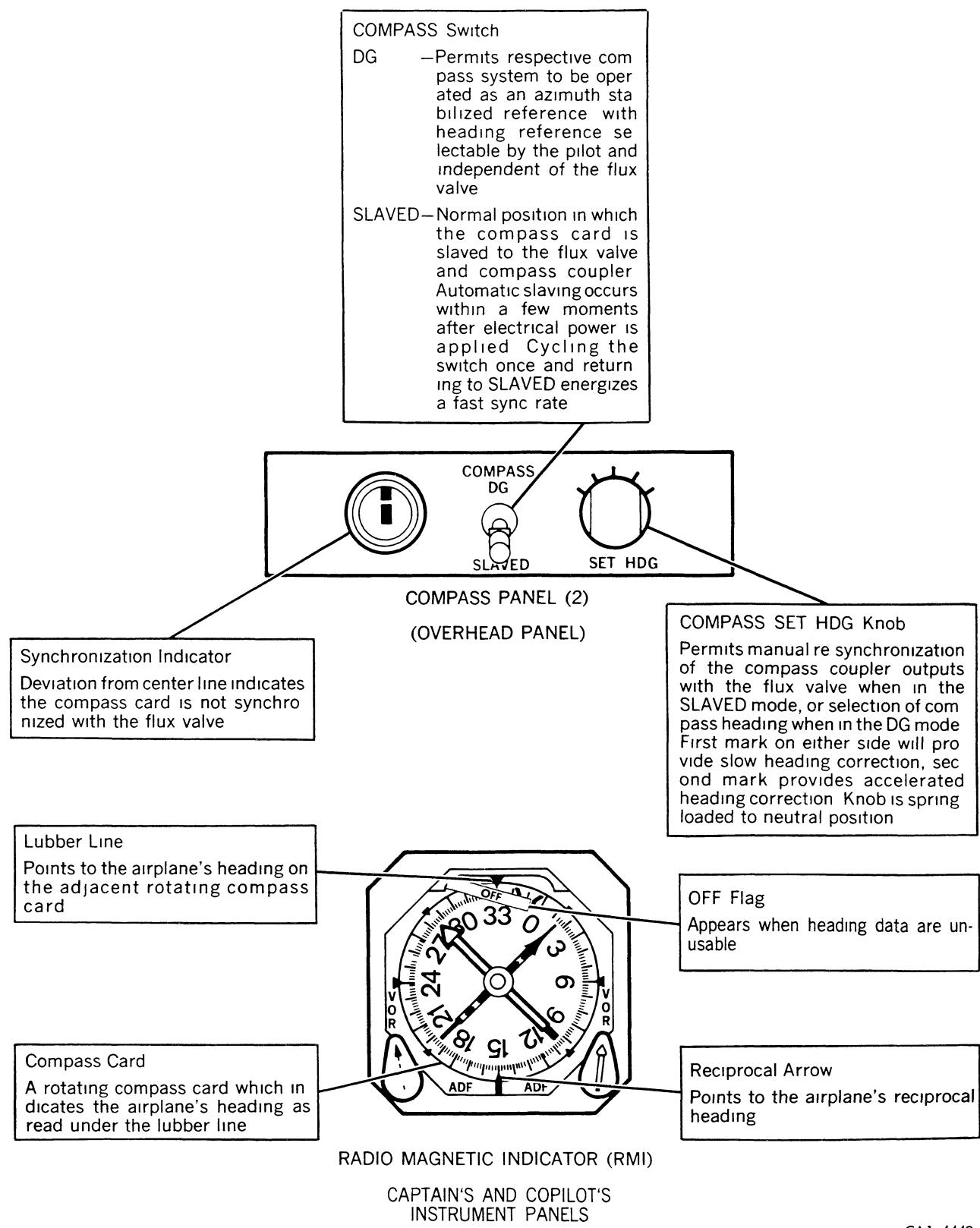


STBY ALT
CENTER INSTRUMENT PANEL

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FLIGHT INSTRUMENTS - Controls and Indicators



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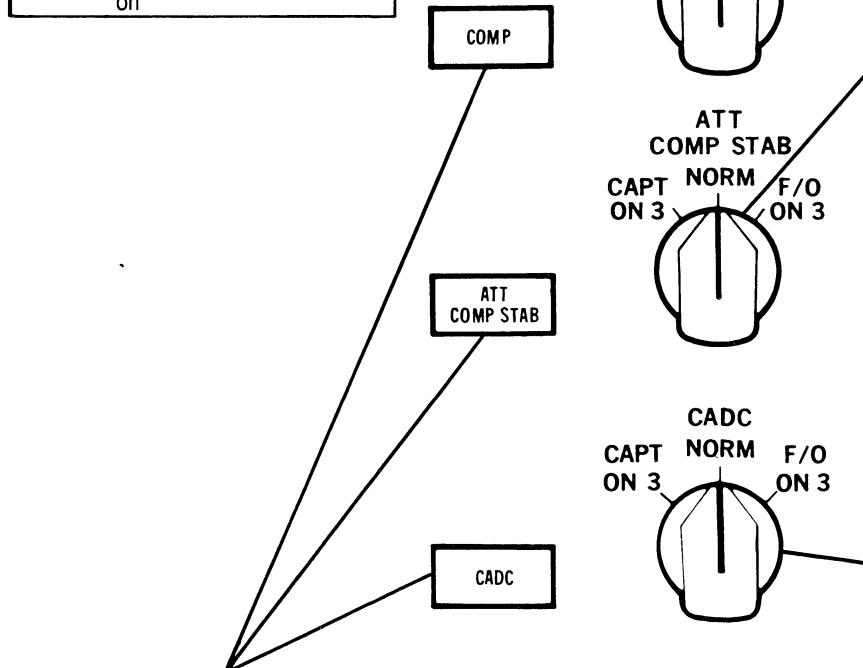
FLIGHT INSTRUMENTS - Controls and Indicators

COMP Selector

NORM — Compass system 1 (2) provides magnetic heading for Capt's (F/O's) HSI (with HSI switch in RAD) and the F/O's (Capt's) RMI. No annunciator light

BOTH — Compass system 1 ON 1 provides magnetic heading for both the Capt's and F/O's HSI's (with HSI switch in RAD) and RMI's COMP annunciator light on

BOTH — Compass system 2 ON 2 provides magnetic heading for both the Capt's and F/O's HSI's (with HSI switch in RAD) and RMI's COMP annunciator light on



Annunciator Lights
Light on indicates selector not in NORM position and switching unit has switched to correct position

ATT COMP STAB Selector

NORM — INS 1 (2) (if installed) or VG/DG 1 (2) (if INS not installed) provide attitude reference signals to the Capt's (F/O's) ADI, FGS 1 (2), ATS 1 (2), and weather radar 1 (2), and also provides azimuth stabilization signals to the Capt's (F/O's) compass system. No annunciator light

CAPT — All instruments and systems that normally (switch in NORM) receive signals from INS 1 (if installed) or VG/DG 1 (if INS not installed) now receive signals from INS 3 (if installed) or VG/DG 3 (if INS not installed). ATT COMP STAB annunciator light on.

F/O — All instruments and systems that normally (switch in NORM) receive signals from INS 2 (if installed) or VG/DG 2 (if INS not installed) now receive signals from INS 3 (if installed) or VG/DG 3 (if INS not installed). ATT COMP STAB annunciator light on.

CADC Selector

NORM — CADC 1 (2) provides data for the Capt's (F/O's) pitot/static instruments and FGS 1 (2). No annunciator light

CAPT — CADC 3 provides data for Capt's pitot/static instruments and FGS 1. CADC 2 provides data for F/O's pitot/static instruments and FGS 2. CADC annunciator light on

F/O — CADC 3 provides data for F/O pitot/static instruments and FGS 2. CADC 1 provides data for Capt's pitot/static instruments and FGS 1. CADC annunciator light on

NOTE
If a CADC fails verify that the ATC Transponder in use is matched with the operating CADC

OVERHEAD PANEL

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FLIGHT INSTRUMENTS - Controls and Indicators

BRT Control

Rotating the brightness control clockwise increases the brightness of the IDENT and VALUE annunciators

EVENT Button

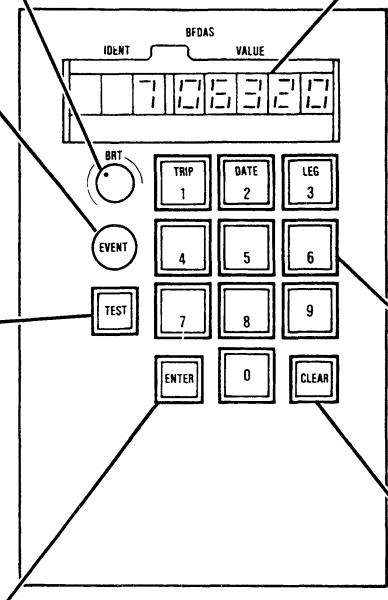
Pushing the EVENT button transmits a discrete entry to the flight recorder

TEST Button

Pushing the TEST button, momentarily causes the flight recorder to turn on thereby causing the FLT RECORDER OFF light to go off and all six IDENT and VALUE annunciators to display the number 8

ENTER Button

Pushing the ENTER button causes the displayed data to be transmitted to the digital flight data recorder via the flight data acquisition unit. When both the IDENT and VALUE annunciators go off, the recorder is ready to receive the next segment of information. Up to four seconds may be required for the IDENT and VALUE annunciators to clear.



FLIGHT DATA ENTRY PANEL (FDEP)

FLT RCDR OVRD



FLIGHT ENGINEER'S
UPPER PANEL NO 3

FLT RECORDER OFF

(F/E UPPER PANEL NO 2)



IDENT and VALUE Annunciator

The first two blank IDENT annunciators on the left are reserved for future monitoring of AIDS information

The third IDENT annunciator on the left displays the identification code number of the parameter being entered in the flight recorder. The number pushed first will appear in this IDENT annunciator

The right group of five VALUE annunciators display the value of the parameter being entered in the flight recorder. As the numerical values are being inserted, the numbers will transfer from right to left in the VALUE annunciator

Pushbutton Keyboard

The pushbutton keyboard consists of ten illuminated pushbuttons which are used to insert the IDENT code number of the parameter (trip, date, leg) and the numerical VALUE of the parameter

CLEAR Button

Pushing the CLEAR button will erase the IDENT and VALUE annunciators. This results in no data transmission to the flight recorder and allows new data to be selected and displayed

FLT RCDR Switch

OVRD – Applies power to the flight recorder system

NORM – Applies power to the flight recorder system when parking brakes are released with any engine operating or the ground sensing relay is in flight mode

FLT RECORDER OFF Light

Comes on to indicate the flight recorder is not recording information properly

PILOT IN CMD Switch (Provisions only)

Provides for future monitoring and recording of switch position by the AIDS

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Effective for airplanes with BFDAS FLIGHT DATA
ENTRY PANEL (FDEP) installed.

FLIGHT INSTRUMENTS - Controls and Indicators

Pushbutton Keyboard
The pushbutton keyboard consists of ten illuminated pushbuttons which are used to enter the parameter identifier code and/or the value of the parameter to be transmitted to the Data Management Unit.

DISPLAY Button
After entering the parameter identifier code into the Flight Data Entry Panel (FDEP), pushing the DISPLAY button will transmit the code to the Data Management Unit (DMU). The DMU will convert the code into alpha-numeric values, establish its value, and transmit both back to the FDEP for IDENT and VALUE display. The VALUE display will be updated by the DMU at one second intervals.

INSERT Button
After entering the parameter identifier code into the Flight Data Entry Panel (FDEP), pushing the INSERT button will transmit the parameter identifier code to the Data Management Unit (DMU). The DMU will convert the code into alpha-numeric values and transmit it back to the FDEP for IDENT display. After verifying the IDENT display is correct, enter the value (the VALUE will be displayed as it is entered) and push the INSERT button. The VALUE will be transmitted to the DMU and both the IDENT and VALUE will be transmitted by the DMU to the Digital AIDS Recorder (when the data is recorded the VALUE display will erase).

MODE Select Knob
STBY - The Digital AIDS recorder (DAR) receives no data from the Data Management Unit (DMU)
AUTO - The DAR receives all data determined by and transmitted by the DMU
FAST — Turns on the DAR when on the ground, without engines running, and receives and records continuously transmitted data.

VALUE Readout
Displays the value of the parameter identifier

IDENT Readout
Displays the parameter identifier value or the identification of a fault condition.

LIMIT Switch/Light
Comes on when a monitored parameter is out of limits. Pushing the switch/light turns the light off (light will remain on if there are additional LIMIT exceedance), and transmits a request signal to the Data Management Unit (DMU) to display the out of limits parameter identifier and its value on the IDENT and VALUE readouts. The VALUE will be updated at one second intervals until the CLEAR button is pushed. If the light remained on, repeat the procedure for other out of limit parameter(s).

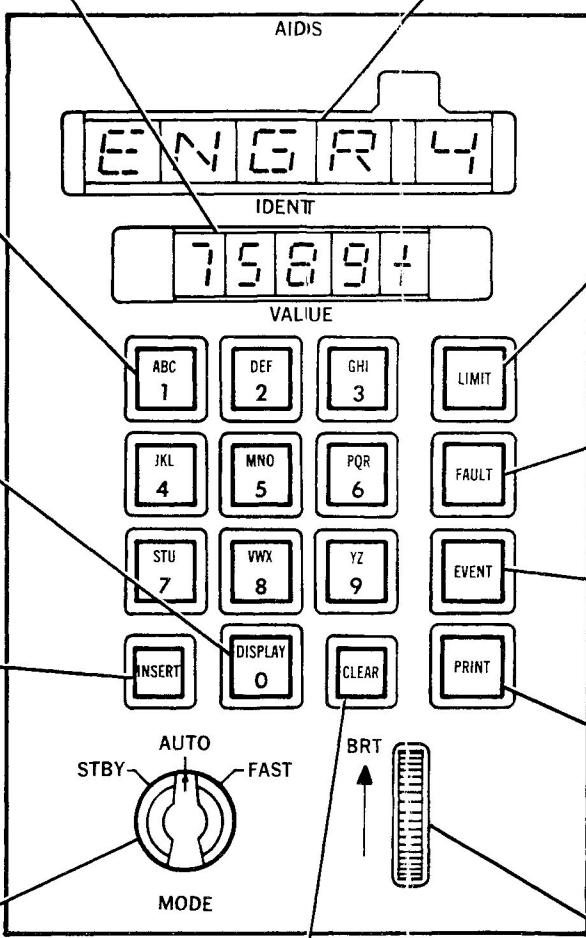
NOTE
Whenever a LIMIT exceedance occurs the DMU will transmit the data to the airborne printer.

FAULT Switch/Light
Comes on when one of the Airborne Integrated Data System units is indicating a fault. Pushing the switch/light will turn the light off (light will remain on if there are additional FAULT indications) and transmits a request signal to the Data Management Unit (DMU) to display the source of the FAULT condition. The display is removed by pushing the CLEAR button. If the light remained on, repeat the procedure for other FAULT indications.

EVENT Button
Pushing the EVENT button transmits a discrete entry to the Digital AIDS Recorder and the Digital Flight Data Recorder.

PRINT Button
After entering the parameter identifier code into the Flight Data Entry Panel (FDEP), pushing the PRINT button will transmit the code to the Data Management Unit (DMU). The DMU will convert the code into alpha-numeric values, establish its value, and transmit both to the Airborne Printer, the parameter identifier value will also be transmitted to the FDEP IDENT readout.

BRT Control
Rotating the BRT control controls brightness of the IDENT and VALUE readouts.



FLIGHT DATA ENTRY PANEL (FDEP)

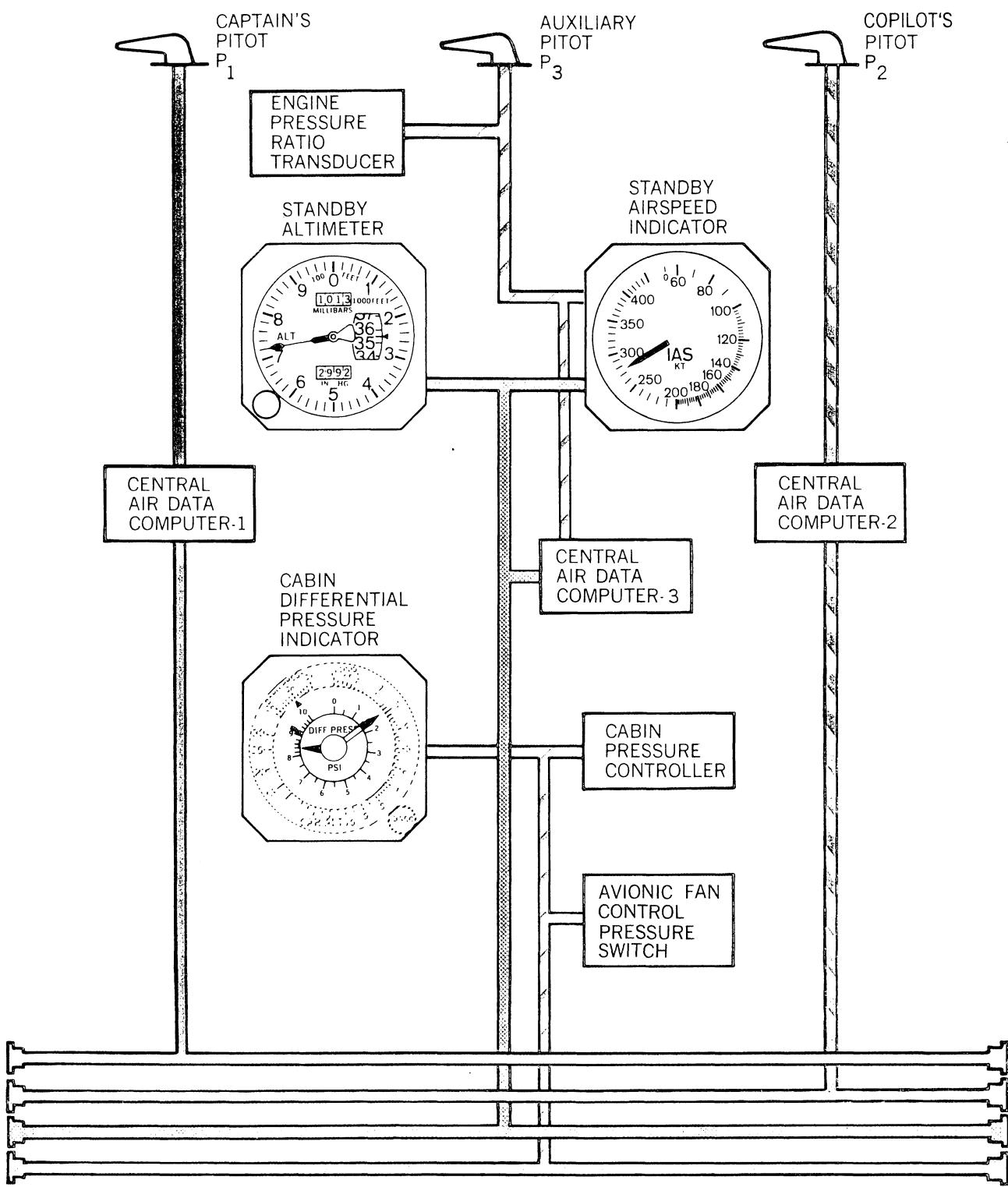
FLIGHT ENGINEER'S UPPER PANEL NO. 3

Effective for airplanes with AIDS FLIGHT DATA ENTRY PANEL (FDEP) installed.

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PITOT/STATIC SYSTEM



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CENTRAL AIR DATA COMPUTER/PITOT STATIC INTERFACE

