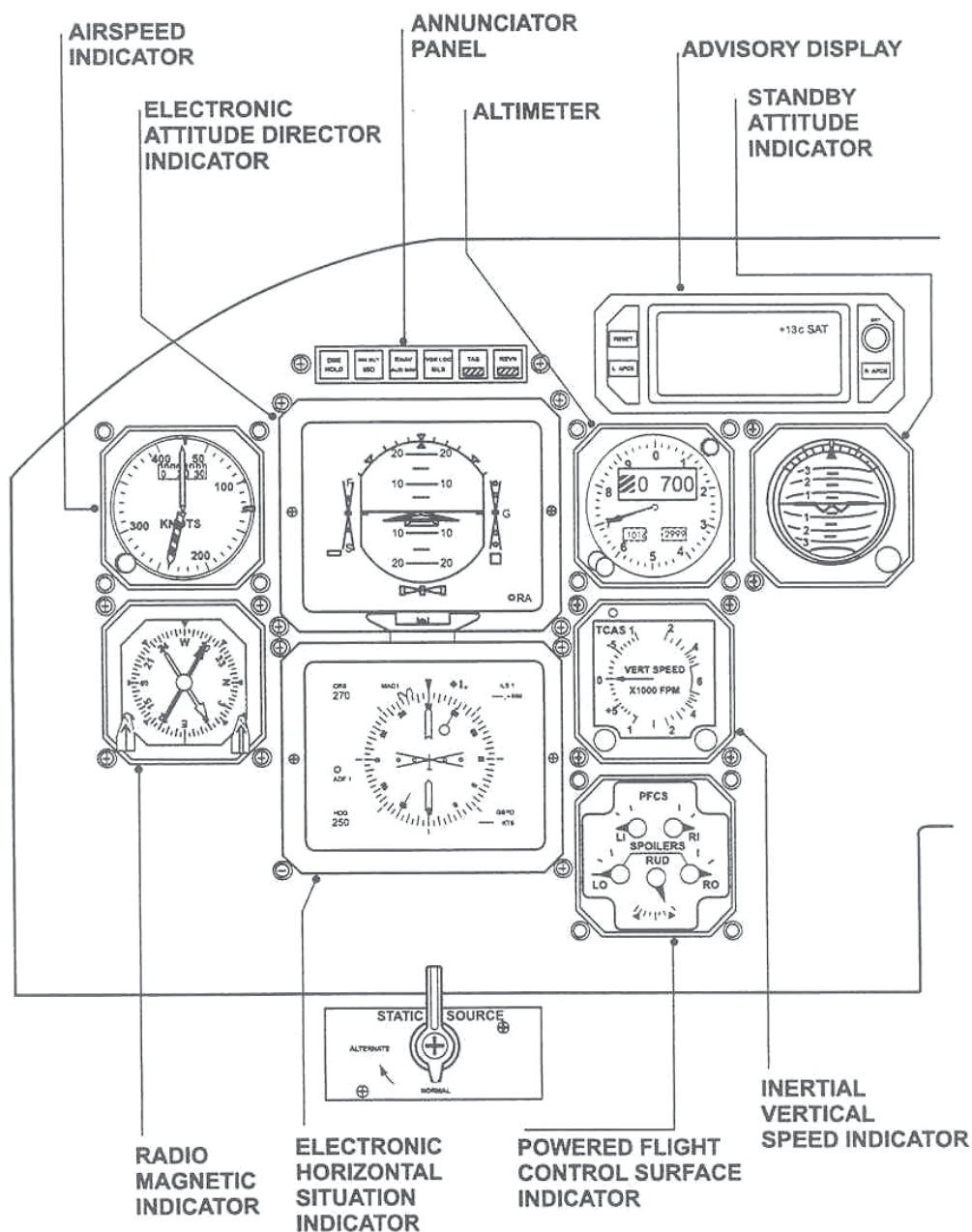
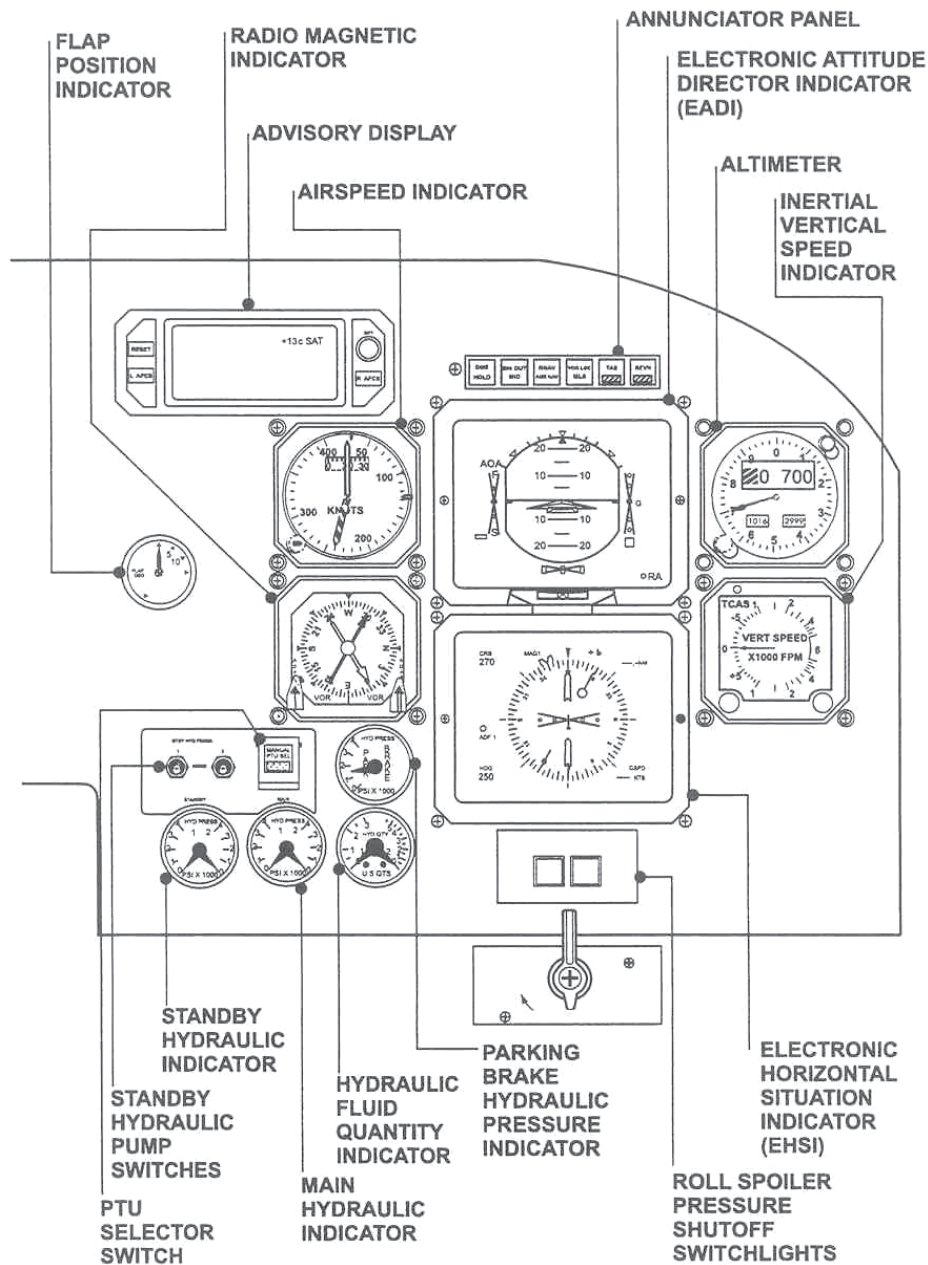


FLIGHT INSTRUMENTS

CONTROLS AND INDICATORS



Left pilot's instruments panel



Right pilot's instrument panel

**DIRECTIONAL GYRO MODE (HDG/DG)
PUSHBUTTON (alternate action)**

- used for FAST/SLOW slaving or when red "SLAVE" annunciator comes on (indicating possible flux valve failure)

PUSH - selects DG mode

- DG annunciator (green)
- HDG flag on HSI will appear
- SLAVE annunciator remains on
- heading card may be manually set using DG SLEW knob

PUSH - DG annunciator (blank)

- enables automatic slaving of heading outputs if valid flux valve magnetic heading reference is available

**VERTICAL GYRO FAST ERECT
PUSHBUTTON (VG ERECT)
(momentary action)**

PUSH and HOLD - erects vertical gyro (when in basic mode)

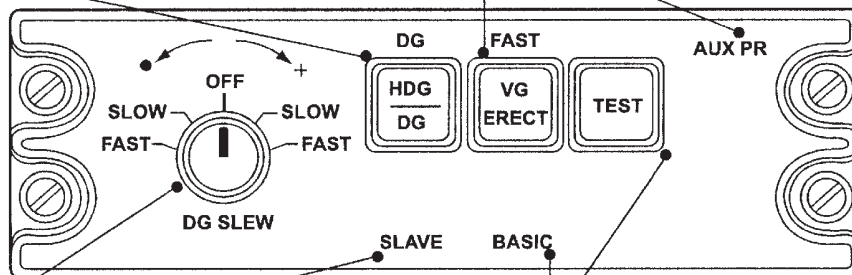
- FAST annunciator (amber)
- ATT will be displayed on the EADI

RELEASE - ATT flag on EADI will clear

- roll attitude will become active
- FAST annunciator (blank)

**AUXILIARY POWER (AUX PR)
(amber)**

- system has automatically switched to opposite side electrical supply


CENTER CONSOLE (2)
SLAVE ANNUNCIATOR (red)

- AHRS magnetic heading reference is invalid

**DIRECTIONAL GYRO SLEW KNOB
(DG SLEW) (rotary control)**

- slews HSI/EHSI compass cards when in DG mode
- • SLOW or FAST changes compass card indications to the left
- + SLOW or FAST changes compass card indications to the right
- SLOW rate is 6° per second
- FAST rate is 20° per second
- automatically centers to OFF position when released

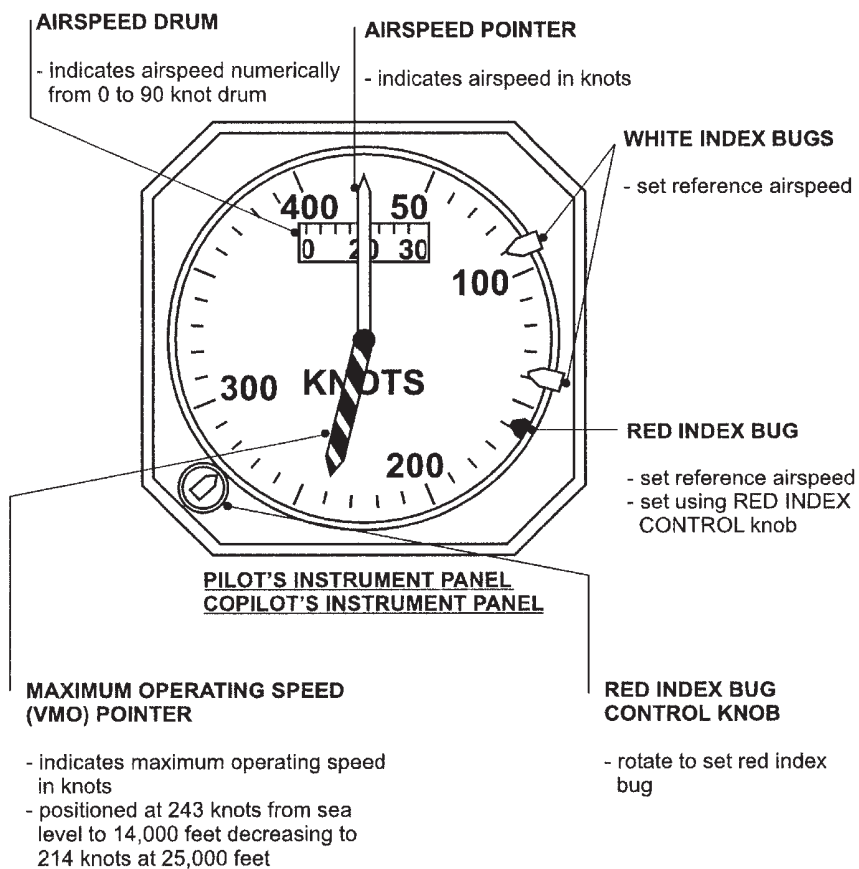
**TEST PUSHBUTTON
(momentary action)**

- PUSH - initiates five second test sequence
- all attitude and heading flags appear for the first 2.5 seconds of test
- all AHRS controller annunciators come on
- ADI displays 10° pitch up and 20° right bank
- compass indications slew right at 3° per second

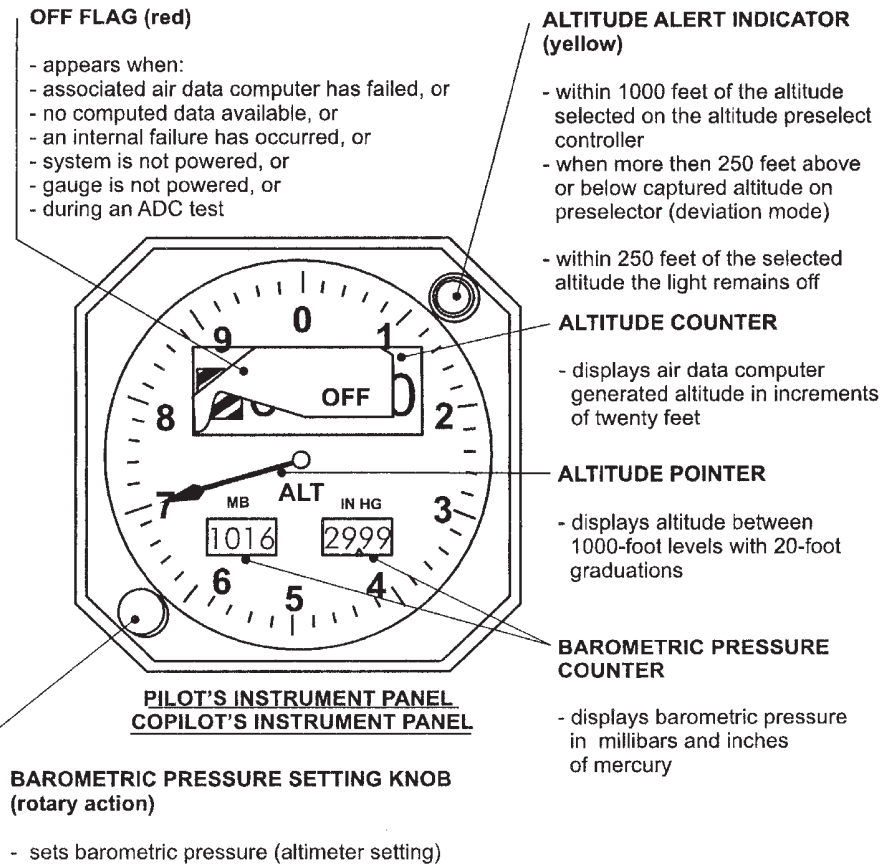
BASIC ANNUNCIATOR (green)

- system operating in basic mode
- enters automatically when true airspeed becomes invalid from the air data computer

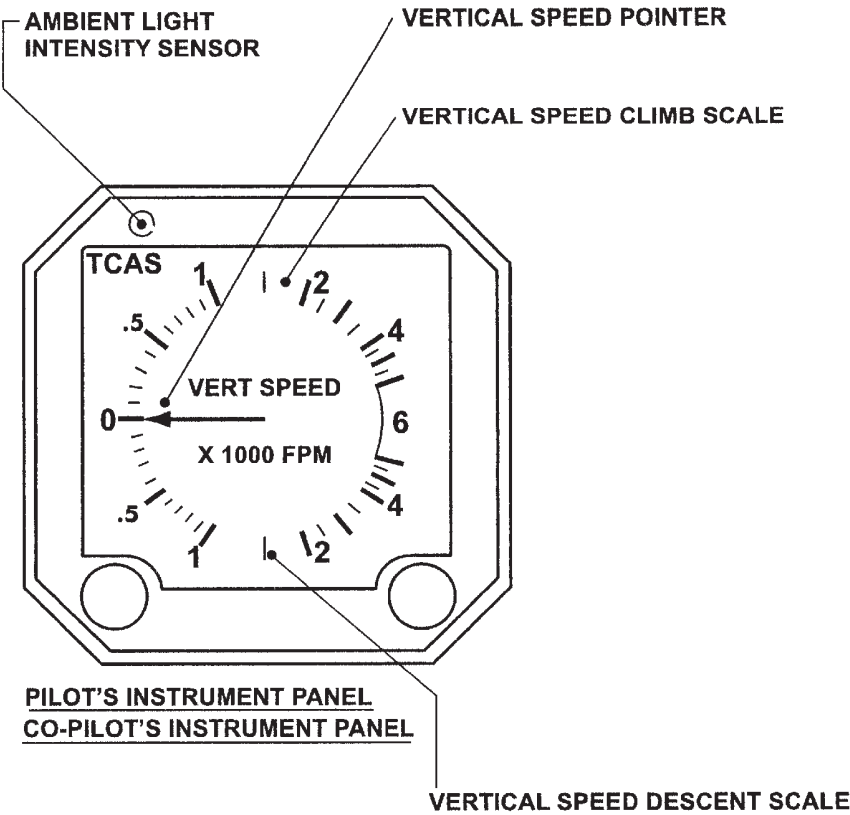
Attitude and heading reference system controller



Airspeed indicator



Primary altimeter



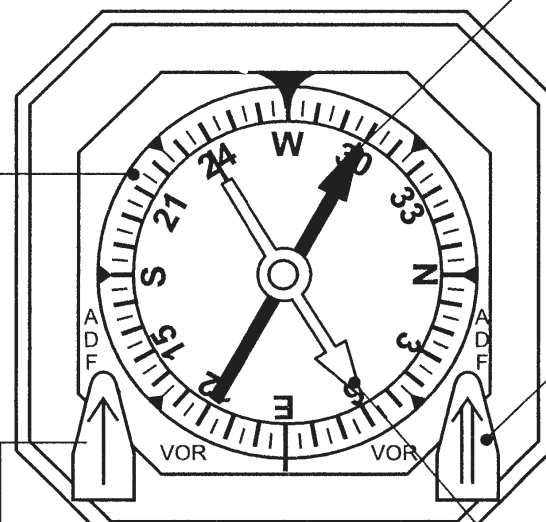
Inertial vertical speed indicator with TCAS

**COMPASS CARD**

- indicates aircraft heading under lubber line
- on pilot's side compass card is driven by No. 2 AHRS
- on copilot's side compass card is driven by No. 1 AHRS

NO.1 ADF/VOR POINTER

- indicates magnetic bearing to the No. 1 ADF or VOR depending on the position of the No. 1 ADF/VOR selector knob pointers park at "3 o'clock" position with invalid signal
- VOR pointer will also park if an ILS frequency is selected on the NAV control head.

**NO. 2 ADF/VOR SELECTOR KNOB**

ADF - ADF bearing is supplied to the No. 2 pointer when a valid signal is available

VOR - VOR bearing to the tuned station is supplied to the No. 2 pointer when a valid signal is available.

PILOT'S INSTRUMENT PANEL
COPILOT'S INSTRUMENT PANEL

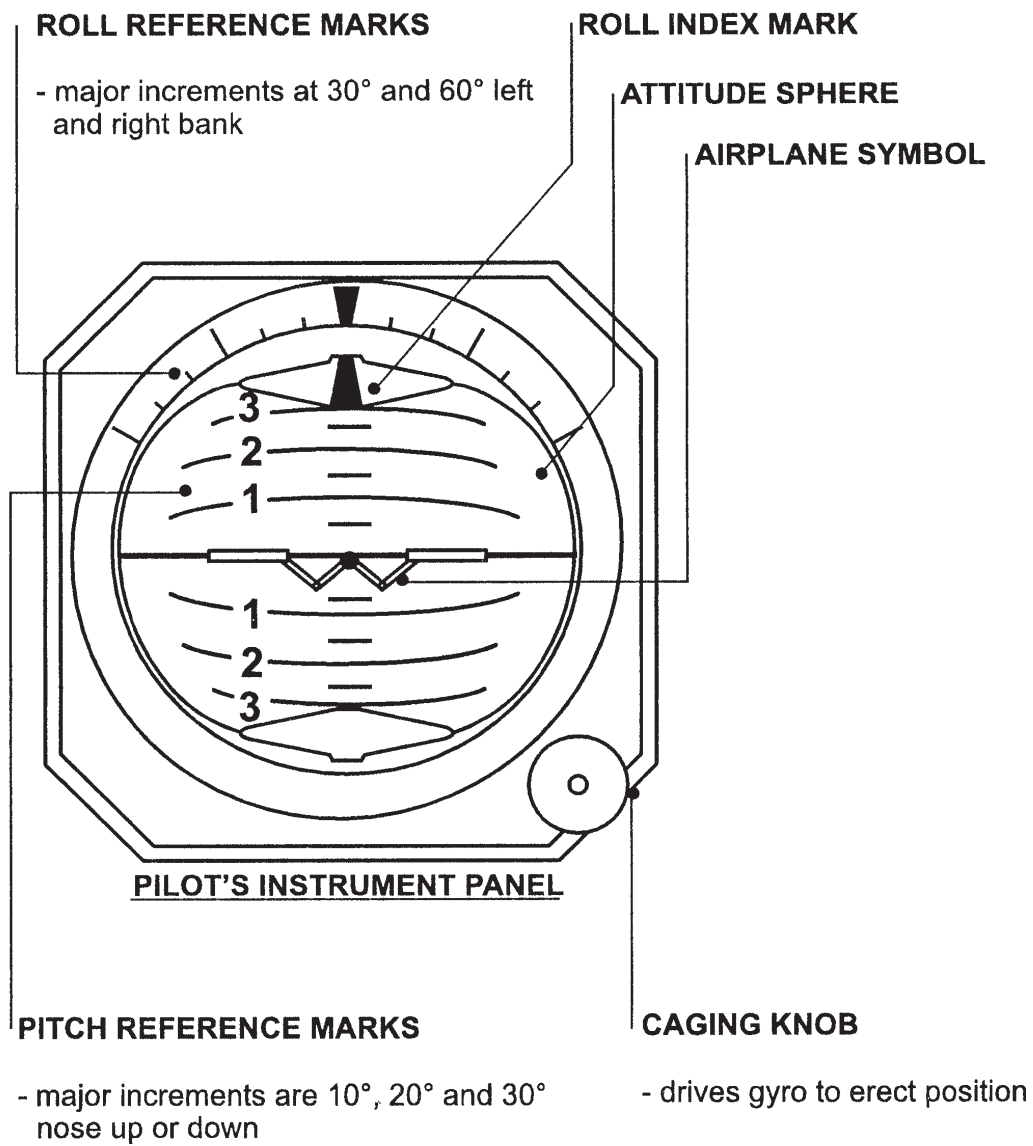
NO. 2 ADF/VOR POINTER**NO. 1 ADF/VOR SELECTOR KNOB**

ADF - ADF bearing is supplied to the No.1 pointer when a valid signal is available.

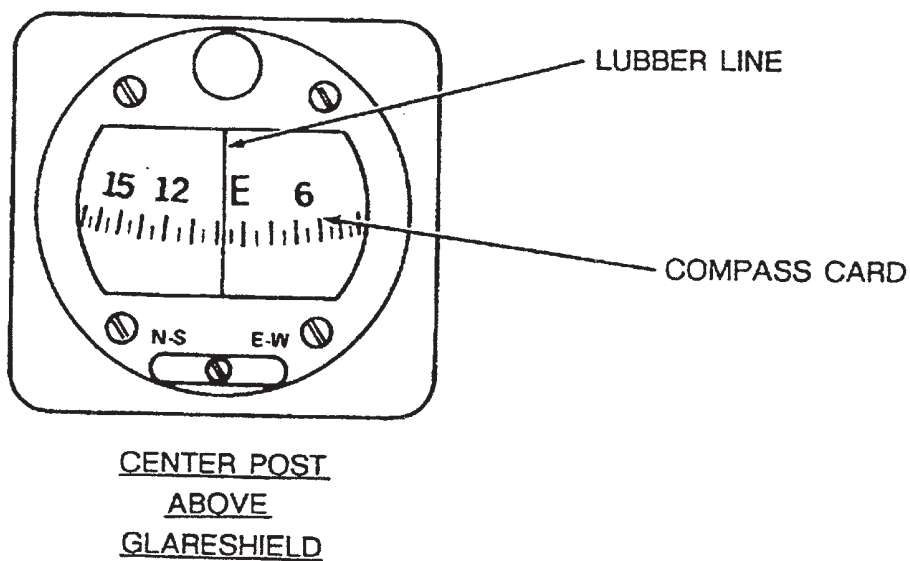
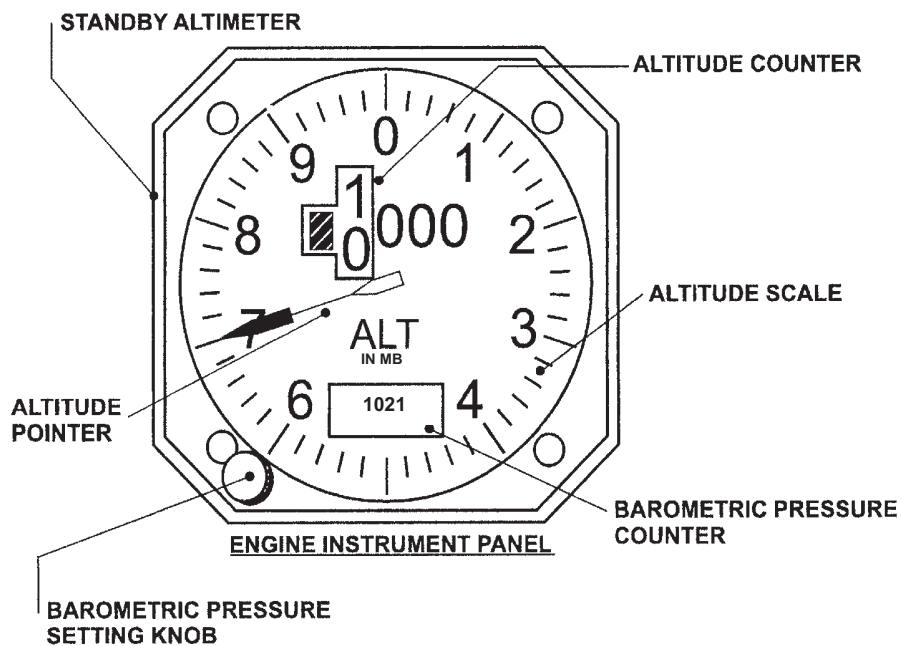
VOR - VOR bearing to the tuned station is supplied to the No. 1 pointer when a valid signal is available.

- indicates magnetic bearing to the No. 2 ADF or VOR depending on the position of the No. 2 ADF/VOR selector knob
- pointers park at "3 o'clock" position with invalid signal
- VOR pointer will also park if an ILS frequency is selected on the NAV control head.

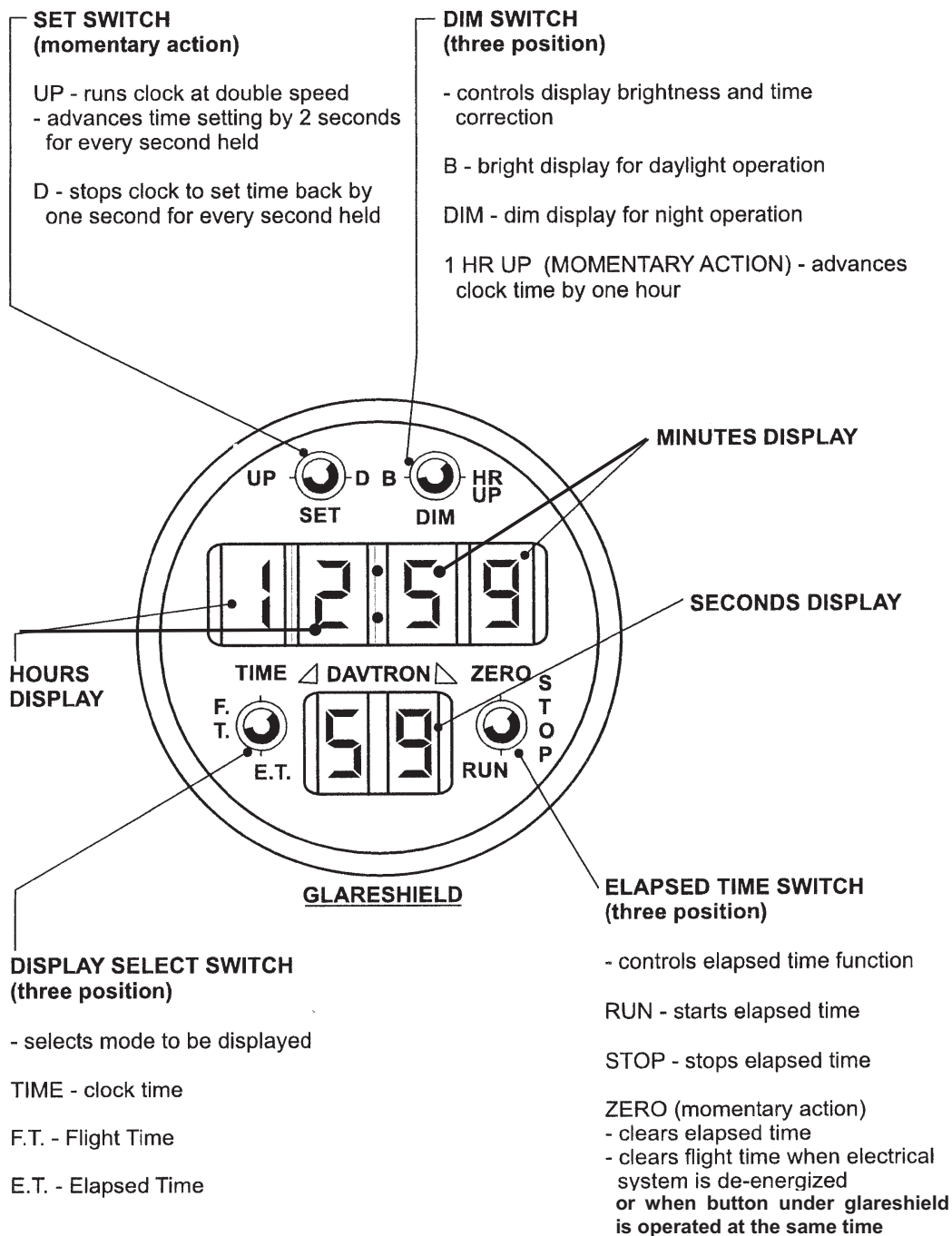
Radio magnetic indicator



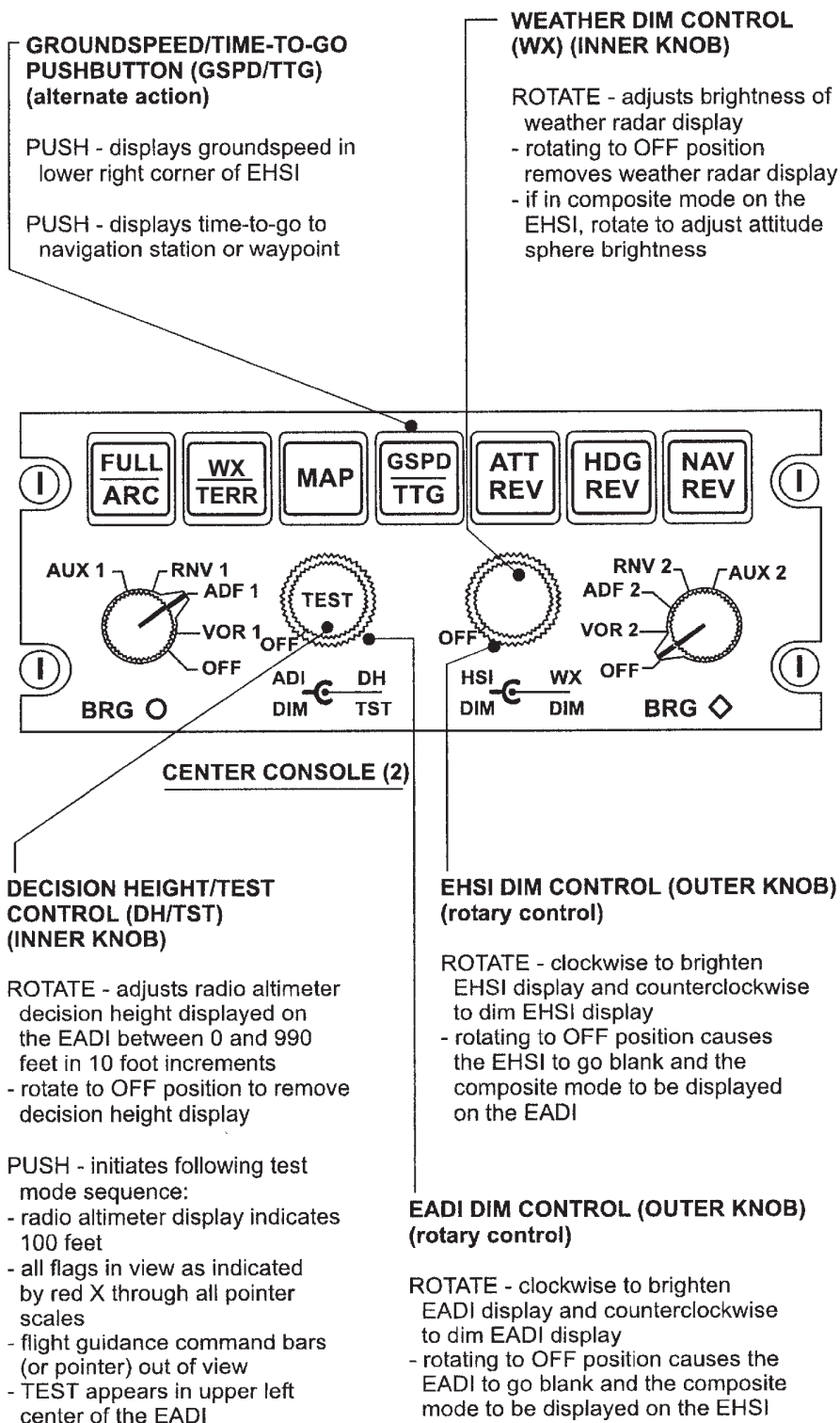
Stand-by attitude indicator



Standby altimeter and standby magnetic compass



Davtron clock



EFIS controller

**FULL/PARTIAL COMPASS FORMAT
PUSHBUTTON (FULL/ARC)
(alternate action)**

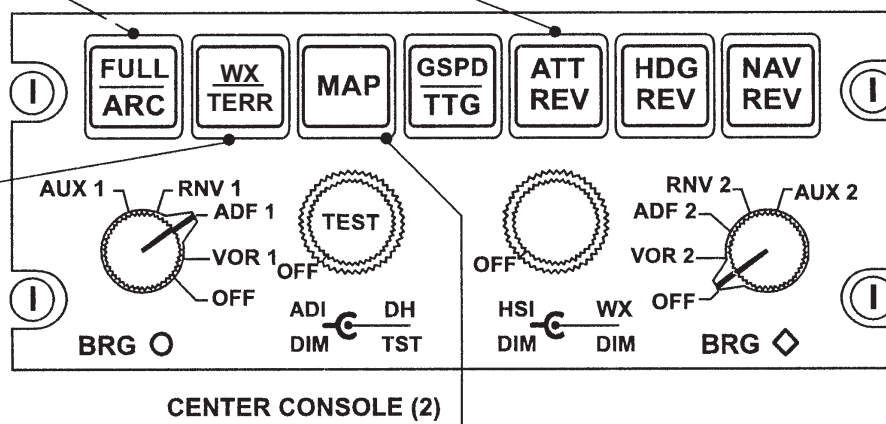
PUSH - EHSI display changes to partial compass format
- partial compass format displays 90° of heading scale

PUSH - EHSI changes back to full compass format
- full compass format displays 360° of heading scale

**ATTITUDE REVERSION PUSHBUTTON
(ATT REV) (alternate action)**

PUSH - selects cross-side attitude source (AHRS) for EADI display
- when both EADIs are selected to the same attitude source, ATT 1 or ATT 2 annunciation is displayed in amber

PUSH - reselects normal attitude source (AHRS 1 for pilot's side, AHRS 2 for copilot's side)
- when selected to normal attitude source no annunciation is displayed


**WEATHER MODE PUSHBUTTON
(WX/TERR)(alternate action)**

PUSH - displays weather radar returns on the EHSI partial compass format
- if initially in compass format display, the display will automatically change to partial compass format

PUSH - displays (E)GPWS terrain map on the EHSI partial compass format

PUSH - display will show EHSI data only, in partial compass format

**MAP PUSHBUTTON
(alternate action)**

PUSH - displays navigation aid map on the EHSI partial compass format
- one waypoint for each bearing pointer and VOR/DME ground station positions is displayed (when in range as selected on weather radar)
- WX and MAP may be selected together to provide weather radar returns and navigation aid map

PUSH - removes navigation aid map from the EHSI display
- EHSI remains in the partial compass format

EFIS controller

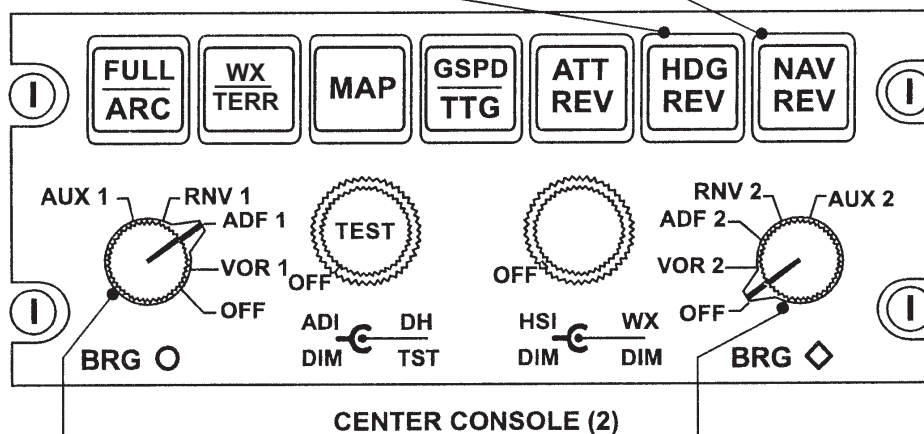
HEADING REVERSION PUSHBUTTON (HDG REV) (alternate action)

PUSH - selects cross-side compass heading source (AHRS) for EFIS display
 - when both EHSIs are selected to the same heading source, MAG 1 or MAG 2 annunciation is displayed on EHSI in amber

PUSH - reselects normal heading source, MAG 1 or MAG 2 annunciation is displayed in white

NAVIGATION REVERSION PUSHBUTTON (NAV REV) (alternate action)

PUSH - selects comparable cross-side navigation source information to be displayed on EHSI (with VOR 1 selected, pressing NAV REV causes VOR 2 information to be displayed)
 - selected navigation source is displayed by an appropriate amber VOR 1, VOR 2, ILS 1, ILS 2, R NAV 1 or 2 annunciation


"O" BEARING POINTER SELECTOR (BRG O)

ROTATE - selects desired navigation source for bearing to be displayed by the blue bearing pointer on the EHSI
 - selectable positions are labeled OFF, VOR 1, ADF 1, RNAV 1

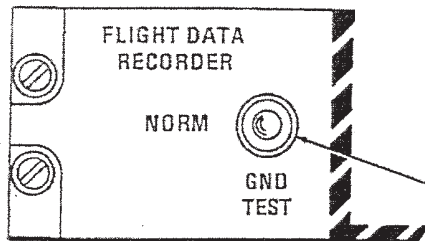
- bearing pointer is removed from display when turned OFF
 - selected navigation source is annunciated on the EHSI

"DIAMOND-SHAPED" BEARING POINTER SELECTOR (BRG ◇)

ROTATE - selects desired navigation source for bearing to be displayed by the green pointer on the EHSI
 - selectable positions are labeled OFF, VOR 2, ADF 2, RNAV 2

- bearing pointer is removed from display when turned OFF
 - selected navigation source is annunciated on EHSI

EFIS controller



OVERHEAD PANEL

FLIGHT DATA RECORDER GROUND TEST SWITCH
(two position toggle)

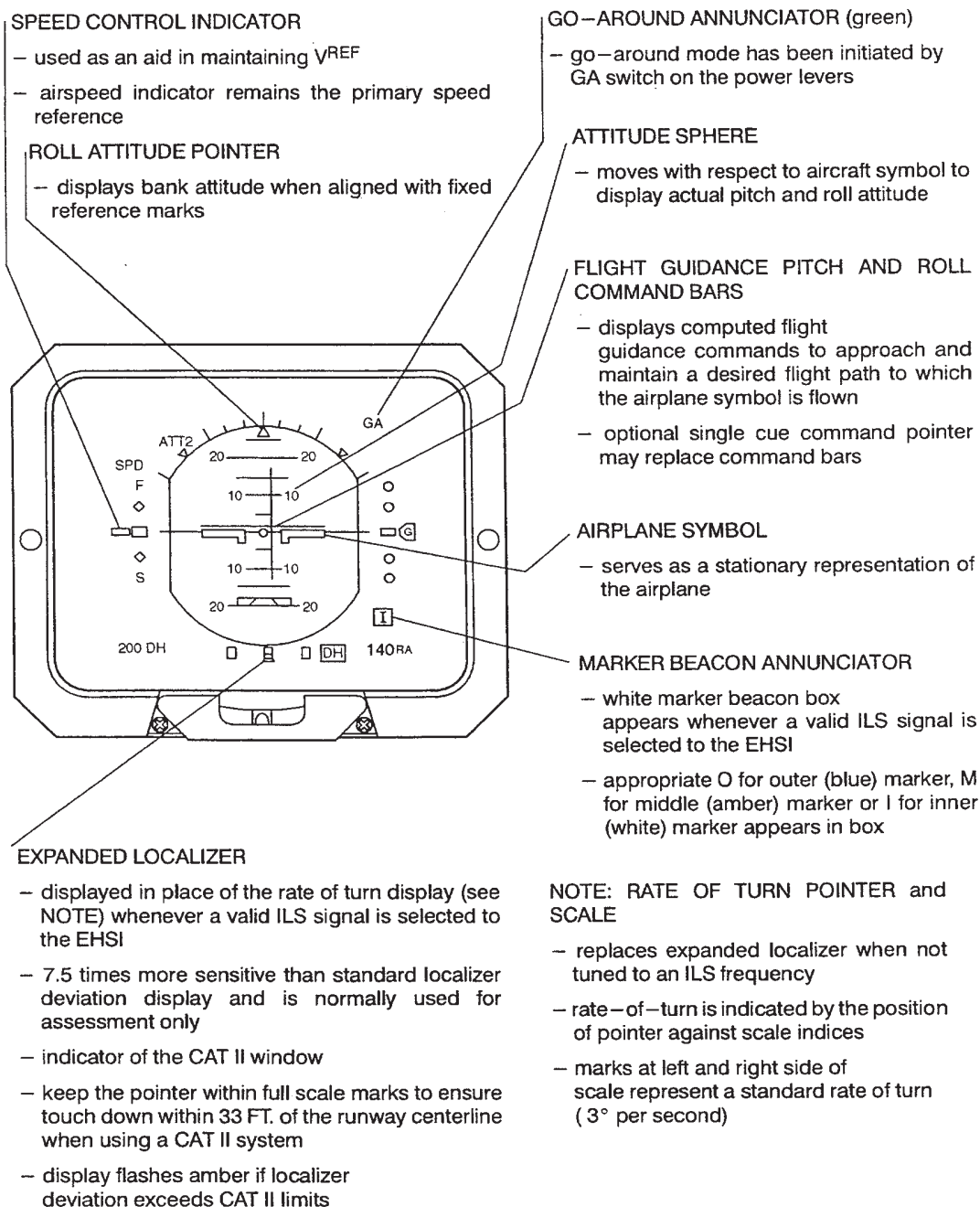
NORM - applies power automatically to the flight recorder when:

- anti-collision (A/COL) light is selected to the WHITE or RED position
- the aircraft leaves the ground

TEST (momentary)

- applies power to flight recorder
- spring loaded to NORM position
- when held at GND TEST, FLT DATA RECORDER caution light will extinguish
- operation of anti-collision light, causing the caution light to extinguish, is also a valid check of the system

Flight data recorder test switch



Electronic Attitude Director Indicator (EADI)

ACTIVE EHSI ANNUNCIATION

- caret (< or >) points to the active EHSI (points in same direction as HSI SEL pointer on flight guidance controller)
- annunciation appears on non-active side (e.g. pilot's EADI, if copilot's EHSI is selected)

LATERAL FLIGHT DIRECTOR MODE ANNUNCIATION

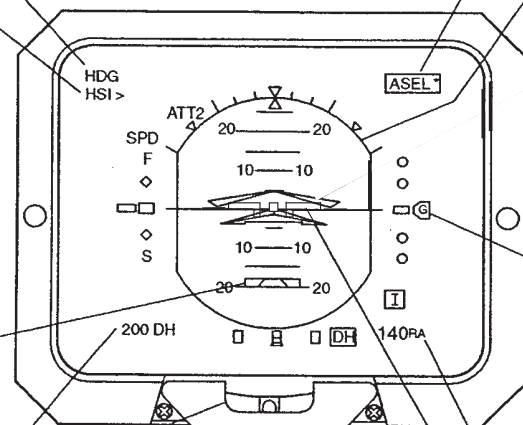
- selected lateral flight guidance mode (HDG, LOC, VOR, VOR APP, LNAV or BC)
- armed mode appears in white
- captured state appears in green with asterisk
- mode transition from armed to capture state is emphasized by annunciation appearing in a white box
- asterisk will be removed when airplane is tracking the mode

VERTICAL FLIGHT DIRECTOR MODE ANNUNCIATION

- selected vertical flight guidance mode (GS, IAS, VS, ALT or ASEL).
- armed mode appears in white
- captured state appears in green with asterisk
- mode transition from armed to capture state is emphasized by annunciation appearing in a white box
- asterisk will be removed when airplane is tracking the mode
- GA annunciation appears in green at this location if the go-around buttons are selected

ROLL SCALE

- fixed index reference marks at 0,10,20, 30,45 and 60 degrees

**GLIDESLOPE POINTER AND SCALE**

- in view when associated NAV receiver is tuned to an ILS frequency
- presents a fly-to-the-pointer display of aircraft deviation from the glideslope beam
- letter G is annunciated inside the pointer
- if pointer moves off scale, the letter G remains in view at the maximum deflection position of the scale
- display flashes amber if glideslope deviation exceeds Category II limits

INCLINOMETER

- provides slip or skid indication as an aid for turn coordination

DECISION HEIGHT DISPLAY

- displays selected decision height as set on EFIS display controller

RISING RUNWAY

- appears at 200 ft AGL
- rises when below 200 ft AGL

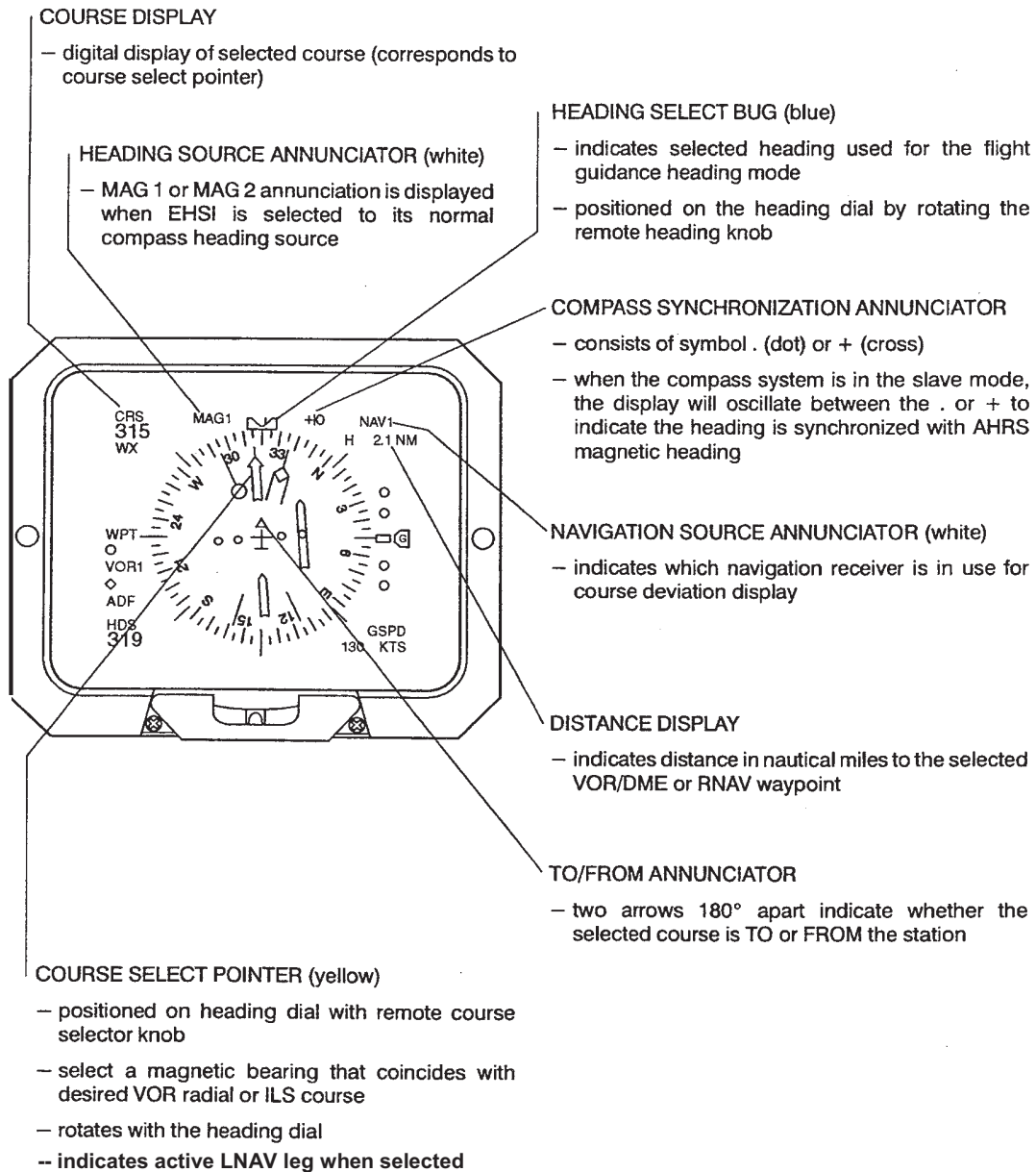
RADIO ALTITUDE DISPLAY

- blank above 2500 ft AGL
- displays radio altitude below 2500 ft AGL in 10 ft increments above 200 ft and 5 ft increments below 200 ft

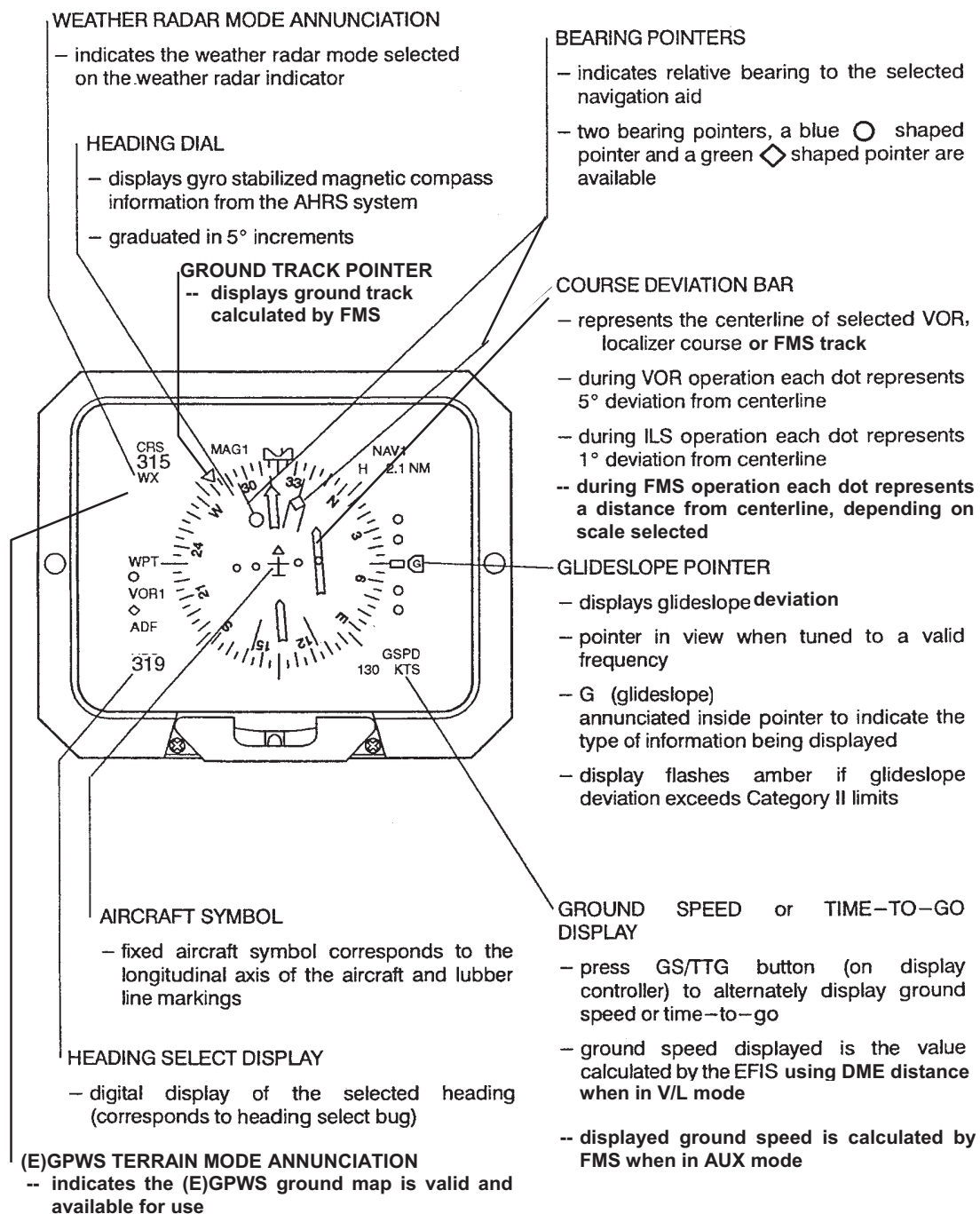
AIRPLANE SYMBOL

- serves as a stationary representation of the airplane

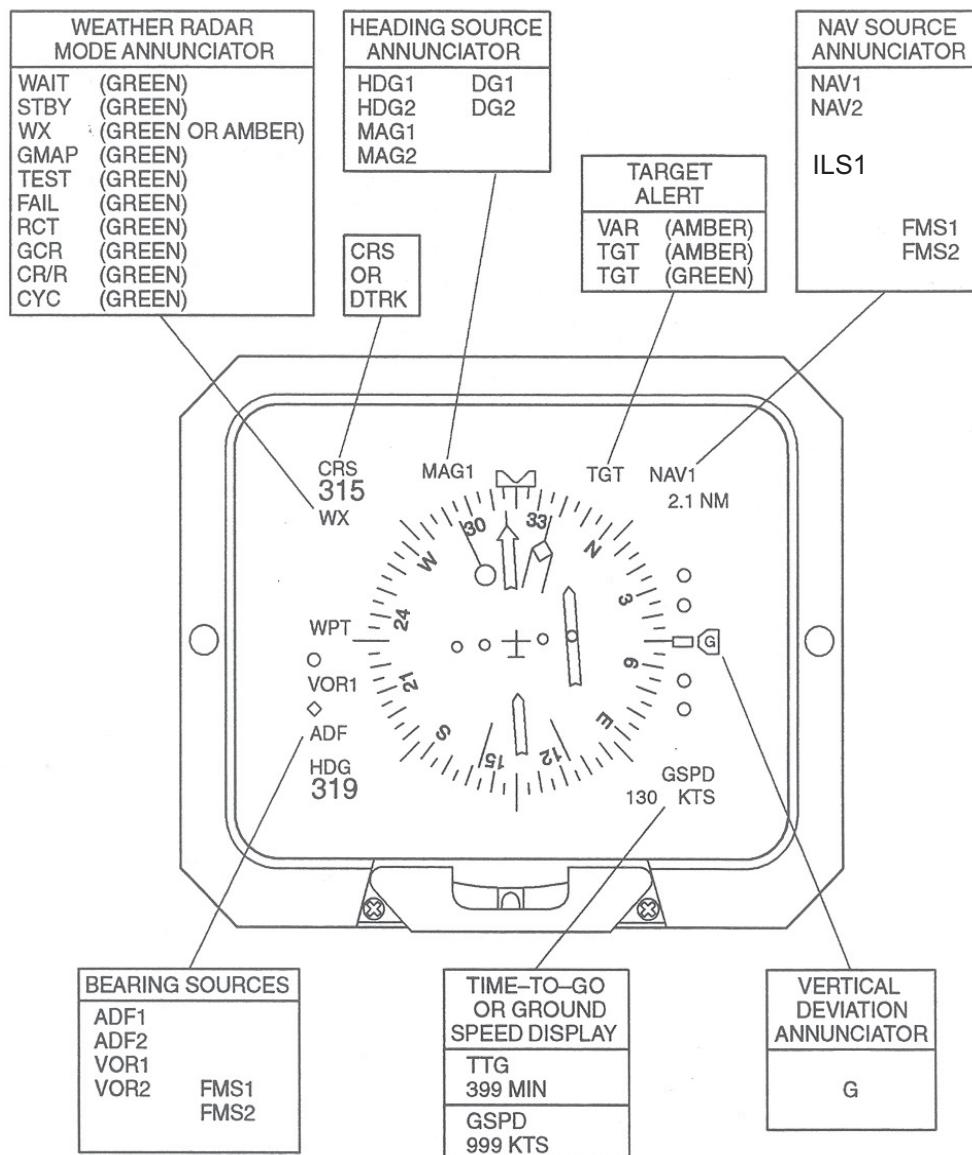
Electronic Attitude Director Indicator (EADI)



Electronic Horizontal Situation Indicator (EHSI)

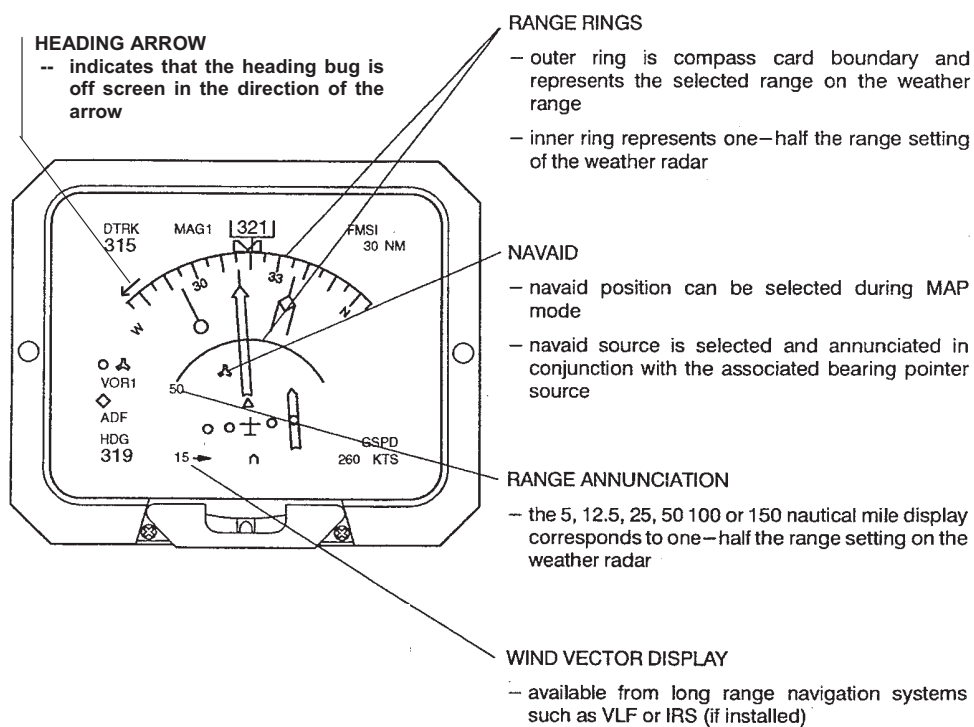


Electronic Horizontal Situation Indicator (EHSI)

**NOTE**

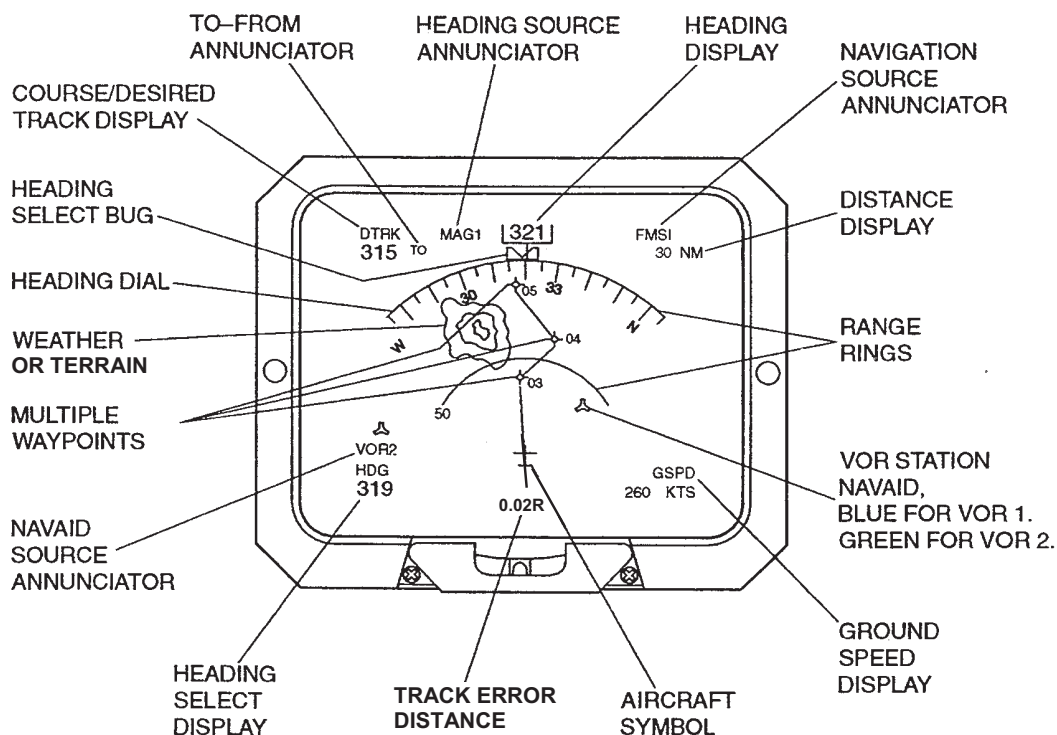
The presence of each display depends upon flight phase, navigation radio tuning and installed navigation equipment.

EHSI annunciation displays

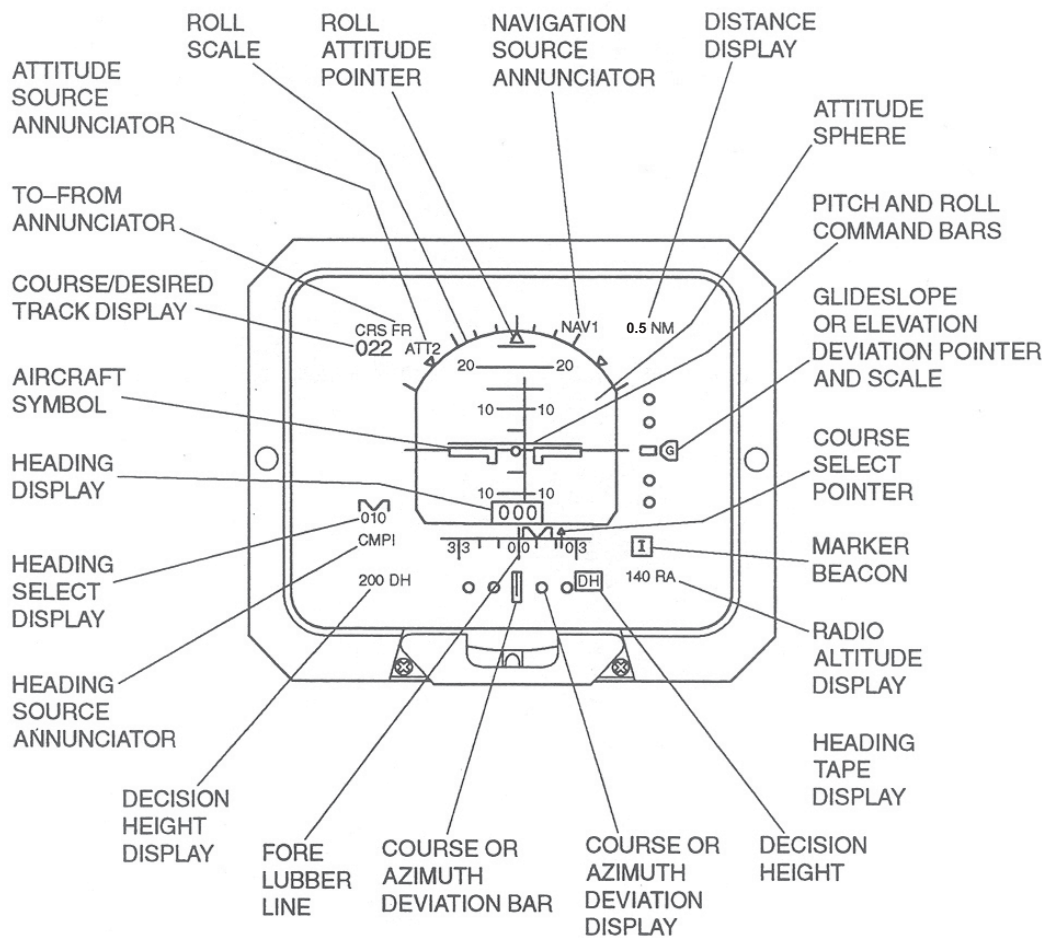


I

EHSI partial compass format - map mode



EHSI partial compass format - map mode with multiple waypoints



Composite mode display

SYSTEM DESCRIPTION

Flight instruments general

Flight instruments are arranged on both pilot's instrument panels. Each panel consists of an airspeed indicator, altimeter, inertial vertical speed indicator, attitude director indicator (EADI), horizontal situation indicator (EHSI) and a radio magnetic indicator (RMI).

The electronic flight instrument system (EFIS) is covered separately in this chapter. Additional instruments include a standby attitude indicator located on the left pilot's flight instrument panel; a standby altimeter on the engine instrument panel and two digital clocks located one at each end of the glareshield.

Systems involved with the operation of the flight instruments include the pitot-static system, the air data system, and the attitude heading reference system.

Air data system

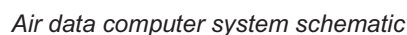
The air data system is comprised of two digital air data computers (DADC) located on the avionics rack left of the flight deck door. The computers compute parameters based on altitude, airspeed, temperature and pressure inputs and provide the information to the aircraft systems (see system schematic).

ADC output is available, via the avionics standard communication bus (ASCB) system, to the flight guidance computer, the attitude heading reference system, the advisory displays and EFIS. Other systems, including altimeter, VSI/TCAS display, altitude alert, FMS computers, proximity switch electronic unit (PSEU), flight control systems, and the aircraft overspeed warning system, also receive air data computer output.

Both air data computers independently perform computations and conversions but the information from only one is chosen for flight guidance computer operation and advisory display. This is selected by the HSI SEL switch, located on the flight guidance controller.

Static air temperature (SAT) and true airspeed (TAS) are displayed on the advisory display units. The air data computers supply these values.

An air data computer self test function checks the integrity of the overspeed warning circuits. The test is initiated by switching the ADC test switch located on the left pilot's side console.



Pitot-static system

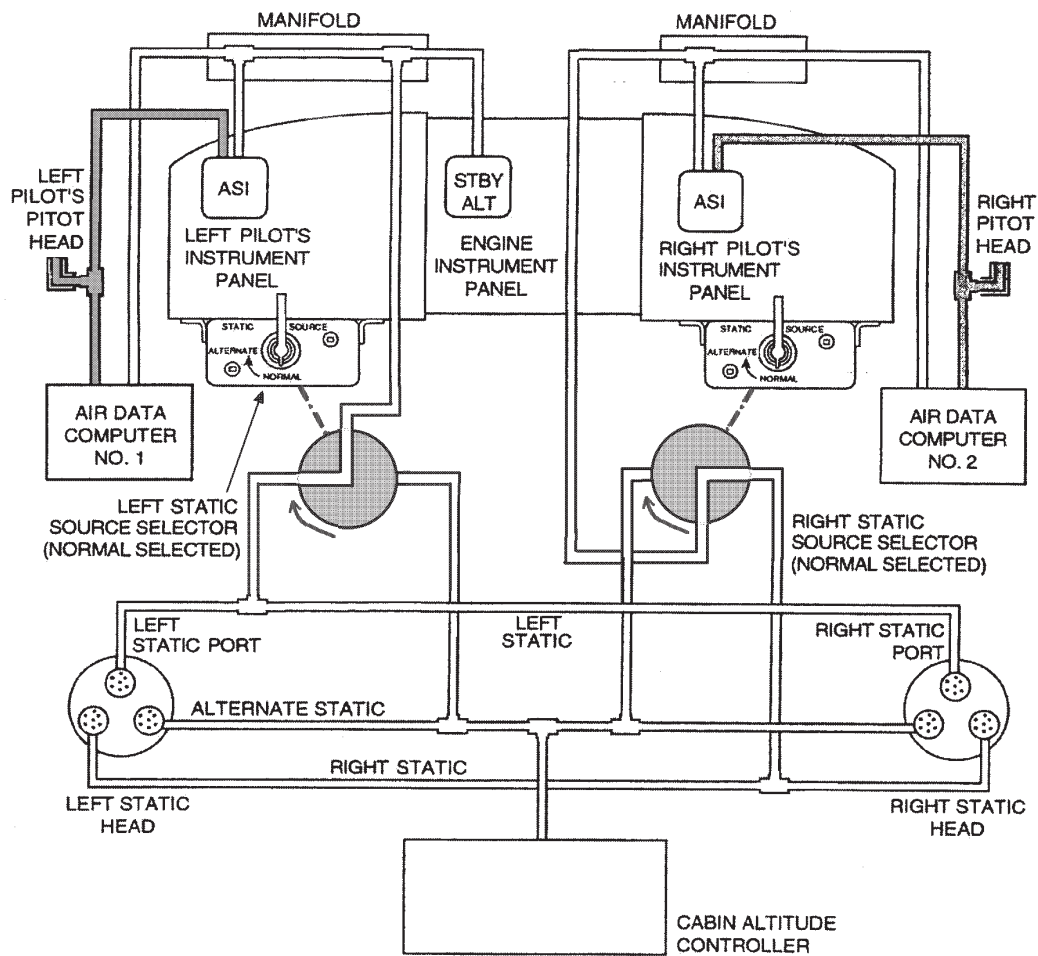
Two pitot heads and two static heads supply pitot and static pressure for operation of the airspeed indicators, standby altimeter, air data computers and the cabin pressure controller.

The pitot head located on the left side of the fuselage supplies the left pilot's airspeed indicator and number 1 air data computer. The right side pitot head supplies the right pilot's air speed indicator and number 2 air data computer.






Each static head has three static ports, which supply both pilots' and alternate static air systems. STATIC SOURCE selectors, located below each pilots' flight instrument panel, control system selection.

The alternate static system supplies the cabin pressure controller regardless of STATIC SOURCE selector position.

Each pitot and static head is equipped with an anti-ice heater controlled from the ICE PROTECTION panel.



LEGEND

-  PILOT'S PITOT
-  COPILOT'S PITOT
-  PILOT'S STATIC
-  COPILOT'S STATIC
-  ALTERNATE STATIC

Pitot-static system schematic

Attitude/Heading Reference System (AHRS)

The dual attitude/heading reference system (AHRS) provides aircraft attitude and heading information to the flight instruments (EADI, EHSI and RMI), the air data computer system, the flight guidance computer system, and the weather radar (see system schematic).

Each side of the AHRS consists of an attitude/heading reference unit (AHRU), a remote flux valve, and AHRS controller.

The AHRU, located underneath the passenger compartment floor, uses vertical and directional gyros and accelerometers that are 'strapped down' to the aircraft's principal axes to sense rate of aircraft movement.

The remote flux valves detect the relative bearing of the earth's magnetic field. Compensation circuits in the AHRS controllers correct flux valve heading errors, created by magnetic disturbances in the aircraft.

The dual AHRS installation is approved as the primary attitude and heading reference source. Several operational modes are provided for continued availability of attitude and heading reference in the event of certain system failures. AHRS faults are displayed on the advisory unit.

Standard modes

The standard AHRS operating modes are the 'Normal' mode for attitude and 'Slaved' mode for heading. The AHRS will enter these modes automatically following initialisation if no system faults are detected. In the 'Normal' mode, true airspeed from the air data computer is used to compensate for acceleration-induced errors.

In the 'Slaved' mode the difference between the indicated heading and the flux valve heading is displayed on the slave error indicator on the HSI. The indicator uses a . (dot) and + (cross) symbol to indicate normal compass synchronization. Oscillation between the . and + symbol is normal and is indicative of good magnetic heading data. During a turn, one symbol may be displayed continuously while the system is adjusting to a changing heading reference.

Reduced performance modes

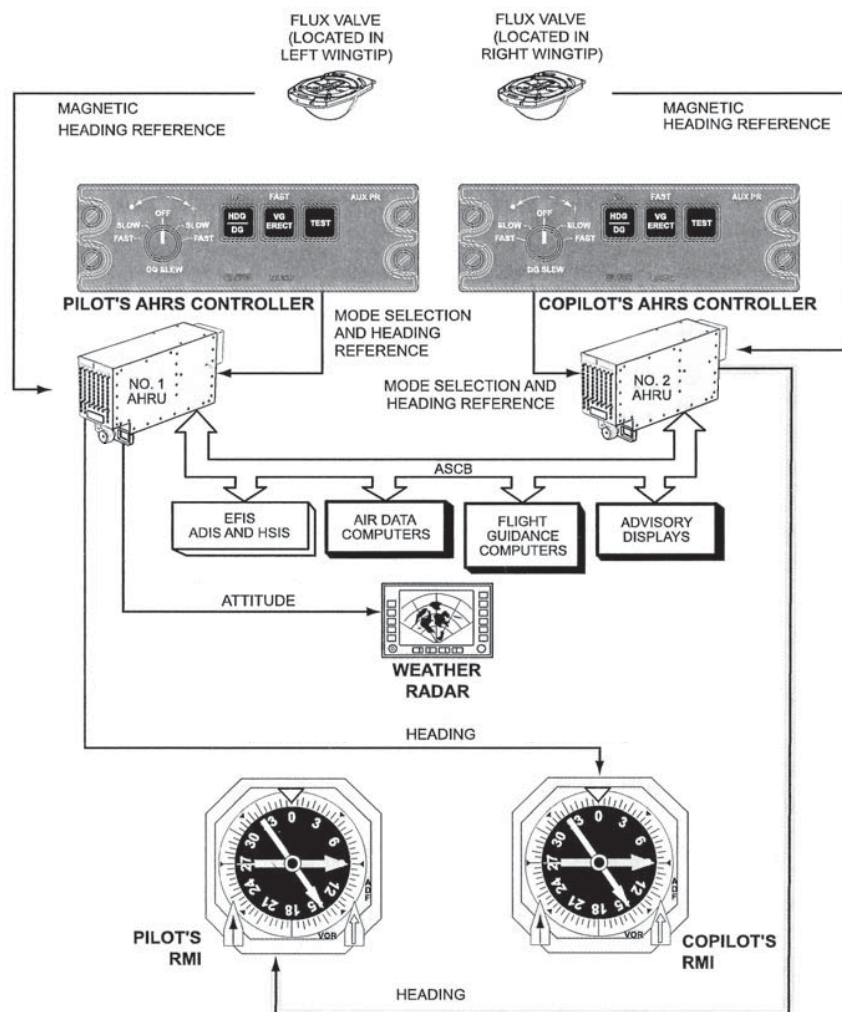
Two reduced performance modes are available: 'Basic' mode for attitude and 'DG' for heading. The 'Basic' mode is entered automatically when true airspeed becomes invalid from the air data computer. The mode is indicated by the illumination of the BASIC annunciation on the AHRS controller. Following entry into the BASIC mode the pilot should avoid sustained shallow banked turns of less than 6°. If an attitude error should develop it may be removed by pushing the VG ERECT pushbutton, on the AHRS controller, while in straight, level and unaccelerated flight.

When a HDG flag on the HSI is observed and the SLAVE annunciation on the AHRS controller is illuminated, the DC mode is entered by pressing the HDG/DG pushbutton. Entry into the DG mode occurs when the pushbutton is released and is confirmed by illumination of the green DG annunciation on the AHRS controller. The heading must now be checked with reference to a known accurate heading source. Any errors may be removed by using the DG SLEW knob on the AHRS controller to set the heading card to the unknown reference source.

Ground initialisation

The AHRS system requires approximately 3 minutes to initialise following application of power. During initialisation the aircraft shall remain stationary on the ground until ATT and HDG flags clear on the EADI and HSI. Normal passenger and cargo loading, engine start and run-up procedures may be performed. If aircraft movement has occurred during initialisation, the AHRS must be recycled and a new initialisation commenced.

To observe the 3-minute's time out initialisation period press the VG ERECT button on the AHRS controller. The HSI heading card will slew to approximately 180° and heading will decrease at a rate of 1 deg/sec until the heading card indicates north. If the heading card stops, the initialisation has not been completed in a satisfactory manner. To restart the initialisation, the main and auxiliary DC power should be removed by pulling and resetting all appropriate circuit breakers.



AHRS schematic

Altimeter

The altimeter provides a combined counter and pointer display of barometrically corrected altitude.

The barometric pressure (altimeter setting) is set by adjusting a BARO knob on the lower left corner of each altimeter. The barometric pressure is displayed in the MB (millibars) and IN HG (inches of mercury) window on the face of the altimeter. Each altimeter provides its associated air data computer with barometric pressure information and receives barometrically corrected altitude information from the air data computer.

A single altitude pointer makes one revolution of the dial for each 1000 feet of altitude change. An altitude counter provides a five-digit altitude display. The range of altitude display is minus 1000 feet to 50,000 feet.

A black and white striped warning bar appears in the extreme left counter digit when the aircraft is below 10,000 feet. When the displayed altitude is below sealevel, a flag with the sign NEG covers the first two digits.

A failure flag marked OFF appears in front of the altitude counter to indicate a power failure or loss of altitude inputs. An amber altitude alert advisory light is located on the upper right corner

Standby altimeter

A standby barometric altimeter provides an alternate display of barometrically corrected altitude. The standby altimeter operates directly from static pressure of the pitot-static system and is completely independent of the air data computer operated altimeters.

The barometric pressure (altimeter setting) is set by the pilot with an adjustment knob on the lower left corner of the standby altimeter. Turning the knob adjusts both IN HG (inches of mercury) and MB (millibars) windows on the face of the instrument at the same time.

The standby altimeter display is a single pointer and altitude counter type, similar to the display of the air data computer operated altimeters.

Airspeed indicator

The airspeed indicator senses pitot and static air pressure from the pitot/static system to indicate airspeed and maximum operating speed (Vmo).

A 0 to 90 knot rotating drum and a white airspeed pointer on the 50 to 400 knot scale indicates airspeed. A red and white pointer indicates Vmo on the 50 to 400 knot airspeed scale.

A knob on the lower left of each airspeed indicator controls an amber index bug on the airspeed scale. This index bug may be moved by rotating the knob to reference any speed on the airspeed scale. Two white index bugs outside the glass on each indicator face slide around the airspeed scale to reference additional airspeeds.

Vertical Speed Indicator / Traffic and Resolution Advisory (VSI/TRA) Display

The VSI/TRA display provides a digital presentation of a conventional Inertial Vertical Speed Indicator and the TCAS generated Traffic and Resolution Advisories. The pointer and outer ring on the instrument display present the actual vertical rate of climb or descent to the pilot. This information is obtained from the onside Digital Air Data Computer. For information on the TCAS system, refer to section 12-18 'warning systems'.

Radio magnetic indicator

The radio magnetic indicator (RMI) displays aircraft heading and radio bearing. A compass dial displays the aircraft heading. The compass dial on the left pilot's indicator is driven by number 2 AHRS and number 1 AHRS drives the right pilot's compass dial. An OFF flag located on the upper-right quadrant appears to indicate loss of the compass information or power supply.

A single bar pointer-designated pointer number 1 and a double bar pointer designated pointer number 2 displays radio bearing. The pointers can be switched for either ADF or VOR bearing indication by means of two pointer selector knobs located on the lower corners of the indicator face.

Standby magnetic compass

The standby magnetic compass, located on the windshield centre post below the caution lights panel, is a standard fluid dampened magnetic compass. The standby compass is integrally lighted and dimmed with the CAUT/ADVSY LIGHTS dimming switch on the overhead console. A compass correction card is located on the flight compartment ceiling in front of the right pilot.

.Standby attitude indicator

A standby attitude indicator provides an alternate display of aircraft pitch and roll attitude.

The standby attitude indicator is gyro stabilized by integral electrical gyros that are powered from both 28 VOLT DC essential buses. A striped 'off' flag appears in the display to indicate an invalid attitude display because of inadequate gyro speed. A caging knob on the lower right corner of the instrument, when pulled, drives the gyros and display to the erect position.

Clock

Two digital electronic clocks provide three independent functions: clock time (TIME), flight time (FT), and elapsed time (ET). A display select switch selects the desired TIME, FT or ET function. All three functions continue to operate normally, regardless of which function is selected for display.

All internal functions of the clock are powered by an integral battery and do not need aircraft electrical power for operation. The display however, is powered by the 28 Volt DC aircraft electrical system and will therefore be visible only when its associated 28 Volt DC bus is

powered. The left clock display uses the left essential bus, the right clock display utilises power from the right main bus.

The clock time function uses a twenty-four hour clock format. Time corrections are made with the SET switch. Making time corrections does not affect the operation of other functions.

For time zone transition, using the 1 HR UP position of the DIM switch may set clock time; there is no change to the minutes and seconds.

The flight time function is initiated automatically by a 'weight-off-wheels' signal from the proximity switch electronic unit (PSEU). Flight time is recorded from the time the aircraft is airborne until it lands. The flight time function can be cleared if the elapsed time switch is selected to ZERO when the aircraft electrical system is de-energized, or if the elapsed time switch is selected to ZERO while simultaneously pressing the flight time erase pushbutton. A flight time erase pushbutton for each clock is located underneath the glareshield panel in line with that clock. Cumulative flight time of several legs in a trip can be recorded to a maximum of 24 hours; normally, flight time is cleared before each trip.

Elapsed time is started by selecting RUN and stopped by selecting STOP. Selecting ZERO clears the accumulated elapsed time. Maximum accumulated elapsed time is 24 hours.

Display brightness is controlled by the DIM and B (bright) positions of the DIM switch.

.Overspeed warning

An overspeed warning horn, located in the flight compartment, sounds an intermittent 1000 Hz tone when the aircraft exceeds its maximum operating speed (V_{mo}). The air data computers sense airspeed and conditions effecting V_{mo} accordingly.

The air data computers method of computer V_{mo} and sensing airspeed using true airspeed values is more accurate than the V_{mo} indication provided by the airspeed indicators. The result is that the airspeed overspeed warning may occur at a speed up to 6 knots higher than the V_{mo} indication on the airspeed indicators.

The aircraft overspeed warning circuits can be checked by selecting the ADC test switch, located on the left pilot's side console panel.

Take-off warning system

A take-off warning horn, located in the flight compartment, sounds an intermittent 1000 Hz tone to alert the crew if a take-off is being commenced with detrimental conditions existing. The horn is operated by position switches incorporated in the power levers, condition levers, parking brake lever, elevator trim, flap position indicator, engine ECU rating selector, and weight-on-wheels signals from the proximity switch electronic unit (PSEU).

The conditions that cause the take-off warning horn to sound are:

Weight on all wheels, one or both power levers advanced above 12° above flight idle, and any one or more of the following conditions:

- Elevator trim out of the take-off range.
- Flaps extended more than 20° or less than 5°.
- One or both condition levers not at MAX.
- Parking brake lever selected to PARK.
- Engine ECU rating selector not at take-off power (TOP).

The take-off warning will cease when the detrimental conditions are corrected.

Flight data recorder

The digital flight data recorder system assesses, measures and records parameters of flight for subsequent analysis or investigation of incidents or accidents. The system consists of a crash protected flight data tape recorder mounted in the tail cone, an acquisition/measurement unit mounted on the avionics rack, a three axis accelerometer located on the rear spar, and a control panel located on the overhead console in the flight compartment. The system is energized when the anti-collision lights are on and the aircraft electrical system is powered. The system is also energized without the anti-collision lights being turned on when the aircraft leaves the ground. A FLT DATA RECORDER caution light on the caution lights panel illuminates whenever the flight data recorder is inoperative.

Data is recorded on a Mylar based magnetic recording tape to provide a crash-survivable record of critical flight parameters for the previous 25 hours. Playback of recorded information is only possible by maintenance personnel. The flight data tape recorder is equipped with an underwater locator beacon that automatically emits a sonar 'ping' when the unit is immersed in water.

For system test select the FLIGHT DATA RECORDER switch on the overhead console to the momentary GND TEST. The FLT DATA RECORDER caution light will go out to indicate serviceability.

Radio altimeter

A radio altimeter provides a measurement of aircraft altitude above the terrain with a 0 to 2500 feet operating range. Radio altitude information is displayed on both EADI's. Radio altitude is also used by the (E)GPWS and TCAS, and is available to the flight guidance computer, air data computers, and flight data recorder via the ASCB.

The system consists of a transmitter receiver unit mounted under the cabin floor and two antennas on the underside of the fuselage. The system is energized by the aircraft's electrical system and operates automatically.

The radio altimeter self test can be selected by pushing the inner left rotary knob on each EFIS controller. Turning the same knob sets the radio altitude decision height on the EADI.

Electronic Flight Instrument System (EFIS)

The electronic flight instrument system (EFIS) consists of four cathode-ray tube (CRT) electronic display units, dual display controllers and a symbol generator (SG) for each set of two CRTs. The upper display is the electronic attitude director indicator (EADI) and the lower display is the electronic horizontal situation indicators (EHSI).

The EADI and EHSI display the images generated by its on-side symbol generator. The related display controller selects display format of attitude, heading, and navigation source.

The number 1 symbol generator and left pilot's EFIS display controllers operate the left EADI and EHSI. The right hand side EADI and EHSI are controlled and operated by the number 2 symbol generator and right pilot's EFIS controller.

In non-normal situations the CRTs may be fed data from the opposite SG.

Composite mode

If a display unit (EADI or EHSI) fails, turning the failed unit off will select the composite mode. The composite mode combines the information that is normally on both display units (EADI and EHSI) onto the remaining operational display (same side). The display unit displaying the composite mode is still operating from its normal symbol generator and display controller.

As in normal EADI and EHSI presentations, all elements are not displayed at the same time. Flight phase, navigation radio tuning, radio altimeter altitude and selected flight director modes determine the presence of each display element. The failure, caution, and warning annunciations are similar to the normal EADI and EHSI displays.

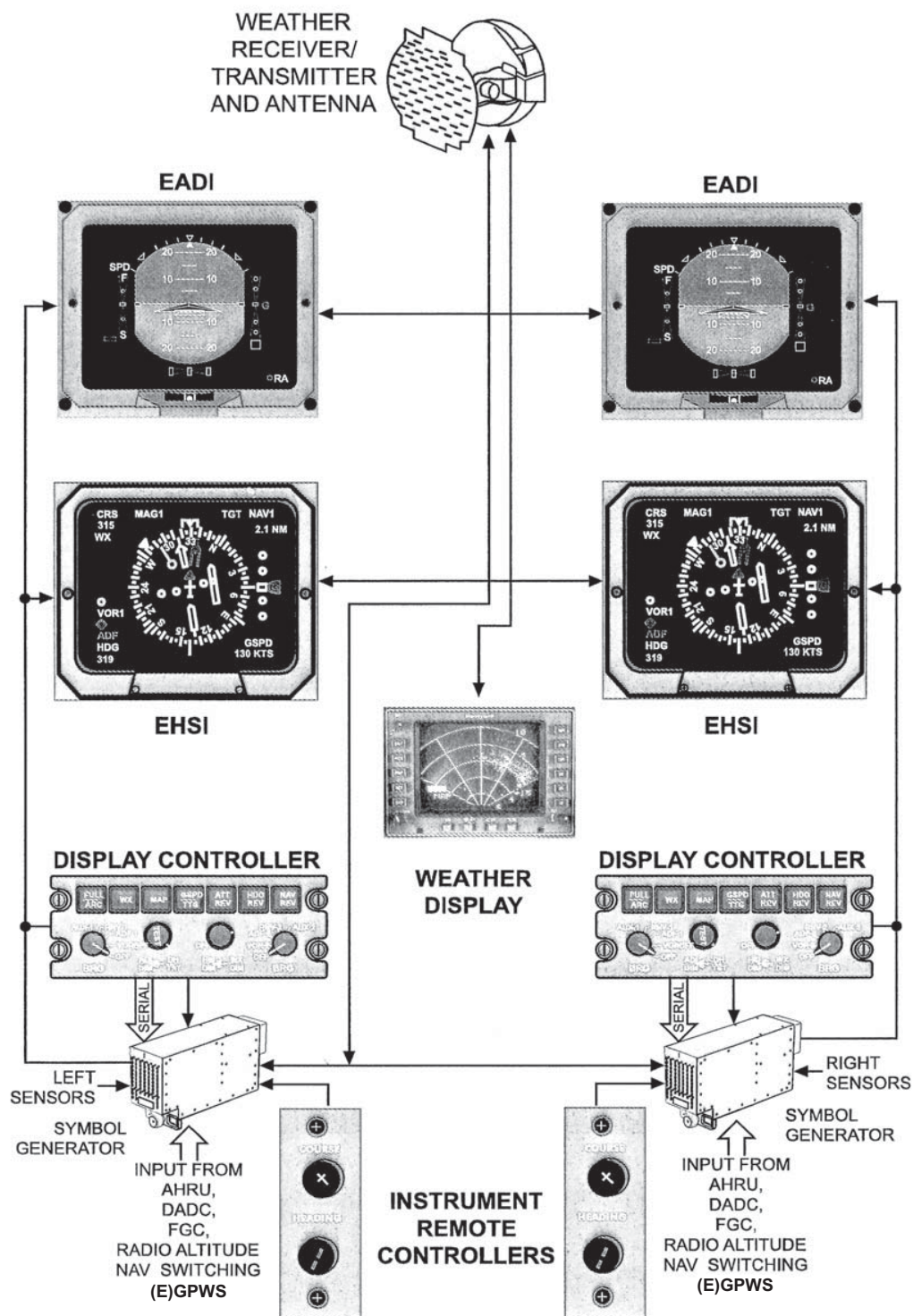
Reversionary mode

If a symbol generator fails, pushing the REVN pushbutton, located above the failed EADI, will duplicate the cross mode is annunciated on both EADI's by a SG1 or SG2 annunciation representing which symbol generator is producing the displays. The display controller of the operational symbol generator controls both EADI and EHSI displays during reversionary mode. Selecting the REVN pushbutton on the failed side a second time reverts the EADI and EHSI on that side back to the original failed condition. The REVN pushbuttons have no function unless a symbol generator failure occurs.

EFIS display controller

The EFIS display controller allows selection of the desired display format on the EADI and EHSI. The controller also includes two bearing select knobs, EADI DIM control, EHSI DIM control, and TEST pushbutton.

The EFIS portion of the test is only functional on the ground. The radio altimeter portion of the test is functional at all times except during GS CAP/TRK flight guidance modes.



EFIS schematic

Electronic Attitude Director Indicator (EADI)

The electronic attitude director indicator (EADI) combines a sphere-type attitude display with lateral and vertical flight guidance command bars (or single cue command pointer) to provide the guidance necessary to intercept and maintain a desired flight path. The EADI provides the following display information:

- Aircraft attitude
- Flight Director commands and annunciators
- Glideslope deviation
- Expanded localizer deviation
- Radio altitude (rising runway and digital)
- Decision height
- Marker beacon annunciation
- Rate of turn
- Speed reference
- Attitude, heading and navigation sources

The EADI receives pitch and roll inputs from the attitude/heading reference system (AHRS).

A flight director failure will remove the command bars and all FD mode annunciations. In the event of an EADI failure, select the EADI DIM control to the OFF position to allow the composite mode to be displayed on the EHSI.

When below 2500 feet AGL, radio altitude is displayed in the lower right hand corner. Amber dashes indicate that radio altitude data is invalid. The display is blank if the radio altitude is above 2500 feet.

A relative speed indication is displayed on the left side of the indicator. The speed indication is displayed on the left side of the indicator. The speed indication is a FAST or SLOW indication relative to 1.3 times the aircraft stall speed (V_s), and is intended for use in an approach or during slow flight.

When descending through the selected decision height an amber DH will appear inside a white box to warn the pilot.

.EADI display indicators

The basic attitude display of the EADI is similar to a conventional ADI and consists of the following:

Attitude sphere	The sphere moves with respect to the aircraft symbol to display actual pitch and roll attitude. Pitch attitude marks are in 5° increments.
Aircraft symbol	The aircraft symbol serves as a fixed representation of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the stationary symbol and the moving attitude sphere.
Roll pointer and scale	The pointer displays actual roll attitude when aligned with the fixed index reference marks at 0°, 10°, 20°, 30°, 45° and 60° on the roll scale.
Rate of turn pointer and scale	The rate-of-turn of the aircraft is indicated by the position of the pointer against scale indices. The marks at the extreme left and right side of the scale represent a standard rate of turn (3° per second).
Inclinometer	A conventional inclinometer is mounted on the lower edge of the EADI to provide aircraft slip or skid indication to assist turn coordination.
Attitude source annunciation	An amber annunciation of the EADI attitude source (ATT 1 for number 1 AHRS; ATT 2 for number 2 AHRS) is displayed when both EADI's are selected to the same source.
Flight guidance controller mode annunciation	Flight guidance modes annunciated in the advisory display are also displayed on the EADI. The following, with an associated heading, are annunciated in the upper left corner of the EADI: HDG, LOC, VOR and VOR APP. The following are annunciated in the upper right corner of the EADI: IAS, VS, ALT, GS and A SEL. Mode selection is indicated by a white annunciation. Mode capture is indicated by the associated mode annunciation changing from white to green. In addition to the above, AP MSG is annunciated on the lower right of the EADI to indicate an autopilot message on the advisory display. An amber 'HSI>' or '<HSI' legend is annunciated in the upper left corner on the HSI not selected by the HSI SEL button to indicate that opposite side navigation is being processed by the FGC's.

.Flight director and approach display indicators

Command pointers	Displays flight guidance commands to approach and maintain a desired flight path to which the airplane symbol is flown. The horizontal bar rises and descends to display vertical commands, the vertical bar moves left or right to display horizontal commands.
Glideslope pointer and scale	The glideslope pointer and scale are in view when the VHF navigation receiver is tuned to an ILS frequency and BC is not active. The glideslope pointer and scale present a fly-to-the-pointer display of aircraft deviation from the glideslope beam. The letter 'G' is annunciated inside the pointer. When the pointer moves off the scale, the letter 'G' remains in view at the maximum deflection position of the scale. As the pointer comes on to the scale it picks up the letter and carries it inside the pointer as it moves about the scale. Between 1200 feet and 100 feet radio altitude (RA), a CAT II excessive deviation mode is enabled when the glideslope is in track mode. Localizer and/or glideslope pointers and displays flash amber during excursions outside of the CAT II window. The flashing amber annunciation is replaced by a steady green when the localizer and/or glideslope is within the CAT II window.
Expanded localizer	An expanded localizer pointer and scale is displayed in place of the rate of turn display whenever a valid ILS signal is selected to the EHSI. The expanded deviation display is 7.5 times more sensitive than standard localizer deviation displays and is normally used for assessment only. During final approach, the pointer serves as an indicator of the CAT II window. Keeping the expanded localizer pointer within its full-scale marks ensures the pilot of touchdown within 33 feet of the centreline of the runway when using a CAT II ILS system.
Fast/slow indicator	The pointer provides indication of approach speed relative to Vref. The airspeed indicator remains the primary approach speed indicator.
Marker beacon annunciator	A white marker beacon box appears whenever a valid ILS signal is selected to the EHSI. When a marker beacon is received, an appropriate O for outer (blue), M for middle (amber), or I for inner (white) marker appear in the marker beacon box.
Radio altitude display	A four-digit display indicates radio altimeter altitude for -20 to 2500 feet to within the nearest 10 feet above 200 feet of altitude, and the nearest 5 feet below 200 feet altitude. The display is blanked above 2500 feet. Below 2500 feet, the display will show dashes if the radio altitude signal is invalid.

Rising runway	Radio altimeter altitude is displayed by the relative position of the rising runway symbol to the aircraft symbol. The rising runway appears at 200 feet RA and moves toward the aircraft symbol, contacting the bottom of the symbolic aircraft at touchdown. If the radio altitude is invalid, the rising runway is out of view.
Decision height display	Decision height is displayed by a three-digit display that is set by the DH/TST control on the EFIS controller from 0 to 990 feet in 10-foot increments.

Electronic Horizontal Situation Indicator

The electronic horizontal situation indicator (EHSI) combines numerous displays to provide a map-like presentation of the aircraft position. The EHSI displays aircraft displacement relative to a selected VOR radial, localizer or FMS track, and a glideslope beam when an ILS frequency is tuned on the VHF NAV receiver. At power up, the EHSI presents a full compass display. By pressing the MAP pushbutton, on the display controller, the full compass display is changed to a partial compass format.

The EHSI receives heading information from the attitude/heading reference system (AHRS) and is the primary heading indicator.

Each instrument remote controller, located on the glareshield panel, provides heading and course selection for its respective EHSI. The HEADING selector knob adjusts the heading bug; the COURSE selector knob adjusts the course pointer.

In the event of an EHSI failure, select the HSI DIM control on the display controller to the OFF position to allow the composite mode to be displayed on the EADI.

The type of navigation signal (VOR/LOC or LNAV) displayed on an EHSI for course deviation information is first selected with the NAV SEL switch and the appropriate V/L or AUX switch on the flight guidance controller. Subsequent selection of a NAV REV pushbutton on the display controller selects between the number 1 and number 2 of that type of receiver.

.EHSI partial compass format

The partial compass mode displays a 90° arc of the heading dial with range rings. The outer range ring represents the selected range on the weather radar. The range annunciation on the inner ring represents one half the range setting of the weather radar. If the weather radar is off or unserviceable the default range is 100 NM.

Pressing the MAP button on the EFIS controller displays the partial compass format with navigation position locators that are selected in conjunction with the bearing pointer selection.

Pressing the WX/TERR button the EFIS controller once allows weather radar returns to be displayed on the partial compass format. A second push on the WX/TERR button allows (E)GPWS terrain profiles to be displayed on the partial compass format.

When RNAV is selected to the EHSI and MAP is selected on the EFIS controller, multiple RNAV waypoints and the tracks between them are displayed on the partial compass format. When the aircraft is not following the displayed track, the aircraft symbol and the track line separate. The combination of a large (angular and/or parallel) deviation from track and a low selected range, will cause the track to disappear off the display. Distance to the active RNAV leg (cross track distance) is displayed by a digital readout under the aircraft symbol.

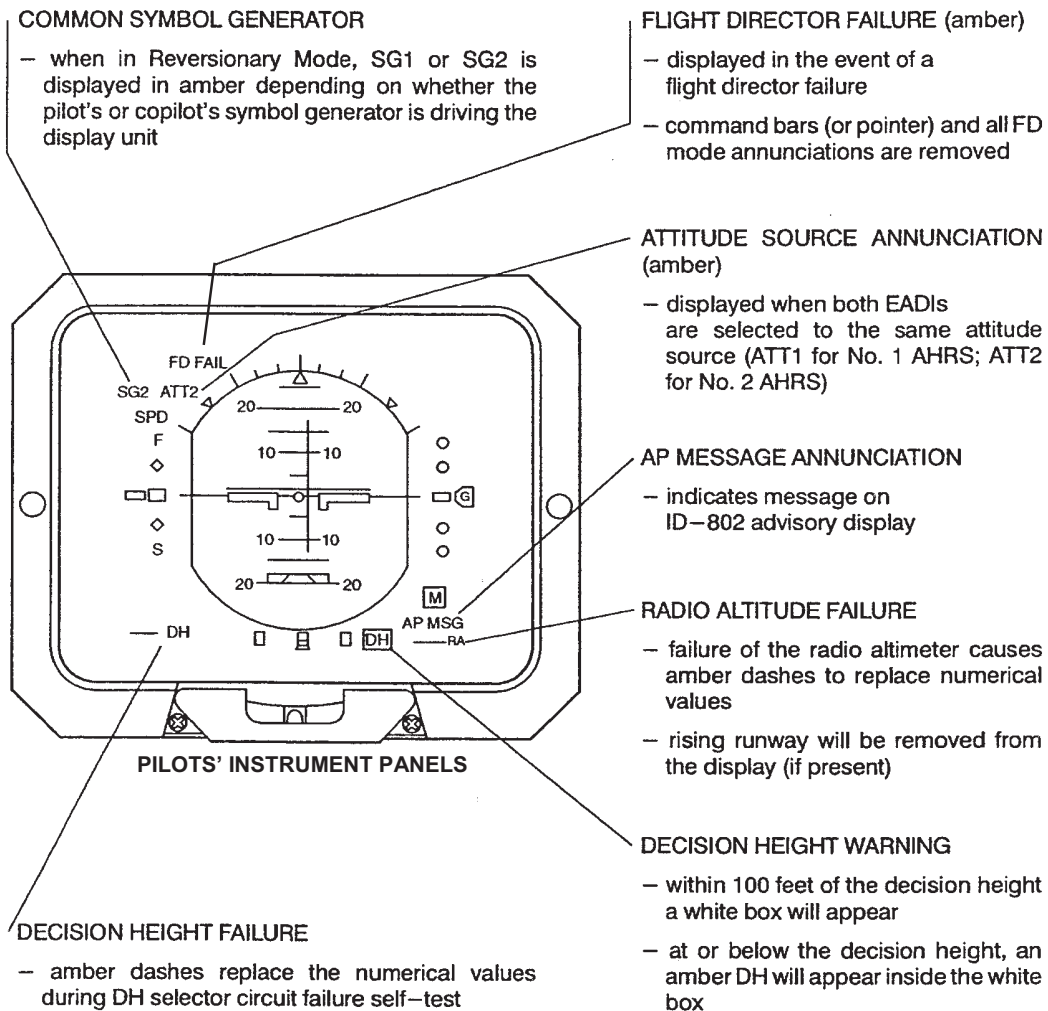
EHSI display indicators

The basic heading and course deviation display of the EHSI is similar to a conventional HSI and consists of the following:

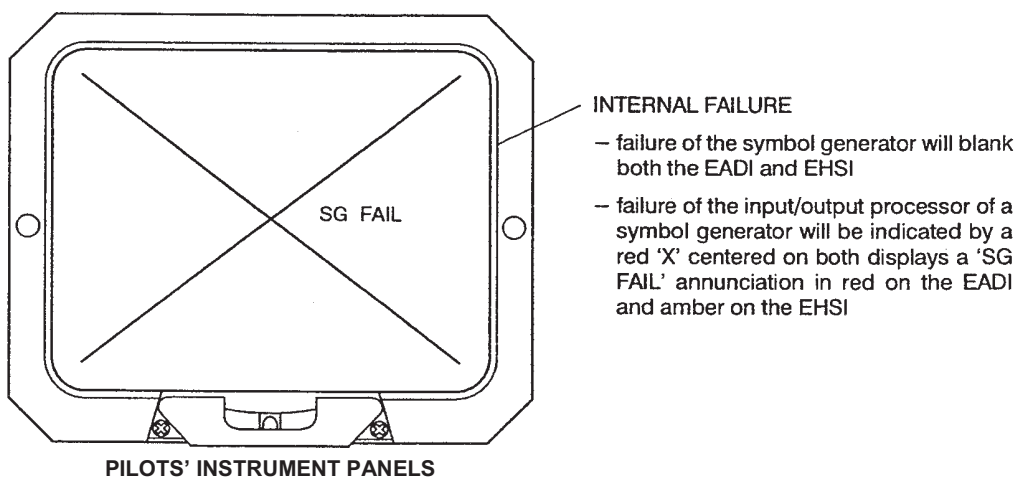
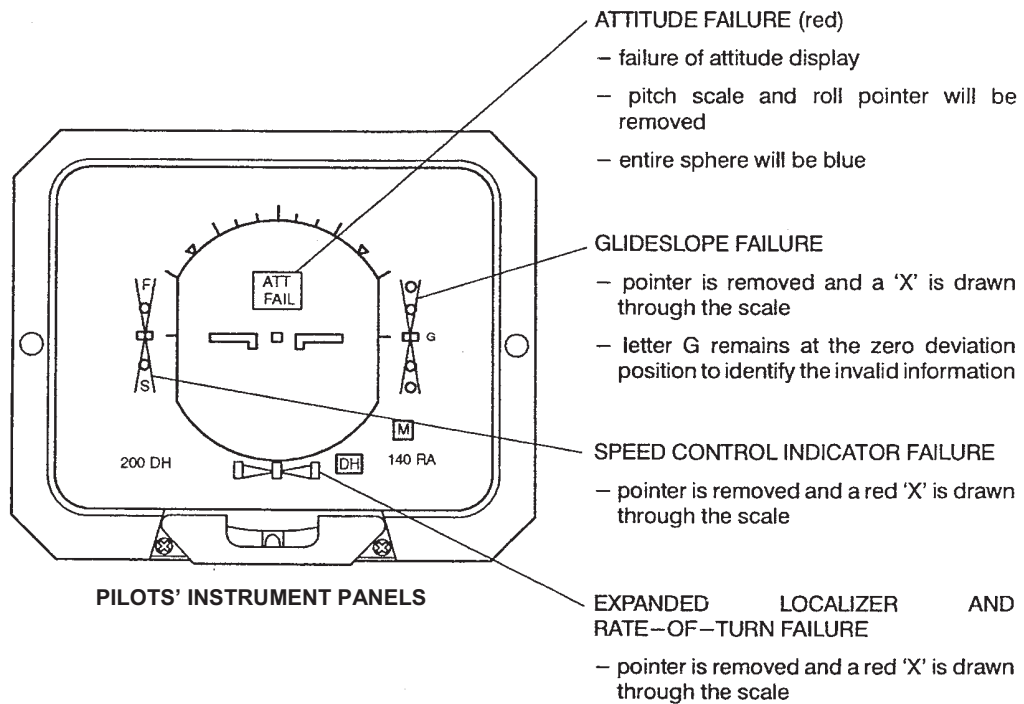
Heading display	Gyro stabilized magnetic compass information from the AHRS system is displayed on the heading dial, which rotates with the aircraft through 360°. The heading dial is graduated in 5° increments. Fixed heading marks are at the fore and aft lubber line positions and at 45° bearings.
Heading select bug and display	A notched blue heading select bug is positioned on the heading dial by rotating the remote heading knob located on the glareshield panel (one for each HSI). The bug is used to indicate a selected heading, which is used for the FD heading mode when operational. A digital display of the selected heading is in the lower left corner of the EHSI. If the bug is turned off the display in partial compass format, an arrow indicating the position of the bug replaces it. If the bug is turned through 180° relative to the present heading and the FD is in HDG mode, the 'smart turn' programming continues the turn in the direction of the bug.
Aircraft symbol	A fixed miniature aircraft symbol corresponds to the longitudinal axis of the aircraft and lubber line markings. The symbolic aircraft position and heading with respect to the rotating heading dial gives the aircraft position in relation to a VOR course.
Course select pointer	The yellow course pointer is positioned on the rotating heading dial by a remote course knob. A knob is located on each glareshield panel for each EHSI, to select a magnetic bearing that coincides with the desired VOR radial or localizer course. The course pointer rotates with the rotating heading dial. The tail of the course select pointer acts as a reciprocal course pointer to indicate the 180° reciprocal of the selected course. A digital readout of the selected course is displayed on the upper left of the EHSI display.

Course bar	The course bar represents the centreline of the selected VOR radial or localizer course. The aircraft symbol shows pictorially actual aircraft position in relation to the selected course. In VOR operation, each dot represents 5° deviation from centreline. In ILS operation, each dot represents 1.5° deviation from centreline.
Nav TO-FROM annunciator	An arrowhead in the centre of the EHSI indicates whether the selected course is TO or FROM the station. The TO-FROM annunciator is not in view during localizer operation.
Distance display	The distance display indicates the nautical miles to the VOR/DME or RNAV waypoint. An amber 'H' adjacent to the distance readout indicates DME HOLD. Number 1 VOR/DME or RNAV distance is presented on the pilot's EHSI display. Number 2 VOR/DME or RNAV is displayed on the co-pilot's EHSI.
Ground speed or time-to-go display	Pressing the GS/TTG button on the EFIS controller alternately displays ground speed or time-to-go. In VOR/LOC mode, ground speed is calculated by the EFIS using the on-side DME distance information. In LNAV mode, the displayed ground speed is copied directly from the FMS.
Glideslope pointer and scale	A glideslope pointer and scale are displayed on the right side of the EHSI when VOR/LOC is selected and that VHF NAV source is tuned to a localizer frequency. The glideslope pointer and scale present a fly-to-the-pointer display of aircraft deviation from the glideslope beam. The letter 'G' is annunciated inside the pointer. When the pointer moves off the scale, the letter 'G' remains in view at maximum deflection. As the pointer comes on to the scale it will pick up the letter and carry it inside the pointer as it moves about the scale. If BC (localizer back course) is selected all glideslope information is inhibited and removed from display.
Bearing pointers	<p>The bearing pointers indicate relative bearing to the selected navigation aid. Two bearing pointers, a blue 'O' shaped pointer and a green, diamond-shaped pointer are available and can be tuned to navigation aids or selected OFF from the EFIS controller. The source navigation aid for each bearing pointer is annunciated on the left side of the EHSI below the appropriate pointer symbol.</p> <p>The bearing pointers and source annunciation are removed from the display when the bearing pointer is selected to OFF.</p>
Weather radar mode annunciation	A weather radar mode annunciator indicates the weather radar mode selected on the weather radar indicator.
(E)GPWS terrain mode annunciation	A TERR annunciation indicates the (E)GPWS terrain map is available for display.
Compass synchronization annunciator	Compass synchronization is displayed by a dot or a cross symbol which indicates the direction of compass slewing in the slaved mode. The synchronization annunciator is removed during unslaved compass operation.

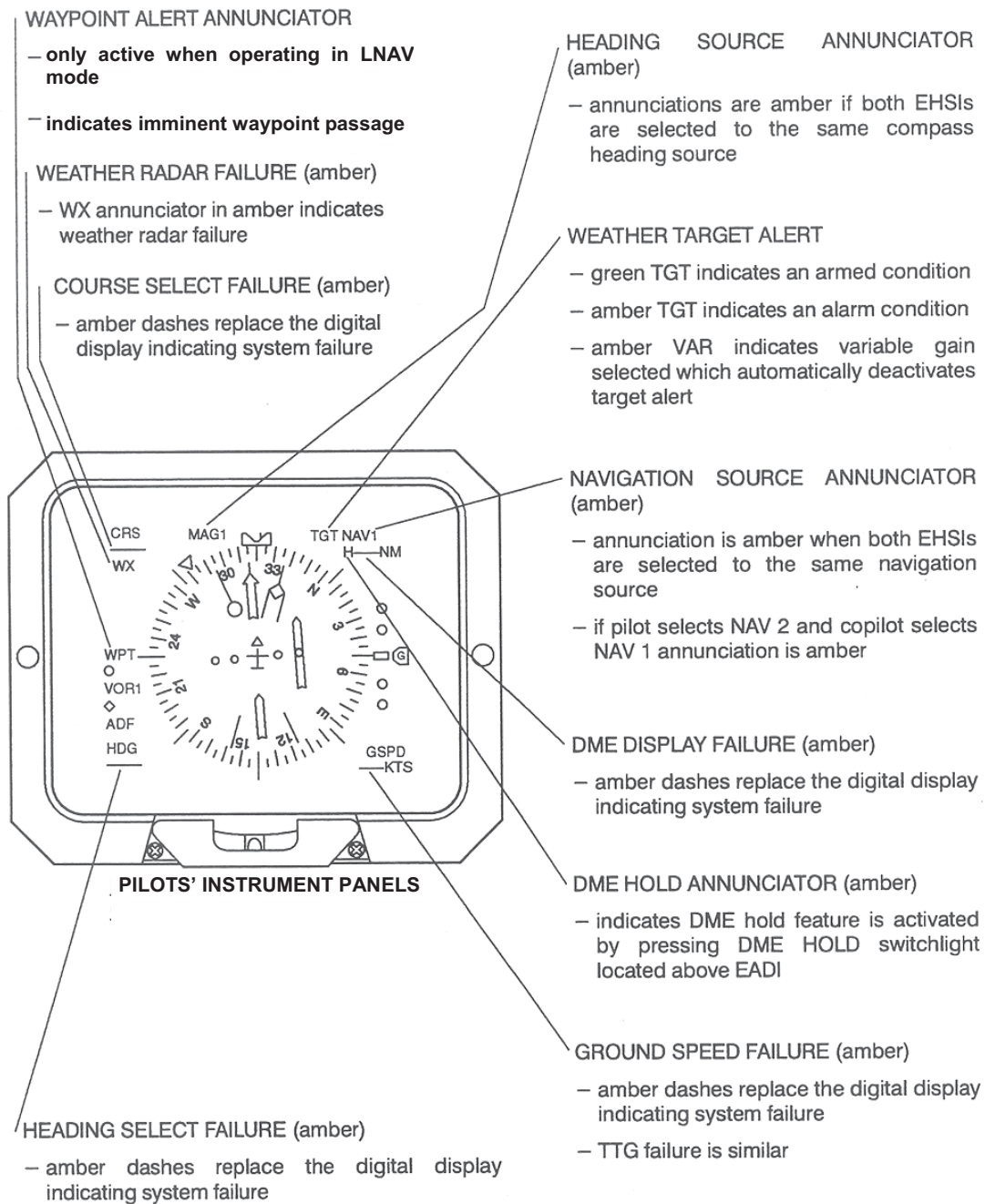
NON-NORMAL INDICATIONS AND OPERATION



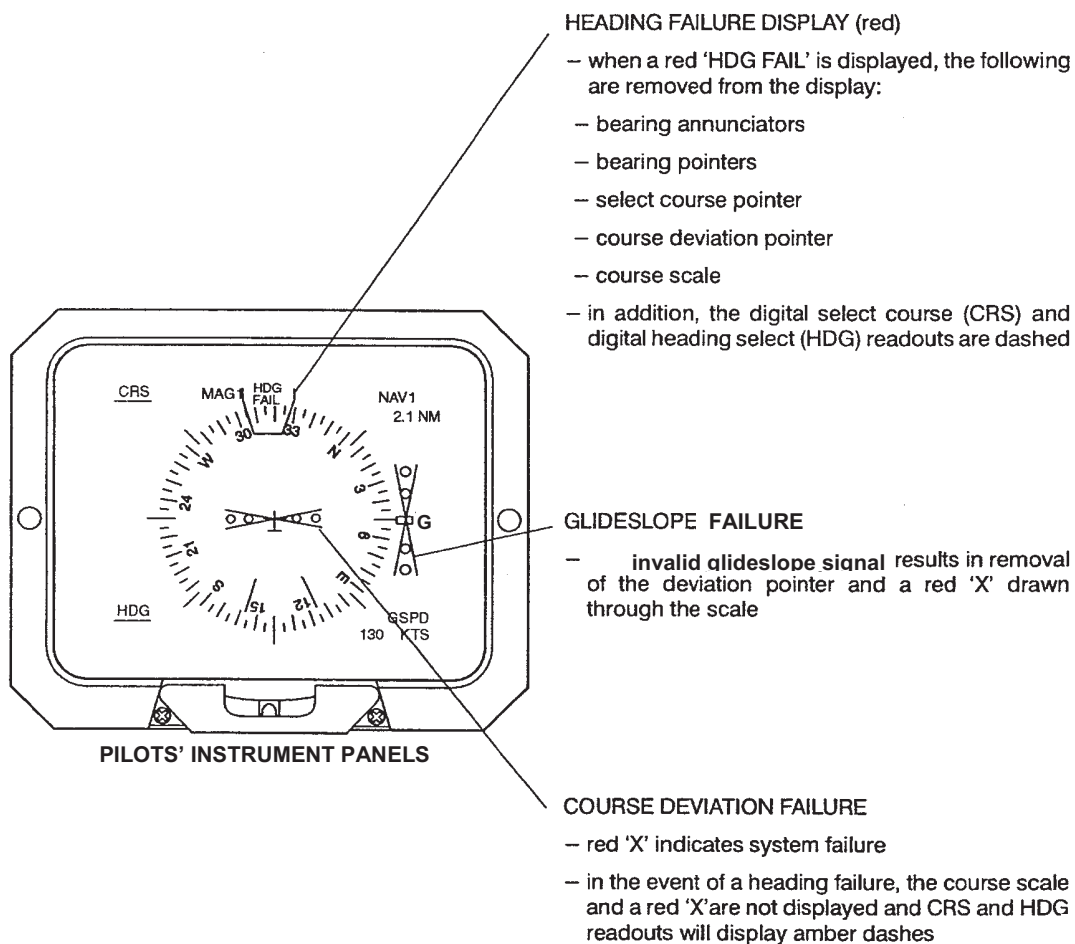
Amber EADI caution and failure annunciations



Red EADI failure annunciations



Amber EHSI caution and failure annunciations



Red EHSI failure annunciations

AHRS abnormal operation

If an apparent abnormal indication appears on the EADI or EHSI, correct operation of the AHRS may be confirmed by pressing the TEST pushbutton on the AHRS controller.

NOTE: The autopilot may disengage when activating the AHRS TEST function.

The following limitations apply to the AHRS system:

- Take-off in 'basic' mode is prohibited
- Take-off in 'DG' mode is prohibited
- Take-off with the primary power source failed

Amber EADI failure annunciations

Attitude source	No attitude source is annunciated if the pilot and co-pilot are using normal attitude sources. If the pilot and co-pilot have selected the same attitude source, that attitude source is annunciated in amber on both EADI's.
Radio altitude failure	In the event of a failure of the radio altimeter, amber dashes will replace numerical values and the rising runway, if displayed, will be removed from the display.
Decision height warning	When the radio altitude is within 100 feet of the decision height, a white box will appear to the left of the radio altitude display. When at or below the decision height, an amber DH will appear within the white box.
Decision height failure	In the event of a failure in the DH selector circuits or during self-test, amber dashes will replace the numerical values of the decision height display.
Common symbol generator	When in the reversionary mode and one symbol generator is driving both the pilot and co-pilot display units, a reversionary warning is displayed in amber, which indicates the display source. As appropriate, SG 1 or SG 2 will appear in the upper left corner in amber.

Red EADI failure annunciations

Attitude failure	In the event of a failure of the attitude display, the pitch scale and roll pointer will be removed, the sphere will be blue and a red ATT FAIL will be displayed in the middle of the sphere upper half.
Glideslope, expanded localizer and rate-of-turn failures	In the event of a failure of any of these systems, the pointer is removed and a red 'X' is displayed through the scale. The letter 'G' remains at the zero deviation position to identify invalid information.
Fast/slow indicator failure	A red 'X' through the indicator scale displays failure of the fast/slow indicator. The fast/slow pointer is not displayed.
Internal failure	In the event of internal failure within a symbol generator itself, the displays will be blank. A red 'X' cantered on the EADI and EHSDI displays with annunciations SG FAIL will indicate a failure of the input/output processor of a symbol generator. SG FAIL is annunciated in red on the EADI and amber on the EHSDI.

Amber EHSI caution and failure annunciations

Heading source annunciation	A white MAG 1 or MAG 2 annunciation is displayed on the EHSI when it is selected to its normal compass-heading source. If the EHSI's are selected to the same compass heading course, the annunciation is amber.
Navigation source annunciation	A white navigation annunciation is displayed on the EHSI to indicate that the normal source of the navigation receiver information is being used for course deviation display. If the pilot's and co-pilot's EHSI's are selected to the same navigation source, the annunciation is amber.
DME hold annunciation	When the DME is in the hold mode, amber 'H' is displayed to the left of the numerical DME readout. The number 1 DME hold switch light, located on the left pilot's instrument panel, operates the number 1 DME hold feature. The number 2 DME hold switch light, located on the right pilot's instrument panel, operates number 2 DME hold mode.
Weather radar mode annunciation	A green 'WX' annunciation in the upper left corner of the EHSI indicates the weather radar is operational. An amber 'WX' annunciation in the upper left corner indicates a weather radar failure.
Weather target alert	Weather target alerts are annunciated on the EHSI in the upper right corner. A green TGT indicates an armed condition while an amber TGT indicates an alert condition. An amber VAR indicates variable gain selected which automatically deactivates target alert.
(E)GPWS terrain map failure	An amber TERR annunciation indicates the (E)GPWS terrain map is invalid and will not be displayed.
Display failures	<p>When any of the following systems fail, the digital is replaced by amber dashes:</p> <ul style="list-style-type: none">• Time-to-go (TTG ---)• Course select (CRS ---)• Distance measuring equipment (--- NM)• Heading select (HDG ---)• Ground speed (GSPD ---)

Red EHSI failure annunciations

Heading failure

A failure of the heading system valid results in the removal of bearing annunciations, bearing pointers, select course pointer, course deviation pointer, course scale and the red 'X' across course scale if deviation is invalid. The digital select course and digital heading select readouts are dashed and a red HDG FAIL is displayed at the top of the heading dial.

Course deviation, azimuth deviation, vertical deviation, glideslope deviation or elevation deviation failure

A failure of any of these systems results in the removal of the deviation pointer and a red 'X' drawn through the scale.

Internal failure

In the event of an internal failure within the display system, the display will be blank. A failure of the input/output processor will be indicated by a red 'X' centred on the EADI and EHSI displays with an annunciation of SG FAIL. SG FAIL is annunciated in red on the EADI and amber on the EHSI.

Caution lights

FLT DATA RECORDER	Recorder is not operating.
Applicable ECL:	FLIGHT DATA RECORDER FAILURE.
Remarks:	Flight data recorder is energized when aircraft is airborne, when on the ground with anti-collision lights ON, or with the switch in TEST.