



OPERATIONS MANUAL
SECTION 6-16

FLIGHT INSTRUMENTS

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PITOT-STATIC SYSTEM

The Pitot Static System provides pitot and static pressure inputs to pressure-sensing instruments and systems, which have functions that vary with altitude and/or airspeed.

There are three pitot static systems: the pilot's, the co-pilot's and the auxiliary systems.

Pressure inputs to the pitot static systems are provided by combination of three pitot and static probes located at the forward fuselage. Each probe provides one pitot and two static inputs. The pilot's static system and the auxiliary static system are cross connected for dynamic balance.

Two Air Data Sensors are connected to both pitot and static lines, providing altitude and airspeed signals to the autopilot computer.

Airplanes equipped with Flight Data Recorder System (FDRS) or Ground Proximity Warning System (GPWS) are equipped with a third Air Data Sensor, replacing the True Airspeed Computer. The third Air Data Sensor provides altitude and indicated airspeed signals to the FDRS and GPWS System.

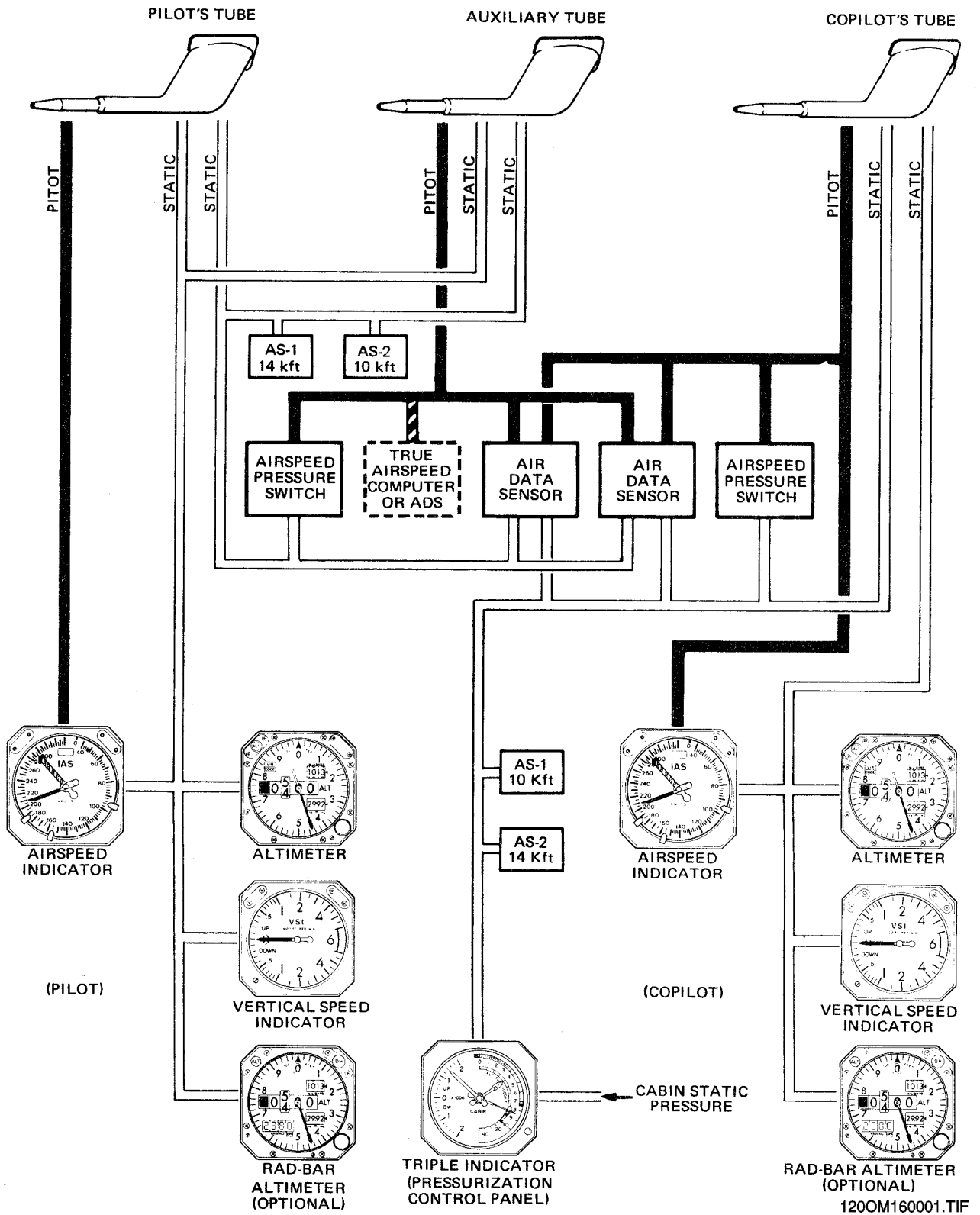
Two airspeed pressure switches provide output signals to the landing gear warning system and stall warning system.

Four altitude pressure switches are connected to the static lines. Two of these switches have a set point at 14000 ft and the other two have a set point at 10000 ft. When the static pressure reaches the 14000 ft set point, the relevant switches are activated providing output signals to the HMU enrichment solenoid valve. An output signal will be provided to the EEC warning by the 10000 ft switches, should a failure occur in the operation of the 14000 ft switches.



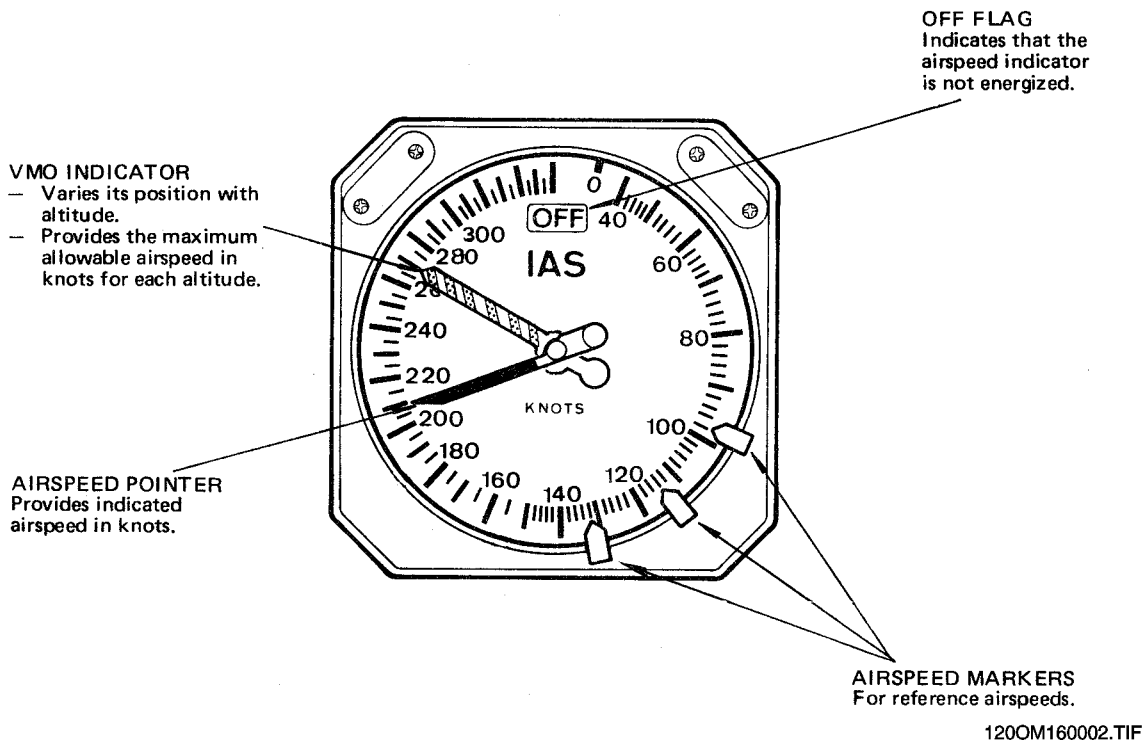
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EMB120 Brasilia
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SYSTEMS DESCRIPTION
FLIGHT INSTRUMENTS



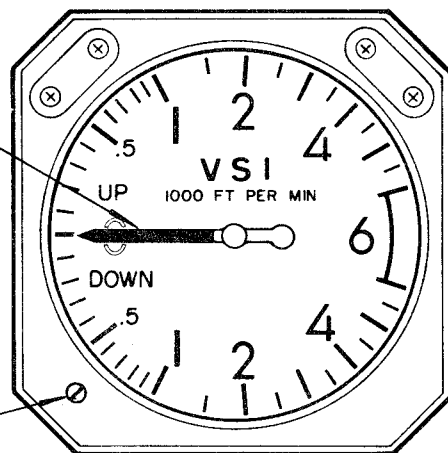
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PITOT-STATIC SYSTEM SCHEMATIC



**AIRSPED INDICATOR
(PILOT'S AND COPILOT'S PANEL)**

**VERTICAL SPEED INDICATOR
POINTER**
Depicts rate of climb or descent
from 0 to 6000 feet per minute.



SCALE
— 100-foot increments
from 0 to 1000 feet
— 500-foot increments
from 1000 to 6000
feet

ZERO ADJUSTMENT SCREW
Used to set vertical speed
indicator pointer to zero.

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**VERTICAL SPEED INDICATOR
(PILOT'S AND COPILOT'S PANEL)**

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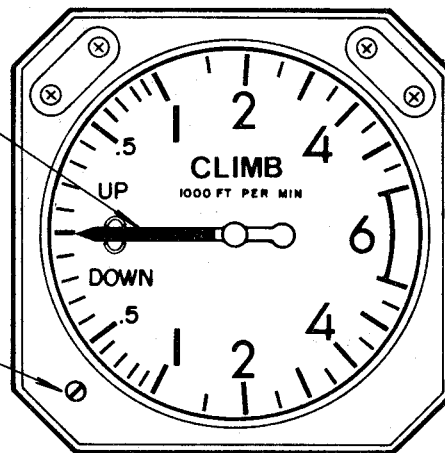


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NOTE: The Instantaneous Vertical Speed Indicator (IVSI) is improved by an incorporated accelerometer which reduces pointer response time. The IVSI can replace the conventional VSI, being connected to the same static lines.

VERTICAL SPEED INDICATOR POINTER
Depicts rate of climb or descent from 0 to 6000 feet per minute.

ZERO ADJUSTMENT SCREW
Used to set vertical speed indicator pointer to zero.



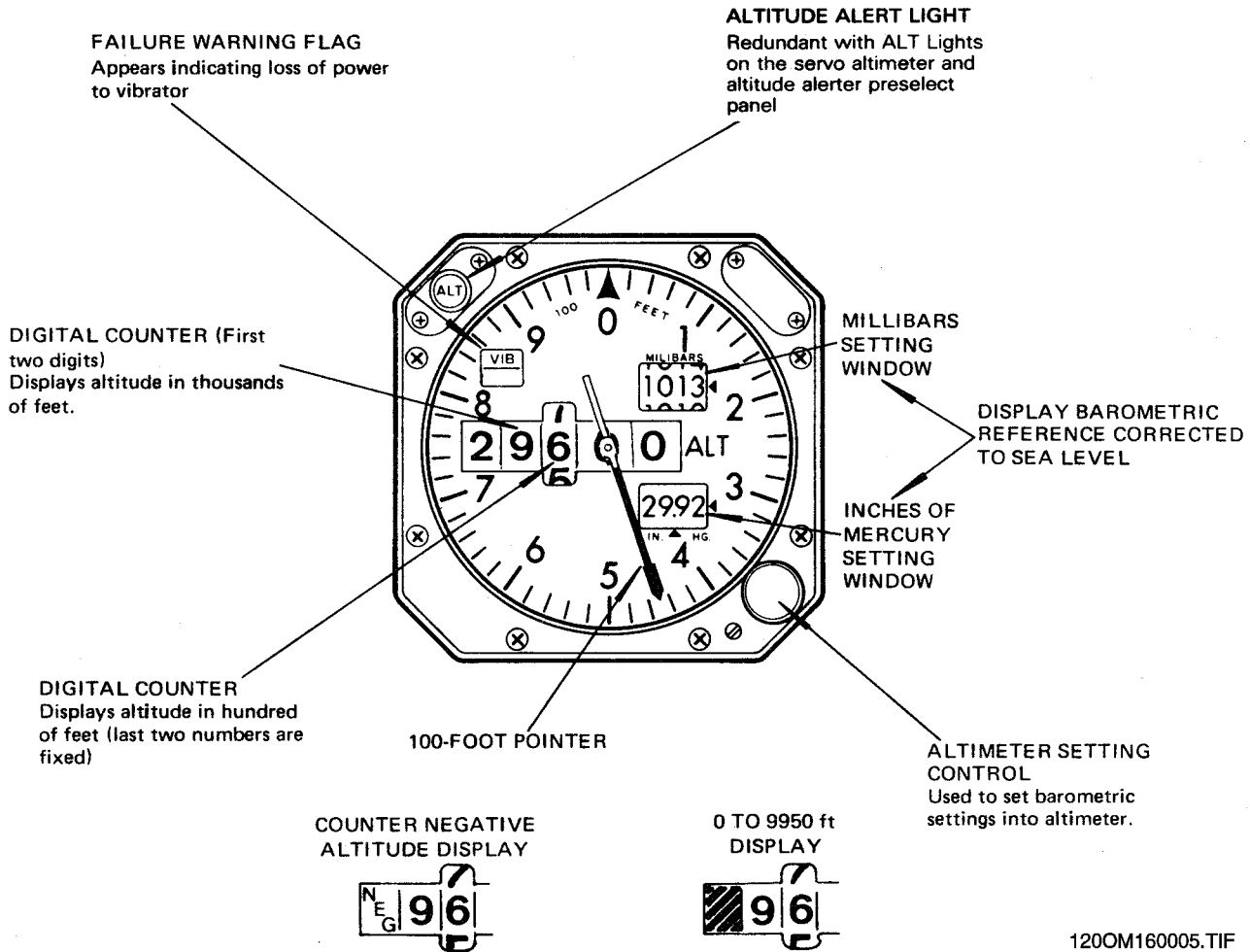
SCALE

- 100 - foot increments from 0 to 1000 feet
- 500 - foot increments from 1000 to 6000 feet

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**INSTANTANEOUS VERTICAL SPEED INDICATOR – IVSI
(PILOT'S AND COPILOT'S PANEL) – OPTIONAL**



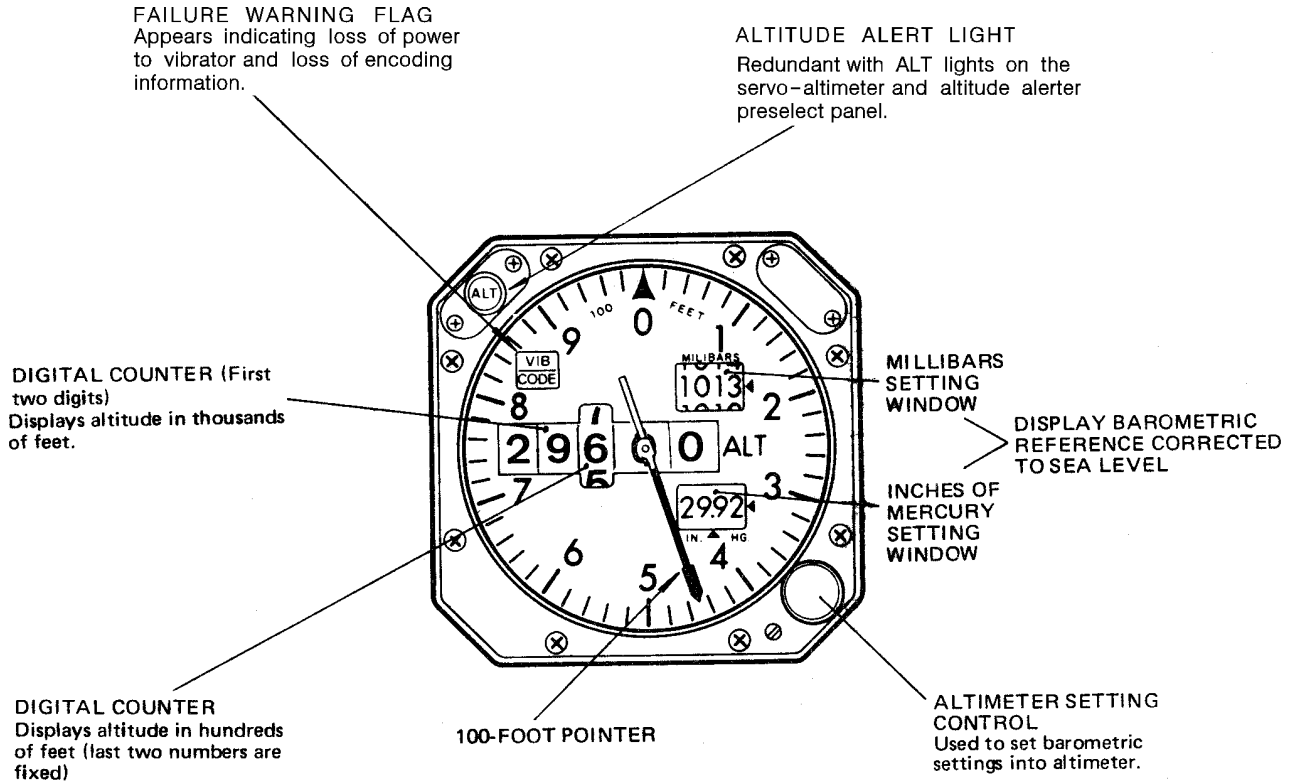
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**NON-ENCODING ALTIMETER
(COPILOT'S PANEL)**

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OPERATIONS MANUAL



COUNTER NEGATIVE ALTITUDE DISPLAY



0 TO 9950 ft DISPLAY



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ENCODING ALTIMETER
(PILOT'S OR COPILOT'S PANEL)

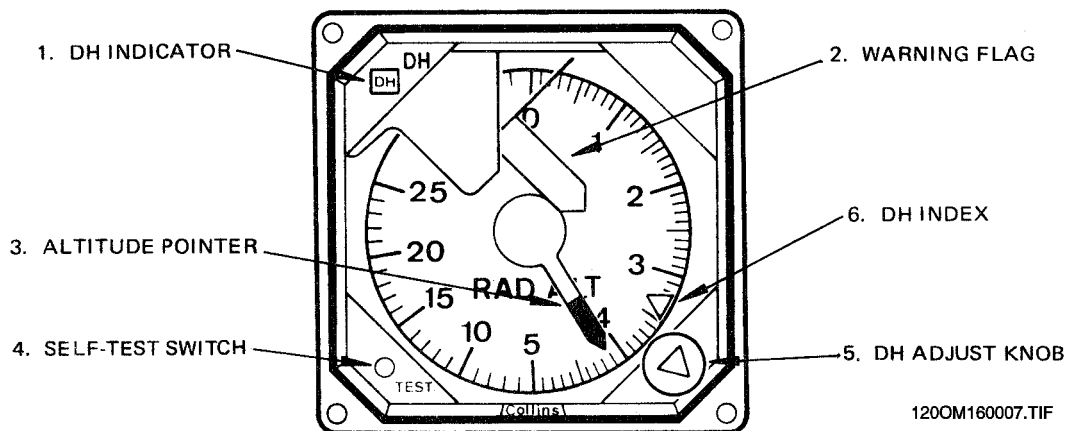


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RADIO ALTIMETER INDICATOR (OPTIONAL)

1. DH INDICATOR – Lights when aircraft descends to the selected decision height. Remains lit at all altitudes below the decision height (during descent). During ascent, remains lit until altitude pointer is above decision height.
2. WARNING FLAG – Comes into view when the system loses power, when the altitude pointer does not track the altitude signal from the radio altimeter, or during self-test of the system.
3. ALTITUDE POINTER – Indicates airplane height above the terrain during approach phase. The scale of the indicator is linear from 0 to 500 ft with major scale divisions every 50 ft and minor divisions every 10 ft. From 500 to 2500 ft the scale is compressed and linear with major scale marks every 500 ft and minor scale marks every 100 ft.
4. SELF-TEST SWITCH – When pressed, if the system is functioning properly (excluding antennas), the pointer indicates a self-test altitude of 50 ± 5 ft, the flag comes into view, and the DH indicator lights if the DH index is set above 50 ft.
5. DH ADJUST KNOB – Adjusts the DH index to the selected altitude.
6. DH INDEX – Indicates selected decision height.

NOTE: Radio altimeter is offered as an optional equipment. One or two may be installed on the airplane. Radio altimeter indicator is installed when the airplane has the FIS configuration.

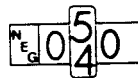
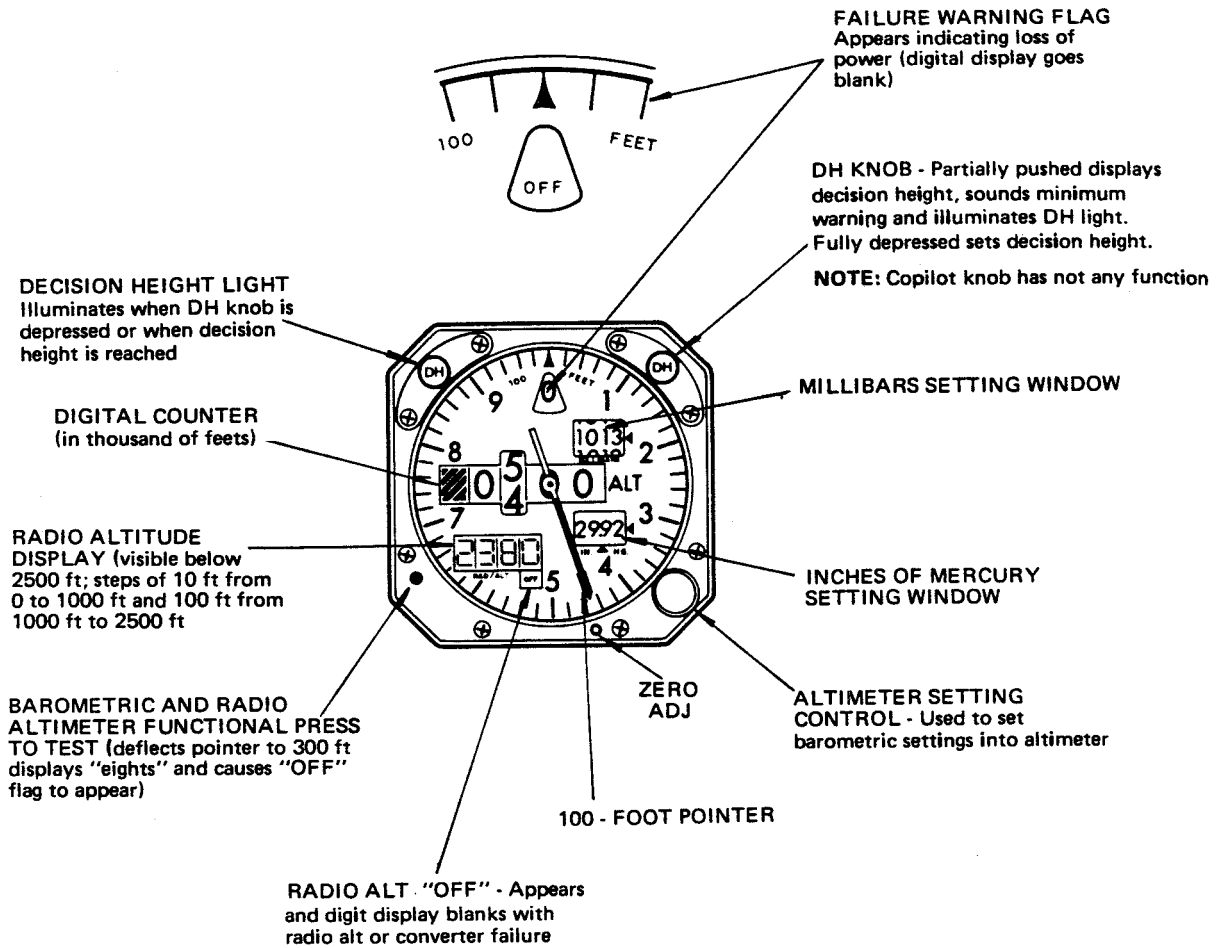


RADIO ALTIMETER
(PILOT'S AND COPILOT'S PANEL)

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NEGATIVE
ALTITUDE
DISPLAY

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RADIO/BAROMETRIC ENCODING ALTIMETER (OPTIONAL) (PILOT'S AND COPILOT'S PANEL)



OPERATIONS MANUAL

ALTITUDE ALERTER SYSTEM (OPTIONAL)

Altitude alerting references the altitude selected on the Altitude Alerter Pre-select Panel. Alerting occurs when approaching or departing the selected altitude.

Alerting consists of illumination of altitude alerter and altimeters lights and three tones or an ALTITUDE ALERT voice message.

Altitude information for the altitude alerter system is obtained from the servo altimeter.

Acquisition Alerting

Standard Configuration

When approaching within 400 ft of selected altitude, the altitude alerter and altimeters lights illuminate, three tones sound or the ALTITUDE ALERT voice message sounds. When at 200 ft from the selected altitude, the lights extinguish.

Alternative Configuration

When approaching within 1000 ft of selected altitude, the altitude alerter and altimeters lights illuminate, three tones sound or the ALTITUDE ALERT voice message sounds. When at 200 ft from the selected altitude, the lights extinguish.

Deviation Alerting

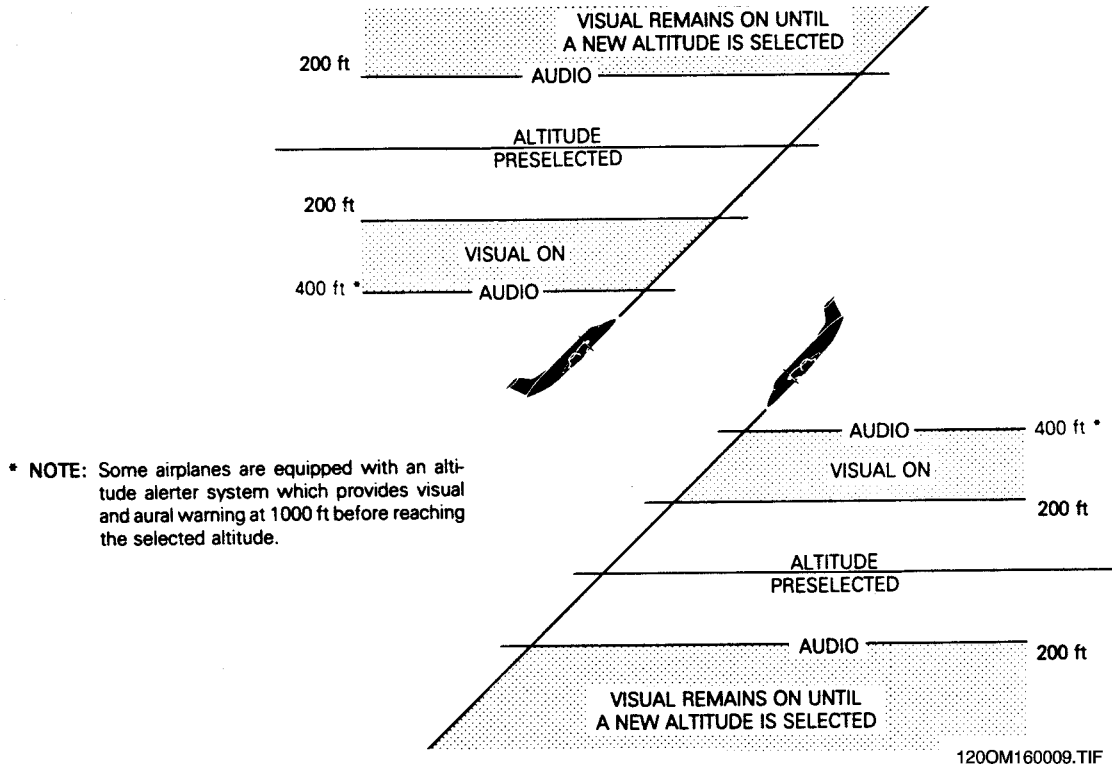
Upon deviating from the selected altitude by more than 200 ft, the lights illuminate and the audio signals sounds. The lights will remain lit until the airplane reenters the 200 ft range from selected altitude or until a new altitude is selected.

The figure below depicts the altitude alerter system operational sequence.

NOTE: If two different altitudes are selected (for airplanes equipped with two altitude alerter pre-select panels), altitude alerting will only occur for the first selected altitude reached. To have the altitude alerting for the second pre-selected altitude, it is necessary to reset the activated system by the selecting a new altitude on the applicable panel.



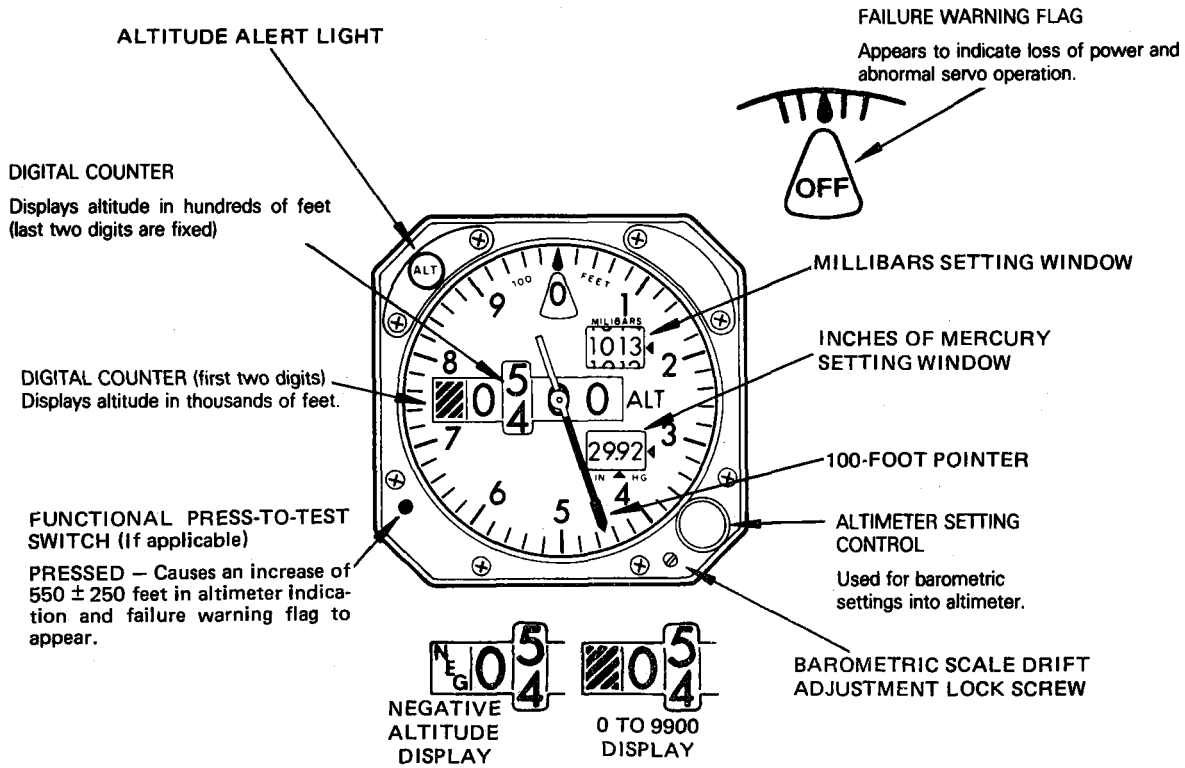
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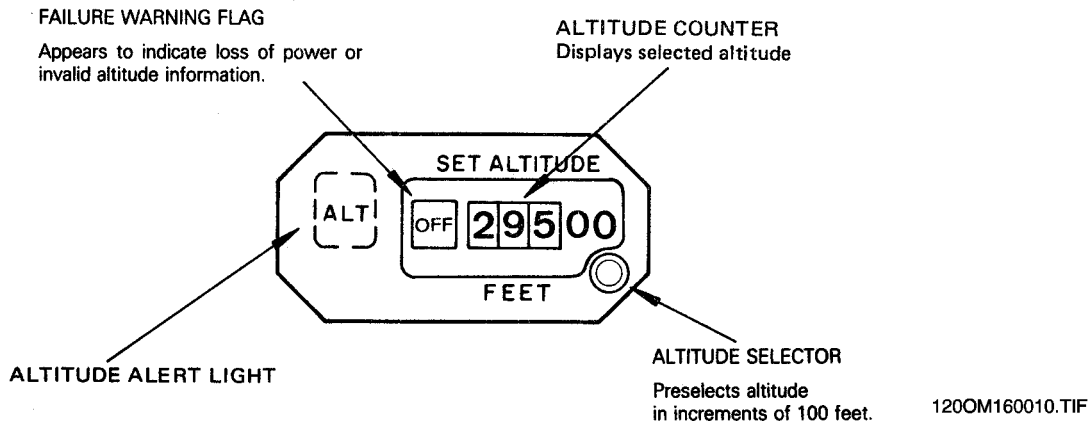
OPERATIONAL SEQUENCE

Altitude information for the altitude alerter system is obtained from the servo altimeter.

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**SERVO ALTIMETER
(PILOT'S PANEL)**



**ALTITUDE ALERTER PRESELECT PANEL
(GLARESHIELD PANEL OR
CENTER PANEL)**

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OPERATIONS MANUAL

CLOCK TIMER

A clock timer is installed on each control wheel. Selection of clock or timer operation is done by pressing the MODE button. In the Timer mode an annunciator appears above the word TIMER. In the Clock mode there's no annunciator.

CLOCK MODE

Clock mode displays time (hours, minutes). When the ST-SP button is pressed, the clock mode displays date (month, day) for 2.5 seconds and then returns to the Clock Display mode. The display will then automatically return to the Clock Display mode displays date (month, day) for 2.5 seconds.

TIMER MODE

The timer initially keeps track of minutes and seconds, with the colon blinking each second. After 59 minutes and 59 seconds the timer will keep track of hours and minutes, with the colon blinking each ten seconds, up to 23 hours and 59 minutes.

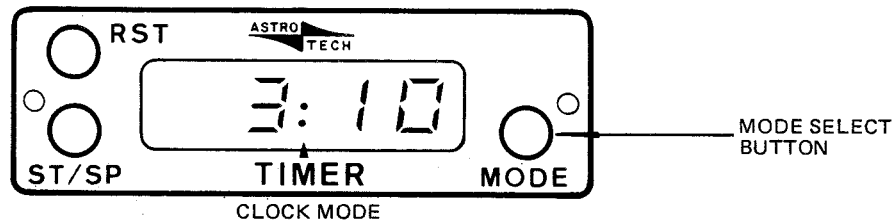


DATE SETTING

Pressing the RST button one time the month's digit will flash, then the month's digit will be advanced to the desired month by pressing and holding the ST-SP button.
Pressing the RST button once more the day's digit will flash, then the day's digit will be advanced to the desired day by pressing and holding the ST-SP button.
Pressing the RST button again the date is set.

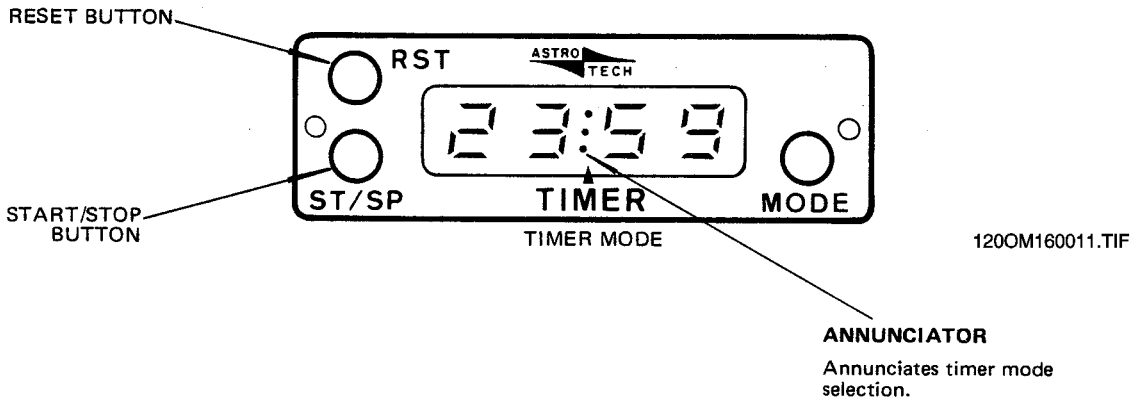
TIME SETTING

Hour and minute setting is analog to date setting. The minute should be set to the next minute to come up on the time standard being used for the correct time. The RST button is pressed once more to hold the time displayed. When the time standard shows the exact time displayed, the ST-SP button should be pressed to start the clock function at the exact second.



TIMER OPERATION

Pressing the RST button, the time will read zero.
Pressing the ST-SP button one time the timer will start counting.
The timer count may be stopped and held at a particular time by pressing the ST-SP button. Pressing ST-SP button again, the timer will continue counting up from the previous total.



**CLOCK-TIMER
(PILOT AND COPILOT'S CONTROL WHEEL)**

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CLOCK/CHRONO

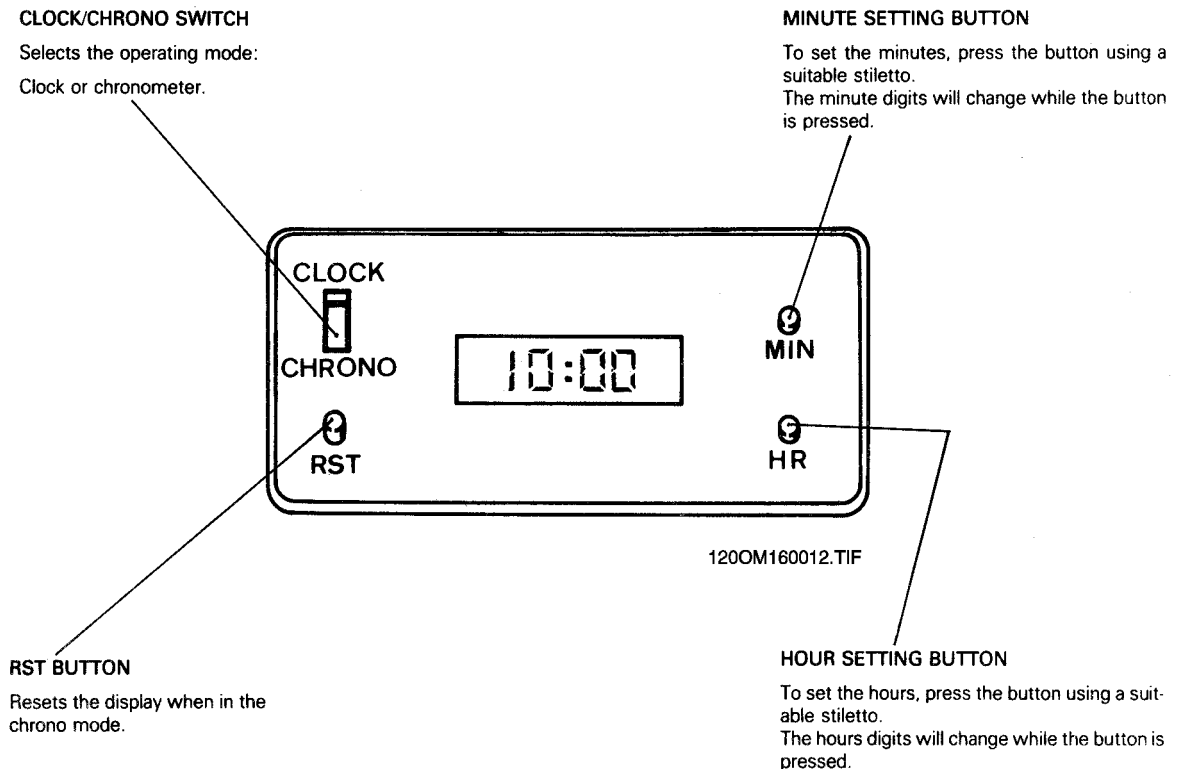
A digital clock/chrono may be installed on each control wheel replacing the clock timer. In normal flight conditions the clock is powered by the RELAY BOX DC BUS 2 and BACK-UP buses. When the airplane is deenergized the clock display blanks, but its internal circuitry remains fed by the HOT BATT BUS, avoiding the need for hour setting every time the airplane is energized.

CLOCK MODE

When the CLOCK/CHRONO switch is set to CLOCK position, time (hours, minutes) is displayed.

CHRONO MODE

When the CLOCK/CHRONO switch is set to CHRONO position, the display will indicate a random number. Pressing the RST button the display is reset and the chrono function is initiated. The chronometer cycle is 20 minutes.



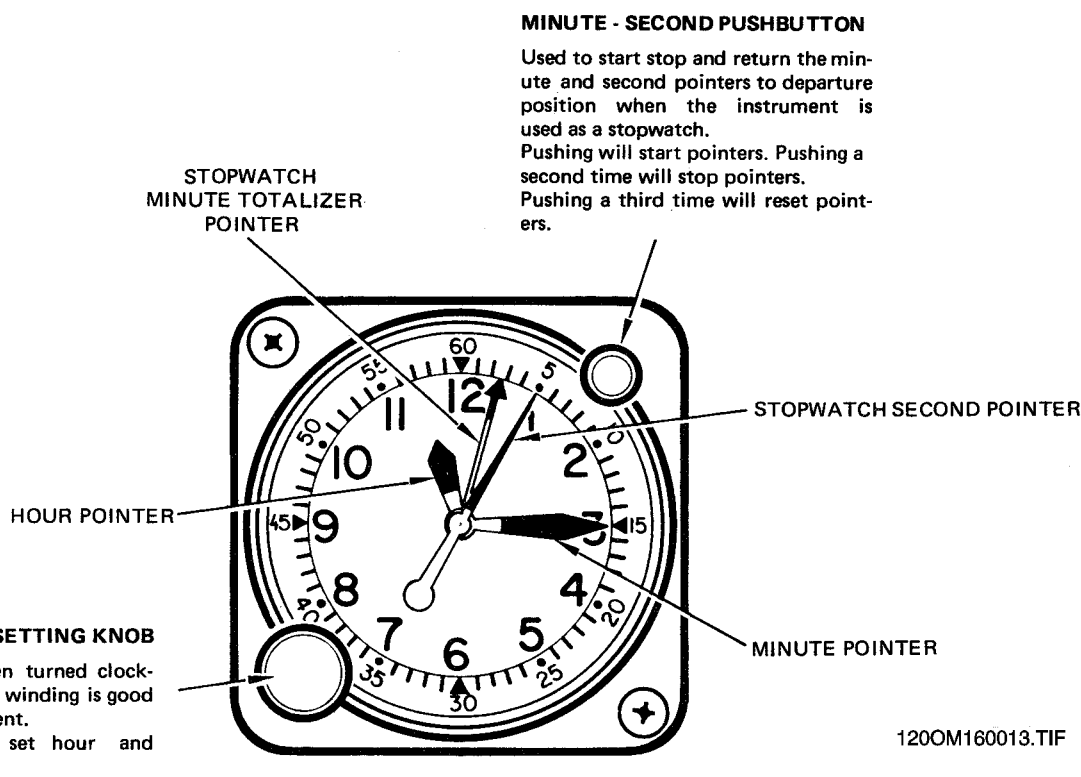
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CLOCK/CHRONO
(PILOT AND COPILOT'S CONTROL WHEEL)



OPTIONAL CLOCK

An optional wind driven clock may be installed on the instrument panel, in addition to the clock-timers installed on the control wheels.



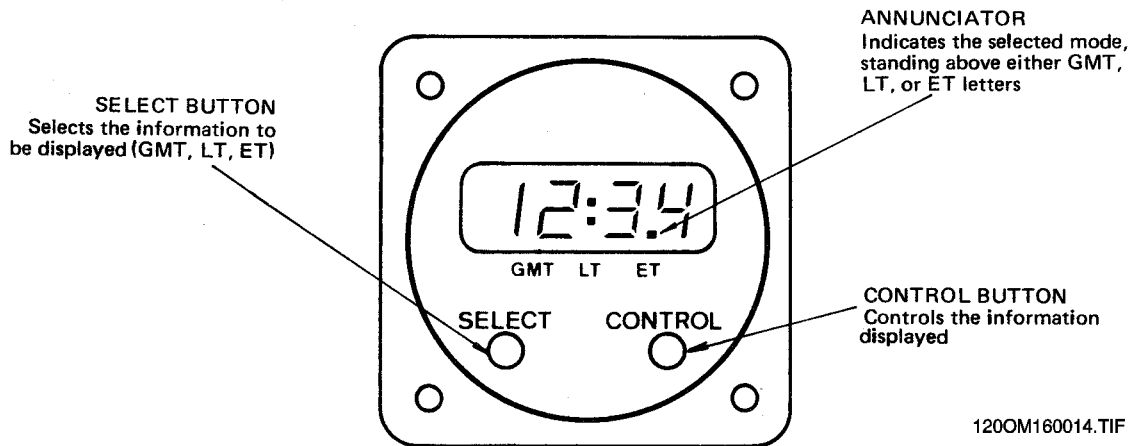
OPTIONAL CLOCK (PILOT'S AND COPILOT'S PANEL)

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OPTIONAL DIGITAL CLOCK (DAVTRON M-800)



SETTING GMT (GREENWICH MEAN TIME)

Select GMT with the SELECT button. Press SELECT and CONTROL buttons simultaneously to enter set function. The tens of hours will start flashing. Press CONTROL button as many time as required to set the flashing digit. Once the digit is set, press SELECT button to select the next digit to be set. After setting the last digit, press SELECT button. The display annunciator will resume its normal flashing to indicate the clock is running.

SETTING LT (LOCAL TIME)

Setting LT is similar to GMT, except that minutes are already synchronized with GMT and cannot be set.

ET (ELAPSED TIME) COUNT DOWN

Entering the time is similar to GMT time setting. When the time is entered, press momentarily CONTROL button to start countdown. When the count reaches zero the display flashes and the external alarm is activated. Press either SELECT or CONTROL button to deactivate the alarm. Then ET continues counting up.

ET COUNT UP

Select ET Press CONTROL button to start ET counting up. The display will show minutes: seconds until 59:59, then hours minutes until 99:59. Press CONTROL button again, when required, to reset ET to zero.

TEST MODE

Press and hold SELECT button for 3 seconds. Check if the display shows 88:88 and all annunciators on.

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STANDBY HORIZON

The standby horizon indicator provides attitude information that is independent of the primary attitude displays.

The indicator is powered by the 28 V DC airplane bus. It is also powered by the emergency battery which provides reliable operation for at least 30 minutes after total failure of the airplane electrical generating system.

In addition, the rotor speed and mechanical erection systems enable the indicator to provide useful attitude information for a minimum of 9 minutes after complete loss of the electrical power to the indicator.

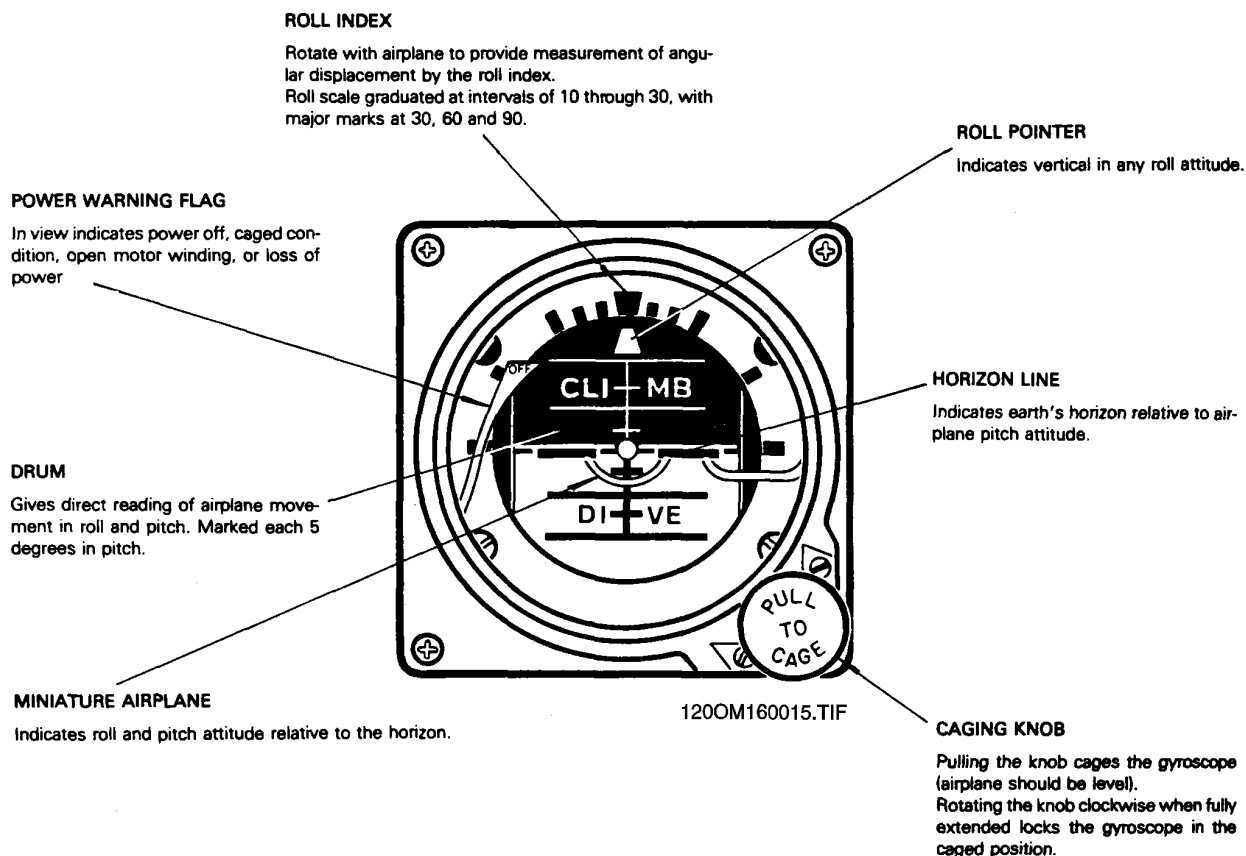
It is recommended to cage-lock the indicator before the airplane is energized. The indicator should be uncaged after the airplane is energized, by pulling the knob and rotating it counter clockwise.

The indicator will be completely stabilized within 3 minutes after releasing the knob.

Any adjustment during flight, although not normally required, should be made by bringing the airplane to level flight, and momentarily caging the indicator.

The indicator should be cage-locked after the airplane is de-energized.

NOTE: Never cage-lock an operating Standby Horizon while the airplane is in motion.



STANDBY HORIZON INDICATOR
(CENTER PANEL)

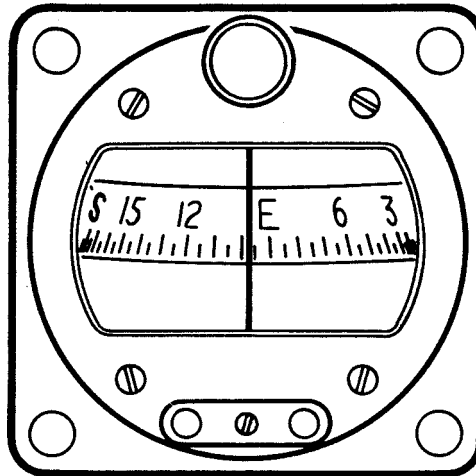
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MAGNETIC COMPASS

A standard liquid-damped magnetic standby compass is provided.
A card located at the top of the compass provides heading correction factors.
A card with heading correction factors for the standby compass when an electrical emergency occurs is provided.

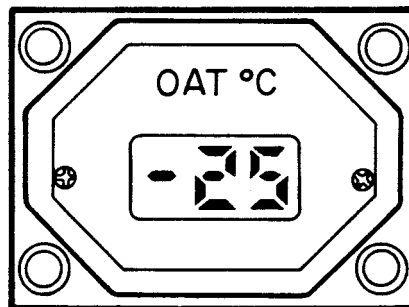


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**MAGNETIC COMPASS
(WINDSHIELD MOUNTING BRACKET)**

OUTSIDE AIR TEMPERATURE INDICATOR

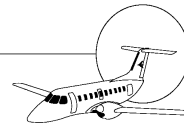
Receives signal from a thermistor sensor located on front fuselage external skin and indicates the outside air temperature in degrees centigrade.



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**OUTSIDE AIR TEMPERATURE INDICATOR
(PILOT'S PANEL OR CENTER PANEL)**

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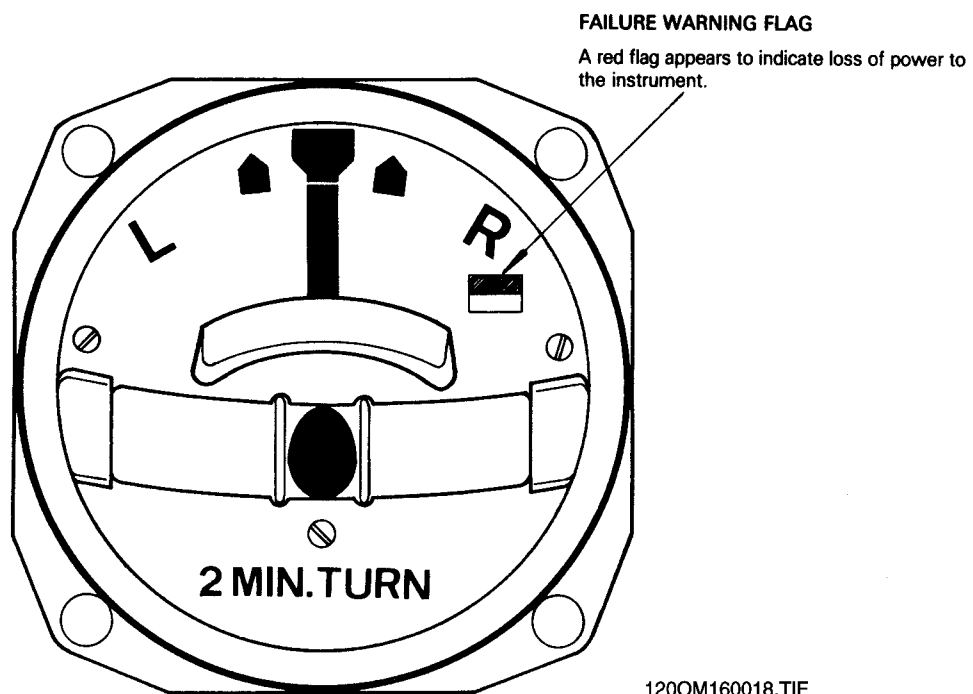
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TURN AND BANK INDICATOR (OPTIONAL)

It is a conventional "ball-and-pointer" instrument calibrated for 2 minutes turns. When the pointer is displaced in a distance equal to its width, the rate of turn is 1°30' per second or 360° in four minutes.

When the pointer covers the side index, it means that the aircraft is describing a standard 360° turn in 2 minutes.

NOTE: Some airplanes are equipped with the turn and bank indicator installed on the pilot's panel only.



TURN AND BANK INDICATOR
(PILOT AND COPILOT'S PANEL)

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20 JANUARY 2002



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FLIGHT DATA RECORDER SYSTEM (FDRS) (OPTIONAL)

The FDRS system consists of one Flight Data Acquisition Unit (FDAU), one Flight Data Entry Panel (FDEP), one Digital Flight Data Recorder (DFDR) and airplane systems sensors.

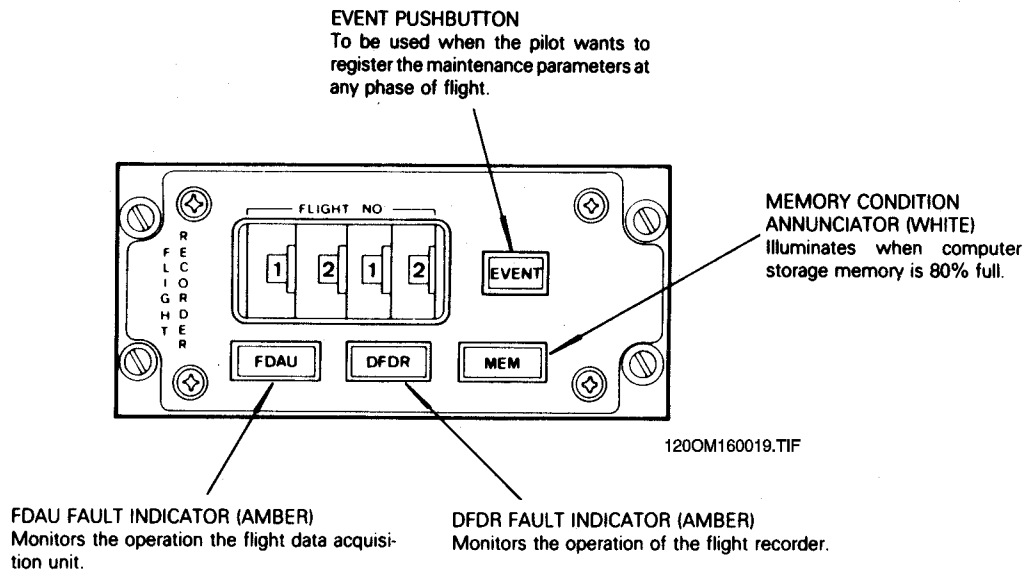
The FDAU receives information in the form of analog and discrete signals from existing airplane systems and transducers. These signals are transformed into serial digital data and then recorded in the DFDR. The DFDR records the latest 25 hours.

The parameters to be collected are classified as mandatory and maintenance. For airplanes equipped with 16-channel FDRS, the mandatory parameters are: time, altitude, airspeed, vertical acceleration, lateral acceleration, longitudinal acceleration, heading, pitch attitude, roll attitude, pitch trim control, pilot's control column, pilot's control wheel, rudder pedal, N_p , torque, Beta mode, flap angle and PTT action. Airplanes equipped with 28-channel FDRS have the following mandatory parameters also recorded: marker beacon passage, glide slope deviation, localizer deviation, NAV frequency selection, DME distance, master warning, angle of attack, GPWS warnings, hydraulic low pressure, landing gear lever position, radio altitude, autopilot mode, copilot's control column and copilot's control wheel position. In addition, the DFDR records the following maintenance parameters, which are also stored in the FDAU non-volatile memory for engine trend monitoring and exceedance tracking: T_6 , N_H , static air temperature, bleed condition, fuel flow, propeller imbalance, GND/AIR condition, and condition lever position. The FDAU starts to store the maintenance data when the condition lever is out of FUEL CUT OFF position. The parameters will be enabled to be recorded by the DFDR from the moment that the airplane is energized. However, these parameters will only be recorded by the DFDR when the Rotating Beacon switch is positioned to ON, or when the airplane is airborne.

The DFDR is mounted on an anti-vibration rack, located in the baggage compartment. An impact switch automatically cuts off electrical power to the system if a crash occurs. An Underwater Location Beacon, externally attached to the DFDR case, transmits a 37-kHz signal when submerged.

The Teledyne version of FDEP has four thumbwheel switches for entering flight numbers, two amber failure lights (DFDR and FDAU), a white MEM indicator light, and the EVENT pushbutton.

The Sextant version of FDEP has three amber lights (FDR, FDAU and MEM), two buttons (EVENT and TEST) and one multiple selector that allows setting and displaying the flight number, date, local time, and GMT time (Greenwich Mean Time).



**FLIGHT DATA ENTRY PANEL (FORWARD PANEL)
TELEDYNE VERSION**

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GMT, LOCAL TIME, DATE AND FLIGHT NUMBER INDICATOR

Displays time in 24 hours format.
 Displays date alternating between month/day and year.
 Displays flight number from 0000 to 9999.

CHRONOMETER BUTTON

Pressed once starts the chronometer.
 Pressed the 2nd time stops the chronometer.
 Pressed the 3rd time, resets to zero and returns the indicator to the elapsed time.
 Increments digits when setting time, date, and flight number.

INDICATING LIGHTS

FDR - Illuminates when FDR is failed.
 FDAU - Illuminates when FDAU is failed.
 MEM - Illuminates when the computer storage memory is 80% full.

CHRONOMETER POINTER

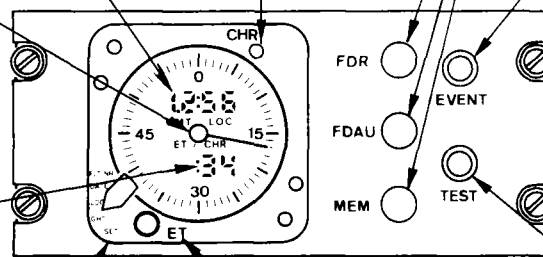
Indicates chronometer seconds.

EVENT BUTTON

To be used to register the maintenance parameters at any phase of flight.

ELAPSED TIME AND CHRONOMETER INDICATOR

Displays flight time from 0 to 99 hours 59 minutes.
 ET is incremented only inflight and can be reset only on ground.
 Displays chronometer minutes from 0 to 99. Chronometer displaying doesn't affect ET value.



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TEST BUTTON

Performs the system test. All the lights, annunciators and segments of the digital indicators come on while the button is pressed.

MULTIPLE SELECTOR

FLT NR - Displays the flight number.
 - Permits to set the flight number (successively press ET button to select thousands, hundreds, tenths, or units digits; then press CHR to increment the selected digit).

DATE - Displays date.

LOC - Displays local time.

GMT - Displays GMT time.

SET - To be used for time setting.
 - Successively press ET to select GMT minutes, GMT hours, LOC minutes, LOC hours, days, months and years (on power up, year is preset to 90). Selected function flashes on and off. Press CHR button to increment selected function.

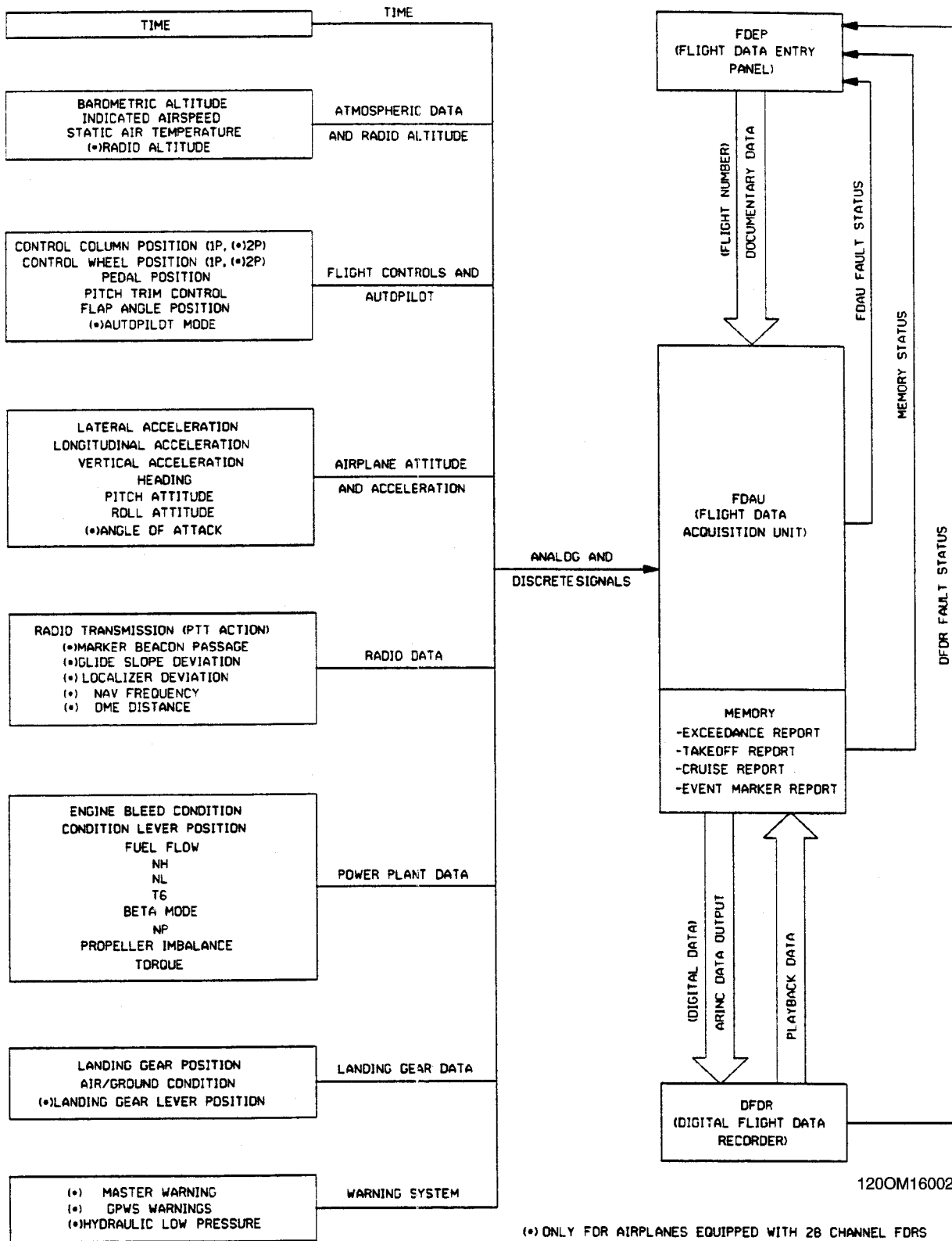
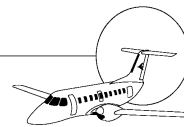
ELAPSED TIME BUTTON

Successively pressing:
 On ground - Displays ET.
 - Resets ET to zero.
 - Displays chronometer minutes.

Inflight - Alternates between ET and chronometer minutes.

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**FLIGHT DATA ENTRY PANEL (FORWARD PANEL)
 SEXTANT VERSION**



FLIGHT DATA RECORDER SYSTEM (FDRS) SCHEMATIC