AUTOPILOT SYSTEM

The Flight Control system is an integrated 3-axis autopilot and flight director, containing automatic elevator trim control. The system is configured for dual flight directors and is certified for ILS Category 2 operations.

The system consists of the following:

- Two FCC-4005 Flight Control Computer modules which are installed in the Integrated Avionics Processor Subsystem (IAPS).
- FCP-4004 Flight Control Panel
- One SVO-85C/SMT-86C servo and mount
- Two SVO-85B/SMT-86B servos and mounts

Malfunction Protection

The flight control system uses a multi-layered approach to respond to failures which occurs within the system and data from external sensors. Malfunction protection and response is provided by a dual channel main processor (Level II verified) and I/O processor (Level I verified) architecture. The main processor provides protection against flight guidance data failures and single channel attitude control failures. The I/O processor provides additional limiters and monitors including protection for possible generic software design errors in the main processor program.

Flight Guidance Data Failures

When there is a failure detected in any sensor data used in the flight guidance computations, the system internally reverts to the basic mode for the affected axis, pitch attitude hold for vertical modes and roll attitude hold for lateral modes. If the failure condition remains for a period of time, typically four seconds, the flight director display will remove the steering command and annunciate the failure by placing a red line through the active mode annunciation. The flight director

returns to normal operation if the data returns to a valid condition.

Response to undetected flight guidance data is provided by pitch and roll attitude and attitude rate limiters. These limiters will limit aircraft response to those approaching normal maneuvering; 5 °/sec of roll rate in the lateral axis, and 0.2g in the vertical axis.
Aircraft response to failures which result in main processor servo commands within the maximum rate limit are limited by the I/O processor cutout function and servo torque limiting. If the aircraft exceeds predetermined attitudes, attitude rates, or accelerations, the I/O processor will zero the command going to the servo control loop. The servo will drive the control surface toward the position it was in prior to the malfunction. The cutout switch is activated only if the command is in the opposite direction to arrest the malfunction.

In addition to the cutout function, servo torque is limited through direct electronic limiting of servo motor current. By limiting the maximum rate of change of the control surface, torque limiting limits the aircraft response prior to cutout operation.

Servo Control Failures

The dual channel analog servo control architecture provides fully fail passive response to failures occurring within the servo control function.

The pilot's flight director commands are computed in one FCC-4005 module and the copilot's flight director commands are computed in the other module. Using the CPL switch on the FCP, the pilot selects which flight director steering commands are displayed on both PFD’s with two exceptions. In approach or go-around modes, left flight director commands are displayed on the left PFD and right flight director commands are displayed on the right PFD. The autopilot, if engaged, is always coupled to the selected flight director. The selected flight director commands are sent to the attitude loops in both computers where identical computations are performed using redundant sensor data for command limiting and feedback. The resulting servo commands in each computer are fed to the analog servo loop where they are voted before being applied to the servo.

The FCP-4004 Flight Control Panel (Figure 7-5-53) is a single unit that controls two independent flight guidance systems using the following controls:

CRS knob (2) - Provides control of the pilot and copilot selected courses. The knobs are continuously turning with no mechanical or electrical stops. An integral button in center of the knob provides a direct-to function.

ALT SEL knob - Controls the altitude preselect display on the PFD. The knob is continuously rotating with electrical stops at -1000 ft and 50,000 ft. Normally each “click” of this switch changes the preselected altitude by 1000 foot increments. The switch has a second position that is achieved by pulling the knob away from the panel. The increment size is changed to 100 ft per click. In either position, the full range (-1000-50,000) is available. Movement of the switch automatically arms altitude select, except when in approach mode.

HDG/TRK knob/selector - Consists of a lower two-position selector, an upper continuously turning knob, and an integral center button. The selector sets the reference for pilot selected angles - track or heading (TRK is only available when an IRS is installed). The knob is used to select the desired angle. The button provides a “sync” to current angle function.

Vertical Speed/Pitch Wheel - Has two separate functions. If vertical speed mode is active, this wheel is used to change the vertical speed reference proportionally to the rotation angle. If vertical speed mode is not active, movement of this wheel deselects any vertical mode that may be active (except glideslope capture) and selects pitch mode. In pitch mode, rotation of the wheel changes the pitch reference proportionally to the rotation angle.

AP/YD DISC disconnect bar - Provides a positive means of disconnecting the autopilot and yaw damper by directly removing power from the servos. Once the autopilot and yaw damper are disconnected using this means, the bar must be restored to its normal position before reengagement is possible.

FD pushbutton (2) - Selects and removes the steering commands on the PFD. At power up, the steering commands are displayed on the PFD. Steering commands are selected on both PFD's by engaging the autopilot, selection of go around mode, automatic selection of overspeed mode, or by manual selection of a vertical or lateral mode, when steering commands are not displayed on either PFD and the autopilot is not engaged. Coupling to a flight director selects the steering commands on the coupled side, if steering commands are displayed on either side, or if the autopilot is engaged.

AP pushbutton - Engages or disengages the autopilot. Note that there is also an AP disconnect switch mounted on each pilot control wheel. Engagement of the autopilot automatically engages the yaw damper.

YD pushbutton - Engages or disengages the yaw damper. Manual engagement/disengagement of the yaw damper is completely independent of autopilot engagement.

CPL pushbutton - Controls the routing of flight guidance commands to the autopilot and flight directors. The coupled side is indicated by illumination of the appropriate arrow adjacent to the CPL pushbutton. When the left arrow is on, the autopilot uses flight guidance commands from the pilot channel. When the right arrow is on, the autopilot uses guidance commands from the copilot channel. Except when in ILS approach submode or go-around modes, the CPL pushbutton controls which flight guidance commands

drive the flight director command bars. In approach and go-around modes, the flight directors operate independently.

The following pushbuttons are momentary pushbuttons used to select/deselect modes. Unless the active mode is approach, selection of a lateral or vertical mode respectively, automatically deselects any other lateral or vertical mode. Unless the active mode is go-around, a second press deselects the mode. Go-around is cleared by autopilot engagement or selection of another mode:

HDG/TRK pushbutton - Automatically selects and clears either heading select mode or track select mode, based upon the setting of the HDG/TRK select knob. When in heading select mode, or track select mode, changing the position of the HDG/TRK select knob clears one mode and select the other.

BANK pushbutton - Allows the pilot to override the FCS automatic transitions to/from half bank mode. Half bank limits the maximum command bank angle to 12.5°. Half bank is indicated by a green * prefixed to the lateral capture message on the PFD.

Selection of half bank is inhibited when lateral go-around is active by onside localizer/azimuth capture/track, or by onside FMS navigation capture/track.

NAV pushbutton - Selects/deselects the NAVIGATION mode. In NAV mode the autopilot uses the active navigation source selected on the Display Control Panel (DCP).

APPR pushbutton - Selects/deselects the APPROACH mode.

B/C pushbutton - Selects/deselects the BACK COURSE mode. There is no automatic selection of BACK COURSE mode.

ALT pushbutton - Selects/deselects the ALTITUDE HOLD mode.

VNAV pushbutton - Selects/deselects the VERTICAL NAVIGATION mode. In VNAV mode, the autopilot follows pitch commands generated by the FMS.

FLC pushbutton - Selects/deselects the FLIGHT LEVEL CHANGE mode. In FLC mode, desired airspeed is synchronized to the aircraft's current speed at the time of mode selection. This speed can then be slewed up/down using the SPEED rotary switch on the Air Data Reference Panel (ARP). When FLC mode is selected, a climb or descent submode is entered automatically based on the difference between the aircraft present altitude and the preselected altitude. If the preselected altitude is higher than the current altitude, the climb submode is entered. If the preselected altitude is lower than the current altitude, the descend submode is entered. In either case, a minimum vertical speed is implemented, which forces the aircraft toward the selected altitude with a certain minimum vertical speed.

VS pushbutton - Selects/deselects the VERTICAL SPEED mode.

There are two additional autopilot switches external to the panel. A momentary button on the control wheel serves as the primary means to disconnect the autopilot. A momentary button on the thrust levers engages the go-around mode.

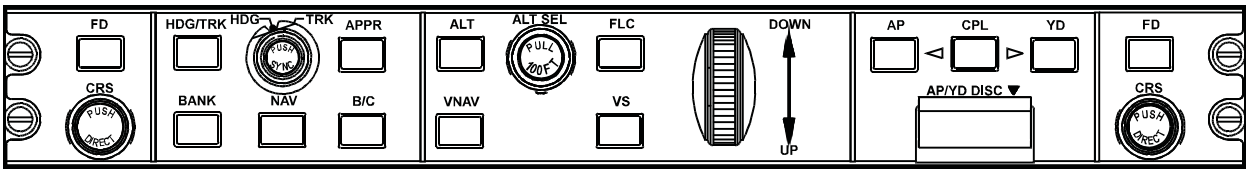

Figure 5-53. FCP-4004 Flight Control Panel

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The Electronic Flight Instrument System consists of the following:

- Four EFD-4077 7.25 inch square Electronic Flight Displays (color)
- Two DCP-4002 Display Control Panel
- Two RSP-4000 Reversionary Switch Panel
- Two INC-4000 Inclinometers
- One DAU-4000 Data Acquisition Unit

Two EFD's function as Primary Flight Displays (PFD), the other EFD's function as Multi Function Displays (MFD). All EFD's can implement both stroke and raster type images. All units in a multi display system receive sensor data from both sides of the aircraft, and provide comparison monitoring capability. Parameters typically monitored include roll, pitch, heading, altitude, and airspeed. In addition, the EFD is capable of monitoring localizer and glideslope information during an ILS approach. Comparator warnings are displayed on the PFD, and MFD.

The EFD-4077 display contains integral over-temperature sensing. This feature provides a red text warning on the screen when temperature rises to the level where automatic shutdown of the display occurs within the next five minutes.

The displays are installed in a side by side arrangement. Each pilot PFD is approximately centered over the control wheel with the MFD located immediately to the inside of the PFD.

The PFD (Figure 5-54) combines all the display functions of an attitude indicator, a Horizontal Situation Indicator (HSI), an altimeter, an airspeed indicator, a Vertical Speed Indicator (VSI), and a radio altimeter into one display format. The basic T arrangement of attitude, heading, airspeed, altitude is preserved.

(Continued)

The following data is displayed in the general area of the attitude ball:

- Roll attitude
- Pitch attitude
- Flight director command bars
- Digital radar altitude

The following data is displayed in the general area of the airspeed scale:

- Indicated airspeed
- Indicated mach
- Reference airspeeds (V_1,V_R, V_2 V_T, V_{Bug} - on airspeed scale)
- Digital selected airspeed
- V_{MO}/M_{MO}
- Airspeed trend vector
- V_{FE}

The following data is displayed in the general area of the barometric altitude scale:

- Barometric corrected altitude
- Barometric pressure
- Digital metric altitude
- Preselected altitude reference (on altitude scale)
- Digital preselected altitude
- Digital preselected metric altitude
- Minimum descent altitude reference (on altitude scale)
- Decision Height Reference (on altitude scale)
- Digital minimum descent altitude
- Digital decision height
- Vertical radio sensor deviation (ILS/MLS)
- Vertical navigation deviation (FMS)

The following data is displayed in the general area of the vertical speed scale:

- Vertical speed
- Digital vertical speed (including direction)
- Selected vertical speed reference
- Digital selected vertical speed (including direction)
- TCAS resolution advisories (optional)

The following data is displayed in the general area of the compass arc:

- Heading type annunciation (magnetic/true/DG)
- Selected heading or track bug
- Digital selected heading or track
- Course arrow
- Course deviation indicator
- To/from indicator
- Digital course
- Navigation source annunciation
- Active station/waypoint ID
- Digital distance to station/waypoint
- Track indicator
- Bearing pointer
- Bearing pointer source annunciation
- Digital selected MLS glidepath angle
- Elapsed time
- Digital static air temperature (SAT - reversionary display)
- Digital total air temperature (TAT - reversionary display)

The following data is displayed in the general area of the flight control system modes field:

- Active flight director/autopilot modes
- Armed flight director/autopilot modes
- Mistrim annunciations (pitch, roll, yaw)
- Yaw damper actuator not centered (on ground only)

In addition, various caution and alert annunciations are provided. These include the following:

- Sensor flags attitude, airspeed, altitude, TCAS (optional), etc.
- Sensor comparators (pitch, roll, airspeed, altitude, radar altitude, localizer, glideslope, heading)
- Reversion annunciations (attitude/heading, radio altimeter, air data computer, display control panel)
- AHRS STIM mode annunciation
- Display overheat annunciation
- Minimum descent altitude annunciation
- Decision height annunciation
- Marker beacon annunciation (outer, middle, inner)
- Excessive deviations for Category II approaches (airspeed, localizer, glideslope)

In general, the following color code is used for both PFD and MFD symbology:

- Green represents on-side sensor data
- Yellow represents cross-side sensor data or other abnormal annunciations
- Cyan represents pilot selected data
- Magenta represents secondary data
- Red represents limitations exceeded or not to exceed, or failure flag

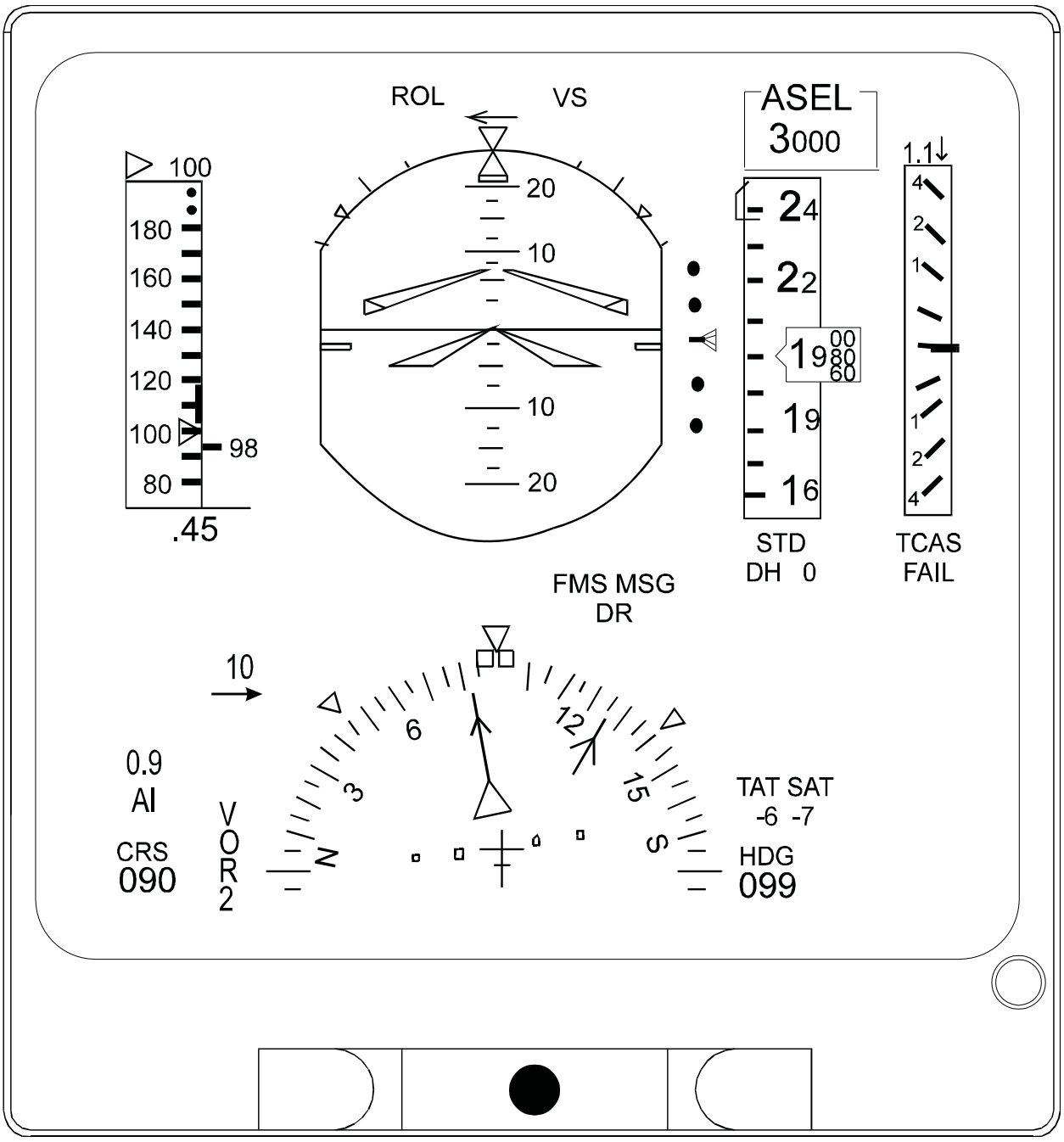

Figure 5-54. Primary Flight Display (PFD)

The MFD (Figures 5-55 and 5-56) can display any of the eight display formats listed below:

- Rose
- Arc
- VOR map
- Present map
- Plan map
- TCAS traffic display (optional)
- Remote
- PFD

The active format is selected by the pilot using the DCP or the RSP.

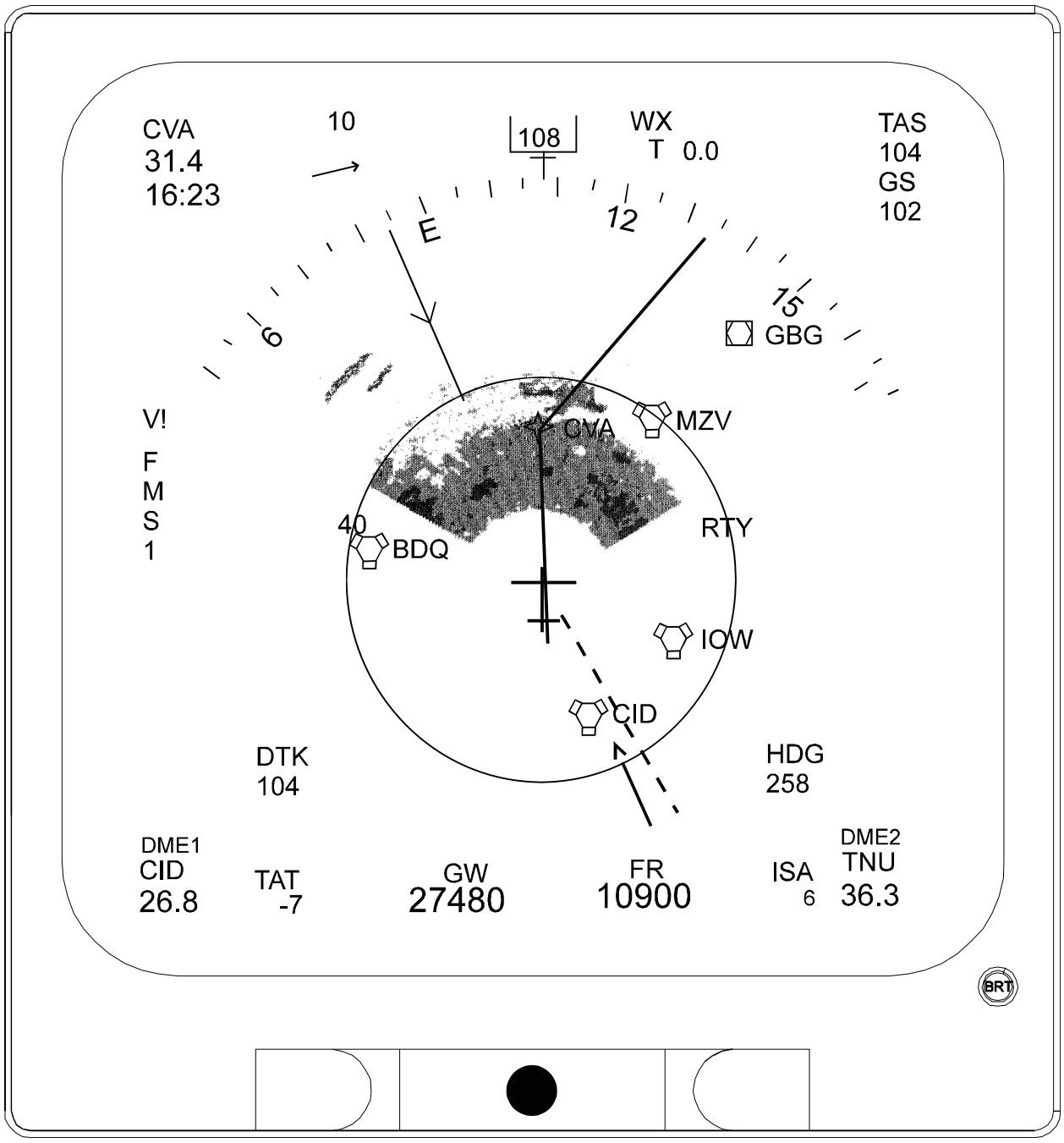

Figure 5-55. MFD Radar Display

The following information is displayed on the MFD regardless of the selected display format (except remote and PFD):

- True airspeed (TAS)
- Groundspeed
- Wind direction and magnitude
- Total air temperature (TAT)
- Static air temperature (SAT)
- DME 1 channel 1 identifier and distance
- DME 2 channel 1 identifier and distance

In addition to the data listed above, the pilot can choose to display radar imagery on all formats except the ROSE. Note that if radar imagery is selected while displaying a plan map, the format is automatically changed to present position map.
When the ROSE format is selected the following additional information is displayed:

- 360° compass rose
- Heading
- Heading type annunciation (magnetic/true)
- Selected heading or track bug
- Digital selected heading or track
- Course arrow
- Course deviation indicator
- To/from indicator
- Digital course
- Navigation source annunciation
- Active station/waypoint ID
- Digital distance to station/waypoint
- Digital time to station/waypoint
- Track indicator
- Bearing pointer
- Bearing pointer source annunciation
- Selected MLS azimuth
- Selected MLS glidepath

The ARC mode displays the same data as the ROSE mode with the exception that instead of a compass rose, a partial compass arc of 120° is displayed across the top of the display.

The present position map displays a map graphically depicting the locations of various navigation stations, waypoints, flight plans, etc., with respect to the airplane. The airplane symbol can be shifted “down” on the map display if desired to give a more extensive forward view of the map. Also, a 5 line block of text from the FMS can be displayed if desired. This field is enabled from the FMS. The exact content of the map is controlled by the FMS.
The plan map is similar to the present position map except that instead of the map being centered around the present position of the airplane, the map can be arbitrarily centered about any geographic point selected by the pilot via the FMS. If the airplane position is within the display range of the map, an airplane symbol is displayed with its position relative to the map center and oriented according to its heading.

For both the present position map and the plan map, the FMS transmits all data to be displayed directly to the MFD via a high speed ARINC 429 data bus. Each MFD supports two independent map buses. The data protocol is ARINC 702. The FMS periodically transmits all symbols with absolute latitude/longitude coordinates.

The MFD software then correctly places the symbols relative to the map center. The MFD performs rotation and translation of the map symbols between map updates from the FMS.
The optional TCAS traffic display format displays a present position centered map with the relative position of intruder aircraft. The altitude and direction of vertical movement of these aircraft are shown as well. Both different symbols and colors are used to indicate non-threat, caution, or warning conditions. In addition, TCAS traffic symbology can be overlaid on the rose, arc, VOR map, or present position map.

The Remote format configures the MFD to operate as a remote ASCII display. In this configuration, the autopilot, FMS, or MDC can display text data.

The PFD format is a reversion capability in which the normal PFD symbology is displayed on the MFD.

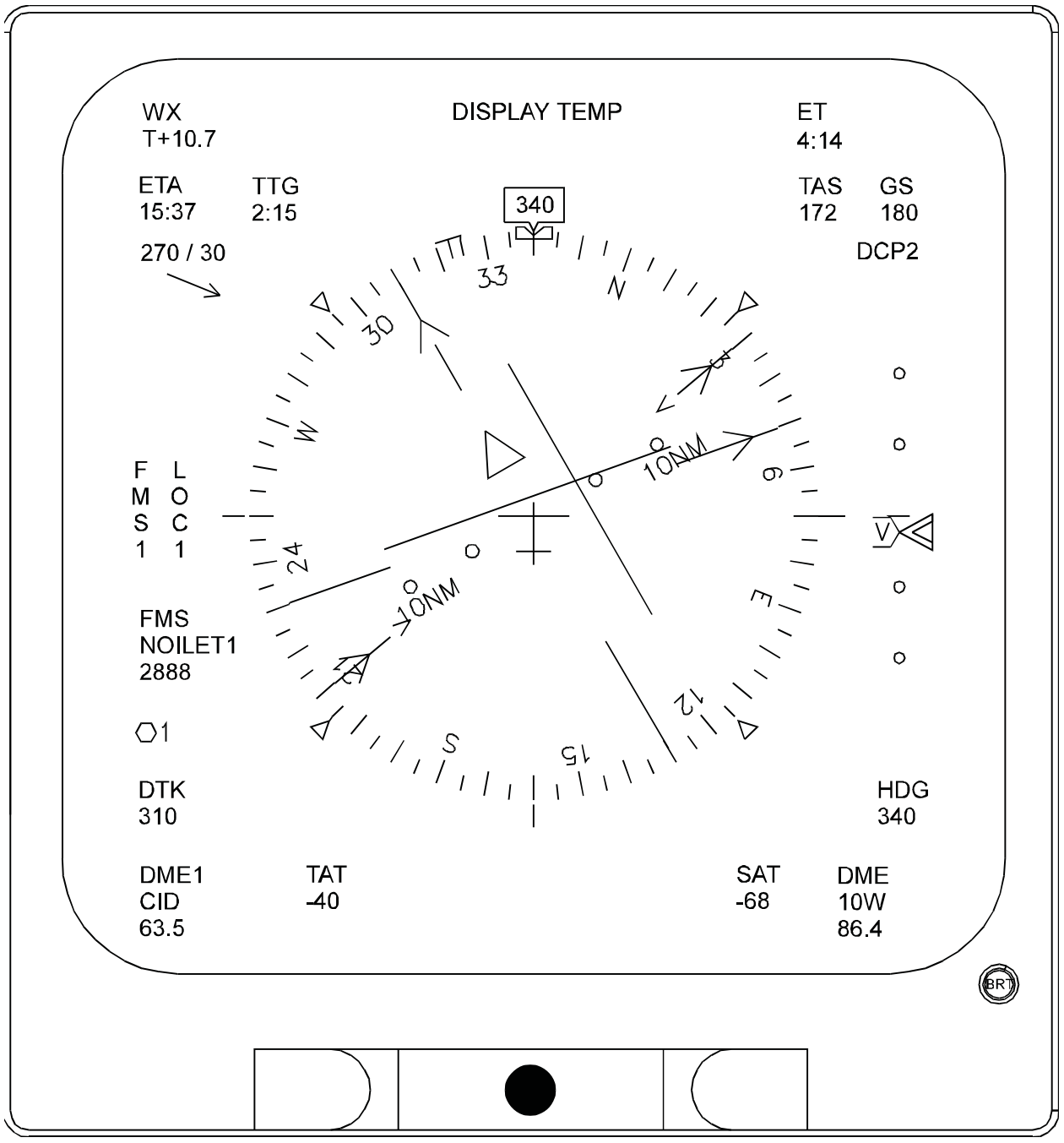

Figure 5-56. Multifunction Display (MFD)

The DCP-4002 Display Control Panel (Figure 5-57) controls the display of information on the on-side PFD and MFD.

BRG knob - Controls the selected bearing pointer. The knob is continuously turning with electrical stops but no mechanical stops. The default sensor selection is on-side. A center integral button allows selection of cross-side sensors. The bearing pointer is selected from the blind menu listed below:

- Off (most counterclockwise position)
- VOR
- ADF
- FMS

RDR momentary pushbutton - Used to enable/disable the display radar imagery.

TFC momentary pushbutton - Used to enable/disable the display of optional TCAS traffic symbology on the MFD. TFC is an FAA directed acronym for TRAFFIC.

FMS momentary pushbutton - Used to select the source for FMS generated maps (present position and plan) for dual FMS configurations. For single FMS configurations the switch is inactive. The default source for FMS generated maps is the on-side FMS unless the selected navigation source is cross-side FMS. Sequential pressing alternately select the other or default map source.

(Continued)

MFD MODE/RANGE knob - Dual stage continuously turning switch assembly. The lower knob selects the desired MFD display format from the menu listed below:

- Rose
- Arc
- Map
- Plan map
- TCAS
- Remote

The upper knob selects the desired range for both the MFD and the radar.

ET momentary pushbutton - Used for control or the elapsed timer display.

NAV SOURCE knob - Continuously rotating switch with electrical stops but no mechanical stops. The default sensor selection is on-side. A center integral push button switch allows selection of cross-side sensors. The switch selects the navigation source for both the PFD and MFD from the following menu:

- VOR/LOC (most counter clockwise position)
- FMS
- MLS (most clockwise position)

MAG/TRUE pushbutton - pressed to select magnetic north or true north based heading information. When true north information is selected **TRU** is annunciated to the left of the compass card on the PFD. True north heading information is only available if the heading source is an Inertial Reference System. Otherwise, the button is inactive.

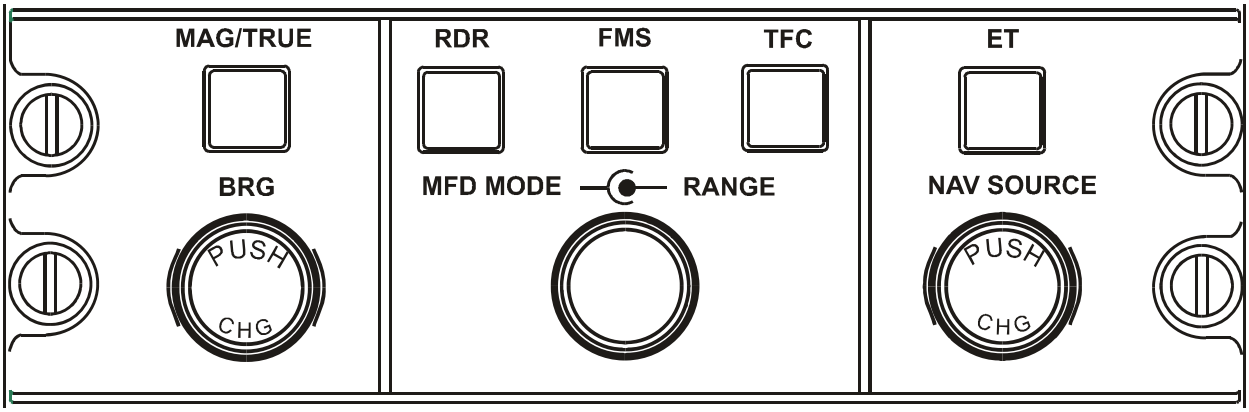

Figure 5-57. DCP-4002 Display Control Panel

The RSP-4000 Reversion Switching Panel (Figure 5-58) provides both reversion control of sensors and displays.

All pushbuttons on the RSP are mechanically latching. All but the PFD switch are electrically interlocked with the corresponding cross-side RSP pushbutton such that only one side can be reverted at a time. The pilots side has priority (reversion on the pilot side either cancels or prevents reversion of the same sensor on the copilot side).

AHS XFR pushbutton - Pressed to select the cross-side attitude heading system, The pushbutton remains in and the alternate source is identified by a boxed **AHS1**, **AHS2** or **AHS3** (if installed) annunciation on the onside PFD. Second press reselects the on-side attitude heading system. The pushbutton comes out, and the alternate source annunciation is removed.

ADC XFR pushbutton - Pressed to select the cross-side air data (computer) system. The button remains in and the alternate source is identified by a boxed **ADC1** or **ADC2** annunciation on the onside PFD. Second press reselects the on-side air data system. The pushbutton comes out and the alternate source annunciation is removed.

DCP XFR pushbutton - Pressed to select the cross-side DCP. The pushbutton remains in and the alternate control source is identified by a boxed **DCP1** or **DCP2** annunciation on the PFD. Second press reselects the on-side DCP. The pushbutton comes out and the alternate control source annunciation is removed.

ED pushbutton - Selects EICAS display. If an MFD is selected to be an ED while the center display is still operable, the reverted MFD will automatically display the EICAS status page. The EICAS page button will page only the reverted MFD while the center EICAS display remains on the primary engine format. If only a single display is functioning as an ED, the page button will cause the ED to page between the primary engine format and the two status pages

PFD MFD pushbutton - Pressed to display PFD information on the MFD. The button remains in, the PFD blanks and the MFD displays the PFD information. Second press reselects the normal formats. The pushbutton comes out, the PFD displays PFD information, and the MFD displays MFD information.

When the pilot's PFD is selected on the MFD, the speed target may change.

Recommended actions: before selecting reversionary switch, disengage the autopilot FLC mode or the autothrottle if engaged. After reversion is complete, verify that the speed target is correct, then reselect the desired autopilot vertical mode and autothrottle (if installed).

DIM knob - Controls the dimming of the on-side PFD and MFD. The lower skirt of the knob controls the dimming of the PFD, and the upper part of the knob controls the dimming of the MFD

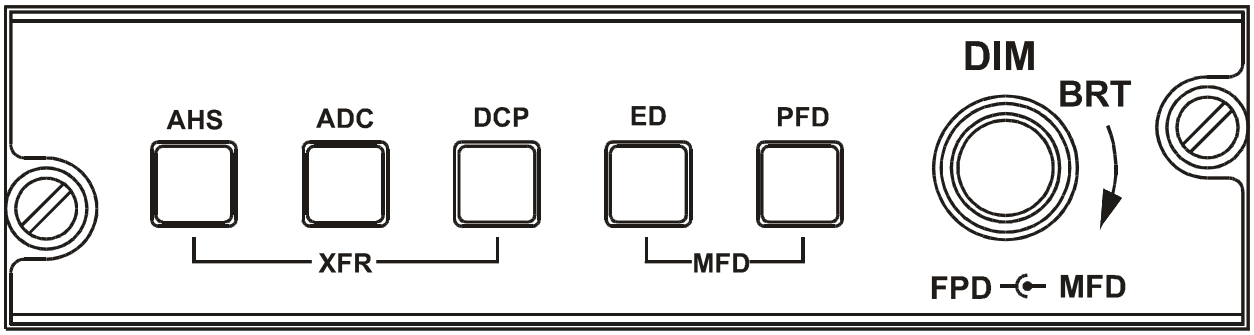

Figure 5-58. RSP-4000 Reversionary Switching Panel

EFIS Caution Messages

EFIS MISCOMPARE - EFIS data difference (heading, attitude, LOC, G/S etc.)

EFIS COMPRTR FAIL - EFIS comparator system malfunction

DATA ACQUISITION UNIT

The DAU-4000 Data Acquisition Unit provides the primary interface between the Collins Pro Line 4 system and the aircraft systems. The DAU accepts discrete, analog, and serial digital inputs and concentrates these inputs onto low speed ARINC 429 serial digital buses. In addition, the DAU provides drivers for annunciators and aural alerts in the aircraft.

RADAR ALTIMETER SYSTEM

The ALT-4000 Radar Altimeter System provides height above the terrain from 2500 feet to touchdown. The system consists of the following equipment types:

- ALT-4000 Receiver/Transmitter
- ANT-52 Antenna (2)

Radar altitude and decision height, as well as DH annunciation, are displayed on the PFD. A pilot operated control for setting DH and activating self-test is located on the ARP-4002 (See Figure 5-51).

WEATHER RADAR SUBSYSTEM

The Weather Radar System consists of:

- RTA-858 Receiver/Transmitter/Antenna Assembly
- WXP-4220 Weather Radar Control Panel

The weather radar provides a gyro stabilized, four color (green, yellow, red, magenta) display. The magenta color indicates areas of very heavy rainfall rates - two inches per hour or greater. In addition, **PAC** Alert indicates areas of unknown rainfall rates caused by intervening areas of precipitation. In addition to the expected function of detecting precipitation, the weather radar also detects accompanying turbulence. The Doppler frequency shift is used as the basis for this detection. The weather radar picture is displayed on the MFD of the Electronic Flight Instrument System.

The RTA-858 Receiver/Transmitter/Antenna, an all solid-state receiver/transmitter/antenna/processor assembly. This 18 inch diameter unit mounts on the front bulkhead. Mounted on the forward portion of this unit is the flat plate radiator. Directly behind the antenna is the RF assembly, consisting of an IMPATT diode based solid state transmitter, and the receiver. No wavegudie is required because of this packaging.

The receiver/transmitter/antenna moves as a single unit as the system scans. This assembly is mounted on a drive mechanism which contains the motors and gears for the scan and tilt process.

The WXP-4220 Weather Radar Panel (Figure 5-59) provides all the system operating controls, except RANGE selection, to the RTA-858 for system operation. Weather Radar RANGE selection is provided by the DCP-4002.
The WXP-4220 features transfer switching for RANGE selection. Other WXP-4220 functions include auto-tilt, reduced sector scan, and an inflight stabilization alignment mode for the RTA.

The WXP-4220 contains three rotary knobs (two with integral buttons) and three mode control pushbuttons as follows:

Six position mode selector - Used to select the various operating modes of the weather radar system:
OFF - Removes power from the RTA and also removes all radar displays except the **RADAR OFF** annunciation on the display from the side on which OFF was selected.
TEST - Initiates the RTA self-test function and causes the **RADAR TEST** annunciation to be displayed.
MAP - Causes the RTA to use a mapping STC curve until maximum sensitivity is reached.
WX - Causes the RTA to operate in a weather detection mode.
W+T - Causes the RTA-858 to operate in the weather detection mode in addition to detecting areas of turbulence. If a range greater than 40 nm is selected, the system operates in weather detection only mode. The TURB position is spring loaded. When TURB is selected, non-turbulence radar returns are removed and only turbulence is displayed. The TURB mode is only operational for ranges of 40 nm or less.

GAIN knob - Selects radar gain. Settings of -3, -2, -1, NORM, +1, +2, and +3 are provided, with mechanical stops at each end. Ground clutter suppression is selected for momentary display with the PUSH GCS button and is only valid when WX mode is selected.

TILT knob - Continues to function for manual adjustment of tilt from -15° to +15° in quarter and half degree steps. The PUSH AUTO integral button (push on/push off) selects the autotilt function of the weather radar system. Selection of autotilt causes the RTA to automatically estimate new tilt settings when RANGE setting is changed or when aircraft altitude changes.

STAB pushbutton - Selects antenna stabilization. In off situation, **STABILIZATION OFF** is annunciated on the MFD display.

SEC pushbutton - Selects reduced antenna sweep of ±30° and a correspondingly reduced display of radar reflectivity.

XFR pushbutton - With a single WXP installed, the same control selections are always sent to both channels of the radar, and reflectivity data from both channels is always displayed on all radar displays. All radar control selections except radar range originate in the WXP. Radar range is controlled with the DCP (Display Control Panel) RANGE knob on the same side of the cockpit as the WXP. Pressing XFR transfers radar range control to the cross cockpit DCP RANGE knob. A **WXP TRANSFER** annunciation comes on the MFD display on the side that does not have control of radar range.

After initial installation or repair activities that affect antenna alignment, electronic trim is provided for use during flight to align the antenna. Electronic trim is selected by pushing a button behind a small hole in the front panel of the WXP-4220.

The system provides the safety enhancing features of heavy rainfall rate emphasis and indicators of areas of unknown precipitation rate.

A second WXP-4220 is an option to the turbulence detecting weather radar system. Each of the two WXP-4220s would control a channel of RTA-858. Pressing the XFR button on one WXP, transfers complete control of all functions to the other WXP. Only one WXP's functions can be transferred at one time.

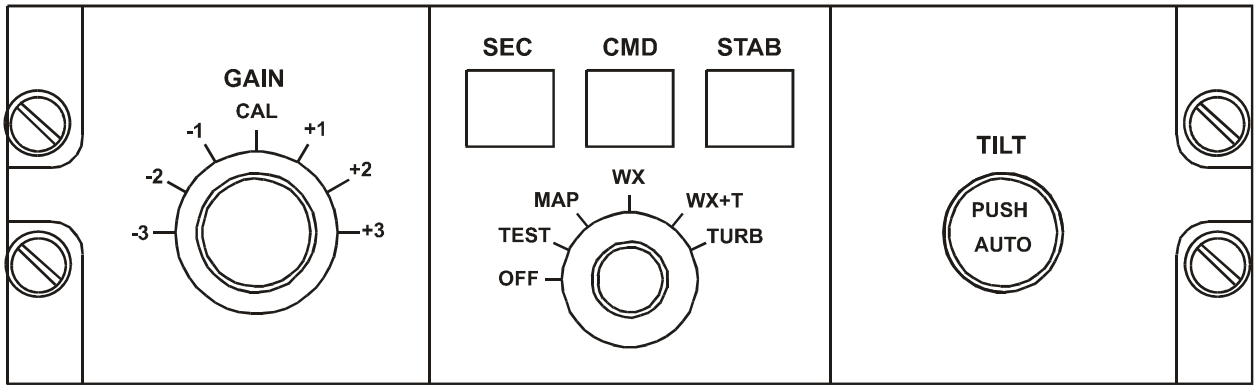

Figure 5-59. WXP-4220 Weather Radar Panel

RADIO SYSTEM

The Radio Tuning system (Figures 5-60) consists of:

- Two RTU-4220 Radio Tuning Units
- One ADF-462
- One ANT-462A
- Two DME-442
- Two TDR-94
- Two VHF-422A/B/C
- Two VIR-432
- One TCAS (See supplement No. 2)

RTU-4220 Radio Tuning Unit

The RTU-4220 (Figure 5-60) provides centralized control and display functions for the installed radio (Comm/Nav/ATC) suite. The RTU employs an active matrix LCD display with soft, page dependent, keys, three dedicated function keys and two concentric knobs. The RTU has the capacity to control all of the following equipment:

- Three VHF transceivers
- Two VOR/ILS receivers
- Two DME transceivers
- Two ADF receivers
- Two Mode S transponders

- Two HF transceivers
- TCAS
- Marker beacon sensitivity

Each RTU is capable of controlling the entire radio suite. Control functions are only displayed for installed radios.
VHF tuning is possible with 25 kH_Z or 8.33 kH_Z spacing.
The RTU has a reversionary HSI display providing VOR or localizer and glideslope deviation as well as DME distance information, TCAS and marker sensitivity control.

With Mod 10154 installed, the following systems are modified to enable the requirements of enhanced surveillance (EHS) flight ID capability:

- TDR-94D, P/N 622-9210-004 is modified to P/N 622-9210-008 with SB 501 and 502.
- RTU-4220, P/N 822-0730-214 is modified to P/N 822-0730-234 with SB 501.
- IOC-4000, P/N 622-9814-302 is modified to P/N 622-9814-322 with SB 507.

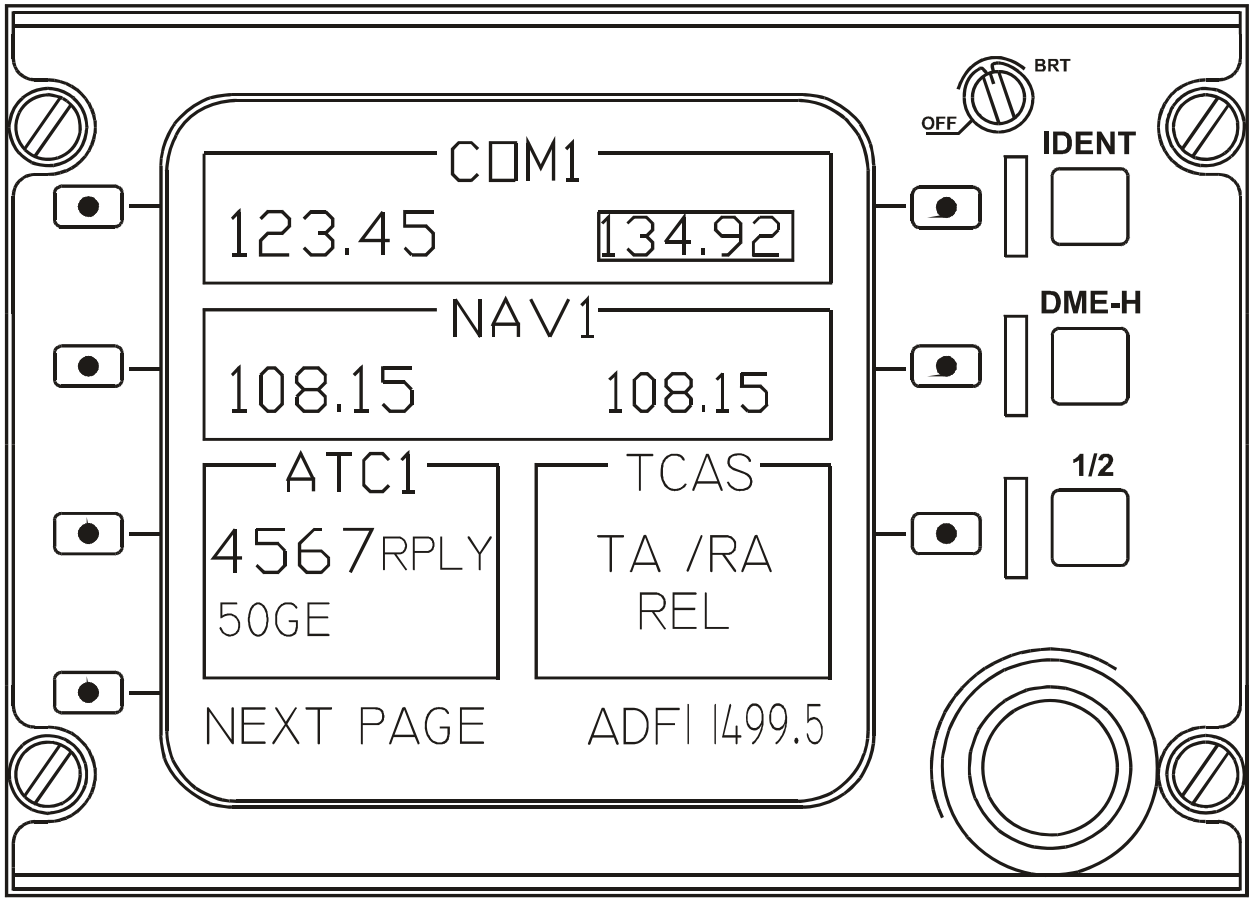

Figure 5-60. RTU-4220 Radio Tuning Unit

VHF Communication

The VHF communication is provided by two VHF-422A/B/C VHF Comm Transceivers.

The Pro Line II VHF-422A/B/C is a digital radio. It accepts serial digital tuning in ARINC 429 format from the RTU-4220.

Transponder

The Air Traffic Control Radar Beacon is provided by two TDR-94 Mode S Transponders.

Navigation Sensors

The navigation equipment consists of:

- Two VIR-432 Navigation Receiver
- Two DME-442 Distance Measuring Equipment
- Two ADF-462 Automatic Direction Finder Receiver
- One ANT-462B Dual ADF Antenna

The VIR-432 Navigation Receiver is a fully-digital navigation receiver that provides reduced comm-to-nav interference and extensive full-time monitoring.

The DME-442 Distance Measuring Equipment uses microprocessor technology and provides complete information from up to three DME stations from a single receiver/transmitter.

The ADF-462 Automatic Direction Finder System consists of:

- ADF-462 Receiver
- ANT-462B Antenna

All sensors accept serial digital tuning in ARINC-429 format from the RTU-4220.

MAINTENANCE DIAGNOSTICS SYSTEM

The Maintenance Diagnostics Computer System consists of:

- One MDC-4000 Maintenance Diagnostics Computer
- One DBU-4000 (DBU-5000 with Mod 20271) Data Base Unit

The MDC-4000 is housed in the ICC-4005 and provides computation and storage of maintenance parameters for the avionics LRU's.

The DBU-4000 (Figure 5-61, sheet 1 of 2) is a self contained 3.5 inch floppy disk storage unit.

DBU-5000 (Figure 5-61, sheet 2 of 2) (Mod 20271) replaces DBU-4000. It has two USB ports, two tri-color LED's (one for each port), and a protective cover.

The DBU is mounted outside of the avionics rack where it is accessible for the insertion or removal of a floppy disk (or USB devices with DBU-5000). The DBU is used primarily to load database updates to the FMC, maintenance tables to the MDC, checklist data to the MDC and download maintenance data from the MDC.

(Continued)

The following units provide diagnostic information to the MDC.

TYPE NUMBER DESCRIPTION

ALT-4000 Radio Altimeter
ADC-850C Air Data Computer
ADF-462 Automatic Direction Finder Unit
AHC-85E (or AHC-3000 with MOD 7035) Attitude Heading Computer
CSU-4000 Central Strapping Unit
DBU-4000 Data Base Unit (DBU-5000 with Mod 20271)
DCP-4002 Display Control Panel
DAU-4000 Data Acquisition Unit
DME-442 Distance Measuring Equipment
EFD-4077 Electronic Flight Displays
FCC-4005 Flight Control Computer Module
IOC-4000 Input/Output Concentrator
PWR-4000 Power Supply
RTA-858 Receiver/Transmitter/Antenna
RTU-4220 Radio Tuning Unit
TDR-94D Mode S Transponder
VHF-422A/B/C VHF Comm Transceiver
VIR-432 Navigation Receiver

The Maintenance and Diagnostics System, is an integral part of the avionics system. It monitors line replaceable units to detect failures, isolates faults to a particular LRU and provides historical fault data.
Control of the system is done through the DCP and system diagnostic information is displayed on the MFD.
The Maintenance system is accessed by reverting either MFD to the maintenance mode. An easily understood menu system, The menu selection is controlled by using the associated DCP pushbutton. An appropriate DCP key reference is provided at the bottom of each maintenance page.

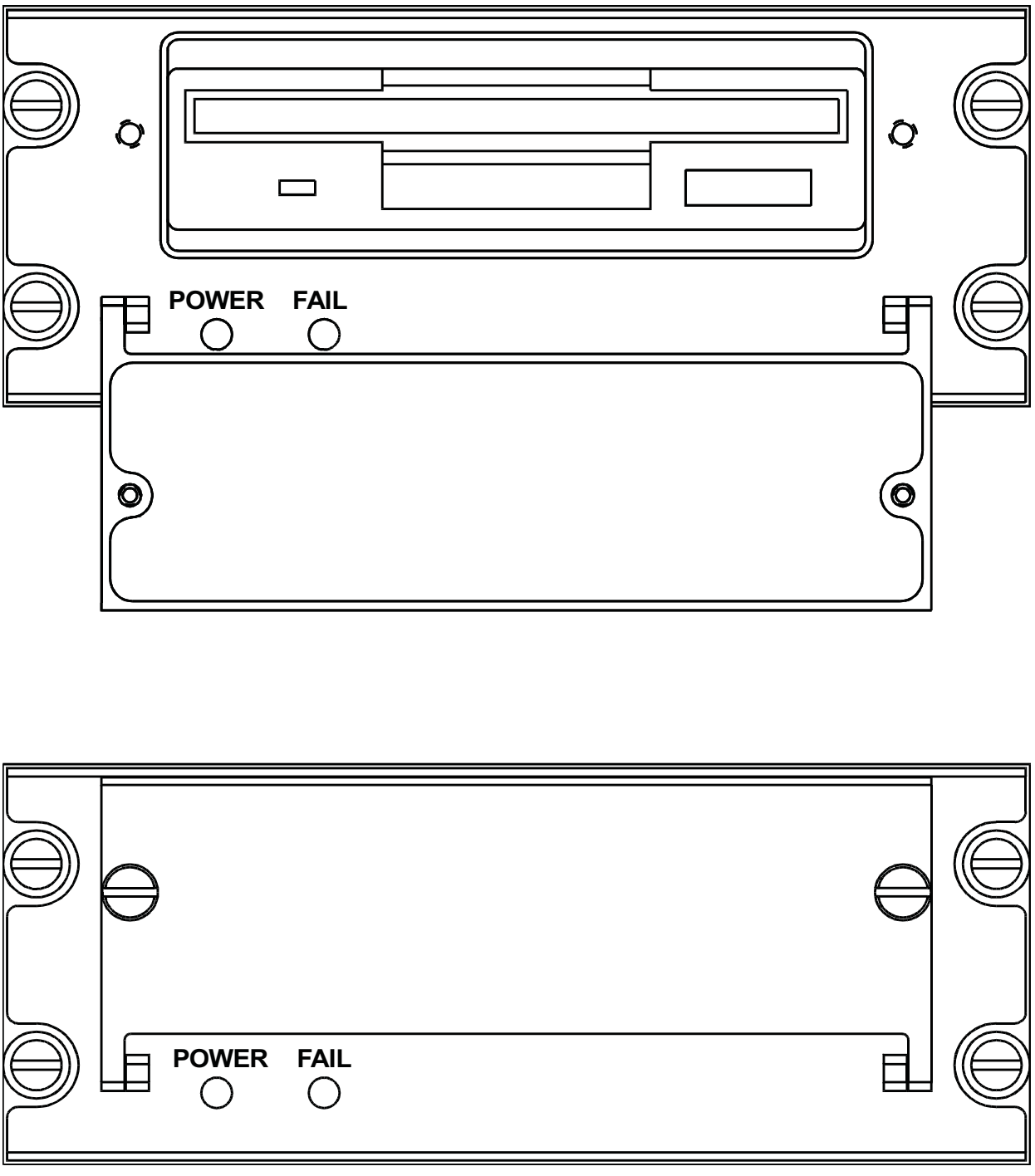

Figure 5-61. Data Base Unit; DBU-4000
Sheet 1 of 2

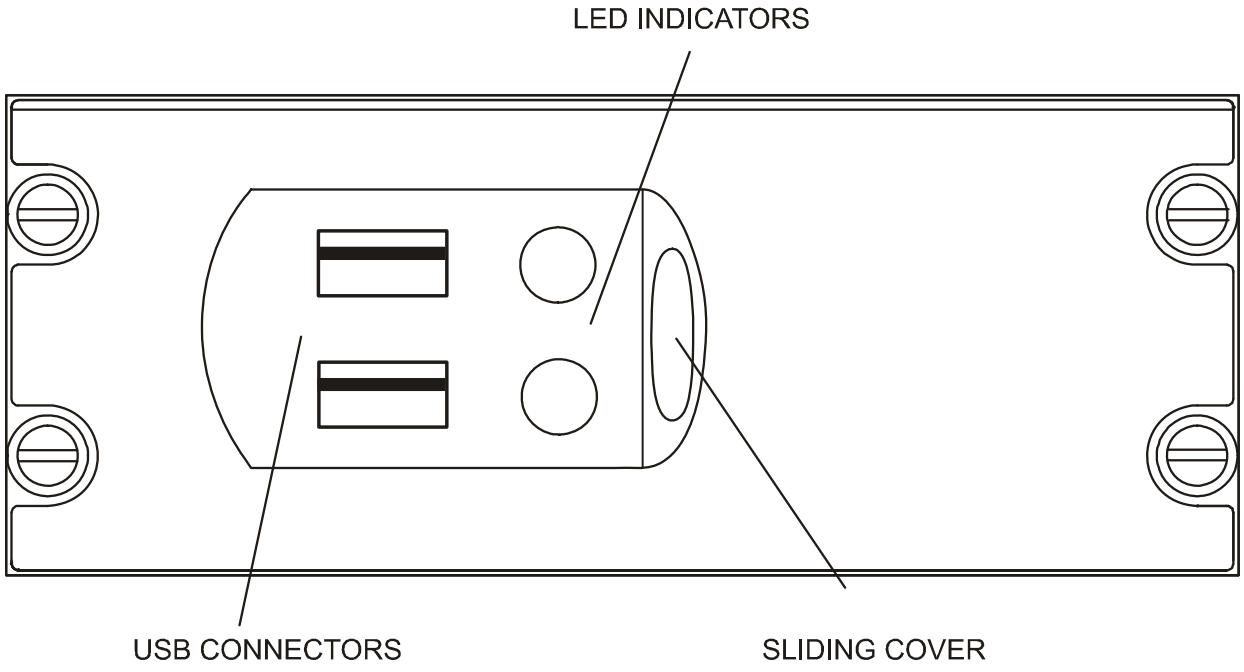

Figure 5-61. Data Base Unit; DBU-5000 (Mod 20271)
Sheet 2 of 2

INTEGRATED AVIONICS PROCESSOR SYSTEM

The IAPS Integrated Avionics Processor System is a physical collection of several functional modules combined into one mechanical package as follows:

- CSU-4000 Configuration Strapping Module
- ICC-4005 Integrated Card Cage (one unit)
- IEC-4001 Internal Environmental Control Module (2 Modules)
- IOC-4000 Input/Output Concentrator (4 modules)
- LHP-4000 Lightning/HIRF Protection Module (1 Module)
- LHP-4001 Lightning/HIRF Protection Module (1 Module)
- PWR-4000 Power Supply (4 modules)
- FCC-4005 Flight Control Computer (2 modules)
- MDC-4000 Maintenance Diagnostics Computer (1 module)

The PWR-4000 provides power to the IAPS modules.

The IOC-4000 Input/Output Concentrators provide data concentration and distribution for the aircraft. The IOC's receive inputs from various aircraft sensors, concentrate the data on redundant buses, and output the data to appropriate users, both inside and outside the IAPS.
The IAPS provides internal relays for reversionary switching for attitude sources (AHRS/IRS) and air data. The relays are controlled by the RSP-4000.

When energized, the attitude relay will electrically "replace" the deselected attitude source with the third attitude source. The RSP-4000 are electrically interlocked such that the third attitude source can only be selected by either the pilot or copilot - not both. Also, pilot selection has priority - it either cancels or disables copilot selection of the third source.

(Continued)

The outputs from the third attitude source are mapped to the IOC-4 bus for use by the FMS regardless of the state of the reversion relays. In normal operation, the FMS has access to all three attitude sources. During reversion operation, the FMS does not have access to the deselected sensor.

TCAS II SYSTEM

The TCAS II system consists of the following equipment:

- One TRE-920
- One TTR-920
- Two TDR-94D

The TDR-94D is a solid-state, air traffic control (ATC) transponder that responds to ATCRBS (Air Traffic Control Radar Beacon System) Mode A, Mode C, and Mode S interrogations. it is capable of operating through either of two antenna for air-to-air surveillance and communications.