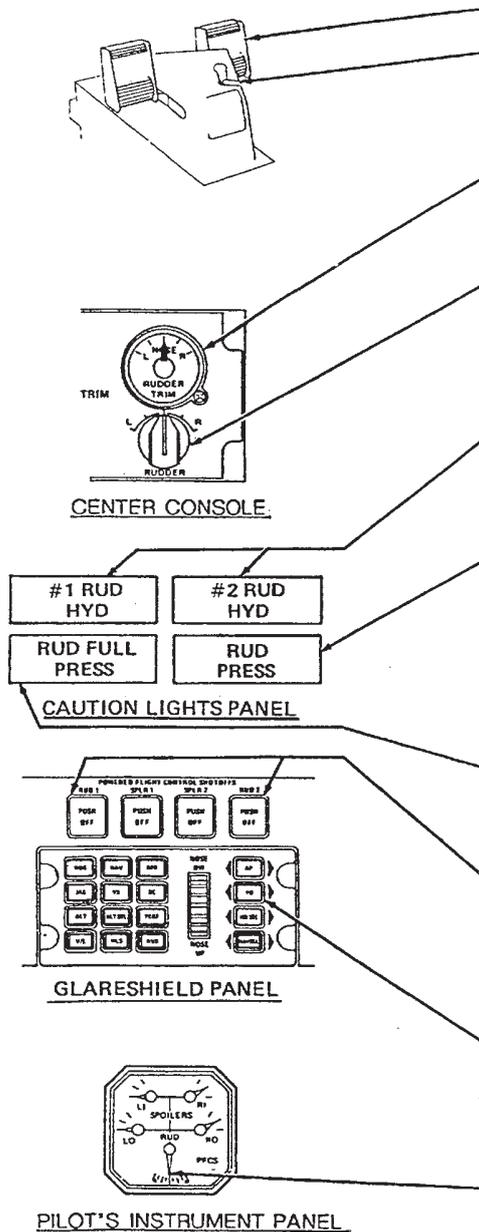


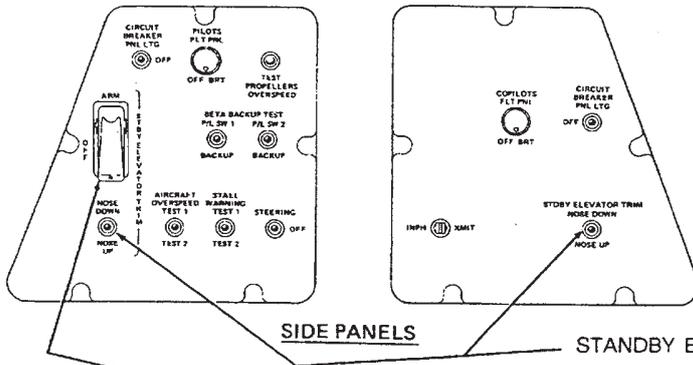
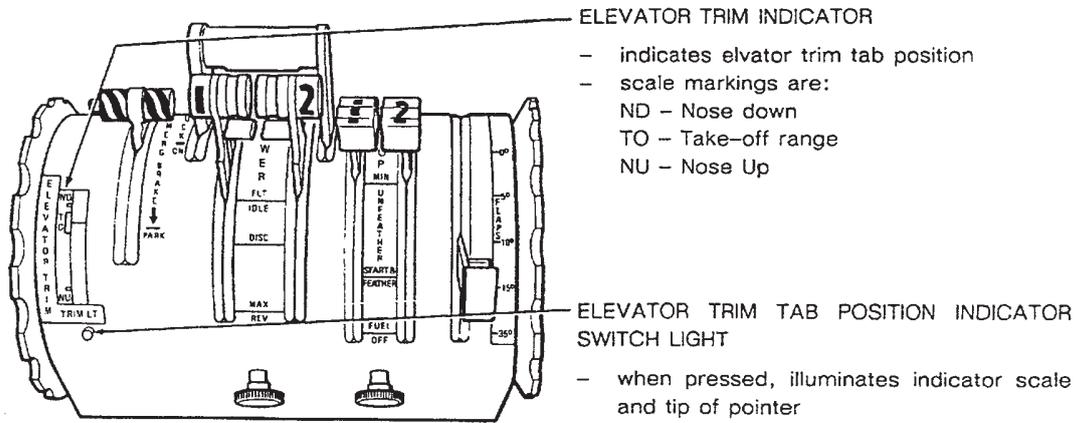
**FLIGHT CONTROLS**

**CONTROLS AND INDICATORS**



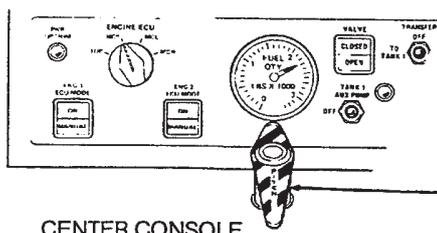
- RUDDER PEDALS
- RUDDER PEDALS ADJUSTMENT HANDLE
- ROTATE – extends or shortens distance of both pedals from operator
- RUDDER TRIM POSITION INDICATOR
  - indicates direction and amount of rudder trim applied
- RUDDER TRIM SWITCH (spring loaded to center)
  - ROTATE – selects two rates of trim in either direction, permitting fine or coarse adjustment.
- RUDDER HYDRAULIC PRESSURE CAUTION LIGHTS (AMBER)
  - ILLUMINATED indicates pressure loss at #1 or #2 rudder hydraulic actuator
- RUDDER HYDRAULIC PRESSURE REDUCTION CAUTION LIGHT (AMBER)
  - ILLUMINATED – failure of rudder pressure regulator to reduce to 900 psi when airspeed exceeds 150 kt.
  - illuminates if regulator fails to increase rudder pressure to 1500 psi when airspeed below 150 kt.
  - illuminates when system pressure is 3000 psi
- RUDDER FULL PRESSURE CAUTION LIGHT (AMBER)
  - ILLUMINATED – whenever 3000 psi is being applied to either rudder actuator
- RUDDER PUSH OFF SWITCH LIGHTS
  - either light illuminates to indicate a jam in the respective No. 1 or No. 2 actuator linkage
  - PUSH – depressurizes affected hydraulic actuator
- YAW DAMPER ENGAGE SWITCHLIGHT
  - PUSH – engages yaw damper
  - active channel annunciated by lighted pointer
- POWERED FLIGHT CONTROL SURFACE INDICATOR (PFCS)
  - RUD pointer indicates the position of fore rudder

*Rudder and yaw damper*



**STANDBY ELEVATOR TRIM SWITCHES**

- with arming switch at ARM, holding switch at NOSE DOWN or NOSE UP trims aircraft in pitch until switch is released



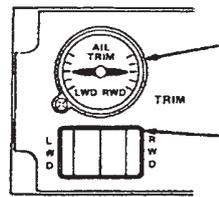
**STANDBY ELEVATOR TRIM ARMING SWITCH (GUARDED)**

- when selected to ARM (guard raised), control of pitch trim servo is transferred from autopilot to standby elevator trim switch

**PITCH DISCONNECT HANDLE**

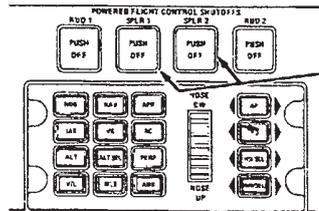
- when pulled out and rotated 90° clockwise or counterclockwise, the right side elevator control systems are separated from the left

*Elevators*



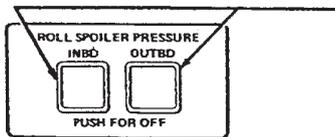
CENTER CONSOLE

- AILERON TRIM POSITION INDICATOR
  - indicates left wing down or right wing down trimming bias as selected on trim switch
- AILERON TRIM SWITCH (Rocker-type momentary switch)
  - controls electric actuator in right aileron for aileron trimming



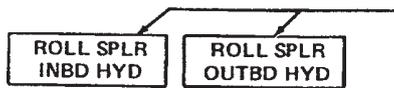
GLARESHIELD PANEL

- ROLL SPOILERS PUSH OFF SWITCHLIGHTS (AMBER)
  - ILLUMINATED (SPLR 1) indicates jam in inboard roll spoiler actuator
  - ILLUMINATED (SPLR 2) indicates jam in outboard roll spoiler actuator
  - PUSH - affected hydraulic circuit depressurizes and spoilers retract.
  - switch light goes out



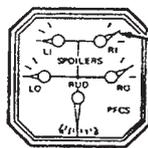
COPILOT'S INSTRUMENT PANEL

- ROLL SPOILER PRESSURE SHUTOFF SWITCH/LIGHTS (AMBER)
  - duplicates operation of SPLR 1 and 2 switchlights for non-emergency use. Switchlight illuminates when pressed



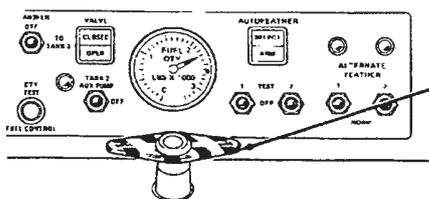
CAUTION LIGHTS PANEL

- ROLL SPOILER CAUTION LIGHTS (AMBER)
  - ILLUMINATED - indicates hydraulic pressure loss in related roll spoiler circuit



PILOT'S INSTRUMENT PANEL

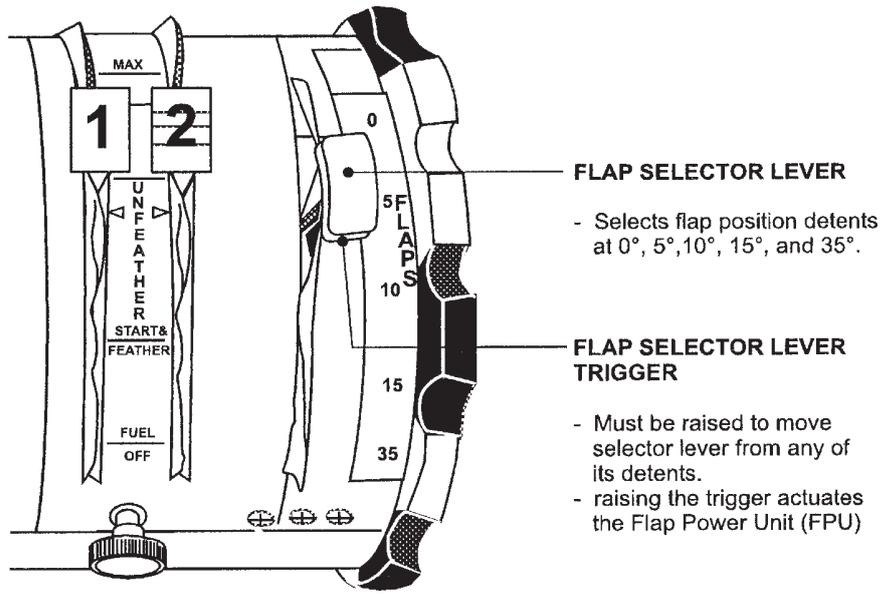
- POWERED FLIGHT CONTROL SURFACE INDICATOR (PFCS)
  - indicates corresponding inboard and outboard roll spoiler deflection



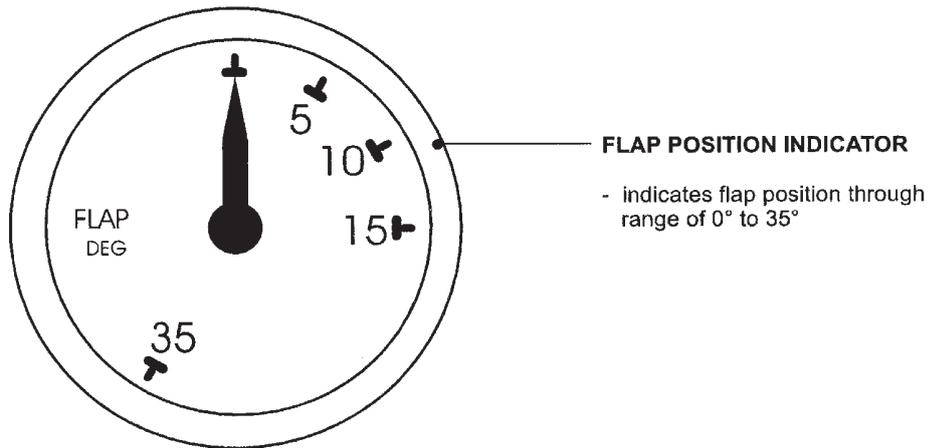
CENTER CONSOLE

- ROLL DISCONNECT HANDLE
  - when pulled out and rotated 90° clockwise or counterclockwise, the pilot's control wheel controls the spoilers only, while the copilot's control wheel controls the ailerons only

*Spoiler and aileron*



ENGINE CONTROL QUADRANT



COPILOT'S FLIGHT INSTRUMENT PANEL

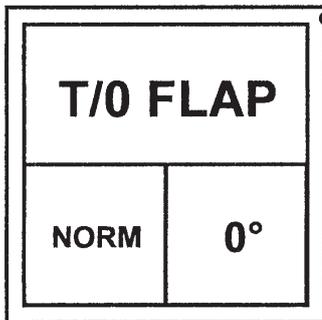
Flaps



**GPWS FLAP OVERRIDE SWITCH**  
(two position, alternate action)  
(amber)

- inhibits GPWS mode 4B to permit 0° flap landings without aural warning. All other GPWS modes remain active

PILOT'S SIDE CONSOLE



**T/O (TAKE-OFF) WARNING FLAP SWITCH**  
(alternate action)

- NORM segment (green)
- Take-off Warning Horn sounds when take-off flap setting is less than 5° or greater than 15°
- PUSH - NORM segment (blank)
- 0° segment (green)
- Take-off Warning Horn is inhibited when take-off flap setting is less than 5° (permits 0° take-off flap setting)
- After T/O - NORM segment (green)
- 0° segment (blank)

PILOT'S SIDE CONSOLE

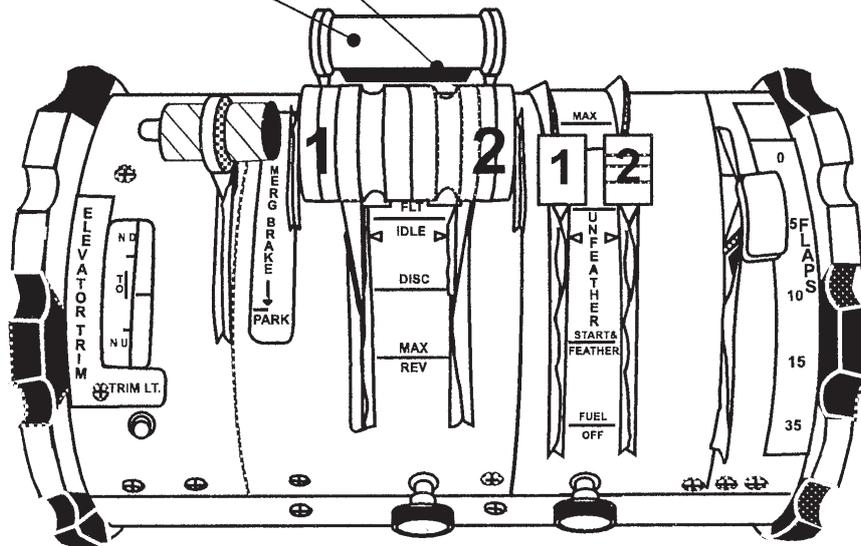
Flaps

**AILERON AND ELEVATOR CONTROL  
LOCK LEVER  
(two position, spring loaded to off position)**

OFF - Pull lever aft, then squeeze trigger to release. Move lever forward to OFF position.

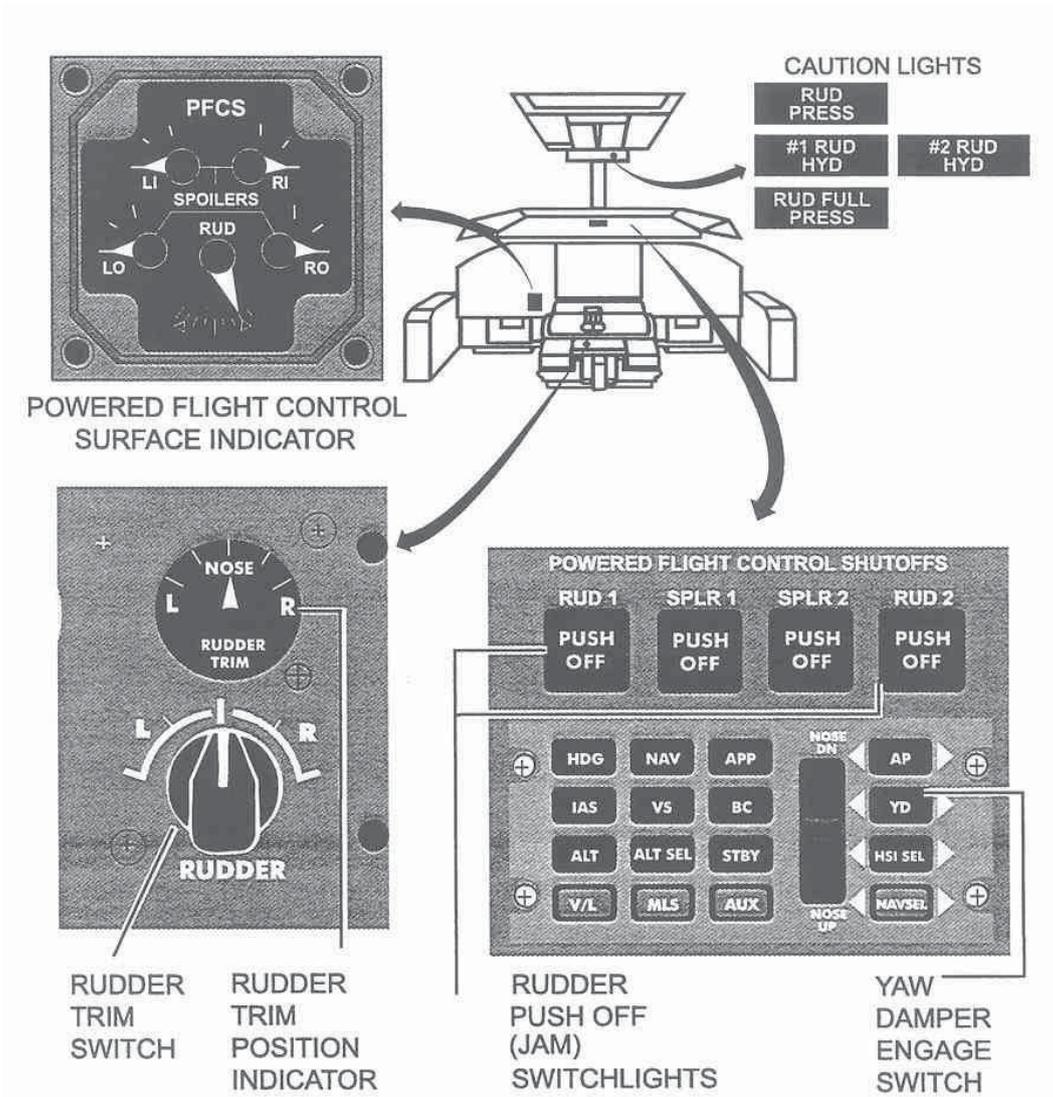
ON - Pull lever aft until it locks into position.

**CONTROL LOCK  
LEVER TRIGGER**

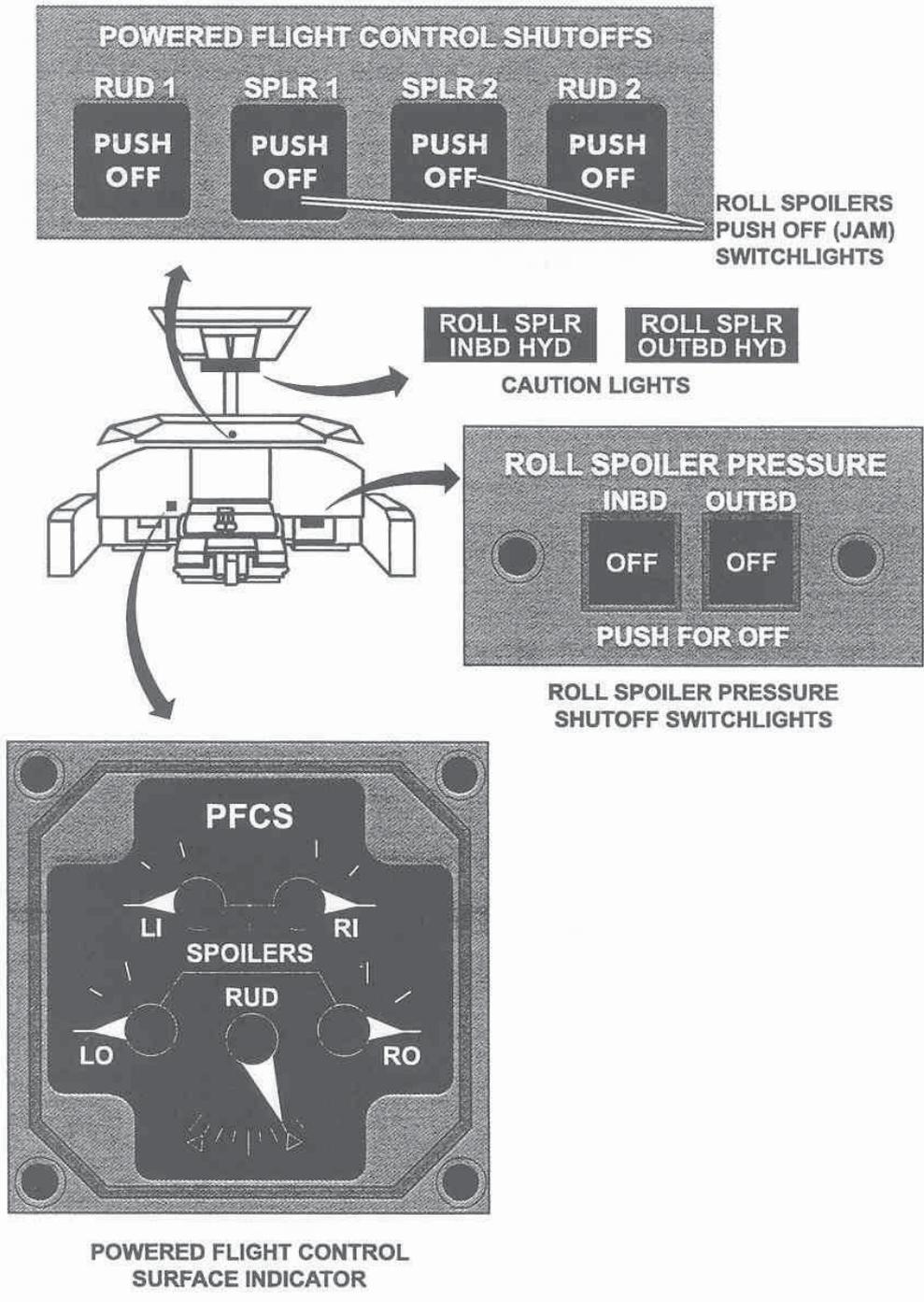


**ENGINE CONTROL QUADRANT**

*Miscellaneous controls*



Powered flight control surface controls and indications



Powered flight control switches and indications

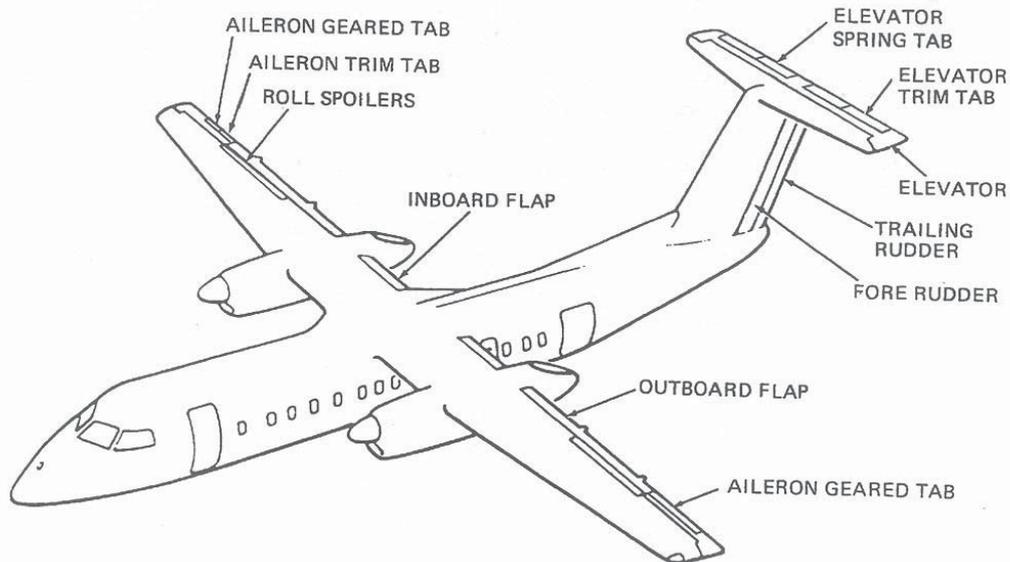
## 1 SYSTEMS DESCRIPTION

### General

The primary flight controls consist of ailerons and spoilers for roll control, elevator for pitch control and a two sectioned (fore and trailing) rudder for yaw control. Roll spoilers and fore rudder are hydraulically powered.

Secondary flight controls, consists of wing flaps and trimming systems for the primary flight controls, and a flight control gust lock mechanism. All flight controls may be operated from either the left or right pilots' position.

Indications for flight control positions or malfunctions are provided by trim position indicators, the powered flight control surface indicator and a series of caution lights.



*Flight control surfaces location*

## Yaw control

Directional control about the yaw axis is provided by the rudder control system. The rudder is hydraulically powered and controlled through displacement of either pilot's rudder pedals. A yaw damper operates through the rudder control system to improve directional stability.

## Rudder control system

The rudder has two sections (fore and trailing) driven by dual hydraulic actuators positioned by either pilot's rudder pedals.

The position of the rudder is shown on the PFCS indicator. Full-scale rudder deflection is indicated by movement of the pointer to the index marks (16° left marking, 18° right marking).

Rudder trim is provided by a two speed electric actuator, which has the capability to displace the fore rudder 10° left or right of centre. Control of this actuator is by a spring-loaded rotary switch on the TRIM panel to the rear of the aft electronics panel.

The fore rudder is hinged to the vertical stabilizer and is moved by both actuators. The trailing rudder is hinged to the fore rudder and is geometrically geared to the vertical stabilizer by push rods such that trailing rudder deflection is twice that of the fore rudder.

A pressure regulator controls hydraulic pressure to each rudder actuator. The regulator limits actuator pressure to 1500 Psi at airspeeds below 150 KIAS and 900 Psi above 150 KIAS, in response to speed signals from the air data computers (ADC's), to reduce rudder sensitivity at high speeds. Pressure switches, armed by ADC speed signals, are positioned in each actuator's supply lines.

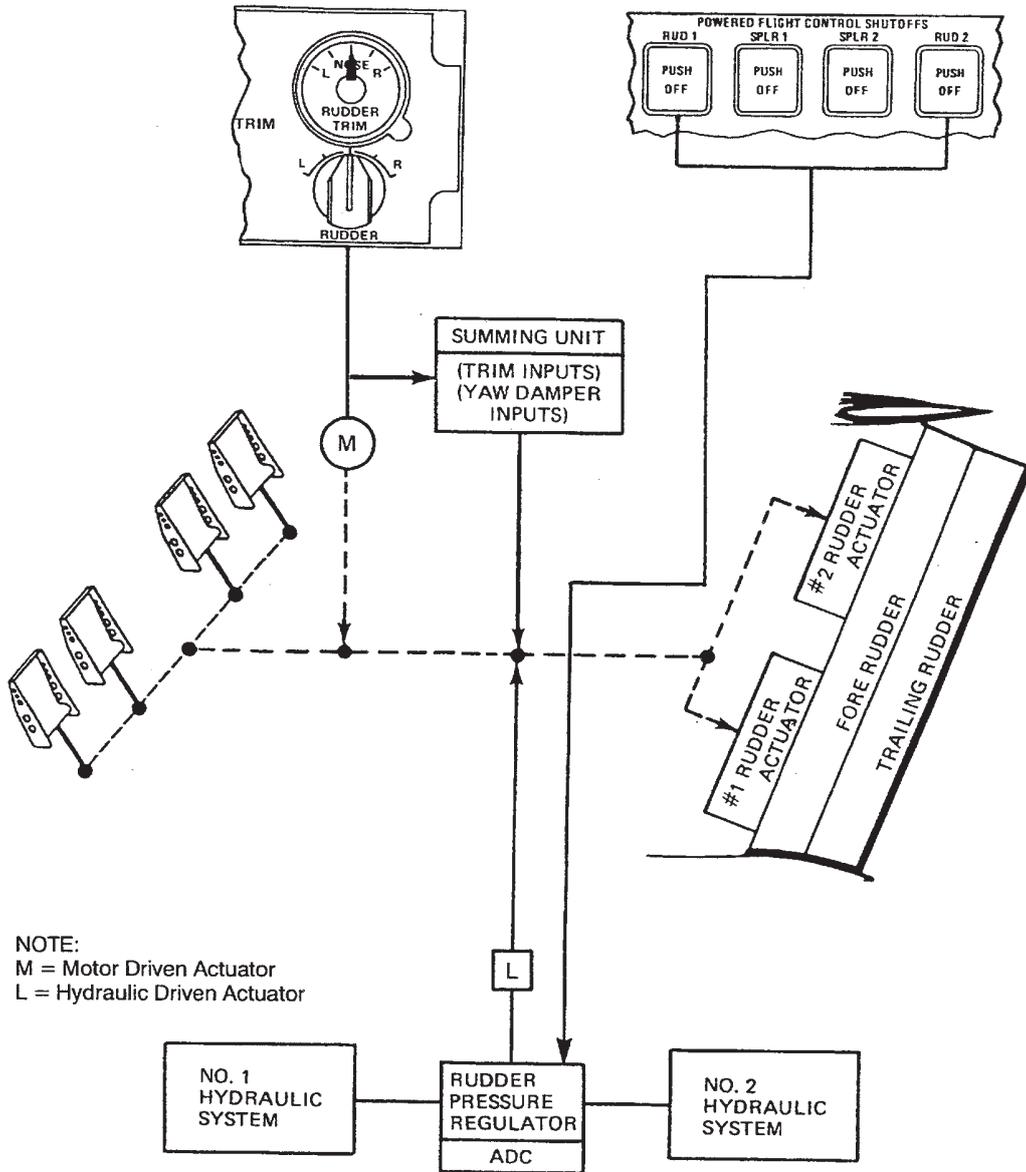
Maximum fore rudder travel is allowed only when the flap selector lever is out of the 0° position to provide necessary authority at lower airspeeds. A mechanical rudder travel restrictor limits rudder deflection to 12° with the flap selector lever at 0.

## Yaw damper

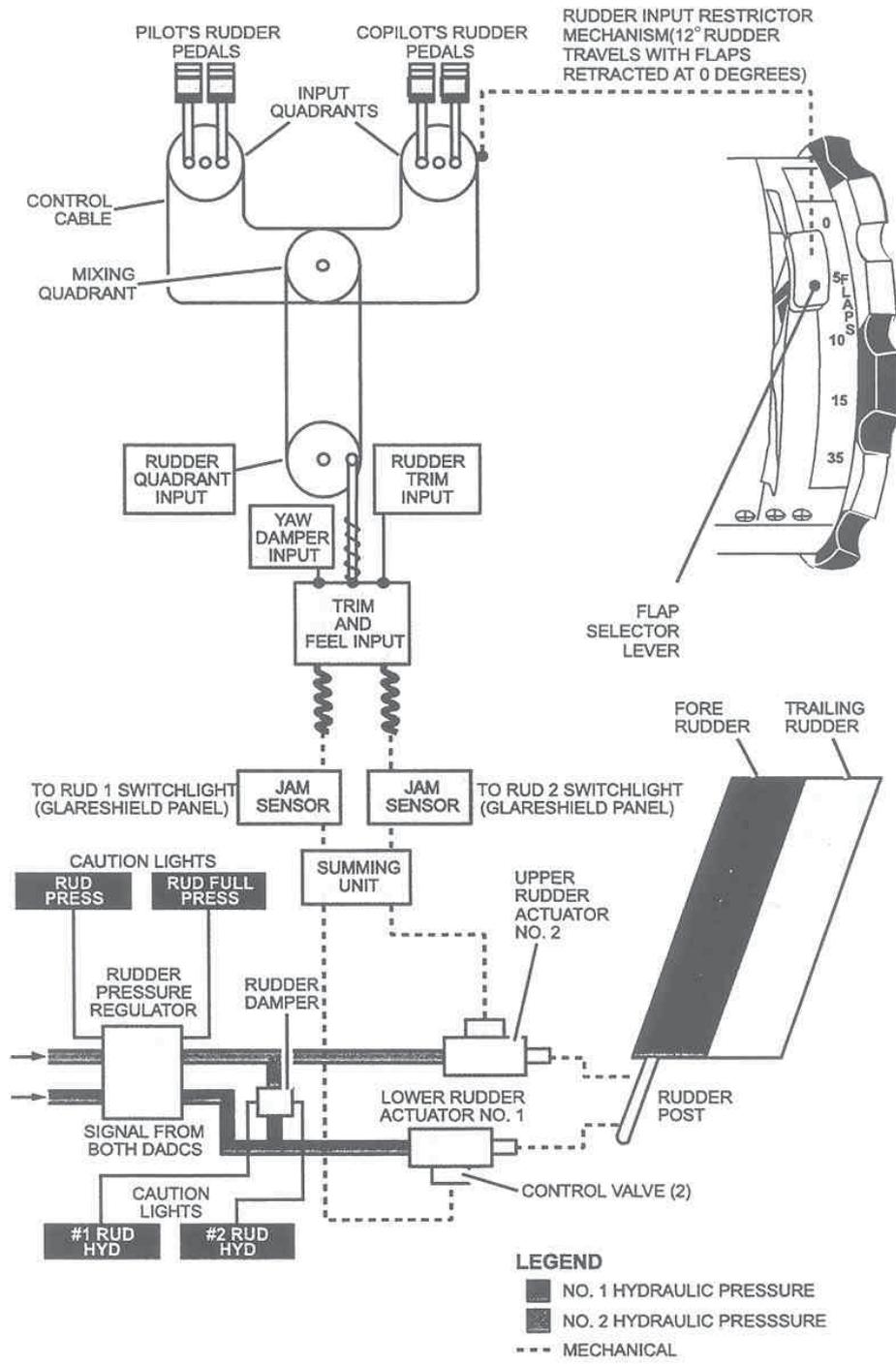
A yaw damper system operates independently or in conjunction with the automatic flight control system (AFCS) to provide compensating rudder inputs whenever the aircraft deviates from coordinated flight. In level flight it acts to improve directional stability by damping oscillation in yaw caused by turbulence. In turns initiated by the crew or the AFCS it provides the necessary rudder deflection to maintain turn coordination.

Accelerometers within the flight guidance computer provide yaw data, which is combined with other flight condition information. To provide output command signals to an electric yaw damper actuator that can reposition the rudder up to 5° to left or right of an existing rudder setting to maintain coordinated flight.

The yaw damper is engaged by means of an YD press-on/press-off switch light on the flight guidance controller, located on the glareshield panel. Engaging the autopilot will automatically switch on the yaw damper. The autopilot can not be engaged with the yaw damper off.



Rudder control diagram



Rudder control diagram

## Pitch control

The pitch control surfaces consist of two, spring tab assisted elevators.

## Elevators

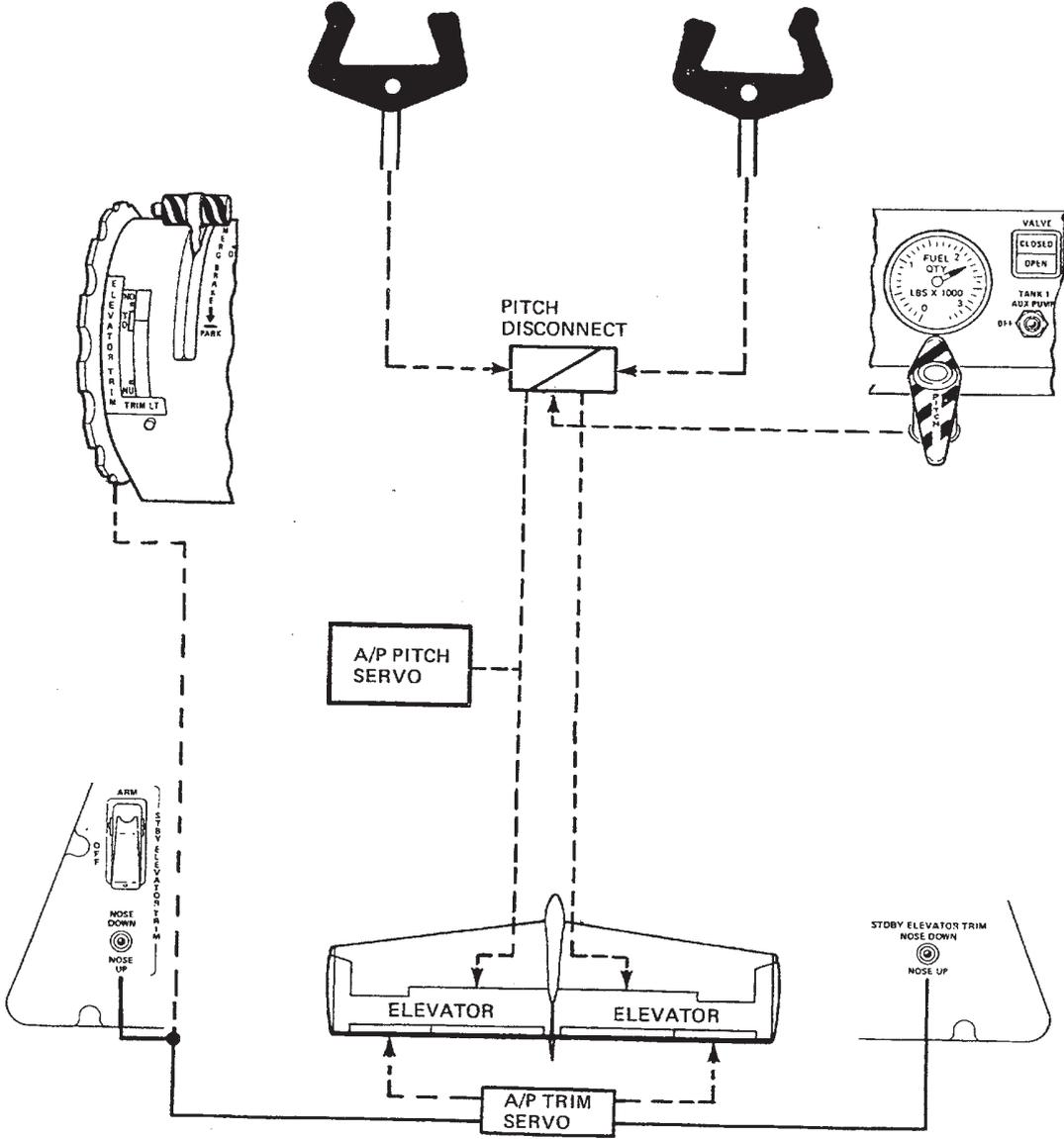
Pitch movement is controlled by two elevator surfaces, each having an independent control system. The left elevator is controlled by fore and aft movement of the left pilot's control column and the right elevator by fore and aft movement of the right pilot's control column. The control columns are mounted at each end of a torque tube below the flight compartment floor, which normally joins the columns so that they move together. The torque tube incorporates a latch mechanism, which permits the columns to be separated following a jam in either elevator system. A pitch disconnect handle located on the left side of the centre console, marked PITCH DISC, releases the latch when pulled out following an elevator jam. With the columns separated, the jammed side is isolated and pitch can be controlled with the remaining elevator system.

Each elevator has a torsion spring mechanism, which drives the elevator surface in conjunction with a spring tab on its inboard trailing edge. With elevator control input, this provides a servo assist, which reduces elevator control forces.

Elevator trim is provided by tabs on each surface, outboard of the spring tabs. Two trim wheels, mounted on a common shaft, are provided on each side of the power lever quadrant on the centre console.

A trim position indicator is geared to the trim wheel shaft, consisting of a window and pointer in the top of the power lever quadrant beside the pilot's trim wheel. A potentiometer within the indicator sends trim position signals to the flight data recorder.

The standby trim system provides a means of trimming the aircraft following failure of the manual trim system. A guarded standby elevator trim switch is located on the left pilot's side console panel. When selected from OFF to ARM it switches control of the trim servo from the autopilot to an adjacent NOSE UP/NOSE DOWN switch. A duplicate NOSE UP/NOSE DOWN switch is provided on the right pilot's side console panel. Selection of either switch to its spring-loaded NOSE UP or NOSE DOWN position activates the servo to trim the aircraft in pitch. Arming the standby trim system immobilizes the normal elevator trim system.



Elevator control diagram

## Roll control

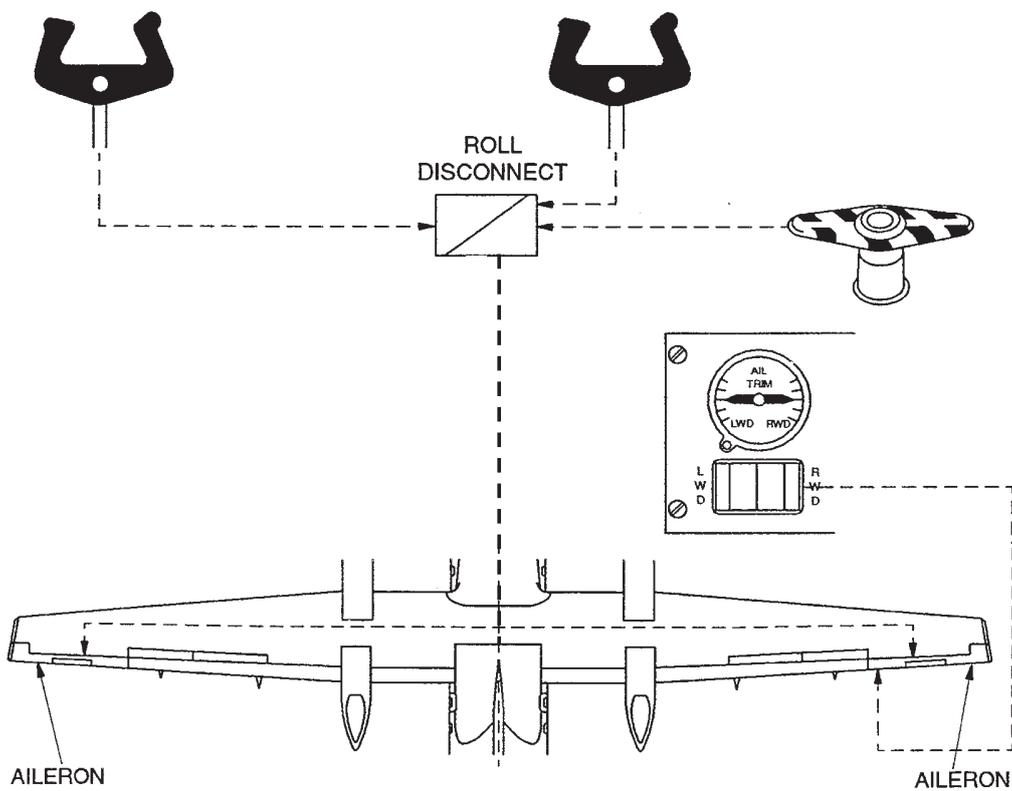
Roll control is by conventional cable-operated ailerons, augmented by cable-operated, hydraulically activated, roll spoilers. The rotational movement of the pilot's control wheel activates the roll spoilers while the co-pilot's control wheel activates the ailerons. An interconnect linkage joins the pilot's and co-pilot's control wheels so that both systems are operated from either wheel. A clutch within the linkage can be disengaged manually, by means of a roll disconnect handle on the flight compartment centre console, to separate the left and right roll control circuits in the event of a jam in either circuit. With the control circuits separated, control can be maintained with the un-jammed control wheel.

## Ailerons

An aileron is located on each wing outboard of the flaps. Rotation of either control wheel actuates the ailerons differentially by means of a cable control loop, with inter-connection to applicable roll spoilers.

Geared tabs on the trailing edge of each aileron assist aileron deflection. The tabs are geared to a static position, which is aerodynamically neutral relative to the aileron. When the aileron is deflected, the geared tab moves in the opposite direction creating a localized lifting force about the tab in the direction of aileron deflection, thus assisting aileron movement.

The right aileron trim tab, using an electric actuator built into the aileron, provides aileron trim. A L/R AILERON rocker switch, located on the TRIM panel on the centre console operates the actuator when depressed to the left or right. The actuator trims aileron control pressure by biasing the static neutral position of the trim tab. An indicator adjacent to the L/R AILERON rocker switch shows the degree of trim actuator displacement from neutral.



*Aileron control diagram*

## Roll Spoilers

The roll spoilers consist of four spoiler panels, two to a wing, positioned inboard of the ailerons on the upper wing surfaces and driven by individual hydraulic actuators. The spoilers respond differentially to control wheel movement by extending from the left or right wing in proportion to associated upward displaced aileron. At airspeeds above 140 KIAS, the outboard roll spoilers are disabled to reduce control sensitivity. Each actuator linkage is connected so that in the event of a jam, overpowering force applied to the control wheel disengages the linkage preventing the jam from immobilising the roll spoiler cable circuit.

A limit switch built into each mechanism illuminates one of the POWERED FLIGHT CONTROL SHUTOFFS - SPLR switch lights (either SPLR 1 in the event of an inboard actuator linkage jam or SPLR 2 for an outboard actuator linkage jam).

When pressed, each switch light disables the affected roll spoilers.

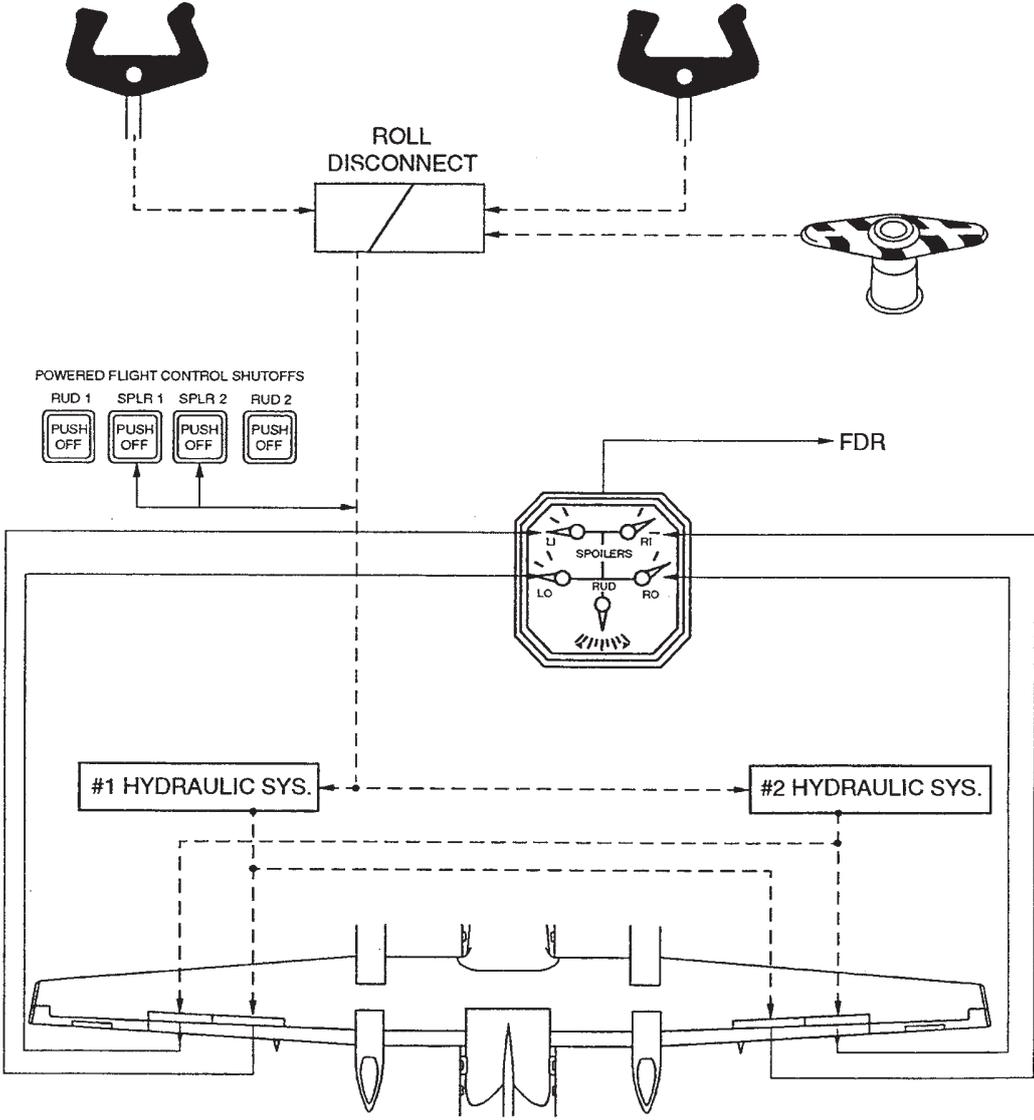
A roll spoiler cable circuit jam, necessitating operation of the ROLL DISC handle to control the aircraft by ailerons alone, may result in partially extended roll spoilers if the jam occurred during a roll input. The resulting counteracting aileron input necessary to control the aircraft will illuminate both SPLR switch lights (via an under floor limit switch) if aileron travel exceeds 50° of control wheel displacement from neutral. The switch lights must then be immediately pressed to retract the spoilers and restore symmetrical aileron control.

Two caution lights, marked ROLL SPLR INBD HYD and ROLL SPLR OUTBD HYD are provided to warn that extension pressure to the affected actuators has been removed following operation of the switch lights mentioned above or hydraulic system failure. The OUTBD HYD light, however, does not illuminate when its system is depressurised by ADC signals.

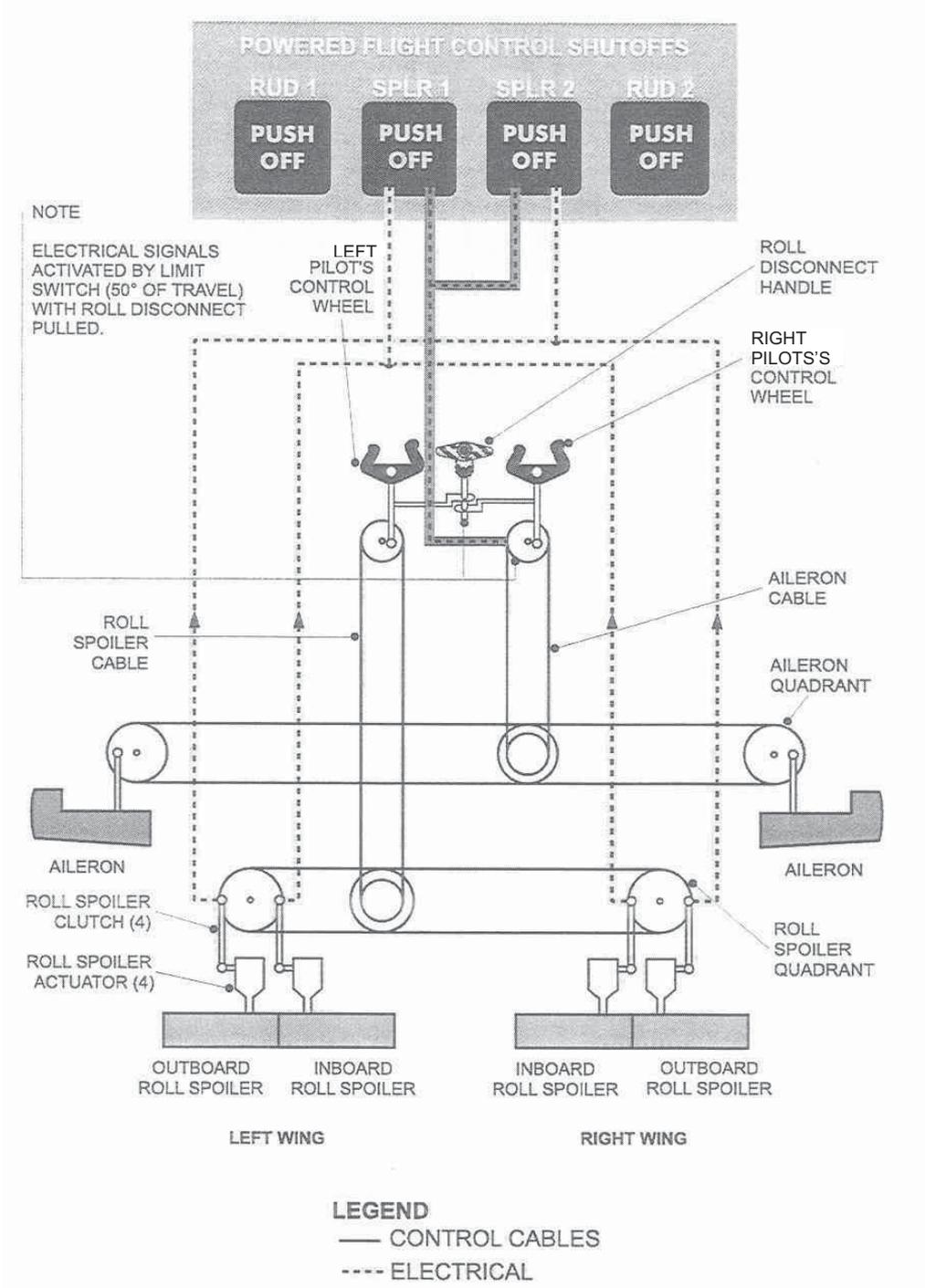
Spoiler motion and position is at all times directly proportional to control wheel movement. The PFCS indicator in the flight compartment displays roll spoiler position in response to position sensors at each roll spoiler panel.

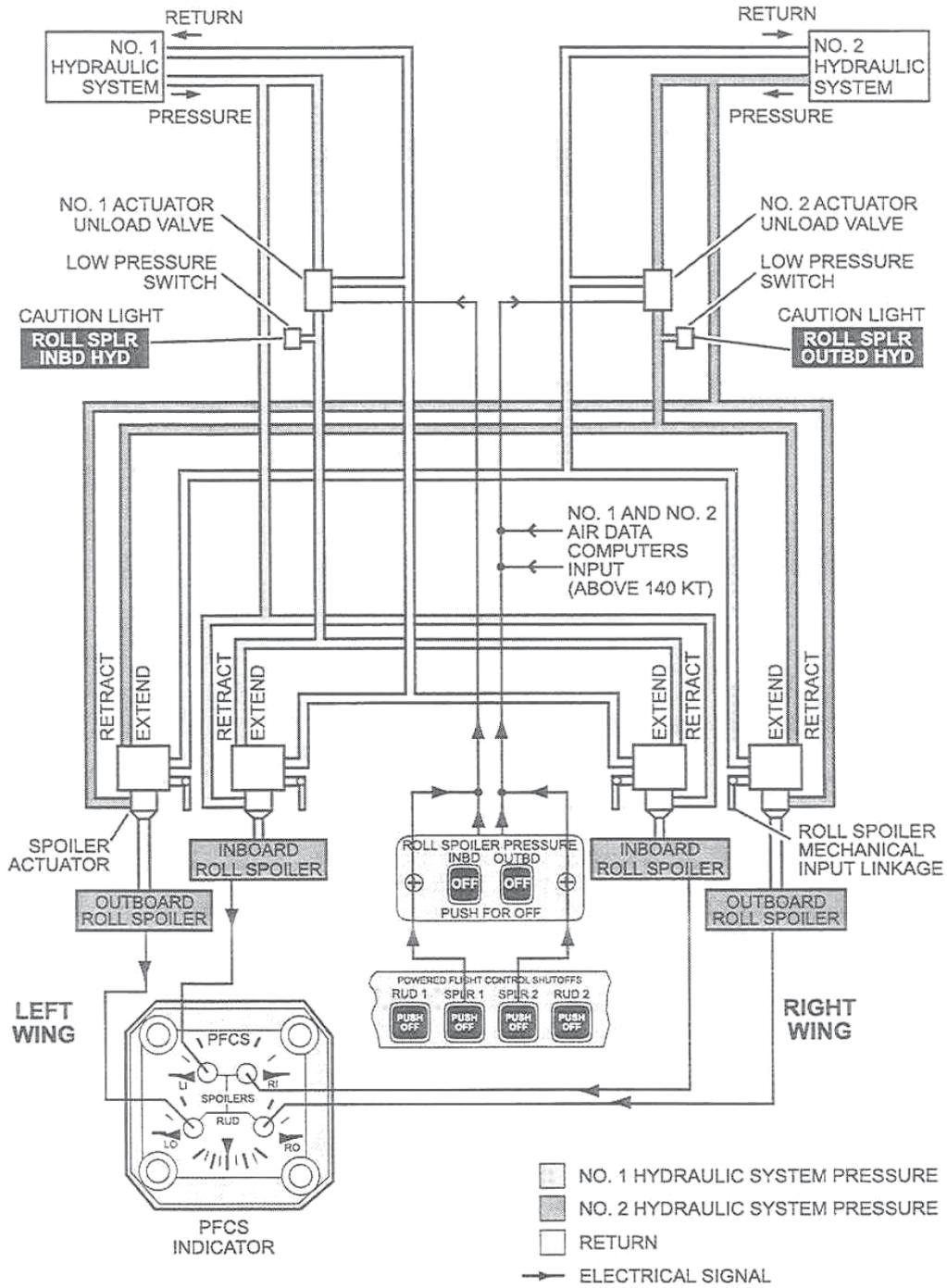
### Alternate roll spoiler pressure switches

Two roll spoiler switch lights labelled INBD and OUTBD provide an alternate method of deactivating a roll spoiler during flight training. These switch lights perform the same function as the SPLR 1 and SPLR 2 switch lights on the glareshield panel. However when INBD and/or OUTBD switch light is/are pushed ROLL SPLR OUTBD HYD (all airspeeds) caution light(s) SPLR 1 and SPLR 2 switch light remain active in the event a genuine roll control malfunction occurs.



Roll spoiler control diagram





Roll spoilers diagram

### Flap control system

The primary flap drive actuated by a hydraulic powered flap power unit (FPU), extends or retracts the flaps in response to selections from the flap selector lever. The selector has detented positions marked 0°, 5°, 10°, 15°, and 35°.

A trigger incorporated into the lever must be raised to move the lever from any of its detents, but should be released when moving handle so that the detent can engage the next selectable position. Operation of the lever directs power to the Flap Power Unit Sensors in the flap drive system provide flap position data to the landing gear warning system, the stall warning computer, flap position indicator and the Flight Data Recorder.

### Flap Power Unit (FPU)

The FPU is a hydraulic motor, which receives inputs from the number 1 hydraulic system and electrical inputs from the flap lever trigger.

### Primary drive

The primary drive system operated by the FPU extends and retracts the flaps. When flap selections are made, rotation of the primary drive positions the flaps at the selected position. Primary drive rotation stops when the flaps reach their selected position.

### Secondary drive

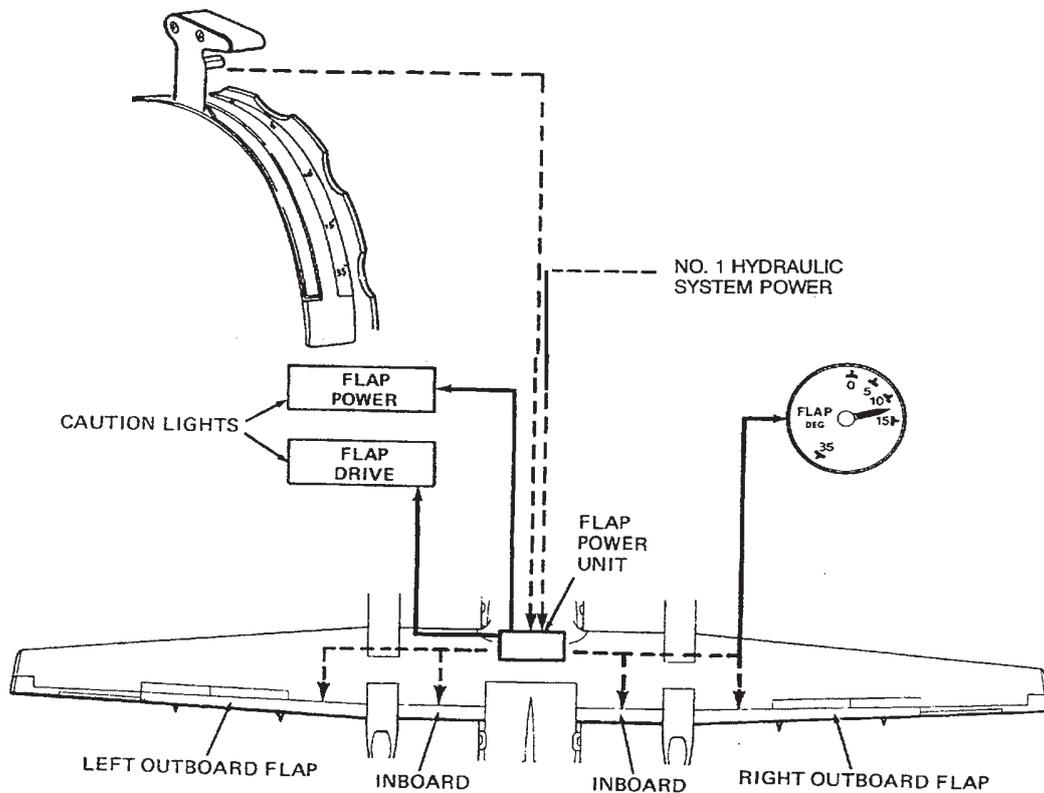
The secondary drive consists of a flexible shaft coupled to the primary drive system through two transfer gearboxes. The purpose for the secondary drive is to maintain symmetrical operation of all flap sections, if the primary drive breaks during flap operation. During flap operation, the primary and secondary shafts operate together, but only the primary drive is under load.

If the primary drive breaks, torque is transferred to the secondary shaft, then back to the primary shaft outboard of the failure. This prevents a split flap condition. Flap movement continues to the selected position. When the secondary drive is operating under load, due to a primary drive failure, the FLAP DRIVE caution lights come on.

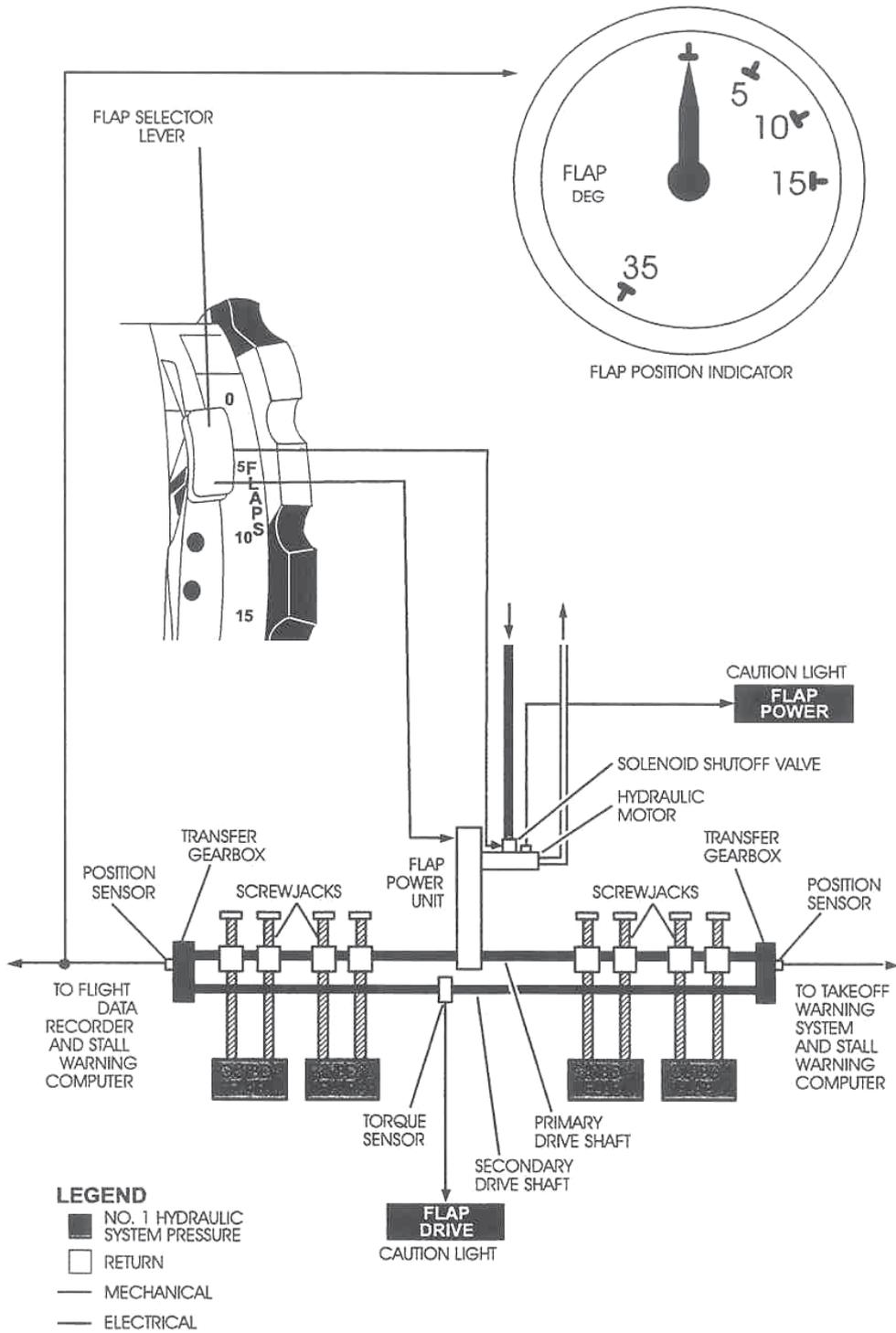
### Operation

When the flap lever is in the 0° position, all flaps are retracted, and the flap position indicator points to 0°. Squeezing the flap lever trigger energizes the FPU. Moving the flap lever to 5°, 10°, 15°, or 35°, signals the FPU to extend flaps to be selected position. The FPU remains energized for 70 seconds to allow sufficient time for flap movement to the selected position. At flap 35° position, all flaps are fully extended and the flap position indicator points to 35°.

**NOTE:** During flap selections, to avoid excessive loading of the flap drive system, flaps must be allowed to come to a complete stop before the selector lever is reversed.



Flap control diagram



Flap control schematic

**Flight control lock (gust lock)**

Ailerons and elevators are locked with the control lock lever. The elevators lock in the down position and the ailerons lock in the neutral position. Rudder movement is damped by hydraulics within the rudder system. The control lock handle is spring loaded to the OFF (forward) position.

A trigger under the control lock lever must be squeezed prior to releasing the lever from its ON position. With the flight control lock ON, the power levers can only be moved as far the control lock lever, which is equivalent to approximately 80%  $N_h$  / 35% torque.

**Exposure to high wind & wind gusts when parked**

Exposure of the aircraft to high winds or strong gusts for extended periods, especially while parked, may require a maintenance check prior to dispatch. Flight crew are urged to report known exposure to strong winds or wind gusts to maintenance.

**CAUTION:** If the aircraft is parked outside in strong winds (more than 61 knots) and the wind direction is forecast to change, make sure that the aircraft is pointed into wind as soon as the wind direction changes. If you do not do this, the winds can cause damage to the aircraft

**NOTE:** Exposure to wind gusts to a maximum speed of 61 knots is permitted without inspection, provided the aircraft gust locks are engaged. If the winds or wind gusts were more than 61 knots and the wind direction was from a direction more than 45° from the nose-into-wind position, during the time the aircraft was parked, an inspection should be carried out by maintenance personnel.

## NON-NORMAL INDICATIONS AND OPERATION

### Rudder control system

The pressure switches illuminate the RUD PRESS caution light if pressure fails to reduce to 900 Psi above 150 KIAS, or if pressure fails to increase to 1500 Psi when airspeed reduces to below 150 KIAS.

Should either actuator's hydraulic supply fail or be selected off, the rudder pressure regulator automatically admits full hydraulic system pressure (3000 Psi) to the remaining actuator (overriding the pressure reduction function described above). A RUD FULL PRESS caution light illuminates when 3000 Psi is being applied to either actuator. As this situation is abnormal, the RUD PRESS caution light also illuminates.

In the event of an actuator servo valve jam, a sensing mechanism is incorporated in the actuator linkages illuminates the appropriate POWERED FLIGHT CONTROLS SHUTOFFS PUSH OFF RUD 1 or RUD 2 switch light. The illuminated switch light must be pressed to depressurize the affected hydraulic actuator.

A #1 RUD HYD or #2 RUD HYD caution light illuminates whenever hydraulic pressure to the affected actuator has been removed, either by operation of the PUSH OFF switch light or by hydraulic failure.

### Roll control jam

Each actuator linkage is connected so that in the event of a jam, overpowering force applied to the control wheel disengages the linkage preventing the jam from immobilizing the roll spoiler cable circuit. This causes either SPLR 1 or SPLR 2 PUSH OFF switch lights to come ON indicating a jam.

If the PUSH OFF switchlight remains on continuously while attempting to maintain wings level, a spoiler may be jammed in the extended position. The related switch light must be pushed OFF to depressurize its system. This will cause the ROLL SPLR INBD HYD (all airspeeds) or ROLL SPLR OUTBD HYD (below 140 KIAS) to come ON. During subsequent roll control inputs, control wheel movement will not be as smooth, this due the clutch engaging and disengaging.

If an aileron or spoiler cable linkage jam occurs, further roll inputs will be prevented. To regain control, the ROLL DISC handle must be pulled and turned 90° to determine which pilot has control. The pilot with the un-jammed wheel will have control.

### Left control wheel free

If the left control wheel is free, only the spoilers will operate. Roll control forces will be low and the tendency to over control should be avoided.

### Right control wheel free

If the right control wheel is free, only the ailerons will be operational. Roll control will be reduced, and forces will be normal. If the control wheel deflection required to maintain level flight, exceeds 50° of displacement from the neutral position; SPLR 1 and SPLR 2 switch light will come ON. This may be due to one or both spoilers are deployed on the same side.

If SPLR 1 and SPLR 2 switch lights remain on continuously, both must be pushed OFF this will depressurise the affected spoiler system and turn on the ROLL SPLR INBD HYD (all airspeeds), and ROLL SPLR OUTBD HYD (below 140 KIAS) caution lights. Any spoiler that may have been jammed in the extended position will retract roll spoiler positions are presented on the PFCS indicator.

**CAUTION:** With the ROLL disconnect handle pulled, the autopilot must remain disengaged.

### Flap control system

If during flap extension or retraction, a flap jam occurs, the flap system automatically shuts down. Flap operation will continue if flaps are selected in the reversed direction away from the jam.

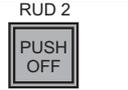
The FLAP POWER caution light will come on when the flaps are selected and the hydraulic pressure to the FPU has dropped below 1500 Psi. The caution light will go out when either pressure is restored or 70 seconds after flap selector lever trigger actuation.

The FLAP DRIVE caution light indicates that the primary flap drive shaft has failed. The flap system can be operated normally as the secondary flap drive shaft has taken over.

A 0° flap landing will be required with either a loss of number 1 hydraulic system or a total flap failure. To override the ground proximity warning system (GPWS) TOO LOW FLAP call on approach, select the GPWS flap override switch on the pilot's side panel.

**Caution lights**

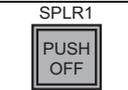
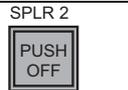
		Indicates pressure loss at #1 or # 2 rudder hydraulic actuator.
Applicable ECL:		#1 RUD HYDRAULIC or #2 RUD HYDRAULIC FAILURE.
Remarks:		Other rudder actuator operates at 3000 Psi and RUD FULL PRESS caution lights illuminate.

		Indicates jamming of #1 or # 2 rudder hydraulic actuator.
Applicable ECL:		RUD 1 SWITCHLIGHT or RUD 2 SWITCHLIGHT ON.
Remarks:		Pushing the switchlight deactivates the applicable rudder actuator, causing the #1 or #2 RUD HYD caution light to illuminate. The remaining rudder actuator operates at 3000 Psi and RUD FULL PRESS and RUD PRESS caution lights illuminate.

	3000 Psi is being applied to either rudder actuator.	
Applicable ECL:		RUDDER FULL PRESSURE.
Remarks:		RUD PRESS caution light of remaining actuator illuminates if aircraft speed exceeds 150 KIAS.

	Failure of rudder pressure regulator to adjust pressure to the proper value, dependent on IAS.	
Applicable ECL:		RUDDER PRESSURE FAILURE.
Remarks:		Illuminates regardless of speed when system pressure is 3000 Psi.

		Indicates hydraulic pressure loss in related roll spoiler circuit.
Applicable ECL:		ROLL SPLR INBD or ROLL SPLR OUTBD HYDRAULIC FAILURE.
Remarks:		None

		Indicates jamming of either roll spoiler actuator (1 switchlight illuminated) or disagreement between aileron and roll spoiler control systems.
Applicable ECL:		ROLL CONTROL MALFUNCTION or ROLL CONTROL JAM.
Remarks:		Pushing the switchlight(s) deactivates the applicable spoiler actuators.

<b>FLAP DRIVE</b>	Indicates failure in primary flap drive.
Applicable ECL:	FLAP DRIVE FAILURE.
Remarks:	Flaps will continue to operate using secondary transmission shaft. Flap may be operated normally for remainder of flight.

<b>FLAP POWER</b>	Indicates loss of hydraulic supply pressure.
Applicable ECL:	FLAP POWER FAILURE.
Remarks:	Unless hydraulic power to flap drive is restored, flaps are immobilized at existing position.