

TRIM SYSTEM

HORIZONTAL STABILIZER TRIM SYSTEMS

General

The variable incidence horizontal stabilizer serves for longitudinal (pitch) aircraft trim. Two independent electrical trim systems ensure the ability to trim the aircraft if one system fails.

The stabilizer travel is $+2.5^\circ$ to -9.5° which covers the entire flight and cg envelopes trim requirements.

Normal System

Trim switches, located on top outboard side of pilot and copilot control wheels, control normal operation. When either trim switch is moved UP or DOWN, actuator's primary motor energizes to retract or extend the actuator to desired position. Limit switches are incorporated in the actuator to restrict stabilizer travel.

Pitch trim tone (from EICAS) sounds whenever normal system operates. Autopilot trim is also achieved through the normal system.

Mach Trim

Mach trim is operative when autopilot is disengaged. Mach trim is activated when ADC mach data indicates that longitudinal trim is necessary ($0.79 M_j$).

Override System

When the primary drive control fails to operate, pressing PITCH TRIM REL. button, located on the control wheel, provides the following functions:

- Disconnects power from trim unit primary channel.
- Powers up to the secondary channel.
- Powers up the override switch.
- Disconnects the autopilot

When PITCH TRIM REL. button is pressed, the RESET pushbutton illuminates and then by pressing the HORIZ TRIM switch in NOSE UP or NOSE DN position, the secondary drive control of trim actuator is energized, causing the horizontal stabilizer to move in desired direction. Autopilot is inoperative when override system is operating.

When RESET pushbutton is pressed, the secondary drive control deenergizes (light - out). Power is restored to the primary drive system.

LATERAL TRIM SYSTEM

Lateral trim is achieved by the ailerons. An electrical trim actuator mounted near the artificial feel system operates the ailerons through the normal control system. The aileron travel, when operated by the trim system, is 1/3 of full aileron travel.

Aileron trim is controlled by a switch located on the pedestal alongside the rudder trim switch.

DIRECTIONAL TRIM SYSTEM

Directional (rudder) trim is accomplished by moving a trim tab on the rudder. This tab is operated by two mechanically interconnected electrical actuators, each protected by separate circuit breaker.

The rudder trim control switch is located on the pedestal alongside the aileron trim switch.

TRIM SYSTEMS CONTROLS AND INDICATORS

Pitch Trim Switches (2) - Located on each outboard prong of pilot and copilot control wheels. The switches have three positions:

Center - Stops horizontal stabilizer trim operation.

NOSE DOWN - Momentary position to trim nose down. Spring loaded to center.

NOSE UP - Momentary position to trim nose up. Spring loaded to center.

NOTE

Pilot pitch trim switch has priority over copilot switch.

PITCH TRIM REL. Button - Located on pilot control wheel inboard prong. Pressing the button deactivates normal system and arms OVRRD system; RESET OVRRD button light comes on.

HORIZ TRIM OVRRD Switch - Controls the override trim system in the same manner the normal pitch trim switches control the normal system.

RESET OVRRD Button - When pressed, the override system is de-energized and normal system is armed. It lights up when PITCH TRIM REL. button is pressed.

AILERON Trim Switch - Has three position as follows:

Center - Stops aileron trim operation.

RW DN - Momentary position. Moves control wheel to right (right roll).

LW DN - Momentary position. Moves control wheel to left (left roll).

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RUDDER Trim Switch - Has three positions as follows:

Center - Stops rudder trim operation.

NOSE R - Momentary position. Trims rudder to right.

NOSE L - Momentary position. Trims rudder to left.

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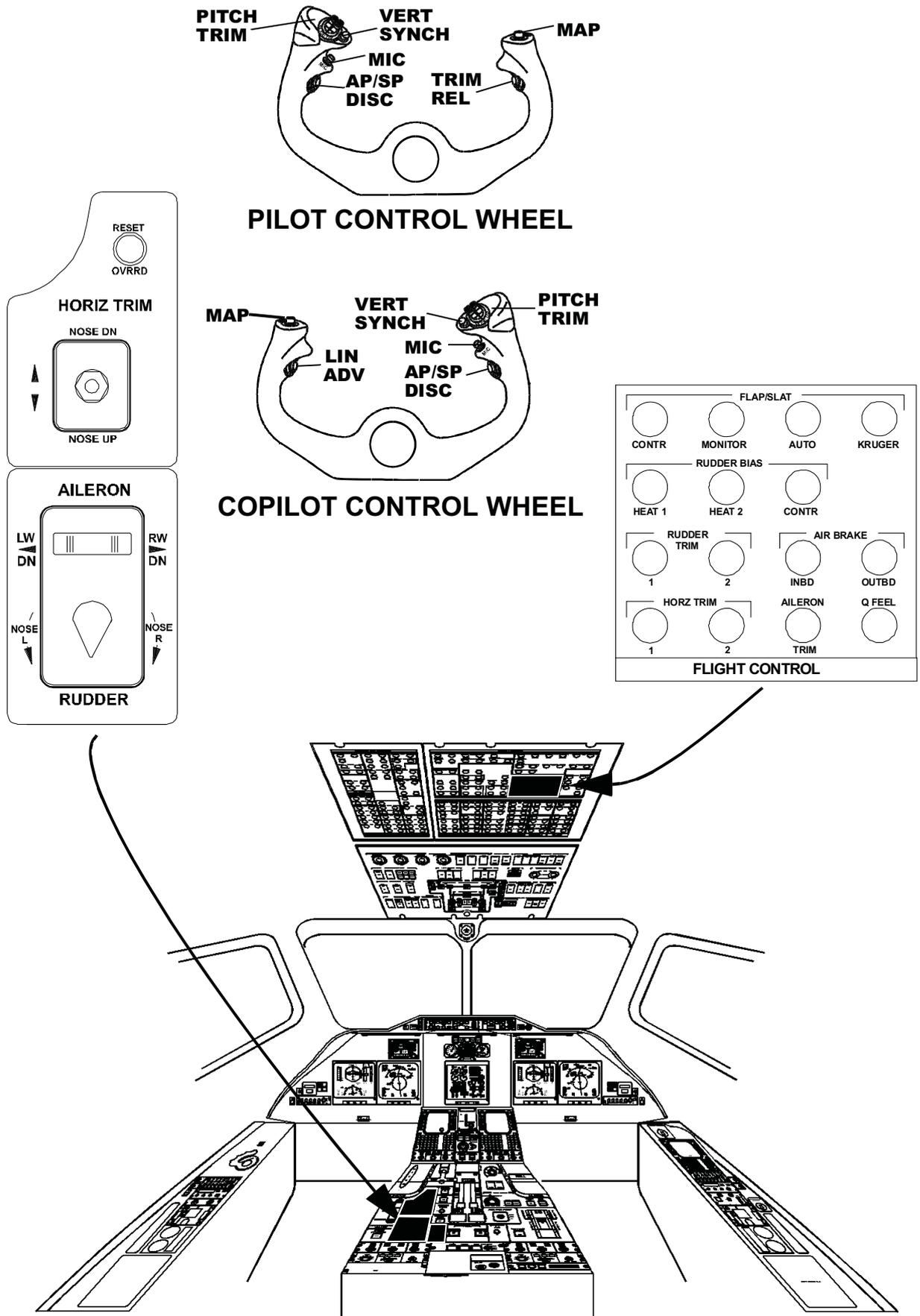


Figure 5-30. Horizontal Stabilizer, Rudder and Aileron Trim Controls and Indicators

SLATS, KRUEGER AND FLAPS SYSTEMS

Each wing is equipped with two-piece trailing edge flap, one piece leading edge slat and one piece krueger flap. The flaps and slats are mounted on and guided by rail and rollers assemblies, driven by ball-screw linear actuators. The krueger flaps are hydraulically actuated.

The flaps or slats are operated each by a single electrical rotary actuator driving a flexible shaft, interconnecting mechanically the ball-screw actuators of both wings.

The actuators are equipped with torque limiters at each output end to wing. Electronic controller governs flaps and slats operation and automatically stops their motion when asymmetry conditions are created.

The krueger flaps are powered from the right hydraulic system and electrically controlled by Flap/Slat Electronic Control Unit (FSECU) and by SLATS/KRUEGER/FLAPS selector.

Each krueger flap is operated by hydraulic actuator with internal locks for both extended and retracted positions. The actuators incorporate limit switches for indication of locked positions.

Slats/flaps/krueger position is displayed on EICAS. Slats/flaps selector lever is located on the pedestal. When the lever is placed in one of the flaps angle positions (12°, 20° and 40°), the slats are extended first. Slats/krueger flaps may also be selected individually (DN position of the lever).

The slats always extend fully before flaps and krueger flaps start to extend and, conversely, flaps and krueger flaps always retract before slats are retracted.

(Continued)

Reversal of flaps or slats position selection when surface is in motion is not recommended. The system should come to a complete stop prior to reversing flaps or slats travel.

If a malfunction occurs in slats extension/retraction system, they may be disabled and bypassed by pressing SLAT BYPASS ARM pushbutton, on the pedestal. Slats operation is, then, stopped even during motion. Krueger flaps stay retracted if slats are not fully extended. The slats bypass function is inoperative when slats are fully extended. Pressing SLATS BYPASS ARM pushbutton removes the flaps and slats primary drive motor protections. Therefore, it should be used only once, after slats system failure.

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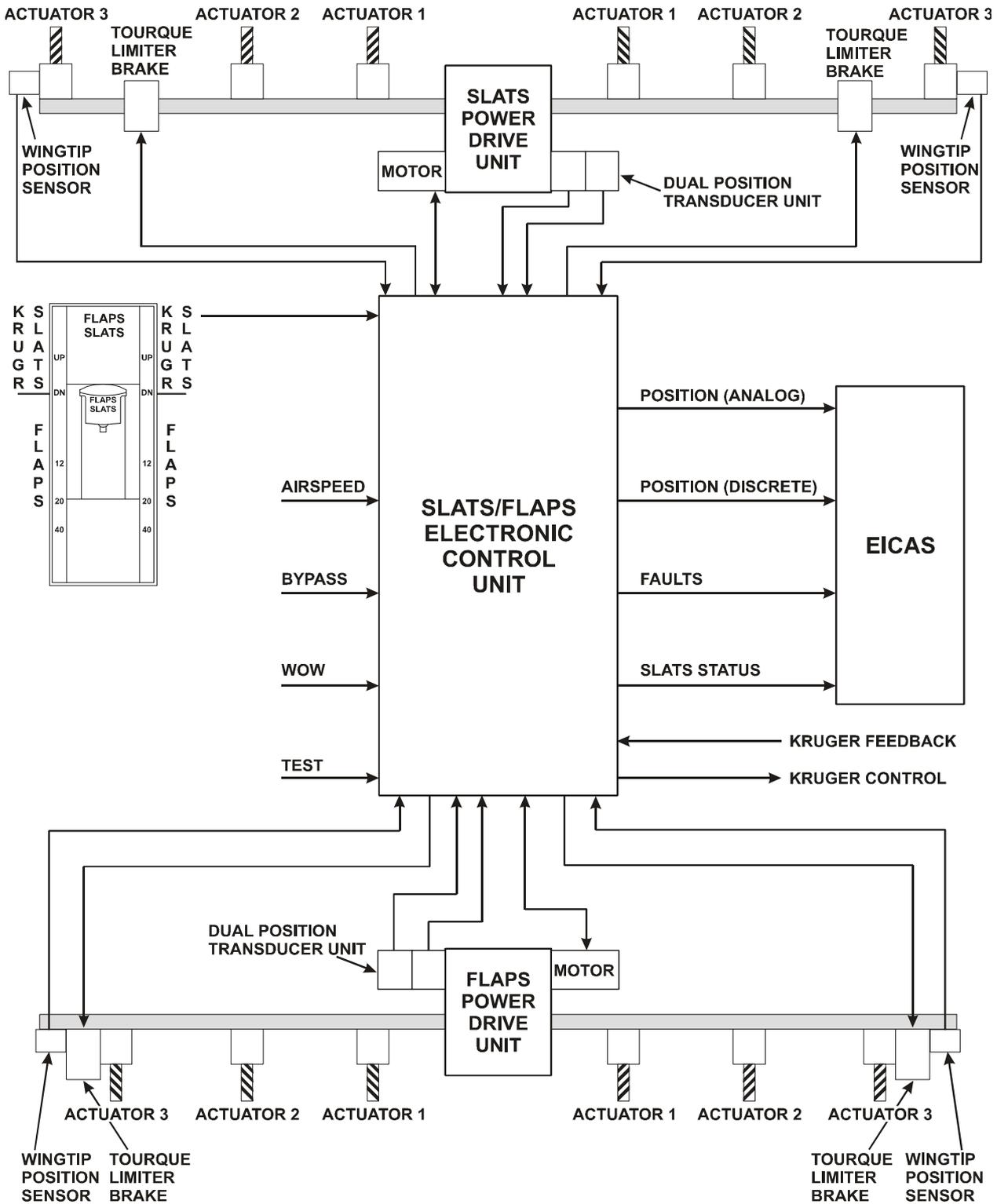


Figure 5-31. Slats/Flaps System - Block Diagram

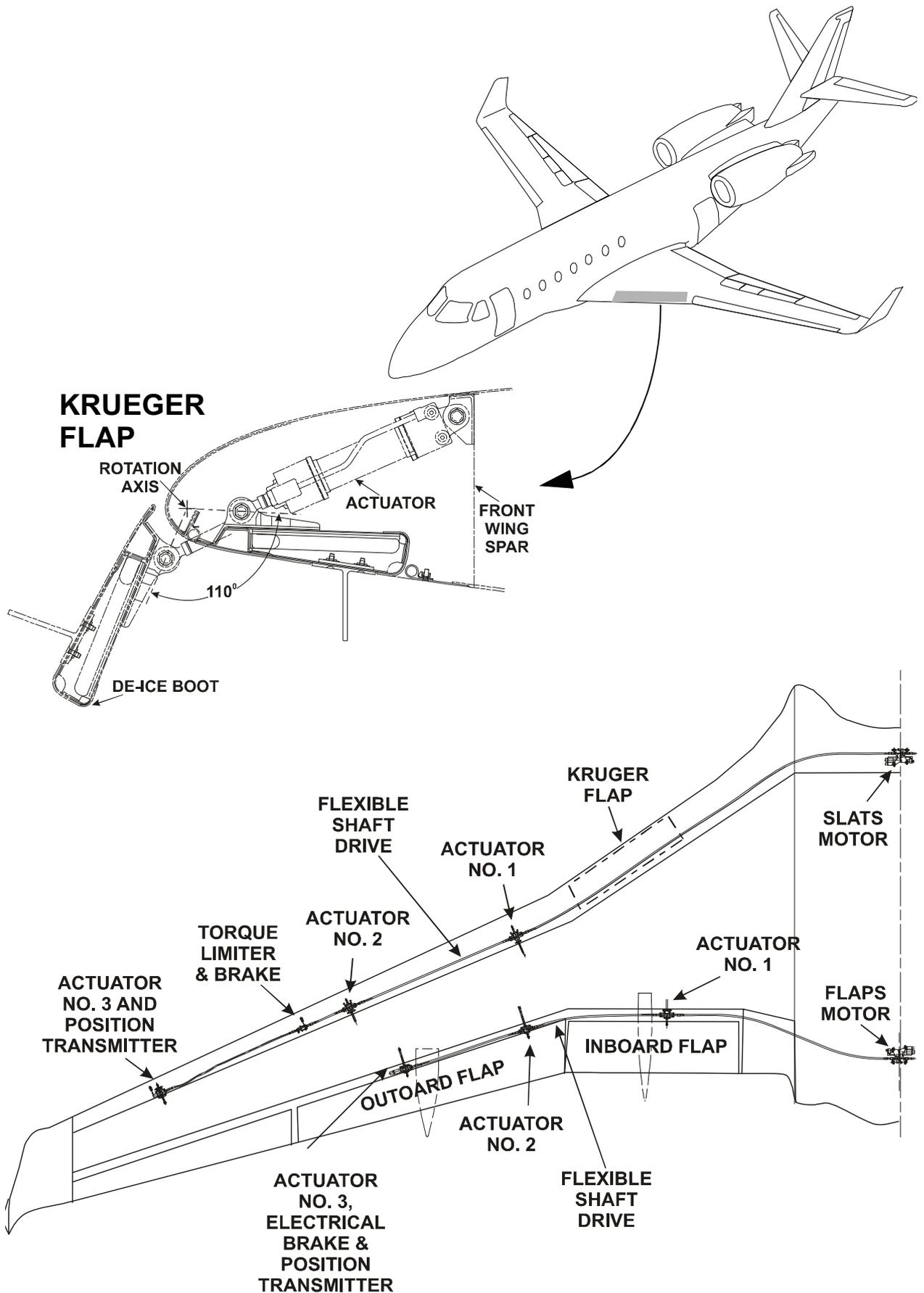


Figure 5-32. Slats and Flaps Drive Systems - Schematic

SLATS/FLAPS SYSTEM CONTROLS AND INDICATORS

SLATS/KRUEGER/FLAPS Control Lever - Has five positions as follows:

UP - Flaps, krueger flaps and slats are up.

DN - Slats and krueger flaps are extended, flaps stay retracted

12°; 20°; 40°; - Slats and krueger flaps stay extended. Flaps are extended, as required for the particular operation (take-off, approach or landing)

SLAT BYPASS ARM Pushbutton - Used to stop and bypass slats operation if failure occurs to slats extension/retraction system

FLAP/SLAT TEST Switch (on pedestal side) - This switch is used to test the slats/flaps controller. The switch is spring loaded to center (ON) position. Placing the switch in TEST position, tests all of the system components (SLATS/FLAPS position transmitters, drive disconnect switches, oleo switch connection, up/down limit switches and slats/flaps monitor power supply). OFF/RESET position stops the test and reset the system.

This switch
is intended only for maintenance checks.

Aural Warnings

Overspeed Sound - Aural warning sounds when slats, flaps and krueger flaps are not fully retracted and airspeed above 250 KIAS/ 0.55M

Caution Messages

FLAPS UNBAL - Asymmetry between left and right flaps exceeds 1.2°

KRUEGER FAIL - Slats are extended and krueger flaps remain retracted

KRUEGER UNBAL - Difference between left and right krueger flaps positions

SLATS UNBAL - Asymmetry between left and right slats exceeds 1.75°

Advisory Messages

T/O SLAT BYPASS - Replaces **T/O UNSAFE - SLATS** warning message following MASTER WARNING reset due to take-off configuration setting of flaps - 20° and SLATS BYPASS selected

Status Messages

SLAT/FLAP MAINTEN - FSECU (flaps/slats electronic control unit) has detected a fault in the flaps/slats system

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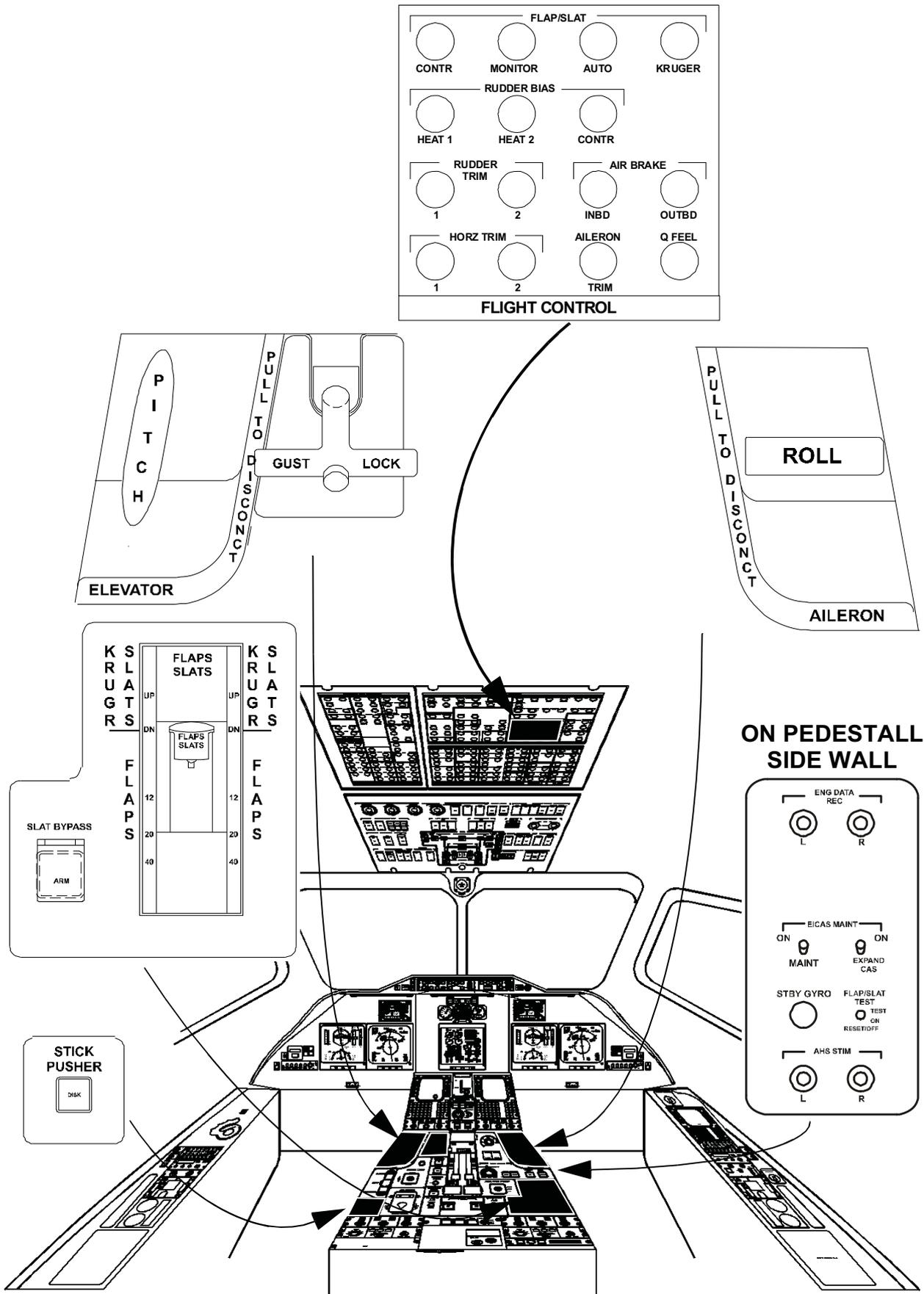


Figure 5-33. Slats/Krueger/Flaps System Controls and Indicators