GENERAL

The Challenger 605 has conventional flight controls organized on an advanced technology airfoil, and a T-tail configuration empennage. The flight control surfaces are actuated by crew or autopilot inputs via mechanical connections to hydraulic power control units (PCUs). Artificial control loading is provided at the individual control columns, control wheels and rudder pedals.

The flight controls may be divided functionally into two categories: Primary and secondary flight controls.

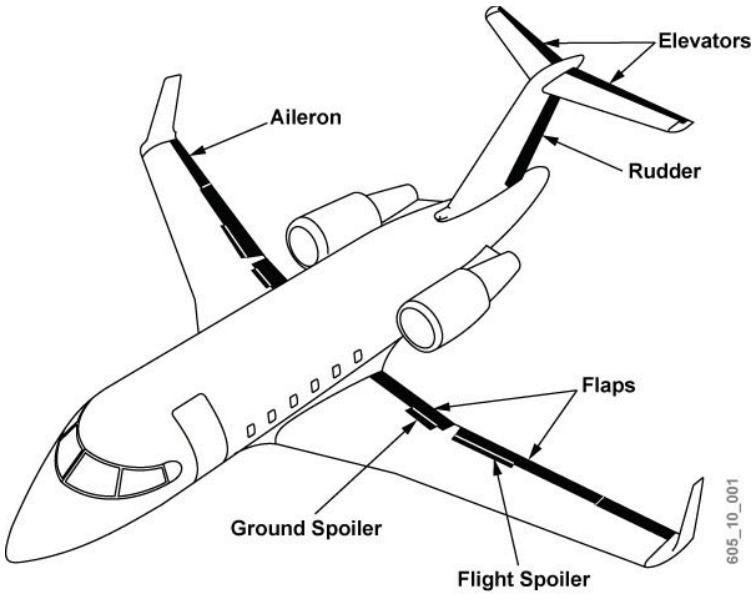
Primary Flight Controls

The primary flight controls are the ailerons, elevators and rudder. Each aileron and elevator is powered by two hydraulic systems. The rudder is powered by all three hydraulic systems.

In the unlikely case of total electrical failure or double-engine failure, ACMP 3B can be electrically energized directly from the air-driven generator (ADG). This ensures hydraulic power is available to the flight controls.

Secondary Flight Controls

The secondary flight controls include the trim systems (aileron, rudder and horizontal stabilizer), flaps, flight spoilers and ground spoilers. The stall protection system (SPS) is also considered a function of the secondary flight control system.



Flight Control Surfaces
Figure 10–10–1

PRIMARY FLIGHT CONTROLS

Description

The primary flight controls are arranged conventionally, with rudder pedals and a control wheel and column for both the pilot and copilot. Movement of the cockpit controls is transmitted mechanically via cable and/or pushrods to the aileron, elevator and rudder power control units (PCUs), which hydraulically move the control surfaces. Artificial control loading provides tactile feedback to the pilots at the individual control columns, control wheels and rudder pedals.

PRIMARY FLIGHT CONTROLS (CONT'D)

Position indicators are located on the FLIGHT CONTROLS synoptic page. White triangles and position scales indicate relative deflection of the ailerons, elevators and rudder.

Aileron and elevator flight control surfaces are each powered by two hydraulic systems, and the rudder is powered by all three systems. Flight control system design ensures that the loss of one hydraulic system will not prevent the operation of any control surface. Furthermore, should two hydraulic systems be lost, the remaining hydraulic system is sufficient to maintain safe aircraft control. Protection against cable jam/failure or PCU jam/failure is also provided for each axis.

Gust damping is provided for all three sets of primary flight controls. When the aircraft is parked and the hydraulic systems are unpressurized, built-in valves in the aileron, elevator and rudder PCUs protect against rapid flight control surface movement.

Components and Operation

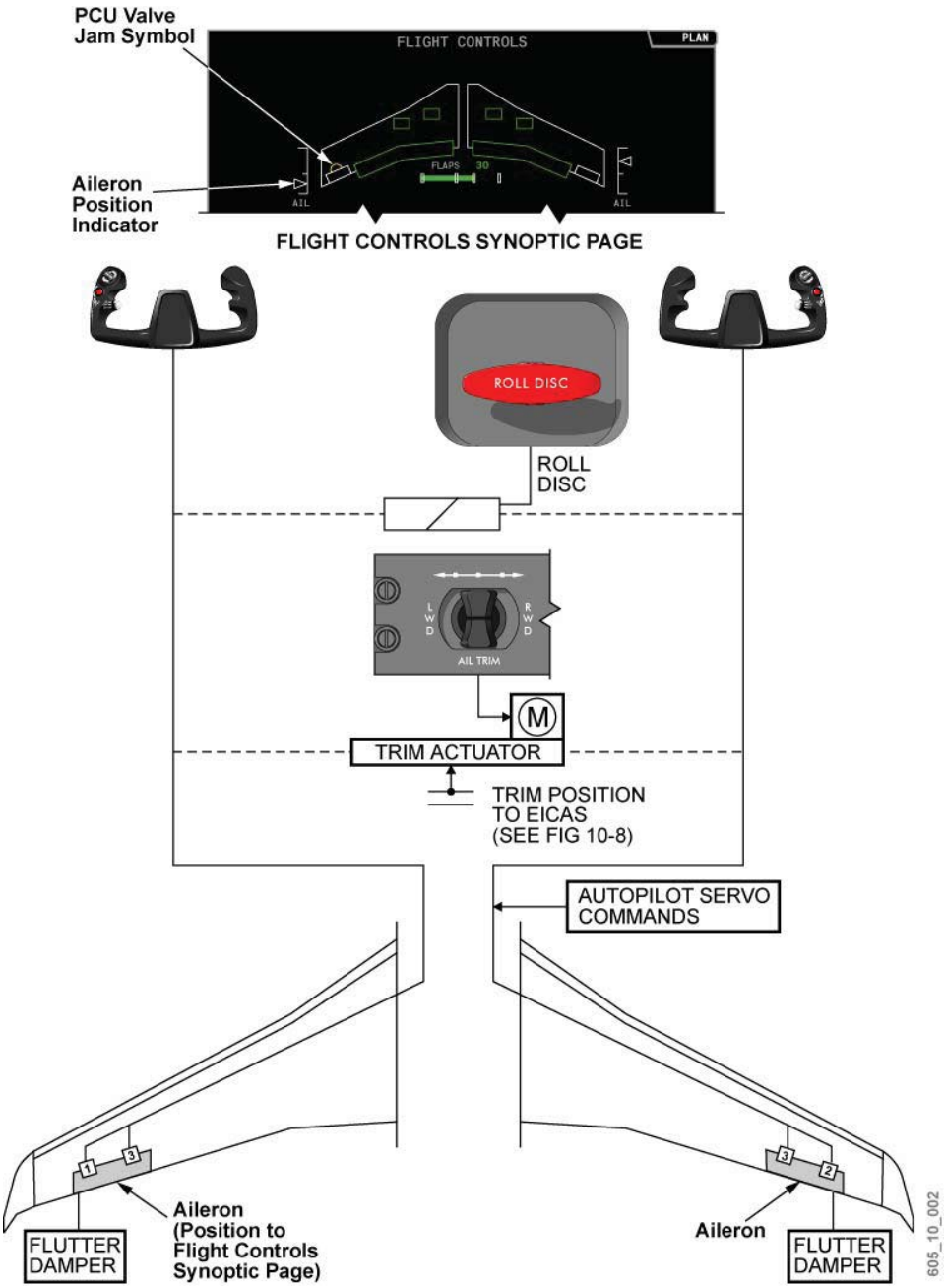
Ailerons

Lateral (roll) control is provided by ailerons. Two separate control paths are provided from the pilot's and copilot's control wheels. The pilot's side controls the left aileron and the copilot's side controls the right aileron. Movement of both pilot's and copilot's controls is simultaneous when the controls are interconnected (normal operation). Rotating either control wheel activates, via cables and pulleys, the PCUs (actuators) for the ailerons. Two actuators are used for each aileron. The left aileron PCUs use hydraulic pressure from systems 1 and 3, and the right aileron PCUs use hydraulic systems 2 and 3. A position transmitter, linked to each aileron, provides visual indication of the aileron deflection on the FLIGHT CONTROLS synoptic page

Aileron Disconnect

In the event of a control cable jam or PCU malfunction, the left and right sides of the aileron control circuit can be isolated by pulling the ROLL DISCONNECT handle on the center pedestal. This disengages a locking pin on the interconnect torque tube to isolate the failed circuit. The aileron on the operable circuit provides roll control at a reduced roll rate. The ROLL DISCONNECT handle can be reset at any time, locking the two control circuits together again.

PRIMARY FLIGHT CONTROLS (CONT'D)



Roll Control – Schematic
Figure 10–10–2

PRIMARY FLIGHT CONTROLS (CONT'D)

Aileron Power Control Unit Protection

If a PCU is malfunctioning, a failure detection will cause the EICAS to display a PCU valve jam symbol on the FLIGHT CONTROLS synoptic page (an amber half-circle above the aileron outline), and an amber **AILERON PCU** caution EICAS message to appear. Two sets of shear rivets on each aileron PCU provide additional protection against internal PCU linkage jams. If the linkage to one cylinder jams, the pilot can overpower the jammed condition, which will shear the rivets on that side and allow the other cylinder to operate the aileron.

Flutter Dampers

A flutter damper is installed on each aileron. This prevents control surface flutter in flight, in the event of a complete loss of hydraulic fluid at the PCU. A breakaway link provides jam protection in the case of flutter damper seizure.

Elevators

Longitudinal (pitch) control is provided by elevators, and supplemented by a movable horizontal stabilizer. Two separate control paths are provided through the pilot's and copilot's control columns. The pilot's control column controls the left elevator, and the copilot's control column controls the right elevator. Movement of both pilot's and copilot's controls is simultaneous when the systems are interconnected (normal operation). Moving either control column activates, via cables and pulleys, the PCUs (hydraulic actuators) for the elevators. Two actuators are used for each elevator. The left elevator PCUs use hydraulic pressure from systems 1 and 3, and the right PCUs use systems 2 and 3.

A position transmitter linked to each elevator provides visual indication of the elevator deflection on the FLIGHT CONTROLS synoptic page. If a differential of greater than 5° between each elevator position exists, an **ELEVATOR SPLIT** caution message will appear.

Within the elevator control mechanism, a stick shaker and stick pusher system can be activated via the stall protection system (SPS). The SPS is covered later in this chapter.

Pitch Disconnect

In the event of a control cable jam or elevator system malfunction, the left and right elevator control circuits can be isolated by pulling the PITCH DISC handle on the center pedestal. This provides reduced pitch authority through the one elevator on the operable circuit. The PITCH DISC handle can be reset at any time, locking the two circuits together again.

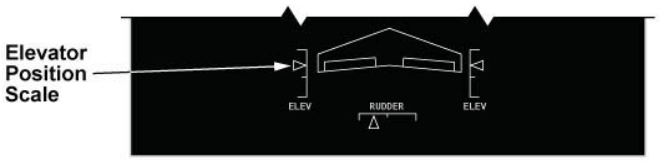
Elevator PCU Protection

An elevator PCU jam or failure can be overcome by integrated jam-tolerant input rods. These rods collapse or expand in the event of both PCUs on one side having no hydraulic pressure, and enable operation of the opposite side elevator. If one of the pair of on-side PCU control valves jams, the jam-tolerant input rod will allow operation of the adjacent PCU control valve.

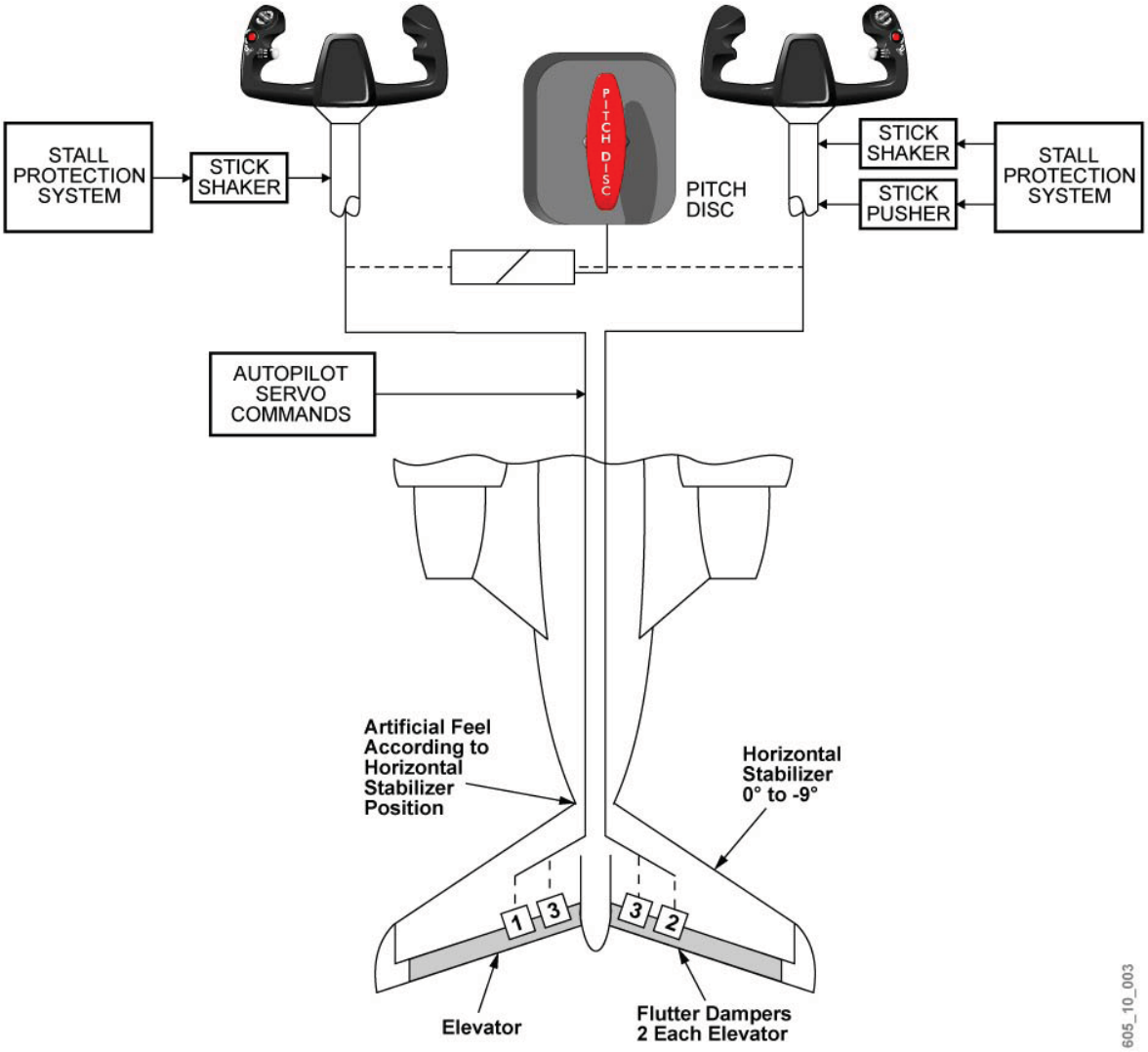
Flutter Damper

Two flutter dampers are installed on each elevator. These are identical in design and function to those installed on the ailerons.

PRIMARY FLIGHT CONTROLS (CONT'D)



FLIGHT CONTROLS SYNOPTIC PAGE



Pitch Control – Schematic
Figure 10–10–3

PRIMARY FLIGHT CONTROLS (CONT'D)

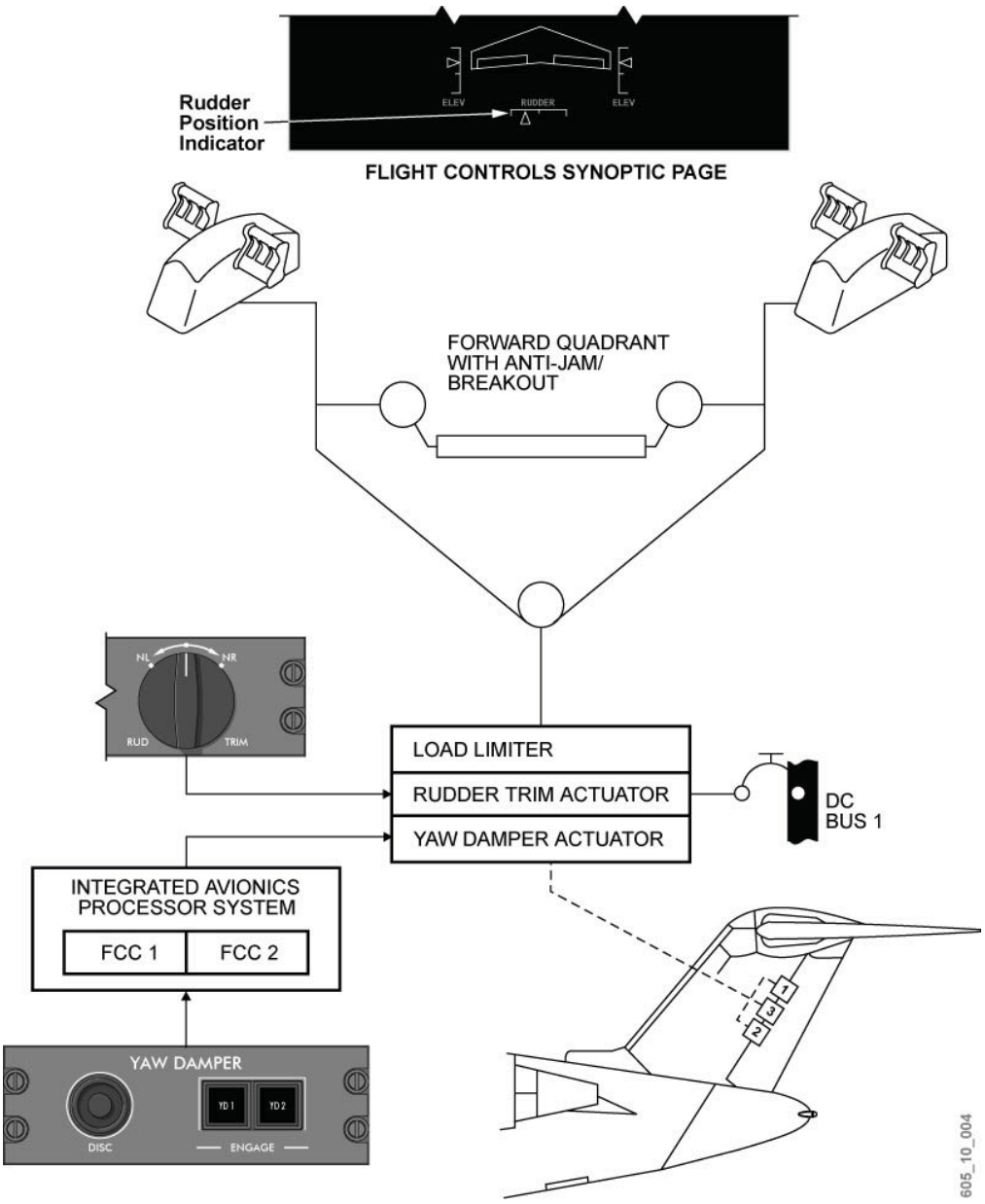
Rudder

Yaw control is provided by a hydraulic actuated rudder, hinged on the rear spar of the vertical stabilizer. Two separate mechanical control paths are provided from the rudder pedals to three independent PCUs. Each PCU is powered by a separate hydraulic system. A position transmitter provides visual indication of rudder deflection on the FLIGHT CONTROLS synoptic page.

Both rudder pedal control systems have an anti-jam breakout mechanism. In the event of a jammed rudder control on one side, both pilot and copilot rudder pedals are capable of operating the remaining control system. Additional force on the rudder pedals is required to bypass the inoperative side, allowing rudder operation.

A two-channel yaw damper system is installed, and supplies small rudder corrections in response to reference signals from the IRUs through the FCCs. This is considered a function of the automatic flight control system (AFCS). Refer to Chapter 4, Automatic Flight Control System, for additional information.

PRIMARY FLIGHT CONTROLS (CONT'D)



Yaw Control – Schematic
Figure 10–10–4

SECONDARY FLIGHT CONTROLS

Description

The secondary flight controls include the horizontal stabilizer, inboard and outboard flaps, flight and ground spoilers, and the associated trim systems. The horizontal stabilizer trim is electrically actuated via a jackscrew. Flaps are electrically powered, and are driven by flex cables and ball screw actuators. Spoilers are hydraulically powered. Trim about all three axes is electrically controlled from the cockpit.

SECONDARY FLIGHT CONTROLS (CONT'D)

Components and Operation

Horizontal Stabilizer Trim

Pitch trim is accomplished by varying the angle of incidence of the horizontal stabilizer. The horizontal stabilizer trim control unit (HSTCU) commands the actuation of the stabilizer leading edge with a jackscrew, driven by two electric motors through a range of 0° to –9° at specific rates of movement. The HSTCU receives inputs from the pilot's and copilot's control wheel pitch trim switches, the autopilot, and the Mach trim system. The HSTCU has two channels that are engaged by the CH 1 and CH 2 switch/lights on the STAB TRIM panel on the center pedestal. Normally, with both channels engaged, CH 1 is in command, with CH 2 in standby.

Operation of the horizontal stabilizer is continuously monitored by the HSTCU. In the event of a single-channel failure, the **STAB CH 1 (2) INOP** status EICAS message will appear, and the remaining channel will provide control. If both channels fail, the **STAB TRIM** caution EICAS message appears, and stabilizer trim becomes inoperative.

Horizontal stabilizer trim position is displayed on the EICAS page and the FLIGHT CONTROLS synoptic page. The normal trim setting for takeoff (3 to 8 units) is depicted on the indicator as a green band.

If stabilizer trim is not set in this range with the aircraft in the take-off mode, a **CONFIG STAB** warning EICAS message will be displayed, and an aural "CONFIG TRIM" will sound.

Horizontal Stabilizer Trim Priority

The stabilizer trim can be operated manually with the pilot's and copilot's control wheel pitch trim switches, or automatically with the autopilot or the Mach trim system. The order of priority and rate of movement are as follows:

1. Pilot manual trim – The pilot's control wheel pitch trim switch is highest in the order of priority. The stabilizer rate of movement is 0.5°/sec.
2. Copilot manual trim – The copilot's control wheel pitch trim switch is next highest in the order of priority. The stabilizer rate of movement is 0.5°/sec.
3. Autopilot trim – The stabilizer rate of movement is 0.1°/sec. If a flap selection is made with the autopilot engaged, the rate of movement reverts to the higher rate of 0.5°/sec during flap transition.
4. Mach trim – The Mach trim is lowest in the order of priority. The stabilizer rate of movement is between 0.03° and 0.06°/sec.

Horizontal Stabilizer Trim Clacker

If the horizontal stabilizer is in motion at a rate of more than 0.3°/sec for more than 3 seconds, a clacker ("drumroll" sound) is activated, to alert the pilot of a possible horizontal stabilizer trim runaway condition.

In the event of a runaway stabilizer trim condition, both channels can be quickly disconnected, by pressing the STAB TRIM DISC button on either outboard control wheel horn.

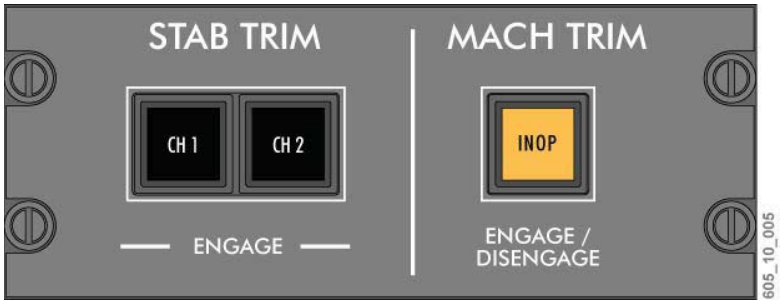
SECONDARY FLIGHT CONTROLS (CONT'D)

Mach Trim

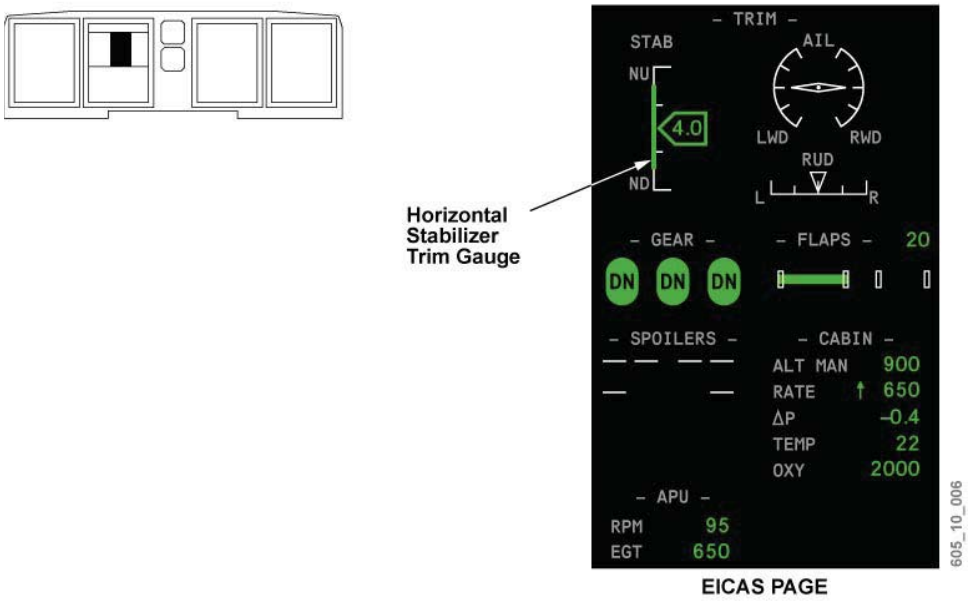
At least one STAB TRIM channel must be engaged to have Mach trim engaged. The Mach trim system, when engaged and active, compensates for the rearward shift of the aerodynamic center of pressure as Mach number increases. The Mach trim system schedules inputs to the HSTCU to command movement of the horizontal stabilizer, when hand-flying at speeds greater than Mach 0.4.

Aileron Trim

Aileron trim is accomplished by activation of the AIL TRIM switches on the center pedestal. Actuation of both switches provides arming and directional signals, which bias the control circuits to actuate the PCUs and deflect the ailerons. Actuation of the aileron trim will cause the control wheels to deflect in the direction of trim input. Aileron trim position is indicated on the primary EICAS display.



Stab Trim Panel
Figure 10–10–5

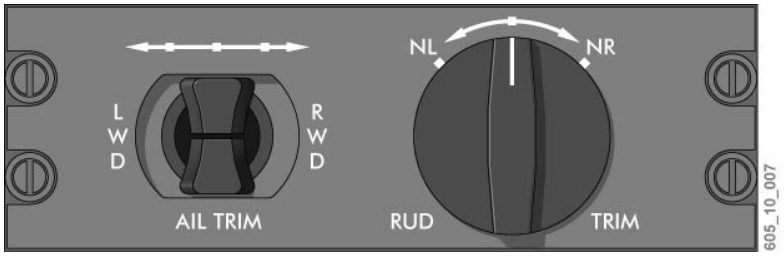


Stab Trim Indications
Figure 10–10–6

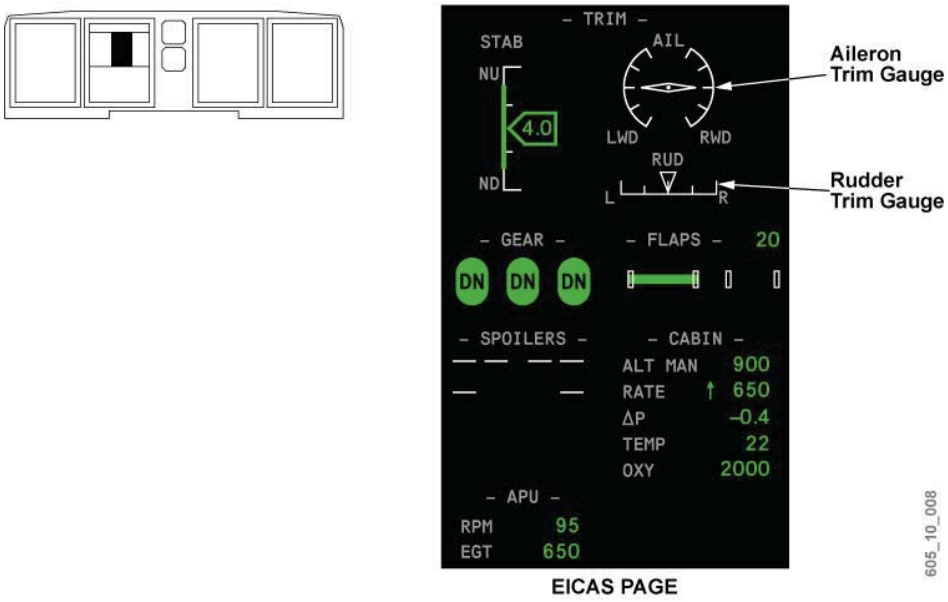
SECONDARY FLIGHT CONTROLS (CONT'D)

Rudder Trim

Rudder trim is accomplished by turning the RUD TRIM switch. Rudder trim input is applied by the trim actuator into the yaw damper/trim mixer assembly, and will supplement the primary rudder input, as applicable. Actuation of the rudder trim does not cause rudder pedal deflection. The rudder trim position is indicated on the EICAS page.



Aileron/Rudder Trim Panel
Figure 10–10–7



Aileron/Rudder Trim Indications
Figure 10–10–8

Flaps

Two double-slotted flap panels (inboard and outboard) are externally hinged on the trailing edge of each wing. A flap lever, located on the center pedestal, sends a signal to the flap control unit (FCU) to initiate flap movement.

SECONDARY FLIGHT CONTROLS (CONT'D)

The flaps may be set to one of four positions: 0, 20, 30, and 45 degrees. A flap gate is incorporated within the flap lever 20-degree detent. This minimizes the possibility of accidental flap retraction to 0 degrees during a go-around procedure. Flap position is displayed on the EICAS page and the FLIGHT CONTROLS synoptic page, in both analog (colored bar) and digital formats. The indications on the EICAS page are in view only if the flaps are extended, or if the landing gear is not up and locked.

Maximum Flap Speeds

FLAP SETTING	MAXIMUM AIRSPEED
20 degrees	231 KIAS
30 degrees	197 KIAS
45 degrees	189 KIAS

NOTE

To prevent damage, maximum indicated airspeeds for each flap setting must not be exceeded. These are placarded on the instrument panel (See Airplane Flight Manual for current airspeeds).

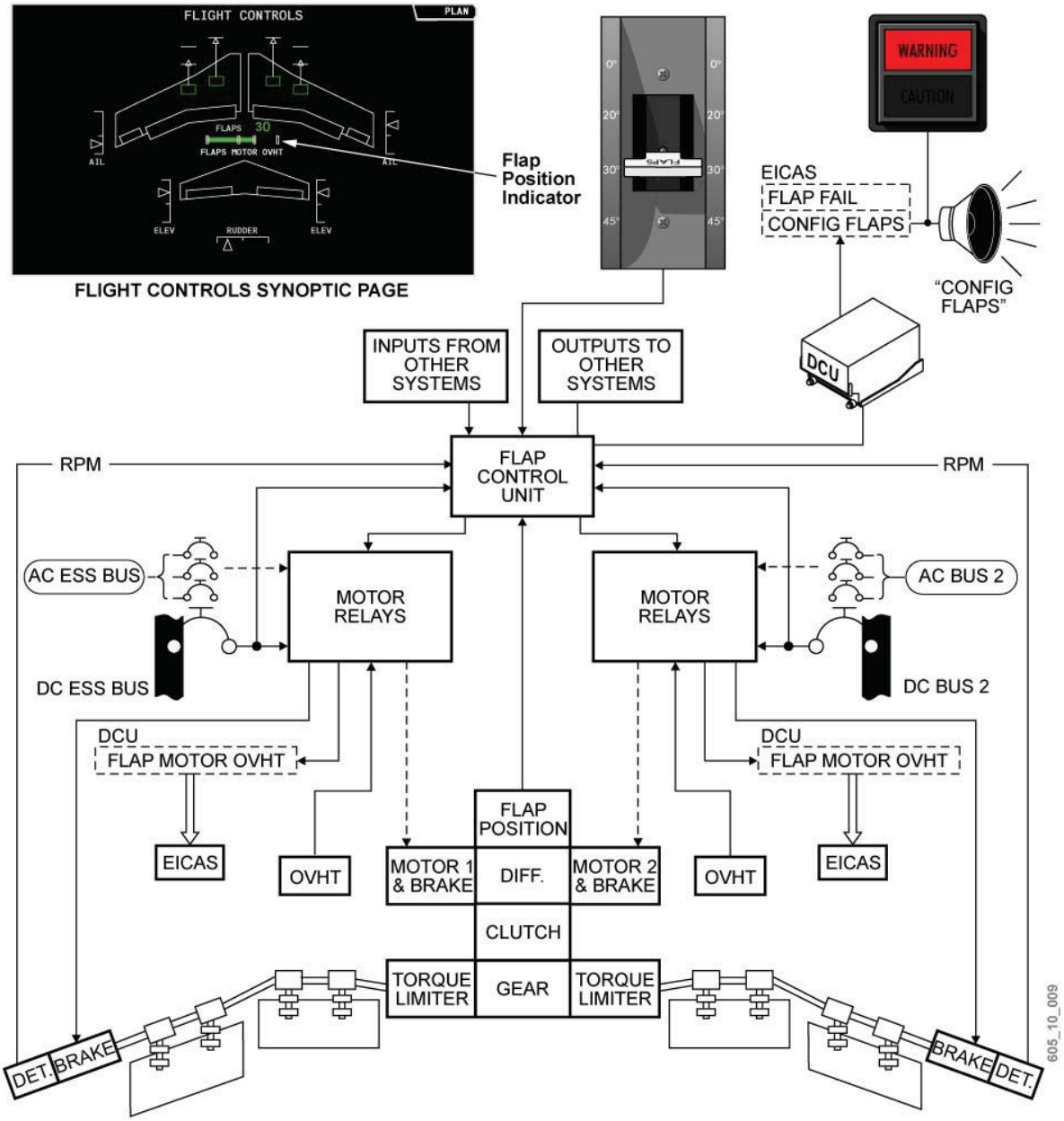
Flap Control Unit

When the FCU commands a change in flap position, the flap brakes are released, and two AC-powered motors, mounted on a flap gearbox, are energized. The gearbox rotates flex shafts, which move the flap ballscrew actuators, extending or retracting the flaps. When the desired setting is reached, the motors are deenergized and the flap brakes are applied. The flaps are mechanically interconnected for simultaneous movement of the inboard and outboard flap sections.

Flap position and condition are continuously monitored by the flap control unit. In the event of failure or overheat of a single flap motor (indicated by a **FLAPS MOTOR OVHT** status EICAS message), the remaining motor can operate the flaps at half speed. Complete failure of the flap system, including an asymmetry of >2.75°, will generate a **FLAPS FAIL** caution EICAS message, as well as an amber symbol on the FLIGHT CONTROLS synoptic page.

If the flaps are not set at 20° with the aircraft in takeoff mode, a **CONFIG FLAPS** warning EICAS message and aural warning will be displayed/sounded.

SECONDARY FLIGHT CONTROLS (CONT'D)



Flap Schematic
Figure 10–10–9

Flight Spoilers

These provide lift dumping and speed control when airborne, and reduce ground roll during landing and rejected takeoffs.

SECONDARY FLIGHT CONTROLS (CONT'D)

Each flight spoiler panel is hydraulically operated by two identical PCUs, powered by hydraulic systems 1 and 2. The flight spoilers are mechanical controlled by the flight spoiler control lever on the center pedestal, and can be deployed up to a maximum of 40° in flight or on the ground. The flight spoiler control lever travels through nine detents, allowing the pilot to select variable amounts of flight spoiler deployment.

Spoiler position is indicated on both the EICAS page and FLIGHT CONTROLS synoptic page, using white arrows which move upward towards lines indicating relative extension (for flight spoilers only), and full extension (for both flight and ground spoilers). When the flight and ground spoilers are fully retracted, all EICAS spoiler icons and position arrows disappear.

An amber **FLT SPLRS DEPLOY** caution EICAS message appears if the flight spoilers are deployed in flight, and:

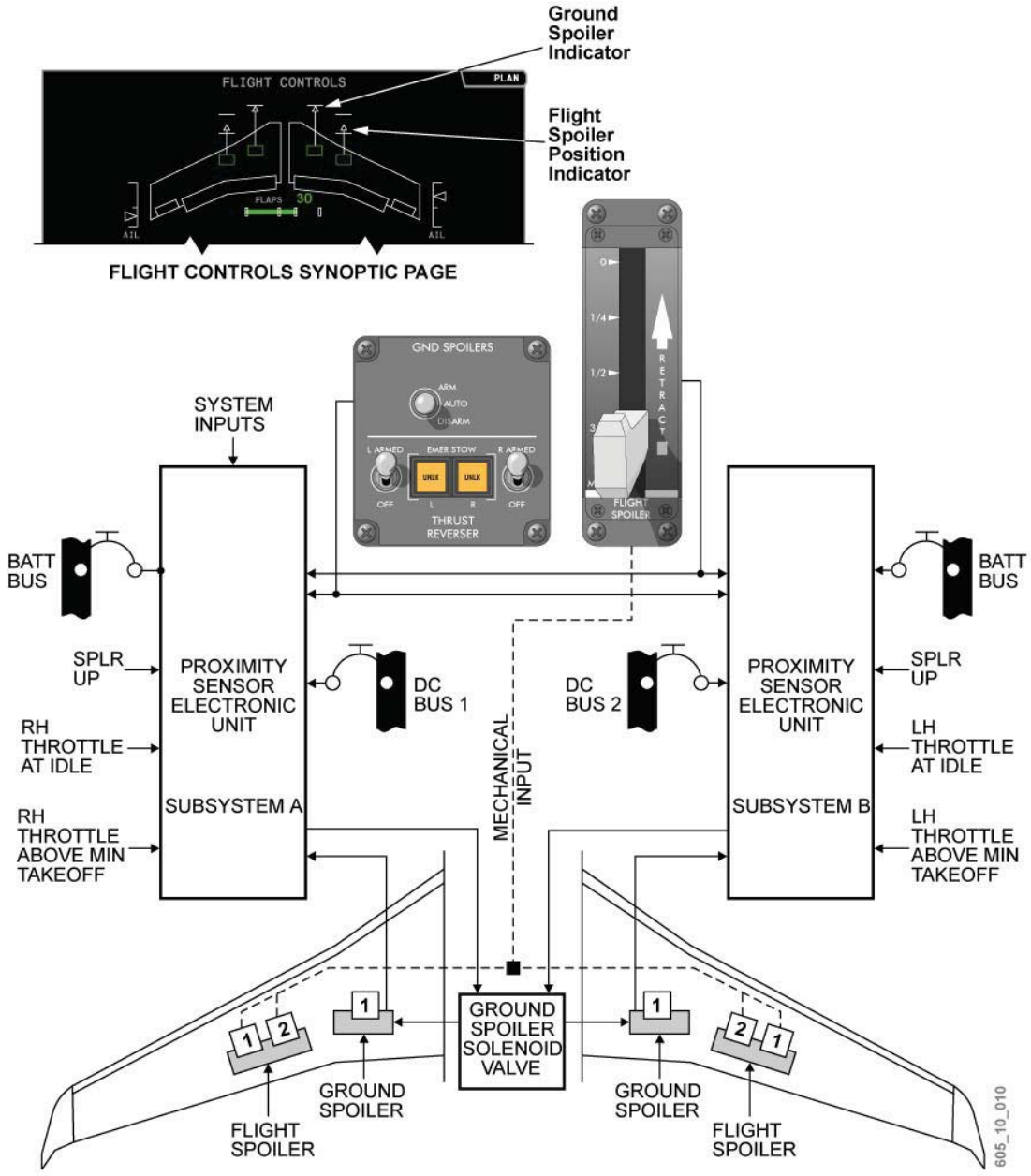
- The aircraft radio altitude is between 10 and 300 feet AGL, or
- The left or right engine N_1 is greater than 79%, or
- If radio altitude is not available, at any time the landing gear is extended.

If the flight spoilers are not stowed with the aircraft in takeoff mode, a **CONFIG SPOILERS** warning EICAS message and aural warning will be displayed/sounded.

20° Detent Mechanism

A 20° detent mechanism prevents asymmetrical deployment of the flight spoilers in the event of a disconnected input linkage. The PCU control valves are spring-loaded retracted, but the detent mechanism will apply force to hold a mid-position if the spoiler has been deployed to greater than 20°. When on the ground with hydraulic pressure available, a sensor on each detent mechanism will generate a **FLT SPLRS** caution EICAS message, and cause the appropriate flight spoiler outline to turn amber on the FLIGHT CONTROLS synoptic page, if the spoiler position does not correspond to the detent position.

SECONDARY FLIGHT CONTROLS (CONT'D)



Flight and Ground Spoilers – Schematic
Figure 10–10–10

Ground Spoilers

The inboard spoiler panels on each wing are the ground spoilers. The ground spoilers have only two positions: retracted or fully deployed to 45°. A single actuator, powered by hydraulic system 1, operates each ground spoiler.

SECONDARY FLIGHT CONTROLS (CONT'D)

After touchdown or during a rejected takeoff, the ground spoilers extend to dump lift and increase drag, to assist in aircraft braking. Ground spoiler deployment is normally automatic, but can be activated manually by the pilot.

In the automatic or manual modes, arming, deployment and retraction is controlled by the proximity sensor electronic unit (PSEU). The PSEU monitors inputs from the following:

- Ground spoiler arming switch;
- Thrust lever position microswitches;
- Ground spoiler surface position;
- Flight spoiler lever position switch; and
- Anti-skid control unit (wheel speed).

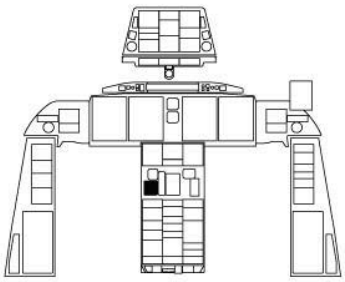
In the event of a malfunction or failure of the automatic arming and disarming logic, the ground spoiler system may be manually armed or disarmed through the GND SPOILERS panel, located on the center pedestal.

Spoiler position is indicated on both the EICAS page and FLIGHT CONTROLS synoptic page, using white arrows which move upward toward lines, indicating relative extension (for the flight spoilers only), and full extension (for both flight and ground spoilers). When the flight and ground spoilers are fully retracted, all EICAS spoiler icons and position arrows disappear.

Ground Spoiler Arming Logic

The ground spoiler circuit must be armed before deployment can take place. The ground spoilers are armed or disarmed by the three-position GND SPOILERS switch, located on the center pedestal next to the flight spoiler control lever. The ground spoiler system can be armed either automatically or manually as follows:

SECONDARY FLIGHT CONTROLS (CONT'D)



GROUND SPOILER PANEL

Automatic Arming

Must meet the following conditions:
- GND SPOILERS Switch in the AUTO position
- L and R Thrust > Min Takeoff Setting
- Wheel Speed > 16 kts

Manual Arming

Must meet the following conditions:
- GND SPOILERS Switch in the AUTO position
- Flight Spoiler Lever > 1/4 detent

OR

- GND SPOILERS Switch in the ARM position

Deploy Logic

Must meet the following conditions:
- L and R Thrust Lever at IDLE
- Main Landing Gear Weight-on-Wheels

OR

- Wheel Speed > 16 kts

Automatic Retract

Must meet the following conditions:
- L or R Thrust Lever > IDLE (go-around)

OR

- L or R Thrust Lever < Min required for Takeoff
- Inboard and Outboard Wheel Speed < 16 kts
- Deploy Logic (airplane on the ground for at least 3 seconds)

Manual Retract

Must meet the following conditions:
- GND SPOILERS Switch in the DISARM position

OR

- Flight Spoiler Lever < 1/4 detent (if spoilers were manually armed using the Flight Spoiler Lever and the GND SPOILERS Switch at AUTO)

605_10_011

Ground Spoilers Arming Logic
Figure 10–10–11

STALL PROTECTION SYSTEM

The stall protection system (SPS) provides the flight crew with aural, visual and tactile (stick shaker) indications of an impending stall and, if no corrective action is taken, will activate a stick pusher to prevent the aircraft from entering a full stall.

Stall Protection System Computer

A dual-channel SPS computer monitors the following inputs:

- Angle of attack – LH, RH angle-of-attack vanes;
- Lateral acceleration – inertial reference system (IRS);
- Flap position; and
- Pressure altitude – air data computers (ADCs).

The SPS uses these inputs to continuously calculate angle-of-attack (AOA) trip points while in flight. The AOA trip points are biased with the lateral accelerometers (sideslip and skid), flap position and pressure altitude.

As the trip point is approached, continuous ignition is activated. If the AOA continues to increase, the stick shaker activates and the autopilot disengages. If the AOA still continues to increase, the stick pusher activates, along with red STALL annunciation displayed left of the ADI, and Master Warning lights on the glareshield, and a warbler aural warning. The stick pusher only activates when the signals from both channels of the SPS computer are in agreement.

NOTE

The crew should initiate approved recovery techniques at the first indication of an impending stall (i.e., recognition of proximity of low-speed cue at airframe buffet, at autoignition, or any time the stick shaker or pusher activates).

In the event of an AOA increase rate greater than one degree per second, the SPS computer lowers the AOA trip points to activate the aural, visual and tactile indications at a lower AOA. This prevents the aircraft's pitching momentum from carrying it through the stall warning/stick pusher sequence into the stall.

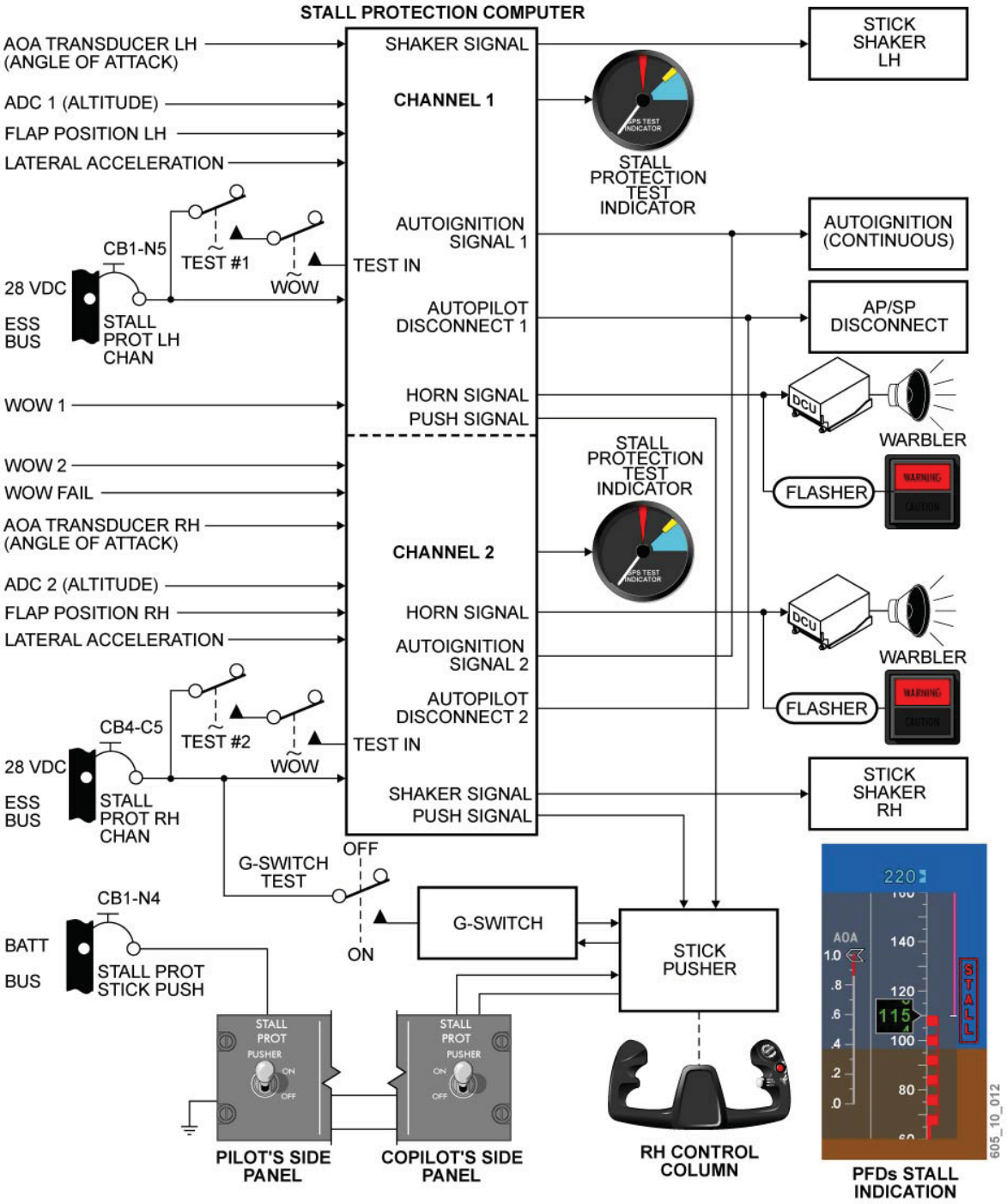
Stick Pusher Disconnect

The stick pusher subsystem is armed when both STALL PROT PUSHER switches, located on the pilot and copilot side panels, are ON. An acceleration switch will disconnect the stick pusher to prevent an unusual attitude, if less than +0.5 'G' is reached during pusher operation. The pusher may also be disabled momentarily by pushing the AP/SP DISC button on the pilot's or copilot's control wheels. This will disconnect the pusher only as long as either button is held in. In the event of a malfunction, the stick pusher may be deactivated by switching either STALL PROT PUSHER switch to OFF (located on the side panels). To enable pusher operation, both switches must be returned to the ON position.

NOTE

The stick shaker is always armed. The STALL PROT PUSHER switches affect only the stick pusher function.

STALL PROTECTION SYSTEM (CONT'D)



Stall Protection System – Schematic
Figure 10–10–12

STALL PROTECTION SYSTEM (CONT'D)

SPS Ground Testing

Preflight testing of the system is accomplished by SPS TEST switches on the miscellaneous test panel, located on the center pedestal. Either the L (R) SPS TEST switch will cause the system to progressively sweep through the AOA range from no stall to full stall, as indicated on the SPS test indicator, activating ignition (blue arc) and shaker/autopilot disconnect (yellow arc). This is followed by red flashing STALL annunciation on the PFD, and an aural warbler warning. If both switches are activated simultaneously, the stick pusher will activate (red arc).

Pusher disconnects can then be tested by pushing, in sequence, the pilot's AP/SP DISC, the copilot's AP/SP DISC and the G-switch.

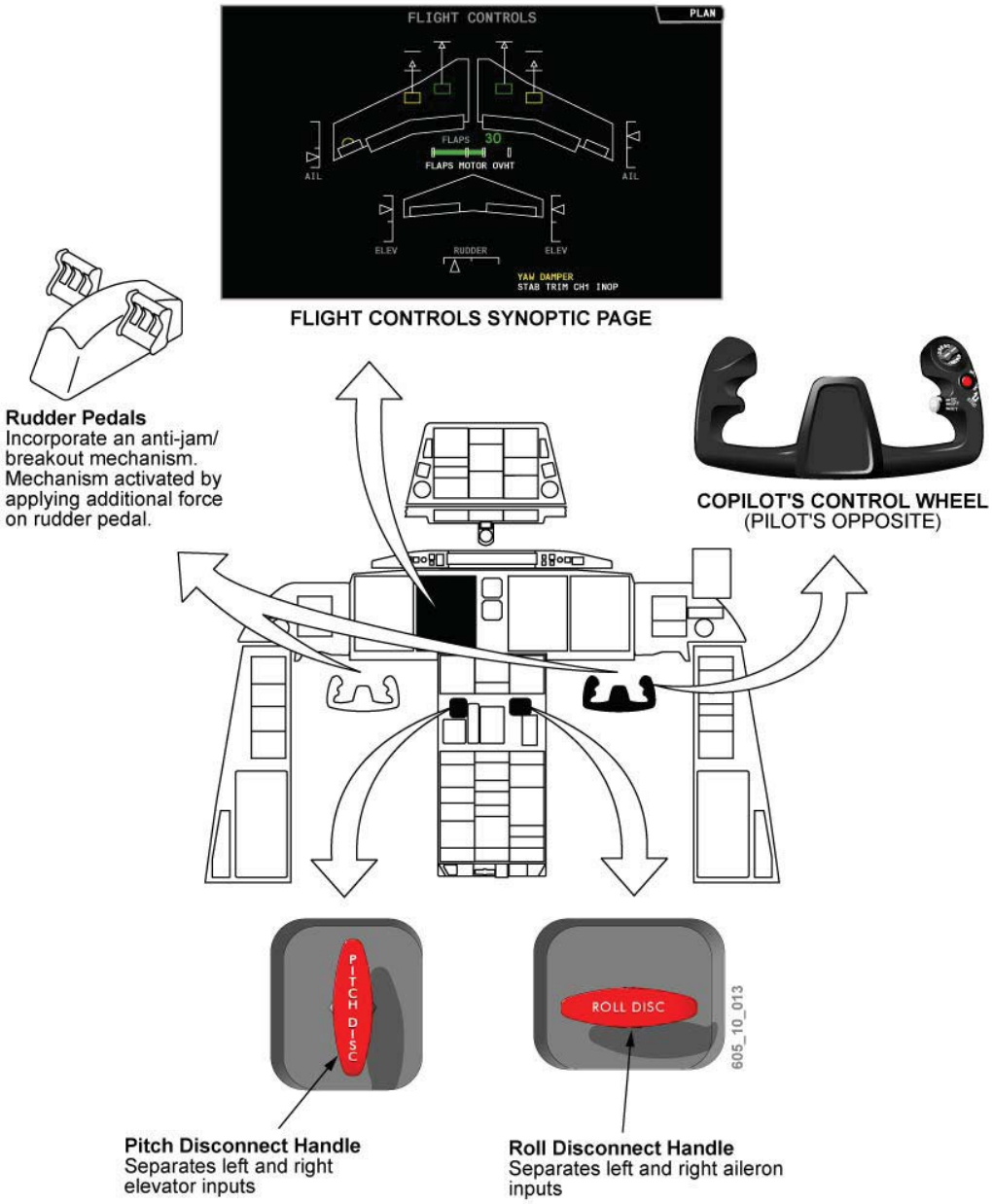
See the Airplane Flight Manual for full testing procedures. Ignition is activated during the test, and may pose a hazard in enclosed areas.

CONTROLS AND INDICATORS

Primary and secondary flight controls and indicators are accessible from both pilot seats. Warning, caution, advisory and status messages are presented on the EICAS page and on the FLIGHT CONTROLS synoptic page.

CONTROLS AND INDICATORS (CONT'D)

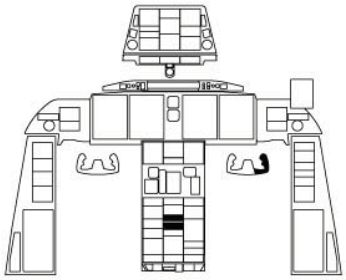
Primary Flight Controls



Pitch, Roll and Yaw Controls
Figure 10–10–13

CONTROLS AND INDICATORS (CONT'D)

Stab Trim, Aileron Trim, Rudder Trim



Stabilizer Trim Disconnect Switch
(momentary-action)
Disconnects stabilizer trim (Both CH 1 and CH 2)

Note: Mach trim function will also disengage when switch is actuated

Stabilizer Trim Switches
(spring-loaded to center)
NOSE UP – Activates nose up trim
NOSE DN – Activates nose down trim

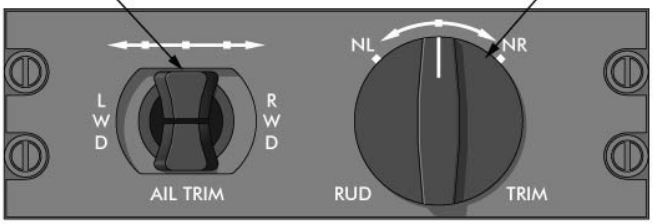
Note: Both switches must be pushed fully up or down to activate trim.

COPILOT'S CONTROL WHEEL
(MIRROR OF PILOTS)

AILERON TRIM Switches
(spring-loaded to center)
LWD – Commands left wing down aileron trim
RWD – Commands right wing down aileron trim

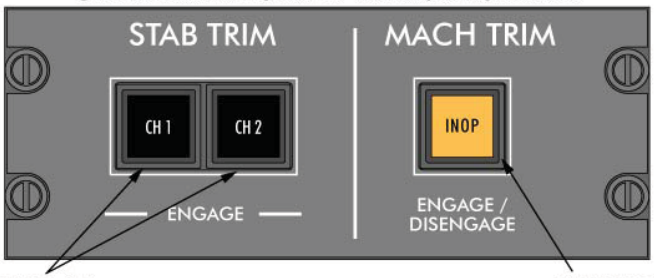
Note: Both switches must be pushed fully left or right to activate trim.

RUDDER TRIM Switch
(spring-loaded to center)
NL – Commands nose left rudder trim
NR – Commands nose right rudder trim



AILERON/RUDDER TRIM CONTROL PANEL

STABILIZER TRIM & MACH TRIM CONTROL PANEL



STAB TRIM CH1, CH2 Switches
(momentary-action)
Engages respective channel of the Horizontal Stabilizer Trim Control Unit (HSTCU)

MACH TRIM Switch/Light
(momentary-action)
Alternately engages or disengages the Mach trim function

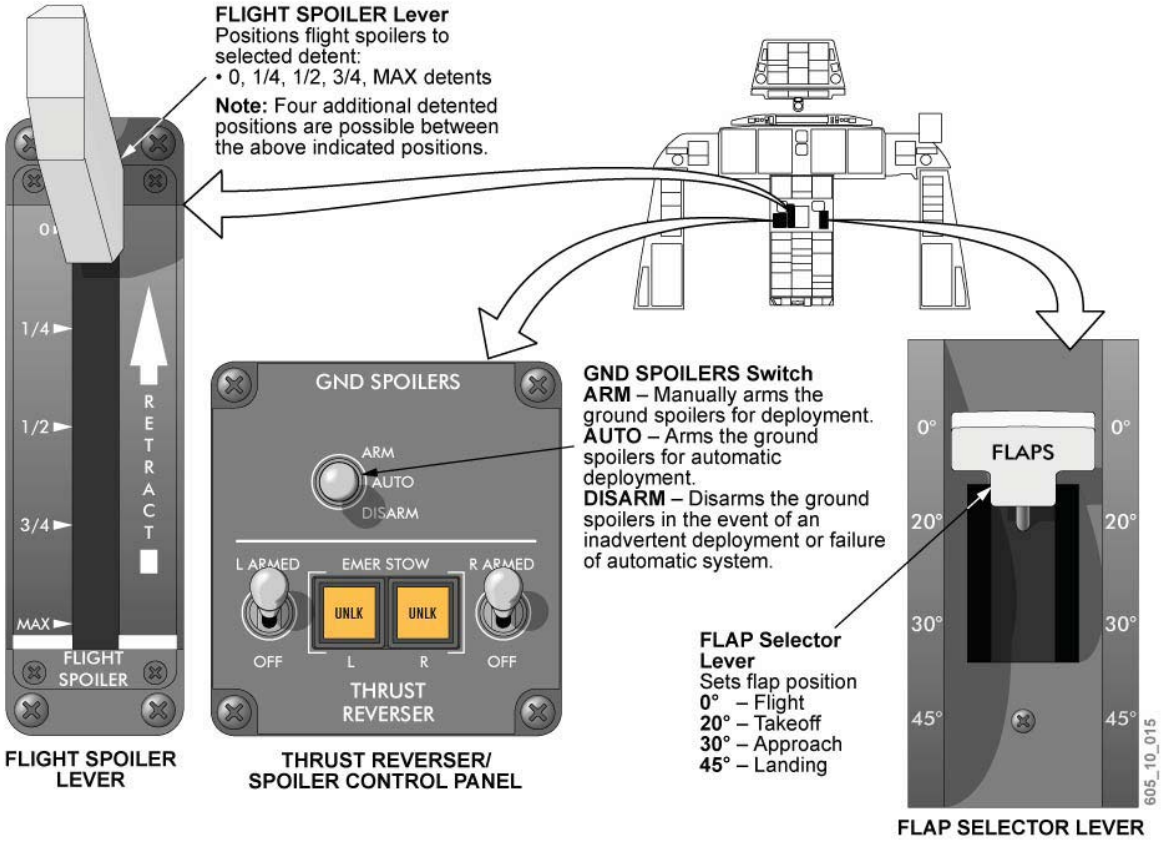
INOP Light
Illuminated – Indicates Mach trim function is inoperative/disengaged

605_10_014

Trim Controls
Figure 10–10–14

CONTROLS AND INDICATORS (CONT'D)

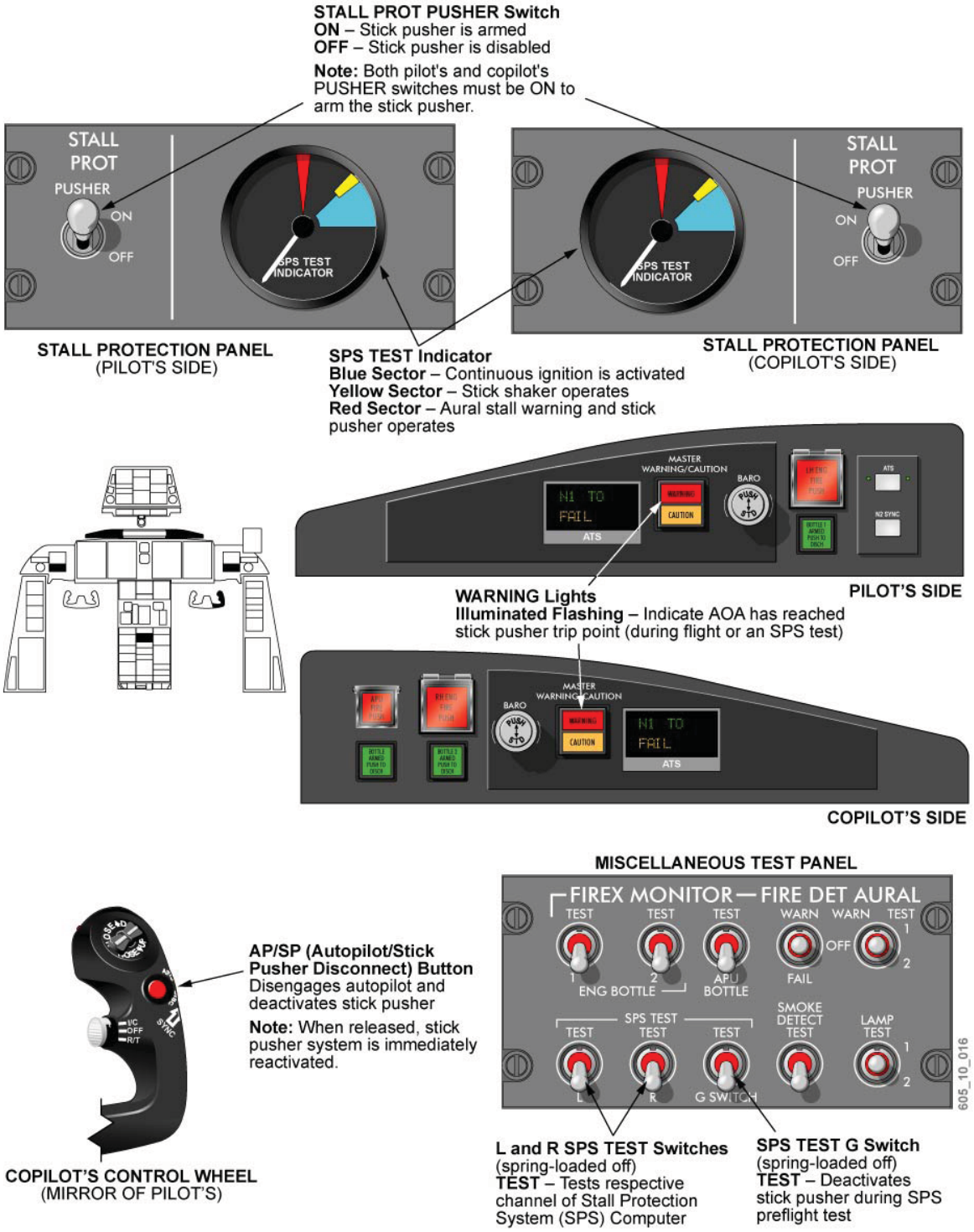
Flaps, Spoilers



Flap and Spoiler Controls
Figure 10–10–15

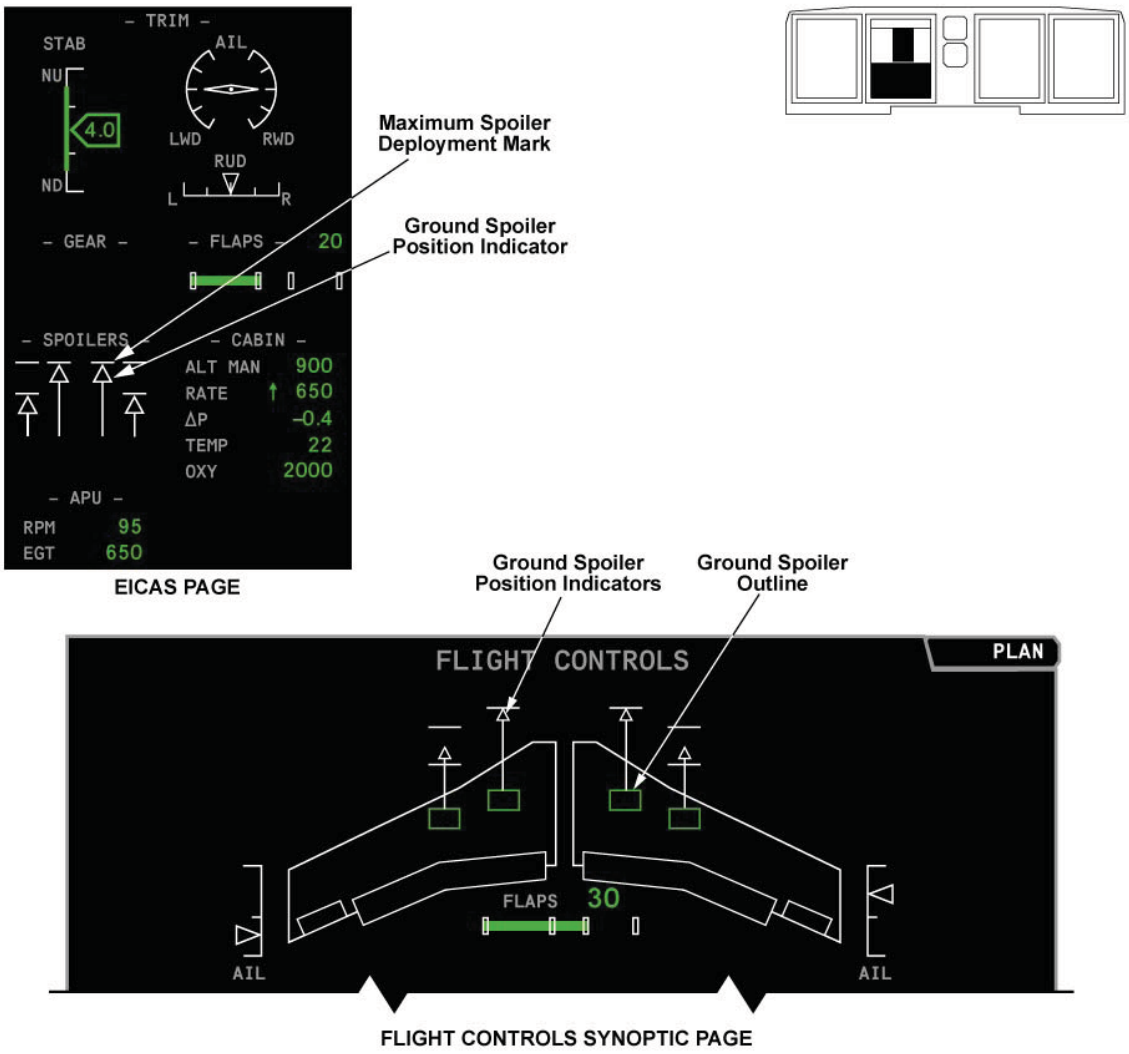
CONTROLS AND INDICATORS (CONT'D)

Stall Protection System



Stall Protection System
Figure 10–10–16

CONTROLS AND INDICATORS (CONT'D)



Description	Symbol	Condition
Ground Spoiler Position Indicators		Ground spoilers are fully extended. **Note:** Indicators are not displayed when ground spoilers are retracted or input data is invalid.
Ground Spoiler Outline		Respective hydraulic pressure and PSEU valid.
		Respective hydraulic manifold or PSEU are inoperative.
		Invalid data

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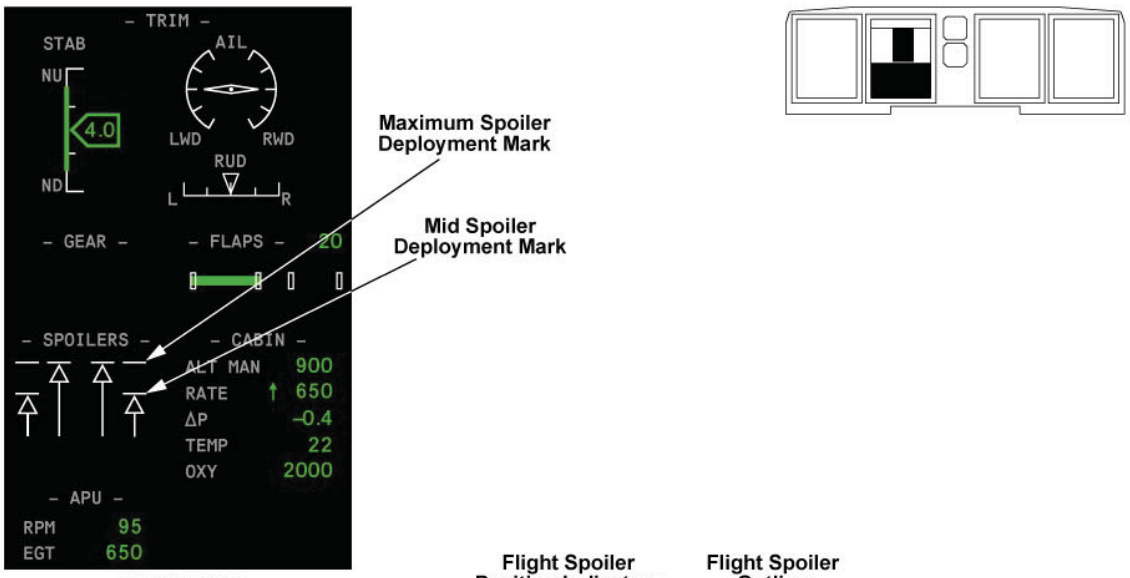
EICAS Flight Controls Indications (Ground Spoilers)
Figure 10–10–17

CONTROLS AND INDICATORS (CONT'D)



Description	Symbol	Condition
Flight Spoiler Position Indicators		Indicates relative position of respective spoiler. **Note:** Indicators are not displayed when respective spoilers is retracted or input data is invalid.
Flight Spoiler Outline		Respective flight spoiler detent mechanism and associated surface position are valid.
		Abnormal condition of flight spoiler detent mechanism and associated surface position.
		Invalid data

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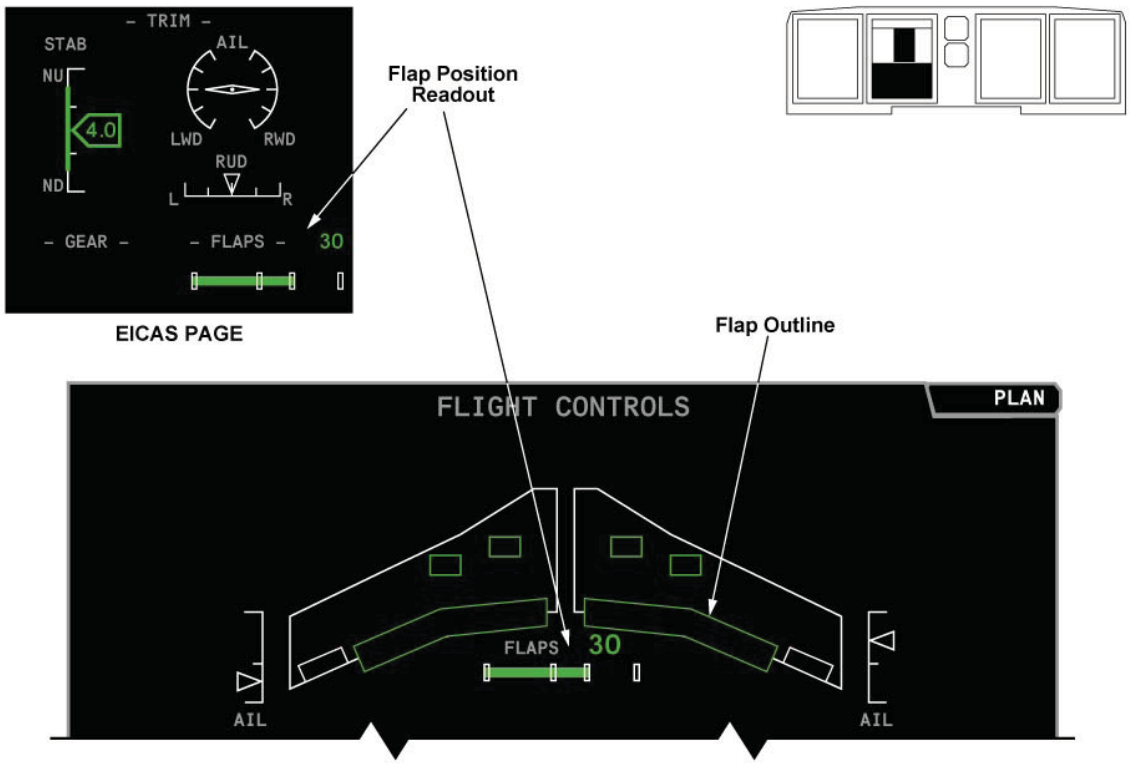
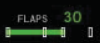
EICAS Flight Controls Indications (Flight Spoilers)
Figure 10−10−18

CONTROLS AND INDICATORS (CONT'D)



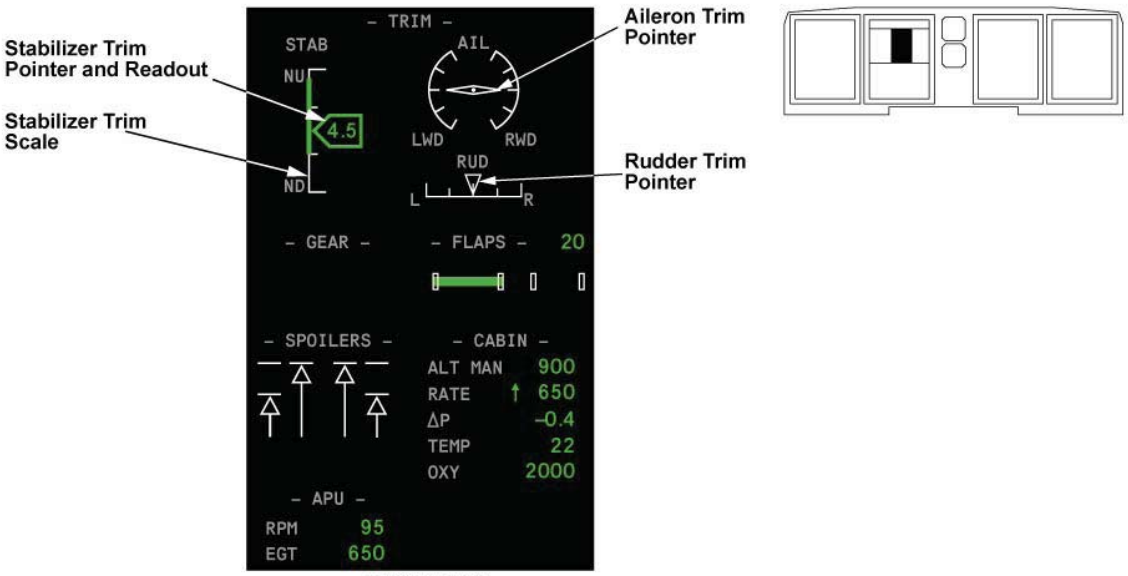
FLIGHT CONTROLS SYNOPTIC PAGE

Description	Symbol	Condition
Flap Position Readout		Indicates in degrees, the position of the LH an RH flaps. **Notes**: The flap information is removed from display 60 seconds after the landing gear and flaps are fully retracted
		Invalid data
Flap Outline		Flaps are operating normally
		Flaps are operating at half speed due to a single flap motor overheat
		Flaps failed or both flap motors overheated
		Invalid data

605_10_019

EICAS Flight Controls Indications (Flaps)
Figure 10−10−19

CONTROLS AND INDICATORS (CONT'D)



EICAS PAGE

Description	Symbol	Condition
Stabilizer Trim Pointer and Readout		Stabilizer position is within the takeoff trim range (3 to 8 units) NU – Nose Up (Top tick mark: 9) ND – Nose Down (Bottom tick mark: 0)
		Stabilizer position is outside of the takeoff trim range
Aileron Trim Pointer		Indicates aileron trim displacement LWD – Left Wing Down RWD – Right Wing Down
Rudder Trim Pointer		Indicates rudder trim displacement NL – Nose Left NR – Nose Right

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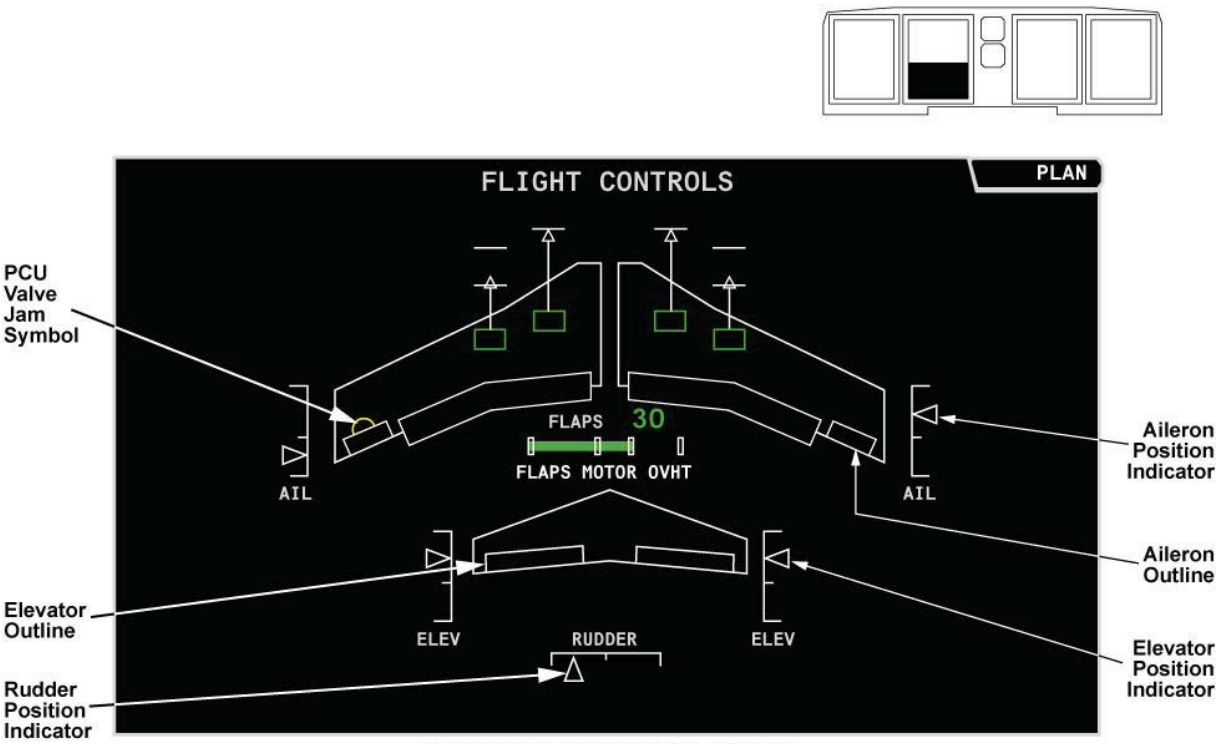
EICAS Flight Controls Indications (Trim)
Figure 10–10–20

CONTROLS AND INDICATORS (CONT'D)



FLIGHT CONTROLS SYNOPTIC PAGE

Description	Symbol	Condition
Aileron Position Indicator	AIL AIL	Indicates relative position of respective aileron Top tick mark: 20.8° Center tick mark: 0° Bottom tick mark: -21.3°
Aileron PCU Valve Jam Symbol		Mechanical jam of PCU control valve is detected
Elevator Position Indicator	ELEV ELEV	Indicates relative position of respective aileron Top tick mark: 23.6° Center tick mark: 0° Bottom tick mark: -18.4°
Rudder Position Indicator	RUDDER	Indicates relative position of rudder Left tick mark: -25° Center tick mark: 0° Right tick mark: 25°

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EICAS Flight Controls Indications (Aileron, Elevator, Rudder)
Figure 10–10–21

EICAS MESSAGES

MESSAGE	MEANING	AURAL WARNING (IF ANY)
CONFIG FLAPS	Flaps are not set at 20° with the aircraft in takeoff mode.	"CONFIG FLAPS"
CONFIG SPOILERS	Spoilers are not stowed with the aircraft in takeoff mode.	"CONFIG SPOILERS"
CONFIG STAB	Pitch trim is not set in the green band with the aircraft in takeoff mode	"CONFIG TRIM"
AILERON PCU	One or both ailerons have a jammed power control unit.	
ALT COMP FAIL	The left or right altitude compensation circuit of the stall protection computer has failed.	
ELEVATOR SPLIT	Indicates >5 degrees difference between left and right elevator surface position.	
FLAPS FAIL	Either both flap motors are overheated or the flaps have failed.	
FLT SPLRS DEPLOY	Flight spoilers are deployed with either the radio altitude between 10' – 300' or engine N_1 >79% or, with the radio altimeter inoperative, the gear is extended.	
FLT SPLRS	Left and/or right detent mechanism has failed (displays on ground only, unless there is a loss of system 1 and 2 hydraulic pressure).	
GND SPLRS	Ground spoilers are inoperative.	
GND SPLRS DEPLOY	Ground spoilers are not stowed and the radio altitude is greater than 10'.	
GND SPLRS NOT ARMED	The ground spoilers are not armed with the aircraft in either takeoff mode or in the landing mode.	
MACH TRIM	Mach trim is disengaged or failed.	
STAB TRIM	Both pitch trim channels are off or failed.	
STALL FAIL	One or both channels of the stall protection system have failed, resulting in the stick pusher system becoming inoperative.	
AILERON MON OK	All four aileron PCU failure detection sensors are functioning properly.	
T/O CONFIG OK	With engines running, and on ground, the aircraft is in takeoff configuration.	
FLAPS MOTOR OVHT	One flap motor is hot and has shut down.	
STAB CH 1 INOP	The respective pitch trim channel is off or failed, and the other channel is engaged and not failed.	
STAB CH 2 INOP		

POWER SUPPLY AND CIRCUIT BREAKER SUMMARY

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Flight Controls	Flaps	FLAP MOTOR 1	AC ESS	3	B11	
		FLAP MOTOR 2	AC BUS 2	2	B5	
		FLAP CONT 1	DC ESS	4	A9	
		FLAP CONT 2	DC BUS 2	2	F3	
	Trims	RUD TRIM	DC BUS 1	1	F5	
		AIL TRIM	DC BUS 2	2	F5	
	Stall Protection	STALL PROT R CH	DC ESS	4	C5	
		STALL PROT LH CH	DC BATT	1	N5	
		STALL PROT STICK PUSH	DC BATT	1	N4	
	Stabilizer Trim	STAB CH 1 HSTCU	DC BUS 2	2	F8	
		STAB CH 2 HSTCU	DC ESS	4	B8	
		STAB CH 1 HSTA	AC BUS 2	2	C5	
		STAB CH 2 HSTA	AC ESS	3	A5	
	Ground Spoilers	GND SPLR	DC BUS 1	1	F4	
			DC BUS 2	2	F4	
	Position Indication	FLAP TRIM IND	DC BATT	1	N6	
		SURF POS IND L	AC ESS	3	C6	
		SURF POS IND R	AC BUS 2	2	B11	