



FAULT ISOLATION MANUAL

- (3) ECU NVM Download: Use a personal computer (PC) and a locally manufactured interface cable to connect to the ECU to retrieve sequentially logged Fault Code information that is stored in the ECU Non Volatile Memory (NVM). Depending on the available PC configuration, the NVM download procedures (Ref. AMM Task 32-51-10-700-801) and interface cable details are as follows:

NOTE: A Nose Wheel Steering Fault Decoder tool (Excel File) is available for downloading from "iflybombardier" web site under "Technical Support" > "Quick Links" > "Engineering and Aircraft Databases".

- For PCs with Windows 95 Operating System or earlier and a 9 pin Serial Ports adapter cable.
- For PCs with Windows 7 Operating System or later and a USB ports (9 pin Serial Port to USB adapter required).

NOTE: The Last FAULT code that was detected by the ECU will be the first shown in the FAULT log data. There can be more than 100 logged FAULTS in the log and the oldest fault log data will be overwritten. It is recommended to clear the NVM Fault Log after faults have been recorded.

Although this method takes longer, it is the most effective when trying to diagnose an intermittent fault or when the ECU Maintenance Display Codes indicate that numerous LRUs are at fault. Refer to Table 102 for a cross-reference between ECU Maintenance Display Codes and NVM Fault Codes as well as fault isolation procedures associated with these codes.

2. Nose Wheel Steering System — Description/Operation:

Refer to Figure 101 and 102

- A. A Nose Wheel Steering arming switch is installed on the Pilots Side Panel (Optional on Co-Pilots Side Panel). When the ARM switch is selected to ARM, 28 V dc is provided to the ECU and to the Solenoid Selector Valve (SSV) from the DC BUS 1 and/or DC BUS 2. The primary Steer-By-Wire (SBW) mode is then armed.
- B. With the ARM Switch selected to ARM, and the NLG DOWN LOCK 1 or NLG DOWN LOCK 2 indicating that the Nose Landing Gear is down and locked (PSEU Driver Output DO_49), and the Nose Landing Gear is Weight on Wheels (WoW1 = Driver Output DO_17 and WoW2 = Driver Output DO_37) and there are no faults detected by the ECU, the ECU will trigger a ground discrete driver to energize the SSV. Hydraulic # 3 System pressure will then be supplied to open the spring biased transfer valve within the Steering Manifold and port hydraulic pressure to the RH or LH Steering Actuators based on command inputs from the Steering Hand Wheel RVDT (+/- 70 Deg of center) or the Rudder Pedal RVDT (+/- 8 Deg of center).
- C. The Nose Wheel Steering System has two modes of operation, "Steer-By-Wire" and "Free Caster". A controlled "Steer-By-Wire" provides precise backlash-free control of the steering at all aircraft speeds from maximum take-off/landing speed to low speed ground maneuvering. The steering is armed continuously during flight but is enabled only when the aircraft is on the ground (WoW 1 or WoW 2 and Nose Gear Downlock discrete signal from the PSEU).
- D. Steering control is terminated when the WoW signal is removed. In the air, command signals are replaced by a straight ahead reference which makes sure the NLG maintains the correct position even in the presence of a stuck open SSV. There is also a mechanical cam mechanism inside the NLG Strut which ensures that the NLG is straight

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ahead when the strut is fully extended.

- E. In the "Free Caster" mode, hydraulic pressure to the steering system is isolated and the nose wheels are allowed to free caster via differential braking. Shimmy dampening in this mode is available through the use of two restrictors in the hydraulic lines.
- F. In the dual actuator configuration, the reversal of the shortening actuator after reaching the minimum length is made possible by the internal porting of the rotary valve by the rotation of the actuator, so the reversal of the actuator is transparent to the rest of the control system.
- G. Hydraulic System #3 (either ACMP 3A or 3B) supplies hydraulic pressure to the Nose Wheel Steering system. Hydraulic pressure is available through the NLG Selector Valve which provides pressure to the steering system when energized to the down (extended) position. A NLG Priority Valve and a NLG Check Valve are also located downstream of the NLG Selector Valve and can result in a reduction of hydraulic pressure to the NWS System (ECU may detect a lack of pressure to the NWS System pressure switch PS1) should this Priority Valve fail or should the check valve becomes blocked or if there were a hydraulic leak in the steering system downstream of the NLG Selector valve. Refer to AMM 32-51-00, Nose Wheel Steering Description and Operation, Figure 2, 7 and 8 for a more detailed hydraulic schematic.
- H. When the ECU receives a steering command via the Hand Wheel or Rudder Pedals, it performs electrical signal summing (feedback vs. command signals) and applies the resulting servo error signal through the servo amplifier to the torque motor coils of the EHSV, the EHSV then converts the input current into a proportional spool displacement. With the spool directing a differential hydraulic pressure across opposite sides of the actuator piston. As the actuator responds to the pressure and flow control from the EHSV, the actuator turns the NLG towards the commanded position.

NOTE: The EHSV spool is biased to either the Steer Left or Steer Right position without electrical power available. If there is hydraulic pressure to the EHSV manifold (downstream of the SSV) and no electrical power to the ECU, the Nose Gear could be driven to the right or left without command. This mode of failure may indicate that the SSV has failed OPEN.
- I. The ECU maintains an electrical current through the servo coils until the feedback signal from the feedback RVDT reduces the servo error to zero. The zero signal restores the EHSV spool to a neutral position and the actuator stops the motion to hold the NLG at the commanded position until the signal changes. When the Hand Wheel or Rudder Pedals are returned to neutral, this cancels the original command, the resulting servo error signal reverses current through the EHSV. The EHSV restores the actuator and the NLG to a neutral position by reversing the differential pressure and flow across the piston. The Hand Wheel and Rudder Pedals must be held throughout a turn or the NLG will return to the neutral position due to the action of the Hand Wheel and Rudder Pedal centering springs.
- J. A failure in the system occurs when there is a discrepancy in the position between signals of the RVDTs, or the EHSV LVDT. An analog and digital supervisor within the ECU monitors the discrepancy. When a voltage lag occurs between the RVDTs and the EHSV LVDT, a failure signal trips a discrete driver in the ECU and removes the ground for the SSV and the SSV is de-energized closed. At the same time, another discrete driver within the ECU trips and provides a ground discrete to the DCU and the STEERING INOP (caution) message will be posted on EICAS.

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Maint. Display Code [1], [2]	NVM Fault Codes [3], [4]	Description	Possible Cause(s)	Maintenance Action (Definition/Fault Isolation Steps)
"--" (alone)	15	AIR_TO_GROUND_MODE_CMD_FAULT	N/A	A fault was detected, the probable cause is one of the following: – The hand wheel commanded steering angle (upon air-to-ground transition) exceeded 7 degrees of nose wheel angle (7.89 degrees of hand wheel RVDT) – The hand wheel RVDT was rotated beyond 83 degrees – The hand wheel RVDT or the rudder pedal RVDT was rotated in excess of 500 degrees/second – A failure of the nose gear downlock signal, nose gear WOW 1 signal or nose gear WOW 2 signal was detected. Do the steps that follow to correct the fault: 1. Reset the system (cycle the NWS ARM switch on the pilots side panel). 2. Do the operational test of the NWS (Ref. AMM Task 32-51-00-710-801 or AMM Task 32-51-00-710-802). 3. If no further defects noted, system is normal.
	30	PILOT_HANDWHEEL_MAG-FAULT		
	31	CO_PILOT_HANDWHEEL_MAG_FAULT		
	33	PILOT_HANDWHEEL_RATE_FAULT		
	34	CO_PILOT_HANDWHEEL_RATE_FAULT		
	35	RUDDER_PEDAL_RATE_FAULT		
	40	DOWNLOCK_SWITCH_FAILURE		
	41	WOW_2_SWITCH_FAILURE		
	42	WOW_1_SWITCH_FAILURE		
"--"	166 [5]	MAINTENANCE_MODE_PERFORMED	N/A	
	167 [5]	RIGGING_PERFORMED	N/A	
Nose Wheel Steering System (NWS) ECU BIT Display Fault Isolation Table 102				