



**OPERATIONS MANUAL**  
**SECTION 6-7**

**LANDING GEAR AND BRAKES**

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## **OPERATIONS MANUAL**

### **GENERAL DESCRIPTION**

The airplane has two main landing gears and a single nose gear. Each main gear is a conventional two-wheeled landing gear. The nose gear is a conventional steerable two-wheeled unit. Hydraulic power for retraction, extension, and nose wheel steering is supplied by the green hydraulic system. An alternate electrical override system for landing gear extension and an emergency free-fall extension system are also provided.

The normal brake system is powered by the hydraulic systems, with the outboard pair being supplied by the green hydraulic system and the inboard pair by the blue hydraulic system. The emergency braking system is powered by the blue hydraulic system. Antiskid protection is also provided.



## LANDING GEAR

### ACTUATION SYSTEM

The landing gears are normally controlled by the LANDING GEAR Lever. On the ground, a lever lock prevents the LANDING GEAR Lever from moving to the up position. In flight, the air/ground system automatically releases the lever lock.

### LANDING GEAR RETRACTION

Two pairs of doors enclose each landing gear bay. The aft pair of doors is mechanically linked to each landing gear and the forward pair of doors is hydraulic actuated. When the gear is down, the aft pair of doors is open and the forward pair of doors is closed.

When the LANDING GEAR Lever is moved to UP, the forward pair of doors opens, allowing the landing gear to be retracted to the stowed position. During retraction, the brakes automatically stop rotation of the main landing gear and snubbers stop rotation of the nose landing gear. After retraction, the doors are closed and the gears are held in place by mechanical uplocks.

If the LANDING GEAR Lever cannot be moved UP, the downlock release button may be pressed to release the LANDING GEAR Lever downlock.

### LANDING GEAR EXTENSION

When the LANDING GEAR Lever is moved to DOWN, hydraulic pressure is used to release the uplocks, the landing gear extends by hydraulic pressure, gravity and air loads.

Overcenter mechanical and hydraulic locks hold the gear at full extension.

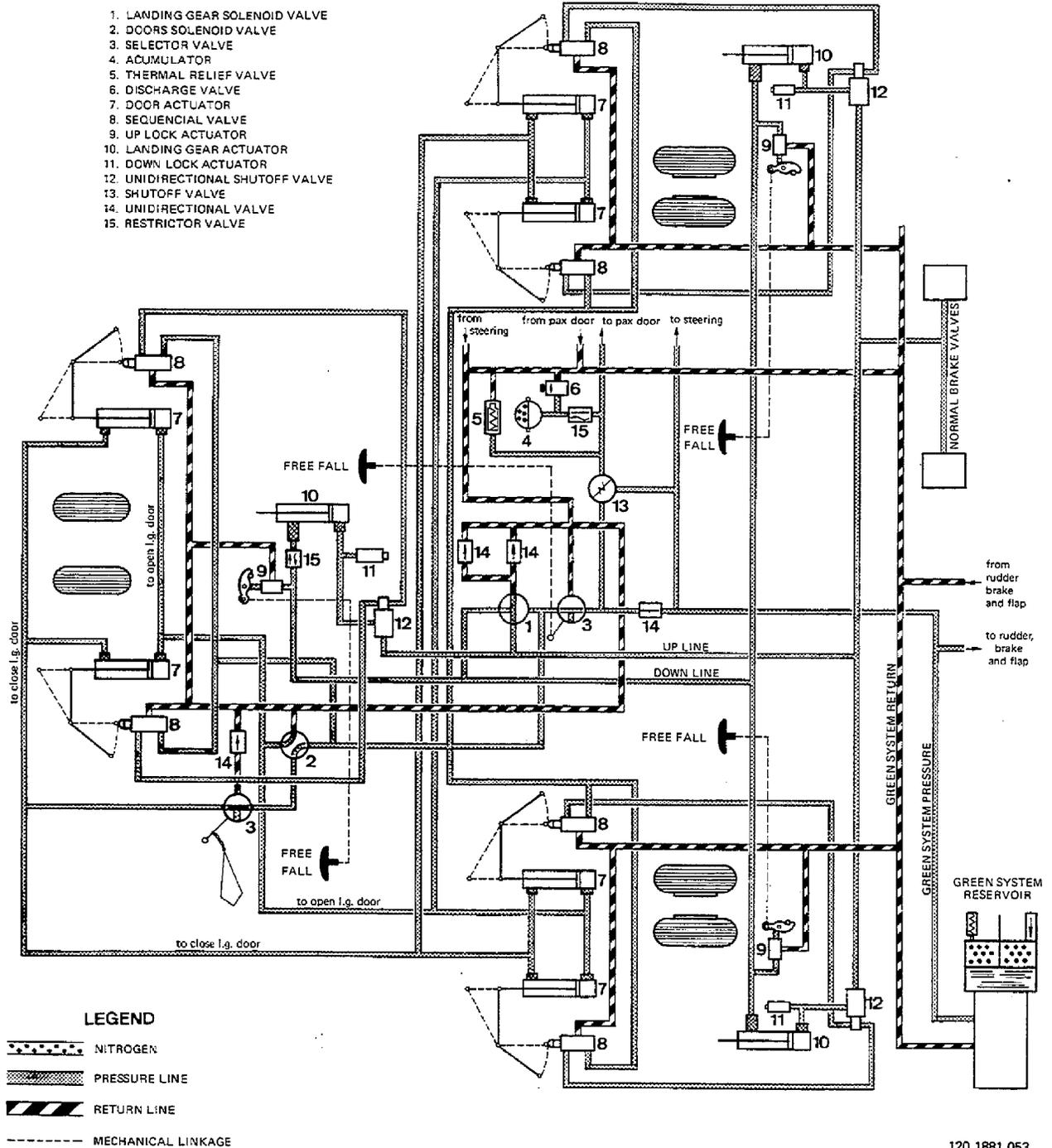
After extension, the forward pair of doors is closed.

The alternate actuation system consists of an electrical override down command. Should any electric component failure preclude gear extension when the landing gear control lever is moved to the DOWN position, the alternate electrical override down command should be used.

This system is operated by a guarded three-position switch located in a compartment on the floor, on the copilot's seat left side.

With the landing gear control lever selected to the DOWN position, the copilot should move the switch to the DOORS position and wait at least 3 seconds to allow the doors to open and then move the switch to the GEAR/DOORS position. When the landing gear is locked down, the switch should be commanded to the NORMAL position, allowing the doors to close.

The emergency free-fall extension system is to be used in case of failure of both normal and alternate electrical override gear actuation systems. It is a mechanical system, commanded by cables, which act directly on the uplock hooks. Once the command device is actuated the landing gear will be unlocked, fall freely and be locked down by gravity.

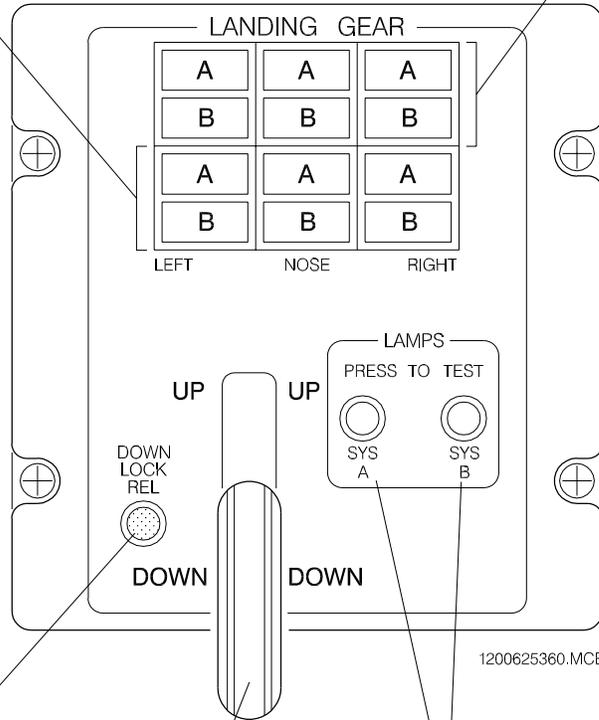


**LANDING GEAR HYDRAULIC SYSTEM-SCHEMATIC**



**INDICATION SYSTEM A & B GREEN**  
**LANDING GEAR LIGHTS**  
 ILLUMINATED — When the respective gear is down and locked.

**INDICATION SYSTEM A & B RED**  
**LANDING GEAR LIGHTS**  
 ILLUMINATED — Indicates a disagreement between selection lever and gear position.



**DOWNLOCK RELEASE BUTTON**  
 PRESSED — Releases the landing gear lever downlock to permit the retraction of the landing gear on the ground and in flight.

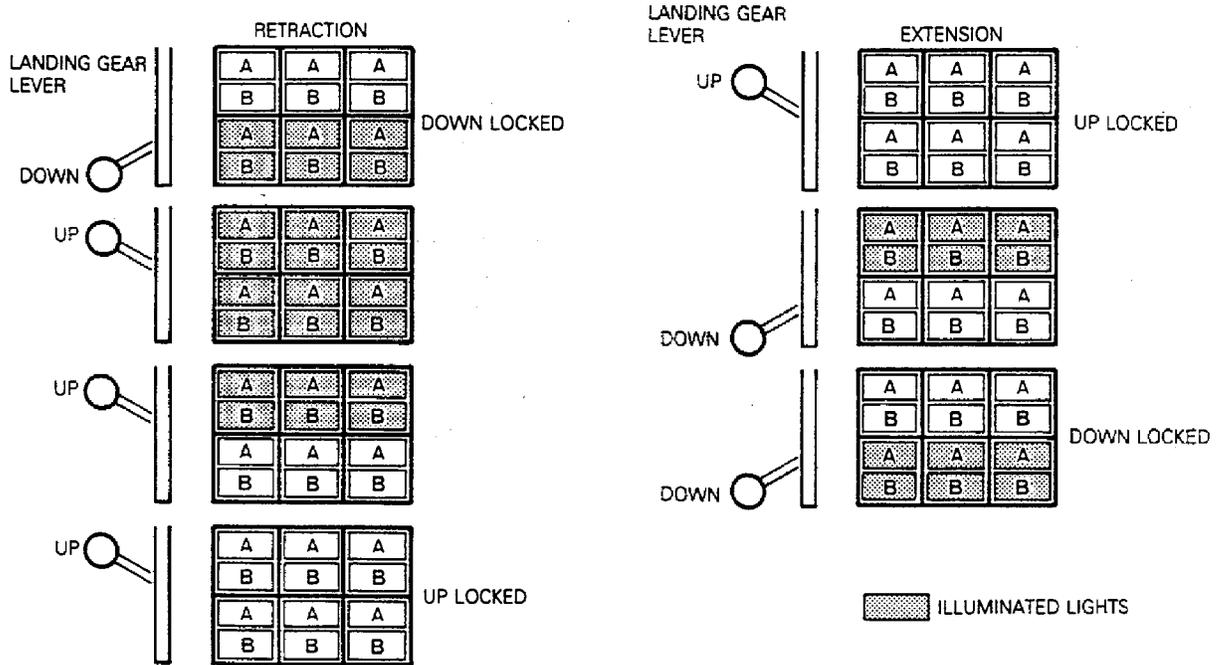
**LANDING GEAR LEVER**  
 Operates solenoid valve to raise (UP) or lower (DOWN) landing gear.  
 Landing gear control lever latch prevents movement to UP position when the airplane is on the ground.

**INDICATION SYSTEMS BUTTONS**  
**LAMP TEST**  
 PRESSED — All lights illuminate independently of gear position or circuit failure.

**NOTE**

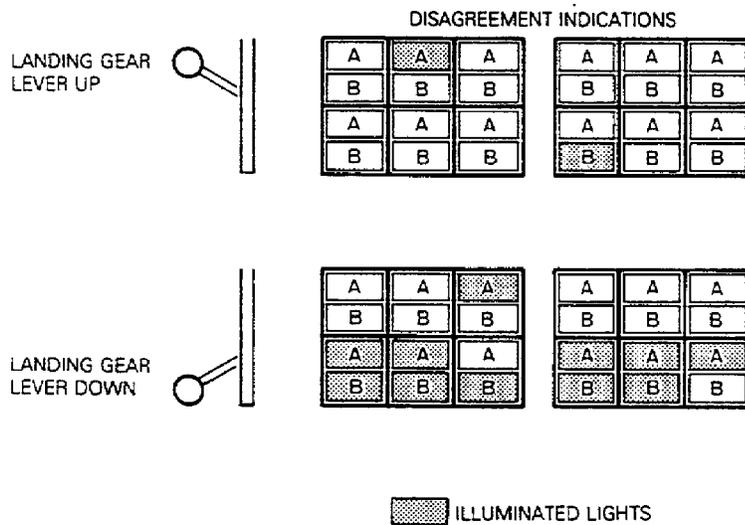
Two landing gear position indication systems are provided (systems A and B).  
 A disagreement in the position indication of the landing gear will be defined when systems A and B give conflicting indication. Refer to ABNORMAL PROCEDURES to determine which is the correct indication system.

**LANDING GEAR PANEL**



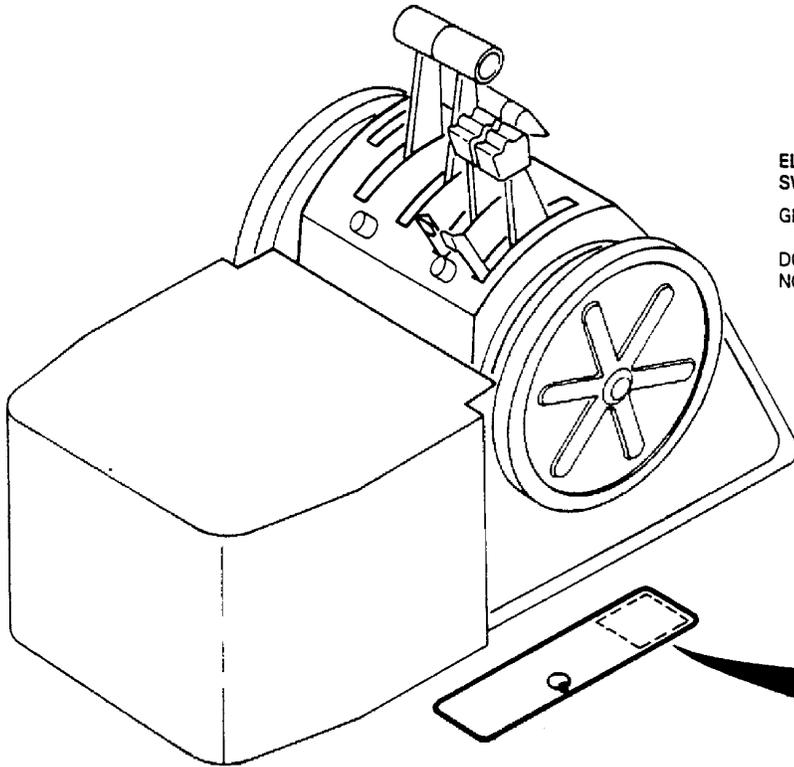
120 1V97 206

### LANDING GEAR RETRACTION AND EXTENSION SEQUENCES



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### TYPICAL DISAGREEMENT INDICATIONS

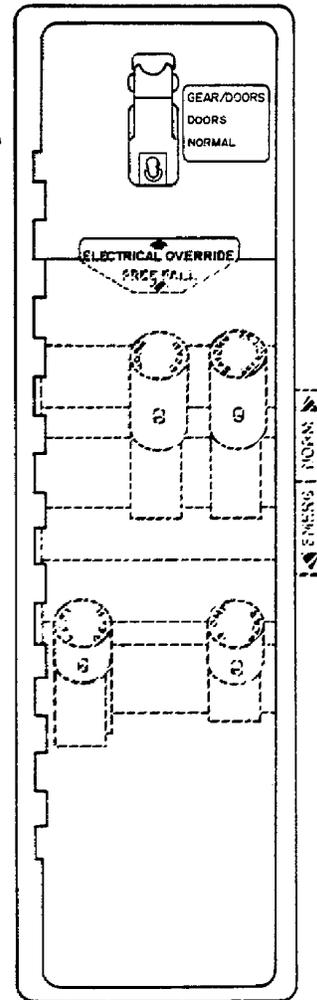


**ELECTRICAL OVERRIDE GEAR ACTUATION SWITCH**

**GEAR/DOORS** - Lets down and locks the landing gear.

**DOORS** - Allows to open the doors.

**NORMAL** - Allows to close the doors.



**NOTE**

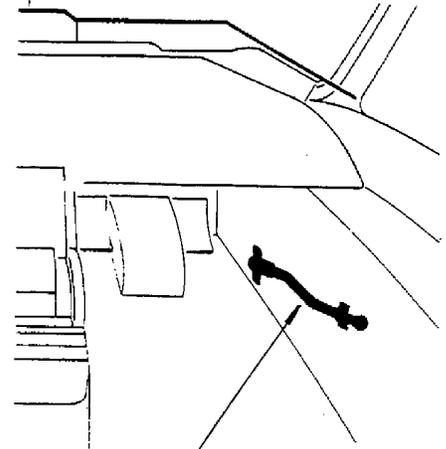
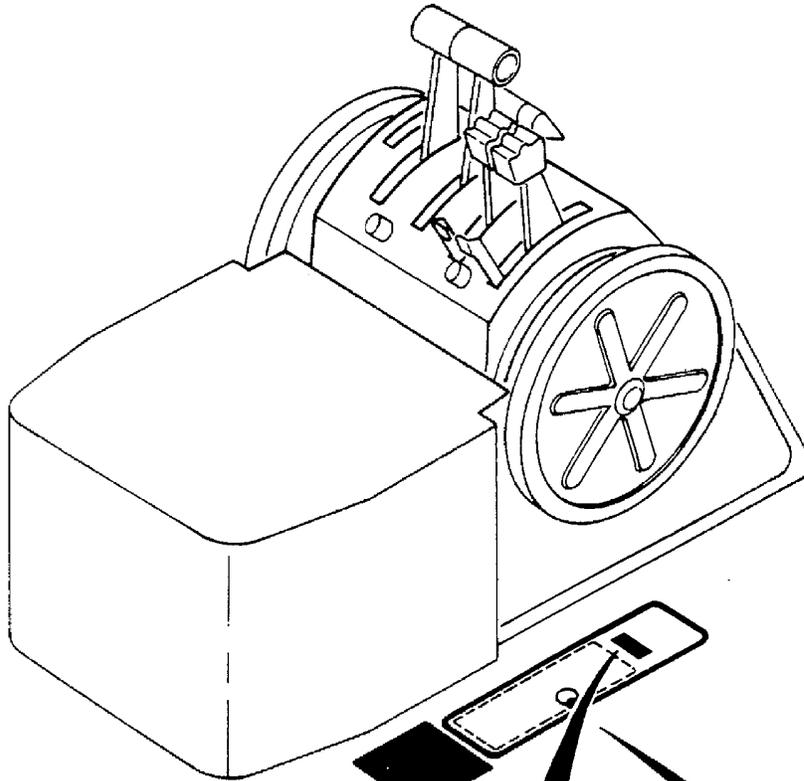
ALL OPERATION MUST BE PERFORMED WITH LANDING GEAR CONTROL LEVER IN THE DOWN POSITION.

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**ALTERNATE ELECTRICAL OVERRIDE  
GEAR ACTUATION SYSTEM**



# OPERATIONS MANUAL



FREE FALL ACTUATION LEVER  
(COPILOT'S LATERAL CONSOLE)

LANDING GEAR  
EMERGENCY

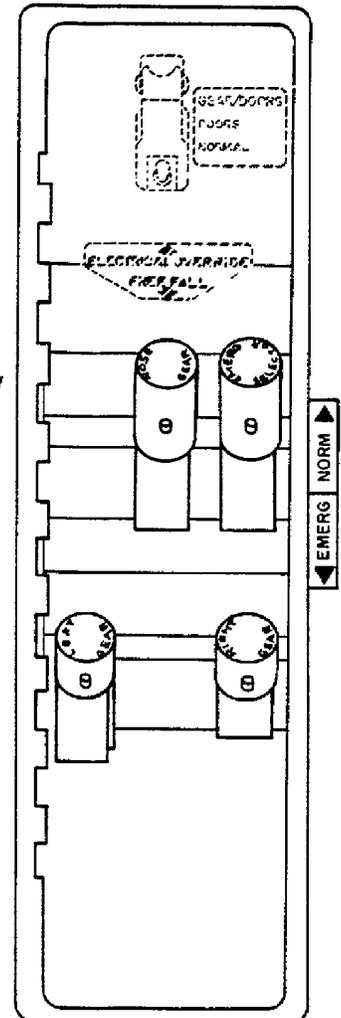
FREE FALL OPERATION  
1-INSTALL THE LEVER IN THE SELECTOR AND ACTUATE TO THE EMERGENCY POSITION BREAKING THE LOCK WIRE  
2-INSTALL THE LEVER IN EACH GEAR SOCKET AND ACTUATE TO GET THE FREE FALL

AIRPLANES PRE-MOD. S.B. 120-032-0067

OR

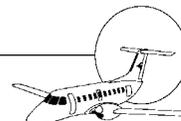
FREE FALL OPERATION  
1-INSTALL THE LEVER IN THE SELECTOR AND ACTUATE TO THE EMERGENCY POSITION  
2-INSTALL THE LEVER IN EACH GEAR SOCKET AND ACTUATE TO GET THE FREE FALL

AIRPLANES POST-MOD. S.B. 120-032-0067  
OR S/N 120.181, 120.185 AND ON.



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## EMERGENCY FREE FALL EXTENSION SYSTEM



## WARNING SYSTEM

The landing gear warning system is provided to alert the pilot with respect to abnormal landing conditions. It has two features which are:

- Aural warning (three tones followed by a LANDING GEAR voice message).
- Visual warning (GEAR red light on the multiple alarm panel flashing simultaneously with the WARNING lights on the glareshield panel).

The warning system will be activated in the following conditions:

### 1. Depending on Flap Setting.

If flap selector lever is set beyond 17° with the landing gear not downlocked.

The visual warning may be cancelled by pressing one of the ALARM CANCEL buttons, but the GEAR red light will remain illuminated as long as the abnormal condition persists.

The aural warning cannot be cancelled unless the airplane configuration is corrected.

### 2. Depending on Power Lever Angle.

#### A. For airplanes Pre-Mod. SB 120-032-0052 and Pre-Mod. SB 120-032-0055.

If any engine power lever is retarded to less than 64° PLA with the landing gear not downlocked.

The aural and the visual warnings may be cancelled, by pressing one of the ALARM CANCEL buttons, but the GEAR red light will remain illuminated as long as the abnormal condition persists.

**NOTE:** The aural and the visual landing gear warnings, due to the power lever angle, will be inhibited in two conditions:

- When the airplane speed is above 158 knots;
- For 1 minute after landing gear retraction. If any power lever is retarded during this period, the warnings will remain inhibited.

#### B. For airplanes Post-Mod. SB 120-032-0055.

If any engine power lever is retarded to less than 66° PLA (EEC off) or 46° PLA (EEC on), with the landing gear not downlocked.

The aural and visual warnings may be cancelled, by pressing one of the ALARM CANCEL buttons, but the GEAR red light will remain illuminated as long as the abnormal condition persists.

**NOTE:** • The aural and the visual warnings, due to the power lever angle, will be activated if EEC is reverted to manual mode and any power lever is set between 46° and 66° PLA.



## **OPERATIONS MANUAL**

- The aural and the visual warnings, due to the power lever angle, will be inhibited in two conditions:
  - When the airplane speed is above 158 knots;
  - For 1 minute after landing gear retraction. If any power lever is retarded during this period, the warnings will remain inhibited.

C. For airplanes Post-Mod. SB 120-032-0052 or S/N 120.071, 120.081, 120.100 and on.

If any engine power lever is retarded to less than 66° PLA (EEC off) or 46° PLA (EEC on), with the landing gear not downlocked.

The aural and the visual warnings may be cancelled, by pressing one of the ALARM CANCEL buttons, but the GEAR red light will remain illuminated as long as the abnormal condition persists.

- NOTE:**
- The landing gear warning, due to power lever angle will be activated if EEC is reverted to manual mode and any power lever is set between 46° and 66° PLA.
  - In case of radio altimeter failure or radio altimeter deferred, the landing gear warning associated with power lever angle will be activated whenever the power levers are retarded to those angles previously mentioned, regardless of airplane radio altitude.
  - The aural and visual landing gear warnings will be inhibited when the radio altitude is above 1500 ft.

3. Depending on Radio Altitude. (Only for airplanes Post-Mod. SB 120-032-0052, or S/N 120.071, 120.081, 120.100 and on).

When the airplane is descending and reaches 200 ft radio altitude with the landing gear not downlocked.

The aural and the visual warnings may be cancelled, by pressing one of the ALARM CANCEL buttons.

**NOTE:** The landing gear warning due to radio altitude is inhibited on the ground and reset on crossing 200 ft radio altitude, climbing.

Further descents with the landing gear not down and locked will activate the alarm.

When the airplane is equipped with two radio altimeters, the previously described warning inhibition above 1500 ft radio altitude and warning activation during descent on crossing 200 ft radio altitude, will remain available even though one radio altimeter is lost.



## OPERATIONS MANUAL

### BRAKES ACTUATION SYSTEM

The normal brake system is actuated by either pilot's rudder pedals. The pedals are linked via push-pull cables to dual brake/anti-skid valves. Each valve actuates in one pair of wheels: the outboard or the inboard pair.

The inboard valve is fed by the blue system and the outboard valve by the green system. Both valves receive 3000 psi from the associated hydraulic power system.

A hydraulic fuse automatically interrupts oil flow to the brake unit, if a leakage occurs, maintaining pressure level in the other line. Electronic circuitry for the anti-skid system is contained in the anti-skid control box.

The emergency/parking brake consists of a hydraulic accumulator, two check valves, one emergency/parking brake valve, mechanical actuation devices, one thermal relief valve, and two pressure switches. The actuating lever located on the control stand is connected to the emergency/parking brake valve by push-pull cables. When the emergency/parking brake valve is actuated, pressure is equally fed to the four brake units. Pressure level is proportional to the lever displacement and is limited to the maximum value of 1300 psi.

In case of a failure in the normal brake system the emergency/parking brake system provides effective brake power to bring the airplane to a complete stop after touchdown or during a rejected takeoff. The emergency/parking brake handle has a capacity of 8 to 10 complete actuations.

If, during takeoff, the emergency/parking brake is applied, the TAKEOFF BRAKES voice message will sound.

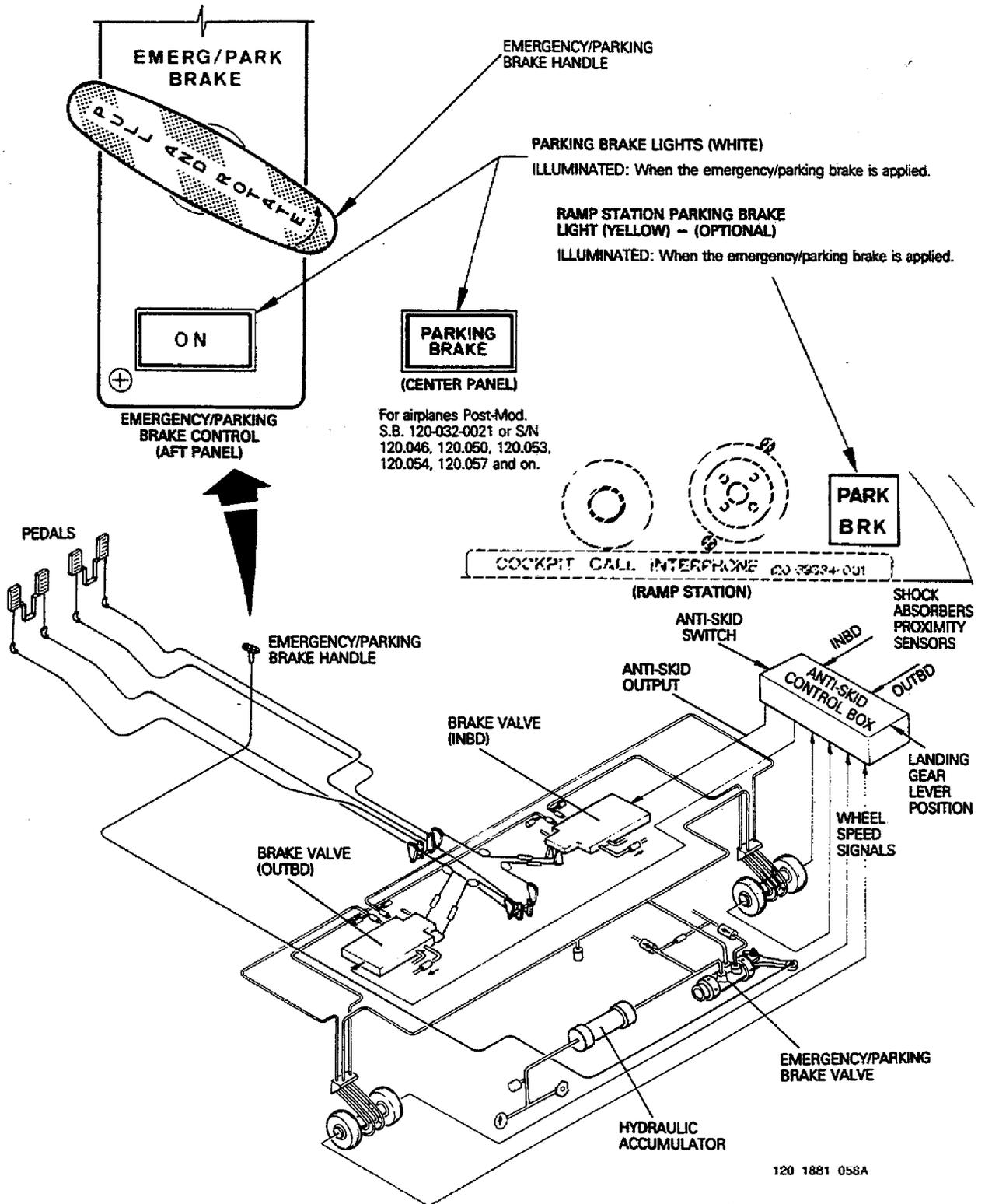
Installed in each brake assembly is a shuttle valve which allows the brake fluid to come from the green or the blue system.

**NOTE:** To prevent transfer of hydraulic fluid from one system to the other, normal braking should be applied and held while the parking brake is fully applied or released.



**EMBRAER**  
**EMB120 Brasilia**  
**OPERATIONS MANUAL**

**SYSTEMS DESCRIPTION**  
**LANDING GEAR**  
**AND BRAKES**



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**NORMAL BRAKE SYSTEM**



## ANTI-SKID

The anti-skid system limits the hydraulic pressure applied to each brake valve by inputs from the pedals. The anti-skid system provides maximum stopping performance, thus minimizing wheel skidding and, consequently, enabling minimum tire wear under any runway condition.

The system is primarily composed of four wheel speed transducers, installed at main landing gear wheel axles, one electronic control box, and two brake valves, one for the outboard pair of wheels and other for the inboard pair.

The system is enabled when the following conditions are met:

- Anti-skid switch set to ON,
- Landing gear lever set to DOWN,
- At least one main landing gear shock absorber compressed (airplane on the ground).

When the anti-skid system is actuating, the skid control circuitry computes the initial wheel speed signal, received from the speed transducers, to determine an airplane reference speed. This reference speed is continuously updated and compared with the average speed from the wheels, to determine whenever the airplane is skidding or not. If a skidding is sensed, the brake valves are commanded to relieve the pressure applied by the pilots through pedals, thus eliminating the skidding. It is important to emphasize that the anti-skid system does not apply pressure on the brakes, but only relieves it when one or more wheel slips.

Thus, there are some instances when the conventional differential braking technique may not be applicable. In these cases, when it is necessary to apply differential braking, the pilots may have to reduce the pedal force on the side opposite to the turn.

The anti-skid system incorporates the locked wheel protection and touchdown protection features.

### LOCKED WHEEL PROTECTION

For wheel speeds above 22 kt, the anti-skid system activates the locked wheel protection between left and right wheels of the same pair. The anti-skid compares the wheel speed signals from both wheel of inboard (outboard) pair. If the slower wheel speed is less than or equal to 40% of the faster wheel speed, the skid control circuitry sends a corrective signal to the associated brake valve. The brake valve then commands a full brake pressure relief to both paired wheels, allowing wheel speed recovery. The 40% tolerance between wheel speeds is provided to permit an amount of differential braking, for steering purposes.

For wheel speeds below 22 kt, the locked wheel protection is deactivated, and the anti-skid system actuates normally, but without the wheel speed comparator. For wheel speeds below 6 kt, the anti-skid protection is deactivated, allowing the pilot to lock and pivot on a wheel.

### TOUCHDOWN PROTECTION

The touchdown protection is a feature that prevents brake actuation before main wheels spin up, when the airplane is still airborne, during landing. This protection permits the brake actuation only after 3 seconds have elapsed since the latest touchdown or after the wheels have spun-up to 50 kt.

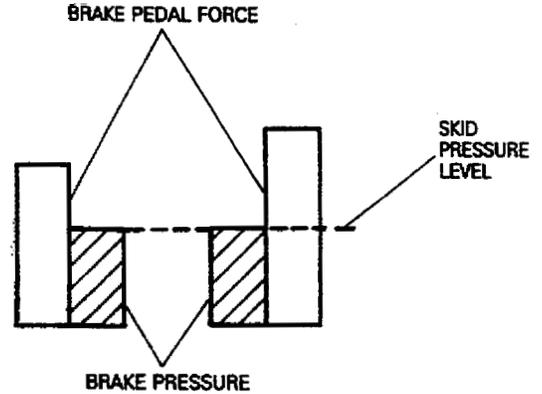
To provide the touchdown protection, the anti-skid system receives signals from both main landing gear proximity sensors. In the event one landing gear proximity sensor fails at the air posi-



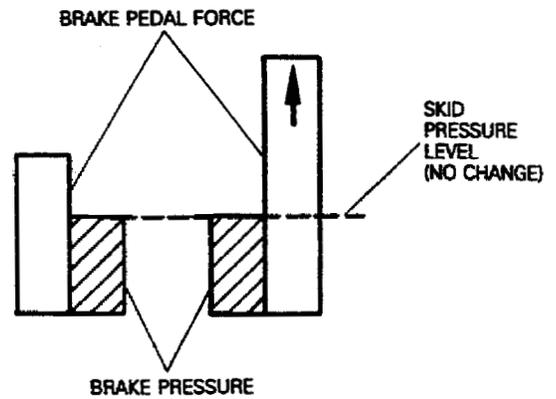
# OPERATIONS MANUAL

tion, the anti-skid system will operate normally. However, if both landing gear proximity sensors fail at the air position, thus generating a false signal to the anti-skid system, braking capacity will be available only for wheel speeds above 50 kt. Below 50 kt, a total loss of the brake capacity will occur, and no anti-skid inoperative indication light will illuminate. In this case, turning the anti-skid system off will restore the braking capability, but without anti-skid protection.

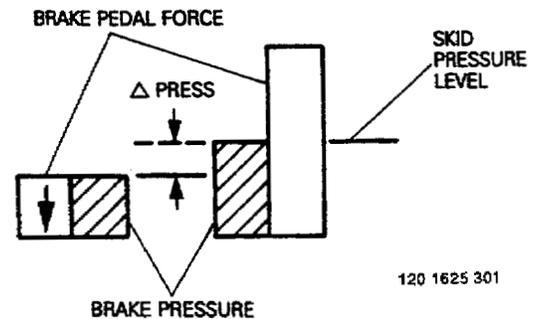
The anti-skid system modulates the brake pressure to a level which avoids the wheels from skidding. If one of the wheels locks, the anti-skid system reduces the brake pressure of the associated pair, thus eliminating the skidding.



If the pilot modulates the pedal force, in an attempt to steer the airplane through differential braking, the anti-skid system maintains the skid pressure level, thus precluding the airplane from turning.



The correct action consists in a reduction of the opposite pedal force to a level below the skid level, which permits the reduction of the corresponding braking pressure.

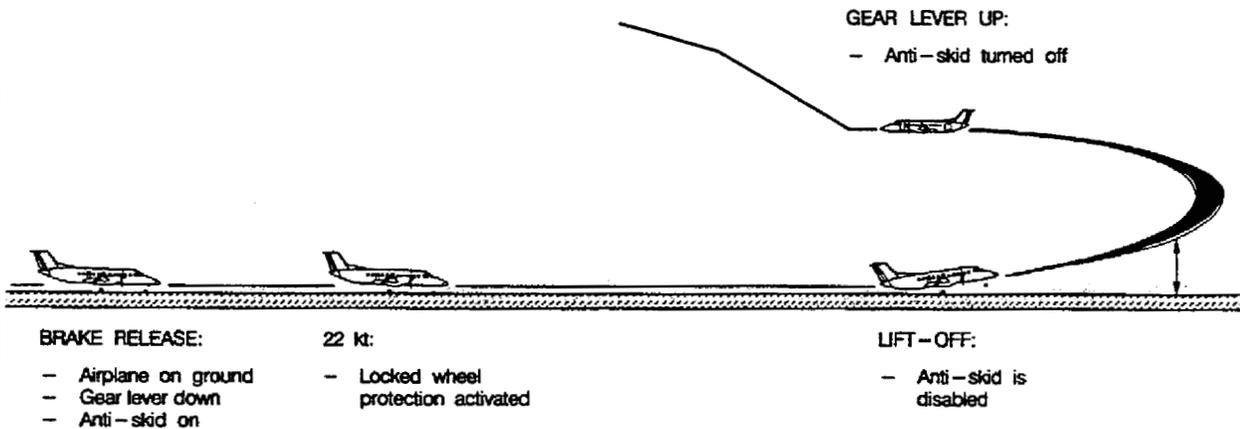


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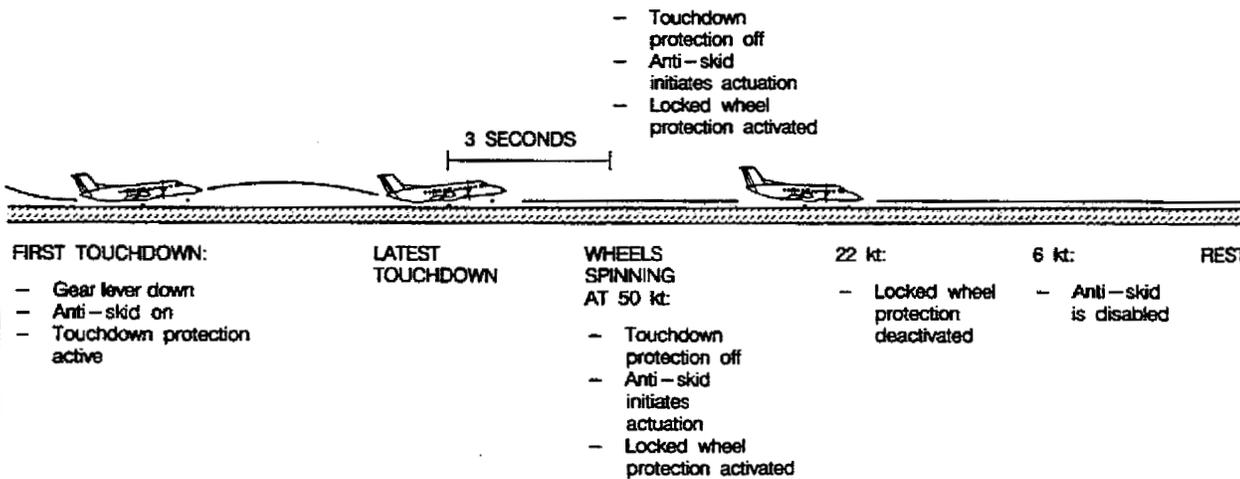
## DIFFERENTIAL BRAKING TECHNIQUE SCHEMATIC



**DURING TAXI AND TAKEOFF**



**DURING LANDING**



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**ANTI-SKID SYSTEM OPERATION SEQUENCE**

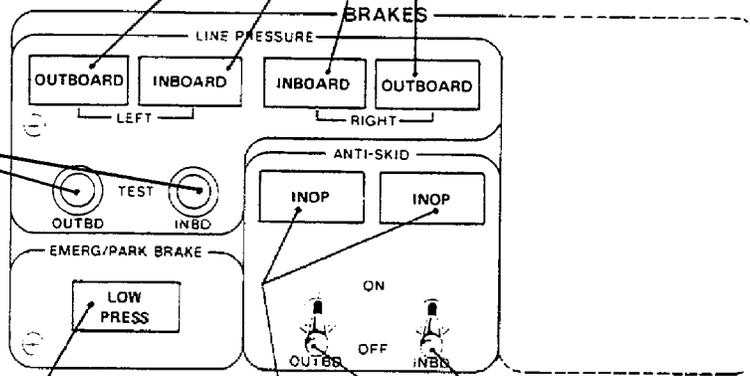


**BRAKES LINE PRESSURE LIGHTS (GREEN)**

**ILLUMINATED** - When the brakes are applied through the pedals and the relevant test switches are pressed, indicating that positive pressure is applied in respective line.

**INBOARD AND OUTBOARD TEST**

**SWITCHES** - Both pressed in conjunction with application of the left and right brakes pedals, all line pressure lights should illuminate.



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**EMERGENCY/PARKING BRAKE LOW PRESSURE LIGHT (AMBER)**

**ILLUMINATED** - Indicates low pressure in the relevant system.

**ANTI-SKID SYSTEM CONTROL SWITCHES**

**ON** - Turns on the relevant anti-skid system.  
**OFF** - Turns off the relevant anti-skid system.

**ANTI-SKID SYSTEM INOPERATIVE INDICATION LIGHTS (AMBER)**

**ILLUMINATED** - When the relevant anti-skid is inoperative due to a failure or if an enabling condition is not met (only when landing gear selector lever is at DOWN position).

**BRAKE CONTROLS (OVERHEAD PANEL)**



## **NOSE WHEEL STEERING**

The airplane is equipped with a nose wheel steering system, which is powered by the green hydraulic system and is electrically controlled.

Primary steering is controlled through the nose wheel steering handle and allows 50° nose wheel deflection in both directions its use being recommended during taxi. The steering handle is located on the pilot's left console and has to be pushed and rotated to the desired direction to be actuated.

Limited steering control is available through the rudder pedals and allows 7° of nose wheel deflection in both directions, its use being recommended during takeoff and landing. Steering angles may be increased up to 57° when the nose wheel steering handle is used in conjunction with the rudder pedals.

When the airplane is being steered by the rudder pedals and the nose wheel turns above 9°, the nose wheel will be disengaged, allowing free castoring of the nose wheel and illuminating the PEDAL STEER INOP amber light. To reset the system, the steering handle should be pushed. Manual disengagement is performed by actuating the disengage pushbutton installed on the control wheel.

The nose wheel will automatically center whenever the green hydraulic pressure is lost, or the weight is removed from the nose gear.

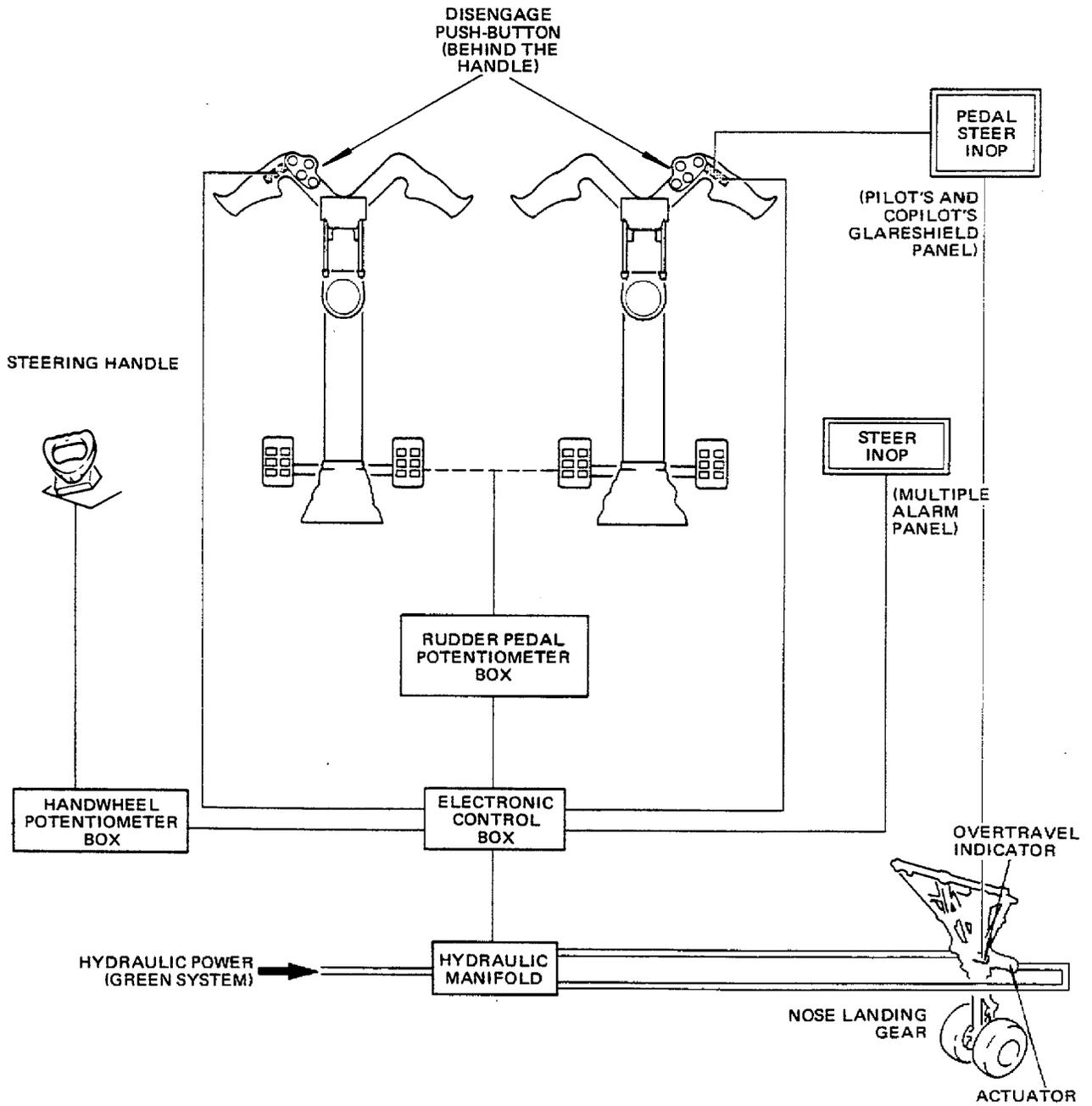
When the airplane is airborne, the steering handle and rudder pedal commands are disabled. To indicate a steering failure, the STEER INOP light illuminates on the multiple alarm panel (MAP).

A steering jack overtravel indicator, installed on the actuator body, protrudes from its housing when a steering overtravel occurs.



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**OPERATIONS MANUAL**

**SYSTEMS DESCRIPTION**  
**LANDING GEAR**  
**AND BRAKES**



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**NOSE WHEEL STEERING**

