

 A320 <small>SIMULATOR</small> FLIGHT CREW OPERATING MANUAL	LANDING GEAR	1.32.00	P 1
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32.00 CONTENTS

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AIRBUS TRAINING  A320 SIMULATOR FLIGHT CREW OPERATING MANUAL	LANDING GEAR		1.32.10	P 1
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DESCRIPTION

GENERAL

The landing gear consists of :

- two main gear that retract inboard,
- a nose gear that retracts forward.

Doors enclose the landing gear bays. Gear and doors are electrically controlled and hydraulically operated.

R The doors, which are fitted to the landing gear struts, are operated mechanically by the gear and close at the end of gear retraction.

All gear doors open while the gear is retracting or extending.

Two Landing Gear Control and Interface Units (LGCIUs) control the extension and retraction of the gear and the operation of the doors. They also supply information about the landing gear to ECAM for display, and send signals indicating whether the aircraft is in flight or on the ground to other aircraft systems.

A hand crank on the center pedestal allows the flight crew to extend the landing gear if the aircraft loses hydraulic systems or electrical power.

MAIN GEAR

Each main gear has twin wheels and an oleopneumatic shock absorber.

Each main wheel has an antiskid brake.

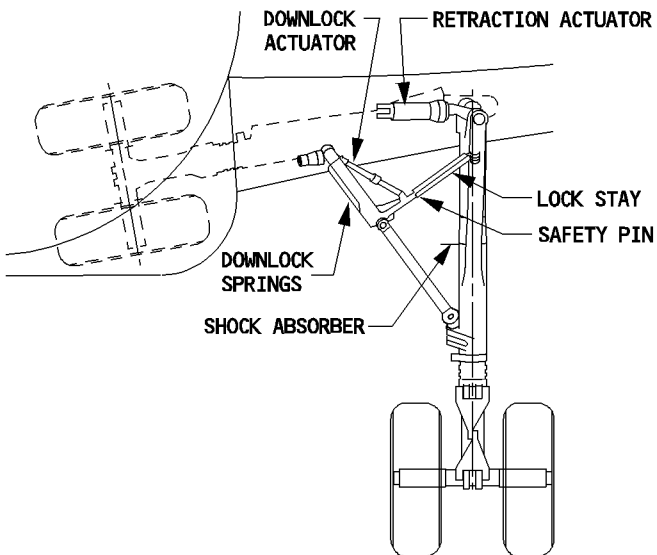
NOSE GEAR

The two-wheeled nose gear has an oleopneumatic shock strut and a nose wheel steering system.



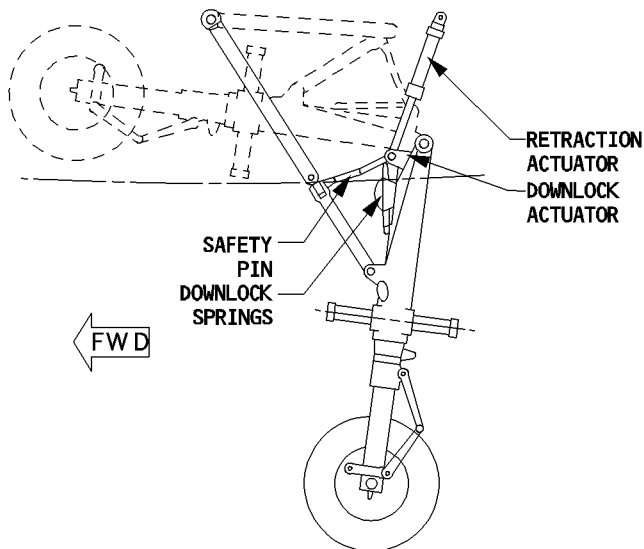
DRAWINGS

MAIN LANDING GEAR



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NOSE GEAR



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OPERATION OF GEAR AND DOORS

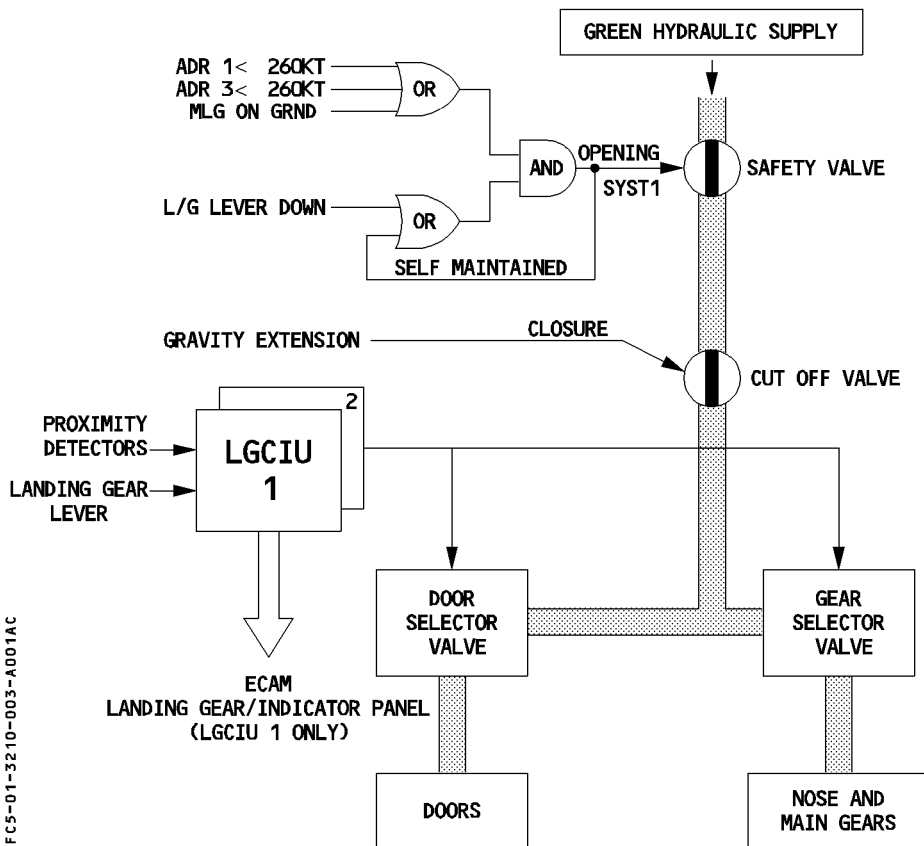
NORMAL OPERATION


The flight crew normally operates the landing gear by means of the lever on the center instrument panel.

The LGCIUs control the sequencing of gear and doors electrically. One LGCIU controls one complete gear cycle, then switches over automatically to the other LGCIU at the completion of the retraction cycle. It also switches over in case of failure.

The green hydraulic system actuates all gear and doors. When the aircraft is flying faster than 260 kt, a safety valve automatically cuts off hydraulic supply to the landing gear system. Below 260 kt, the hydraulic supply remains cut off as long as the landing gear lever is up.

FOR INFO



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EMERGENCY EXTENSION

If the normal system fails to extend the gear hydraulically, the flight crew can use a crank to extend it mechanically.


When a crew member turns the crank, it :

- isolates the landing gear hydraulics from the green hydraulic system,
- unlocks the landing gear doors and the main and nose main gear,
- allows gravity to drop the gear into the extended position.

Locking springs help the crew to crank the main gear into the locked condition, and aerodynamic forces assist in the locking of the nose gear.

The gear doors remain open.

The flight crew can reset the emergency extension system in flight after using it for training (if green hydraulic pressure is available).

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LANDING GEAR SYSTEM INTERFACE

LGCIUs

The LGCIUs receive position information from the landing gear, cargo door, and landing flap systems.

LANDING GEAR

The LGCIUs receive the following information about the landing gear from proximity detectors :

- gear locked down or up,
- shock absorbers compressed or extended,
- landing gear door open or closed.

Failure of a proximity detector :

- The LGCIU detects any electrical failure in a proximity detector, and signals the associated output to the flight position (shock absorber not compressed or landing gear unlocked).

The other LGCIU then automatically takes over control of the landing gear operation.

- In case of mechanical failure, the LGCIU does not modify the associated output. The effect that such a failure has on the system depends upon which condition is signalled incorrectly.

Electrical failure of an LGCIU :

- The other (healthy) LGCIU takes control of the landing gear.
- The system does not force the outputs of the failed LGCIU to the safe (flight) condition.
 - Some users will see "flight" condition.
 - Some users will see "ground" condition.

CARGO DOORS

Sensors send to the LGCIUs the position of the following components :

- manuel selector valves,
- locking shaft,
- locking handle,
- safety shaft,
- door sills .<

The LGCIUs detect electrical failures only in certain proximity switches in the cargo door system :

- locking shaft,
- locking handle,
- safety shaft.

When an LGCIU makes such a detection, it indicates the NON LOCKED condition for that component.

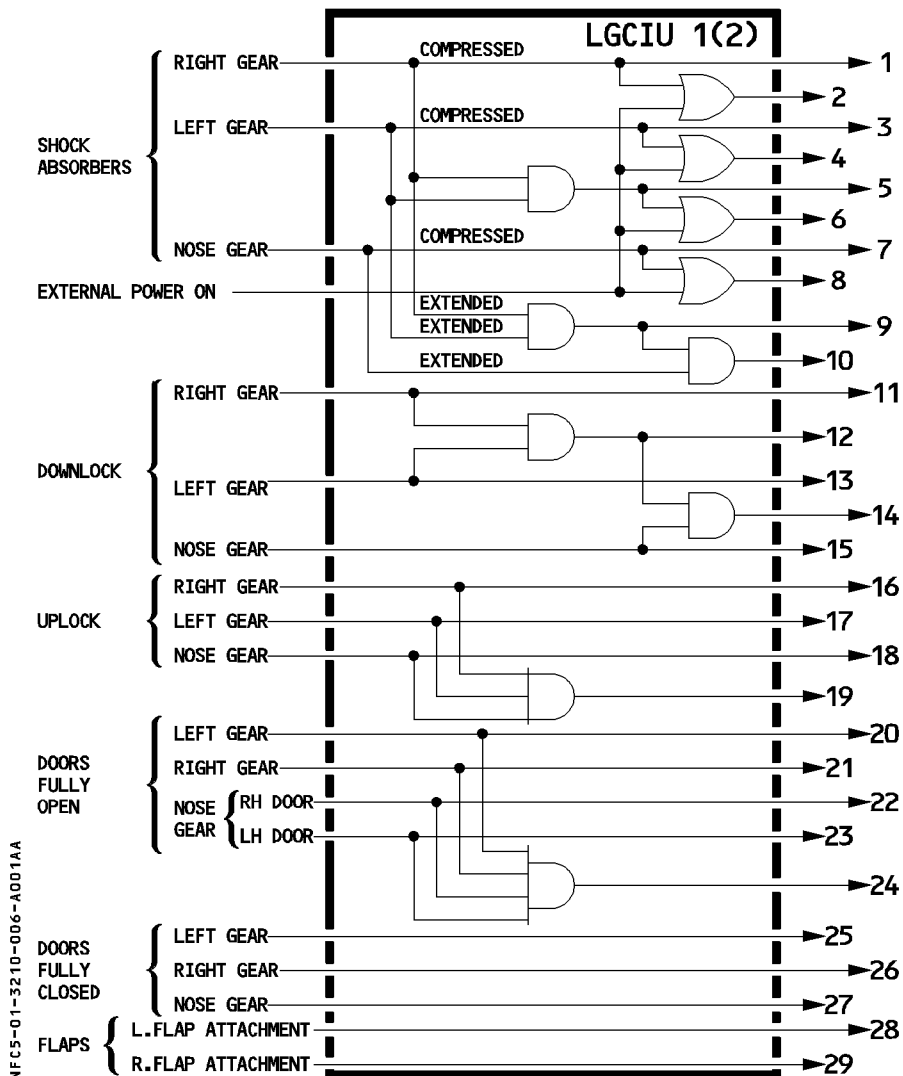


FLAPS

The LGCIUs process the signals from four flap disconnect proximity switches, then send them to the Slat/Flap Control Computers (SFCCs).

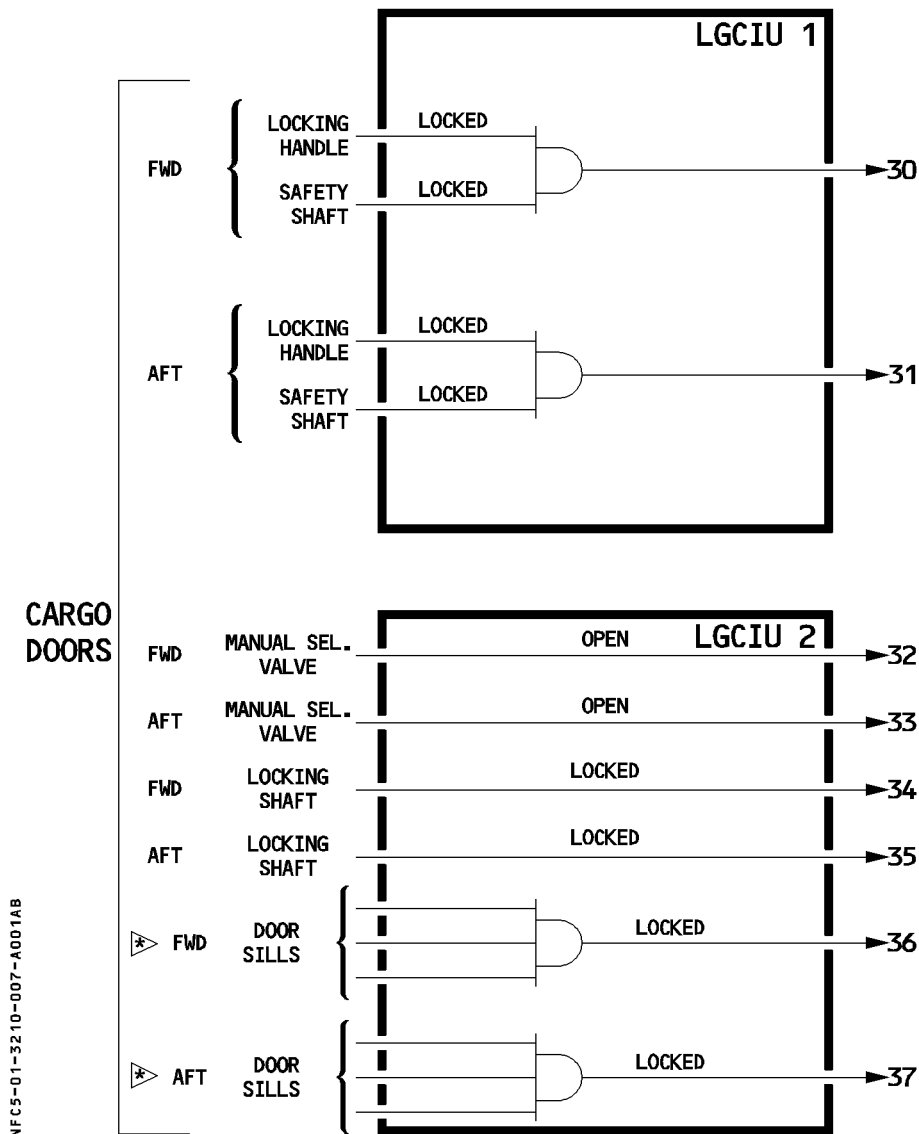
The LGCIUs do not monitor failures in the SFCC system.

PROXIMITY DETECTOR OUTPUT SIGNALS





PROXIMITY DETECTOR OUTPUT SIGNALS (CONT'D)



INTERACTIONS BETWEEN LANDING GEAR AND AIRCRAFT SYSTEMS

The following tables present the operational effects of the proximity detectors on aircraft systems.

How to read the tables :

R

SYSTEM	LGCIU 1	LGCIU 2	A/C IN FLT	A/C ON GROUND
SERVICE INTERPHONE	6	6
SFCC 1(2)	5	(5)


The above lines mean that the service interphone receives the output n° 6 from both LGCIUs, while SFCC 1 receive the output 5 from LGCIU 1 and SFCC 2 the output 5 from LGCIU 2.

The two additional columns give the system functioning when the aircraft is in flight and on the ground.

PROXIMITY DETECTORS ON SHOCK ABSORBERS

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	A/C IN FLT	A/C ON GRND
G E N E R A L	STROBE Its		5	On when AUTO selected	Off when AUTO selected
	LOGO Its		5	Off when flaps retracted	On
	AIRSTAIRS (if installed)	3	1	Control inhibited (1)	Control not inhibited (2)
	CARGO DOOR (5)		5	normal control not available	normal control available
	WATER FILLING		5	Preselect water servicing inhibited	Preselect water servicing available
A I R C O N D	AVNCS COOLING	5	5	. Skin temp. < 35° C : The system is in closed conf. (1) . Skin temp. > 35° C : The system is in intermediate conf. (1)	. Skin temp. < 5° C : The system is in closed conf. (2) . Skin temp. > 5° C : The system is in open conf. (2)
	GRND COOLING (if installed)	1 3	1 3	Inhibited (1)	Not inhibited (2)
	FWD CARGO VENT		5	Extract fan stopped when $\Delta P > 1$ psi	Extract fan on
	CAB PRESS	5	5	– Climb mode active (4)	– Prepressurization active before TO (3) – Depressurization active after LDG (3)
	PACK 1 (2) TEMP CONTROL		3 (1)	Pack air inlet flaps opened.	Pack air inlet flap fully closed at T.O and LDG

- (1) When either LGCIU indicates flight
- (2) When both LGCIU indicate ground
- (3) When either LGCIU indicates ground
- (4) When both LGCIU indicate flight
- (5) Valid from MSN 44.

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PROXIMITY DETECTORS ON SHOCK ABSORBERS

R

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	A/C IN FLT	A/C ON GRND
A P U	APU AUTO SHUTDOWN	5		– In case of oil low press, automatic shutdown is delayed by 15.5 seconds	– In case of oil low press, the automatic shutdown is delayed by : · 15.5 seconds if the oil temp < – 4°C · 0.05 seconds if oil temp > – 4°C
	APU SPEED CONTROL			– Speed is controlled at 101 %	– Speed is controlled at 99 % (101 % for eng start or when ambient temp ≥ 30° C)
C O M M U N I C A T I O N S	SERVICE INTERPHONE	6	6	Inhibited (1)	Available (2)
	PUBLIC ADDRESS	1 3	1 3	PA. increased level (1)	PA. low level (2)
	ADIRU and AVIONICS ground warning	1 3	1 3	External horn and light inhibited (1)	External horn and light not inhibited (2)
	FLT INTERPHONE	9		Communication with ground mechanic inhibited	Communication with ground mechanic available
	COCKPIT CALL LIGHT	9		Inhibited	Not inhibited
	ACARS		7	Available	Available
	CVR	1 3 7	1 3	Runs (1)	Runs : (2) · during the first 5 minutes following energization · with one engine running Stops : (2) 5 minutes after second engine shutdown
	CVR		5	· ERASE function inhibited · No low frequency signal in the loudspeakers if test performed	· ERASE function not inhibited · Low frequency signal in the loudspeakers if test performed

(1) When either output indicates flight.

(2) When all outputs indicate ground.

PROXIMITY DETECTORS ON SHOCK ABSORBERS

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	A/C IN FLT	A/C ON GRND
E L E C	DC generation	5		APU start on batteries only, is delayed by 45 seconds	No APU start delay when on batteries only
	GALLEY supply		5	Main galley not supplied when APU GEN only is supplying	Main galley supplied when APU GEN only is supplying
E I S	EIS	5		Display test inhibited when ANN LT TEST is selected	Display test not inhibited
F I R E	APU	5		No APU fire automatic extinguishing	Automatic extinguishing not inhibited
F L T C T L	SFCC 1(2)	5	(5)	<ul style="list-style-type: none"> · For SFCC 1(2) : Slats alpha/speed lock function active · For SFCC (2) : No flaps movement inhibition if the cargo door is opened 	<ul style="list-style-type: none"> · For SFCC 1(2) : Slats alpha/speed lock function active if speed > 60 kt · For SFCC (2) : Flaps movement inhibition if cargo door is opened
F L T I N S T	<ul style="list-style-type: none"> · DFDR · QAR (If installed)	1 3 7	1 3	Runs (1)	Runs : (2) · during the first 5 minutes following energization · with one engine running Stops : (2) 5 minutes after second engine shut down
F U E L	FQI	5		FQI uses flight attitude correction due to wing bending	FQI uses ground attitude correction

(1) When either output indicates flight
 (2) When all outputs indicate ground

PROXIMITY DETECTORS ON SHOCK ABSORBERS

R

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	A/C IN FLT	A/C ON GRND
H Y D	BLUE and GREEN pumps	1 3		Blue or green pump "FAULT" light not inhibited when related pump is stopped (1)	Blue or green pump "FAULT" light inhibited when related pump is stopped (4)
	BLUE pump	7		Runs when electrical power is available	Runs when at least one engine is running
	BLUE and YELLOW pumps		1 3	Blue or yellow pump "FAULT" light not inhibited when related pump is stopped (1)	Blue or yellow pump "FAULT" light inhibited when related pump is stopped (2)
	PTU			7	PTU runs if green/yellow diff. press > 500 psi
I C E R A I N P R O T	CAPT, (F/O), (STBY) probes and CAPT, (F/O) windows heating	4, (2) ((8))	4, (2) ((8))	<ul style="list-style-type: none"> · CAPT, (F/O), ((STBY)) pitots and CAPT, (F/O) windows : high heating level applied · All other probes and windows are heated (1) 	<ul style="list-style-type: none"> · With engines stopped : no heating (2) · With at least one engine running : · CAPT, (F/O), ((STBY)) pitots and CAPT, (F/O) windows are heated at low level (2)
	WING ANTI ICE	3	1	Wing anti ice valves open when the WING ANTI ICE pb is at ON (1)	Wing anti ice valves open for 30 seconds when the WING ANTI ICE pb is at ON (2)
	RAIN REPELLENT	1 3	1 3	Not inhibited (1)	Inhibited if engines are stopped (4)
	DRAIN MAST (5)			9	High heating level is applied

- (1) When either outputs indicates flight
- (2) When both outputs indicate ground
- (3) One valid output is sufficient
- (4) When all outputs indicate ground
- (5) Valid from MSN 22



PROXIMITY DETECTORS ON SHOCK ABSORBERS

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	A/C IN FLT	A/C ON GRND
L A N D I N G G E A R	L/G SAFETY VALVE	6		Safety valve closes if aircraft speed > 260 kt	Safety valve opened
	L/G control	10	10	Retraction not inhibited (1)	Retraction inhibited (1)
	TIRE PRESS ◀		5	"TYRE LO PRESS" warning threshold set to its flight level	"TYRE LO PRESS" warning threshold set to its ground level
N A V I G A T I O N	STAND BY ALTI	5		VIBRATION function active	Vibration function inhibited
	ATC 1(2)	3	(1)	ATC 1(2) available in AUTO mode	ATC 1(2) inhibited in AUTO mode
	ADIRU 1 (2)	7		No external horn when ADIRU supplied from batteries only	External horn not inhibited

(1) One valid output is sufficient

(2) Valid from MSN 22

PROXIMITY DETECTORS ON SHOCK ABSORBERS

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	A/C IN FLT	A/C ON GRND
P O W E R P L A N T	FADEC 1(2)	1 3	(1) (3)	On Eng 1(2) : (1) <ul style="list-style-type: none"> · Reverse inhibited · No automatic start abort · FADEC always supplied · FLEX not available · If installed, BUMP not selectable 	On Eng 1(2) : (2) <ul style="list-style-type: none"> · Reverse available · Automatic start abort available · 5 minutes after eng-shut down FADEC 1(2) no more supplied · FLEX available · If installed, BUMP selectable
		1 3 8	(1) (3) (8)	Modulated idle and approach idle are available (1)	Modulated idle only available (3)

- (1) When either output indicates flight
- (2) When both outputs indicate ground
- (3) When all outputs indicate ground

PROXIMITY DETECTORS ON UPLOCKS

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	L/G UNLOCKED	L/G NOT UNLOCKED
L A N D I N G G E A R	L/G control	19	19	. If UP selected : (1) L/G doors will close	. If UP selected : (1) L/G doors will not close
	ECAM WHEEL page	16 17 18	16 17 18	. If UP selected : (2) L/G unlocked indications	. If UP selected : (2) L/G in transit indications
	L/G indicator panel	16 17 18		. If UP selected : (2) no indication	. If UP selected : (2) "UNLKR" red indications

DOORS PROX DET

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	DOORS FULLY OPENED	DOORS CLOSED
L A N D I N G G E A R	L/G control	24	24	L/G extension or retraction possible (1)	L/G extension or retraction inhibited (1)
	ECAM WHEEL PAGE	20 21 22 23	20 21 22 23	Doors fully opened indication	Doors closed indication

- (1) One valid output is sufficient.
- (2) When all outputs indicate the same position.

PROXIMITY DETECTORS ON DOWNLOCKS

R

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	L/G DOWNLOCKED	L/G NOT DOWNLOCKED
GEN	TAXI/T.O lights		15	lights not inhibited	lights inhibited
C O M M.	SIGNS	12	12	"NO SMOKING" and "EXIT" signs on when AUTO selected (1)	"NO SMOKING" and "EXIT" signs inhibited when AUTO selected (2)
FLT. INST.	WBS ◁	15	15	active (3)	inhibited (4)
FMGS	FAC 1(2)	12	12	VLE indication displayed on PFD 1(2)	no VLE indication
L A N D I N G G E A R	L/G control	14	14	If DOWN selected : (5) L/G doors will close	If DOWN selected : (5) L/G doors will not close
	ECAM WHEEL page	11 13 15	11 13 15	If DOWN selected : (6) L/G down indications	If DOWN selected : (6) L/G in transit indications
	L/G INDIC panel	11 13 15		If DOWN selected : (6) L/G down indications	If DOWN selected : (6) L/G in transit indications
	BRAKING STEERING	15	15	BSCU test operative (1)	BSCU test inhibited (1)
	BRAKES COOLING ◁		13	Cooling available when ON selected	Cooling inhibited when ON selected
NAV	GPWS	13		"TOO LOW-FLAPS" or "TOO LOW TERRAIN" warning operative	"TOO LOW-GEAR" or "TOO LOW TERRAIN" warning operative

- (1) When either output indicates DOWNLOCK.
- (2) When both outputs indicate NOT DOWNLOCK.
- (3) When both outputs indicate DOWNLOCK.
- (4) When either output indicates NOT DOWNLOCK.
- (5) One valid output is sufficient.
- (6) When all outputs indicate the same position.

PROXIMITY DETECTORS ON CARGO DOORS

LOCKING HANDLE OR SHAFT, DOOR SILLS

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	LOCKED	UNLOCKED
C R G O D O O R S	ECAM DOOR PAGE	30 (31)		Forward (aft) door symbol appears green	Forward (aft) door symbol appears amber, associated with "CARGO" amber.
	CARGO DOOR OPERATION		34 (35)	Forward (aft) door normal opening inhibition	Forward (aft) door normal opening possible
			36 (37) ◀	Forward (aft) door normal operation possible	Forward (aft) door normal operation inhibited

MANUAL SELECTOR VALVE

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	CLOSE	OPEN
C R G O D O O R S	CARGO DOOR OPERATION		32 (33)	Forward (aft) door normal opening inhibition	Forward (aft) door normal opening possible

PROXIMITY DETECTORS ON FLAP ATTACHMENTS

	SYSTEM	LGCIU 1 OUTPUT	LGCIU 2 OUTPUT	FLAP ATTACHMENT	FLAP ATTACHMENT FAILURE
FLT CTL	SFCC	28 (29)	28 (29)	L(R) FLAPS normal operation (1)	"FLAPS LOCKED" warning (2)

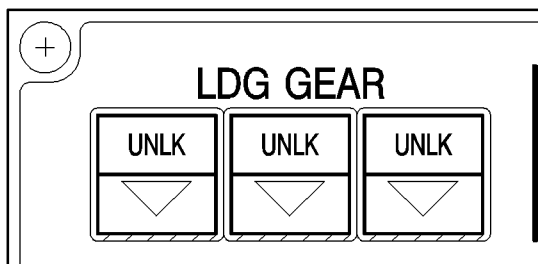
- (1) When at least one SFCC detects normal operation
- (2) When both SFCCs detect attachment failure



CONTROLS AND INDICATORS

LANDING GEAR INDICATOR PANEL

NFC5-01-3210-018-A001AA



This panel is connected to LGCIU1, which receives signals from proximity detectors.

UNLK : come on red if the gear is not locked in the selected position.

▽ : come on green if the gear is locked down.

R Note : The lights on the LDG GEAR indicator panel come on as long as the LGCIU1 is
R electrically supplied.

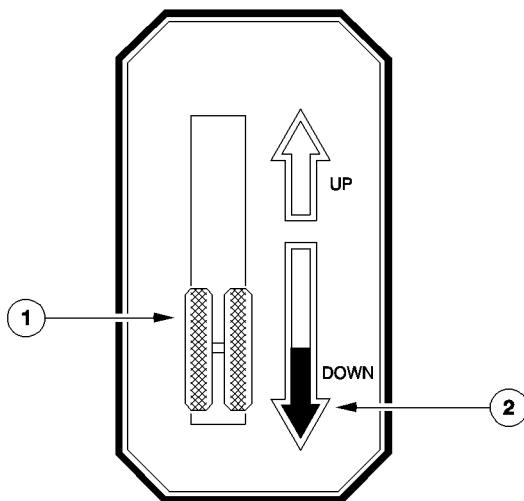


LANDING GEAR SELECTOR LEVER

A two-position selector lever sends electrical signals to the two LGCIUs. These control the green hydraulic supply to the landing gear system by means of selector valves.

When the flight crew selects UP or DOWN (and if the airspeed is below 260 knots) :

- All landing gear doors open.
- Each landing gear moves to the selected position.
- All landing gear doors close.



NFCS-01-3210-019-A001AA

① L/G LEVER

UP : This position selects landing gear retraction.

While the landing gear doors are opening, the normal brake system brakes the wheels of the main gear automatically. A brake band in the nose gear well brakes the nose gear wheels as the doors close.

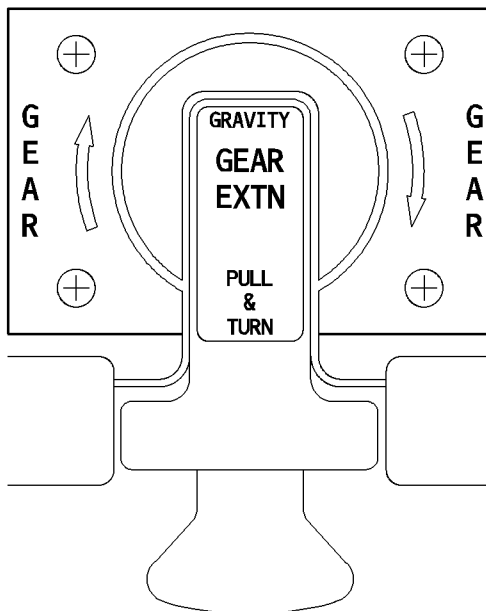
DOWN : This position selects landing gear extension.

An interlock mechanism prevents anyone from accidentally retracting the gear while the aircraft is on the ground. It does so by locking the lever in DOWN position when the shock absorber on either main gear is compressed (aircraft on ground) or the nose wheel steering is not centered. The landing gear hydraulic system remains pressurized as long as the landing gear is extended (if green hydraulic pressure is available).

② RED ARROW

R This red arrow lights up if the landing gear is not locked down when the aircraft is in the landing configuration, and a red warning appears on ECAM.

EMERGENCY EXTENSION



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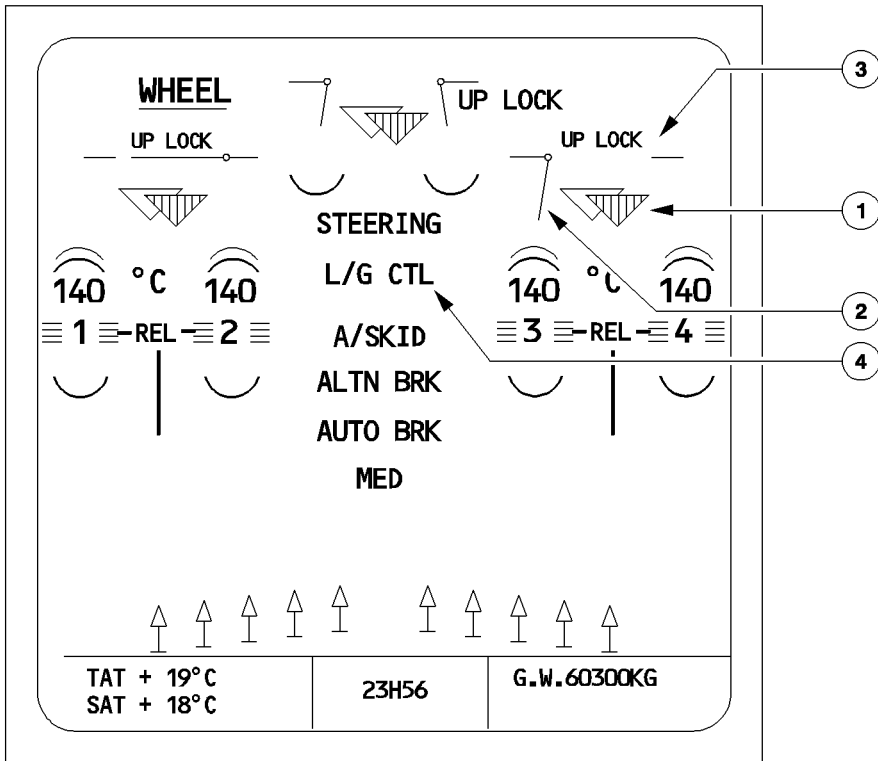
To put the landing gear down by gravity, the flight crew must pull the gear crank out, then turn it clockwise for 3 turns.

When the flight crew operates the crank handle, the cutout valve shuts off hydraulic pressure to the landing gear system and depressurizes it.



ECAM WHEEL PAGE

R



NFC5-01-3210-021-A001AB



① Landing gear position indication

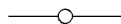
The landing gear positions are indicated by 2 triangles for each gear.

Each triangle is controlled by one LGCIU :

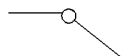
- a green triangle indicates that one LGCIU detects a landing gear downlocked,
- a red triangle indicates that one LGCIU detects a landing gear in transit,
- no triangle indicates that one LGCIU detects a landing gear uplocked,
- amber crosses indicates that one LGCIU is failed.

② Landing gear door position indication

NFCS-01-3210-022-A001AA



- DOOR LOCKED UP (GREEN)



- DOOR IN TRANSIT (AMBER)



- DOOR FULLY OPEN (AMBER)

③ UP LOCK

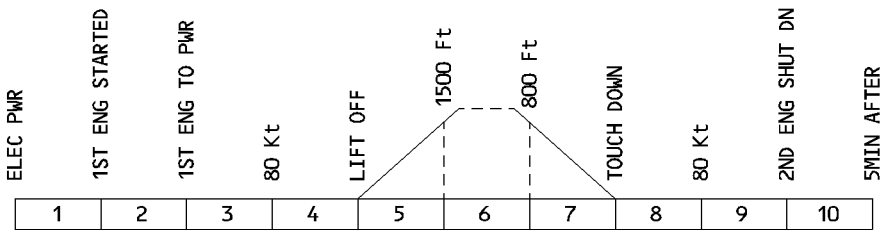
This legend appears amber along with a caution on the ECAM if the landing gear uplock is engaged when the landing gear is down locked.

④ L/G CTL

This legend appears amber along with an ECAM caution if the landing gear lever and the landing gear position do not agree.

WARNINGS AND CAUTIONS

NFC5-01-3210-023-A110AA



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
GEAR NOT DOWNLOCKED One gear not downlocked and L/G selected down	CRC	MASTER WARN	WHEEL	UNLK lt on	3, 4, 5
GEAR NOT DOWN 1. L/G not downlocked and radio height lower than 750 ft and both engines N1 lower than 75 % (or if engine shut down N 1 of remaining engine lower than 97 %) or 2. L/G not downlocked and radio height lower than 750 ft and flaps at 3 or FULL or 3. L/G not downlocked and flaps at 3 or FULL and both radio altimeters failed NOTE : In the cases 2 and 3 above, the aural warning can only be cancelled by the emergency cancel pushbutton.			NIL	DOWN ARROW lt on LDG GEAR panel	
SHOCK ABSORBER FAULT One shock absorber not extended when airborne or not compressed after landing			NIL	NIL	
DOORS NOT CLOSED One gear door is not uplocked	SINGLE CHIME	MASTER CAUT	WHEEL	NIL	1, 3, 4, 5, 8, 9, 10
GEAR NOT UPLOCKED One gear not uplocked and L/G not selected down	NIL	NIL		UNLK lt on LDG GEAR panel	3, 4, 7, 8, 9, 10
GEAR UPLOCK FAULT One gear uplock engaged with corresponding gear downlocked				4	
LGCIU 1 (2) FAULT	NIL	NIL	NIL	NIL	4, 5, 7, 8
SYS DISAGREE Disagree between L/G positions detected by the two LGCIU's				3, 4, 5, 7, 8	

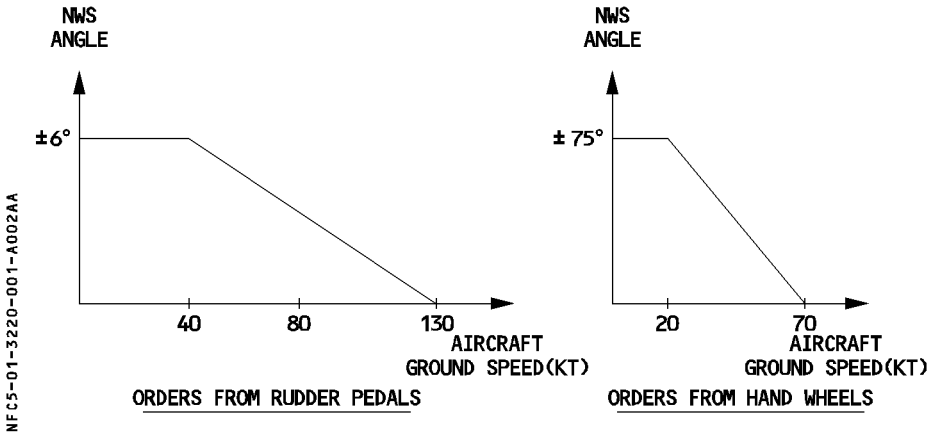
DESCRIPTION

A hydraulic actuating cylinder steers the nose wheel. The green hydraulic system supplies pressure to the cylinder, and electric signals from the Brake and Steering Control Unit (BSCU) control it.

The BSCU receives orders from :

- the Captain’s and the First Officer’s steering hand wheels (orders added algebraically),
- the rudder pedals,
- the autopilot.

The BSCU transforms these orders into nose wheel steering angle. That angle has the following limits, which depend on ground speed and the origin of the orders.



The steering system receives actuating hydraulic pressure when :

- the A/SKID & N/W STRG switch is on and,
- the towing control lever is in normal position and,
- at least one engine is running and,
- the aircraft is on ground.

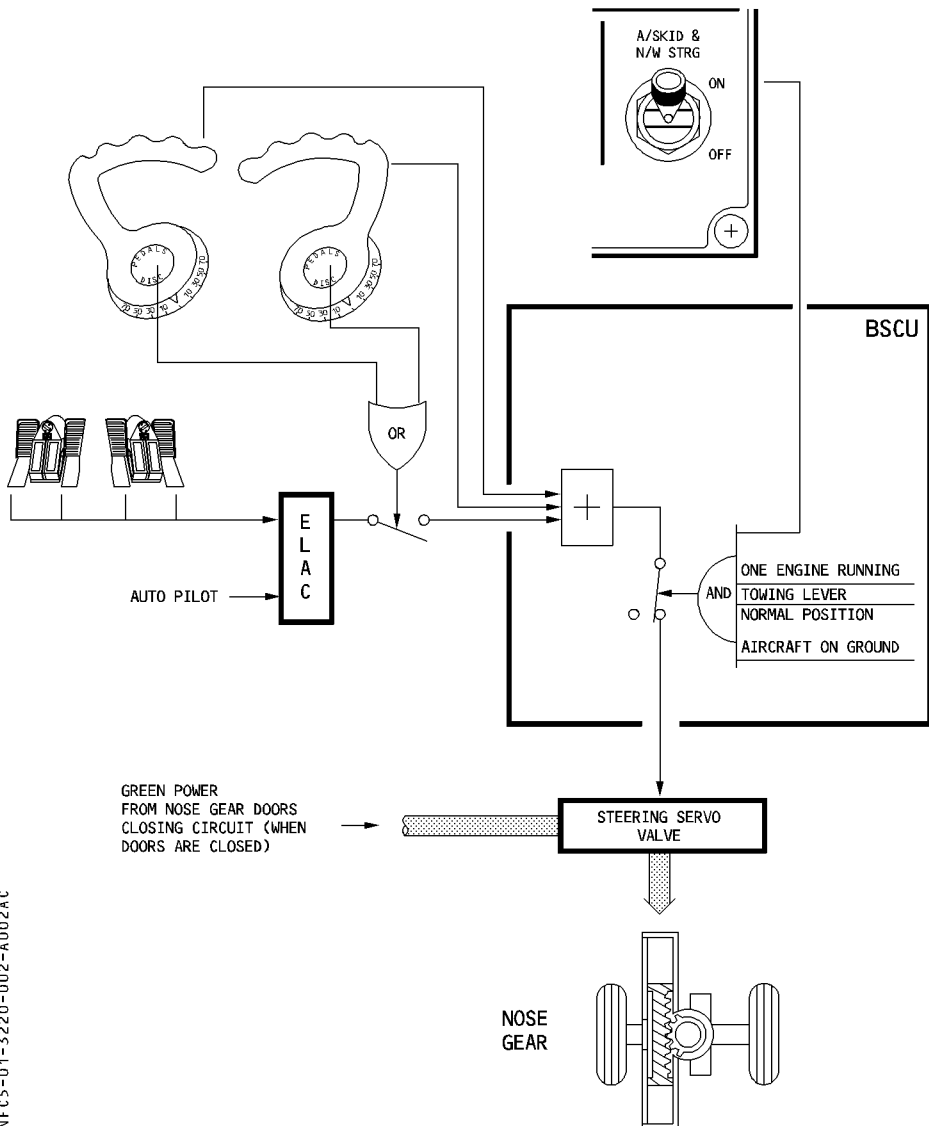
The nose landing gear doors must be closed in order for the green hydraulic system to apply pressure to the actuating cylinder.

The handwheel can turn the nose wheel up to 75° in either direction. A lever on the towing electrical box (on nose landing gear) allows ground crew to deactivate the steering system for towing. This then allows the wheel to be turned 95° in either direction.

R The pilots can use a pushbutton on either steering handwheel to prevent rudder pedal orders or autopilot orders from going to the BSCU.

An internal cam mechanism returns the nose wheel to the centered position after takeoff.

R



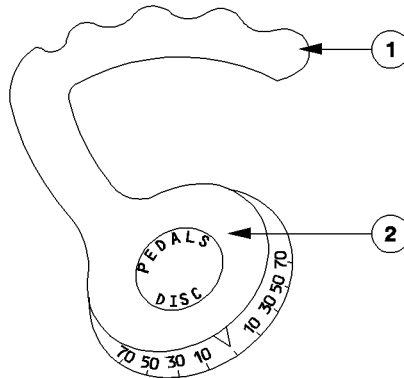
NFCS-01-3220-002-A002A C



CONTROLS AND INDICATORS

SIDE CONSOLES

NFC5-01-3220-003-A001AA



① Steering handwheels

The steering handwheels, which are interconnected, can steer the nose wheel up to 75° in either direction.

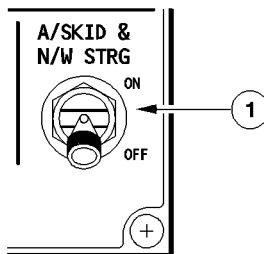
Note : The steering system centers the nose wheel automatically after liftoff.

② Rudder PEDAL DISC pb

Pressing this button on either handwheel removes control of nose wheel steering from the rudder pedals until the button is released.

CENTER INSTRUMENT PANEL

NFC5-01-3220-003-B001AA

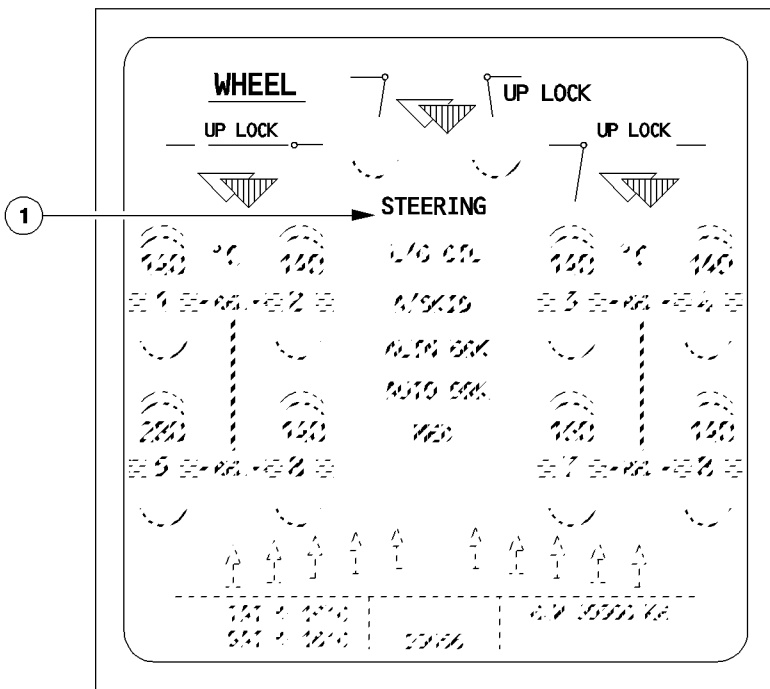


① A/SKID & N/W STRG sw

This ON/OFF switch activates or deactivates the nose wheel steering and anti-skid. (Refer to 1.32.30, BRAKES AND ANTI-SKID).



ECAM WHEEL PAGE



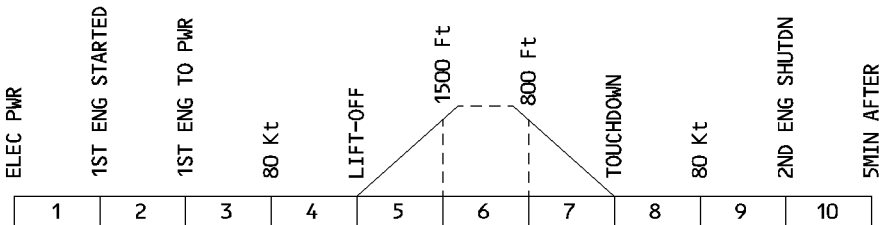
① STEERING

This legend appears along with an ECAM caution if either the nose wheel steering or the anti-skid feature fails.



WARNINGS AND CAUTIONS


NF C5-01-3220-005-A 103AA



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
N/W STRG FAULT detected by BSCU	SINGLE CHIME	MASTER CAUT	WHEEL	NIL	3, 4, 5, 8

MEMO DISPLAY

When the nosewheel steering selector is in the towing position, “NW STRG DISC” is displayed in green. The legend is in amber, if one engine is running.

 AIRBUS TRAINING A320 SIMULATOR FLIGHT CREW OPERATING MANUAL	LANDING GEAR BRAKES AND ANTI-SKID	1.32.30	P 1
		SEQ 100	REV 24

DESCRIPTION

GENERAL

The main wheels have multidisc brakes that can be actuated by either of two independent brake systems.

The normal system uses green hydraulic pressure : the alternate system uses the yellow hydraulic system backed up by a hydraulic accumulator.

An anti-skid system and autobraking work through the brake system.

Braking commands come from either the brake pedals (pilot action) or the autobrake system (deceleration rate selected by the crew).

Two units on each main gear monitor the temperature of the brakes.

All braking functions (normal and alternate braking control, anti-skid control, autobraking, brake temperature indication) are controlled by a two-channel Brake and Steering Control Unit (BSCU).

The main wheels have fusible plugs that prevent the tires from bursting if they overheat.

The main wheels may also have brake cooling fans. ◀

ANTI-SKID SYSTEM

The anti-skid system produces maximum braking efficiency by maintaining the wheels just short of an impending skid.

When a wheel is on the verge of locking, the system sends brake release orders to the normal and alternate servovalves — and to the ECAM, which displays the released brakes.

The anti-skid deactivates when ground speed is less than 20 knots.

An ON/OFF switch turns the anti-skid system and nose wheel steering on and off.

PRINCIPLE

The system compares the speed of each main gear wheel (given by a tachometer) with the speed of the aircraft (reference speed). When the speed of a wheel drops below 0.87 times the reference speed, the system orders brake releasing in order to maintain the brake slip at that value (best braking efficiency).

In normal operation, the BSCU determines the reference speed from the horizontal acceleration furnished by ADIRU1, ADIRU2, or ADIRU3.

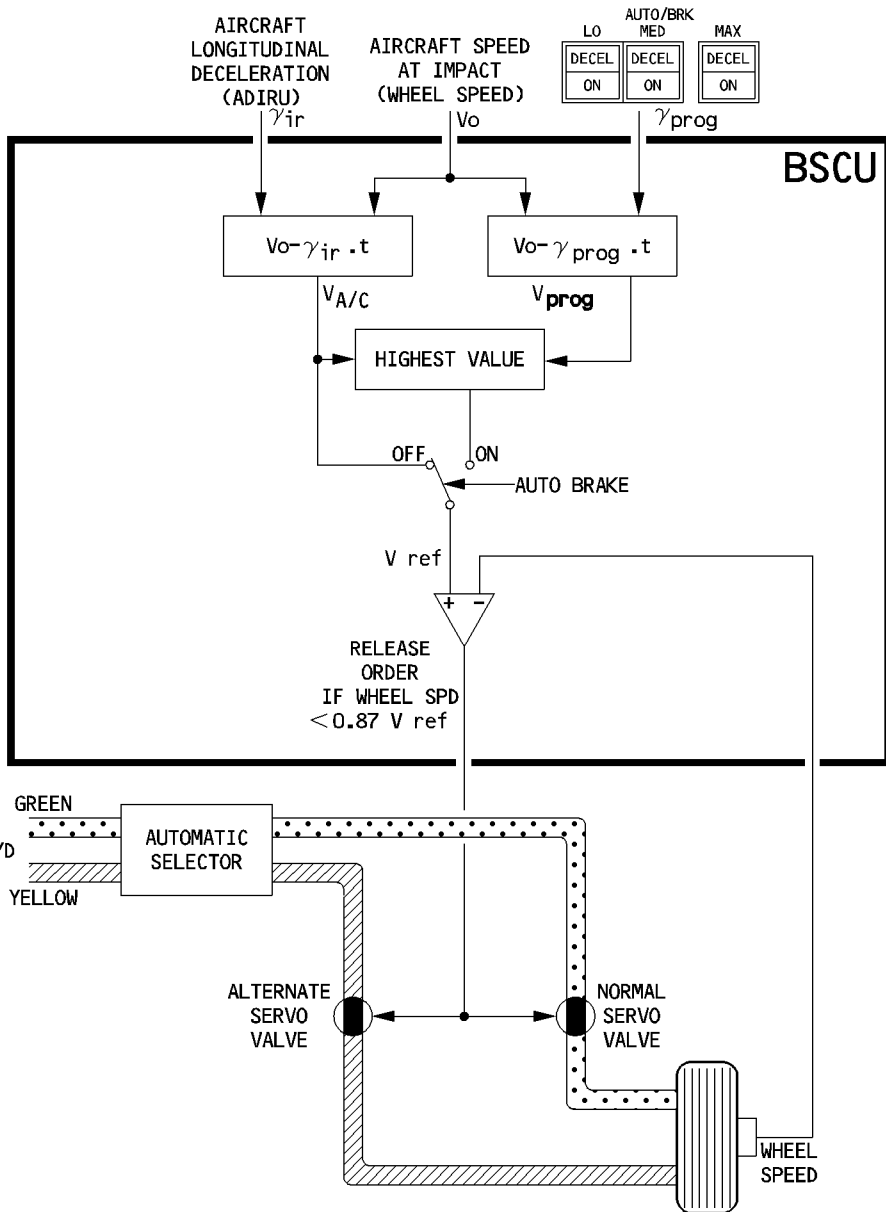
If all three ADIRUs fail, reference speed equals the greater of either main landing gear wheel speed. Deceleration is limited to 1.7 meters/second² (5.6 feet/second²)




ANTI-SKID PRINCIPLE

FOR INFO

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NFCS-01-3230-002-A001AB

 AIRBUS TRAINING A320 SIMULATOR FLIGHT CREW OPERATING MANUAL	LANDING GEAR	1.32.30	P 3
	BRAKES AND ANTI-SKID	SEQ 100	REV 37

AUTO BRAKE

The purposes of this system are :

- to reduce the braking distance in case of an aborted takeoff
- to establish and maintain a selected deceleration rate during landing, thereby improving passenger comfort and reducing crew workload.

R SYSTEM ARMING

The system arms when the crew presses the LO, MED, or MAX pushbutton switch if :

- Green pressure is available.
- The anti-skid system has electric power.
- There is no failure in the braking system.
- At least one ADIRS is functioning.

Note : Auto brake may be armed with the parking brake on.

R SYSTEM ACTIVATION

R Automatic braking activates when the ground spoilers extend (Refer to 1.27.10 SPEED BRAKES AND GROUND SPOILERS). Therefore, if the aircraft makes an acceleration stop and begins to decelerate when its speed is under 72 knots, the automatic braking will not

R activate because the ground spoilers will not extend.

For autobrake to activate, at least two SEC's must be operative.

R SYSTEM DEACTIVATION

R The system deactivates :

R – When it is disarmed (see below).

R – When the ground spoilers retract. In this case it remains armed.


R SYSTEM DISARMING

The system disarms when :

- Flight crew presses the pushbutton switch or,
- One or more arming conditions is lost or,

R – Flight crew applies enough deflection to at least one brake pedal when autobrake is active in MAX, MED or LO mode.

R – After take-off/touch and go.

 AIRBUS TRAINING A320 SIMULATOR FLIGHT CREW OPERATING MANUAL	LANDING GEAR	1.32.30	P 4
	BRAKES AND ANTI-SKID	SEQ 100	REV 30

OPERATION

There are four modes of operation :

- Normal braking,
- Alternate braking with anti-skid,
- Alternate braking without anti-skid,
- Parking brake.

NORMAL BRAKING

Braking is normal when :

- Green hydraulic pressure is available.
- The A/SKID & N/W STRG switch is ON.

During normal braking, anti-skid operates and autobrake is available.

Braking is controlled electrically through the BSCU :

- from the pilot's pedals or,
- automatically
 - on the ground by the autobrake system,
 - in flight when the landing gear lever is up.

The anti-skid system is controlled by the BSCU via the normal servo valves.

There is no indication of brake pressure in the cockpit.

ALTERNATE BRAKING WITH ANTI-SKID

Braking uses this mode when green hydraulic pressure is insufficient and :


- Yellow hydraulic pressure is available.
- The A/SKID & N/W STRG switch is ON.
- The parking brake is not ON.

An automatic hydraulic selector changes from the green to the yellow system.

The pedals brake through the auxiliary low-pressure hydraulic distribution line acting on the dual valves. The BSCU controls the anti-skid system via the alternate servo valves.

A triple indicator on the center instrument panel shows the pressure delivered to the left and right brakes, as well as the accumulator pressure.

Autobrake is inoperative.

 AIRBUS TRAINING A320 SIMULATOR FLIGHT CREW OPERATING MANUAL	LANDING GEAR BRAKES AND ANTI-SKID	1.32.30	P 5
		SEQ 100	REV 28

ALTERNATE BRAKING WITHOUT ANTI-SKID

The anti-skid system can be deactivated :

- electrically (A/SKID & N/W STRG switch OFF, or power failure or BSCU failure),
- hydraulically (low pressure in both green and yellow systems, brakes being supplied by the brake accumulator only).

The pilot controls the braking with the pedals (acting on the dual valves).

Alternate servo valves are fully open.

The pilot must refer to the triple indicator to limit brake pressure in order to avoid locking a wheel.

The accumulator can supply at least 7 full brake applications.

Autobrake is inoperative.

PARKING BRAKE

Brakes are supplied by yellow hydraulic system or accumulator via the dual shuttle valves. Alternate servo valves open allowing full pressure application.

The accumulator maintains the parking pressure for at least 12 hours.

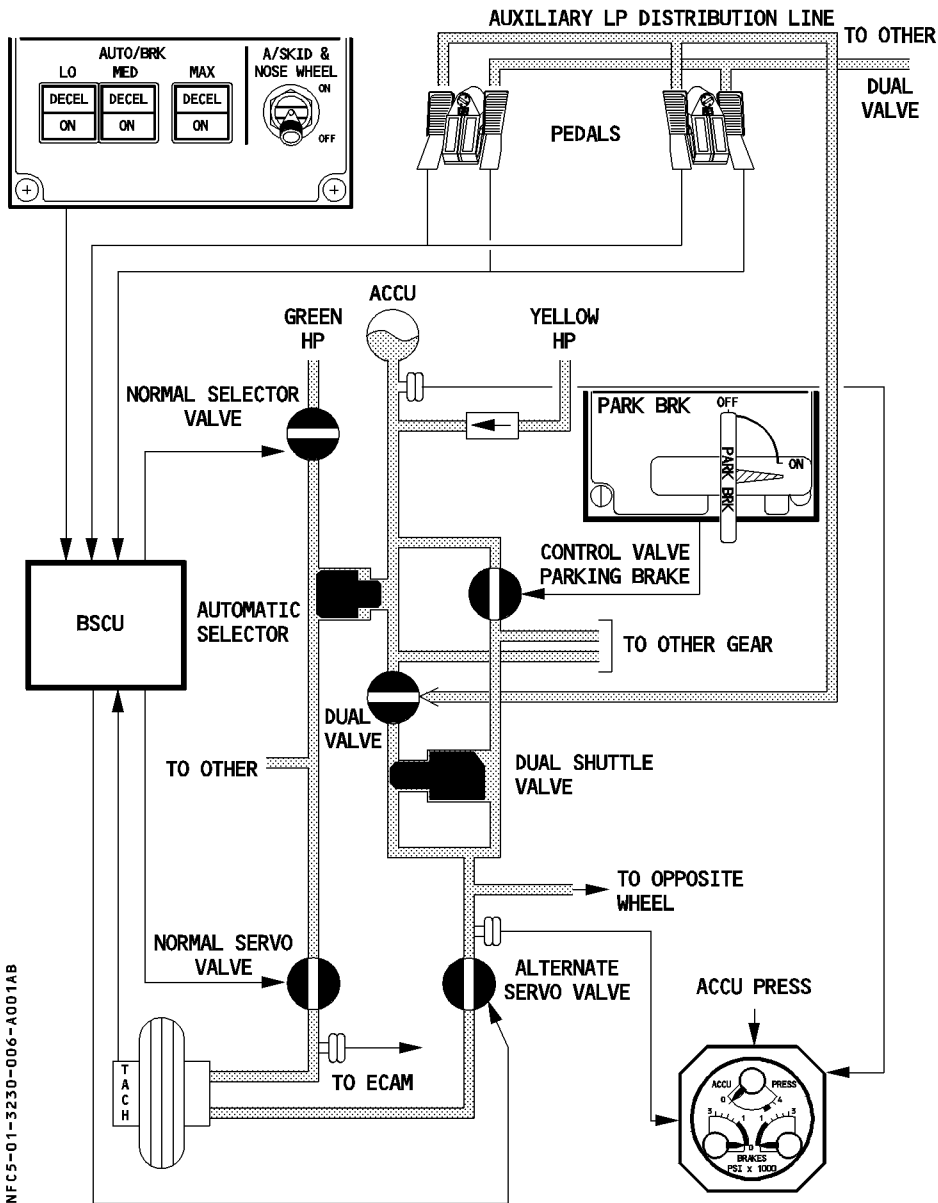
If the parking brake is activated and no yellow hydraulic or accumulator brake pressure is available, then the normal braking system can be applied via the brake pedals.

Yellow accumulators can be pressurized by pressing the yellow electrical pump switch.

Brake pressure indications are available on the triple indicator.



BRAKING SCHEMATIC



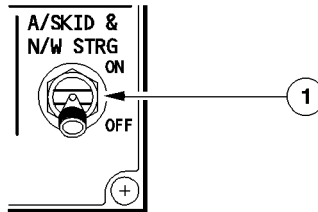
NCS-01-3230-006-A001AB



CONTROLS AND INDICATORS

CENTER INSTRUMENT PANEL

NFC5-01-3230-007-A001AA



① A/SKID & N/W STRG sw

ON : If green hydraulic pressure is available :

- Anti-skid is available.
- Nose wheel steering is available.

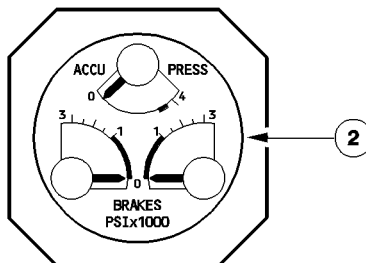
If green hydraulic pressure is lost :

- Yellow hydraulic pressure takes over automatically to supply the brakes.
- Anti-skid remains available.
- Nose wheel steering is lost.
- The triple indicator shows yellow system brake pressure.

OFF : Yellow hydraulic system supplies pressure to the brakes.

- Anti-skid is deactivated. The pilot must refer to the triple indicator to limit brake pressure and avoid locking a wheel.
- Nose wheel steering is lost.
- Differential braking remains available through the pedals.
- The triple indicator displays yellow system brake pressure.

NFC5-01-3230-007-B001AA



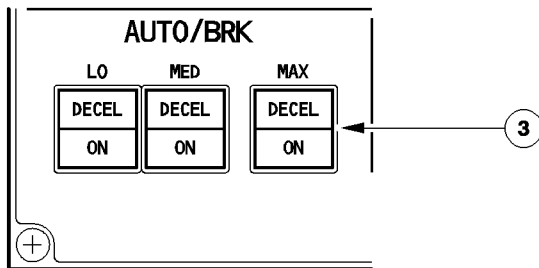
② BRAKES and ACCU PRESS indicator

ACCU PRESS : Indicates the pressure in the yellow brake accumulators.

BRAKES : Indicates the yellow pressure delivered to the left and right brakes, as measured upstream of the alternate servo valves.

AUTO BRK panel

NFS5-01-3230-008-A100AA



③ AUTO/BRK panel

The springloaded MAX, MED, and LO pushbutton switches arm the appropriate deceleration rate.

- MAX mode is normally selected for takeoff.
 If the pilot aborts the takeoff, maximum pressure goes to the brakes as soon as the system generates the ground spoiler deployment order.
- MED or LO mode is normally selected for landing.
 - LO mode sends progressive pressure to the brakes 4 seconds after the ground spoilers deploy in order to decelerate the aircraft at 1.7 meters/second² (5.6 feet/second²).
 - MED mode sends progressive pressure to the brakes 2 seconds after the ground spoilers deploy in order to decelerate the aircraft at 3 meters/second² (9.8 feet/second²).
- Lights :
 - The blue ON light comes on to indicate positive arming.
 - The green DECCEL light comes on when the actual deceleration is 80% of the selected rate.

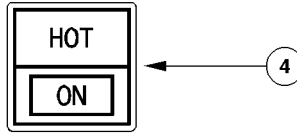
R Note : On slippery runway, the predetermined deceleration may not be reached due
 R to antiskid operation. In this case DECCEL light will not illuminate. This does
 R not mean that autobrake is not working.

- Off : The indicated brake mode is not active.



NFC5-01-3230-009-A100AA

BRK FAN



④ BRK FAN pb sw ▽

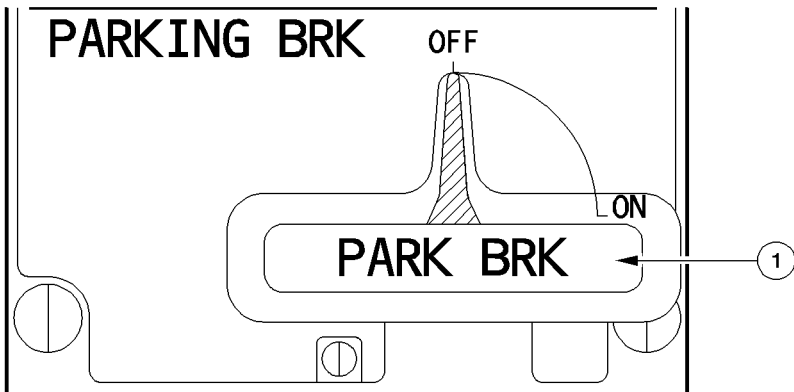
ON : The brake fans run if the lefthand main landing gear is down and locked.

OFF : The brake fans stop.

HOT : This amber light comes on when the brakes get too hot. (A caution appears on ECAM, also).

PEDESTAL

NFC5-01-3230-009-B100AA



① PARKING BRK handle

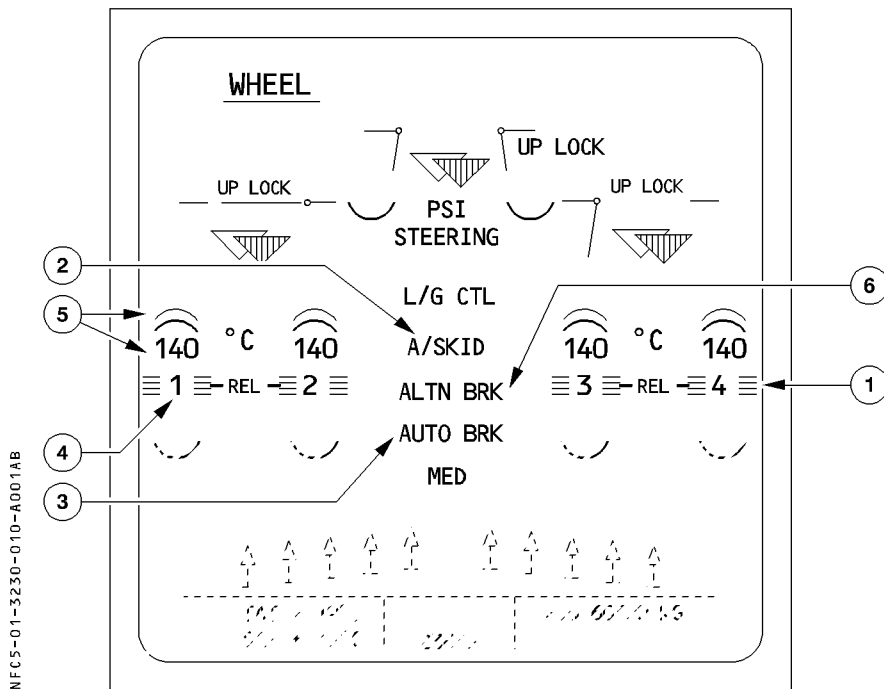
Flight crew pulls this handle, then turns it clockwise, to apply the parking brake. The ECAM memo page displays "PARK BRK".

CAUTION

If the pointer is not at ON, the parking brake is not on.

ECAM WHEEL PAGE

R




① Release indicators

≡ These green lines appear temporarily after the landing gear has been lowered to indicate that the anti-skid function is ready. They reappear after touchdown, along with REL (blue), when the anti-skid is active.

② A/SKID

This legend appears in amber, along with an ECAM caution, in case of total BSCU failure, or when the A/SKID & N/W STRG switch is OFF, or if the BSCU detects an ANTI-SKID failure.

 AIRBUS TRAINING A320 SIMULATOR FLIGHT CREW OPERATING MANUAL	LANDING GEAR BRAKES AND ANTI-SKID	1.32.30	P 11
		SEQ 001	REV 36

③ AUTO BRK

This legend appears :


- in green when auto brake is armed,
 - flashing green for 10 seconds after autobrake disengagement.
 - in amber, along with an ECAM caution, to indicate a system failure.
- MED, LO, or MAX appears underneath in green to show which rate has been selected.

④ Wheel number

This white number identifies individual wheels of the main landing gear.

R ⑤ Brake temperature

- The temperature normally appears in green.
- The green arc appears on the hottest wheel when one brake temperature exceeds 100°C.
- The green arc becomes amber, and an ECAM caution appears, when the corresponding brake temperature exceeds 300°C.

	LANDING GEAR BRAKES AND ANTI-SKID	1.32.30	P 12
		SEQ 001	REV 36

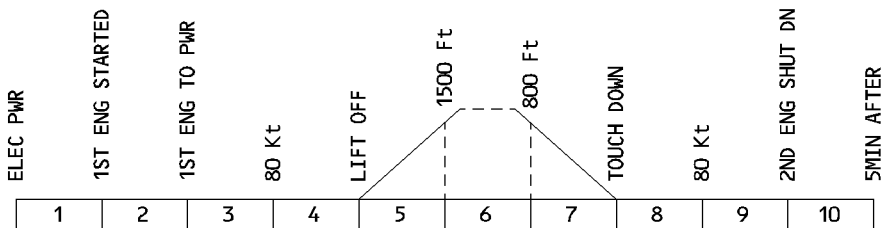
⑥ ALTN BRK

This legend appears in green if the braking system is in alternate mode.




WARNINGS AND CAUTIONS

NFE C5-01-3230-013-A 105AA



E/W/D : FAILURE TITLE condition	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
CONFIG PARK BRK ON parking brake is on when thrust levers are set at TO or FLX TO power position	CRC	MASTER WARN	NIL	NIL	1, 2 5 to 10
BRAKES HOT one brake temperature higher than 300°C	SINGLE CHIME	MASTER CAUT	WHEEL	HOT It on BRK FAN pb sw	4, 8
AUTO BRK FAULT failure of autobrake when armed				NIL	3 to 5
A/SKID NWS FAULT · loss of normal brake system associated with Y HYD sys lo press or · failure of both BSCU channels				NIL	4, 5
ANTI SKID/NWS OFF switch at OFF position				NIL	4, 5
HYD SEL FAULT failure of brake normal selector valve or NWS selector valve in open position			NIL	NIL	NIL
SYS 1 (2) FAULT failure of one BSCU channel	NIL	NIL			

 A320 <small>SIMULATOR</small> FLIGHT CREW OPERATING MANUAL	LANDING GEAR	1.32.30	P 14
	BRAKES AND ANTI-SKID	SEQ 001	REV 36

MEMO DISPLAY

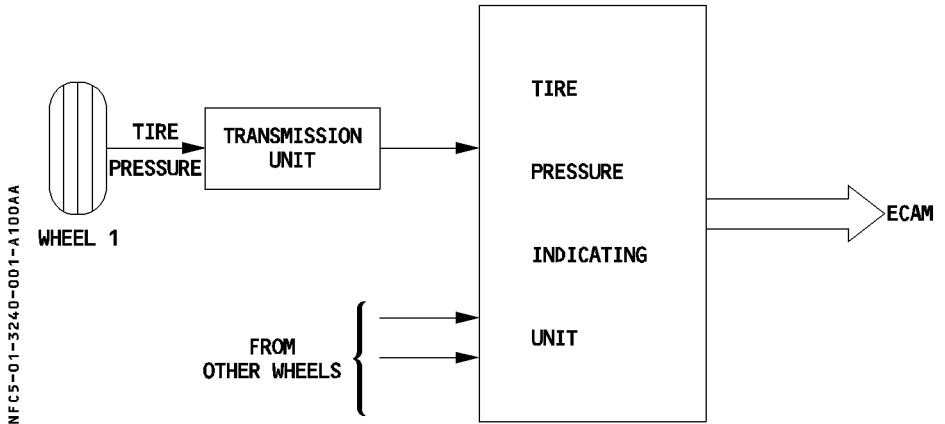
- If the parking brake is on, this display shows “PARK BRK” :
 - In green, in flight phases 1, 2, 9, and 10.
 - In amber, in flight phases 4 to 8.
 It does not display this message in flight phase 3.
- If the autobrake is on, AUTO BRK LO, AUTO BRK MED, or AUTO BRK MAX appears.
- If the autobrake is faulty, AUTO BRK OFF appears.
- BRK FAN appears in green, if the BRK FAN pushbutton is ON <l.



DESCRIPTION

The tire pressure indicating system includes :

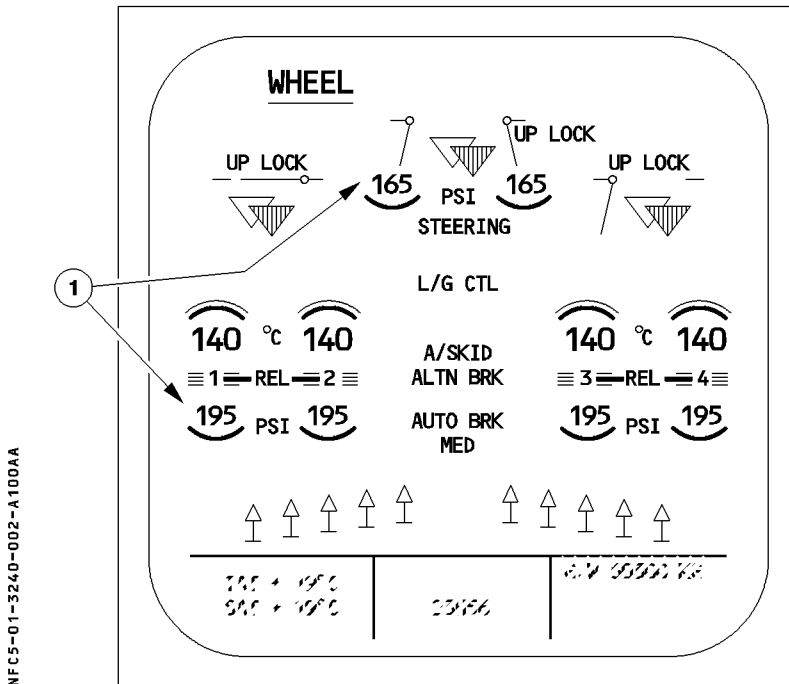
- a sensor that measures the pressure of each tire,
- a transmission unit that transmits the electrical pressure signal from the sensor to the computer,
- a tire pressure indicating unit computer that sends information to the ECAM for cautions and the system page display.





CONTROLS AND INDICATORS

ECAM WHEEL PAGE



① Tire press indication

The normal indication is green.

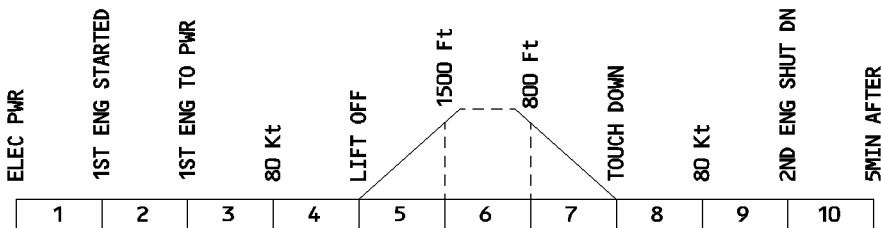
It becomes amber, and ECAM caution appears, if the tire pressure gets too low.

Note : The prescribed tire pressure depends on tire type and aircraft weight.



WARNINGS AND CAUTIONS

NFC5-01-3240-003-A100AA



E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PHASE CALLED	LOCAL WARNING	FLT PHASE INHIB
TYRE LO PR One tire pressure is lower than : 74 % of nominal pressure from lift off to engines shut down 89 % of nominal pressure in other cases, or difference of pressure between two wheels on the same axle is higher than : 21 % of nominal pressure from lift off to engines shut down 15 % of nominal pressure in other cases.	SINGLE CHIME	MASTER CAUT	WHEEL	NIL	4, 5, 8

BUS EQUIPMENT LIST

R

		NORM		EMER ELEC		
		AC	DC	AC ESS	DC ESS	HOT
LANDING GEAR	LGCIU 1		GRND/FLT		X	
	LGCIU 2		GRND/FLT			
	SAFETY VALVE				X	
	L/G INDICATOR PANEL			SHED (1)	X	
BRAKES	BSCU CH 1	AC1	DC1			
	BSCU CH 2	AC2	DC2			
	PARK BRK CTL		GRND/FLT			HOT1
	PRESS INDICATOR				X	
	BRK FAN CTL ◀		DC2			
	COOLING FANS ◀ (Wheels 1, 2, 3, 4)	AC2	DC2			
	COOLING FANS ◀ (bogie : Wheels 5, 6, 7, 8)	AC1	DC1			
TYRE PRESS	TIRE PRESS IND UNIT◀		DC1			

- (1) The AC STAT INV supplies the landing gear indicator panel when the main generators are lost and the emergency generator is not running.