BLACKWING
SWEDEN

BW 635RG

User's Manual

orbx

Introduction

The Blackwing BW 635RG is an ultralight two-seater aeroplane designed for recreational flying and training purposes. It features a sleek and modern design, with a composite airframe and a low-wing configuration. The Blackwing has a cruising speed of up to 120 knots and a range of approximately 700 nautical miles, making it suitable for both short and long-distance flights. The cockpit is equipped with state-of-the-art avionics, including a glass cockpit display and an autopilot system. The Blackwing is also known for its superior handling and stability, making it a popular choice among flying enthusiasts and flight schools. The BW 635RG is powered by the venerable Rotax 915 iS engine.

Development Credits:

Mal Cartwright	Product Lead
Russ White	3D Modelling, Interior and Exterior Texturing
Jack Lavigne	Integration
Harry Stringer	Animation
PropAir	Flight Model and Systems
Jordan Gough	Manual

With special thanks to our Beta Testers:

Rob Abernathy	**John Burgess**
Nick Cooper	**John Dow**
Matt McGee	**Darryl Wightman**

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Notes on Hardware

Due to the unusual 3-position switches in this aircraft, conventional hardware 2 position toggle switches (eg. strobe or nav light switches) cannot be translated to the single 3-position switch which combine these.

Additionally, as this aircraft utilises a single level power control (throttle), conventional throttle/prop/mixture hardware may interfere with the function of this system, and not work as intended. It is recommended to place your propeller and mixture levers in the IDLE position, and not move them while the engine is running.

Overview

The Orbx BW 635RG has been developed using official documentation and Computer Aided Design (CAD) resources from Blackwing Sweden. As a result, the aeroplane has been created through masterful modelling, texturing, systems integration, and flight model development.

Aircraft Dimensions	
Length	6.6m
Height	2.2m
Wingspan	8.4m

Weights	
Basic Empty Weight	375kg
Maximum Take-off Weight	600kg
Maximum Fuel Capacity (Litres)	130L

Figure 1 – Aircraft 3-view

The content in this manual and the operation of the BW 635RG in Microsoft Flight Simulator strictly must not be used as reference material in any form for operating the real aircraft.

Aircraft Limitations

Airspeed Limitations

Airspeed Description		Airspeed (KIAS)	Remarks
Vne	Never Exceed Speed	157	Must not exceed this speed in any operation.
Va	Manoeuvring Speed	109	If full or abrupt control deflection is made, the airframe may be overstressed.
Vfe1	Max flap extended speed 20 degrees	90	Maximum speed for flaps 20°
Vfe2	Max flap extended speed 35-45 degrees	70	Maximum speed for flaps 35-45°
Vlo	Maximum landing gear operating speed	70	Do not extended or retract the landing gear above this speed.
Vle	Maximum landing gear extended speed	90	Do not exceed this speed with the landing gear already down.
Vs0	Stall speed flaps/gear extended	38	Stall speed with gear down/flaps >0° and in level flight at MTOW
Vs1	Stall speed clean	49	Stall speed flaps retracted, gear up and in level flight at MTOW

Engine Limitations

Engine		
Engine Manufacturer		Rotax
Engine Model		Rotax 915 iS
Maximum Power	Take-off (Max 5 min.)	141 hp
	Continuous	135 hp
Maximum RPM	Take-off (Max 5 min.)	5800
	Continuous	5500
Critical Altitude		15000ft AMSL
Maximum Operating Altitude		23000ft AMSL

Operating Conditions

Aerobatic manoeuvres, flight in IFR conditions and flights in icing conditions are prohibited in this aircraft.

Fuel

Fuel Tanks	Left		Right	
	Litres	US Gal	Litres	US Gal
Total Fuel in Tank	67.5	17.8	62.5	16.5
Unusable Fuel	2.5	0.7	2.5	0.7
Total Useable Fuel in Tanks	66.5	17.6	61.5	16.2

Baggage weight (kg)	Maximum allowed filling of the fuel tanks in liters to not get over MTOW									
	Crew weight (kg)									
	120	130	140	150	160	170	180	190	200	210
0	F	F	116	103	89	75	62	48	34	21
5	F	123	110	96	82	68	55	41	27	14
10	F	116	103	89	75	62	48	34	21	7
15	123	110	96	82	68	55	41	27	14	-
20	116	103	89	75	62	48	34	21	7	-
25	110	96	82	68	55	41	27	14	-	-

Other Limitations

Maximum demonstrated crosswind for the BW 635RG is **20 knots.**

Emergency Procedures

Note: The following procedures have been modified to be suitable for simulation. It does not cover emergencies that are a) not simulated and b) not reasonable. Checklist items from the real procedures have been omitted and these procedures must not under any circumstances be used for training purposes.

Engine Failure on the Take-off Roll

Throttle:	IDLE
Ignition:	OFF
Fuel Pump:	MAIN (DOWN POS)
Brakes:	APPLY
When stopped:	SECURE AIRCRAFT

Engine Failure after Take-off

Nose:	IMMEDIATELY LOWER
Airspeed:	65 KNOTS
Landing Area:	DETERMINE WITHIN 30° OF NOSE
Flaps:	USE AS REQUIRED
Landing Gear:	USE DESCRETION
Fuel Selector:	OFF
Ignition:	OFF
Master Switch:	OFF

Glide Performance

The BW 635RG, the approximate performance for a glide is 65 KIAS which will give approximately a 545ft/min rate of descent in the clean configuration. Glide performance will degrade significantly on extension of flaps and landing gear.

Emergency Landing

Airspeed:	65 KIAS
Field:	PICK BEST OPTION
Landing Gear:	USE DISCRETION DEPENDING ON FIELD TYPE
Flaps:	AS REQUIRED
Fuel Selector:	OFF
Ignition:	OFF
Fuel Pump:	MAIN (down)
Master Switch:	OFF BEFORE LANDING

Spin Recovery

Throttle:	IDLE
Control Stick:	AILERON NEUTRAL
Rudder:	FULL OPPOSITE TO DIRECTION OF ROTATION
Control Stick:	POSITIVELY FORWARD OF NEUTRAL
Rudder:	NEUTRAL WHEN ROTATION STOPS
Control Stick:	SMOOTHLY PULL OUT OF DIVE

WARNING:

INTENTIONAL SPINS ARE NOT APPROVED IN THIS AIRCRAFT.

Normal Procedures

Note: The pre-flight inspection portion of the normal procedures has been removed due to impracticality in the simulator.

Before Starting Engine

Ignition:	OFF
Master Switch:	OFF (down)
Backup Battery:	OFF/AUTO (down)
Landing Gear Lever:	DOWN
Circuit Breakers:	IN
Canopy	CLOSED (CLICKING THE LATCH ON THE INSIDE LEFT SIDEWALL.)

Starting Engine

Parking Brake:	HOLD TOE BRAKES AND ENGAGE PARKING BRAKE
Master Switch:	ENGINE START (middle position)
Fuel Selector:	SET
Fuel Gauge:	CHECK
Fuel Pump:	BOTH (up)
Ignition:	BOTH
Nav Lights:	STROBE (middle position)
Throttle:	SET ½-1 INCH OPEN
Ignition:	START
Oil Pressure:	GREEN WITHIN 10 SEC
Warnings:	NONE

Before Taxiing

Master Switch:	NORMAL OPERATION (up)
Altimeter:	SET
Avionics:	SET
Parking Brake:	DISENGAGE

Taxiing

Instruments:	CHECKED (COMPASS/HSI/BALL/ATT)

Engine Runup

Parking Brake:	ENGAGE
RPM:	2500 RPM
Fuel Pump:	CYCLE, CHECK FUEL PRESSURE
Idle:	CHECK IDLE 1800 +/- 100 RPM

Before Take-off

Canopy:	CLOSED AND LOCKED
Flaps:	1 STAGE (20°)
Elevator Trim:	SET FOR TAKE-OFF
Engine Instruments:	NORMAL
Landing Light:	ON (up)
Controls:	FULL FREE AND CORRECT MOVEMENT
Parking Brake:	DISENGAGE

Take-Off

Throttle:	FULL
Controls:	NEUTRAL
45 Knots:	ROTATE
Accelerate:	NOSE ON HORIZON, ACCEL TO 80 KIAS
Positive Rate of Climb:	GEAR UP
Landing Light:	OFF (down)
Flaps:	RETRACT ABOVE 500’ AGL

Initial Climb

Throttle:	MAX CONTINUOUS (5500 RPM)
Airspeed:	90 KIAS
Fuel Pump:	MAIN (down) ABOVE 500’ AGL

Cruise Climb

Throttle:	MAX CONTINUOUS (5500 RPM)
Airspeed:	130 KIAS

Cruise

Throttle:	55-75% Power
Airspeed:	120-157 KIAS (<130 KIAS IN TURB)

Landing

Fuel:	QTY CHECKED
Fuel Selector:	FULLEST TANK
Fuel Pump:	BOTH (up position)
Airspeed:	90 KIAS
Flaps:	EXTEND FLAP 1 <90 KIAS
Downwind Airspeed:	65 KIAS
Landing Gear:	DOWN @ 65 KIAS; CHECK 3 GREEN
Landing Light:	ON (up position)
Base Leg:	EXTEND FLAP 2 < 65 KIAS
Final Approach Airspeed:	60 KIAS

Balked Landing

Throttle:	SMOOTHLY INCREASE
Airspeed:	60 KIAS
Trim:	COURSE TRIM TO RELIEVE PRESSURE
Flaps:	RETRACT TO POSITION 1 (20°)
Gear:	UP
Trim:	TRIM FOR CLIMB

After Landing

Flaps:	RETRACT
Exterior Lights:	AS REQ'D
Fuel Pump:	MAIN (down)

Securing Aircraft

Parking Brake:	ENGAGED
Throttle:	IDLE
Switches:	ALL OFF EXCEPT ACL AND MASTER
Ignition:	OFF
Nav Lights:	OFF (down)
Master Switch:	OFF

Basic Performance

Stall Speeds

MTOW 600kg | CG 32% MAC | Power Idle | Level Flight

Flap Position	Stall Speed (KIAS)
0°	49
20°	44
35°	39
45°	38

Take-Off Performance

MTOW | ISA CONDITIONS | SEA LEVEL | FLAPS 1 (20°) | MTOW (600kg)

Runway Surface	Ground Roll		Over 50ft Obstacle	
	ft	m	ft	m
Paved Runway	328	100	656	200
Unpaved (Grass) Runway	361	110	689	208

Cruise Performance

Pressure Altitude	Power (%)	TAS	Fuel Flow LPH	MAP (inHg)	Endurance (hr)	Range (nm)
5000	55	161	19.7	30	5.8	941
	65	170	23.3	34.1	4.9	827
	75	178	26.9	37.4	4.1	738

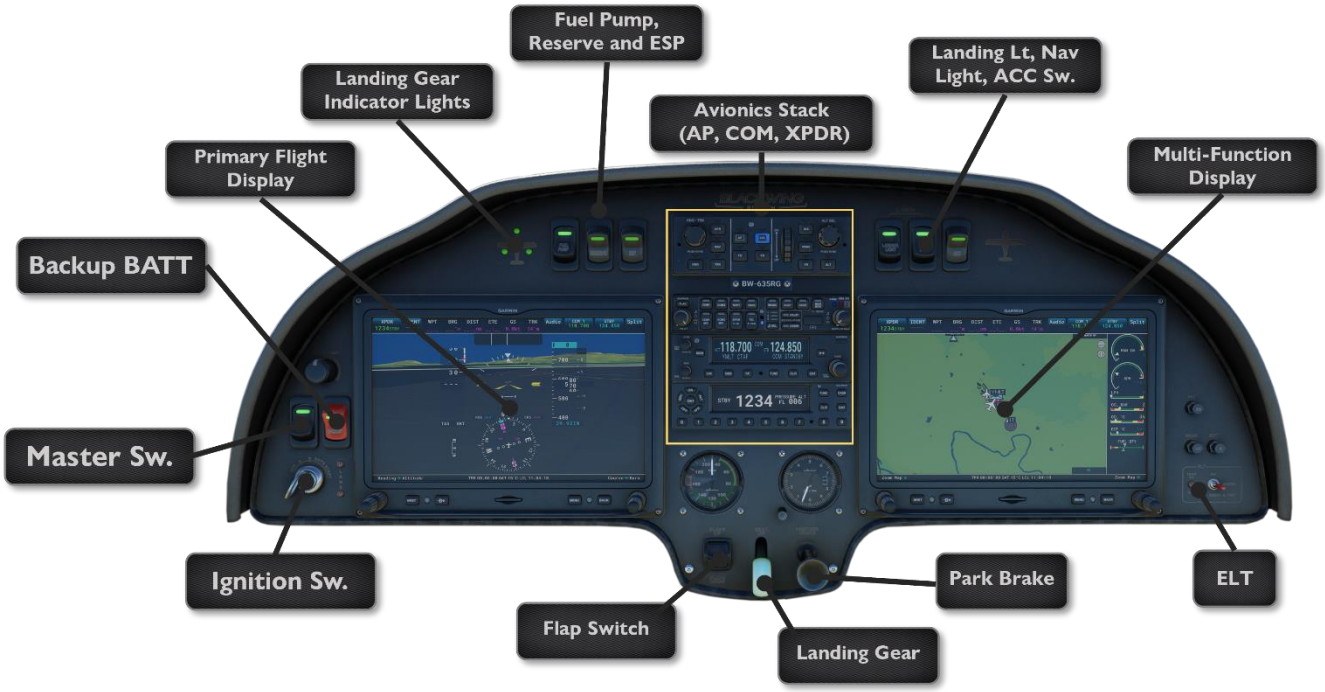
Landing Performance

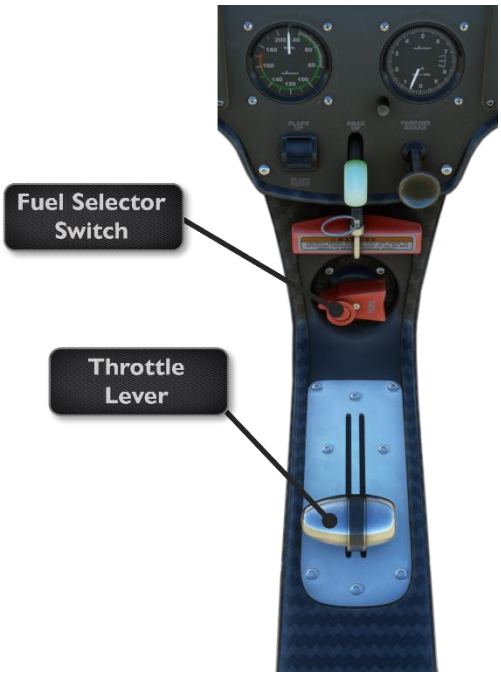
MTOW | ISA CONDITIONS | FLAPS 2 (35°) | MTOW (600kg) | Speed 1.3 x Vso

Runway Surface	Ground Roll		Over 50ft Obstacle	
	ft	m	ft	m
Paved Runway	525	160	951	290
Unpaved (Grass) Runway	558	170	984	300

Systems Description

Instrument Panel Layout





Switch Logic and Electrical System

The electrical switches in the BW 635RG are 3-position switches. These are generally known as “DOWN”, “MIDDLE” and “UP”. They are briefly explained below.

Master Switch

The MASTER switch functions in a unique way, with the following switch logic:

1. When the MASTER switch is DOWN, all battery power is off. There will be no electrical power provided to the aircraft.
    - Note: The engine CANNOT be shut down when the master switch is off. Electrical power must be present for the engine to turn off.
2. When the MASTER switch is in the MIDDLE (Engine Start) position, limited system functionality will be present. The backup battery will be activated and power the following systems:
    - Primary Flight Display
    - Compass
    - AHRS (Attitude Heading Reference System)
    - Radio
3. When the MASTER switch is UP (Normal Operation), full electrical supply will be provided to the aircraft. The following systems will be powered on:
    - Note: the engine CANNOT be started with the MASTER switch in the UP position. If the engine won’t start, check the switch is in the MIDDLE position
    - Multi-Function Display
    - Transponder
    - Autopilot
    - Audio panel
    - STBY instruments
    - Pitot Heat
    - *Main battery is disconnected from running engine. Alternator provides power.*

See Section NORMAL PROCEDURES for positioning of the MASTER switch.

Fuel Pump Switch

The Fuel Pump switch also has some advanced logic to it, due to two fuel pumps being present, however, to put it simply, it operates in the following way:

1. In the DOWN position, the main fuel pump is in use.
2. In the MIDDLE position, the auxiliary fuel pump is in use.
3. In the UP position, both fuel pumps will be on.

LAND/TAXI Switch

The LAND/TAXI switch powers the Taxi and Landing lights. It operates in the following logic:

1. In the DOWN position, both lights will be OFF.
2. In the MIDDLE position, the taxi light will switch on when the landing gear is extended.
3. In the UP position, the Landing Light will switch on when the landing gear is extended.

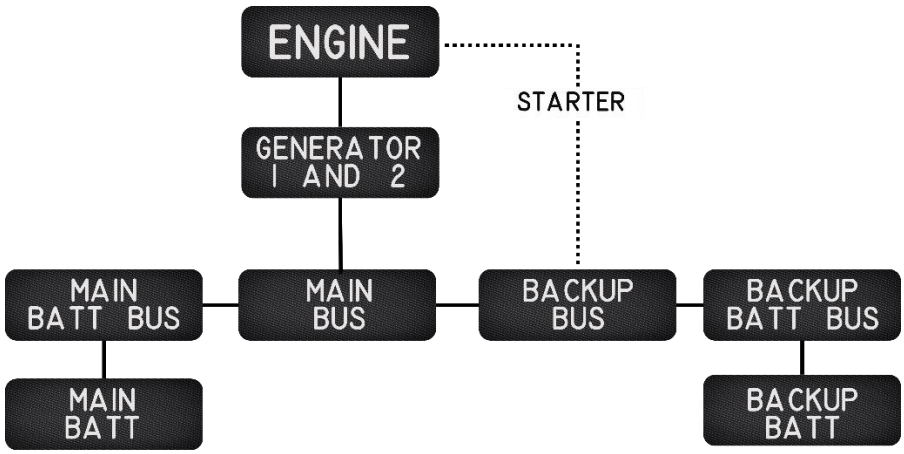
Strobe/Nav Switch

The Strobe/Nav switch powers the Navigation (Red/Green) and Strobe (flashing white) lights. It operates in the following logic:

1. In the DOWN position, both lights will be OFF.
2. In the MIDDLE position, the STROBE light will be on.
3. In the UP position, both the strobe and Nav lights will be on.

Electrical System Diagram

The BW 635RG's electrical system is modelled in the following way in Microsoft Flight Simulator.



Because the starter system is connected to the BACKUP BUS, this means you cannot start the engine with the MASTER switch in the UP position, due to the BACKUP BUS being disconnected from the circuit once the MAIN BAT BUS is powered.

Engine

The BW 635RG is powered by the Rotax 915iS. The Rotax 915iS is a four-stroke, four-cylinder, fuel-injected, turbocharged aircraft engine with a maximum power output of 141 horsepower. The engine utilizes electronic fuel injection (EFI) technology to provide precise fuel delivery and improved fuel efficiency. It also features a modern liquid-cooling system and a dual electronic ignition system for reliable performance. The Rotax 915iS engine has a maximum operating RPM of 5,200, with a recommended continuous operation range of 5,000 RPM or less.

Propeller

The propeller is a 3-blade wood-composite design, which is hydraulically adjustable for operation at various pitch angles, controlled independently of the pilot. The propeller is linked to the engine through an electronically controlled governor, where RPM is adjusted in accordance with the position of the throttle control. This pitch curve cannot be adjusted in flight, however is designed to ensure maximum performance in all phases of flight.

Fuel

Both wings have fuel tanks, which are fed to the engine via electric fuel pumps. Fuel system information is fed via sensors to the Garmin avionics suite and can be viewed on the displays inside the cockpit.

BW 635RG QUICK REFERENCE SHEET

AIRPLANE WEIGHTS

Basic Empty Weight.....375 Kg
Maximum Takeoff Weight.....600 Kg
Maximum Fuel Weight.....95 Kg
Maximum Landing Weight.....600 Kg

FUEL CAPACITY

TANK	USABLE FUEL
LEFT WING TANK	67.5 litres 17.8 US Gallons
RIGHT WING TANK	62.5 litres 16.5 US Gallons
TOTAL	130 litres 34.3 US Gallons

ALTITUDE LIMITS

Maximum Operating Altitude.....23 000ft

POWERPLANT LIMITATIONS

ENGINE LIMITS (RPM)

Take-off (5 Minutes).....5800 RPM
Max Continuous.....5500 RPM

AIRSPEEDS

Never Exceed Speed.....173 KIAS
Max Structural Cruising Speed.....156 KIAS
Maneuvering Speed MTOW.....109 KIAS
Initial Climb.....80 KIAS
Best Angle Climb.....75 KIAS
Best Rate of Climb.....90 KIAS
Max Flap Ext 20°.....90 KIAS
Max Flap Ext 35-45°.....70 KIAS
Max Landing Gear Operation.....70 KIAS
Max Landing Gear Extended.....90 KIAS
Planned Cruise TAS.....130 KIAS
Final Approach Speed.....60 KIAS

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BW-635RG NORMAL PROCEDURES

MEMORY ITEMS

BEFORE STARTING ENGINE

Preflight Inspection.....COMPLETE
Crew Briefing.....COMPLETE
Ignition.....OFF
Master Switch.....OFF
Backup Battery.....OFF/AUTO
Landing Gear Lever.....DOWN
Circuit Breakers.....IN
Canopy.....CLOSED

STARTING ENGINE

Area.....CLEAR
Parking Brake.....HOLD TOE BRAKES AND ENGAGE
Master Switch.....ENGINE START (MID)
Fuel Selector.....SET
Fuel Pump.....BOTH (UP)
Ignition.....BOTH
External Lights.....AS REQ
Throttle.....$^{1}/_{2}$-1 INCH OPEN
Ignition.....START

AFTER START

Oil Pressure.....RISING
Master Switch.....NORMAL (UP)
Radios.....SET
Altimeter.....SET
ATIS and Clearance.....OBTAINED

BEFORE TAXI

Brakes/Park Brake.....DISENGAGE
Flight Instruments.....CHECKED
Compass.....CHECKED

ENGINE RUN UP

Parking Brake.....ENGAGE
Engine Instruments.....CHECKED
Engine RPM.....SET 2500 RPM
Fuel Pump.....CYCLE
Idle.....CHECK IDLE 1800 ± 100RPM
Navigation Equipment.....SET

BEFORE TAKEOFF

Canopy/Harnesses.....SECURE
Flaps.....1 STAGE (20°)
Trim.....SET FOR TAKEOFF
Flight Instruments.....SET
Engine Instruments.....CHECKED NORMAL
Avionics.....SET
External Lights.....AS REQ
Flight Controls.....FULL, FREE AND CORRECT
Takeoff Safety Brief.....DELIVERED

TAKEOFF

Brakes/Park Brake.....DISENGAGE
Power.....SMOOTHLY INCREASE TO MAXIMUM
45 knots.....ROTATE
Accelerate.....NOSE ON HORIZON, TO 80 KTS
Positive Rate of Climb.....GEAR UP
Landing Light.....OFF (DOWN)
Flaps.....RETRACT ABOVE 500’ AGL

AFTER TAKEOFF

Engine Instruments.....WITHIN LIMITS
Climb Speed.....90 KIAS
Fuel Pump.....MAIN (DOWN) ABOVE 500’ AGL

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BW-635RG NORMAL PROCEDURES

MEMORY ITEMS

CRUISE

Power.....SET 55-75%
Airspeed.....120-157KTS (<130KTS IN TURB.)

DESCENT

Altimeter.....SET
Fuel Selector.....FULLEST TANK
Power Lever.....AS REQUIRED FOR ROD
Approach Brief.....COMPLETE

BEFORE LANDING

Brakes.....OFF
Fuel .....QTY CHECKED
Fuel Selector.....FULLEST TANK
Fuel Pump.....BOTH (UP)

LANDING

DOWNWIND
Airspeed.....90 KIAS
Flaps.....STAGE 1 (20°)
Airspeed.....65 KIAS
Landing Gear.....DOWN @ 65 KIAS
CHECK 3 GREEN
Landing Light.....ON (UP)

BASE
Flaps..... STAGE 2 (35°) < 65 KIAS

FINAL
Airspeed.....60 KIAS
Touchdown.....MAIN WHEELS FIRST
Stick.....FULL BACK
Brakes.....APPLY

AFTER LANDING

Flaps.....RETRACT
Landing Lights.....OFF
Fuel Pump.....MAIN (DOWN)

SHUTDOWN

Parking Brake.....ENGAGE
Throttle.....IDLE
Switches.....OFF EXCL. MASTER
Ignition.....OFF
Lights.....OFF (DOWN)
Master Switch.....OFF (DOWN)

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