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System Overview
projectmax
C212-200

*For Simulation Use Only

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Aircraft Systems

This section provides an overview of the primary aircraft systems of the projectmax C212-200.

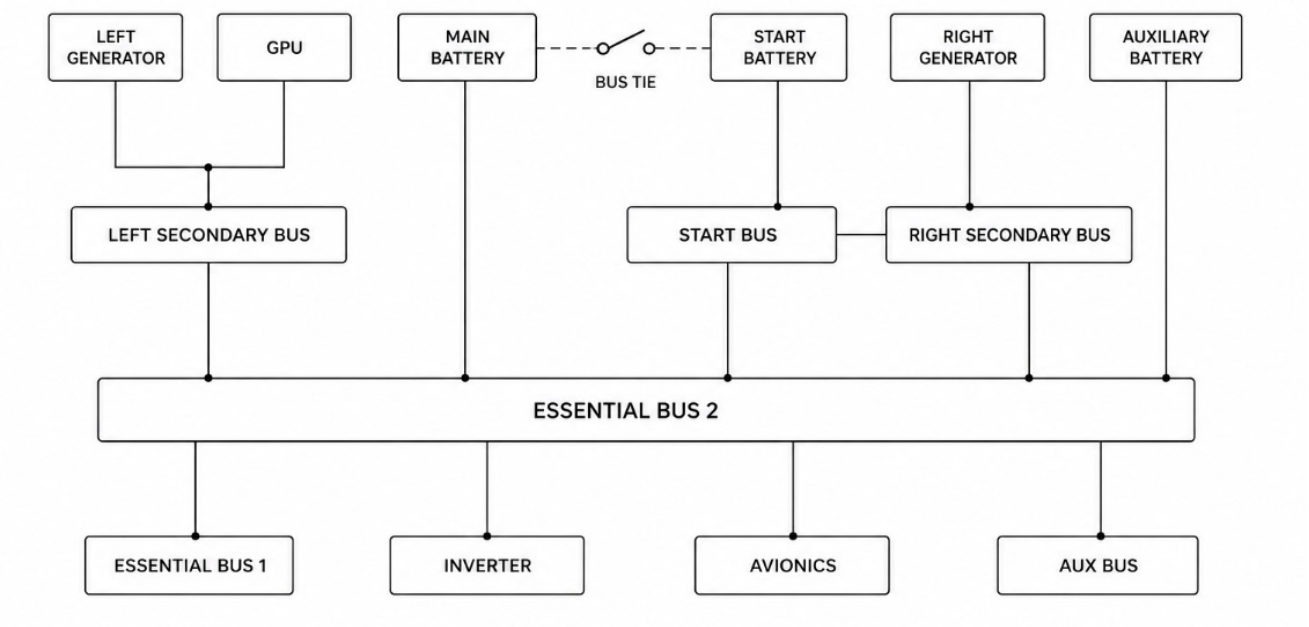
The following chapters explain system architecture, normal operation, cockpit controls, and operational limitations to help pilots better understand aircraft operation.

► **CONTENTS OVERVIEW**

1. Electrical System

The projectmax C212 electrical system generates, controls, and distributes DC and AC power for aircraft systems. DC is the primary source, produced by two engine-driven starter-generators with battery backup; AC is derived from DC via inverters. On the ground, the aircraft can be powered by an external Ground Power Unit (GPU).

ELECTRICAL SYSTEM DIAGRAM



DIRECT CURRENT (DC) GENERATION

Each engine drives a starter-generator (dual-purpose unit) mounted on its gearbox — used to crank the engine for start, then to generate 28 VDC (up to 300A) once running. Output is regulated by a Generator Control Unit (GCU) per side, which:

- Regulates voltage against RPM/load changes
- Prevents reverse current flow into the generator
- Trips the generator off-line on over/under-voltage or a grounding fault (test switches on the overhead panel let the crew simulate these trips)

Batteries: Three Ni-Cad batteries — two 24V/40Ah main batteries and one 24V/7Ah auxiliary battery — provide starting power and emergency backup. The two main batteries can be connected in series (48V) or parallel (24V) via a SERIES/PARALLEL switch for engine starting; series start is recommended for the first start of the day or when oil temperature is below 5°C. Each battery has a thermal probe: BAT TEMP caution at 54°C, BATTERY OVERTEMP warning at 66°C.

Ground Power: A GPU can be plugged in near the LH main gear and connected via the EXT POWER switch; batteries are automatically isolated from the bus when GPU power is selected.

DC BUS ARCHITECTURE

Power is distributed via five DC buses:

- Essential Bus No. 1 — critical loads (pitot heat, stall warning, nav/beacon/taxi lights, directional gyro)
- Essential Bus No. 2 — hub for most avionics (radios, autopilot, transponder, ADF/DME)
- Primary/Auxiliary Bus — backed by the auxiliary battery through a one-way diode (prevents backfeed to Essential Bus 2)
- Secondary Bus — general aircraft systems, tied to Essential Bus 2 via a BUS TIED switch (NORMAL/EMERG)
- Starting Bus — dedicated to engine start circuits

All DC buses are cross-tied through fuses so a single bus failure doesn't isolate critical loads.

ALTERNATING CURRENT (AC) GENERATION

AC (115V/26V, 400Hz) is produced by three inverters — No. 1, No. 2, and a standby Auxiliary inverter. In normal operation, inverters 1 and 2 each feed their own AC bus. Each has overload protection: a fault trips the inverter offline and lights the corresponding INVERTER warning. The auxiliary inverter can be manually switched to back up either failed bus via the AUX INV/AC BUS SEL selector.

ITEM	LIMITATION
Starter-generator max load	300A continuous
Duty cycle	30 sec ON – 1 min OFF (repeatable once more), then 15 min OFF after a third 30-sec cycle
Battery operating range	–10°C to 66°C
Inverter load	450 VA normal, 600 VA transient (1 min max)

2. HYDRAULIC SYSTEM

The projectmax C212 hydraulic system provides pressurized fluid to actuate the ramp/cargo door, flaps, and normal/emergency/parking brakes, and nosewheel steering. A single electrically-driven variable-flow pump supplies the system at a nominal 2000 psi; a manual hand pump provides backup pressure if the electric pump or its power supply fails.

COMPONENTS

1. Reservoir	7.8-liter capacity tank with a sight-glass level window (FULL/REFILL markings), fed by return lines from all subsystems.
2. Electric pump	driven by an electric motor, controlled by the HYD PUMP switch on the overhead panel; delivers fluid at 2000 psi through a check valve and filter.
3. Manual hand pump lever	mounted at the RH side of the C/M-2 seat; a double-acting pump usable if the electric pump or its power fails. A check valve prevents backflow through the electric pump while hand-pumping.
4. Relief valve	protects the system from overpressure, relieving at 2350 psi.
5. Pressure sensor/indicator	feeds the HYD pressure gauge on the central instrument panel (0–4000 psi, green arc 1850–2050 psi, red line at 2720 psi).

SYSTEMS SERVED

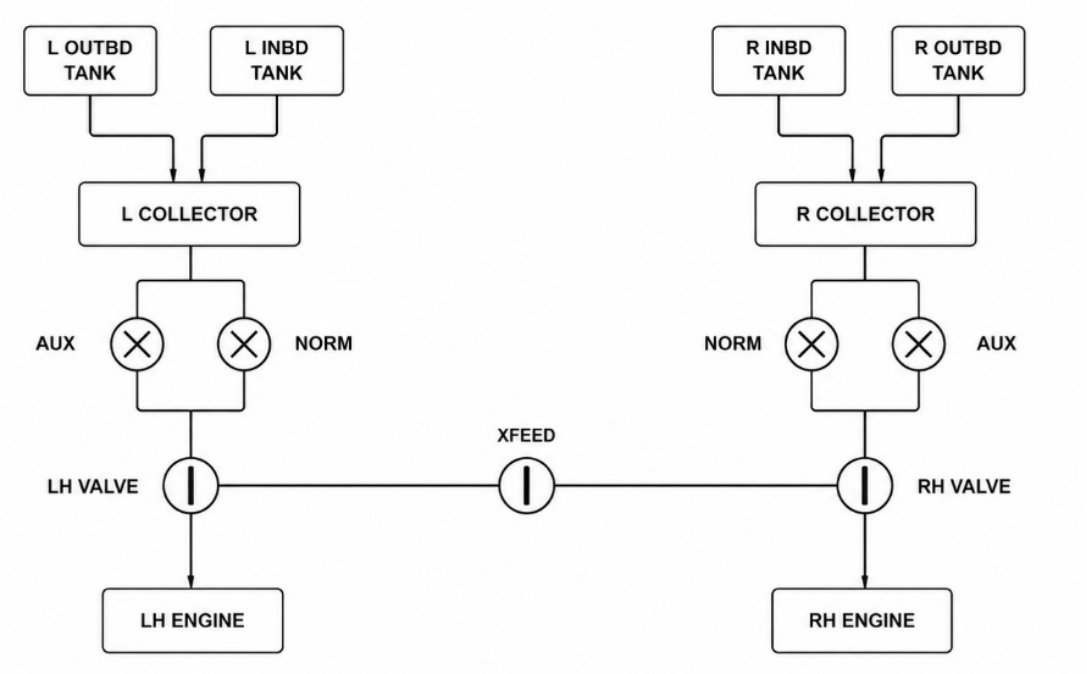
1. Ramp and cargo door	opening/closing sequence via the CARGO DOORS CONTROL handle (OPEN/CLOSED)
2. Flaps	extend/retract via the flap lever (UP/NORMAL/DOWN), each direction routing pressure to one side of the flap actuator
3. Brakes	normal braking is proportional/differential via brake pedals
4. Nosewheel steering	hydraulic actuator driven by the steering handwheel, with a low-pressure accumulator providing a ti-shimmy damping

FAILURE INDICATIONS

Loss of pressure is not separately annunciated by a dedicated caution light beyond the low-reading gauge itself, but subsystem-specific effects appear: flaps stop responding to the lever, nosewheel steering stiffens/centers, and braking authority may be reduced until the accumulator(s) are depleted — at which point the manual hand pump become the crew's recovery tools.

3. FUEL SYSTEM

The projectmax C212 aircraft fuel system stores fuel and supplies it to the engines at the required flow and pressure. Two independent subsystems, one per wing, each collect fuel from an outboard and an inboard tank into a collector section, from which submerged booster pumps deliver fuel under pressure to the associated engine through a shutoff valve. A crossfeed line, controlled from the cockpit, permits either engine to be fed from either wing's fuel supply.



FUEL TANKS

Each wing carries an outboard tank and a larger inboard tank, feeding by gravity into a small collector section at the root of the inboard tank. The collector houses the submerged booster pumps and represents the fuel immediately available to the engine regardless of attitude or maneuvering. Usable capacity is slightly reduced from tank capacity by a small unusable residue in each tank.

FUEL DISTRIBUTION

Two electric booster pumps — **NORMAL** and **AUXILIARY** — are installed per side, each controlled by its own switch on the overhead panel. In normal operation, the **NORM** pump supplies fuel continuously; the **AUX** pump is held in reserve and is selected for takeoff, landing, or in the event of a **NORM** pump failure. Fuel from the booster pumps passes through a shutoff valve before reaching the engine-driven fuel control unit. The shutoff valve is controlled electrically by the **FUEL** switch on the overhead panel and is also closed automatically by the **EMERGENCY SHUTDOWN** lever or upon fire-bottle discharge, whichever occurs first — the valve position responds to whichever of these conditions demands it, with a short, realistic transit time as it drives to the commanded position (extended further if a valve fault is present).

FUEL CROSSFEED

A crossfeed valve, controlled by the **FUEL FEEDING** lever on the overhead panel, connects the two wing fuel supplies. Moving the lever to **XFEED** opens the valve and illuminates the red **XFEED** light, allowing either engine to draw fuel from either side. In **NORMAL**, the valve is closed and each side is isolated to its own engine.

FUEL QUANTITY INDICATION

Each wing subsystem has a fuel quantity gauge on the central instrument panel, with an associated three-position **FUEL QTY IND** selector:

- **INB** — displays inboard tank quantity only
- **SUM** — displays the total of outboard and inboard quantities
- **OUT** — displays outboard tank quantity only

This is functionally identical to the reference documentation's **OUT/INB/SUM** arrangement, implemented here as a compact panel selector rather than a full rotary switch.

LOW FUEL LEVEL WARNING

A FUEL LEVEL LEFT/RIGHT TANK caution light illuminates when the combined remaining fuel on that side falls below a preset threshold, warning the crew that the collector supply is approaching a level requiring attention. A FUEL PRESSURE LEFT/RIGHT ENGINE warning light similarly alerts the crew to a fall in delivery pressure from the booster pumps, and a FUEL SHUTOFF VALVE light indicates a valve that is not fully open or fully closed. All three conditions are also reflected in the aircraft's master caution system.

ELECTRONIC FLIGHT BAG (EFB) FUEL PAGES

The aircraft's EFB provides two dedicated fuel displays:

1. Load & Balance a fuel-loading page allowing ground crew or the pilot to set the desired fuel load by weight prior to departure, with an interactive station-loading diagram for adjusting left/right wing fuel directly.

2. Fuel System Schematic (under Simulations) a live synoptic diagram of the full fuel system: both wing tanks and collectors with animated fill levels, both booster pumps per side (selectable directly from the diagram), the LH/RH shutoff valves and crossfeed valve (also selectable), animated flow-line indication, and live per-engine fuel-flow readouts.

4. WEATHER RADAR SYSTEM

The Bendix WXR-2021A is an airborne color weather radar providing forward-looking precipitation and terrain awareness. The system consists of a Bendix/King IN-2021A control panel, a CRT-style weather radar display, and a scanning radar antenna. Radar processing is shared with the Freeflight 2101 display and, where applicable, the EFD84 EHSI map overlay.

The system operates from two independent electrical circuits: the display bus and the antenna bus. Failure of either circuit results in a distinct system fault indication.

COMPONENTS

CONTROL	FUNCTION	RANGE
MODE / POWER KNOB	OFF / STBY / TEST / ON	4 detents
SUB-MODE (WHILE ON)	MAP / WX / WXA, stepped via MODE ▲▼	3 states
TILT	Antenna tilt indication	–15° to +15°, 1° steps
GAIN	Receiver sensitivity	0–100%
RANGE ▲▼	Display range scale	10 / 20 / 40 / 80 / 160 / 240 NM
TRACK ◄►	Azimuth offset cursor	±30°
60°	Narrows scan sector	90° → 60°
HOLD	Freezes current picture	On / Off
STAB OFF	Antenna stabilization defeat annunciation	On / Off
NAV	Reserved	—

OPERATING MODES

- **OFF**
  Removes electrical power from the radar display and antenna.
- **STBY**
  Warms the radar system and prepares it for operation. The antenna remains stationary and no radar returns are displayed.
- **TEST**
  Displays a fixed internal calibration pattern used to verify receiver operation and display integrity independently of weather conditions.
- **WX**
  Standard weather-detection mode. Precipitation returns are displayed using the following color scale:
  Green — Light precipitation
  Yellow — Moderate precipitation
  Red — Heavy precipitation
- **WXA**
  Weather Alert mode. Operates identically to WX mode, but high-intensity (red) returns flash at approximately 1 Hz to emphasize hazardous weather cells.
- **MAP**
  Ground-mapping mode. Weather returns are suppressed and terrain reflections are displayed using the same green/yellow/red color convention, scaled according to terrain reflectivity. Display intensity is reduced to improve terrain definition.

DISPLAY PRESENTATION

The radar display presents a forward-looking sector centered on the aircraft symbol located at the bottom of the screen. Range rings are displayed at ¼, ½, ¾, and full selected range.

A sweeping scan line indicates antenna movement and refreshes the display whenever the radar picture is updated. Selecting the 60° scan option reduces the azimuth coverage from 90° to 60°, increasing target resolution within the selected sector.

Pressing MODE ▲▼ opens the radar menu, providing access to operating modes, display range, and the weather color legend. After a short period of inactivity, the display automatically returns to the live radar presentation.

GAIN AND TILT

- **Gain**
  GAIN controls receiver sensitivity and determines the reflectivity threshold required for radar returns to be displayed. Reducing gain suppresses weaker echoes, while increasing gain progressively amplifies returns and may saturate the display toward red regardless of actual precipitation intensity.

- **Tilt**
  TILT adjusts the antenna elevation between –15° and +15° and is provided for crew reference. Within the current simulation, tilt indication is displayed but does not influence antenna scanning or the radar picture, as vertical beam modelling is not simulated.