



## **Welcome to Orange County Flight Center**

The POH Summary for the Liberty XL-2 is attached. Please study it and review areas of concern using the Pilot's Operating Handbook/Airplane Flight Manual—available on OCFC's website at [ocflightcenter.com](http://ocflightcenter.com)—before you meet your instructor for the airplane checkout.

We have taken this reasonable approach to airplane checkouts in order to save you time and ensure that the material you study includes all of the airplane's nuances—elements that are often missed when one quickly reviews an aircraft's POH.

During the checkout, your instructor will ask you questions about the airplane in order to ascertain that you have in fact acquired the proper knowledge. Your checkout will be complete after the instructor signs-off your dispatch record and you sign a statement acknowledging that you have studied the POH Summary and resolved areas of concern using the airplane's POH.

This nice flying airplane does not have magnetos. It has a FADEC system that controls engine functions and it can be powered by the alternator, the main battery, or the emergency battery. FADECs are very reliable, have excellent redundancy, and have been used on turbine powered airplanes for many years.

Fly smart, fly safe,

The OCFC team



***LIBERTY XL-2***  
***N604XL***  
***POH SUMMARY***

*(revised 04/29/2010)*

***General, Section 1***

1. Engine make and model: Teledyne Continental IOF-240-B with FADEC™
2. Horsepower rating: 125 hp@2800 rpm
3. Propeller manufacturer and type: Sensenich Corp. wood/fiberglass, fixed pitch
4. Fuel capacity and type: 29.5 gallons, 28.0 gallons useable, 100LL and 100 grades.
5. Oil sump capacity: 6 U.S. quarts, 5 quarts minimum. Never overfill. *(The airplane owner asks that at 5 quarts add only 1/2 quart to prevent oil blow-by that coats the airplane's belly.)*
6. Oil grade - Above 40°F: SAE 50. Below 40°F SAE 30 or 15W50
7. Maximum takeoff and landing weight: 1653.0 lbs.
8. Maximum weight in baggage compartment: 100 lbs.
9. Basic empty weight: 1178.5 lbs.
10. Maximum useful load: 474.5
11. Payload with full fuel: 306 lbs.
12. Terms unique to this airplane:
  - ACU - Alternator Control Unit
  - BPMS - Boost Pump Mode Switch
  - EBAT - Emergency Battery
  - ECU - Electronic Control Unit

FADEC - Full Authority Digital Engine Control  
FL - Fail  
HSA - Health Status Annunciator  
PMP - Pump (Fuel)  
PPWR - Primary Power  
SPSC - Secondary Power Source Circuit  
SSA - Speed Sensor Assembly  
WOT - Wide Open Throttle

## ***Limitations, Section 2***

### 13. Airspeeds:

V <sub>NE</sub>	157 KIAS
V <sub>NO</sub>	122 KIAS
V <sub>A</sub>	100 KIAS at 1653 lbs. (max gross weight), 94 KIAS at 1450 lbs.
V <sub>FE</sub>	86 KIAS
V <sub>SO</sub>	44 KIAS
V <sub>S1</sub>	50 KIAS

For Emergency Operations (*Listed in the POH's Emergency section*):

Best Glide Speed: 80 KIAS at 1653 lbs.

Approach speeds without engine power: 70 KIAS flaps up, 65 KIAS flaps 30°.

For Normal Operations (*Listed in the POH's Normal Procedures section*):

V <sub>x</sub>	65 KIAS flaps 20°, 70 KIAS flaps up
V <sub>y</sub>	80 KIAS
V <sub>cruise climb</sub>	80-85 KIAS
V <sub>approach</sub>	65-70 KIAS flaps 30°, 70-75 flaps 20°, 80-85 flaps 0°
V <sub>max x-wind</sub>	15 KIAS demonstrated for landing

14. Maximum engine power rating: 125 hp @ 2800 rpm.

15. Maximum engine rpm: 2800 rpm.

16. Minimum engine idle speed: 825 rpm.

17. Minimum oil temperature for takeoff: 75° F (*bottom of green arc is 100° F.*)

18. Minimum cylinder head temperature for takeoff: 240° F. (*bottom of green arc*)

19. WARNING: Flight is prohibited if any FADEC HSA annunciators are illuminated.

20. Maximum airspeed for chandelles, lazy eights, and steep turns: 100 KIAS

21. Flight load factors: Flaps up 3.8G positive, -1.52G negative; Flaps down 2.0 G positive, 0.0 G negative.

22. Maximum operating altitude: 12,500 feet.
23. Approved flap takeoff setting: 20° (*yes, 20° flaps are used for all takeoffs*)
24. Approved flap landing settings: 0°, 20°, and 30°
25. Solo flight limitation: The airplane must be flown from the left seat only.
26. RPM limitation: Avoid prolonged operation between 850 and 900 rpm.
27. Operations allowed: day/night VFR and IFR operations.
28. Location of Safety Hammer for breaking canopy: Copilot's seat-back compartment.
29. Limitation for both seat-back compartments: Soft goods only, 2 lbs. max.
30. Maximum baggage capacity: 100 lbs.
31. Location of the Kinds Of Operation Equipment List: It's in the limitations section of the POH/AFM and in FAR 91.205.

### ***Emergency Procedures, Section 3***

32. Study the Emergency Procedures Checklist that's on the OCFC website. Six of those checklists, which follow, must be memorized.
33. Engine Failure During Flight (*must be memorized*):
  - Establish Best Glide Attitude for airspeed.
  - Fuel Selector Valve checked on.
  - Throttle open 3/4 inch.
  - Fuel Boost Pump Mode Switch on.
  - FADEC A and B PWR Switches recycled simultaneously.
  - Ignition Switch on Both.
  - Ignition Switch to Start if prop NOT windmilling.
34. Engine Partial Power Loss during flight (*must be memorized*):
  - Fuel Boost Pump Mode Switch on.
  - Fuel Selector Valve on.
  - Alternate Induction Air pulled on.
  - Ignition Switch check R, L, Both. Leave in best position for smooth engine operation.
  - Land as soon as practical.
35. Engine Fire In Flight (*must be memorized*):
  - Do not attempt an engine restart.
  - Fuel Selector Valve off (*lift knob to turn off*).
  - Throttle closed.
  - Fuel Boost Pump Mode Switch off.
  - FADEC A and B PWR switches off.

Ignition Switch off.  
Perform forced landing checklist.

36. Door Open in Flight (*must be memorized*):

Airspeed 80 to 90 knots.

Door close and latch (*yaw airplane in direction of door if necessary*).

If unable to latch door in flight land as soon as practical.

37. ALT FAIL Annunciator Illuminated in Flight (*must be memorized*).

Check ammeter for 0 amps.

Alternator side of master switch off.

Non-essential electrical equipment off.

Alternator circuit breaker check in.

Alternator side of master switch on.

Check that ALT FAIL annunciator is off.

Check that voltmeter is in green arc.

If annunciator remains illuminated, turn alternator side of master switch off.

Land as soon as practical.

After loss or shutdown of alternator, EBAT FL and PPWR FL annunciators may illuminate. Engine may continue to operate normally from the emergency battery for up to 60 minutes if the battery is properly maintained and fully charged. Plan to land well within 60 minutes from the illumination of EBAT FL and PPWR FL annunciators. (*Remember, the XL-2 does not have conventional magnetos. Engine ignition occurs due to the electrically powered FADEC.*)

38. Elevator Trim Malfunctions:

Elevator Trim Inoperative:

ELEV TRIM circuit breaker checked and reset if necessary.

Check trim motor in both directions.

If trim moves in only one direction, minimize further use of trim to reduce out-of-trim forces on landing.

Uncommanded Elevator Trim Motion:

Restrain control stick to maintain flight path.

Move elevator trim switch in opposite direction, which may trip circuit breaker.

Pull ELEV TRIM circuit breaker and DO NOT reset.

Land as soon as practical.

To relieve control stick forces if nose-down trim runaway occurred, use flaps 0° for landing. If nose-up trim runaway occurred, use flaps 30° for landing.

### ***Normal Procedures, Section 4***

39. Propeller hazard: Ensure that airplane master switch, FADEC PWR A and B switches, and ignition switch are off before approaching or moving propeller. Engine may start if any or all of these switches are on and propeller is moved.
40. Stabilator trim tab should deflect in same direction as stabilator trailing edge and should be faired with the trailing edge when stabilator is in mid-range position.
41. Avionics master switch: It must be off during engine start to prevent damage to the avionics.
42. Cockpit doors limitations: In calm wind conditions, doors may be left open for engine start and taxi at low power only. Close with gusty winds or high engine power.
43. FUEL PMP annunciator lamp. It may illuminate and the Fuel Boost Pump may operate after starting the engine, when the Fuel Boost Pump Mode Switch is in the AUTO position, until automatically deactivated by the FADEC system when the engine's fuel pressure reaches acceptable levels.
44. Fuel Pump auto activation for starting: With the Fuel Boost Pump Switch in the AUTO position, the Fuel Boost Pump will automatically be activated by the FADEC system when the ignition switch is placed in the L or BOTH position. A minimum of 5 seconds of fuel boost pump operation is required to ensure that fuel lines to the injectors are purged of air.
45. HSA PPWR FL and/or EBAT FL annunciators remain illuminated before and for a few minutes after engine start: This will occur if the airplane has not been operated for an extended period.
46. Maintaining directional control while taxiing: Use differential braking. Use the rudder only to assist during gusty wind conditions. During all ground operations, a hand must be kept near the finger brake and throttle controls. Keep all taxi speeds to a minimum. Never exceed a brisk walking pace.
47. RPM drop or engine surge: If this occurs during the FADEC primary (PWR A) and secondary (PWR B) power transfer check, takeoff is PROHIBITED. Abort flight and notify maintenance. Do not attempt flight until discrepancy has been corrected.
48. Cockpit door pins: Each door has two pins, one FWD, one AFT. Verify doors are closed by pushing on aft section of each door.
49. HSA indications: If abnormal indications are observed after all operational checks are complete, takeoff is PROHIBITED. Abort flight and notify maintenance. Do not attempt flight until the discrepancy has been corrected.

50. Fuel Boost Pump Mode Switch position: The normal position for all stages of flight is the AUTO position.
51. Power check: During full-throttle engine operation early in the takeoff run, the engine should turn approximately 2400 RPM and all engine instruments should read in the green.
52. Takeoff flap setting: 20° is the only approved flap setting. All takeoff data are based on that flap setting.
53. Cruise power setting: Never cruise at full throttle (WOT annunciator illuminated). This will prevent engine fuel flow optimization and significantly reduce range. For optimum fuel economy, do not change the throttle position for approximately five minutes after setting cruise power.
54. Postflight check: If any abnormal HSA indications are observed after flight, or if the engine loses rpm when the fuel boost pump mode switch is turned off, advise maintenance immediately. Further flight is PROHIBITED until the discrepancy has been corrected.

If the secondary power (PWR B) switch is left in the ON position after engine shutdown, the aircraft's backup battery will discharge and be drained of power. Be sure to turn off the primary (PWR A) and secondary (PWR B) switches.

### ***Performance, Section 5***

55. Use the POH performance chart to determine the takeoff ground roll using the following information:  
Aircraft weight 1653 lbs.  
Flaps 20°.  
Pressure altitude 3,000 ft.  
Temperature 30°C  
CHT is 440°F  
A 17 kt. quartering headwind exists that's 45° from the runway heading.  
Your answer should be 1,305 feet.
56. Use the POH performance chart to determine the maximum rate of climb:  
Aircraft weight 1653 lbs.  
Power is full throttle (WOT annunciator on).  
Flaps 0°  
80 KIAS  
Pressure altitude 3,000 feet.  
Temperature 30° C  
Your answer should be approximately 257 fpm. (At 20°C climb rate is 514 fpm. At 40°C climb rate is less than 100 fpm. Assuming zero fpm at 40°C, the average would be 257 fpm.)

57. Use the POH performance chart to determine the landing distance over a 50-foot obstacle using the following information:  
Aircraft weight 1653 lbs. (XL2 performance charts are based on max gross weight.)  
Flaps 30°.  
Pressure altitude 3,000 ft.  
Temperature is 30°C  
Wind is calm.  
Your answer should be 1,722 feet.

### ***Weight and Balance, Section 6***

58. Use the POH weight and balance charts to determine if OCFC's XL2, N604XL, is within limits for flight based on the following information for N604XL:  
Maximum Gross Weight: 1653.0 lbs  
Basic Empty Weight: 1178.5 lbs  
Empty Moment: 97,748.96 in/lbs  
Empty CG: 82.93 In  
Fuel: 28 gallons useable  
Pilot: 200 lbs  
Passenger 170 lbs  
Baggage: 33 lbs.  
Your answer should be no, unless 16 gallons of fuel are removed.
59. 16 gallons of fuel are removed leaving 12 gallons useable. The airplane burns no more than 6 gallons per hour during cruise, so how long could you fly during the day?  
Your answer should be 1.5 hours: 9 gallons burned leaving 3 gallons for the required FAR 30 minute reserve fuel.
60. Is 604XL now legal for flight with respect to C.G.?  
Your answer should be yes.

### ***Airplane and Systems Description, Section 7***

61. Flap system: Electric with 30°, 20°, and 0° settings.
62. Stabilator trim system: An electric motor moves the trim tabs hinged to the horizontal stabilator. When not being moved by the motor, the tabs are geared to move in the same direction as the stabilators themselves, thus providing an "anti-servo" effect and generating consistent pitch control forces for the pilot.
63. Seat characteristics: They are not adjustable, but the rudder pedals can be adjusted fore and aft. The seat cushions are attached to the seat by Velcro fasteners, and you must ensure that the cushions do not obstruct the flight controls.
64. Safety hammer: Use it to smash out enough of the canopy door to exit the aircraft.
65. Fire extinguisher: It is mounted in the passenger seat storage compartment.

66. Tires: Normal pressure for all tires is 50 psi.
67. Nose wheel: It casters to allow up to 80 degrees left or right for nose wheel steering.
68. Brake system: Operated by individual master cylinders installed in the cockpit center console. Two brake levers are installed in the center console. To operate the brakes, pull either or both levers aft. Ground steering is controlled by differential application of the left and right main landing gear brakes. Brake fluid is stored in a common reservoir for both master cylinders located on the starboard side of the engine bay aft of the firewall. The upper engine cowling must be removed in order to service the reservoir.
69. FADEC system: It continuously monitors and controls ignition timing, fuel injection timing, and fuel mixture. It automatically sets the fuel mixture and ignition timing accordingly for any given power setting. Consequently, the engine does not require magnetos or a manual fuel/air mixture control.

The FADEC System provides control in both specified operating conditions and fault conditions. It is designed to prevent adverse changes in power or thrust. In the event of the loss of primary aircraft-supplied power, the engine controls continue to operate using a Secondary Power Source (SPS). As a control device, the system performs self-diagnostics to determine overall system status and conveys this information to the pilot by various indicators on the Health Status Annunciator (HSA) panel.

The basic components of the FADEC System include: Two Electronic Control Units (ECUs), Health Status Annunciator (HSA—a panel installed in the cockpit), and a FADEC sensor set. *To better understand this system, view the PowerPoint presentations on the OCFC website.*

70. FADEC Electronic Control Units (ECU): Two units, each of which is assigned to a pair of engine cylinders on this four-cylinder engine. The ECUs control the fuel mixture and spark timing for their respective cylinders.

Each ECU is divided into upper and lower portions. The lower portion contains an electronic circuit board that contains two, independent microprocessor controllers, which serve as control channels. The upper portion houses the ignition coils. During normal engine operation, one control channel is assigned to operate a single engine cylinder. Therefore, one ECU can control two engine cylinders.

Each ECU is capable of operating both its assigned cylinder and the other opposing engine cylinder as backup control for fuel injection and ignition timing. When leaning or enriching an individual cylinder, the other three cylinder mixtures are not affected.

71. FADEC Health Status Annunciator (HSA): It is located on the primary instrument panel and provides indications of primary or secondary (emergency) power malfunctions, erroneous sensor indications, fuel pump malfunctions, and possible misfiring cylinders.

Each HSA annunciator light is associated with a specific system condition. Illumination of a given light indicates that the associated condition has been detected and some pilot response may be necessary.

**FADEC CAUTION light:** It indicates pressure or temperature sensor failures, abnormal pressure or temperature above limits, cylinder misfire or not firing, or cylinder not enabled (ignition switch OFF or not in the BOTH position).

**FADEC WARN light:** It indicates that more than one cylinder is faulted. The FADEC WARN light is always preceded and/or accompanied by illumination of the FADEC CAUTION light.

**EBAT FAIL light:** It illuminates when there is a fault condition with the backup (secondary) power supply: the charging current into the backup battery is too high, the charge is too low, bad battery, the wire charging the battery is not connected, or the secondary power source is off or has failed. It will also illuminate if the primary power source is off or has failed.

**PPWR FAIL light:** It indicates that the FADEC system is drawing power from the backup power supply because the primary electrical supply has been interrupted, the backup power supply voltage is higher than the primary bus voltage, or the primary power source is off or has failed.

72. **FADEC Sensor Set:** All essential components of the FADEC system are connected using a low voltage harness. It acts as a signal transfer bus interconnecting the two Electronic Control Units (ECUs) with aircraft power sources, the Ignition Switch, Speed Sensor Assembly (SSA), Health Status Annunciator (HSA), and temperature and pressure sensors.
73. **FADEC IGNITION SYSTEM:** The engine's ignition system timing is electronically determined by the FADEC computers. It is not self-powered like a magneto; it requires power from the airplane's electrical system.

To provide system redundancy, the FADEC has two power sources. The primary source, labeled FADEC A, is the airplane's main power distribution system—the alternator and/or the primary battery.

The secondary power source, labeled FADEC B, is powered by a separate battery, which is continually charged by the airplane's main power distribution system. In the event of primary DC system failure, the secondary battery will power the FADEC for a period sufficient to locate and land at a suitable airport.

**WARNING:** The engine may continue to operate normally from the emergency battery for up to 60 minutes if properly maintained and fully charged. Plan to land well within 60 minutes from the illumination of EBAT FAIL and PPWR FAIL annunciators.

The FADEC is fully operational when powered by the FADEC A bus, the FADEC B bus, or both. Switches are provided to check operation on both systems before flight. PPWR FAIL and EBAT FAIL on the FADEC HSA illuminate to confirm operation of the FADEC from either or both sources.

74. FADEC FUEL INJECTION SYSTEM: Fuel is routed from the fuel tank to the intake of the engine-driven fuel pump, which is mounted on the front left side of the engine and gear-driven from the camshaft.

Fuel entering the pump passes through a centrifugal separator, where fuel vapor is removed and returned to the fuel tank. Next it passes into the pump element where pressure is increased to a value that is higher than is required by the engine fuel injectors.

75. Engine oil system: The gear-type engine oil pump draws oil from the 6-quart capacity sump and routes it to an oil filter and oil cooler adapter on the left side of the engine accessory case. An integral bypass valve will open in the event of blockage of the oil cooler or oil filter.
76. Engine air induction system/alternate air control: Air is admitted through an air filter assembly located above the right-side cylinders. If that filter becomes blocked, pilot selection of alternate air admits warm unfiltered air from the heater muff around the engine exhaust. The alternate air control is a pull-push knob located in the lower left center console.
77. VM1000 engine indicating display: It displays RPM, percent power (use it to set cruise power), manifold pressure, oil pressure and temperature, fuel pressure, electrical system voltage and alternator output amperage, and individual graphic displays of exhaust gas temperature (EGT) and cylinder head temperature (CHT) for each cylinder. It is powered by the airplane's primary electrical system and the "VM1000FX" circuit breaker.

Oil pressure and oil temperature displays: A warning alert activates when either red-line is reached and the displays will flash until the condition is corrected.

Cylinder Analyzer Operation—CHT and EGT: This system displays all cylinder information both graphically and digitally and is referred to as the diamond graph display. In the normal mode, CHT is between the green, yellow and red range marks, left to right, cylinders 1 through 4. EGT graphics are displayed above the CHT redline marks.

The high resolution mode is selected by pressing button 1 while in the normal mode. In this mode the entire display is temporarily used for high resolution monitoring of EGT. Return to the normal mode by pressing button 1 again.

The Autotrack system is designed to automatically detect subtle changes in engine

parameters that can precede major problems. Autotrack provides automatic alerts if such changes occur. You can use it during climb, cruise, and descent.

To use, allow the engine time to stabilize (temperatures and pressures) after power has been set. Now press Button 3. The Autotrack indicator will activate in the display and the system will begin tracking the engine's performance from this point. If any engine parameter deviates beyond the initial set point, the system will flash the corresponding graphic display and the Autotrack indicator. Push Button 3 again to turn Autotrack off.

The VM1000 Flight Data Recorder records engine operating parameters for each flight. That information is retained until the following flight when it is overwritten.

78. Fuel System: Fuselage-mounted fuel tank, fuel strainer assembly (gascolator), electric fuel boost pump, cockpit shutoff valve, fuel distribution manifold, inline fuel filter, and fuel injection nozzles. No fuel tanks are in the wings.

The fuel shutoff valve has OFF and ON positions. The button in the center of the valve handle must be lifted to allow valve movement to the OFF position. There are two sump drains under the fuselage: one under the tank and one further forward for the fuel system strainer (gascolator). If either valve is rotated after it is open, it will remain open so that fuel can be drained to reduce fuel quantity regardless of the fuel shutoff valve position, which is forward of the drains. The unlabeled opening between the two labeled fuel drains is the fuel booster pump drain. The non-icing fuel system vent is located and labeled on the bottom of the fuselage.

79. Electrical System: The 24 ampere-hour (Ah) primary battery provides power for engine starting and is a backup power source in case of alternator failure. This maintenance-free battery is located on the electrical equipment shelf in the aft fuselage.

The 12 Ah secondary battery, also maintenance free and located in the aft fuselage, provides emergency backup power to the FADEC system, attitude indicator, and turn coordinator in the event of primary power failure. It will operate the FADEC B system for up to 60 minutes and is continually recharged by the primary electrical system through the SPSC (Standby Power Source Circuit) circuit breaker.

Warning: The secondary battery does not power the airplane electric fuel pump. Simultaneous loss of airplane primary electrical power and the engine driven fuel pump will result in engine stoppage.

A 60 Ah, belt-driven alternator is installed on the right forward side of the engine. The alternator control unit (ACU) controls alternator output to maintain voltage and current within its operating limits. The ACU will automatically disconnect the alternator if output voltage exceeds 15 volts. The ACU may be reset by cycling the ALT half of the master switch OFF, then ON.

The ammeter is a load meter type device. That is, it displays the amount of current delivered by the alternator to the main distribution bus. In case of alternator failure, the rate of battery discharge will not be displayed.

80. Exterior lighting: Position and strobe lights on each wingtip and a landing/taxi light installed in the airplane nose. Each wingtip lighting module contains an aft-facing white position light in addition to the red or green position light.
81. Interior lighting: Illumination of many primary flight instruments, post lighting of additional instruments, internal lighting of the integrated engine instrument display, and an overhead LED floodlight.

Internal lighting for some instrument lights and legends is provided by electro-luminescent devices operating on small amounts of 120 VAC current. This current is provided by a solid-state inverter. Other internal instrument lights uses low-voltage DC.

82. Cabin ventilation: Two NACA-type flush inlets on either side of the fuselage admit ambient air to adjustable cooling vents in the cabin sidewalls.
83. Stall warning system: A stall warning vane on the left wing leading edge activates the warning device behind the instrument panel when 5 to 10 knots above stall speed.
84. Alternate static source: It is located to the left of the center console, above the pilot's right knee, under the edge of the instrument panel. When used, instruments using static pressure may have minor errors. Those errors can be minimized by leaving the cabin vents open.
85. The airplane does not have a vacuum system. Consequently, the attitude indicator and heading indicator are powered electrically.
86. A digital clock also contains an integrated Outside Air Temperature probe and a voltmeter. Push the center top button to switch the display between OAT and VOLTS.

### ***Handling, Service, and Maintenance, Section 8***

87. When moving the airplane backward, the nose landing gear will tend to caster to the "hard over" left or right position. Maintain a firm grip on the tow bar to prevent the nose gear from contacting the limit stops at the 80-degree left or right positions.
88. To lift the nose wheel of the aircraft manually, use body weight to push down on the vertical stabilizer where the strake meets the fuselage in front of the horizontal stabilator. Do not push on the horizontal stabilator or rudder, and do not allow the underside of the fuselage to touch the ground during maneuvering.