

Centre of gravity limits

- Aircraft's safe centre of gravity position ranges between 25% and 37% of mean aerodynamic chord.
- Centre of gravity point ranges between 267 mm and 375 mm backwards of datum. Datum is wing's leading edge.

Manoeuvre limits

Virus SW is certified as a Microlight/Ultralight aircraft. Therefore, all basic non-aerobatic manoeuvres are permitted within operational speed range, with respect to flap positions.

Following NON-aerobatic manoeuvres are permitted as defined:

- Power on and off stalls not below 300 meters (1000 feet) above ground level.
- Power on and off lazy eights not below 300 meters (1000 feet) above ground level.
- Steep turns with a maximum bank of 60° and initial speed of 160 km/h (85 kts).
- Chandelle maneuver not below 150 meters (500 feet) above ground level.
- Intentional spin (at most 180° in actual spinning manoeuvre).

G-load factors

max. positive wing load: + 4 G

max. negative wing load: – 2 G

Cockpit crew

- There is NO LIMIT to the minimum cockpit crew weight.
- Cockpit crew may weigh at most 180 kg.
- Maximum takeoff weight (MTOM) MUST NOT, under any circumstances, exceed 450 / 472,5 kg.

Types of operations

Virus SW is built to fly under day visual flight rules (day VFR) in zero icing conditions.

WARNING! Should you find water drops on the airframe during preflight check-up at temperatures close to freezing, you may expect icing to appear in flight. Spoilers (airbrakes) are especially prone to icing under such circumstances. As water may accumulate underneath the top plate(s), spoilers may freeze to the wing surface. Should this occur, you will most definitely be unable to extend spoilers before the ice melts. Therefore, flying under circumstances mentioned above, it is recommended to extend and retract the spoilers in flight frequently to prevent its surface freezing to the airframe.

Minimum equipment list

- Airspeed indicator (functional)
- Altimeter (Functional)
- Compass (Functional)
- Tachometer / RPM (Functional)

Other restrictions

Due to flight safety reasons it is forbidden to:

- fly in heavy rainfalls;
- fly during thunderstorm activity;
- fly in a blizzard;
- fly according to instrumental flight rules (IFR) or attempt to fly in zero visibility conditions (IMC);
- fly when outside air temperature (OAT) reaches 40°C or higher;
- perform any form of aerobatic flying;
- take off and land with flaps retracted or set to negative (-5°) position (landing with -5° is permissible only in case of very strong winds, but is not to be performed as a normal procedure)
- take off with spoilers extended.

Powerplant, fuel, oil

Engine manufacturer: ROTAX

Engine type: ROTAX 912 iS(c), 100 HP fuel injected

Data below is data relevant for pilot. Consult the original Rotax 912 iS(c) engine manual for all details.

The engine

TEMPERATURE °C / ROTAX ENGINE	912 iS(c) 100 HP
cylinder head temp. (CHT); minimum, working, highest	80; 110; 120
max. CHT difference	/
cooling fluids temperature (WATER); minimum, highest	50; 120
oil temperature (OIL TEMP); minimum, normal, highest	50; 90-110; 130
RPM, PRESSURE	912 iS(c) 100 HP
oil pressure (OIL PRESS); lowest, highest bar (psi)	0.8; 7.0 (12.0; 102.0)
fuel pressure (FUEL PRESS); lowest, highest bar (psi)	2.8; 3.2 (42; 45)
engine revolutions (RPM); on ground recommended	5500
RPM on ground; max. allowable	5800
magneto check at (RPM)	4000
max. single magneto drop (RPM)	300
ambient temperature limits (manifold inlet temperature)	-20 to +60 deg C (-14 to +140 deg F)

Fuel and oil

ROTAX ENGINE	912 iS(c) 100 HP
recommended fuel	unleaded super, grade RON 95 (AKI 912 and up, no alcohol content)
also approved fuels	leaded* or AVGAS 100LL*
recommended oil	API SJ SAE 10W-50
oil capacity typical 3 quarts (3 liters)	check dipstick

***Engine life is reduced. Should you be forced to used this kind of fuel, changing the engine oil every 50 flight hours is crucial. Please consult the manufacturer on which type of oil to use.**

IMPORTANT!

Four-stroke engines should only be powered by unleaded fuel, for lead sedimentation inside the engine shortens its life. Provided you are unable to use unleaded fuel, make sure engine oil and the oil filter are replaced every 50 flight hours.

Introduction

This section provides information for coping with emergencies that may occur. Emergencies caused by airplane or engine malfunctions are extremely rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered. In any emergency, the most important task is continued control of the airplane and manoeuvring to execute a successful landing.

Stall recovery

First reduce angle of attack by pushing the control stick forward, then

1. **Add full power (throttle lever in full forward position).**
2. **Resume horizontal flight.**

Spin recovery

Virus SW is constructed in such manner that it is difficult to be flown into a spin, and even so only at aft centre of gravity positions. However, once spinning, intentionally or unintentionally, react as follows:

1. **Set throttle to idle (lever in full back position).**
2. **Apply full rudder deflection in the direction opposite the spin.**
3. **Lower the nose towards the ground to build speed (stick forward).**
4. **As the aircraft stops spinning neutralise rudder deflection.**
5. **Slowly pull up and regain horizontal flight.**

Virus SW tends to re-establish normal flight by itself usually after having spun for 90°-180°.

WARNING! Keep the control stick centred along its lateral axis (no aileron deflections throughout the recovery phase! Do not attempt to stop the aircraft from spinning using ailerons instead of rudder!

WARNING! After having stopped spinning, recovering from the dive must be performed using gentle stick movements (pull), rather than overstressing the aircraft. However, VNE must not be exceeded during this manoeuvre.

When the aircraft has the wings level and flying normally, add throttle and resume normal flight.

Engine failure

Engine failure indication modes

WARNING! Consult Rotax 912 iS(c) Operators Manual for handling of various engine failure modes. This sub chapter provides an abstract of Rotax instructions.

The Rotax 912 iS(c) uses a dual redundant system of fuel pumps, fuel injector, ignition system, ECUs and generators.

LANE failures

Failure modes of LANEs are indicated with 2 (two) LANE LED lights, designated LANE A and LANE B on the main electrical panel. The lights indicate three modes:

LED OFF - proper healthy operation, no malfunction

LED intermittent (blinking) - abnormal operation, pilot is advised to manually switch to the remaining healthy LANE. It is recommended to land soon and inspect engine systems to discover fault

LED ON (permanent) - LANE failure, pilot **MUST** manually switch over to healthy LANE and end as soon as possible.

Fuel pump

The system uses two redundant high pressure fuel pumps. Should a pump fail, the other pump can replace its role. Only one functional pump is required for the engine to function nominally. In case of a pump failure, switch over to the remaining healthy pump. Should the engine quit before the pump is activated, restart engine normally. Should both fuel pumps fail, the engine cannot be restarted as not enough fuel pressure is produced.

Electrical system failure

In case of battery failure, be aware that the engine will keep running, however a re-start will not be possible. In event of generator failure, the battery will support the onboard avionics, provided the "Emergency battery switch" is ENGAGED.

Generator failure

The master electrical board features two lights, which indicate generator failures. There are two generators on board, designated by Generator 1 and Generator 2. The Rotax 912 iS(c) electrical system is able to handle single generator failures without pilot intervention. Generator fail lights serve as an advisory.

When one solid light is on (indicating Generator failure of Generator 1 or 2), pilot is to land as soon as possible and troubleshoot.

In case of a double generator failure, the engine will stop, however a restart is possible (both on ground and in flight). In this case, proceed as follows:

- 1. Fuel selector - select fuller fuel tank**
- 2. Emergency battery switch - ENGAGE (position right)**
- 3. Fuel pumps - BOTH ON**
- 4. Start the engine (ignition switch to START).**

Engine failure during takeoff

Ensure proper airspeed first (55 kts) and land the aircraft on the runway heading, avoiding obstacles in your way. Fuel selector to OFF position

WARNING! DO NOT CHANGE COURSE OR MAKE TURNS IF THIS IS NOT OF VITAL NECESSITY!
After having landed safely, ensure protection of aircraft and vacate the runway as soon as possible to keep the runway clear for arriving and departing traffic.

Rough engine operation or engine failure in flight

First ensure proper airspeed (64 kts), then start analyzing terrain underneath and choose the most appropriate runway or site for landing out.

Provided the engine failed aloft, react as follows:

Make sure the master switch is in the ON position, Fuel selector to fuller tank. Fuel pumps - set both ON. Attempt to restart the engine. If unsuccessful, begin with the landing out procedure immediately.

Emergency landing / Landing off airport

1. Fuel selector to OFF
2. Master switch OFF.
3. Approach and land with extreme caution, maintaining normal airspeeds.
4. After having landed leave the aircraft immediately.

The off airport landing manoeuvre MUST be performed with regard to all normal flight parameters.

Engine fire

Engine fire on ground

This phenomenon is very rare in the field of sport aviation. However, if an engine fire occurs on ground, react as follows:

1. Fuel selector to OFF
2. Come to a full-stop, set throttle to full power (lever full forward to use fuel).
3. Disconnect the battery from the circuit (pull battery disc. ring on the switch column)
4. Master switch OFF immediately after the engine has stopped.
5. Abandon the aircraft and start the fire extinguishing.

WARNING! After the fire has been extinguished DO NOT attempt to restart the engine.

Engine fire in flight

1. Fuel selector to OFF. Fuel pumps BOTH OFF
2. Disconnect the battery from the circuit (pull battery disc. ring on the switch column)
3. Keep avionics ON and master ON as required, on approach set both OFF.
4. Set ventilation for adequate breathing. Keep in mind that oxygen intensifies fire.
5. Perform side-slip (crab) manoeuvre in direction opposite the fire.
6. Perform emergency landing out procedure.

Power plant

Virus SW is equipped with the Rotax 912 iS(c), 100 horsepower fuel injected engine. The engine is equipped with two sets of redundant fuel injector sets, two electrical generators, two ECU engine computers, dual ignition and dual high pressure electrical fuel pumps.

Engine description:

Engine:	ROTAX 912 iS(c) (4-stroke boxer, four cylinders, 1352 cm³) fuel injected, with twin ECUs, double electronic ignition
cooling:	housing aircooled, cylinder heads watercooled - own radiator and pump, other moving parts oilcooled - own radiator and pump
lubrication:	centrally oiled - own oil pump and radiator
reduction gearbox:	integrated
reduction ratio:	1 : 2.43
el. generator output power:	20 A @ 14 V (Generator 1) + 30 A @14 V (Generator 2)
starter:	electric (0.8 kW)
engine power:	100 HP at 5800 RPM
battery:	12 V, 16 Ah

Throttle is controlled via a self-lubricating cable-bowden.

More information can be found in Rotax documentation (www.flyrotax.com)

Fuel system

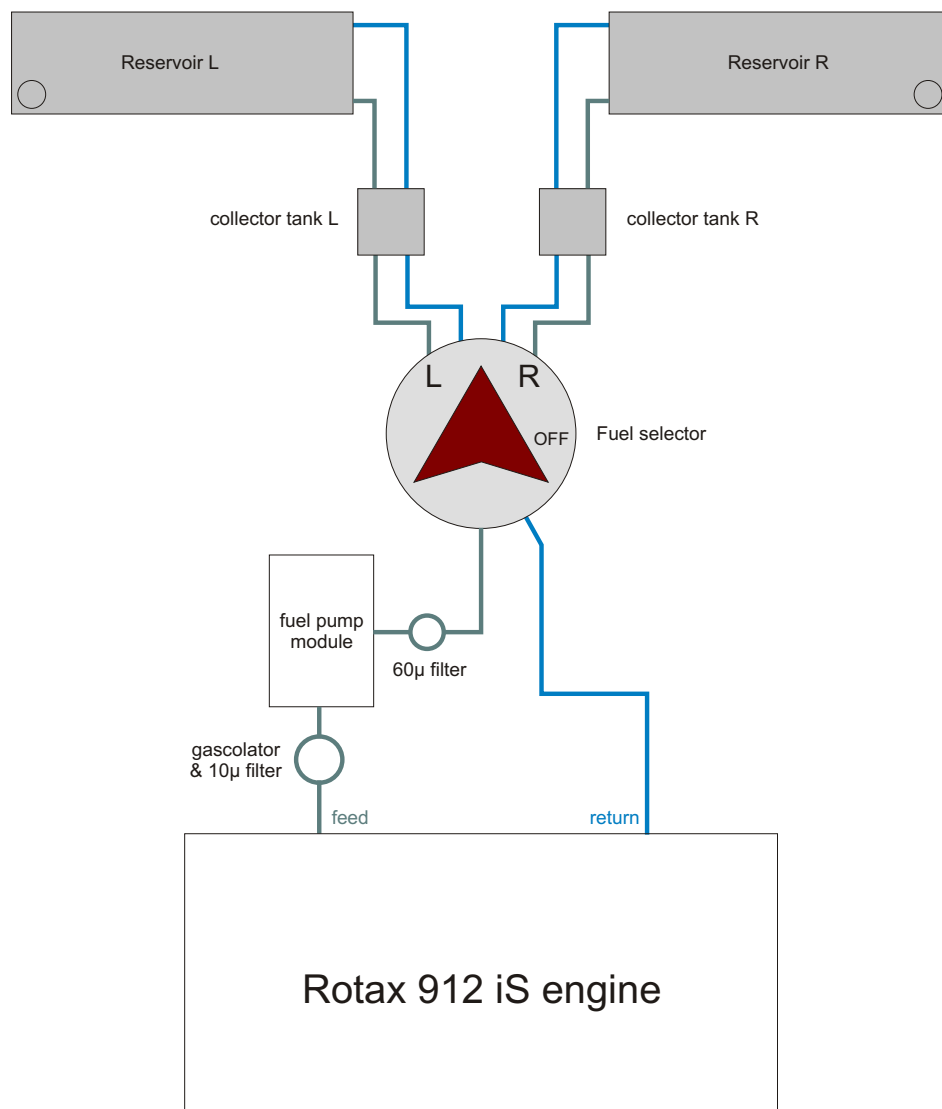
description:	vented wing fuel tanks with fuel cap on top of the wings, high pressure fuel system with two electrical fuel pumps
fuel selector:	central, with two feeds and two return lines. Positions: L, R, OFF
gascolator:	filter equipped with drain valve
fuel capacity:	50 + 50 litres
unusable fuel (per reservoir):	4 litres
fuel filters:	see schematic

All fuel hoses are protected with certified glass-terflon cover. Virus SW's fuel system for Rotax 912 iS (c) features a dual fuel return circuit. Fuel pressure regulator is part of engine assembly. Operation of fuel pumps is controlled via panel switches (Main pump is always engaged with switch in form of a circuit breaker. AUX fuel pump is controlled via a toggle switch.

WARNING! Visual fuel quantity indicator (tubes) in cockpit do not always provide relevant information about the actual fuel quantity on board. Due to reasons of wing dihedral, angle of attack, sideslip and reservoir supply point the readout may be incorrect. Flying with less than 3 cm (1 Inch -see red marking!) of indicated fuel (measured from the bottom of the tube upwards in any of the reservoirs) is therefore regarded as hazardous and may result in engine fuel starvation and/or engine failure.

CAUTION! Due to the position of the fuel reservoir supply point, flying in considerable sideslip for a longer time may result in fuel starvation to the engine if the fuel tank in the opposite direction of the sideslip is closed. Should this occur, switch over to the other tank, righten the flight and engage the AUX fuel pump immediately to prevent engine failure.

Schematic of fuel system



Electrical system

description:	Double ECU controlled ignition. Standard, 12 V circuit charges the battery and provides power to all appliances and instruments.	
generators:	20 A @ 14 V (Generator 1) + 30 A @14 V (Generator 2)	
master switch:	toggle switch, energizes main bus via relay	
avionics switch:	toggle switch, energizes avionics bus via relay	
LANE switches:	in scope of ignition key (A, B, AUTO A+B modes possible)	
other switches:	fused switches for illumination and circuit breakers for individual	
battery:	12 V, 16 Ah	
measured power consumption of some circuit breakers:	Landing light: 4.5 A, Nav/Strobe lights: 1 (steady) - 2 (peak) A , Cockpit light: 0.5 A, Radio & Transponder, EFIS, autopilots: Please consult item's operating manual	

Electrical system architecture

The Rotax 912 iS(c) electrical system is controlled by the engines FUSE Box and engine computers (ECU). The engine is equipped with two integrated permanent-magnet electric generators, which do not require any outside voltage to be applied for their function. Generator 1 is the main generator (20 A), which powers all engine vital systems (ignition, fuel pumps, fuel injectors, engine computers (ECU). Generator 2 is the on-board generator, which powers all avionics and aircraft's systems (e.g. electrical constant speed propeller, illumination, etc.). There are warning lights indicating malfunction of a certain Generator, however the FUSE box is able to bridge loads from Generator 1 to Generator 2 in case of failure, automatically, in order to keep engine running. The pilot cannot manually select Generator 1 or Generator 2 to be in function. In case of Generator 1 failure, should, Generator 2 be overloaded then supporting both engine and avionics, the system will de-rate power on the avionics bus. This can be prevented using the Emergency battery switch (set ON), which will bring the battery into the system to support the electrical consumption. Note that in normal engine operation, with Generator 1 and Generator 2 functioning normally, the battery is only being charged by the system and not used to support loads. The only sources of electrical power in the normal situation are the generators.

The emergency battery switch (set ON) is also able to support the operation of the engine and on-board loads in case of total generator failures for up to 30 minutes. See emergency Procedures.

The electrical system itself includes three solenoids, one activated by the master switch, the second activated by the avionics switch and the starter engage. All electrical loads, apart from the 12 V socket and the Pitot heat, are connected to the avionics bus via push-pull circuit breakers. For loads, which are engaged and disengaged more often, fused rocker switches are used (12 V socket, NAV lights, LDG light, etc.) All other loads (e.g. avionics) receive power as soon as the Avionics switch is ON. The avionics switch has no function when the master switch is OFF. The starter engage button is also disabled when the master switch is OFF.

Pitot heat

Pitot heat is available in combination with the AOA sensing pitot tube. It is the single most powerful electrical load in the system, consuming more than 100 Watt of power. When activating the Pitot heat (toggle switch on the main electrical panel), monitor system voltage (and or current) to make sure the battery is not being discharged due to prolonged use of large electrical loads in combination with the Pitot heat, both on ground and in flight.

Battery disconnection system

On the Virus SW, the main battery can be disconnected from the circuit.

There are two handles in the cockpit used to operate the battery disconnection, the battery disconnection lever and the battery disconnection ring. The battery disconnection lever, which is a red flag-type lever is found on the firewall above the main battery on the left-hand side of the cockpit. This lever has an attached wire which leads to the battery disconnection ring on the instrument panel's switch column.

To disconnect the battery from the circuit, simply pull the battery disconnection ring on the instrument panel's switch column.

To reconnect the battery back to the circuit, use the flag-type lever on the firewall.

Deflect the lever so that its flag end points towards the firewall. Having done this correctly, you will feel the flag-lever jam into position.

Battery reconnection can be done in-flight as well (e.g. following a successfully rectified emergency situation) but only from the left-hand seat, since you cannot reach the flag-lever from the right-hand side of the cockpit.