

S200 AFM



S200 AIRCRAFT FLIGHT MANUAL

Model:

Serial No:

Registration:

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Signature:

Agency: N/A

Stamp: N/A

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This airplane must be operated in compliance with information and limitations contained herein. This pilot operating handbook must be available on board of the airplane at all times.

0 MANUAL ADMINISTRATION

0.1 APPROVAL

The content of approved chapters is approved by EASA. All other content is approved by Sonaca Aircraft S.A. under the authority of EASA DOA No. EASA.21J.614 in accordance with Part 21.

0.2 RECORD OF REVISIONS

All revisions of this manual, with the exception of -

- Temporary Revisions,
- updates of the modification level,
- updated mass and balance information,
- updates of the Equipment Inventory, and
- updates of the List of Supplements,

Must be recorded in the following table and in case of approved Sections endorsed by the Agency.

The new or amended text in the revised pages will be indicated by a black vertical line in the left hand margin, and the Revision No. and the date will be shown on the bottom left hand side of the page.

Rev. N°	Affected Section	Affected Pages	Approval Date	Approved by
A	All	All	12/06/2018	EASA
B	1.5	1-10	16/07/2018	Sonaca Aircraft
C	All	All	23/07/2019	Sonaca Aircraft

23/07/2019	SONAIR-S2-D-MAN-001	Page : 0-1
Rev. : C		

0.3 LIST OF EFFECTIVE PAGES

This section lists the pages of the manual, together with the revision corresponding to each page and the approving organism.

Page	Rev. N°	Approved by
0-0	C	Sonaca Aircraft
0-1	C	Sonaca Aircraft
0-2	C	Sonaca Aircraft
0-3	C	Sonaca Aircraft
0-4	C	Sonaca Aircraft
0-5	C	Sonaca Aircraft
0-6	C	Sonaca Aircraft
1-1	C	Sonaca Aircraft
1-2	C	Sonaca Aircraft
1-3	C	Sonaca Aircraft
1-4	C	Sonaca Aircraft
1-5	C	Sonaca Aircraft
1-6	C	Sonaca Aircraft
1-7	C	Sonaca Aircraft
1-8	C	Sonaca Aircraft
1-9	C	Sonaca Aircraft
1-10	C	Sonaca Aircraft
1-11	C	Sonaca Aircraft
1-12	C	Sonaca Aircraft

1-13	C	Sonaca Aircraft
1-14	C	Sonaca Aircraft
1-15	C	Sonaca Aircraft
1-16	C	Sonaca Aircraft
1-17	C	Sonaca Aircraft
1-18	C	Sonaca Aircraft
1-19	C	Sonaca Aircraft
1-20	C	Sonaca Aircraft
2-1	C	Sonaca Aircraft
2-2	C	Sonaca Aircraft
2-3	C	Sonaca Aircraft
2-4	C	Sonaca Aircraft
2-5	C	Sonaca Aircraft
2-6	C	Sonaca Aircraft
2-7	C	Sonaca Aircraft
2-8	C	Sonaca Aircraft
2-9	C	Sonaca Aircraft
2-10	C	Sonaca Aircraft
2-11	C	Sonaca Aircraft
2-12	C	Sonaca Aircraft

2-13	C	Sonaca Aircraft
2-14	C	Sonaca Aircraft
2-15	C	Sonaca Aircraft
2-16	C	Sonaca Aircraft
2-17	C	Sonaca Aircraft
2-18	C	Sonaca Aircraft
2-19	C	Sonaca Aircraft
2-20	C	Sonaca Aircraft
2-21	C	Sonaca Aircraft
2-22	C	Sonaca Aircraft
2-23	C	Sonaca Aircraft
2-24	C	Sonaca Aircraft
3-1	C	Sonaca Aircraft
3-2	C	Sonaca Aircraft
3-3	C	Sonaca Aircraft
3-4	C	Sonaca Aircraft
3-5	C	Sonaca Aircraft
3-6	C	Sonaca Aircraft
3-7	C	Sonaca Aircraft
3-8	C	Sonaca Aircraft

23/07/2019	SONAIR-S2-D-MAN-001	Page : 0-2
Rev. : C		

3-9	C	Sonaca Aircraft
3-10	C	Sonaca Aircraft
3-11	C	Sonaca Aircraft
3-12	C	Sonaca Aircraft
3-13	C	Sonaca Aircraft
3-14	C	Sonaca Aircraft
3-15	C	Sonaca Aircraft
3-16	C	Sonaca Aircraft
3-17	C	Sonaca Aircraft
3-18	C	Sonaca Aircraft
3-19	C	Sonaca Aircraft
3-20	C	Sonaca Aircraft
3-21	C	Sonaca Aircraft
3-22	C	Sonaca Aircraft
3-23	C	Sonaca Aircraft
3-24	C	Sonaca Aircraft
3-25	C	Sonaca Aircraft
3-26	C	Sonaca Aircraft
3-27	C	Sonaca Aircraft
3-28	C	Sonaca Aircraft
3-29	C	Sonaca Aircraft
3-30	C	Sonaca Aircraft
4-1	C	Sonaca Aircraft
4-2	C	Sonaca Aircraft

4-3	C	Sonaca Aircraft
4-4	C	Sonaca Aircraft
4-5	C	Sonaca Aircraft
4-6	C	Sonaca Aircraft
4-7	C	Sonaca Aircraft
4-8	C	Sonaca Aircraft
4-9	C	Sonaca Aircraft
4-10	C	Sonaca Aircraft
4-11	C	Sonaca Aircraft
4-12	C	Sonaca Aircraft
4-13	C	Sonaca Aircraft
4-14	C	Sonaca Aircraft
4-15	C	Sonaca Aircraft
4-16	C	Sonaca Aircraft
4-17	C	Sonaca Aircraft
4-18	C	Sonaca Aircraft
4-19	C	Sonaca Aircraft
4-20	C	Sonaca Aircraft
4-21	C	Sonaca Aircraft
4-22	C	Sonaca Aircraft
4-23	C	Sonaca Aircraft
4-24	C	Sonaca Aircraft
4-25	C	Sonaca Aircraft
4-26	C	Sonaca Aircraft

4-27	C	Sonaca Aircraft
4-28	C	Sonaca Aircraft
4-29	C	Sonaca Aircraft
4-30	C	Sonaca Aircraft
4-31	C	Sonaca Aircraft
4-32	C	Sonaca Aircraft
4-33	C	Sonaca Aircraft
4-34	C	Sonaca Aircraft
5-1	C	Sonaca Aircraft
5-2	C	Sonaca Aircraft
5-3	C	Sonaca Aircraft
5-4	C	Sonaca Aircraft
5-5	C	Sonaca Aircraft
5-6	C	Sonaca Aircraft
5-7	C	Sonaca Aircraft
5-8	C	Sonaca Aircraft
5-9	C	Sonaca Aircraft
5-10	C	Sonaca Aircraft
5-11	C	Sonaca Aircraft
5-12	C	Sonaca Aircraft
5-13	C	Sonaca Aircraft
5-14	C	Sonaca Aircraft
5-15	C	Sonaca Aircraft
5-16	C	Sonaca Aircraft

23/07/2019	SONAIR-S2-D-MAN-001	Page : 0-3
Rev. : C		

5-17	C	Sonaca Aircraft
5-18	C	Sonaca Aircraft
5-19	C	Sonaca Aircraft
6-1	C	Sonaca Aircraft
6-2	C	Sonaca Aircraft
6-3	C	Sonaca Aircraft
6-4	C	Sonaca Aircraft
6-5	C	Sonaca Aircraft
6-6	C	Sonaca Aircraft
7-1	C	Sonaca Aircraft
7-2	C	Sonaca Aircraft
7-3	C	Sonaca Aircraft
7-4	C	Sonaca Aircraft
7-5	C	Sonaca Aircraft
7-6	C	Sonaca Aircraft
7-7	C	Sonaca Aircraft
7-8	C	Sonaca Aircraft
7-9	C	Sonaca Aircraft
7-10	C	Sonaca Aircraft
7-11	C	Sonaca Aircraft
7-12	C	Sonaca Aircraft
7-13	C	Sonaca Aircraft
7-14	C	Sonaca Aircraft
7-15	C	Sonaca Aircraft

7-16	C	Sonaca Aircraft
7-17	C	Sonaca Aircraft
7-18	C	Sonaca Aircraft
7-19	C	Sonaca Aircraft
7-20	C	Sonaca Aircraft
7-21	C	Sonaca Aircraft
7-22	C	Sonaca Aircraft
7-23	C	Sonaca Aircraft
7-24	C	Sonaca Aircraft
7-25	C	Sonaca Aircraft
7-26	C	Sonaca Aircraft
7-27	C	Sonaca Aircraft
7-28	C	Sonaca Aircraft
7-29	C	Sonaca Aircraft
7-30	C	Sonaca Aircraft
7-31	C	Sonaca Aircraft
7-32	C	Sonaca Aircraft
7-33	C	Sonaca Aircraft
7-34	C	Sonaca Aircraft
7-35	C	Sonaca Aircraft
7-36	C	Sonaca Aircraft
7-37	C	Sonaca Aircraft
7-38	C	Sonaca Aircraft
7-39	C	Sonaca Aircraft

7-40	C	Sonaca Aircraft
7-41	C	Sonaca Aircraft
7-42	C	Sonaca Aircraft
7-43	C	Sonaca Aircraft
7-44	C	Sonaca Aircraft
7-45	C	Sonaca Aircraft
7-46	C	Sonaca Aircraft
7-47	C	Sonaca Aircraft
7-48	C	Sonaca Aircraft
7-49	C	Sonaca Aircraft
7-50	C	Sonaca Aircraft
7-51	C	Sonaca Aircraft
7-52	C	Sonaca Aircraft
7-53	C	Sonaca Aircraft
7-54	C	Sonaca Aircraft
7-55	C	Sonaca Aircraft
7-56	C	Sonaca Aircraft
7-57	C	Sonaca Aircraft
7-58	C	Sonaca Aircraft
7-59	C	Sonaca Aircraft
7-60	C	Sonaca Aircraft
7-61	C	Sonaca Aircraft
8-1	C	Sonaca Aircraft
8-2	C	Sonaca Aircraft

23/07/2019	SONAIR-S2-D-MAN-001	Page : 0-4
Rev. : C		

8-3	C	Sonaca Aircraft
8-4	C	Sonaca Aircraft
8-5	C	Sonaca Aircraft
8-6	C	Sonaca Aircraft
8-7	C	Sonaca Aircraft
8-8	C	Sonaca Aircraft

8-9	C	Sonaca Aircraft
8-10	C	Sonaca Aircraft
8-11	C	Sonaca Aircraft
9-1	C	Sonaca Aircraft
9-2	C	Sonaca Aircraft
9-3	C	Sonaca Aircraft

9-4	C	Sonaca Aircraft
9-5	C	Sonaca Aircraft
9-6	C	Sonaca Aircraft
9-7	C	Sonaca Aircraft
9-8	C	Sonaca Aircraft

0.4 TABLE OF CONTENT

0	MANUAL ADMINISTRATION	0-1
1	GENERAL INFORMATION.....	1-1
2	LIMITATIONS	2-1
3	EMERGENCY PROCEDURES	3-1
4	NORMAL PROCEDURES	4-1
5	PERFORMANCE	5-1
6	WEIGHT AND BALANCE	6-1
7	AIRPLANE AND SYSTEMS DESCRIPTION.....	7-1
8	AIRPLANE GROUND HANDLING AND SERVICING.....	8-1
9	ADDITIONAL INFORMATION.....	9-1

1 GENERAL INFORMATION**1.1 TABLE OF CONTENT**

1.1	TABLE OF CONTENT	1-1
1.2	INTRODUCTION	1-2
1.3	CERTIFICATION BASIS	1-4
1.4	WARNING, CAUTION AND NOTES.....	1-5
1.5	AIRCRAFT DESCRIPTION AND DIMENSIONS	1-6
1.6	DEFINITION AND ABBREVIATIONS.....	1-11
1.7	UNITS OF MEASUREMENT	1-16
1.8	SOURCE DOCUMENTATION	1-19

1.2 INTRODUCTION

This Aeroplane Flight Manual has been prepared to provide pilots and instructors with information for the safe and efficient operation of the S200 aeroplane.

This manual includes the information required by CS-VLA to be furnished to the pilot of the Sonaca S200. It also contains supplemental data supplied by Sonaca Aircraft S.A., the aeroplane manufacturer.

The S200 is a two seat (side-by-side), single engine, tricycle fixed undercarriage, aluminium aircraft with a conventional low wing design.

The S200 is certified based upon the EASA CS-VLA (Certification Standard Very Light Aircraft) standard, having a maximum Take Off Weight of 750 kg.

The S200 is intended primarily for training and recreational flying. It is not intended for aerobatic operations.

The S200 is approved for day and night VFR operation.

Minimum equipment required for day or night VFR are defined in paragraph 7.13.

VFR flights in rain are authorized.

The present document is also referenced as Pilot Operating Handbook, or Handbook, or Manual.

NOTE

THIS MANUAL IS WRITTEN FOR THE STANDARD ROTAX 914 F POWERED S200, AS MANUFACTURED ON THEIR PREMISES BY SONACA AIRCRAFT S.A. DIFFERENCES APPLICABLE TO POSSIBLE OPTIONS, AS INSTALLED OR APPROVED BY SONACA AIRCRAFT S.A., ARE INCLUDED IN APPLICABLE SUPPLEMENTS OF THIS HANDBOOK SECTION 9.

AIRCRAFT WHICH DIFFER FROM THE PRODUCTION STANDARD, IN WHATEVER WAY, ARE NOT ADDRESSED IN THIS MANUAL, EXCEPT TO THE EXTENT THE SAID AIRCRAFT CORRESPONDS TO SONACA AIRCRAFT APPROVED MODIFICATIONS

NOTE

THIS EDITION OF THIS MANUAL IS BASED ON EASA REQUIREMENTS. DEFINITIONS ARE ACCORDINGLY CONSISTENT WITH EASA REGULATIONS ONLY.

S200 AFM



1 - GENERAL INFORMATION

1.3 - CERTIFICATION BASIS

1.3 CERTIFICATION BASIS

This type of aircraft has been approved by the European Aviation Safety Agency in accordance with CS-VLA including Amendment 1 and the Type Certificate No. EASA.A.626 has been issued on 12 June 2018.

Category of Airworthiness: Normal

Noise Certification Basis: CS-36 Amendment 4.

23/07/2019

Rev. : C

SONAIR-S2-D-MAN-001

Page : 1-4

1.4 WARNING, CAUTION AND NOTES

The following definitions apply to warnings, cautions and notes used in the flight manual.

WARNING

WARNING: means that the non-observation of the corresponding procedure leads to an immediate or important degradation of the flight safety.

CAUTION

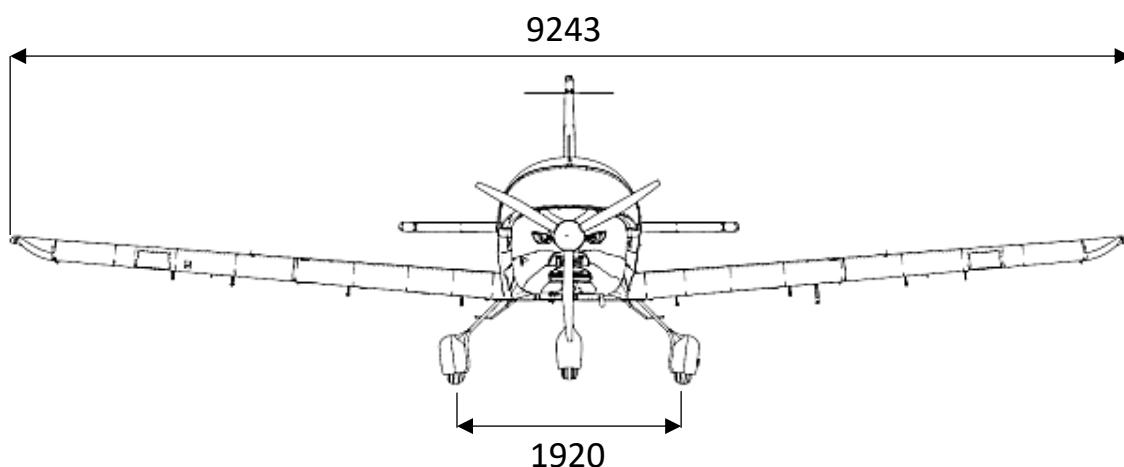
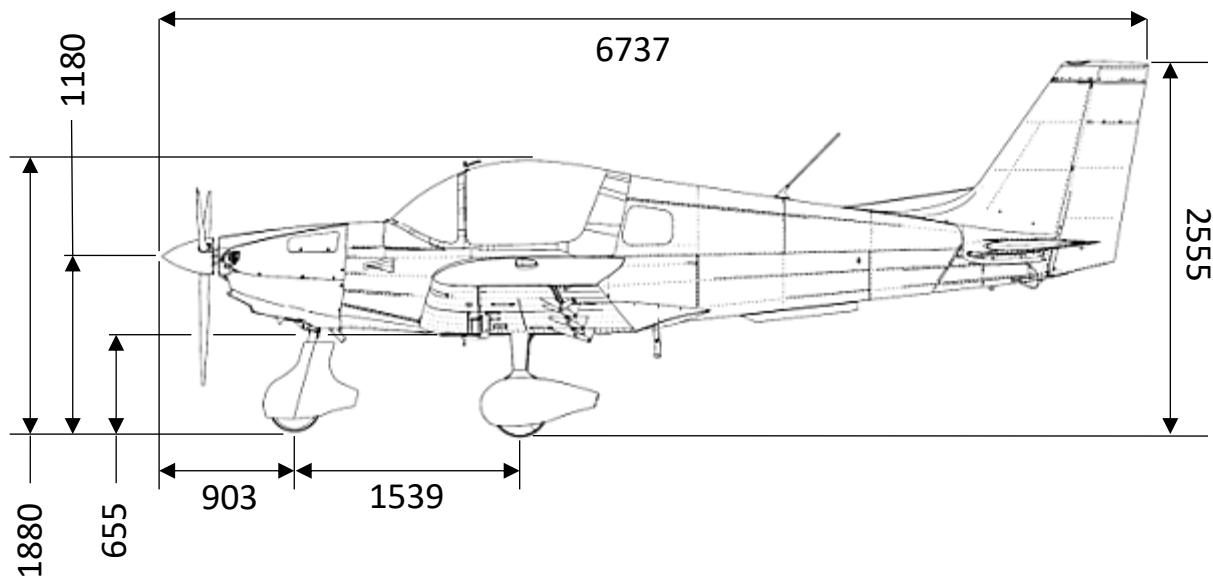
CAUTION: means that the non-observation of the corresponding procedure leads to a minor or to a more or less long term degradation of the flight safety.

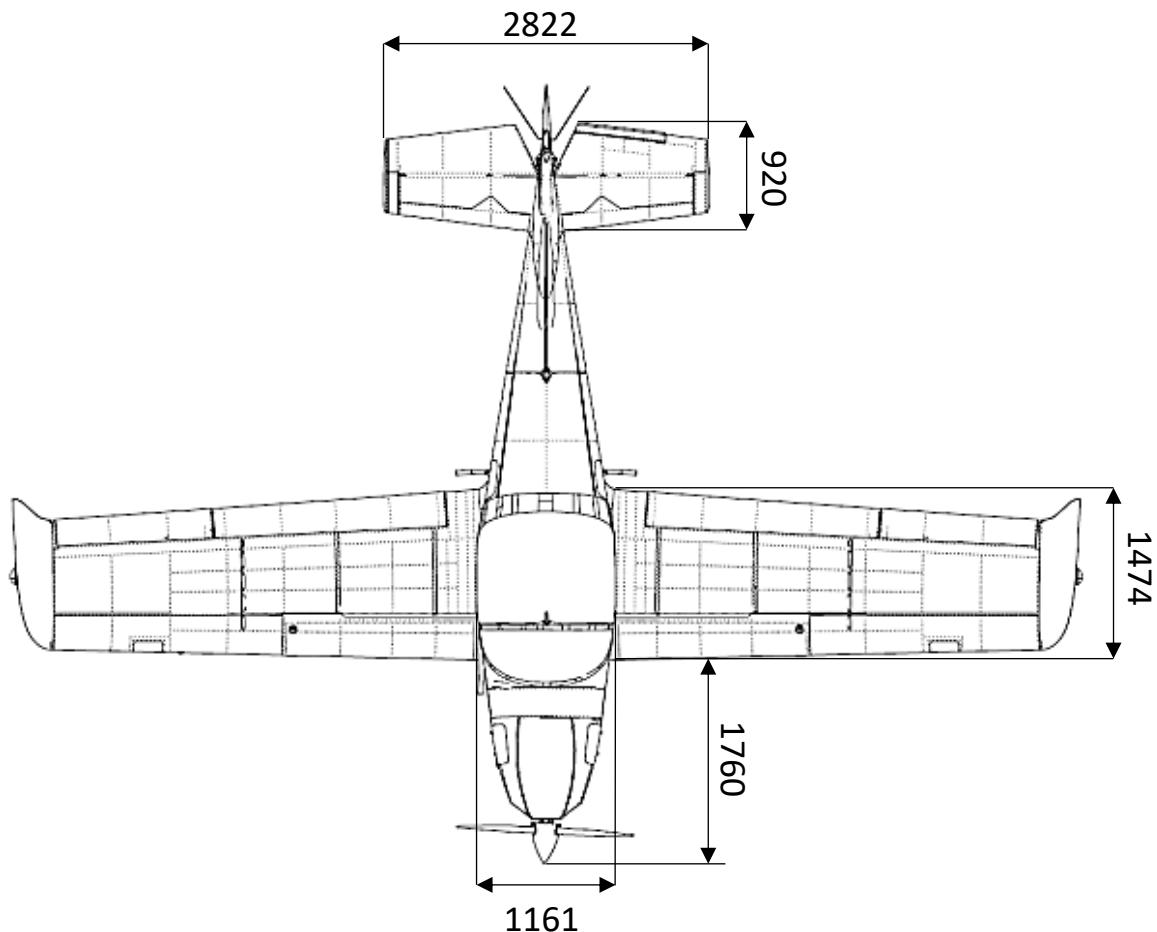
NOTE

NOTE: draws the attention to any special item not directly related to safety but which is important or unusual.

1.5 AIRCRAFT DESCRIPTION AND DIMENSIONS

The Sonaca S200 is a Very Light Airplane (VLA), certified under the rules of EASA CS-VLA Amendment 1. It features two seats (side-by-side), a single Rotax 914F engine with a 3-blades fixed pitch DUC Flash-R propeller, a tricycle fixed undercarriage, and an all aluminum structure with a conventional low wing design.





DIMENSIONS IN THIS DRAWING ARE IN MILLIMETRES.

For detailed description including Power plant and Systems, see Section 7.

WING

	Metric	Imperial
Wing span:	9.243 m	30 ft. 4 inch
Mean Aerodynamic Chord:	1.318 m	51.9 inch.
Wing surface area:	11.845 m ²	131.75 sq ft.
Wing loading:	59.10 kgm ⁻²	11.7 lbs /sq ft.
Aspect ratio:	7.04.	
Taper ratio:	1.375.	
Dihedral:	5°	

FUSELAGE

	Metric	Imperial
Fuselage length:	6 m	19 ft. 8 inch
Overall length:	6.675 m	22 ft. 1 inch.
Overall width:	1.16 m	46 inch.
Overall height:	2.55m	100 inch.

EMPPENNAGE

	Metric	Imperial
Horizontal stabilizer span:	2.822 m	9 ft 3 inch.
Horizontal stabilizer surface area:	0.96 m ²	10 ft ²
Elevator surface area:	1.02 m ²	11 ft ²
Horizontal stabilizer angle of incidence	-1.45°	
Vertical stabilizer span:	1.47 m	16 ft
Vertical stabilizer surface area:	0.53 m ²	6 ft ²
Rudder surface area:	0.59 m ²	6 ft ²

LANDING GEAR

	Metric	Imperial
Wheel track:	1.92 m	6ft 4 inch.
Wheel base:	1.54m	5ft 1 inch.
Brakes:	Hydraulic.	
Main gear tyres pressure :	3.4 bar	49 psi
Nose gear tyre pressure :	2.2 bar	29 psi

CONTROL SURFACE TRAVEL LIMITS

Ailerons:	24° $\pm 2^\circ$ up and 24° $\pm 2^\circ$ down
Elevator:	28° $\pm 2^\circ$ up and 22° $\pm 2^\circ$ down
Trim tab:	13° $\pm 5^\circ$ up and 23° $\pm 5^\circ$ down
Rudder:	25° $\pm 2^\circ$ left and right
Flaps:	0° $\pm 1^\circ$ Flaps up (UP) 10° $\pm 1^\circ$ Take-off position (T/O) 20° $\pm 1.5^\circ$ Approach position (APP) 30° $\pm 2^\circ$ Landing position (LD)

1.6 DEFINITION AND ABBREVIATIONS**General terminology / acronyms**

AC	Alternating Current.
AFM	Aircraft Flight Manual
ALT	Altimeter.
API	American Petroleum Institute
ASI	Airspeed Indicator.
ASTM	American Society for Testing and Materials
AKI	Anti Knock Index
AVGAS	Aviation gasoline.
COM	Communication (radio).
CS-VLA	Certification Standard Very Light Aircraft
DC	Direct Current
EASA	European Aviation Safety Agency
EFIS	Electronic Flight Information System.
FAA	Federal Aviation Authority.
GmbH	Gesellschaft mit beschränkter Haftung (company with limited liability).
GPS	Global Positioning System.
IFR	Instrument Flying Rules.
LED	Light Emitting Diode.
MOGAS	Automobile (car) gasoline.
N-VFR	Night Visual Flight Rules
NGL	Normal Ground Line.
NRV	Non Return Valve.
PTT	Push-To-Talk (button).
RON	Research Octane Number
VFR	Visual Flying Rules.
VMC	Visual Meteorological Conditions.
VSI	Vertical Speed Indicator.

General airspeed terminology and symbols

CAS	Calibrated Airspeed, being the indicated airspeed corrected for position and instrument error,
IAS	Indicated Airspeed, being the speed shown on the airspeed indicator.
KCAS	Calibrated Airspeed expressed in knots.
KIAS	Indicated Airspeed expressed in knots.
KTAS	True Airspeed expressed in knots.,
TAS	True Airspeed, being the airspeed relative to undisturbed air, and which is CAS corrected for altitude and temperature.
V_A	Manoeuvring speed.
V_{BG}	Best Glide Speed, being the speed (at MTOW) which results in the greatest gliding distance over the ground.
V_{FE}	Maximum Flap Extended Speed, being the highest speed permissible with wing flaps deployed.
V_{LOF}	Lift-off Speed, being the speed at which the aircraft generally lifts off from the ground during take-off.
V_{NE}	Never Exceed Speed, being the speed that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed, being the speed that should not be exceeded, except in smooth air, and then only with caution.
V_s	Stall Speed, at maximum weight, engine idling, flaps fully retracted.
V_{so}	Stall Speed in landing configuration (flaps fully extended), MTOW, engine idling.
V_x	Best Angle of Climb Speed, being the speed (at MTOW, flaps fully retracted) which results in the greatest altitude gain over a given horizontal distance (i.e. highest climb angle).
V_y	Best Rate of Climb Speed, being the speed (at MTOW, flaps fully retracted) which results in the greatest altitude gain over a given time period.

Meteorological terminology

ISA	International Standard Atmosphere.
QNH	The local pressure setting that if set on the subscale of an altimeter will cause the altimeter to indicate local altitude above mean sea level.
QFE	The local airfield pressure setting that if set on the subscale of an altimeter will cause the altimeter to indicate local height above airfield.

Engine terminology

CHT	Cylinder Head Temperature.
EGT	Exhaust Gas Temperature.
OHV	Overhead Valve.
RPM	Revolutions per minute, being the number of revolutions per minute of the engine crank.
TCU	Turbocharger Control Unit

Airplane performance and flight planning terminology

Crosswind component	The velocity of the crosswind component for which adequate control of the aircraft during take-off and landing can be demonstrated.
g	The load factor.
Landing run	The distance measured during landing from actual touchdown to the end of the landing run.
Landing distance	The distance measured during landing from clearance of a 15 m obstacle (in the air) to the end of the landing run.
Take-off distance	The take-off distance measured from the actual start of the take-off run to clearance of a 15 m (50 ft) obstacle (in the air).
Take-off run	The take-off distance measured from actual start of the take-off run to the wheel lift off point.
Usable fuel	The fuel available for flight planning.
MSL	Mean sea level, the average level of the Earth's oceans.

Weight and balance terminology and symbols

Arm	Is the horizontal distance from the reference datum to the centre of gravity of an item.
CG or CoG	Centre of Gravity, being the point at which the airplane, or equipment, would balance if suspended.
Datum	Reference datum is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
MEW	Maximum Empty weight Is the weight of the airplane with engine fluids and oil at operating levels, without fuel, pax and baggages.
MAC	Mean Aerodynamic Chord.
MLW	Maximum Landing Weight Is the maximum weight approved for the landing touch down.
MTOW	Maximum Take-off Weight is the maximum weight approved for the start of the take-off run.
Moment	Is the product of the weight of an item multiplied by its arm
SG (fuel)	Specific Gravity is the ratio of the mass of fuel to the mass of water for the same given volume
W _R	Weight read from scale under right main wheel during aircraft weighing.
W _L	Weight read from scale under left main wheel during aircraft weighing.
W _N	Weight read from scale under nose main wheel during aircraft weighing.
W _E	Aircraft empty weight.

1.7 UNITS OF MEASUREMENT

1.7.1 UNITS USED IN THE MANUAL

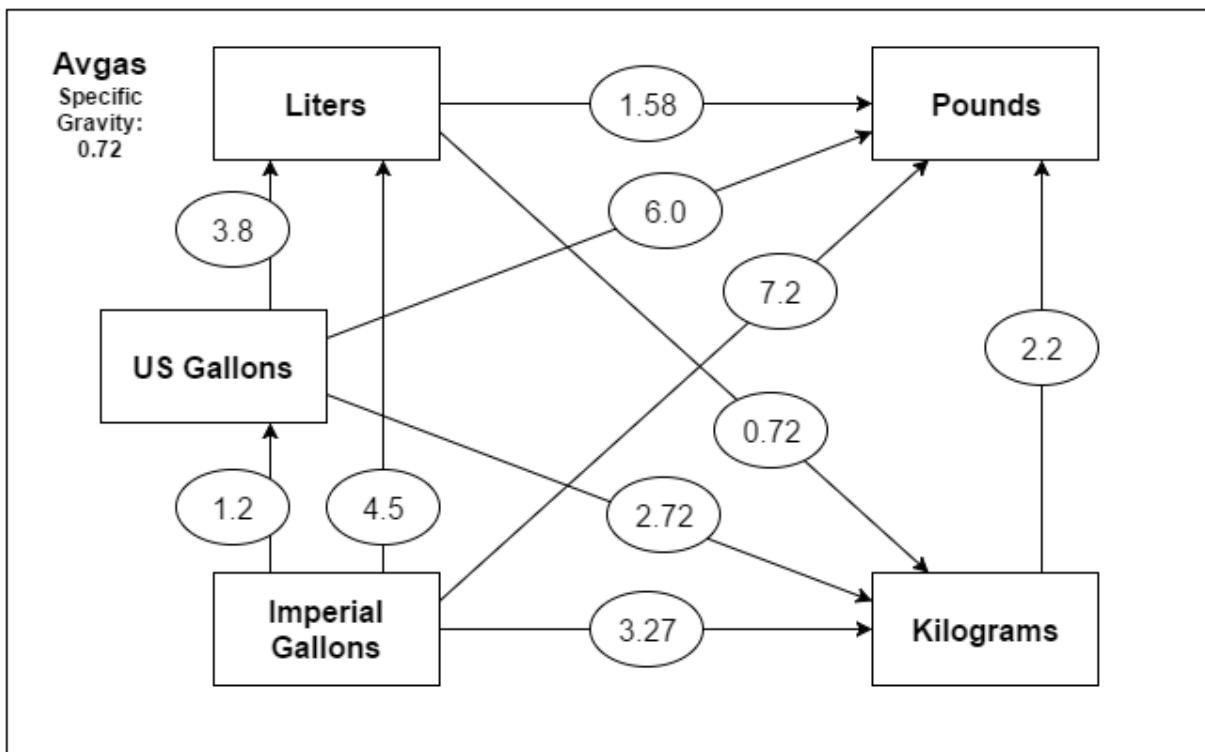
For safety reason, this manual uses the following philosophy:

- The same units as the ones that can be read on any of the S200 instruments and equipment are used in this Manual. They are expressed in one unit system only, imperial OR metric :
 - Imperial System: Altitude in feet, Speed in knots, Climb speed in feet per minute, Engine Manifold Pressure (MAP) in in.Hg, Engine/Propeller Rotation speed in RPM (revolution per minute), Oil and Fuel pressures in psi, Distance in Nm.
 - Metric system: Fuel quantity in liters, Temperatures in °C (degree Celsius), tyre pressure in bar.
- Other units than the ones that can be read on instruments and equipment, like mass, can be expressed in both metric AND imperial systems except for Mass and Balance sheet where only one unit system is used.

1.7.2 CONVERSION FACTORS

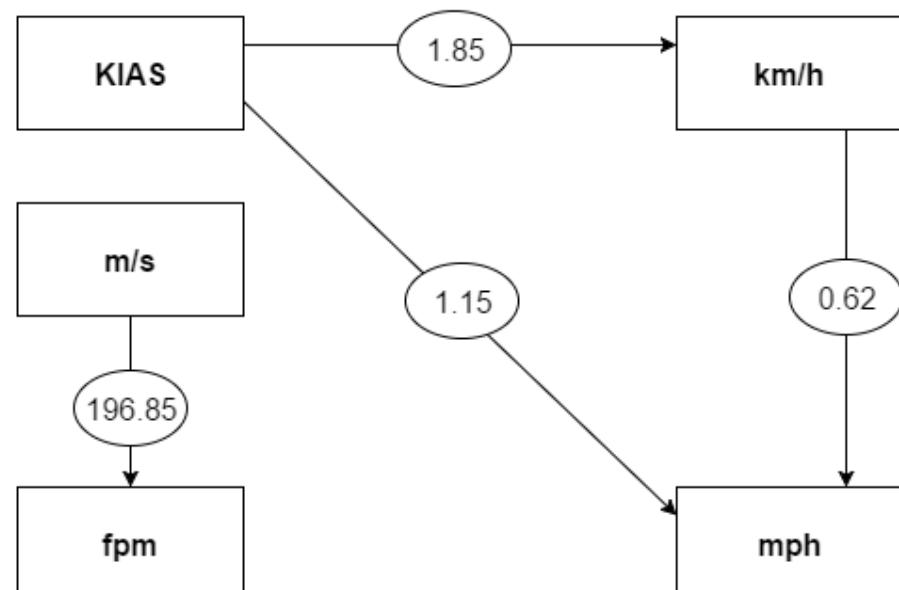
The figure below gives conversion factors for fuel quantities and masses. Fuel SG (0.72 for AVGAS) is based on ISA temperature at MSL. Therefore, fuel weights will be approximate for temperatures other than 15 degrees Celsius.

AVGAS Volume – Mass Conversion Factors Diagram (correct at less than +/- 1%)



The figure below gives conversion factors for speeds:

Speed Conversion Factors Diagram (correct at less than 0.3 %)



1.8 SOURCE DOCUMENTATION

1.8.1 ENGINE

Manufacturer: BRP-Rotax GmbH & Co KG

Model: 914 F2 -01

See the latest revision / edition of the Operators Manual For Rotax® Engine Type 914 Series, Ref No.: OM-914.

See <https://www.flyrotax.com/services/technical-documentation.html>

Searching databank for "914 F" will provide the OM as well as all relevant Service Bulletins and Service Letters.

1.8.2 PROPELLER

Manufacturer: DUC Helices

Model: FLASH-R

No of blades: 3

Diameter: 1750 mm

See the latest revision / edition of the Instruction Manual for tri-blade Flash-R propellers, Ref. no. DH_FSH-R_BE_03_A.

1.8.3 ENGINE INSTRUMENT

Manufacturer: J.P. Instruments

Model: EDM-900

See the latest revision / edition of the Pilot's Guide for EDM-900, entitled "Pilot's Guide, Engine Data Management, EDM-900 Primary TSO/STC".

1.8.4 RADIO AND TRANSPONDER

- Radio:

Manufacturer: Garmin

Model: GNC 255 A

Manual: GNC 255A/255B Pilot's Guide, P/N 190-01182-01

- Transponder:

Manufacturer: Garmin

Model: GTX 335

Manual: GTX 335/345 Series Pilot's Guide, P/N 190-01499-00

2 LIMITATIONS

2.1 TABLE OF CONTENT

2.1	TABLE OF CONTENT	2-1
2.2	INTRODUCTION	2-2
2.3	AIRSPEED	2-3
2.4	AIRSPEED INDICATOR MARKINGS.....	2-4
2.5	POWERPLANT LIMITATIONS	2-5
2.6	MASS (WEIGHT)	2-11
2.7	DATUM & CENTER OF GRAVITY RANGE	2-12
2.8	APPROVED MANOEUVERS.....	2-13
2.9	MANOEUVERING LOAD FACTORS.....	2-14
2.10	KIND OF OPERATIONS	2-15
2.11	OTHER LIMITATIONS	2-16
2.12	LIMITATION PLACARDS	2-18

2.2 INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for safe operation of the Sonaca S200, its engine, standard systems and standard equipment.

The limitations included in this section and in Section 9 have been approved by European Aviation Safety Agency.

The minimum crew for operation of the S200 is one pilot.

2.3 AIRSPEED

Airspeed limitations and their operational significance are shown below –

Speeds at MTOW:

SPEED		KIAS	REMARKS
V_{NE}	Never exceed speed	135	Never exceed this speed in any operation
V_{NO}	Maximum structural cruising speed	120	Never exceed this speed unless in smooth air, and then only with caution
V_A	Manoeuvring speed	105	Do not make full or abrupt control movements above this speed as this may cause stress in excess of limit load factor
$V_{FE,10^\circ}$	Maximum flap 10° speed	105	Never exceed this speed with flaps T/O setting
$V_{FE,20^\circ}$	Maximum flap 20° speed	95	Never exceed this speed with flaps APP setting
$V_{FE,30^\circ}$	Maximum flap extended speed	85	Never exceed this speed with flaps LD setting
$V_{S1,0^\circ}$	Stall speed	50	At maximum take-off weight, with flaps fully retracted, engine idling, the aircraft will stall if flown slower than this speed
V_{S0}	Stall speed with flaps	45	With full flap, maximum take-off weight, engine idling

2.4 AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their colour-code significance are shown below –

MARKING	KIAS	SIGNIFICANCE
White arc	45-85	<p>Positive Flap Operating Range</p> <ul style="list-style-type: none">• Lower limit is V_{S0} at maximum weight• Upper limit is the maximum speed permissible with flaps LD setting (V_{fe})
Green arc	50-120	<p>Normal Operating Range</p> <ul style="list-style-type: none">• Lower limit is V_{S1} at maximum weight, most forward CG with flaps retracted, engine idling• Upper limit is maximum structural cruising speed
Yellow arc	120-135	Manoeuvres must be conducted with caution and only in smooth air
Red line	135	Maximum speed for all operations

2.5 POWERPLANT LIMITATIONS

2.5.1 ENGINE

- Engine : BRP Rotax Model: 914 F2 -01

NOTE

Always refer to the latest Engine Manufacturer document (TCDS, OM, MM, SB / SI, ...)

See <https://www.flyrotax.com/services/technical-documentation.html>

Searching databank for "914 F" will provide the OM as well as all relevant Service Bulletins and Service Letters.

- Maximum Engine RPM:
 - Min Idle: 1400 RPM
 - Max continuous : 5500 RPM
 - Between 5500 and 5800 RPM : Maximum 5 minutes
 - More than 5800 RPM : See Rotax 914 Line Maintenance Manual, Ref. MML-914
- Coolant Temperature:
 - Maximum 120 °C

- Oil Temperature:
 - Minimum: 50°C
 - Maximum: **130°C**

NOTE

Below 50°C Oil Temperature on ground, Engine RPM limited to 2500

NOTE

Ensure at least once per flight day to reach an Oil Temperature of 100°C to avoid oil dilution issues.

- Oil Pressure
 - Minimum (allowed below 3500 RPM) : 12 psi (0.8 bar)
 - Normal range (above 3500 RPM) : **29 to 73 psi** (2.0 to 5.0 bar)
 - Maximum: 102 psi (7 bar)
- Oil Grade (Specification) – See Rotax 914 Operator Manual, Ref. OM-914:
 - See Rotax SI-914-019 for approved oil types.
 - When operating on unleaded fuels or MOGAS fully synthetic oil is recommended.
 - Oils for Diesel engines and oils with friction modifier are unsuitable.

- Fuel pressure
 - Minimum: Airbox pressure + **2.18 psi** (0.15 bar)
 - Normal : Airbox pressure + **3.63 psi** (0.25 bar)
 - Maximum: Airbox pressure + **5.08 psi** (0.35 bar)

WARNING

Exceeding maximum allowed fuel pressure will override the float valves of the carburetors and lead to engine failure.

NOTE

On the S200, fuel pressure is directly measured as difference between fuel and airbox pressure. Therefore, the operating range as indicated on the EMS is 2.18 to 5.08 psi.

- Fuel Grade (Specification): see section 2.5.3.

- Coolant Grade (Specification):
 - Ethylene glycol based coolant mixed 50%/50% with distilled water
 - See Rotax SI-914-019 for approved coolant types.

NOTE

Do not use concentrated water free propylene glycol based coolant.

NOTE

Coolant component can be increased up to max. 65%

- Other Limitations applicable to the Rotax 914 F engine
 - External temperature limits

ENGINE START AND OPERATION TEMPERATURE LIMITS – 914 F

Maximum	50 °C (ambient air temperature)
Minimum	-25 °C (oil temperature limitation)

NOTE

Normal operation does not allow negative load factor manoeuvres - see section 2.10.

In case of unintentional negative load factor, the pilot should ensure that it does not exceed -0.5g for a maximum of 5 sec. in accordance with Rotax Engine operating limits.

2.5.2 ENGINE INSTRUMENT MARKINGS

Powerplant instrument markings and their colour code significance are shown below:

Instrument	Minimum Range (Red)	Normal Operating Range (Green)	Caution Range (Yellow)	Maximum Range (Red)
RPM	None	1600-5500 RPM	5500-5800 RPM	5800-6400 RPM
Oil Temperature	0-50°C	50-110°C	110-130°C	130-150°C
Coolant Temperature	None	0-120°C	None	120-150°C
Oil pressure	0-12 psi	29-73 psi	12-29 psi 73-102 psi	102-130 psi
Exhaust Gas Temperature	None	700-900°C	900-950°C	950-1000 °C
Fuel pressure	0-2.18 psi	2.18-5.08 psi	None	5.08-5.8 psi
Manifold Pressure	None	25-35.4 in.Hg	35.4-39.9 in.Hg	39.9-42 in.Hg
Fuel level	0-5 L	5-73 L	None	None

NOTE

Full power throttle setting is allowed for Max. 5 minutes and can lead to engine RPM and MAP in yellow range.

2.5.3 FUEL

Type	Capacity (liter)
Capacity of each tank	73 l
Approved fuel grades	Minimum RON 95 / minimum AKI 91. MOGAS: EN 228 Super, EN 228 Super plus, ASTMD4814 Leaded AVGAS: AVGAS 100LL (ASTM D910). Unleaded AVGAS: UL91 (ASTM D7547).

See Rotax SI-914-019 for Rotax list of approved fuel types.

WARNING

Operation of engine on a fuel tank with less than 3 L fuel remaining wings level will lead to engine stop in flight

NOTE

Remaining fuel below 10 L in both tank will lead to low fuel indication on EMS

NOTE

The operator of the aircraft must select a standard operating fuel and establish its Approved Maintenance Program in accordance with the selected fuel. When refueling with a fuel type different than the selected standard, it is good practice to record it in the aircraft logbook for traceability and the maintenance schedule must be adapted if required.

2.5.4 PROPELLER

- Propeller : DUC Hélices - Model: FLASH-R - 1750 mm

Remark : No blade rework permitted.

- Propeller Rotational speed restriction (2700 RPM) is covered by the Engine Max. RPM (at 5800 Engine Max RPM, Propeller RPM = $2387 < 2700$)

2.6 MASS (WEIGHT)

	Metric	Imperial
Maximum Take-off weight	750 kg	1650 lbs
Maximum Landing weight:	750 kg	1650 lbs
Maximum Taxi weight	750 kg	1650 lbs
Maximum Zero Fuel weight:	750 kg	1650 lbs
Maximum baggage weight Area 1 + Area 2	35 kg	77 lbs
Maximum baggage weight Area 1	35 kg	77 lbs
Maximum baggage weight Area 2	25 kg	55 lb

Refer to section 7.8.4 for Area 1 and 2 definition.

2.7 DATUM & CENTER OF GRAVITY RANGE

	Metric	Imperial	% of MAC
Datum	Centreline of firewall front face bottom edge		
Longitudinal horizontal reference	Upper surface of canopy slides		
Forward limit at 650 kg and below	0.876 m*	2.873 ft*	20%
Forward limit at 750 kg	0.915 m*	3 ft*	23%
Rear limit at 650 kg and below	1.021m*	3.349ft*	31%
Rear limit at 750 kg	1.034 m*	3.392 ft*	32%

*aft of datum.

There is a linear variation between all points of the centrogram (see section 6.4).

WARNING

It is the pilot's responsibility to ensure that the airplane is properly loaded. Refer to section 6 for information on weight and balance.

2.8 APPROVED MANOEUVERS

This aeroplane is certified in the Normal Category.

In addition to manoeuvre for normal flying, the following manoeuvres are approved for the S200 with the flaps fully retracted:

Approved Manoeuvres	Entry speed
Steep turns*	90 KIAS
Lazy eights*	
Chandelles*	
Stalls (excluding whip stalls)	

*angle of bank limited to 60°

WARNING

Aerobatics and intentional spins are prohibited

WARNING

Limit load factor would be exceeded by moving flight controls abruptly to their limits at a speed above V_A .

Maneuvering must always be conducted smoothly and carefully in order not to exceed the limit load factors (see §2.9)

2.9 MANOEUVERING LOAD FACTORS

Load factor type	Maximum value
Maximum positive limit load factor	+ 4.4 g
Maximum negative load factor	-1.76 g
Maximum positive flap down load factor	+ 2,2 g
Maximum negative flap down load factor	0 g

CAUTION

-0.5g max for 5 sec for an engine proper running in case of inadvertent negative g manoeuvre.

2.10 KIND OF OPERATIONS

The Sonaca S200 is approved for day and night VFR operation.

Minimum equipment required for day or night VFR are defined in paragraph 7.13.

VFR flights in rain are authorized.

WARNING

IFR flights and intentional flights into known icing conditions are prohibited!

NOTE

Additional equipment may be required to fulfill national or specific requirements

2.11 OTHER LIMITATIONS

2.11.1 OPERATING ALTITUDE

Service ceiling is 13 000ft. However, independently from the aircraft limitations, the flight crew must comply with the applicable local regulation regarding oxygen supply and flight duration at high altitude.

NOTE

Oxygen supply is not provided in the basic Sonaca S200

2.11.2 TEMPERATURE

No limitation on external temperature other than engine temperature limitations defined in 2.5.1.

2.11.3 BATTERY CHARGE

Taking off for a flight with an empty battery is not permitted.

WARNING

Flying with an empty battery may result in an in-flight battery fire

A battery voltage below 10V is considered empty and requires a maintenance action.

2.11.4 OPERATION TIME OF ELECTRICAL EQUIPMENT

Following a dual alternator failure, it can be expected that the systems are supplied with battery power for 30 minutes.

2.11.5 STARTING ATTEMPTS

Max starter time 10 seconds, followed by a cooling time of 2 min.

Maximum 4 starting attempts.

Do not operate the starter if the engine is running.

2.11.6 ELECTRONIC EQUIPMENT

Auxiliary 12V plug is protected by a 2 amps breaker.

2.11.7 CANOPY LOCKING DEVICE

Flight is authorized only with Canopy closed and properly latched.

Taxi with open canopy is allowed. Caution should be applied to avoid unexpected forward canopy movement that could injure the flight crew. Slow braking is recommended.

2.11.8 LANDING GEAR FAIRINGS

Operations without Landing Gear Fairings installed is authorized and does not modify handling qualities.

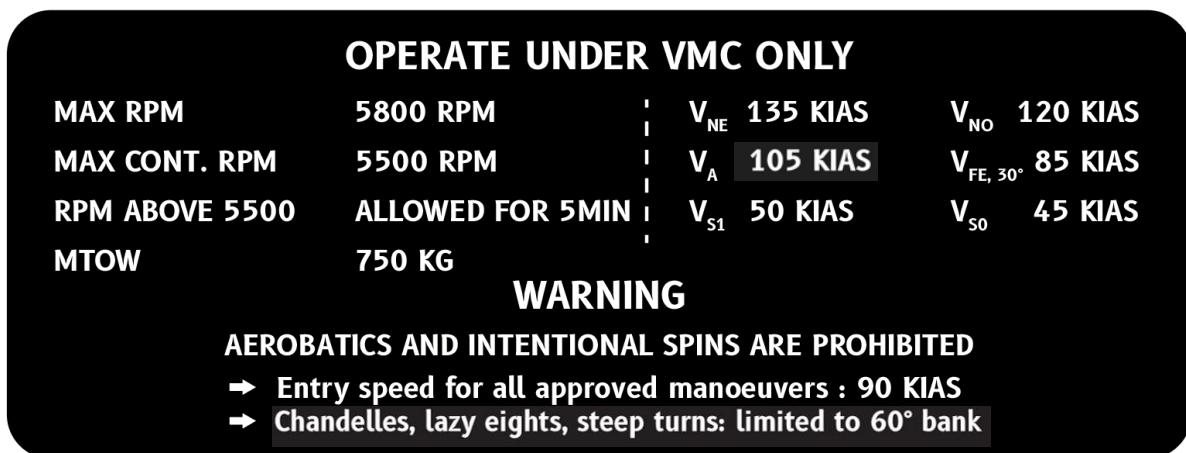
NOTE

Flying without wheel fairings will result in increased fuel consumption.

2.12 LIMITATION PLACARDS

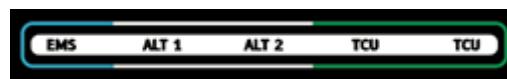
The following limitation and warning placards are placed in the aircraft and positioned in plain view of the occupants. Other markings and placards are described and shown in section 9.4.

On the instrument panel:



This aeroplane is classified as a very light aeroplane approved for day and night VFR in non-icing conditions. All aerobatic manoeuvres including intentional spinning are prohibited. See Flight Manual for other limitations.

Under the warning and caution lights:



Around the master switch:



In a place visible to pilot and passenger:

NO SMOKING

In plain sight of the pilot and co-pilot/passenger below the fuel selector:

70L USABLE FUEL PER FUEL TANK

In between the flap indicator and handle:



On the baggage space separator channel:



MAX BAGGAGE WEIGHT - AREA 1+2	35 KG / 77 LB
MAX BAGGAGE WEIGHT - AREA 1	35 KG / 77 LB
MAX BAGGAGE WEIGHT - AREA 2	25 KG / 55 LB

On the moveable trim
tab indicator:



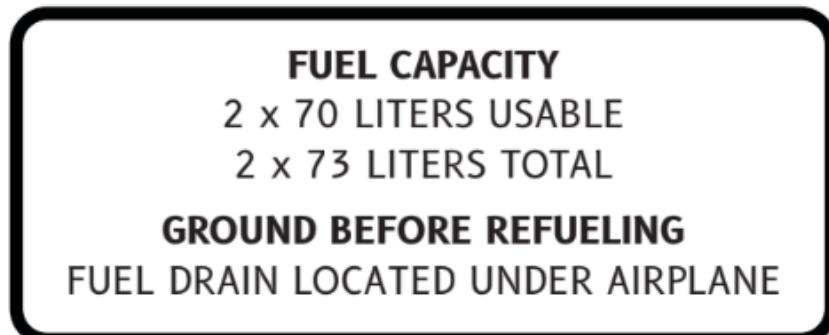
In between the trim
wheel and trim
indicator:



Left of the throttle:



Adjacent to the fuel filler caps:



**AVGAS 100LL OR UL91
OR MOGAS min RON 95**

On the cowl access door:



On the inboard upper wing flap surface:

NO STEP

On the elevator surface:

NO PUSH

At the static ports location:

**STATIC PORT
KEEP CLEAN**



At the jacks:

JACK ATTACH POINT

On the wheel fairings:

TIRE PRESSURE
NOSE-5.00x5.....2,2 BAR
MAIN-5.00x5.....3,4 BAR

S200 AFM



2 - LIMITATIONS

2.12 - LIMITATION PLACARDS

On a first fireproof metal plate attached to the aircraft:

MANUFACTURER – SONACA AIRCRAFT S.A.

MODEL – S201

SERIAL NO – MSNXXX

MANUFACTURED – MM/YYYY

On a second fireproof metal plate, placed immediately above or below the first plate:

A/C REG. No - AA-BBB

On the bottom of the rear fuselage a third fireproof metal plate is placed.

REGISTRATION

HOME BASE

OWNER

NOTE

The external crash plate content varies according to the
country of registration

3 EMERGENCY PROCEDURES

3.1 TABLE OF CONTENT

3.1	TABLE OF CONTENT	3-1
3.2	INTRODUCTION	3-2
3.3	ENGINE FAILURES	3-4
3.4	SMOKE AND FIRE.....	3-16
3.5	LANDING WITH DEFECTIVE TYRE	3-19
3.6	LANDING WITH DEFECTIVE BRAKES	3-19
3.7	RECOVERY FROM UNINTENTIONAL SPIN	3-20
3.8	PRECAUTIONARY LANDING	3-21
3.9	INSTRUMENT INDICATION OUTSIDE OF GREEN RANGE	3-22
3.10	OTHER EMERGENCIES.....	3-23

3.2 INTRODUCTION

3.2.1 GENERAL

Section 3 provides checklist and amplified procedures for coping with emergencies that may occur. Emergencies caused by aeroplanes or engine malfunction are extremely rare if proper pre-flight inspections and maintenance are practised. However, should an emergency arise, the procedures described in this section should be considered and applied as necessary to correct the problem.

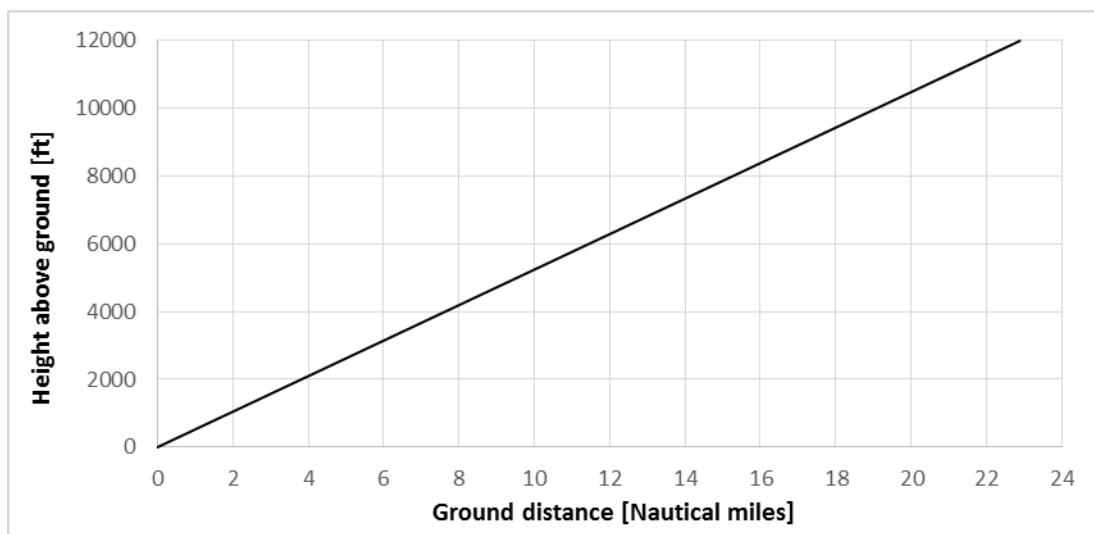
In case of emergency the pilot should remember the following priorities –

- 1 Keep control of and continue flying the aircraft.**
- 2 Analyse the situation.**
- 3 Apply applicable procedures.**
- 4 Inform air traffic control of the situation if time and conditions permit.**

3.2.2 AIRSPEED IN EMERGENCIES

SPEED		KIAS	REMARKS
V_{BG}	Best Glide Speed	65	The speed (Flaps fully retracted) which results in the greatest gliding (horizontal) distance.

Conditions:	Flaps	- retracted
	Airspeed	- $V_{BG} = 65$ KIAS
	Propeller	- wind milling propeller
	Wind	- zero



Horizontal distance travelled (still air) is approximately 1.9 Nmi (3.5 km) per 1000 ft (305 m) descent (i.e. glide ratio of 11.6 : 1).

3.3 ENGINE FAILURES

3.3.1 ENGINE FIRE / FAILURE DURING TAKE-OFF RUN

Aircraft on ground	- reject take-off
1. Throttle	- idle
2. Brakes	- apply as needed.

With airplane stopped –

3. Electric fuel pumps (both)	- off
4. Fuel selector valve	- off
5. Magnetos / ignition	- off
6. Radio communication as required.	
7. Master switches	- off
8. Parking brakes	- on
if required	- evacuate aircraft

WARNING

Do not open the cowlings.

If fire extinguisher is used, discharge in the air intakes after propeller stopped

NOTE

Fire extinguisher is located in baggage compartment behind right seat if required

3.3.2 ENGINE FIRE / FAILURE DURING TAKE-OFF CLIMB

1. Throttle position	- check Full Power
2. Main and Auxiliary fuel pumps	- check on
3. Fuel selector valve	- change to opposite tank
4. Turnkey position	- check both ignition channels on.

If engine does not provide enough power, otherwise go to 7

5. Perform emergency landing – refer to 3.3.4 EMERGENCY LANDING WITH ENGINE OFF

If engine continues to run irregularly but able to maintain 65 KIAS level flight

6. Cabin heat	- close.
7. Land as soon as practical.	
8. ELT (optional equipment)	- on

CAUTION

Minimum altitude recommended for short circuit in case of engine failure is 500 ft AGL

CAUTION

Maximum bank angle allowed with Flaps T/O at 65 KIAS is 40°. Failing to maintain this speed will lead to stall and/or spin.

3.3.3 ENGINE FAILURE IN FLIGHT

Engine failure or engine stopped:

1. Turnkey position	- check both ignition channels are on.
2. Throttle position	- check position (power as required).
3. Fuel selector valve	- change to opposite tank except if already empty
4. Auxiliary fuel pump	- on
5. Main fuel pump	- check circuit breaker pushed

NOTE

In case of Main fuel pump filter clogging, engine may run irregularly and shut down if Full Power is applied. In this case, reduce power lever to 65%

If engine did not restart –

6. Start gliding descent at flaps UP, 65 KIAS
7. Refer to 3.3.4 EMERGENCY LANDING WITH ENGINE OFF

3.3.4 EMERGENCY LANDING WITH ENGINE OFF

1. During descent glide
 - locate most suitable landing location, free of obstacles and preferably into wind.
 - if time and height permit, and if appropriate, attempt to identify reason for engine failure, correct and attempt a restart (see §3.3.6).
 - tighten harnesses
 - declare emergency on radio and report location

If re-start fails

2. Ignition
 - off
3. Fuel selector
 - shut off
4. Aux fuel pumps
 - off
5. Main fuel pump
 - pull circuit breaker

6. Navigate
 - join suitable landing area at or above 1500ft AGL
7. Speed
 - V_{BG} 65 KIAS.
8. Flaps
 - T/O setting
9. ELT (optional equipment)
 - on
10. Align for final approach
11. Flaps
 - as required (see note below)
12. Master switches
 - off before landing
13. Canopy
 - unlock before landing
14. Speed
 - land at normal flaps setting speed
15. Evacuate aircraft

NOTE

Flaps cannot operate without power on the main bus. Make final flap selection before turning master switch off.

11 sec are needed to re-boot the Flap System if the master switch has been turned on again, after being put off before the Flaps are in position.

3.3.5 LOW FUEL PRESSURE

EMS Low fuel pressure indication and RAL flashing and/or engine RPM fluctuation:

1. Throttle setting	- decrease to 65% max. (if possible)
2. Auxiliary fuel pump	- on
3. Fuel selector	- change to opposite (except if already empty)

If fuel pressure remains low

4. Expect Engine Failure in Flight – refer to 3.3.3 ENGINE FAILURE IN FLIGHT

NOTE

In case of Main fuel pump filter clogging, engine may run irregularly and shut down if Full Power is applied. In this case, power reduction to 65% will ensure fuel consumption rate below 20 L/h, even with clogged pump filter.

3.3.6 LOW OIL PRESSURE

1. Oil temperature - check

If oil temperature is high or increasing

2. Refer to 3.3.7 - HIGH OIL TEMPERATURE

Otherwise,

3. Throttle - reduce throttle to minimum for level flight
4. Land as soon as practical and remain vigilant for impending engine failure.

3.3.7 HIGH OIL TEMPERATURE

If oil temperature rises above 110°C,

1. Throttle - reduce below Max Continuous Power
2. Airspeed - increase
3. Oil Pressure - check

If Oil Temperature rises above 130°C,

4. Power - idle
5. Prepare for emergency landing – refer to 3.3.4 EMERGENCY LANDING WITH ENGINE OFF

3.3.8 ENGINE RESTART WITH AND WITHOUT WINDMILLING PROPELLER

WARNING

After engine fire, never attempt to re-start the engine!

NOTE

With engine off, the propeller may continue rotating down to about 60 KIAS. In such circumstances, do not use starter (step 6). If the propeller stops rotating, either use starter or increase airspeed up to 80 KIAS to windmill. An altitude loss of minimum 300 ft must be expected to accelerate from 60 to 80 KIAS and restart the engine.

NOTE

Priority should be given to flying the aircraft and selecting a suitable landing area before attempting any restart

1. Auxiliary fuel pump - on
2. Fuel selector - switch to unused / fullest tank.
3. Throttle - set to middle position.
4. Master switches - check on.
5. Magnetos / ignition - check both on.
6. Starter - engage if necessary (if no windmill)
7. Auxiliary fuel pump - off (after positive start).

If engine fails to restart or if height is insufficient

8. Proceed with an emergency landing with Power Off (§3.3.4)

3.3.9 DEFECTIVE ENGINE CONTROLS

NOTE

In case of throttle cable detached, the affected carburettor will run on Full Power, causing load imbalance between left and right cylinder banks and high vibrations

- Engine RPM increasing and high vibrations:

1. Throttle - Full Power

If vibrations stops -

2. Keep Full Power, select landing area
3. Once above landing area, go to step 4

If vibrations continue or increase –

4. Throttle - idle
5. Fuel selector - off
6. Main Fuel pumps - pull circuit breaker
7. Aux Fuel pump - off

8. Perform emergency landing – refer to 3.3.4 EMERGENCY LANDING WITH ENGINE OFF

- Throttle lever blocked or engine not responding to power inputs:

1. Throttle - keep current setting
2. Land as soon as practicable
3. Perform emergency landing on selected airfield – refer to 3.3.4 EMERGENCY LANDING WITH ENGINE OFF.

3.3.10 SUDDEN DROP IN ENGINE RPM AND MAP

Possible turbocharger failure, associated or not with TCU CAUTION light flashing:

1. Throttle : - reduce to minimum acceptable
2. Oil pressure : - monitor
3. Land as soon as practicable.

3.3.11 SUDDEN INCREASE IN ENGINE RPM AND MAP

Possible overboost of turbocharger, associated with TCU CAUTION light flashing:

1. Throttle : - reduce immediately down to RPM/MAP limits
2. Land as soon as practicable.

If Throttle is ineffective, refer to 3.3.9 DEFECTIVE ENGINE CONTROLS.

3.3.12 PERIODICAL RISE AND DROP IN ENGINE RPM AND MAP

Possible automatic regulation of the system due to airbox temperature limit

1. Carburettor heater - check pushed
2. Throttle - reduce to 65% or below if practicable to allow quicker cooling

If variations continue after more than 30 seconds,

3. TCU switch - off

4. Continue flight adjusting power regarding OAT conditions and monitor engine parameters

NOTE

Normal air intake turbo heat rise is between 15°C at idle and 50°C at Full Power at ISA conditions. Maximum airbox temperature before regulation is 88°C. Leaving carburettor heater on with high power settings or flying in elevated OAT can lead to reach quickly the airbox temperature limit.

3.3.13 EMS REMOTE ALERT LED INDICATION

The EDM 900 Remote Alert LED (RAL) will flash in orange and red color in case of:

- any primary parameter exceeding the red line
- low fuel, below 20 L total quantity
- any sensor disconnected

NOTE

Upon power up, the RAL shows Red and yellow indicating it is functional. Before each flight, confirm that it is functional. Non-functioning RAL must be repaired before flight.

Refer to section 7.9.7 ENGINE for more information on the engine instrument operation.

3.3.14 TCU CAUTION or WARNING LIGHT INDICATION

The Rotax TCU caution and warning lights will illuminate in following cases:

		Yellow Caution light	Red Warning light
Blinking	Cause	<ul style="list-style-type: none"> Indicates a failure of a sensor, sensor wiring, TCU, or leakage in the airbox Wastegate not fully 	<ul style="list-style-type: none"> The Full Power time limitation of 5 minutes is exceeded. The blinking disappears if the MAP is reduced below 36.9 in.Hg.
	Remedy	<ul style="list-style-type: none"> Reduce speed and MAP at least to maximum continuous limit. Limited flying operation, as boost pressure control may be unavailable or insufficient. 	<ul style="list-style-type: none"> Reduce speed and boost pressure at least to maximum continuous limit.
Permanently on	Cause	N/A	<ul style="list-style-type: none"> The max. admissible MAP is exceeded. The lamp illumination will be deactivated if the MAP is reduced under 45.7 in.Hg.
	Remedy		<ul style="list-style-type: none"> Reduce speed and MAP manually to be within the operating limits. Limited flying operation, as boost pressure control may be unavailable or insufficient.

NOTE

Any exceeding of the maximum admissible operating limits must be recorded by the pilot in the logbook, stating the duration, exact time and extent of the exceeding.

3.4 SMOKE AND FIRE**3.4.1 ENGINE FIRE**

1. Throttle - full power.
2. Fuel selector - close.
3. Auxiliary Fuel pump - off.
4. Cabin heat - close.
5. Main Fuel Pump - pull circuit Breaker
6. Fresh air venting vents) - open (except if smoke comes in via those
7. Ignition - switch off after the fuel in carburettors is consumed and engine has shut down.
8. Emergency landing - refer to 3.3.4 EMERGENCY LANDING WITH ENGINE OFF

WARNING

After engine fire, never attempt to re-start the engine!

NOTE

Estimated time to empty carburetors after pumps are stopped is 15 seconds

3.4.2 ELECTRICAL FIRE

An electrical fire is often characterized by white smoke and an acrid smell.

1. Master switches - BATT and ALT 2 off (see NOTE and WARNING below).
2. Cabin heat - close.
3. Fresh air venting - open
4. In level flight you could slightly or totally open the canopy to allow fresh air in (recommended max airspeed 100 KIAS – see note below)

See continued procedure on next page -

WARNING

The Engine Monitoring System, the radio and the transponder are not operational when the master switch is off.

NOTE

Engine will continue to run with Master switch off, as long as ignition is on, providing power is supplied to Main Fuel pump by the Alternator 1 or the Battery (see electrical system description in section 7.11).

NOTE

Flying with canopy open is forbidden in normal condition. In case of emergency, canopy can be open up to 100 kts. When opening, higher pull force than usual is required to slide backward the first 20 cm. Once open, it can be easily maintained in position and closed afterward.

5. Check Circuit Breaker panel - look for pulled breakers

WARNING

Never attempt to push an automatic pulled breaker after electrical fire !

CAUTION

If conditions and location allows, prefer landing as soon as possible instead of fire source identification

6. If the source of the electrical fire can be determined and electrical power can be removed from that system by isolating / switching the system off, do so :

7. All switches - off

8. ALT 2 switch - on

9. All switches - restore one by one, waiting 10 seconds minimum between each. Switch off bad circuit if smoke appears again.

10. BATT switch - on

11. Land as soon as practicable (with canopy closed)

NOTE

Battery power is restored at last to protect this source for final approach and landing

3.5 LANDING WITH DEFECTIVE TYRE

If aircraft veers off centreline during landing, expect main tyre depletion.

1. Apply rudder and/or brake action on opposite side
2. In case of runway excursion, refer to 3.3.1 ENGINE FIRE / FAILURE DURING TAKE-OFF RUN
3. If possible, vacate runway at low speed and stop the aircraft

If high vibrations at de-rotation, expect nose tyre depletion

1. Relieve weight on nose gear by applying back stick forces
2. If possible, vacate runway at low speed and stop the aircraft

3.6 LANDING WITH DEFECTIVE BRAKES

CAUTION

In case of inconsistent brake check on approach, expect increased landing ground roll distance.

If aircraft veers off when applying brakes,

1. Release brakes and apply rudder control to try to stay on runway
2. Apply smooth brake action on remaining brake as much as possible
3. In case of runway excursion, refer to 3.3.1 ENGINE FIRE / FAILURE DURING TAKE-OFF RUN

3.7 RECOVERY FROM UNINTENTIONAL SPIN**WARNING**

Intentional spins are prohibited!

1. Throttle - idle
2. Rudder pedals - full rudder in direction opposite to spin
3. Longitudinal control - forward
4. Lateral control - ailerons neutral

When rotation stops:

5. Rudder pedals - neutralize rudder immediately
6. Flaps - UP if applicable.
7. Lateral control - use as required to level wings
8. Longitudinal control - pull to level off avoiding stall warning

3.8 PRECAUTIONARY LANDING

A precautionary landing is generally carried out in cases where the pilot may be unable to continue the flight, the aircraft has no fuel reserve or possibly in bad weather conditions.

1. Choose landing area, determine wind direction.
2. Report your intention to land and the landing location via radio.
3. Perform a low altitude pass into wind, over the right-hand side of the selected area, with flaps extended as required and thoroughly inspect the landing area.
4. Perform a circuit pattern.
5. Perform normal approach and landing following procedures 4.4.12 and 4.4.14.
6. After stopping the aircraft switch off all switches, shut off the fuel selector, lock the aircraft and seek assistance.

NOTE

Keep the chosen area in sight during precautionary landing.

3.9 INSTRUMENT INDICATION OUTSIDE OF GREEN RANGE

Exceeding of max. admissible engine speed

- Reduce engine speed.
- Record the stating duration and extend of over speed in the logbook.

Exceeding of max. admissible coolant temperature

- In case of one Coolant or EGT values out of tolerance for a single cylinder, it may be the result of a loose sensor. The aircraft should be serviced.
- In case of several sensors indications in caution range:
 - Reduce engine power setting to the minimum necessary to maintain flight.
 - Carry out precautionary landing.

Oil temperature below 50°C

- Increase slowly engine power setting and reduce airspeed to reach Oil Temperature above 50°C.

3.10 OTHER EMERGENCIES

3.10.1 CARBURETTOR ICING

NOTE

Progressive engine power decrease and associated EGT increase is a possible carburettor icing evidence and may occur when flying in visible moisture and below +15°C OAT, especially at reduced power settings

To recover the engine power, the following procedure is recommended:

1. Carburettor heater
 - on (pull lever slowly to avoid thermal shocks)
2. Throttle
 - increase

If you fail to recover engine power, land at the nearest airfield (if possible) or, depending on the circumstances, perform a precautionary landing according to paragraph 3.8.

3.10.2 ELECTRICAL EQUIPMENT FAILURES**CAUTION**

Do not attempt to reset a tripped circuit breaker to avoid electrical fire

1. Verify if corresponding equipment is switched on and dimmer is appropriate
2. Verify if corresponding circuit breaker is pushed
3. Assess situation and check voltage and amperage
4. Refer to section 7.13 MINIMUM INSTRUMENTS AND EQUIPMENTS FOR FLIGHT for flight continuation

3.10.3 ALT 1 AND/OR 2 WARNING LIGHTS - ALTERNATOR FAILURE

Alternator failure is evidenced by the illumination of the ALT 1 and/or ALT2 charge warning light.

In the case of ALT 1 warning light illuminating:

1. Pitot switch (optional)	- switch off heated pitot (if weather condition permits)
2. Ammeter on EMS	- check for positive battery charge
3. Equipment switches	- reduce power consumption to ensure positive battery charge if required.

NOTE

Flight can be continued safely with ALT 1 inoperative, however power supply redundancy of Main Fuel Pump is not ensured anymore.

In this case, it is recommended to leave the Auxiliary Fuel Pump on throughout the flight.

In the case of ALT 2 warning light illuminating:

1. ALT 2 switch	- off for 10 seconds
2. ALT 2 switch	- on

If ALT 2 warning light stays on:

3. Switch off ALT 2 and other equipment to reduce power consumption to maximum 14 A – consult table on next pages for total load calculation.
4. Continue flight ensuring power consumption below 14 A in all cases. Ammeter on EMS should show positive charge.

If ALT 1 and ALT 2 warning lights illuminating:

1. Switch off Avionics 2 to reduce power consumption to maximum 14 A – consult table on next page for total load calculation (visible on EMS, should not be below -14A)
2. Restrict radio emission to minimum / only that which is absolutely necessary.
3. Consider switching off Avionics 1 switch to reduce current draw
4. Land as soon as practicable.

NOTE

Failure of both alternators / of the charge system will result in the main battery not being charged. The engine will stop running when the battery is depleted (about 30. min for a full battery). The engine will cease running due to fuel starvation when the battery is depleted.

NOTE

Consider applying Max Continuous Power to shorten time to destination

Electrical equipment and their associated current draw are listed in the table below. **In case of emergency, calculate total load and ensure maximum 14 A.**

Significant power consumers are highlighted in bold.

Component	Qty on board	Operating Current (A)
Radio (COM function)	1	0,6 (Reception) 4,2 (Emission)
Radio (NAV function)	1	0,6
VOR indicator	1	0,1
Model S Transponder	1	0,6 (Reception) 0,9 (Emission)
EMS	1	2
Turn & Slip indicator	1	0,4
Stall Warning device	1	2,3
Landing light	1	1,2
Taxi light	1	1,2
Nav. / position Lights	2	0,5 (1 total)
Strobe/ anti col Lights	2	1 (2 total)
Inst. Lights	1	1,4
Panel lights	1	0,2
Cabin Light	1	0,3
Dimmer switch	1	0,9
Flap controller	1	0,1
Flap motor	1	3
Fuel Pumps (Main)	1	1,7
Fuel Pumps (Aux)	1	1,7
Engine starter	1	75
	Total	

In the event of a **total loss of aircraft electrical power**, the following equipment will cease to operate:

- Engine
- EMS
- Radio
- Transponder
- Flaps actuator

3.10.4 SUSPICION OF CABIN CARBON MONOXIDE CONTAMINATION**CAUTION**

Carbon Monoxide is clear and does not have any particular smell. It is therefore not possible to detect it, except if aircraft is equipped with a CO detector indicating possible contamination.

In case of other abnormal smell or fumes in cabin, apply the same procedure

1. Cabin heat - close.
2. Fresh air venting - open
3. In level flight you could slightly or totally open the canopy to allow fresh air in (recommended max airspeed 100 kts)
4. Land as soon as practical (with canopy closed).

NOTE

Flying with canopy open is forbidden in normal condition. In case of emergency, canopy can be open up to 100 kts. When opening, higher pull force than usual is required to slide backward the first 20 cm. Once open, it can be easily maintained in position and closed afterward.

3.10.5 FAILURE OF FLAP OPERATING SYSTEM

In the case where flap indicator does not respond to flap lever switch:

1. Confirm flap position visually
2. Set back flap lever to actual position
3. Check Flaps Circuit Breaker **but do not reset if pulled**
4. Apply speed limitation corresponding to flap setting (see table below)

CAUTION

Cruising with flaps extended will result in increased drag and higher fuel consumption. Check fuel flow and evaluate remaining flight duration accordingly.

CAUTION

Aircraft speed will increase in descent with flaps retracted. Expect longer final during flaps up landing. Perform landing approach at idle power with flaps at UP or T/O.

CAUTION

Landing distances with flaps retracted are increased as indicated in table below.

Flap setting	UP	T/O	APP	LD
V_{FE} (KIAS)	N/A	105	95	85
Approach speed (KIAS)	65	63	57	55
Landing distance (15m obstacle)	585	560	495	475
Landing run	305	285	245	225

4 NORMAL PROCEDURES**4.1 TABLE OF CONTENT**

4.1 TABLE OF CONTENT	4-1
4.2 INTRODUCTION	4-2
4.3 AIRPSPEEDS FOR NORMAL OPERATING PROCEDURES	4-2
4.4 CHECKLISTS FOR NORMAL OPERATING PROCEDURES.....	4-3
4.5 HIGH ALTITUDE OPERATION.....	4-33
4.6 STALL BEHAVIOUR.....	4-33
4.7 ENGINE FAILURE TRAINING	4-34

4.2 INTRODUCTION

Section 4 provides checklist and amplified procedures for conducting of normal operation. Normal procedures associated with optional systems can be found in Section 9.

4.3 AIRPSPEEDS FOR NORMAL OPERATING PROCEDURES

Unless otherwise specified, the following speeds are based on a maximum weight of 750 kg.

SPEED		KIAS	REMARKS
V_x	Best Angle of Climb Speed	65	The speed (at MTOW, flaps fully retracted) which results in the greatest altitude gain over a given horizontal distance (i.e. largest climb angle).
V_y	Best Rate of Climb Speed	70	The speed (at MTOW, flaps fully retracted) which results in the greatest altitude gain over a given time period.
V_{LOF}	Lift-off Speed	55	The speed at which the aircraft lifts off the ground during take-off.
	Approach speed - long finals	65	Approach speed for normal landing with flaps fully extended.
V_{REF}	Approach speed – short finals	55	Approach speed for normal landing with flaps fully extended and maintained down to the 15 m (50 ft) height.

4.4 CHECKLISTS FOR NORMAL OPERATING PROCEDURES

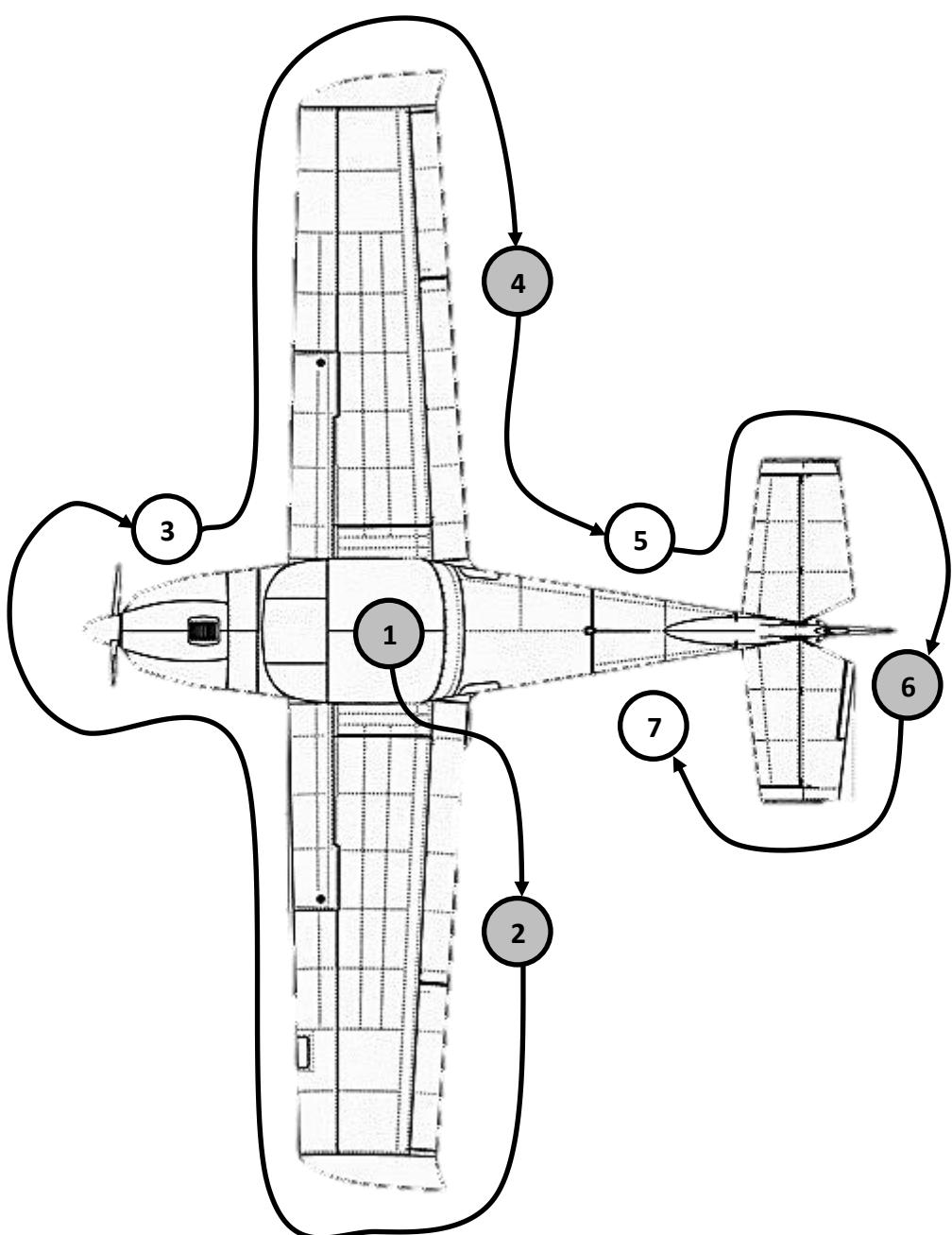
4.4.1 PRE-FLIGHT INSPECTION

Carry out the pre-flight inspection prior flying. Pre-flight inspections must also be performed after any “on the field” maintenance activities. Incomplete or careless inspection can result in an accident. Carry out the inspection following the instructions in the Inspection Check List.

NOTE

The word “condition” in the instructions means a visual inspection of surface for cracks, damage deformations, scratching, chafing, corrosion or other damages, which may lead to flight safety degradation.

The next page presents the steps to inspect the S200 before flight. Then, the following pages list inspection points to perform at each step.



1. Cabin

- Ignition - off
- Fuel selector valve - switch to A or B tank
- Master switches - on
- Fuel level indicator - verify fuel quantity
- Fuel selector valve - switch to fullest tank
- Internal Lights - on – Check inside - off
- Navigation Lights - on – Check outside - off
- Strobe lights - on – Check outside - off
- Flaps - move to LD setting
- Master switches - off
- Avionics - verify condition
- Control System - visual inspection,
- free movement up to stops,
- no abnormal play in stick
- Brakes - push on both pedals and engage parking brake
- check for no leaks in the cockpit
- Canopy - attachment condition, clean
- Cockpit - check for loose objects
- Fire extinguisher - verify presence, correct support attachment, safety pin in place and pressure in green range
- Hammer - verify presence and correct attachment
- Documentation - verify presence of last approved version of applicable documents (AFM and other documents in accordance with National Regulations).

2. Left Wing and Main Gear

- Chocks & Ropes - remove
- Wheel fairing - check attachments and no cracks
- Wheel and brakes - check fluid leaks, tyre inflation and wear
- Wheel strut - general condition, no cracks
- Wing trailing edge - check condition
- Aileron - check freedom of movement,
- check surface condition
- Aileron attachments and hinges, control horn, bolts, pushrod
- check free motion and condition
- Flap hinges, control horn, bolts, and pushrod
- check free motion and condition
- Wing tip - check condition
- Strobe/Nav light and lens - check for condition
- Pitot tube - security, unobstructed, remove cover
- Leading edge condition - check OK (no deformations, no cracks)
- Taxi / landing lights and lens - check for cracks and condition.
- Fuel level - open fuel cap and check fuel level
- Fuel vent (underside of wing) - unobstructed
- Access Hatches (underside of wing) - present and properly closed
- Fuel drain - drain for min. 2 sec

WARNING

Visually verify the fuel level before each flight to make sure you have sufficient fuel and update EMS. Fuel level can be evaluated through the filler cap – refer to section 7.10.6 FUEL QUANTITY INDICATION AND EVALUATION.

3. Nose Section and Nose Gear

Refer to Section 7.9 for systems description and location in engine bay.

- Cowling access doors (LH then RH) - rotate fasteners to open
- Through LH access door:
 - Visual inspection of fuel system - general check and no leaks.
 - Visual inspection of electrical system - general check
 - Carburettor control cables - check throttle and chock cables securely tightened
 - Check Engine mount and exhaust manifold condition
 - Check for visible oil leaks
- Engine cowling condition - check
- Propeller and spinner condition - check
- Radiators and circuits (Oil / Water) - check for leaks or dirt
- Air intakes - check
- Gascolator - drain
- Through RH access door:
 - Repeat same checks as for LH door, plus:
 - Coolant overflow bottle - check level in the overflow bottle, replenish as required
 - Open oil tank
 - Slowly rotate propeller in normal engine direction until gurgling noise is heard. Always handle the propeller blade area with the palm of the hand, do not grasp only the blade edge with your fingers. Make sure no resistance point other than engine compression are observed during rotation.

- Check Oil level above 50% before long flight, replenish as required. Do not exceed the Max. level.
- Close oil tank with cap
- Close access doors (LH then RH)
 - rotate fasteners in airstream direction to close. Check secured.
- Tyre
 - condition, inflation, wear.
- Wheels
 - security, general condition.
- Wheel fairing
 - check attachments and no cracks
- Wheel strut
 - general condition, no cracks
- Chocks and tie-down ropes
 - remove
- Suspension and undercarriage
 - test by gently pulling downward on propeller blades root

4. Right Wing and Main Gear

- Leading edge condition
 - check OK (no deformations, no cracks).-
- Fuel drain
 - drain for min. 2 sec
- Fuel level
 - open fuel cap and check fuel level
- Fuel vent (underside of wing)
 - unobstructed.
- Access Hatches (underside of wing)
 - present and properly closed
- Stall Warning Device
 - check OK (free tab movement)
- Taxi / landing lights and lens
 - check for cracks and condition.
- Wing tip
 - check condition.
- Strobe/Nav light and lens
 - check for condition.
- Wing trailing edge
 - check condition.
- Aileron
 - check freedom of movement,
 - check surface condition.
- Aileron attachments and hinges, control horn, bolts, pushrod
 - check free motion and condition.
- Flap hinges, control horn, bolts, and pushrod
 - check free motion and condition.
- Chocks & Ropes
 - Remove
- Wheel fairing
 - check attachments and no cracks.
- Wheel and brakes
 - check fluid leaks, tyre inflation and wear.
- Wheel strut
 - general condition, no cracks.

WARNING

Visually verify the fuel level before each flight to make sure you have sufficient fuel and update EMS.. Fuel level can be evaluated through the filler cap – refer to section 7.10.6 FUEL QUANTITY INDICATION AND EVALUATION.

5. Right Fuselage

- Access Hatches (underside of cabin) present and properly closed
- Surface condition - check
- Wing/fuselage fairings - check
- Access doors under rear fuselage - closed
- Static Port - unobstructed and clean
- Antenna/e - check condition and attachments.
- Empennage fairing - check

6. Empennage

- Tie-down rope
- Antenna/e
- Horizontal and vertical stabilizers
- Hinges, control horns, bolts, pushrods
- Elevator
- Tab
- Rudder
- removed.
- check condition and attachments.
- check condition
- check free motion and condition
- check for free movement and condition
- check for secure attachment and condition.
- check for secure attachment and condition.

7. Left Fuselage

- Empennage fairings - check
- Surface condition - check
- Antenna/e - check condition and attachments.
- Access doors under rear fuselage - closed
- Static Port - unobstructed and clean
- Wing/fuselage fairings - check

4.4.2 BEFORE START

Strobe and navigation lights should be used as an indicator / warning of imminent engine start (i.e. switch on the strobe before starting the engine).

1. Pre-flight inspection	- completed
2. Weight and Balance	- calculated and within range (see chap.6)
3. Emergency equipment	- on board
4. Passenger	- briefed
5. Seats, seatbelt and harnesses	- adjust and secure
6. Brakes	- parking brake on
7. Throttle	- free movement on full actuation range
8. Canopy	- closed and latched (not mandatory)
9. TCU switch	- always on (refer to 9.3)

4.4.3 AVIONICS START-UP

1. Fuel selector - check on fullest tank
2. Master switches - on.
3. Warning lights function test - check TCU and RAL illuminate for 1-2 sec when the Master Switch is triggered, then extinguish.
- push on all lights to test and open dimmer
4. EMS
 - wait for start-up and all indications are on
 - verify indicated fuel tank levels are in accordance with visual checks during pre-flight inspection.
 - verify “REM” fuel parameter is in line with fuel tank level, correct using “Refuel” function if required. Refer to section 7.9.7.
 - **reset fuel used** - see Caution below
5. Strobe lights - on

CAUTION

Always check EMS fuel level indication before flight and compare with visual level checked during pre-flight inspection.

Always reset fuel used and adjust fuel quantity on board before each flight, as the remaining fuel function is the most accurate way for fuel management (especially when the aircraft is not in level flight).

Failing to do so might result in shortage of fuel in flight.

4.4.4 STARTING THE ENGINE

1. Choke - pull for cold start only (engine at ambient T°)
2. Throttle - idle if choke used,
- 1cm max forward from idle if choke is not used
3. Magneto / ignition switches - on (Both)
4. Propeller area - clear of people and obstructions
5. Starter - engage, maximum 10 seconds with no interruption. Wait 2 min for next attempt if start fails. See Caution below.

Immediately after engine start-up:

6. Throttle - adjust for smooth running at 2000 rpm.
7. Oil pressure - check if in green range within 10 seconds.
8. EMS - verify battery charging
9. Choke (cold engine) - if used, gradually release
10. Avionics switches (both) - on.
11. Warm engine - 2000 rpm for 2 minutes, then 2500 rpm until oil temp is 50 °C.

WARNING

Do not operate the aircraft if any deficiency shows up. Refer to Maintenance Manual for corrective actions.

NOTE

Alternator 1 does not charge the battery below 3000 RPM. ALT 2 Master Switch must be on during warm-up and taxiing to ensure positive charge and prevent battery depletion.

CAUTION

- The starter should be activated for a maximum of 10 seconds, followed by 2 minute pause to allow the starter to cool.
- Increase the engine RPM only if oil pressure is steady above 29 psi (2 bar). At an engine start with low oil temperature continue to watch the oil pressure as it could drop again due to the increased resistance in the suction line. Increase engine rpm only as required to keep oil pressure steady. Refer to section 2.5.1 for RPM, Pressure and Temperature limitations.
- To avoid shocks in the gearbox, start the engine with the throttle lever set to idle if Choke is used, or 10% open at maximum when engine is already warm (Oil Temperature above 40°C), then wait 3 seconds for engine to reach constant speed before accelerating engine rpm.

NOTE

It is good practice to test the correct operation of Aux Fuel pump by switching it on, pulling the CB of the Main Fuel pump and checking Fuel Flow. Refer to section **Erreur ! Source du renvoi introuvable.** for fuel flow information.

After performing this check, return to normal configuration (Main Fuel pump)

4.4.5 TAXIING

Taxi lights should be used as an aid to enhancing the aircraft's visibility to other traffic or pedestrians.

1. Fuel selector	- switch tank (to emptiest tank)
2. Flaps	- UP setting
3. Brakes pedals	- push both pedals during parking brake release
4. Parking brake valve	- off
- carefully verify that the brakes are released and wheels are free to rotate	
5. Controls	- neutral position, or as required for wind
6. Power and brakes	- as required
7. Brakes	- check
8. Instruments	- check

Apply power and brakes as needed.

Apply brakes to control movement on ground.

Taxi carefully when wind velocity exceeds 15 knots. Hold the control stick in neutral position or as required, using conventional techniques.

CAUTION

Failing to apply pressure on brake pedals while releasing the parking brake valve might result in calipers sticking and brakes overheat. Always apply pressure before and during releasing the valve.

CAUTION

Taxiing with canopy open is allowed. Maintain canopy with hand or elbow during taxi to prevent unintentional forward slide that could injure the pilot or passenger.

4.4.6 ENGINE CHECK BEFORE TAKE OFF**CAUTION**

Always ensure Oil Temperature above 50°C before increasing engine speed above 2500 RPM

CAUTION

The engine check should be performed with the aircraft heading upwind and not on loose terrain (the propeller may suck grit which can damage the leading edges of blades).

1. Align aircraft against wind on an appropriate location (usually near or at runway holding point).
2. Brake pedals - push both pedals to apply brakes
3. Parking Brake - on
4. Canopy - closed and latched
5. Fuel quantity - confirm OK
6. Fuel selector - fullest tank
7. Choke - off
8. Carburettor heater - off
9. Auxiliary Fuel Pump - on
10. Ignition Switch - both circuits
11. Throttle - adjusted for 4000 RPM
12. Switch to Magneto L - check RPM drop < 500RPM
13. Ignition Switch - both circuits
14. Switch to Magneto R - check RPM drop < 500RPM
15. Ignition Switch - both circuits

NOTE

Only one ignition circuit (at a time) should be switched on/off during ignition/magneto check.

NOTE

The maximum difference between both drops may not exceed 150 RPM.

16. Carburettor heater - on
 - check engine speed drop 50-80 RPM after 5sec
17. Carburettor heater - off
18. Fuel Pressure - check within green range
19. Auxiliary Fuel Pump - off
20. Fuel Pressure - check within green range
21. Auxiliary Fuel Pump - on
22. Vacuum pressure - check within green range
23. Throttle - Max Continuous Power
24. Throttle - Full Power
25. Check engine parameters:
 - RPM stabilized around 5200 RPM (typical value for no wind, ISA condition)
 - all Pressures and Temperatures within green ranges
 - no abnormal vibrations
26. Reduce Power to idle – If Oil Temperature above 100°C, cool down shortly the engine at 3000 RPM before Take-Off procedure.

4.4.7 BEFORE LINE UP

1. Controls - verify full and free movement, directions.
2. Ignition Switch - check on both circuits
3. Switches - verify, as required.
4. Auxiliary fuel pump - check on.
5. Instruments - verify all.
6. Altimeter - set QNH / QFE.
7. Engine parameters - verify temperatures, pressures, current/voltage
8. Fuel quantity - confirm as required.
9. Circuit breakers - all in.
10. Flaps - T/O setting
11. Fuel selector - check on fullest tank.
12. Trim - T/O setting
13. Canopy - check closed and latched.
14. Safety harnesses - on and tight.

CAUTION

If carburetor heater is on, close carburetor heater before setting Full Power.

4.4.8 TAKE-OFF

CAUTION

Ensure that engine oil temperature is above 50 °C prior to take off.

1. Brakes	- apply pressure on pedals (parking brake off)
2. Throttle	- Maximum Continuous Power
3. Engine RPM	- verify (min. 4700 RPM).
4. Brakes	- release
3. Instruments within limits	- verify.
4. Throttle	- when airspeed active, apply Full Power
5. Engine RPM	- verify (min. 5000 RPM).
6. Take off	- rotate at $V_{LOF} = 55$ KIAS, accelerate and climb to reach 63 KIAS at height of 50 ft AGL
7. Flaps	- UP setting above 300 ft AGL, at min. 65 KIAS.
9. Auxiliary fuel pump	- off above 300 ft AGL.
10. Brakes	- apply briefly brakes to stop wheel rotation.
11. Transition to climb.	

WARNING

Take-off is prohibited if:

The engine is running unsteadily or intermittently.

The engine parameters (instrument indications) are outside operational limits.

Full Power setting: 5800 RPM maximum, for maximum 5 minutes

Max Continuous power setting: 5500 RPM maximum

Refer to section 3.3.14 for information on warning light illumination in case of exceeding 5 minutes at Full Power.

4.4.9 CLIMB

1. Throttle
 - Full Power,
5 800 rpm (for maximum 5 minutes).
 - Maximum Continuous Power,
5 500 rpm.
2. Airspeed
 - $V_{Y,0^\circ} = 68$ KIAS $V_{X,0^\circ} = 65$ KIAS
 - $V_{Y,10^\circ} = 63$ KIAS $V_{X,10^\circ} = 63$ KIAS
3. Trim
 - as required.
4. Instruments - verify:
 - Oil temperature and pressure.
 - Coolant temperature within limits.

CAUTION

If the coolant temperature or oil temperature approach their limits, reduce the climb angle to increase airspeed and thus fulfill the limits.

WARNING

Fuel level indication on EMS is only accurate when aircraft is in level flight attitude. During climb, there is less fuel than indicated and during descent there is more fuel than indicated.

Always check fuel level before initiating a climb / descent to ensure sufficient fuel reserve up to landing.

4.4.10 CRUISE

Refer to section 5 for recommended cruising speeds.

WARNING

Avoid using a tank below 3 L as engine stoppage will result. When one tank is empty, or close to empty, the fuel selector valve should be switched to the fullest tank.

4.4.11 DESCENT

Adjust power to get the desired slope – typical cruise descent parameters are:

1. Speed - 110 KIAS
2. Descent rate - -600 ft/min
3. Throttle - adjust to about 65% power to keep speed constant
4. Carburettor Heater - on if required - Refer to 4.4.21 for carburettor heater operation.

Check engine temperature for cooling – **see Caution hereunder**.

Expect fuel consumption of about 17 L/h during cruise descent.

WARNING

Fuel level indication on EMS is only accurate when aircraft is in level flight attitude. During climb, there is less fuel than indicated and during descent there is more fuel than indicated.

Always check fuel level before initiating a climb / descent to ensure sufficient fuel reserve up to landing.

CAUTION

During descent, do not allow Oil Temperature to decrease below 50°C. If necessary, apply power accordingly.

If required, increase throttle and perform a short level flight to increase temperature.

4.4.12 APPROACH

Proceed with circuit pattern in accordance with the selected airfield procedure.

1. Auxiliary fuel pump - on
2. Landing light - on
3. Carburettor Heater - on if required (refer to section 4.4.21)
4. Speed and Flaps settings (sequentially):

Flaps setting	Speed
UP	Descent speed -> 105 KIAS
T/O	105 -> 95 KIAS
APP	95 -> 85 KIAS

5. Trim position - as required
6. Fuel selector - fullest tank
7. Parking brake valve - check off
8. Brake - check symmetrical pressure on pedals

CAUTION

During traffic pattern, EMS Remaining Fuel is the most accurate indication. Crosschecking with fuel gages will be performed only if the aircraft is in level flight for more than 2 minutes (see section 7.10.6).

Ensure sufficient reserve in case of go-around.

4.4.13 ON FINAL

1. Flaps - LD setting
2. Approach speed - 65 to 55 KIAS
3. Throttle - as required to achieve 3° slope
(approx. 2800 RPM)

4.4.14 LANDING

1. Speed on final - $V_{REF} = 55$ KIAS at 50 ft AGL
2. Throttle - reduce to idle at approx. 50 KIAS
3. Nose wheel - gently lower to ground
4. Apply brakes - as required

4.4.15 GO-AROUND

1. Aircraft attitude	- transition to level
2. Throttle	- Full Power (max. 5800 RPM for max. 5 min.)
3. Carburettor heater	- push to close if open
4. Wing flaps	- retract to T/O as soon as possible and UP when reaching 65 knots (at 300 ft minimum height)
5. Airspeed	- $V_x = 65$ KIAS
6. Trim	- as required
7. Auxiliary fuel pump	- off (300 ft minimum)
8. Landing light	- off
9. EMS Remaining fuel	- check for sufficient quantity

4.4.16 AFTER LANDING

1. Vacate runway
2. Engine speed - set as required for taxi
3. Wing flaps - UP setting
4. Throttle - reduce during taxi to ensure max. 2500 RPM if Oil Temperature below 50°C

CAUTION

Taxi with reduced speed on soft grass or uneven airfields to avoid propeller ground strike.

4.4.17 ENGINE SHUT-DOWN

1. Throttle - idle
2. Instruments - engine parameters within limits.
3. Avionics 1 and 2 switches - off
4. Aux fuel pump - off

Wait for minimum 2 minutes between throttle setting reduction and ignition switch off to allow engine to cool down.

5. Ignition - off
6. All electrical systems switches - off
7. Master switches - off
8. Fuel selector - off

CAUTION

Under normal conditions the engine temperatures stabilize during descent, landing and taxi at values suitable to stop the engine.

If necessary, cool for minimum 2 minutes the engine at idle to stabilize the temperatures prior to engine shut down.

4.4.18 POST-FLIGHT

1. Site - if possible park the aircraft on level area
2. Ignition - off
3. Master switch - check off
4. Fuel selector - off
5. Parking brake - use as necessary, only for short-period parking (below one day)
6. Wheel chocks - use as necessary, for long-term parking (above one day)
7. Secure the airplane (refer to section 8.5.5 for more information)
 - Move control stick rearward and secure it together with the seat belt bottom laps
 - Use the anchor eyes on the wings and fuselage rear section to secure the airplane to the ground
8. Canopy - close, lock as necessary

4.4.19 FLIGHT IN RAIN

No particular precautions are required when flying in rain.

VMC should be maintained at all time. Avoid negative outside temperatures.

Use Carburettor Heater if required (refer to section 4.4.21).

4.4.20 NIGHT FLIGHT

When flying in low luminosity or by night:

1. Instrument lights switch - on
2. Instrument lights dimmer - turn to dim as required
3. Instrument panel dimmer - turn to switch on and dim as required
4. Rear red cabin light - turn on to illuminate cabin and panel as required
5. EMS display - dim as required using automatic dimming function or manual controls – refer to section 7.9.7

NOTE

The rear red cabin light can be turned on / off using the switch located immediately next to the light. The luminosity of the light can be adjusted using the instrument panel dimmer.

NOTE

When using the rear red cabin light, the EMS display automatic dimming may not reduce luminosity enough for required light condition. In this case, use manual display dimming controls to reduce luminosity - refer to section 7.9.7.

4.4.21 FLIGHT IN COLD AND MOIST CONDITION

If flying into humid area with Dew Point close to 0°C OAT, engine is warmed up with carburettor heater on full position.

Select appropriate carburettor heater control position according to flight conditions:

Take off, Climb and Go-Around	- carburettor heater off - pitot heat on (optional equipment)
Flight	- carburettor heater on (open slowly to avoid thermal shock) - pitot heat on (optional equipment)
Descent, Approach, Landing	- carburettor heater on - pitot heat on (optional equipment)
After Landing	- pitot heat off (optional equipment)

CAUTION

Always close carburettor heater during operation at maximum continuous power or above. Failing to do so might damage the engine.

CAUTION

Carburettor heater should be used either fully open (pulled) or fully closed (pushed). Do not use intermediate position.

4.4.22 REFUELING

The aircraft must be connected to a ground bonding point before refuelling.

On the Sonaca S200, the electrical bonding is done on the exhaust pipe.

When refuelling with portable tanks, always use a funnel with incorporated fine filter. One exemplary is furnished with the aircraft.

WARNING

In case of suspicion of dust or dirt in fuel, do not refuel the aircraft.

NOTE

The operator of the aircraft must select a standard operating fuel and establish its Approved Maintenance Program in accordance with the selected fuel. When refueling with a fuel type different than the selected standard, it is good practice to record it in the aircraft logbook for traceability and the maintenance schedule must be adapted if required.

4.5 HIGH ALTITUDE OPERATION

Not covered in basic S200 configuration. Refer to limitations section 2.11.1.

4.6 STALL BEHAVIOUR

Refer to Section 5.3.4 for stall behaviour information.

4.7 ENGINE FAILURE TRAINING

1. Navigate - start above landing area at 1500ft AGL
2. Throttle - reduce to idle
3. Speed - V_{BG} 65 KIAS
4. Flaps - T/O setting
5. Oil Temperature - check, apply power if required (see note below)
6. Align for final approach - adjust landing pattern in order to be at an adequate height above the landing spot during approach
7. Flaps - as required
8. Speed - approach between 55 - 60 KIAS (as required to maintain desired glideslope and depending on flaps setting)
9. Gently touch-down on main wheels at 55 KIAS
10. Nose wheel - maintain above ground using elevator control until airspeed below 50 KIAS, then gently lower to ground
11. Apply brakes - as required

NOTE

During descent, do not allow Oil Temperature to decrease below 50°C. If necessary, apply power accordingly.

5 PERFORMANCE

5.1 TABLE OF CONTENT

5.1 TABLE OF CONTENT	5-1
5.2 INTRODUCTION	5-2
5.3 PERFORMANCE TABLES AND DIAGRAMS.....	5-3

5.2 INTRODUCTION

Section 5 provides approved data for airspeed calibration, stall speeds and take-off performance and non-approved additional information.

The data in the charts has been computed from actual flight tests with the aeroplane and engine in good condition and using average piloting techniques.

If not stated otherwise, the performance stated in this section is valid for maximum take-off weight (750 kg) and under ISA conditions, canopy closed, landing gear fairing installed.

5.3 PERFORMANCE TABLES AND DIAGRAMS

5.3.1 AIRSPEED CALIBRATION

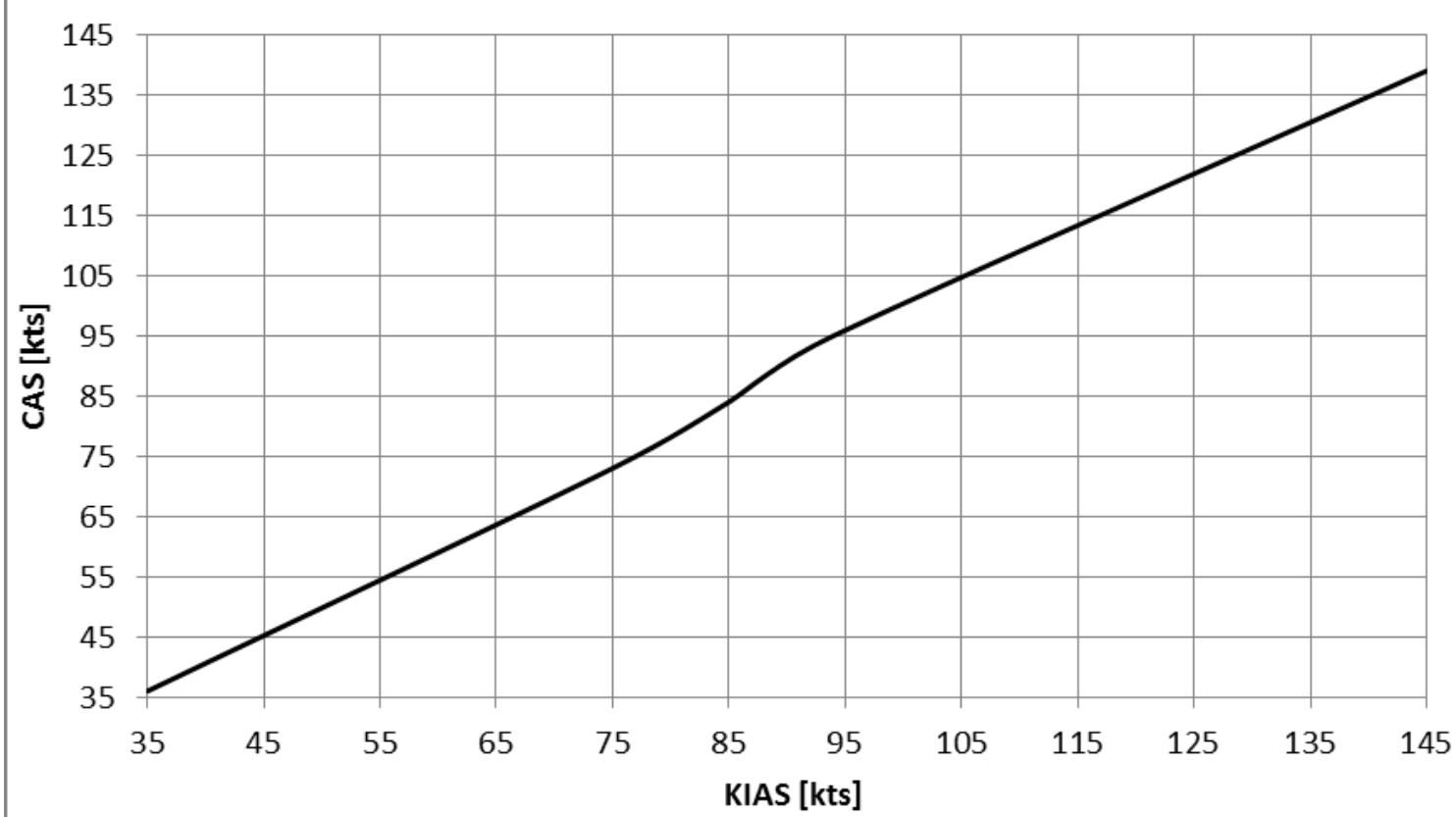
The data present Calibrated Airspeed (CAS) versus Indicated Airspeed (IAS) assuming zero instrument error. The calibration is applicable for all flaps settings.

KIAS [kts]	CAS [kts]	KIAS [kts]	CAS [kts]
43	40	96	95
47	45	100	100
52	50	105	105
57	55	110	110
62	60	115	115
66	65	120	120
71	70	125	125
76	75	131	130
81	80	136	135
86	85	141	140
91	90	146	145

S200 AFM



5 - PERFORMANCE
5.3 - PERFORMANCE TABLES
AND DIAGRAMS



23/07/2019

Rev. : C

SONAIR-S2-D-MAN-001

Page : 5-0

5.3.2 ENGINE PERFORMANCE

MAXIMUM CONTINUOUS POWER [kW] (Approx. 5500 RPM)

Standard Atmosphere			Delta temperature with standard temperature [°C]																	
Hp	T (°F)	T(°C)	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35	
-2000	66	19	88	86	85	83	81	80	78	77	76	74	73	72	71	70	69	67	66	
0	59	15	87	85	84	82	80	79	78	76	75	74	72	71	70	69	68	67	66	
2000	52	11	87	85	83	81	80	78	77	76	74	73	72	70	69	68	67	66	65	
4000	45	7	86	84	82	81	79	78	76	75	73	72	71	70	68	67	66	65	64	
6000	38	3	85	83	82	80	78	77	75	74	73	71	70	69	68	66	65	64	63	
8000	30	-1	84	82	81	79	77	76	74	73	72	70	69	68	67	66	64	63	62	
10000	23	-5	83	81	80	78	76	75	73	72	71	69	68	67	66	65	63	62	61	
12000	16	-9	82	80	79	77	75	74	72	71	70	68	67	66	65	64	62	61	60	
14000	9	-13	81	79	78	76	74	73	71	70	68	67	66	65	63	61	60	59	59	
16000	2	-17	80	78	77	75	73	72	70	69	67	66	65	64	62	60	59	58		

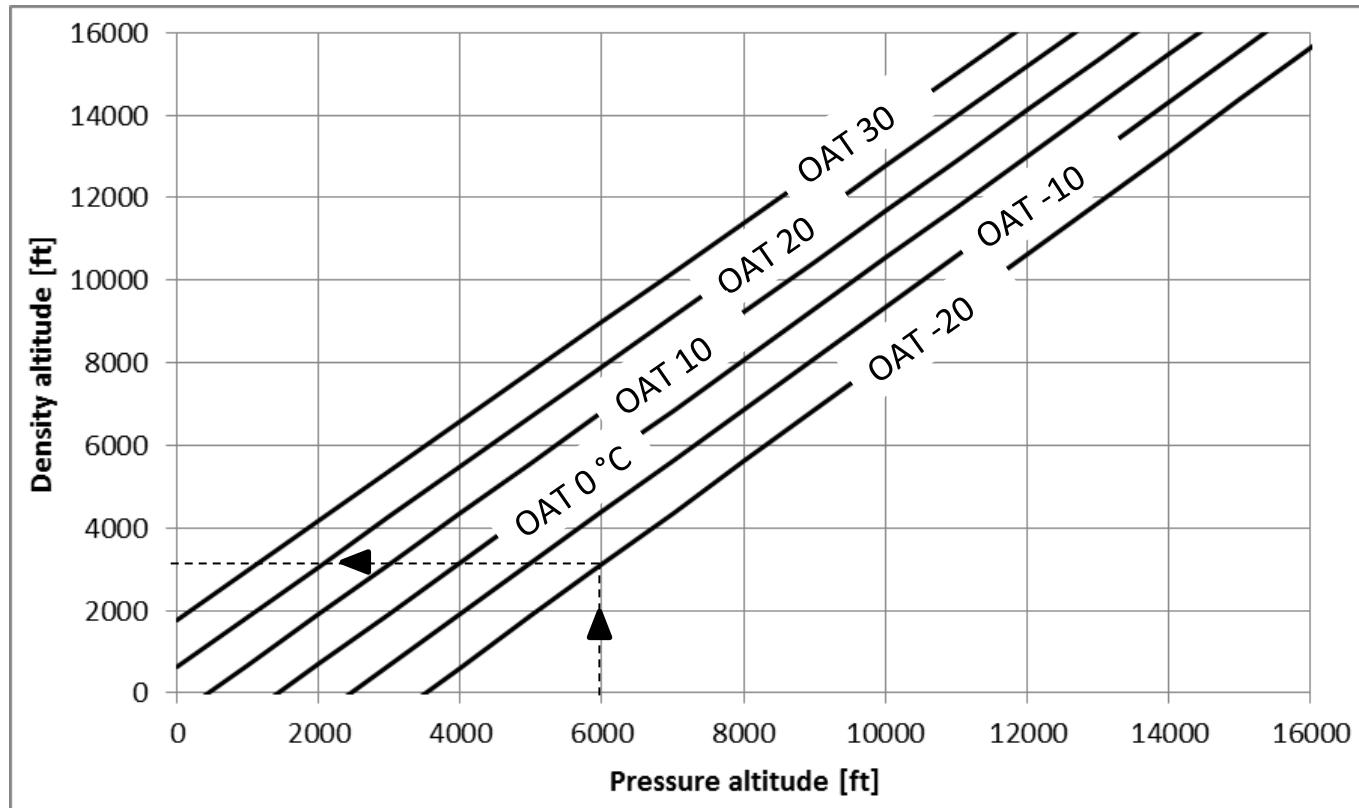
MAXIMUM TAKE OFF POWER [kW] (Approx. 5800 RPM)

Standard Atmosphere			Delta temperature with standard temperature [°C]																		
Hp	T (°F)	T (°C)	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35		
-2000	66	19	101	99	97	95	94	92	90	89	87	86	84	83	81	80	79	78	76		
0	59	15	100	98	96	94	93	91	89	88	86	85	83	82	80	79	78	77	75		
2000	52	11	99	97	95	93	92	90	88	87	85	84	82	81	79	78	77	76	74		
4000	45	7	98	96	94	92	91	89	87	86	84	83	81	80	78	77	76	75	73		
6000	38	3	97	95	93	91	90	88	86	85	83	81	80	79	77	76	75	74	72		
8000	30	-1	96	94	92	90	88	87	85	83	82	80	79	78	76	75	74	73	71		

According to the above tables, the correction at all altitudes is approximately :

- -5% for an increase of temperature of 15°C with respect to ISA temperature, and
- -10% for an increase of temperature of 30°C with respect to ISA temperatures.
- +5% for a decrease of temperature of 15°C with respect to ISA temperature, and
- +10% for a decrease of temperature of 30°C with respect to ISA temperatures.

Source : Rotax Operator's Manual, Ref. OM-914

5.3.3 PRESSURE ALTITUDE - DENSITY ALTITUDE

5.3.4 STALL SPEEDS

Conditions:	Weight	- 750 kg
	Flight	- straight and level flight (non-turning) - load factor of 1 g.
	Engine	- idle

Bank angle [°]	Load factor [-]	Vs : Stall speed [kts]							
		Flaps UP		Flaps T/O		Flaps APP		Flaps LD	
		KIAS	CAS	KIAS	CAS	KIAS	CAS	KIAS	CAS
0	1.00	51	49	50	47	45	42	44	41
15	1.04	52	50	51	48	45	43	45	42
30	1.15	55	53	53	51	48	45	47	44
45	1.41	60	58	58	56	52	50	51	49
60	2.00	70	69	68	67	61	59	60	58

When approaching stall speed, the aircraft will start gently buffeting.

If airspeed is further reduced, the aircraft will lose lift which results in a stalls.

Depending on CG, the aircraft nose may not drop until elevator control input is applied forward to decrease angle of attack and regain speed.

Following altitude loss can be expected during a wing level stall:

Power setting	Altitude loss
Idle	250 ft
75 %	450 ft

These values are valid for all flaps settings and for any weight & balance configuration within the approved limits.

CAUTION

Always maintain the aircraft in straight flight (no slip) using gentle rudder and ailerons control inputs during stall. Failing to do so will result in spin.

The aircraft nose is off-centered by 3° from the aircraft centerline. Use Turn and Slip indicator to maintain straight flight during stall.

5.3.5 WIND COMPONENTS

The maximum demonstrated cross wind component for take-off and landing is:

19 kts

5.3.6 TAKE-OFF

Conditions:	Flaps	- T/O setting
	Power	- Full Power
	Airspeed	- rotate at $V_{LOF} = 55$ KIAS
	Wind	- zero

Surface	Take-off run	Take-off distance
		15m (50 ft) obstacle
Concrete	325 m	470 m
Grass	Apply following multiplying factors to distance on concrete surface: Dry grass : 1.2 Wet grass : 1.3	

NOTE

The following factors are to be applied to the computed take-off distance for the noted condition:

- Headwind; Subtract 6 m (20 ft) from table distances for each knot headwind.
- Tailwind; Add 24 m (79 ft) from table distances for each knot tailwind up to 10 knots.
- Sloped Runway; Increase / decrease table distances by 30 m (98 ft) of the ground roll distance for each degree of upslope/downslope.

Correction table below is given for take-off distance versus OAT and elevation.
OAT and Altitude values are given in absolute measure.

Hp [ft] \ OAT [°C]	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35
0	<470	<470	<470	<470	<470	<470	<470	<470	<470	470	475	480	485	490
1000	<470	<470	470	475	480	490	495	500	505	510	510	510	510	510
2000	500	510	515	520	525	525	525	525	525	530	535	540	550	555
3000	540	540	540	540	545	555	560	565	570	570	570	575	575	575
4000	565	575	580	590	590	590	590	590	595	605	610	620	625	630
5000	610	610	610	615	620	630	640	645	650	655	655	660	665	670
6000	645	655	665	670	675	680	680	685	695	700	705	710	720	725
7000	700	700	705	715	720	730	735	745	750	755	765	770	780	785
8000	750	755	765	775	780	790	800	805	815	820	830	840	845	855

5.3.7 CLIMB PERFORMANCE – TAKE-OFF CLIMB

Conditions:	Full Power - MAP = 39
Weight	- 750 kg
Flaps	- T/O setting
$V_x, 10^\circ$	- 63 KIAS with a climb angle of 12%
$V_y, 10^\circ$	- 63 KIAS with a climb rate of 760 ft/min

Climb Angle at $V_x, 10^\circ$ [%]	Delta with ISA [°C]						
	-30	-20	-10	0	10	20	30
0	14	13	13	12	11	10	9
2000	14	13	12	11	10	9	9
4000	13	12	11	10	10	9	8
6000	12	11	11	10	9	8	8
8000	11	11	10	9	8	8	7

Climb rate at $V_y, 10^\circ$ [ft/min]	Delta with ISA [°C]						
	-30	-20	-10	0	10	20	30
0	915	865	810	760	710	655	620
2000	875	825	770	720	670	620	585
4000	830	780	730	680	635	585	550
6000	785	735	690	625	595	550	515
8000	735	690	630	585	555	510	480

CAUTION

Maximum take-off power should only be maintained for a maximum of 5 minutes, after which the throttle setting should be set back to maximum continuous power.

5.3.8 CLIMB PERFORMANCE – CRUISE CLIMB

Conditions: Full Power	- MAP = 39
Weight	- 750 kg
Flaps	- UP setting
$V_x, 0^\circ$	- 65 KIAS for best climb angle of 11%
$V_y, 0^\circ$	- 68 KIAS for best climb rate of 760 ft/min

Climb rate at $V_y, 0$ [ft/min]	Delta with ISA [°C]						
	-30	-20	-10	0	10	20	30
0	915	865	810	760	710	655	620
2000	875	825	770	720	670	620	585
4000	830	780	730	680	635	585	550
6000	785	735	690	625	595	550	515
8000	735	690	630	585	555	510	480

Climb Angle at $V_x, 0^\circ$ [%]	Delta with ISA [°C]						
	-30	-20	-10	0	10	20	30
0	13	12	11	11	10	9	9
2000	12	12	11	10	9	9	8
4000	12	11	10	9	9	8	8
6000	11	10	10	9	8	8	7
8000	10	10	9	8	8	7	7

CAUTION

Maximum take-off power should only be maintained for a maximum of 5 minutes, after which the throttle setting should be set back to maximum continuous power.

Conditions: Max. Continuous Power - MAP = 34.9

Weight	- 750 kg
Flaps	- UP setting
$V_x, 0^\circ$	- 65 KIAS for best climb angle of 11%
$V_{Y, 0^\circ}$	- 68 KIAS for best climb rate of 540 ft/min

Climb rate at $V_{Y, 0^\circ}$ [ft/min]	Delta with ISA [°C]						
	AP [ft]	-30	-20	-10	0	10	20
0	670	865	585	540	495	450	420
2000	630	825	545	500	460	415	390
4000	590	780	505	465	425	385	355
6000	545	735	470	415	390	350	325
8000	505	690	415	380	355	315	290

Climb Angle at $V_x, 0^\circ$ [%]	Delta with ISA [°C]						
	AP [ft]	-30	-20	-10	0	10	20
0	10	13	9	8	7	7	6
2000	10	13	8	8	7	6	6
4000	9	12	8	7	6	6	5
6000	8	11	7	6	6	5	5
8000	8	11	6	6	5	5	4

5.3.9 CRUISE SPEED

Data provided for ISA condition

ISA	ISA T°	RPM	IASa	TAS	Cons.	Range 140l -45min
[ft]	°C	[min-1]	[kts]	[kts]	[l/h]	Nmi
2000	11	4500	84	89	21	533
		4800	93	97	25	479
		5000	98	102	27	450
		5500	112	115	34	393
4000	7	4500	84	92	19	619
		4800	93	100	23	546
		5000	98	105	25	508
		5500	112	118	31	437
6000	3	4500	84	95	17	727
		4800	93	103	20	628
		5000	98	108	23	578
		5500	112	122	29	488
8000	-1	4500	84	97	15	868
		4800	93	106	18	729
		5000	98	112	21	664
		5500	112	126	27	548
10000	-5	4500	84	101	12	1058
		4800	93	110	16	859
		5000	98	115	19	769
		5500	112	130	25	620

*add or subtract 500ft on altitude for each 5°C above or below ISA T°

5.3.10 LANDING DISTANCE – FLAPS IN LANDING POSITION

Conditions:	Flaps	- LD setting
	Power	- idle
	Airspeed	- approach at 55 KIAS
	Wind	- zero

Surface	Landing run (braked)	Landing distance over 15 m (50 ft) obstacle
Concrete	225 m / 730 ft	475 m / 1560 ft
Grass	Apply following multiplying factors to distance on concrete surface: Dry grass : 1.2 Wet grass : 1.4	

NOTE

The following factors are to be applied to the computed landing distance for the noted condition:

- Headwind; Subtract 6 m (20 ft) from table distances for each knot headwind.
- Tailwind; Add 24 m (79 ft) from table distances for each knot tailwind up to 10 knots.
- Sloped Runway; Increase / decrease table distances by 13 m (43 ft) of the ground roll distance for each degree of downslope / upslope.

Correction table below is given for landing distance versus OAT and elevation.
OAT and Altitude values are given in absolute measure.

Hp [ft] \ OAT [°C]	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30	35
0	<475	<475	<475	<475	<475	<475	<475	<475	<475	475	480	480	485	485
1000	<475	<475	<475	475	480	480	480	485	485	490	495	495	500	500
2000	475	480	485	485	490	495	495	500	505	505	510	515	515	520
3000	490	495	500	505	505	510	515	515	520	525	525	530	535	535
4000	510	510	515	520	525	525	530	535	535	540	545	545	550	555
5000	525	530	535	535	540	545	550	550	555	560	560	565	570	570
6000	545	545	550	555	560	560	565	570	575	575	580	585	590	590
7000	560	565	570	575	575	580	585	590	595	595	600	605	605	610
8000	580	585	590	595	595	600	605	610	615	615	620	625	630	630

5.3.11 CLIMB GRADIENT ON GO-AROUND

The S200 reaches a constant gradient of climb of 8.4% in the following condition:

Full Power	- MAP = 39						
Weight	- 750 kg						
Flaps	- LD setting						
V_x , 30°	- 60 KIAS with a climb angle of 8.4%						

Climb Angle	Delta with ISA [°C]						
	AP [ft]	-30	-20	-10	0	10	20
0	9	8	8	7	7	6	6
2000	8	8	7	7	6	6	5
4000	8	7	7	6	6	5	5
6000	7	7	6	6	5	5	5
8000	7	6	6	5	5	5	4

The corresponding rate of climb for the climb angles are given below:

Climb Rate	Delta with ISA [°C]						
	AP [ft]	-30	-20	-10	0	10	20
0	615	560	510	460	405	355	320
2000	560	510	460	410	360	310	275
4000	510	460	410	360	310	265	230
6000	450	405	360	295	265	215	185
8000	395	350	290	245	215	170	140

5.3.12 APPROVED NOISE DATA

In accordance with ICAO Annex 16 – Volume I – Part II - Chapter 10 – Amendment 11 - §10.4 b), and as the aircraft Maximum Take Off Mass of the Sonaca 200 is 750 kg, the maximum permitted Noise Level to be met is 74.25 dB(A).

It has been demonstrated that the noise level, using the standard Take Off and Climb procedure in ISA condition at sea level, is:

Propeller pitch setting angle	Noise Level
25°	67.9 dB(A) ± 0.6 dB(a)

6 WEIGHT AND BALANCE**6.1 TABLE OF CONTENT**

6.1	TABLE OF CONTENT	6-1
6.2	INTRODUCTION	6-2
6.3	DATUM PLANE AND REFERENCES	6-2
6.4	WEIGHT AND CENTER OF GRAVITY LIMITS.....	6-3
6.5	MASS AND BALANCE REPORT.....	6-4
6.6	AIRCRAFT WEIGHING.....	6-6
6.7	EQUIPMENT LIST	6-6

6.2 INTRODUCTION

This section contains

- The Aircraft Datum point and references
- The Weight & Center of Gravity range within which the aeroplane may be safely operated.
- A calculation method for establishing the actual Center of Gravity position.

The procedure for aircraft weighting, including the installed equipment during the weighing of the aircraft are contained in the applicable Maintenance Manual Ref. SONAIR-S2-D-MAN-002-S200.

6.3 DATUM PLANE AND REFERENCES

Reference description	Reference location
Datum point	Centre of firewall front surface bottom edge (engine side)
Longitudinal horizontal reference	Upper surface of canopy left slide
Transversal horizontal Reference	Upper surface of baggage compartment beam just behind the seats

Mean Aerodynamic Chord (MAC) of the SONACA S200

Length : 1318 mm

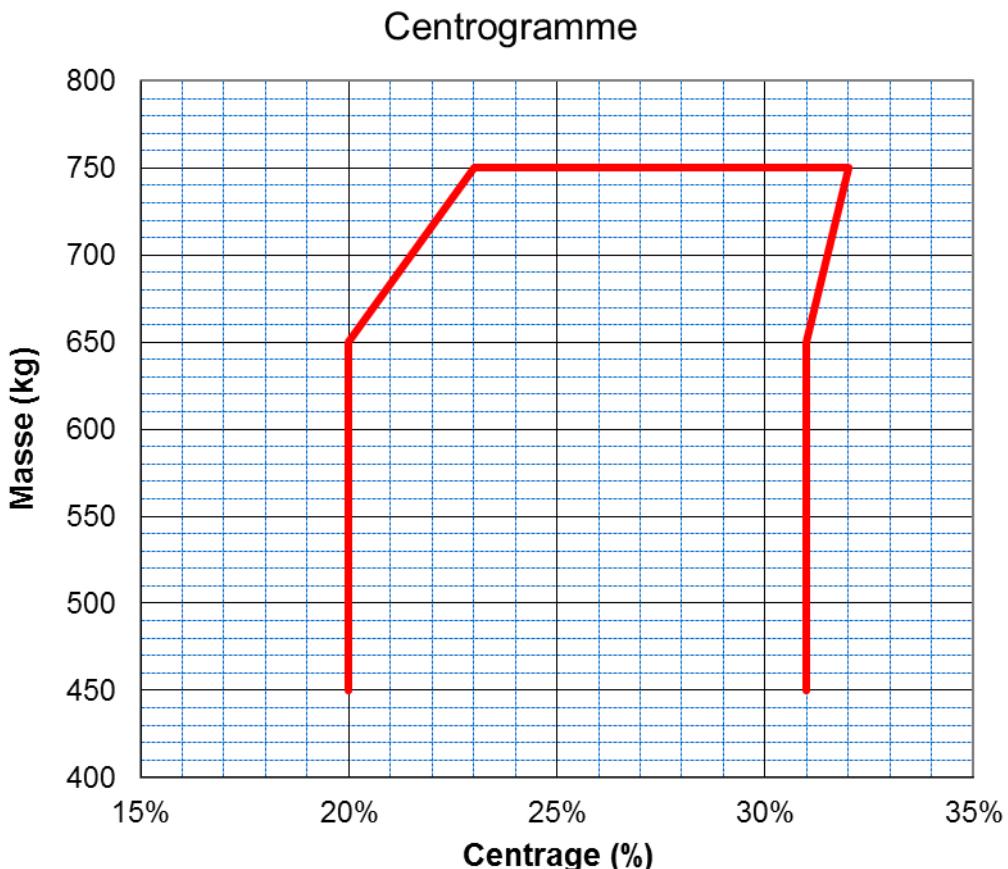
MAC Leading Edge position : 612 mm

6.4 WEIGHT AND CENTER OF GRAVITY LIMITS

	Metric	Imperial	% of MAC
Forward limit	0.876 m	2.873 ft	20%
Rear limit	1.034 m	3.392 ft	32%

Maximum Take Off Weight : 750 kg or 1650 lbs

The Weight and CG of the Aircraft must always be within the limits depicted in the following centrogram (in kg vs % MAC).



6.5 MASS AND BALANCE REPORT

Mass & Balance must be calculated before every flight for Take Off and Landing condition.

Fill the table on next page and check that you are within the authorized range.

WARNING

Aircraft CG and MTOW limitations must be adhered to at all times.

WARNING

For each flight the most forward CG (i.e. with take-off fuel) and the most rearward CG (i.e. with landing fuel) must be calculated and must be within aircraft CG range and weight limits).

NOTE

Fuel weight (kg) is fuel volume (liters) x fuel density (0.72 for Avgas)

NOTE

All Mass and Balance calculations are made using metric units (kg and millimeter). Refer to section 1.7.2 for conversion factors.

S200 AFM

6 - WEIGHT AND BALANCE
6.5 - MASS AND BALANCE
REPORT

ITEM		MASS [kg]	ARM [mm]	MOMENT (mass x arm) [kg.mm]
(1)	Empty aircraft	W _E =		
(2)	Pilot & passenger		1150	
(3)	Baggage (Area 1)		1500	
(4)	Baggage (Area 2)		2296	
(5)	Fuel Mass at TO		706	
(6)	TOTAL at TO (1) thru (5)		CG position=..... (% MAC =.....)	
(7)	Estimated mission Fuel burn Mass		706	
(8)	Total at Landing = (6)-(7)		CG position=..... (% MAC =.....)	

INFORMATION

CG position = Moment / Mass

CG position in % MAC = 100*(CG position – 612 mm) / 1318 mm

23/07/2019

SONAIR-S2-D-MAN-001

Page : 6-5

Rev. : C

6.6 AIRCRAFT WEIGHING

Weighting the empty aircraft is a maintenance task, performed by an approved Maintenance Organisation. Refer to the SONACA S200 Maintenance Manual for aircraft weighing instructions. This is needed periodically or when a modification or a repair is made to the aircraft.

6.7 EQUIPMENT LIST

7 AIRPLANE AND SYSTEMS DESCRIPTION

7.1 TABLE OF CONTENT

7.1	TABLE OF CONTENT	7-1
7.2	INTRODUCTION	7-2
7.3	AIRFRAME	7-3
7.4	FLIGHT CONTROLS	7-4
7.5	INSTRUMENT PANEL	7-10
7.6	WARNING, CAUTION AND STATUS LIGHTS	7-15
7.7	INSTRUMENTS AND AVIONICS.....	7-16
7.8	FLIGHT CREW AND CABIN.....	7-21
7.9	POWERPLANT.....	7-27
7.10	FUEL SYSTEM.....	7-43
7.11	ELECTRICAL SYSTEM	7-51
7.12	LANDING GEAR.....	7-57
7.13	MINIMUM INSTRUMENTS AND EQUIPMENTS FOR FLIGHT	7-60

7.2 INTRODUCTION

This section provides description and operation of the aeroplane and its systems. It includes a basic description of the airframe, the control systems, the cabin and instrument panel, as well as key elements of the aircraft like powerplant, anemometric system and landing gear.

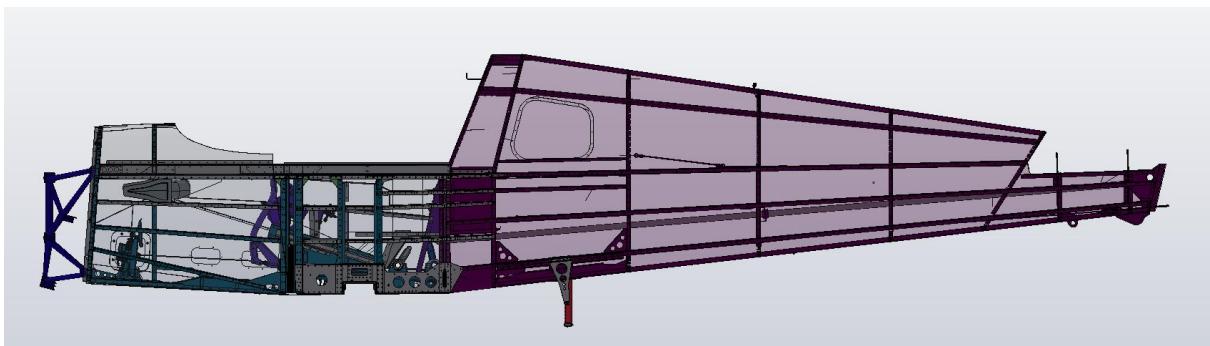
Refer to Section 9, Supplements, for details of optional systems and equipment.

7.3 AIRFRAME

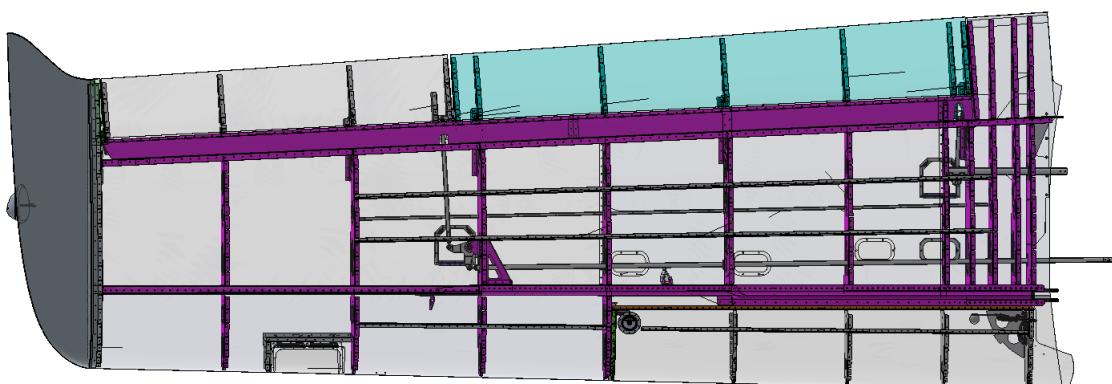
The whole airplane structure (wing, fuselage and empennage) is of an all-metal semi-monocoque construction with single curvature stressed aluminium alloy skins riveted to spars, stiffeners, ribs and frames.

Construction is of 6061-T6 aluminium alloy sheet assembled by the means of blind rivets, with exception of the main spar being built of 2024-T3 aluminium alloy. This high strength aluminium alloy construction provides long life and low maintenance costs thanks to its durability and corrosion resistant characteristics. The wing has a high lift airfoil having the advantage of being only slightly sensitive to rain and reasonable amount of dust and insects. It is equipped with single slotted Fowler type flaps.

S200 Fuselage structure:



S200 Wing structure:



7.4 FLIGHT CONTROLS

Flight controls are composed exclusively of pushrods and torque tubes for ailerons and elevator, linked to both pilot and co-pilot sticks. The rudder is controlled by means of cables linked to pedals.

The nose gear is controlled by pushrods permanently linked to pedals.

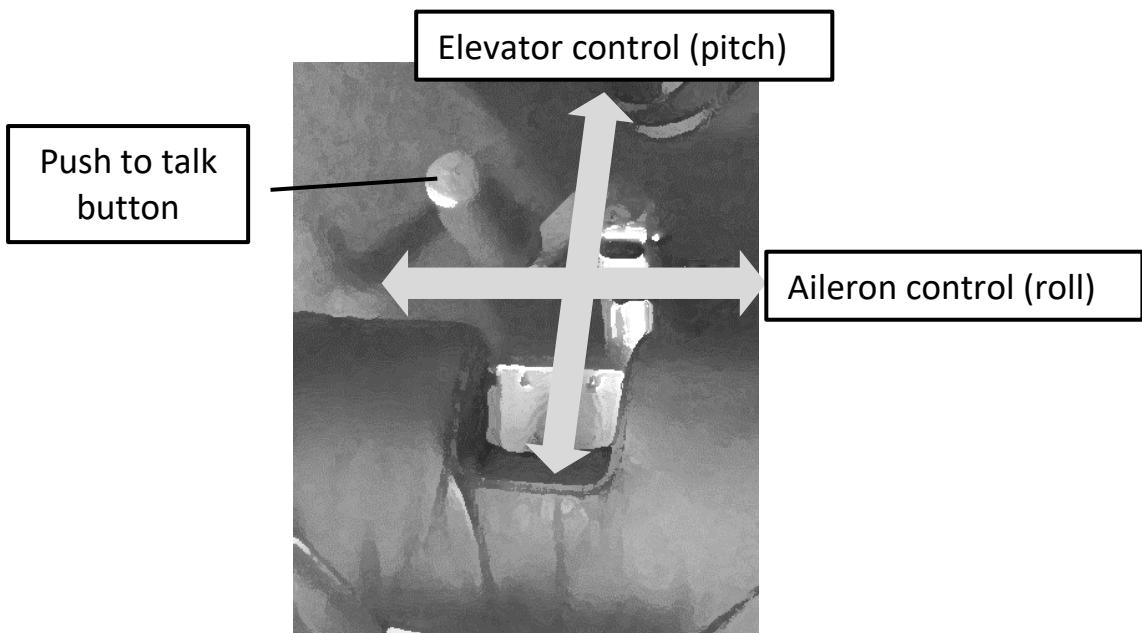
Flaps are controlled by pushrods and torque tubes linked to an electrical actuator located in the centre console.

The elevator trim tab is controlled by a push-pull cable.

7.4.1 CONTROL STICKS

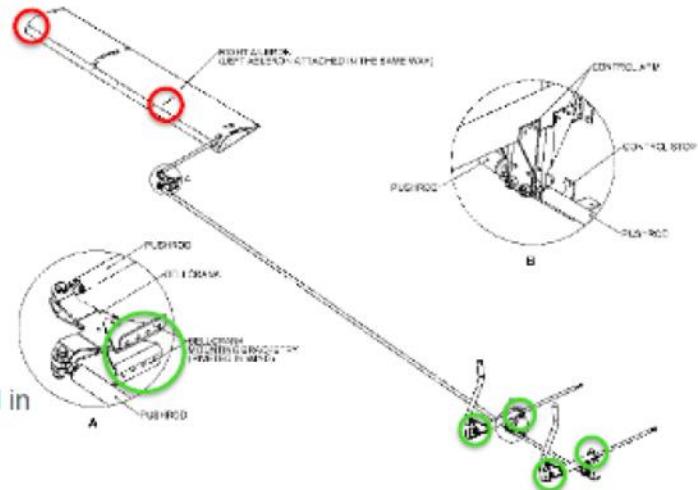
The aircraft is equipped with dual control sticks. The control sticks operate in the standard pitch and roll (elevator and aileron) configuration.

See the picture below for control stick use:



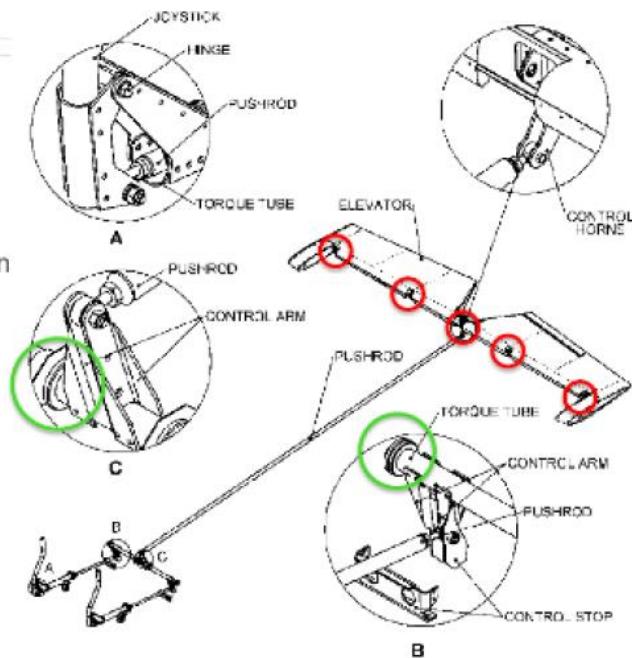
7.4.2 AILERON CONTROLS

- Semi monocoque structure, no spar, leading edge aluminium balancing tube.
- Mechanically actuated
- Push-pull rod, bell crank arrangement
- Riveted and attached to structure with bushes (marked in green)
- Two sealed ball bearing hinges(marked in red).



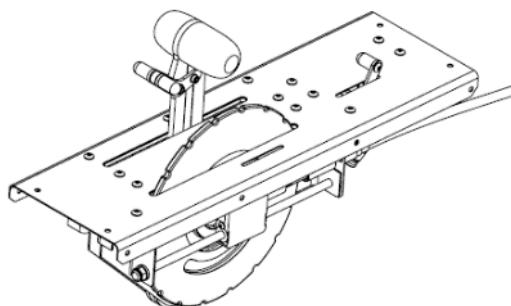
7.4.3 ELEVATOR CONTROL

- Mechanically actuated.
- Push-pull rod, bell cranks arrangement with torque tubes
- 5 Sealed ball bearing hinges (marked in red).
- Attachment points to structure (marked in green)



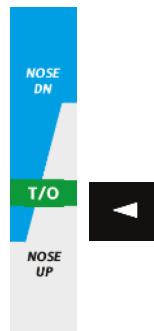
7.4.4 ELEVATOR TRIM

The elevator trim is controlled manually via a wheel on the centre console. Moving the top of the wheel forward will apply a pitch down correction, and moving it rearward will apply pitch up correction.



A trim level indicator is provided left of the actuation wheel, indicating on a mobile scale the current trim tab position.

The indicator provides a blue area for nose down trimming, a white area for nose up trimming, and a green area near the centre to indicate the take-off position.



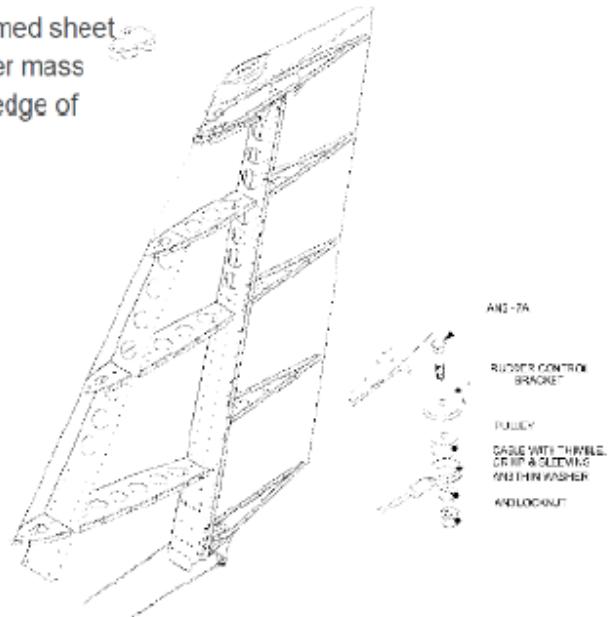
WARNING

Always select take-off position before taking off with the aircraft to ensure controllability in flight !

7.4.5 RUDDER, PEDALS AND NOSE WHEEL STEERING

The aircraft is fitted with nonadjustable dual rudder pedals, which control the rudder and steer the nose wheel. Refer to section 0 for seat adjustment.

- The rudder consists of a spar with formed sheet metal ribs and sheet-metal skin. Rudder mass balancing is placed under the leading edge of the rudder horn, on the top rudder rib



- The front wheel is not fitted with a braking mechanism. Ease of steering movement is ensured through the use of three needle roller bearings on the weight bearing surfaces of the strut.

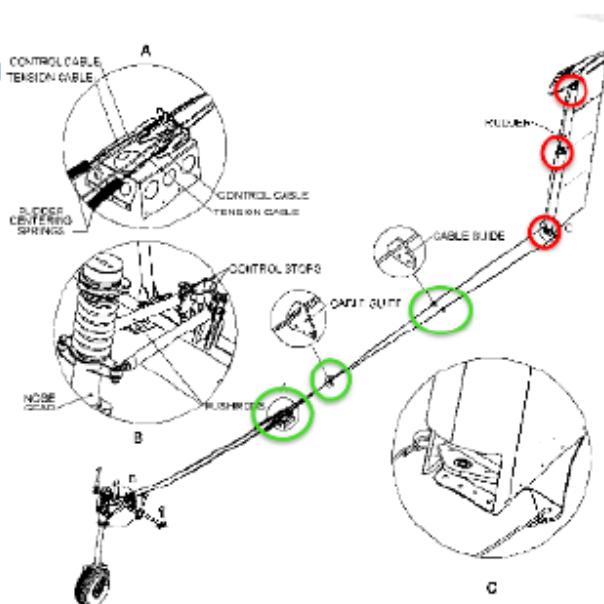
Mechanically actuated.

- Nose gear actuated with push-pull rods. Rudder actuated with cables

The nose gear strut is attached to the engine mount with two guide brackets. A compression spring provides suspension.

Structural attachment points (marked in green)

The rudder rotates / deflects around three hinges (marked in red)



7.4.6 FLAP CONTROL

Wing flaps are electrically controlled by a four-position lever located on the instrument panel (refer to paragraph 7.5). A mechanical flap indicator located next to the lever shows the current flap position.

The flap motor is located in the cabin centre console. The two wing flaps are interconnected via a torque tube, which is driven at a single point by the flap motor. In case of a failure in the linkage system, this prevents the flaps from being deployed to asymmetrical positions.

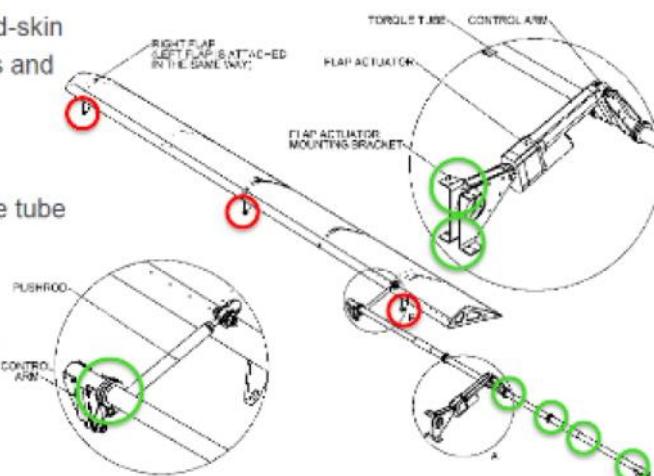
- Flaps comprise of a conventional stressed-skin semi-monocoque structure comprising ribs and riveted sheet metal skin, without a spar.

- Electrically actuated

- Push-pull rods attached to a linking torque tube

- Attachment points to structure (marked in green)

- Three flap hinges comprise of sealed ball bearings (marked in red)



See section 7.5 for the location of the flap lever and indicator location on the instrument panel.

Following flaps settings are defined on the S200:

Selector Position	Degrees flap deflection
UP	0°
T/O	10°
APP	20°
LD	30°

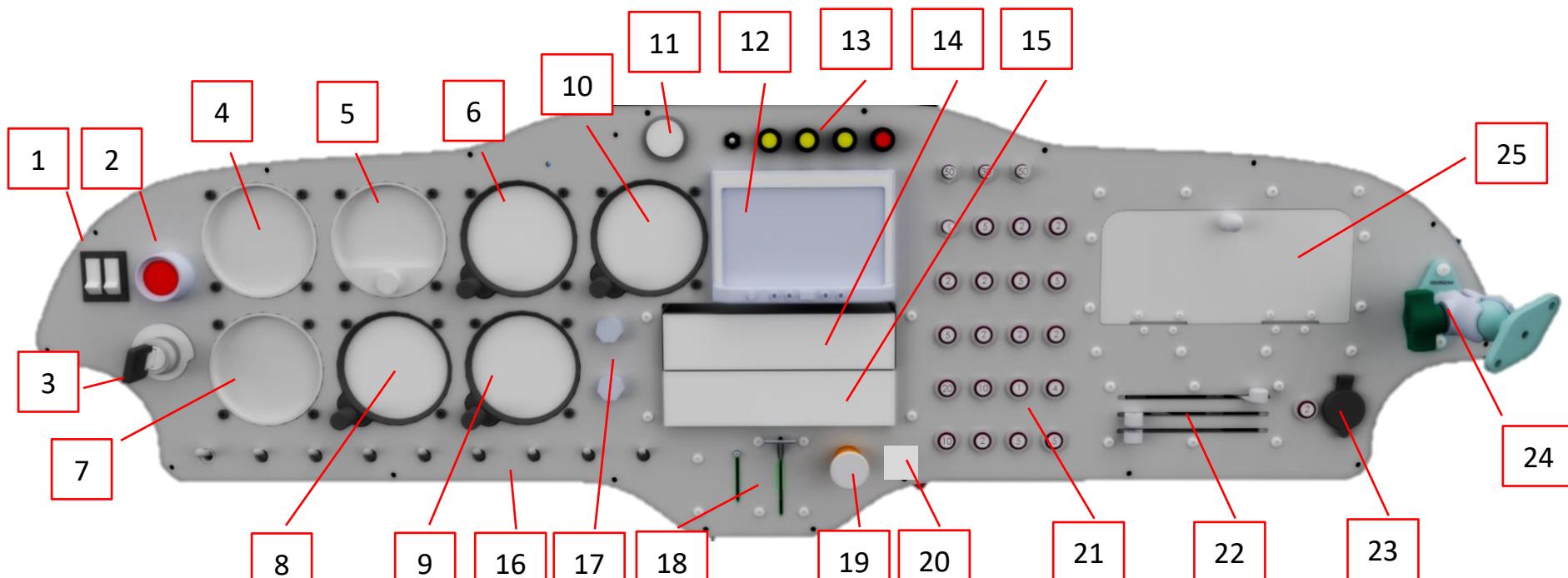
The flap controller is powered from the main bus. The flap controller in turn powers the flap motor, via a circuit breaker located on the instrument panel (refer to paragraph 7.5). The Flap control necessitates a power up time of 11 sec. The Flap cannot be actuated during that period of time.

WARNING

The flap system becomes non-operational with loss of power to the main bus. The main bus is powered by the Master Switch.

7.5 INSTRUMENT PANEL

The Sonaca 200 Instrument panel features traditional flight instruments, an Engine Monitoring System (EMS), a radio and transponder, a VOR indicator, equipment switches and breakers, a cabin heating control, a glove box, an optional RAM mount for portable equipment and a 12V auxiliary plug. The layout is as follows:



Component	Number on figure	Function	Operation
BATT Switch	1	Battery power supply (Master Switch)	Up : On / Down : Off
ALT 2 Switch		ALT 2 power supply (Master Switch)	Up : On / Down : Off
Start Button	2	Engage starter motor	Push : (On)
Ignition Key	3	Disconnect Ignition	Full Left : OFF
		Select Ignition R	Middle 1: R
		Select Ignition L	Middle 2 : L
		Select Ignition R & L	Full Right : BOTH
Airspeed	4	Airspeed indicator (ASI)	N/A
Artificial Horizon	5	Artificial horizon (vacuum driven, with 10° tilt)	Pull to cage
Altitude	6	Altitude indicator	Set QNH
Turn & bank	7	Turn & bank coordinator with slip indicator (electrically driven)	N/A
Directional Gyro	8	Directional gyroscope (vacuum driven)	Turn to set as required

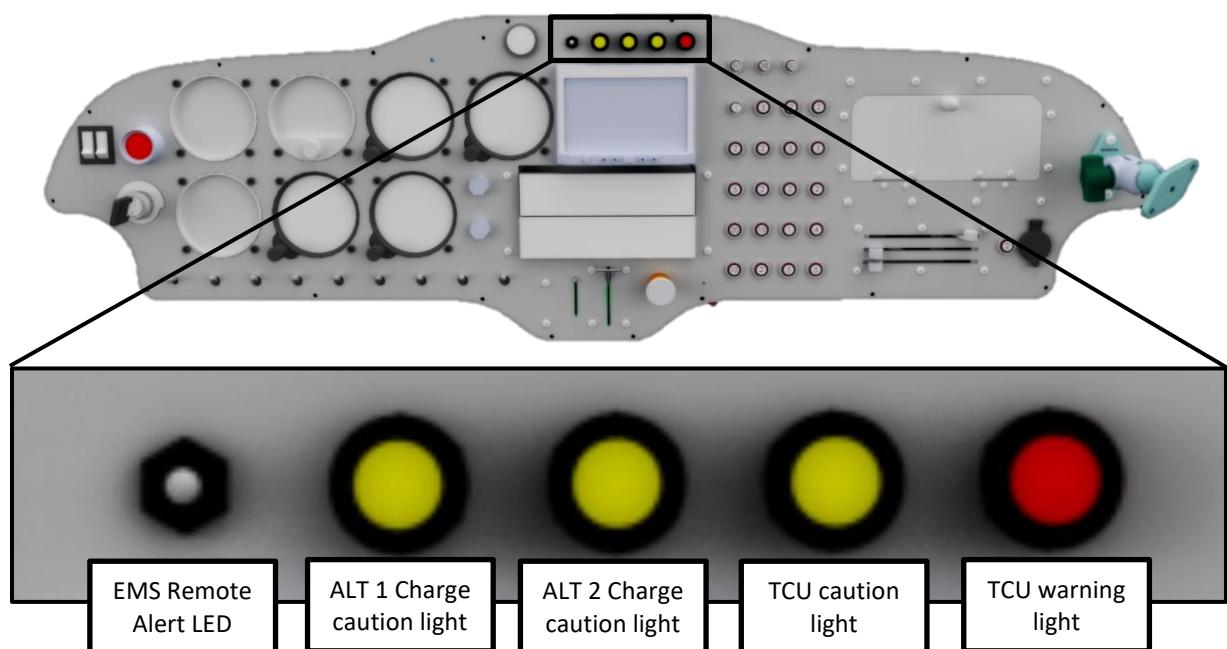
Vertical Speed	9	Vertical speed (rate of climb) indicator	N/A
VOR	10	VOR indicator (CDI)	OBS
Vacuum indicator	11	Vacuum indicator for instruments	N/A
EMS	12	JPI EDM900 Engine Monitoring System (EMS)	See section 7.9.7
Warning lights	13	Alternator and engine warning lights	See section 7.6
Radio	14	Garmin GNC255A Radio with COM and NAV functions	Refer to radio operation manual
Transponder	15	Garmin GTX335 Transponder	Refer to transponder operation manual

Equipment switches	16	From Left to right: <ul style="list-style-type: none"> - TCU : Freeze the turbo waste gate position when off - AVI 1 : Switches Radio and VOR indicator - AVI 2 : Switches Transponder and Turn and Slip indicator - Instrument lights : Switches instrument integrated lighting - Anti-collision lights : Switches strobe lights - Navigation lights : Switches position lights - Landing light : Switches landing light(s) - Taxi light : Switches taxi light(s) - Aux fuel pump : Switches auxiliary fuel pump 	Up : On / Down : Off
Panel dimmer (top)	17	Dim the cockpit lights	Left : min / Right : Max
Instrument dimmer (bottom)	17	Dim the instruments lights	Left : min / Right : Max
Flap position indicator (left)	18	Indicates the current flap position	N/A

Flap selector (right)	18	Select position of Flaps (from top to bottom settings)	UP T/O APP LD
Choke	19	Engage engine choke	Pulled : choke on Pushed : normal operation
Carburettor heater	20	Engage carburettor heater	Pulled : heater on Pushed : heater off
Circuit breaker board	21	Circuit breakers for all electrical systems	Refer to section 7.11
Cabin heat system	22	Top lever : windscreens defogging Middle lever : feet heating Bottom lever : heating control	Left : closed Right : open Refer to section 7.8.5
Aux 12V Plug	23	12V plug for auxiliary devices, with its breaker	N/A
RAM Mount	24	Mount point for optional portable devices	N/A
Glove box	25	Glove box for flight crew use	N/A

7.6 WARNING, CAUTION AND STATUS LIGHTS

Warning lights are provided to announce hazardous system operation to the pilot. They are located at the top centre of the instrument panel as described below:



All warning lights except the EMS RAL can be dimmed by turning the light housing and can be tested by pushing on them.

The EMS RAL features a self-test at start-up of the EMS display.

Refer to sections 3.10.3, 3.3.13 and 3.3.14 for information on causes and adequate action in case of warning light illumination.

7.7 INSTRUMENTS AND AVIONICS

7.7.1 GENERAL INFORMATION

The diagram in section 7.5 represents the instrument panel-mounted avionics. A description of specific equipment functionalities and operation is provided in the table below.

N° on diagram	Equipment	Important functionalities	Operation Instructions
12	JPI EDM900 Engine Monitoring System	Refer to section 7.9.7	Refer to section 7.9.7
14	Garmin GNC 255A Radio with COM and NAV functions	8.33 & 25kHz VHF Flight crew Interphone system	Refer to section 1.8
15	Garmin GTX 335 Transponder	Mode A/C/S ADS-B compatible	Refer to section 1.8

Note:

- Power to the EMS is provided directly by the main bus.
- Power to Radio COM and NAV, and CDI need activation by Avionics 1 switch.
- Turn & Slip Indicator and transponder need activation by Avionics 2 switch.

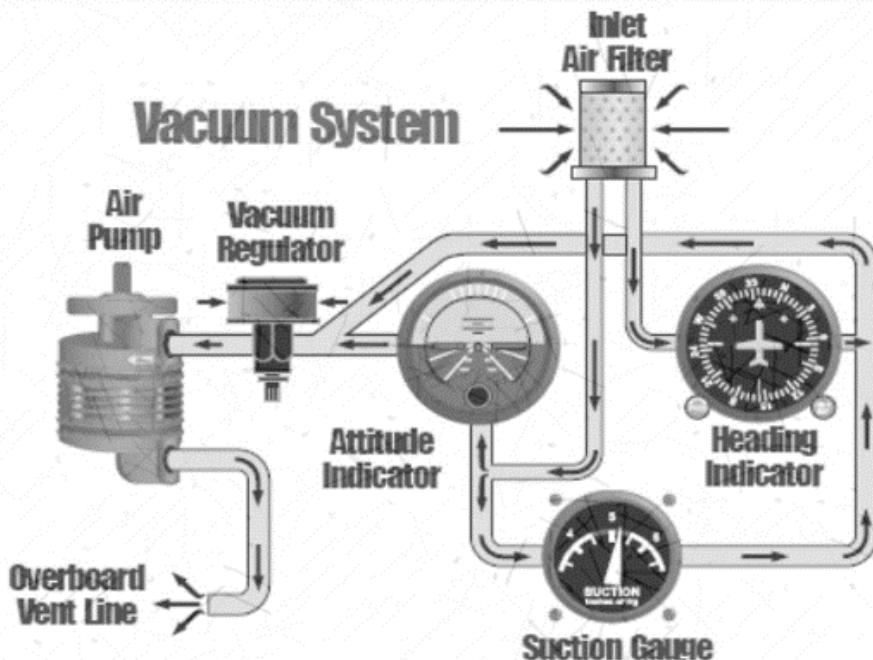
Both switches (Avionics 1 and Avionics 2) are located on the instrument panel (Refer to paragraph 7.5).

7.7.2 VACUUM SYSTEM

The S200 is equipped by a traditional vacuum system composed of:

- A mechanical vacuum pump mounted on the engine directly behind the gearbox
- A pressure regulator mounted behind the instrument panel
- An air filter mounted next to the pressure regulator
- A suction gage mounted on the instrument panel, indicating proper vacuum level is supplied to the instruments
- Interconnection hoses of blue color

The general system layout is presented on the diagram below.



To ensure adequate operation of both gyro instruments, the suction should be within the following range:

Minimum pressure: **4.5 in.Hg**

Maximum pressure: **5.4 in.Hg**

7.7.3 PITOT-STATIC SYSTEM

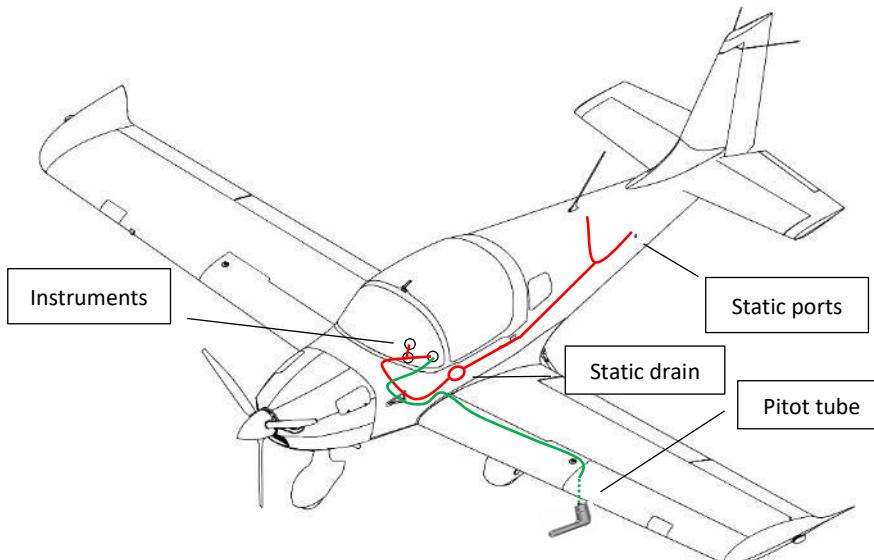
The anemometric system of the S200 is composed of:

- A total pressure measurement line:

A pitot tube is located below the left wing. Pressure distribution to the instruments is through flexible plastic hoses installed in the wing and central fuselage. The ASI is connected to this line.

- A static pressure measurement line:

Static ports are located on both sides of the rear fuselage. Both ports are joined to equalize pressure. A drain bottle is located under the co-pilot seat to evacuate moisture and is checked during maintenance activities. The Altimeter, ASI, VSI and alticoder are connected to this line.



Keep the pitot head clean to ensure proper functioning of the system. Ensure that the Pitot tube cover is removed prior to every flight and that it is replaced after every flight. Check the static ports on both side of the fuselage for any obstructions before every flights.

WARNING

Flight is prohibited with any obstructions in the Pitot tube or static ports.

The S201 may optionally be equipped by a Heated pitot tube.

In this case, a “PITOT” switch is located in the right of the switch line on the instrument panel, as well as the corresponding Circuit Breaker.

The Pitot switch can be used safely once the engine is running above 3000 RPM and both alternators are on and operative, otherwise it may deplete the battery due to its high electrical power consumption.

When flying in cold and moist weather condition, it is recommended to switch the pitot heater on to avoid pitot icing. Icing can be recognized by an indicated airspeed increase in level flight without increasing throttle.

In case of icing, switching the pitot heat should be sufficient to eliminate ice from the pitot tube.

After landing, it is recommended to switch off the pitot as soon as possible to avoid unnecessary current consumption and cool down the pitot tube before installing the pitot cover.

WARNING

The optional Heated Pitot does not allow Flight into known icing condition!

CAUTION

Avoid touching the pitot tube with bare hands when pitot heat is on as you may suffer of skin burn.

NOTE

Ensure pitot tube is cooled down after flight before installing pitot cover

7.7.4 STALL WARNING

A stall warning device is installed on the Right wing, connected to a buzzer in the cockpit. The system is programmed to start alerting the pilot between 5 and 10 KIAS before the wing stall.

NOTE

When approaching stall speed, aileron and elevator controls might have a reduced effect on aircraft motion. It is recommended to keep sufficient margin on airspeed during take-off, approach and landings!

Refer to section 4.6 for stall behaviour information.

7.8 FLIGHT CREW AND CABIN

The S200 can be used with the following crew:

- Minimum crew : 1 pilot (left hand seat preferably)
- Maximum occupants : 2

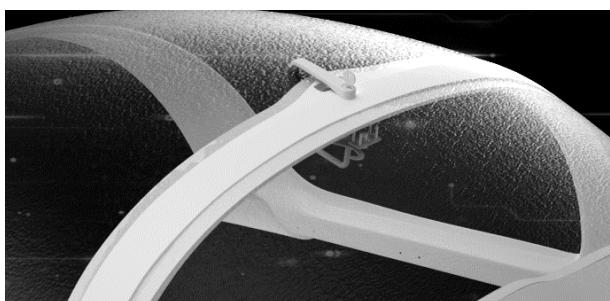
7.8.1 CANOPY OPENING AND CLOSING

The airplane is equipped with a sliding canopy mechanism. External access to the cabin is from either side. Latching mechanisms are provided inside the cabin at the top of the roll-over bar in the centre and outside on the centre of the canopy.

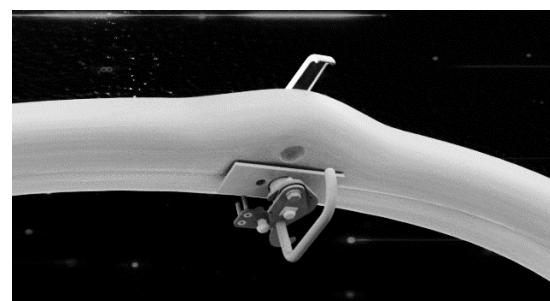
After unlocking the mechanism with the key, rotate the handle toward right wing to open.

To close and lock the canopy, push main canopy fully in contact with front canopy and rotate the handle in flight direction.

After closing, check proper locking by applying a rearward force.



Canopy outer handle



Canopy inner handle and locking mechanism

WARNING

Ensure that the canopy / mechanism is securely latched into position before operating the aircraft.

7.8.2 COCKPIT LAYOUT

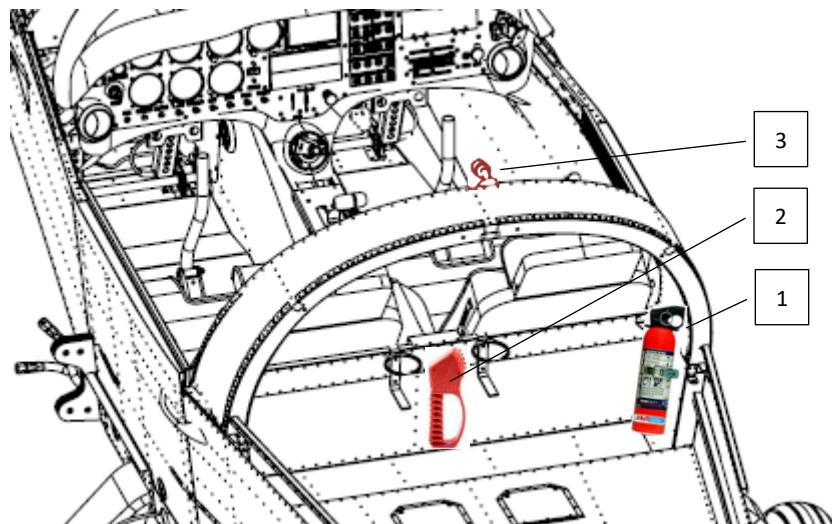
The cockpit layout is configured conventionally.

Baggage space is immediately behind the seats and can be accessed easily by moving the seat backrest forward by lifting the small lever on each seat's external side. See section 7.8.4 for more information.

A fire-extinguisher (1) is held in place against the right retaining wall of the baggage space.

A hammer (2) to break the canopy for an emergency escape in case it is jammed is held in place in the baggage compartment between both seats.

An adjustable red interior cockpit light (3) is positioned behind and between the pilot's and passenger's heads, on the rear fuselage front structure.



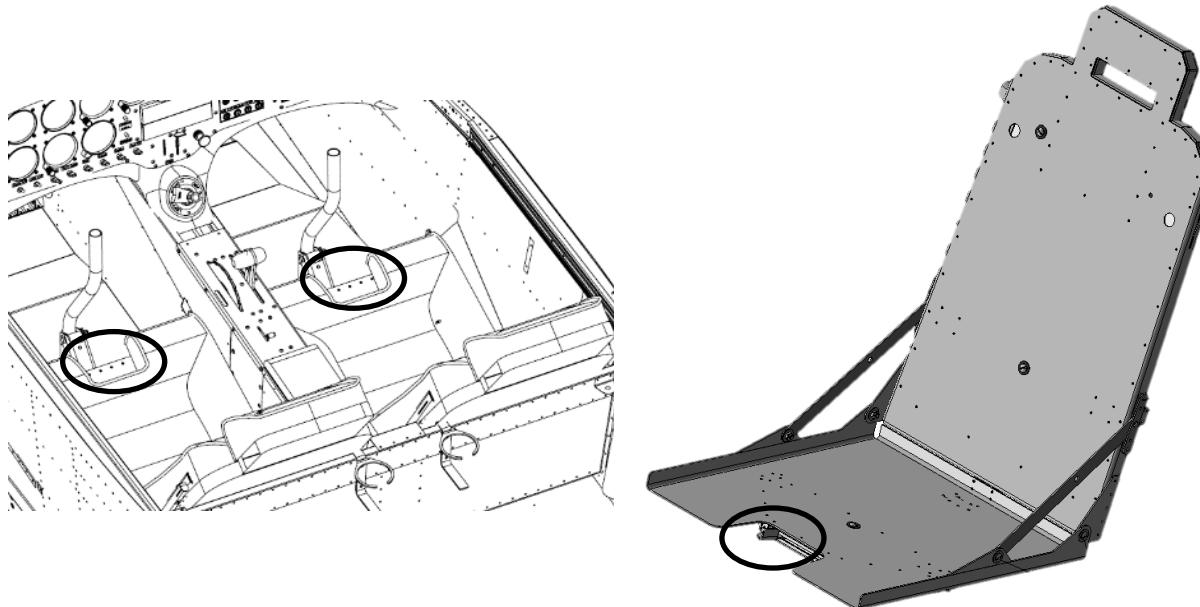
7.8.3 SEATS AND SAFETY HARNESSSES

Seats are constructed in aluminium and covered with cushions.

Each seat can be adjusted backwards and forwards for comfort with forward movement, which is slightly raising the seat height, in order to ensure that the rudder pedals can easily be reached by all pilots – see warning and note on next page.

The longitudinal adjustment lever is located between the pilot legs as indicated in the circles below. To adjust seat:

1. Pull lever left
2. Adjust seat as required
3. Release lever
4. Move seat forward and backward until mechanism is locked. This is confirmed by the lever going back to its full right position
5. Check seat secure by trying to lift it in an upward / forward combined force on backrest



WARNING

Ensure that the seat(s) is (are) securely locked into position after adjustment.
Always adjust seat before starting the engine !

NOTE

For easier operation, adjust the seat before climbing in aircraft as the pilot weight will create more friction in the system.

The aircraft has side-by-side seating. Four point safety belts with a single point release are provided for each seat.

Seat belt laps can be adjusted independently to ensure maximum comfort and security.

NOTE

Prior to each flight, ensure that the seat belts are firmly secured to the airframe, and that the belts are not damaged. Adjust the buckle so that it assumes a central position relative to the body.

7.8.4 BAGGAGE COMPARTMENT

The baggage compartment comprises two sections positioned behind the seats and is designed to carry up to 35 kg (77 lb) in total.

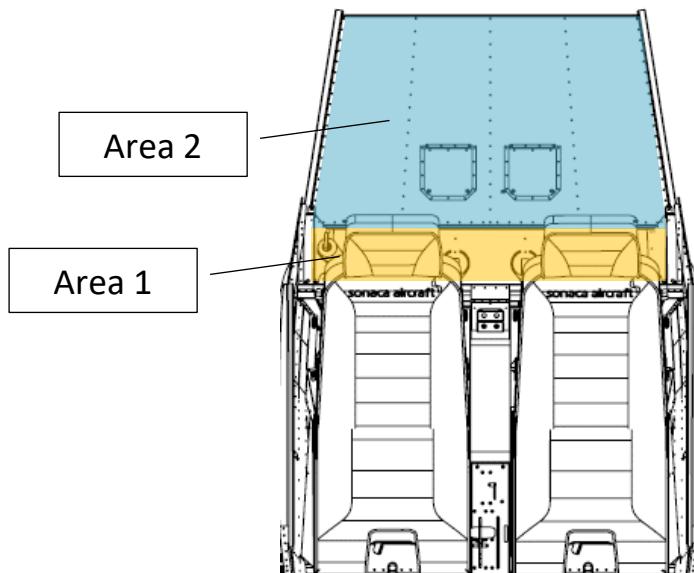
The baggage compartment comprises:

- Area 1 : a narrow, slightly lowered front section and a
- Area 2 : a higher, larger back section.

Up to 35 kg (77 lb) of luggage may be loaded in Area 1 and 25 kg (55 lb) in Area 2, subject to a total maximum baggage weight of 35 kg (77 lb).

Regardless of the manner in which baggage is loaded, it is the obligation of the pilot to ensure that the aircraft CG is within the permissible limits.

All baggage must be properly secured under the baggage net supplied with the aircraft.

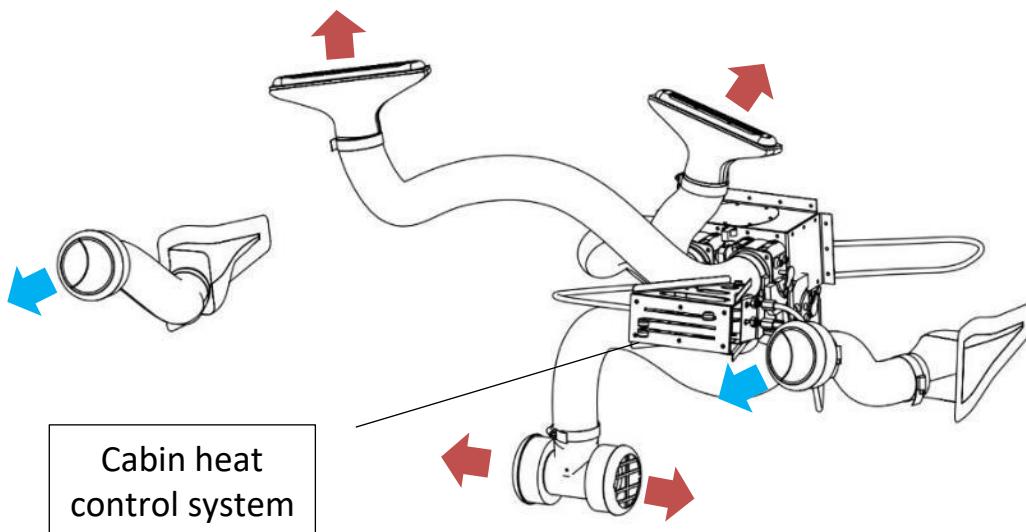


WARNING

Ensure no luggage is stored between seat and baggage compartment on the soft textile separation as it could jam the flight controls.

7.8.5 CABIN HEAT SYSTEM

Heated air (warmed by a heat exchanger around the engine exhaust) can be selected via a selection lever located on the instrument panel. Refer to the instrument panel layout in paragraph 7.5.



- Hot air:

Hot air is allowed through the firewall valve by moving the bottom lever to the right. This valve can be closed by moving the lever back to the left (to be closed immediately in case of engine fire or fumes).

The heated air is then distributed to either feet vents or windscreens demisting vents by the mean of respectively the middle and top levers.

- Cold air:

Air vents located on the lower right and left sides of the instrument panel are directly connected to external ambient air intakes and can be opened by pushing on the vent. Rotating the vent will allow to select flow direction.

7.9 POWERPLANT

This paragraph describes the engine, the engine controls and instrumentation, as well as the propeller. The engine's Operator Manual is provided with the aircraft.

7.9.1 ENGINE – GENERAL

The S200 is equipped by a Rotax 914 F which is a 4-stroke, 4-cylinder, horizontally opposed, turbocharged spark ignition engine with one central camshaft using pushrods driven OHV (2 valves per cylinder).

The engine features liquid cooled cylinder heads with air cooled cylinders.

It utilizes dry sump forced lubrication and has a dual contactless capacitor discharge ignition system.

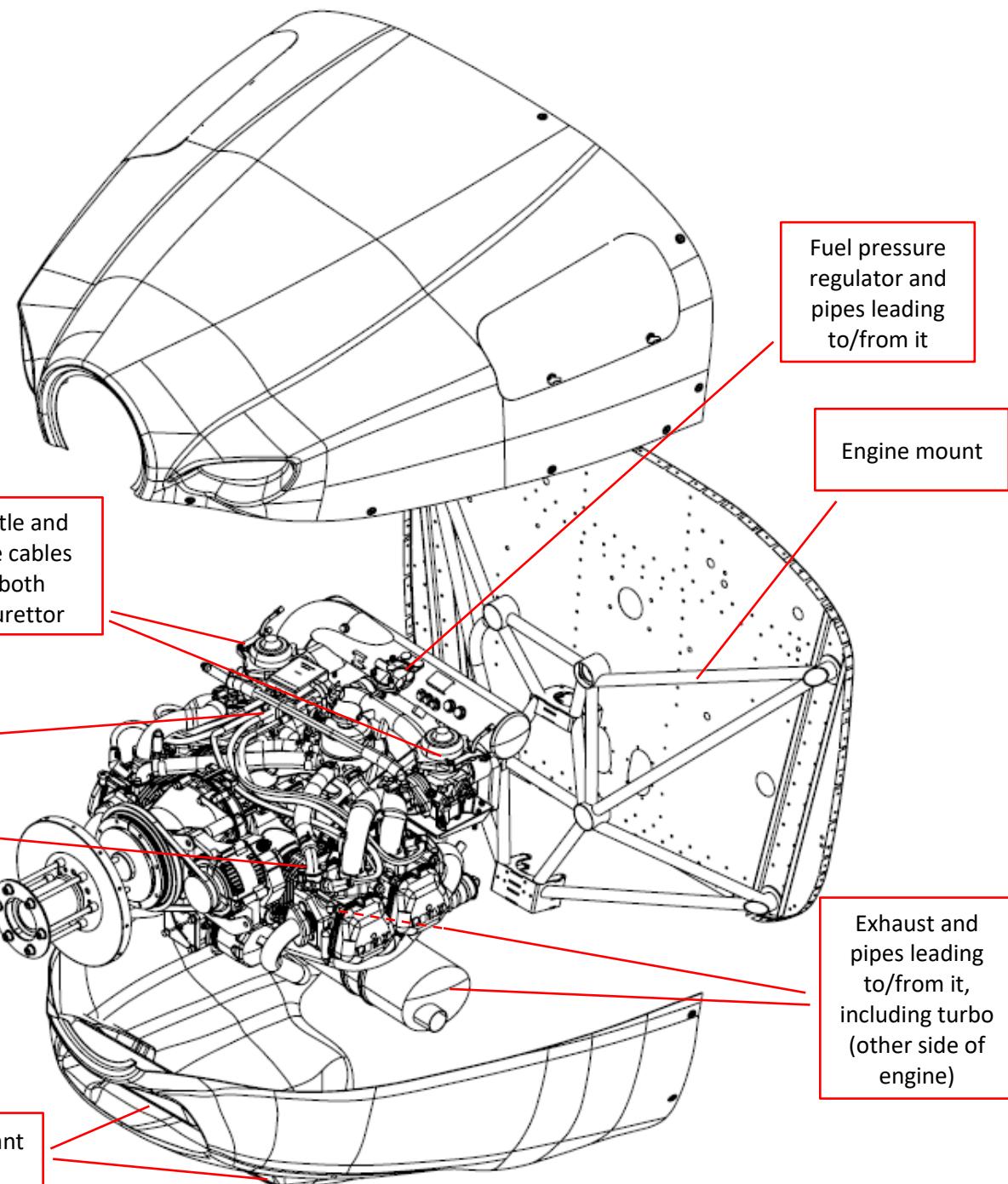
The turbocharger boost is controlled by an electronic control unit ensuring optimum manifold pressure in all cases.

The engine is fitted with an electric starter, dual alternators and two electrical fuel pumps.

Propeller drive is via reduction gear with integrated shock absorber.



Following items should be inspected during pre-flight check:



7.9.2 COOLING SYSTEM

The Rotax 914 features dual cooling means:

- Cylinders are air cooled.
- Cylinder heads are liquid cooled via a closed circuit system with an expansion tank. A camshaft driven coolant pump circulates coolant from a radiator through the cylinder heads, then through an expansion bottle and back to the radiator.

The expansion tank is closed by a pressure cap. At temperature rise of the coolant an excess pressure valve in the expansion tank opens and coolant flows (via a hose) at atmospheric pressure to an overflow bottle mounted on the firewall. When cooling down the coolant in the overflow bottle is sucked back into the cooling circuit.

Refer to latest revision of Rotax operator / maintenance manuals and latest revision of Rotax service instruction SI-914-019 with regard to selection of operating fluids.

COOLANT		
Grade / type	1:1 Ethylene glycol based coolant and distilled water mixture. Type : YACCO LR-35 Organic	Do not use concentrated waterfree propylene glycol based coolant. See section 2.5.

7.9.3 LUBRIFICATION SYSTEM

The engine is provided with a dry sump forced lubrication system with a camshaft driven main pump with integrated pressure regulator and additional suction pump. The main pump delivers oil from the oil reservoir, through an oil cooler (radiator) and oil filter to points of lubrication.

Surplus oil emerging from the points of lubrication gathers at the bottom of the crankcase from where it is forced back to the oil reservoir by a piston blow-by gasses.

Oil temperature is sensed by a sensor located on the oil pump housing.

The lubrication circuit is vented at the oil reservoir. The oil reservoir is located on the firewall.

The turbocharger is supplied with oil via a separate oil line from the main pump. Return oil from the turbocharger is collected in a stainless steel sump and is sucked back to the suction pump and then pumped back to the oil reservoir via a return line.

The lubrication system volume is approximately 3.5 litres (7.4 pints).

Oil type is Automotive grade API SG (or higher) type oil, preferably synthetic or semi-synthetic.

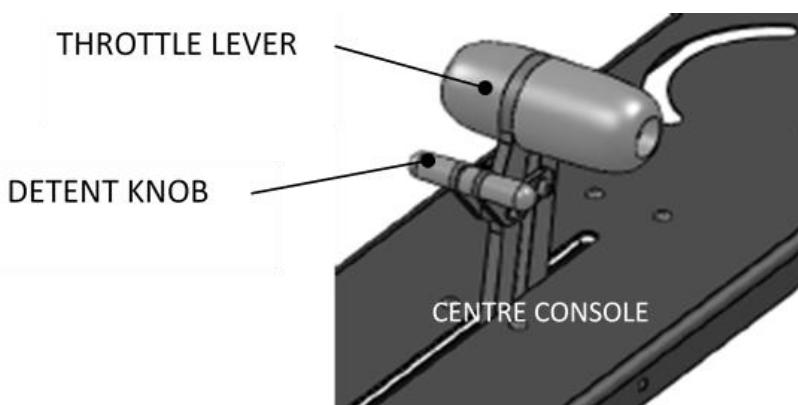
Refer to the latest revision of the applicable Rotax engine and operator manuals and the latest revision of the applicable Rotax service bulletins

7.9.4 OPERATING CONTROLS

Engine power is controlled by means of a hand operated throttle lever situated on the cabin centre console. Forward movement of the throttle lever increases engine power output and backward movement decreases engine power output.

The throttle lever incorporates a detent mechanism which stops the lever at the Maximum Continuous Power position.

Moving the throttle lever past the 100% throttle selection requires the manipulation of the detent control / enabling knob located on the throttle lever. This will allow to select throttle settings between 100% and 115% which corresponds to Full Power setting.



A choke knob (round) is positioned in the right centre of the instrument panel. Refer to paragraph 7.5. Pulling out the choke knob activates the choke mechanism.

A Carburettor heater knob (square) is positioned to the right of the choke control. Pulling the heater knob activates the carburettor heater.

WARNING

Do not use carburetor heater when applying Full Power. Doing so will result in exceeding maximum allowed airbox temperature and reduced engine power.

7.9.5 TURBOCHARGER CONTROL UNIT

The applicable sections in the Rotax 914 F operator's manual should be carefully read in conjunction with this section.

A throttle arm position sensor is mounted on one carburettor. The sensor measures the throttle position linearly from 0% to 115%, corresponding to engine idle and engine full (100%) power respectively. The TCU (Turbocharger Control Unit) utilizes throttle position in conjunction with aircraft ambient pressure, airbox pressure, engine rpm and airbox temperature to actuate an electronically controlled waste gate to regulate the speed of the turbocharger / boost pressure in the engine airbox.

Relationship between throttle position and engine power		
Throttle position	Engine power	
115%	100 %	Full Power
100%	85 %	Maximum Continuous Power

NOTE

Throttle position from 108% to 110% result in a rapid rise in boost pressure. Avoid constant throttle settings in this range, as it may result in boost pressure control fluctuations (surging).

To avoid unstable boost pressure the throttle should be moved smoothly through this range to full power (115% throttle position), or on a power reduction, to maximum continuous power (100% throttle position)

The TCU controls two indicator lights mounted on the instrument panel. When supply voltage is supplied to the TCU (master switch is switched on) the TCU is subjected to a self test. Both the BOOST and CAUTION lights should illuminate for 1 to 2 seconds and then turn off. If not, this is indicative of a deficiency and the engine should not be taken into operation before the problem has been identified and rectified.

Refer to section 3.3.14 for information on cause and remedy in case of warning light illumination in flight.

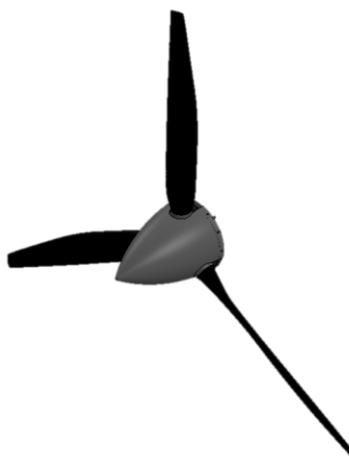
CAUTION

When supply voltage to the TCU fails the waste gate servo (and thus the waste gate flap) will remain in its last commanded position. Boost pressure regulation is not available and limited flight operation is applicable.

7.9.6 PROPELLER

The Sonaca 200 is equipped by a DUC Hélices FLASH-R 3 blade, 1750mm diameter, ground adjustable propeller. It is constructed from carbon fiber with an Inconel leading edge protection.

Refer to manual listed in section 1.8.2 for more information.



The following table lists approved ground adjusted pitch settings. Other settings impact aircraft performance and noise and must be approved.

Propeller setting	Blade pitch setting angle	Impact on performances
Standard	25°	No impact – see Section 5 content
Other settings	No other settings approved	See section 9

NOTE

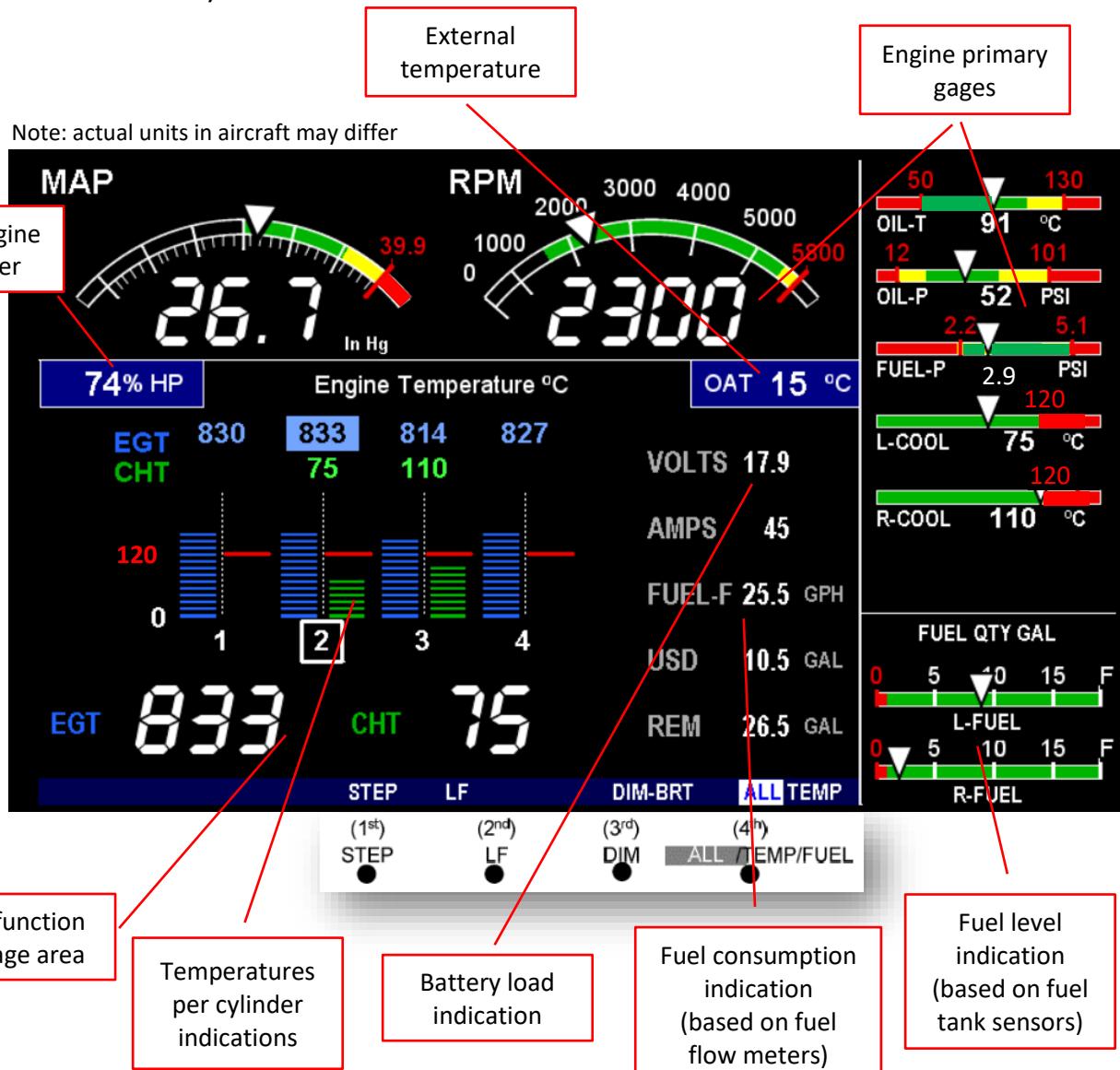
Changing the setting affects the airplane performance and is subject to an approval by the manufacturer and EASA. It can only be made with their approval.

7.9.7 ENGINE MONITORING SYSTEM (EMS)

The Sonaca 200 features a JPI EDM900 instrument to control all powerplant parameters. An explanation of the control screen is given in the picture below, and essential information about control buttons is given in the next pages.

Further functions and explanation can be found in the latest issue of the JPI EDM-900 Pilot's Guide furnished with your aircraft.

- Screen layout presentation (see next page for operation via control buttons):



Buttons operations	Action on EMS
STEP	In the Automatic mode, tapping the STEP button stops Scanner autosequencing and changes to Manual mode. Each tap of the STEP button then displays the next measurement in the sequence. Holding the STEP button sequences in reverse order.
LF	In Automatic or Manual modes holding the LF button for three seconds will toggle between Standard and Normalize (NRM) views. Holding LF during power up will display the primary alarm limits after the self-test is complete.
DIM	Tapping DIM (brightness decreases) or holding DIM (brightness increases) allows decrease or increase brightness respectively.
LF + DIM	Holding both the LF and DIM buttons simultaneously will display the Hobbs readings. Tap button labeled NEXT to see additional information screens.
ALL / TEMP / FUEL	Select what is shown during Scanner auto-sequence. Choices are ALL, TEMP or FUEL. Highlighted one is what is active.

- Detailed information on important functionalities:

- Fuel management:

USD (used fuel) is automatically reset whenever you perform **REFUEL** on your EDM (except if TRIP mode = yes). After filling your tanks and prior to engine start you should inform the EDM that the aircraft has been filled. In this case **USD** is automatically set to zero.

Start-up fuel: The EDM will flash **REFUEL?** On start-up. If there is no need to adjust the **REM** (remaining fuel on board) fuel parameter, simply tap **NO** to quit, otherwise tap **YES**, then on the next screen tap **ADD/SUB**.



You can then select either **ADD** or **SUBTRACT** buttons to adjust to the desired quantity the **REM** parameter:

New REM = Initial REM +/- adjustment

The minimum value for **REM** parameter is 0 L. Holding the **ADD** or **SUBTRACT** buttons pressed will allow for faster variation in case of large volume adjustment.



To manually set to zero the amount of fuel **USD** at any time, manually **STEP** to display **USD** and then hold both **DIM** (button 3) and **EGT/FF** (button 4) until the display shows '**USD 0.0 L**' (this normally takes about five seconds).

Trip mode is typically used if you want to track the total fuel used over a multi-stop cross country. To have the **USD** parameter continuously accumulate total consumed fuel, set **TRIP? Y**. 'Trip Mode' is described in the 'Program Mode section' of the EDM 900 Pilot's Guide.

NOTE

Typically, **TRIP** is set to 'N' so that **USD** will be reset every time you fuel the aircraft.

See section 7.10.6 for fuel management

o Hobbs time:

The EMS has an integrated timer that will display EMS total time, Airframe and Engine Hobbs time.

• Recommended EMS use:

In the next pages, recommended settings and use of the EMS are presented for each flight phase.


**Engine
Run-Up**
Suggested setup:

- Set engine to run-up RPM

Normalize view:

- Manual mode

Verify:

- Uniform rise of about 30°C in all EGTs in single magneto operation.
- Uniform rise of EGTs with application of the mixture control.

Be alert for:

- unusually low voltage (less than nominal battery voltage)
- cold OIL and normal oil pressure
- abnormally high CHT
- Large drop in EGT on one cylinder in single magneto operation—may be fouled spark plug.


**Take-Off,
Climb, and
Full
Throttle
Operations**
Suggested setup:

- Standard view
- Automatic mode

Verify: EGTs and CHTs consistent with past climbs. EGTs

- Should be in the 700° to 900°C range (55° to 165°C
Cooler than cruise) due to fuel cooling.

Be alert for:

- High EGT in one cylinder, 165°C above the others indicate plugged injector or leaking manifold gasket on a carbureted engine. At high density altitude an overly rich mixture can significantly reduce engine power.
- If all EGT columns go off scale to the top of the column, be sure you are not in Normalize view, as indicated by the symbol NRM above the Scanner® section.



Cruise

Suggested setup:

- Normalize view
- Automatic mode

Be alert for:

- Uneven EGTs (injected engines). Make fine adjustments to throttle, then RPM, then mixture to level the display columns.
- Abnormal patterns of EGTs and CHT. (see *Engine Diagnosis Chart* on next page).



Descent

Suggested setup:

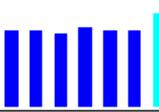
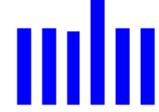
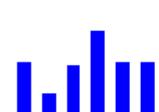
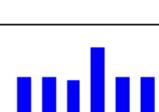
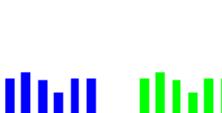
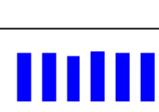
- Standard view
- Manual mode

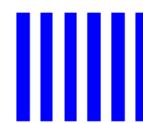
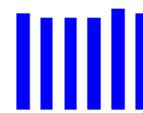
Be alert for:

- Coolant: shock cooling alarm is set to -51°C/minute. Average cool rates of -22°C/minute to -28°C/minute are normal

- Engine Diagnosis Chart:

The following charts can be used to diagnose engine problems and perform troubleshooting in your aircraft.

Display	Symptom	Probable Cause	Recommended Action
	TIT ~100° higher than EGTs	This is normal	
	75° to 100° EGT rise for one cylinder during flight	Spark plug not firing due to fouling, faulty plug, wire or distributor.	Enrich mixture to return EGT to normal. Have plugs checked.
	EGT Increase or decrease after ignition maintenance	Improper timing: high EGT → retarded ignition; low EGT → advanced ignition.	Check EGT for each magneto to determine any uneven timing.
	Loss of EGT for one cylinder. Engine rough	Stuck valve. Other cylinders are okay.	Have valve train checked.
	Loss of EGT for one cylinder; no digital EGT	Failed probe or failed wire harness.	Swap probes to determine if probe or wire harness is bad.
	Decrease in EGT for one cylinder	Intake valve not opening fully; faulty valve lifter.	Have valve lifter or rocker arm checked.
	Increase in DIF at low RPM	Low compression (blow by) in cylinder	Check compression.
	EGT and CHT not uniform	Normal for carbureted engines. Dirty fuel injectors or fouled plugs.	Check injectors and plugs.
	Decrease in EGT for all cylinders	Decrease in airflow into the induction system. Carb or induction ice.	Check for change in manifold pressure.

Display	Symptom	Probable Cause	Recommended Action
 	Slow rise in EGT. Low CHT	Burned exhaust valve. CHT is low due to low power output.	Have compression checked.
 	High CHT on cylinders on one side of engine	Obstruction under cowling.	Check for improper installed baffling, cowl flap misalignment or bird nests.
 	Rapid rise in CHT of one cylinder	Detonation.	Reduce power.
	Sudden off scale rise for any or all cylinders	Pre-ignition Normalize view or failed probe	Full rich and reduce power. Change to Standard view Check probe
(no picture)	Loss of peak EGT	Poor ignition or vapor in fuel injection system.	Have magneto tested.
(no picture)	Decrease in peak or flat EGT response to leaning process	Detonation. Usually the result of 80 Octane fuel in 100 Octane engine.	Enrich mixture, reduce power and relean mixture. Repeat to find power setting where normal peak is obtained or run rich.
	Below 10,000 ft. full throttle causes EGTs to rise	Weak or defective mechanical fuel pump.	Apply booster pump. If EGTs drop, replace fuel pump.
 	CHT more than 500°, EGT normal. Adjacent EGT may be low	Leaking exhaust gasket blowing on CHT probe.	Look for white powder around cylinder to determine leak area.

7.10 FUEL SYSTEM

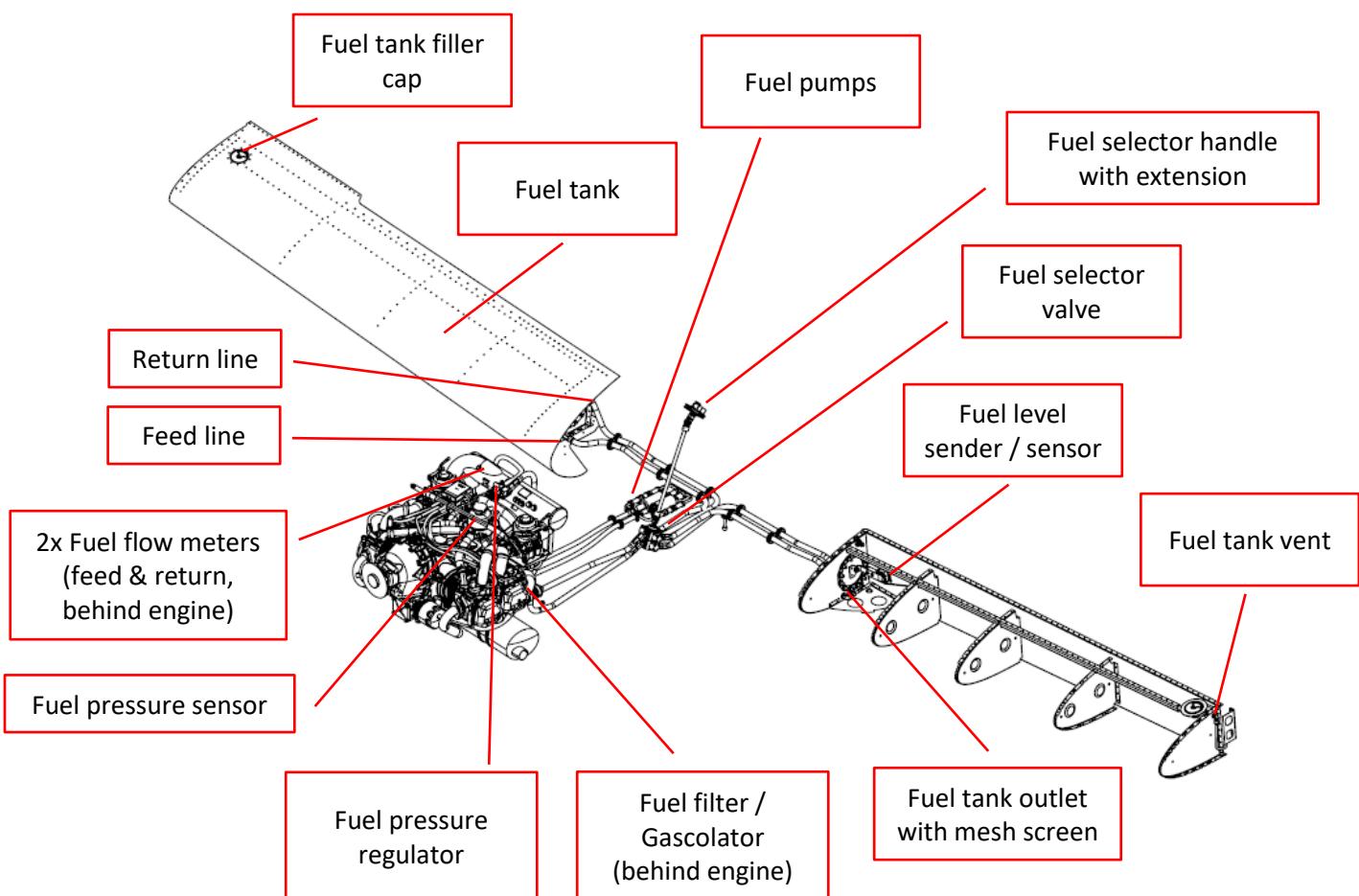
The airplane has 2 fuel tanks located each in the inside leading edge of each wing. Each tank is equipped with a vent with an internal inlet at the inboard top of the tank and the outlet underneath the wing. The Fuel tank outlet is equipped with an internal copper mesh finger screen acting as a filter.

A drain valve is located in the lowest point of the each tank.

Tank outlets lead to a fuel selector valve situated on the central console in the cockpit.

Fuel return lines return excess fuel supplied by the fuel pump to the fuel tank in use.

The system is configured as in the diagram below.



7.10.1 FUEL TANKS

The Sonaca 200 is equipped with 2 wing tanks, each tank integrated within the inboard wing leading edges and equipped with strainers in pick up line and drain fittings.

Type	Capacity (liter)
Capacity of each tank	73 L
Total capacity	146 L
Total Usable fuel	140 L
Total unusable fuel	6 L (3 L per tank)
Approved fuel grades	Minimum RON 95 / minimum AKI 91 MOGAS: EN 228 Super, EN 228 Super plus, ASTMD4814 Leaded AVGAS: AVGAS 100LL (ASTM D910). Unleaded AVGAS: UL91 (ASTM D7547).

WARNING

Do not fly with fuel under unusable fuel level.

The fuel pickup is located inboard rearward in the fuel tank. The aircraft should at not be subjected to sustained side slip when fuel tanks are nearly empty as this may expose the fuel lift pipe to suck air, thereby starving the engine of fuel leading to engine failure.

Unusable fuel quantity is determined in cruise attitude, wings level. Climb attitude is less critical and descent attitude is more critical when reaching low fuel level.

NOTE

Operate with Unleaded rather than Leaded fuel as much as possible. Leaded fuel will make the engine run rougher and will increase maintenance costs.

7.10.2 FUEL SELECTOR

Fuel tank feed selection is enabled by a red coloured, three-position (RIGHT, LEFT, OFF) rotary fuel selector valve, located at the bottom centre of the instrument panel / front of centre console. Refer to the instrument panel layout in paragraph 7.5.

An additional round knob must be pulled to move the selection lever through a detent to the OFF position, preventing inadvertent closure (OFF selection) of the valve.

7.10.3 FUEL PUMPS

Fuel feed is through two electric pumps. Each pump operates in parallel tanks to the installed check valves (Non Return Valve).

The main fuel pump is connected directly to the Alternator 1 and the battery, using a diode bridge. The pump is not operated when Alternator 1 and Battery Master switch are off.

The auxiliary fuel pump is connected to the main bus which is supplied in power by Alternators 1 and 2, as well as by the Battery.

If the main pump fails, the auxiliary fuel pump can be operated via power from the main bus, provided that the charge relay remains energised / is not failed, the master switch is on and there is no failure of the power supply to the main bus.

If power to the main bus is unavailable, or the charge relay fails, the charge system is disconnected from the main bus and battery. In this case the auxiliary pump is not operative.

WARNING

At least one fuel pump must be operational at all times during flight for the engine to be operational! With no pump operational engine stoppage will occur due to fuel starvation.

7.10.4 FUEL FILTER AND PRESSURE REGULATOR

In addition to the finger screen in the tank outlet, the fuel feed from the fuel pumps enters a filter, also called Gascolator, which filters dusts and sediments as well as water that may have accumulated in the tanks.

The fuel tanks and Gascolator drains shall be checked for water accumulation during each pre-flight inspection.

Fuel is then routed to the engine fuel pressure regulator mounted on the engine, where after it splits into two separate branches, one for each carburettor. A fuel pressure sensor is connected in parallel of the fuel pipe branches.

Fuel return lines return excess fuel supplied by the fuel pump(s) to the fuel tank in use. In normal operation, a pump will deliver 120 L / hour to the regulator, the engine will use 25 L / hour and about 95 L / hour will return to the fuel tank.

NOTE

Fuel pumps are equipped with an integrated fine filter. In case of refueling with fuel containing microscopic fibers or dust (invisible to human), dirt will accumulate in fine filters until they become clogged. This will result in pumps being unable to supply enough fuel to the engine.

Always use the funnel with integrated fine filter when refueling the aircraft.

In case of suspicion of filter clogged, check Fuel Flow on EMS.

7.10.5 FUEL FLOW METERS

The Sonaca 200 is equipped with two fuel flow meters to measure the amount of fuel per hour pumped to the pressure regulator, and the amount returning from the regulator to the tank.

The EMS collects measurements from both sensors and calculates the difference, which is the exact engine fuel consumption. Refer to next section for information on the use of this indication.

The following table allows troubleshooting an abnormal fuel flow indication:

Observed indication	Cause
Engine idle: approx. 3.5L/h Full power: approx. 30L/h	Normal condition
Engine idle: approx. 3.5L/h Full power: below 20L/h and engine stalling	Fuel pump filter clogged
No indication at all or 0L/h	Both sensors failed
	Connector behind instrument disconnected
High fuel flow: between 80 and 130 L/h	Return fuel flow sensor failure
Negative fuel flow	Feed fuel flow sensor failure

WARNING

In case of abnormal fuel flow indication, finish flight by calculating fuel consumption based on table in section 5.3.9 and bring aircraft to maintenance.

7.10.6 FUEL QUANTITY INDICATION AND EVALUATION

The Sonaca 200 features 3 independent methods to assess and manage fuel quantity on board. These methods are described below.

- Fuel quantity indication on EMS :

After EMS start-up, the fuel quantity is indicated in the bottom right corner of the screen on two gages, one per fuel tank.

A red warning range is programmed for the last 5 L per tank.

The indicator minimum (0 L) corresponds to unusable fuel quantity.

See also notes on next page.

WARNING

Fuel level indication on EMS is only accurate when aircraft is in level flight attitude. During climb, there is less fuel than indicated and during descent there is more fuel than indicated.

Before initiating climb or descent, always crosscheck Remaining Fuel value (**REM**) and gauges indications on EDM 900 to ensure proper fuel management.

NOTE

The EMS fuel tank level indication is an average measurement updated each 2 minutes.

NOTE

The EMS will only indicate exact fuel levels between 0 and 60 L. Fuel levels between 60 and 74 L are shown as “Full” on the instrument and must be evaluated visually using both procedures on next pages.

NOTE

A white “Low Fuel” warning will appear on the EMS in the multifunction area if total remaining quantity is below 20 L (Left plus Right tanks).

- Fuel flow indication on EMS:

During flight, the EMS will display the engine instant fuel consumption, as well as the total fuel used and the remaining fuel on board. These data are calculated independently from fuel tank level senders, and are not impacted by aircraft attitude.

It is therefore required to:

- Reset the “Fuel Used” (USD) parameter before each flight
- Enter correct total amount of fuel on board before each flight via the “Refuel” option
- Continuously monitor the “Fuel Used” parameter in flight and make sure it is in line with initial quantity fuel on board minus remaining indicated quantity

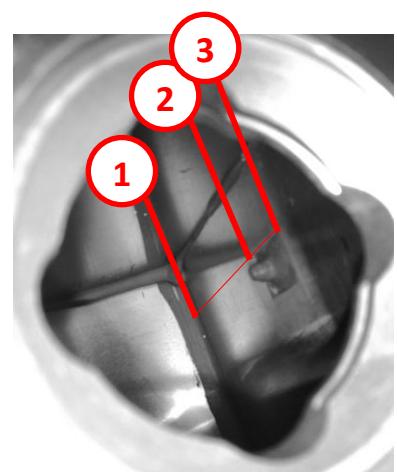
Refer to section 7.9.7 for information on EMS functionalities and use.

NOTE

The EMS fuel flow and fuel used indication is an instantaneous measurement updated each second.

- Visual fuel quantity evaluation :

The remaining fuel quantity in each fuel tank can be evaluated visually after opening the fuel filler cap:

Visual mark	Corresponding fuel level	Illustration
Above 3 (above sealant mark)	Above 70 L	
Between 2 and 3 (between top and bottom sealant edge)	Between 65 and 70 L	
Between 1 and 2 (between tank bottom and bottom sealant edge)	Between 30 and 65 L	
Below 1 (fuel not covering the bottom of the tank)	Below 30 L	

NOTE

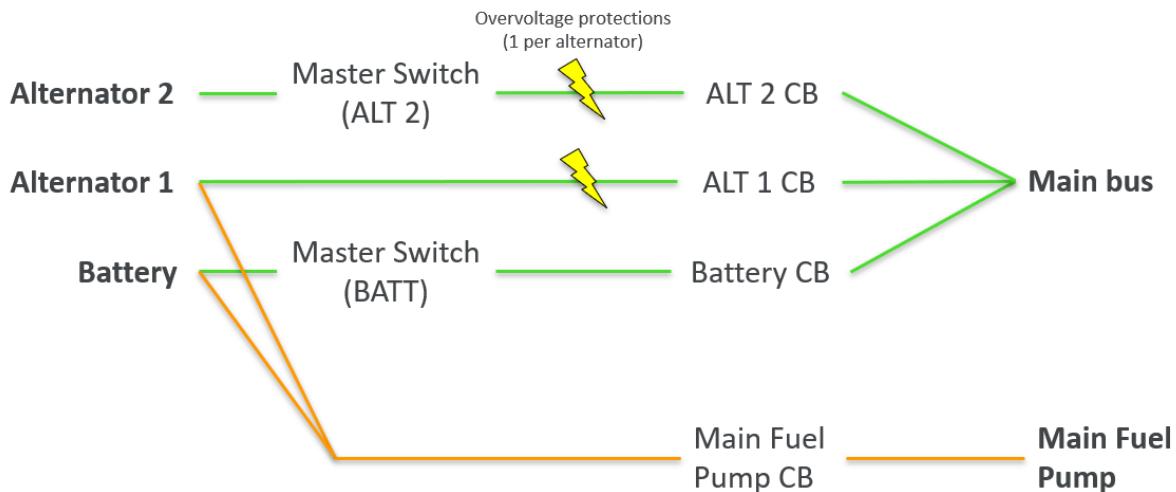
Fuel level evaluation is only accurate when the aircraft is parked level on even ground. Select appropriate parking spot to perform visual evaluation!

7.11 ELECTRICAL SYSTEM

This paragraph describes electrical systems on board of the S200 and includes wiring diagrams which are relevant or can aid the pilot's understanding of the aircraft's systems with respect to the operational procedures described in this manual. Refer also to paragraphs 7.5 and 7.9.

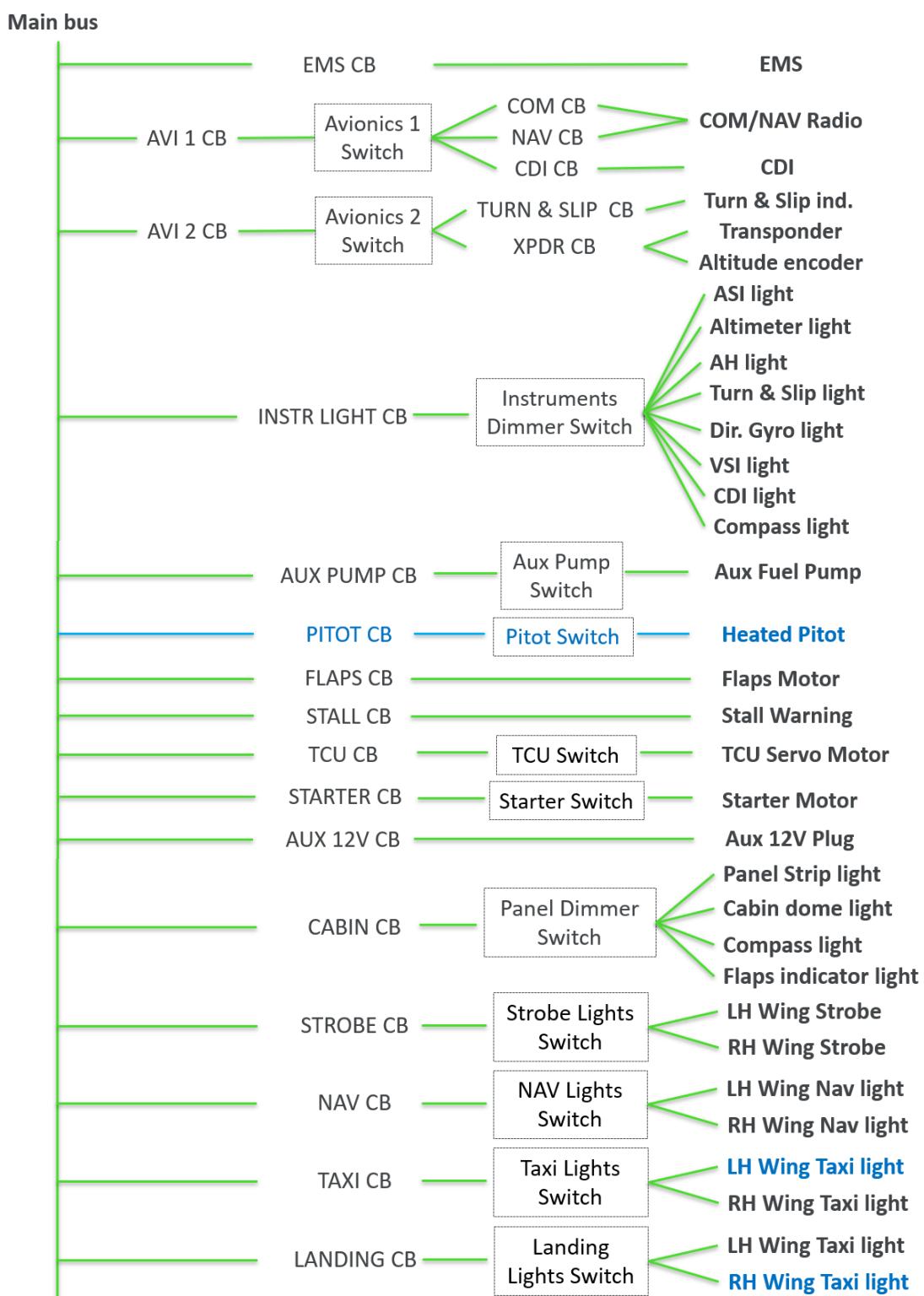
7.11.1 ELECTRICAL SYSTEM OVERVIEW – WIRING DIAGRAMS

The electrical system is described on the schematics below. For detailed electrical wiring diagrams, refer to the Aircraft Maintenance Manual.



The next page describes the electrical systems power supply, starting from the Main Bus.

All equipment represented in Blue colour are optional.



7.11.2 CHARGE SYSTEM

The alternating current (AC) output of the engine driven alternator is routed to a rectifier / regulator where it is rectified and regulated, to provide 12V direct current (DC) output available to the aircraft systems.

Alternators 1 and 2 outputs are as follow:

Alternator	Maximum continuous output (under 12V)	Regulated Output Voltage
1 (Internal in Rotax 914F)	14 A / 168 W	13.5 V
2 (External, belt-driven)	34 A / 408 W	14.3 V
Total	48 A / 576 W	N/A

Charge system output measured at Main Bus is approximately 14 V DC (from 2000 \pm 250 rpm and higher) when both Alternators are on.

When both alternators are operating in parallel, Alternator 2 will deliver most of the electrical power due to it's higher regulated voltage. This is the normal operating configuration.

Alternator 1 relay is automatically powered as soon as any of the two Master switches are on or engine running. It will supply power to main bus as long as the engine is running, even if Master Switches (BATT and ALT 2) are turned off.

Loss of power to the main bus will result in Alternator 1 relay de-energizing and disconnecting the charge system output from the battery / main bus.

Alternator 2 charge relay is controlled by ALT 2 Master Switch.

Battery power relay is controlled by BATT Master Switch.

Failure (i.e. with the relay contact opening) of any of the two charge relay will disconnect the corresponding charge system from the battery / main bus. The main bus / system voltage (indication on EMS) could show a reduced reading.

NOTE

Alternator 1 does not charge the battery below 3000 RPM. ALT 2 Master Switch must be on during warm-up and taxiing to ensure positive charge and prevent battery depletion.

7.11.3 BATTERY

The 12 V battery is mounted on the engine side of the firewall in a fireproof insulated box. It is a gel-type battery that does not require specific maintenance.

NOTE

Battery life is optimal when stored in cool temperatures (0-30 °C). To prevent premature battery failure, avoid as much as possible parking in direct sunlight on hot days.

Battery deep discharge will result in battery failure. Always stop Master Switch when engine is off and voltage indicates below 10 V and charge battery immediately.

7.11.4 MAIN BUS

Following equipment are directly connected to the main bus and may become non-operational in case of main bus power supply failure:

1. Auxiliary fuel pump
2. Flaps
3. EMS
4. Radio
5. Transponder
6. Cabin and instruments light(s)
7. Strobe, navigation and taxi lights.

7.11.5 MASTER AND STARTER SWITCHES

The Sonaca 200 is equipped with a dual master switch mounted on the instrument panel, connected to Battery and Alternator 2 relays.

The starter switch is a push button mounted on the instrument panel and can be activated after powering the main bus.

7.11.6 IGNITION SWITCHES

Two ignition switches are grouped into a turnkey switch located on the left hand side of the instrument panel. This switch allows to activate one, the other or both ignition circuits.

Both ignition switches should be ON to operate the engine.

NOTE

The engine ignition system is independent of the aircraft electrical system (except for starter motor operation) and will operate even with the master switch and / or any circuit breaker(s) off. However the engine requires adequate power supply to at least one electrical fuel pump to remain operational (to prevent fuel starvation).

7.11.7 AVIONICS AND EQUIPMENT SWITCHES

Refer to paragraph 7.5. Lever type switches are switched UP for activation (i.e. ON).

7.11.8 CIRCUIT BREAKERS

Circuit breakers are push-to-reset for protection of the electrical wirings and circuits. Circuit breakers are located on the instrument panel. Refer to paragraph 7.5.

7.11.9 ALTERNATOR FAILURE INDICATION

The electrical system incorporates two alternator charge warning lights located in the warning lights row on the upper central part of the instrument panel (refer to paragraph 7.5). The light corresponding to the failed alternator will illuminate if there is an AC generator (alternator) failure. The main bus / system voltage (indicated on EMS) will result in a reduced reading.

Refer to section 3.10.3 for action in case of alternator failure.

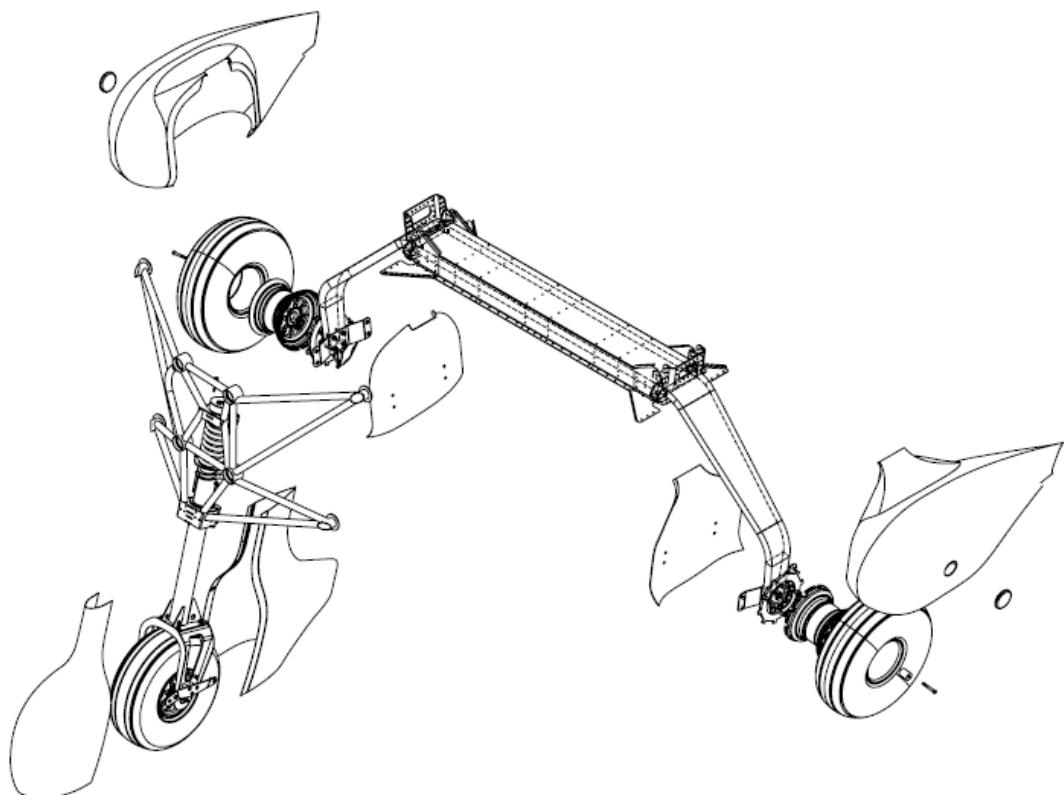
7.12 LANDING GEAR

7.12.1 LANDING GEAR STRUCTURE

The landing gear is a tricycle landing gear with a steerable nose wheel.

The main landing gear uses a single continuous aluminium leg.

The nose landing gear incorporates a spring and is attached to the engine mount truss.



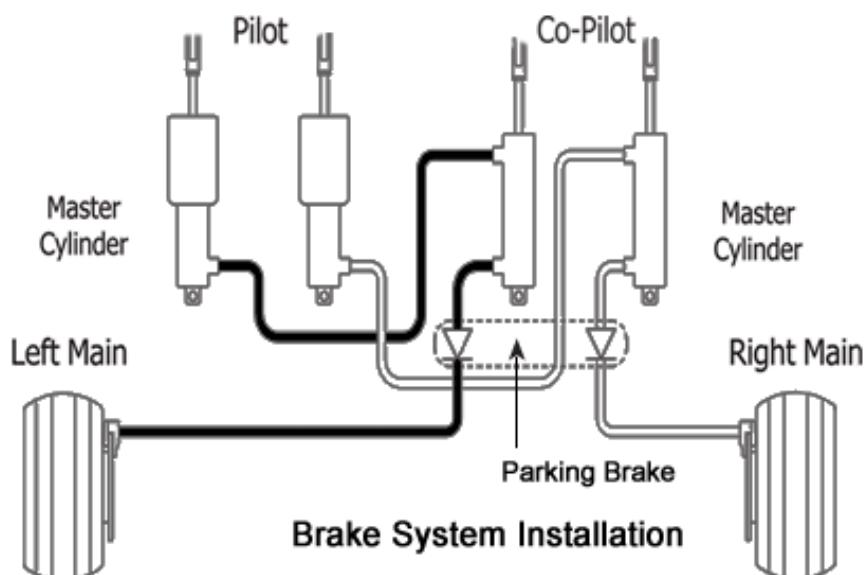
7.12.2 BRAKING SYSTEM

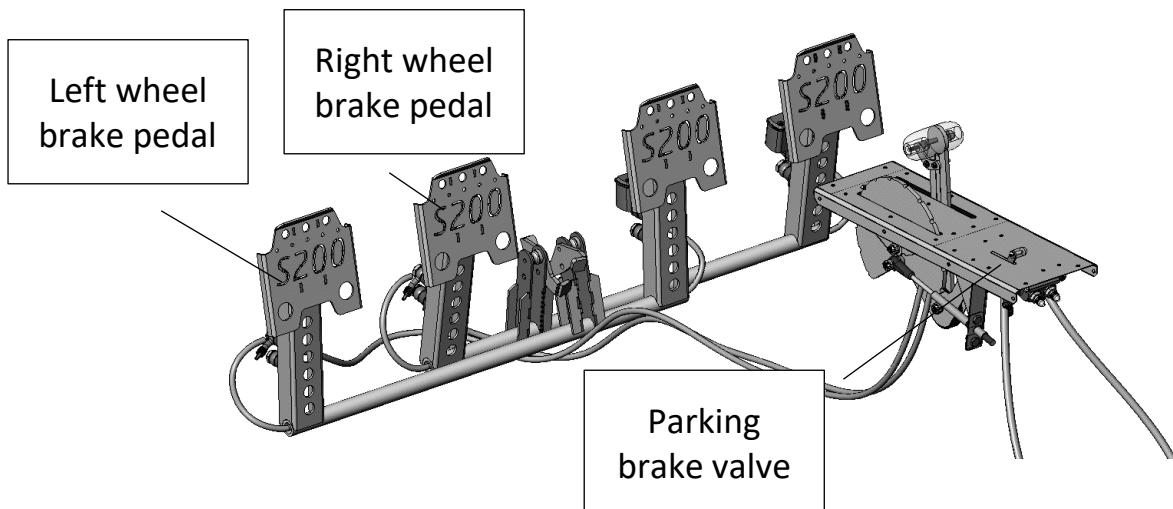
The aircraft braking system is differential, foot controlled braking system acting on both wheels of the main landing gear through disk brakes.

Each brake calliper, on left and right hand wheels, is separately actuated by an independent hydraulic line. There are interconnected Master Hydraulic Cylinder fitted on the rudder pedals of the pilot and the co-pilot. By pushing the top of the rudder pedal in order to rotate it, the Master Hydraulic Cylinder is actuated. The pilot and copilot left brake pedals actuate the left wheel brake, and pilot and copilot right brake pedals actuate the right wheel brake. Brake liquid tanks for both, left and right hand hydraulic lines, are located behind the rudder pedals, on top of the copilot Master Hydraulic Cylinders.

An intercept valve acts as a parking brake by stopping pressure relief.

For braking to be operational the brake intercept valve must be off and the brake pedals activated. This can be activated by a dedicated brake handle in the cockpit. The arrangement is apparent in the diagram below:





To actuate the brakes using pedals, apply pressure on the top of each pedals using your toes. This will rotate the pedals around their central axis, and compress the two brakes cylinders.

To activate the Parking Brake, apply brakes as described above and pull the Park Brake valve rearward, keeping the pedals pushed until the valve has reached its rearward stop. To release the Parking Brake, apply pressure on pedals and move the valve forward in the same way.

Pressure on both pedals should always be applied when engaging and disengaging the parking brake valve.

7.12.3 TYRES

Tyre approved types :

Nose Landing Gear Tyre : Michelin Aviator 5.00-5/10/120

Main Landing Gear Tyres : Michelin Air 380X150/15X6.00-5/6/120

Tyre inflating pressure :

Nose Landing Gear Tyre : 2.2 bar (39 psi) with a tolerance of +0.2 bar;

Main Landing Gear Tyres : 3.4 bar (49 psi) with a tolerance of +0.2 bar.

7.13 MINIMUM INSTRUMENTS AND EQUIPMENTS FOR FLIGHT

The following minimum instrumentation and equipment is required for day VFR flight :

- Altimeter (pressure altitude).
- Airspeed indicator (IAS).
- Compass (magnetic heading).
- Chronometer (integrated in radio).
- Fuel gauges.
- Oil pressure indicator.
- Oil temperature indicator.
- Coolant temperature indicator.
- Outside air temperature indicator.
- Tachometer.
- First aid kit (compliant with national legislation).
- Fire extinguisher.
- Hammer to break the canopy in case of emergency (canopy blocked)
- Personal Location Beacon (PLB) on pilot or in central console storage
- Spare electrical fuses
- Seat belt with upper torso restrain system, having a single point release
- Headset with boom microphone (in case of training flights – 2 crew members)

In addition, following minimum instrumentation and equipment are required for night VFR flights:

- Taxi light.
- Landing light.
- Position/Navigation lights.
- Anti-collision/Strobe lights.
- Instruments lighting system
- Cabin light
- Independent portable light for each crew member station
- Radio communication Equipment

Other equipment are mandatory when required by the airspace to be flown:

- Radio communication Equipment
- Navigation equipment
- Transponder

WARNING

The Aircraft is certified with its original instrumentation.

Notwithstanding that user installed equipment may include certified or uncertified GPS or/and other advanced flight and navigational aids, such equipment may not be used as the sole information source for purposes of navigation or flight, except where specifically permitted by law.

See section 8.4.1 for any modification to the aircraft instrumentation.

8 AIRPLANE GROUND HANDLING AND SERVICING**8.1 TABLE OF CONTENT**

8.1 TABLE OF CONTENT	8-1
8.2 INTRODUCTION	8-2
8.3 AIRPLANE INSPECTION INTERVALS	8-3
8.4 AIRPLANE ALTERATION OR REPAIRS.....	8-4
8.5 GROUND HANDLING	8-5
8.6 CLEANING AND CARE.....	8-10

8.2 INTRODUCTION

This section contains factory-recommended procedures for proper ground handling and servicing of the aeroplane. It also identifies certain inspection and maintenance requirements which must be followed. It is wise to follow a planned schedule of lubrication and preventive maintenance based on climatic and flying conditions encountered.

This document does not replace the maintenance manual. Refer to the maintenance manual ref. SONAIR-S2-D-MAN-002 supplied with the aircraft for more information.

8.3 AIRPLANE INSPECTION INTERVALS

Refer to the maintenance manual ref. SONAIR-S2-D-MAN-002 supplied with the aircraft for more information.

Inspections and servicing should be carried out according to (at least) the following periods:

- After the first 25 flight hours,
- Thereafter after every 100 flight hours or annually, whichever is soonest, and as stipulated in the latest revision of the applicable engine manufacturer and propeller manufacturer documentation.

8.4 AIRPLANE ALTERATION OR REPAIRS

8.4.1 MODIFICATIONS

It is mandatory that you contact the aircraft manufacturer and get its authorization prior making any modifications to the aircraft, to ensure that the airworthiness of the aircraft is not affected.

It is essential that the EASA be contacted by the manufacturer prior to any alterations on the aeroplane to ensure that airworthiness of the plane is not violated.

If the aircraft weight is affected by a modification, a new mass and balance determination is necessary. This should be completed comprehensively and new data / figures should be recorded in all relevant documentation.

8.4.2 REPAIRS

For repairs, refer to the maintenance manual ref. SONAIR-S2-D-MAN-002 supplied with the aircraft for more information.

Always use only original spare parts produced by the aircraft (or engine/propeller) manufacturer, as the case may be.

8.5 GROUND HANDLING

The S200 can be manoeuvred on ground with or without tow bar. Read carefully following procedures to ensure safe manoeuvres.

CAUTION

Check surrounding aircraft and hangar doors / pillars before maneuvering the aircraft on ground. Propeller blades, wing leading edges and wing tips are exposed areas sensitive even to smallest impacts

8.5.1 GROUND HANDLING WITH TOW BAR

Push on tow bar lever to open the forks.

Engage the forks in the two holes on the nose wheel and release lever to secure the tow bar in the nose wheel brackets.

Once the tow bar is secured, eventually ask somebody to remove the wheel chocks and make sure the parking brake of the aircraft is released, then manoeuvre the aircraft gently by pulling the tow bar forward, pushing rearward, or rotating the nose wheel by applying a side movement on the Tow Bar handle.

Always pay attention to not hit the propeller blade with tow bar while manoeuvring the aircraft

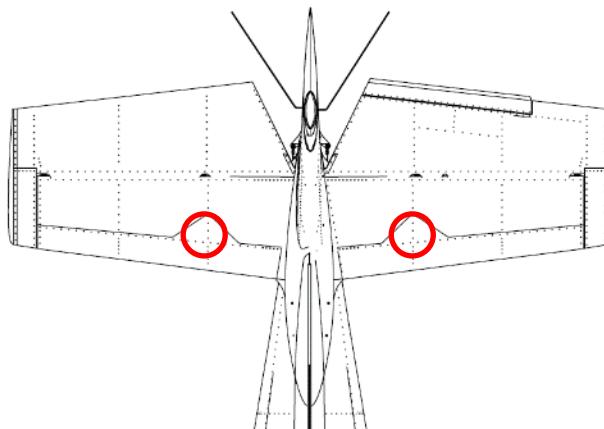
CAUTION

Remove tow bar before starting the engine.

8.5.2 GROUND HANDLING WITHOUT TOW BAR

If you wish to move the aircraft on the ground otherwise than under its own power, it is best to pull the aircraft forwards or push it backwards by hand holding one or more propeller blades, close to the spinner.

The rear fuselage may be pushed down directly above a bulkhead or the horizontal stabilizer may be pushed down at the locations indicated by a red circle below, in order to lift the nose of the aircraft for manoeuvring purposes. It is best to press down on both points at once to spread the load.



It is also acceptable to push the aircraft carefully backwards by putting pressure on the wing leading edges close to the root, directly on a nose rib, or on the horizontal stabilizer leading edge next to the root over a rib.

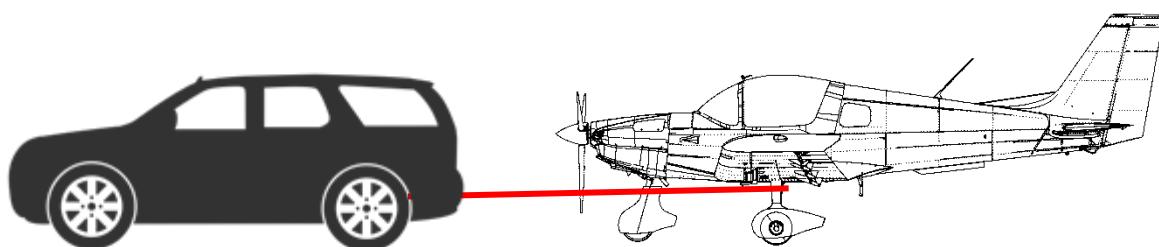
CAUTION

Avoid excessive pressure on the aircraft airframe - especially at or near control surfaces. The skins are very thin and minimum pressure should be placed on them. Maintain all safety precautions, especially in the propeller area.

8.5.3 TOWING BY VEHICLE ON GROUND

The aircraft may be towed at slow speed on an even ground by a rope attached to a vehicle. In this case, following precautions must be taken:

1. Verify: Fuel tank selector off, Master Switches off
2. Attach ropes on the upper part of both Main Landing Gear legs, immediately below the fuselage attachment
3. Carefully tighten the ropes to the vehicle, making sure that no force is applied on the propeller or any other part of the aircraft
4. Release Parking brakes
5. Start slow towing
6. Stop immediately in case one or several aircraft wheels are stranded in a ditch or in soft ground, or if the ropes enter in contact with the propeller or any other part of the aircraft
7. After towing, remove ropes and visually inspect aircraft to ensure no part was damaged.



8.5.4 PARKING

It is advisable to park the aircraft inside a hangar, or alternatively inside any other suitable space (garage), with stable temperature, good ventilation, low humidity and a dust-free environment.

When parking for an extended period, cover the cockpit canopy, and possibly the whole aircraft, by means of a suitable tarpaulin.

8.5.5 MOORING

The aircraft should be tied down when parked outside a hangar. Mooring is necessary to protect the aircraft against possible damage caused by wind and gusts.

For this reason the aircraft is equipped with mooring eyes located on the lower surfaces of the wings and (one) under the tail.

Mooring procedure:

1. Verify: Fuel selector shut off, Master switch switched off.
2. Verify: Ignition switched off.
3. Secure the control stick(s) using the seat belts lower laps
4. Close air vents.
5. Close and lock canopy.
6. Moor the aircraft to the ground by means of a mooring rope passed through the mooring eyes located on the lower surfaces of the wings and below the rear fuselage.

NOTE

In the case of long term parking, especially during winter, it is recommended to cover the cockpit canopy, or possibly the whole aircraft, by means of a suitable tarpaulin attached to the airframe.

8.5.6 JACKING

Jacking must be done by authorized maintenance operators in accordance with the Maintenance Manual.

NOTE

Nobody is authorized in the cockpit during aircraft jacking operation.

It is possible to lift the aircraft in the following manner:

- Main gear wheels can be lifted by jacking carefully on the jack points installed under the wings.
- By pressing down on the horizontal stabilizer, the fuselage front section may be raised and then supported under the firewall.
- By lifting the rear fuselage under a bulkhead the rear fuselage may be raised and then supported under that bulkhead. The support should comprise a large, flat surface area to avoid damage to the under-fuselage skin. The wings should also be gently supported to prevent the aircraft from rolling.
- To lift a wing, push from underneath the wing only at the intersection of the front spar with a rib, and using a support that has a large contact area with the wing lower surface to spread the lifting load on a sufficient length of the spar and rib. Avoid pushing directly on the skin. Lift only one wing at a time.

This procedure can be used, for instance, to put the airplane on scales in order to weigh it.

8.5.7 ROAD TRANSPORT

The aircraft may be transported after loading on a suitable trailer. It is necessary to remove the wings before road transport. The aircraft and dismantled wings should be attached securely to protect against possible damage.

Aircraft disassembly and assembly must be performed by qualified personnel.

Refer to the aircraft maintenance manual for assembly and disassembly instructions.

8.6 CLEANING AND CARE

This paragraph describes cleaning procedures, explains the recommended cleaning agents and give caution notes.

8.6.1 PAINTED SURFACES

Use efficient cleaning products to clean the aircraft surface. Oil spots on the aircraft surface may be cleaned with petrol / gasoline. Take care not to spill cleaning agent on the canopy!

8.6.2 CANOPY

The canopy may only be cleaned by window cleaning agent adapted to perspex. Use either a soft, clean cloth sponge or deerskin.

CAUTION

Never clean the canopy under dry conditions,

Never use petrol or chemical solvents.

8.6.3 INTERIOR SURFACES

Upholstery and covers may be removed from the cockpit, brushed and washed in lukewarm water with a small quantity of detergents. Dry the upholstery thoroughly before insertion into the cockpit.

8.6.4 ENGINE

Refer to the latest revision of the ROTAX 914 F operator manual for cleaning information.

WARNING

Use only approved cleaning agent for cleaning metal parts. Non observance can lead to damage to the cooling system and engine.

8.6.5 PROPELLER

DUC propeller blades are made of Carbon Fiber with an Inconel blade leading edge protection. Use of DUC cleaning treatment (ref. 01-80-003) or similar.

Refer to the latest revision of the DUC Flash-R operator manual for more details.

9 ADDITIONAL INFORMATION**9.1 TABLE OF CONTENT**

9.1 TABLE OF CONTENT	9-1
9.2 INTRODUCTION	9-2
9.3 ENHANCED SAFETY TAKE-OFF.....	9-3
9.4 OTHER MARKINGS AND PLACARDS	9-4
9.5 LIST OF SUPPLEMENTS.....	9-8
9.6 AMENDMENTS	9-8

9.2 INTRODUCTION

This section contains the appropriate supplements necessary to safely and efficiently operate the aeroplane when equipped with various optional systems and equipment not provided with the standard aeroplane.

Each supplement covers only a single system, device or piece of equipment. The supplement may be issued by the aeroplane manufacturer or by any other manufacturer of the applicable item.

Each supplement is approved by the EASA and contains all deviations and changes relative to the basic Flight Manual – Chapter 1 to 8.

Each supplement is a self-contained, miniature Flight Manual. If there is no change in a section, this is explicitly notified in the relevant section.

9.3 ENHANCED SAFETY TAKE-OFF

NOTE

Switching TCU off when Full Power is set freezes the turbo wastegate to fully closed position, ensuring maximum power even in case of TCU failure

Same as normal take off but:

Throttle - Full Power stabilized on brakes

TCU switch - off (down position)

Release brakes and perform normal take-off

Above safety altitude,

TCU switch - on

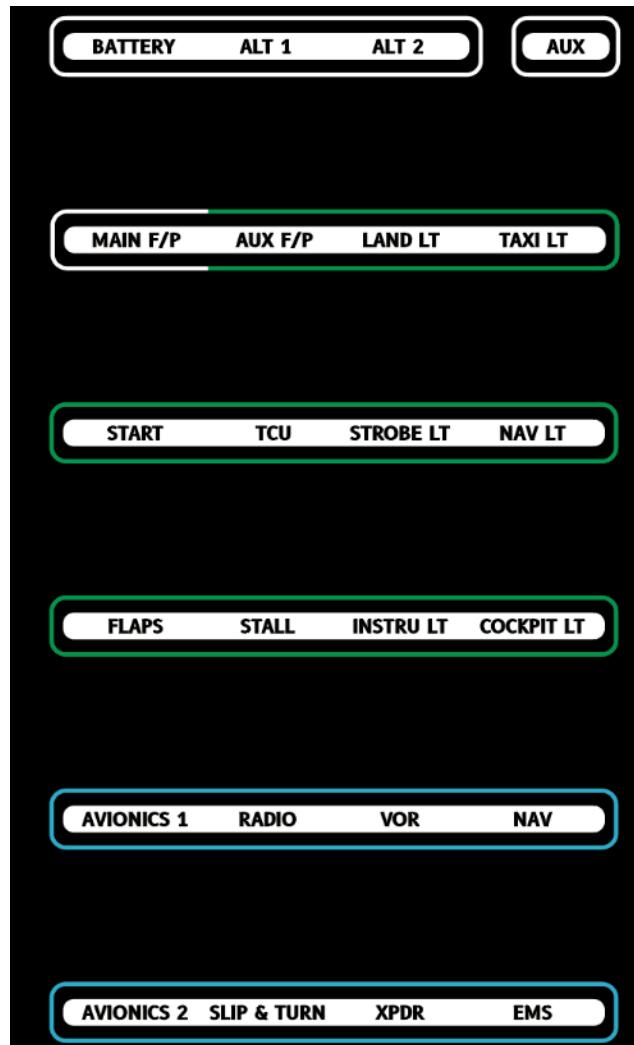
NOTE

This procedure requires additional workload and is not recommended for normal operation

9.4 OTHER MARKINGS AND PLACARDS

The following markings and placards are placed in the aircraft and positioned in plain view of the occupants. Markings concerning limitations or warnings are described and shown in section 2.12.

On the instrument panel under the circuit breakers:



S200 AFM



9 - ADDITIONAL INFORMATION

9.4 - OTHER MARKINGS AND PLACARDS

Under the switches:



Around the dimmer knob:



Under the choke and carburettor heater actuators:



In a place visible to pilot and passenger:



23/07/2019

Rev. : C

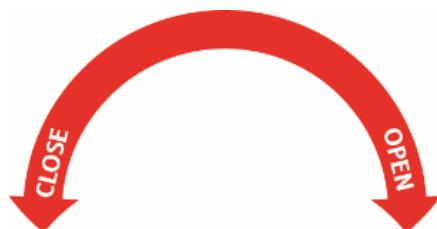
SONAIR-S2-D-MAN-001

Page : 9-5

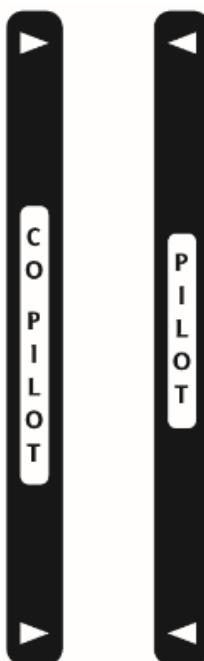
Between the cabin heat system controls:



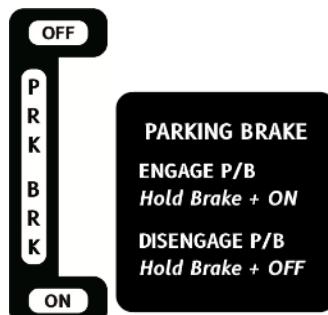
Around the canopy handle:



Adjacent to the microphone jacks:



Adjacent to the parking brake handle:



On the spacing panel between the cockpit and baggage area 1:

**ACCESS TO EMERGENCY
SAFETY HAMMER**

On the emergency hammer handle:

STRIKE IN THE CORNERS

Adjacent to each fuel drain:

FUEL DRAIN

S200 AFM



9 - ADDITIONAL INFORMATION

9.6 - AMENDMENTS

9.5 LIST OF SUPPLEMENTS

NONE at initial issue of this document

Date	Manufacturer	Document Reference	Title

Section 1 - General: system or equipment specifically addressed.

Section 2 - New limitations markings or placards.

Section 3 - Additional emergency procedures.

Section 4 - Additional normal procedures.

Section 5 - Affected performance and new performance tables.

Section 6 – Effect on Weight and balance.

9.6 AMENDMENTS

NONE at initial issue of this document

23/07/2019	SONAIR-S2-D-MAN-001	Page : 9-8
Rev. : C		