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PILOTS OPERATING HANDBOOK

AND

CIVIL AVIATION AUTHORITY OF NEW ZEALAND

APPROVED FLIGHT MANUAL AIR 3002

FOR THE

ALPHA 160Ai

(TYPE CERTIFICATE MODEL R2160i)

Manufacturer’s Serial No:

Registration:

Type Certificate No: A-15

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE CIVIL AVIATION AUTHORITY OF NEW ZEALAND AND ADDITIONAL INFORMATION PROVIDED BY THE MANUFACTURER, AND CONSTITUTES THE CIVIL AVIATION AUTHORITY OF NEW ZEALAND APPROVED AIRPLANE FLIGHT MANUAL.

Civil Aviation Authority of New Zealand approved in the Acrobatic and Utility Category based on FAR 23. This document must be carried in the airplane at all times.

Accepted by: EUROPEAN AVIATION SAFETY AGENCY

Approved by: CIVIL AVIATION AUTHORITY OF NEW ZEALAND

By:____________________________________________________________

(NAME)  (TITLE)

Date: _____________________________

Manufacturer’s Name: ALPHA AVIATION MANUFACTURING LTD

INGRAM ROAD

R D 2,

HAMilton

NEW ZEALAND

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Issue: March 2007
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Overall Dimensions

Wing Span ......................................................... (27ft 3.6in) 8.32m
Overall length ............................................... (23ft 3.5in) 7.10m
Overall height ............................................... (7ft) 2.135m

Internal Cabin Dimensions

Length ................................................................. (6ft 8.7in) 2.05m
Width ................................................................. (3ft 5.7in) 1.06m
Height ............................................................... (4ft 1.2in) 1.25m
2 seats, accessible from both sides by a jettisonable forward sliding canopy.
Luggage Hold .................................................. 0.4m³ (14cu ft)

Wings

Wing area ......................................................... (140sq. ft) 13m²
Airfoil ............................................................... NACA 23015
Aspect ratio .......................................................... 5.42
Wing setting .................................................. 6°18'

Ailerons

Slotted type
Surface (each) ........................................... (5.54sq. ft) 0.515m²
Deflection .................................................. up 20° (± 1.5°)
.......................................................... down 15° (± 1.5°)

Wing Flaps

Surface (each) ........................................... (6.8sq. ft) 0.635m²
Span (each) ................................................ (6ft 3.9in) 1.929m
Deflection ................................................ 0° to 35° (± 2.0°)
Horizontal Stabilizer
Total control area ...................................................... (25.2 sq ft) 2.35 m²
of which anti-balance tab ..................................... (2 x 0.6 sq ft) 2 x 0.063 m²
Span ....................................................................... (9 ft 11.5 in) 3.04 m
Deflection ................................................................. up 10° (± 0.5°)
........................................................................... down 12.5° (± 0.5°)
Anti-tab deflection:
Elevator up .......................................................... 33° ± 3°, tab up
......................................................................... 5° ± 3°, tab down
Elevator down ...................................................... 14° ± 3°, tab up
......................................................................... 22° ± 3°, tab down

Vertical Stabilizer
Surface overall ...................................................... (16.5 sq ft) 1.53 m²
Stabilizer ................................................................. (3.8 sq ft) 0.35 m²
Rudder ................................................................. (12.7 sq ft) 1.18 m²
Deflection .......................................................... 0° to 30° (± 2.0°)

Landing Gear
Fixed Tricycle Type
Oleo-pneumatic dampers ....................................... stroke (6.3 in) 160 mm
Track ....................................................................... (9 ft 5.3 in) 2.88 m
Wheel base ............................................................ (4 ft 8.3 in) 1.434 m
Tyre size ................................................................. 380 x 150
Oil/Air shock strut Hydraulic Oil ......................... MIL–PRF-5606H

Nose Gear
Tyre pressure ............................................................ (23 psi) 1.6 bar
Shock strut pressure ................................................. (58 psi) 4 bar
Main landing gear
Tyre pressure ..................................................... (26 psi) 1.8 bar
Shock strut pressure. ............................................ (116 psi) 8 bar

Brakes
The disc brakes are operated by an independent hydraulic circuit on each main gear wheel. Brakes can be applied by either pilot.
Hydraulic oil.................................................................... MIL–PRF-5606H

Power Plant
Engine
Manufacturer .......................................................... LYCOMING
Model ................................................................. AEIO-320-D2B
Type ............ Horizontally opposed, 4 cylinders, normally aspirated
Maximum continuous power .............................. 160 HP at 2700 rpm
Maximum normal operating speed ........ ............. 2600 rpm

Propeller
Manufacturer ....................................................... Sensenich
Model ................................................................. 74DM7S5-2-64
Diameter ........................................................................ 1.83m (72in)*
Pitch ............................................................................ 1.62m (64in)
Type ................................................................. Fixed pitch, two bladed, metal
Minimum Static RPM, Full Throttle at sea level........ 2150 rpm
Maximum RPM .......................................................... 2700 rpm
Maximum normal operating speed ........ ............. 2600 rpm

* Any reduction in diameter during repair is forbidden
Fuel

Aviation petroleum\(^1\) .................................................. AVGAS 100 LL
Fuel grade\(^1\) .......................................................... (octane) 100 minimum

Single fuselage tank:
Total fuel capacity ....................... (35.2 Imp. gal/42.2 US gal) 160 l
Total usable fuel ......................... (34.8 Imp. gal/41.7 US gal) 158 l
Unusable fuel ............................. (0.4 Imp. gal/0.5 US gal) 2 l

Oil
Total engine capacity .............................. (8 US quarts) 7.5 l
Usable capacity ................................. (4 US quarts) 5.7 l

\[\boxed{\begin{align*}
\text{During the first 50 hours of operation:} \\
\text{Use Only Pure mineral oil} \\
\text{After the first 50 hours of operation:} \\
\text{Dispersant oil}
\end{align*}}\]

Grades\(^2\)

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<td>SAE 40, 30 or 20W40</td>
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<td>Below -10°C (10°F)</td>
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\(^1\) Refer to the Service Instruction Lycoming n°1070 latest edition

\(^2\) Refer to Service Instruction Lycoming 1014 latest edition.
## Maximum Authorised Weights

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<td>Stalling speed flaps in landing position</td>
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<td>Indicated airspeed</td>
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List of Radio Abbreviations

ADF ......................... Automatic Direction Finder
ATC ......................... Air Traffic Control
COM ......................... Communication Transceiver
DME ......................... Distance Measuring Equipment
ELT ......................... Emergency Locator Transmitter
IFR ......................... Instrument Flight Rules
ILS ......................... Instrument Landing System
MKR ......................... Marker Beacon Receiver
NAV ......................... Navigation Indicator and Receiver
AUDIO ..................... Audio Control Panel
VFR ......................... Visual Flight Rules
VHF ......................... Very High Frequency
VOR ......................... VHF Omni-Range (beacon)
Conversion Factors

nautical mile ........ x ........ 1.852 ............. = ....... kilometres
feet .................... x ........ 0.305 ............. = ....... metres
inches ................. x ........ 0.0254 ............. = ....... metres
inches .................. x ........ 25.4 ............. = ....... millimetres
feet/minute ........... x ........ 0.00508 ........... = ....... metre/second
gallons (US) ........ x ........ 3.785 ............. = ....... litres
gallons (Imp) ........ x ........ 4.546 ............. = ....... litres
quarts (US) .......... x ........ 0.946 ............. = ....... litres
knots ................... x ........ 1.852 ............. = ....... km/h
psi ........................ x ........ 0.0689 ............. = ....... bar
in.Hg ................... x ........ 33.86 ............. = ....... mbar
lb ........................... x ........ 0.453 ............. = ....... kg
ft.lb ........................ x ........ 0.138 ............. = ....... kg.m
(°F-32) .................... x ........ 5/9 ............. = ....... °C

kilometres ............ x ........ 0.539 ............. = ....... nautical mile
metres .................. x ........ 3.281 ............. = ....... feet
metres .................. x ........ 39.37 ............. = ....... inches
millimetres ............ x ........ 0.03937 ........... = ....... inches
metre/second .......... x ........ 197 ............. = ....... feet/minute
litres .................. x ........ 0.264 ............. = ....... gallons (US)
litres .................. x ........ 0.220 ............. = ....... gallons (Imp)
litres .................. x ........ 1.057 ............. = ....... quarts (US)
knots ................... x ........ 0.539 ............. = ....... knots
bar ........................ x ........ 14.51 ............. = ....... psi
mbar .................... x ........ 0.02953 ........... = ....... in.Hg
kg .......................... x ........ 2.205 ............. = ....... lb
kg.m ...................... x ........ 7.234 ............. = ....... ft.lb
°C .......................... x ........ 9/5 + 32 ............. = ....... °F
Barometric Pressure Conversion Table

Below pressure in MILLBAR or HECTOPASCAL, the pressure in INCHES of MERCURY is indicated.

<table>
<thead>
<tr>
<th>Millbar</th>
<th>950</th>
<th>960</th>
<th>970</th>
<th>980</th>
<th>990</th>
<th>1000</th>
<th>1010</th>
<th>1020</th>
<th>1030</th>
<th>1040</th>
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<td>28.05</td>
<td>28.35</td>
<td>28.64</td>
<td>28.94</td>
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<td>29.53</td>
<td>29.83</td>
<td>30.12</td>
<td>30.42</td>
<td>30.71</td>
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<tr>
<td>951</td>
<td>28.08</td>
<td>28.38</td>
<td>28.67</td>
<td>28.97</td>
<td>29.26</td>
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<td>29.58</td>
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<td>28.47</td>
<td>28.76</td>
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<td>29.50</td>
<td>29.77</td>
<td>30.07</td>
<td>30.55</td>
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<td>956</td>
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<td>28.82</td>
<td>28.96</td>
<td>29.26</td>
<td>29.48</td>
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<td>30.01</td>
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<td>28.85</td>
<td>28.97</td>
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<td>29.46</td>
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<td>29.50</td>
<td>29.78</td>
<td>30.09</td>
<td>30.68</td>
<td>30.98</td>
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</table>

Reminder:
The standard pressure of 1013.2 mbar or hPa equals 29.92 in.Hg.
Section 2 : Limitations

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Certification Standards

The R2160i aircraft has been certified in the “ACROBATIC” and “UTILITY” categories conforming to the following technical conditions:

- Standard technical conditions: FAR 23, Amendments 1 to 9 included
- Complimentary conditions AIR 2052, 3.397 and 3.399
- Special condition: the canopy must be jettisonable.

NOTE

All speeds in this manual are indicated airspeeds unless otherwise specified.

Approved Operation

VFR by day & night in non-icing conditions.

<table>
<thead>
<tr>
<th>AIRSPEED LIMITATIONS</th>
<th>kt</th>
<th>km/h</th>
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</thead>
<tbody>
<tr>
<td>Vne (never exceed)</td>
<td>178.5</td>
<td>331</td>
</tr>
<tr>
<td>Vno (max. cruise)</td>
<td>127</td>
<td>236</td>
</tr>
<tr>
<td>Va (max. manoeuvre)</td>
<td>127</td>
<td>236</td>
</tr>
<tr>
<td>Vfe (max. flaps extended)</td>
<td>97</td>
<td>180</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AIRSPEED INDICATOR MARKINGS</th>
<th>kt</th>
<th>km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red line (never exceed)</td>
<td>$V_{ne}$</td>
<td>178.5</td>
</tr>
<tr>
<td>Yellow arc</td>
<td>$V_{nc}-V_{ne}$</td>
<td>127-178.5</td>
</tr>
<tr>
<td>Green arc (normal operating range)</td>
<td>$V_{so}-V_{so}$</td>
<td>63-127</td>
</tr>
<tr>
<td>White arc</td>
<td>$V_{so}-V_{so}$</td>
<td>51-97</td>
</tr>
</tbody>
</table>
Flight Load Factor Limits at Gross Weight

<table>
<thead>
<tr>
<th>Category</th>
<th>Flaps up</th>
<th>Flaps down</th>
</tr>
</thead>
<tbody>
<tr>
<td>“U”</td>
<td>+ 4.4 g</td>
<td>+ 2 g</td>
</tr>
<tr>
<td>“A”</td>
<td>+ 6 g</td>
<td>+ 2 g</td>
</tr>
<tr>
<td></td>
<td>-1.76 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3 g</td>
<td></td>
</tr>
</tbody>
</table>

Maximum Authorised Weights

<table>
<thead>
<tr>
<th>Category</th>
<th>On take off</th>
<th>On landing</th>
</tr>
</thead>
<tbody>
<tr>
<td>“U”</td>
<td>(1984 lb) 900kg</td>
<td>(1984 lb) 900kg</td>
</tr>
<tr>
<td>“A”</td>
<td>(1764 lb) 800kg</td>
<td>(1764 lb) 800kg</td>
</tr>
</tbody>
</table>

Weight and Balance Envelope

Levelling: upper fuselage longeron
Datum: leading edge at rib n°5 (stn 540)
Chord: (61.2in) 1.554m

NOTE

It is the responsibility of the aircraft owner and the pilot to ensure that the aircraft is properly loaded. See Section 6 Weight & Balance for proper loading instructions.
Engine Limitations

Continuous starter operation ........................................... 15 to 20 sec.
Maximum rpm (red line) ................................................... 2700 rpm
Maximum Normal Operating ............................................. 2600 rpm

Tachometer Markings

Green arc .................................................................... 2300 to 2600 rpm
Red line ......................................................................... 2700 rpm

Fuel

Aviation petroleum ³ ...................................................... AVGAS 100 LL
Fuel grade ³ ................................................................. (octane) 100 minimum
Total fuel capacity ........................................ (35.2 Imp. gal/42.2 US gal) 160 l
Total usable capacity ...................................(34.8 Imp. gal/41.7 US gal) 158 l
Usable fuel ................................................................. (0.4 Imp. gal/0.5 US gal) 2 l
Normal pressure .......................................................... 12 to 45 psi

Oil

Maximum temperature (red LED) ................................. (245°F) 118°C
Normal temperature (green LED) ................... (140 to 245°F) 60 to 118°C
Minimal idle pressure (red LED) ................................. 25 psi
Yellow arc ....................................................................... 25 to 55 psi
Normal pressure (green LED) ........................................ 55 to 95 psi
Yellow LED (ground warm up) ................................. 95 to 115 psi
Maximum pressure cold start and take-off (red LED) ....... 115 psi

³ Refer to Service Instruction Lycoming nº 1070 latest edition.
Cylinder Head Temperatures
Maximum temperature ................................................(500°F) 260 °C
Normal Operating temperature range ......(150 to 435°F) 66 to 224°C

Payload Load Limits
Number of occupants .......................................................... 2
Maximum authorized weight of baggage (in Utility Category ONLY)
............................................................................................... (77lb) 35kg

Operational Limits in “U” Category
Within the limits of this category, the following manoeuvres are authorized:

Turn at more than 60º bank....................entry speed 108 kt (200 km/h)
Lazy eight............................................entry speed 130 kt (240 km/h)
Chandelle ............................................entry speed 130 kt (240 km/h)

Low Temperature Operations
The aircraft can be used down to a temperature of -25 C (-13 F) on the ground.

Refer to oil grade chart on page 1-7 when operating at low temperatures.

When ambient air temperatures less than 5°C or if the oil temperature remains below 80°C for sustained periods it is recommended that the winterisation plate P/N 54.23.17.010 is fitted to the oil cooler in accordance with the maintenance manual.
Operation Placards

In full view of the pilot

| INVERTED FLIGHT PERMITTED IF SUSTAINED OIL PRESSURE DROP IS LESS THAN 20 PSI | SPINNING IS FORBIDDEN IN UTILITY CATEGORY | MAX. FUEL 120 Litres (37.5 US gal) | IN ACROBATIC CATEGORY | G.P.S. NOT APPROVED FOR I.F.R FLIGHT |

On annunciator panel

| MAX MANOEUVRING SPEED: 127 kts 236km/h | INVERTED | SPINNING PROHIBITED | VFR FLIGHT BY DAY AND NIGHT IN NON-ICING CONDITIONS | THIS AIRCRAFT MUST BE USED IN ACROBATIC OR UTILITY CATEGORY IN ACCORDANCE WITH THE APPROVED FLIGHT MANUAL | ON THIS AIRCRAFT, ALL PLACARDS CORRESPOND TO ACROBATIC UTILIZATION, REFER TO THE APPROVED FLIGHT MANUAL | NO SMOKING |

On instrument panel above ASI & AH

ACROBATIC CATEGORY

APPROVED MANOEUVRES

| SPIN (FLAPS UP) | 54 KIAS |
| POSITIVE LOOP | 130 KIAS |
| ROLL | 108 KIAS |
| STALL TURN | 120 KIAS |
| 45’ HALF ROLL & DIVE OUT | 120 KIAS |
| CHANDELLE | 120 KIAS |
| HALF LOOP & ROLL OUT | 115 KIAS |
| FLICK ROLL | 86 KIAS |
| LAZY EIGHT | 120 KIAS |

SPIN RECOVERY PROCEDURE

FULL OPPOSITE RUDDER
ELEVATOR CONTROL NEUTRAL
AILERON NEUTRAL

AUX. PWR.
12 V
5 AMP MAX

On sub panel adjacent to vacuum gauge

On instrument panel by socket

NO BAGGAGE ALLOWED DURING ACROBATIC FLIGHT
MAXIMUM BAGGAGE LOAD
35kg (77 lb)
REFER FLIGHT MANUAL

FUEL SHUT OFF
LIFT GUARD
PULL CONTROL KNOB

On baggage compartment aft bulkhead

Adjacent to control knob
CANOPY JETTISON PULL HANDLE

Adjacent to jettison handle on canopy over head frame

CANOPY RELEASE (PULL)

On each of the canopy release handles

EXIT

On bottom aft of Sliding Canopy (internal and external)

External fuselage

AVGAS 100LL

160 Litres

42.2 US Gal

120 Ltr MAX FOR ACROMATICS

Adjacent to refuelling receptacle
Section 3: Emergency Procedures

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Engine Failure During Take-Off (roll)

With sufficient runway remaining:
Throttle................................................................. idle (pull)
Brakes..............................................................as required
Mixture ............................................................full lean (pull out)
Magneto switch ..............................................OFF
Alternator switch ..............................................OFF
Battery switch ..............................................OFF

Without sufficient runway remaining:
Throttle................................................................. idle (pull)
Brakes..............................................................apply heavily
Mixture ............................................................full lean (pull out)
Magneto switch ..............................................OFF
Alternator switch ..............................................OFF
Battery switch ..............................................OFF

Engine Failure Immediately After Take-Off

Glide speed......................................................(800 kg) 78 kt (145 km/h)
......................................................(900 kg) 83 kt ( 154 km/h)
Mixture ............................................................full lean (pull out)
Magneto switch ..............................................OFF
Alternator switch ..............................................OFF
Battery switch ..............................................ON (in order to use the flaps)

NOTE CAREFULLY
Land straight ahead, with only small direction changes to avoid obstructions.
Never try to turn back to the runway, as altitude after take-off is seldom sufficient.
**Engine Failure in Flight**

If altitude is sufficient to try an engine restart:

Establish maximum glide speed, flaps up 78 kt (145 km/h) for 800 kg or 83 kts (154 km/h) for 900 kg. In these conditions and without wind, the aircraft covers approximately 8.7 times its altitude.

Fuel shut off control................................................................. push in
Electric fuel pump.......................................................................... ON
Mixture ................................................................. full rich (push in)
Throttle .........................................................¼ travel forward
Magneto switch ............................................................on BOTH

If the propeller is still turning, the engine should restart.

If the propeller is stopped, operate the starter.

If the engine still does not start, prepare for a forced landing, following the procedure below.

**Power Off Forced Landing Off Airfield**

Look for a suitable landing area:

Airspeed ................................................................. (800 kg) 78 kt (145 km/h)
................................................................. (900 kg) 83 kt (154 km/h)
Belt and harnesses................................................................. tight
Electric fuel pump.......................................................................... OFF
Mixture ................................................................. full lean (pull out)
Throttle ................................................................. to idle (pull)
Magneto switch ........................................................................... OFF
Fuel shut off control................................................................. pull out
Alternator switch ........................................................................... OFF
Battery switch (for flap operation) ................................................ ON

**Final**

Flaps ................................................................. full down
Battery switch........................................................................... OFF
Canopy .............................................................................. unlocked
Precautionary Power Landing Off Airfield

Fly over the chosen field several times at low speed, 78 kt (145 km/h) for 800 kg or 83 kts (154 km/h) for 900 kg, in order to locate the most suitable landing area, flaps in “take-off” position (10°), then make a precautionary approach at, 66 kt (122 km/h) for 800 kg or 71 kt (131 km/h) for 900 kg, flaps in “landing” position (35°).

On final, unlock the canopy.

Before touchdown

Magneto switch ................................................................. OFF
Battery switch ...................................................................... OFF

NOTE: IN CASE OF CANOPY JAMMING

Canopy handle in “open” position.
Remove the safety locking device from central Jettison Handle.
Pull handle down and aft.
OR
Free the two canopy release levers located on the arm rests, on both sides of the instrument panel, and place them in vertical position activating the canopy jettison system.

Canopy should be reinstalled in accordance with the aircraft service manual.

Fire

Engine fire during starting

Keep the engine turning with starter:
Fuel shut off control ......................................................... pull out
Electric fuel pump ............................................................ OFF
Throttle .............................................................................. full power (push)
Mixture .............................................................................. full lean (pull out)

The aim of this procedure is to make the engine “swallow” the accumulated fuel in the inlet pipes (generally following an excess of fuel priming during a difficult engine start).
If the fire continues
Magneto switch ........................................................................... OFF
Battery switch ............................................................................ OFF
Alternator switch .......................................................................... OFF
Abandon the aircraft and try to extinguish the fire with the aids available: fire extinguishers, covers, clothing or sand.

Engine fire in flight
Fuel shut off control ................................................................. pull out
Throttle ........................................................................... full power until engine stops
Mixture ........................................................................... full lean (pull out)
Electric fuel pump ...................................................................... OFF
Alternator switch .......................................................................... OFF
Cabin heat and ventilation ............................................................... off
Speed ........................................................................... 86 kt (160 km/h)
Prepare for a forced landing off airfield, following the procedures in the chapter “Power off forced landing off airfield”

Do not attempt to restart the engine.

Cabin Fire
Extinguish the fire by all means possible (optional extinguisher).
To eliminate smoke, apply maximum ventilation.
In case of an electrical fire (fumes indicating insulation burning):
Cabin ventilation ....................................................................... reduce
Alternator switch .......................................................................... OFF
Battery switch ................................................................................ OFF
Battery circuit breaker ................................................................... pull out
Alternator circuit breaker ............................................................. pull out
Land immediately if the fire continues.
Vibration and Rough Engine Operation

Vibrations and rough engine operation are generally due to (verify in this order):

- Mixture set too rich or too lean: adjust the mixture (see section 4)
- Contamination in the fuel system: verify fuel pressure. Switch on the electric fuel pump
- Ignition failure: magneto switch on “L”, then “R”, then return to “BOTH”. Select the position providing the best engine operation and fly to the nearest airfield, at reduced power and mixture set to obtain the smoothest engine operation possible.
- Air intake blockage: Pull ON alternate air knob. If no change detected, push OFF.

Low Oil Pressure

In case of low oil pressure indication, check oil temperature and if it is too high (red arc):

- Reduce power
  If oil pressure does not recover:
- Fly to the nearest airfield, and/or prepare for an off airfield landing.

Canopy Jettisoning

Remove the safety locking device from central Jettison Handle

Pull handle down and aft.

If the central jettison handle fails.

Free the two canopy release levers located on the arm rests, on both sides of the instrument panel, and place them in vertical position activating the canopy jettison system.

Push canopy up
Icing

Although it is forbidden to fly in icing conditions, proceed as follows when inadvertently encountering icing:

- Increase power in order to reduce ice build-up to minimum
- Switch on pitot heat (if installed)
- Select maximum cabin heat and direct the total output to the windscreen ("defrost" position) in order to remove the ice quickly
- Turn back or change altitude, to obtain an outside air temperature less conducive to icing
- Plan to land at the nearest airfield.
- Do not use the flaps

With an extremely rapid ice build-up, carry out a forced landing.

Remember that a layer of 0.5 cm (0.2 in) on the wing leading edge will increase stall speed. If needed, use a higher than normal approach speed: 139 to 150 km/h (75 to 81 kt).
Electrical Power Supply Malfunction

Alternator failure is indicated when the red “ALT FAIL” warning light on the annunciator panel is lit. The “ALT FAIL” warning light indicates that the battery, rather than the alternator, is supplying power to the bus-bar.

If the “ALT FAIL” warning light is on

Switch off the alternator, and then switch it back on.

This operation resets the overvoltage relay which may have cut-out due to a transient overvoltage.

**NOTE**

*Warning light may come on during low engine rpm. Check that increasing rpm makes the light go out.*

If the “ALT FAIL” warning light remains on

- Switch off the alternator.
- Switch off all the electrical equipment not essential to the continuation of the flight.
- Land as soon as possible and have the electrical system inspected.

**NOTE**

*An alternator failure does not prevent the engine from operating normally.*
**Inadvertent Spin**

Should a spin occur, use the following procedure:

- **Throttle**: idle (pull)
- **Rudder**: full opposite to direction of rotation
- **Elevator**: forward to neutral
- **Ailerons**: neutral

Once the rotation stops, rudder to neutral position and recover within flight limitations.

**NOTE**

*If the flaps are down when the spin begins, retract them immediately.*

**Loss of Elevator Control**

In case of a loss of elevator control (accidental disconnection):

- Stabilize the aircraft in level flight, flaps at 35º, at 75 kt (139 km/h), using the elevator trim and throttle.
- Do not change the elevator trim setting and control the angle of descent with throttle only. Reduce throttle only when in short final and near to the ground.
# Section 4: Normal Procedures

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<td>Engine Run-Up</td>
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<td>Before Take-Off</td>
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<tr>
<td>Take-Off</td>
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<td>Cruise</td>
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<td>Descent</td>
<td>4-14</td>
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<td>Landing</td>
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<td>After Landing</td>
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</tr>
<tr>
<td>Acrobatic Flights</td>
<td>4-16</td>
</tr>
</tbody>
</table>
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Loading

Before each flight, insure that the total weight and the load balance are within the established limits. For this, use the weight and balance chart in Section 6.

Normal Operating Speeds

The speeds identified hereunder are indicated Airspeeds recommended for normal operations.

They are based on a standard aircraft, operated at gross weight, in standard atmosphere, at sea level. They can change from one aircraft to another, depending on the installed equipment, aircraft and engine condition, atmospheric conditions and pilot proficiency.

Best rate of climb speed

Flaps in take-off position (10°) ....................................(800 kg) 75 kt (139 km/h)
(900 kg) 79 kt (147 km/h)
Flaps up ..................................................................(800 kg) 78 kt (145 km/h)
(900 kg) 83 kt (154 km/h)

Best angle of climb speed

Flaps in take-off position (10°) ..................(800 kg) 70 kts (130 km/h)
(900 kg) 73 kts (135 km/h)

Flaps up ..................................................................(800 kg) 73 kt (135 km/h)
(900 kg) 78 kt (145 km/h)

Maximum operating speed in turbulence

Flaps up ..........................................................127 kt (235 km/h)

Maximum speed

Flaps in landing position (35°).................................97 kt (180 km/h)

Landing speed, final approach

Flaps in landing position (35°).......................(800 kg) 65 kt (120 km/h)
(900 kg) 70 kt (130 km/h)
Pre-Flight Inspection

To be performed before each flight.

This inspection may be reduced after intermediate en route landings.

Magneto switch ................................................................. OFF
Controls ................................................................. free
Control surface deflections ........................................... check
Battery switch ................................................................. ON
Flaps ................................................................. check operation
Fuel quantity ................................................................. check
Battery switch ................................................................. OFF
Fuel shut off control: pushed in and cover closed ..................... check
Aircraft documents .......................................................... check availability on board
Instruments ................................................................. ensure all are in good condition
Baggage ................................................................. check stowed

Make an aircraft walk-around inspection (as shown below) beginning at the fuselage left side.
1 Fuel quantity ........................................................... check with dip stick
Fuel filler cap .......................................................... in place, locked
Static vent ............................................................... clean, unobstructed
Fuel Drains (2 positions) ......................... Purge the fuel system to ensure all water is removed
Canopy jettisoning handle ......................... check lock wire attachment

2 Horizontal stabilizer ............................... surface condition, hinges without play
Rudder .............................................................. check hinges and play

3 Static vent ........................................................... clean, unobstructed

4 Flap, aileron ................................................ check condition and hinges
Wing tip, strobe and navigation lights ............... check condition
Stall warning .................................................. clean, check displacement

5 Right main landing gear ................. check attachment and fairing condition normal shock absorber compression, tyre inflated

6 Oil level ............................................................ check, oil cap secured, panel closed
Min. 4 qts, Max. 8 qts
Engine cowl attachments .................................................. check
Propeller .......................................................... clean, in good condition, check for no cracks
Propeller spinner ................. no play, clean, in good condition, no cracking
Air inlets ............................................................... clean, unobstructed
Landing Lights ............................................................. window clean

7 Nose gear ................................................ check attachment and fairing condition normal shock absorber compression,
                              tyre inflated, tow-bar removed
Exhaust pipes .......................................................... rigid
Canopy cleanliness .......................................................... check

8 Left main landing gear ............... check attachment and fairing condition normal shock absorber compression, tyre inflated
Pitot ............................................................... clean, unobstructed

9 Wing tip, navigation-, taxi- landing-lights ............... check condition
Flap, aileron ................................................ check condition and hinges

10 Check all surfaces (look for missing rivets, cracks, permanent buckling in panels)
Remove the snow or ice that may be present on the wings and tail unit.
Remove the chocks and tethering gear.
Cabin Interior Check Prior Start-Up

Canopy.......................................................... closed and locked
Parking brake.................................................. ON and locked
Seats.............................................................. adjusted and locked
Belts and harnesses ......................................... adjusted and fastened
Flight controls.......................... free, without play or excessive friction
                                          (check rudder during taxi)
Elevator trim.......................... verify travel, and return to take-off position
Fuel shut-off control (pushed in and cover closed) .......... checked
Battery switch......................................................... ON
Fuel Flow Indicator............ adjust as necessary, select FLOW mode

Before Starting Engine

Cabin Equipment .......................................................... Secure
Pilot (& passenger) .............................................. Harness On
Avionics Master......................................................... OFF

Parking Brake Use

Brake on
Press on both pedals. Keep pressure on, while pulling the parking brake control out. Then, release the pressure on the pedals (the parking brake control remains in the pulled position).

Brake off
Push the control in.
Starting the Engine

Normal procedure

Alternate air ................................................................. OFF (push in)
Mixture ................................................................. full rich (push in)
Throttle ................................................................. set full (push in)
Boost pump ............................................................. ON for 3-5 seconds
Boost pump ............................................................. OFF
Mixture ................................................................. full lean (pull out)
Throttle ................................................................. set open ¼ travel
Starter ................................................................. engage

When engine fires;
Mixture ................................................................. slowly to full rich (push in)
Throttle ................................................................. set to 1000 rpm

Engine “flooded”

Electric fuel pump ............................................................. OFF
Mixture ................................................................. full lean (pull out)
Throttle ................................................................. full power (push in)
Alternator ................................................................. OFF
Starter ................................................................. operate for 10-15 seconds

As soon as the engine fires, reduce throttle to ¼ and advance mixture control to “rich” and resume the normal procedure.

ATTENTION: Avoid operating the starter for more than 20 seconds. Wait at least a minute before operating it again.

As soon as the engine is running, check the engine oil pressure. If it is zero after 15 to 20 seconds, switch off and investigate the cause.
After Engine Start

RPM ............................................................................................ 1200
Electric fuel pump ................................................................. OFF
Alternator switch ................................................................. ON
Voltmeter .............................................................................. green range
c
Vacuum gauge ......................................................................... green range
Annunciator Lights .................................................... test and select brightness
Avionics Master ................................................................. ON
COM/NAV, navigation instruments .................................. set
Altimeter ................................................................................ set

Taxiing

Parking brake ................................................................. released
Brakes ................................................................................ test
Turn co-ordinator ............................................................. check
Directional gyro ............................................................... check setting
Avoid exceeding 1200 rpm while oil temperature is in yellow arc.
Engine Run-Up

Parking brake ................................................................. applied
Oil pressure and temperature ............................ green range
Fuel pressure ............................................................... green range
Mixture .............................................................. full rich (push in)

Magneto check
Throttle ................................................................. 1800 rpm
Magneto selection:
Max. drop between “L” or “R” and “BOTH” .................. 175 rpm
Max. difference between “L” and “R” ......................... 50 rpm

Mixture check
Lean until rpm reduction, then return to “full rich”.

Engine idle check
Throttle ................................................................. 600 to 650 rpm
Before Take-Off

Controls.............................................................................................. free
Magneto switch .................................................................................. BOTH
Cabin (seats and belts) ................................................................. check
Fuel shut off control: pushed in and cover down .................... check
Electric fuel pump .............................................................................. ON
Elevator trim ................................................................................... take-off position
Instruments ................................................................................... check, set
Transponder ..................................................................................... as required
Flaps ............................................................................................... (10°) take-off position
Throttle ....................................................................................... “holding” at 1200 rpm
Canopy ............................................................................................ closed and locked

Take-Off

Normal take-off

Take-off minimum rpm ................................................................. 2150 rpm
Rotation speed ................................................................. (800 kg) 55 kts (102 km/h)
................................................................................................. (900 kg) 58 kts (107 km/h)
Initial climb speed ................................................................. (800 kg) 75 kts (139 km/h)
................................................................................................. (900 kg) 79 kts (147 km/h)

After obstacles clearance,

Reduce angle of climb to obtain .................. (800 kg) 78 kts (145 km/h)
................................................................................................. (900 kg) 83 kts (154 km/h)
Electric fuel pump .............................................................................. OFF
Fuel pressure ................................................................................ check (12 to 45 psi)
Flaps .............................................................................................. up
Short field take-off
Flaps .................................................................(10°) take-off position
Apply full power, brakes applied,
then release the brakes .........................minimum 2150 rpm
Rotation speed .............................................(800 kg) 55 kts (102 km/h)
.............................................(900 kg) 58 kts (107 km/h)

Then, if necessary (to clear an obstacle)
Best angle of climb speed ......................(800 kg) 70 kts (130 km/h)
.............................................(900 kg) 73 kts (135 km/h)

Crosswind take-off (greater than 12 kts crosswind)
Flaps ................................................................. take-off position (10°)
Ailerons ................................................................. into the wind

Take-off at 10% higher airspeed than normal. Correct drift in the
normal way (max bank angle close to the ground: 15°).
Demonstrated crosswind velocity: 18 kts (33 km/h)

Climb

Normal climb (flaps up)
Set speed for best rate of climb:
800 kg – 78 kts (145 km/h); 70 kts (130 km/h) at 10,000 ft.
900 kg – 83 kts (154 km/h); 75 kts (139 km/h) at 10,000 ft
Above 5 000 ft, adjust mixture.

Best angle of climb
The best angle of climb is obtained at,
800 kg - 73 kts (135 km/h) clean; 70 kts (128 km/h) flaps 10°
900 kg - 78 kts (145 km/h) clean; 73 kts (135 km/h) flaps 10°

NOTE
This type of climb should only be used only as necessary, due to
poor engine cooling.
Cruise

Refer to Section 5 for rpm setting and cruise performance.

Operation of mixture control

Maintain mixture control in the “full rich” position during take-off and in the climb.

In certain conditions (high altitude take-off, or long climb above 5000 ft), this setting may be too rich and could result in irregular engine operation or loss of power.

In these cases, adjust the mixture to recover regular engine operation, and not for fuel economy.

Mixture adjustment in stable cruise:

Progressively lean the mixture until a slight reduction in rpm is noted; then lightly enrich to re-establish power and normal operation.

NOTE

Take care not to lean the mixture too much, which would cause engine overheating.

ALWAYS ENRICH THE MIXTURE BEFORE INCREASING POWER.

NOTE

For maximum service life, cylinder head temperatures should be maintained below 435°F (224°C) during high performance cruise operation and below 400°F (205°C) for economy cruise powers.
Descent

Rapid Descent
Power ............... as required to maintain the desired descent path
Each 1500 ft, apply power to avoid excessive engine cooling and to clean the spark plugs.

Approach or down wind
Mixture .............................................................. full rich (push in)
Electric fuel pump .................................................. ON
Cabin (belts and seats) ........................................... check
Flaps ...................... below 97 kts (180 km/h) in take-off position (10°)
Speed ........................ reduce to 70 to 76 kts (130 to 140 km/h)
Elevator trim ......................................................... set

On Final
Flaps ................................................................. landing position (35°)
Approach speed (power on) ... (800 kg) 65 to 68 kts (120 to 125 km/h)
(900 kg) 70 to 73 kts (130 to 135 km/h)
Elevator trim ......................................................... set

Maximum demonstrated cross wind 18 kts
Landing

Short landing

Flaps ................................................................. landing position (35º)
Approach speed (with power on) .......... (800 kg) 62 kts (115 km/h)
(900 kg) 67 kts (124 km/h)

After touchdown, brake heavily keeping nose up with elevator and retract flaps.

Landing in crosswind or gusty conditions

Flaps ........................................................................................... (10º)
Approach................................. (800 kg) 73 kts (135 km/h) + ½ gust speed
(900 kg) 78 kts (145 km/h) + ½ gust speed

Drift .............................................................correct in the normal way
Demonstrated crosswind ...................... 18 kts (33 km/h)

Overshoot procedure

Throttle........................................................................................... full
Speed........................................................(800 kg) 65 kts (120 km/h)
(900 kg) 70 kts (130 km/h)

Flaps .................................................................(10°) take-off position
Normal climb speed ...............................(800 kg) 75 kts (139 km/h)
(900 kg) 79 kts (147km/h)

After Landing

Electric fuel pump .................................................................OFF
Flaps ............................................................................................ up
Navigation instruments ............................................................ off
Transponder................................................................. standby
Engine Shut-Down

Park brake.......................................................................................on
ELT........................................................................ Check not triggered
Avionics master........................................................................... OFF
Electrical equipment......................................................................off
Canopy .....................................................................................closed, locked
Magneto cut-off check at idle ................................... OFF then BOTH
RPM ............................................................................................1000
Mixture .....................................................................................idle cut-off

After the engine stops

Magneto switch ........................................................................... OFF
Alternator switch.......................................................................... OFF
Battery switch................................................................................ OFF
When wheel chocks in place...................... release the parking brake

Acrobatic Flights

**IMPORTANT NOTES**

- The luggage hold must be empty and no object may be loose in the cabin.
- Make sure that the aircraft C of G is within the permissible limits.
Spinning

It is recommended to perform the spin in the following manner:

- Flaps must be retracted
- Start the spin at an adequate height above the safety altitude, taking into consideration that the loss of altitude is about 230 ft per revolution and that the final recovery takes about 1300 ft.
- Throttle back in level flight, decrease the speed with a slightly positive vertical position
- When close to the stalling point (54 kts):
  Pull the elevator control fully back, ailerons in neutral and simultaneously apply rudder in the direction of required rotation
- When 2 or 3 rotations have been completed, apply the following recovery procedure:
  Rudder in fully opposite direction, elevator control to neutral and ailerons in neutral
- When spin rotation stops, recover to normal flight taking care to remain within operating limits.

Example to recovery from a LH spin

- Apply and maintain full Right rudder, ailerons in neutral
- Stick to neutral
- After 3 revolutions, recovery is performed in approximately three quarters of a revolution.

Only one action is important - Keep the rudder fully in opposite direction!

- In a spin of more than 3 revolutions, the engine is likely to stall. This raises no difficulty: the propeller should wind mill once airspeed is restored and re-start the engine. (Caution: Engage starter only if propeller stops rotating.)
- With a 4 revolution (or more) spin, recovery is performed in 1 ½ revolutions.
- During the recovery phase, keep a watch on the A.S.I. and on the accelerometer, to keep within the operating limits.
### Authorized acrobatic figures

<table>
<thead>
<tr>
<th>Authorized Acrobatic Figures</th>
<th>Initial Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive spin</td>
<td>54 kts</td>
</tr>
<tr>
<td>Positive loop</td>
<td>130 kts (240 km/h)</td>
</tr>
<tr>
<td>Roll</td>
<td>108 kts (200 km/h)</td>
</tr>
<tr>
<td>Stall turn</td>
<td>120 kts (220 km/h)</td>
</tr>
<tr>
<td>45° half roll and dive out</td>
<td>120 kts (220 km/h)</td>
</tr>
<tr>
<td>Chandelle</td>
<td>120 kts (220 km/h)</td>
</tr>
<tr>
<td>Half loop and roll out</td>
<td>135 kts (250 km/h)</td>
</tr>
<tr>
<td>Flick roll</td>
<td>86 kts (160 km/h)</td>
</tr>
<tr>
<td>Lazy eight</td>
<td>120 kts (220 km/h)</td>
</tr>
<tr>
<td>Turns at more than 60° bank</td>
<td>108 kts (200 km/h)</td>
</tr>
</tbody>
</table>

### Authorized “U” category figures

<table>
<thead>
<tr>
<th>Authorized “U” Category Figures</th>
<th>Initial Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chandelle</td>
<td>130 kts (240 km/h)</td>
</tr>
<tr>
<td>Lazy eight</td>
<td>130 kts (240 km/h)</td>
</tr>
<tr>
<td>Turns at more than 60° bank</td>
<td>108 kts (200 km/h)</td>
</tr>
</tbody>
</table>

Intentional spins are prohibited in utility category operations.

If, during one of the figures the engine stops, it is preferable to close throttle during the recovery only. The above figures can be performed without causing the engine to stop and at a load factor not exceeding 4 g.

**INVERTED SPIN PROHIBITED.**
Inverted flight
Entry Speed .......................................................... 119 kts (220 km/h)
Invert aircraft
Maintain speed above 80 kts (150 km/h)
All Alpha 160Ai aircraft are fitted with inverted oil and fuel systems and dry battery.

**NOTE**

*Because of the longer oil pick-up flow path, oil pressure inverted may be 5 to 10 pounds less than oil pressure during normal flight.*

**CAUTION**

*Do not fly for more than ten seconds in the following attitudes:*

1. **Vertical flight, steep dive.**
2. **Inverted flight, steep dive.**
3. **Zero G periods.**
4. **Wing-down or knife-edge flights.**

*In these modes the oil system will not scavenge and engine damage can occur. Normally oil pressure will “flicker” from 10 to 30 psi when transitioning from upright to inverted flight; however, return immediately to normal attitude anytime oil pressure drops 20 psi below normal.*
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Section 5 : Performance

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### Noise Limitation

The maximum acceptable noise level in accordance with ICAO annex 16, chapter 6, for the R2160i aircraft, at a certified gross weight of (1984 lb) 900 kg, is 72 dB(A).

The actual noise level determined under the ICAO criteria is 69.8 dB(A).

### Stall Speeds

<table>
<thead>
<tr>
<th>Engine idling, Weight: 800 kg (1763 lb)</th>
<th>kt (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank angle</td>
<td>0°</td>
</tr>
<tr>
<td>Flaps up</td>
<td>59 (110)</td>
</tr>
<tr>
<td>Flaps 10°, take off position</td>
<td>58 (107)</td>
</tr>
<tr>
<td>Flaps 35°, landing position</td>
<td>48 (87)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engine idling, Weight: 900 kg (1984 lb)</th>
<th>kt (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank angle</td>
<td>0°</td>
</tr>
<tr>
<td>Flaps up</td>
<td>63 (117)</td>
</tr>
<tr>
<td>Flaps 10°, take off position</td>
<td>61 (113)</td>
</tr>
<tr>
<td>Flaps 35°, landing position</td>
<td>51 (94)</td>
</tr>
</tbody>
</table>
Airspeed Installation Calibration

Example

If KIAS is 135 kts (250 km/h), flaps up then KCAS will be 137 kts (254 km/h)

NOTE

All speeds in this manual are indicated airspeeds unless otherwise specified.
### Take-Off Performance

Concrete level dry runway. Flaps in take-off position. Full throttle

<table>
<thead>
<tr>
<th>Max. weight kg (lb)</th>
<th>Head Wind (kt)</th>
<th>Sea level +15°C</th>
<th>2500 ft – (760 m) +10°C</th>
<th>5000 ft – (1525 m) +5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Run m (ft)</td>
<td>15 m (50 ft) clear m (ft)</td>
<td>Run m (ft)</td>
<td>15 m (50 ft) clear m (ft)</td>
</tr>
<tr>
<td>900 (1984)</td>
<td>0</td>
<td>320 (1050)</td>
<td>574 (1883)</td>
<td>400 (1312)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>224 (735)</td>
<td>476 (1562)</td>
<td>280 (919)</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>147 (482)</td>
<td>385 (1263)</td>
<td>180 (590)</td>
</tr>
<tr>
<td>800 (1764)</td>
<td>0</td>
<td>230 (754)</td>
<td>410 (1345)</td>
<td>285 (935)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>160 (525)</td>
<td>340 (1115)</td>
<td>200 (656)</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>105 (344)</td>
<td>275 (902)</td>
<td>130 (427)</td>
</tr>
<tr>
<td>700 (1543)</td>
<td>0</td>
<td>160 (525)</td>
<td>285 (935)</td>
<td>200 (656)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>110 (361)</td>
<td>240 (787)</td>
<td>140 (459)</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>70 (230)</td>
<td>190 (623)</td>
<td>90 (295)</td>
</tr>
</tbody>
</table>

- Increase distances by 8% for every 10°C increase of the standard temperature, at the appropriate altitude concerned.
- Take-off from dry grass runway: add 8%.
Climb Performance

- Flaps up
- 64' Sensenich propeller
- Full throttle
- No wind
- Standard atmosphere

Best power mixture
Climb speed: sea level: 78 KIAS
10 000 ft: 70 KIAS
OAT correction: ± 3.5% for 10°C
Climb Time/Climb Distance

Standard atmosphere
Flaps up
Full throttle
MTOW 800 kg
Climb speed (IAS): 78 kt (145Km/h)
Cruise Performance

MTOW 900 kg (1984 lb)
Flaps up
Standard atmosphere
No wind
Mixture at best power setting

<table>
<thead>
<tr>
<th>Altitude ZP ft</th>
<th>Power %</th>
<th>RPM</th>
<th>True Air Speed Kt (km/h)</th>
<th>Fuel Consumption l/h (us gal)</th>
<th>Endurance H:min</th>
<th>Range Km</th>
<th>Range Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEA LEVEL</td>
<td>75</td>
<td>2550</td>
<td>116 (215)</td>
<td>35 (9.2)</td>
<td>4.30</td>
<td>965</td>
<td>520</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>2450</td>
<td>111 (206)</td>
<td>30 (7.9)</td>
<td>5.15</td>
<td>1080</td>
<td>580</td>
</tr>
<tr>
<td>3000</td>
<td>75</td>
<td>2625</td>
<td>121 (224)</td>
<td>35 (9.2)</td>
<td>4.30</td>
<td>1010</td>
<td>540</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>2525</td>
<td>116 (215)</td>
<td>30 (7.9)</td>
<td>5.15</td>
<td>1125</td>
<td>605</td>
</tr>
<tr>
<td>5500</td>
<td>75</td>
<td>2650</td>
<td>125 (232)</td>
<td>35 (9.2)</td>
<td>4.30</td>
<td>1040</td>
<td>560</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>2550</td>
<td>119 (220)</td>
<td>30 (7.9)</td>
<td>5.15</td>
<td>1155</td>
<td>627</td>
</tr>
<tr>
<td>7500</td>
<td>70</td>
<td>2675 (*)</td>
<td>126 (233)</td>
<td>32 (8.7)</td>
<td>4.55</td>
<td>1150</td>
<td>620</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>2600</td>
<td>122 (226)</td>
<td>30 (7.9)</td>
<td>5.15</td>
<td>1185</td>
<td>640</td>
</tr>
</tbody>
</table>

(*) full throttle
Glide Performance

Airspeed ...........................................(800 kg) 78 kt (145 km/h)
(900 kg) 83 kt (154 km/h)

Propeller ................................................. windmilling
Flaps ............................................................. up
Without wind

Altitude and temperature do not have a noticeable influence.

In wind-less conditions, with engine off, flaps up, propeller spinning and \( V_i = 78 \text{ kt} \) (145 km/h), the aircraft will glide over a distance equal to 8.7 times the altitude. Altitude and temperature have no substantial effect.
## Landing Performance

Landing on grass runway: increase distances by 20%.

Approach speed: 65 kt (120 km/h)

Touch-down speed: 58 kt (107 km/h)

<table>
<thead>
<tr>
<th>Max. weight kg (lb)</th>
<th>Head Wind (kt)</th>
<th>Sea level +15°C</th>
<th>2500 ft – 760 m +10°C</th>
<th>5000 ft – 1525 m +5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Run m (ft)</td>
<td>Distance to clear 15 m (50 ft) m (ft)</td>
<td>Run m (ft)</td>
<td>Distance to clear 15 m (50 ft) m (ft)</td>
</tr>
<tr>
<td>900 (1984)</td>
<td>0</td>
<td>233 (764) 440 (1444) 250 (820) 465 (1526)</td>
<td>265 (869) 490 (1607)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>165 (541) 365 (1197) 175 (574) 390 (1279)</td>
<td>185 (607) 413 (1355)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>120 (394) 295 (968) 130 (426) 310 (1017)</td>
<td>140 (459) 335 (1099)</td>
<td></td>
</tr>
<tr>
<td>800 (1764)</td>
<td>0</td>
<td>220 (722) 415 (1361) 235 (771) 440 (1443)</td>
<td>250 (820) 465 (1526)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>155 (508) 345 (1132) 165 (541) 370 (1214)</td>
<td>175 (574) 390 (1279)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>115 (377) 280 (918) 125 (410) 295 (968)</td>
<td>130 (426) 315 (1033)</td>
<td></td>
</tr>
<tr>
<td>700 (1543)</td>
<td>0</td>
<td>190 (623) 375 (1230) 205 (672) 400 (1312)</td>
<td>215 (705) 420 (1378)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>135 (443) 315 (1033) 145 (476) 335 (1099)</td>
<td>150 (492) 350 (1148)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>100 (328) 250 (820) 110 (361) 270 (886)</td>
<td>115 (377) 280 (918)</td>
<td></td>
</tr>
</tbody>
</table>
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Weight & Balance Work Sheet

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Use of Weight and Balance Diagram

1 Calculate the total loaded aircraft weight:

Empty weight (from the weight and balance sheet)
- Pilot and passenger
- Baggage
- Standard fuel

Ensure that total weight does not exceed 900 kg (1984 lb).

2 Place the empty aircraft moment (from the weight and balance sheet) on the upper scale of the previous diagrams, and follow the example indicated by the dashed line.

The resulting point must be within the centre of gravity moment envelope (shaded area) for the load to be within limits.

EXAMPLE* (dashed line on work sheet)
Empty aircraft moment ....................................... (1063 ft.lb) 147 m.kg
Empty aircraft weight ................................................. (1217 lb) 552 kg
Pilot and passenger ...................................................... (154 lb) 70 kg
Fuel 60 l (13 imp/16 US gal) ........................................... (95 lb) 43 kg
Baggage .......................................................................... (44 lb) 20 kg

TOTAL WEIGHT ....................................................... (1510 lb) 685 kg

CENTRE OF GRAVITY: with the envelope

1 litre AVGAS = 0.72 kg (1.6 lb)
1 imp gal AVGAS = 3.27 kg (7.2 lb)
1 US gal AVGAS = 2.7 kg (6 lb)

* ATTENTION
For your aircraft centre of gravity calculation, do not use values of empty aircraft weight and empty aircraft moment indicated in the above example! Use the values indicated in the last weight and balance sheet of your aircraft.
### Fitted Equipment List

<table>
<thead>
<tr>
<th>Serial No:</th>
<th>Registration:</th>
<th>Date:</th>
</tr>
</thead>
</table>

**NOTE**
The installed equipment listed in this table has been included in the initial aircraft Weight and Balance carried out by the manufacturer.

<table>
<thead>
<tr>
<th>Item No</th>
<th>Item Mark if Installed</th>
<th>Weight (kg)</th>
<th>ARM (m)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Airspeed Indicator</td>
<td>0.3</td>
<td>-0.07</td>
</tr>
<tr>
<td>2</td>
<td>Artificial Horizon</td>
<td>0.9</td>
<td>-0.14</td>
</tr>
<tr>
<td>3</td>
<td>Altimeter</td>
<td>0.9</td>
<td>-0.1</td>
</tr>
<tr>
<td>4</td>
<td>Optional Equipment</td>
<td></td>
<td>-0.54</td>
</tr>
<tr>
<td>a. CDI</td>
<td></td>
<td>1.5</td>
<td>-0.11</td>
</tr>
<tr>
<td>b. CDI</td>
<td></td>
<td>1.6</td>
<td>-0.11</td>
</tr>
<tr>
<td>5</td>
<td>Turn Coordinator</td>
<td>0.6</td>
<td>-0.09</td>
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<td>6</td>
<td>Directional Gyro</td>
<td>1.2</td>
<td>-0.13</td>
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<tr>
<td>7</td>
<td>Vertical Airspeed</td>
<td>0.3</td>
<td>-0.1</td>
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<tr>
<td>8</td>
<td>Tachometer</td>
<td>0.4</td>
<td>-0.08</td>
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<tr>
<td>9</td>
<td>Optional Equipment</td>
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</tr>
<tr>
<td>a. Altimeter (secondary)</td>
<td></td>
<td>0.9</td>
<td>-0.1</td>
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<tr>
<td>b. AD Indicator (KI227)</td>
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<td>10</td>
<td>Fuel Flow/Pressure Gauge</td>
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<td>11</td>
<td>Fuel Contents Gauge</td>
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<td>12</td>
<td>Oil Pressure/Temperature Gauge</td>
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<td>G Meter</td>
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<td>b. EGT/CHT/OAT (EAC-1)</td>
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<td>Item</td>
<td>Mark if Installed</td>
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<td>a. GPS (GNS 430)</td>
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<td></td>
<td>b. GPS (GNC 250XL)</td>
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<td></td>
<td>c. COM 2 (SL30)</td>
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<td></td>
<td>d. COM 2 (SL40)</td>
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<td>21</td>
<td>a. Intercom (PMA4000)</td>
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<td></td>
<td>b. Audio Panel (GMA340)</td>
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<td>22</td>
<td>a. Transponder (GTX327)</td>
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<td>b. Transponder (GTX330)</td>
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<td>23</td>
<td>Automatic Direction Finder (KR87)</td>
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<td>DME (KN64)</td>
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<td>25</td>
<td>Encoder</td>
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<td>0.1</td>
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<tr>
<td>26</td>
<td>Emergency Locator Unit</td>
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<td>27</td>
<td>Avionics Cooling Fan</td>
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<td>0.5</td>
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<tr>
<td>28</td>
<td>First Aid Kit</td>
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<tr>
<td>29</td>
<td>Fire Extinguisher</td>
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<td>2.5</td>
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## Section 7 : Description of Aircraft & Systems

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<td>Garmin GTX 327 Transponder</td>
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<tr>
<td>Garmin GNC250XL VHF Com / GPS Receiver</td>
<td>7-28</td>
</tr>
<tr>
<td>PS Engineering PMA4000 Audio Selector</td>
<td>7-29</td>
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</table>
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Airframe

The Alpha R2160i is a low wing, tricycle undercarriage, acrobatic two seat trainer. It is an all metal design of conventional semi monocoque construction. The undercarriage is fitted with fairings to aid drag reduction.

Access to the cabin is via a built in step, hand grabs and a forward sliding bubble canopy.

Cabin

The cabin has provision for pilot, passenger and luggage. The luggage deck has built in tie down points to secure the luggage.

The seats are adjustable fore and aft. A five point acrobatic harness is fitted as standard.

<table>
<thead>
<tr>
<th>Cabin width</th>
<th>1.06m (42&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>2.06m (81&quot;)</td>
</tr>
<tr>
<td>Height</td>
<td>1.25m (49&quot;)</td>
</tr>
</tbody>
</table>

Engine

Lycoming AEIO-320-D2B 160 BHP @ 2700 rpm

The engine is fuel injected. An air/oil separator is fitted in the breather line terminating on the lower fuselage panel aft of the left step. Recovered oil is returned to the sump. A “Slick Start” magneto system is installed to improve starting. Also fitted is a “Skytech” light weight starter.

Propeller

Sensenich metal propeller 74DM7S5-2-64
Electrical System

The electrical system is conventional 14 volt with a GelCell lead acid battery and charged by an alternator of 60 Amp output. The system is protected by Circuit Breakers of varying capacity. A dual volt/ammeter is provided to monitor the electrical system.

The electrical system includes electrically actuated flaps, navigation lights, anti collision strobe lights, landing lights and cockpit/instrument lighting.

ATTENTION

The electrical system includes an Auxiliary Power socket, which is always live.

Ensure nothing is connected to this socket during take-off and landing.

Alternator Failure Warning Light

The “ALT FAIL” warning light on the annunciator panel is lit when the alternator is inoperative and the battery is providing power to the bus.

The “ALT FAIL” warning light is activated by the same system that activates the “DISCHARGE” LED on the VA/1A50 Voltmeter/Ammeter gauge.

VA/1A50: Voltmeter / Ammeter

An E.I. Inc digital/analogue combined volt/ammeter is installed to monitor the electrical system.

The instrument is fitted with two warning lights which have the following function:

- Yellow “DISCHARGE” LED which indicates the alternator is inoperative and the battery is providing power to the bus.
- Red “HIGH VOLTS” LED illuminates when the bus voltage exceeds 15.3V.

Cockpit and Instrument Light Controls

The cockpit and instrument lights are controlled via three dimmer controls on the annunciator panel and one dimmer on the centre console.
Fuel System

The fuel system consists of a 160 litre tank mounted under the luggage deck and aft of the seat back. The fuel tank has two outlets, one at the bottom of the tank and the other at the top to ensure sufficient fuel flow when inverted. Fuel flows from the tank through mesh finger strainers via flexible lines to the inverted flight valve. The inverted flight valve is a shuttle type valve that uses gravity to shut off the highest fuel outlet. From the inverted fuel valve the fuel flows to the fuel shut off valve mounted on the lower fuselage skin. The shut off valve is actuated by a push/pull control mounted on the centre console. The line from the bottom of the fuel tank to the inverted flight valve forms a low point in the system and as such is fitted with a quick drain valve to enable the removal of water.

From the shut off valve, fuel flows to the adjacent electric fuel pump. From the pump, the piping carries the fuel to the gascolator (combined filter, water / sediment trap) which forms a low point in the fuel system. The gascolator is fitted with a quick drain valve to enable the removal of water. From the gascolator, the fuel flows to the engine driven pump and then to the fuel injector. The boost pump is actuated by a switch on the centre console.

Two warning lights in the annunciator panel are provided for the fuel system. One advises low fuel pressure (Fuel Press) and the other low fuel level (Low Fuel Level). A fuel gauge is fitted to the lower sub panel and adjacent is a combined fuel flow/totaliser instrument. A calibrated dip stick is provided as an alternate method of determining fuel level.

The fuel system is schematically shown on the following page.
Fuel System Schematic
Inverted Oil System

This aircraft has a “Christen” inverted oil system fitted. This consists of an oil/air separator in the breather line and an inverted oil valve which provides oil supply to the oil pump when the aircraft is operated inverted. See the schematic below.
Heating & Ventilation

Fresh air is provided by face level air vents integral with the instrument panel. Heating and demisting is also provided and selected by controls on the lower instrument panel.

The heat source is a heat box around the muffler. The hot air is directed by a heat control box on the firewall. This on/off control permits air to the heat distribution box which in turn can direct heated air to either the cabin or to the windscreen for demisting.
Flight Controls

The aircraft is fitted with dual flight controls and can be flown from either the left or right hand seat. The control surfaces are of all metal construction and all are statically balanced. The control surfaces are operated by cables. In the case of the ailerons the cables operate a bell crank which in turn moves a push rod attached to the aileron. This arrangement provides for differential movement of the ailerons.

Pitch control is provided by a horizontal stabiliser fitted with anti-servo tabs. The pitch trim system is operated by a knurled trim wheel in the centre consol and via a Telflex cable controls the angular relationship between the anti-servo tabs and the stabiliser.

The flaps are electrically actuated with three preset positions 0°, 10°, and 35° selected via a three position switch on the centre console. Flap position is shown on the indicator bar adjacent to the flap selector switch.

Nose gear steering is controlled by the rudder pedals.
Key to Panel Image

1. Airspeed indicator
2. Gyro horizon
3. Altimeter
4. Optional equipment
5. Turn Coordinator
6. Directional gyro
7. Rate of climb indicator
8. Tachometer
9. Optional equipment
10. Fuel pressure/flow
11. Fuel Quantity Indicator
12. Oil pressure/Temp
13. G Meter
14. Voltmeter/Ammeter
15. EGT/OAT/CHT
16. Vacuum gauge
17. Magnetic compass
18. Clock
19. Voice Annunciator Control Panel
20. COM/NAV
21. Intercom
22. Transponder
23. Magneto selector switch with starter
24. Mixture control
25. Throttle controls
26. Fuel shut off control
27. Flaps control lever
28. Flaps Position indicator
29. Elevator trim tab control wheel & Indicator
30. Parking brake control
31. Electric fuel pump switch
32. Battery and alternator switch
33. Circuit breakers (from left to right):

1st Row
- Turn & Slip
- Nav Lights
- Land/Taxi Lights
- Strobe Lights
- Cabin / Instrument Lights
- Pitot Heat (when fitted)
- Avionics 1

2nd Row
- Magneto (Slick Start)
- Console Lights
- Flaps Power
- Flaps Control
- Digital Instruments 1
- Digital Instruments 2
- Avionics 2
- Battery
- Alternator

3rd Row
- Warnings
- Altitude Encoder
- Com 2
- Audio
- Nav
- GPS & Com 1
- Transponder
- Avionics Cooling Fan
- Spare
- Spare
- Spare
- Auxiliary Power Socket
- Mike/Headset Jack sockets
- Safety switches (from left to right):
  - Landing lights
  - Taxi light
  - Strobe light
  - Navigation lights
  - Spare
- Panel lighting controls (from left to right):
  - Panel lights (under glare shield)
  - Cockpit lights (overhead flood lights)
  - Instrument / Radio
- Warning Lamps (from left to right):
  - Low oil pressure
  - Low fuel pressure
  - Low fuel level
  - Low Volt
  - Starter
  - Flaps down
  - 2 warning lamps unused

40 ............ Warning lights test and dimming control
41 ............. ELT Remote Switch
42 ............. Cabin Fresh Air Vents
43 ............. Cabin Heat/Demist Controls
Annunciator Panel

The annunciator panel contains:

Six warning lights:
  • Low oil pressure
  • Low fuel pressure
  • Low fuel level
  • Low Volt
  • Starter
  • Flaps down

Four safety switches:
  • landing lights
  • taxi light
  • Strobe light
  • navigation lights

Four panel lighting controls:
  • Warning light DAY/NIGHT/TEST
  • Instrument panel dimmer
  • Overhead light dimmer
  • Instrument / Radio light dimmer

Warning Light Description:

OIL PRESS: Illuminates RED when the oil pressure drops below 25 psi.

FUEL PRESS: Illuminates RED when the fuel pressure drops below 12 psi.

LOW FUEL: Illuminates RED when the fuel level drops below 20 litres.

LOW VOLT: Illuminates YELLOW when the battery voltage drops below 13V.

STR: Illuminates RED when the starter is activated.

FLAPS DOWN: Illuminates GREEN when the flaps are extended.
Specialised Instrumentation

FP5 : Fuel Flow / Fuel Pressure

An Electronics International Inc. FP5 fuel flow/pressure instrument is fitted to the sub panel in this aircraft.

The fuel flow has been set at the factory to indicate the flow in litres/hour, the fuel quantity in litres and the fuel pressure in PSI. For more information on various operations and use of different units refer to the latest edition of the "Operating Instructions” P/N OI 050593P.

The instrument controls are as follows:

1. Low Fuel Warning LED.
2. High/Low Pressure Warning LED.
3. Display Mode Indicator LED’s.
4. Left “PRG” (Program) button.
5. “STEP” switch.
6. Right “PRG” (Program) button.

On power up note the following:-

1. When the master is turned on the fuel flow will display the theoretical fuel remaining in the tank if the added fuel has been updated.

2. The green “REM” led and the red “High/Low Fuel Pressure Warning” led are blinking as a reminder to update the fuel quantity.

3. To change the fuel remaining perform the following steps:
   - Check that “REM” mode is selected
   - Momentarily push both “PRG” buttons at the same time
   - The display will show “ADD”
   - Push either one of the “PGR” buttons
   - The display will show the current fuel remaining. The blinking left digit indicates that you may programme this digit first
   - Advance the digit count. Moving the mode select switch to the
right will increase the blinking digit by one
- Increase next digit by pushing a “PGR”
- To exit the “ADD” programming mode press both “PGR” buttons

4. Select the display mode to “FLOW”

**NOTE**

*It is imperative the pilot verify the calibration of the FP-5 over many tanks of fuel before using the “REM” and/or “USED” modes as an indication of the fuel remaining or fuel used. Even after verifying the calibration of the FP-5 it should never be used as the primary indicator of fuel quantity in the tanks.*
SC-5 Super Clock

The SC-5 is a multi purpose timing device. Apart from the usual timing functions it also monitors engine time. There are five display modes as follows:

1. “LOCAL” Clock – this mode displays local time in either 12 or 24 hr format.
2. “ZULU” Clock – this mode displays Zulu time.
3. “UP” Timer – in this mode the timer counts up automatically from when the “Master” is turned on, acting as a flight timer. Alarms may also be programmed in to alert the pilot at chosen intervals.
4. “DN” Timer – in this mode the timer counts down. The start time can be set as required and when the timer reaches 0:00 a yellow warning LED will blink.
5. “ENGINE TIME” – in this mode the SC-5 acts as a “Hobbs” meter and displays the total time the engine has been running. It is not possible to reset this timer.

On start up (master switch on) the SC-5 performs a self diagnostic test, displaying “88:88” and flashing the yellow warning LED’s.

The SC-5 face is shown below indicating warning LED and button locations.

For instructions on set up and using the functions refer to Electronics International Operating Instruction manual OI 0313961 latest issue.
Voice Annunciator AV-17

General Description

This aircraft is equipped with a voice annunciator which warns the pilot when certain limits have been exceeded. The annunciator is wired through the audio panel and gives voice massages to the pilot. The unit is controlled by a small control panel mounted on the co-pilots instrument adjacent to the SC-5 clock. This panel allows the pilot to acknowledge (and thereby deactivate the alarm temporarily) or turn the Voice Annunciator off.

The AV -17 is a voice Annunciator packaged in a 4.1” by 2.6” by 1.7” control box located under the right hand side of the instrument panel. There is also a small remote control switch mounted on the right side of the main instrument panel.

Control Panel

The control panel allows you to turn the AV-17 ON or OFF. Also, it allows you to acknowledge and thereby deactivate any active alarm to either 1 minute or 10 minutes.

The AV-17 is connected to the aircraft speaker system. The AV-17 is capable of providing AURAL warnings relating to 18 different events. Additionally, a “Check Bus Voltage” warning is built into each AV-17.

NOTE:

Only the warnings listed below are in service on this aircraft and they are listed in order of priority:

1. Airspeed
2. Oil Pressure
3. Oil Temperature
4. Fuel Level
5. Fuel Pressure
6. Bus Voltage

Immediately any of the pre-set parameters are exceeded the Voice Annunciator will chime through the speaker and a female voice will announce the appropriate warning with a phrase, such as: “Check Oil Pressure,” or “Check Airspeed” etc.

If two or more alarms are activated, the alarms are placed on the AV-17’s “Task List” and are announced one at a time with a one second delay.
between alarms. After the last alarm on the list is announced there is a five second delay and the alarms are once again announced in order.

Power - up Announcement

When power is applied to the AV-17 and the control panel switch is placed in the on position, the unit will announce "Voice Annunciator Enabled. Have a nice flight". This announcement will be made only once, at the beginning of each flight.

Acknowledging and Silencing an Alarm

An activated alarm can be silenced by momentarily moving the switch on the AV-17 to the "ACK" position; a high pitch tone will be heard through the speaker and all active alarms will be silenced for one minute. By moving the switch to the "ACK" position three times within three seconds the active alarms can be silenced for ten minutes.

Turning the AV-17 “OFF”

To disable the AV-17, silence all voice alarms through the speaker and reset any delay times, set the control panel switch to the “OFF” position. When the AV-17 is once again set to the “ON” position the AV-17 will announce “Voice Annunciator Enabled” This will be followed by any active alarms.

NOTE

It is the responsibility of the Pilot in Command to ensure that he has read and fully understands the information contained in the instrument manufacturers installation and operations manual for correct operation of the AV-17 Voice Annunciator prior to embarking on any flight.
Artex ME–406 Emergency Locator Transmitter

Description:

The Artex ME-406 is a single output Non-Portable type Emergency Locator Transmitter (ELT). Two emergency frequencies (121.5 and 406.028 MHz) utilize the Radio Frequency (RF) output, which requires only one coax cable to connect to the new series of Artex single output antennas.

Location

The ELT is located in the rear fuselage section of the aircraft and is attached by bracket to the floor section on the starboard side of the aircraft.

Operation

In the event of a crash, the ELT automatically activates and will transmit the standard sweep tone on 121.5 MHz. Every 50 seconds for 440 milliseconds and the 406 MHz transmitter turns on and transmits an encoded digital message to the Cospas/Sarsat satellite system.

Remote Switch

A three position (ON/ARM/RESET) remote switch is located on the instrument panel, this gives the pilot or maintenance provider the ability to control the ELT manually if required.

The Artex ME-406 ELT is accurate to within Three (3) Kilometres
EAC-1: EGT/OAT/CHT

Description:

The EAC-1 instrument fitted in this aircraft is a combination "single channel" Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT) and Outside Air Temperature gauge (OAT). The Pilot is able to monitor the above functions by manipulating the 3 way toggle switch on the face of the instrument to the desired position, this will result in the appropriate information being displayed in digital format on the LCD display located in the centre of the instrument.

Exhaust Gas Temperature (EGT)

The Exhaust Gas Temperature (EGT) is directly related to the combustion temperature, it is an indication of the engine’s ability to produce power. With correct use of the mixture control, the pilot is able to establish by monitoring the EGT when the engine is operating at an optimum for that particular condition of flight.

Cylinder Head Temperature (CHT)

The Cylinder Head Temperature (CHT) instrument helps the pilot protect the engine against the threat of excessive heat. Most general aviation aircraft monitor the hottest CHT, as determined by extensive flight test done by the aircraft manufacturer.

Shock cooling of the engine is also a problem that is common with aircraft engines, this is caused by rapid descents with little or no power and excessively rich mixtures.
Outside Air Temperature (OAT)

The probe for this instrument is located approximately mid-point in the outboard section on the underside of the Port wing. This particular instrument is very sensitive and it is for this reason, when the aircraft is stationary on a hot surface, such as Asphalt or concrete the unit will read the actual temperature to which it is exposed. Once removed from the heat source the temperature readings will rapidly change to read ambient temperature.

Ice Zone Warning Light

This light will come on when the Outside Air Temperature drops to + 4°C and stays above - 12°C.

This feature can be very useful for warning the pilot of the possibility of structural ice if the prevailing conditions are right, it is independent of the other functions of this instrument

NOTE:

Pilots must familiarise themselves with the engine manufacturers recommended procedures when leaning the aircraft engine, failure to follow the correct procedures could result in damage to the engine and possible engine failure. It is advised that all “Normal” and “Non Normal” operating temperatures and pressures and the corresponding instrument markings on this aircraft are noted prior to embarking on any flight.
OPT-1: Oil Temperature/Pressure Gauge

Features:
- Dual 90 degree graphic analog displays with green, yellow, and red LED's.
- Accurate digital display. 1 PSI and 1°F Resolution. Remote oil pressure and temperature transducers.

Specifications:
- 2 1/4" Mount. 3.65" Depth. 22 Oz. Kit.
- Viewable in direct sunlight.
- Backlit for night operation.
- Operates from 7.5 to 35 volts at .3 amps.

**Important Information**

Note: This instrument designates any "Caution Range" with yellow LED's, the "Maximum and Minimum Limits" each with a red LED, and the "Safe Operating Range" with green LED's. The "Safe Operating Range" on this instrument is equivalent to an analog gauge's green "Normal Operating Range".

The Pressure range is marked with a Red LED on the low end followed by a Yellow Caution LED and then green LED's up to a high end Yellow LED followed by the “Maximum Temperature Limit.” Red LED

The Temperature range is marked with a yellow LED on the low end and green LED's up to the “Red LED Maximum Temperature Limit.”
NOTE:

For full instructions on the operation of the OPT 1 Oil Pressure/Temperature Gauge refer to the manufacturers “Operating and Installation Instructions Manual”

It is the responsibility of the Pilot in Command to ensure that he has read and fully understands the information contained in the “Operating and Installation Instructions Manual” for correct operation of the OPT 1 Oil Pressure/Temperature Gauge prior to embarking on any flight.
Garmin GMA 340 Audio Panel (where fitted)

Function Selection Switches

The left small knob (5, 7) controls the ON/OFF function.

Marker Beacon

1. Marker Beacon Lamps
2. Marker Beacon Receiver Audio Select/Mute Button
3. Marker Beacon Receiver Sensitivity Indicator LED’s
4. Marker Beacon Receiver Sensitivity Selection Button

Pilot Intercom System (ICS)

5. Pilot Intercom System (ICS) Volume
6. Pilot ICS Voice Activated (VOX) Intercom Squelch Level
7. Copilot and passenger ICS Volume Control (Pull out for Passenger Volume)
8. Copilot and Passenger VOX Intercom Squelch Level
9. Crew Isolation Intercom Mode Button
10. Pilot Isolation Intercom Mode Button
11. Passenger Address (PA) Function Button
12. Speaker Function Button

Communication & Navigation

13. Transceiver Audio Select Buttons (COM 1, COM 2, COM 3)
14. Transmitter (Audio/Mic) Selection Buttons
15. Split COM Button
16. Aircraft Radio Audio Selection Buttons (NAV 1, NAV 2, DME, ADF)
17. Annunciator Test Button
18. Locking Screw Access
19. Photocell – Automatic Annunciator Dimming
NOTE:

For full instructions on the operation of the GMA 340 refer to the manufacturers “Pilots Guide”

It is the responsibility of the Pilot in Command to ensure that he has read and fully understands the information contained in the “Pilots Guide” for correct operation of the GMA 340 Audio Panel prior to embarking on any flight.
Garmin GTX 327 Transponder

The Garmin GTX 327 Transponder is powered by pressing the STBY, ALT or ON keys. Or by a remote avionics master switch (if applicable). After power on, a start-up page is displayed while the unit performs a self test. If the unit detects an internal failure, the screen displays SELF TEST FAILED. (See your GARMIN Dealer for Software Upgrades)

Mode Selection Keys

OFF – Powers off the GTX 327. Pressing STBY, ON or ALT Key powers on the transponder displaying the last active identification code.

STBY – Selects the standby mode. When in standby mode, the transponder will not reply to any interrogations.

ON – Selects Mode A. In this mode, the transponder replies to interrogations, as indicated by the reply Symbol ®. Replies do not include altitude information.

ALT – Selects Mode A and Mode C. In ALT mode, the transponder replies to identification and altitude interrogations as indicated by the Reply Symbol ®. Replies to altitude interrogations include the standard pressure altitude received from an external altitude source, which is not adjusted for barometric pressure. The ALT mode may be selected in aircraft not
equipped with an optional altitude encoder; however, the reply signal will not include altitude information.

Any time the function **ON** or **ALT** is selected the transponder becomes an active part of the Air Traffic Control Beacon System (ATCRBS). The transponder also responds to interrogations from TCAS equipped aircraft.

**NOTE:**

For full instructions on the operation of the GTX 327 refer to the manufactures “Pilots Guide”

| It is the responsibility of the Pilot in Command to ensure that he has read and fully understands the information contained in the “Pilots Guide” for correct operation of the GTX 327 Transponder prior to embarking on any flight. |
Garmin GNC250XL VHF Com / GPS Receiver

The GNC 250XL System is a fully integrated panel mounted instrument, which contains a 760 channel VHF Communications transceiver and Global Positioning System (GPS) Navigation computer. The system consists of an antenna and a receiver in its mounting rack. The primary function of the VHF Communication portion of the equipment is to facilitate communication with Air Traffic Control. The primary function of the GPS portion is to acquire signals from the GPS satellites, recover the orbital data, make range and Doppler measurements, and process this information in real-time obtain the user’s position, velocity, and time.

Provided that the Garmin GNC 250XL navigation system is receiving adequate usable signals, it has been demonstrated of and has been shown to meet the accuracy specifications of FAA Advisory Circular 20-138 for VFR flight.

Navigation is accomplished using the WGS-84 (NAD-83) co-ordinate reference datum. Navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States of America.

It is the responsibility of the Pilot in Command to ensure that he has read and fully understands the information contained in the “Pilots Guide & Reference” for correct operation of the GNC 250XL VHF Com / GPS prior to embarking on any flight.
PS Engineering PMA4000 Audio Selector (where fitted)

The PMA4000 is a 4-place panel mounted intercom with added capability for switching two communications transceivers and navigation receivers, as well as providing a speaker amplifier. The intercom features PS Engineering's exclusive IntelliVox® with individual volume controls for both the pilot and copilot.

- A multi-position mode switch allows the pilot to select either Pilot Isolate or All intercom modes.
- The ISO mode isolates the pilot from the intercom, and connects directly with the aircraft radios. The copilot and passengers are free to have conversation and enjoy the entertainment without radio interruption. The pilot is not distracted by passenger intercom use and has control over the radio communications.
- The "ALL" mode places everybody on a party line. Each person hears all intercom conversation and aircraft radio reception. Everyone hears the entertainment source as well.
- The "Off" mode is part of the automatic fail-safe interconnect to the aircraft systems. If power to the intercom is disrupted, the pilot's headset is automatically connected to the aircraft radio. This permits continuous radio communications.

The PMA4000 has independent intercom volume controls for the pilot, and the copilot. Because this system was designed with the tandem cockpit in mind, the copilot volume can be remotely-mounted in another location. Because the pilot and copilot volume control does not affect the aircraft radio volume, balance between the intercom and radio audio is easily achieved. For instance, by reducing the pilot's intercom volume, the aircraft radio volume will be in the foreground, while the intercom will be at a background level.

The PMA4000 IntelliVox® intercom squelch system eliminates complicated squelch adjustments. In addition, by using independent microphone circuits unwanted noise is kept out of the audio. Since only the microphone being spoken into is open,
extraneous cabin noise is minimized. Individual squelch controls mean that the system can be tailored to different microphones, as well as variations in voice levels in the cockpit.

The PMA4000 has two switched com transceiver inputs and two switched navigation receiver inputs. In addition, there are four un-switched audio inputs that can be used for other receivers or audio warnings such as autopilot disconnect or GPS alerts.

There is a built in speaker amplifier in the unit. Pushing the volume control will place all selected audio, or any un-switched audio present, over a cabin speaker.

With the PMA4000 installed, both pilot and copilot have transmit capability over the aircraft radios. Only the person who presses the PTT is heard over the radio. The selected com LED shows green when selected, and flashes during radio transmissions. This feature acts as a stuck microphone indication.

The COM transceiver switching is automatic. When the toggle switch microphone selector is in COM 1, the receive audio and microphone signals are both presented to the audio. The push button selector controls receive audio only, and is used to select multiple com receivers.

**NOTE**

It is the responsibility of the Pilot in Command to ensure that he has read and fully understands the information contained in the instrument manufacturers installation and operations manual for correct operation of the PMA4000 Audio Selector prior to embarking on any flight.
Section 8 : Handling, Servicing & Maintenance

Contents

Ground Handling 8-3
Mooring 8-3
Routine Maintenance 8-3
Ground Handling

To enable the aircraft to be moved by hand without pushing on the airframe, a tow bar is provided. When steering the aircraft with the tow bar care should be taken to ensure the limit stops are not forced.

**NOTE**

*The outer two thirds of the propeller and/or spinner should not be used to push against while manoeuvring the aircraft.*

Mooring

Mooring points are provided under the wings near the tips. The third point is the tail spring fitting. When mooring, the controls should be prevented from moving by utilising the lap straps to secure the control stick. Care should be taken to ensure the controls are not forced by using only sufficient tension to prevent movement of the surfaces in the wind.

Routine Maintenance

This aircraft is to be maintained in accordance with section 3 of the R2000 Service Manual.

Pilot maintenance may be permitted if the Rules of the Civil Aviation Authority of the country in which the aircraft is operated provides for such maintenance.
### Section 9 : Supplements

#### Contents

##### STANDARD SUPPLEMENTS

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CAA Approved AFM Supplements must be in the airplane for flight operations when the subject optional equipment is installed or the special operations are to be performed.
160Ai FLIGHT MANUAL
SUPPLEMENT

OPERATION OF AIRCRAFT WITHOUT WHEEL SPATS

CAA approved supplementary information.
OPERATION OF AIRCRAFT WITHOUT WHEEL SPATS

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SECTION 1- GENERAL

Removal of the wheel spats is permitted.

Information in this document supplements or supersedes information in the basic Aircraft Flight Manual. For limitations, emergency procedures, normal procedures and performance information not contained in this supplement refer to the basic CAA approved Flight Manual.

SECTION 2- LIMITATIONS

Unchanged.

SECTION 3- EMERGENCY PROCEDURES

Unchanged.

SECTION 4- NORMAL PROCEDURES

Unchanged.

SECTION 5- PERFORMANCE

Take off performance  
The 50 ft (15 m) clearance distance must be increased by 2.1%.

Climb Performance  
The climb rate must be decreased by 2%.

Cruise Performance  
Level flight speeds must be decreased by 6%.

SECTION 6- WEIGHT & BALANCE

The empty weight must be decreased by the weight of the wheel spats.

The movement of the Centre of Gravity is insignificant.