Preliminary

FLIGHT MANUAL

for Powered Sailplane

Variant: **Ventus – 3M**

Edition: **Performance**

Serial-No.: **053MP**

Registr. No.: **OH – 1031**

Date of issue: **March 2019**

~~Pages as indicated by „appr.“ Are EASA approved by~~

~~**„Type Certificate EASA.A.627“ vom 00. Monat 0000.**~~

This powered sailplane is to be operated in compliance with information and limitations contained herein.
Approval of translation has been done by best knowledge and judgement. In any case the original text in German language is authorative.

0.1 Record of revisions

Any revision of the present manual, except actual weighing data, must be recorded in the following table.

The new or amended text in the revised page will be indicated by a black vertical line in the left-hand margin. The revision number and the date will be shown on the bottom left hand side of the page.

0.1 Erfassung der Berichtigungen/*Records of revisions*

Lfd. Nr. der Berichtigung	Abschnitt	Seite	Ausgabe-datum	Bezug	Datum der Einarbeitung	Zeichen/ Unterschrift
Revision No.	*Affected section*	*Affected page*	*Date of issue*	*Reference*	*Date of Insertion*	*Signature*

ÄB / MB: Änderungsblatt – *Modification Bulletin*
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Hinweis: Nicht eingefügte Berichtigungen sind zu streichen.
Das Verzeichnis der Seiten ist gegebenenfalls handschriftlich zu aktualisieren.

Note: Cross out revisions which are not included.
The list of effective pages must be amended by hand if necessary.

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0.3 Table of contents

Section 1

1 General

1.1 Introduction

This Flight Manual has been prepared to provide pilots and instructors with all necessary information for the safe and efficient operation of the powered sailplane.

This manual includes at first all the material that needs to be provided to the pilot according to EASA airworthiness code „CS 22”. It also contains supplemental data and operating procedures which could, in the manufacturer´s opinion, be useful for the pilot.

1.2 Certification basis

This self-launching powered sailplane, model designation

V e n t u s - 3 M

has been approved by the European Aviation Safety Agency (EASA) in compliance with the airowrthiness requirements contained in

CS-22 vom 05. März 2009.

The Type Certificate is No. EASA.A.627 and was issued on

****. MONAT ******

Category of Airworthiness: UTILITY

1.3 Warnings, cautions and notes

Particularly important statements in this manual regarding flight safety or important matters for operation are preceded by one of the following terms

„**WARNING**“	means that the non-observation of the indicated procedure leads to an immediate or important degradation of the flight safety.
„**CAUTION**“	means that the non-observation of the indicated procedure leads to a minor or to a more or less long term degradation of the flight safety.
„**NOTE**“	draws the attention on any special item not directly related to safety, but which is important or unusual.
„**CS 22**“	Pages marked with CS 22 at the lower right side contain only information required by CS 22.1583 through CS 22.1587(a).

1.4 Descriptive data

1.4.1 Description

The Ventus-3M is a single-seat high performance self-launching powered sailplane built from fiber reinforced plastic (FRP), featuring camber-changing flaps and a T-tail (fixed horizontal stabilizer with elevator, fin and rudder).

Wing

The six-piece wing with winglets is four-stage trapezoid in planform with triple-panel “Schempp-Hirth” type airbrakes on the upper surface. The flaps are full-span and act at the same time as ailerons.
The water ballast tanks are integral compartments in the forward section of the wing. Every right and left wing contains 2 water ballast tanks. The water ballast tank in the outboard panel is connected to the next tank in the inboard wing panel. During rigging, the outboard tank is connected automatically to the inboard panel. Their total capacity is approx. 132 liters (34.9 US Gal., 29.0 IMP Gal.).
The wing shells are a CFRP/foam-sandwich construction with spar flanges of carbon fiber rovings and shear webs made from GFRP/foam-sandwich.

Fuselage

The pilot has a semi-reclined position in the comfortable cockpit. The one-piece canopy hinges forward and opens to the front. The cockpit region is constructed as a Kevlar/carbon/glass fiber laminate in order to achieve a high energy absorption. The aft fuselage section is a pure carbon fiber (non-sandwich) shell for high strength. The stiffening of the fuselage shell is made in the aft fuselage cone by carbon fiber bulkheads and glass fiber webs. In the cockpit area the stiffening is done by a double fuselage shell at the side with integrated cockpit frame and seatpan supports.
The spring-suspended main landing wheel is retractable and features a hydraulic disc brake. The tail wheel is steerable or fixed.

Horizontal tailplane

The horizontal tailplane consists of a fixed stabilizer with elevator. The elevator trim is adjusted automatically when actuating the flap.
The stabilizer is a GFR /foam-sandwich construction, the elevator halves are a pure CFRP shell.

Vertical Tail

Fin and rudder are constructed as a GFRP/foam-sandwich.
Optionally a water ballast trim tank with a capacity of 7.8 liter (2.06 US Gal., 1.72 IMP. Gal.) can be integrated in the fin.
The dumping valve of the water ballast trim tank in the vertical fin is linked to the dump valves of the wing water ballast tanks.

Controls

Rigging the wing panels and the tail will automatically hook up the control surfaces.

Power plant

The Ventus-3M was developed from the self-sustaining powered sailplane Ventus-3T by integrating a stronger propulsion system, a larger propeller and the use of a suitably adapted fuselage.

The Ventus-3M is powered by a liquid-cooled 45 kW (61 PS) SOLO engine – type 2625-01i – having a programmable fuel injection.
The power plant is housed in the fuselage aft of the wings and an electrical spindle drive pivots it such that the propeller pylon extends from the engine bay in the fuselage cone.

The power plant is stopped by reducing the airspeed and turning off the ignition. After turning off the ignition, the retraction process is conducted automatically by the power plant control unit MCU 3.

With the power plant control unit MCU 3 apart from the ignition switch, the RPM indicator, the fuel valve and the throttle control no more controls have to be considered. The fuel level in the control unit is displayed in LITERS.

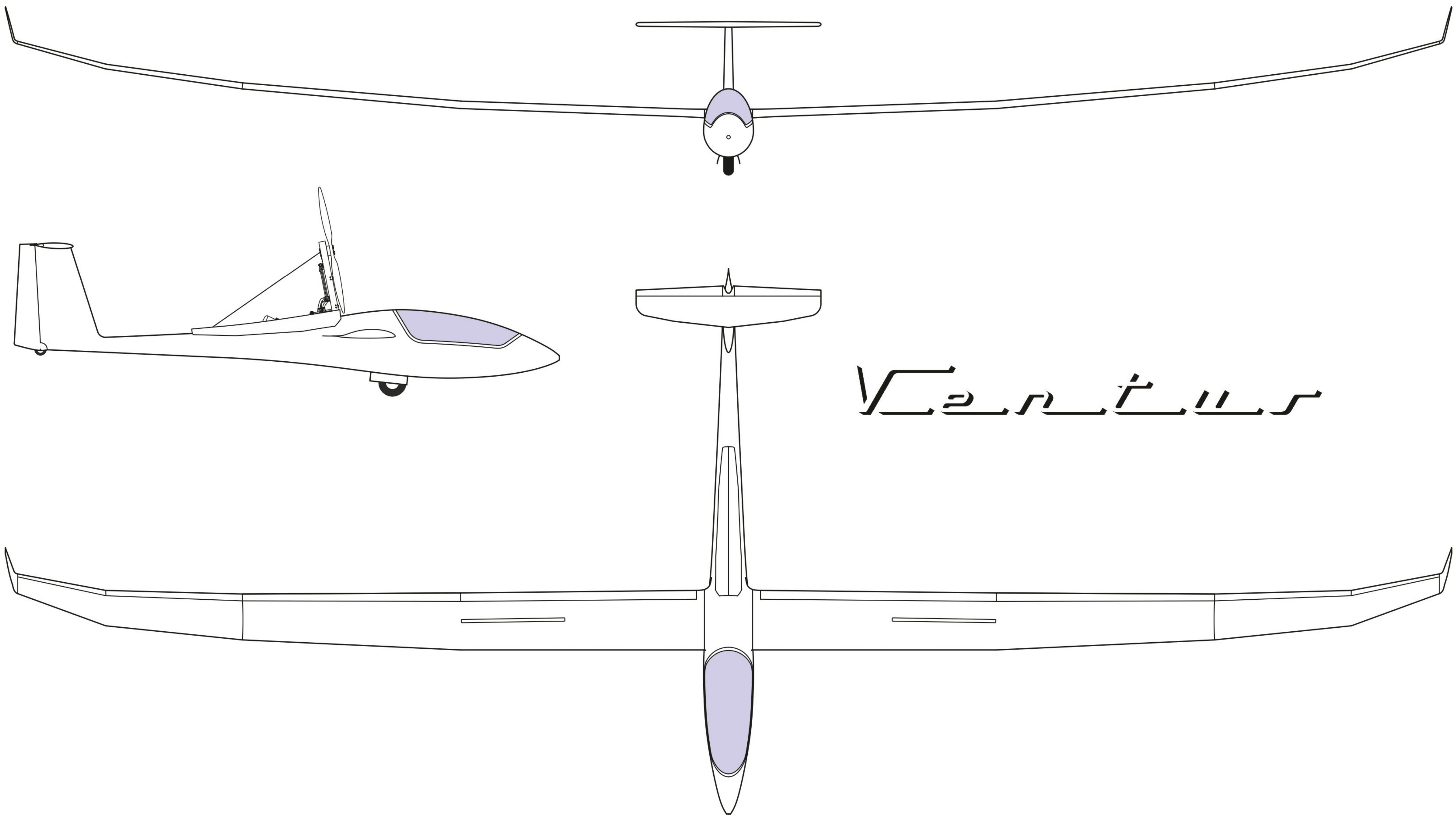
The propulsion system has an integrated Power Supply Switch, that maintains the power supply of the battery ignition and the electronic engine control unit Trijekt directly from the alternator in case of failure.

Flight characteristics and performances are identical with those of a correspondingly loaded Ventus-3T.

1.4.2 Technical Data

Wing	Span	18.00 m	59,06 ft
	Area	10.84 m²	116,68 ft²
	Aspect ratio	29.90	
	MAC	0.602 m	1,975 ft
Fuselage	Length	6.78 m	22,24 ft
	Width	0.62 m	2,03 ft
	Height	0.81 m	2,66 ft
Weight (mass)	Empty mass from approx.	395 kg	870,83 lb
	Empty mass with power plant removed approx.	345 kg	760,59 lb
	Maximum all-up mass	600 kg	1322,77 lb
	Wing loading	38.3 - 55.4 kg/m²	7,84 – 11,34 lb/ft²
Engine	Model	SOLO 2625-01i	
	Power	45 kW at 6200 RPM	
	Manufacturer	Fa.Solo Kleinmotoren GmbH	
Propeller	Model	KS-1G-152-R-122	
	Manufacturer	Fa. Technoflug Leichtflugzeugbau GmbH	

1.5 Three-side View



Section 2

2 Limitations

2.1 Introduction

This section includes operating limitations, instrument markings and basic placards necessary for safely operating the aircraft, its standard systems and its standard equipment.

The limitations included in this section and in section 9 have been approved by the EASA.

2.2 Airspeed

Airspeed limitations and their operational significance are shown below:

Abbr.	SPEED	IAS	REMARKS
V_{NE}	Never exceed speed in calm air for flap settings “0”, “-1”, “-2”, “S”, “S1”	280 km/h 151 kt 174 mph	Do not exceed this speed in any operation and do not use more than 1/3 of control deflection
V_{FE}	Maximum speed for flap extended on settings “+2”, “+1”	180 km/h 97 kt 112 mph	Do not exceed this speed with the given flap settings
V_{FE_L}	Maximum speed for flap extended on setting “L”	150 km/h 81 kt 93 mph	Do not exceed this speed with the given flap setting
V_{RA}	Rough air speed	180 km/h 97 kt 112 mph	Do not exceed this speed while flying in strong turbulence. Strong turbulence is met in lee-wave rotors, thunderclouds etc.
V_A	Maneuvering speed	180 km/h 97 kt 112 mph	Do not make full or abrupt control movements above this speed as the aircraft structure might get overstressed.
V_{LO}	Maximum landing gear operating speed	180 km/h 97 kt 112 mph	Do not operate (retract or extend) the landing gear above this speed

Abbr.	SPEED	IAS	REMARKS
V_T	Maximum speed for aerotow	180 km/h 97 kt 112 mph	Do not exceed this speed during an aerotow
V_W	Maximum speed for winch launch	150 km/h 81 kt 93 mph	Do not exceed this speed during a winch launch
V_{max}	Maximum speed with power plant extended	180 km/h 97 kt 112 mph	Do not exceed this speed with power plant extended
V_{POmin}	Minimum speed for extending / retracting the power plant	92 km/h 50 kt 57 mph	Do not extend / retract the power plant outside this speed range
V_{POmax}	Maximum speed for extending / retracting the power plant	120 km/h 65 kt 75 mph	

2.3 Airspeed indicator markings

Airspeed indicator markings and their colour code significance are shown below:

MARKING	IAS	SIGNIFICANCE
Red line at	280 km/h 151 kt 174 mph	Maximum permitted speed
Yellow arc	180 – 280 km/h 97 – 151 kt 112 – 174 mph	Manoeuvres must be conducted with caution and operating in rough air is not permitted.
Green arc	102 - 180 km/h 56 – 97 kt 64 – 112 mph	Normal operating range lower limit is the speed 1.1 times V_{S1} at maximum mass, with c/g in the most forward position and flaps at the neutral position; upper limit is the max. allowed speed in rough air
White arc	94 - 180 km/h 51 – 97 kt 58 – 112 mph	Positive flap operating range Lower limit is the speed $1.1V_{S0}$ at maximum mass and in landing configuration; upper limit is the max. permissible speed with flaps extended positive
Yellow triangle at	110 km/h 59 kt 68 mph	Recommended approach speed at maximum mass without water ballast
Blue line at	100 km/h 54 kt 62 mph	Speed V_Y for best rate of climb

2.4 Power plant, fuel and oil

Engine manufacturer:	SOLO-Kleinmotoren GmbH. 71050 Sindelfingen
Engine model:	SOLO 2625-01i
Engine power (MSL, ISA):	
Take-off power:	45 KW (61 PS) at 6200 RPM
max. continuous power:	45 KW (61 PS) at 6200 min $^{-1}$
Maximum permitted coolant Liquid temperature:	115° C
Fuel:	premium unleaded Not below RON 95 AVGAS 100LL, or mixtures of the two fuels
Oil (lubrication):	Fuel / oil mixtrue 1 : 50 (2%) with - Castrol ACT>EVO 2T or - Castrol Power 1 RS 2Tor - Castrol GO! 2T or - Castrol Super TT or - Castrol TTS or - other two-stroke engine oils according to JASO FC or JASO FD
Propeller manufacturer:	Technoflug Leichtflugzeugbau GmbH. 78713 Schramberg-Sulgen
Propeller model:	KS-1G-152-R-122
Reduction ratio:	1 : 2,81

Fuel capacity:

SN 31 and on after manufacture

Ventus-3M SN 31 and on	Tank in fuselage			Tanks in inboard wing panels left (Option)			Tanks in inboard wing panels right (Option)			Total capacity incl. optional tanks		
	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.
Fuel capacity	13,0	3,43	2,86	13,0	3,43	2,86	13,0	3,43	2,86	39,0	10,3	8,58
Usable fuel	12,7	3,35	2,79	12,0	3,17	2,64	12,0	3,17	2,64	36,7	9,69	8,07
Non-usable fuel	0,3	0,08	0,07	1,0	0,26	0,22	1,0	0,26	0,22	2,3	0,6	0,51

SN 21 after manufacture

Ventus-3M SN 21	Tank in fuselage			Tanks in inboard wing panels left (Option)			Tanks in inboard wing panels right (Option)			Total capacity incl. optional tanks		
	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.	Liter	US Gal.	IMP Gal.
Fuel capacity	11,3	2,98	2,48	6,0	1,58	1,32	6,0	1,58	1,32	23,3	6,14	5,12
Usable fuel	11,0	2,90	2,42	5,0	1,32	1,10	5,0	1,32	1,10	21,0	5,54	4,62
Non-usable fuel	0,3	0,08	0,07	1,0	0,26	0,22	1,0	0,26	0,22	2,3	0,6	0,51

2.5 Power plant instrument markings

The following table describes the indications and the range limits of the power plant instrument and the meaning of the used color markings:

Power plant instrument	Prompt	Normal range	Caution range	Maximum Limit
RPM-Indication	TFT-Display	2500 – 6250 RPM	6250 – 6600[1)] RPM	> 6600[2)] RPM
	Illustration	Green range	Yellow range	Red range
	Message + Audio warning	---	Yellow flashing display	Red flashing display + audio warning
Coolant Liquid Temperature Indicator	TFT-Display	40 – 115 °C	< 25 bzw. 95 - 115 C°	> 115 °C (blinkend)
	Illustration	Green range	Yellow range	Red range + red flashing display + operation note
Fuel Quantity Indicator	Operating range	≥ 7 L	6 bis 0 L	---
	TFT-Display	Fuel content – fuselage and wing tank(s)[3)]	Fuel content – only fuselage tank (flashing)	---
	Illustration	---	Red flashing display + Warning message	---

1) If the RPM is in the area between 6250 and 6600 RPM for more than 5 minutes, the RPM-Indication on the TFT-Display of the operating unit a warning message (yellow triangle) and an operation note will be displayed.

2) The RPM-indication on the TFT-Display is flashing.

3) The content of the wing fuel tank(s) will only taken into account, if the fuel content of the wing tank(s) was entered manually into the power plant operating unit before the flight.

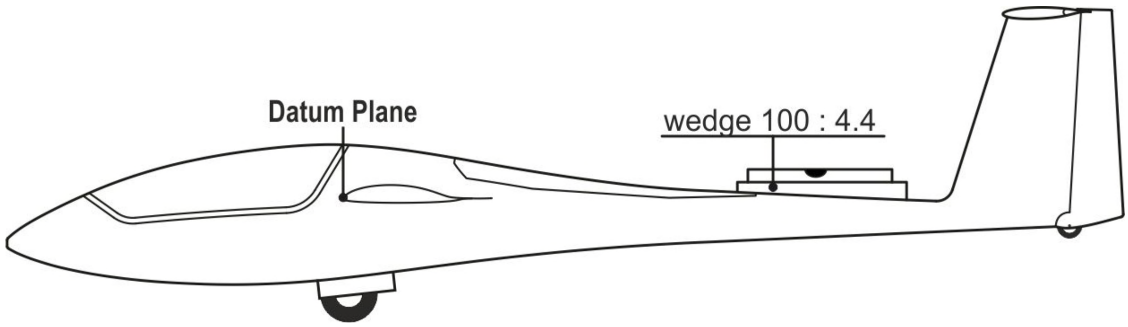
2.6 Weights (masses)

Wingspan:	18 m
Maximum permitted take-off mass:	600 kg 1323 lb
Maximum permitted landing mass:	600 kg 1323 lb
Maximum permitted take-off and landing mass without water ballast:	
- with installed power plant:	545 kg 1202 lb
- with removed power plant:	512 kg 1129 lb
Maximum permitted mass of non-lifting parts	
- with installed power plant:	365 kg 805 lb
- with removed power plant:	320 kg 705 lb
Minimum permitted take-off and landing mass	
- with installed power plant:	446 kg 983 lb
- with removed power plant:	401 kg 884 lb
Maximum permitted mass in baggage compartment – see also page 7.8	2 kg 4,4 lb

2.7 Center of gravity in flight

Aircraft attitude:	Tail jacked up such that the upper edge of a 100 : 4.4 wedge is horizontal when placed on top of the tail cone
Datum plane:	Wing leading edge at root rib
Maximum forward c/g position:	power plant removed: 300 mm (11.81 in.) aft of datum plane power plant installed: 320 mm (12.60 in.) aft of datum plane
Maximum rearward c/g position	430 mm (16.93 in.) aft of datum plane

It is extremely important not to exceed the maximum rearward c/g position; which is met by observing the minimum seat load.
The minimum seat load is given in the loading table and is shown by a label in the cockpit.
A lower seat load must be compensated by ballast – see section 6.2.2 „Weight and Balance Record / Permitted Payload Range“.



2.8 Approved maneuvers

The powered sailplane is certified in category

Utility, self-launching

Warning:

Aerobatic maneuvers are **NOT** approved!

2.9 Maneuvering load factors

The following maneuvering load factors must not be exceeded:

- With airbrakes retracted

  at V_A = 180 km/h, 97 kt, 112 mph
  n = + 5.3 g
  n = - 2.65 g

  at V_{NE} = 280 km/h, 151 kt, 174 mph
  n = + 4.0 g
  n = - 1.5 g

- With airbrakes extended

  at V_{NE} = 280 km/h, 151 kt, 174 mph
  n = + 3.5 g
  n = - 1.5 g

2.10 Flight crew

The powered sailplane is single-seated.

Observe the minimum seat load.

In case the minimum seat load can´t be achieved, ballast must be installed to compensate this to a permissible configuration. See also section 6.2.2 “Weight and Balance Record / Permitted Payload Range”.

2.11 Kinds of operation

This powered sailplane is approved for

- o VFR-flying in daytime
- o cloud flying up to a maximum mass of 490 kg (1080 lb)

with the prescribed minimum equipment installed (see page 2.12).

2.12 Minimum equipment

Instruments and other parts of the prescribed minimum equipment must be of an approved type and should be selected from the list in section 7 of the Ventus-3M Maintenance Manual.

Normal operations

1 Airspeed indicator with range up to 300 km/h, 162 kt, 186 mph and colour markings complying with page 2.3.1

1 Altimeter

1 Outside air temperature indicator (OAT) with sensor
(when flying with water ballast – red line at + 2°C, 35,6°F)

1 Magnetic compass

1 Engine control unit with:
- RPM indication
- Coolant liquid temperature indication
- Fuel quantity indication
- Engine time
- Warning signals

1 Rear view mirror

1 Four-piece safety harness (symmetrical)

1 automatic or manual parachute
or
1 back cushion (thickness approx. 10 cm / 3.0 in. when compressed)

Caution:

The sensor for the OAT must be installed in the ventilation air intake.
For structural reasons the mass of the instrument panel with instruments installed must not exceed 10 kg (22 lb).

Cloud flying

In addition to the minimum equipment listed under normal operations the following is required:

1x Turn and bank indicator with slip ball

1x Variometer

1x VHF-Transceiver

Recommended additional equipment for cloud flying:

1x Artifical horizon

1x Clock

Warning:

Cloud flying is only permissible under following conditions:

- without waterballast
- up to a maximum mass of 490 kg (1080 lb)
- if permitted by the applicable national air traffic act

Note:

From experience gained to date it appears that the airspeed indicator system installed remains fully operational when flying in clouds..

2.13 Aerotow and winch launch

Aerotow

Maximum towing speed:	180 km/h	(97 kt, 112 mph)
Weak link in tow rope:	max. 660 daN	(max. 1484 lb)
Minimum length of tow rope:	30 m	(98 ft)
Tow rope material:	Hemp or Nylon	

> **Warning:**
> Only permissible on nose tow hook and with retracted power plant!

Winch launch

Maximum launching speed:	150 km/h	(81 kt, 93 mph)
Weak link in winch cable	max. 750 daN	(max. 1686 lb)

> **Warning:**
> Only permissible on c/g tow hook and with retracted power plant!

2.14 Other limitations

Waterballast system

Below +2°C (36°F) outside temperature no water ballast may be used.

Life time of the airframe

The maximum life time of the powered sailplane is 12000 hours.

To reach this life time several special inspections of the airframe according the inspection program are necessary.

When the aircraft has reached a maximum of 6000 hours of service time, a special inspection of the airframe must be accomplished in accordance with the inspection program for the extension of the allowed service time.
If the results of this special inspection, possibly after proper repair of detected defects, are satisfactory, the allowed service time is increased by 3000 hours up to a maximum of 9000 hours in total.
Thereafter the special inspection in accordance with the above mentioned inspection program must be repeated in intervals not exceeding 1000 hours. If the results are satisfactory and the detected defects properly repaired, the allowed service time may be increased step by step at each inspection by 1000 hours up to a maximum of 12000 hours in total.

The instructions given in the Ventus-3M Maintenance Manual section 3.3 regarding the inspection procedure for the extension of the allowed service time must be observed.

2.15 Limitation placards

MAXIMUM PERMITTED SPEED (IAS):	km/h	kt	mph
Flap setting **0, -1, -2, S, S1**	280	151	174
Flap setting **+2, +1**	180	97	112
Flap setting **L**	150	81	93
Rough air speed	180	97	112
Aerotowing speed	180	97	112
Winch launching speed	150	81	93
Maneuvering speed	180	97	112
Landing gear operating speed	180	97	112
For power plant extension/retraction	120	65	75
Power plant extended speed	180	97	112
PERMISSIBLE MINIMUM SPEED (IAS)			
For power plant extension/retraction	92	50	57
MAXIMUM PERMITTED ALL-UP MASS:	**600 kg / 1323 lb**		

MAX. PERMITTED SPEED				
Altitude		V_{NE} (IAS)		
m	ft	km/h	kt	mph
0	0	280	151	174
1000	3281	280	151	174
2000	6562	280	151	174
3000	9843	280	151	174
4000	13123	266	144	165
5000	16404	252	136	157
6000	19685	239	129	149
7000	22966	226	122	140
8000	26247	214	116	133
9000	29528	201	109	125
10000	32808	189	102	117

LOAD ON PILOT`S SEAT (pilot and parachute)	
Minimum load:	**75*** kg / **165*** lb
Maximum load:	**115*** kg / **254*** lb

For seat loads
below placarded minimum
refer to flight Manual, section 6.2

Fuel at maximum seat load				
9.8 kg	21.6 lb	13 Ltr.	3.43 US GAL.	2.85 IMP GAL.

*) possible discrepancies from this, see page 6.2.2 and 6.2.3, must be registered.

WEAK LINK FOR TOWING	
for aerotow and winch lunch:	**max. 750 daN (1686 lb)**
TIRE PRESSURE	
Main wheel :	**4.0 bar (58 psi)**
Steerable tail wheel, pneumatic-tired:	**3.0 bar (44 psi)**
fixed tail wheel:	**2.5 bar (36 psi)**

Note:

For further placards refer to the Maintenance Manual Ventus-3M.

Section 3

3 Emergency procedures

3.1 Introduction

This section provides check lists and recommended procedures for dealing with emergencies that may occur.

Emergency situations can be minimized by proper pre-flight inspections and regular maintenance.

3.2 Jettisoning the canopy

- Stop and retract power plant, if possible.
- Swing back both red levers (on right and left side of canopy frame) to their stops (more than 90°).
- Lift the canopy as forward as possible with both red levers (the canopy is held in its place at its rear end by the Röger-Hook).
  This process can by supported by pushing up the instrument panel with the legs.
- The aerodynamic forces will then lift the canopy at its front end and swing the canopy around the Röger-Hook upwards to the back.

3.3 Bailing out

- o Stop and retract power plant, if possible
- o After jettisoning the canopy – see page 3.2.1 – bailing out is done as follows:
- o Actuate release buckle of restraint system.
- o Bend upper part of the body slightly forward. Grab canopy coaming frame on fuselage with both hands and lift body. Legs will tilt-up the instrument panel, if needed.
- o Leave the cockpit to the left or to the right
- o Pull rip cord of manual parachute at a safe distance and height..

3.4 Stall recovery

Power plant retracted

When stalling during straight flight or in a banked turn, normal flying attitude is regained by firmly easing the control stick forward and, if necessary, applying opposite rudder and aileron.

Important note:

If increased control vibrations, vibrations of the cockpit and softening of the controls occur while stalling, release the elevator control immediately and – if necessary – regain normal flight attitude with suitable countermeasures of rudder and aileron control.

Power plant extended

The stall behaviour is only marginally influenced by the power plant.

Warning:

When stalling with extended power plant and ignition off or idling engine the vibration in the controls are superimposed from the turbulent airflow produced by the propeller, therefore no significant stall warning is noticeable in this case.

Caution:

If, on stalling, the vibration in the controls and in the cockpit becomes more pronounced with controls getting spongy and engine noise increasing, immediately release the back pressure on the stick and, if necessary, apply opposite rudder and aileron for entering normal flight.

3.5 Spin recovery

A safe recovery from a spin is performed as follows:

- o Aileron in neutral position.
- o Apply rudder against the direction of the spin rotation
- o Ease control stick forward until rotation ceases and the airflow is restored
- o Centralize rudder and pull gently out of dive.

With the center of gravity in medium to rearward position a steady spinning motion is possible at every flap setting. After having applied the standard recovery method, the aircraft will continue rotating, depending on the flap position for about ¼ to 1 turn.

The loss of height, from the point at which recovery is initiated to the point at which horizontal flight is first regained, can be up to 250 m / 820 ft. The recovery speeds are between 160 and 250 km/h (86 - 135 kt, 100 - 155 mph).
At positive flap settings and high all-up masses, a resetting of the flaps at “0” may be required to avoid exceeding the speed limits for positive flap settings when pulling out of the dive.

Spinning with the center of gravity in the foremost position is only possible with positive flap settings and very dynamic stall. If stalling normally the aircraft mostly enters in a spiral dive - sometimes with strong side slip angle - or a side slip. Recovery is done by applying the manoeuvers indicated for this case - see section 3.6.

CAUTION:

Should the powered sailplane enter a spin with its engine running, then– in addition to the actions required by the above recovery method – the throttle must immediately be closed.
Spinning may be safely avoided by following the procedure given in section 3.4 “Stall recovery”.
The recovery from spin with positive flap settings is speeded up by easing the flap handle in negative flap settings.
When spinning in extreme configurations (i.e. unintentional extreme aft c.g. position or extreme asymmetric water ballast) it can be required to stop the spin – especially at positive flap positions – by moving the flap in position “0”.
In such extreme configurations it may be possible that the aircraft will do more than 1 additional turn after initiating recovery.

3.6 Spiral dive recovery

A spin - depending on c/g position, flap setting and use of controls - may turn into a spiral dive, which is indicated by a rapid increase in speed and acceleration.

Recovery from a spiral dive is achieved by easing the control stick forward and applying opposite rudder and aileron.

Warning:

When pulling out of the dive, the limiting airspeed for the various flap settings (if necessary, reset flaps at “0”) and the permissible control surface deflections at VA / VNE - see section 2.2 - must be observed!

In spiral dive or to stop the spiral dive airbrakes should not be extended since the permissible load factor with airbrakes extended is below the permissible load factor with airbrakes retracted - see section 2.9 – and this may lead to overstress of the wing.

3.7 Engine failure

Engine failure on take-off

Ease the control stick forward immediately to obtain sufficient airspeed. Ignition OFF.

Should the engine fail on take-off from a runway with sufficient length, land straight ahead.

If the runway is too short, the procedure for a proper landing approach will depend on height, position and terrain.

If the safety of the selected landing procedure is improved, the power plant should at least be partly retracted – regardless of the position of the propeller blades:

- with the manual control switch (For retraction: Ignition OFF!) or
- with the emergency system switch (press DOWN)

Even with partly retracted power plant the glide ratio will improve considerably.

Thereafter:

Close fuel shut-off valve
Power plant master switch OFF

Warning:

With power plant fully extended, the rate of descend increases to a value of about 2.3 m/s (453 fpm) at 105 km/h (57 kt, 65 mph) and the L/D deteriorates to about 13 : 1 – therefore use airbrakes with caution!

Engine failure in flight

Should the engine fail in flight, check:

Sufficient fuel quantity?
Fuel shut-off valve OPEN?
Circuit breaker “Fuel pump“ CLOSED?
Circuit breaker “Power plant system” CLOSED?

Should it be impossible to restart the engine, continue the flight with retracted power plant.

Emergency procedure for starting the engine in flight despite a defective starter motor

Follow the normal checklist until the item “depress starter button”

Set flaps at „0“ and accelerate to 160 km/h (86 kt, 99 mph) so that the engine revs will quickly build up (with audible prop noise).

Maintain speed until the engine has started. Then pull up with about 2 g and reduce speed to the desired climb flight speed.
If possible, increase the throttle carefully during the pull up with reducing airspeed to ensure sufficient lubrication of the engine.

CAUTION:

Observe the speed limits of the engine!
The loss of height from the moment of acceleration to the point where the aircraft is leveled off is in the order of 150 m to 200 m (490 ft – 660 ft). For this reason, this emergency procedure should not be applied at altitudes below 400 m (1312 ft) above the ground.

Icing of induction system

Form experience gained to date, no induction system icing has yet occurred on the engine model installed.

CAUTION:

Should the engine fail in flight due to the lack of fuel or a defect., retract the power plant as quickly as possible to avoid any unnecessary deterioration of the flight performance (for more precise date refer to section 5).

Extending / Retracting power plant in spite of a defective power plant operating unit

Emergency system for lifting spindle drive (see also page 7.3.40)

If the power plant control system fails, it is still possible to extend and retract the power plant with a separate emergency system.

For the full function of the emergency system, the following circuit breaker of the electrical system have to be engaged:

- Main switch Power plant system	**MAIN Power Plant**
- Circuit breaker Spindle drive	**Spindle**
- Circuit breaker Emergency system	**Emergency System**

The Emergency system is located in the base of the instrument panel. The emergency switch for the extension and the retraction of the power plant is accessible after flipping the red switching cover:

Rocker switch upwards	⇨	Power plant extends
Rocker switch downwards	⇨	Power plant retracts

Warning:

After opening the red protective cap, all safety functions of the power plant control system are deactivated! When the starter button is pressed, the starter motor is operated regardless of the position of the power plant!

Extending and starting the engine with the emergency system

- Open red switching cover.
- Operation note

  Emergency mode activated (safety flap open). Normal operation diasabled.

  on the power plant operating unit has to be confirmed with the MENU-button to switch off the warning.

- Extend the power plant completely with the emergency rocker switch
- Ignition ON
- Press starter. If the starter malfunctions, see:
  „3.7.2 Emergency procedure with defective starter engine during flight“

Stopping and retracting the engine with the emergency system

- Ignition OFF
- Close red switching cover.
- Operation note

  Emergency mode activated (safety flap open). Normal operation diasabled.

  on the power plant operating unit has to be confirmed with the MENU-button to switch of the warning.

- Stop the propeller with the manual propeller brake (handle on left side of cockpit, see section 7.2)

- Center the propeller as exactly as possible in the retracting position by varying the manual force on the handle of the propeller brake and hold the propeller there.
  The power plant operating unit shows in the retracting position: P_1 P_2

- Retract the power plant with the emergency system.

CAUTION:

If it is not possible to hold the propeller exactly in the retracting position, the power plant can still be retracted to a large extend. To prevent damages to the airframe, the retraction has to be stopped, if possible, as soon as the not properly aligned propeller touches audibly the engine doors.

Failure of engine control system

If a failure of the engine control system (Trijekt) will occur during operation, the engine will stop and the respective error message with further details will be shown on and stored in the power plant operation unit.
The procedure for a failure of the engine control system corresponds to the procedure described on page 3.7.1 and 3.7.2 in case of an engine failure.

Failure of the electric power supply for the engine

A defect of the electric power supply may occur for two reasons. The respective error message will be displayed on and stored in the power plant control unit:

1. Failure of the generator:

With a defective generator the electrical power supply for the engine control system and the fuel injection is then only provided by the engine batterie in use. As soon as their capacity is depleted, the engine will stop and it will be impossible to retract the power plant.

Because of that, stop the engine as soon as possible in case of a failure of the generator, retract the power plant and continue the flight with retracted engine.

Note:

Under ideal circumstances (fully charged engine battery, no load because of Avionics, normal operation of engine system) it can be assumed that the engine will continue to run at maximum power for about 15 minutes and then retract.

2. Failure of engine battery:

If a failure of the engine battery occurs, this failure will be detected by the Power Supply Switch and the electrical power supply of the power plant system will be ensured via the generator. The power plant control unit will display the corresponding message.

If the electrical power supply of the power plant is provided alone by the generator, the electrical power supply will collapse when the engine is stopped. It’s then impossible to retract or restart the engine.

CAUTION:

In case of a failure of the engine battery the nearest airport or nearest landing site should be approached with running engine. The landing should be made with running engine.

Starting the engine when the on-board battery is empty

By using a powerful LiFePo engine battery, very high currents would flow when this battery is started by a third party due to the low internal resistance, which could damage the battery itself or the wiring in the aircraft.

For this reason, starting the engine via an external battery is not permitted.

Replace the empty engine battery with a charged engine battery and then start the engine normally.

Proceed as follows to replace the engine battery:

- Open canopy, remove the battery cover under the instrument panel and make the poles of the battery accessible.
- Replace the built-in engine battery with a charged engine battery, reconnect the poles and replace the engine battery cover.
- Master switch engine ON and start engine according to normal procedure.

3.8 Engine Fire

In the event of an engine fire, the following steps must be carried out:

- o CLOSE fuel shut-off valve
- o Open throttle fully
- o When the engine is stopped: Master switch OFF
- o Leave powerplant in extended position

This procedure shall followed, if applicable,

- o On the ground
- o During take-off
- o In flight

Warning:

Cancel flight and land immediately!

Any manoeuvres which would cause high fuselage stress should be avoided.

3.9 Other Emergencies

Flight with uneven water ballast

If, while flying or dumping water ballast, the weight distribution should become asymmetrical (for example due to leaks in the water tanks or a single blocked dumping valve), this can be noticed by having to deflect the ailerons for flying straight. In such a situation entering a stall must be avoided.

Should such a situation be caused by a leak in the water tanks, the asymmetrical weight distribution can be remedied by dumping the whole water ballast.
In the case of a single blocked dump valve, the dumping process must be stopped in order not to increase the asymmetry in the water ballast load.

When landing with asymmetrical water ballast, the touch down speed must be increased by approx. 10 km/h (5 kts, 6 mph) and the pilot must be prepared to veer off course as the heavier wing tends to drop somewhat sooner than normal (apply opposite aileron).

Jammed elevator or flap control

While jammed flaps will just result in a "fixed profile flight behaviour", a jammed elevator control is more serious. The pilot, however, should take into consideration that the aircraft is still controllable to at least some extent by using its flaps for longitudinal controls

Flap lever pulled back	=	slower
Flap lever pushed forward	=	faster

This may allow the pilot to move over to a more favourable bail-out area or he may even avoid an emergency exit.

Loss of directional control

Should a rudder control cable break in flight, the aircraft may quickly start yawing and rolling, thus resulting in a spiral dive. An ensuing spiral dive, however, may possibly be avoided by resetting the

flaps immediately at “0".

If the yawing/rolling motion cannot be stopped by normal opposite aileron, then briefly apply aileron in the direction of the roll to stop the yawing and with the aid of the adverse aileron yaw recover again from the spiral dive.

Shallow turns can also be effected by using only the aileron in the described manner.

Emergency landing with retracted undercarriage

An emergency landing with the main wheel retracted is on principle not recommended, because the potential energy absorption of the landing gear is many times higher as compared to the fuselage shell.

Should the wheel fail to extend, the aircraft should be landed at a flat angle, with flaps set at “L”' and without pan caking.

Landing against an obstacle

If there is the danger of the aircraft overshooting the boundary of the landing field in mind, a decision whether or not to initiate a controlled ground loop should be made at least 40 m (131 ft) away from the boundary:

- If possible, always turn into the wind

- As the wing tip is forced down, push the control stick forward simultaneously.

Emergency water landing

From experience gained from composite sailplane landings on water following recommendations can be given:

Approach:

- Landing pattern parallel to the shore
- Undercarriage extended
- Ventilation closed
- Water ballast tank valves closed
- Main switch OFF

Landing:

- Touch down with minimum speed and airbrakes retracted.

Section 4

4 Normal operating procedures

4.1 Introduction

This section provides checklists and amplified procedures for conducting the daily and pre-flight inspection.

Furthermore, this section includes normal operating procedures and recommended speeds.

Normal procedures associated with optional equipment are found in section 9.

4.2 Assembly

4.2.1 Rigging

The Ventus-3M can be rigged by two people if a wing stand or trestle is used under one wing tip.
Prior to rigging, all pins and their corresponding bearings on fuselage, wing panels and tailplane should be cleaned and greased.

Inboard wing panels

- Unlock the airbrake lever and mark out the hole in the guide tube that appears with the mounting screw for the outer wing panel.
- Set water ballast control knob forward into CLOSED position.
- At both inboard root ribs set t he water ballast connecting rod int rigging position.
- Insert spat stub of left wing panel forward into fuselage cut out. Concentrate on lifting the trailing edge more than the leading edge also to avoid the aft locating pin get canted in the fuselage bearing.
- Check that the spar stub is inserted correctly on the far side of the fuselage.
- Ensure that the angular levers on the root rib are definitely inserted into their fuselage funnels.
- Push the main wing pin in approx. 3 cm (1.2 in.) so that the wing panel is prevented from sliding out by the cut-out in the vertical rim of the CFRP-panel covering the front wing locating tube.
- The wing panel may now be placed on a stand or a trestle.
- Again check the airbrakes are unlocked.
- Insert spar stub of right wing panel, observe same hints as on left wing.

- o As soon as both stub pins have engaged in their bearings (this can be detected by a short extension of the unlocked airbrakes), force wing panel in its position under vigorous pressure.

- o Finally push the main wing pin fully home and secure its handle. To do this press locking pin and engage it in the metal bracket’s hole by releasing it again.

Outboard wing panels

- o Take round-headed rigging tool, screw it into wing pin locking lever (on outbd. panel) and swing the latter upwards.

- o Thereafter slide outboard panel onto spar stub of inboard panel until stub pin has just engaged in its corresponding bushing on the outboard wing panel, align aileron coupling lap with slot on adjacent aileron (on inbd. Wing) and push panel fully home.

- o Finally swing wing pin locking lever down, engaging the pin in the spar stub of the inner wing panel. The upper edge of the lever must not protrude above wing’s surface.

- o Remove the round-headed rigging tool and apply covering.

- o Insert winglet on outboard wing panel until the spring-loaded pin is engaged.

Horizontal tailplane

- o Screw the round-headed rigging tool into the front locating pin of the tailplane on the leading edge of the fin.
- o Slide the horizontal tailplane aft onto the two elevator actuating pins, pull ringing tool und its pin forward, seat stabilizer nose.
- o Push locating pin home into the front tailplane attachment fitting, therefore push the leading edge of the tailplane downwards against the resistance of the sealing rubber, so that either a small force is needed to secure the pin or that it even secures on its own.
- o Remove the rigging tool.
- o The locating pin must not protrude in front of the leading edge of the fin.
- o Check whether the elevator actuating pins are really located (by moving the elevator) and if the horizontal tailplane is seated correctly on the fin.

After rigging

- o Check – with the aid of a helper – the controls for full and free movement in the correct sense.

Caution: On the outboard wing panel do not seal the gaps between both outer ailerons, between ailerons of inner and outer wing panels and between outer ailerons and winglets.

- o Use tape to seat off the wing / fuselage joint and the joint between inner and outer wing panels.
- o Use tape to seal off the joint between outer wing and winglet.
- o Mount total energy probe and, if applicable, pitot extension at the fin and seal both with tape.
- o Seal the tail plane locating pin opening at the front of the fin.

Remark:

Sealing with tape is beneficial in terms of performance and it also has a major effect in reducing the noise level.

4.2.2 Derigging

Derigging can be done by two people if a wing stand or trestle is used under one wing tip.

Before derigging remove the total energy probe and, if installed, the pitot extension, from the tail fin. Also remove all sealing tape that has been applied after rigging and drain any water ballast remaining in the water ballast tanks.

Horizontal tailplane

- Using the rigging tool, pull out the front tailplane attachment pin
- Lift the stabilizer leading edge slightly and pull the tailplane forward and off.

Outer wing panels

- Force the spring-loaded locking pin of the winglet down with the mounting pin and pull the winglet from the outboard wing panel.
- Remove the covering between outer and inner wing. Swing up locking lever with the aid of the mounting screw.
- Carefully pull off the outer wing panel.

Inner wing panels

- Unlock airbrakes.
- Set water ballast Control knob forward into CLOSED position.
- Set flaps to position "0“.
- Lift the inner wing to relieve the main pin.
- Loosen the main wing pin from the security latch and pull it out until 2 to 3 cm are left. Pull out the **right** inner wing panel by slightly moving it back and forth.
- Remove main wing pin completely and pull out left inner wing panel.

4.2.3 Refueling / Manual input of the amount of fuel filled up

Internal refueling system

The quick disconnect coupling of the refueling system is located in the engine compartment at the top of the front bulkhead on the left-hand side.

The toggle switch for the refueling pump is located in the cockpit above the back cover on the left side.

This means that only a loose fuel hose with quick disconnect coupling is required for refueling, see description on the following pages and sketch on page 7.11.3.

The refuelling hose used must contain a suitable fuel filter!

Refueling the fuselage tank with the internal refueling system

The fuselage tank can only be refueled via the internal refueling system.

In order to refuel the fuselage tank, attach the external fuel hose to the quick disconnect coupling in the engine compartment, see picture on page 7.11.3.

Place the other end of the external fuel hose in a fuel container that will be used for refueling.

By actuation of the ON/OFF switch the fuel pump is activated and the refueling of the fuselage tank is started.

The fuel capacity display on the powerplant operating unit shows the current content of the fuselage tank.

The fuselage tank is filled completely as soon as the expansion reservoir starts to be filled quickly. The refueling has now to be stopped.

If the fuel tank is overfilled during refueling or if the fuel warms up, fuel may spill via the ventilation pipes into the expansion reservoir in the baggage compartment. As soon as the expansion tank is full, the following fuel will be discharged from the fuselage via the overflow line. The corresponding overflow outlet is on the bottom of the fuselage, right behind the undercarriage cut-out.

Note:

Ventus-3M serial number 021 MP uses the same fuel pump for engine operation and refueling. For this reason, in this serial number the fuel cock has to be set to CLOSED for refueling. After finishing the refueling, the fuel cock shall be reopened.

Refueling of (optional) wing tank(s)

One or two flexible wing fuel tanks are optionally available.

The wing fuel tanks are connected to the fuselage fuel system with one fuel line and one vent line each. Both lines are equipped with quick-disconnect couplings, which must be connected manually when rigging the wings.

The wing fuel tanks are filled via the fuselage fuel tank by means of the built-in refuelling pump in the fuselage: As soon as the fuselage tank is completely filled, the fuel that is pumped further is automatically fed into the wing fuel tanks.

For accurate control of the actual amount of fuel on board, it is recommended to completely empty the wing fuel tanks before refueling, see page 4.2.3.8.

Before refueling the wing fuel tanks, ensure that the vent lines of the wing fuel tanks are also connected to the fuselage. Otherwise overflowing fuel from the wing fuel tanks may also enter the fuselage during flight!

In order to achieve optimum filling of the wing fuel tanks, the wings should be kept horizontal when refueling.

The wing fuel tanks do not have their own level measurement. Therefore it is recommended to use calibrated container for refueling the aircraft, especially when using wing fuel tanks. This makes it easy to determine the total amount of fuel being refueled.

Refueling of (optional) wing tank(s)

Caution:

Due to the simple fuel system it is not possible to achieve a symmetrical fuel distribution between both wing fuel tanks during the refuelling process with only partial filling of the wing fuel tanks.

When the wing is put down, the fuel may also overflow from one wing fuel tank to the other.
It is also possible for fuel to overflow from the fuselage fuel tank into the wing fuel tank.
The associated asymmetry of the wing loading must be taken into account during take-off!

Before self-launching with wing tank(s) that are not or partially filled, make sure that the contents of the fuselage tank is sufficient for a safe self-launch! If necessary, keep the wings horizontal before take-off until the fuselage tank is sufficiently filled.

Due to the risk of leakage, prolonged unattended parking or storage of the aircraft with filled wing fuel tanks is not permitted.

The wing fuel tanks must be emptied for road transport of the aircraft in the trailer!

For emptying the wing fuel tanks see page 4.2.3.8.

Determination of the fuel content

Fuselage tank

The fuel content in the fuselage tank (max. 13 litres/3.43 gallons) is measured by a capacitive sensor integrated in the fuselage tank and displayed in whole liters in the power plant operating unit.

If the fuselage tank starts to empty, the fuel content displayed on the operating unit flashes when the reserve quantity of 6 liter fuselage tank is reached. In addition, a warning tone sounds.

The warning can be switched off by pressing the rotary switch. The warning appears again as soon as the tank capacity has been reduced by another liter.

Optional wing tank(s)

In order to record the actual contents of the wing fuel tanks, the amount of fuel filled into them must be determined during refueling and then manually entered into the operating unit.

Input of the fuel content in the wing fuel tank(s) into the power plant operating unit

A manual input of the fuel quantity is only necessary when using optional wing tank(s).

The prerequisite for the entry is a displayed fuel quantity of at least 6 liter in the fuselage fuel tank (reserve quantity). If there is less fuel in the fuselage fuel tank, the operating unit will not accept an entry for the content of the wing fuel tank(s) (safety measure).

Input method for the amount of fuel in the wing fuel tank(s):

- With the engine retracted (retract limit switch must be actuated), use the rotary switch to scroll through the main menu of the operating unit into the FUEL MENU and select WING TANK.
- Change the number of liters with the rotary switch until the fuel content in the wing tanks is displayed. Confirm the value by pressing the rotary switch and exit the menu.
- If the rotary switch is not operated for more than 5 seconds, the operating unit accepts the entered value for the fuel quantity and automatically returns to the normal operating mode.

If the entered value for the fuel content in the wing fuel tank(s) is greater than zero and the fuel content in the fuselage tank is not 6 liter or below, the change in the fuel content on board during engine operation is calculated.
An internal comparison with the actual remaining fuel content is only made when the reserve quantity in the fuselage tank has been reached or fallen below. The value for the fuel quantity entered in the wing tanks is then automatically set to zero.

The manually entered value for the fuel quantity in the wing fuel tanks is stored by the operating unit and remains stored even after the main switch is switched off.

Caution:

If no wing tank(s) are installed or if the content of the wing fuel tank(s) is not to be taken into account when calculating the amount of fuel on board, the value for the amount of fuel in the wing tanks shall be set to zero. Otherwise the fuel quantity on board may be displayed grossly incorrectly until the reserve quantity in the fuselage fuel tank is reached!

Calibration of the fuel quantity indicator for the fuselage fuel tank

If the fuel grade is changed, e.g. from Avgas to Mogas, or if there is any other suspicion of an inaccurate indication of the fuel content in the fuselage tank, the fuel indication must be recalibrated in the operating unit.

Calibration procedure for the indication of the fuel quantity:

- Set up aircraft on level ground, fuselage on main wheel and tail wheel or tail dolly, align wings horizontally.
- Fill the fuselage tank completely (visual inspection in the expansion container in the baggage compartment),
- With the engine retracted (limit switch “Retracted” must be actuated), turn the rotary switch through the main menu of the operating unit into the FUEL MENU pages, select there CALIB. MAIN TANK.
- The calibration is started by pressing the rotary selector switch.
- If the display shows the new tank calibration factor (e.g. [94]), the calibration is successfully completed.
  After returning to the main menu, the display of the fuselage tank content is set to 13 L.

If the tank calibration factor is not displayed, the tank calibration must be repeated.

The error message TANK CALIB. FAILED (Tank calibration failed) occurs if the calibration would result in a tank calibration factor with a deviation of more than 30% from the original value. This may occur, for example, if the fuselage tank is not fully filled or if the fuel in the fuselage tank is moving during calibration.

The error message must be confirmed by pressing the rotary selector switch.

In this case, no calibration is performed and the previously existing calibration factor continues to be used. Before the next calibration attempt, check that the above requirements for the calibration procedure have actually been met.

Caution:

A tank calibration with a partially filled fuselage fuel tank or a failure to carry out the tank calibration when changing the fuel grade leads to false readings of up to 30%.

The displayed tank content may be larger than the actual tank content!

Draining the fuel tanks

Fuselage fuel tank

The fuselage fuel tank can be drained via the drain valve. The drain valve is located on the left underside of the fuselage behind the landing gear compartment. To drain the fuselage fuel tank, the spring-loaded drain valve must be pushed inwards.

Wing fuel tank(s) (Option)

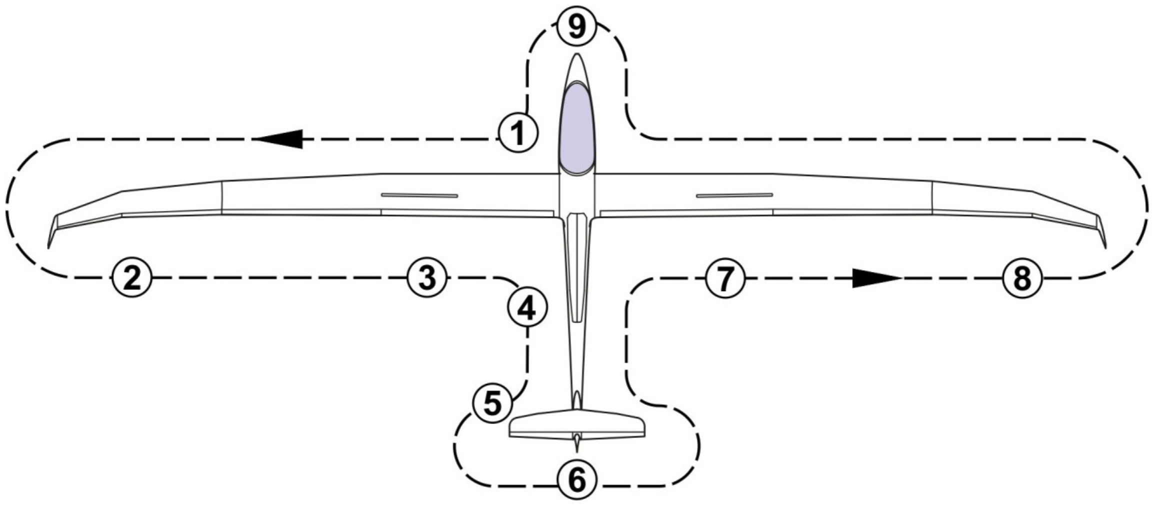
If the fuselage fuel tank is not completely filled, the contents of the wing fuel tank(s) may be emptied into the fuselage fuel tank. To do this, lift the wing with the wing fuel tank to be emptied to allow the fuel to drain quickly.

Alternatively, it is possible to transfer the contents of a wing fuel tank to an external receptacle outside the aeroplane using a defueling hose. This also involves lifting the wing with the wing fuel tank to be emptied to allow the fuel to drain quickly.

4.3 Inspections

4.3.1 Daily inspection

The importance of inspecting the aircraft after rigging or before commencing the day’s flying cannot be over-emphasized, as accidents often occur when these daily inspections are neglected or carried out carelessly.



When walking around the aircraft, check all surfaces for paint cracks, dents and unevenness.
In case of doubt, ask licensed maintenance personnel for advice.

(1)
- o Open the canopy and check the function of the gas strut for opening the canopy.
- o Check that the main pin is secured.
- o Check all control elements in the cockpit by visual inspection.
- o Check the controls for freedom of movement.
- o Check battery(s) are properly locked.

- o Check for foreign objects.
- o Check fuel quantity.
- o Check fuel line(s) and tank vent line(s) for proper connection.
- o Check main wheel tire pressure (4.0 bar/8.8 PSI).
- o Check tow release mechanism(s) for proper condition and function.

(2)
- o Check the upper and lower wing surface for damage.
- o Clean and grease water dump valves (if necessary).
- o Check outboard wing panels for proper connection (locking lever must be below upper wing surface and its cover must be installed and sealed.
- o Check the flaperons of the outer wing panels for proper condition and free movement. Check for unusual play by gently shaking the trailing edge. Check hinges for damage.

(3)
- o Check the flaperons of the inner wing panel for proper condition and free movement. Check for unusual play by gently shaking the trailing edge. Check hinges for damage.
- o Check the airbrakes for proper condition, fit and locking.

(4) o Check fuselage for damage, especially on its lower side.

o Check the STATIC pressure ports for the airspeed indicator at the rear fuselage tube (0.8 m in front of the fin) for cleanliness.

o Visual inspection of the power plant (see also engine manual page 4)

ATTENTION: Ignition **"OFF"**
Extend the power plant with the manual extension/retraction switch.

o Check propeller pylon during extension for sufficient clearance to the rim of the engine compartment.

o Check propeller for damage.

o Check propeller pylon with fittings for damages and cracks.

Check condition and secure attachment of both proximity switches on the propeller pylon and both signal generators on the upper belt-pulley which are needed for the automatic retraction process.

o Propeller brake: Check easy movement of brake lever and clearance to brake bell in inactive position, condition of brake lever with attachments of Bowden cables, wear of brake pad. Check condition of brake servo and Bowden cable from brake servo to brake lever. Check condition and function of manual actuation of propeller brake.

o Check belt drive for changed tension and traces of wear. Check pinch rollers for ease of movement.

o Check air filter and air induction system for tight attachment.

o Check condition and function of throttle attachment at carburettor (Bowden cable, stop for throttle cable).

o Check ignition system incl. cables and spark plug caps on the engine for possible damage and firm attachment.

o Visual inspection: Check bolt connections and their safety devices on the power plant. Check external condition of engine.

- Check cooling water hose for possible damage and firm attachment at the plug-in connections.
- Check level of coolant liquid. Ensure tight closure of pressure cap.
- Check function of the water pump with ignition "ON".
- Visual inspection of the rubber elements for damage (radiator mounts, propeller pylon mounts and front and rear spindle drive mounting).
- Check the exhaust manifold, exhaust joint, exhaust coupling and silencer for damage and cracks.
- Pay attention to scuffing marks on components and cables.
- Check arresting wire and the respective attachments.
- Check the function of the engine-door kinematics.
- Turn the propeller several times by hand. Check for abnormal noise or stiffness in the engine.
- Actuate the drain valve on the left behind the landing gear cut-out and drain off condensation water. Check the outlet of the drain valve for cleanness.
- Check venting line of the fuel system on the right side behind the landing gear for cleanness.

5 o Check condition of tail wheel:

- steerable tail wheel: 3,0 bar (43 PSI)
- Fixed tail wheel: 2,5 bar (36 PSI)

o Mount the TEK probe, if present, and check TEK-line. When blowing from the front onto the probe, the connected variometers must indicate climbing.

If equipped with tail tank (optional)

o Check that fin tank spill holes are clear.

o Check water ballast level in fin tank. In case of doubt, discharge ballast.

o Check dump valve of the tail tank at the fin bulkhead for cleanness.

(6) o Check the correct installation of the battery in the fin according to the loading chart.

o Check the horizontal tailplane for correct installation.

o Check elevator and rudder for free movement.

o Check trailing edge of the elevator and rudder for damage.

o Check elevator and rudder for unusual play by gently shaking the trailing edge.

(7) o See (3)

(8) o See (2)

(9) o Check that the pitot pressure probe in the fuselage nose is clear. When blowing carefully into the pitot pressure probe, the airspeed indicator must register.

Inspection after hard landings:

After heavy landings or after the aircraft has been subjected to excessive loads, the resonant wing vibration frequency should be checked
(its value is to be extracted from the last inspection report for this serial number).

Check the entire aircraft thoroughly for surface cracks and other damage. For this purpose, it should be de-rigged.

After a ground loop, especially the rear part of the fuselage tube and the transition to the vertical tail has to be checked for damage and detached bulkheads.
To do so, support the wings of the rigged glider (without horizontal tail) and apply hand force to the side at the bracket for the horizontal tail. Check the fuselage structure for excessive deformation, buckling and crackling noise.

If damage is discovered (i.e. surface cracks in the fuselage tail boom or tailplane, or if delamination is found at the wing roots or at the bearings in the root ribs etc.), then the aircraft must be grounded until the damage has been judged respectively repaired by a qualified person.

This inspection must also include a complete check of the power plant system.

4.4 Pre-flight check

CHECKLIST BEFORE TAKE-OFF

- O Water ballast in fin tank (if installed) ?
  Dump all water ballast in case of doubt!
- O Loading charts checked ?
- O Parachute securely fastened ?
- O Safety harness secured and tight ?
- O Seat back and pedals in comfortable position ?
- O All controls and instruments easily accessible ?
- O Airbrakes checked and locked ?
- O All control surfaces checked with assistant ?
- O Control surfaces full and free movement in correct sense ?
- O Trim correctly set ?
- O Flaps set for take-off ?
- O Canopy closed and locked ?

CHECKLIST FOR SELF-LAUNCHING

- O Fuel quantity checked ?
- O Warnung messages on operating unit ?
- O Coolant liquid temperature checked ?
- O Ignition circuits checked ?
- O Take-off RPM checked ?
- O Rear-view mirror properly adjusted

4.5 Normal operating procedures and recommended speeds

4.5.1 Methods of launching

Aerotow

Maximum permitted towing speed:
V_T = 180 km/h (97 kt, 112 mph)

> **Warning:**
> Only permitted using nose tow hook and with power plant fully retracted!

Hemp and nylon ropes of between 30 and 50 m (98-164 ft) length were tested.

Prior to take-off flap setting "-1" must be selected to improve the aileron´s effectiveness and the trim must be set as follows:

Rearward c/g positions:	Knob forward to first third of its travel
other c/g positions:	Knob to the middle of its travel

As the tow rope tightens, apply the wheel brake gently (by actuating the stick-mounted lever) to prevent the aircaft from overrunning the rope.
In crosswind conditions the aileron control should be held towards the downwind wing, i.e. in winds from the left the stick should be displaced to the right in order to counteract the lift increase on the right wing generated by the tug's prop wake, which the crosswind forces to drift to the right.

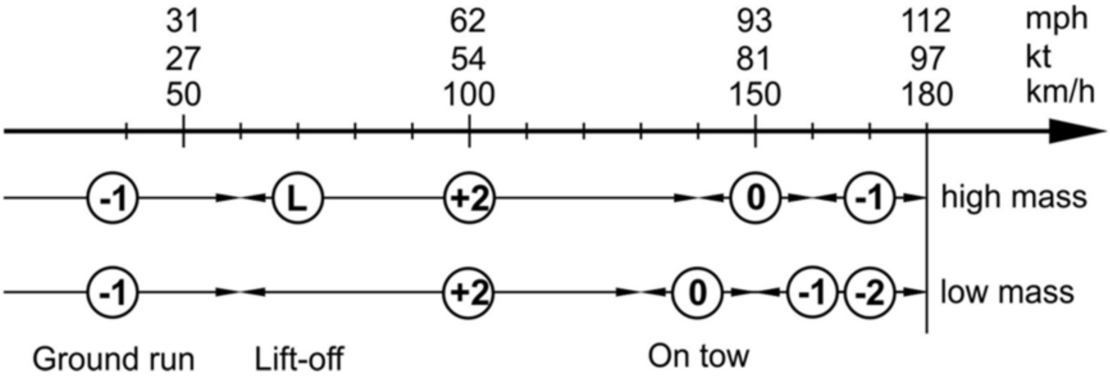
For intermediate to forward c/g positions the elevator should be neutral for the ground run; in the case of rearward c/g positions it is recommended that down elevator is applied until the tail lifts.

For rearward c/g positions and low all-up masses the powered sailplane is lifted off with flaps set at "+2".

In the case of forward c/g positions or high all-up masses a setting of “L” may be used to shorten the ground roll distance.

After lifting off, between about 80 to 90 km/h (43-49 kt, 50-56 mph), depending on wing loading and flap setting, the elevator trim might be set for minimum control stick loads.
With flaps set at "+2", normal towing speed is in the region of 120 to 140 km/h (65-76 kt, 75-87 mph) and between about 130 to 150 km/h (70-81 kt, 68-93 mph) for higher all-up masses.

At higher towing speeds and low all-up masses, i.e. above about 160 km/h (86 kt, 99 mph), flap setting "-1" or "-2" should be used (see diagram below). With these settings, speeds up to V_T are covered by the elevator trim.



Only small control surface deflections are necessary to keep station behind the tug. In gusty conditions or when flying into the propeller slip stream of a powerful tug, correspondingly greater control stick movements are required.

At lower speeds the undercarriage may be retracted during the tow; however this is not recommended at low altitude, because changing hands on the stick could easily cause the powered sailplane to lose station behind the tug.

For releasing the tow rope, pull the yellow knob fully several times and turn only when definitely clear of the rope.

Winch launch

Maximum towing speed

V_W = 150 km/h (81 kt, 93 mph)

> **WARNING:**
> Winch launch is only permissible at the installed c/g tow release and with retracted power plant.

Prior to take-off – with flaps to be at setting "+2" – set the elevator trim as follows:

Rearward c/g positions:	trim knob fully forward
Intermediate c/g positions:	trim knob forward to first quarter of its travel
Forward c/g positions:	trim knob to the middle of its travel

As the cable tightens, apply the wheel brake gently (via the stick-mounted lever) to prevent the aircraft from overrunning the winch cable.

Ground roll and lift-off are normal – there is no tendency to veer-off or to climb excessively steeply on leaving the ground. Depending on the load on the seat, the aircraft is lifted off with the control stick almost fully pushed forward in the case of aft c/g position, slightly pushed forward in case of c/g in central positions and slightly pulled back with the c/g in a forward position. After climbing to a safe height, the transition into a typical steep winch launch attitude is effected by pulling the control stick slightly further back.

At normal all-up masses, without water ballast, the launch speed should not be less than 90 km/h (49 kt, 56 mph), and with water ballast not less than 100 to 120 km/h (54-65 kt, 62-75 mph).

Normal launch speed without water ballast is about 100 to 120 km/h (54-65 kt, 62-75 mph), with water ballast about 115 to 140 km/h (62-76 kt, 71-87 mph).

At the top of the launch the cable will normally back release automatically; nevertheless it should not be neglected to actuate the release knob several times.

> **Warning:**
> It is explicitly advised to avoid winch launching with a tail wind!

Caution:

Winch launching at the maximum permitted all-up mass should only be done if an appropriately powerful winch and a cable in perfect condition are available.
Furthermore, there is not much point in launching by winch for a soaring flight, if the release height gained is less than 300 m (984 ft).

In case of doubt, reduce all-up mass (by dumping water ballast).

Caution:

Prior to launching by winch, it must be ensured that the pilot is properly seated and able to reach all control elements. Particularly when using seat cushions, it must be made sure that during the initial acceleration and while in the steep climbing attitude he does not slide backwards and up.

4.5.2 Self-launch / Starting the engine, runup, taxiing and engine shut-down on the ground

a) Starting the engine on the ground:

- o Apply wheel brake
- o Start the engine according to following check list:

EXTENDING AND STARTING THE POWER PLANT

O Main Switch Engine **ON**
O Fuel shut-off valve **OPEN**
O Power lever **IDLE**

ON GROUND:
O **PULL** brake and elevator
O Prop area clear?

O Airspeed **95-100 km/h (51-54 kt, 59-62 mph)**
O Ignition **ON**
O *Only for manual operation:*
*- **EXTEND** engine with manual operating switch*
O When engine fully extended (green indicator light):
- Push starter button until engine is running

- o As soon as the engine is running, release starter button
- o Set throttle as needed

Ignition circuit check:

- o Warm up engine (CHT ca. 40°C / 104°F)
- o Set rev to 4000 RPM
- o Select Automatic ignition circuit Check (- AUTO)
  or
  Manually select both ignition circuits (- MANUAL – LEFT/RIGHT)
  The drop in rev has to be smaller than 300 RPM.
- o After returning to both ignition circuits, the engine should return to primarily RPM.

b) Runup

Increase speed to full throttle before starting or when starting up.
Full throttle test while standing is only possible with a helper.
The engine runs smoothly if a revolution of approx. 5600 rpm to 5800 rpm is reached at full throttle when stationary or when starting.

4.5.2 Self-launch / Starting the engine, runup, taxiing and engine shut-down on the ground (cont.)

c) Taxiing

Rolling without wingtip wheels can only be carried out with a helper at the tip of the wing.
If the wings are equipped with the respective wheels (optional), the aircraft can be operated independently with the steerable tail wheel on the ground (flap position 0 or -1).
While Taxiing pull the elevator all the way back. Operate the wheel brake with the right hand on the stick.
When Taxiing with one wing down, it is advisable to make larger changes of direction in the direction of the lowered wing in order to achieve a narrow turning circle.

d) Engine shut-down on the ground

If the engine is stopped on the ground with the ignition switch, the powerplant control system will switch into the process for the automatic positioning of the propeller. But on the ground the automatic retraction of the powerplant is not possible without manual help.

To avoid unnecessary power consumption of the powerplant control system in this situation, it is recommended to briefly push the manual operation switch up or down after the engine has stopped. This switches the powerplant control system to the manual operating mode (idle mode).

e) Starting the engine in flight

- Set speed to 95 through 100 km/h (51-54 kts, 59-62 mph) for extending the powerplant and starting the engine

There are no other procedures to be observed than those for starting the engine on the ground.
It is not necessary to warm up the engine when starting it in the air.

4.5.2 Self-launch / Starting the engine, runup, taxiing and engine shut-down on the ground (cont.)

f) Take-off and Climb

Perform take-off check before start, see pages 4.4.1 and 5.2.3 (Start distances). The take-off is carried out with the wing held horizontally by a helper or with the wing down with the wingtip wheel.
Make sure that there is enough fuel in the fuselage tank. If the glider was parked with one wing down and the installed and connected wing fuel tank was not or only partially filled, the fuel can run from the fuselage fuel tank into the wing fuel tank. If the wings are kept horizontal, the fuel flows back from the wing fuel tank into the fuselage fuel tank.
Compensate an asymmetrical fuel load in the wing tanks by applying opposite aileron when commencing the take-off run.

Starting procedure:
- o Set elevator trim at its aft range
- o Set flaps at 0 position (or at -1 in crosswind conditions)
- o Pull control stick **fully** back.
- o Apply full throttle briskly. When accelerating to full throttle take care that the tail wheel just remains on the ground for better directional control.
- o On reaching a speed of about 40 km/h (22 kt, 25 mph), reset flaps to +2 (on soft ground / forward C.G. to L) and adjust the elevator control only so that the tail wheel remains on the ground until lift-off.
- o Lift off aircraft at a speed of around 80-85 km/h (43-46 kt, 49-53 mph), depending on take-off weight, with stick slightly pulled back. Set flaps to +2 or L (in case of forward C.G).
- o Release control stick forward until reaching the speed for best climb (95 to 100 km/h, 51-54 kts, 59-62 mph).

The initial climb to the safety altitude can be performed in the yellow speed range. Observe the coolant temperature during the climb. When the maximum permissible temperature is reached, reduce the throttle to avoid exceeding the limit.

Warning:
Take-off in rain, with wet or iced-up wings is not permitted, as the take-off distance increases considerably and the climbing performance is adversely affected!

4.5.2 Self-launch / Starting the engine, runup, taxiing and engine shut-down on the ground (cont.)

f) Take-off and climb (cont.)

Caution:

If, at high ambient temperatures, the coolant temperature rises too high, the cause may also be the anti-freeze proportion being too much for such temperatures. The effectiveness of coolant liquid with less anti-freeze is significantly better!

Caution:

Even if you’re not going to take-off with own power, but it is possible to put the engine into operation later in flight, it is strongly recommended to carry out the checks described under a) and b) before starting.

4.5.3 Cruise / Cross Country Flight (power plant retracted)

The aircraft has pleasant flight characteristics and can be flown effortlessly at all speeds, loading conditions (with or without water ballast), configurations, and c/g positions.

As the trim is coupled with the flap setting, it should be adjusted in a position with zero force on the stick while flying between 115 and 125 km/h (62-67 kts, 71-77 mph) in flap setting „0”.

With mid-point c/g positions, the trim range is from approx. 80 km/h (flap position "L") to approx. 230 km/h (flap position "S1").

Flying characteristics are pleasant and the controls are well harmonised. Turn reversal from +45° to -45° can be accomplished without any noticeable skidding. Ailerons and rudder may be used to the limits of their travel.

Wing span [m]	Mass	Flap position	Airspeed	Reversal time [sec]
18	383 kg 844 lb	0	110 km/h 59 kts 68 mph	2.2
18	395 kg 870 lb	L	110 km/h 59 kts 68 mph	3.4

Caution:
Flights in conditions conducive to lightning strikes must be avoided.

High Speed Flying (power plant retracted)

When flying at high speeds, particular attention must be paid to the maximum speed limits associated with the various flap settings. These speeds are clearly visible marked on the air speed indicator (ASI) in different colors.

The aircraft Is controllable without any effort up to V_{NE} = 280 km/h (151 kt, 175 mph).

Full deflections of control surfaces may only be applied up to V_A = 180 km/h (97 kt, 112 mph).

Up to V_{NE} = 280 km/h (151 kt, 174 mph) only one third (1/3) of the full deflection range is permissible. Avoid especially sudden elevator control movements.

In strong turbulence, i.e. in wave rotor, thunderclouds, visible whirlwinds or when crossing mountain ridges, the speed in rough air V_{RA} = 180 km/h (97 kt, 112 mph) must not be exceeded.

With the c/g at an aft position, the control stick movement from the point of stall to maximum permissible speed is relatively small, though the change in speed will be noticed through a perceptible change in control stick loads.

The airbrakes may be extended up to V_{NE} = 280 km/h (151 kt, 174 mph). However, at speed above maneuvering speed, they should only be fully extended in emergency cases. When the airbrakes are extended fast at high speed, high deceleration forces will occur. At high speed unlocked airbrakes are violently sucked further out.

Warning:

Extending the airbrakes high speeds:

Check in advance that the safety harnesses are tight and make sure that the control stick is not inadvertently jarred forward when the airbrakes are extended.
Avoid loose objects in the cockpit.
At speeds above maneuvering speed the pilot should actively try to slow down the extension movement of the airbrakes. Aerodynamic forces will strongly such out the airbrakes.
Attention should be paid that in a dive with the airbrakes extended, the aircraft should be pulled out less abprubtly than with retracted airbrakes (see section 2.9).

A dive at V_{NE} = 280 km/h (151 kt, 174 mph) with the airbrakes fully extended is limited to the following an angles to the horizon:

Wing span	Mass	Angle of inclination
18 m	600 kg 1322 lb	approx. 35°
18 m	490 kg 1080 lb	approx. 45°

Use of the wing flaps

The camber-changing flaps alter the wing section such that the laminar bucket is always well suited to the actual flying speed.

For smooth thermals flap setting "+2" is recommended. In turbulent thermals, which require a quick aileron response, flap setting "+1" is advantageous.
Near the lower end of the optimum thermalling speeds the pilot may even use flap setting "L", especially at high all-up masses or in updrafts with hardly any variation in flying speed.

For a speed polar diagram, please refer to page 5.3.2.2.

Use of flaps	flaps at	Wing Span = 18 m Optimum Airspeed in km/h			
		AUW=390 kg	AUW=430 kg	AUW=550 kg	AUW=600 kg
Low speed flying (straight and level)	L	- 76	- 80	- 90	- 94
	+2	76 - 80	80 - 83	90 - 94	94 - 98
	+1	80 - 90	83 - 94	94 - 106	98 - 111
Best L/D	0	90 - 122	94 - 128	106 - 145	111 - 151
Flying between thermals and high speed flying	-1	122 - 150	128 - 158	145 -179	151 - 187
	-2	150 - 169	158 - 178	179 - 201	187 - 210
	S	169 - 188	178 - 198	201 - 224	210 - 234
	S1	188 - 280	198 - 280	224 - 280	234 - 280

Use of flaps	flaps at	Wing Span = 18 m Optimum Airspeed in knots			
		AUW=860 lb	AUW=948 lb	AUW=1213 lb	AUW=1323 lb
Low speed flying (straight and level)	L	- 41	- 43	- 49	- 51
	+2	41 - 43	43 - 45	49 - 51	51 - 53
	+1	43 - 49	45 - 51	51 - 57	53 - 60
Best L/D	0	49 - 66	51 - 69	57 - 78	60 - 81
Flying between thermals and high speed flying	-1	66 - 81	69 - 85	78 - 97	81 - 101
	-2	81 - 91	85 - 96	97 - 108	101 - 113
	S	91 - 101	96 - 107	108 - 121	113 - 126
	S1	101 - 151	107 - 151	121 - 151	126 - 151

Use of flaps	flaps at	Wing Span = 18 m Optimum Airspeed in mph			
		AUW=860 lb	AUW=948 lb	AUW=1213 lb	AUW=1323 lb
Low speed flying (straight and level)	L	- 47	- 50	- 56	- 58
	+2	47 - 50	50 - 52	56 - 58	58 - 61
	+1	50 - 56	52 - 58	58 - 66	61 - 69
Best L/D	0	56 - 76	58 - 80	66 - 90	69 - 94
Flying between thermals and high speed flying	-1	76 - 93	80 - 98	90 - 111	94 - 116
	-2	93 - 105	98 - 111	111 - 125	116 - 145
	S	105 - 117	111 - 123	125 - 139	130 - 145
	S1	117 - 174	123 - 174	139 - 174	145 - 174

Low speed flight and stall behaviour

In order to become familiar with the aircraft it is recommended to explore its stall behaviour at a safe height. This should be done using the various flap settings while flying straight ahead and also in banked turns (30° to 45° bank).

Wings level stall

Stall warning usually occurs 5 to 10 km/h (3-5 kt, 3-6 mph) above stalling speed. It begins with a slight vibration in the controls. If the stick is pulled further back, these effects become more pronounced, the ailerons get spongy and the aircraft sometimes tends to slight pitching motions (speed increases again and will then drop to stalling speed).

Note:

Befor reaching stalling speed, the ASI reading drops quickly depending on the c/g-position. The ASI starts oscillating because of the turbulent airflow affecting the pitot pressure probe.

When reaching a stalled condition with the c/g in rearward positions, the aircraft can be maintained in this condition with the stick fully pulled back or it may slowly drop a wing.

A normal flight attitude is regained by easing the stick firmly forward and, if necessary, applying opposite rudder and aileron.

The loss of height from the beginning of the stall until regaining a normal level flight attitude is may be between 70 m and 120 m (230-390 ft).

In the case of forward c/g positions and stick fully pulled back, the aircraft mostly continues to fly in a mushed condition.

Normal flying attitude is regained by easing the stick forward.

Turning flight stalls

When stalled during a coordinated 45° banked turn and with the c/g at an aft position, the aircraft rolls slightly into the turn and, when easing the stick forward, slightly drops its nose and a normal flying attitude is regained by applying opposite rudder and aileron. There is no uncontrollable tendency to spin.

In a forward c/g position, the aircraft just stalls without dropping its nose or wing.

Normal flying attitude is regained by applying corresponding control deflections.

The loss of height from the beginning of the stall until regaining a normal level flight attitude depends on the time of correction of the stalled flight condition and can be between 60 m and 150 m (200-500 ft).

Influence of Water Ballast

Apart from higher stall speeds - caused by the higher mass in flight - water ballast in the wing tanks has no negative influence on the stall characteristics.

The loss of height from the beginning of the stall until regaining a normal level flight attitude can be up to 150 m (500 ft).

With water ballast in the fin tank (option), stall characteristics are like those found at aft c/g positions.

4.5.4 Flight/Cross Country Flight (power plant extended)

For flight performance with extended powerplant please refer to page 5.3.2.1.

Maximum climb rate is achieved with flaps in „L“ position and between 98 and 100 km/h (53-54 kts, 61-62 mph).
At higher air speeds, the climb rate decreases. Maximum horizontal air speed V_H with flaps at „0“ and full throttle is approx. 160 km/h (86 ft, 99 mph).

Caution:
With flaps at „+1“ or at low mass and flaps at „0“, a slow climb will be achieved at V_H.

From the figures - see page 5.3.3.1 - it can immediately be seen that sawtooth technique provides the greatest range.

It consists of the following repetitive flight sections:

o a climb at a speed of approx. 100 km/h (54 kt, 62 mph)

o a glide in “clean” sailplane configuration

Thereby the height to be consumed in glide should not be less than 500 m (1640 ft).

The maximum range in glide is achieved at a speed of approx. 115 km/h (62 kts, 71 mph), resulting in an average speed of around 110 km/h (59 kts, 68 mph). In addition, the range of course also depends on the amount of water ballast carried and decreases with higher load.

Should the “sawtooth method” be impracticable due to low clouds ceiling or because of airspace restrictions, the cruising in level flight at a speed of approx. 160 km/h (86 kt, 99 mph) is also possible.

The range, however, is then considerably less – see apge 5.3.3.1.

In principle, sawtooth technique is to be preferred for cruising flights, as it is much more pleasant for the pilot due to noise reasons in addition to the greater range. This is due to the lower engine speeds during climb compared to horizontal flight.

Note:
Engine use in rain must be avoided as this may damage the propeller.

Low speed flight and stalling behaviour (power plant extended)

There are no significant differences in stalling from straight flight to stalling from turning flight to the stalling behaviour with the power plant retracted. Stall speeds - see page 5.2.2.
When the engine is running (ignition ON) there is a strong increase in the engine noise when stalling.

Warning:

When stalling with extended power plant and engine idling or with ignition off the turbulent airflow produced by the propeller superimposes the vibration in the controls, so that in this case a stall warning is not noticeable.

4.5.5 Extending the power plant, starting the engine in flight

1. With the powerplant extended and engine off, the rate of descent is approx. 2.30 m/s (450 fpm) at a speed of 105 km/h (57 kt, 65 mph), resulting in a glide ratio of only about 13 : 1 – contrary to the best L/D of around 50 : 1 in clean configuration (power plant retracted).
   Therefore the engine should only be restarted over terrain suitable for an off-field landing and, if possible, n o t below 300 m (984 ft) AGL.

   However, it is better to extend the power plant on the downwind leg to a suitable landing field at 200 m (656 ft) AGL than eg. starting it at 500 m (1640 ft) AGL above a forest or similar.

   Should a flight be planned over long distance without any acceptable landing fields, the power plant should be extended at a height giving sufficient time for all emergency procedures and, if necessary, for re-retracting the power plant.

2. Starting the Engine in Flight:
   (See also check-list on page 4.5.2.1)

   o Power plant master switch **ON**
   o **OPEN** fuel shut-off valve
   o Set throttle to idle
   o Set speed to **95 to 100 km/h** (51-54 kt, 59-62 mph)
   o Ignition **ON**
   o *Only in manual operation:* ***EXTEND*** *powerplant using manual control switch*
   o When power plant is fully extended (green signal):
   o Depress starter button

The loss of height from extending the propeller to the moment the engine is running is about 40 to 50 m (131-164 ft) and needs 35 to 45 seconds.

4.5.6 Stopping Engine and Retracting Powerplant

See also the following checklist:

STOPPING AND RETRACTING THE POWER PLANT

- O Airspeed **95-100 km/h (51-54 kt, 59-62 mph)**
- O Cooling run by 20% power for 1 minute
- O Ignition **OFF**
- O *Only for manual operation:*
  - *Brake propeller with manual propeller brake and hold it in the vertical position*
  - ***RETRACT** engine*
- O *When Engine is fully retracted (green indicatior light):*
  - Main Switch Engine **OFF**

a) Procedure for stopping and retracting the power plant in automatic mode (normal operation)

- o Carry out the cooling run with approx. 20% of power until the indicated cooling water temperature has dropped to below 60°C.
- o Speed 95-100 km/h (51-54 kt, 59-62 mph) and flap position +2
- o Ignition OFF
- o When the engine has stopped, the aerodynamic forces causes the propeller to slowly turn into the retracted position.
- o As soon as the propeller stopps outside the retraction position, the propeller stopper engages as a stop.
- o The movement of the propeller close to the retraction position can be accelerated by pressing the starter button (electronically controlled pulse operation of the starter).

  Caution:

  The starter control interrupts the impulse operation as soon as the propeller is approx. 15° in front of the retraction position.
  The further movement of the propeller to the retraction position is only done by the aerodynamic forces, the rotational speed of the propeller is limited by the propeller brake. To ensure that this process can be carried out reliably, the specified airspeed range must be met.

- o When the propeller has reached the retraction position (power plant operating unit unit shows) the powerplant retracts automatically.

  The powerplant retracts within about 15 seconds, but the entire process from stopping the engine to the moment the propeller has fully retracted takes about 90 seconds and consumes a height of about 100 m (328 ft).

b) Procedure for stopping and retracting the power plant in manual mode or with insufficient effect of the electric propeller brake in automatic mode

- Carry out the cooling run with approx. 20% of power until the indicated cooling water temperature has dropped below 60°C.
- Speed 95 -100 km/h (51-54 kt, 59-62 mph) and flap position +2
- Ignition OFF
- Approx. 3 seconds after switching off the ignition, first stop the propeller by actuating the manual propeller brake.
  Then release the manual propeller brake again.
- Observe the propeller in the rearview mirror: By varying the manual force on the handle of the propeller brake, center the propeller as precisely as possible in the retraction position with the aid of the aerodynamic forces and then hold on tight.
  (In retraction position, the power plant operating unit unit shows P_1P_2)
- Retract the engine with the manual control switch.

  Caution:

  If it is not possible to hold the propeller exactly in the retraction position, the power plant can still be retracted to a large extent. In order to prevent damage to the aircraft, the retraction should be stopped as soon as the propeller can be heard touching the engine doors.

- After the flight, determine the cause why the electric propeller brake did not work correctly and eliminate it.

Caution:

Observe the propeller when retracting in the rear-view mirror.
If the propeller should turn out of the retraction position during automatic retraction of the power plant, the automatic retraction process is interrupted and the power plant control system switches to manual mode.

- If the power plant is already retracted to such an extent that the propeller is no longer visible in the rear-view mirror, the retraction process can be continued carefully by pressing the manual retraction switch briefly and repeatedly.
  If it is not possible to retract the power plant completely and there is still sufficient flight altitude, then the power plant must be extended again to start the retraction process again.

- To repeat the retraction process and return to automatic mode, first fully extend the power plant again using the ignition switch (note the position displayed on the power plant operating unit).

- If the height is sufficient for another retraction process, switch off the ignition again. This restarts the automatic retraction process.

- After the flight, determine the reason for the weak propeller brake function and eliminate it.

Caution:

The effectiveness of the electric brake servo and the propeller stopper servo for automatic operation of the propeller brake also depends on the state of charge of the engine battery.

4.5.7 Approach

Power plant retracted / power plant removed

Normal approach speed with airbrakes fully extended, flap position **L** and wheel down is 105 km/h (56 kts, 65 mph), or 115 km/h (62 kts, 71 mph) at maximum permitted all-up mass.

The yellow triangle on the ASI at 110 km/h (59 kts, 68 mph) is the recommended approach speed for the maximum all-up mass without water ballast

With fully extended airbrakes and maximum all-up mass, the L/D is around 1 : 6.9 at 18 m wing span.

The airbrakes open smoothly and are very effective. There is no noticeable change of trim.

Caution:

For the approach or for the landing, especially at cross wind, the flaps can also be set to “+2” or “+1” to improve the effectiveness of the ailerons and the handling of flaps for approach and landing. The approach speed quoted previously should then be increased by at least 5 km/h (3 kts, 3 mph).

Side slip

Side slipping is very effective landing aid, please also see page 4.5.7.2.

Side slips in 18 n configuration may be conducted in a straight line with up to 80% of the rudder travel, resulting in a yaw angle of about 40° and a bank angle of about 15 to 25°.
Due to a control reversal a significant amount of opposite pedal pressure is required to keep the rudder displaced.

To return to level flight, normal opposite controls are required.
Side slipping causes the IAS to read lower than the actual speed. Side slipping was tested up to an IAS of 150 km/h (81 kt, 93 mph).

Caution:

1. In 18 m configuration and rudder displaced more than 80% of its travel, a straight flight path cannot be maintained and the aircraft will turn in the direction of the displaced rudder. Since the airbrakes are very effective and because of this behaviour, side slipping is not recommended.

2. With extended airbrakes and increased yaw angle a slow pitch down movement arise though the stick is pulled followed by an increase of speed. To stop this movement lessen the yaw angle by reducing the rudder deflection or retract airbrakes.

3. During side slip with not completely filled water ballast tanks a shift of the water ballast can arise which can change the flight behaviour. Slips with water ballast are therefor not recommended.

Warning:

Both the performance and the aerodynamic characteristics of the aircraft are affected adversely by rain or ice on the wing.
Be cautious when landing!
Increase the approach speed by at least 5 to 10 km/h (3-5 kts, 3-6 mph).

Power plant extended (only permitted with ignition OFF and in case of an emergency)

Landings with the powerplant extended (ignition OFF) can be done in the same manner as landings with the retracted power plant.

Approach speed: 115 km/h (62 kt, 71 mph) (without water ballast)
120 km/h (65 kt, 75 mph) (with water ballast)

On approach, it must be taken into account that the flight performances with the power plant extended are deteriorated considerably.

Wingspan	18 m
All-up mass	525 kg 1157 lb
Approx. sink rate	2.75 m/s 540 ft/min
At IAS	115 k/mh 62 kt 71 mph
Approx. L/D	1 : 11.6

Because of the reduced performance the approach has to be started at a significantly higher altitude in order to perform the landing approach with the same procedure as in glider condition.

Warning:

1. Be cautious when extending the airbrakes. Due to the additional drag with the extended power plant, more forward stick must be applied to maintain the above mentioned approach speed.
2. When stalling with extended power plant and ignition of the turbulent airflow produced by the propeller superimposes the vibration in the controls, so that in this case a stall warning is not noticeable.

Caution:

Approaches and landings should normally be made with retracted power plant.

4.5.8 Landing

Power plant retracted / power plant removed

For off field landing the undercarriage should always be extended as the protection of the pilot is much better, especially from vertical impacts on landing.

Main wheel and tail wheel should touch down simultaneously.

After touching down the flap may be set at “0” for improved aileron response during landing run.

To avoid a long ground run, make sure that the aircraft touches down at minimum speed. A touch down at 90 km/h (49 kt, 56 mph) instead of 80 km/h (43 kt, 50 mph) means that the kinetic energy to be dissipated by braking is increased by a factor of 1.26 and therefore the ground run is lengthened unnecessarily.

The landing run may be shortened noticeable by applying the effective hydraulic wheel brake (stick pulled fully back)

Powerplant extended (Ignition OFF):

Landings with the power plant extended must only be carried out in an emergency.

4.5.9 Flight with Water Ballast

Water ballast is necessary to reach the maximum all-up mass.

Wing ballast tanks

The water tanks are integral compartments in the nose section of the wing panels. In the right and left wing are on each side 2 water tanks integrated.
The outer tank (in the outer wing panel) is linked to the adjacent tank (in the inner wing panel). The connection is automatically done when rigging the outer wing panel.

These tanks are to be filled with clear water only, through 4 round openings in the upper wing surface.
The openings are closed with filler caps provided with thread. The filler caps have a slit and may be opened with the help of the rigging tool or a coin.
A hole in the filler caps serves for venting the tank. The hole features a valve preventing the loss of bigger amount of water when the wings are i.e. placed on the ground.

> **Warning:**
>
> The hole in the water filler caps must always be kept open and not taped.
> Keep the valve and the plastic ball in it always clean. No grease of oiling!
> The plastic ball must be able to move freely.

The capacity of right and left inner tanks combined is

approx. 106 litres (28 gallons)

The combined capacity of the right and left outer tanks (in the outer wing panels) is

approx. 26 litres (6.8 gallons).

4.5.9 Flight with water ballast (cont.)

Filling the water tanks

The tanks must be filled only in rigged condition and dumped prior to de-rigging.

> **Warning:**
>
> The water ballast load in the left and right wings must always be the same so that the lateral stability is not adversely affected.

Each tank features a round opening in the upper wing surface near its outside end.

Since the inner and outer tanks of a wing are connected, these tanks can either be filled individually via their own filling openings or together via the filling openings of the outer tanks.
Filling the water ballast through the filling opening of the outer tank is slower than filling the inner and outer tanks individually, as the flow through the separation point between the inner and outer tanks is reduced.

When filling the tanks it must be ensured that the maximum water ballast is not exceeded - see 6.2.2 and 6.2.3.

Dumping the water ballast

The operating handle for dumping the water ballast is located on the right-hand side of the cockpit. It is guided in a slide. In the front position, all dump valves are closed. In the rear position all tanks including the fin tank (optional) are emptied.
The inner and outer wing tanks are emptied together via the dump valve of the inner tank.

The dumping time in flight at approx. 120 km/h (65 kt, 65 mph) with full tanks for inner and outer tanks is approx. 12 minutes 30 seconds.

When the inner and outer wing tanks are full, the discharge quantities from these tanks are approximately as follows:

After 30 seconds	ca. 50 litres (13 gallons)
After 120 seconds	ca. 90 litres. (24 gallons)

4.5.9 Flight with water ballast (cont.)

Flying with water ballast

Before starting with partly filled tanks, ensure that the wing is held level to allow the water to be equally distributed so that the wing panels are balanced.

Because pf the additional mass in the wing, the wing tip runner should continue running for as long as possible during the launch.

Thanks to baffles inside the ballast tanks there is no perceptible movement of the water ballast when flying with partly filled tanks.

When flying at maximum permitted all up mass, the low speed and stall behaviour of the aircraft is slightly different from its behaviour without water ballast. The stall speeds are higher (see section 5.2.2) and for correcting the flight attitude larger control surface deflections are required. Furthermore more height is lost until a normal flight attitude is regained.

Warning:

In the unlikely event of the tanks emptying unevenly (recognized by having to apply more opposite aileron for a normal flight attitude), it is necessary to fly somewhat faster to take into account the higher mass and also to avoid positive flap settings (“+2” and “L”). Stalling the aircraft should be avoided.

Approach to landing is to be done at higher speeds and with flaps set at "0" or "+1".

During the landing run the heavier wing should be kept somewhat higher (if permitted by terrain) so that it touches down at the lowest possible speed. This reduces the danger of the aircraft to veer of course.

4.5.9 Flight with water ballast (cont.)

Water ballast fin tank (optional)

For optimum performance in circling flight, the forward travel of the center of gravity, caused by water ballast in the wing nose, may be compensated by carrying water ballast in the fin tank.

The water ballast tank is an integral compartment in the fin with a capacity of 7.8 kg/Liter (2.06 US Gal., 1.72 IMP Gal.). The fin tank has for every Liter including the maximum capacity of 7.8 kg/Liter (2.06 US Gal., 1.72 IMP Gal.) spill holes, all properly marked, on the right hand side of the fin, which indicate the water level – see accompanying sketch. These spill holes are necessary for the indication of the water ballast level and are needed for venting. Also with completely filled tank the uppermost spill hole 7.8 kg/Liter (2.06 US Gal., 1.72 IMP Gal.) always must be open.

The ballast quantity to be filled depends on the water load in the wing tanks – see loading table on section 6.2.5.

Filling is done with rigged or de-rigged horizontal tailplane as follows:

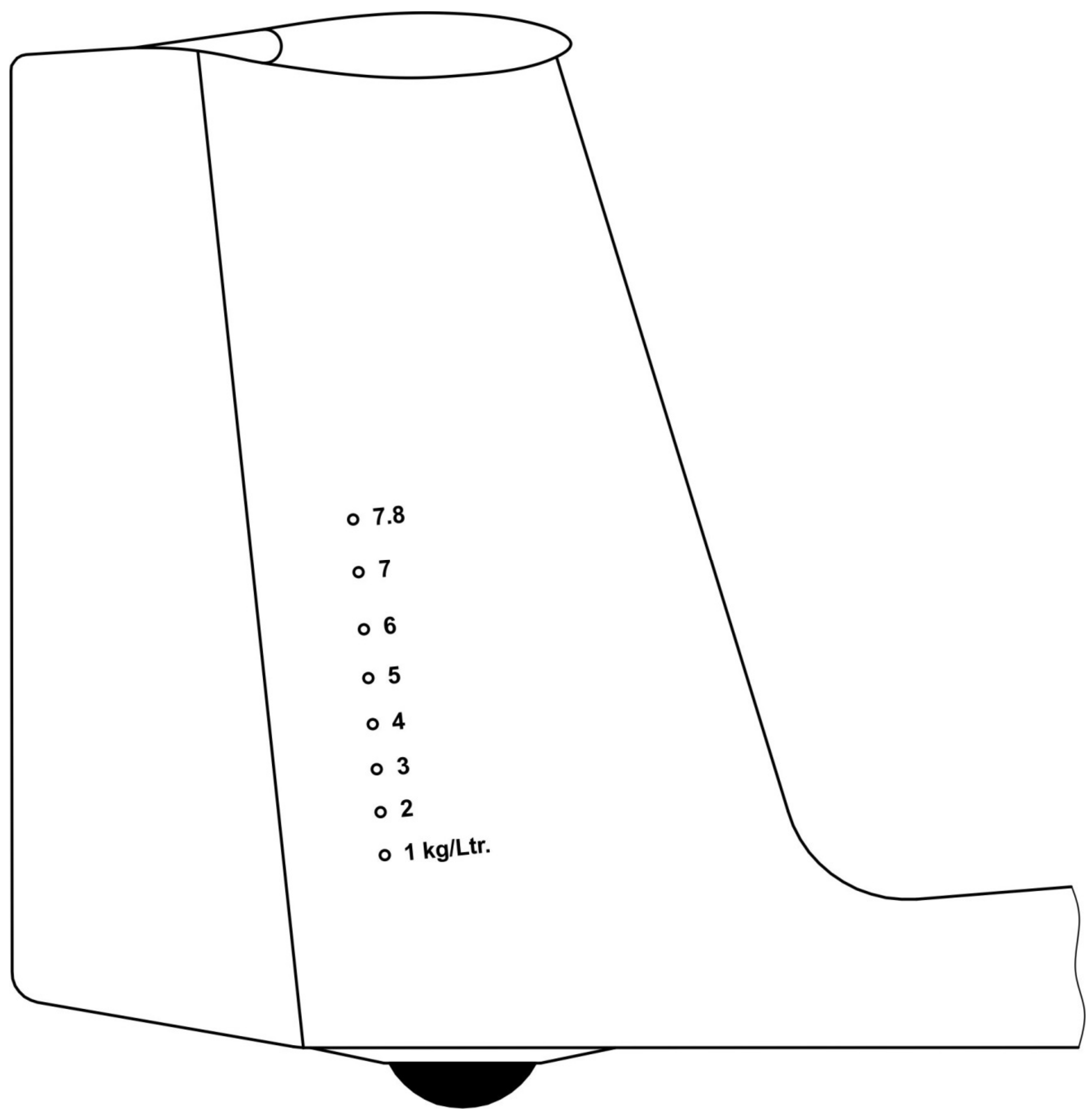
- Before filling the tank, always tape closed one hole less than the load required, measured in kg/Liter.

  Example:

  If a fin ballast load of 3.0 kg /Liter (0.79 US Gal., 0.66 IMP Gal.) is required, only the lower two holes (1 and 2) are taped closed.
  Any excessive water then escapes through the third spill hole, thus preventing any overloading.

- Set elevator trim fully back. Only necessary in case horizontal tailplane is rigged.

Insert one end of a flexible plastic hose (outer diameter 8.0 mm/0.31 in.) into the tube protruding from the rudder gap at the top of the fin on the left hand side. The other end of this hose is than connected to a suitable container and finally the required amount of clear water is tanked.



4.5.9 Flight with water ballast (cont.)

Water ballast is dumped from the fin tank through an opening on the lower side of the fuselage tail boom, in front of the rudder. The fin tank dump valve is mechanically linked to the drive for the valves of the middle wing tank, so that the middle and outboard wing tanks are always opened simultaneously with the fin tank.

The time required to dump the ballast from a full fin tank is about 90 seconds, therefor draining the fin tank always takes less time than emptying the middle and outboard wing tanks.

Caution:

o Before the wing water tanks are filled, it must be checked (with dump valves opened) that both drain plugs open up equally. Leaking (dripping) valves are avoided by cleaning and greasing the plugs and their seats (with valves opened). With closed dumping lever in the cockpit the valves must close fully. Leaking (dripping) valves are avoided thereafter, with valves closed, pulling the drain plugs home with the threaded tool used to attach the tailplane.

o There is little point in loading much water ballast if the average rate of climb expected does not exceed 1.0 m/s (197 fpm). The same applies to flights in narrow thermals requiring steep angles of bank.

o If possible all water ballast is to be dumped before conducting an off field landing.

Warning:

- While flying for longer time at air temperatures near 0° C (32° F), water ballast must be dumped in any case when reaching a temperature of 2° C (36° F). Thus avoiding freezing of the dump valves and possible structural damage of the aircraft parts.
- Never pressurize the tanks for instance by filling them directly from a water hose and always pour in clear water only.
- On no account whatsoever must the aircraft ever be parked with full ballast tanks if there is the danger of them freezing up. The parking period with full tanks should not exceed several days. For parking all water ballast is to be completely drained off with filler caps removed to allow the tanks to dry out.
- When using the fin tank, check that those spill holes not being taped closed are clear.

4.5.10 High altitude flight

When flying at high altitude it should be noted that true airspeed (TAS) increases in relation to indicated airspeed (IAS).

This difference does not affect the structural integrity or load factors, but to avoid any risk of flutter, the following indicated values (IAS) must not be exceeded

Altitude		IAS		
m	ft	Km/h	kts	mph
0	0	280	151	174
1000	3281	280	151	174
2000	6562	280	151	174
3000	9843	280	151	174
4000	13123	266	143	165
5000	16404	252	136	156
6000	19685	239	129	148
7000	22966	226	122	140
8000	26247	214	114	133
9000	29528	201	108	125
10000	32808	189	102	117

– see also page 2.15.1 –

4.5.11 Flying at low temperatures

When flying at temperatures below 0° C (32° F), as in wave or during the winter months, it is possible that the usual ease and smoothness of the control circuits is reduced. It must therefore be ensured that all control elements are free from moisture so that there is no danger of them freezing solid. This applies especially to the airbrakes.

From experience gained to date it has been found beneficial to cover the mating surfaces of the airbrakes with "Vaseline" along their full length so that they cannot freeze solid. Furthermore the control surfaces should be moved frequently.

When flying with water ballast, observe the instructions given in section 4.5.9.

Warning:

For the preservation of a proper surface finish free from cracking, the manufacturer strongly advises against high altitude flights with temperatures below – 20 °C (- 4 °F)!

A steep descent with the airbrakes extended should only be conducted in case of emergency (instead of the airbrakes the undercarriage may also be extended to increase the rate of sink).

Caution:

From many years of experience, the polyester finish on this aircraft is known to become very brittle at low temperature.

Particularly when flying in wave at altitudes in excess of about 6000 m (approx. 20000 ft), where temperatures below – 30 °C (- 22 °F) may occur, the gel-coat, depending on its thickness and the stressing of the aircraft's components, is prone to cracking! Initially, cracks will only appear in the polyester coating, however, with time and changing environment, cracks can eventually reach the Epoxy/glass cloth matrix.

Cracking is obviously enhanced by quick descents from high altitudes with associated very low temperatures.

4.5.12 Flight in Rain

When flying the aircraft with a wet surface or in rain, the size of the water drops adhering to the wing causes a deterioration of its flight performance which cannot be expressed in numerical values due to the difficulties involved with such measurements. Often the air mass in which it´s raining is also descending so that – compared with a wet aircraft in calm air – the sink rates encountered are even higher.

Flight tests in rain, conducted by the manufacturer, did not reveal any significant differences in the stalling behaviour or stalling speeds.

It cannot be excluded, however, that excessive alterations of the airfoil (as caused by snow, ice or heavy rain) may result in higher minimum speeds.

Approach in rain: see page 4.5.7.

Caution:

The approved propellers didn’t show any defects after operation in light rain so far.

Nevertheless, the use of the engine in rain is not recommended.

4.5.13 Aerobatics

Aerobatics are not permitted!

Section 5

5 Performance

5.1 Introduction

This section provides approved data for airspeed calibration, stall speeds and additional information.

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

5.2 Data (structured according to CS 22)

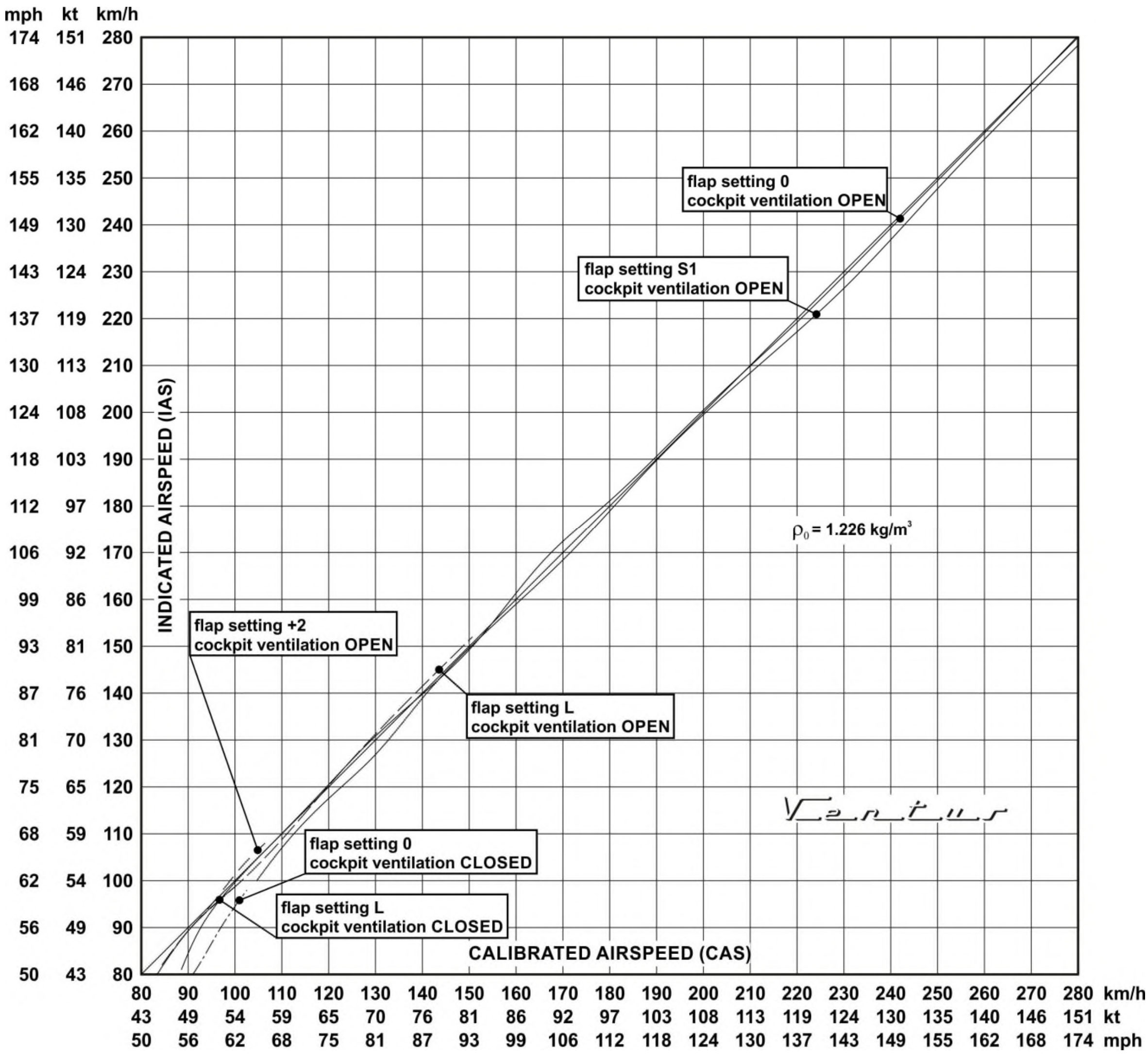
5.2.1 Airspeed indicator system errors

Errors in the indicated airspeed (IAS) caused by the measurement of Pitot/Static pressure may be read from the following calibration chart. This chart is applicable to free flight.

PITOT pressure source: Fuselage nose cone

STATIC pressure source: Fuselage tail boom, approx.
0,8 m (31.5 in) in front of the fin

All airspeeds shown in this manual are indicated airspeeds (IAS) as registered by the airspeed indicator.



5.2.2 Stall speeds

The following stall speeds (IAS) at various flap settings were determined in straight and level flight:

Configuration		Powerplant retracted	
Wingspan		18 m	
All-up mass (approx.)		600 kg 1322 lb	600 kg 1322 lb
C/G position (aft of datum)		320 mm 13 in.	430 mm 17 in.
Stall speed, airbrakes closed.			
Flaps at „+2“	km/h kts mph	76 ± 3 41 ± 1.6 47 ± 1.9	70 ± 5 38 ± 2.7 44 ± 3
Flaps at „0“	km/h kts mph	78 ± 3 42 ± 1.6 48 ± 1.9	72 ± 5 39 ± 2.7 45 ± 3
Flaps at „S1“	km/h kts mph	88 ± 3 47 ± 1.6 55 ± 1.9	75 ± 5 40 ± 2.7 47 ± 3
Stall speed, airbrakes extended			
Flaps at „L“	hm/h kts mph	74 ± 3 40 ± 1.6 46 ± 1.9	72 ± 5 39 ± 2.7 45 ± 3

Airspeed indication is oscillating with rearward c/g positions.
The loss of height from the beginning of the stall until regaining a normal level flight attitude is up to 110 m (360 ft).

Configuration		Powerplant extended, Full throttle	
Wingspan		18 m	
All-up mass (approx.)		600 kg 1322 lb	600 kg 1322 lb
C/G position (aft of datum)		320 mm 13 in.	430 mm 17 in.
Stall speed, airbrakes closed			
Flaps at „+2“	km/h kts mph	79 ± 5 42 ± 2.7 49 ± 3	69 ± 5 37 ± 2.7 43 ± 3
Flaps at „L“	km/h kts mph	76 ± 5 41 ± 2.7 47 ± 3	68 ± 5 37 ± 2.7 42 ± 3
Stall speed, airbrakes extended			
Flaps at „L“	km/h kts mph	77 ± 5 42 ± 2.7 48 ± 3	69 ± 5 37 ± 2.7 43 ± 3

Airspeed indication is oscillating with rearward c/g positions.
The loss of height from the beginning of the stall until regaining a normal level flight attitude is up to 90 m (295 ft).

5.2.3 Take-off distances (at calm air)

All figures shown below refer to ICAO standard atmosphere and are based on the maximum permitted all-up mass for self-launch of 600 kg (1322 lb).

Ground run on paved runway (0 m MSL): 243 m (797 ft)

Total distance over 15 m / 50 ft obstacle: 387 m (1269 ft)

Lift-off speed approx.: 85 to 90 km/h
(46-49 kts, 53-56 mph)

Speed over 15m / 50 ft obstacle: 100 km/h
(54 kts, 62 mph)

	Field elevation above MSL		Outside air temperature							
			- 15 °C 5 °F		0 °C 32 °F		+ 15 °C 59 °F		+ 30 °C 86 °F	
	m	ft	m	ft	m	ft	m	ft	m	ft
Ground run distance until lift-off	0	0	191	616	216	708	243	797	272	892
	500	1640	208	682	235	771	265	869	296	971
	1000	3281	226	741	256	839	288	944	322	1056
	1500	4921	246	807	279	915	313	1026	351	1151
	2000	6562	268	879	304	997	342	1122	382	1253
Total distance over 15m/50 ft obstacle	0	0	303	994	344	1128	387	1296	432	1417
	500	1640	330	1082	374	1227	420	1377	470	1541
	1000	3281	359	1177	406	1332	457	1499	511	1676
	1500	4921	391	1282	443	1453	498	1633	557	1827
	2000	6562	426	1397	483	1584	543	1781	607	1991

The above distances are for take-off from a paved runway.

Taking-off from a level hard grass runway lengthens the above ground run distances by about 20%.

Warning:

Wet and/or soft ground lengthens the take-off distance considerably.

5.2.4 Additional information

None.

5.3 DATA (not structured according to CS 22)

5.3.1 Demonstrated crosswind performance

The maximum crosswind velocity, at which take-offs and landings have been demonstrated, is

20 km/h (11 kts).

5.3.2 Flight polar

All values shown below refer to MSL (0 m) and 15° C (59° F).

Powerplant retracted:

Wingspan	18 m
Performance at an all-up mass of	600 kg / 1322 lb
Wing loading	55.4 kg/m² / 11.3 lb/ft²
Lowest sink rate	*
At an airspeed of	90 km/h 48 kts 56 mph
Best L/D	*
At an airspeed of	120 km/h 65 kts 75 mph

Speed polar diagram – see page 5.3.2.2
* not yet measured

Powerplant extended:

Ignition OFF, Flap position „+2“	
Wingspan	18 m
All-up weight	600 kg / 1322 lb
Sinken	2.46 m/s 484 ft/min 4.8 kts
At airspeed	115 km/h 62 kts 71 mph

Maximum Power applied, Flap position „L“		
Wingspan	18 m	
All-up weight	525 kg / 1157 lb	600 kg / 1322 lb
Best climb at 0 m MSL	3.24 m/s 638 ft/min 6.3 kts	2.81 m/s 553 ft/min 5.5 kts
At [km/h]	98	100
Horizontal flight V_H [km/h], flap setting „-1“	160	

Speed polar diagram not yet measured

5.3.3 Range (without influence of wind)

a) Values below refer to level flight at cruising power (continuous RPM):

Crusing speed approx.: 160 km/h (86 kts, 99 mph)
Fuel consumption approx.: 22.5 ltr/h (5.94 US Gal/h, 4.94 IMP Gal/h)

Usable fuel			fuselage-tank	Option Right wing tank	Option Left wing tank	Level flight endurance [h:mm]	Rang
Liter	US Gal.	IMP Gal.	SN 31 and on:				
12.7	3.7	2.8	X			0.33	90 km / 48 nm
12	3.17	2.6	X	X		1:05	175 km / 94 nm
12	3.17	2.6	X	X	X	1:37	260 km / 140 nm
			SN 21:				
11	2.9	2.4	X			0:29	75 km / 40 nm
5	1.3	1.1	X	X		0:42	110 km / 59 nm
5	1.3	1.1	X	X	X	0:55	145 km/ 78 nm

b) The following values are based on the “sawtooth"-method, see page 4.5.4, and the following parameters:

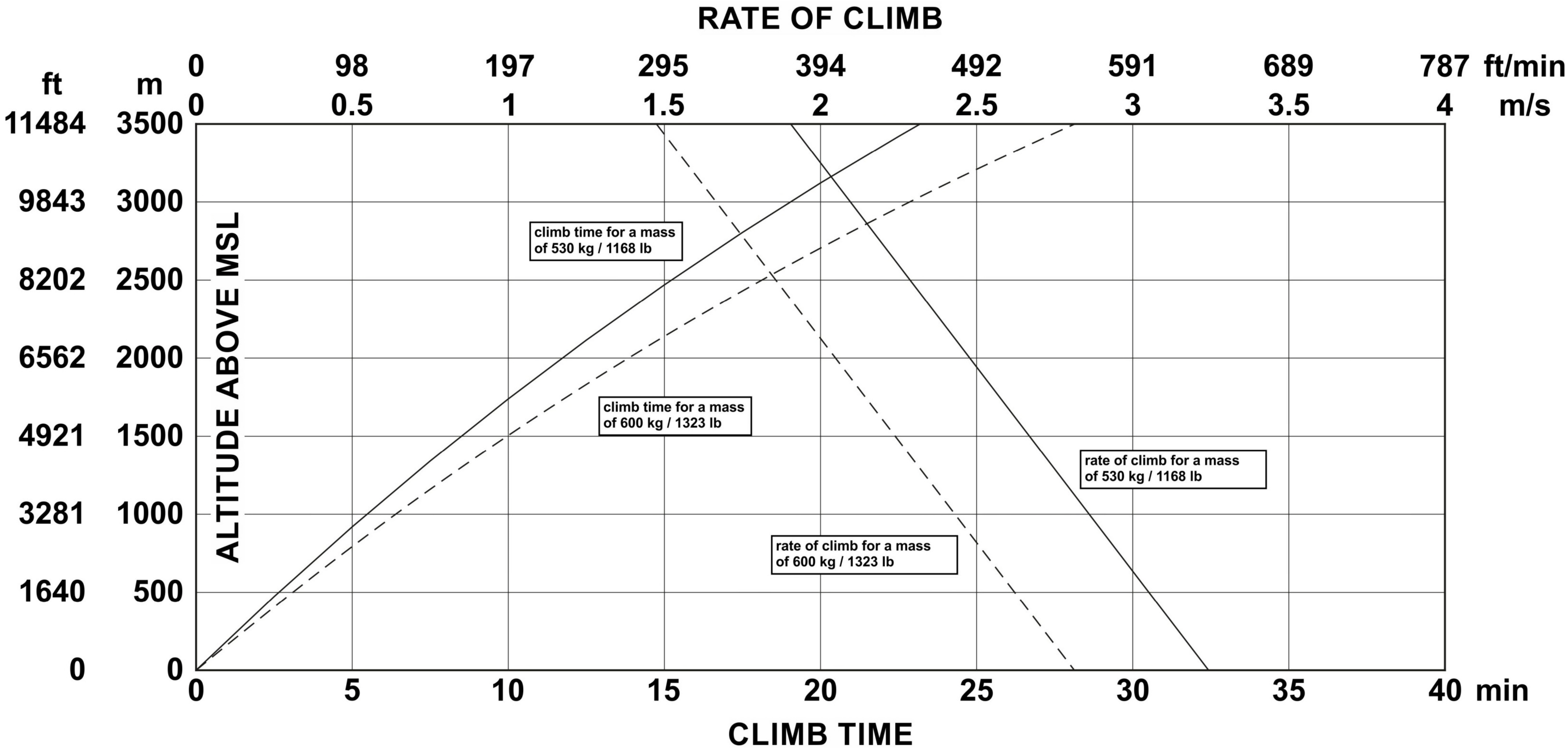
- Climbing with maximum continuous power
- All-in weight 530 kg (1168 lp), climbing speed 98 km/h (53 kts, 61mph)
- Climbing from 500 m (1640 ft) MSL to 1500 m (5000 ft) MSL
- Gliding at the speed of the L/D
- Fuel consumption approx. 22.5 ltr/h (5.9 US Gal./h, 4.9 IMP Gal./h)

This results in an average cruising speed of approx. 110 km/h (60 kts, 68 mph).

Usable fuel			fuselage-tank	Option Right wing tank	Option Left wing tank	Level flight endurance [h:mm]	Rang
Liter	US Gal.	IMP Gal.	SN 31 and on:				
12.7	3.7	2.8	X			2.24	265 km / 143 nm
12	3.17	2.6	X	X		4:45	525 km / 283 nm
12	3.17	2.6	X	X	X	7:00	775 km / 418 nm
			SN 21:				
11	2.9	2.4	X			2:06	230 km / 124 nm
5	1.3	1.1	X	X		3:00	330 km / 178 nm
5	1.3	1.1	X	X	X	3:59	440 km/ 237 nm

Climb performance

All in weight = 530 kg (1168 lb) - See diagram on page 5.3.3.2.


RATE OF CLIMB
0
98
197
295
394
492
591
689
787
ft/min
0
0.5
1
1.5
2
2.5
3
3.5
4
m/s
ft
m
11484 3500
9843 3000
8202 2500
6562 2000
4921 1500
3281 1000
1640 500
0 0
ALTITUDE ABOVE MSL
climb time for a mass of 530 kg / 1168 lb
climb time for a mass of 600 kg / 1323 lb
rate of climb for a mass of 530 kg / 1168 lb
rate of climb for a mass of 600 kg / 1323 lb
0
5
10
15
20
25
30
35
40
min
CLIMB TIME

5.3.4 Noise data

The noise level limit according ICAO Appendix 16, Volume I, for the powered sailplane Ventus-3M (equipped with the SOLO engine 2625-01i) is

65.9 dB(A) < Noise level limit 70.8 dB(A)

and is thus far below the noise level limit.

It is nevertheless recommended to wear headphones when flying with the engine running.

Section 6

6 Weight (mass) and balance

6.1 Introduction

This section contains the payload range within this aircraft may be safely operated.

Procedures for weighing the aircraft, the calculation method for establishing the permitted payload range and a comprehensive list of all equipment available are contained in the Ventus-3M Maintenance Manual.

The equipment actually installed during the last weighing of the aircraft is shown in the equipment list of the weight and balance report – see also section 6.2.2 and 6.2.3.

6.2 Weight and balance record and permitted payload range

The following loading chart, see sections 6.2.2 and 6.2.3, show, besides other data, the empty weight, the maximum and minimum load on the seats and the maximum payload in the fuselage.
These charts are established with the aid of the last valid weighing report - the required data and diagrams are found in the Maintenance Manual of the Ventus-3M.
Both loading charts (weight & balance log sheets) are only applicable for this particular aircaft, the serial number of which is shown on the title page.

6.2.1 Seat load of less than the required minimum

There are two procedures to compensate a seat load of less than the required minimum.

o Ballast by means of lead or sand cushions in the pilot seat

The ballast (lead or sand cushion) must be attached firmly to the lap belt mounting brackets. The ballast weight is added to the payload in the seat.

o Ballast by means of Lead plates (optional)

A trim ballast mounting provision is provided in the fuselage nose forward of the rudder pedal assembly. The ballast mounting provision holds up to three (3) lead plates with a weight of 2.0 kg (4.4 kb) each and allows a reduction of the minimum seat load indicated on the cockpit placards as shown in the following table:

Number of lead plates	Difference to the minimum load
1	- 4.2 kg - 9.3 lb
2	- 8.4 kg - 18.5 lb
3	- 12.6 kg - 27.8 lb

Lever arm of trim ballast plates: 1800 mm (5.90 ft) ahead of datum.

Important note:

Be aware that, even when using trim plates, it is not allowed to fall below the minimum flight mass (see page 2.6). It is only allowed to use as many plates, that the absolute value of the difference to the minimum shown in the table above, added to the real mass in the seat, does not exceed 105 kg (231 lb).

6.2.2 Weight and balance log sheet)
for S/N.: ___________ (power plant **installed**)

<table>
<tr><td colspan="2">Date of weighing:</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Empty mass [kg]
(without usable fuel)</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Equipment list dated</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2" rowspan="4">Installed batteries [1)]</td><td colspan="2">Quantity /Masst</td><td colspan="2">Quantity /Masst</td><td colspan="2">Quantity /Masst</td><td colspan="2">Quantity /Masst</td></tr>
<tr><td></td><td>M</td><td></td><td>M</td><td></td><td>M</td><td></td><td>M</td></tr>
<tr><td></td><td>C</td><td></td><td>C</td><td></td><td>C</td><td></td><td>C</td></tr>
<tr><td></td><td>S</td><td></td><td>S</td><td></td><td>S</td><td></td><td>S</td></tr>
<tr><td colspan="2">Empty mass c/g position aft of datum</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Max. payload incl. water ballast [kg]</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Max. Payload without water ballast [kg] [2)]</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Max. Payload in fuselage Incl. fuel in fuselage tank [kg]</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td rowspan="2">Seat payload (pilot and parachute) [kg]</td><td>min.</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>max.</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Fin tank installed
YES / NO [3)]</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Inspector
Signature, Inspector's stamp</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

[1)] Installed batteries (see section 7.12):
(M) one battery under the instrument panel
(C) one or two batteries near the undercarriage are (optional)
(S) one battery in the vertical fin (optional)

At least one battery must be installed as the battery for the power plant.

[2)] Fuel in wing tanks counts as water ballast and does not need to be respected.

[3)] **Warning:**

If a fin tank is installed, the pilot must either dump the water ballast prior the launch or check precisely the amount of water in the fin tank with respect of the amount of water in the wing water tanks

For determination of water ballast in the wing tanks refer to section 6.2.4
For determination of water ballast in the fin tank refer section 6.2.5

6.2.3 Weight an balance log sheet

for S/N.: ___________ (power plant **removed**)

Date of weighing:									
Empty mass [kg] (without usable fuel)									
Equipment list dated									
Installed batteries [1]		Quantity /masst		Quantity /masst		Quantity /masst		Quantity /masst	
			M		M		M		M
			C		C		C		C
			S		S		S		S
Empty mass c/g position aft of datum									
Max. payload incl. water ballast [kg]									
Max. Payload without water ballast [kg] [2]									
Max. Payload in fuselage Incl. fuel in fuselage tank [kg]									
Seat payload (pilot and parachute) [kg]	min.								
	max.								
Fin tank installed YES / NO [3]									
Inspector Signature, Inspector's stamp									

[1] Installed batteries (see section 7.12):
(M) one battery under the instrument panel
(C) one or two batteries near the undercarriage are (optional)
(S) one battery in the vertical fin (optional)

If the battery for the power plant has been removed, any electrical consumer (i.e. bug wipers) connected to this battery may no longer be functional.

[2] Fuel in wing tanks counts as water ballast and does not need to be respected.

[3]

> **Warning:**
>
> If a fin tank is installed, the pilot must either dump the water ballast prior the launch or check precisely the amount of water in the fin tank with respect of the amount of water in the wing water tanks

For determination of water ballast in the wing tanks refer to section 6.2.4
For determination of water ballast in the fin tank refer section 6.2.5

6.2.4 Wing water ballast load

Maximum all-up weight incl. water ballast m_{max}: 600 kg (1322 lb)

C/G position of water ballast in wing tanks (aft of datum):
Inner tank (inner wing): 194 mm (7.64 inch)
Outer tank (outer wing): 214 mm (87.43 inch)

Total capacity of both wing tanks (inbd. and outbd. Panels):	132 kg (291 lb)
both inner tanks:	106 kg (233 lb)
both outer tanks:	26 kg (57 lb)

Note:

The inner wing tanks can be filled either directly or through the outer wing tanks.

Wing water ballast load:

When determining the max. permitted wing water ballast load m_{WB_Wing} the following data are helpful:

- o Maximum all-up mass with water ballast m_{max} [kg]
- o Empty mass of the aircraft m_{empty} [kg] – see sections 6.2.2 and 6.2.3
- o Payload in cockpit $m_{Cockpit}$ [kg]
- o Fin water ballast m_{FT} [kg] – see section 6.2.5

The calculation of the maximum payload of the water ballast in the wings m_{WB_Wing} in kg is carried out using the following formula:

$$m_{WB\_Wing} = m_{max} - m_{empty} - m_{Cockpit} - m_{FT}$$

The fuel in the wing fuel tanks is part of the water ballast in the wings.

6.2.5 Water ballast loading the fin (option)

> **Warning:**
>
> The fin ballast may only be used to compensate the top-heavy moment of the wing water tank!

The determination of the ballast quantity carried in the fin tank (m_{FT}) is done with the aid of the diagram shown on the next page.
The maximum capacity of the fin tank is 7.8 kg/litre (17.2 lb, 2.06 US Gal., 1.72 Imp. Gal.)

Note:

When determining the useful load in the fuselage the quantity of water ballast in the fin must not be taken in account because of flight mechanic reasons.

Example:

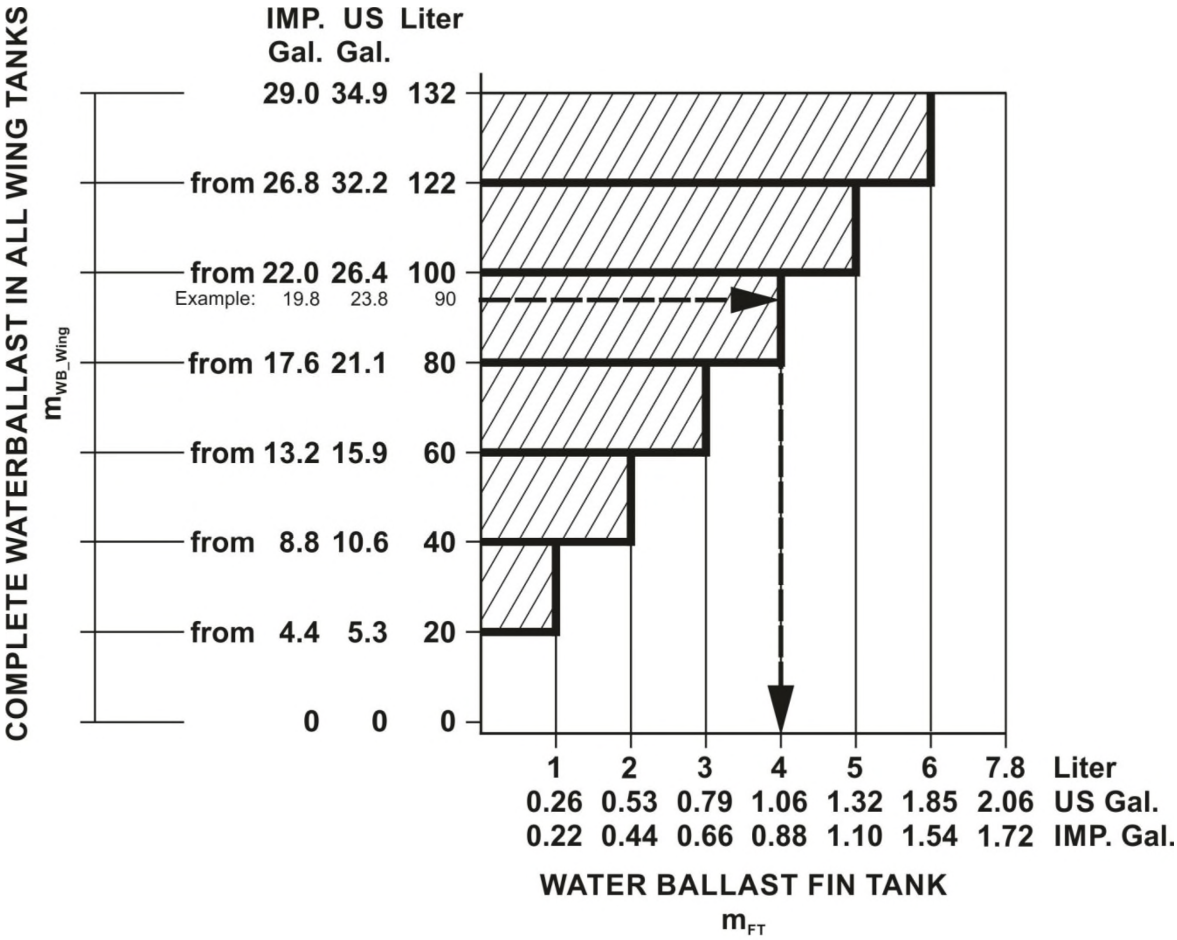
Chosen: Wing water ballast 90 kg (198 lb)

The diagram on the following page shows the permissible rear water ballast of

m_{FT} = 4 kg/Liter (8.8 lb)

as only whole kg/litre can be filled.

Table Water Ballast Overview



Lever arm of water ballast fin tank:
4194 mm (165.12 in.) aft of datum
Fin tank capacity: 7.8 Liter - 2.06 US Gal. - 1.72 IMP Gal.

Caution:

Fill always full liters in the fin tank.

At the discontinuity of the diagram (vertical axis, wing water ballast) the corresponding fin water ballast (Full liters) can be filled.

Section 7

7 Description of the aircraft and its systems

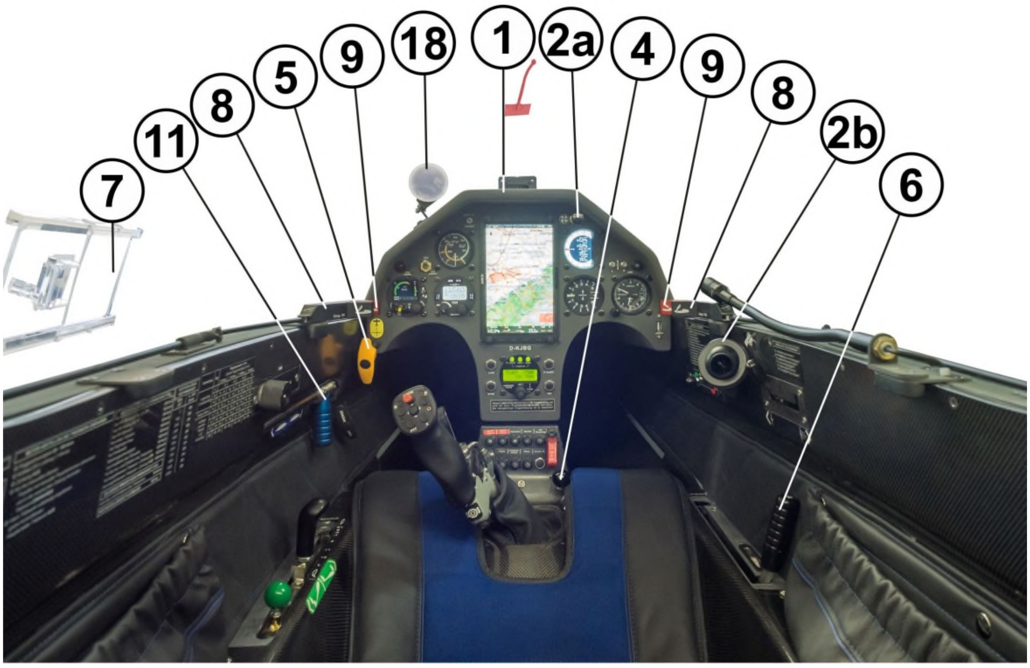
7.1 Introduction

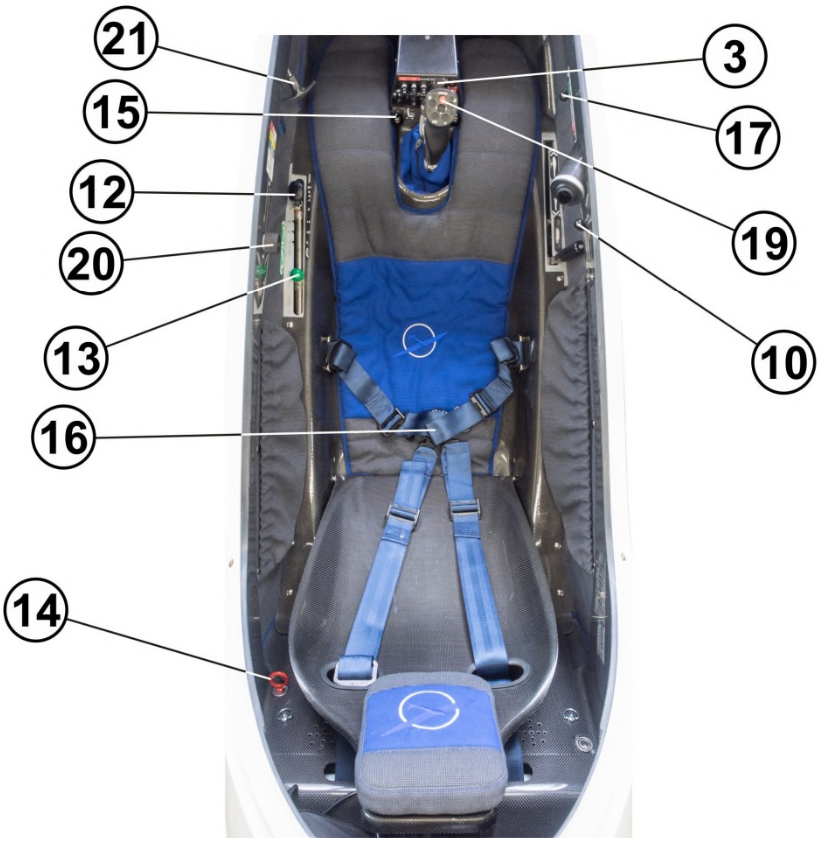
This section provides a description of the aircraft including the operation of its systems.

For details concerning optional and not standard systemy and equipment refer to section 9 “Supplements”.

For further descriptions of components and systems, please refer to section 1 of the Maintenance Manual for the Ventus-3M.

7.2 Cockpit Description





All instruments and controls are within easy reach of the pilot.

(1) Pivoting instrument panel

The instrument panel is placed clearly visible in front of the pilot. When the canopy is opened, the instrument panel swings upwards. The instrument panel cover is attached to the canopy frame with screws.

(2) Ventilation control

a) A small black ball knob on the right side of the instrument panel controls the amount of air for the canopy ventilation.

Open ventilation	-	pull
Close ventilation	-	push

b) Adjustable ventilation nozzle on the right-hand side of the cabin

CLOSE nozzle	-	turn clockwise
OPEN nozzle	-	turn counterclockwise

For additional ventilation, either the sliding window or the ventilation inlet in it can be opened.

(3) Wheel brake

The wheel brake lever is mounted to the control stick. The braking force depends on the force applied to brake lever.

Increase braking force	-	pull lever
Decrease braking force	-	release lever

(4) Rudder pedal adjustment

Black round knob, actuating the locking of the rudder pedal adjustment, is located on the right base of the instrument panel console. Adjustment of the rudder pedal on the ground and in the air is possible.

Forward adjustment	-	Release locking device by pulling the handle, push the pedals to the desired position with the heels and let them engage.
Backward adjustment	-	Pull handle back until pedals have reached the desired position. Shortly pushing forward with the heels engages the locking device with an audible click.

(5) Control handle for tow release mechanism(s)

The yellow handle actuating the nose and/or the c/g tow release (whichever is installed) is to be found on the instrument panel.

Tow release(s) open	-	pull
Tow release(s) close	-	release

(6) Undercarriage

The black handle for operating the undercarriage is situated on the right at the seat pan support.

Retract undercarriage	-	Disengage the handle, pull it back and lock in the rear recess
Extend undercarriage	-	Disengage handle, push it forward and lock in the front recess

(7) Canopy

The one-piece plexiglass canopy can be opened to the front and is attached to the instrument panel support.

(8) Canopy locking

Black levers with white markings on the right and left side of the canopy frame.

Canopy locked	-	forward position
Canopy unlocked	-	rearward position

To open the canopy, swing both levers backwards. Then lift the canopy by the levers with a little jerk or push the canopy upwards. This will release the spring-loaded lock in the rear area of the canopy frame.

(9) Canopy jettisoning

Red lever with white marking on the right and left side of the canopy frame. Pull both levers back to jettisoning the canopy.

Canopy locked	-	forward position
Canopy detached from instrument panel support	-	rearward position

(10) Water ballast dumping for wing tanks and optional fin tank

Black knob in the middle of the cockpit inner skin on the right is guided in a crank. Opening and closing the valves of the wing tanks simultaneously with the optional fin tank.

All valves closed	-	forward position
All valves opened	-	rearward position

(11) Airbrakes lever

Blue lever on the left hand side of the cockpit to operate the airbrakes.

Airbrakes locked	-	forward position
Airbrakes unlocked	-	pulled by approx. 40 mm (1 ½ inch)
Airbrakes fully extended	-	rearward position

(12) Flap lever

Black lever on the seat pan mounting flange on the left for flap operation. The crank guiding the lever features several positions to engage for an appropriate flight condition.

High speed range	-	Swing lever slightly inwards, move forward and let lever engage
Low speed range	-	Swing lever slightly inward, pull back and let lever engage

(13) Elevator trim

Elevator trim on the left side of the cockpit. The spring-loaded trim is gradually adjustable by swinging the green knob inwards, sliding it to the desired position and let it engage outwards again. A normal position of the trim at flap setting “0” is shown at the recess by means of a green marking

Trim nose heavy	-	Push lever forward
Trim tail heavy	-	Pull lever backward

(14) Parachute rip cord attachment

Red ring, situated at the bulkhead in front of the fuselage steel tube center frame, on the left side.

(15) Adjustment of backrest

The backrest is adjustable and pivot-mounted on the seat pan. It is longitudinally and inclinally adjustable to allow each pilot an optimal seating position.

Longitudinal adjustment (not illustrated)

Three positions through three holes each on the right and left in the seat pan. Insert the backrest with the fixed bolt into the selected hole and snap the spring-loaded bolt into the corresponding hole on the other side.
This adjustment is only possible on the ground.

Inclination adjustment

Black button at the bottom left of the base of the instrument panel, which is pulled back to unlock.

Flatter backrest	-	Pull the button backwards and push the backrest backwards, then release the button.
Steeper backrest	-	Pull button back and relieve backrest, then release button

(16) Harness

The lap seatbelts are looped around bolts that are laminated to the seat pan, the shoulder seatbelts are looped around the front transverse tube of the fuselage steel frame. The belt system is closed and reopened via a central locking mechanism.

(17) Fuel shut-off valve

Black ball knob on the right side of the cockpit inner skin above the landing gear operation.

Fuel shut-off valve OPEN	-	forward position
Fuel shut-off valve CLOSED	-	rearward position

(18) Rear view mirror

The rear-view mirror is mounted on the instrument panel cover and is intended to enable the pilot to visually monitor the power plant.

(19) Starter button

Red button on top of control stick.

Operate starter motor	-	Push button
Stop starter motor	-	Release button

(20) Throttle control

Slidable black knurled knob on the left cockpit side. To release or lock, turn knob.

Full throttle	-	forward position
Idling	-	rearward position

(21) Manual propeller brake

Black T-handle on the front of the left cockpit inner skin in front of the airbrake handle.

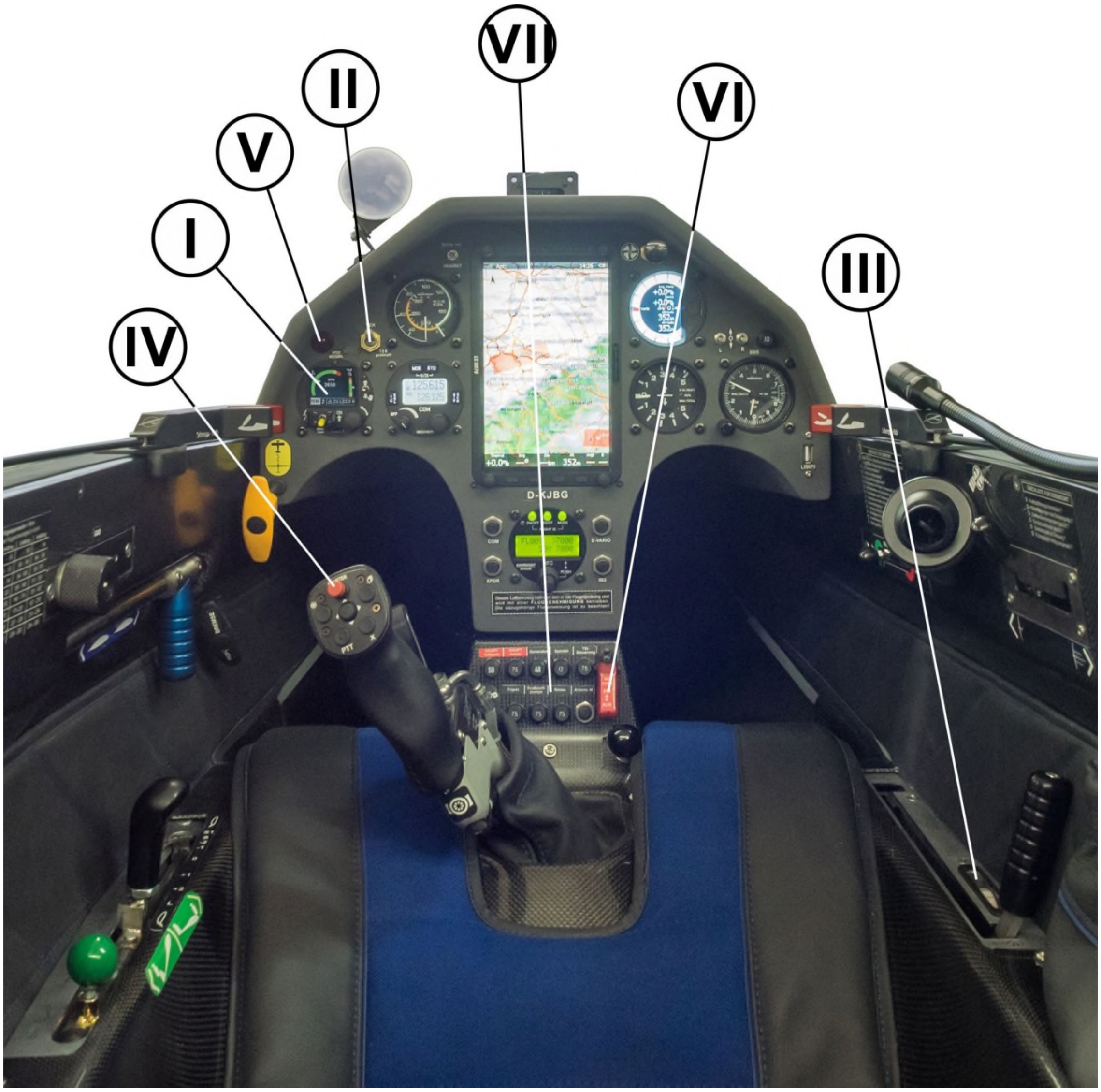
Apply brake	-	Pull handle
Release brake	-	Release handle

With the powerplant control unit, manual operation of the propeller brake is only required if the automatic operation of the propeller brake via the brake servo is defective.

As long as the handle is pulled and held, the mechanical propeller brake slows down the power plant at the small belt pulley.

The manual propeller brake may only be actuated when the ignition is OFF!

7.3.1 Instrument Panel



A description of the marked components I - VII can be found on the following pages. A description of the instruments is not included.

I Power plant operating Unit

Description see page 7.3.5 ff

II Pneumatic valve

Optional toggle switch in the instrument panel for changing the variometer display.

TE	tube to TE probe
STATIC	Static pressure

or

TE	tube to TE probe
TE dampened	Tube to TE probe with constrictor

III Outside air thermometer

When flying with water ballast, the outside temperature must not fall below 2 °C (36 °F).

IV Starter button on control stick

The starter motor is operated in two different modes:

1) Starting the engine

The following prerequisites must be met in order the starter motor can be used to start the engine:

- power plant main switch switched on
- power plant fully extended (note position indication on display)
- ignition ON
- engine speed 0 RPM

or:

- The red emergency system switch flap is open.
  In this case the starter motor can be operated in any position of the power plant and independent of the engine speed (see page 7.3.47 ff)!

2) Pulse-Mode for propeller positioning

After the power plant has been switched off, the alignment of the propeller in the retraction position can be supported by pressing the starter button. The propeller is then slowly turned with the starter motor until just before the retraction position.
For this special function of the starter motor, the following prerequisites must be fulfilled:

- power plant fully extended (note position indication on display)
- ignition OFF
- engine speed 0 RPM
- emergency system inactive (red emergency system switch flap is closed)
- propeller is not yet close to retraction position

V Blinking fire warning light (red)

The temperature gauge for the fire waring LED is mounted in the upper part of the front engine compartment wall. In the event of strong heat development in the engine compartment, e.g. as a result of a fire, the fire warning LED starts flashing when the temperature exceeds approx. 140 °C.

Caution:

When the power plant control system is switched on, the fire warning LED flashes briefly for a self-test.

VI Emergency system

Description see page 7.3.47 ff

VII Fuse panel

Description see page 7.3.50 ff.

I. Power plant operating unit MCU3 BG

No.	Meaning
1	TFT Display *All messages*
2	Ignition switch with yellow cap
3	Memory Card / SD Card Slot *Data exchange / Updates*
4	Manual operation switch
5	Rotary selector switch with push button

I. Power plant operating unit MCU3 BG (cont.)

The MCU3 power plant control system reduces the pilot's effort when operating the power plant.

- For the pilot, the extension and retraction of the power plant is normally reduced to the operation of the ignition switch (automatic mode).

- The power plant control system informs the pilot about all essential parameters of the power plant system. If limits are exceeded or important components fail, warning messages are displayed by the power plant operating unit.

- If necessary, the pilot can manually extend and retract the power plant (manual operation).

The powerplant control system of the Ventus-3M consists of two main components:

1. The MCU3 BG Power plant operating Unit is located in the instrument panel (see page 7.3.1). It contains important control elements for controlling the power plant and displays all data important for the operation of the power plant.

2. The MCU II SG Power plant control Unit is located to the right of the landing gear box. It monitors the data of all sensors relevant for the operation of the power plant in a processor-controlled manner and switches signal and power currents to all elements of the power plant control system.

I. Power plant operating Unit MCU3 BG (cont.)

A) Device description:

The switches for starting the power plant control are located in the fuse console in the lower fixed portion of the instrument panel (see section VII of this chapter, p. 7.3.50 ff).

For the operation of the power plant control system, at a minimum the following circuit breakers must be closed:

- o Master switch power plant **Master-switch Power plant**
- o Power plant control system circuit breaker **Power plant control**

Note:
After switching on the main switch of the power plant and the circuit breaker for the power plant control system, a warning tone can be heard and a short moment of a completely white screen can be seen.

If the circuit breakers for the spindle drive (**Spindle drive**) and the engine control system (**Trijekt**) are open when the power plant control system is switched on, warnings are given by the operating unit, which can be confirmed and switched off by pressing the MENU button.

I. Power plant operating unit MCU3 BG (cont.)

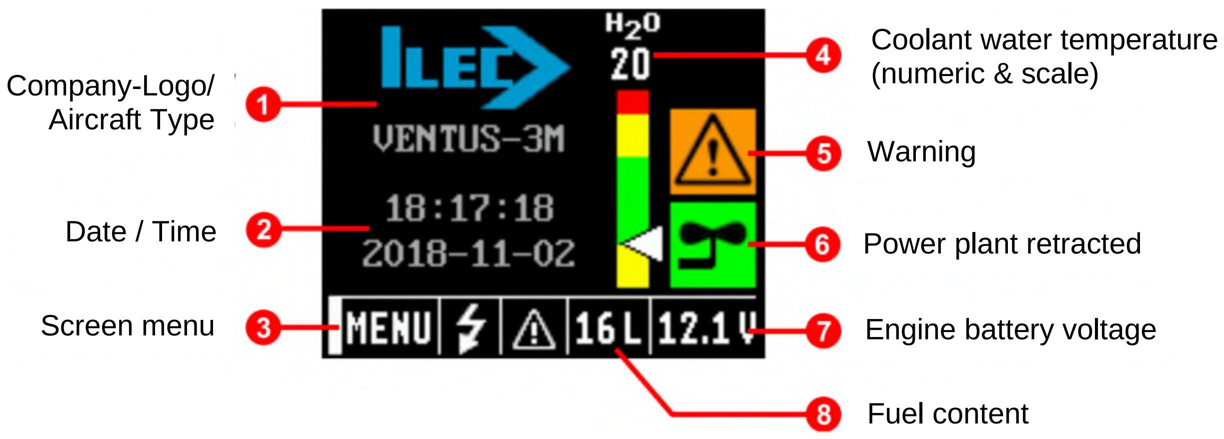
A) Device description (cont.)

1. TFT Display

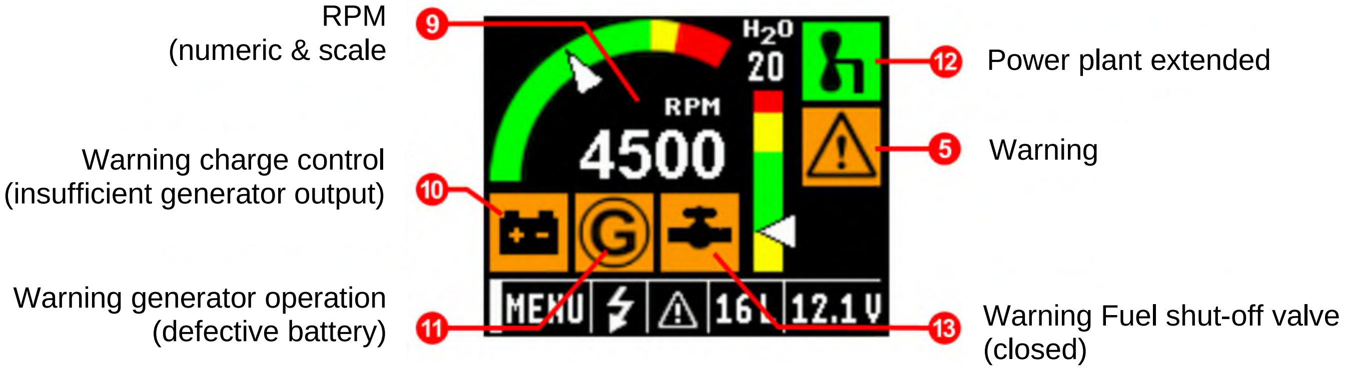
The individual displays of the three operating modes (gliding operation, power plant operation and travel operation) are described below. The exact treatment of the individual displays follows in the next chapter B) Functional description.

If the menu is selected, a function is selected or the cursor is moved away from its default position and there is no further interaction with the operating unit, the screen and the cursor return to the default state after 20 seconds when in gliding mode. In power plant operation mode this happens after 10 seconds. The return is announced by a rotating hourglass.

Display in gliding mode:



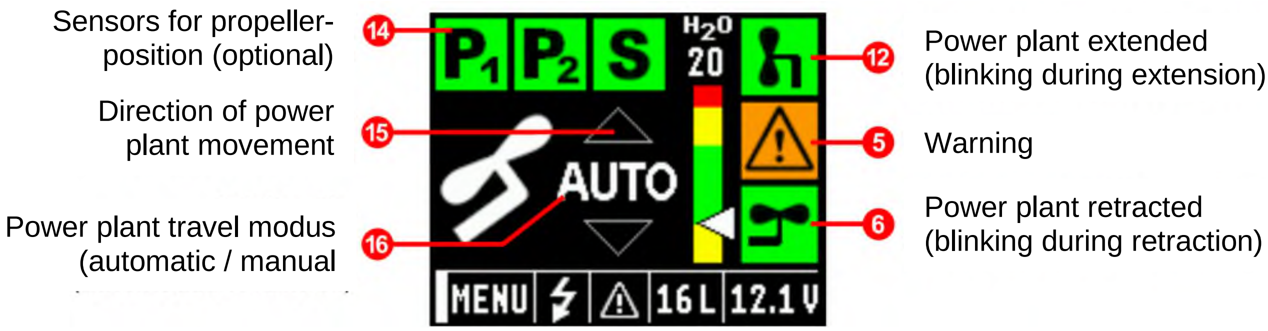
Display during power plant operation:



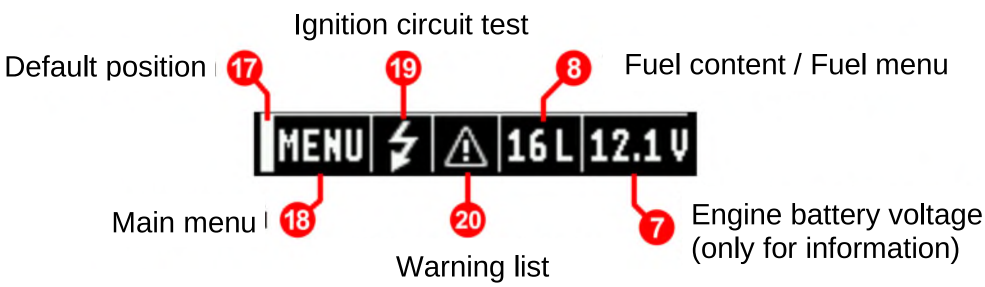
I. Power plant operating unit MCU3 BG (cont.)

A) Device description (cont.)

Display during travel operation:



Screen menu:



Operating notifications and error messages:

Example for an operating notification

Example for a critical error message

A comprehensive list of all messages and their meanings can be found in chapter I B) 3) on page 7.3.31.

I. Power plant operating unit MCU3 BG (cont.)

A) Device description (cont.)

2. Ignition switch

Position UP:
- Ignition ON
- The power plant extends completely (automatic mode)
- Electric fuel pump is switched on
- Electric cooling water pump is switched on

Position DOWN:
- Ignition OFF
- The power plant retracts automatically as soon as the engine is stopped and the correct propeller position is reached (automatic mode)
- Electric fuel pump is switched off
- The electric cooling water pump is switched off when the cooling water temperature has fallen below 60°C

Note:

When the power plant reaches the fully extended position with ignition ON but is not started, after a short period of time the electrical fuel pump and the cooling water pump will be shut off (energy saving mode).
As soon as the starter button is pressed, both devices are switched on again.

3. Memory Card Slot

The memory card reader built into the MCU3 operating unit accepts Micro-SD cards. Using this interface, error data can be transferred to an SD card and, for example by e-mail, transferred to the manufacturer for analysis. In addition, a software update for the operating unit and the power plant control system can be imported via this interface if required.

I. Power plant operating unit MCU3 BG (cont.)

A) Device description (cont.)

4. Manual operation switch (switch for spindle drive)

a) If the pilot starts the extension or retraction process during flight with the ignition switch, there is no need to use the manual operation switch as long as there is no failure in the power plant control system.

b) The manual control switch (toggle switch) has three positions:

Position UP	-	Automatic operation turned off
	-	Extraction of the power plant as long as the switch is held
	-	Spindle drive stops by itself when the power plant is fully extended and the limit switch is reached.
Position middle	-	Automatic mode (default position)
Position DOWN	-	Automatic operation turned off
	-	Retraction of the power plant as long as the switch is held
	-	Spindle drive stops by itself when the power plant is fully retracted and the limit switch is reached.

c) The manual control switch can be used to extend and retract the power plant in the following cases:

i) on the ground (recommended for pre-flight inspection and maintenance).
ii) when in flight the automatic operation of the power plant control system for extension and retraction is switched off automatically. This occurs when there is missing or unclear information about the position or operating status of the power plant. The power plant control system then switches to manual mode (display: ) and the pilot must take over further control of the extension or retraction process.
iii) if the pilot wants to take over control of the automatic retraction and extension process from the power plant control system.

Caution:
The power plant can only be retracted with the manual operation switch if the ignition is OFF.

I. Power plant operating unit MCU3 BG (cont.)

A) Device description (cont.)

d) Transition from automatic mode to manual mode (interruption of the automatic extension and retraction process with the manual control switch):

Is the manual operation switch pushed up or down while the power plant is extended or retracted with the ignition switch (i.e. in automatic mode of the power plant control system):

- the movement of the power plant is stopped
- the automatic operation is switched off (transition to manual mode, display + warning tone).
- the brake servo for the automatic propeller brake is opened and releases the propeller.
- if the automatic propeller positioning has already started, the process will be aborted.

e) Return from manual mode to automatic mode

i) To continue the extension in automatic mode:

- Ignition OFF and back to ON
  ⇨ *Continuation of the automatic extension process*

ii) To continue retraction in automatic mode or automatic propeller positioning:

- Ignition ON

- Wait until the power plant has fully extended (note the position indicator on the display).

- Ignition back to OFF

Caution:

In manual mode

- all automatic operations are stopped. The pilot must conduct and control the extension or retraction process by himself with the manual operation switch.
- the manual propeller brake (see section 7.2) must be operated by the pilot to stop, position and hold the propeller during retraction of the power plant.

I. Power plant operating unit MCU3 BG (cont.)

A) Device description (cont.)

5. Rotary selector switch with push button

The rotary selector switch with push button is used to:

- make Selections in the screen menu
- confirm operating notifications, warnings and error messages by pressing rotary selector switch
- navigate in the menu and function structure of the operating unit
- enter data

Special characteristic:

If functional data are entered (e.g. time or contents of wing fuel tanks), this is done by pushing in the rotary selector switch and simultaneously turning it. Turning it clockwise increases the value, turning it counter-clockwise decreases the value. If the rotary selector switch is released, the value is accepted.

Operating notifications are confirmed by pressing the rotary selector switch. Critical errors cannot be eliminated; the error must be eliminated.

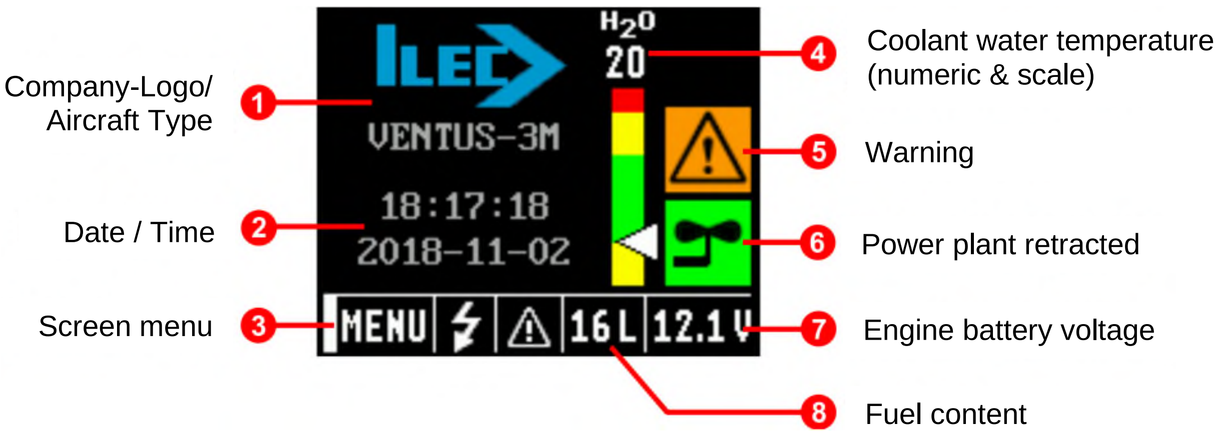
I. Power plant operating unit MCU3 BG (cont.)

B) Functional description

Displays of the operating unit

The displays of the control unit differ in the three operating modes gliding operation, Power plant operation and traversing operation.

1. Display in gliding mode:



1.1 Company logo and aircraft type

Display of the ILEC logo and the aircraft type for which the firmware was designed.

1.2 Date / Time

Displays the current time and date (yyyy.mm.dd). The factory setting is UTC. In the menu->Settings->Date/Time the clock can be set as desired. See chapter I B) 1.5 on page 7.3.28

1.3 Screen menu

The rotary selector switch can be used to rotate the cursor to the various functions and to select the function by pressing the rotary selector switch. The Motor battery voltage field (7) cannot be selected. Further explanations can be found in this chapter under "On Screen Menu" on page 7.3.20.

1.4 Coolant water temperature

The coolant water temperature is displayed numerically in ° Celsius and also as a pointer on a colour scale in which the operating ranges are colour-coded in accordance with Section 2.5. If the maximum permissible temperature is exceeded, a warning message is issued. The limit values are described in the table in Section 2.5.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description

1.5 Warning

The orange warning symbol (5) appears as soon as an error has occurred or a limit value has been exceeded. The error is also indicated by an error message. This error message can be confirmed by pressing the rotary selector switch if the error does not prevent operation. However, this does not correct the error. By selecting the warning list (see page 7.3.20), the error message can be read again in chronological order. The possible error messages are explained on page 7.3.31.
The display is coupled with the warning tone a).

a) Warning tone (buzzer) (without picture)

Tone sequence	Meaning	Display
Pulsating Tone	Operating notification Fuel shut-off valve	Open fuel valve
Double Tone	Operating notification Manual Mode	
Continuous tone	Warning tone for limit overruns, error messages, various operating notifications	*Diverse*

1.6 Power plant retracted

The power plant retracted display appears statically as soon as the power plant is fully retracted and has actuated the limit switch. If the symbol (6) flashes, the power plant is retracting and has not yet reached the limit switch. The limit switch for the retracted position of the power plant is located in the engine compartment on the propeller bulkhead.

1.7 Engine battery voltage

The engine battery voltage (7) supplied to the MCU 3 system by the Trijekt engine control system is displayed. If the Trijekt signal fails, the voltage detected by the operating unit is displayed.

1.8 Fuel content / Fuel menu

The total amount of the fuel present in the fuselage tank and the unused remainder of the additional fuel quantity in the wing fuel tank(s) (optional) entered manually is displayed. If the fuel level falls below 6 litres, this display flashes red.
In addition, this field can be selected with the rotary selector switch to enter the fuel menu. Further explanation regarding the fuel menu can be found on page 7.3.23.
The limit values can be found in the table in chapter 2.5 of this manual.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

2. Display during powerplant operation:

2.5 Warning

The orange warning symbol (5) appears as soon as an error has occurred or a limit value has been exceeded.

2.9 RPM

The engine speed is represented numerically in revolutions per minute with a resolution of 50 rpm and also as a pointer on a colour scale in which the operating ranges are colour coded in accordance with section 2.5. If the corresponding limit values are exceeded, the corresponding warning message appears on the TFT display.
The speed values are transmitted from the Trijekt engine control system to the operating unit.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

2.10 Warning charge control

The warning regarding the charge control appears if the power supply from the generator is insufficient or missing. The remaining running time of the power plant thus depends on the remaining energy of the engine battery. If the engine battery is empty, the engine stops because the engine control unit is no longer supplied with power.

a) The symbol appears statically when the power plant main switch is closed and
   - the ignition is ON and
   - there is no charging voltage at the charge controller (e.g. when the engine is not running)

   In this case, the generator does not supply any energy. All electrical loads in the circuit of the main power plant switch are then supplied only by the engine battery.

b) The symbol disappears, with the main power plant switch closed, if the following occurs
   - Ignition is OFF or
   - a charging voltage is present at the charge controller while the engine is running

   In this case, the battery is charged, if the generator wiring is intact and the generator circuit breaker is closed.

c) The symbol flashes when the ignition is switched on during undervoltage.

Warning:
If the charge control warning lights up during engine operation at speeds in the normal operating range, this is an indication that the generator is not supplying sufficient power to the electrical system.
Due to the high power consumption by the power plant system, only a very short engine running time is possible, depending on the current battery charge level.

If the battery is exhausted, the engine stops!

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

2.11 Warning generator operation

The Ventus-3M has an intelligent supply switch for the redundant supply of electrical energy to the engine system. In the event of a battery failure (main switch power plant tripped), the supply switch shifts to direct power supply via the charge controller / generator while the engine is running. In the event of a malfunction of the charge controller / generator, the supply switch disconnects these components from the power plant system and maintains the power supply via the engine battery until the engine battery is exhausted.

2.12 Power plant extended

The display power plant extended appears statically as soon as the power plant is fully extended and has actuated the limit switch. If the symbol (12) flashes, the power plant is in the extension movement and has not yet reached the limit switch. The limit switch for the retracted power plant is located on the spindle drive.

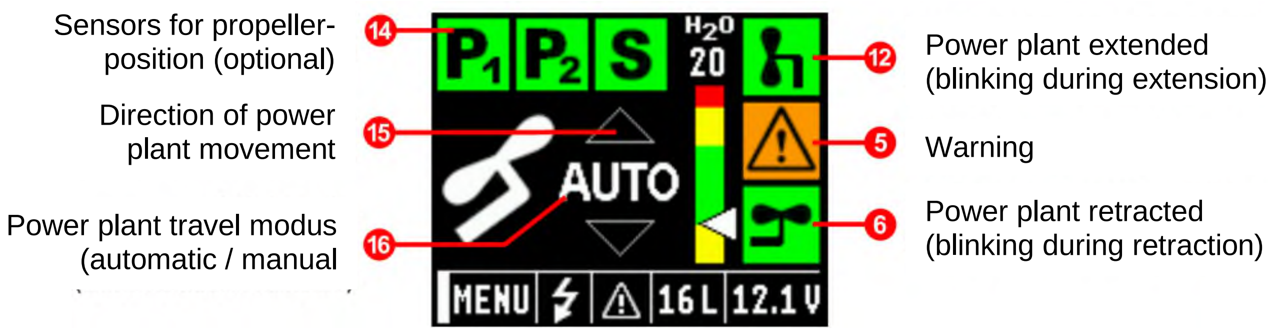
2.13 Warning fuel shut-off valve

If the ignition is switched on while the fuel shut-off valve is closed, a warning message appears on the display with a warning tone. The warning can be confirmed by pressing the rotary selector switch. The symbol (13) remains visible until the fuel shut-off valve is opened. The corresponding limit switch is located at the fuel shut-off valve.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

3. Display during travel operation:



3.6 and 3.12 Power plant retracted/extended

(12) Upper indicator

green indicator flashes ⇨ Power plant is being extended
green indicator lights up ⇨ Power plant fully extended

(6) Lower indicator

green indicator flashes ⇨ Power plant is being retracted
green indicator lights up ⇨ Power plant fully retracted

3.14 Sensors for propeller position

The status of the propeller position sensors (P1 and P2) and the propeller stopper (S) can be displayed here. This display can be activated or deactivated in Menu-> Setting-> Prop. sensors.

3.15 Direction of power plant movement

The filled triangle shows the current direction of movement.

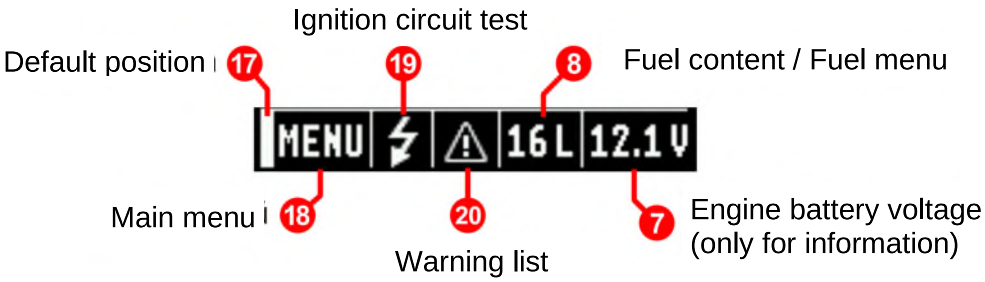
3.16 Power plant travel modus

In normal operation, the power plant is automatically retracted and extended when the ignition switch is actuated. Automatic operation is indicated by the AUTO display. If the Power plant is moved manually, a hand symbol is displayed here.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

4. Screen Menu:



4.7 Engine battery voltage

As described above, the voltage of the engine battery is displayed.

4.8 Fuel content / Fuel menu

As explained above, the entire fuel content is displayed. You can also access the fuel menu here. The limit values can be found in section 2.5. Further details on page 7.3.23.

4.17 Default position

After some time without interaction at the operating unit, the cursor jumps to this default position.

4.18 Main menu

If the cursor is moved to this position with the rotary selector switch and pressed, the main menu is opened. The main menu is described on page 7.3.21.

4.19 Ignition circuit test

Selecting this menu item starts the ignition circuit test function. The MCU3 operating unit no longer has its own switch to test the individual ignition circuits. This can be done in this function via the rotary selector switch. An automatic test and a manual option are available for this purpose. Further details on page 7.3.25.

4.20 Warning list

All error messages are stored in this list and can be displayed again. A list of the possible operating notifications and error messages can be found on page 7.3.30 and on.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

5. Selectable functions in the main menu

The cursor is used to select a function from the screen menu. The selected function is confirmed by pressing the rotary selector switch. Selecting the first field **Back** jumps back one level.

1. Main menu:

The MAIN MENU offers all functions of the screen menu and additionally the **Engine menu**, **Settings** and the **Service menu**.
By turning and then pressing the rotary selector switch, one of the offered functions is selected and started.

1.1 Warning list:

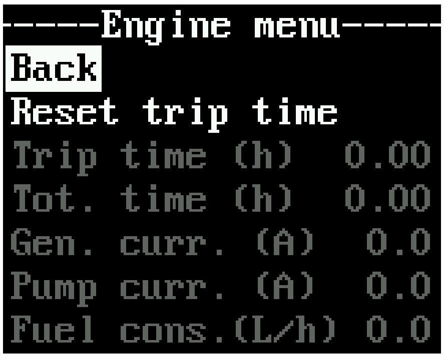
All currently existing error messages are listed chronologically here and can be read in case of doubt. It turned out that the error messages are confirmed quickly in the heat of the moment without having read the message. The sense of this error message is then lost. The messages are displayed repeatedly after some time. Errors are additionally recorded in a log file in the device and can thus be used later for a comprehensive error analysis. The entry in the warning list is made with the corresponding error number, see page 7.3.31 ff.
The entry of the error in the warning list is deleted after it has been selected in the warning list.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

1.2 Engine menu:

In the **Engine menu** the total engine running time of the aircraft can be read (**Tot. time**). There is also a **Trip time** which can be reset manually. To do this, select the **Reset trip time** item in the engine menu using the rotary selector switch and push it. The **Trip time** value jumps back to 0.00 hours.



The additional parameters in the **Engine menu** show the current values of the generator charging current (**Gen. Curr. (A)**), the water pump current (**Pump curr. (A)**) and the current fuel consumption (**Fuel cons.(L/h)**).

I. Power plant operating unit MCU3 BG (cont.)

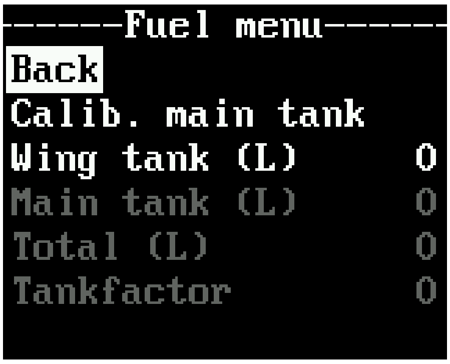
B) Functional description (cont.)

1.3 Fuel content / Fuel menu:

Important note:

Prerequisites for making settings in the tank menu:

- Completely filled fuselage tank
- Ignition OFF
- Power plant completely retracted (retracted limit switch actuated)



Calib. main tank:

If the correct number of litres is not displayed despite the fuel tank being completely filled, the fuel measurement may be to recalibrated. To do this, the fuel tank must be completely filled.
With the function **Calib. Main tank** in the **Fuel menu** the calibration can be carried out. Select the function with the rotary selector switch and press to select.
If a calibration has been carried out successfully, a new value is entered for Tankfactor. The calibration is now complete. After a few moments, the fuel content is corrected to the target value.
If the calibration was not successful, the error message **Tank calib. failed** appears. The previous **Tankfactor** value is still used. The cause of the error can be an incompletely filled tank, a too high alcohol content in the fuel or sloshing of the fuselage tank contents during the calibration procedure.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

1.3 Fuel content / Fuel menu (cont.):

Wing tank (L):

Up to 2 wing fuel tanks can be installed in the Ventus-3M optionally. No fuel level sensors are installed in the wing fuel tanks. Therefore, the total amount of fuel filled into the wing tanks must be entered in the **Fuel menu** under **Wing tank (L)** in whole litres to display the correct amount of fuel. The system adds the fuselage tank capacity to fuel content in the wing tank and displays the total amount of fuel.
The prerequisite for entering the fuel content in wing tanks is a displayed fuel quantity of 13 L in the fuselage fuel tank (fuselage tank full). The **Wing tank** menu item is shown in white. If there is less fuel in the fuselage fuel tank, the operating unit does not accept an input for the contents of the wing fuel tanks (safety measure). The menu item **Wing tank (L)** is displayed in grey and cannot be selected.

The entry is made by selecting the function with the rotary selector switch. By pressing down the rotary selector switch and simultaneously turning it, the value for the wing tank to the right of **Wing tank (L)** is changed.

The displayed fuel content and its decrease are calculated on the basis of the current fuel consumption. (This applies if the value entered for the fuel content in the wing fuel tanks is greater than zero and the amount of fuel in the fuselage tanks hasn’t dropped below the reserve volume).

If the amount of fuel in the fuselage tank has dropped below the reserve volume, then only the measured content of the fuselage fuel tank is displayed and the manually entered value for the fuel quantity in the wing fuel tanks is deleted.

As long as the reserve volume of the fuselage fuel tank is not reached, the manually entered value for the fuel content in the wing fuel tanks is stored by the operating unit and remains stored even after the main switch is switched off.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

1.4 Ignition circuit test:

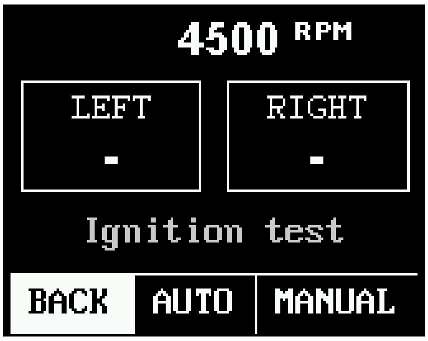
The MCU3 operating unit doesn’t have a separate switch to switch off the individual ignition circuits in order to check the function of the individual ignition coils and spark plugs. The operating unit offers two possibilities to perform this important test with the rotary selector switch, either

- by selecting the ignition circuit test  symbol on the screen menu
- or by selecting **Ignition test** from the main menu.

First of all:

o Warm up the engine (CHT approx. 40°C)
o Set engine speed to approx. 3000 RPM

The automatic test "AUTO" carries out the test independently and displays the speed differences numerically. To do this, select and confirm the **AUTO** function.



The engine’s speed may drop by max. 300 RPM when switched to left or right ignition circuit (**LEFT** / **RIGHT**).
After completion of the test and switching back to both ignition circuits, the speed must increase again to the original value.

The test can be aborted by pressing the rotary selector switch, but the test only takes about 10 seconds.
A green progress bar from left to right indicates the progress.
With **BACK** you can leave this function.

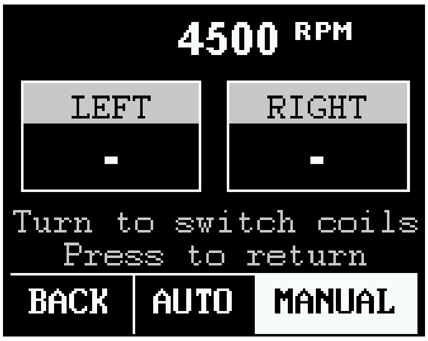
I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

1.4 Ignition circuit test (cont):

The manual test is similar:

- o Warm up motor (CHT approx. 40°C)
- o Set engine’s speed to approx. 3000 rpm



Select **MANUAL** and switch off the left ignition circuit by turning the rotary selector switch one position to the left and select **LEFT**.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

1.4 Ignition circuit test (cont):

A turn to the right by one position then switches on both ignition circuits again, a further position to the right switches off the right ignition circuit. One position back to the left switches on both ignition circuits again. The change in the engine's speed is automatically recorded and displayed.

The measurement is terminated by pressing the rotary selector switch and the ignition circuit test menu is exited with **BACK**.

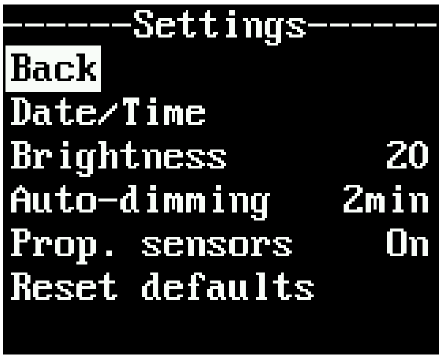
I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

1.5 Settings:

The Settings menu offers the possibility to adjust some settings of the MCU3 operating unit. Changing values always follows the same pattern:

- The value is selected with the rotary selector switch,
- Press down the rotary selector switch and turn it in the pressed state
- Turn clockwise to increase a value, turn counterclockwise to decrease it



- **Date/Time** is used to set the battery-buffered real-time clock.
- **Brightness** is used to adjust the brightness
- **Auto-dimming** sets the time after which the display goes into energy-saving mode and darkens slightly. As soon as a switch or the rotary selector switch is operated, the display lights up again with full intensity.
- **Prop. Sensors** on/off switches the symbols P1, P2, S on or off on the travel screen.
- **Reset defaults** restores the basic device settings of these settings.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

1.6 Service menu:

The **Service menu** is mainly available for diagnosis and maintenance of the system.

- With **Com diagnose,** the status of the various inputs and outputs and switch queries is displayed.
- **Analog meas.** shows the input voltage, the voltage of the internal battery, the raw value of the temperature sensor and the CPU temperature.
- **Boot menu** is a menu for firmware updates and service settings that may only be performed by qualified personnel.
  In the **Boot Menu** you can also download the log file of the operating unit:

  1. Retract power plant completely (limit switch must be actuated)
  2. Insert the Micro SD card into the operating unit.
  3. Select **Service menu ➔ Boot menu ➔ Save BG logfile**

  The logfile can only be evaluated by the manufacturer.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

6. Operating notifications

Operating notification should inform the pilot:

- if individual steps in the process flow of an operation were not executed or not completely executed, and

- if corrective measures have to be taken by the pilot to safely finish the current process

For these reasons, the operating notifications are sometimes combined with warning alerts to draw the pilot's attention to the display.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

6. Operating notifications (cont.)

Number	**INFO_FEHLERTANKKALIBRIERUNG (15)**
Display	**Tank calib. failed**
Description	After triggering a tank calibration: More than 30% deviation from reference value. The calibration is discarded and the previous calibration is retained.
Text	Fuel tank calibration failed. Fill tank completely and restart calibration!
Short Text	Tank calib. failed

Number	**INFO_EINAUSFAHR_BLOCKIERUNG (16)**
Display	**Engine move paused**
Description	When the unit is turned on or the emergency mode is exited, a switch status is found that the spindle drive would immediately start moving (i.e. ignition is on when the power plant is retracted, or ignition is off when the power plant is extended, or manual operation switch is pressed). However, the immediate start is prevented for safety reasons. To start the spindle drive, the corresponding switch must first be released and reset. (e.g. ignition off-on or on-off.)
Text	Engine movement paused. Switch ignition off and back on or vice versa!
Short Text	Engine move paused

Number	**INFO_STARTER_BLOCKIERUNG (17)**
Display	**Engine start blocked**
Description	*Case 1:* On turning on the operating unit, the ignition is ON, the power plant is fully extended and the starter button is pressed so that the engine would start immediately. However, immediate engine start is prevented for safety reasons. To start the engine, the starter button must first be released and reset. *Case 2:* On turning on the operating unit, the ignition is OFF, the Power plant is fully extended and the propeller is not in the retract position, so it cannot be retracted. However, the engine starter would be released in this state despite the ignition being deactivated to enable propeller positioning. However, an engine start is prevented for safety reasons. To start the engine, the ignition must first be switched ON and OFF again. Remedy in both cases: Release starter button, ignition OFF/ON.
Text	Engine start blocked. Release start button, switch ignition off and back on or vice versa!
Short Text	Engine start blocked

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

6. Operating notifications (cont.)

Number	**INFO_HANDBETRIEB (19)**
Display	**Manual engine move**
Description	Automatic spindle travel is not possible for various reasons. Spindle travel is only possible via manual operation.
Text	Automatic Power plant movement disabled. Manual operation required!
Short text	Manual engine move

Number	**INFO_DREHZAHL_HOCH (25)**
Display	**RPM too high**
Description	The propeller speed is in the red range. This can normally only occur during a dive, as the engine power is automatically throttled before reaching the red range.
Text	Engine RPM too high. Reduce flight speed.
Short text	RPM too high

Nummer	**HINWEIS_PROPELLER_AUSFAHREN (30)**
Display	**Extend engine**
Description	Attempt to start engine with power plant not fully extended. Engine start is prevented.
Text	Extend Power plant before starting!
Short text	Extend engine

Number	**HINWEIS_ZUENDUNG_EINSCHALTEN (31)**
Display	**Switch on ignition**
Description	Attempt to start engine with power plant extended but ignition switched off.
Text	Switch on ignition before starting!
Short text	Switch on ignition

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

6. Operating notifications (cont.)

Number	**HINWEIS_ZUENDUNG_AUSSCHALTEN (32)**
Display	**Switch off ignition**
Description	Manual retraction attempt with ignition switched on. Retraction is prevented. To retract, the ignition must first be switched off.
Text	Switch off ignition before retracting Power plant!
Short text	Switch off ignition

Number	**HINWEIS_HOHE_DREHZAHL (33)**
Display	**RPM too high to retract engine.**
Description	Manual retraction attempt at too high engine speed. Retraction is prevented.
Text	RPM too high to retract engine.
Short text	RPM too high to retract engine.

Number	**HINWEIS_SPINDELSICHERUNG_AUSGELOEST (34)**
Display	**Spindle fuse triggered**
Description	Manual/automatic spindle travel attempt with spindle drive fuse triggered.
Text	Spindle fuse triggered. Engine movement not possible.
Short text	Spindle fuse triggered

Number	**HINWEIS_NOTBETRIEB_AKTIV (35)**
Display	**Emergency mode active**
Description	Emergency system is active (emergency switch flap open) and the desired operation is not possible when emergency system activated. (Pilot tries to move the Power plant via ignition or manual extension/retraction switch. The spindle control is not possible because the emergency switch is open).
Text	Operation not possible during emergency mode.
Short text	Emergency mode active

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

6. Operating notifications (cont.)

Number	**HINWEIS_BENZINHAHN_OEFFNEN (36)**
Display	**Open fuel valve**
Description	The Power plant is being extended or is extended, but the fuel shut-off valve is still closed. This condition does not prevent the engine from starting. This message is deleted automatically as soon as the fuel shut off-valve is opened.
Text	
Short text	Open fuel valve

Number	**HINWEIS_TANK_RESERVE (38)**
Display	**Low fuel level**
Description	The tank capacity falls below a type-dependent threshold (approx. 6L). This message is repeated every 4min while the engine is running, otherwise every 20min.
Text	Low fuel tank level. Limited engine operation time.
Short text	Low fuel level

Number	**HINWEIS_BATTERIESPANNUNG (39)**
Display	**Bat. volt. low/high**
Description	The battery voltage is outside the permissible range (<11.5V or too high). This may limit the motor running time. This message is repeated at different intervals depending on the battery status.
Text	Battery voltage out of range. Limited engine operation time.
Short text	Bat. volt. low/high

Number	**HINWEIS_WASSERTEMP_HOCH (40)**
Display	**Water temp. high**
Description	The cooling water temperature is above its limits.
Text	High cooling water temperature. Reduce engine speed or cool engine.
Short text	Water temp. high

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

6. Operating notifications (cont.)

Number	**HINWEIS_GENERATORBETRIEB (41)**
Display	**Battery malfunction**
Description	The supply switch has switched to generator operation, i.e. the battery supply of at least one of the monitored lines has failed. This can have different consequences depending on the failed device. After stopping the engine, the power supply for the ignition and/or the spindle drive may no longer be available. Restarting or retracting the Power plant is no longer possible in this case.
Text	Battery supply malfunction. Engine restart and retraction may be impossible.
Short text	Battery malfunction

Number	**HINWEIS_DAUER_GELBEDREHZAHL (42)**
Display	**RPM yellow > 5min**
Description	The yellow speed range has been exceeded for more than 5min.
Text	Engine RPM too high. Reduce RPM to green range.
Short text	RPM yellow > 5min

Number	**HINWEIS_MOTOR_GANZAUSGEFAHREN (43)**
Display	**Motor fully extended?**
Description	The automatic extension process presumes a defect at the extension limit switch. Reliable detection of the extended position is therefore no longer possible. After confirmation of this message, the engine start is enabled without the signal of the extension limit switch ("error operation"). Before starting the engine, the pilot must ensure that the Power plant is fully extended.
Text	Engine start enabled. Extended manually before starting.
Short text	Motor fully extended?

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7. Error messages

Error messages should inform the pilot:

- if electrically operated components and sensors required for safe operation of the power plant have failed.

- if corrective measures have to be taken by the pilot to end the unsafe condition in flight. The cause of the fault must be determined and eliminated before the next power plant operation!

- if the pilot is required to pay increased attention to the operation of the power plant due to the fault.

For these reasons, error messages are always associated with warning displays to draw the pilot's attention to the display.

The error messages are divided into:

- Tripped fuse of an electrical circuit (FUSE)
- Limit switch malfunction (SWITCH)
- Device failure or error (ERROR)

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.1 Error Messages – Tripped fuse of an electrical circuit (FUSE):

Number	**FEHLER_SCHALTER_AUSGEFAHREN (50)**
Display	**Extend sw. malfunc.**
Description	*Case 1:* When extending the power plant, the extension limit switch is not detected even after the longest extension period to be assumed. *Case 2:* When the power plant is extended, the spindle drive fuse triggers, which indicates a mechanical stop of the spindle. drive In both cases, the extension limit switch is subsequently assumed to be defective. The extended position can therefore no longer be detected automatically.
Text	Extend end switch not detected. Engine position unknown.
Short text	Extend sw. malfunc.

Number	**FEHLER_SCHALTER_EINGEFAHREN (51)**
Display	**Retract sw. malfunc.**
Description	Retract limit switch defective, see FEHLER_SCHALTER_AUSGEFAHREN
Text	Retract end switch not detected. Engine position unknown.
Short text	Retract sw. malfunc.

Number	**FEHLER_MAIN_FUSE (52)**
Display	**Main fuse trig.**
Description	No voltage at the power supply input, probably because the external main fuse for the power plant (Master-switch power plant) has tripped. The fuse must be reset by the pilot. This error cannot occur in the current hardware version because the SG has no redundant power supply.
Text	Main fuse triggered. Reset main fuse!
Short text	Main fuse trig.

Number	**FEHLER_SPINDLE_FUSE (53)**
Display	**Spindle fuse trig.**
Description	No voltage at spindle drive supply input, probably because the external spindle fuse has tripped. The fuse must be reset by the pilot. This message is not repeated after confirmation, and is automatically cleared when the spindle drive power supply is restored.
Text	Spindel fuse triggered. Reset spindle fuse!
Short text	Spindle fuse trig.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.2 Error Messages – Limit switch malfunction (SWITCH):

Number	**FEHLER_WATERPUMP_FUSE (54)**
Display	**Waterpump fuse trig.**
Description	The internal fuse for the water pump has tripped (self-resetting). The fuse is automatically reset if possible. No action by the pilot is necessary.
Text	Cool water pump fuse triggered. Overheat possible. Limited engine operation time.
Short text	Waterpump fuse trig.

Number	**FEHLER_RPM_FUSE (56)**
Display	**Pos. sensor malfunc.**
Description	The internal fuse for position and speed sensors has tripped (self-resetting). The fuse is automatically reset if possible. No action of the pilot is necessary. Without functional position sensors neither the automatic propeller stop nor an automatic spindle drive movement is possible.
Text	Position sensors malfunction. Automatic propstop and Power plant extend/retract disabled.
Short text	Pos. sensor malfunc.

Number	**FEHLER_BEIDE_ENDSCHALTER (57)**
Display	**Endswitch malfunc.**
Description	Both spindle limit switches are simultaneously detected as closed. This state cannot occur normally and therefore indicates at least one defective limit switch. The automatic drive extension/retraction process is deactivated in sequence. The power plant can only be retracted and extended manually.
Text	Endswitch malfunction. Manual power plant drive required.
Short text	Endswitch malfunc.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.3 Error Messages – Device failure or error (ERROR)

Number	**FEHLER_WASSERPUMPE (60)**
Display	**Cool pump malfunc.**
Description	Power supply or wiring to the cooling water pump is interrupted. Detected when switched off due to lack of voltage at the low-side switch.
Text	Cooling pump malfunction. Engine overheat possible. Limited Engine operation time.
Short text	Cool pump malfunc.

Number	**FEHLER_WASSERPUMPE_STROM (61)**
Display	**Cooling malfunction**
Description	Current consumption of the water pump too high or too low. Possible causes: Pump sucks air, pump is blocked, water pipe is blocked or broken, water level is too low.
Text	Engine cooling malfunction. Overheat possible. Limited engine operation time.
Short text	Cooling malfunction

Number	**FEHLER_SERVO (62)**
Display	**Prop. brake malfunc.**
Description	The servo motor for the propeller brake has failed. Possible causes are e.g.: short circuit in the H-bridge, interruption of the power supply or the supply line.
Text	Propeller brake malfunction. Manual break operation required.
Short text	Prop. brake malfunc.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.3 Error Messages – Device failure or error (ERROR) (cont.)

Number	**FEHLER_NOTBETRIEB (64)**
Display	**Emerg. mode activated**
Description	Emergency system has been activated (protective cover of the external emergency switch opened). This message is displayed once when emergency system is activated (with confirmation). The purpose of the display is to prevent unintentional activation of emergency system, which would prevent normal operation of the operating unit.
Text	Emergency mode activated. Normal operation disabled.
Short text	Emerg. mode activated

Number	**FEHLER_POSITION1SENSOR (66)**
Display	**Prop. sensor malfunc.**
Description	Propeller position sensor 1 has failed (no signal). Automatic retraction is not possible, unit switches to manual operation. The pilot must bring the propeller with the manual brake into the retraction position and retract the power plant with the manual retraction switch.
Text	Propeller sensor malfunction. Manual propeller break and retract required.
Short text	Prop. sens. malfunc.

Number	**FEHLER_POSITION2SENSOR (67)**
Display	**Prop. sensor malfunc.**
Description	Propeller position sensor 2 failed (no signal). See FEHLER_POSITION1SENSOR
Text	Propeller sensor malfunction. Propeller position unknown.
Short text	Prop. sensor malfunc.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.3 Error Messages – Device failure or error (ERROR) (cont.)

Number	**FEHLER_LADESTROM (68)**
Display	**Battery discharge**
Description	The battery is discharged unusually quickly (measured by decrease of battery voltage). This indicates a defective generator/charge regulator or a tripped generator fuse. Possibly the pilot can close a triggered generator fuse again.
Text	Unusual battery discharge. Limited engine operation time.
Short text	Battery discharge

Number	**FEHLER_LOW_CURRENT (69)**
Display	**Low generator curr.**
Description	The generator output current is too low to supply all consumers; therefore the battery is discharged even during engine operation, which limits the remaining flight time. This indicates a generator failure.
Text	Low generator current. Limited Engine operation time.
Short text	Low generator curr.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.3 Error Messages – Device failure or error (ERROR) (cont.)

Number	**FEHLER_CAN (73)**
Display	**Engine malfunc.**
Description	No reception at the CAN bus of the Trijekt engine control unit for >0.5 sec. This indicates a defect in the Trijekt engine control unit, a triggered Trijekt fuse or a wiring defect in the CAN bus. If there is a wiring defect or the Trijekt-fuse tripped, the engine might still run. Engine operation is not possible with a Triject-defect.
Text	Engine control malfunction (CAN).
Short text	Engine malfunc.

Number	**FEHLER_MOTORSENSOR (75)**
Display	**Engine malfunc. (75)**
Description	Error signal from the Trijekt Engine control unit: Crankshaft sensor defective. No engine operation possible.
Text	Engine malfunction (75): Crankshaft sensor failure
Short text	Engine malfunc. (75)

Number	**FEHLER_LUFTDRUCK_INTERN (77)**
Display	**Engine malfunc. (77)**
Description	Error signal from Trijekt Engine control unit: mixture regulation. Engine start and operation may no longer be possible.
Text	Engine malfunction (77): Air mix regulation
Short text	Engine malfunc. (77)

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.3 Error Messages – Device failure or error (ERROR) (cont.)

Number	**FEHLER_GASPOTENTIOMETER (78)**
Display	**Throttle malfunc.**
Description	Error signal from the Triject-engine control unit: Wiring to gas potentiometer or potentiometer defective. To be on the safe side, the engine control unit assumes full throttle operation to avoid a possible loss of power in a critical flight segment. This also leads to reduced performance in partial load operation. An engine start in this condition is typically not possible. Full throttle should be used to avoid engine failure while the engine is running!
Text	Throttle valve malfunction. Motor start not possible. Apply full throttle!
Short text	Throttle malfunc.

Warning:
If THROTTLE malfunc. Is displayed during critical flight segments apply full throttle immediately!

Number	**FEHLER_SW_CRC (81)**
Display	**SG prog. corrupt**
Description	The program memory of the power plant control unit is damaged. The program is stopped permanently for safety reasons. The power plant control unit must be regarded as a total loss. The operating unit will not be operable. Use emergency system.
Text	SG program corruption. All operations disabled. Use emergency system!
Short text	SG prog. corrupt

Number	**FEHLER_BG_SENDET_NICHT (82)**
Display	**Com malfunc.**
Description	The data transmission from the power plant control unit to the operating unit is disturbed. This indicates a wiring defect. As long as the disturbance persists, the operating unit is not operable. Use emergency system.
Text	Communication malfunction. All operations disabled. Use emergency system!
Short text	Com malfunc.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.3 Error Messages – Device failure or error (ERROR) (cont.)

Number	**FEHLER_PROPSTOPPER_BLOCKIERT_STARTER (83)**
Display	**Propstop in place**
Description	The engine is to be started, but the propeller stopper is still extended. The engine start is therefore blocked to prevent damage to the propeller stopper. After confirmation of the message the blocking is suspended, i.e. the engine can be started even if the propeller stopper is extended, even if this may destroy the propeller stopper.
Text	Propellerstopper still in place. Acknowledge to start anyway!
Short text	Propstop in place

Number	**FEHLER_PROPSTOPPERSCHALTER (84)**
Display	**Propstop malfunc.**
Description	Malfunction of the propeller stopper limit switch or the propeller stopper servo. Automatic retraction is also possible without propeller stopper.
Text	Propellerstopper malfunction.
Short text	Propstop malfunc.

Number	**FEHLER_PROPSTOPPERSERVO (85)**
Display	**Propstop malfunc.**
Description	The servo of the propeller stopper has failed. Possible causes: Short-circuit in the power section (H-bridge), power supply interrupted, wiring interrupted. Automatic retraction is also possible without propeller stopper.
Text	Propellerstopper malfunction.
Short text	Propstop malfunc.

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

7.3 Error Messages – Device failure or error (ERROR) (cont.)

Number	**FEHLER_COMSUPPLYSWITCH (86)**
Display	**Supply sw. com malfunc.**
Description	The data transmission from the supply-switch to the power plant control unit is interrupted. This indicates a wiring interruption/removal or a defect in the supply switch. No effects are to be expected in the event of removal or wiring interruption. In the event of a defect, engine operation may not be possible or only limited engine operation may be possible.
Text	Supply-switch communication malfunction. Engine operation may be restricted.
Short text	Supply sw. com malfunc.

Number	**FEHLER_SUPPLYSWITCH (87)**
Display	**Supply sw. malfunc.**
Description	Internal error in the supply switch. Engine operation may not be possible or only limited engine operation is possible.
Text	Supply switch malfunction. Engine operation may be restricted.
Short text	Supply sw. malfunc.

Number	**MCU3_BG_ERROR_SG_OFFLINE (201)**
Display	**Com malfunc.**
Description	The data transmission from the power plant control unit to the operating unit is disturbed. This indicates a defective wiring or a defective control unit. Since there is no information on the cooling water temperature, overheating of the engine cannot be ruled out. As long as the fault persists, operation on the operating unit is not operable. Use emergency system.
Text	Communication malfunction. Engine overheat possible. All operations disabled. Use emergency mode!
Short text	Com malfunc.

Number	**MCU3_BG_ERROR_FIRMWARE (202)**
Display	**BG prog. corrupt**
Description	The program memory of the power plant operating unit is damaged. The program is stopped permanently for safety reasons. No operation is possible on the operating unit. Use emergency system. This problem can possibly be solved by updating the operating unit in the boot menu.
Text	BG program corruption. All operations disabled. Use emergency mode!
Short text	BG prog. corrupt

I. Power plant operating unit MCU3 BG (cont.)

B) Functional description (cont.)

8. Information on the hardware and firmware of the devices

The hardware and software versions as well as the serial number can be retrieved in the menu item **System information**:

Menu->Service menu->System information

The system information is displayed, for example, as follows:

Type	MCU3-BG	*Type Operating unit*
Serial	19/0018	*Serial number Year/continuous number*
HW version	2.1.0	*Hardware version*
HW options		*Hardware options, none here*
SW version	2.1.7	*Software version*
SW options		*Software options, none here*
SW date	Jan 15 2019	*Creation date of the software, here 15.1.2019*
BL version	2.1.7	*Bootloader version*
BL date	Jan 15 2019	*Creation date of the bootloader, here 15.1.2019*
--------------SG------------------		*Separation line for Control unit information*
Serial	19/1	*Control unit serial number*
HW version	01.08	*Hardware version of the control unit*
SW version	x17	*Software version of the control unit*
------Supply Switch-----------		*Separation line for information Supply Switch*
HW version	4	*Hardware version*
SW version	5	*Software version*

VI Emergency system for the spindle drive

If the power plant control unit fails or the operating unit in the instrument panel no longer responds to the pilot's inputs, the power plant can be extended and retracted using a separate emergency system.

The emergency system is located on the fuse panel below the folding instrument panel. It consists of a red switch flap which covers the actual emergency switch (rocker switch) of the emergency system.

To extend and retract the engine with the emergency system, at least the following main switches and fuses of the electrical system must be switched on:

- Power plant main switch **MAIN/SW Power plant**
- Circuit breaker spindle drive **Spindel drive**
- Fuse emergency system **Emergency System**

The emergency system is already activated when the red switch flap is folded up (operating notification Emergency mode activated in the operating unit). The emergency switch, which controls the spindle drive for the movement of the power plant, is then accessible under the red switch flap:

Toggle switch UP	⇨	Power plant extends
Toggle switch NEUTRAL	⇨	No power plant movement
Toggle switch DOWN	⇨	Power plant retracts

When the power plant is extended or retracted with the emergency switch, the travel of the spindle drive is no longer limited by the limit switches. Therefore, it is necessary to estimate visually (rear-view mirror!) whether the end position of the spindle drive has been reached during extension. The end position is indicated during extension and retraction at the latest by the release of the automatic circuit breaker of the spindle drive **Spindle drive** in the cockpit.

VI <u>Emergency system for the spindle drive</u> (cont.)

a) Extending and starting the power plant with the emergency system:

- Open red switch flap
- Acknowledge the operating instructions

on the operating unit by pressing the rotary selector switch to confirm the warning message.

- Extend the powerplant <u>completely</u> with the emergency switch.
- To start the engine: Ignition ON, Press starter button

b) Switching off and retracting the power plant with the emergency system:

- Ignition OFF
- Open red switch flap
- Acknowledge the operating instructions

on the operating unit by pressing the rotary selector switch to confirm the warning message.

- Stop the propeller with the manual propeller brake (handle left front in the cockpit, see section 7.2).
- By varying the manual force on the handle of the propeller brake, the air stream can be used to center the propeller as precisely as possible in the retraction position and hold it there (the control unit shows  in the retraction position of the propeller
- Retract the power plant with the emergency switch.

  If it is not possible to hold the propeller exactly in the retraction position, the power plant can still be retracted to a large extent. In order to prevent damage to the aircraft, the retraction should be stopped as soon as the propeller can be heard touching the engine covers.

VI Emergency system for the spindle drive (cont.)

Warning:

Operation with the emergency system should be limited to emergency situations. If the red switch flap is folded upwards, all security checks of the power plant control system are switched off, in contrast to operation with the manual control switch. The following applies to the operation with the emergency system:

- The electric starter motor can be operated in any position of the power plant and even if the engine is running!
- The power plant can be extended and retracted with the emergency switch even if the engine is running and regardless of the speed or position of the propeller!
- Due to the vibrations during flight with idle power setting a regular readjustment of the spindle drive is to prevent creeping retraction of the powerplant. This function is performed automatically by the powerplant control system during normal operation.
  When operating with the emergency system, this tracking function is not applicable!

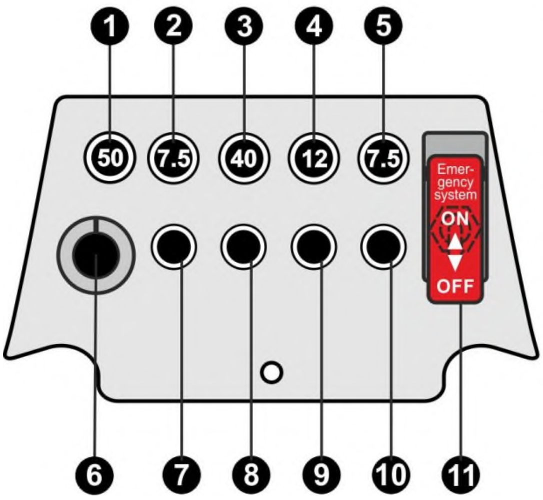
Note:

If the circuit breaker for the power plant control system is still closed during operation with the emergency system and the TFT display of the operating unit is working, the following displays will be visible:

- When the red switch flap is opened, the TFT display shows the corresponding warning message. This message can be switched off by pressing the MENU button. Then the operating unit displays all functional systems for monitoring the power plant.

- If the limit switches for the power plant are still functional, they are detected, and the reaching of the limit positions is indicated by the position indicator in the operating unit.

VII Fuse panel (In the fixed lower part of the instrument panel)



1	Master switch Power plant - 50A	MAIN/SW Power plant
2	Master switch Avionic - 7.5A	MAIN/SW Avionic
3	Generator fuse - 40A	Generator
4	Spindel drive fuse - 12A	Spindel drive
5	Powerplant system fuse - 7.5A	Power Plant syst.
6	Battery selector switch	
7	Trijekt fuse - 7.5A	Trijekt
8	Fuel pump fuse - 7.5A	Fuel-pump
9	Relay fuse - 7.5A	Relay
10	Fuse Avionic Batt E - 6.3A	Avionic E
11	Emergency system	

All master switches and fuses of the most important circuits of the motor glider are located in the upper row and are designed as automatic circuit breakers which can be opened and closed manually.
Electrical circuits, which only have to be electrically protected in case of a electrical defect, are located in the lower row and are equipped with a manually resettable fuse.

1 Master switch Power plant
(Circuit breaker 50 A)

MAIN/SW Power plant

The master switch power plant interrupts the power supply via the engine battery (Batt E).

> **Caution:**
> If the power plant master switch is opened, the power plant system is supplied by the generator via the supply switch.

2 Master switch Avionic
(Circuit breaker 7.5 A)

MAIN/SW Avionic

The master switch avionic disconnects the instrument power supply when operating from the avionic batteries (Batt 1/2/F).

Alternatively, the avionic power supply can be switched to the engine battery by the battery selector switch.
If the avionic is powered by the engine battery, the master switch power plant (1) and the master switch avionic (2) must be opened to switch off the avionic.

VII Fuse panel (cont.)

3 Generator fuse
(Circuit breaker 40 A)

Generator

During engine operation, the generator only charges the engine battery (Batt E). Battery charging is interrupted when the fuse is tripped.

> **Warning:**
> When the generator fuse is tripped, the power plant and the engine control system are only supplied with energy via the engine battery (Batt E). If the battery is exhausted, the engine will stop!

4 Spindel drive fuse
(Circuit breaker 12 A)

Spindel drive

Protection of the spindle drive for extend and retract the power plant.

5 Powerplant control system fuse
(Circuit breaker 7.5 A)

Power Plant syst.

Protection of the operating and control unit for the power plant control (without starter motor).

The following loads are individually protected by self-resetting fuses within the control unit:

- cooling water pump
- engine speed sensor and both proximity switches for propeller vertical position
- brake servo
- servo for propeller stopper

6 Battery selector switch

Rotary switch for switching the avionic power supply to different batteries (option)

- Batt 1 = avionic battery 1
- Batt 2 = avionic battery 2
- Batt E = powerplant battery
- Batt F = additional avionic battery in the fin

VII Fuse panel (cont.)

7 Trijekt fuse
(fuse 7.5 A)

Trijekt

Protection of the engine control system ("Trijekt") including the sensors for the speed, the position of the throttle valves, the cooling water temperature, the air pressure and the air temperature.

8 Fuel pump fuse
(fuse 7.5 A)

Fuel-pump

Protection of the fuel pump of the engine control system and of the built-in refuelling pump

9 Relay fuse
(fuse 7.5 A)

Relay

Protection of relays for ignition

10 Fuse for avionic when switched to battery E

Avionic E

(Fuse 6.3 A)

Separate protection of the avionic in case of power supply via the engine battery

7.4 Undercarriage

The Ventus-3M has a retractable main wheel with hydraulic disc brake and a steerable or rigid (optional) tail wheel.

The extension/retraction process is described on page 7.2.3.

For technical descriptions of the retractable landing gear system with wheel brake - see section 1 in the Ventus-3M Maintenance Manual.

7.5 Seat and restraint systems

The seat pan is bolted to the mounting flanges provided on both sides of the cockpit. The seat features a backrest with integrated headrest that is adjustable during flight. The lap straps are anchored to the seat pan. The shoulder straps are attached to the front main bulkhead of the fuselage steel frame.

Permitted seat belts - see section 7 in the Ventus-3M Maintenance Manual.

7.6 Static pressure and Pitot pressure system

7.6.1 Static pressure sources

- o Static pressure ports are on either sid of the fuselage tail boom, approx. 0.8 m / 30 ½ in front of the base of the fin

These pressure ports are determined for altimeter and airspeed indicator and are optionally also suitable for other devices.

7.6.2 Pitot pressure sources

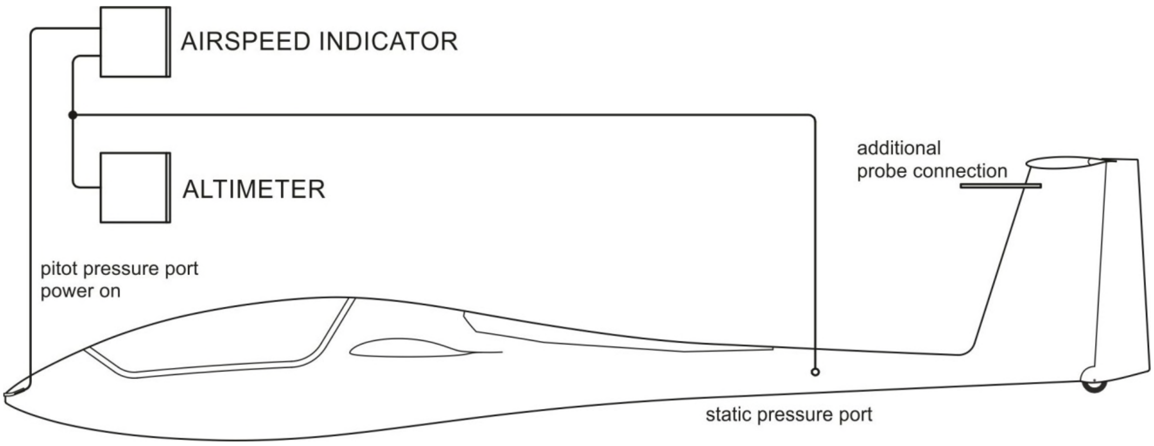
- o At the nose of the aircraft

This pressure port is determined for the airspeed indicator and also optionally for other devices.

7.6.3 Additional pressure source

- o At the fin

This pressure probe features up to 3 pressure connections for further optional devices.



7.7 Airbrake system

Triple panel Schempp-Hirth type airbrakes are employed on the upper surface of the wings. They open smoothly and are very effective, the change in trim is just noticeable.

When unlocked, the airbrakes might get slightly sucked out by their spring loaded cover strips, which, in this position, may then oscillate within their travel, causing some rattling and/or banging.

This is immediately stopped by further extending or retracting the airbrakes.
The control of the glider is not affected.

A view of the airbrake system can be found in the maintenance manual.

7.8 Baggage compartment

Although an enclosed baggage compartment is not provided, soft objects (like jackets etc.) may be placed on the removable panel (covering the control linkage) behind the main spar stubs. Such baggage must be taken into account when determining the permissible load on the seat.
Maximum mass of the baggage compartment is 2kg (4.4 lb).

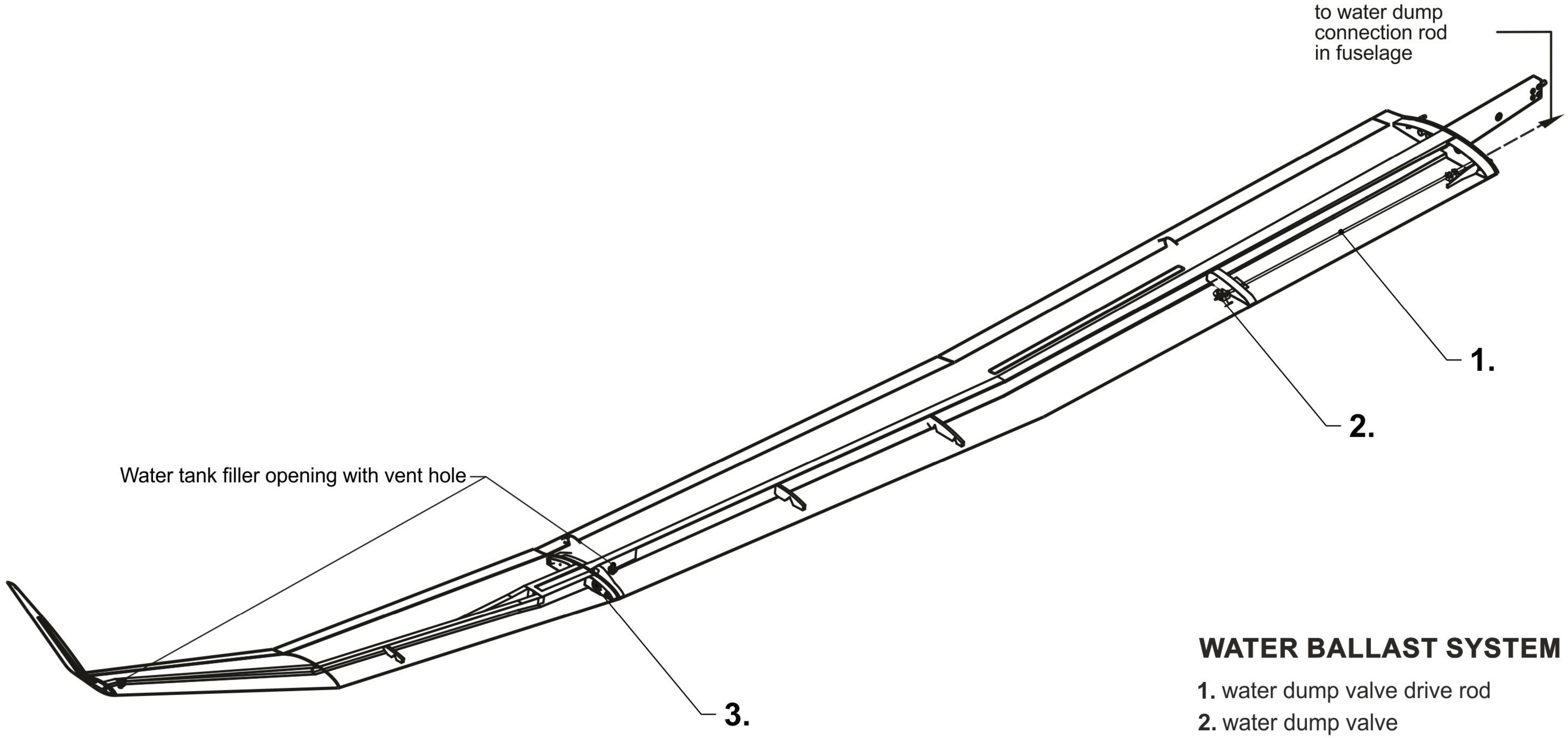
The head rest obstructs a great part of the access opening.

7.9 Water ballast system(s)

The operating knob in the cockpit actuates the wing tanks and the fin tank (option). The fin tank dump valve is driven by a steel cable connected to the torsion drive for the wing tanks, see page 7.9.3 and page 7.9.4.
The torsion drive of the wing tanks is operated via a push rod, see page 7.9.3. For serial numbers V3M 021 and V3M 031, the torsion drive is actuated via a cable drive.
The water ballast is dumped through an opening on each side of the lower wing surface. The opening is located at half wing span of approx. 1.8 m, see page 7.9.2.

The torsion drive for the wing dump valves is automatically connected during wing assembly. The operating knob in the cockpit must be in the "CLOSED" position and the torsional drive at the root rib must be in rigging position.
The operating knob runs in a gate and can be locked in its respective end positions.

Information on flying with water ballast and handling - see page 4.5.9.1ff.

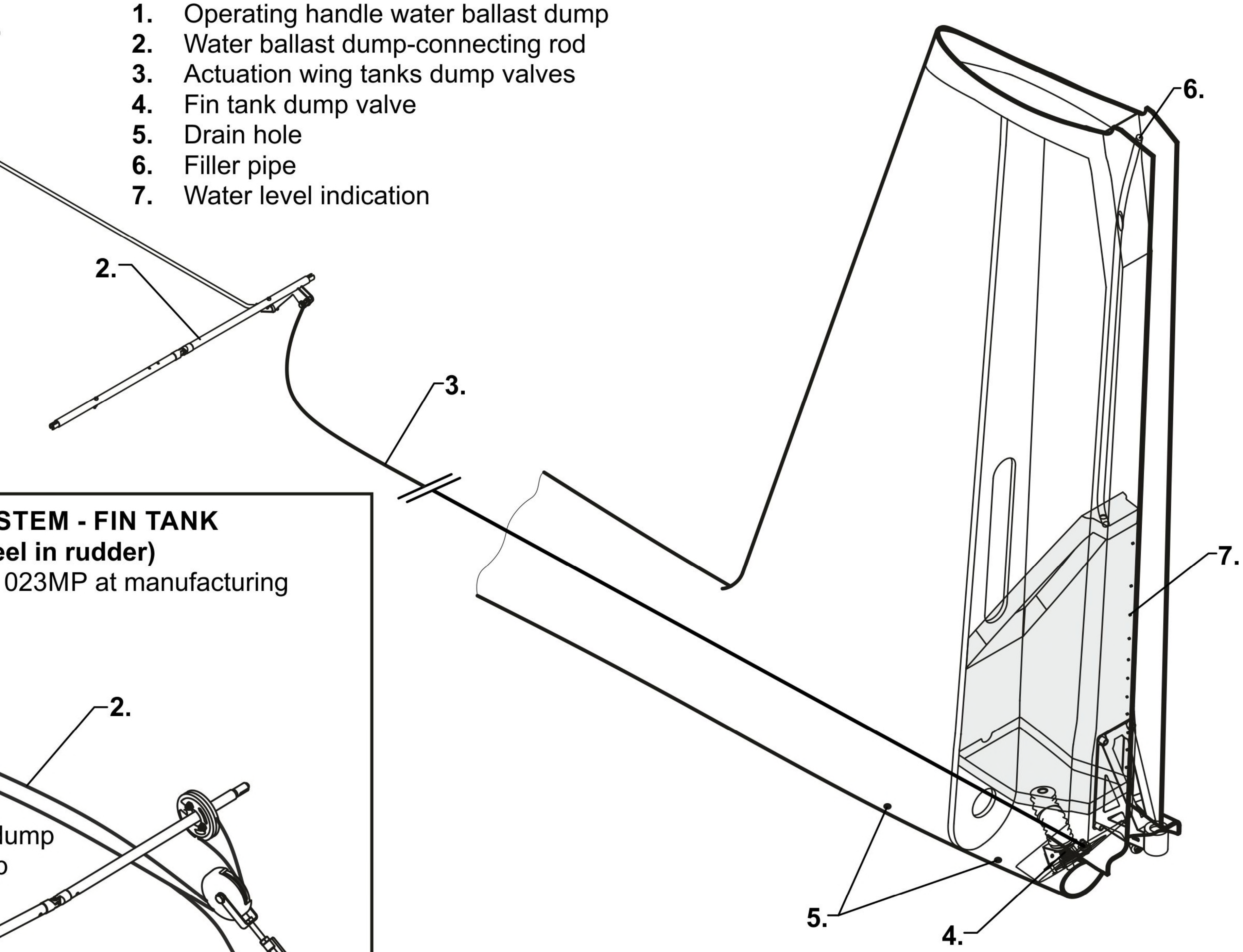


WATER BALLAST SYSTEM - WING

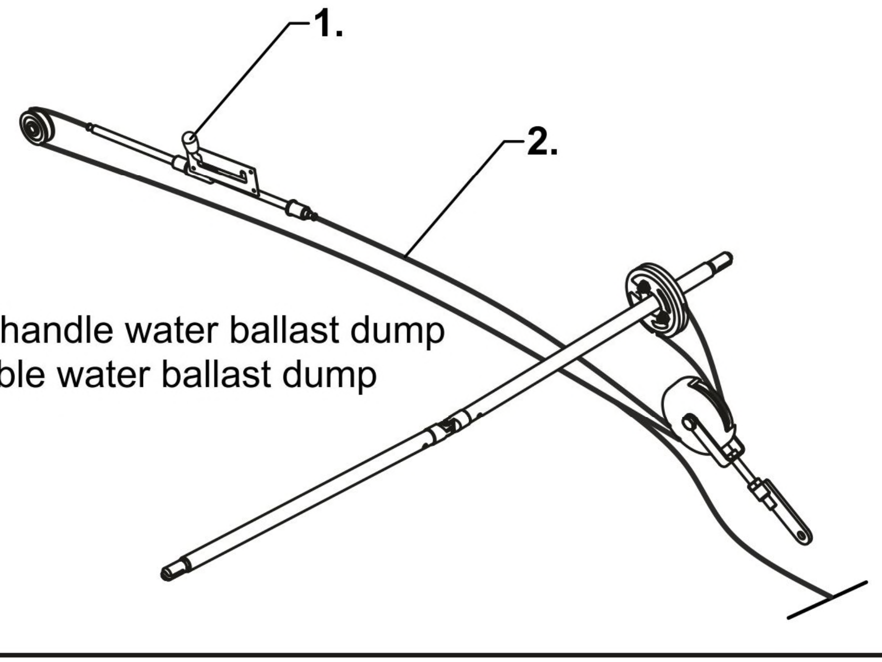
1. water dump valve drive rod
2. water dump valve
3. water tank connection to outer wing

WATER BALLAST SYSTEM - FIN TANK
(stearable tail wheel in rudder)

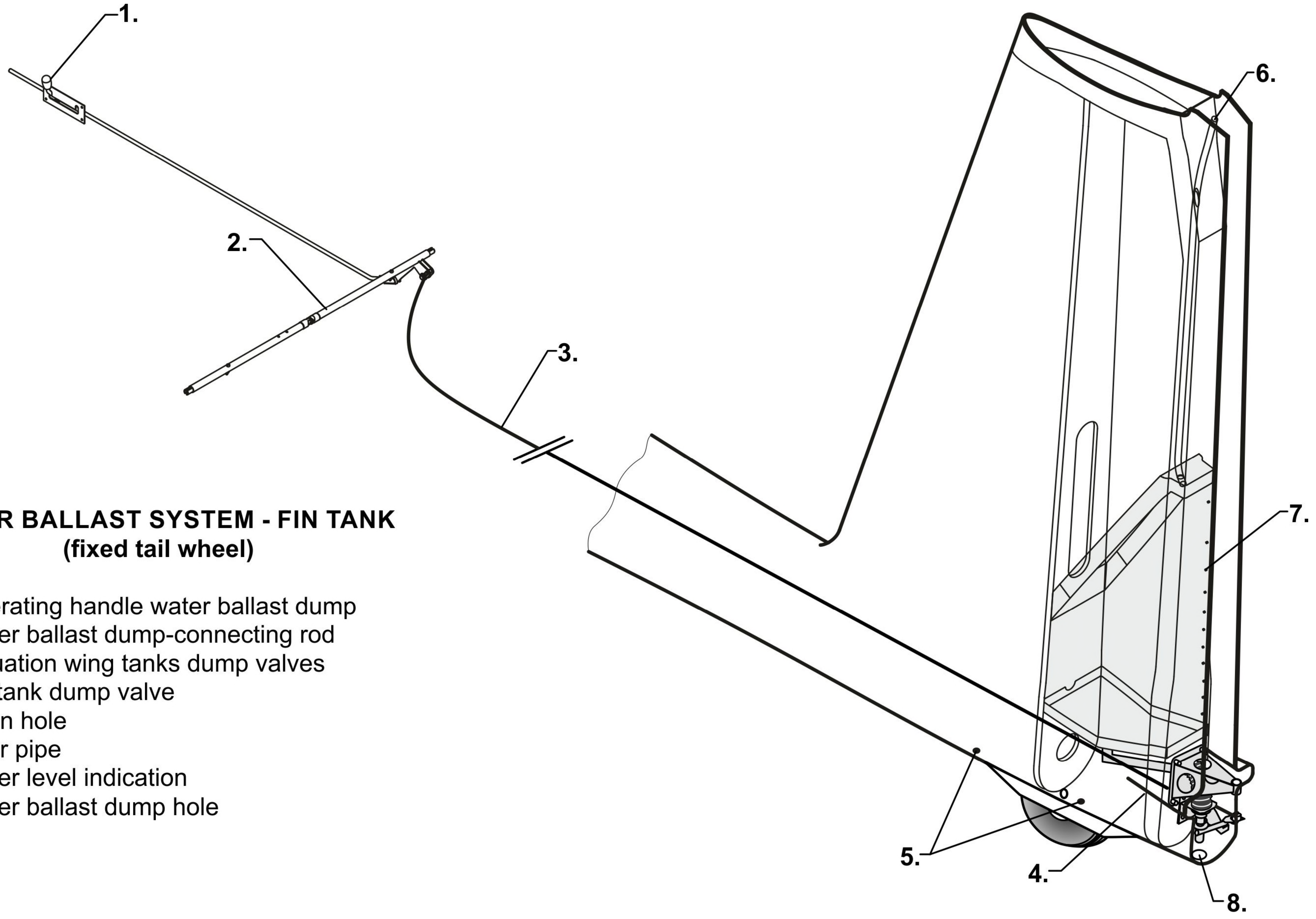
1. Operating handle water ballast dump
2. Water ballast dump-connecting rod
3. Actuation wing tanks dump valves
4. Fin tank dump valve
5. Drain hole
6. Filler pipe
7. Water level indication



WATER BALLAST SYSTEM - FIN TANK
(stearable tail wheel in rudder)
only for Serial-No. 021MP and 023MP at manufacturing



1. Operating handle water ballast dump
2. Control cable water ballast dump



WATER BALLAST SYSTEM - FIN TANK
(fixed tail wheel)

1. Operating handle water ballast dump
2. Water ballast dump-connecting rod
3. Actuation wing tanks dump valves
4. Fin tank dump valve
5. Drain hole
6. Filler pipe
7. Water level indication
8. Water ballast dump hole

7.10 Power plant system

The engine and the propeller (see engine and propeller manual for construction and data) are attached to the propeller mount and connected by individual V-belts. This unit is rotatably mounted at two points to the fuselage steel frame with rubber elements for vibration damping and is rotated around a pivot point in the fuselage. The arresting wire is attached to the propeller pylon.

An electrical spindle drive, anchored to the fuselage deck and linked to the pylon, extends and retracts the latter.

The doors of the engine compartment are automatically opened and closed by a linkage while the pylon extends / retracts.

The most important functions and displays for the operation of the power plant are summarized in the power plant control system. The corresponding operating unit for the pilot is mounted in the instrument panel. See page 7.3.5 and following for further description of the power plant control system.

As additional control elements for the power plant, the pilot must also operate the fuel shut-off valve, the throttle lever and, if necessary, the manual propeller brake.

After the engine has been stopped in flight, the further retraction of the power plant is normally carried out by the power plant control system without any further action of the pilot. After the ignition is switched off, the propeller is stopped, slowly turned into the retraction position with assistance from the air stream, held there and then the power plant retracts.
If necessary, the pilot can accelerate the alignment of the propeller by selectively actuating the starter motor.

The stopping and the positioning of the propeller as well as retraction of the power plant during flight can also be carried out by the pilot without automatic operation with the aid of the manual propeller brake.

7.11 Fuel system

Description

A view of the fuel system is given on page 7.11.3, for Specifications of the fuel to be used refer to page 2.4.

Flexible fuel tanks in the right and left wings are available as an option. The description of refueling can be found in section 4.2.3.

Fuel supply

Fuel is always supplied to the engine from the fuselage tank, which is filled by the optional wing tanks by means of an interconnecting line featuring a quick-disconnect coupling at the root rib.

Fuel form the fuselage tank is fed via the fuel shut-off valve, a strainer, the electrical fuel pump and a filter element to the injection system, which is connected to the engine.

The fuselage tank is drained via the externally accessible drainage valve on the left side behind the gear.

Venting

The vent line of the fuselage tank is connected to the expansion reservoir via a pressure relief valve and a non-return valve.
From there, a line leads to the outlet of the vent line on the right side behind the landing gear box.
Each wing fuel tank has its own vent line with a pressure relief valve integrated in the tank. The vent line of the wing fuel tank is connected to the expansion reservoir in the fuselage via the connecting line at the root rib with quick disconnect coupling.

Warning:

In order to prevent that the engine stops due to lack of fuel, the opening of the vent line must never be taped closed!

7.11 Fuel system (cont.)

Fuel content indication

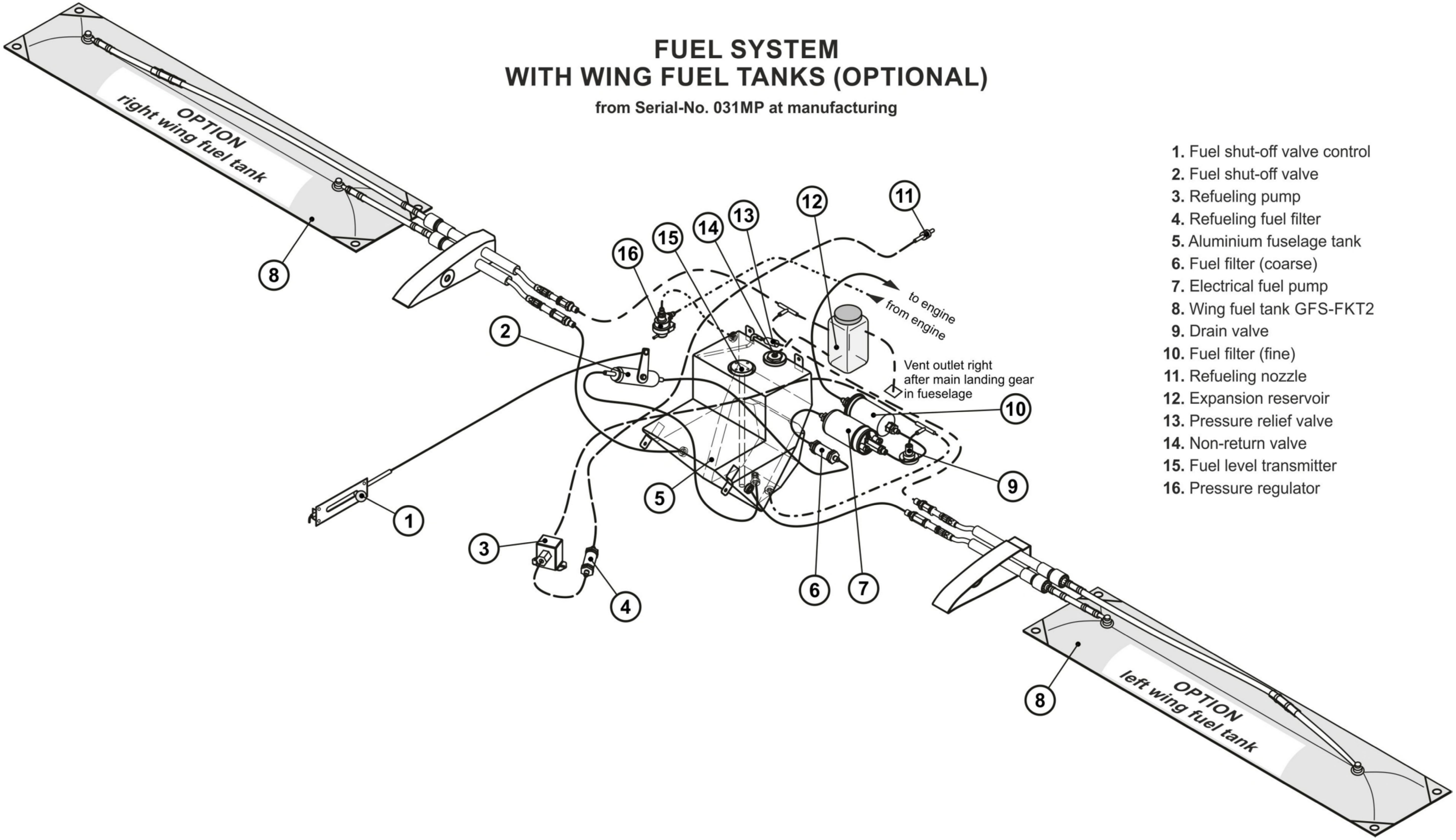
The fuel content in the fuselage and wing fuel tanks is displayed on the operating unit of the power plant control system. The contents of the fuselage fuel tank are detected automatically. The contents of the wing fuel tanks must be entered into the operating unit by the pilot, see section 4.2.3.

Built-in refuelling system

The connection of the refueling system is located in the engine box on the left side (direction of flight) of the front wall of the engine box. The toggle switch for the electric fuel pump is mounted in the cockpit on the left side of the back cover.
The electric fuel pump of the refueling system with fuel filter is mounted on the right side (direction of flight) under the seat pan, see page 7.11.3.
The description of the refueling procedure can be found on page 4.2.3.1.

FUEL SYSTEM
WITH WING FUEL TANKS (OPTIONAL)

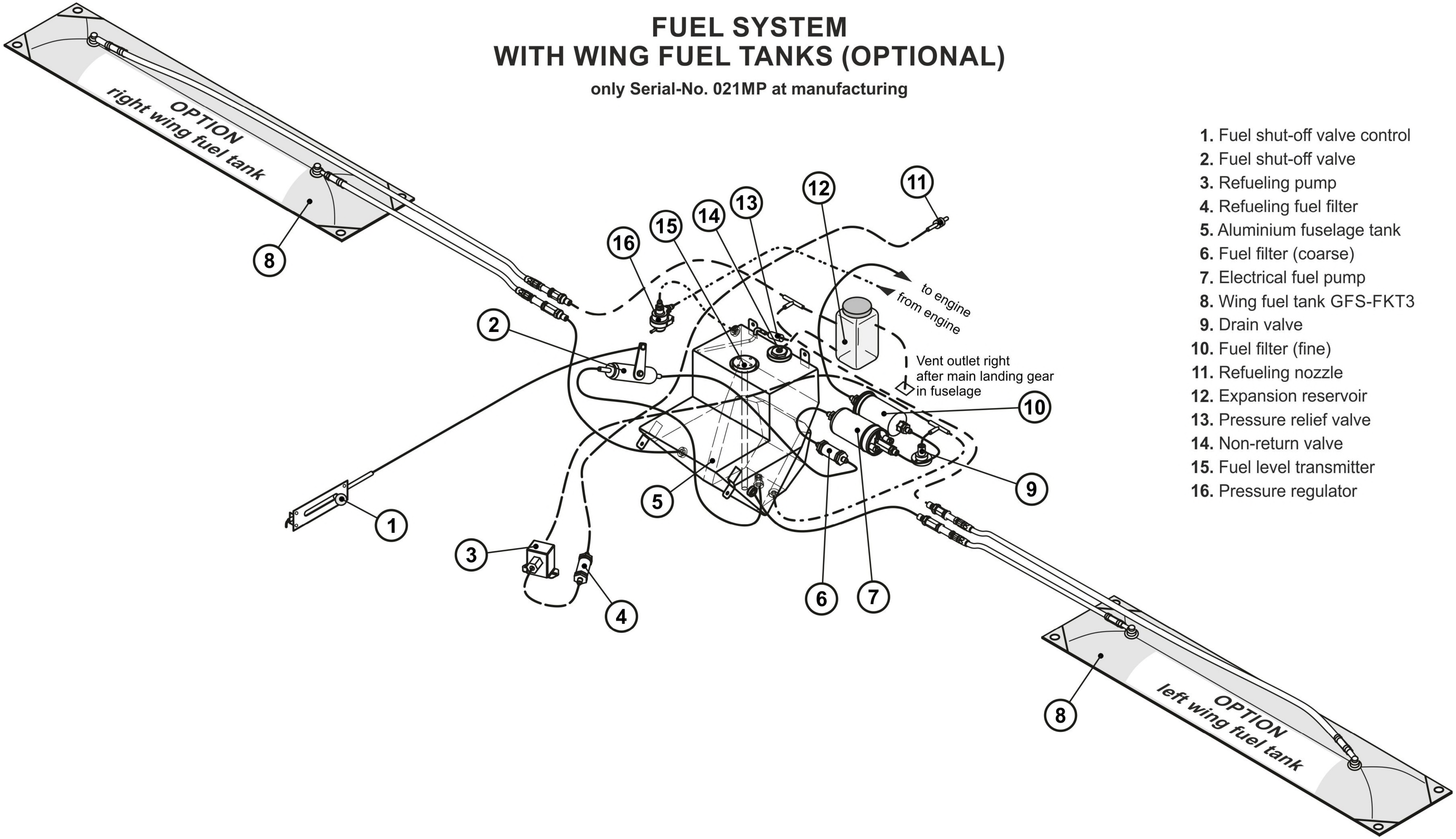
from Serial-No. 031MP at manufacturing



1. Fuel shut-off valve control
2. Fuel shut-off valve
3. Refueling pump
4. Refueling fuel filter
5. Aluminium fuselage tank
6. Fuel filter (coarse)
7. Electrical fuel pump
8. Wing fuel tank GFS-FKT2
9. Drain valve
10. Fuel filter (fine)
11. Refueling nozzle
12. Expansion reservoir
13. Pressure relief valve
14. Non-return valve
15. Fuel level transmitter
16. Pressure regulator

FUEL SYSTEM
WITH WING FUEL TANKS (OPTIONAL)

only Serial-No. 021MP at manufacturing



1. Fuel shut-off valve control
2. Fuel shut-off valve
3. Refueling pump
4. Refueling fuel filter
5. Aluminium fuselage tank
6. Fuel filter (coarse)
7. Electrical fuel pump
8. Wing fuel tank GFS-FKT3
9. Drain valve
10. Fuel filter (fine)
11. Refueling nozzle
12. Expansion reservoir
13. Pressure relief valve
14. Non-return valve
15. Fuel level transmitter
16. Pressure regulator

7.12 Electrical system

Gliding avionics

When operated in the plain sailplane configuration, the minimum instrumentation prescribed does not require an electrical power source.

Additional equipment is connected to the power supply "Electrical System Avionics", see page 7.12.3 and 7.12.4, and according to the manufacturer's instructions for the respective equipment.

Power is supplied by the engine battery or one of up to 3 optional additional batteries, which can be selected with the battery selector switch, see pages 7.12.3 and 7.12.5.

Separate main switches are installed for the glider avionics and the power plant system.

7.12 Electrical system (cont.)

Power plant

The engine is operated with a contactless, map-controlled magnetic field ignition, which is designed as a double ignition system. The engine is managed by an electronic engine control unit (Trijekt).

A power supply is required to operate the spindle drive, the starter motor, the engine control system and the power plant control system. A separate 12 V engine battery is provided for this purpose, which is installed underneath the instrument panel in the steering frame.
The engine battery is switched on by the main switch power plant. The state of charge can be checked on the display of the operating unit of the power plant control system in the instrument panel. The glider avionics can also be powered from the engine battery by means of the battery selector switch.

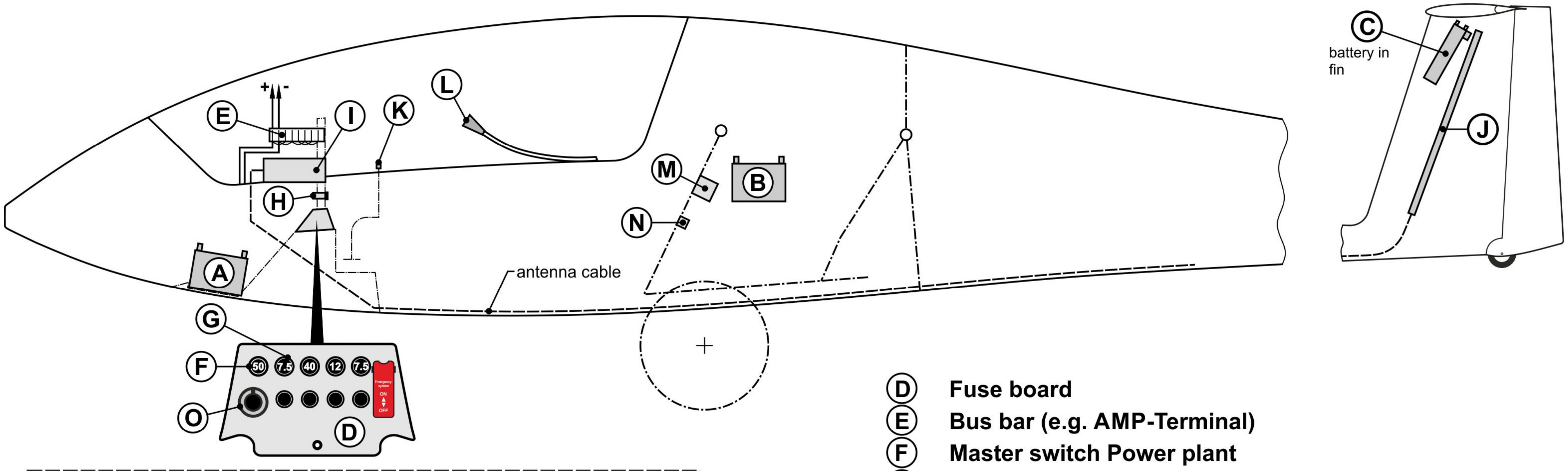
The engine features an AC-generator which recharges the battery via a rectifier regulator.

With the main switch Power plant ON and the fuse of the power plant control system ON the displays and values of the power plant control system are visible on the operating unit.

In order to prevent an engine failure in case of a failure of the engine battery, the supply switch maintains the power supply of the following devices directly from the generator governor, see also chapter "Failure of the electric power supply for the engine" on page 3.7.5:

1. Trijekt engine control system
2. Fuel pump of the engine control system
3. MCU 3 System
4. Ignition circuits

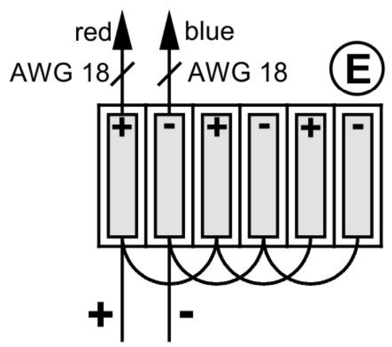
The supply switch tests itself each time the engine is started. Any errors or operating instructions that occur are displayed in the operating unit.
The various functions of the power plant control unit, the other operating elements of the power plant control system and their interlinking are described in section 7.3.



Battery-installation positions

Engine battery:
Position (A)

Optional Avionic-Batteries:
Position (B) up to two Avionic-Batteries
Position (C) one Avionic-Battery

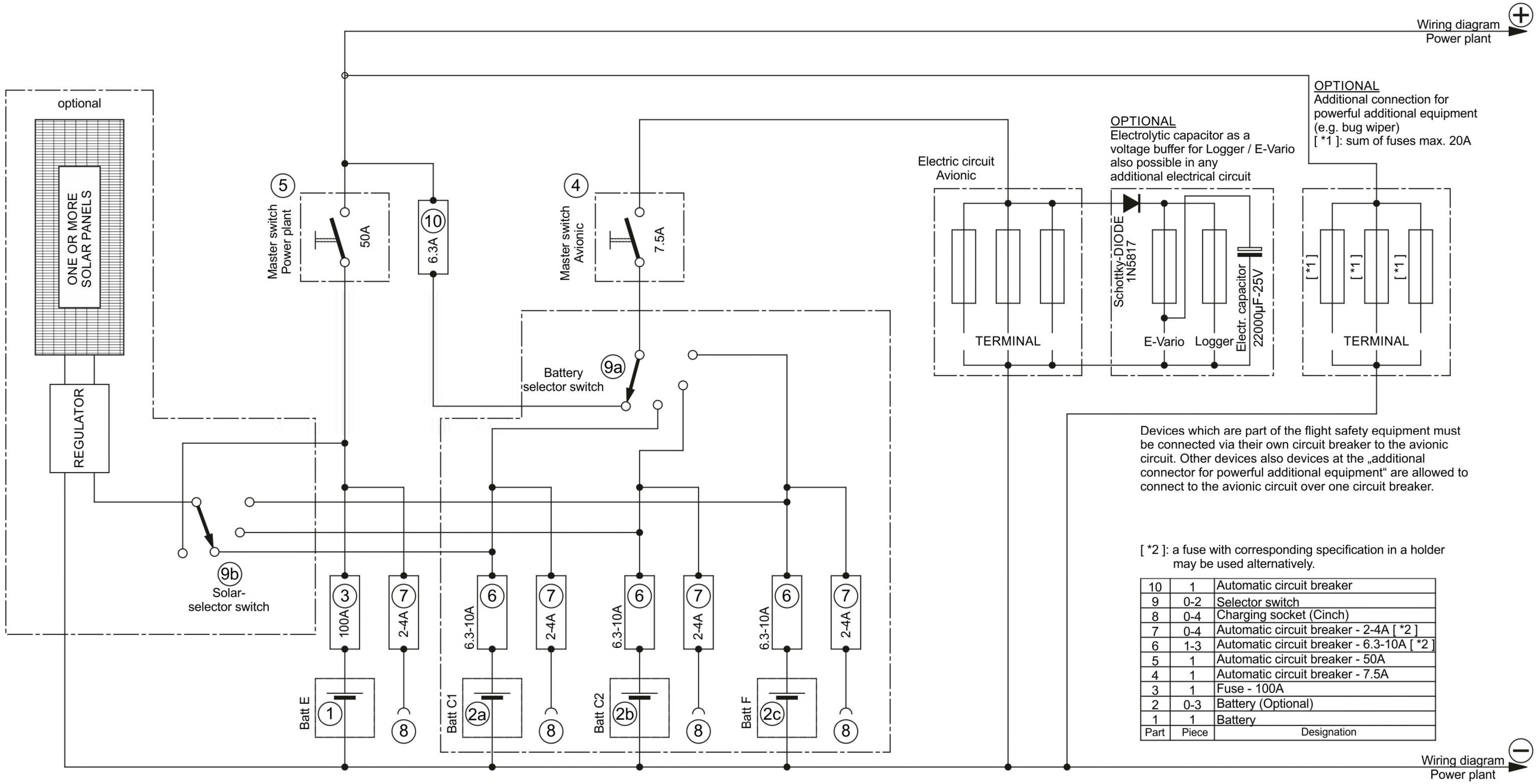


(E) Bus bar (e.g. AMP-Terminal)

Note:
VHF-Transceiver and other additional equipment to be wired in comliance with the manufacturer´s instructions and be fused individually.

(D) **Fuse board**
(E) **Bus bar (e.g. AMP-Terminal)**
(F) **Master switch Power plant**
(G) **Master switch Avionic**
(H) **Consumer load fuse (e.g. VHF Transceiver, E-Vario etc.)**
(I) **VHF-Transceiver**
(J) **Antenna**
(K) **PTT button**
(L) **Boom-microphone**
(M) **Speaker**
(N) **Headset connector**
(O) **Battery-selector switch - Avionic**

ELECTRICAL SYSTEM-AVIONIC



Devices which are part of the flight safety equipment must be connected via their own circuit breaker to the avionic circuit. Other devices also devices at the „additional connector for powerful additional equipment“ are allowed to connect to the avionic circuit over one circuit breaker.

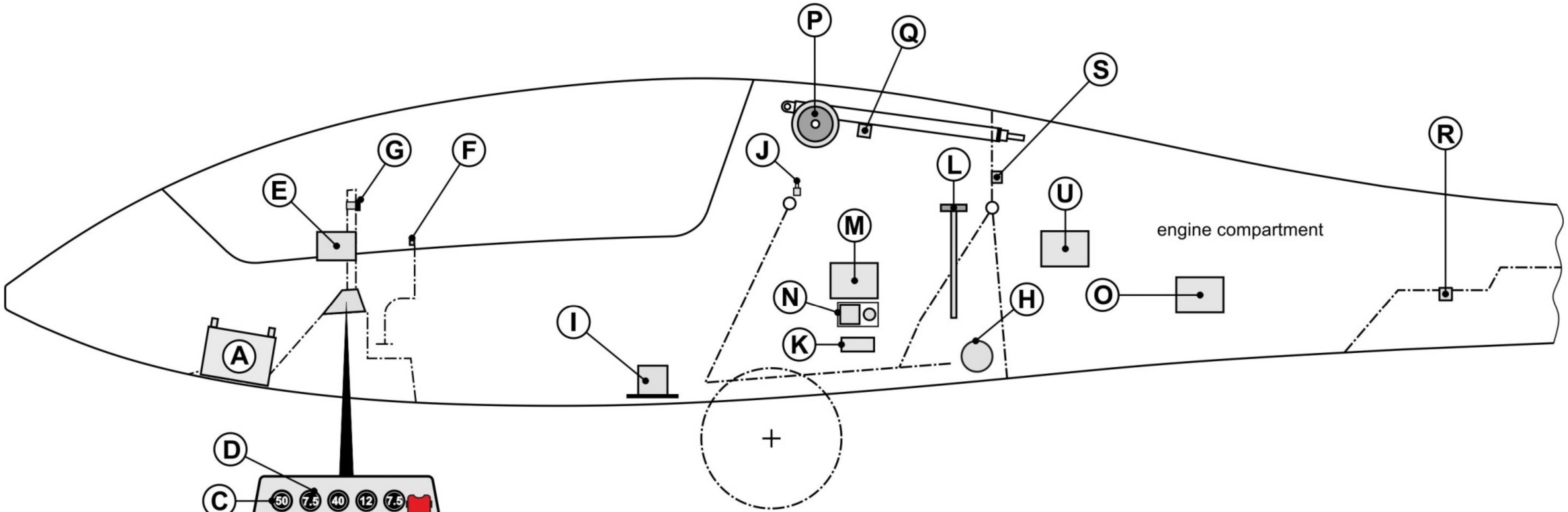
[*2]: a fuse with corresponding specification in a holder may be used alternatively.

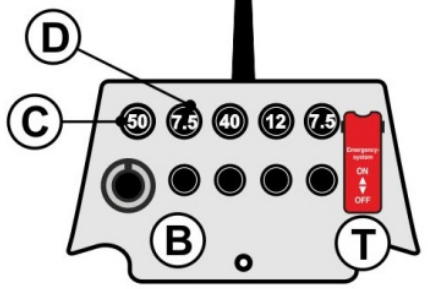
Part	Piece	Designation
10	1	Automatic circuit breaker
9	0-2	Selector switch
8	0-4	Charging socket (Cinch)
7	0-4	Automatic circuit breaker - 2-4A [*2]
6	1-3	Automatic circuit breaker - 6.3-10A [*2]
5	1	Automatic circuit breaker - 50A
4	1	Automatic circuit breaker - 7.5A
3	1	Fuse - 100A
2	0-3	Battery (Optional)
1	1	Battery

Solar panels must be wired at the main power supply by a regulator. An appropriate battery type must be used.

2a to 2c: optional up to 3 batteries (without battery (1))
9a: battery selector switch for Avionic
9b: Solar-selector switch (optional)

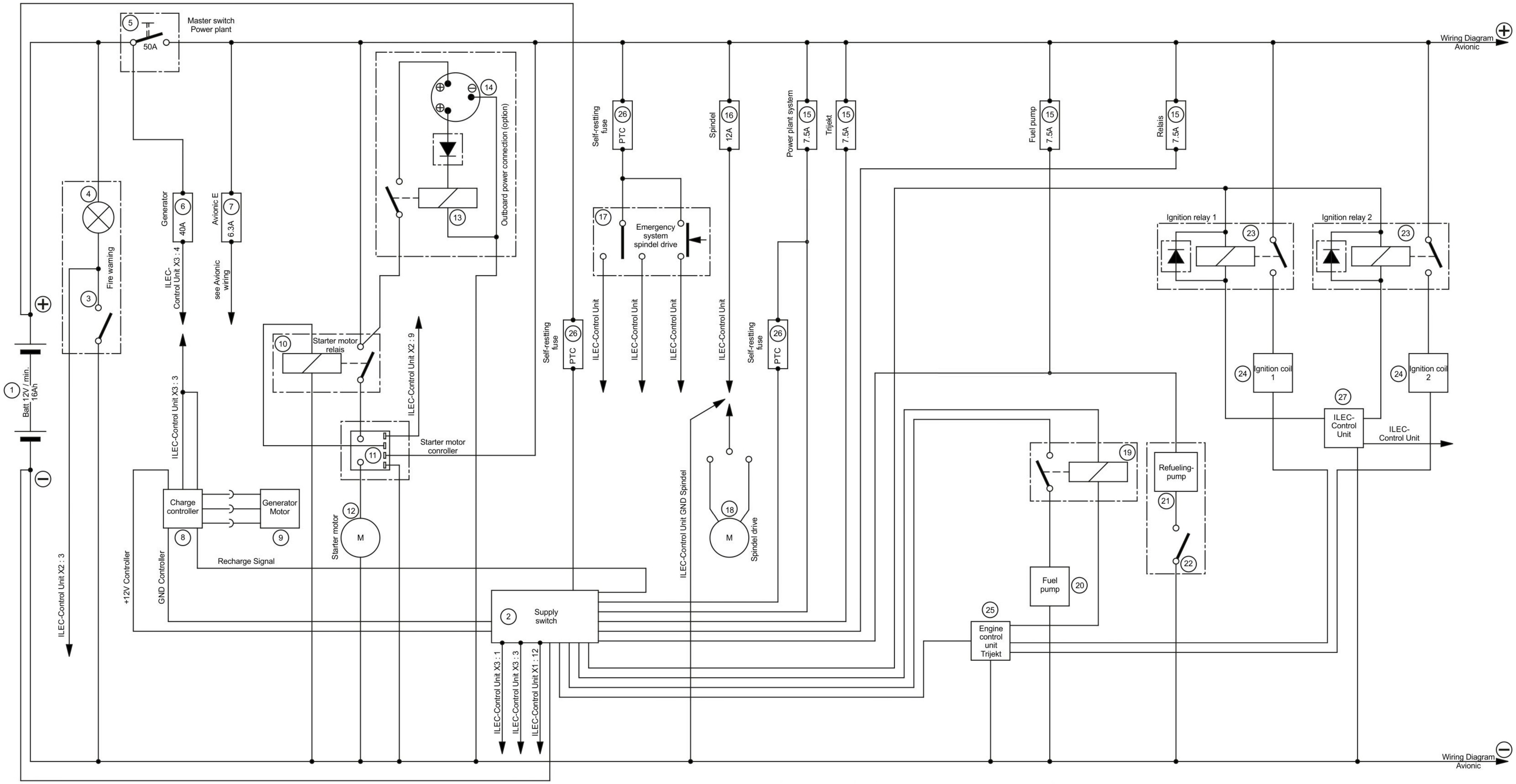
WIRING DIAGRAM - AVIONIC





ELECTRICAL SYSTEM-POWER PLANT

- **(A) Engine battery below instrument panel**
- **(B) Fuse board**
- **(C) Main switch Power plant**
- **(D) Main switch Avionic**
- **(E) Engine Control Unit**
- **(F) Starter button**
- **(G) Flashing light (fire warning)**
- **(H) Electrical fuel pump**
- **(I) Electrical refueling pump (right-hand side)**
- **(J) Refueling pump ON/OFF switch (left-hand side)**
- **(K) Power Supply Switch (right-hand side)**
- **(L) Fuel level transmitter (inside fuel tank)**
- **(M) Power plant control unit (right-hand side)**
- **(N) Starter motor control (left-hand side)**
- **(O) Propeller brake servo+prop stop servo (left-hand side)**
- **(P) Spindle drive**
- **(Q) Limit switch - prop extracted**
- **(R) Limit switch - prop retracted**
- **(S) Thermal switch (fire warning)**
- **(T) Emergency switch**
- **(U) Trijekt Engine Control Unit**



			20	1	Fuel pump	10	1	Starter motor relais
			19	1	Relais	9	1	Generator
			18	1	Direct current-spindel drive	8	1	Charge controller
27	1	ILEC control unit	17	1	Emergency switch spindel drive	7	1	Automatic circuit breaker - 6.3A/NA
26	3	Self-resetting fuse	16	1	Automatic circuit breaker - 12A	6	1	Automatic circuit breaker - 40A
25	1	Engine control unit - Trijekt	15	4	Automatic circuit breaker - 7.5A	5	1	Automatic circuit breaker - 50A
24	2	Ignition coil	14	1	Outboard power connection (option)	4	1	Flashing-LED-red
23	2	Relais	13	1	Relais (option)	3	1	Thermal switch
22	1	Refueling pump ON/OFF switch	12	1	Starter motor	2	1	Supply Switch
21	1	Refueling pump	11	1	Starter motor controller	1	1	Engine-battery
Part	Piece	Designation	Part	Piece	Designation	Part	Piece	Designation

WIRING DIAGRAM - POWER PLANT

7.13 Miscellaneous equipment

Removable ballast (option)

A mounting provision for removeable ballast (trim ballast weights) is provided in the fuselage noes forward of the rudder pedal assembly. The trim ballast weights (lead plates) are attached to the FRP-frame by means of a wing nut
For information on influence on the minimum seat load refer to section 6.2.1.

Oxygen system (option)

The oxygen system will be mounted in the baggage compartment.

Caution:

After installation and de-installation of an oxygen system it is necessary to re-establish the empty mass and the c/g position of the aircraft. The modified loading plan must be entered in the weighing & balance log sheet - see page 6.2.3 or 6.2.4.

A list of currently approved devices can be found in the maintenance manual.

7.13 Miscellaneous equipment (cont.)

ELT installation

The emergency transmitter can be installed at the following points in the fuselage according to the instructions of Schempp-Hirth Flugzeugbau GmbH:

- on the baggage compartment floor

A list of currently approved ELT’s can be found in the maintenance manual.

Section 8

8 Handling, care and maintenance

8.1 Introduction

This section contains manufacturer’s recommended procedures for proper handling and servicing. It also identifies certain inspection and maintenance requirements which must be followed if the powered sailplane is to retain that “new plane” performance and dependability.

Caution:

It is recommended to follow a planned schedule of lubrication and preventive maintenance, to be repeated more often if rough climate and flying conditions are encountered - see section 3 of the Ventus-3M Maintenance Manual.

8.2 Inspection periods

For detailed maintenance information, please see Ventus-3M Maintenance Manual.

Airframe maintenance

Under normal operating conditions no airframe maintenance work is required between the annual inspections.

The greasing – except of spigots and ball bearings of the wing and tailplane attachment fittings – is done only if the control system becomes heavy to operate in fuselage and wing (i.e. airbrake actuating linkage).

Cleaning and greasing the wheel(s) as well as the nose tow coupling and C.G. tow coupling depends on accumulation of dirt.

Rudder cables

After every 200 operating hours and at each annual inspection, the rudder cables are to be inspected at the point where they feed though the S shaped guides in the pedals, especially at the point of the extreme positions of the pedals.

If damaged, worn or corroded, the rudder cables must be replaced. It is permissible for individual strands of the cables to be worn up to 25%.

Power plant maintenance

Propeller

Maintenance work on the propeller is required after every 25 hours of engine operation time or at least once a year in accordance with the instructions given in the propeller manual.

Engine

Maintenance work on the engine is required after every 25 hours of engine operation time or at least once a year in accordance with the information given in the engine manual.

For the remaining parts of the power plant (pylon, pivoting mechanism, fuel system, etc.) maintenance work is also required according to the specifications given in the Ventus-3M maintenance manual.

8.3 Alterations or repairs

Alterations

Any change to the approved type which may affect its airworthiness has to be notified to the airworthiness authority prior to its implementation. The airworthiness authority will determine whether and to what extent a supplementary type examination has to be carried out.

The opinion of the manufacturer must be obtained in any case. This ensures that the airworthiness does not become adversely affected and enables the aircraft owner / Operator to demonstrate at any time that the aircraft concerned complies with an approved version.

Amendments of the approved sections of the Flight- and / or the Maintenance Manual must in any case be approved be the responsible airworthiness authority.

Repairs

Abreviations:

CFRP: carbon fibre reinforced plastic
GFRP: glass fibre reinforced plastic

Before every take-off and especially after the aircraft has not been used for a while, it should be checked on the ground as shown in section 4.3.

Check for any signs of change in condition of the aircraft, such as cracks in the surface, holes or delamination in the CFRP/GFRP structure etc.

If there is any uncertainty whatsoever regarding the significance of damage discovered, the aircraft should always be inspected by a CFRP/GFRP expert.

For the repair of a damage, the legal regulations of the country in which the aircraft is registered must be observed.

8.4 Ground handling / road transport

Towing/pushing

When towing the powered sailplane behind a car, a tail dolly should always be used to avoid unnecessary tailplane loads due to vibrations on the fittings especially in tight turns.
When pushing the aircraft by hand, it should not be pushed at its wing tips, but as near to the fuselage as possible

Hangaring

The aircraft should always be hangared or kept in well ventilated conditions. If it is kept in a closed trailer, there must be adequate ventilation.
The water ballast tanks and the wing fuel tanks must always be left completely empty.

The aircraft must never be subjected to loads whilst not in use, especially in the case of high ambient temperatures.

Tie-down

In the case of a powered sailplane remaining rigged permanently, it is important that the maintenance program includes rust prevention for the fittings on fuselage, wing panels and tailplane. Dust covers should be regarded as essential for the powered sailplane. Tie down kits common in trade may be used to anchor the aircraft.
The water ballast tanks and the wing fuel tanks must always be left completely empty due to risk of leaks.

Preparation for road transport

As the wing panels have a thin airfoil section, it is important that they are properly supported. Wing panels must be transported with their leading edge down, with a support at the spar stubs and one at the outer portion of the nose in cradles with correct airfoil section.
The fuselage can rest on a broad cradle just forward of the u/c doors and on its tail wheel.
The horizontal tailplane should be kept leading edge down in two cradles of correct airfoil section or placed horizontally on a padded support.
On no account should the tailplane be supported by its fittings in the trailer.

8.5 Cleaning and care

Although the surface coating of a composite aircraft is robust and resistant, always take care to maintain a perfect surface.

For cleaning and caring the following is recommended:

- Clean the surface (especially the leading edge of the wing panels, horizontal stabilizer and fin) with clear water, a sponge and a chamois leather.
- Do not use rinsing additives common in trade too often.
- Polish and polishing materials may be used.
- Petrol and alcohol may be used momentarily only, thinners of any kind are not recommended.
- Never use chlorine hydrogen (Tri, Tetra, Per, etc.).
- The best polishing method is the buffing of the surface by means of an edge buffing wheel, fitted to a drilling or polishing machine:

  Hard wax is applied against the rotating disc or liquid wax is applied to the surface to be polished. Then the polishing machine distributes the wax lengthwise and crosswise across the surface.

Warning:
To avoid localized overheating, the buffing wheel should be moved constantly

- FLEET MAGIC from Chemsearch is recommended for cleaning the fuselage and tailplane, which are in the wake of the propeller.

  Note:

  Polishes, way and additives containing silicon should not be used because this might cause additional work in case of repairs of the coating.

- It is advisable to clean the canopy with PLEXIKLAR or a similar cleaning agent for Plexiglas or with warm water if necessary.
  The canopy should be wiped down with a soft clean chamois leather or a very soft material such as cotton.
  Never rub the canopy when it is dry!

- The aircraft should always be protected from the wet. If water is found inside, the components should be stored in a dry environment and turned frequently to eliminate the water.

- The aircraft should not be exposed unnecessarily to intense sunlight or heat and should not be subjected to continual mechanical loads.

Warning:

All external portions of the aircraft exposed to sunlight must be painted white with exceptions of the areas for the registration and anti-collision markings.
Colours other than white can lead to the CFRP/GFRP overheating in direct sunlight, resulting in insufficient strength.

Section 9

9 Supplements

9.1 Introduction

This section contains appropriate supplements necessary to safely and efficiently operate the aircraft when equipped with various optional systems and equipment.

9.2 List of inserted supplements

Date	Section	Title of the inserted supplements