FLIGHT MANUAL

for powered sailplane

Model: **A R C U S M**

according to Modification Bulletin A532-4

Sales designation: A R C U S M - 20

Serial No.:

Registr.-No.:

Date of issue: **M a y 2 0 2 0**

The pages marked with „appr“ are EASA approved

with approval-No. 10074746, dated 04 November 2020

This power glider can only be operated in accordance with the instructions and determined operational limits given in this flight manual.

Approval of translation has been done by best knowledge and judgement. In any case the original text in German language is authoritative.

0.1 Record of revisions

Any revisions 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, and the revision number and the date will be shown on the bottom left hand side of the page.

0.1 Erfassung der Berichtigungen / *Record of Revisions*

Lfd. Nr. der Berichtigung	Abschnitt	Seiten	Datum der Berichtigung	Bezug	Datum und Anerkennung durch	Datum der Einarbeitung	Zeichen /Unterschrift
Revision No.	*Affected section*	*Affected page*	*Date of issue*	*Reference*	*Date and Approval by*	*Date of Insertion*	*Signature*
1	0 2	0.2.1 2.4	Apr. 2021	**Änderungen für die Ausfuhr nach Brasilien** ***Modification for export to Brazil***			
2	0 4	0.2.2 4.3.6 4.3.7 4.3.8	Jan. 22	**Technische Mitteilung Nr. A532-9** Einführung der täglichen Kontrolle des unteren Seitenruder-Beschlags - alle Werknummern - **Technical Note No. A532-9** Introduction of a daily inspection of the lower ruder attachment - all serial numbers -			
3	0 4	0.2.2 4.3.6	Apr. 2022	**TechnischeMitteilung Nr. A532-10** Kontrolle Höhenruder-Antriebsbe-schlag auf Beschädigungen - alle Werknummern – ***Technical Note No. A532-10*** *Inspection of the elevator U-bracket in the horizontal tail for damage* *- all serial numbers -*			

MB: *Modification Bulletin* – Änderungsblatt
TN : *Technical Note* – Technische Mitteilung

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.

0.2 Verzeichnis der Seiten / *List of effective pages*

Abschnitt *Effective section*	Seite *Effective page*	Ausgabe-Datum *Date of issue*	Bezug *Reference*
0	0.1.1		
	0.1.2		
	0.2.1		
	0.2.2		
	0.2.3		
	0.2.4		
	0.2.5		
	0.2.6		
	0.2.7		
	0.3.1		
1	1.0	Mai/*May* 2020	
	1.1	Mai/*May* 2020	
	1.2	Mai/*May* 2020	
	1.3	Mai/*May* 2020	
	1.4.1	Mai/*May* 2020	
	1.4.2	Mai/*May* 2020	
	1.4.3	Mai/*May* 2020	
	1.5	Mai/*May* 2020	
2	2.0	Mai/*May* 2020	
	2.1	Mai/*May* 2020	
	anerk./*appr.* 2.2.1	Mai/*May* 2020	
	anerk./*appr.* 2.2.2	Mai/*May* 2020	
	anerk./*appr.* 2.3	Mai/*May* 2020	
	anerk./*appr.* 2.4	Mai/*May* 2020	
	anerk./*appr.* 2.5	Mai/*May* 2020	
	anerk./*appr.* 2.6	Mai/*May* 2020	
	anerk./*appr.* 2.7	Mai/*May* 2020	
	anerk./*appr.* 2.8	Mai/*May* 2020	
	anerk./*appr.* 2.9	Mai/*May* 2020	
	anerk./*appr.* 2.10	Mai/*May* 2020	
	anerk./*appr.* 2.11	Mai/*May* 2020	
	anerk./*appr.* 2.12.1	Mai/*May* 2020	
	anerk./*appr.* 2.12.2	Mai/*May* 2020	
	anerk./*appr.* 2.13	Mai/*May* 2020	
	anerk./*appr.* 2.14	Mai/*May* 2020	
	anerk./*appr.* 2.15	Mai/*May* 2020	

0.2 Verzeichnis der Seiten / *List of effective pages*

Abschnitt *Effective section*	Seite *Effective page*	Ausgabe-Datum *Date of issue*	Bezug *Reference*
3	3.0	Mai/*May 2020*	
	3.1	Mai/*May 2020*	
	anerk./*appr*. 3.2	Mai/*May 2020*	
	anerk./*appr*. 3.3	Mai/*May 2020*	
	anerk./*appr*. 3.4	Mai/*May 2020*	
	anerk./*appr*. 3.5	Mai/*May 2020*	
	anerk./*appr*. 3.6	Mai/*May 2020*	
	anerk./*appr*. 3.7.1	Mai/*May 2020*	
	anerk./*appr*. 3.7.2	Mai/*May 2020*	
	anerk./*appr*. 3.7.3	Mai/*May 2020*	
	anerk./*appr*. 3.7.4	Mai/*May 2020*	
	anerk./*appr*. 3.8	Mai/*May 2020*	
	anerk./*appr*. 3.9.1	Mai/*May 2020*	
	anerk./*appr*. 3.9.2	Mai/*May 2020*	
4	4.0	Mai/*May 2020*	
	4.1	Mai/*May 2020*	
	anerk./*appr*. 4.2.1.1	Mai/*May 2020*	
	anerk./*appr*. 4.2.1.2	Mai/*May 2020*	
	anerk./*appr*. 4.2.1.3	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.1	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.2	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.3	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.4	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.5	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.6	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.7	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.8	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.9	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.10	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.11	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.12	Mai/*May 2020*	
	anerk./*appr*. 4.2.2.13	Mai/*May 2020*	
	anerk./*appr*. 4.3.1	Mai/*May 2020*	
	anerk./*appr*. 4.3.2	Mai/*May 2020*	
	anerk./*appr*. 4.3.3	Mai/*May 2020*	
	anerk./*appr*. 4.3.4	Mai/*May 2020*	
	anerk./*appr*. 4.3.5	Mai/*May 2020*	
	anerk./*appr*. 4.3.6	April 2022	TN A532-9 / TN A532-10
	anerk./*appr*. 4.3.7	Jan. 2022	TN A532-9
	anerk./*appr*. 4.3.8	Jan. 2022	TN A532-9
	anerk./*appr*. 4.4	Mai/*May 2020*	

0.2 Verzeichnis der Seiten / *List of effective pages*

Abschnitt Effective section	Seite Effective page		Ausgabe-Datum Date of issue	Bezug Reference
4	anerk./appr	4.5.1.1	Mai/*May 2020*	
	anerk./appr.	4.5.1.2	Mai/*May 2020*	
	anerk./appr.	4.5.1.3	Mai/*May 2020*	
	anerk./appr.	4.5.1.4	Mai/*May 2020*	
	anerk./appr.	4.5.1.5	Mai/*May 2020*	
	anerk./appr.	4.5.1.6	Mai/*May 2020*	
	anerk./appr.	4.5.2.1	Mai/*May 2020*	
	anerk./appr.	4.5.2.2	Mai/*May 2020*	
	anerk./appr.	4.5.3.1	Mai/*May 2020*	
	anerk./appr.	4.5.3.2	Mai/*May 2020*	
	anerk./appr.	4.5.3.3	Mai/*May 2020*	
	anerk./appr.	4.5.3.4	Mai/*May 2020*	
	anerk./appr.	4.5.3.5	Mai/*May 2020*	
	anerk./appr.	4.5.3.6	Mai/*May 2020*	
	anerk./appr.	4.5.3.7	Mai/*May 2020*	
	anerk./appr.	4.5.3.8	Mai/*May 2020*	
	anerk./appr.	4.5.3.9	Mai/*May 2020*	
	anerk./appr.	4.5.3.10	Mai/*May 2020*	
	anerk./appr.	4.5.4.1	Mai/*May 2020*	
	anerk./appr.	4.5.4.2	Mai/*May 2020*	
	anerk./appr.	4.5.5	Mai/*May 2020*	
	anerk./appr.	4.5.6.1	Mai/*May 2020*	
	anerk./appr.	4.5.6.2	Mai/*May 2020*	
	anerk./appr.	4.5.6.3	Mai/*May 2020*	
	anerk./appr.	4.5.6.4	Mai/*May 2020*	
	anerk./appr.	4.5.6.5	Mai/*May 2020*	
	anerk./appr.	4.5.7.1	Mai/*May 2020*	
	anerk./appr.	4.5.7.2	Mai/*May 2020*	
	anerk./appr.	4.5.8	Mai/*May 2020*	
	anerk./appr.	4.5.9.1	Mai/*May 2020*	
	anerk./appr.	4.5.9.2	Mai/*May 2020*	
	anerk./appr.	4.5.9.3	Mai/*May 2020*	

0.2 Verzeichnis der Seiten / *List of effective pages*

Abschnitt Effective section	Seite Effective page		Ausgabe-Datum Date of issue	Bezug Reference
	.			
5		5.0	Mai/*May* 2020	
		5.1	Mai/*May* 2020	
	anerk./*appr.*	5.2.1	Mai/*May* 2020	
	anerk./*appr*.	5.2.2	Mai/*May* 2020	
	anerk./*appr.*	5.2.3	Mai/*May* 2020	
	anerk./*appr*.	5.2.4	Mai/*May* 2020	
		5.3.1	Mai/*May* 2020	
		5.3.2.1	Mai/*May* 2020	
		5.3.2.2	Mai/*May* 2020	
		5.3.2.3	Mai/*May* 2020	
		5.3.2.4	Mai/*May* 2020	
		5.3.3	Mai/*May* 2020	
6		6.0	Mai/*May* 2020	
		6.1	Mai/*May* 2020	
		6.2.1	Mai/*May* 2020	
		6.2.2	Mai/*May* 2020	
		6.2.3	Mai/*May* 2020	
		6.2.4	Mai/*May* 2020	
		6.2.5	Mai/*May* 2020	
		6.2.6	Mai/*May* 2020	
		6.2.7	Mai/*May* 2020	
		6.2.8	Mai/*May* 2020	
7		7.0	Mai/*May* 2020	
		7.1	Mai/*May* 2020	
		7.2.1	Mai/*May* 2020	
		7.2.2	Mai/*May* 2020	
		7.2.3	Mai/*May* 2020	
		7.2.4	Mai/*May* 2020	
		7.2.5	Mai/*May* 2020	
		7.2.6	Mai/*May* 2020	
		7.2.7	Mai/*May* 2020	
		7.3.1	Mai/*May* 2020	
		7.3.2	Mai/*May* 2020	
		7.3.3	Mai/*May* 2020	
		7.3.4	Mai/*May* 2020	
		7.3.5	Mai/*May* 2020	

0.2 Verzeichnis der Seiten / *List of effective pages*

Abschnitt Effective section	Seite Effective page	Ausgabe-Datum Date of issue	Bezug Reference
	7.3.6	Mai/*May 2020*	
	7.3.7	Mai/*May 2020*	
	7.3.8	Mai/*May 2020*	
	7.3.9	Mai/*May 2020*	
	7.3.10	Mai/*May 2020*	
	7.3.11	Mai/*May 2020*	
	7.3.12	Mai/*May 2020*	
	7.3.13	Mai/*May 2020*	
	7.3.14	Mai/*May 2020*	
	7.3.15	Mai/*May 2020*	
	7.3.16	Mai/*May 2020*	
	7.3.17	Mai/*May 2020*	
	7.3.18	Mai/*May 2020*	
	7.3.19	Mai/*May 2020*	
	7.3.20	Mai/*May 2020*	
	7.3.21	Mai/*May 2020*	
	7.3.22	Mai/*May 2020*	
	7.3.23	Mai/*May 2020*	
	7.3.24	Mai/*May 2020*	
	7.3.25	Mai/*May 2020*	
	7.3.26	Mai/*May 2020*	
	7.3.27	Mai/*May 2020*	
	7.3.28	Mai/*May 2020*	
	7.3.29	Mai/*May 2020*	
	7.3.30	Mai/*May 2020*	
	7.3.31	Mai/*May 2020*	
	7.3.32	Mai/*May 2020*	
	7.3.33	Mai/*May 2020*	
	7.3.34	Mai/*May 2020*	
	7.3.35	Mai/*May 2020*	
	7.3.36	Mai/*May 2020*	
	7.3.37	Mai/*May 2020*	
	7.3.38	Mai/*May 2020*	
	7.3.39	Mai/*May 2020*	
	7.3.40	Mai/*May 2020*	
	7.3.41	Mai/*May 2020*	
	7.3.42	Mai/*May 2020*	
	7.3.43	Mai/*May 2020*	
	7.3.44	Mai/*May 2020*	
	7.3.45	Mai/*May 2020*	

0.2 Verzeichnis der Seiten / *List of effective pages*

Abschnitt *Effective section*	Seite *Effective page*	Ausgabe-Datum *Date of issue*	Bezug *Reference*
	7.3.46	Mai/*May* 2020	
	7.3.47	Mai/*May* 2020	
	7.3.48	Mai/*May* 2020	
	7.3.49	Mai/*May* 2020	
	7.3.50	Mai/*May* 2020	
	7.3.51	Mai/*May* 2020	
	7.3.52	Mai/*May* 2020	
	7.3.53	Mai/*May* 2020	
	7.3.54	Mai/*May* 2020	
	7.3.55	Mai/*May* 2020	
	7.4	Mai/*May* 2020	
	7.5	Mai/*May* 2020	
	7.6	Mai/*May* 2020	
	7.7	Mai/*May* 2020	
	7.8	Mai/*May* 2020	
	7.9.1	Mai/*May* 2020	
	7.9.2	Mai/*May* 2020	
	7.9.3	Mai/*May* 2020	
	7.9.4	Mai/*May* 2020	
	7.10	Mai/*May* 2020	
	7.11.1	Mai/*May* 2020	
	7.11.2	Mai/*May* 2020	
	7.11.3	Mai/*May* 2020	
	7.12.1	Mai/*May* 2020	
	7.12.2	Mai/*May* 2020	
	7.12.3	Mai/*May* 2020	
	7.12.4	Mai/*May* 2020	
	7.12.5	Mai/*May* 2020	
	7.12.6	Mai/*May* 2020	
	7.12.7	Mai/*May* 2020	
	7.12.8	Mai/*May* 2020	
	7.13.1	Mai/*May* 2020	
	7.13.2	Mai/*May* 2020	

0.2 Verzeichnis der Seiten / *List of effective pages*

Abschnitt *Effective section*	Seite *Effective page*	Ausgabe-Datum *Date of issue*	Bezug *Reference*
8	8.0	Mai/*May* 2020	
	8.1	Mai/*May* 2020	
	8.2.1	Mai/*May* 2020	
	8.2.2	Mai/*May* 2020	
	8.3	Mai/*May* 2020	
	8.4	Mai/*May* 2020	
	8.5.1	Mai/*May* 2020	
	8.5.2	Mai/*May* 2020	
9	9.0	Mai/*May* 2020	
	9.1	Mai/*May* 2020	
	9.2	Mai/*May* 2020	

0.3 Table of contents

Section 1

1 General

1.1 Introduction

The Flight Manual for this powered sailplane has been prepared to provide pilots and instructors with every required information for the safe, appropriate and efficient operation of the powered sailplane

This manual contains all the information according manufacturer specification C22 which is required for the pilot.
It also contains supplemental data supplied by the manufacturer of the aircraft that could be very useful for the pilot.

1.2 Certification basis

This self launching powered sailplane, model designation

A r c u s M

according to Modification Bulletin A532-4

has been approved by the EASA in compliance with “CS 22", effective on November 14th, 2003.

The Type Certificate is No. **EASA.A.532** and was issued originally on

June 20th, 2013

Category of Airworthiness:	UTILITY
Noise Certification Basis:	Neufassung der Lärmvorschriften für Luftfahrzeuge (LVL)", effective on August 1st, 2004 (Aircraft Noise Protection Requirements)

1.3 Warnings, cautions and notes

Statements of the manual regarding the flight safety or important matters for operation are highlighted with the following notions:

“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 corresponding procedure leads to a minor or to a more or less long term derogation of the flight safety
"Note"	draws the attention on any special item not directly to safety, but which is import or unusual.

1.4 Descriptive data

The "Arcus M" is a two-seat, high-performance powered sailplane, manufactured of fibre reinforced plastic (FRP), featuring camber-changing flaps and a T-tail (with fixed horizontal stabilizer and elevator).

Wing

The four piece wing including winglets has 4 distinct trapezoidal sections, equipped with three-parted ”Schempp-Hirth”- style airbrakes.
On the innermost section of each wing, the leading edge sweeps slightly forward, then from the second section on, the wing tapers more and more aft.
The flaps span evenly along the entire length of the wing and simultaneously serve as ailerons.

The water tanks are integrated in the wing and can hold approx. 185 liters (48.9 US Gal., 40.7 IMP Gal.).
The wing skin is a CFRP foam sandwich, the wing spar caps are made from carbon fibre rovings and the spar shear web is a GFRP foam sandwich.

Fuselage

The comfortable cockpit provides a tandem seat for two pilots. The one-piece canopy hinges sideways and opens to the right. For high energy absorption the cockpit region is constructed as an aramid/carbon fibre laminate, which is reinforced by a steel tube transverse frame and a double skin on the sides with integrated canopy coaming frame and seat pan mounting flanges. The aft fuselage section is a pure carbon fibre (non-sandwich) shell of high strength, stiffened by CFRP-sandwich bulkheads and webs. The main wheel is retractable with shock absorber struts and features a hydraulic disc brake. The nose wheel (if installed) and tail wheel (or skid) are fixed.

Horizontal tailplane

The horizontal tailplane consists of a fixed stabilizer with elevator.
The stabilizer is a GFRP/foam-sandwich construction with CFRP-reinforcements, the elevator halves are a pure CFRP/GFRP shell. The spring trim is gradually adjustable by a lever resting against a threaded rod.

Vertical tail

The fin and rudder are constructed as a GFRP/foam-sandwich.
Optionally a water ballast trim tank with a capacity of 11 Litres (2.9 US Gal., 2.4 IMP Gal.) is provided in the fin.

Controls

All controls are automatically hooked up when the Arcus M is rigged.

1.4 Descriptive data (cont.)

Power plant

The „Arcus M“ was derived from the non-self-launching powered sailplane model “Arcus T” by integrating a more powerful engine and a larger propeller.

The “Arcus M” is powered by an liquid-cooled 50 kW (68 HP) SOLO engine - type 2625-02i - having a programmable fuel injection.
The power plant is housed in the fuselage aft of the wing, and together with the propeller driven by an electrical spindle which cares for the propeller pylon to extend from the engine bay in the fuselage cone.

To stop the power plant, reduce the airspeed and turn off the ignition.
After turning off the ignition, the retraction process is conducted automatically by the power plant control unit MCU 3.

Beside the ignition switch, with the power plant control unit MCU 3, no more controls have to be considered except the RPM indicator, the fuel valve and the throttle control. The fuel level in the control unit is displayed in liters.

In its appearance the “Arcus M” differs from the model “Arcus T” only by having longer doors covering on the engine compartment.

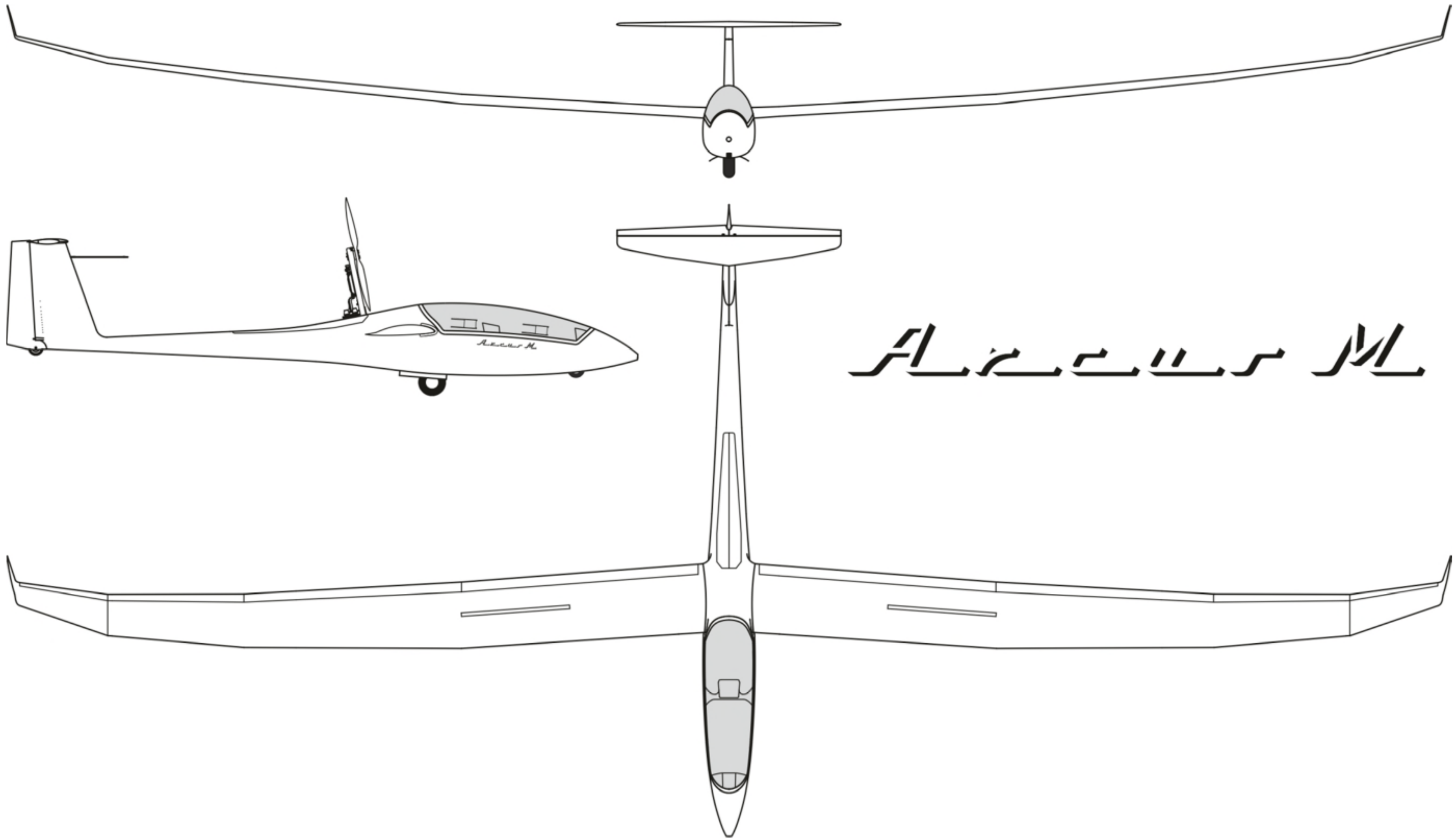
Flight characteristics and performances are identical with those of a correspondingly loaded “Arcus T” (by means of water ballast).

1.4 Descriptive data (cont.)

TECHNICAL DATA

Wing	Span	20.00 m	65.62 ft
	Area	15.59 m²	167.81 ft²
	Aspect ratio	25.7	
	MAC	0.824 m	2.70 ft
Fuselage	Length	8.73 m	28.64 ft
	Width	0.71 m	2.33 ft
	Height	1.00 m	3.28 ft
Weight (mass)	Empty mass from approx.	550 kg	1213 lb
	Maximum all-up mass	850 kg	1874 lb
	Wing loading	39.5 - 54.5 kg/m²	
		8,1 - 11,2 lb/ft²	
Engine	Model:	SOLO 2625-02 i	
	Manufacturer:	Fa. Solo Vertriebs- und Entwicklungs GmbH, Germany	
	Power at 6600 rpm	50 kW (68 hp)	
Propeller	Model:	KS-1G-160-R-120	
	Manufacturer:	Fa. Technoflug Leichtflugzeugbau GmbH. / Germany	
or (optional)	Model:	BM-G-160-R120-1	
	Manufacturer:	Fa. Binder Motorenbau / Germany	

1.5 Three-side view



Section 2

2 Limitations

2.1 Introduction

Section 2 includes operating limitations, instrument markings and basic placards necessary for safely operating the aircraft, its standard systems and 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:

SPEED		(IAS)	REMARKS
V_{NE}	Never exceed speed in calm air. Flaps set at 0, -1, -2, S	280 km/h 151 kn 174 mph	Do not exceed this speed in any operation and do not use more than 1/3 of control deflection
V_{RA}	Rough air speed	180 km/h 97 kn 112 mph	Do not exceed this speed in rough air and turbulences. Rough air is met in lee-wave rotors, thunderclouds etc.
V_{A}	Maneuvering speed	180 km/h 97 kn 112 mph	Do not make full or abrupt control movements above this speed as the aircraft structure might get overstressed.
V_{FE}	Maximum “flap extended” speed Flaps set at "+2", "+1", "L"	180 km/h 97 kn 112 mph	Do not exceed this speed with the given flap setting.
V_{T}	Maximum speed on aerotow	180 km/h 97 kn 112 mph	Do not exceed this speed during an aerotow.
V_{W}	Maximum winch launch speed	150 km/h 81 kn 93 mph	Do not exceed this speed during a winch launch.
V_{LO}	Maximum landing gear operating speed	180 km/h 97 kn 112 mph	Do not extend or retract the landing gear above this speed.

2.2 Airspeed (cont.)

Speed		(IAS)	Remarks
V_{PEmax}	Maximum speed with propeller extended	180 km/h 97 kn 112 mph	Do not exceed this speed with propeller extended.
V_{POmax}	Maximum speed for extending / retracting the propeller	120 km/h 65 kn 75 mph	Do not extend / retract the propeller outside this speed range.
V_{POmin}	Minimum speed for extending / retracting the propeller	90 km/h 49 kn 56 mph	

2.3 Airspeed indicator markings

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

MARKING	VALUE OR RANGE (IAS)	SIGNIFICANCE
White arc	90 - 180 km/h 49 - 97 kn 56 - 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).
Green arc	98 - 180 km/h 53 - 97 kn 61 - 112 mph	Normal operating range (lower limit is the speed 1.1V_{S1} at maximum mass, c/g at the most for-ward position and flaps at the neutral "0" position; upper limit is the max. permissible speed in rough air).
Yellow arc	180 - 280 km/h 97 - 151 kn 112 - 174 mph	Manoeuvres must be conducted with caution and operating in rough air is not permitted.
Red line	280 km/h 151 kn 174 mph	Maximum permitted speed
Blue line	98 km/h 53 kn 61 mph	Speed of the best climbing V_Y
Yellow triangle	105 km/h 57 kn 65 mph	Approach speed at maximum mass without water ballast.

2.4 Power plant, fuel and oil

Engine manufacturer:	Solo Vertriebs- und Entwicklungs GmbH. D-71069 Sindelfingen, Germany
Engine model:	SOLO 2625-02i
Engine power (MSL, ISA):	
Take-off and max. continuous power:	50 kW (68 HP) at 6600 RPM
Max. engine speed:	6700 RPM
Maximum permitted coolant liquid temperature:	115 °C (240 °F)
Fuel:	two-stroke mixture premium unleaded not below RON 95, AVGAS 100LL, or mixtures of the two fuels
Oil (lubrication):	Fuel / oil mixture 1 : 50 (2%) Oils according specification JASO FC or FD, recommended oil Castrol ACT>EVO
Propeller manufacturer:	Technoflug Leichtflugzeugbau GmbH. D-78669 Wellendingen, Germany
Propeller model:	KS-1G-160-R-120
or (optional)	
Propeller manufacuter:	Binder Motorenbau GmbH D-97645 Ostheim v.d. Rhön Germany
Propeller model:	BM-G-160-R-120-1
Reduction:	2.75 : 1
Fuel capacity:	See table below

	Tank in fuselage			Tank(s) in inboard wing panels starbd. side			port side - OPTION -			Total capacity incl. optional tank		
	Liter	US Gal	IMP Gal	Liter	US Gal	IMP Gal	Liter	US Gal	IMP Gal	Liter	US Gal	IMP Gal
Fuel capacity	14.5	3.8	3.2	13.0	3.4	2.9	13.0	3.4	2.9	40.5	10.6	9.0
Usable fuel	14.0	3.7	3.1	12.5	3.3	2.7	12.5	3.3	2.7	39.0	10.3	8.5
Non-usable fuel	0.5	0.13	0.11	0.5	0.13	0.11	0.5	0.13	0.11	1.5	0.39	0.33

2.5 Power plant instrument markings

Power plant instrument markings and their colour code significant are shown below:

Power plant instrument	indicator	Normal range	Caution range	Maximum Limit
RPM-Indication	TFT-Display	2500 – 6600 RPM	6600 – 6700[1] RPM	> 6700 [2] RPM (flashing)
	Indication	Green range	Yellow range [1]	Red range
	Caution-LED + Audio warning	---	Yellow flashing	Red flashing + continuous tone
Coolant Liquid Temperature Indicator	TFT-Display	25 – 115 °C	< 25 bzw. 95 – 115 °C	> 115 °C (flashing)
	Indication	Green range	Yellow range	Red range + Red flashing + Operating notification
Fuel quantity Indicator	Operating range	≥ 7 L (1.85 Gal, 1.54 IMP Gal)	6 bis 0 L (1.59 Gal, 1.32 IMP Gal – 0 Gal)	---
	TFT-Display	Fuel content – fuselage and wing tank(s) [3]	Fuel content – only fuselage tank (flashing)	---
	Caution-LED + Audio warning	---	Red flashing + Operating notification	---

1) If the RPM is in the range between 6600 and 6700 RPM for more than 5min, a warning (yellow triangle) appears on the TFT display of the operating unit and an operation notification is shown.

2) The speed limitation of the engine control system (Trijekt) and the redundancy system prevent the exceeding of a speed of 6800 RPM by switching off the ignition.

3) The content of the wing fuel tank(s) will only be considered, if the fuel content value of the wing tank(s) was entered manually into the powerplant operating unit before flight.

2.6 Weights (masses)

Maximum permitted take-off weight (mass):	850 kg	(1874 lb)
Maximum permitted landing weight (mass):	850 kg	(1874 lb)
Maximum permitted take-off and landing weight (mass) without water ballast:		
Power plant installed:	798 kg	(1759 lb)
Power plant removed:	765 kg	(1687 lb)
Maximum permitted weight (mass) of all non-lifting parts:		
Power plant installed:	560 kg	(1235 lb)
Power plant removed:	530 kg	(1169 lb)
Maximum permitted weight (mass) in baggage compartment: (see page 7.8)	2 kg	(4 lb)

2.7 Centre of gravity

Centre of gravity in flight

Aircraft attitude:	Tail raised up such that a wedge-shaped block, 100 : 4.5, placed on the rear top fuselage, is horizontal along its upper edge
Datum:	Wing leading edge at root rib
Maximum forward c/g position:	75 mm (2.95 in.) aft of datum (power plant removed) 95 mm (3.74 in.) aft of datum plane (power plant installed)
Maximum rearward c/g position:	290 mm (11.42 in.) aft of datum plane

It is extremely important that the maximum rearward c/g position is not exceeded. This requirement is met when the minimum front seat load is observed. The minimum front seat load is given in the loading table and is shown by a placard in the cockpit.
A lower front seat load must be compensated by ballast – see section 6.2 "Weight and Balance Record / Permitted Payload Range".

2.8 Approved manoeuvres

The powered sailplane is approved in category

Utility, self-launching

Permitted aerobatic manoeuvres:

- without wing water ballast,
- up to a maximum all-up mass of 690 kg (1521 lb)
- with retracted or removed powerplant
- with flap position "0"

a) inside loops

b) stalled turns

c) lazy eight

d) spinning

It is recommended to install in addition to the instrumentation recommended in section 2.12 an accelerometer (drag indicator, resettable).

2.9 Manoeuvring load factors

The following manoeuvring load factors must not be exceeded:

a) With airbrakes retracted

at V_A = 180 km/h, 97 kn, 112 mph

n = + 5.3

n = - 2.65

at V_{NE} = 280 km/h, 151 kn, 174 mph

n = + 4.0

n = - 1.5

b) With airbrakes extended

n = + 3.5
n = - 1.5

2.10 Flight crew

The aircraft is two-seated.
When flown solo, the Arcus M is controlled from the front seat.
Observe the minimum load on the front seat – if necessary, ballast must be installed to bring the load up to a permissible figure, see also section 6.2 “Weight and Balance Record / Permitted Payload Range”.

When flown with two pilots, the front as well as the rear seat can be designated as seat for the Pilot in Command. The following requirements have to be met, when the rear seat is designated for the Pilot in Command:

- All necessary control elements and instruments, including power plant operating unit, must be installed for the rear seat. The priority selector switch must be switched with the key up (power plant control unit in the rear panel active).

- The responsible pilot needs sufficient experience and practice in flying from the rear seat.
  The person in the front seat must be sufficiently pre-briefed in order that there is no negative effect on flight safety.

- No water ballast in the wings (because the water dump control is only accessible from the front seat)

2.11 Kinds of operation

With the prescribed minimum equipment installed (see page 2.12), the aircraft is approved for

V F R - flying in daytime

Cloud flying

Restricted aerobatics

2.12 Minimum equipment

Instruments and other basic equipment must be approved and should be selected from the list in the Maintenance Manual.

a) Normal operations

2 Airspeed indicator
(range up to 300 km/h, 162 kn, 186 mph)
with colour markings according to page 2.3

2 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 Power plant operating unit MCU 3:

- RPM
- Coolant liquid temperature
- Fuel quantity
- Engine time
- Warning signals/displays

1 Rear-view mirror

2 Four-piece safety harnesses (symmetrical)

Caution:

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

Additionally to the minimum equipment each occupant must be equipped either with an automatic or manual rescue parachute, or must use a back cushion (thickness approx. 8 cm / 3.15 in. when compressed)

2.12 Minimum equipment (cont.)

b) Cloud flying:

only permissible:
- without wing water ballast
- up to a maximum all-up mass of 690 kg (1521 lb)
- when it is authorized by the applicable national operating rules

In addition to the minimum equipment listed under a) the following instruments are required:

1 Turn & bank indicator with slip ball

1 Variometer

1 VHF-Transceiver

NOTE:
By previous experience it appears that the airspeed indicator system installed remains fully operational when flying in clouds.

Recommended additional equipment for cloud flying:

1 Artificial horizon
1 Clock

c) Restricted aerobatics

only permissible:
- without wing water ballast
- up to a maximum all-up mass of 690 kg (1521 lb)
- flap setting "0"
- power plant retracted or removed

Recommended additional equipment for restricted aerobatics

1 Accelerometer (drag indicator, resettable)

2.13 Aerotow and winch launch

Aerotow (Power plant retracted)

Only permissible on the nose tow release and with retracted power plant!

Maximum towing speed:	180 km/h (97 kn, 112 mph)
Rated break point in tow rope:	max. 850 daN (1911 lbf)
Minimum length of tow rope:	30 m (98 ft)
Tow rope material	Hemp or Nylon

Winch launch (power plant retracted)

Only permissible on the c/g tow release and with retracted power plant!

Maximum launching speed:	150 km/h (81 kn, 93 mph)
Rated break point in tow rope:	max. 1000 daN (2.248 lbf)

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 Maintenance Manual section 3.3 regarding the inspection procedure for the extension of the allowed service time must be observed.

2.15 Limitation placards

SPEEDS (IAS)

MAXIMUM PERMITTED SPEEDS

	km/h	kn	mph
Flaps setting **0 / -1 / -2 / S**	280	151	174
Flaps setting **+2 / +1 / L**	180	97	112
Rough air speed	180	97	112
Maneuvering speed	180	97	112
Aerotowing speed	180	97	112
Winch launching speed	150	81	93
Landing gear operating speed	180	97	112
For power plant extension/retraction	110	59	68
Power plant extended, ignition ON	125	67	78
Power plant extended, ignition OFF	160	86	99
PERMISSIBLE MINIMUM SPEED			
For power plant extension/retraction	90	49	56

m	km/h	kn	mph
0	280	151	174
1.000	280	151	174
2.000	280	151	174
3.000	280	151	174
4.000	263	142	163
5.000	245	132	152
6.000	232	125	144
7.000	220	119	137
8.000	207	112	129
9.000	195	105	121
10.000	182	98	113

WEAK LINK FOR TOWING

for Aerotow:	**max. 850 daN (1910 lb)**
for Winch launch:	**max. 1000 daN (2248 lb)**

TIRE PRESSURE

Nose wheel:	**3.0 bar (43 psi)**
Main wheel:	**4.0 bar (57 psi)**
Tail wheel:	**3.0 bar (43 psi)**

WATER BALLAST IN THE FIN

The rear limit for the in-flight center of gravity must not be exceeded. Therefore for loading the fin tank strictly **follow the Flight Manual section 6.2!**

BALLAST IN FIN TANK SIMULTANEOUSLY DUMPED WITH WING TANK

LOAD ON THE SEATS

Crew inclusive parachutes

Seat load	One Person min.	One Person max.	Two Persons min.	Two Persons max.
front seat load	**70* kg 154* lb**	**115 kg 254 lb**	**70* kg 154* lb**	**115 kg 254 lb**
rear seat load	——	——	at choice	**115 kg 254 lb**

valid for the following battery location(s):

1 battery	engine battery (E)
2 batteries**	in front of rear stick mounting frame (C1,C2)**
1 battery**	in fin (F1)**

Maximum fuel: **15.9 Ltr. / 12 kg / 26.5 lb**
4.20 US Gal. / 3.50 IMP. Gal.

Permitted all-up mass: **850 kg / 1874 lb**

DIFFERENCE TO MINIMUM LOAD

Front seat load	Plates Required
- 05 kg (11 lb)	1
- 10 kg (22 lb)	2
- 15 kg (33 lb)	3

Maximum load in the cockpit when the fuel tank is completely filled* 232* kg / 512* lb**

The maximum load in the cockpit (load on both seats + baggage + trim ballast) must not be exceeded.
If the front seat load is below the minimum front seat load: see instructions in the flight manual section 6.2.

With nose skid minimum load increases by 2 kg (4.4 lb)!

AEROBATICS

Only without water ballast in the wings, up to an all-up mass off 690 kg (1512 lb), with retracted or removed power plant and with flap position „0" the following aerobatic maneuvers are permitted:

A Inside loops	**C** Lazy eight
B Stalled turns	**D** Spinning

Operating conditions see Flight Manual!

*) Values as an example, the actually applicable values - see Flight Manual log chart section 6.2 - must be entered.

**) Enter number of batteries installed at weighing and enlisted in equipment list.

***) With removed power plant the amandment „when fuel tank is completely filled“ must be crossed out.

Note:
The asterisks (*) are only for the accompanying explanations. They are not shown in the original cockpit shield.

Note:

Further placards are shown in the Maintenance Manual.

Section 3

3 Emergency procedures

3.1 Introduction

Section 3 provides check lists and procedures for handling with emergencies that may occur.

3.2 Jettisoning the canopy

The canopy is to be jettisoned as follows:

Swing **back** one of the red locking levers provided on the left side of the canopy frame up to the stop (approx. 90°) and swing canopy sideways fully open.

The canopy will then be torn out from its hinges by the airstream and get carried away.

3.3 Emergency Bail out

If possible, first stop the engine (ignition OFF) and retract power plant (manual control switch "Retraction" respectively press emergency system switch DOWN).

After jettisoning the canopy (see section 3.2) the emergency exit can be performed.

- release harness

Front crew:

- Bend upper body slightly forward, grab the canopy coaming frame of the fuselage with both hands and lift the body up. The instrument panel is pushed up by the legs.

Rear crew:

- Grab the handles on either side of the instrument panel and use the canopy coaming frame or the arm rest of the seat pan for support.

- Leave the cockpit to the left.

- The rip cord of a manual parachute should be pulled at a safe distance and height.

3.4 Stall recovery

a) Power plant retracted

When stalling during straight and level fight 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 input.

b) Power plant extended

With the power plant extended, there are no significant differences in the stall behaviour, but the turbulent airflow produced by the propeller superimposes any vibration in the controls.

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 input.

3.5 Spin recovery

A safe recovery from a spin is accomplished by the following method:

a) Hold aileron neutral
b) Apply opposite rudder (that means against the direction of rotation of the spin).
c) Ease control stick forward until rotation ceases and the airflow is restored.
d) Level the wings, neutralize rudder, and pull gently out of dive.

With the centre of gravity in the mid to rearward position, a steady spinning motion is possible. After having applied the standard recovery method, the Arcus M will stop rotating after about 1/2 to 3/4 turn, depending on the flap position.

The loss of altitude - from the point at which recovery is initiated to the point at which horizontal flight is first regained - can be up to 250 m (590 ft) and the recovery speeds are between 130 and 210 km/h (70 – 113 kn, 81 – 130 mph). Therefore, when recovering using a positive flap position, make sure the maximum speed for that flap setting is not exceeded. It is recommended for positive flap settings to change the flap setting to "0" during spin recoveries.

With the center of gravity in the foremost position, a steady spinning motion is not possible. The sailplane stops rotating after a half to a full turn and usually ends in a spiral dive. In a spiral dive the sailplane accelerates very rapidly. Therefore a spiral dive must be recovered immediately.
Recovery is by normal use of controls (see page 3.6).

Caution:

Should the “Arcus M” enter a spin with its engine running, then - in addition to the actions required for the above recovery method – the throttle must immediately be closed.

Spinning may be safely avoided by following the actions given in section 3.4 “Stall recovery”.

Recovery from a spin with a positive flap setting can be hastened by adjusting the flaps to a negative setting.

In extreme configurations outside the allowable limits (e.g. accidental extreme rearward c/g position or extreme asymmetric water ballast) it may be necessary, especially in positive flap settings, to change the flap setting to "S" to stop the rotation.

3.6 Spiral dive recovery

Depending on the use of the controls, a spin may turn into a spiral dive if the centre of gravity is in forward positions.
This 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 a dive, the permissible maximum speed of the respective flaps position (if necessary use flap position"0" when pulling out) and the permissible control surface deflections at V_A respectively V_{NE} are to be observed (see also page 2.2).

3.7 Engine failure

Engine failure at take-off

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

Should the engine fail on take-off from a runway of 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 prop blades – (Ignition OFF and press manual control switch "retraction" respectively press emergency system switch 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 2.25 m/s (443 fpm) at 105 km/h (57 kn, 65 mph) and glide ratio degradation decreases to 13 : 1 – therefore use airbrakes with caution.

3.7 Engine failure (cont.)

Engine failure in flight

Should the engine fail in flight, check:

- Fuel quantity
- Fuel shut-off valve (OPEN?)

Should it be impossible to restart the engine, land 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 150 km/h (81 kn, 93 mph) at this speed the propeller turns up quickly (audible at the propeller noise).

Maintain speed until the engine has started. Then pull up with about 2g and reduce speed to the desired climb flight speed.

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 (492 ft).
For this reason, the emergency procedure should not applied at altitudes below 400 m (1312 ft) over ground.
At altitudes below 400 m (1312 ft) the engine should be retracted and a safe landing / off-field landing should be performed.

Icing of air intake / suction system

By previous experience, no suction system icing has yet occurred on the engine model installed.

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 data refer to section 5).

3.7 Engine failure (cont.)

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

The emergency extension/retraction switch is located at the base of the front instrument panel and accessible by lifting up its red guard.
With the key of this switch held up at “EXTD”, the propeller extends – held down at “RETR”, it retracts.
By lifting the red switch guard, automatically a bridging of the pylon limit switch “extended” takes place (which normally cut off the spindle drive).
Therefore the final position of the extended propeller pylon has to be checked visual or can be recognized when the 15 A circuit breaker is released.
To start the engine (by following the standard procedure), the emergency system is not required.

Note:

In the complete “down” position the spindle is stopped by the limit switch “retracted” and is shown by the green signal.

Failure of engine control system

The engine SOLO 2625-02i is equipped with a redundancy system for the engine control that allows the continued engine operation if a failure of the normal engine control system occurs.
The failure of the normal engine control system will be indicated by the powerplant operating unit in the instrument panel.

Engine control
malfunction
(CAN).

Redundancy system for the engine control can only be selected manually by the pilot (position of switch see chapter 7.3).

During operation with the redundancy system the engine power will be decreased because the adaption of the engine operation map to altitude and temperature is missing. The engine operational data and limitations remain the same.
To switch over to the redundancy system is possible while the engine is running. Also starting the engine in the air with activated redundancy system is possible.

Warning:

Self-launch is not approved under operation with the redundancy system

3.7 Engine failure (cont.)

Failure of the electric power supply for the engine

A defect of the electric power supply is displayed with an error message on the power plant control unit MCU 3.
The electric power for the engine control and fuel injection will then only be provided by the engine battery. As soon as the engine battery capacity is depleted the engine will stop running and the retraction of the engine is no more possible.

For this reason, as soon as a failure of the electric power supply is indicated, quickly stop and retract the engine.

Caution:

Under optimal conditions (fully charged engine battery, no load from avionic, normal operation of power plant system) it can be assumed, that the power plant can be operated for about 15 minutes at maximum power and then still be retracted.

Starting the engine despite a flat battery

Via the (optional) ground service receptacle

Plug in special starting cable into the receptacle provided below the aft seat on the left hand side.
Clamp negative ground strap to proper terminal of an external 12 V power source, then clamp power strap to positive terminal.
Thereafter follow normal starting procedure with master switch ON.

Note:

When connecting an external power source, a bridging of the master switch (circuit breaker) takes place so that even with master switch OFF the electrical system is ready for operation as displayed by the powerplant control unit.

Warning:

Beware of the propeller!

3.8 Fire

- CLOSE fuel shut-off valve
- Open throttle fully
- If the engine stops: master switch to position “OFF”
- Leave powerplant in extended position

This sequence should be followed – if possible –

(a) on ground
(b) during take-off
(c) in flight

Warning:
Abort flight and land immediately! Avoid any manoeuvres causing a high stressing of the fuselage.

3.9 Other emergencies

Flying with uneven water ballast

If, on dumping water ballast, the wing tanks are emptying unevenly or on one side only - which is recognized at lower speeds by having to apply opposite aileron for normal flying attitude -entering a stall must be avoided.

When landing in this condition, the touch down speed must be increased by about 10 km/h (5 kn, 6 mph) and the pilot must be prepared for the powered sailplane 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 the pilot may even avoid an emergency bail-out.

Loss of rudder control

Should a rudder control cable break in flight, the aircraft may quickly start yawing and rolling. 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 so that the wing will level with the aid of the adverse aileron yaw.
Shallow turns can also be effected by using only the aileron in the described manner.

3.9 Other emergencies (cont.)

Emergency landing with retracted landing gear

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

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

Ground-loop

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
- landing gear 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

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

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.

4.2. Assembly

4.2.1 Rigging and derigging

Rigging

The Arcus M 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 set water ballast control lever to “CLOSED” -
flap position "L":

Insert the left wing panel first. It is important that the helper on the wing tip should concentrate on lifting the trailing edge of the wing panel more than the leading edge, so that the rear wing attachment pin does not jam into the fuselage bearing.
Check that the spar stub tip is located correctly in the cut-out on the far side of the fuselage and that the fuel- and vent pipes are located correctly in the corresponding cut-out in the fuselage (if necessary, tilt the fuselage or move the wing gently up and down to help it home).
Check that the angular levers on the wing root rib are properly inserted into their corresponding funnels on the fuselage.
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 GFRP-panel covering the front wing locating tube.
The wing tip can now be placed on a wing stand.
Next insert the right wing panel – the procedure is the same as for the left wing. As soon as the pin on the right wing spar stub has engaged in its corresponding bearing on the opposite wing panel (recognized by a sudden extension of the unlocked airbrakes), the right wing panel can be pushed fully home under some pressure.
If it is difficult / impossible to push fully home, remove the main wing pin and draw the panels together with the aid of the rigging lever (use flat side only).

Finally push the main wing pin fully home and secure its handle (depress locking pin and let it engage in the metal fitting on the fuselage inner skin).

4.2.1 Rigging and derigging (cont.)

Wing tip extensions (outboard. panels)

Insert the spar of the wing tip extension – with locking pin pushed down and aileron deflected upwards – into the spar tunnel of the corresponding inboard wing panel. When fully home, the spring-loaded pin must have engaged (snapped up) in the corresponding opening on the inboard wing panel(s). Make sure that the coupling lap on the lower side of the inner aileron has correctly slid under the adjacent outer aileron.
With the rigging pin, make sure the locking bolt is snapped.

Horizontal stabiliser

Take the round-headed rigging tool (to be stored in the side-pocket) and screw it into the front of the horizontal stabiliser locating pin on the leading edge of the fin. Thereafter slide the stabiliser aft onto the two elevator actuating pins, pull rigging tool and its pin forward, seat stabilizer nose and push locating pin home into the front stabiliser attachment fitting.
Remove rigging tool – locating pin must not protrude in front of the leading edge of the fin.
Check whether the elevator actuating pins are really located (by moving the elevator) and check that the nose of the stabilizer is properly mated with the top of the fin.

After rigging

Connect the fuel line(s) of the wing tank(s) (option) to the fuselage tank with the aid of the quick disconnect coupling(s) and connect the small coupling of the vent line(s) from the wing tank(s) to the appropriate line(s) of the fuselage tank.
Check – with the aid of a helper – the controls for full and free movement in the correct sense. Use tape to seal off the wing / fuselage joint and the joint between main wing panels and their tip extension.

Caution:

Do not mask the aileron gap between inner wing and wing tip extension with any kind of tape.

Mask the opening for the front stabiliser attachment pin and also the joint between fin and horizontal stabilizer (only necessary if there is no rubber sealing on the upper end of the fin).
Sealing with tape is beneficial in terms of performance and it also serves to reduce the noise level.

4.2.1 Rigging and derigging (cont.)

Derigging

Remove sealing tape from wing panels and horizontal stabiliser, disconnect fuel line and vent line of wing tank(s).

Draining fuel from wing tank(s):

Connect fuel hose to the wing tank(s). Raise respective wing and empty wing tank(s) into a separate canister.

Wing tip extensions (outbd. panels)

Push the locking pin down (using rigging pin) and carefully pull out each tip extension.

Horizontal stabiliser

Using the threaded rigging tool, pull out the front stabiliser attachment pin, lift the stabilizer leading edge slightly and pull the stabiliser forward and off.

Main wing panels

Unlock airbrakes, set the water dump valve control lever to the "CLOSED" position and unlock the handle of the main wing pin.

With a helper on the tip of each wing panel, pull out the main wing pin till the last 20 to 30 mm (0.8 -1.2 in.) and withdraw the **right wing** panel by gently pulling and rocking it backwards and forwards if necessary.
Thereafter, remove the main wing pin and withdraw the left wing panel.

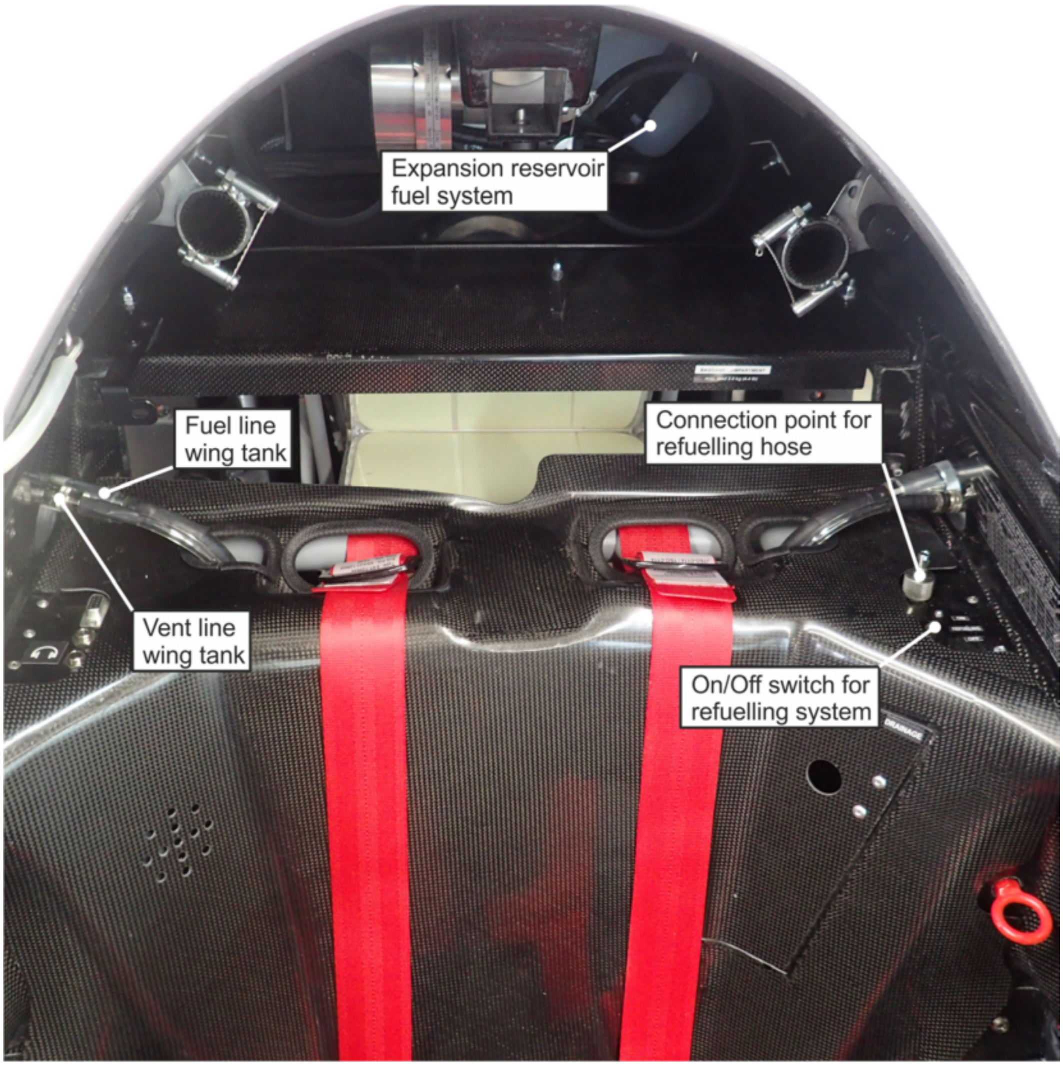
4.2.2 Refuelling

The Arcus M is equipped with a rigid fuselage tank and optional with up to two flexible wing tanks (see section 7.11)

Permitted fuel grades and capacity of fuel tanks see section 2.4.

The electrical fuel pump installed to the fuselage allows the refuelling of the fuel tanks with the aid of a fuel hose equipped with a quick-disconnect coupling.

The connection point for fuel hose and the ON/OFF switch of the refueling system is located in the aft cockpit above the back cover on the left side of the airplane.



4.2.2 Refuelling (cont.)

Fuel system with refuelling system (Example with one wing fuel tank)

While refuelling the fuselage and/or the wing tank(s) monitor the fuel level in the expansion reservoir in the baggage compartment. Stop the refueling at least when the expansion reservoir starts filling quickly.

Fuselage and wing tank(s) are connected by the vent lines with the expansion reservoir in the baggage compartment. All vent lines are equipped with a pressure relief valve which will prevent the filling of the expansion reservoir over the vent lines under normal conditions.

If the fuselage tank or the wing tank(s) are overfilled while refuelling or if the fuel is heated, fuel can stream via the vent lines into the expansion reservoir. As soon as the expansion reservoir is full, the subsequent fuel will bleed via the overflow line out of the fuselage (overflow outlet on the right, lower fuselage side behind the gear doors).

Caution:

The engine is supplied with fuel from the fuselage tank. Therefore always fill sufficiently the fuselage tank first and only afterwards the wing tank(s).

The external fuel hose used for the refuelling of fuselage and wing tank(s) has to be equipped with a suitable fuel filter.

4.2.2 Refuelling (cont.)

a) Refuelling of fuselage tank with installed refuelling system

The fuselage tank can only be filled via the installed refuelling pump.

In order to refuel the fuselage tank, attach the external fuel hose (see parts list in section 7.11) to the connection point in the baggage compartment, see picture on page 4.2.2.1.

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

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

The fuel capacity display on the power plant operating unit in the cockpit 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. At least now the refuelling has to be stopped.

Caution:

The installed refuelling pump will be damaged, if it is operated without pumping fluid over a prolonged period of time.

Only with optional wing tank(s):

For refuelling the fuselage tank it is recommended to disconnect the fuel lines of the wing tank(s) at the quick disconnect couplings. Otherwise an unnoticed overflow of fuel into the wing tank(s) might occur during the refuelling process, even before the fuselage tank is completely filled.
After refuelling the fuselage tank, reconnect the fuel line(s) of the wing tank(s).

If one wing will be dropped after refuelling the fuselage tank and reconnection of the wing tank(s), partial overflow of fuel from the fuselage tank into the dropped wing tank can occur.
The resulting asymmetric wing loading must be considered for the takeoff run.

4.2.2 Refuelling (cont.)

b) Refuelling of wing tank(s) (Option)

The wing tanks are connected to the fuselage fuel system via one fuel line and one venting line for each wing tank. All lines are equipped with quick release couplings that have to be operated manually.

The wing tank(s) can be refueled with the airplane rigged. The refuelling is possible with the installed refuelling pump or with an external fuel pump (optional).

It is recommended to empty the wing tanks before starting the refuelling, see page 4.2.2.12, to avoid overfilling of the wing tanks and to obtain a precise control over the amount of fuel on board.

Before refuelling the wing tanks at the rigged airplane, connect the vent lines of the wing tanks to the fuselage. Otherwise overflowing fuel can enter the fuselage.

In order to achieve the optimal filling of the wing tanks, the wings have to be kept horizontally while refuelling.

The wing tank(s) aren’t equipped with their own level measurement. Therefore it is recommended to refuel the wing tank(s) from calibrated canisters so that the total amount of fuel on board is known.

Furthermore should the fuselage tank be completely filled before starting to refuel the wing tank(s).

4.2.2 Refuelling (cont.)

b) Refuelling of wing tank(s) (Option) (cont.)

Caution:

If both wing tanks are connected with the fuselage fuel system, fuel can flow from one wing tank into the other if one wing will be dropped.
The resulting asymmetric wing loading must be considered for takeoff!

Due to the risk of leakage a longer, unobserved parking or storage of the airplane with filled wing tanks is not permitted.

For the road transport of the airplane in the trailer the wing tanks have to be empty!

Emptying the wing tank(s), see page 4.2.2.12

4.2.2 Refuelling (cont.)

b) Refuelling of wing tank(s) (Option) (cont.)

I) Refuelling of wing tanks with installed fuel pump

Connect the fuel line and the vent line of the fuel tank that will be refueled with the connections in the fuselage.

Attach the external fuel hose to the connection point in the baggage compartment, see picture on page 4.2.2.1. Place the other end of the external fuel hose in a fuel canister that will be used for refuelling.

By actuating the ON/OFF switch to the ON position, the fuel pump is activated and the refuelling of the wing tank through the fuselage tank is started

Are both wings equipped with a wing tank, it is recommended to refuel the wing tanks one after the other to be able to maintain control of the actual amount of fuel. To do so, disconnect the fuel line of one wing tank from the fuel system at the quick release coupling before refuelling the other one.

Refuelling has to be stopped at least when the maximum amount of fuel (see section 2.4) for the wing tank(s) is reached.

If there is unknown amount of remaining fuel in the wing tank(s) at the beginning of the refuelling, the fuel level in the expansion reservoir has to be observed while refuelling the wing tank(s).
As soon as the fuel level in the expansion reservoir starts to climb quickly, the respective wing tank is completely filled. The amount of fuel inside the wing tank then exceeds the content listed in section 2.4.

Reconnect the fuel line(s) of the wing tank(s) with the fuselage fuel system when the refuelling of the wing tank(s) is finished.

4.2.2 Refuelling (cont.)

b) Refuelling of wing tank(s) (Option) (cont.)

II) Refuelling of wing tank(s) with external fuel pump

For refuelling the wing tank(s) directly with an external fuel pump a special quick release coupling for the connection of the external fuel hose to the wing tank is necessary (see parts list in section 7.11).

Connect the fuel hose of the external fuel pump with the quick-release coupling of the fuel line of the respective wing tank. Then switch on the external fuel pump.

Refuelling has to be stopped at least when the maximum amount of fuel (see section 2.4) for the wing tank is reached.

If there is unknown amount of fuel remaining in the wing tank at the beginning of the refuelling, the fuel level in the expansion reservoir has to be observed while refuelling the wing tank.
As soon as the fuel level in the expansion reservoir starts to climb quickly, the respective wing tank is completely filled. The amount of fuel inside the wing tank then exceeds the content listed in section 2.4.

Reconnect the fuel line of the wing tank with the fuselage fuel system when the refuelling of the wing tank is finished.

Caution:

Observe the maximum fuel content of the wing tank when refuelling with an external fuel pump!
Powerful fuel pumps can produce enormous pressure and cause damage to the wing structural, if the wing tank will be overfilled, although a pressure relief valve exists.

4.2.2 Refuelling (cont.)

c) Determination of fuel content in fuselage tank

I) Fuselage tank

The fuel content of the fuselage tank is measured with a capacitive sensor. The power plant operating unit in the cockpit displays the fuel content of the fuselage tank in total liters.

When fuel content in the fuselage tank drops below the reserve volume of 6 liters (1.58 U.S. Gal, 1.32 IMP Gal) (allows approx. 15 min engine running time with max. continuous power), the displayed value for the fuel content is blinking and an audio warning sounds.
You can switch off the warning temporarily by pressing the rotary switch.

The warning will reappear when the fuel content is decreased by another liter.

4.2.2 Refuelling (cont.)

c) Determination of fuel content in fuselage tank (cont.)

II) Calibration of fuel quantity indicator of the fuselage tank

If the fuel grade is changed, (for example 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 reservoir in the baggage compartment).
- Retract power plant (limit switch “Retracted” must be actuated)

In the MAIN MENU select with the rotary switch the FUEL MENU, select there CALIB. MAIN TANK. The calibration is started by pushing the rotary switch. If the display shows the new tank calibration factor (for example [94]), the calibration is successfully completed.
After returning to the main menu, the display of the fuselage tank content is set to 16 L.

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

The error message TANK CALIB. 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.

4.2.2 Refuelling (cont.)

c) Determination of fuel content in fuselage tank (cont.)

Caution:

During level flight the fuel content indication is sufficiently accurate. On the ground with one wing dropped or in flight at extreme pitch attitudes deviations in the fuel indication may occur.

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!

4.2.2 Refuelling (cont.)

d) Determination of fuel content in wing tank(s) (Option)

I) Wing tank(s) (Option)

The fuel content of the wing tank(s) is not monitored by the power plant operating unit. Therefore, the amount of fuel filled into the wing tank(s) has to be determined during refueling.

II) Indication of total amount of fuel on board

It is possible to take the fuel quantity in the wing tank(s) into account for the displayed fuel quantity by entering the fuel quantity manually into the power plant operating unit.

Prerequisites for this are:

- o the total fuel quantity on board is known.
- o the displayed fuel quantity in the fuselage tank is at least 6 liters.
- o the power plant is retracted (limit switch "retracted" must be actuated).

Then use the rotary switch to navigate through the main menu of the power plant operating unit to the FUEL MENU und select WING TANK.
Adjust the displayed fuel quantity until the fuel quantity in the wing tank(s) is shown, confirm the fuel quantity by pressing the rotary switch and exit the menu.
If the rotary switch is not operated for more than 5 s, the operating unit accepts the entered value for the fuel quantity and returns automatically to the operating mode.

The amount of fuel consumed during engine operation is calculated during operation from consumption data of the power plant control unit. With these values the power plant control unit calculates the current total fuel quantity on board and displays this fuel quantity on the power plant operating unit.

4.2.2 Refuelling (cont.)

d) Determination of fuel content in wing tank(s) (Option) (cont.)

If the fuel quantity in the fuselage tank drops below the reserve quantity of 6 liters for the first time, the operating unit displays the fuel quantity of the fuselage tank, independently of the calculated current total fuel quantity on board.
In this case the calculated value for the total fuel quantity on board will be deleted.
As a result, the operating unit displays only current measured fuel quantity in the fuselage tank, even if the reserve fuel quantity is exceeded again by fuel slowly running out of the wing tank(s) into the fuselage tank.

Caution:

The manually entered total fuel quantity on board is preserved, even when the power plant control system is turned off.

If the manually entered fuel quantity is incorrect or if the fuel quantity in the wing tank(s) decreases during operation for example due to leakage, you will not see this deviation immediately at the displayed total fuel quantity on board!
Such a deviation of the fuel quantity on board will only be detected, if the reserve fuel quantity in the fuselage tank is reached earlier.

4.2.2 Refuelling (cont.)

e) Emptying of fuel tanks

I) Fuselage tank

The fuselage tank can be emptied through the drain valve. The drain valve is located on the lower left side of the fuselage behind the landing gear box. The outlet of the drain line is a short piece of tube within the gearbox on the left-hand side at the edge of the landing gear cutout.

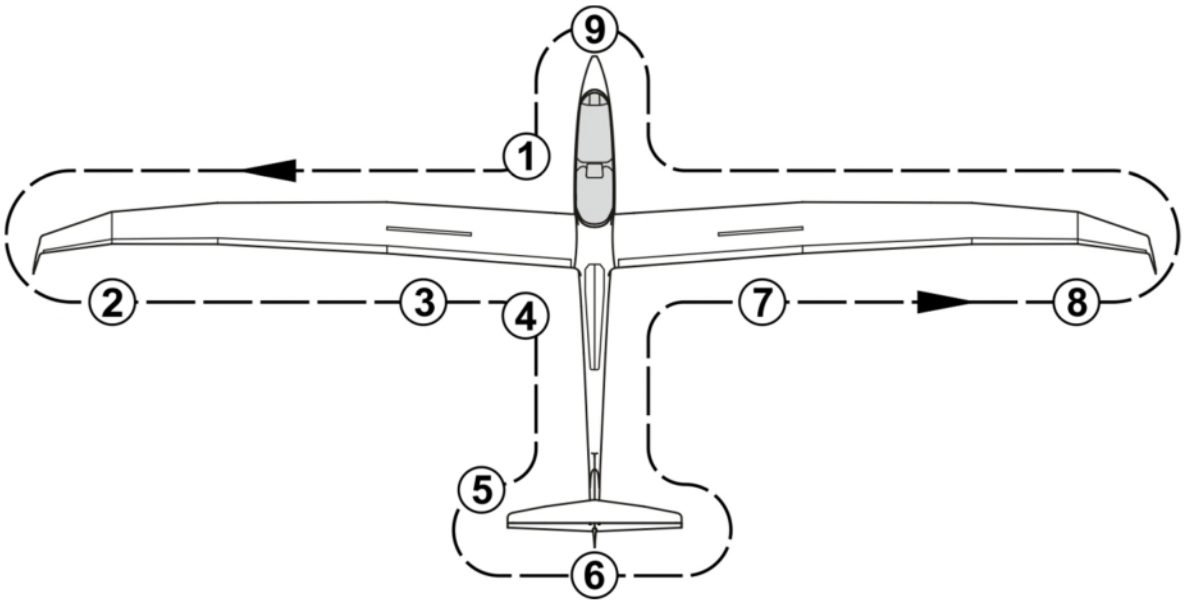
II) Wing tank(s) (Option)

If the fuselage tank is not completely filled the fuel content of the wing tank can be emptied into the fuselage tank. In order to allow a rapid draining of the fuel, lift the respective wing with the wing tank.

Alternatively it is possible to fill the fuel content of the wing tank into an external canister with a special defueling tube (see parts list in section 7.11). In order to allow a rapid draining of the fuel, lift the respective wing with the wing tank.

4.3 Daily Inspection

The importance of inspecting the powered sailplane after rigging and before the first flight of the day 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 an expert for advice.

(1) a) Open canopy

b) Check that the main wing pin is properly secured

c) Perform a visual Check of all accessible flight control components in the cockpit

d) Check for full and free movements of the control elements

e) Check batteries for firm attachment and accordance with the loading chart

4.3 Daily Inspection (cont.)

f) Check for foreign objects

g) Check fuel quantity (at powerplant operating unit)

h) Check fuel line(s) and vent line(s) – especially those for the wing tank(s) - for proper connection

i) Check tire pressure:

Nose wheel:	3.0 bar	(43 psi)
Main wheel:	4.0 bar	(57 psi)

j) Check tow release mechanism(s) for proper condition and function

(2) a) Check upper and lower wing surface for damage

b) Clean and grease water ballast dump valves (if necessary)

c) Check wing tip extensions for proper connection

d) Check the flaperons for good condition and freedom of operation. Check for any unusual play by gently shaking the flaperons. Check flaperon hinges for damage

(3) Check airbrakes for proper condition, fit and locking

4.3 Daily Inspection (cont.)

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

b) Check that the Static pressure ports for the airspeed indicator on the tail boom are clear (1.02 m / 3.35 ft forward of the base of the fin)

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

Attention: make sure that the IGNITION is **"OFF"**!
Extend power plant with manual extension/retraction switch

c) Check propeller pylon during extension for sufficient clearance to the rim of the engine compartment

d) Check propeller for damage

e) Check propeller pylon and fittings for damages and cracks

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

g) Propeller brake: Check for 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 brake servo and Bowden cable from brake servo to brake lever. Check condition and function of manual actuation of propeller brake.

Propeller stopper: Check for easy movement and clearance of propeller circle in inactive position. Check condition of propeller stopper with attachment of Bowden cables and return spring. Check condition of upper servo and Bowden cable from servo to propeller stopper.

h) Check belt drive for changed tension and wear. Check pinch roller for easy movement.

i) Check air intake filter of air induction system for tight attachment

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

k) Check ignition system incl. cables and igniter plugs at the engine for damage and firm attachment.

l) Visual inspection: Check bolt connections at the power plant and their respective locking. Check external condition of engine.

4.3 Daily Inspection (cont.)

m) Check cooling water hose for damage and firm attachment at the plug-in connections

n) Check level of coolant liquid. Ensure tight closure of pressure cap.

o) Check functionality of water pump with ignition “ON”

p) Visual inspection of rubber elements for damage (radiator mounts, propeller pylon mounts and front and rear spindle drive mounting)

q) Check exhaust manifold, exhaust joint, exhaust coupling and silencer for damages and cracks.

r) Check for chafing marks on components and cables

s) Check arresting cable and the respective attachments

t) Check functionality of engine-door kinematic

u) With ignition “OFF” turn propeller manually several times. Check if abnormal sounds or stiffness are noticeable

v) Drain water from the fuselage tank with drain valve in rear cockpit, on the left side of the landing gear wheel well behind the back-seat cover. Check outlet of the drain valve for cleanliness

w) Check venting line of the fuel system on the right hand side behind the landing gear wheel well door. Outlet has to be clean and not covered with any kind of tape.

4.3 Daily Inspection (cont.)

(5) a) Check condition of tail wheel (tire pressure 3.0 bar (43 PSI))

b) If TEK-probe is available, install probe and check TEK-line (connected variometer has to read climbing when blowing from front on probe)

When equipped with water ballast fin tank (option):

c) Check that fin tank spill holes are clear and clean

d) Check water ballast level in fin tank (in case of doubt, discharge ballast)

e) Check that the dump hole of the fin tank in the aft fuselage forward of the rudder, is clear

4.3 Daily Inspection (cont.)

(6) a) Check correct battery installation in vertical tail according to loading chart

b) Check horizontal tailplane for proper attachment and locking. Check horizontal and vertical play of the horizontal tailplane at the tip

c) Check elevator and rudder for free movement

d) Check trailing edge of elevator and rudder for damage

e) Check elevator and rudder for any unusual play by gently shaking the trailing edge

f) Check axial play in the rudder mounting (possible jamming of the rudder bracket in the rudder fairing). If a steerable tailwheel is installed, support the fuselage cone in such a way that the steerable tailwheel is relieved of load (e.b. by mounting the tail dolly).

g) Check stiffness of the elevator U-bracket. To do that, grap both elevators with two fingers at the trailing edge in the area of the elevator U-bracket and apply a noticeable force (approx. 30-40 N) in opposite directions. No noticeable relative motion between both elevator halves is permissible. If in doubt, de-rig the horizontal tailplane and repeat the test.

(7) See (3)

(8) See (2)

(9) Check pitot pressure head in the nose cone for cleanliness.
When blowing gently into the tube, the airspeed indicators must register

After heavy landings

After heavy landings, ground loops or unusual mechanical loads on the airframe because the operating limitations have been exceeded during flight, the aircraft has to be inspected for damage.

Described below are simple inspection procedures that can be used to identify typical damage:

- Check the entire aircraft thoroughly for surface cracks, deformations or other visible damage. For this purpose, check the riffed aircraft and also the individual parts in the derigged condition.
- Check resonant wing vibration frequency. Compare the determined frequency with the one on the last inspection report of this serial number.
- Check entire control system for ease of operation and for unchanged, symmetrical deflections. Check stiffness of the control system between control element and control surface. After hard landing especially check the functionality of the over center of the airbrake control system.
- Remove seat pan and back cover from the cockpit. Check accessible areas of the cockpit structure for delamination, check fuselage steel frame for visible deformations.
- In particular after a ground loop, check the rear part of the fuselage tube und the transition to the vertical tail 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 rear bracket of the horizontal tail. Check the fuselage structure for excessive deformation, buckling and crackling noise.
- Check the connection between horizontal stabilizer and vertical tail for unusual softness. Disassemble horizontal stabilizer and check fittings of vertical tail and horizontal stabilizer for plastic deformations or broken joints.
- The rudder has to be checked for increased axial play, which may lead to a jamming of the rudder bracket in the rudder fairings. The tail must be jacked up for this check if the aircraft is equipped with a steerable tailwheel (e.g. by mounting the tail dolly).
- Check the root ribs and the spar stubs of the inner wings and of the wing separation as well as the associated bolts, bushings and pivoting bearings.
- Check the power plant system for damage as well.

After heavy landings (continued)

If any damage is found, the damage has to be repaired properly before the next flight.

Note:

The execution of the listed inspections and the judgement of the findings require a level of expertise that lies beyond the qualifications required for a pilot.
Therefore the listed inspections in this section are restricted to personnel with approved ratings for the approval of similar maintenance activities, issued from the responsible national aviation authority.

4.4 Preflight inspection

CHECKLISTE BEFORE TAKE-OFF

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

CHECKLIST SELF LAUNCHING

- Fuel checked?
- Warnings power plant operating unit?
- Cooling water temperature checked?
- Ignition circuits checked?
- Redundancy system checked?
- Take-off RPM checked?
- Rear view mirror set correctly?

4.5.1 Methods of launching

a) Aerotow

(Only permissible on nose tow release and retracted power plant)

Maximum permitted towing speed:

V_T = 180 km/h (97 kn, 112 mph)

For aerotow only the nose tow release may be used - hemp and nylon ropes of between 30 and 40 m length (98-131 ft) were tested.

Prior to take-off set elevator trim as follows:

Rearward c/g positions:	Lever full forward
Other c/g positions:	Lever 1/3 of its travel from forward

As the tow rope tightens, apply the wheel brake gently (by actuating the stick-mounted lever) to prevent the airplane from over running the rope.

In crosswind conditions, keep in mind that at the beginning of the take off roll, there is an increase of the lift generated on the downwind wing from the tug's prop wake, which drifts with the wind. Therefore it may be necessary to hold downwind aileron to start.

For intermediate to forward c/g positions the elevator control should be slightly pulled back; in the case of rearward c/g positions it is recommended that neutral elevator is maintained until the tail lifts.

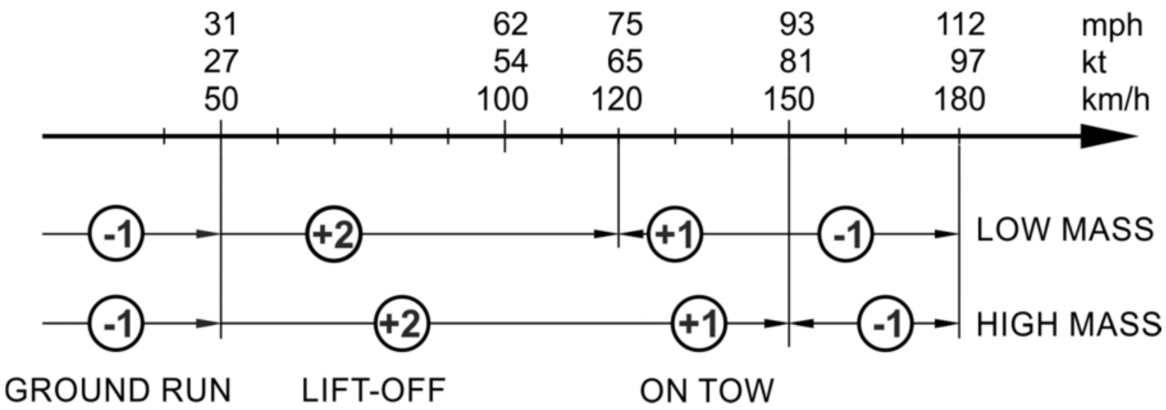
After lift-off the elevator trim can be set for minimum control stick loads.

An aerotow can be made with a flap setting of "+2". Although it is recommended to start the takeoff roll with a negative flap setting ("-1" or "-2") in a crosswind take off or on rugged surface. When sufficient aileron control is attained (at about 50 km/h / 26 kn / 30 mph) the flap position should be moved to "+2" for lift off.
With a negative flap setting during takeoff roll the effectiveness of the ailerons will be increased and it will be easier to keep track behind the towplane.

4.5.1 Methods of launching (cont.)

After lift off at 80 to 90 km/h (43-49 kn, 50-56 mph) – depending on loading and flap setting – the trim can be set so that minimal force is felt in the elevator control.
Normal towing speed is 110 to 130 km/h (59-70 kn, 68-80mph) with a flap setting "+2". At higher flying masses the towing speed is about 120 to 140 km/h (65-76 kn, 75-87 mph).

At higher towing speeds, negative flap settings as far as flap setting "S" can be used. Flap settings can be performed in this manner, that the handling force in the elevator control is very comfortable.



Only small control surface deflections are normally necessary to keep position behind the towplane. In turbulent weather conditions or when flying into the propeller slip stream of a powerful towplane, correspondingly greater control stick movements are required.

The landing gear may be retracted during the low speed towing; this is not, however, recommended at low altitude, as changing hands on the stick could easily cause the aircraft to lose altitude behind the towplane.

When releasing the tow rope, pull the yellow T-shaped handle fully multiple times and turn away only after the rope has definitely disconnected.

4.5.1 Methods of launching (cont.)

b) Winch launch

(Only permissible on c/g tow release and retracted power plant)

Maximum permitted launching speed:

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

For winch launching only the c/g tow release and the flap settings "+1" or "+2" must be used.
With only one seat occupied and no water ballast or with an aft c/g position, a flap setting of “+1” should be used.
With both seats occupied or when water ballast is used, a flap setting of “+2” should be used.

Prior to take-off set elevator trim as follows:

Rearward c/g Positions	Lever full forward
Intermediate c/g Positions	Lever full forward
Forward c/g positions	Lever neutral

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

Ground run 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 seats, the Arcus M is lifted off with the control stick pushed slightly forward in case of aft c/g positions and pulled slightly 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.

With standard payload (with two occupants) the launch speed should not be less than 100 km/h (54 kn, 62 mph). At maximum takeoff mass the launch speed should not be less than 115 km/h (62 kn, 71 mph).

Normal launch speed (with two occupants) is about 110 to 120 km/h (59-65 kn, 68-75 mph). At maximum takeoff mass the launch speed is about 125 km/h (67 kn, 78 mph).

By reaching the maximum launch altitude, the tow cable will release automatically. The cable release handle should, nevertheless, be pulled firmly multiple times to ensure that the cable is actually gone.

4.5.1 Methods of launching (cont.)

Warning:

It is explicitly advised against winch launching in tail wind!

Caution:

Winch launching at the maximum permitted all-up mass should only be done if there is an appropriately powerful winch and a cable in perfect condition 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 the all-up mass.

Prior to launching it must be ensured that the crew is properly seated and able to reach all control elements.
Particularly when using seat cushions, it has to be ensured that during the initial acceleration and while in steep climbing attitude the occupants are not able to slide back- and upwards.

4.5.1 Methods of launching (cont.)

c) Self launch

I) Starting the engine on the ground

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

POWER PLANT EXTENSION & STARTING PROCEDURE

- Power plant master switch on
- Open fuel shut-off valve
- Set throttle to idle
- Set speed to 95 - 100 km/h (51 - 54 kn, 59 - 62 mph)
- Ignition on

Only in manual operation:
- Extend power plant

- When power plant is fully extended and green indicator light is on: Push starter button until is running

On the ground:
- Apply wheel brake, pull stick back
- Check that propeller is clear?

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

II) Ignition circuit check

- o Warm up engine (CHT ca. 40 °C / 104 °F)
- o Set RPM to 3000 - 3500 RPM
- o Select Automatic ignition circuit Check (- AUTO)
  or
  Manually select both ignition circuits (- MANUAL – LEFT/RIGHT)
  The drop in RPM has to be smaller than 300 RPM.
- o After returning to both ignition circuits, the engine should return to primarily RPM.

III) Engine control redundancy system test

- o Warm up engine (CHT ca. 40 °C / 104 °F)
- o Set RPM to 4000 through 4500 RPM
- o Activate redundancy system by activating the appropriate position on the switch located next to the power plant operating unit
- o Test: engine must maintain operation and react to changes in throttle settings despite a temporary drop in speed. Otherwise the redundancy system is defective.
- o Switch back to normal system for engine control
- o Set RPM to normal idle speed

4.5.1 Methods of launching (cont.)

III) Engine control redundancy system test (cont.)

> **Warning:**
>
> A ground start with the activated redundancy system is prohibited!

IV) Engine run up

Before or during take-off increase rev until full throttle. At a minimum RPM of 6000 RPM in idle, the engine runs smoothly.

V) Taxiing

If the wings are equipped with the respective wheels, the aircraft can be operated independently with the steerable tail wheel on the ground. Nevertheless, you have to take care, that the lowered wing won't be damaged by bigger stones for example.
While taxiing pull the elevator control all the way back. Operate the wheel brake with the right hand on the stick.

VI) Stopping the engine on the ground

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

To avoid unnecessary electrical power consumption of the power plant control system in this situation, it is recommended to push shortly the manual operation switch up or down after the engine has stopped. This way the power plant control system will switch into the manual mode (idle mode).

VII) Starting the engine in flight

- Set speed to 95 km/h (51 kn, 59 mph) through 100 km/h (54 kn, 62.2 mph) for extending the power plant and starting the engine

The starting procedure of the engine in flight is the same as on the ground.

4.5.2 Take off (on own power) and climb

Conduct take-off check (see page 4.4) and observe page 5.2.3 (take-off distances).
For take-off the wing should be held in level by an assistant. Compensate an asymmetric fuel load in the wing tanks by applying opposite aileron when commencing the take-off run.

Note:

During the initial acceleration for the take-off run only apply so much throttle that the tail wheel still remains on the ground. Rolling on the nose-wheel respectively on the nose skid increases especially on soft grounds the rolling drag and therefore also the take-off distance considerably.
That’s why the above described method is recommended especially on uneven grounds and at high cockpit payload (forward c/g position!).

The following launching method is recommended:

- Set elevator trim at its aft range
- Set flaps at “0” (or “-1” in crosswind conditions)
- Pull control stick fully back and
- Advance gradually to full throttle setting
- On reaching a speed of about 40 km/h (22 kn, 25 mph), reset flaps at “+ 2” (or “L” on soft ground)
- With the c/g in forward position, lift off aircraft at a speed of about 85 km/h (46 kn, 53 mph) with the stick fully pulled back.
  In the case of aft c/g positions slightly less back pressure is applied.
  If flap setting “L” was used for lift off, reset flaps at “+2”
- Ease control stick forward until reaching the speed for best climb 95 km/h (51 kn, 59 mph)

Observe coolant liquid temperature while climbing.
When reaching the maximum permitted temperature, reduce power to avoid exceeding the limit.

4.5.2 Take off (on own power) and climb

Warning:

Taking-off in rain, with wet or iced-up wings is not permitted, as the take-off distance increases considerably and furthermore the climb performance is adversely affected.

Caution:

If, at high ambient temperatures, the coolant liquid 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.

4.5.3 Cruise flight / Cross country flight

a) 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.

With a mid-point c/g position the maximum speed range covered by the elevator trim ranges from about 70 km/h (38 kn, 43 mph) (flap “L”) to about 200 km/h (108 kn, 124 mph) (flap “S”).

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

All-up mass	600 kg 1323 lb
Flaps at	“L”
Speed	98 km/h 53 kn 61 mph
Reversal time	4.8 sec

Caution:

Flights in conditions conducive to lightning strikes must be avoided.

4.5.3 Cruise flight / Cross country flight (cont.)

High speed flying (power plant retracted)

At high speeds up to V_{NE} = 280 km/h (151 kn, 174 mph) the aircraft is easily controllable.
Full deflections of control surfaces may only be applied up to V_A = 180 km/h (97 kn, 112 mph).

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

In strong turbulence, for example in wave rotor, thunderclouds, visible whirlwinds or when crossing mountain ridges, the speed in rough air V_{RA} = 180 km/h (97 kn, 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 kn, 174 mph). However, they should only be used at such high speeds in an emergency or if the maximum permitted speed is being exceeded inadvertently.

When extending the airbrakes suddenly, the deceleration forces are noticeable.

Warning:
Consequently it is wise to check in advance that the seat harnesses are tight and that the control stick is not inadvertently moved when the airbrakes are extended. There should be no loose objects in the cockpit. At speeds above 180 km/h (97 kn, 112 mph) extend the airbrakes gradually (2 seconds).

It is strictly noted that in a dive with airbrakes extended the aircraft has to be pulled out less abruptly (maximum 3.5 g) that with retracted airbrakes (maximum 5.3 g), see section 2.9 “Manoeuvring Load Factors”. Therefore pay attention when pulling out with airbrakes extended at higher speeds.

A dive at V_{NE} with the airbrakes fully extended is limited to an angle to the horizon of 36° at maximum permitted all-up mass of 850 kg (1874 lbs).

At an all-up mass of up to 690 kg (1521 lbs) an angle to the horizon is more than 45°.

4.5.3 Cruise flight / Cross country flight (cont.)

Optimum flap positions

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

Use of flaps for	Flap setting	unit	AUW = 665 kg 1466 lbs	AUW = 850 kg 1874 lbs
Low speed flying (straight and level)	L	km/h kn mph	Up to 86 46 53	Up to 97 52 60
	+2	km/h kn mph	86 – 93 46 – 50 53 - 58	97 – 103 52 – 55 60 - 64
	+1	km/h kn mph	93– 108 50 – 58 58 – 67	103 – 124 55 – 67 64 – 77
Max. L/D	0	km/h kn mph	108 – 134 58 – 72 67 – 83	124 – 155 67 – 84 77 - 96
Flying between thermals and high speed flying	-1	km/h kn mph	134 – 160 72 – 86 83 – 99	155 – 186 84 – 100 96 – 115
	-2	km/h kn mph	160 – 180 86 – 97 99 – 112	186– 201 100 – 108 115 – 125
	S	km/h kn mph	180 – 280 97 – 151 112 - 174	201 – 280 108 – 151 125 - 174

For a speed polar diagram refer to section 5.3.2.

For smooth thermals and while climbing in slow straight flight flap setting "+2" is recommended. In turbulent thermals, which require a quick aileron response, and climbing in straight, slow flight flap setting "+1" is advantageous.

Near the lower end of the optimum circle speeds in thermals the pilot may even use flap setting "L", especially at high all-up masses or in updrafts with hardly any variation in flying speed.

Best glide and moderate inter-thermal speeds are covered by flap setting "0" and "-1" for high cruise the optimum performance is achieved with the more negative settings.

4.5.3 Cruise flight / Cross country flight (cont.)

Low speed flight and stall behaviour (power plant retracted)

In order to become familiar with the aircraft it is recommended to explore its low speed and stall characteristics at a safe altitude. This should be done using the various flap settings while flying straight ahead and also in a 30° to a 45° banked turn.

Wings level stall

The first signs of a stall usually occur 5 to 10 km/h (3-5 kn, 3-6 mph) before stalling speed. It begins with a slight rolling motion and 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:
>
> Before reaching a stall condition, depending on c/g position, the air speed indicator reading drops obviously.

When reaching a stalled condition with the c/g in middle and rearward positions, the stick reaches the stop and the powered sailplane remains in deep stall or drops the wing respectively the nose.

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 up to 60 m (200 ft)

In the case of forward c/g positions and stick fully pulled back, the aircraft just continues to fly in a mushed condition without the nose or wing dropping.

Normal flying attitude is regained by easing the stick forward.

4.5.3 Cruise flight / Cross country flight (cont.)

Turning flight stalls (power plant retracted)

When stalled during a coordinated 45° banked turn and a forward c/g, the Arcus M - with the control stick pulled fully back -will continue to fly in a stalled condition.
With aft c/g during the turning stall, the inside wing will drop and the nose will drop below the horizon. The stall can be stopped immediately by relieving the back pressure on the control stick.
There is no uncontrollable tendency to enter a spin. The transition into a normal flight attitude is conducted by an appropriate use of the controls.

The loss of height from the beginning of the stall until regaining a normal level flight attitude is approx. 150 m (492 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.

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

4.5.3 Cruise flight / Cross country flight (cont.)

b) Power plant extended

During level flight it is possible to reach speeds of approx. 160 km/h (86 kn, 99 mph) at 6600 RPM and flap setting “-1”, because the propeller is primarily built for climb.

At this speed the sailplane shows a stable behaviour and is easy to control.

Flown in a shallow dive, the maximum permitted engine speed of 6700 RPM must not be exceeded.

Idling only in emergency:

With engine idling (throttle closed), descending flights are only allowed for short periods.
Long idling periods must be strictly avoided to prevent the danger of an engine failure due to carbon accumulation on the spark plugs or leck of lubrication.

Caution:

On longer flights with the throttle closed it is therefore necessary to open it momentarily at least once every minute to keep the engine clean!

Caution:

Flight conditions under lightning strikes must be avoided!

4.5.3 Cruise flight / Cross country flight (cont.)

Cruise flight on own power

As clearly shown by the figures of section “Flight Performance”, the longest range results can be expected from the sawtooth method.

It consists of the following flight sections being repeated as required:

- climb at a speed of about 98 km/h (53 kn, 61 mph)
- a glide in sailplane configuration

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. 110 to 120 km/h (59-65 kn, 68-75 mph), resulting in an average speed of about 100 km/h (54 kn, 62 mph).

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 kn, 99 mph) is also possible.

The range, however, is then considerable less – see section 5.3.2.

For cruise flight, the sawtooth method should always be preferred as besides the longer range the crew is also less exposed to engine noise.

4.5.3 Cruise flight / Cross country flight (cont.)

Stopping the engine, retracting the power plant

See also the following checklist:

STOPPING PROCEDURE & POWER PLANT RETRACTING

- Set speed to 95 - 100 km/h (51 - 54 kn, 59 - 62 mph)
- Cooling run by 20% power for 1 minute
- Ignition off

Only in manual operation:
- Brake propeller with manuel propeller brake and hold it in the vertical position

- Retract power plant

- When power plant is fully retracted and green inidcation light is on:
  Power plant master switch off

Remarks regarding the vertical positioning of the propeller

- o If the propeller hasn’t reached its vertical position after the engine has stopped, the movement of the propeller can be accelerated by:
  - increasing the flight speed or
  - pressing the starter button

- o If the propeller has to turn only about 15° until reaching its vertical position, don’t use the starter anymore

- o If the propeller was not caught in its vertical position by the automatic propeller stop for the last three attempts, support the vertical positioning of the propeller with the manual propeller stop during the next attempt.

  Caution:
  Through the mirror observe the propeller retracting to check if the propeller rotates further.

The power plant retracts within approx. 14 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).

4.5.3 Cruise flight / Cross country flight (cont.)

Extending the power plant, starting the engine in flight

1. With the power plant extended and engine off, the rate of descent is approx. 2.25 m/s (443 fpm) at a speed of 105 km/h (57 kn, 65 mph), resulting in a glide ratio of only about 13 : 1 – contrary to the best L/D of around 49 : 1 in configuration with power plant retracted.
   Therefore the engine should only be restarted over terrain suitable for landing and, if possible, not below 300 m (984 ft) AGL.

   But extending the power plant at a height of 200 m (656 ft) AGL on the down-wind leg to a suitable landing field is safer than for example restarting it at 500 m (1640 ft) AGL above a forest or something like that.

   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 procedures: see also check list on page 4.5.1.5

   - Power plant master switch **ON**
   - **OPEN** fuel shut-off valve
   - Set throttle to **IDLE**
   - Set speed to **95 to 100 km/h** (51-54 kn, 59-62 mph)
   - Ignition **ON**
   - *Only in manual operation: **EXTEND** power plant*
   - When power plant is fully extended (green signal): press starter button
   - Set throttle as required

   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.

4.5.3 Cruise flight / Cross country flight (cont.)

Low speed flight and stall behaviour (power plant extended)

Compared with the stall behaviour in “clean” configuration (power plant retracted), there are no significant differences when aircraft stalls from straight and level or from turning flight.

Furthermore the noise of the propeller increases considerably.

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

4.5.4 Approach

a) Power plant retracted / power plant removed

The normal approach speed with airbrakes fully extended, flap position " L" and landing gear down is 95 km/h (51 kn, 59 mph) without water ballast and flown solo, or 108 km/h (58 kn, 67 mph) at maximum permitted all-up mass. The yellow triangle on the airspeed indicator at 105 km/h (57 kn, 65 mph) is the recommended approach speed for the maximum all-up mass without water ballast (798 kg (1759 lb) with power plant installed / 765 kg (1687 lb) with removed power plant.
The airbrakes open smoothly and are very effective.
The landing flare with the airbrakes fully opened, must be flown with care and very precisely. It is not recommended to leave the airbrakes fully opened while flaring. There is no noticeable change in trim.
During approach and landing flap setting "+2" can also be used. Except than a 5 km/h (3 kn, 3 mph) speed increase, there are no other differences in the landing characteristics.
Side slipping is also a useful aid for landing. It is possible to maintain a straight line with the rudder deflected up to about 30 - 50 % of its travel. The result is a yaw angle of up to about 25° and a bank angle of about 10 - 20°. The rudder must be held with perceptible counter-pedal pressure because of the control force reversal.
To return to level flight, normal opposite controls are required.

Caution:

With rudder fully deflected, side slips in a straight flight path are not possible. The sailplane will slowly turn in the direction of the displaced rudder.
Side slipping causes the airspeed indicator to read lower than the actual speed beginning with an angle of sideslip of about 5° to 10°.
During side slip with water ballast some water escapes through the vent hole of the water tank filler cap of the lower wing. Prolonged slips with water ballast are therefore not recommended.

Warning:

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

4.5.4 Approach (cont.)

b) Power plant extended

(only permissible with ignition OFF and in emergency case)

With power plant extended (ignition OFF) it can be landed in a similar manner as with power plant retracted.

However the disturbances of the extended power plant influence the airflow around the fin, whereby a manipulation of the effectiveness of rudder and elevator control is possible.
On approach it must be taken into account that the flight performance has considerably deteriorated due to the extended power plant:

All-up weight (mass)	600 kg 1543 lb	850 kg 1874 lb
Rate of descent Approx.	2.0 m/s 394 fpm	2.32 m/s 456 fpm
Approach speed	95 km/h 51 kn 59 mph	108 km/h 58 kn 67 mph
L/D approx.	13	13

However, the performance, though reduced, is sufficient to conduct approaches with the same techniques as in "clean" configuration.

Warning:

1. Be careful when extending the airbrakes.
Due to the additional drag of the extended power plant, more forward stick must be applied for maintaining the above approach speeds.

2. On stalling with extended power plant and ignition off, the turbulent airflow produced by the propeller overlap the vibration in the controls, so that in this case no noticeable stall warning exists.

Caution:
Approaches and landings are normally conducted with power plant retracted.

4.5.5 Landing

a) Power plant retracted

For off-field landings the landing gear should always be extended, as the protection of the crew is much better, especially from vertical impacts on landing.

Main wheel and tail wheel should touch down simultaneously.

After touch down the flaps can be set at “0” or “-1” for improved aileron response during the 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 kn, 56 mph) instead of 75 km/h (40 kn, 47 mph) means that the kinetic energy to be dissipated by braking is increased by a factor of 1.44 and therefore the ground run is lengthened considerably.

As the effectiveness of the hydraulic wheel brake is good, the landing run is significantly shortened (the elevator control should be hold fully back).

b) Power plant extended (Ignition OFF)

Landings with power plant extended should only be conducted in case of emergency.

4.5.6 Flight with water ballast

Water ballast is required for reaching the maximum permitted all-up mass.

Wing ballast tanks

The water tanks are integral compartments in the nose section of the main wing panels.

The tanks are to be filled with plain water only, through round openings in the upper wing surface featuring a strainer.

Tank openings are closed with plugged-in filler caps having a 6 mm (0.24 in.) thread for lifting and venting. Lifting these caps is done with the tailplane rigging tool.

Warning:

As the threaded hole in the filler cap also serves for venting the tank, it must always be kept open!
Never place any kind of tape over the hole.

Each wing tank has a capacity of approx. 92 litres (24.30 US Gal., 20.24 IMP Gal.).

Dumping the water from full tanks takes approx. 3.5 minutes.

When filling the tanks it must be ensured that the maximum permitted all-up mass is not exceeded - see page 6.2.5.

4.5.6 Flight with water ballast (cont.)

The tank in the right and the left wing must always be filled with the same amount of water to prevent any lateral imbalance.

Before taking off with partially filled tanks, ensure that the wings are held in level to allow the water to distribute equally and both wings are in balance.
Because of the additional mass in the wing panels, the wing tip runner should continue running for as long as possible during the launch.

Water ballast is dumped through an opening on the lower side of the main wing panels, 3.75 m (12.30 ft) away from the inboard root rib.
When dumping water, make sure that water is flowing at the same rate from both wings (see below). If that is not the case, stop dumping in order to avoid unbalanced wings.

The dump valves are hooked up automatically on rigging the aircraft (ballast control knob to be set at "CLOSED).

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

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

> **Warning:**
>
> In the unlikely event that the tanks empty unevenly or that only one of them empties (recognized by having to apply significant opposite aileron during straight flight, particularly at low speed), it is necessary to fly faster because of the higher mass and also to avoid stalling the airplane.
>
> During the landing run the heavier wing should be kept somewhat higher (if permitted by the terrain) so that it touches down only at the lowest possible speed.
> This reduces the danger of the airplane veering off course.

Water ballast fin tank

To ensure optimum performance in circling flight, a forward centre of gravity, caused by water ballast in the wing nose and/or by a crew member in the rear seat, may be compensated by carrying water ballast in the fin tank.

For details concerning the quantities to be filled refer to page 6.2.8.

The water ballast tank is an integral tank in the fin with a capacity of 11 kg/liters (2.91 US Gal., 2.42 IMP Gal.). This tank is filled as follows with the horizontal tailplane in place (or removed):

Set elevator trim to the rear.
Insert one end of a flexible plastic hose (outer diameter 8.0 mm/0.31 in.) into the tube (internal diameter 8 mm/0.31 in.) protruding from the rudder gap at the top of the fin on the left hand side. The other end of this hose is then connected to a suitable container which is to be filled with the required amount of clean water.

The fin tank has eleven spill holes, all properly marked, on the right hand side of the fin, which indicate the water level – see accompanying sketch.

The venting of the tank is through the uppermost 11 kg/liters hole (which always remains open – even with a full tank).

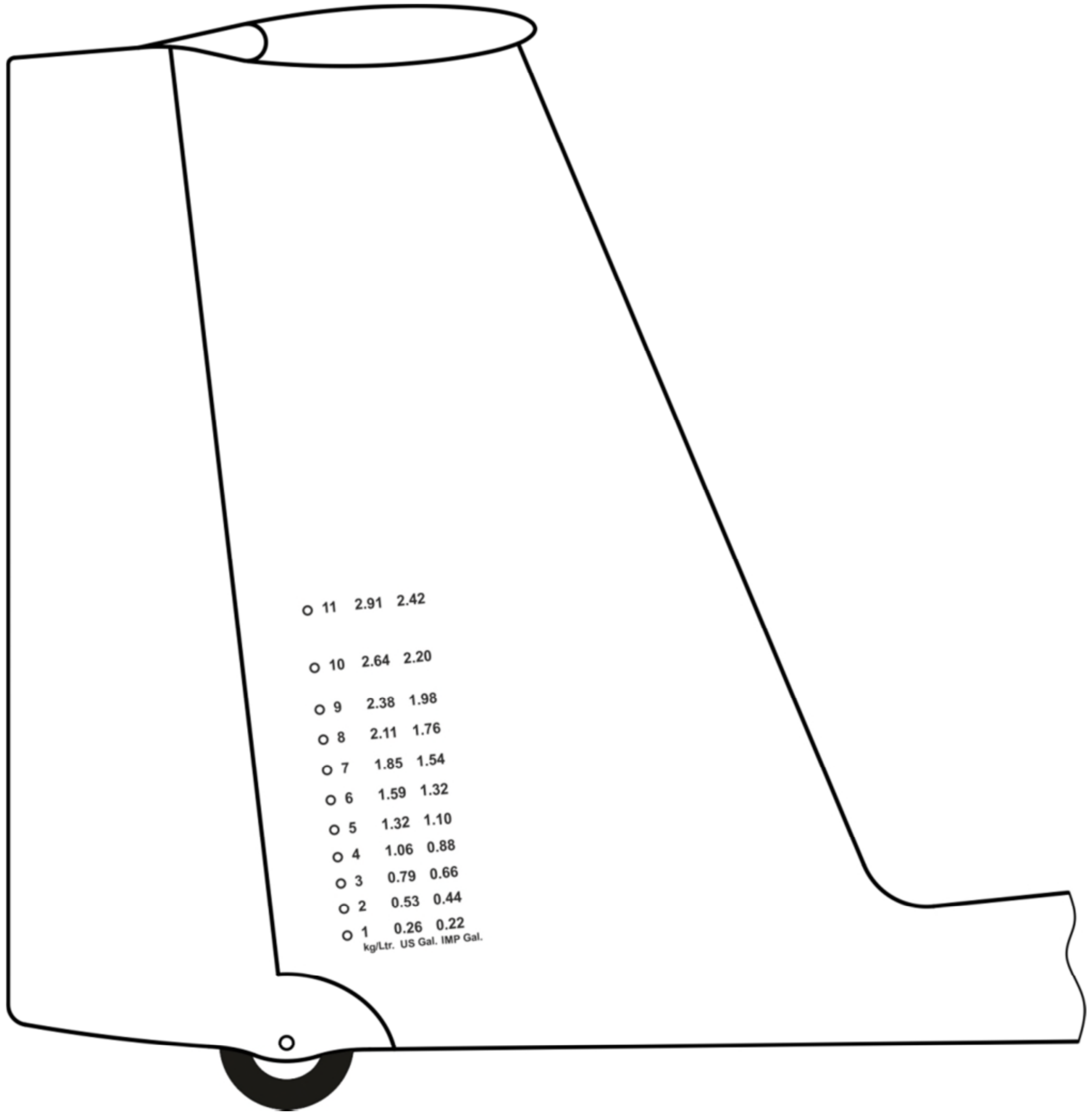
The ballast quantity to be filled depends on the water load in the wing tanks and/or on the load on the aft seat – see loading table on page 6.2.8.

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

If, for instance, a fin ballast load of 3.0 kg /litres is required, only the lower two holes (1 and 2) are taped closed.

After filling the tank with the 3 liters any excessive water then escapes through the third spill hole, thus preventing overloading.

Sketch for the fin tank:



4.5.6 Flight with water ballast (cont.)

Water is dumped from the fin tank through an opening on the lower side of the fuselage tail boom - adjacent to the rudder.
The fin tank dump valve is linked to the torsional drive for the valves in the main wing panels so that these three tanks are always emptying simultaneously.

The time required to dump the ballast from a fuII fin tank is about two (2) minutes, therefore draining the full tanks of the main wing panels always takes longer.

Continued on page 4.5.6.5.

4.5.6 Flight with water ballast (cont.)

General

Warning:

1. On longer flights at air temperatures near 0 °C (32 °F), water ballast must always be dumped when reaching a temperature of 2 °C (36 °F). Thus freezing of the valves with subsequent damages can be prevented.

Caution:

2. Before filling the wing water ballast tanks check with open valves if both sealing caps of the valves open equally wide.
   In addition, the valves seats have to be cleaned and greased slightly. It must be checked that both valves close tight when operated in the cockpit.
   Smaller dripping leaks can easily remedies by pulling down the sealing caps into the valve seat with the mounting screw for the horizontal stabilizer.

3. 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 bank angles.

4. If possible, all water ballast should be dumped before conducting an off-field landing.

Warning:

5. Never pressurize the tanks - for instance by filling them directly from a water hose – and always pour in clean water only.

6. The aircraft should never be parked with full ballast tanks if there is any danger whatsoever of them freezing.
   Even in normal temperatures the parking period with full tanks should not exceed a few days. Optimally, for parking, all water ballast should be completely drained and the filler caps should be removed to allow the tanks to dry out.

7. Before the fin tank is filled, check that those spill holes not being taped closed are indeed clear.

4.5.7 High altitude flight

When flying at high altitude it should be noted that true airspeed (TAS) is higher than 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		V_{NE} (IAS)		
m	ft	km/h	kn	mph
0	0	280	151	174
1000	3281	280	151	174
2000	6562	280	151	174
3000	9843	280	151	174
4000	13123	263	142	163
5000	16404	245	132	152
6000	19685	232	125	144
7000	22966	220	119	137
8000	26247	207	112	129
9000	29528	195	105	121
10000	32808	182	98	113

Flying at temperatures below freezing point

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 freezing. This applies especially to the airbrakes!

From previous experience, it has been found to be beneficial to cover the mating surfaces of the airbrakes with “Vaseline” along their full length so that they cannot freeze together. Furthermore the control surfaces should be moved frequently.

When flying with water ballast observe the instructions given in section 4.5.6.

4.5.7 High altitude flight (cont.)

Notes:

During 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.

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)!

Also, 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).

4.5.8 Flight through rain

a) Power plant retracted:

When flying the aircraft with a wet surface or in rain, the water drops adhering to the wings cause 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 containing the moisture is also descending so that - compared with a wet aircraft in calm air - the sink rates encountered are 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 4.5.4.1

b) Power plant extended, engine running:

The approved propellers didn't show any defects after operation in light rain so far.
Nevertheless, the use of the power plant in rain is not recommended.

4.5.9 Aerobatics

Only allowed **without** water ballast in the wings,

up to an all-up mass of **690 kg (1521 lbs)**

with **retracted or removed power plant** and

with **flap position "0"**:

The following aerobatic manoeuvres are allowed:

(a) inside loop

(b) stall turn

(c) lazy eight

(d) spinning

> **WARNING:**
> The Arcus M is a high performance powered sailplane.
> Therefore the Arcus M will gain speed very rapidly in dive.
> Aerobatic manoeuvres with the Arcus M should only be performed if pilot can handle these aerobatic manoeuvres safely with similar sailplane types or if you've been briefed in detail by a pilot experienced in aerobatic manoeuvres with the Arcus M.
> The permitted operating limits, see section 2, must be observed.

Compensation for the influence of the pilot in the rear seat on the centre of gravity of the aircraft for aerobatic manoeuvres is allowed.

4.5.9 Aerobatics (cont.)

Inside loop

Entering manoeuvres at a speed between 180 km/h (97 kn, 112 mph) and 210 km/h (113 kn, 130 mph), 200 km/h (108 kn, 124 mph) is recommended. The speed during the recovery of this manoeuvre should remain in the same speed range. The load factor during the manoeuvre depends on the selected entering speed. The higher the entering speed is, the lower the needed maximum load factors are.

Lazy eight

Enter manoeuvre at a speed of about 180 km/h (97 kn, 112 mph). After pulling up in a 45°-climb enter the turn at about 120 km/h (65 kn, 75 mph). The speed during recovery: about 180 km/h (97 kn, 112 mph).

Stalled turn

Enter manoeuvre at a speed between 180 km/h (97 kn, 112 mph) and 210 km/h (113 kn, 130 mph).
Pull up continuously into the vertical climb.

It is recommended to enter the manoeuvre at a speed of 200 km/h (108 kn, 124 mph) because then you will have more time to establish the vertical climb and you will not have to apply the maximum permitted load factor.
During the vertical climb you can let the outside wing drag, so to speak.
At an indicated airspeed of about 140 km/h (76 kn, 87 mph) to 150 km/h (81 kn, 93 mph), apply continuous but smooth full rudder deflection in the desired direction, respectively against the dragged wing.
During the turn apply aileron deflection in the opposite direction, to turn as cleanly as possible in one plane.
If you have induced the turn too late or too weakly, the turn may no longer be able to be executed as planned and the powered sailplane will fall backwards or sideward.
If this occurs, the control surfaces could slam to one side and be damaged as the aircraft accelerates backwards. This must be avoided. Hold all the control surfaces firmly to their stops to avoid this knock over. Once the aircraft is moving in a forward direction again, roll level and pull out to recover to normal flight.

4.5.9 Aerobatics (cont.)

Spinning

Stationary spinning is possible with middle to rear c/g positions and is only allowed with flap position **"0"**.

Spinning is induced with the standard method:

Stall the aircraft slowly until the first signs of separated airflow can be recognized, i.e. vibration in the controls. Then jerkily pull back the control stick and apply full rudder deflection into the desired direction of rotation. Depending on the position of the c/g, the pitch attitude will differ widely.

Spinning is terminated with the standard method:

Neutralize aileron, apply full rudder deflection in the opposite direction of the rotation and neutralize elevator deflection. After the rotation has stopped return all control surfaces to neutral and pull out into normal flight.
The loss of height during the recovery to normal flight is about 100m (300ft.), the maximum speed is about 180 km/h (97 kn, 112 mph).

With forward c/g positions no stationary spinning is possible.
The aircraft will switch over into a spiral dive very rapidly. This has to be stopped immediately.
With middle c/g positions stationary spinning is possible if induced with the standard method. But if the spinning is induced with rudder deflection into the direction of rotation and aileron deflection against the direction of rotation, then the aircraft will switch over into the spiral dive after a half to one turn. The spiral dive has to be ended immediately.

You can detect the spiral dive because of the increasing indicated airspeed and the increasing load factor on the pilots.

It is not recommended to attempt a spin with a forward c/g because the spin will change to a spiral dive almost immediately upon being initiated.

Section 5

5.1 Introduction

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

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

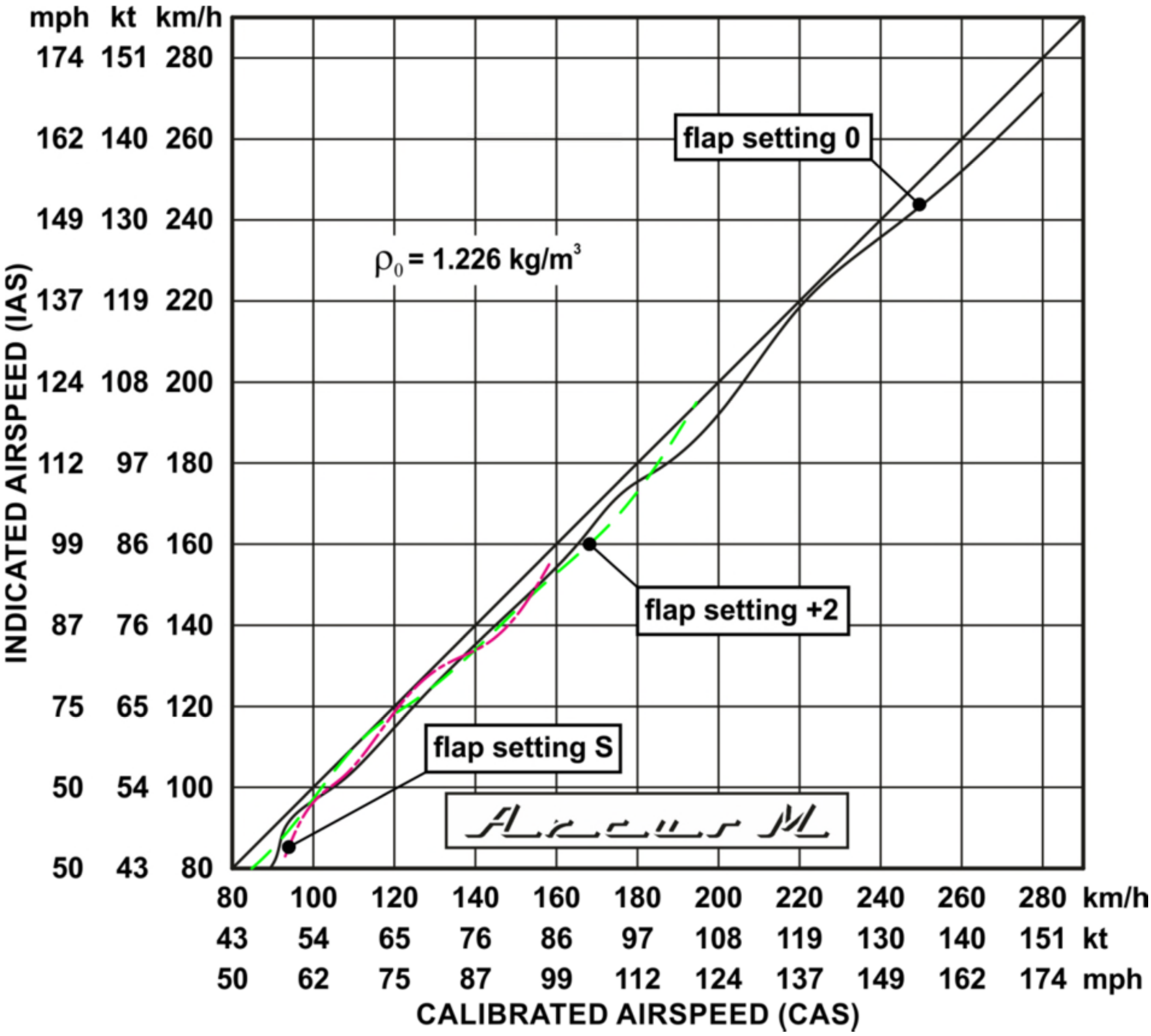
5.2 Approved data

5.2.1 Airspeed indication errors

From the diagram below, the errors of the airspeed indication (IAS) caused by pitot/static pressure errors may be read off. These charts are applicable to free flight.

PITOT pressure source:	Fuselage nose cone
STATIC pressure ports:	Fuselage tail boom, approx. 1.02 m (40.16 in.) forward of the base 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		POWER PLANT RETRACTED	
All-up mass (approx.)		850 kg 1874 lbs	850 kg 1874 lbs
c/g position (aft of datum)		75 mm 3 in.	290 mm 11 in.
Stall speed, airbrakes closed			
flaps at "+2"	km/h kn mph	85 46 53	71* 38* 44*
flaps at "0"	km/h kn mph	90 49 56	71* 38* 44*
flaps at "S"	km/h kn mph	98 53 61	82* 44* 51*
airbrakes extended			
flaps at “L”	km/h kn mph	89 ± 2 48 55	77* 42* 48*

Configuration		POWER PLANT EXTENDED	
All-up mass (approx.)		850 kg 1874 lbs	850 kg 1874 lbs
c/g position (aft of datum)		75 mm 3 in.	290 mm 11 in.
Stall speed, airbrakes closed maximum power			
flaps at "+2"	km/h kn mph	85 46 53	80 43 49
airbrakes extended standing prop			
flaps at “L”	km/h kn mph	85 46 53	85 46 53

The loss of height from the beginning of the stall until regaining a normal level flight attitude is up to 60 m (197 ft).

* Airspeed indication near the stall speed is heavily oscillating especially with rearward c/g positions.

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 of 850 kg (1874 lbs).

Ground run distance:	276 m (906 ft)
Total distance over 15m (50 ft) obstacle:	478 m (1568 ft)
Lift-off speed approx:	82 km/h (44 kn, 51 mph)
Speed over 15 m (50 ft) obstacle:	98 km/h (53 kn, 61 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 till lift-off	0	0	217	712	245	804	276	906	309	1014
	500	1640	236	774	267	876	300	984	335	1099
	1000	3281	256	840	290	951	326	1070	365	1198
	1500	4921	279	915	316	1037	355	1165	397	1302
	2000	6562	304	997	344	1129	387	1270	433	1421
Total distance over 15 m 50 ft obstacle	0	1640	376	1234	425	1394	478	1568	535	1755
	500	3281	408	1339	462	1516	520	1706	581	1906
	1000	4921	444	1457	503	1650	566	1857	632	2073
	1500	6562	484	1588	548	1798	616	2021	689	2261
	2000	1640	527	1729	597	1959	672	2205	751	2464

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 Non-approved additional information

5.3.1 Demonstrated crosswind performance

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

20 km/h (11 kn).

5.3.2 Flight polar

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

a) Power plant retracted (or removed)

All-up weight (mass)	**620*) kg 1367 lb**	**850*) kg 1874 lb**
Wing loading	**kg/m² lbs/ft²**	
Minimum rate of sink	**m/s fpm**	
Best L/D		
at a speed of	**km/hkm/h kn mph**	

*) aircraft performance not yet measured

Speed polar diagram see page 5.3.2.2

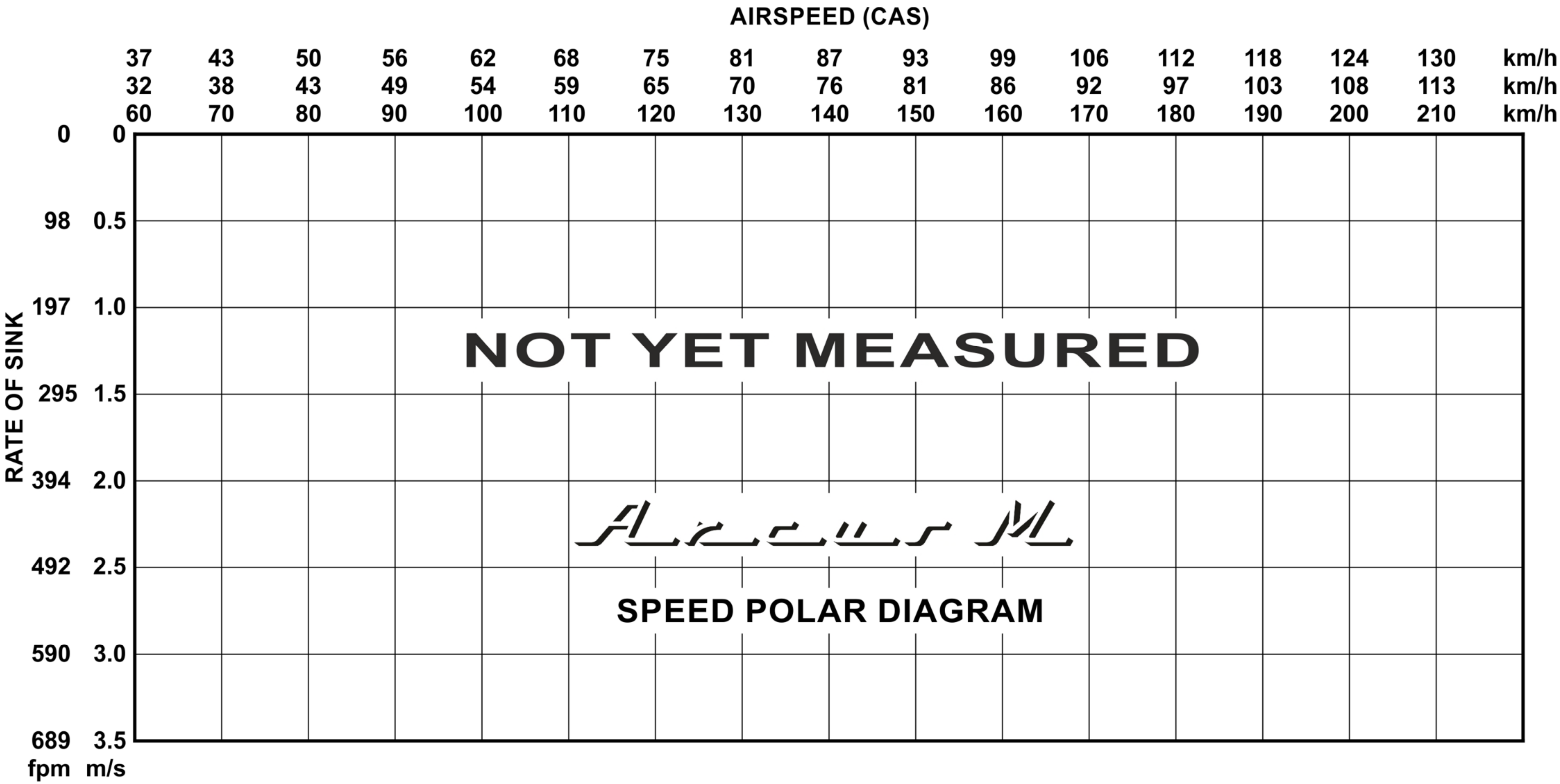
b) Power plant extended and iginition OFF

All-up weight (mass)	850 1874	kg lb
Rate of sink approx.	2.32 457	m/s fpm
at a speed of approx.	108 58 67	km/h kn mph
Best L/D (-)	13	

Power plant extended – maximum power applied, flap setting +2

All-up weight (mass)	680 kg 1499 lb	850 kg 1874 lb
Best rate of climb	3.42 m/s 673 ft/min	2.62 m/s 516 ft/min
at a speed of	90 km/h 49 kn 56 mph	98 km/h 53 kn 61 mph

A level flight attitude is attained at a speed V_H = 150 km/h (81 kn, 93 mph).


AIRSPEED (CAS)
37 43 50 56 62 68 75 81 87 93 99 106 112 118 124 130 km/h
32 38 43 49 54 59 65 70 76 81 86 92 97 103 108 113 km/h
60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 km/h
RATE OF SINK
0 0
98 0.5
197 1.0
295 1.5
394 2.0
492 2.5
590 3.0
689 3.5
fpm m/s
NOT YET MEASURED
Arcus M
SPEED POLAR DIAGRAM

Range (without influence of wind)

a) Values below refer to level flight at max continuous RPM (cruising power) of the power plant:

Cruising speed approx.: 150 km/h (81 kn, 93 mph)
Fuel consumption approx.: 24.50 liters/h (6.47 US Gal./h, 5.39 IMP Gal./h)

Usable fuel: liter	US Gal.	IMP Gal.	Fuel supplied from: fuselage tank	optional: right wing tank	optional: left wing tank	level flight endurance	Range
14.0	3.7	3.1	X			34 min	86 km 46 nm
26.5	7.0	5.8	X	X		65 min	162 km 87 nm
39.0	10.3	8.6	X	X	X	96 min	239 km 129 nm

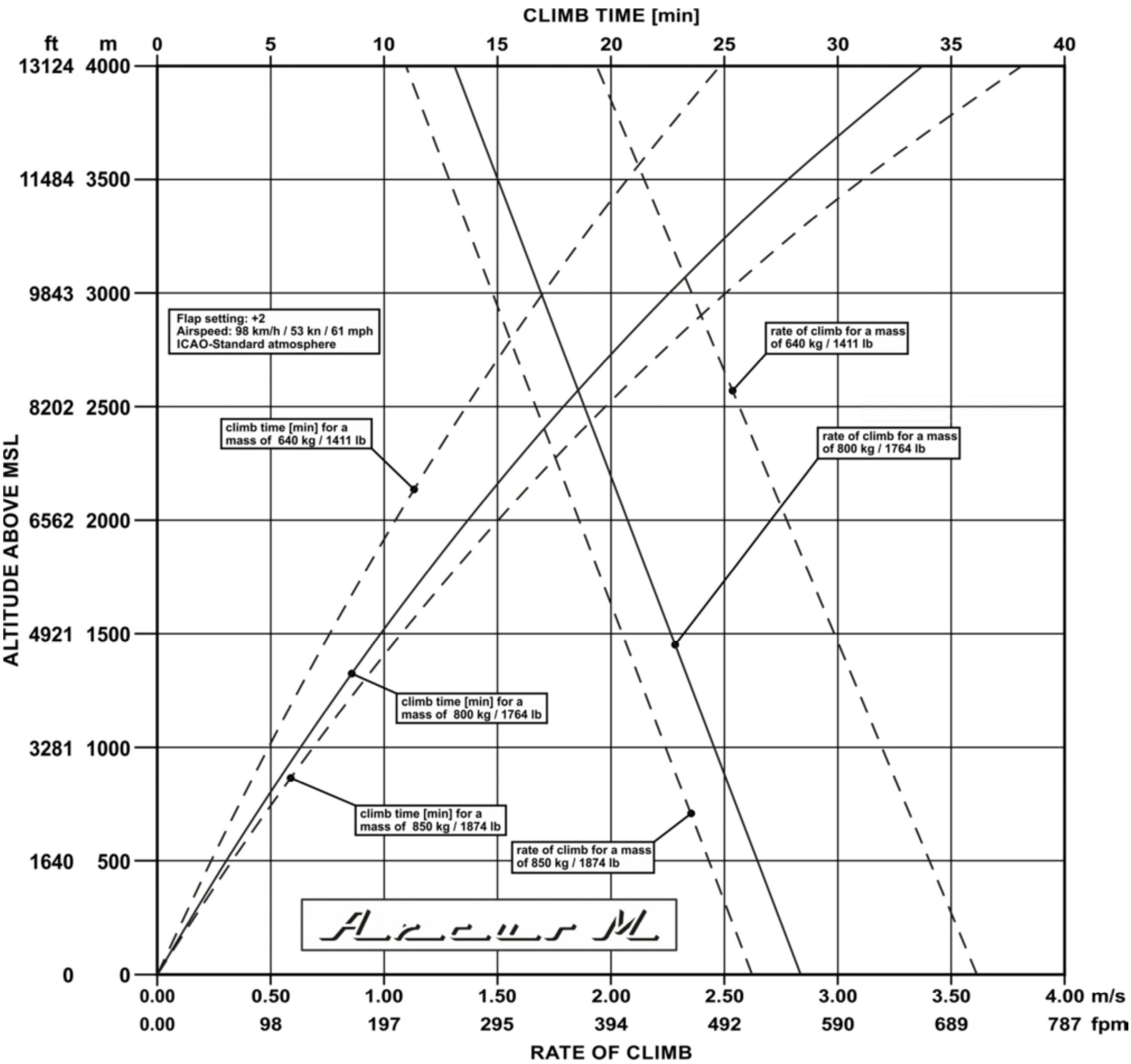
b) The following values are based on the “sawtooth"-method see page 4.5.3.7 at an all-up mass 800 kg(1764 lbs) and the climb effected at max. continuous power:

Average cruising speed approx.: 100 km/h (54 kn, 62 mph)
Fuel consumption approx.: 24.5 liters/h (6.47 US Gal./h, 5.39 IMP Gal./h)

Usable fuel: liter	US Gal.	IMP Gal.	Fuel supplied from: fuselage tank	optional: right wing tank	optional: left wing tank	flight endurance	Range
14.0	3.7	3.1	X			145 min	285 km 154 nm
26.5	7.0	5.8	X	X		275 min	545 km 294 nm
39.0	10.3	8.6	X	X	X	405 min	800 km 432 nm

The range is determined for climb flight between 500 m (1640 ft), and 1500 m (4921 ft) above MSL.

Climb performance: See diagram on page 5.3.2.4 established for a mass of 640 kg / 1411 lbs, 800 kg / 1764 lbs, 850 kg / 1874 lbs.


CLIMB TIME [min]
0 5 10 15 20 25 30 35 40
ft m
13124 4000
11484 3500
9843 3000
8202 2500
6562 2000
4921 1500
3281 1000
1640 500
0 0
ALTITUDE ABOVE MSL
Flap setting: +2
Airspeed: 98 km/h / 53 kn / 61 mph
ICAO-Standard atmosphere
rate of climb for a mass of 640 kg / 1411 lb
climb time [min] for a mass of 640 kg / 1411 lb
rate of climb for a mass of 800 kg / 1764 lb
climb time [min] for a mass of 800 kg / 1764 lb
climb time [min] for a mass of 850 kg / 1874 lb
rate of climb for a mass of 850 kg / 1874 lb
0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 m/s
0.00 98 197 295 394 492 590 689 787 fpm
RATE OF CLIMB

5.3.3 Noise data

The noise level limit according to chapter 10 of ICAO Appendix 16, Volume 1, for the powered sailplane Arcus M (equipped with the SOLO engine 2625-02 i) is

76,2 dB(A).

This noise level limit is met by the Arcus M, equipped with the propellers

- KS-1G-160-R-120 of Technoflug Leichtflugzeugbau GmbH.
- BM-G-160-R-120 of Binder Motorenbau GmbH.

The measured noise level of the Arcus M, equipped with the Propeller KS-1G-160-R-120 of Technoflug Leichtflugzeugbau GmbH is

66,1 dB(A) < noise level limit 76,2 dB(A)

and is thus far below (-10,1 dB(A)) the noise level limit according to chapter 10 of ICAO Appendix 16, Volume 1.

It is recommended to wear a head set while the power plant is running.

Section 6

6. Weight (mass) and balance

6.1 Introduction

6.2 Weight (mass) and balance record and permitted payload range

Determination of:

- Water ballast in wing tanks
- Water ballast in fin tank

6. Weight (mass) and balance

6.1 Introduction

This section contains the payload range within the Arcus M may be safely operated.

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

The equipment actually installed during the last weighing of the aircraft is shown in the “'Equipment List" to which page 6.2.3 and 6.2.4 refer to.

6.2 Weight and balance record and permitted payload range

The following loading chart, page 6.2.3 (power plant installed) or 6.2.4 (power plant removed), shows amongst others the empty mass, the maximum and minimum load on the seats and the maximum payload in the fuselage.

These charts are established referring to the last valid weighing report. The required data and diagrams are found in the Maintenance Manual.

Both loading charts (weight & balance log sheets) are only applicable for this particular Arcus M, the serial number which is shown on the title page.
The indicated required minimum load is only applicable for operating with nose wheel.
If the aircraft is operated with the optional nose skid the indicated required minimum increases about 2 kg (4.4 lbs), see also page 6.9 of the Maintenance Manual.

A front seat load of less than the required minimum load

There are 3 methods to compensate a front seat load of less than the required minimum load:

1. By attaching ballast (lead or sand cushion) firmly to the lap belt mounting brackets.

Optional trim ballast mounting provision(s)

2. a) By installing ballast by means of trim weight **at the base** of the front instrument panel.
For further information refer to page 6.2.2.

   b) In addition to method 2 a) by attaching, ballast by means of trim weight on the **right-hand side** of the base of the front instrument panel.
For further details refer to page 6.2.2.

3. When flown with two occupants, the minimum load on the front seat can be reduced by 25% of the load on the rear seat.
This reduction of the minimum load on the front seat is allowed only if the nose heavy moment of the load in the rear seat is not compensated by water ballast in the fin (see Page 6.2.6).

6.2 Weight and balance record and permitted payload range (cont.)

Altering the front seat load by using trim ballast

Optional trim ballast attachment(s)

On request the aircraft is equipped with one or two attachments for trim ballast, thus allowing a reduction of the placarded minimum front seat load (when flown solo) as shown in the table below.

a) Trim ballast attachment below the front instrument panel:

This tray holds up to three (3) lead plates with a weight of 3.7 kg / 8.2 lb each. Plates are made to fit only into this tray.

Lever arm of trim ballast plates: 2153 mm (7.06 ft) ahead of datum

b) Trim ballast attachment on front stick mounting frame on the right side:

This tray holds up to three (3) lead plates with a weight of 3.9 kg / 8.6 lb each. Plates are made to fit only into this tray.

Lever arm of trim ballast plates: 1953 mm (6.41 ft) ahead of datum

Difference in seat load as compared with placarded front seat minimum - when flown solo -	**Number of lead plate required:**	
up to 5,0 kg (11 lb) less	1	Attachment (a)
up to 10,0 kg (22 lb) less	2	
up to 15,0 kg (33 lb) less	3	
up to 20,0 kg (44 lb) less	4	Attachment (b)
up to 25,0 kg (55 lb) less	5	
up to 30,0 kg (66 lb) less	6	

6.2 Weight and balance record and permitted payload range (cont.)

WEIGHT AND BALANCE LOG SHEET (loading chart) FOR S/N ....
(POWER PLANT INSTALLED)

Date of weighing:									
Empty mass [kg]									
Equipment list dated									
Installed batteries [2]		**count**		**count**		**count**		**count**	
		1	**E**	**1**	**E**	**1**	**E**	**1**	**E**
			C1/C2		**C1/C2**		**C1/C2**		**C1/C2**
			F1/F2		**F1/F2**		**F1/F2**		**F1/F2**
Empty mass c/g position aft of datum									
Max. useable load [kg] in fuselage									
Load [kg/lbs] on the seats (crew including parachute):									
Front seat load when flown solo:	max.	115kg / 254 lb		115kg / 254 lb		115kg / 254 lb		115kg / 254 lb	
with two occupants:	max.	115kg / 254 lb		115kg / 254 lb		115kg / 254 lb		115kg / 254 lb	
Rear seat load with two occupants:	max.	115kg / 254 lb		115kg / 254 lb		115kg / 254 lb		115kg / 254 lb	
Water ballast fin tank installed (YES / NO)									
Front seat load regard-less of load on rear seat	min.[1]								
Inspector Signature / Stamp									

[1]

> **Warning:**
> If fin tank installed, the pilot must either dump all water ballast prior to take-off, or perform an accurate check of the fin tank loading. He must also take the responding compensation loadings (wing water ballast and/or load on rear seat) into account.

[2] Installed batteries (see page 7.12.2):

(E)	engine battery
(C1/C2)	batteries in front of rear mounting frame
(F1/F2)	batteries in fin

For the determination of the water ballast quantity permitted in the wing tanks refer to page 6.2.5.
For the determination of the water ballast quantity permitted in the fin tank refer to page 6.2.6 through 6.2.8.

6.2 Weight and balance record and permitted payload range (cont.)

WEIGHT AND BALANCE LOG SHEET (loading chart) FOR S/N ....
(POWER PLANT REMOVED)

Date of weighing:									
Empty mass [kg]									
Equipment list dated									
Installed batteries 2)		**count**		**count**		**count**		**count**	
			E		**E**		**E**		**E**
			C1/C2		**C1/C2**		**C1/C2**		**C1/C2**
			F1/F2		**F1/F2**		**F1/F2**		**F1/F2**
Empty mass c/g position aft of datum									
Max. useable load [kg] in fuselage									
Load [kg/lbs] on the seats (crew including parachute):									
Front seat load when flown solo:	max.	115kg / 254 lb		115kg / 254 lb		115kg / 254 lb		115kg / 254 lb	
with two occupants:	max.	115kg / 254 ls		115kg / 254 lb		115kg / 254 lb		115kg / 254 lb	
Rear seat load with two occupants:	max.	115kg / 254 lb		115kg / 254 lb		115kg / 254 lb		115kg / 254 lb	
Water ballast fin tank installed (YES / NO)									
Front seat load regard-less of load on rear seat	1) min.[1]								
Inspector Signature / Stamp									

1)

> **Warning:**
> If fin tank installed, the pilot must either dump all water prior of take-off, or perform an accurate check of the fin tank loading. He must also take the responding compensation loadings (wing water ballast and/or load on rear seat) into account.

2) Installed batteries (see page 7.12.2):

(E)	engine battery
(C1/C2)	batteries in front of rear stick mounting frame
(F1/F2)	batteries in fin

For the determination of the water ballast quantity permitted in the wing tanks refer to page 6.2.5.
For the determination of the water ballast quantity permitted in the fin tank refer to page 6.2.6 through 6.2.8.

6.2 Weight and balance record and permitted payload range (cont.)

Maximum water ballast load

Maximum all-up mass including water ballast: 850 kg (1874 lb)

c/g position of water ballast in wing tanks (forward of datum): 17 mm (0.70 in.)

Total capacity of wing tanks: 185 litres (48.9 US. Gal /40.7 IMP Gal)

Table of water ballast loads at various empty masses and seat loads:

Empty mass + fuel + fin ballast		LOAD ON THE SEAT (kg / lb)																													
kg	lb	kg 70	lb 154		kg 80	lb 176		kg 100	lb 220		kg 120	lb 264		kg 140	lb 308		kg 160	lb 353		kg 180	lb 396		kg 200	lb 441		kg 220	lb 485		kg 230	lb 507	
470	1035	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	180	47.6	39.6	160	42.3	35.2	150	39.6	33.0
480	1057	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	170	44.9	37.4	150	39.6	33.0	140	36.9	30.8
490	1079	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	180	47.6	39.6	160	42.3	35.2	140	36.9	30.8	130	34.3	28.6
500	1101	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	170	44.9	37.4	150	39.6	33.0	130	34.3	28.6	120	31.7	26.4
510	1101	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	180	47.6	39.6	160	42.3	35.2	140	36.9	30.8	120	31.7	26.4	110	29.1	24.2
520	1147	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	170	44.9	37.4	150	39.6	33.0	130	34.3	28.6	110	29.1	24.2	100	26.4	22.0
530	1169	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	180	47.6	39.6	160	42.3	35.2	140	36.9	30.8	120	31.7	26.4	100	26.4	22.0	90	23.8	19.8
540	1191	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	170	44.9	37.4	150	39.6	33.0	130	34.3	28.6	110	29.1	24.2	90	23.8	19.8	80	21.1	17.6
550	1213	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	180	47.6	39.6	160	42.3	35.2	140	36.9	30.8	120	31.7	26.4	100	26.4	22.0	80	21.1	17.6	70	18.5	15.4
560	1235	185	48.9	40.7	185	48.9	40.7	185	48.9	40.7	170	44.9	37.4	150	39.6	33.0	130	34.3	28.6	110	29.1	24.2	90	23.8	19.8	70	18.5	15.4	60	15.9	13.2
570	1257	185	48.9	40.7	185	48.9	40.7	180	47.6	39.6	160	42.3	35.2	140	36.9	30.8	120	31.7	26.4	100	26.4	22.0	80	21.1	17.6	60	15.9	13.2	50	13.2	11.0
580	1279	185	48.9	40.7	185	48.9	40.7	170	44.9	37.4	150	39.6	33.0	130	34.3	28.6	110	29.1	24.2	90	23.8	19.8	70	18.5	15.4	50	13.2	11.0	40	10.6	8.8
590	1301	185	48.9	40.7	180	47.6	39.6	160	42.3	35.2	140	36.9	30.8	120	31.7	26.4	100	26.4	22.0	80	21.1	17.6	60	15.9	13.2	40	10.6	8.8	30	7.9	6.6
		litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.	litres	US Gal.	IMP Gal.
		WATER BALLAST IN WING TANKS																													

Caution: When determining the max. permitted wing water ballast load, allowance must be made for water ballast in the fin tank (see page 6.2.7 and 6.2.8) and fuel , i.e. this load must be added to the empty mass shown on the above table.

Empty mass as per page 6.2.3 resp. 6.2.4 / fin ballast as per page 6.2.8.

6.2 Weight and balance record and permitted payload range (cont.)

Water ballast in (optional) fin tank

In order to shift the c/g close to its aft limit (favourable in terms of performance), water ballast may be carried in the fin tank (m_{FT}) to compensate for the nose-heavy moment of:

- water ballast in main wing panels (m_{WT})
  and/or
- loads on the aft seat (m_{P2})

- Compensating water ballast in main wing panels

  The determination of the ballast quantity in the fin tank (m_{FT}) is done with the aid of the diagram shown on page 6.2.8.

- Compensating loads on the aft seat

  Pilots who want to fly with the c/g close to the aft limit may compensate the nose-heavy moment of loads on the aft seat with the aid of the diagram shown on page 6.2.8.

Warning:

Compensation for masses exceeding the placarded minimum front seat load by the use of water ballast in fin tank is not allowed!

If the influence of the load on the rear seat is taken into account for the minimum load on the front seat, the nose-heavy moment of the load on the rear seat may not be compensated with water ballast in the fin tank.

Caution:

When using fin ballast to compensate for the nose - heavy moment of wing ballast and loads on the aft seat, then both values resulting from the diagrams on page 6.2.8 must be taken into account.

Note:

The maximum amount of water ballast, available for compensating the above mentioned nose-heavy moments, is 11 litres (2.91 US Gal., 2.42 IMP Gal.), which is the maximum capacity of the fin tank.

6.2 Weight and balance record and permitted payload range (cont.)

Water ballast in fin tank (optional)

Note:

When determining the maximum usable load in the fuselage, the quantity of water ballast in the fin does **not** need to be taken in account due to aerodynamically reasons.

In order to avoid exceeding the maximum permitted all-up weight (mass), the ballast in the fin tank must be taken into account when determining the maximum allowable ballast quantity for the wing tanks.

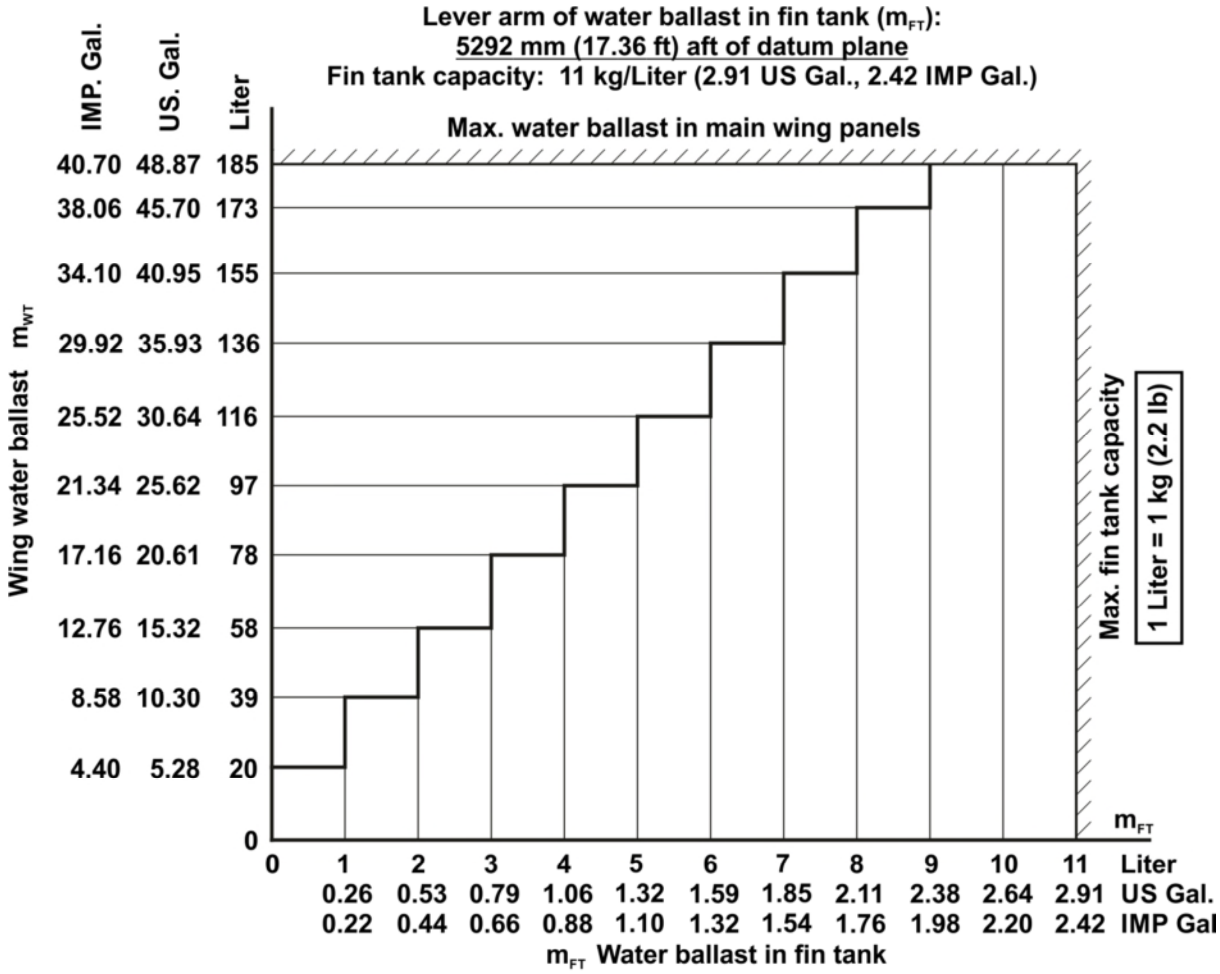
Example:

Assumed ballast load in wing tanks:	40 kg/litres (88 lb/10.6 US Gal)
Assumed load on aft seat:	75 kg (165 lb)

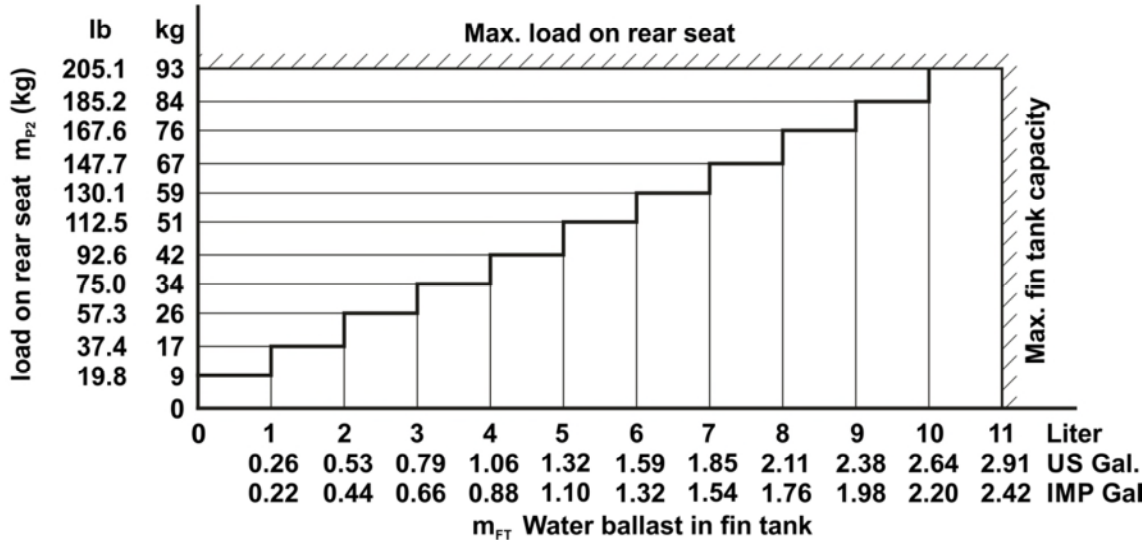
According to the diagrams on page 6.2.8 the following loads in the fin tank are permissible (fill only full litres):

For ballast in wing tank:	m_{FT}	=	2 kg/litres (4.4 lb/0.53 US Gal)
For load on aft seat:	Δm_{FT}	=	8 kg/litres (17.6 lb/2.11 US Gal)
Total ballast in fin tank:	$m_{FT} + \Delta m_{FT}$	=	10 kg/litres (22.1 lb/2.64 US Gal)

6.2 Weight and balance record and permitted payload range (cont.)



NOTE: Always full Liters are to be filled. Where value jumps, either the higher or the lower amount of ballast may be used.



Section 7

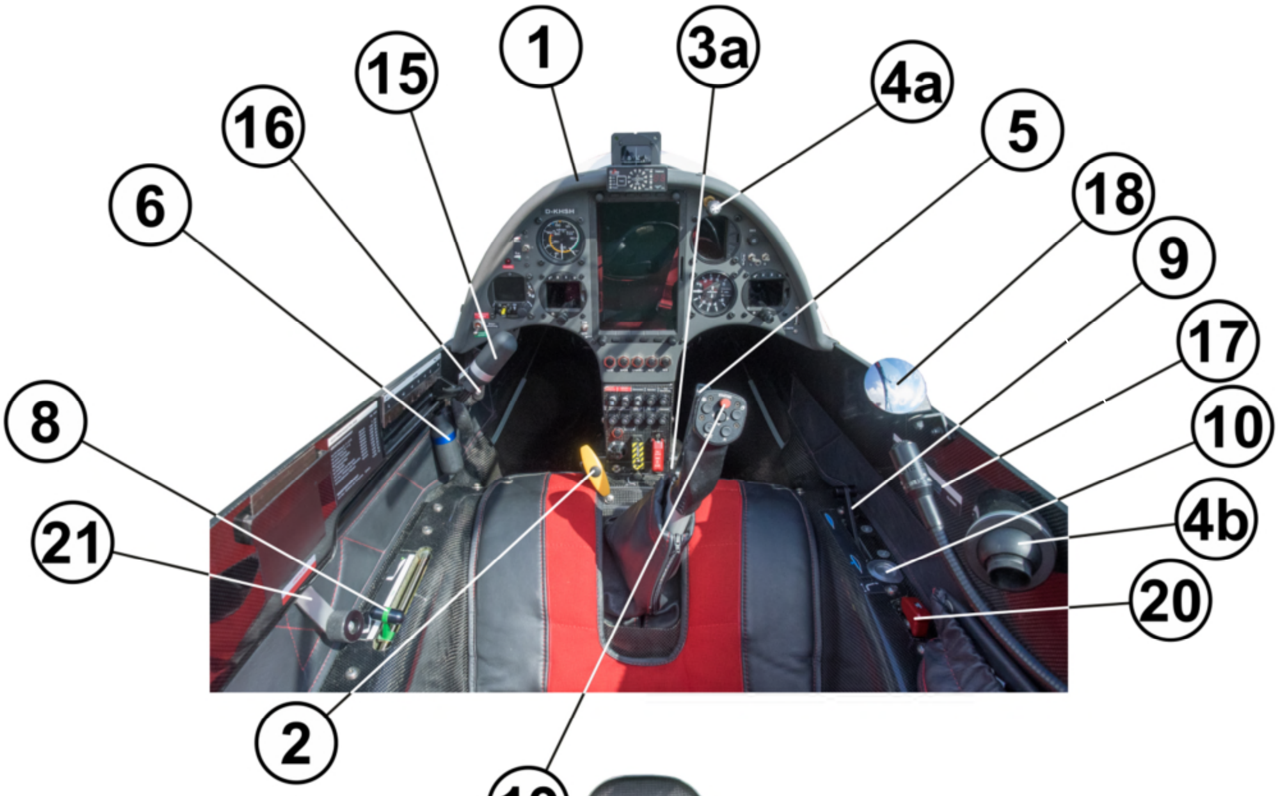
7.1 Introduction

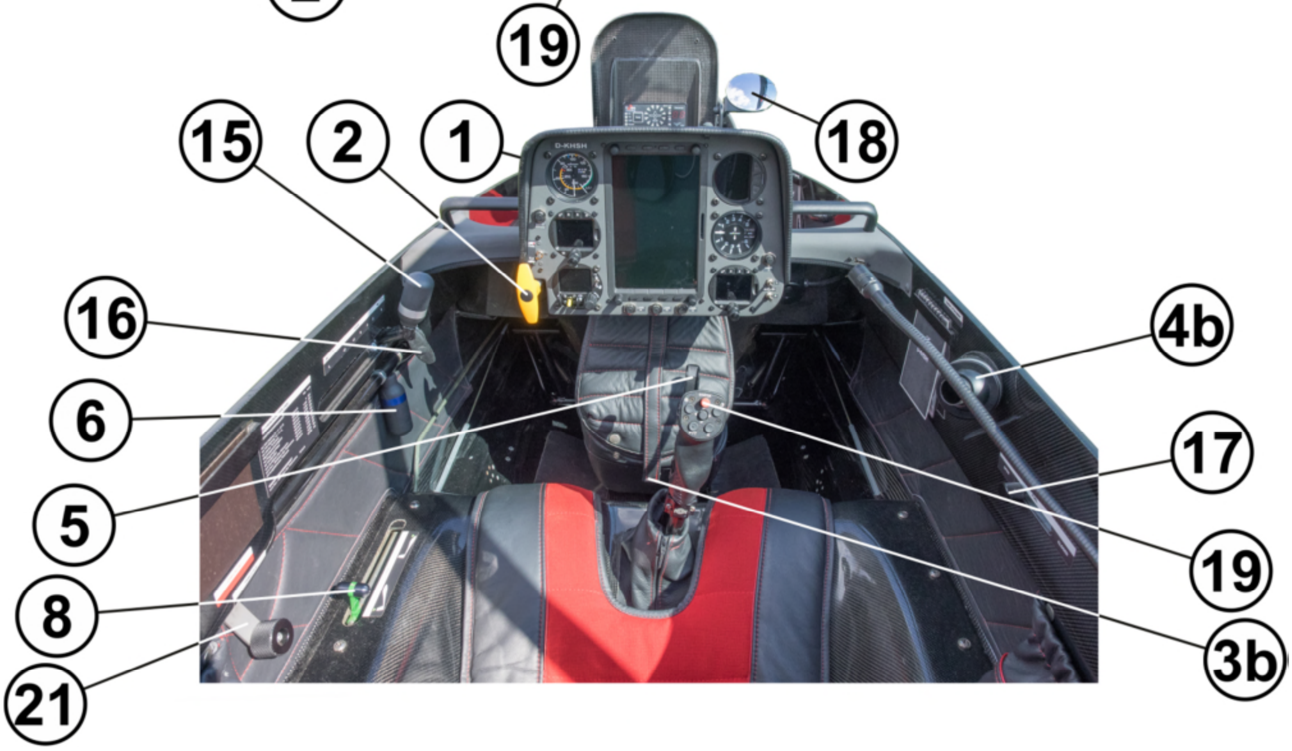
This section provides a description of the aircraft including the operation of its systems including hints for the crew.

In Section 9 supplements to the flight manual due to the incorporation of non-standard systems and equipment can be found – if necessary.

For further descriptions of components and systems refer to section 1 of the Maintenance Manual for the Arcus M.

7.2 Cockpit description





7.2 Cockpit description (cont.)

All instruments and control elements are within easy reach of the crew.

(1) Instrument panels

With canopy opened, the instruments are easily accessible.

After opening the canopy, the front instrument panel can be pivoted upwards.
The front instrument panel covering is attached with two screws to the front instrument panel. With the covering removed, the instrument panel can be detached from the mounting.

The rear panel is mounted to the steel tube transverse frame between the seats. After unscrewing the mounting bolts, the instrument panel and the covering can be removed.

(2) Tow release handles

T-shaped handles, actuating the tow release(s) installed
(c/g and/or nose hook)

Front seat: Yellow handle at the base of the control stick on the left

Rear seat: Yellow handle on the lower left hand side of the instrument panel

The winch cable/aerotow rope is released by pulling one of the handles.

7.2 Cockpit description (cont.)

(3a) Rudder pedal adjustment (front seat)

Black T-shaped handle on the right hand side near the control stick.

Forward adjustment: Release locking device by pulling the handle, push pedals to desired position with the heels and let them engage.

Backward adjustment: Pull handle back until pedals have reached desired position. Forward pressure with heels (not the toes) engages pedals in nearest notch with an audible click.

An adjustment of the rudder pedals is possible on the ground and in the air.

(3b) Rudder pedal adjustment (rear seat)

Locking device on pedal mounting structure on the cockpit floor.

Forward or backward adjustment:

Pull up locking pin by its ring, slide pedal assembly to desired forward or backward position and push locking pin down into nearest recess.

An adjustment of the rudder pedals is possible on the ground and in the air.

7.2 Cockpit description (cont.)

(4) Ventilation

a) Small black knob on the front instrument panel on the right regulates the amount of air.

Pull to open outlet nozzle
Push to close outlet nozzle

b) Adjustable bull-eye-type outlet nozzle right hand cockpit sidewall.

Turned clockwise:	nozzle closed
Turned anti-clockwise:	nozzle open

Additionally the sliding windows or the flaps in the windows may be opened for ventilation.

(5) Wheel brake

A wheel brake handle is mounted on either control stick.

(6) Airbrake levers

Levers (with blue marking), projecting downwards, below cockpit inner skin on the left.

Forward position:	Airbrakes closed and locked
Pulled back about 40 mm (1.6 in.):	Airbrakes unlocked
Pulled fully back:	Airbrakes fully extended

(7) Head rests

Front seat (not illustrated):

Head rest is an integrated component of the seat back and is adjusted with the seat back.

Rear seat (not illustrated):

Mounting rail on upper fuselage. Head rest is gradually and horizontally adjustable:
Depress locking tap, slide head rest in desired position and let locking tap engage into nearest recess.

7.2 Cockpit description (cont.)

(8) Elevator trim

Green handle for either seat at the seat pan mounting flange on the left. The spring-operated elevator trim is gradually adjustable by swinging the handle slightly inwards, sliding it to the desired position and swinging it outwards to lock.

Forward position - nose-heavy
Backward position - tail-heavy

(9) Control- lever for dumping water ballast from wing tanks and (optional) fin tank

Black lever on the front seat rest on the right.

Forward position - dump valves closed
Backward position - dump valves opened

The lever is held in the respective final positions

Fin tank (option)

The fin tank dump valve control is connected to the torque tube actuating the valves in the wing so that all three valves open and close simultaneously.

(10) Seat back

Front seat:

Silver push button on the right seat pan support.

Adjustment:

The adjustment of the seat back is done by means of lockable gas springs. To unlock the gas springs, press the push button and the move the seat back to the desired position. Releasing the push button will lock the current position.
In addition, the lower attachment position of the seat back in the seat pan and the attachment point of the gas springs at the seat back can be altered.
The seat back can be folded forwards if the attachment of the gas springs on the back of the seat back is unlocked.

7.2 Cockpit description (cont.)

(11) Rip cord anchorage (not illustrated)

Front seat	Red steel ring on steel tube transverse frame between the seats on the left
Rear seat	Red steel ring at the front of the steel tube centre frame on the left

(12) Canopy (not illustrated)

The one-piece plexiglas canopy opens sideways to the right and is mounted with flush hinges.
Take care that the cable restraining the open canopy is properly hooked up.

(13) Canopy locking and jettisoning levers (not illustrated)

Lever with red grip on the canopy frame on the left
(for either seat)

Forward position	canopy locked

To open or jettison the canopy, swing one of the levers back up to the stop (approx. 90°) and raise canopy to the side.

(14) Canopy release (not illustrated)

Remove restraining rope from the canopy at the clipper.
To open or jettison the canopy, push one of the levers back up to the stop and raise canopy.

7.2 Cockpit description (cont.)

(15) Flap lever

Black lever, projecting upwards, on cockpit inner skin on the left.
Swing lever slightly inwards, move to desired setting and let engage in appropriate notch.

Forward position	high speed range
Backward position	low speed range

(16) Manual propeller brake

Black T-shaped handle on the front of the left cockpit inner skin (for either seat)

Handle pulled back	brake operation (for manual stopping and holding propeller)

(17) Fuel shut-off valve

Black knob on cockpit inner skin on the right (for either seat)

Forward position	valve opened
Rearward position	valve closed

(18) Rear-view mirror

Rear-view mirror front cockpit	on the right side panel
Rear-view mirror rear cockpit	on the instrument glare shield

(19) Starter button

Red press button on control stick (for either seat)

(20) Emergency switch landing gear

Toggle switch with red safety cover, see also 7.3.54

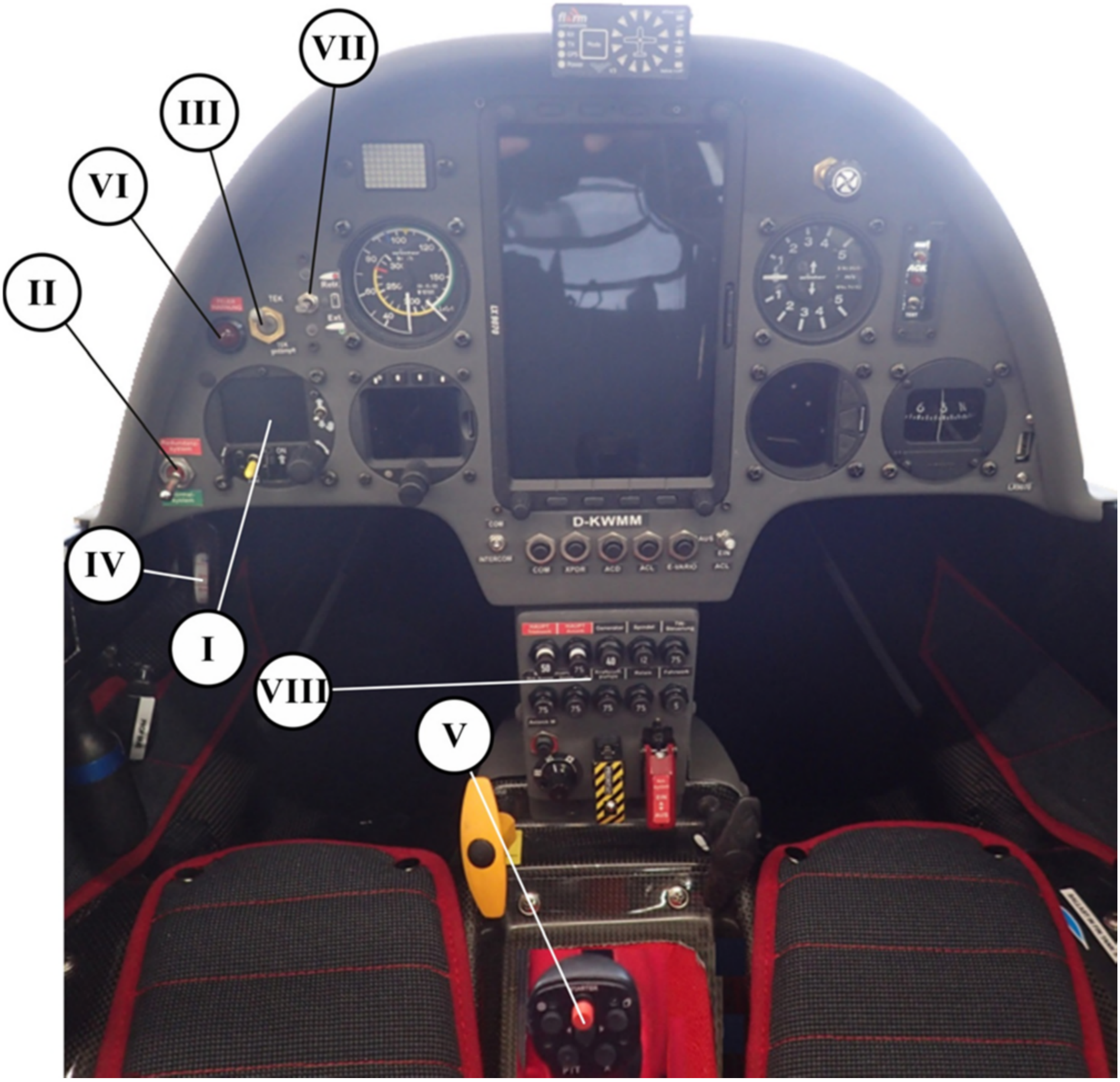
(21) Throttle lever

Pivot lever at the left-hand side panel (for either seat)

Forward position	full throttle
Aft position	idle

7.3 Instrument panels

Instrument panel front:



A description of the designated components I - VIII is found on the following pages section 7.3.2 to 7.3.55.
A description of the instruments as well as presentation of the rear Instrument panel is not included.

7.3 Instrument panels (cont.)

I Power plant operating unit MCU

Description see page 7.3.11 and on

II Switch for the engine control system

Toggle switch in the instrument panel

Position downwards:	- engine control on normal system
Position upwards:	- Emergency operation because of breakdown of normal engine control system (redundancy system activated). - Fuel pump of redundancy system and coolant liquid pump are running permanently

Note:

The power plant operating unit will display the error-massage (see page 7.3.39) when switching the engine control system to redundancy system. Pushing the Selector switch will shut off the warning.

Engine control
malfunction
(CAN)

Please acknowledge

III Switch TE (optional)

The toggle switch is in the instrument panel for use with a TE-probe. Switching to static pressure or heavily muted TE-pressure while in powered flight dampens the variometer reading.

TE	- Tube to TE-nozzle
STATIC	- Static pressure
Or	
TE	- Tube to TE-nozzle
TE dampened	- Tube with constrictor to TE-nozzle

IV Outside air temperature

For flights with water ballast, the ambient temperature shall not go below +2 °C (35 °F)

7.3 Instrument panels (cont.)

V Electric start button on the control stick

The starter motor can be used in two different types of operation

1) Starting the engine

Requirements for starting the engine:
- Power plant fully extended (check Position-Indication)
- RPM of engine 0
- Ignition ON

2) Pulse-Mode for Propeller Positioning

Requirements for Pulse-Mode:
- Power plant fully extended (check Position-Indication)
- RPM of engine 0
- Ignition OFF
- Emergency system inactive (red cap of emergency switch closed)

VI Blinking fire warning light

The temperature sensor for the fire warning lamp is placed in the upper area of the front engine compartment wall. The fire warning lamp will start blinking, if the temperature in the engine compartment exceeds 140 °C (284 °F), for example because of a fire.

Note:

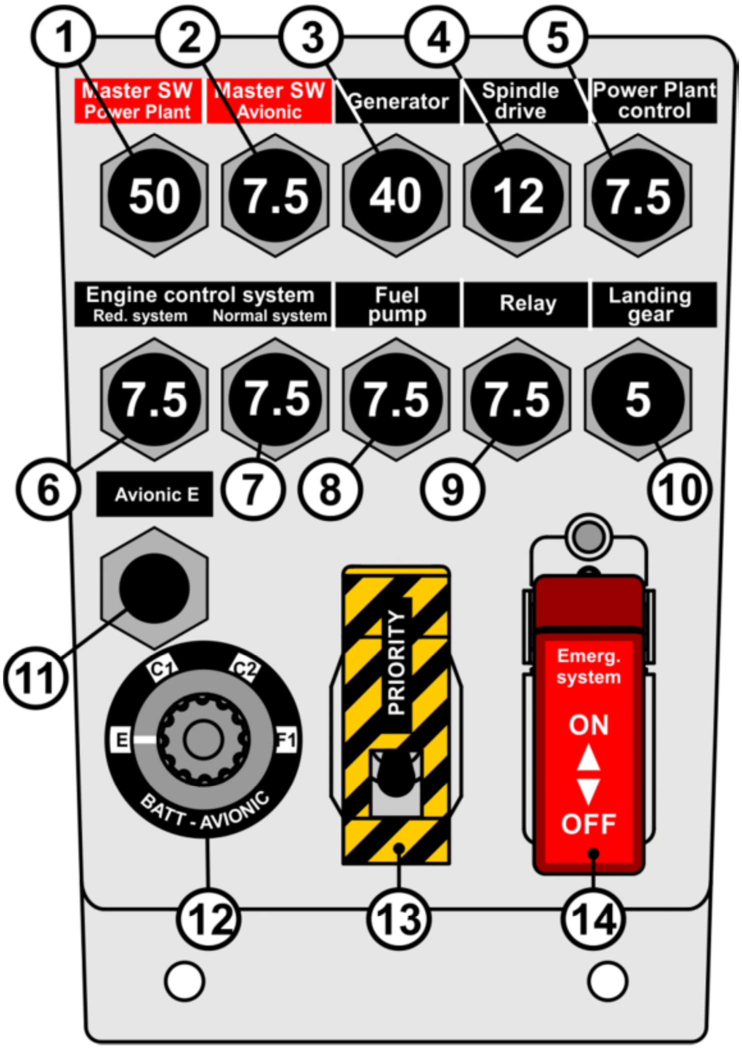
When starting the power plant control, the fire warning light will flash for a short period of time (self-test).

VII Landing gear extension and retraction

Toggle switch for landing gear extension and retraction, see page 7.3.53

7.3 Instrumenten panels (cont.)

VIII Circuit breaker panel below the forward instrument panel



1	Master-switch power plant
2	Master-switch Avionic
3	Circuit breaker generator
4	Circuit breaker spindle drive
5	Circuit breaker power plant control system
6	Circuit breaker engine control - redundancy system
7	Circuit breaker engine control – normal system
8	Circuit breaker fuel system – normal system
9	Circuit breaker – ignition relay
10	Circuit breaker landing gear
11	Circuit breaker Avionic E
12	Battery-selector switch
13	Priority switch for power plant control if two power plant operating units are installed (optional)
14	Emergency system for extract and retract power plant

All master switches and circuit breaker of the most important circuits of the power plant circuits, which only have to be electrically protected in case of an electrical defect, are equipped with a manually resettable circuit breaker.

7.3 Instrument panels (cont.)

VIII Circuit breaker panel (below the instrument panel) (cont.)

1. Master-switch power plant – circuit breaker (50 A)

The master switch interrupts the power supply of the engine battery to the propulsion system and to all other electrical consumers supplied by this battery (battery E).

> **Warning:**
>
> The engine control system (Normal and redundancy system) is supplied by the electrical circuit of the engine battery (battery E). If the master switch power plant is opened, the engine will stop!

2. Master-switch Avionic – circuit breaker (7.5 A)

The main-switch interrupts the power supply from the avionic batteries (C1, C2, F) to all of the avionics.

3. Generator- circuit breaker (40 A)

The generator circuit breaker must always be pushed in when the engine is running. Otherwise the generator won`t supply energy to the engine and also the engine battery will not be charged.

> **Warning:**
>
> - With opened generator circuit breaker the engine and the power plant control system are only supplied with energy by the engine battery (battery E). If the battery is empty, the engine will stop!
>
> - Open the generator circuit breaker during engine operation only in case of an emergency (for example at continuous over-voltage). Otherwise the internal device for measuring the generator current (prompt “GC”) might be damaged!

4. Spindle- circuit breaker (12 A)

Protection for the spindle drive motor to extend and retract the power plant.

5. Power plant control system- circuit breaker (7.5 A)

Circuit breaker for the power plant control system MCU including:

- Power plant operating unit(s) and power plant control unit
- cooling water pump (internal fuse in control unit)
- proximity switches for propeller positioning (internal fuse in control unit)

7.3 Instrument panels (cont.)

VIII Circuit breaker panel (below the instrument panel) (cont.)

6. Engine control redundancy system- circuit breaker (7.5 A)

   Protection for the following electric circuits:
   - Redundancy system for engine control
   - Fuel pump and RPM-sensor of redundancy system

7. Engine control normal operating system - circuit breaker (7.5 A)

   Protection of the normal operating system for the engine control (“Trijekt”) including RPM-Sensor, throttle position sensor, coolant-temperature sensor, airpressure and airtemperature sensor.

8. Fuel pump- circuit breaker (7.5 A)

   Protection for the following electric circuits:
   - Fuel pump for normal system of the engine control
   - Installed refueling pump for the fuselage tank

9. Ignition circuit breaker (7.5 A)

   Protection of relay for ignition.

10. Circuit breaker for electrical landing gear operation (5 A)

    Circuit breaker for landing gear retraction and extension

11. Avionic circuit breaker for operation with engine battery (7,5 A)

    Separate protection for avionics for optional operation with engine battery (see also 12).

12. Battery selector switch

    Battery selector switch to supply the avionic system and additional equipment (optional) with either the engine battery or any optional battery, see page 7.12.3:

E:	Engine battery
C1/C2:	Batteries in the footwell of the rear cockpit.
F (1/2):	Battery in the tail fin (Option)

7.3 Instrument panels (cont.)

VIII circuit breaker panel (below the instrument panel) (cont.)

13. Priority switch (optional, only with two powerplant operating units)

The priority switch (toggle switch) is covered with a yellow-black protecting cap.

If the protecting cap is opened, the active powerplant control can be transferred between the both powerplant operating units in front and rear cockpit.

Position down	⇨	Power plant operating unit in front instrument panel active
Position up	⇨	Power plant operating unit in rear instrument panel active

Note:

With the inactive powerplant operating unit the power plant cannot be operated, but all information is still displayed.

In order to avoid an interruption of the automatic power plant control, be sure to satisfy the following conditions before using the priority switch:

- Both ignition switches must be in the same position
- Power plant must be fully extended or fully retracted
- Both manual operation switches (see page 7.3.11 and 7.3.17) are in the middle position

Warning:

- If the engine is running, switch priority only when the ignition switches on both engine operating units are in the ON position. Otherwise the engine will stop by switching!
- If the engine is stopped, switch priority only if the ignition switches both are in the OFF position.

7.3 Instrument panels (cont.)

VIII Circuit breaker panel (below the instrument panel) (cont.)

14. Emergency system
If the power plant control fails or the power plant operating unit in the instrument panel does not react to pilot input, the power plant can be extended or retracted using a separate emergency system.
For the extension and the retraction of the power plant with the emergency system the following master switches and circuit breakers have to be switched on:

- Master switch power plant **MASTER SW POWER PLANT**
- Circuit breaker spindle drive **Spindle Drive**
- Circuit breaker emergency system **Emergency system**

The emergency system is activated when the red protecting cap lifted:

Emergency mode activated (safety flap open) Normal operation disabled.
Please acknowledge

Below the red protecting cap is the emergency switch (toggle switch) for the control of the spindle drive of the power plant:

Toggle switch UP	⇨	power plant extends
Toggle switch NEUTRAL	⇨	no movement of power plant
Toggle switch DOWN	⇨	power plant retracts

If the power plant is operated with the emergency switch the travel of the spindle drive isn't limited by the limit switches anymore. Therefore, you have to estimate the end-position of the power plant during the extension process visually via the rear-view mirror.
The end position of the extension und retraction process will be indicated at last by triggering the circuit breaker for the spindle drive **spindle** in the cockpit.

a) Power plant extension with the emergency system

- lift red protecting cap
- confirm prompt Emergency mode activated on the display of the power plant operating unit by pushing the Selector switch to light-off the warning
- extend power plant completely with the emergency system
- to start the engine: Ignition ON, Push start button on control stick

7.3 Instrument panels (cont.)

VIII circuit breaker panel (below the instrument panel) (cont.)

14. Emergency system (cont.)

b) Stopping the engine and retraction of power plant with emergency switch

- Ignition OFF
- Lift red protecting cap
- Confirm prompt Emergency mode activated on the display of the power plant operating unit with the Selector switch to light-off the warning
- Stop the propeller with the manual propeller brake (handle on left side in the forward area of the cockpit see section 7.2)
- Center the propeller with the aid of the airstream as close as possible at its retracting position by varying the force on the handle of the manual propeller brake (Display of power plant operating unit will show **P1** and **P2** during propeller retraction).
- Retract power plant with emergency switch

If it's not possible to center the propeller in its proper retracting position, the power plant can be nevertheless retracted as far as possible. In order to prevent damage to the airplane, stop the retraction process, if possible, as soon as the propeller touches audibly the engine cover doors.

Warning:
The operation with the emergency system should be limited to emergency situations.

As soon as the emergency system is activated (red protecting cap lifted up) all functional checks of the power plant control system are deactivated, in opposite to the operation with the manual operation switch. That means:

- The electric starter can be used in all positions of the power plant, even if the engine is running!
- The power plant can be retracted and extended with the emergency switch regardless the RPM of the engine or the position of the propeller!
- Due to vibrations during flights with idle power setting a regular readjustment of the spindle drive is necessary in order to prevent a creepy retraction of the power plant. This function is performed automatically by the power plant control system during normal operation.
  With activated emergency system the readjustment of the spindle drive has to be done by the pilot.

7.3 Instrument panels (cont.)

VIII circuit breaker panel (below the instrument panel) (cont.)

14. Emergency system (cont.)

Note:

If the circuit breaker for the power plant control normal operating system is still closed during the operation with the emergency system for the spindle drive and the TFT-Display of the power plant operating unit is still working, the following notification will be shown:

- After lifting the red protecting cap, the TFT-Display will show Emergencymode activated alternately. This notification can be closed by pushing the Selector switch. After that the operating indicators of all functioning systems for the control of the power plant will be available.

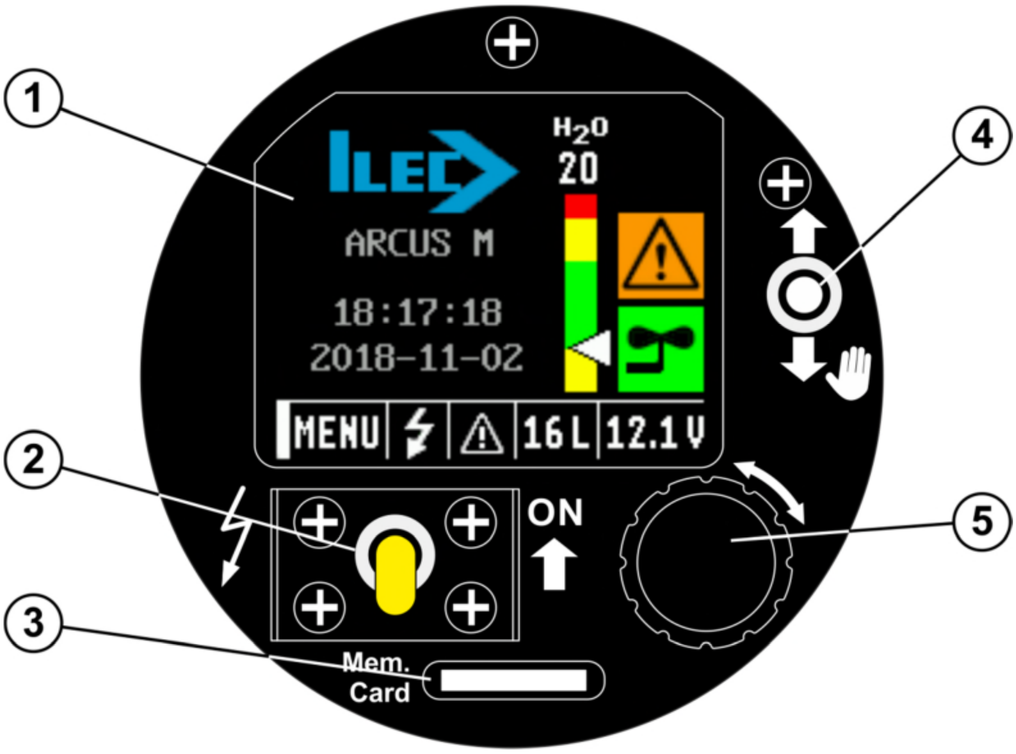
- If the limit stops for the power plant are still operational, they will be recognized and the end positions of the power plant will be indicated in the power plant operating unit.

15. Emergency system – self-resetting circuit breaker (no illustration)

The emergency system for the extension and the retraction of the power plant is protected by a self-resetting circuit breaker.
This circuit breaker is integrated into the electrical circuit as a “flying” circuit breaker and is located in the circuit breaker panel, right behind the emergency system switch.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU



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

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

The MCU 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 power plant control system of the Arcus M consists of two main components:

1. The MCU 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 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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 VIII of this chapter, p. 7.3.4 ff).

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

- Master switch power plant **Master-switch Power plant**
- Power plant control system circuit breaker **Power plant control**
- Circuit breaker spindle drive **Spindle drive**

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 Selector switch.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

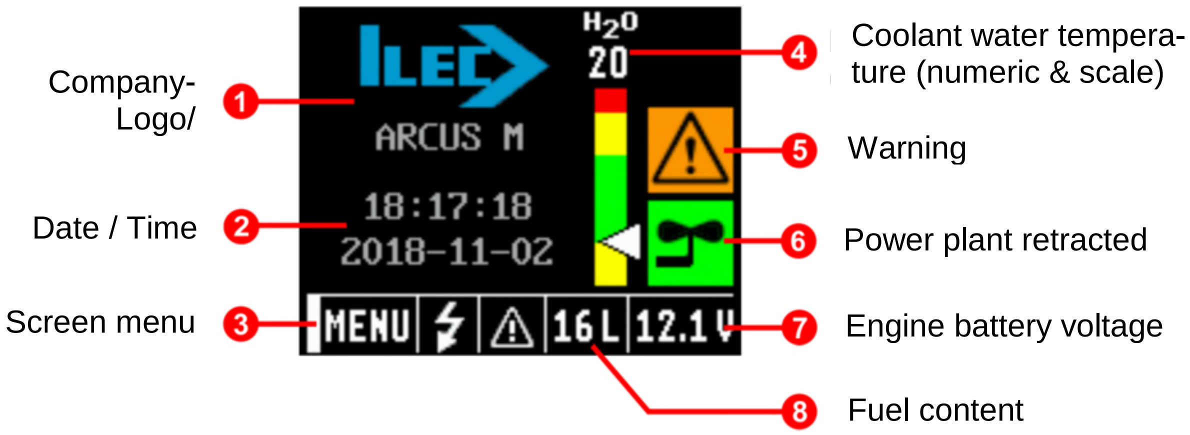
A) Device description (cont.)

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



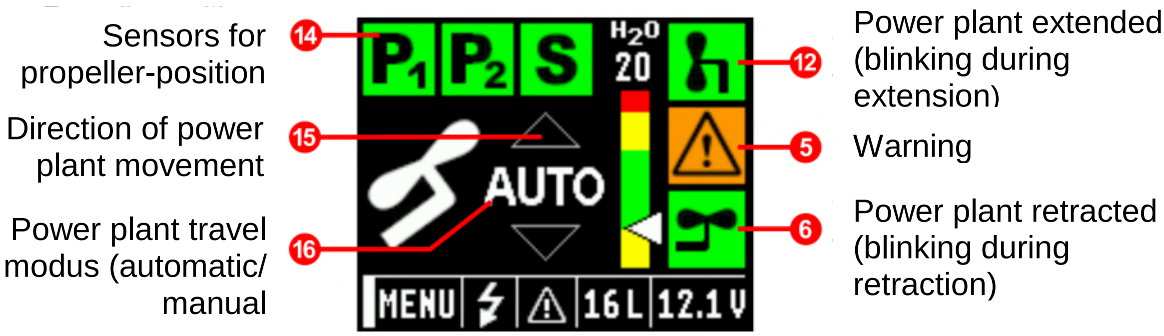
Display during power plant operation

7.3 Instrument panels (cont.)

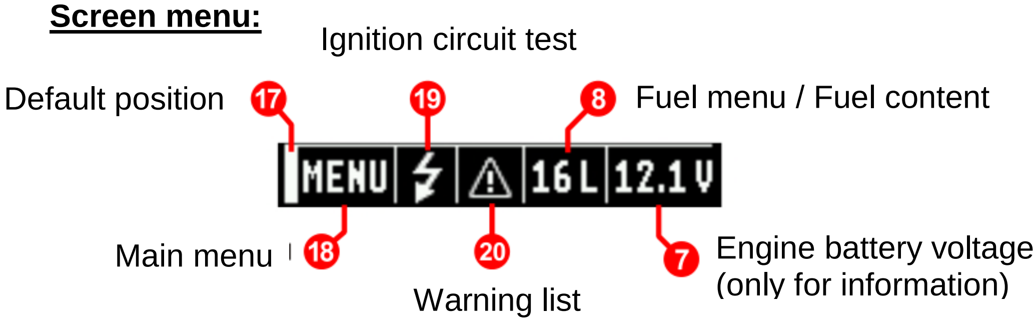
I. Power plant operating unit MCU (cont.)

A) Device description (cont.)

1.) 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 7.3.37.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 MCU 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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

A) Description (cont.)

4. Manual operation switch (spindle drive switch)

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 operating switch (toggle switch) has three positions

Position up	-	Automatic operation turned off Extends the power plant as long as the switch is held
	-	Spindle stops by itself when the power plant is fully extended and the limit switch is reached
Position middle	-	Automatic operation (default position)
Position down	-	Automatic operation turned off
	-	Retracts the power plant as long as the switch is held
	-	Spindle stops by itself when the power plant is fully retracted and the limit switch is reached

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

I) on the ground (recommended for preflight 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 extension or retraction of the power plant control system.

Important Note:

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

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

A) Description (cont.)

4. Manual operation switch (spindle drive switch) (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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

A) 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 pressing 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.

7.3 Instrument panels (cont.)

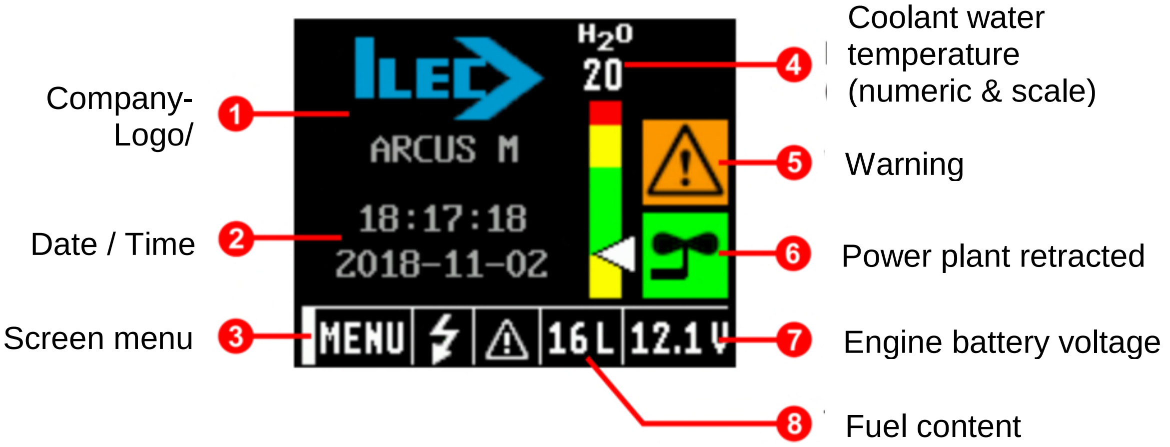
I. Power plant operating unit MCU (cont.)

(B) Functional description

Displays of the power plant operating unit

The displays of the power plant operating 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 7.3.34.

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 "Screen Menu" on page 7.3.26.

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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 7.3.26), the error message can be read again in chronological order. The possible error messages are explained on page 7.3.37. The display is coupled with the warning tone a).

a) Warning tone (buzzer) (not illustrated)

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 Powerplant 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 powerplant is located in the engine compartment on the propeller bulkhead.

1.7 Engine battery voltage
The engine battery voltage (7) supplied to the MCU 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 (1.59 US Gal., 1.32 IMP Gal.), 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 7.3.29.
The limit values can be found in the table in chapter 2.5 of this manual.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

(B) Functional description (cont.)

2. Display during power plant 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 display of the power plant operating unit.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 powerplant 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!

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

2.11 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.

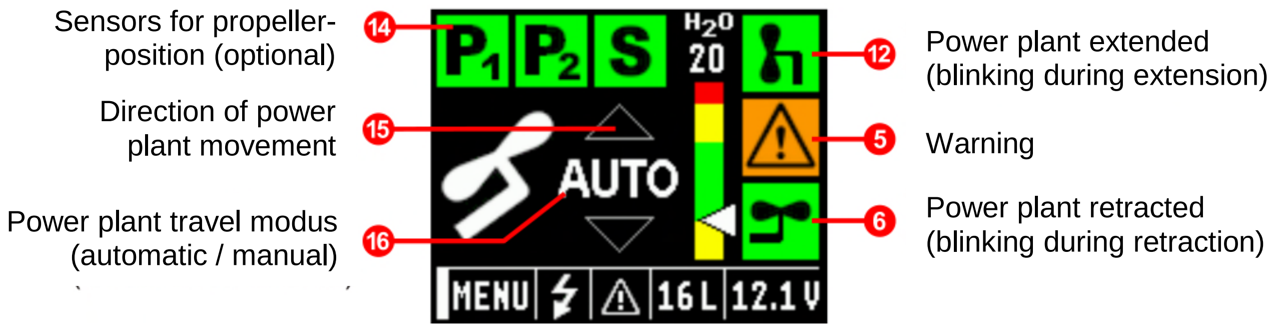
2.12 Warning fuel shut-off valve
If the ignition is switched on while the fuel shut-off valve is closed, a warning message appears on the display with a warning tone. The warning can be confirmed by pressing the rotary selector switch. The symbol (13) remains visible until the fuel shut-off valve is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

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 steady on	➪ Power plant fully extended

(6) Lower indicator

green indicator flashes	➪ Power plant is being retracted
green indicator steady on	➪ 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.

Caution:
When the display is deactivated, the position of the propeller will not be displayed during retraction in emergency case. In this case the position of the propeller can only be checked through the rear mirror.

3.15 Direction of power plant movement

The filled triangle shows the current direction of movement.

3.16 Power plant travel modus

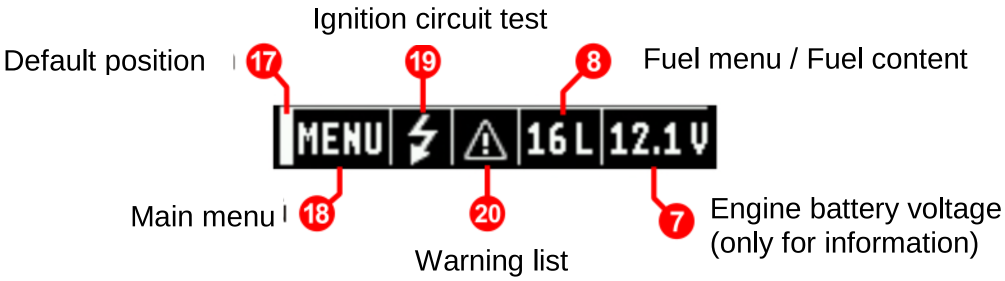
In normal operation, the power plant is automatically retracted and extended when the ignition switch is actuated. Automatic operation is indicated by the AUTO display. If the power plant is moved manually, a hand symbol ✋ is displayed here.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 7.3.29.

4.17 Default position
After some time without interaction at the power plant 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 7.3.27.

4.19 Ignition circuit test
Selecting this menu item starts the ignition circuit test function. The powerplant 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 7.3.31.

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 7.3.37 and on.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 can be 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 7.3.37 and on.
The entry of the error in the warning list is deleted after it has been selected in the warning list.

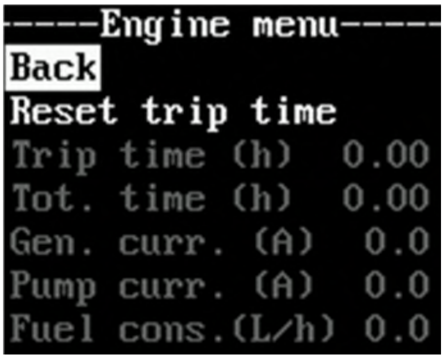
7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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)**).

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

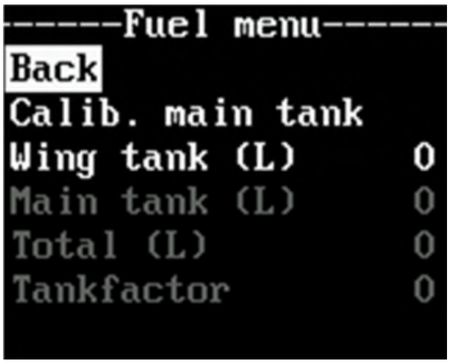
B) Functional description (cont.)

1.3 Fuel content / Fuel menu

Caution:

Prerequisites for making settings in the fuel menu:

- Completely filled fuselage tank
- Ignition OFF
- Powerplant 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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

1.3 Fuel content / Fuel menu (cont.)

Wing tank (L)

Optionally up to 2 wing fuel tanks can be installed in the Arcus M. 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 requirements for entering the fuel content in wing tanks is a displayed fuel quantity of 16 L (4.2 US Gal., 3.5 IMP Gal.) 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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.) /B) Functional description (cont.)

1.4 Ignition circuit test

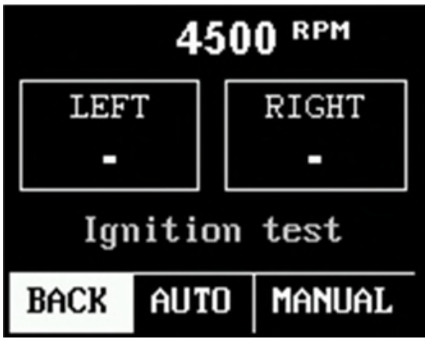
The MCU3operating unit doesn’t have a separate switch to switch off the individual ignition circuits in order to check the function of the individual ignition coils and spark plugs. The operating unit offers two possibilities to perform this important test with the rotary selector switch, either

- 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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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**.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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**.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

1.5 Settings:

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

- The value is selected with the rotary selector switch,
- Press the rotary selector switch and turn it in the pressed state
- Turn clockwise to increase a value, turn counter clockwise 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 in 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 $\mathbf{P_1}$, $\mathbf{P_2}$, **S** on or off on the travel screen.
- **Reset defaults** restores the basic device settings of these settings.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 are 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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

6. Operating notifications

Operating notifications should inform the pilot:

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

- if corrective actions have to be performed 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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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:* With 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:* With turning on the operating unit, the ignition is OFF, the powerplant 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

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 is 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

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

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

6. Operating notifications (cont.)

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

Number	**HINWEIS_BENZINHAHN_OEFFNEN (36)**
Display	**Open fuel valve**
Description	The powerplant 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

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

6. Operating notifications (cont.)

Number	**FRAGE_BREMSE_EINSCHALTEN (37)**
Display	**Activate brake?**
Description	The engine is to be retracted, but the unit cannot decide if the propeller break may be activated, because of missing RPM information (e.g. with speed sensor inoperative / interruption of the CAN-bus to the Trijekt engine control
Text	Activate propeller brake?
Short text	Activate prop brake?

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 4 min 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	Batt. 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

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

6. Operating notifications (cont.)

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 powerplant is fully extended.
Text	Engine start enabled. Extended manually before starting.
Short text	Motor fully extended?

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 actions 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)

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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_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.

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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

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

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.

7.2 Error Messages – Limit switch malfunction (SWITCH):

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 powerplant drive required.
Short text	Endswitch malfunc.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 powerplant 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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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.

Number	**FEHLER_RELAIS (72)**
Display	**Startrelais malfunc.**
Description	The electrical power supply or distribution line to the start relay (cut-off relay) is interrupted. An engine start with the starter button is herewith impossible. Windmilling start and engine running however are possible.
Text	Engine starter malfunction. Windmilling required to start engine
Short text	Startrelay malfunc.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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 (76)**
Display	**Engine malfunc. (76)**
Description	Error signal from Trijekt engine control: air temperature sensor failure. Reduced engine power could occur.
Text	Engine malfunction (76): Air temperature sensor failure. Reduced engine power
Short text	Engine malfunc. (76)

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)

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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.

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (cont.)

B) Functional description (cont.)

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

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 powerplant 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

7.3 Instrument panels (cont.)

I. Power plant operating unit MCU (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

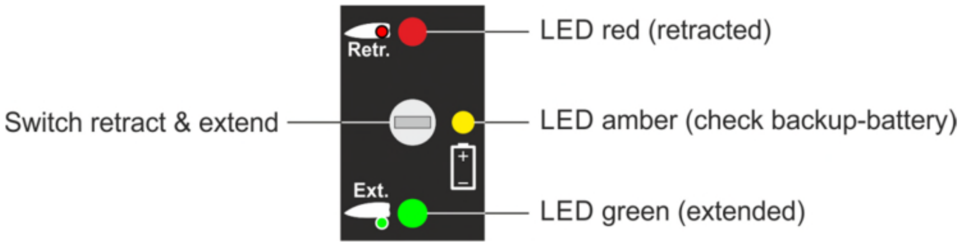
The system information is displayed, for example, as follows:

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*

7.3 Instrument panels (cont.)

VII. Landing gear control system

The operation of the landing gear is carried out by an electrical spindle drive which is operated by an electrical push button in the operation unit installed in both instrument panels.



When the master switch for electrical power supply and the circuit breaker for the electrical landing gear (5 A) are closed, all three LED's light up for approx. 1 second.
If the landing gear is not fully extended when switching on, all three LEDs extinguish at first. Subsequently the red and the green LED are flashing. The system is now ready for operation, however the landing gear can only be extended from this position.
If the landing gear is already fully extended, the orange and yellow LED extinguish. The green LED lights up steady. The system is now ready for operation.
With airbrakes unlocked and landing gear not fully extended, the landing gear warning will be activated. The red LED lights up and a warning signal appears.

Landing gear extension:
To avoid an inadvertent extension of the landing gear, the toggle switch for landing gear operation has to be pushed down for more than 0.5 sec. If the time period is too short, three short acoustic warnings appear. If the time period is sufficient, a confirmation sound occurs and the landing gear extends. During gear transition the green and the red LED are flashing, in the final position of the landing gear, the appropriate LED is permanently illuminated.

Caution
Make sure there is enough space between the fuselage and the ground!

If the landing gear collides with an obstacle or when the toggle switch is pushed upwards, the extension procedure is stopped, an acoustic warning signal sounds and subsequent the red and the green LED are flashing. After removal of the obstacle, the landing gear can be extended further.
When toggle switch is operated permanently the electronic overload protection is deactivated. In this case the landing gear circuit breaker (5 A) can pop out, when the toggle switch, in spite of an obstacle, is being pushed.

7.3 Instrument panels (cont.)

VII. Operation of electrically powered landing gear (cont.)

Landing gear retraction:
To avoid an inadvertent retraction of the landing gear, the toggle switch for landing gear operation has to be pushed upwards for more than 0.5 sec. If the time period is too short, three short acoustic warnings can be recognized. If the time period is sufficient, a confirmation sound occurs and the landing gear retracts. The red LED is flashing until the final position of the landing gear is reached, is steady on for 10 sec. and extinguishes then.

Caution:
Only no-load operation!

If the landing gear collides with an obstacle or when the toggle switch is pushed down, the retraction procedure is stopped, an acoustic warning signal sounds and subsequent the red and the green LED are flashing. After removal of the obstacle, the landing gear first has to be extended completely, before it can be retracted again.

The electronic overload protection during retraction and the weight-on-wheel protective function can only be deactivated with the emergency system of the landing gear.

Double-operation:

There is no priority of front or rear operating unit. This means, that the retraction procedure started with either operating unit can be stopped with the other operating unit at any time. The same applies to the extension procedure. Is an already started operation stopped, the red and the green LED are flashing and an acoustic warning will occur. The landing gear has to be brought into the appropriate position by pushing the toggle switch.

Emergency operation:

In the event of a defect of the control unit or if the engine battery is flat, it is still possible to extend the landing gear with the integrated emergency system. The emergency extension is carried out by a separate emergency switch which is located on the right side on the seat pan support in the front cockpit.

Caution:
It is generally not recommended to operate the landing gear by the emergency system and it should only be performed when normal operation controls are defective.

7.3 Instrument panels (cont.)

VII. Operation of electrically powered landing gear (cont.)

Emergency extension

Open red safety-cover and push and hold toggle switch to forward position. With reaching the final position the system turns off and an acoustic signal can be recognized.
If landing gear is fully extended and the safety-cover is open, the green LED illuminates steady, provided that the limit switch is not defective.
If the limit switch is defective, the final position can be checked by repetitive pushing of the toggle switch (acoustic signal must be recognized).
Should the landing gear not extend by pushing the toggle switch forward, open landing gear circuit breaker (5A) manually and push toggle switch forward again. If the defect is still present, the extension of the landing gear is not possible. In this case the approach has to be performed with retracted landing gear. Therefore consider the information given in Chapter 3.9 “Emergency landing with retracted landing gear“.

Emergency retraction

Open red safety-cover and push and hold toggle switch to backward position. With reaching the final position the system turns off and an acoustic signal can be recognized. The red LED does not illuminate in the final landing gear position.
This function should only be used on ground with suitable fuselage dolly or fuselage support.

Battery for emergency system (back-up battery)

If the back-up battery of the integrated emergency system has insufficient voltage, three long acoustic warnings during power-up will be recognized and the orange LED illuminates steady. If also the engine battery is flat or defective, the functionality of the emergency system is not provided anymore! It is possible that the orange LED illuminates steady after long periods of inactivity.
When the landing gear system is switched on, the back-up battery is recharged by the engine battery. The voltage-warning can be reset by re-starting the landing gear control system after approx. 10 min.
If the voltage warning occurs repeatedly within a short time, the back-up battery is defective and has to be replaced.

Weight on Wheel-Protection:

The landing gear system monitors if the landing gear is loaded and prevents an inadvertent retraction of the landing gear on ground.

7.4 Undercarriage

The landing gear consists of a retractable main wheel and a hydraulic disc brake, a fixed nose wheel (optional) and a steerable tail wheel respectively fixed tail wheel.

The extension/retraction process of the main wheel is described in section 7.2 “Cockpit description” on page 7.2.4 (Wheel brake) and on page 7.3.53 (Landing gear).

For a detailed technical description of the retractable landing gear including its wheel brake system see also page 1.2.3 of the Maintenance Manual.

7.5 Seats and restraint systems

The seat pans are bolted to mounting flanges provided on both sides of the cockpit.

The front seat features a back rest, which is adjustable in flight - see also page 7.2.5 where the procedure of its adjustment will be explained.

For each seat the lap straps are anchored to the seat pan.

While the shoulder straps for the front seat are attached to the steel tube transverse frame, those for the rear seat are anchored to the steel tube centre frame.

A list of approved restraint systems is provided in section 7.1 of the Maintenance Manual.

7.6 Static pressure and Pitot pressure system

Static pressure sources

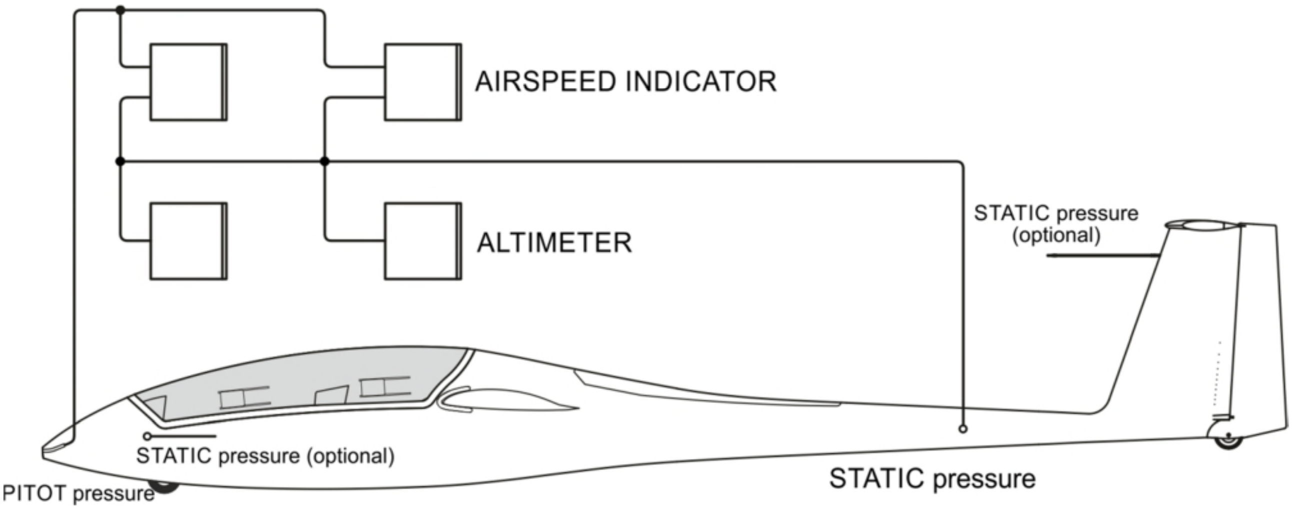
a) Static pressure ports are on either side of the fuselage tail boom, 1.02 m / 40.16 in. forward of the base of the fin.

b) On request a special static pressure probe can be installed near the top of the fin (for other instruments besides the ASI and the altimeter).

c) On request additional static pressure ports can be provided on either side of the fuselage skin next to the front instrument panel.

Pitot pressure sources

a) Pitot pressure probe is located in the nose cone of the fuselage.



7.7 Airbrake system

Schempp-Hirth type airbrakes are employed on the upper surface of the main wing panels.

A schematic view of the airbrake system is given in the Maintenance Manual.

7.8 Baggage compartment

An enclosed baggage compartment is not provided.

There is space above the spar stubs for soft objects (like jackets etc.). Any such items must be taken into account when determining the permissible payload.

7.9 Water ballast system

A steel cable connects the operating lever in the cockpit with the dump valve of the (optional) fin tank and a further steel cable with the torque tube which actuates the wing tanks - see page 7.9.3.

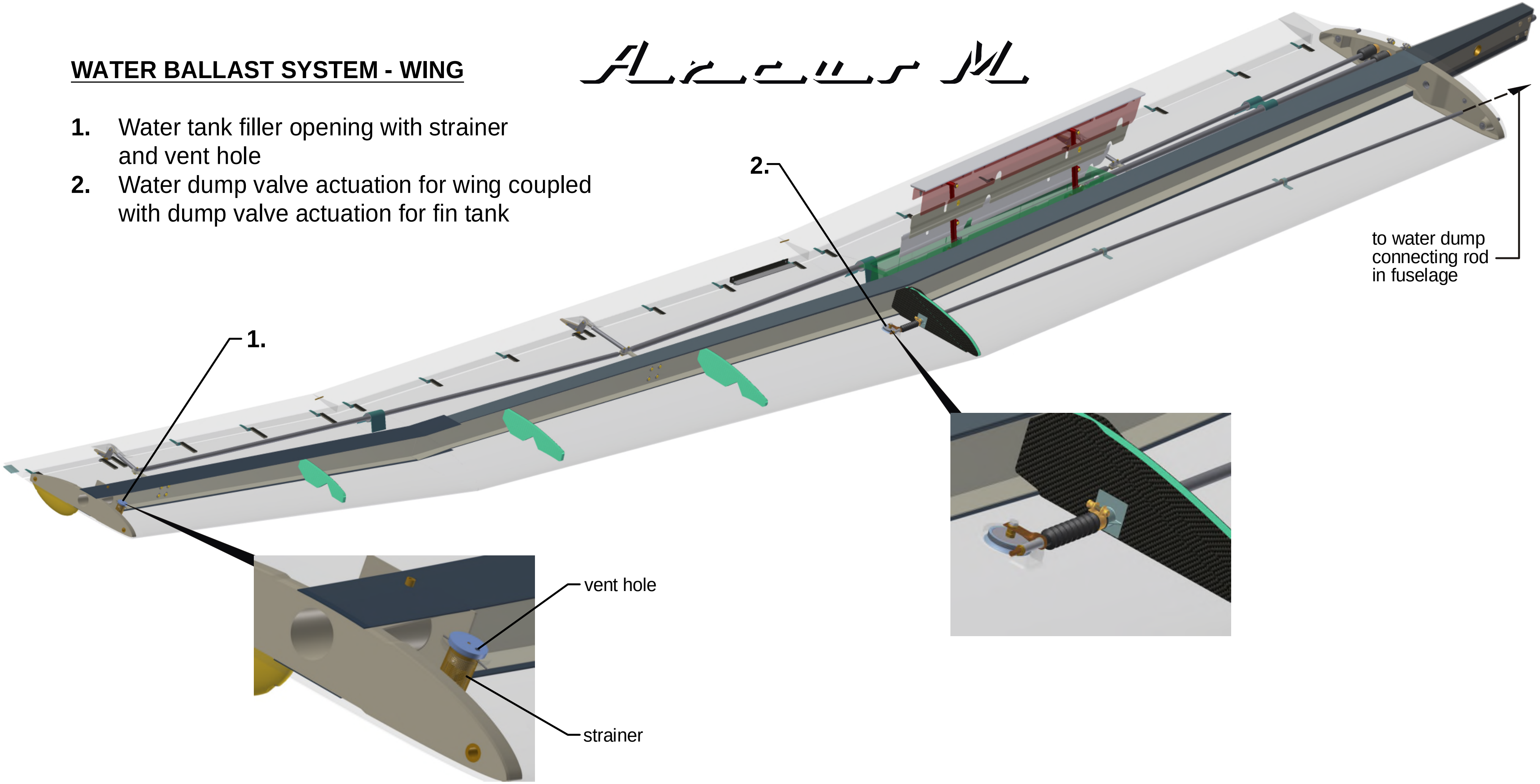
On rigging the main wing panels, the torque tube in the fuselage is automatically connected to the torsional drive of the dump valve plugs.

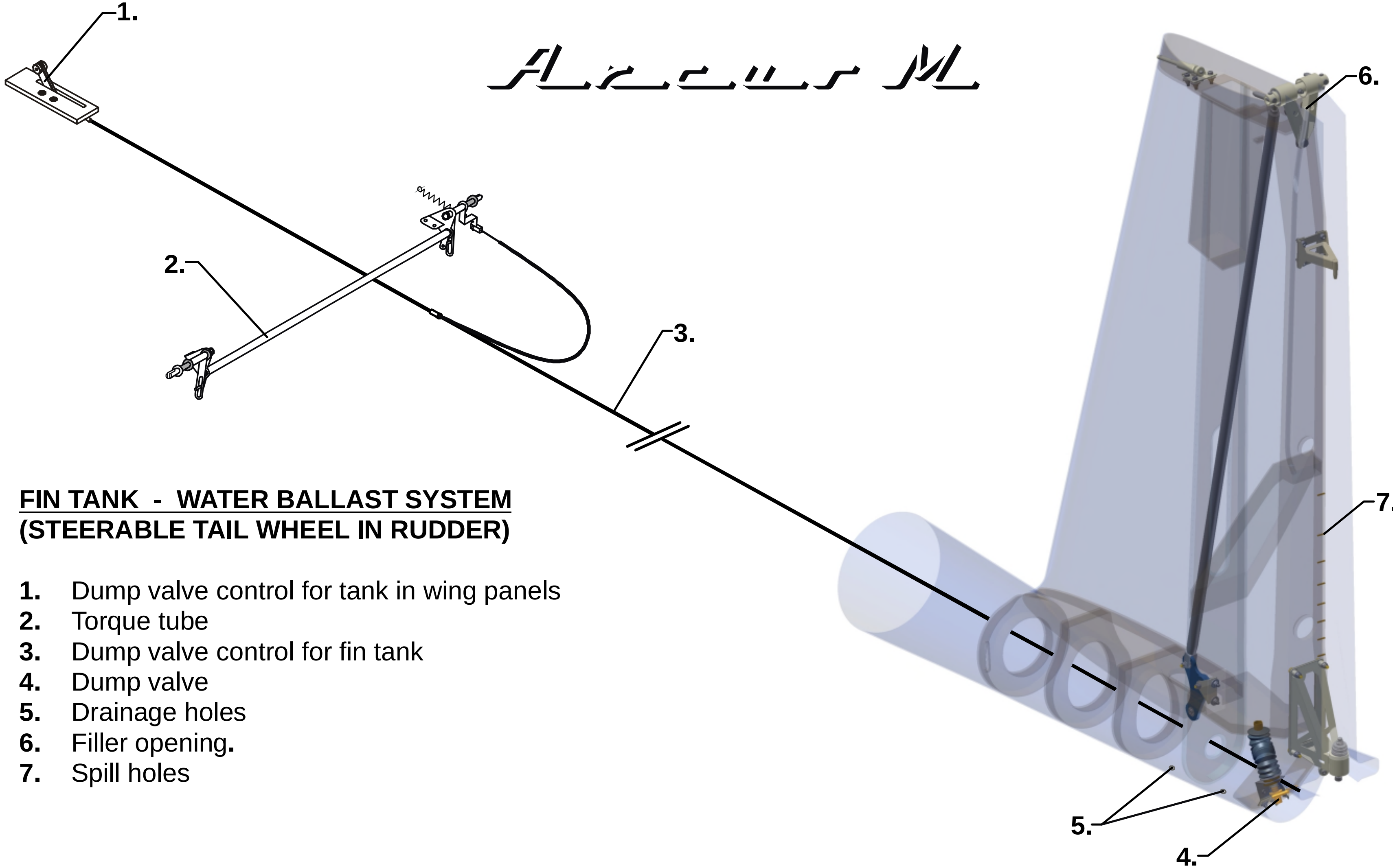
The torque tube is rotated to the "CLOSED" position by spring force - see page 7.9.2.

The operating lever locks in its respective final position.

WATER BALLAST SYSTEM - WING

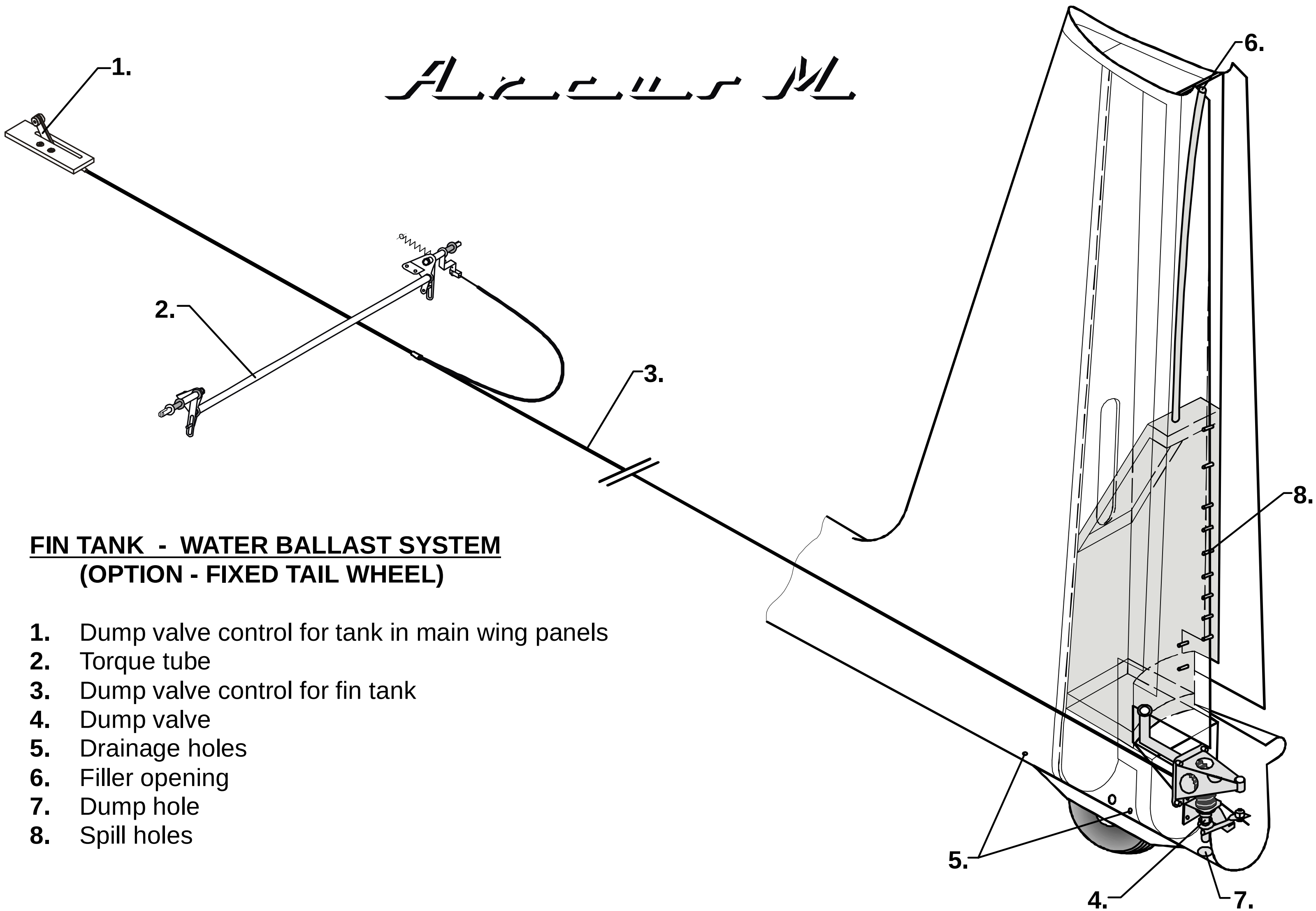
1. Water tank filler opening with strainer and vent hole
2. Water dump valve actuation for wing coupled with dump valve actuation for fin tank





FIN TANK - WATER BALLAST SYSTEM
(STEERABLE TAIL WHEEL IN RUDDER)

1. Dump valve control for tank in wing panels
2. Torque tube
3. Dump valve control for fin tank
4. Dump valve
5. Drainage holes
6. Filler opening.
7. Spill holes



FIN TANK - WATER BALLAST SYSTEM
(OPTION - FIXED TAIL WHEEL)

1. Dump valve control for tank in main wing panels
2. Torque tube
3. Dump valve control for fin tank
4. Dump valve
5. Drainage holes
6. Filler opening
7. Dump hole
8. Spill holes

7.10 Power plant system

The engine is connected to the propeller (for a description and relevant data refer to the engine and propeller manual) through the pylon. This unit is mounted to the fuselage steel tube centre frame by two rubber shock mounts for vibration damping. The arresting wire is attached to the pylon.

The extension and retraction of the pylon is done electrically with a spindle drive, which is mounted to the fuselage deck and acts on the engine mount.

The doors of the engine compartment are automatically opened and closed by a linkage while the pylon extends / retracts.

The panel-mounted power plant control unit combines a number of functions required for operation of the power plant, a description of this unit is given on page 7.3.2 and the following.

Additional controls for the power plant are the fuel shut-off valve, the throttle lever and if necessary, the manually operated propeller brake.

7.11 Fuel system

A view of the fuel system is given on page 7.11.2 – for a specification of the fuel to be used refer to page 2.4

Up to two flexible tanks may be used inside left and right wing optionally.
Instructions on how to refuel the aircraft are found on page 4.2.2.1 through 4.2.2.3.

Fuel from the fuselage tank is drained via a valve installed on the right side of the landing gear.

Fuel to the engine is always supplied from the fuselage tank, which is filled by the optional wing tanks by means of an interconnecting line featuring a quick-disconnect coupling.
Fuel from the fuselage tank is fed via a strainer, the electrical pump, a filter element and the shut-off valve to the injection system, which is connected to the engine.

Total fuel contents (in fuselage and wing panel(s)) are displayed by the power plant operation unit – its fuel quantity indicator is adjustable.

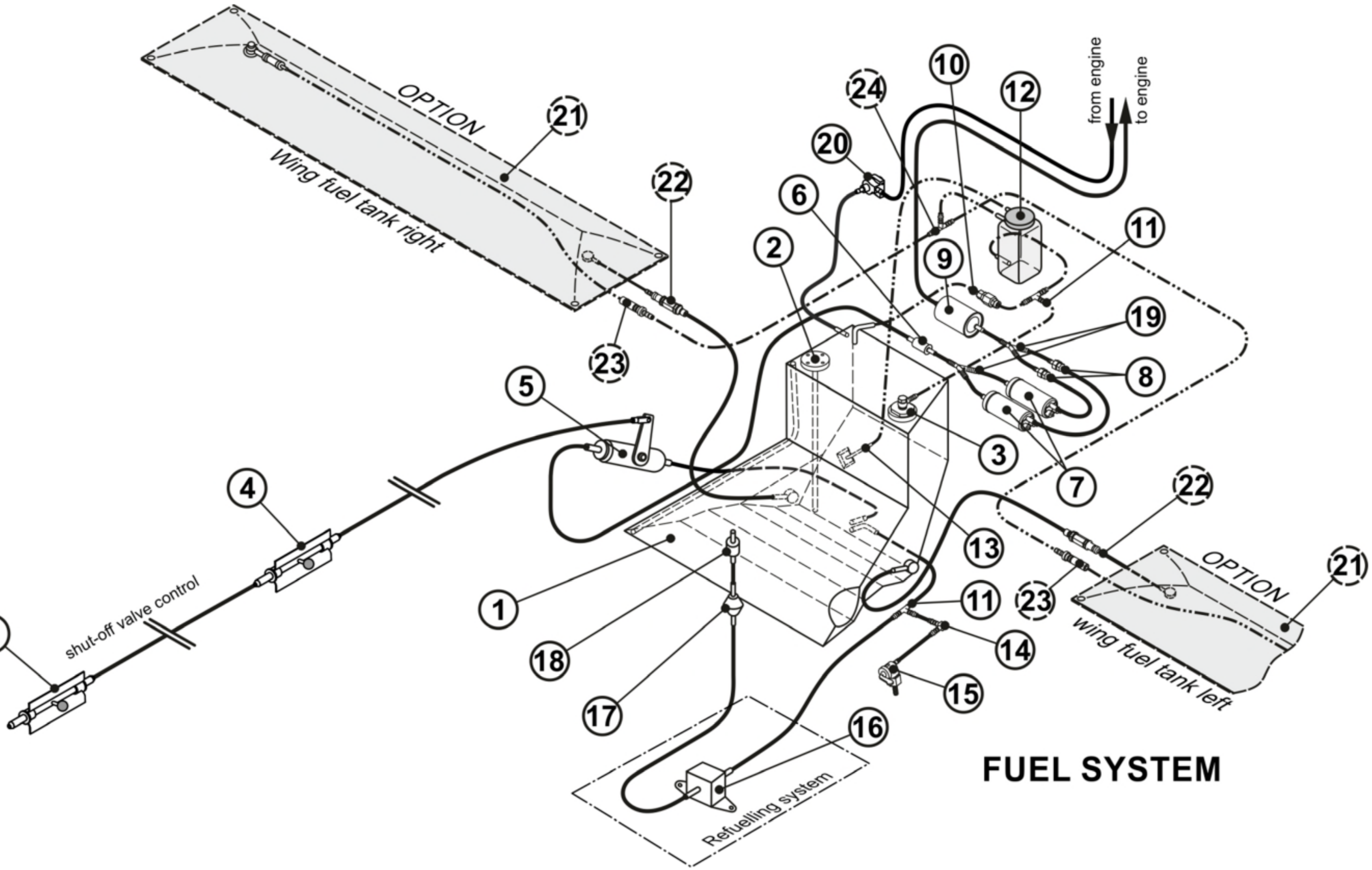
The vent line of the fuselage tank extends via an expansion reservoir to an opening on the lower side of the fuselage tube, on the right side behind the landing gear.

> **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.

Each wing tank has a vent line – routed to the expansion reservoir – featuring a pressure relief valve and a connecting plug for the quick connection coupling on the fuselage tank system.

Refuelling system

The connecting point with ON/OFF switch for the refuelling system is on the left side of the GFRP panel above the front transverse tube of the fuselage steel frame.
The additional electrical fuel pump with strainer is found below the seat pan – see page 7.11.2.


OPTION
Wing fuel tank right
21
22
23
24
20
10
12
from engine
to engine
6
2
9
11
19
8
3
7
5
4
shut-off valve control
1
18
17
13
11
14
15
16
Refuelling system
22
23
21
OPTION
wing fuel tank left

FUEL SYSTEM

Parts list referring to page 7.11.2

Item	Quantity	Description
1	1	Alu fuselage tank
2	1	Fuel level transmittor
3	1	Non-return valve
4	2	Fuel valve control
5	1	Fuel shut-off valve
6	1	Fuel filter
7	2	Fuel pump
8	2	Non-return valve
9	1	Fuel filter
10	1	Pressure relief valve
11	2	T-Connector
12	1	Expansion reservoir
13	1	Hose connector 90°
14	1	Hose coupling
15	1	Drain valve
16	1	Refuelling pump 12 V
17	1	Fuel filter
18	1	Hose coupling
19	2	Y-Connector
20	1	Fuel controller

Options

Item	Quantity	Description
21	1(2)	Wing tank
22	1(2)	Locking coupling
23	1(2)	Hose coupling
24	1	T-Connector

7.12 Electrical system

Avionics for gliding

Also, when operated in the plain sailplane configuration, the minimum instrumentation prescribed requires an electrical power source because of the electrical retractable landing gear.

Additional equipment is connected to the power supply “Electrical system – Avionic”, see pages 7.12.3 and 7.12.5 and must comply with the manufacturer’s instructions for the relevant equipment.
The electrical retractable landing gear is connected to the power supply according to pages 7.12.3 and 7.12.8.

Power for the gliding avionics is supplied by the power plant battery or by one of the up to 4 optional additional batteries which can be selected by the selector switch. See page 7.12.3 and 7.12.5.

For the gliding avionics as well as for the power plant, separate main switches are installed.

7.12 Electrical system (cont.)

Power plant

The engine features a contactless, map-controlled double-magneto ignition.

An electric power supply is necessary for the operation of the spindle drive, the starter motor, the electronic fuel injection system and the power plant operating unit. For this purpose there is a 12V battery provided. It is located at the cockpit steel tube transverse frame see "Electrical system –Power plant", page 7.12.4.

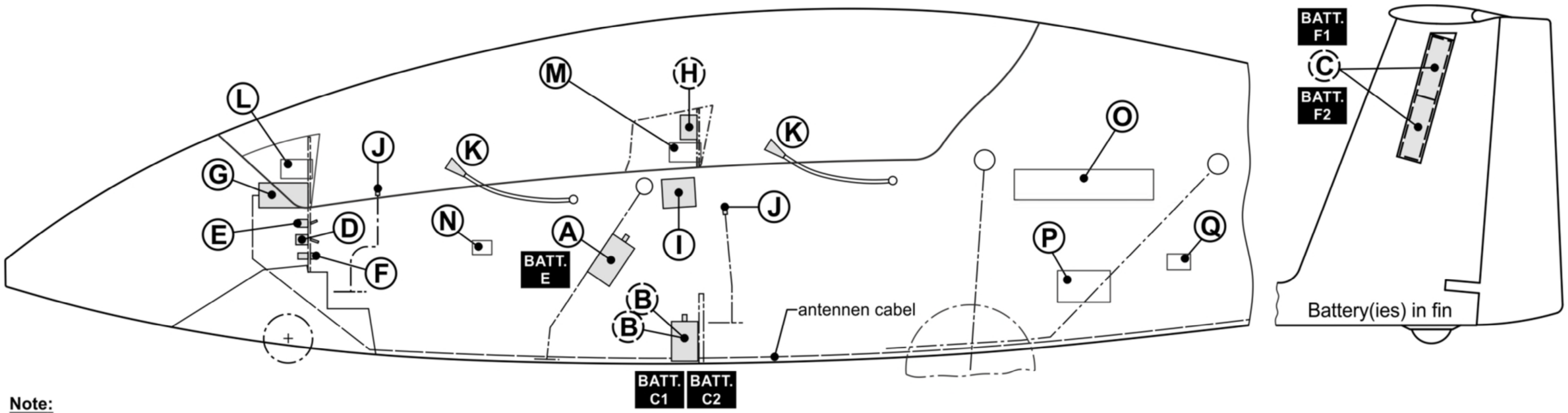
This battery is controlled by the power plant master switch. The state of charge can be checked by the power plant operating unit.

By means of the selector switch the gliding avionics may also be supplied by this battery.

The engine features an AC-generator which recharges this battery via a rectifier regulator. However, the battery may also be charged from an external power source via a charger socket provided on the left side in front of the rear seat.

With power plant master switch and power plant control system switched on, the signals and values from the power plant operating unit are provided.

A description of this unit's various functions and of all other power plant control elements including their interconnections is given in section 7.3.



Note:
VHF-Transceiver and other additional equipment to be wired in comliance with the manufacturer´s instructions and each device individually fused.

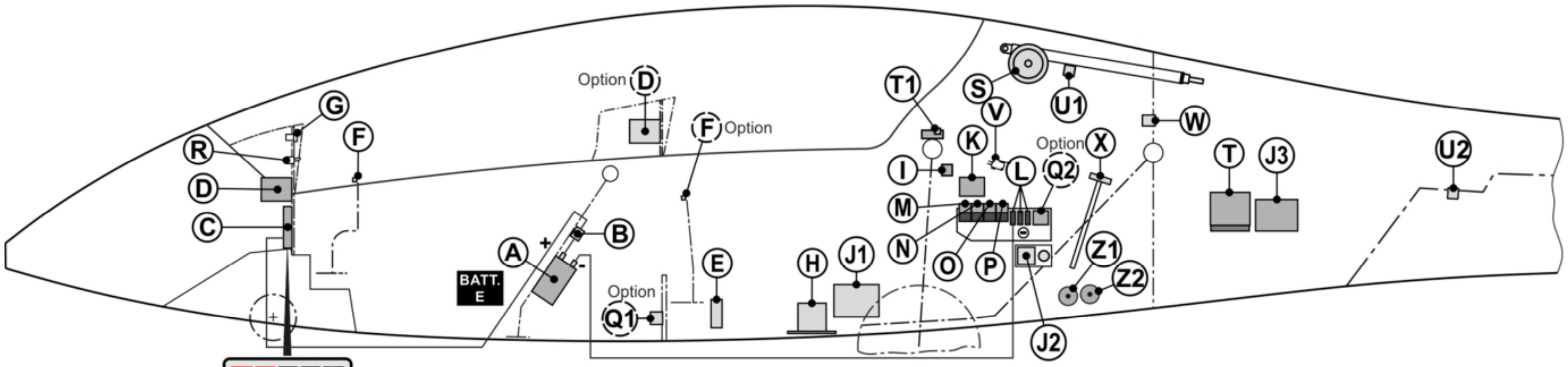
*) Alternative types of storage batteries may be used if they meet the respective demands.

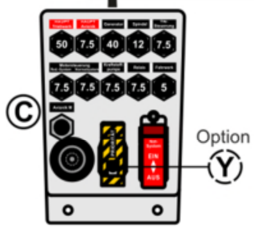
(A) 1 battery 12 V / min. 16 Ah*) BATT. E
(B)(B) 1 - 2 batteries 12 V / min. 5.7 Ah*) (Option) BATT. C1 BATT. C2
(C) 1 - 2 batteries 12 V / min. 5.7 Ah*) (Option) BATT. F1 BATT. F2, optional parallel connected

(D) Master switch
(E) Battery-selector switch-Avionic (Option: additional battery-selector switch - see 7.12.5)
(F) Fuses
(G) VHF-Transceiver
(H) VHF-Transceiver - slave control (Option)
(I) Speaker
(J) PTT button
(K) Boom-microphone
(L) Control unit electr. undercarrriage front seat
(M) Control unit electr. undercarrriage back seat
(N) Emergency actuation undercarrriage
(O) Drive unit undercarriage
(P) Control unit with battery (undercarriage)
(Q) Limit switch airbrakes

Arcus M

ELECTRICAL SYSTEM - AVIONIC

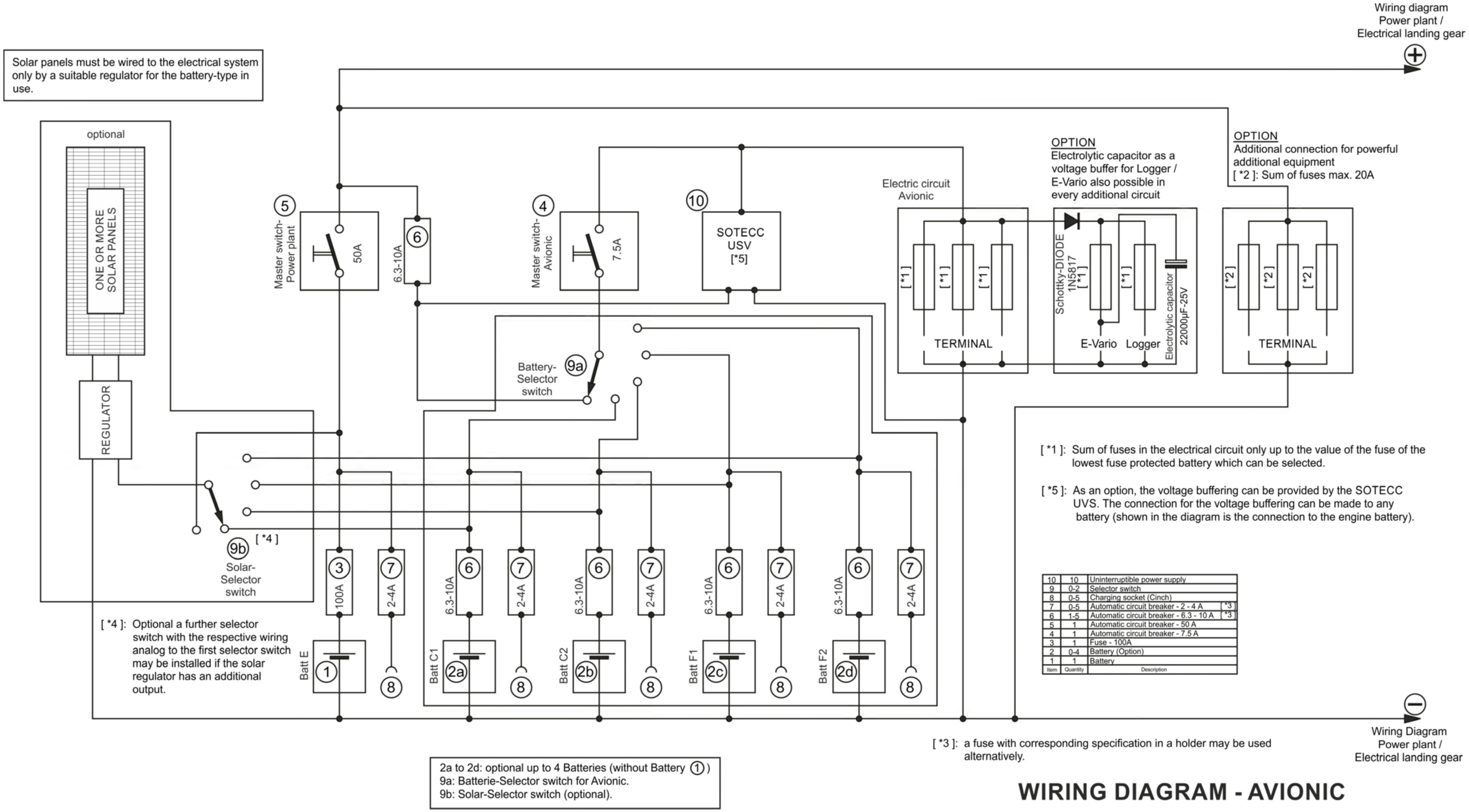




*) Alternative types of storage batteries may be used if they meet the respective demands.

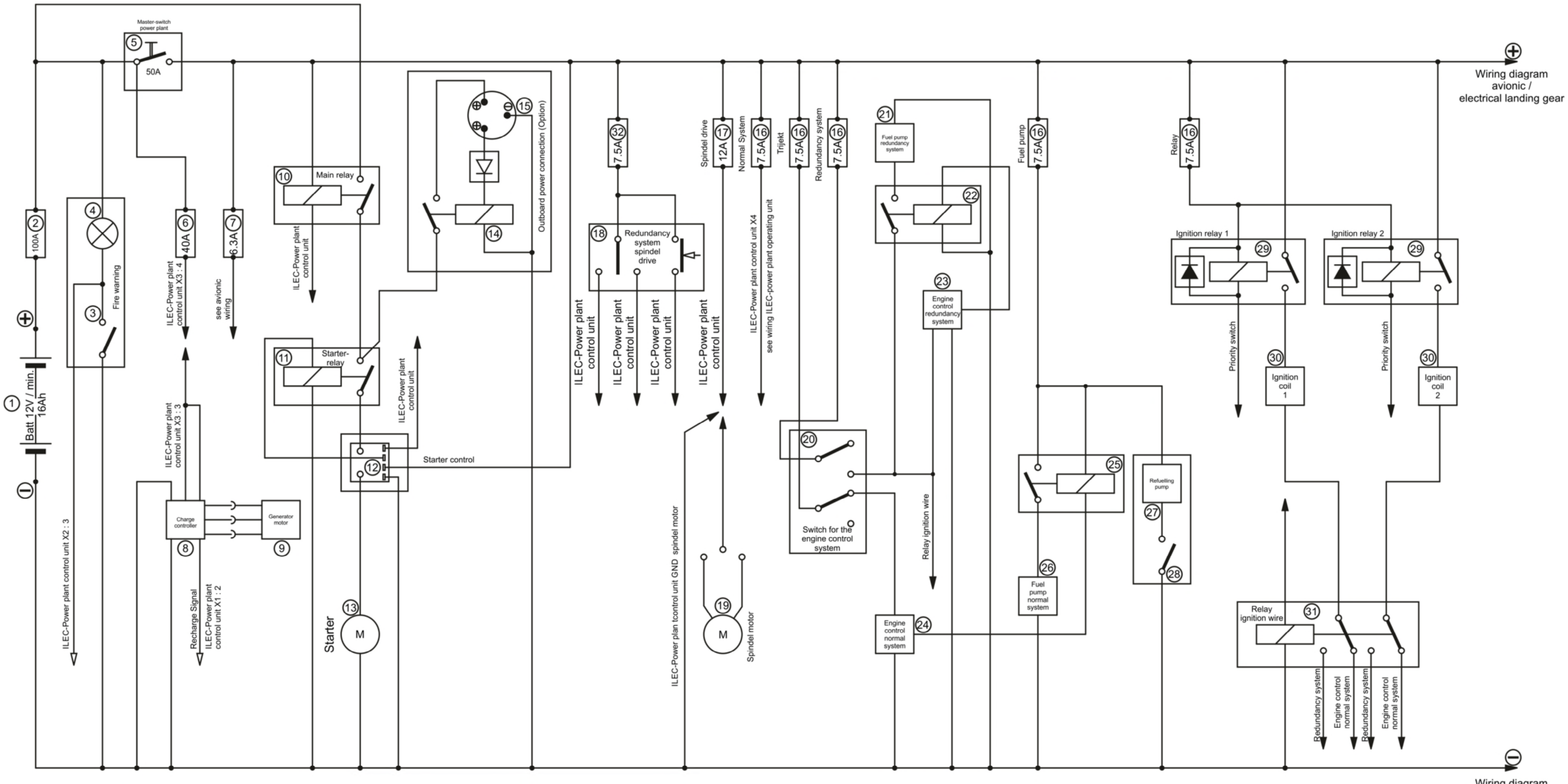
ELECTRICAL SYSTEM - POWER PLANT

- (A) 1 Battery BATT. E 12 V / min. 16 Ah*)
- (B) Crash fuse 100 A
- (C) Fuse panel
- (D) Power plant operating unit
- (E) Rectifier regulator
- (F) Starter button
- (G) Flashing light (Fire warning)
- (H) Electrical refuelling pump
- (I) Refuelling pump on/off switch
- (J1) Power plant control unit
- (J2) Starter motor control
- (J3) Propeller brake servo
- (K) Redundancy system for engine control unit
- (L) Ground connection modul block
- (M) Relay - Fuel pump emergency system
- (N) Relay - Fuel pump normal system
- (O) Relay - Ignition 2
- (P) Relay - Ignition 1
- (Q1) External power connection (Option)
- (Q2) Relay - external power connection (Option)
- (R) Change-over switch - Redundancy system
- (S) Spindle drive
- (T) Engine control unit - Normal system
- (T1) PC-Interface engine control unit
- (U1) Limit switch - Power plant extended
- (U2) Limit switch - Power plant retracted
- (V) Limit switch - fuel shut-off valve opened
- (W) Thermal switch (Fire warning)
- (X) Fuel level transmitter (inside fuel tank)
- (Y) Priority switch (Option)
- (Z1) Fuel pump - Normal system
- (Z2) Fuel pump - Redundancy system



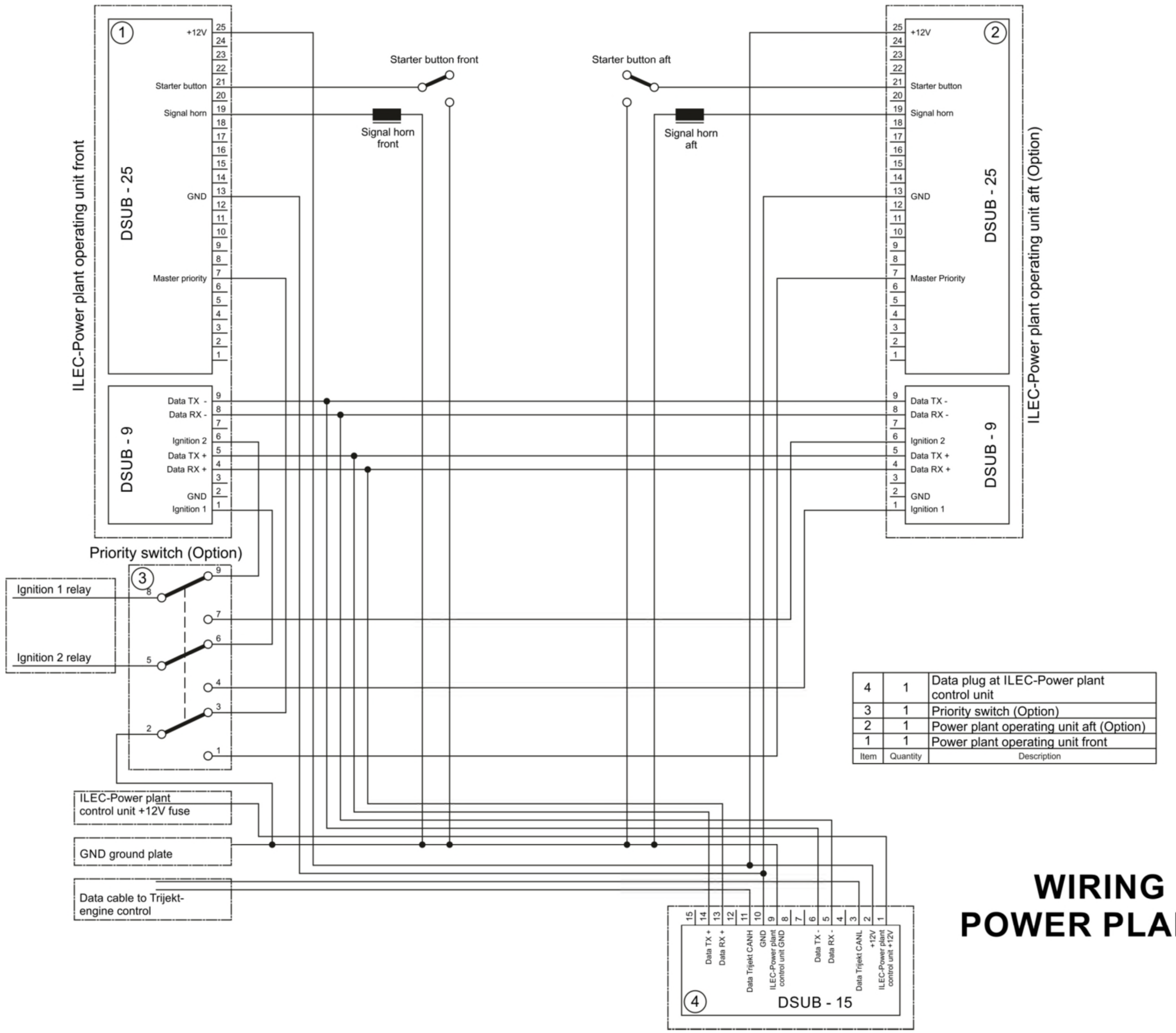
Item	Quantity	Description
10	10	Uninterruptible power supply
9	0-2	Selector switch
8	0-5	Charging socket (Cinch)
7	0-5	Automatic circuit breaker - 2 - 4 A [*3]
6	1-5	Automatic circuit breaker - 6.3 - 10 A [*3]
5	1	Automatic circuit breaker - 50 A
4	1	Automatic circuit breaker - 7.5 A
3	1	Fuse - 100A
2	0-4	Battery (Option)
1	1	Battery

WIRING DIAGRAM - AVIONIC



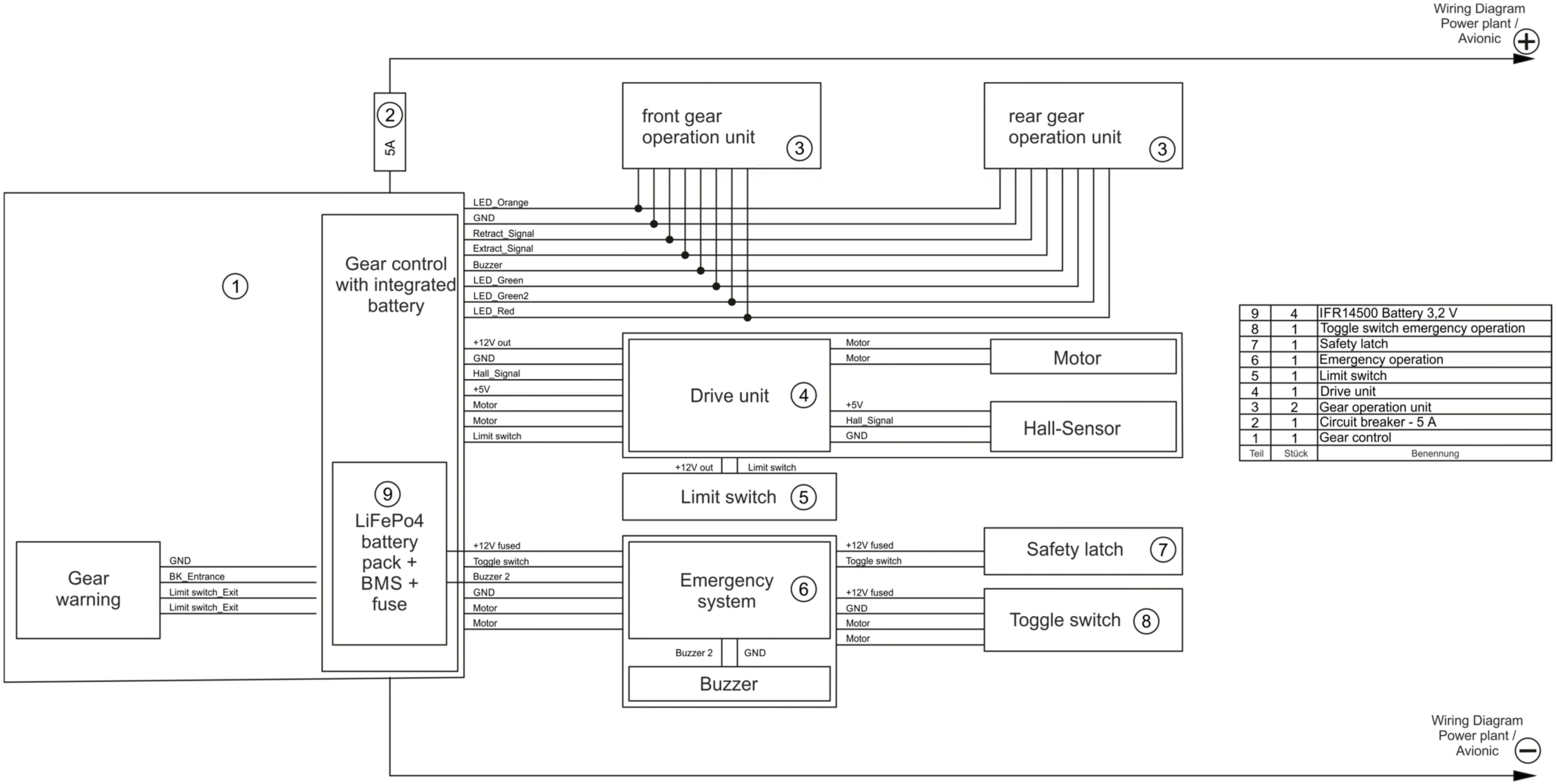
Item	Quantity	Description	Item	Quantity	Description	Item	Quantity	Description	Item	Quantity	Description
32	1	Self-resetting fuse -7.5 A	24	1	Engine control normal system	16	3	Circuit breaker - 7.5 A	8	1	Charge controller
31	1	Relay	23	1	Engine control redundancy system	15	1	Outboard power connection (Option)	7	1	Circuit breaker - 6.3 A/NA
30	2	Ignition coil	22	1	Relay	14	1	Relay	6	1	Circuit breaker - 40 A
29	1	Relay	21	1	Fuel pump	13	1	Starter	5	1	Circuit breaker - 50 A
28	1	On/Off switch for refuelling system	20	1	Switch for the engine control system	12	1	starter control	4	1	Flashing-LED-red
27	1	Refuelling pump	19	1	DC spindel motor	11	1	Starter-relay	3	1	Temperature switch
26	1	Fuel pump	18	1	Emergency switch spindel drive	10	1	Relay	2	1	Fuse - 100 A
25	1	Relay	17	1	Circuit breaker - 12 A	9	1	Generator	1	1	Starter-Battery

WIRING DIAGRAM - POWER PLANT



4	1	Data plug at ILEC-Power plant control unit
3	1	Priority switch (Option)
2	1	Power plant operating unit aft (Option)
1	1	Power plant operating unit front
Item	Quantity	Description

WIRING DIAGRAM ILEC - POWER PLANT OPERATING UNIT



9	4	IFR14500 Battery 3,2 V
8	1	Toggle switch emergency operation
7	1	Safety latch
6	1	Emergency operation
5	1	Limit switch
4	1	Drive unit
3	2	Gear operation unit
2	1	Circuit breaker - 5 A
1	1	Gear control
Teil	Stück	Benennung

WIRING DIAGRAM - ELECTRICAL LANDING GEAR

7.13 Miscellaneous equipment

Removable ballast (optional)

A mounting provision for removable ballast (trim ballast weights) is provided at the base of the front instrument panel.

A second ballast mounting provision can be found on the right side of the front stick mounting frame.

The trim ballast weights (lead plates) are to be secured in place by bolts.

For information on how to alter the minimum front seat load refer to section 6.2.

Oxygen systems

Attachment points for the mounting brackets for oxygen bottles are provided on the fuselage skin above spar joint on the left and right sides. To prevent injuries, a hood must be installed covering each valve.

For the installation of oxygen systems, drawings may be obtained from the manufacturer.

Caution:

After oxygen systems are installed, it is necessary to re-establish the empty mass c/g position of the concerned Arcus M to ensure that the centre of gravity is still within the permitted range.

A List of oxygen regulators, currently approved, is found in the Arcus M Maintenance Manual.

7.13 Miscellaneous equipment (cont.)

ELT-installation

The installation of an Emergency Locator Transmitter is possible in the following places and must comply with the instructions obtained from Schempp-Hirth:

- In the area of the rear seat on either seat pan mounting flange
- beside the top of the main wheel housing
- on the reinforced baggage compartment floor above the wing spar stubs

Section 8

8.1 Introduction

This section contains manufacturer’s recommended procedures for proper ground handling and servicing of the aircraft.
It also identifies certain inspection and maintenance requirements which must be followed if the aircraft is to retain optimal performance and dependability.

Caution:

It is wise to follow a planned schedule of lubrication and preventative maintenance based on climate and flying conditions encountered
- see section 3.2 of the Arcus M Maintenance Manual.

8.2 Periodic inspections

For details concerning the maintenance of this aircraft refer to Arcus M Maintenance Manual.

Airframe maintenance

Under normal operating conditions no airframe maintenance work is required between the annual inspection, except for the routine greasing of the spigots and ball bearings of the wing and tailplane attachment fittings.

Should the control system become heavy to operate, lubricate those places in the fuselage and in the wing panels where plain bearings are used (sliding control rods like landing gear- and airbrake linkage).

Cleaning and greasing of the wheels and the tow release mechanism(s) depends on the accumulation of dirt.

Rudder cables

After every 200 flying hours and at every annual inspection, the rudder cables have to be inspected at the point where they feed through the S-shaped guides in the pedals, especially at the points of maximum pedal adjustment.

If the rudder cables are damaged, worn or corroded, they must be replaced.
It is permissible for individual strands of the cables to be worn up to 25 %.

8.2 Periodic inspections (cont.)

Power plant maintenance

Propeller:

Maintenance work on the propeller is required after every 25 hours of engine time or at least once every year and must comply with the instructions given in the propeller manual.

Engine:

Maintenance work on the engine is required after every 25 hours of engine time or at least once every year and must comply with the instructions given in the engine manual.

For all other power plant accessories (pylon, pivoting mechanism, fuel system etc.), maintenance work is also required after every 25 hours of engine time or at least once every year.

8.3 Modifications or repairs

Modifications

Modifications on the approved model, which might affect its airworthiness, must be reported to the responsible airworthiness authorities p r i o r to their accomplishment. The authorities will then determine whether and to what extent a “supplemental type approval” is to be conducted.

In any case, the manufacturer’s opinion about the modification(s) must be obtained. This ensures that the airworthiness does not become adversely affected and enables the aircraft owner/ operator to demonstrate at any time that the aircraft complies with an approved version.

Modifications of the approved sections of the Flight- and/or Maintenance Manual must in any case be approved by the responsible airworthiness authority.

Repairs

Abbreviations:

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 sign of a change in the 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 Arcus M should always be inspected by a CFRP/GFRP expert.

There is no objection to minor damage - which does not affect the airworthiness in any way - being repaired on site.
A definition of such damage is included in the “REPAIR INSTRUCTIONS" which are found in the appendix to the Arcus M Maintenance Manual.

Major repairs may only be performed by a certified repair station having appropriate authorization.

8.4 Ground handling / road transportation

a) Towing / pushing

When towing the aircraft behind a car, a tail dolly should always be used to avoid unnecessary tailplane vibration 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.

b) Parking

The aircraft should always be parked 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 when not in use, especially in the case of high ambient temperatures.

c) Tie-down

In the case of an aircraft remaining rigged permanently, it is important that the maintenance program includes rust prevention for the fittings on fuselage, wing panels and tailplane.
Tie-down kits common in trade may be used to anchor the aircraft.
Dust covers should be regarded as essential for the aircraft.

d) Preparing for road transport

As the wing panels have a thin airfoil section, it is important that they are properly supported, i.e. leading edge down, with support at the spar stubs and at the outer portion in cradles of correct airfoil section.
The fuselage can rest on a broad cradle just forward of the landing gear doors and on its tail wheel (or skid).
The horizontal tailplane should be kept leading edge down in two cradles of correct airfoil section or placed horizontally on a padded support.
Under no circumstances should the tailplane be supported by its fittings in the trailer.
For the road transport the wing fuel tanks must always be drained completely.

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 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 (i.e. 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. Thereby hard wax is applied to the rotating disc and distributed crosswise over the surface.

  Warning:

  To avoid localized overheating, the buffing wheel should be moved constantly!

- For cleaning those fuselage and tailplane areas that are facing the wake of the propeller, the use of a water soluble degreaser (e.g. FLEET - MAGIC EXTRA by Messrs. Chemsearch) is recommended.

  Note:

  Polishes, wax and additives containing silicone should not be used because this might cause additional work in the case of repairs of the coating.

8.5 Cleaning and care (cont.)

- The canopy should be cleaned with a Plexiglas cleaner (e.g. "Mirror Glaze", "Plexiklar" or similar) 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.
  N e v e r rub the canopy when it is dry!

- The aircraft should always be protected from moisture. If moisture 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 the exception 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 stability.

Section 9

9.1 Introduction

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

9.2 List of inserted supplements

Date	Section	Title of inserted supplements