JS-MD 3 RES

Aircraft Flight Manual Supplement

JONKER SAILPLANES

M+D FLUGZEUGBAU

Aircraft Flight Manual Supplement

JS3 RES

MD11-AFM-00-002

Aircraft Serial No.: .....

Registration: .....

The technical content of this document is approved under the authority of the DOA ref. EASA.21J.603. Sections 2, 3, 4, 5.2 are approved sections.

This sailplane is to be operated in compliance with information and limitations contained herein.

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0 Document Management

0.1 Record of Revisions

Issue	Rev	Date	Reason for Change
00	00	16.05.2022	Initial Issue
01	00	13.12.2022	Grammar improvements made to entire document Added Rescue card and Propeller warning Decal Minimum RES system temperature corrected to -15˚C EXT/RETR toggle switch or command knob to be used, instead of RES guarded master switch, to immediately remove power when system is drawing high amps Warning added that no person should be within proximity of pylon/propeller when extended Added check for operation of fan at a controller temperature of 40˚C (104 ˚F) and higher (for the air-cooled controller) Caution added to always verify vertical alignment of propeller via the rear-view mirror Maximum current of DC-DC Converter added Note added regarding battery ventilation through exhaust in battery and fuselage during thermal event Winter charging changed to storage

Issue	Rev	Date	Reason for Change
			charging Charger manual removed and reference to charging instruction sheet added
02	00	24.03.2023	Added SOC check to Pre-flight Test run Added flap position to Self-launch procedure Added power automatically reduces when controller temperature exceeds 75˚C. Open Direct-Vision (DV) window added to Self-launch procedure Aerotow Assisted Self-launch limitation and procedure added
03	00	06.03.2025	RES reservoir upgrade description and pre-flight check Added V_{POmax} Added voltage and altitude limitations Editorial changes Imperial conversions Added an instruction during the propeller alignment test when the motor bay doors do not open Added caution during the propulsion system ground test Added post-flight procedures and inspections Information on the operation screens during different battery

Issue	Rev	Date	Reason for Change
			configurations added Landing in water and Li-ion fire emergency procedures added Added a note on the storage of the selected charging power setting Caution on the similarity between charge power settings for both batteries Self-launch procedure revised A note on the power bar graph colours has been added A warning on the difference between battery voltages of 2V added Caution on the charging plug pins added Battery care inspection point added
03	01	16.07.2025	Correction of wording about approval of content
04	00	18.09.2025	Corrected issue number, revision number and formatting. System technical data corrected. Note added clarifying that MP and MCP refer to HV battery power as shown on the DCU. Removal of expansion cylinder. Rerouting of liquid cooling system tubing. Note added that DCU shows battery output. Updated note: single-battery warning threshold now defined as 50% of

Issue	Rev	Date	Reason for Change
			delivered power. Added egine power and per-battery continuous power limits to powerplant limitations table. Updated MP time limit for 2-battery configuration and removed MP time limit for 1 battery configuration in powerplant limitations table. Added note explaining 35 kW engine power corresponds to ~40 kW on DCU; system auto-regulates output. Removal of 15m SL. RES limitations placard updated. Added coolant level check to pre-flight inspection for liquid cooling option. Added info on RES MC circuit breaker for emergency motor controller shutdown. EXT/RETR toggle switch paragraph rewritten for ease of reading. Added note: 35 kW max power reached at ~40 kW battery output. Motor operation emergency procedures revised (use of MC circuit breaker). Adjusted take-off performance at maximum weight table. Adjusted sustained performance (single battery) table. Corrected MCP for sustainer. Updated optimum flight profile for single battery operation graph.

Issue	Rev	Date	Reason for Change
			Adjusted cruise flight performance table. Corrected usable energy per battery. Added CB in system overview figure. Added latest list of Warning/Errors/Cautions, Battery access mode added,
05	00	25.03.2026	Revision based on LBA feedback

0.2 List of Effective Sections

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1	00	25.03.2026	4	Issue 05
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0.3 Record of Amendments

Date of Issue/ Revision	Date of Insertion	Signature

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0.6 List of Abbreviations

AMM	Aircraft Maintenance Manual
CAN	Controller Area Network (communications bus)
DCU	Display and Control Unit
DC-DC	Direct current to direct current (power conversion)
EASA	European Aviation Safety Agency
HOA	Head of Airworthiness
HV	High Voltage (typically 400V in this configuration)
IAS	Indicated Airspeed
IMD	Insulation Monitoring Device
HP	Horsepower
ISA	International Standard Atmosphere
kW	Kilowatt
LiPo	Lithium Polymer
Li-ion	Lithium-ion
LED	Light-Emitting Diode
MCP	Maximum Continuous Power
MP	Maximum Power
MCP_B	MCP delivered by HV batteries
MP_B	MP delivered by HV batteries
MTOW	Maximum Take-Off Weight
MAUW	Maximum All-Up-Weight (=MTOW)
OAT	Outside Air Temperature
OEM	Original Equipment Manufacturer
PRS	Power Rail Supply

RES	Rear Electric System
RFU	Retraction & Fuse Unit
RPM	Revolutions per Minute
SB	Service Bulletin
SOC	State of Charge
STC	Supplemental Type Certificate
TAS	True Airspeed
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

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1 General

1.1 Introduction

This manual has been prepared to provide pilots, instructors, and maintenance personnel with necessary information for the safe and efficient operation of JS-MD 3 sailplanes equipped with the RES (Retractable Electric System).

The marketing name for model JS-MD 3 RES is the JS-3 RES and is referred to in this manual as the JS-3 RES.

This aircraft is a powered glider. The propulsion system is intended to support soaring operations but must not be relied upon as the primary means of sustained flight. Engine availability cannot be guaranteed at all times. The pilot must maintain safe gliding options and always plan flight paths such that a suitable landing area is reachable without engine power.

1.2 Certification Basis

Refer to the JS-MD 3 RES Aircraft Flight Manual Section 1.2.

1.3 Warnings, Cautions, and Notes

The following definitions apply to Warnings, Cautions, and Notes used in this Flight Manual Supplement.

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

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

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

1.4 Descriptive Data

The JS-3 with the RES is a sustainer and self-launch version of the pure sailplane. A RES is fitted in the rear fuselage. The system is completely retractable and does not impact the normal operation of the aircraft during conventional soaring flights.

1.5 Technical Data

System Technical Data	
Propulsion System	SOLO 8000/400
Propeller Type	Technoflug KS-1C-120-R-065-S
Max Propeller Speed	4350 RPM
Max Power for Take-Off (2 batteries)	35kW (~40kW from HV batteries)
Max Continuous Power (2 batteries)	21 kW (~25kW from HV batteries)
Max Power (1 battery)	11.5 kW (~12.5kW from HV batteries)
Max Continuous Power (1 battery)	11.5 kW (~12.5kW from HV batteries)
System Weight (without batteries)	~24 kg (53 lbs)

Table 1 System Technical Data

NOTE: All references to maximum power (MP) and maximum continuous power (MCP) in this manual refer to the electrical power supplied by the HV batteries, as indicated on the power indication bar on the DCU.

1.6 RES Illustration

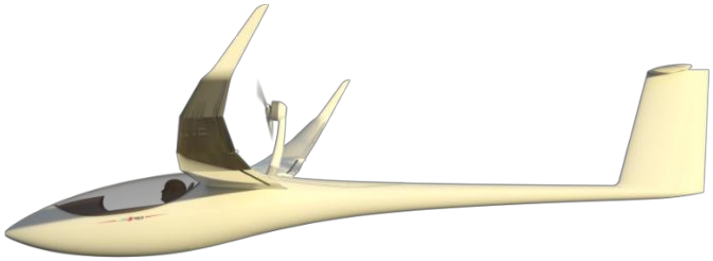

Figure 1 JS-MD 3 with RES pylon extended

1.7 RES controller cooling systems

The RES system has two controller cooling system options as follows:

- Air-cooled (Option 1) - installed behind seatback
- Liquid cooled (Option 2) - installed in the engine bay

The RES has two possible controller cooling systems as shown in the figure below:

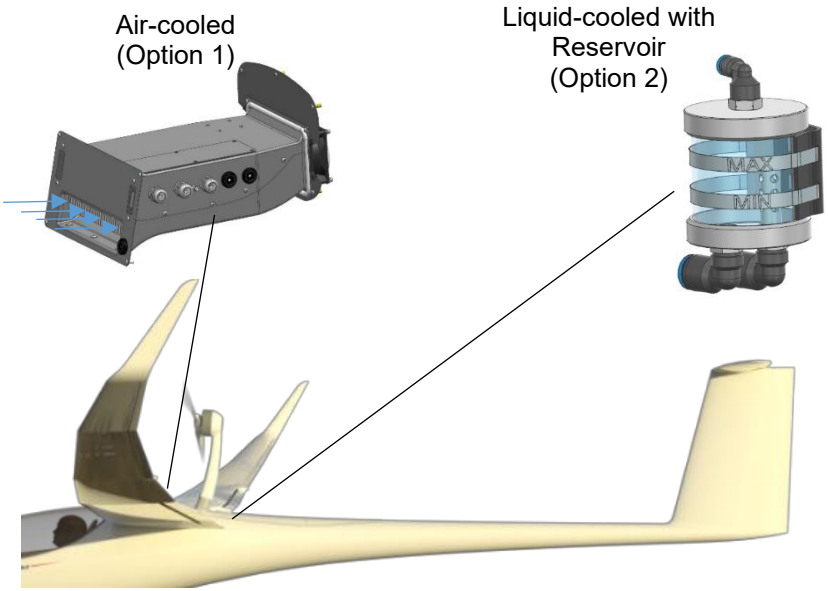

Figure 2 JS-MD 3 RES controller cooling systems

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2 Limitations

Section 2 includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the aircraft equipped with a RES.

The limitations included in this section are approved by the EASA.

2.1 Airspeed Limits

Table 2 gives the speed limitations and their operational significance.

Speed		IAS	Remarks
V_{max}	Maximum speed to operate the RES	150 km/h (80.9 kts)	Do not exceed this speed with the motor running
V_{PE}	Powerplant extended maximum permitted speed	150 km/h (80.9 kts)	Do not exceed this speed with the pylon extended.
V_{PO}	Maximum speed to extend/retract the RES system	150 km/h (80.9 kts)	Do not exceed this speed during the pylon extension/retraction.

Table 2 Airspeed Limits

2.2 Airspeed Indicator Markings

The airspeed indicator requires the following additional markings when fitted with the RES:

Marking		IAS	Significance
Blue line	—	110 km/h (59.3 kts)	Best rate-of-climb speed V_Y (if RES is fitted)

Table 3 Airspeed Indicator Markings

2.3 Powerplant Instrument Markings

The RES powerplant has a dedicated DCU (Display and Control Unit) mounted in the instrument panel.

Horizontal graphics bars with overlaid numerical values display critical operation information to the pilot.

RPM

Power supplied by batteries

Battery State of Charge (SOC)

Battery temperature

Motor temperature

Controller temperature

NOTE: The power indication bar (e.g., 33.4 kW in the example above) displays the power delivered by the batteries to the motor controller. The actual power delivered to the propeller is approximately 15% lower, accounting for system losses such as inverter and motor efficiency.

Operating limits are displayed in green when in the normal operating range, in yellow when in the caution range, and in red indicating the maximum limit has been exceeded:

	Green	Yellow	Red
RPM	0-4000	4000 - 4350	4350
Power from batteries	0 - 25 kW (0 - 33.5 hp)	25 - 40 kW (33.5 - 53.6 hp)	40 kW (53.6 hp)
Motor temperatures	-15 – 105 °C (5 – 221 °F)	105 – 120 °C (221 – 248 °F)	120 °C (248°F)
Controller temperatures	-15 – 75 °C (5 – 167 °F)	75 – 85 °C (167 – 185 °F)	85 °C (185 °F)
HV battery temperatures	0 – 60 °C (32 – 140 °F)	60 – 70 °C (140 – 158 °F)	70 °C (158 °F)

Table 4 Display of Limitations for Dual Battery Operation

NOTE: For single-battery operation, the warning threshold automatically changes to 50% of the delivered power. Motor / Controller & HV battery limitations are unchanged.

Refer to Section 4.3 for a detailed description of the powerplant instrument markings.

2.4 Powerplant Limitations

Parameter	Limitation
Maximum engine power delivered from the SOLO 8000/400 system	35 kW
Maximum continuous power supplied per HV battery (as displayed on DCU)	12.5 kW
Maximum propeller speed	4350 RPM
Maximum propeller speed (Rain conditions)	3800 RPM
Maximum motor temperature	120 °C (248 °F)
Maximum controller temperature	85 °C (185°F)
Maximum HV battery temperature	70 °C (158 °F)
Maximum operating altitude (AMSL)	Same as airframe
Minimum HV battery temperature for take-off	0 °C (32 °F)
Maximum HV battery temperature for take-off	38 °C (100°F)
Maximum time for MP	90s (2 battery configuration)

Table 5 Powerplant Limitations

NOTE: The maximum rated engine power of 35 kW is achieved when the DCU power indication bar reads approximately 40 kW. The system automatically regulates power output to ensure that operational limits are not exceeded.

CAUTION: When applying power, the battery temperature will continuously increase until the maximum allowable temperature is reached.

CAUTION: Operation of the RES system is prohibited if component temperatures are less than -15°C (5°F) as per Section 2.

2.5 Approved Manoeuvres

This aircraft is certified in the Utility category (U). Aerobatic manoeuvres with RES system installed are not permitted.

2.5.1 Approved Flight Rules

Operation of the JS-3 RES in sustained flight is approved for VFR flight by day in VMC conditions only.

2.5.2 Motor Start, Run-Up, Taxi Procedures

Taxiing is permitted with the RES, but no provision is made in the JS-3 RES aerostructure for a steerable tailwheel. Motor operation may also be performed on the ground for maintenance purposes.

2.5.3 Self-Launch

Dual battery self-launch with the RES is permitted with the following limitations:

Parameter	Limitation
Maximum take-off weight (MTOW)	18 m: 575 kg (1267.7 lbs)
Minimum HV Battery State of Charge (SOC) for take-off	60%
Minimum pre-take off HV Battery temperature	0 °C (32 °F)
Maximum pre-take off HV Battery temperature	38 °C (100 °F)
12V battery supply minimum voltage	12.8 V
Both HV Batteries within difference	+/- 2 V

Table 6 Dual Battery Self-launch Limitations

NOTE: Self-launch with one HV battery is not allowed. MTOW in 18m with one HV battery differs from the dual battery value listed in the table above.

2.5.4 Approach and Landing

Approaches and landing with the RES running are approved.

NOTE: Operation of the RES over unlandable terrain outside gliding range of a suitable landing site is not approved.

NOTE: Cloud flying with the pylon extended is not approved.

CAUTION: Operating the RES in heavy rain is not recommended, as it may cause damage to the propeller blades.

2.6 Minimum Equipment List

Additional instrumentation and equipment required if RES is fitted:

- Display and Control Unit (DCU)
- RES master switch guard
- Supplemental (independent) fire warning system
- Limitations and operations placards or booklet
- Magnetic direction indicator (Required only where mandated by the National Aviation Authority [NAA])

Optional but recommended:

- Rear view mirror

2.7 Aerotow Assisted Self Launch

Maximum approved towing speeds and maximum weak link ratings for assisted aerotow launching are listed in Table 7 and Table 8.

Configuration	Minimum safe launch speed		Recommended launch speed	
	15m	18m	15m	18m
Empty	115 km/h / 62.0 kts		130 km/h / 70.2 kts	
MTOW	125 km/h / 67.5 kts		140 km/h / 75.6 kts	

Table 7 Assisted aerotow limitations

NOTE: The maximum power allowed during an assisted take-off is 20 kW (27 hp).

NOTE: Only textile or equivalent ropes may be used for assisted aerotow launching.

Launch method	Maximum speed	Maximum weak link rating
Assisted Aerotow	150 km/h / 80.9 kts	600 daN (E.g. Tost weak link #4, Blue)

Table 8 Assisted aerotow limitations

2.8 Temperature restrictions when flying with the RES

System operation is certified for an air temperature range of -15 °C to +38 °C (5 °F to 100 °F). The minimum and maximum component temperatures are outlined in Section 2.3.

2.9 Altitude limitations

The aircraft has the same altitude limitations as the airframe whilst operating the RES with a maximum altitude of 7000 m (21000 ft). Refer to Section 7.1 for propeller RPM warning and the JS3 RES V_{NE} chart cockpit placard.
The maximum ceiling of the glider is weight dependent. At 600kg, the maximum altitude which can be sustained is 2250m (7400 ft), while at 525, the maximum altitude is 2850m (9350 ft).

2.10 Limitations and RES Operation Placards or Decals

Limitation placards can be fixed decals either on the cockpit side walls, the canopy frame, or the instrument panel face. Placards may alternatively be furnished as a single Placard Booklet located in a cockpit sidewall storage pocket within reach of the pilot.

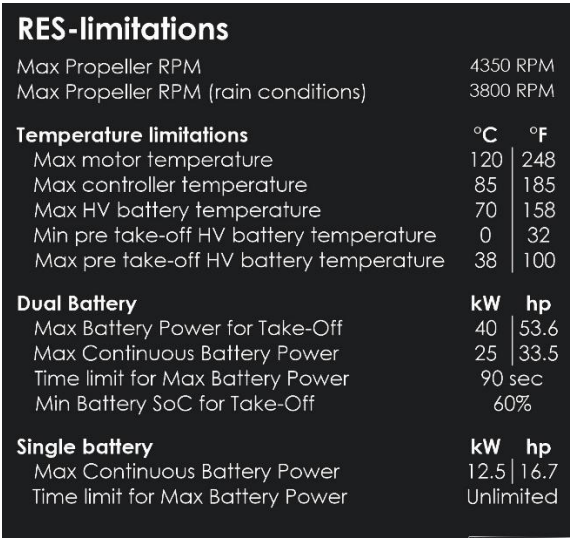

Figure 3 RES limitations placard

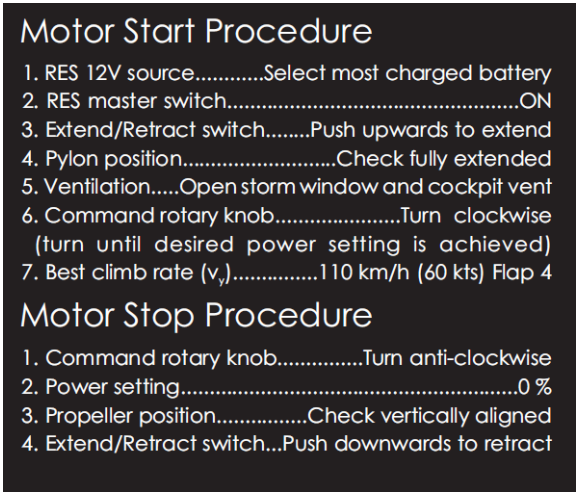

Figure 4 Motor start and stop procedure placard

An emergency high voltage danger decal (see Figure 5) is applied to the fuselage exterior surface just forward of the motor and battery bay to warn ground personnel and rescue teams that a high voltage system is present and to point rescue teams to a Rescue Card (see Figure 7) located in the cockpit or accessible by scanning the QR code on the decal.

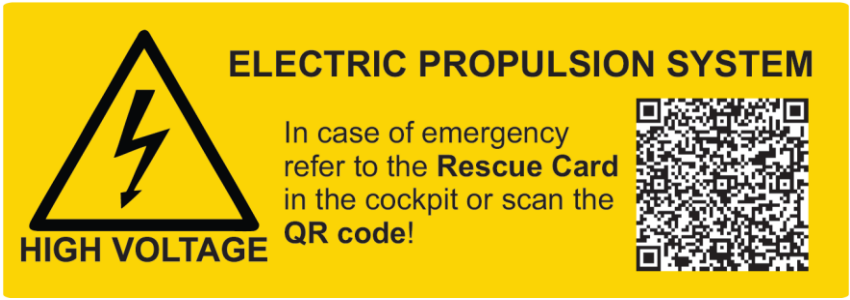

Figure 5 High voltage warning placard

A propeller warning decal (see Figure 6) located on either side of the pylon warns persons to stay clear of the pylon when extended.

Figure 6 Propeller warning placard

Figure 7 Rescue Card

3 Inspections

3.1 Pre-Flight Inspection

Before the first flight of the day, the RES must be inspected to ensure reliable operation. Extend the pylon using maintenance (service) mode (see Section 6.6) and check the following:

12 V Supply batteries	-	Sufficiently charged
Propeller attachment bolts	-	Secured and safety wire intact
Propeller structure	-	No cracks, delamination, or signs of impact damage
Pylon structure	-	No cracks, delamination, or signs of impact damage
Motor bay and tailboom	-	Clean, drain holes clear, no obstructions, no water (liquid or frozen)
Retraction mechanism	-	All fasteners secured
Door hinges and fit	-	All connected, intact, and no door binding
Exhaust nozzles and elbows	-	Clear on HV batteries and in fuselage
HV Batteries	-	In position, secured and charged
	-	Ensure both batteries have similar SOC
Termination plug	-	Secured in battery charge socket (if fitted)
Terminal connector – single-battery operation	-	Secured in removed battery's connection plug

Air-cooled option	-	No blockage or obstructions at controller intake
Liquid-cooled option	-	No leaks observed near radiator, pump, and along supply/return tubes Ensure coolant level is between min and max marks (Figure 2).
Fire warning	-	Circuit tested (LED illuminates and buzzer activates)

After completion of the pre-flight inspection retract the pylon, exit the maintenance (service) mode, and move the guarded RES master switch to the OFF position.

NOTE: If the RES is not serviceable, the aircraft is still deemed airworthy for normal gliding operation. In this case, the HV batteries should be removed and the CG adjusted.

CAUTION: Displayed HV battery SOC percentages are combined average values of all cells in each HV battery pack – the SOC values of individual cells may therefore differ from the displayed averages (especially after extended periods of battery inactivity). Whenever there is a possibility of in-flight HV battery power usage to below 25% average SOC, it is recommended that the charger be reconnected prior to flight in order to ensure the cells are rebalanced, as the RES system protection limit for battery depletion is based on the voltage value of the lowest cell (not on the HV battery average SOC).

CAUTION: Weight and balance are affected by HV battery configuration changes – ensure aircraft is within CG limits before take-off.

CAUTION: The propeller is free to rotate during maintenance (service) mode. Ensure that the propeller does not touch the bay doors during pylon retraction, as propeller tip and/or door damage may occur.

3.2 Propeller Alignment Test

1. Switch the guarded RES master switch ON
2. Activate the HV power by pushing the EXT/RETR toggle switch upwards once. The message “Power Bus PreCharge” should appear on the DCU. Once the pre-charge process is completed the pylon is automatically extended.
3. Check propeller positioning is operational – carefully push the lower tip of the propeller out of position using a wood mixing stick, tongue depressor, plastic ruler, etc and visually check that its position returns to 0 degrees upon release.
4. Verify the presence of the two yellow arrows at each side of the propeller graphic on the DCU display screen.
5. Push the EXT/RETR toggle switch downwards once to retract the pylon.
6. As the pylon begins to retract observe the motor bay doors opening. If the doors do not unseat and begin to open as soon as the pylon starts to retract, immediately push the EXT/RETR toggle switch upwards to stop the pylon motion before it comes into contact with the closed doors.
7. If door opening proceeds normally, observe that the propeller stays aligned during pylon retraction and that the doors close properly. A pronounced clap is normal when the doors close.
8. Switch the guarded RES master switch OFF.

CAUTION: Do not press or rotate the DCU command knob during the function test and do not allow any bystanders near the cockpit while checking the propeller alignment function.

3.3 Pre-flight test run

After recharging and installing the batteries a brief motor test run is highly recommended.

Perform the ground run with the aircraft fully assembled, main wheel chocked, and while seated in the cockpit with the canopy closed.

1. Select the alternate 12 V power supply source.
2. Switch the guarded RES master switch ON.
3. Ensure no persons or obstructions are within the proximity of the pylon or propeller.
4. Extend the pylon by pushing the EXT/RETR switch upwards once (the pre-charge process will occur first and then the pylon will extend).
5. Apply the wheel brake, hold the joystick aft, and announce PROP CLEAR.
6. Advance the propeller slowly by gradually rotating the command knob clockwise once it is safe to do so. Mid-range RPM is typically sufficient for the test.
7. Verify numeric and graphic screen values are displayed as expected.
8. Verify proper motor RPM control by advancing and returning the rotary knob.
9. Check for any unusual noises or vibrations.
10. Check that both batteries are linked to the HV bus by ensuring that their voltage levels have a maximum difference of 2 V.
11. Verify propeller aligns vertically (via the screen graphics and the rear-view mirror) after reducing power to 0%.
12. If the propeller does not align vertically, momentarily apply power, and check propeller again to verify vertical alignment.
13. Apply sufficient power during the stationary ground run to verify controller cooling system functions correctly, including cooling fans (air-

cooled) and pumps (liquid cooled) are activated at a controller temperature of 40˚C (104 ˚F) or higher.

14. Perform extension and retraction of the pylon using MANUAL mode.

NOTE: MANUAL mode is entered from AUTO mode by simply pressing the EXT/RETR toggle switch in the opposite direction of travel.

If the pylon is extending in AUTO mode, press the EXT/RETR toggle switch downwards once – pylon movement will immediately pause and the DCU will automatically change to MANUAL mode.

If the pylon is retracting in AUTO mode, press the EXT/RETR toggle switch upwards once – the pylon movement will immediately pause and the DCU will automatically change to MANUAL mode.

CAUTION: Always disarm the propulsion system by turning off the guarded RES master switch prior to any bystanders approaching. Circuit breakers of the 12 V supply batteries may also be pulled if leaving the aircraft unattended.

CAUTION: Applying full power on the ground may produce enough pitch-down moment from the pylon to push the aircraft's nose to the ground.

CAUTION: Ensure canopy is closed and no loose items (canopy cover, pilot hat, towels, etc) are in proximity to the propeller during propulsion system ground tests.

CAUTION: Ensure the propeller blast will not impinge or blow dust towards other aircraft, equipment, persons, or structures.

WARNING: Perform ground runs only with a fully assembled aircraft positioned well clear of obstacles. **Never** conduct a ground run with the fuselage (assembled or disassembled) resting in the trailer cradle or on extension rails.

WARNING: No person should be in the proximity of the pylon or propeller when extended, as power to the system can result in immediate rotation of the propeller.

3.4 Post-flight procedures and inspections

The following procedures and inspections apply to the RES system only and are **in addition to** standard post-flight tasks such as shutting down avionics and removing 12V avionics batteries.

After landing and during either aircraft disassembly (for trailer storage) or aircraft parking/tiedown (for hangar or outdoor storage), one of the following should be performed.

If batteries are to be removed from the aircraft:

1. Enter Maintenance (Service) Mode via the DCU. Raise the pylon as far as possible without allowing the motor bay doors to close. Verify that the HV red LEDs are OFF. Unlatch the battery retainers, remove the batteries, and store them in a safe location.
2. Before lowering the pylon, return the battery retainer latch(es) to the forward (latched) position to prevent interference with the pylon structure.

CAUTION: After HV battery removal, ensure the battery retainer latches are secured in their forward (latched) positions **before** lowering the pylon. Failure to do so may result in contact between the large-diameter section of the pylon and the unsecured latches during retraction.

If HV batteries are to be left installed in the aircraft, always verify the HV batteries are disabled prior to leaving the aircraft:

1. Retract the pylon and switch the guarded RES master switch OFF.
2. Verify that the HV red LEDs are OFF by visually inspecting through the spring-loaded doors or raising the pylon in Maintenance mode for inspection.
3. Fully retract the pylon and switch the guarded RES master switch OFF.

CAUTION: Storing batteries in humid conditions is strongly discouraged due to the risk of internal moisture condensation. If the aircraft is stored outdoors, seal the motor bay doors with tape to minimize moisture ingress from rain or dew.

WARNING: Never leave HV batteries enabled (red LED illuminated) in the aircraft for extended periods, as gradual discharge can lead to cell damage. If the HV relay remains engaged after the guarded RES master switch is turned OFF, contact the aircraft manufacturer or regional technical support immediately

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4 Control and Display

The RES is operated by the following:

- Guarded RES master switch
- 12V battery selector switch
- Display and Control Unit (DCU)

4.1 Guarded RES Master Switch

The guarded RES master switch is a toggle switch fitted with a spring-loaded guard located on the instrument panel. The switch controls the 12 V power supply to the RES. An adjacent battery selector toggle switch enables the pilot to select the 12 V supply from either of the removable 12 V batteries.

Figure 8 Guarded RES master switch, battery selector switch and RES MC circuit breaker

A 4A circuit breaker labelled “RES MC” is located adjacent to the RES master switch. In an emergency, pulling this circuit breaker will cut power to the motor controller, resulting in immediate loss of propulsion power and disabling the propeller alignment function.

NOTE: The HV batteries cannot be enabled without the external 12 V power supply to the system. When the HV power rail has been activated, the selected 12 V battery can be charged with the built-in DC-DC converter.

CAUTION: The onboard DC-DC converter must **not** be relied upon to ensure sufficient charge of the 12V supply battery(ies). Always verify that the 12V battery selected for RES operation is adequately charged. Insufficient 12V power during self-launch or sustainer operation will render the DCU inoperative, leaving the RES propulsion system without control authority (e.g., windmilling propeller)

When the guarded RES master switch is switched ON, the built-in test procedure is initiated and the system will enter standby mode with the HV batteries not activated (until the EXT/RETR toggle switch is pushed downwards once whilst in standby mode to activate the HV batteries).

When the guarded RES master switch is set to OFF, power to all RES systems (including temperature monitoring) is disconnected. The supplemental fire warning system (see Section 8.4) operates independently and remains active.

4.2 DCU primary controls

The Display and Control Unit (DCU) has two primary controls:

- Command knob which can be rotated and pushed
- XT/RETR toggle switch to extend or retract the pylon

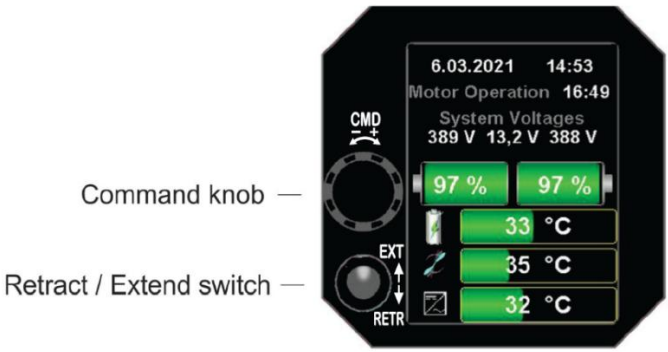


Figure 9 DCU Primary Controls

The Command knob is used to:

- Operate the DCU
  - Rotate – move the selected window or change values
  - Push – select or enter a value
- Control/change the desired power in the propulsion mode

The EXT/RETR toggle switch is used to:

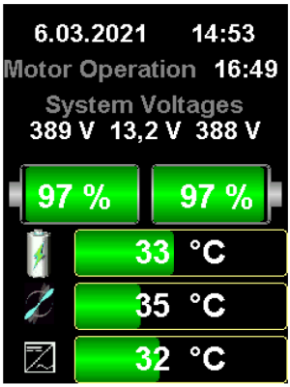
- Raise and lower the pylon
- Activate the DC-DC converter when in Standby mode to charge selected 12 V battery

NOTE: The rotary command knob does not have a physical hard stop and there is no risk of it being rotated too far.

4.3 Normal Operation Screens

4.3.1 Standby Mode

Standby mode is entered when the system is powered up (RES master switch turned ON) and the built-in-test procedure has been completed successfully.



- Date and time (dd.mm.yyyy)
- Motor total time (hh:mm)
- Battery voltages (HV-L / 12 V / HV-R)
- Average State of Charge (SOC) of left and right HV batteries
- Maximum cell temperature in HV battery
- Motor temperature
- Controller temperature

When pushing the EXT/RETR toggle switch upwards once whilst in standby mode, the following actions are triggered:

1. The motor controller is switched ON and pre-charged
2. HV batteries are switched ON (enabled) and connected to the power rail
3. The propeller alignment function of the motor controller becomes active (the motor will emit an electrical humming sound)
4. The electromechanical actuator (spindle drive) extends the pylon (the system will therefore transition out of standby mode into extended mode as discussed below)

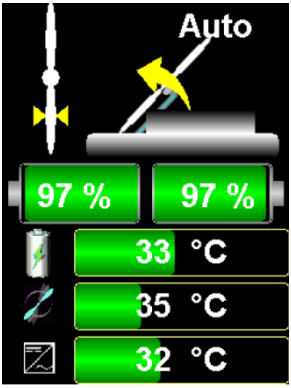
NOTE: The capacitors inside the inverter must be charged before the batteries are connected to the power rail. The message “Power Bus PreCharge” is displayed. This action takes a few seconds to complete.

When pushing the EXT/RETR toggle switch downwards once whilst in standby mode, the following actions are triggered:

1. The motor controller is switched ON and pre-charged
2. HV batteries are switched ON (enabled) and connected to the power rail
3. The DC-DC converter is activated and the selected 12 V battery is charged at a higher rate and the second 12 V battery is charged at a reduced rate. See section 4.3.5.

4.3.2 Extension / Retraction Modes

Extension/retraction modes are entered from the standby or extended modes when the EXT/RETR toggle switch is pushed upwards/downwards.



- “AUTO” indicates that the pylon operation is done in automatic mode
- The yellow triangles indicate that the propeller is stopped and in an aligned position
- The yellow blinking arrow indicates the movement of the pylon
- A yellow triangle in the upper right corner of the display indicates manual mode operation.

The EXT/RETR toggle switch is used to operate the pylon actuator as follows:

- A single upward push initiates the AUTO extension mode when the system is retracted.
- In the event of a take-off abort, the procedure described in Section 5.1.5 must be followed.
- Manual pylon operation can be engaged by a single push in the opposite direction, either upward or downward, while the system is in AUTO mode.

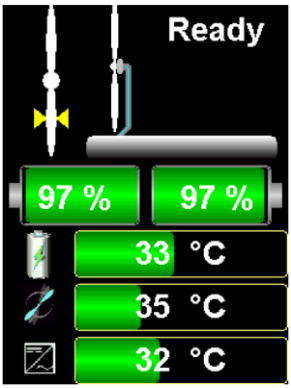
CAUTION: When the pylon is operated in manual mode, the system will allow retraction/extension regardless of the orientation of the propeller or the temperatures of components.

NOTE: Operating the pylon in Manual Mode may cause positioning counter errors to accumulate, triggering a "Retraction Mechanism Not Calibrated" message. Perform the pylon calibration procedure to clear the caution.

4.3.3 Extended Mode

4.3.3.1 Extended Mode (both HV batteries connected to the HV bus)

When the pylon is fully extended and the HV battery voltage levels are within 2 V of each other, both batteries will be connected to the HV bus and the propulsion system is approved for self-launch operation.



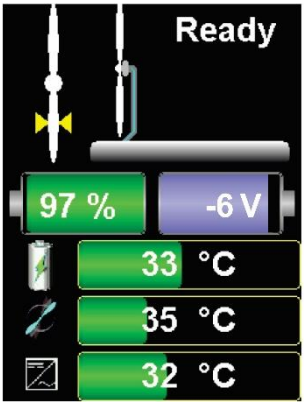
- "Ready" indicates that the propulsion system is ready for operation
- The yellow triangles indicate that the propeller alignment is active and the propeller is kept aligned

Propulsion mode is entered when the rotary command knob is rotated clockwise.

Retraction mode is activated when the EXT/RETR toggle switch is pushed downwards.

4.3.3.2 Extended Mode (one HV battery connected)

When the HV battery voltage levels are not within 2 V of each other, only the battery with the highest voltage will be connected to the HV bus.



- "Ready" indicates that the propulsion system is ready for operation
- The left-hand battery (showing 97% calculated average SoC) is connected to the HV bus.
- The right-hand battery (showing a voltage of 6 V lower than the left-hand battery) is not connected to the HV bus.

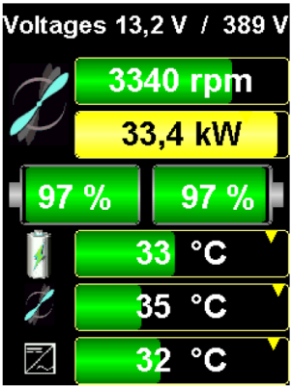
WARNING: If one HV battery is installed, self-launch operation is not approved. Propulsion system is ready to be used for sustainer operation.

Battery equalization can be performed by either charging the lower voltage battery or by temporarily running the motor at a low power setting to reduce (draw-down) the connected battery's SOC.

Once the voltage difference between the connected and non-connected batteries is within 2 V, both batteries will connect to the HV bus, allowing for a normal take-off.

4.3.4 Propulsion

When rotating the command knob clockwise propulsion power is increased.



- Battery voltages (12 V / HV)
- RPM
- Power delivered by batteries
- Average State of Charge of HV batteries
- Maximum cell temperature in HV battery
- Motor temperature
- Controller temperature

The desired power can be adjusted in the propulsion mode as follows:

- Clockwise rotation – increase power
- Anti-clockwise rotation – decrease power

When the power is set to 0 kW, the Extended Mode is entered and the propeller automatically aligns vertically.

The pylon retraction mode is activated when the EXT/RETR toggle switch is pushed downwards.

NOTE: The rotary knob is incremental based on its initial position when the RES is powered ON. It does not have an absolute position for 0 kW and Maximum Power.

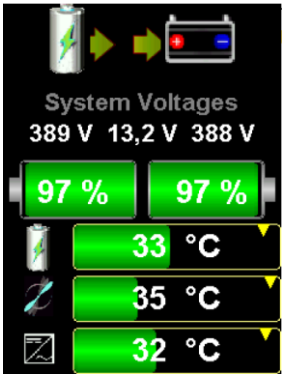
NOTE: The maximum rated power of the SOLO 8000/400 system is 35 kW, which is achieved when the battery output indicates a power delivery of approximately 40 kW.

CAUTION: Always verify the vertical alignment of the propeller via the rear-view mirror, in addition to the triangular yellow graphics on the DCU screen.

4.3.5 12V Battery On-Board Charging

The HV batteries can be used for on-board charging of the 12 V control supply batteries via the built-in DC-DC converter.

The following screen image illustrates that 12 V charging is in progress.



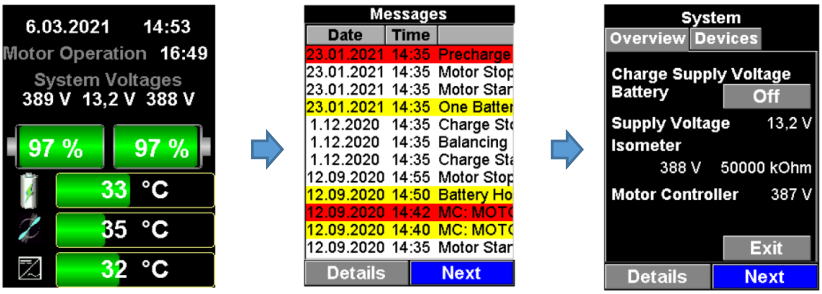
- 12V battery charging is initiated by pressing the EXT/RETR toggle switch downward while in Standby mode.
- Screen changes are performed by turning the rotary command knob at any time.

NOTE: The on-board DC-DC converter provides a maximum current of 15 A. Excess electrical power is used to charge the 12 V supply batteries.

NOTE: The selected 12V supply battery charges at up to 4.5 A, while the non-selected battery charges at up to 2 A. Aircraft with serial numbers prior to 3.MD122 may be equipped with a lower-capacity DC-DC converter, in which case the maximum charge rate is limited to 2 A for both batteries.

4.4 Other Information Screens

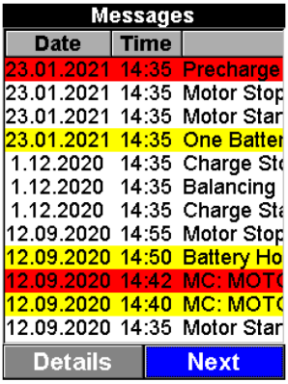
When pressing the command knob during boot-up or operation mode, the display cycles through the screens as follows:



Standby screen | Messages screen | System screen

4.4.1 Messages Screen

Errors/warnings, cautions and information messages are stored by the DCU and can be viewed by the pilot in the message screen. (See section 4.5 for colour codes)



To see the details of a specific listed message:

- Select “Details” using the command knob
- Scroll to the selected message
- Select message
- Observe message detail by rotating the command knob to the right

4.4.2 System Screen

The system screen has the following functionality:

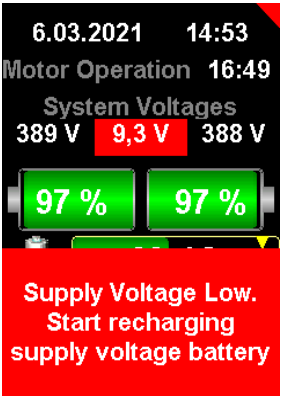
- Enable/disable charging of the 12 V supply battery from the HV batteries
- Provide information from the Insulation Monitor Device (IMD) and system voltages
- Calibrate the pylon actuator travel (see JS-MD 3 RES AMM Supplement for more details)

NOTE: When the message or service screen is shown, the monitoring of the motor operation remains running in the background.

4.5 Warning, Caution and Information Messages

All warning/error, caution, or information messages are stored by the DCU. Messages are prioritised and coloured as follows:

Message type	Background color	Audio warning
Warnings	RED	Loud repeated beep until acknowledged
Cautions	YELLOW	1-second beep
Information	WHITE	½ second beep



Warning/caution/info messages cover the lower part of the screen

- A small triangle in the top right corner will be displayed as a reminder that a message exists. The triangle has the same colour as the original message.
- A message is acknowledged (and cleared) by pressing the command knob.

CAUTION: If an operation limit is exceeded, the pilot is required to take the required action. Only limited automatic system control is implemented to protect the RES if used outside its design limitations.

NOTE: Only the unacknowledged message with the highest priority will be displayed.

A list of messages is provided in the Appendix (Section 10).

5 Emergency Procedures

This section lists emergencies that may occur during operation.

5.1 Propulsion System Failures in Flight

5.1.1 Pylon extended, but power cannot be applied

If the pylon is extended but the required safety checks have not been satisfied, the system will inhibit power application. In this case, the pilot has two options:

- Retract the pylon to reduce the additional drag and continue the flight as a pure glider.
- Recycle the system in an attempt to clear the failure mode:
    1. Select a suitable landing field to perform a safe landing.
    2. Set attitude for a minimum safe flying speed.
    3. Ensure propeller is oriented vertically and push the EXT/RETR switch in the RETR direction (Downwards) to retract the pylon.
    4. Switch the guarded RES master switch OFF.
    5. Switch the guarded RES master switch ON.
    6. Push the EXT/RETR switch in the EXT direction (upwards).

WARNING: Do not push the toggle switch downwards to retract the pylon unless the propeller is oriented vertically!

    7. Confirm the status changes to “OK”.
    8. Turn the command knob clockwise to apply power.
    9. If no power is available, perform the retraction procedure or land with the pylon extended.

NOTE: The pilot may choose to switch the RES system OFF and then back ON while the pylon is extended. This will cause the propeller to windmill, resulting in an increased rate of descent.

5.1.2 Motor fails to deliver power

Propulsion system failure may occur due to the batteries being depleted or due to an electrical failure that may have occurred.

If the propeller remains in the vertically aligned position, it means the HV power is still available. Retract the pylon and continue the flight as a pure glider.

If the propeller windmills it is an indication that HV power to the motor is interrupted. The pilot may attempt to restore power as described in the next section.

5.1.3 Power loss during flight

If the 12 V supply power or HV battery power is lost during flight, the propeller will windmill. The following action can be attempted to restore power:

1. Change the 12 V system power to the alternate battery
2. Switch the guarded RES master switch OFF and back ON
3. If the HV power is restored after being powered up, the motor's automatic propeller position holding will be activated. Normal operation can then be attempted.
4. If HV power is not restored and the propeller continues to windmill, land as soon as possible.

CAUTION: Drag increases significantly with the propeller windmilling.

WARNING: Do not retract the pylon while the propeller is windmilling.

5.1.4 Component Temperature Limits Exceeded

Temperatures of components increase with the application of power. At power settings above the MCP, components may reach their limitations.

CAUTION: The controller requires sufficient power from the 12V batteries to operate its cooling system. If 12V battery charge is low, fan speed (air-cooled systems) or pump performance (water-cooled systems) will decrease, leading to increased controller temperatures. The controller will first reduce power and may shut down if maximum controller temperature limits are exceeded.

WARNING: The system overrides the requested rotary know value shuts OFF power to the motor when limit temperatures are exceeded.

5.1.5 Take-Off Abort Procedure

When it is required to abort a take-off the following procedure is recommended:

1. To remove power immediately either:
    - Turn command knob fully anti-clockwise, or
    - Push the EXT/RETR toggle switch downwards
2. If the take-off must be aborted during ground roll, apply wheel brake as required
3. If a take-off must be aborted after becoming airborne, immediately lower the nose from the powered climb attitude to the unpowered glide attitude to maintain a safe approach speed. Deploy airbrakes and apply the wheel brake as necessary.

NOTE: Switching off the RES master switch while the system is drawing high amperage leads to a very abrupt disconnection of the HV relays, which could damage the HV batteries. Pressing the EXT/RETR toggle switch downwards is preferred.

CAUTION: The propeller will be windmilling when power is immediately removed. As a result, the drag increases significantly with a noticeable decrease in glide performance.

CAUTION: If take-off must be aborted when airborne it is critical to ensure a safe approach speed is maintained while the power is cut.

5.1.6 Landing in water

Water landings are highly discouraged. However, if a precautionary water landing is the safest emergency option, the following considerations must be observed:

1. Follow the procedures for landing in water as described in the Aircraft Flight Manual (AFM).
2. Ensure the RES master switch is in the OFF position before touchdown.
3. If the aircraft has landed safely, attempt to extract the pylon to enable the possible removal of the HV batteries. This operation must be performed in Maintenance Mode only:
    a. Switch ON the system while pressing and holding the command button.
    b. Extend the pylon manually.
    c. Switch OFF the system as soon as possible.

WARNING: The HV batteries must **not** be activated under any circumstances if there is a risk that the system or batteries are in contact with water.

WARNING: Spontaneous thermal runaway of the HV batteries is expected after submersion in water. Batteries should only be removed if the risks of electric shock and fire have been assessed, and adequate technical and medical support is available. In some cases, leaving the aircraft in the water with the batteries submerged may be the safest option to limit damage resulting from thermal runaway.

5.1.7 System not reacting to power command

If the system does not respond to changes in power selected on the DCU, the MC circuit breaker on the instrument panel must be pulled to completely remove power from the motor controller. This action will cause the RES system to windmill, resulting in a significant increase in drag. After the MC circuit breaker is reset, the system will re-boot, align itself, and automatically return to the last commanded power setting.

CAUTION: If the system remains unresponsive after resetting the circuit breaker, the circuit breaker should be pulled again and left disengaged. The aircraft must then be landed as soon as practical with the engine windmilling.

5.2 Fire

5.2.1 Fire on the Ground

1. Switch OFF the RES master switch.
2. Switch OFF all instruments and the avionics master switch
3. Get out of the cockpit.
4. Identify the source of the fire. If the fire is **not** related to the HV batteries, extinguish it using appropriate methods and extinguishing agents.

5.2.2 Li-ion battery fire on Ground

1. Clear all personnel from the immediate vicinity. Establish a safe perimeter of at least 15 meters (50 feet).
2. Notify local fire services and inform them of the presence of high-voltage lithium-ion batteries.
3. Post-Fire Actions:
    a. Do not touch or move the affected batteries for several hours due to risk of re-ignition.
    b. Ensure proper disposal and environmental cleanup per hazardous materials regulations.

WARNING: A Li-ion battery fire is considered a Class B fire. Therefore, a standard ABC or dry chemical fire extinguisher should be used. Do Not Attempt to Extinguish with Water: Water may react with burning cells and exacerbate thermal runaway

WARNING: Only trained personnel should use appropriate Class D fire extinguishers or lithium-ion-specific suppression agents.

WARNING: Do not inhale smoke or fumes emitted from a Li-Ion battery fire. These may contain toxic and corrosive compounds, including hydrofluoric acid, and pose serious health risks.

NOTE: If the fire is isolated and does not endanger other equipment or structures, it may be safer to allow the battery to burn under supervision.

5.2.3 Fire Inflight

An independent fire warning system (see Section 8.4) is installed to detect excessive heat in the motor bay. The system uses a bright red LED situated on the instrument panel and an audible buzzer to warn the pilot of heat detected and a possible fire.

When the LED is illuminated or a fire smell is recognized:

1. Stop the motor immediately by rotating the command knob anti-clockwise to 0% power.
2. Switch OFF the RES master switch.
3. Descend rapidly and land as soon as possible.
4. If a burning odour is evident, open the cockpit ball-vent and the canopy side window.
5. Bail out if the fire spread endangers the life of the pilot.
6. Extinguish the fire after landing.

NOTE: The independent fire warning system detects excessive heat in the motor bay via heat-trace wires and temperature switches. The red LED warns the pilot of a thermal event in the motor bay and does not necessarily confirm the presence of flames or burning.

NOTE: Each battery is fitted with a metal exhaust that automatically plugs into corresponding exhaust elbows in the belly of the fuselage. Fumes and gases from a thermal event inside the battery case are directed out via the exhaust nozzles/elbows and vented overboard. Fumes and gases can enter the motor bay if the integrity of the hard-shell battery case is compromised.

5.3 400 V Insulation Failure

Batteries are of high voltage (400 V). An Insulation Monitoring Device (IMD or Isometer) is installed to detect any high voltage leak to the airframe.

In case the IMD detects any voltage leakage, one of the following warnings will be displayed to the pilot:

- No Data from Isometer
- Isometer defect!
- Isometer Ground Failure!
- Insulation Problem!!!

NOTE: False Isometer errors may be triggered by high currents inducing brief voltage spikes that exceed the monitoring device's threshold. If the error persists after initial clearing, precautionary measures must be taken.

If any Isometer error remains after clearing, immediately switch OFF the RES master switch to mitigate the risk of electric shock. When on the ground, perform the following actions:

1. Stand clear of the glider and only operate the DCU.
2. Switch guarded RES master switch ON while pressing the DCU rotary command knob to enter maintenance (service) mode.
3. Extend pylon manually.
4. Switch guarded RES master switch OFF.
5. Remove HV batteries. Contact an approved maintenance station to rectify the problem.

WARNING: Do not operate the RES if an IMD (Isometer) warning persists after initial clearing.

WARNING: After the batteries have been powered OFF, the high voltage will only dissipate over the next 10 s.

6 Normal Operating Procedures

6.1 Charging and Battery Installation

6.1.1 Charging HV Batteries in the Aircraft

The HV batteries can be charged at the pilot's own risk inside the aircraft using the following procedure:

1. Remove the terminal connector (located in the charge port behind the pilot's left elbow as shown in Figure 11) and connect the Cable A charger plug to the charge port in the fuselage (see Figure 10).
2. Insert a terminal connector (cover) to the unused Cable B of the battery charger.
3. Leave the RES master switch OFF. Turn charger ON.
4. Once the charging process is initiated, the DCU offers two additional charge options that may be selected within 20 sec:
   - Selection of the charging power value; or
   - Selection of storage charging

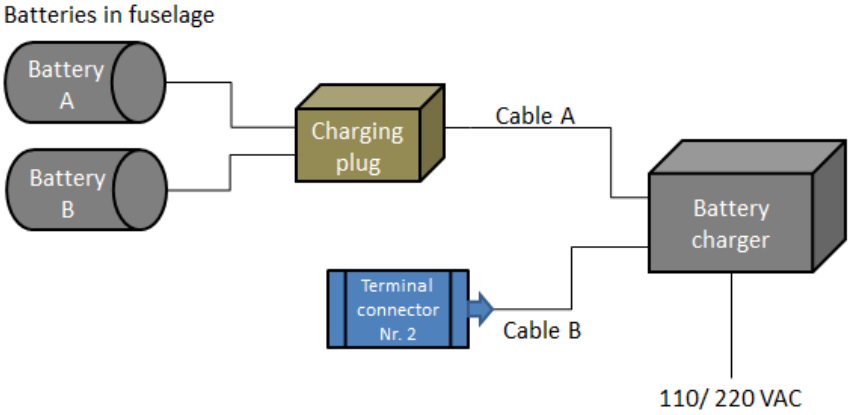


Figure 10 Inside aircraft charging diagram (dual battery)

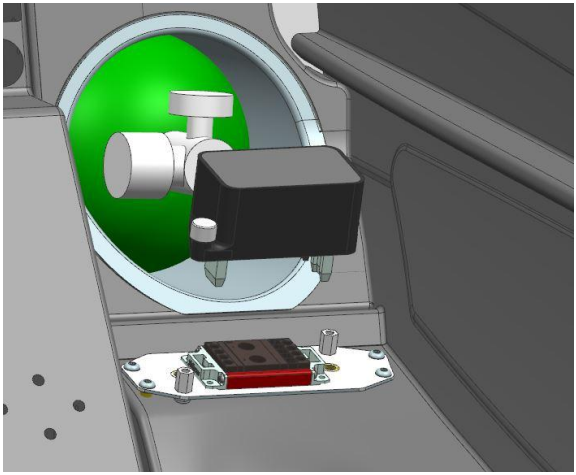


Figure 11 Terminal connector and charging port in cockpit

Once the charger is turned ON, 12V power is supplied to the battery manager, IMD, and DCU (there is no need to turn on the RES master switch). The battery manager starts the charging process by activating the HV relays with the DCU monitoring the process.

Once batteries are fully charged, the battery manager switches off the charging process and the DCU displays the standby screen.

If a single battery is charged inside the fuselage, the terminal connector must also be inserted in the male receptacle at the location of the removed battery, as illustrated in Figure 12 and Figure 13.

NOTE: Adjust the charging power according to the voltage of the electrical utilities grid (lower charging rate for 120 VAC and higher charging rate for 240 VAC) and/or select storage charging when required.

NOTE: The selected charging power setting is retained (stored) within the battery manager of each individual HV battery.

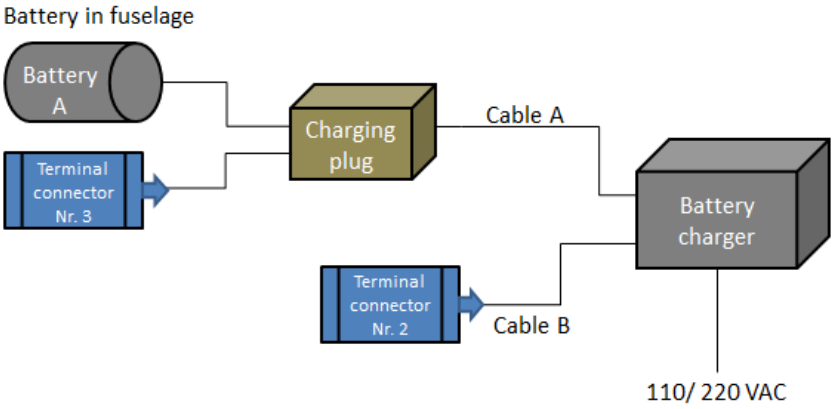


Figure 12 Inside aircraft charging diagram (single battery)

Figure 13 Single battery with terminal connector

6.1.2 Charging the Batteries Outside the Aircraft

The HV batteries should be charged under supervision or where the risk of a battery fire will cause minimum damage to the surroundings.

1. Remove the HV batteries from the fuselage
2. Connect the charger plugs to the batteries
3. Turn charger ON. If the toggle switch is operated while the charger is switched on, the storage charging mode is activated (batteries must be below 50% average SOC for storage charge to occur)

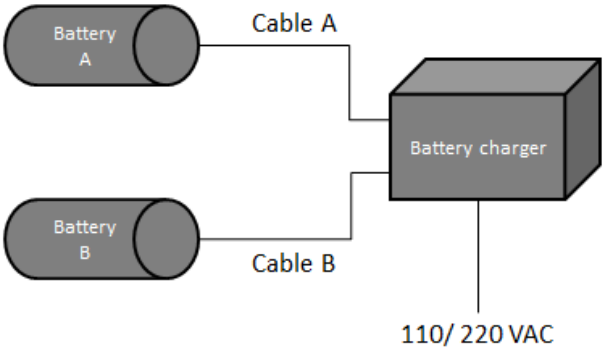


Figure 14 Outside aircraft battery charging diagram (dual battery)

Once the charger is turned ON, 12V power is supplied to the battery manager. The battery manager starts the charging process by activating the HV relays. The charging power setting (previously stored in the battery managers) will be used.

When batteries are fully charged (or charged to 50% for storage), the battery manager switches off the charging process.

If a single battery is charged outside the fuselage, the terminal connector must be inserted in the connector of Cable B of the battery charger, as illustrated in the next figure.

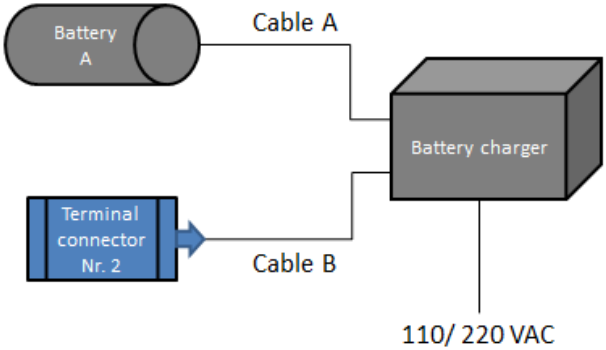


Figure 15 Outside aircraft charging diagram (single battery)

NOTE: Batteries should be charged at temperatures between 23 °C and 45 °C (73 °F and 113 °F). Charging at lower temperatures will result in batteries not being charged to the maximum capacity (cell temperatures of 0 °C can be charged to 85% of their available capacity).

CAUTION: Battery charge power settings (stored within each battery manager) for dual battery charging outside the aircraft must be the same. Do not change charge power setting for one battery without also matching the charge power setting for the second battery. (This could reduce battery life or cause a thermal runaway due to large voltage imbalances and current spikes)

6.1.3 Installing the HV Batteries

1. Select a 12 V supply battery to power the RES system
2. Enter maintenance (service) mode by pressing and holding the command knob on the DCU while switching the RES master switch to ON. See section 6.6.1 for maintenance (service) mode.
3. Whilst in maintenance (service) mode the pylon can be extended by pushing the EXT/RETR toggle switch upwards until the pylon is sufficiently clear.

CAUTION: When the HV system is not activated, the propeller alignment function is inactive. Take care that the propeller is aligned when extending the pylon to avoid damage to the propeller or doors.

4. Switch the RES master switch to OFF.
5. Insert each battery into its respective battery compartment and slide forward into the secured position (note that batteries are physically identical except for their latch orientations). See Chapter 9 for battery specific inspections.
6. Secure each battery with its latch and tighten the retainer thumbscrews, install the retainer sleeves, and safety clips.
7. Insert or ensure that a terminal connector is installed in the charge port, as illustrated in Figure 16.

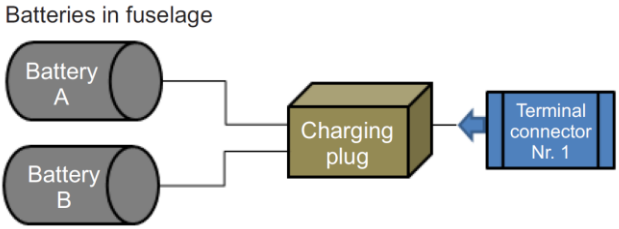


Figure 16 Terminal connector installation (dual battery)

8. If only one HV battery is being used, additionally insert or ensure that a terminal connector is installed in the unused receptacle, as illustrated in Figure 17.

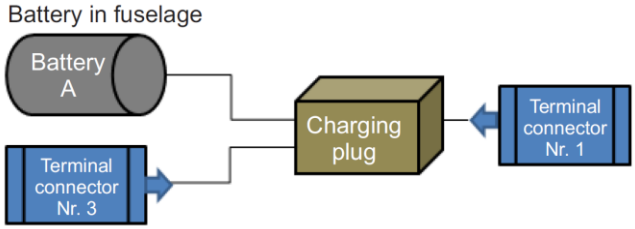


Figure 17 Terminal connector installations (single battery)

9. Switch the RES master switch ON.
10. Verify the propeller is vertically oriented.
11. Retract pylon by pushing the EXT/RETR toggle switch downwards.

6.2 Aerotow Assisted Self-launch Procedure

Aerotows are performed using the nose release hook. Refer to the JS-MD 3 RES Aircraft Flight Manual Section 2.12 for rope lengths.

Initiate the takeoff roll using negative flaps (Flap setting 1) to improve aileron efficiency at low speeds. During a crosswind takeoff, keep the stick aft during initial acceleration to reduce the aircraft's tendency to weather-vane into the wind.

As soon as positive aileron control is available, set the flap to the setting indicated in Table 9.

Aerotow speed table	Flap setting	Airspeed km/h / (kts)
Recommended aerotow speed (No water ballast)	4	130 km/h (70.2 kts)
Recommended aerotow speed (MTOW)	4	140 km/h (75.6 kts)
Minimum safe aerotow speed (No water ballast, calm conditions)	4	115 km/h (62.1 kts)
Minimum safe aerotow speed (MTOW, calm conditions)	4-5	125 km/h (67.5 kts)
Minimum safe aerotow speed (MTOW, turbulent conditions)	3-4	140 km/h (75.6 kts)
Maximum aerotow speed (V_T)	3	180 km/h (97.1 kts)

Table 9 Aerotow speed table

Retracting the landing gear while on aerotow is not recommended.

To release, pull the yellow release handle all the way. If the low tow position is used, it is recommended to release only after moving into the slipstream of the tow plane. The swirling rope end may cause damage to the aircraft when released in the low tow position.

NOTE: With the CG in the aft position the launch should be commenced with the trim in the full forward setting. Adjust the trim during the tow as required.

For an assisted aerotow, the procedure is similar to the one used for conventional aerotows. Aerotowing behind towplanes with less power, e.g. ultra-light aircraft, sport aircraft, or touring motorgliders or taking off from short runways may be conducted with the RES propulsion system running. The take-off distance is significantly reduced if the motor is

extended and running at a, maximum allowed, power of 20 kW (27 hp) during the aerotow.

Once the ground run starts, the glider pilot can start to apply power. Only level tow position is permitted, with the rope length equal to the conventional aerotow rope lengths. The speed and flap range is equal to Table 9 with the difference that the minimum safe speed is 125 km/h (67.5 kts) and the maximum speed is limited to 150 km/h (81 kts).

Should at any time during the assisted tow a significant amount of slack in the towrope occur, it is advised to release immediately and continue the climb as a normal self-launch. Once the sailplane is clear of the rope, the power can be increased to more appropriate settings, depending on the temperature of the components.

NOTE: This take-off procedure is only permitted if the conditions are such that a tow with pylon retracted can be executed safely.

To ensure good communication with the tow pilot the use of a headset is highly recommended. The RES propulsion system must be retracted during cross-country aero tows (ferry flights, retrievals) with speeds exceeding V_{PO}.

Procedure:

1. Complete normal pre-take off checks
2. Extend the motor and test motor operation while applying the wheel brake
3. Initiate the ground roll and aerotow take-off without power
4. Once airborne and clear of towplane propwash dust, slowly advance power to 20 kW (27 hp) while ensuring the tow rope remains under tension.
5. Remain in the level-tow position.

WARNING: If power is lost or temperature readings are increasing abnormally during the ground run the tow must be terminated by releasing the towing rope.

WARNING: The pilot must keep his left hand near the EXT/RETR toggle switch to cut power immediately in case of an aborted take-off.

WARNING: In case of an aborted take-off while the glider is still on the ground, move the EXT/RETR toggle switch downwards, release the towing cable and apply the wheel brake as required.

WARNING: In case of an aborted take-off after the glider is safely airborne, release the towing cable and continue the climb at MCP.

WARNING: If the tow speed approaches V_{PO} the propeller may overspeed if power is not reduced.

Maximum speed for assisted take-off is 150 km/h (V_{PO}) or 81 kts. Minimum speed is selected as 125 km/h (67.5 kts) for all configurations (15m & 18m, regardless of aircraft weight).

The maximum power from HV batteries allowable during an assisted take-off is 20 kW (27 hp).

6.3 Self-Launch Procedure

The self-launch procedure is as follows:

1. Select a sufficiently charged 12V supply battery to power the RES system, preferably not the same battery used for avionics.
2. Switch the guarded RES master switch ON. The system self-test will be initiated and the DCU changes to the operation screen.
3. Push the EXT/RETR toggle switch on the DCU upwards once. The HV system will activate (batteries enabled), the power-bus pre-charge will occur, and the pylon will raise to the extended position.
4. When the system is fully extended and the DCU shows the status as READY, the system is ready for power to be applied.
5. Ensure all pre-take-off checks have been performed and the parameters are within limits.
6. Select flap setting 4 for the best rate of climb (V_Y).

NOTE: The initial take-off run can be performed with full negative flap to improve aileron control in crosswind conditions. Once the aircraft is wings-level during the take-off roll, adjust the flap handle to setting 4.

WARNING: If an air-cooled system is installed, the cockpit ball-vent and the canopy side window **must** be opened

7. Apply the wheel brake, hold the joystick slightly aft, and announce PROP CLEAR.
8. Release the wheel brake.
9. Gradually turn the command knob clockwise by small increments until full power is reached.
10. Reduce power to MCP as soon as a safe altitude has been reached, or before temperatures approach their maximum limitations.

NOTE: The power bar graph display colour changes to yellow when above the Maximum Continuous Power (MCP) setting. Observe all parameters are in limits and no warning messages are displayed.

WARNING: The EXT/RETR toggle switch is used to immediately remove power in an emergency (see Take-Off Abort Procedure in Section 5.1.5). Take care not to unintentionally bump the toggle switch when adjusting the rotary command knob from MP to MCP.

WARNING: If two HV batteries are installed and their voltage difference exceeds 2 V, only the battery with the higher voltage will be connected to the HV bus. The warning message **"One battery disconnected: NO TAKE-OFF!!"** will be displayed. **Do not attempt a take-off in this condition**.

CAUTION: Power is automatically reduced when the controller temperature exceeds 75˚C. The pilot may override this protection by increasing the power again. When the controller temperature reaches 80˚C, the power is reduced by another 25% and a RED warning is displayed on the DCU.

CAUTION: If the system permits only one battery to connect to the HV bus due to a voltage mismatch, battery equalization can be performed by temporarily running the motor at a moderate power setting to reduce the connected battery's state of charge (SOC). Once the voltage difference between the connected and non-connected batteries is within 2 V, both batteries will connect to the HV bus, allowing for a normal take-off. (Refer to section 4.3.3).

6.4 Inflight Start Procedure

The inflight start procedure is as follows:

1. Select 12 V supply battery – sufficiently charged, and preferably not the same battery powering the avionics.
2. Switch guarded RES master switch ON. The system self-test will be initiated and the DCU changes to the operation screen.
3. Push the EXT/RETR toggle switch on the DCU upwards. The HV system is powered up and the pylon is extended.
4. In case of an air-cooled controller system, open the cockpit ball-vent and the canopy side window.
5. When the system is fully extended and DCU shows the status READY, the system is now ready to apply power.
6. Verify the pylon is raised via the rear-view mirror and then turn the rotary command knob clockwise to the desired power setting.
7. Reduce power to MCP as soon as a safe altitude has been reached, or before temperatures approach their maximum limitations.

NOTE: The time duration from initiating pylon extension until motor power becomes available is approximately 16 seconds.

WARNING: Although the extended pylon with the propeller stopped adds very little additional drag when extended, the pilot must ensure enough height is available to land on a suitable field before attempting an in-flight motor start.

6.5 Inflight Motor Stop Procedure

The inflight shutdown procedure is as follows:

1. Turn the command knob anti-clockwise until power shows 0 kW.

   The RPM will reduce and the propeller will automatically orient into a vertical position – two yellow arrows on each side of the propeller will be displayed on the DCU.
2. Using the rear-view mirror, visually verify the propeller is in the vertical position.

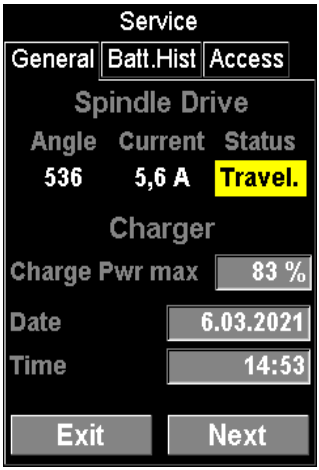
NOTE: If the prop is not aligned in the vertical position, momentarily apply power - the propeller performs a re-alignment procedure and should stop in the vertical position.

3. Push the EXT/RETR toggle switch downwards once - the system will retract automatically.
4. When the retraction process is completed, the guarded RES master switch can be switched OFF.

NOTE: The RES can remain switched ON during flight in order to monitor battery temperatures, or to activate the onboard charging of the 12 V supply batteries.

6.6 Ground Operation Procedures

6.6.1 Maintenance Mode



Enter maintenance mode (or service mode) by pressing and holding the rotary command knob and hold the EXT/RETR up on the DCU while switching the RES master switch to ON.

Whilst in maintenance (service) mode the pylon can be raised/lowered by pushing the EXT/RETR toggle switch.

Current drawn by the electromechanical actuator (spindle drive) is shown as well as the identified status of the retraction mechanism.

6.6.2 Battery access mode

Enter battery service mode by pressing and holding the rotary command knob on the DCU while switching the RES master switch to ON.

Whilst in battery service mode, the pylon can be extended by pressing the EXT toggle up once. Once precharge is completed, the pylon will extend automatically and stop before the doors close. The HV Batteries will switch off. The DCU will indicate “Ready for battery access” (Blue info box). The batteries can now be removed.

Enter battery service mode again to retract the pylon.

This procedure is to be followed to install the batteries as well.

NOTE: The DCU stores the pylon position when the system is shut down. Powering the DCU OFF and ON will not move the pylon - it remains in its last position. A retraction calibration caution message indicates pylon position uncertainty and requires re-calibration (refer to the JS-MD 3 RES AMM Supplement for the procedure).

CAUTION: When the HV system is not ON, the propeller alignment function is inactive. Take care that the propeller is centred when extending or retracting the pylon to avoid damage to the propeller or doors.

7 Performance

Performance data in this section is based on an 80% battery SoC and is corrected to ISA conditions at sea level.

Reductions in take-off performance due to environmental conditions or other factors can be assumed as described in Table 10:

Take off distance correction factors	
Density Altitude:	- Add 1% T/O distance for every degree Celsius above ISA conditions (corrected to airfield altitude with 6.5°C per 1000 m).
Tailwind:	- 10 km/h (5 kt) tailwind: add 25% T/O distance - 20 km/h (10 kt) tailwind: add 55% T/O distance
Slope:	- 2% uphill slope: add 15% T/O distance
Surface:	- Dry and short grass: add 15% to T/O distance

Table 10 Take off distance correction factors

CAUTION: Wet and tall grass increases the T/O distance significantly. Take extreme care when taking off from soft and/or wet unpaved surfaces.

7.1 Take-Off Performance

Table 11 provides performance data for take-off with dual HV battery operation.

Take-off performance at maximum weight	
Max aircraft take-off mass (dual battery)	575 kg (1268 lbs)
Climb rate at MP (40 kW)	Refer to Figure 18
Climb rate at MCP (25 kW)	Refer to Figure 18
Take off distance - hard surface, 15m obstacle	470 m (1542 ft)
Energy used to climb 500 m (1640 ft)	2.1 kWh
Max altitude gain	1700 m (5577 ft)
Sustained range after self-launch	120 km (75 mi)

Table 11 Take-Off Performance at Maximum Weight

NOTE: A take-off distance of 470 m (1542 ft) was obtained during ideal conditions (ISA, MSL, no wind and level runway surface). The take-off distance is affected by factors as described in Table 10.

NOTE: The maximum altitude gain and sustained range after self-launch is affected by atmospheric conditions, aircraft weight, wind, leading edge contamination and age/condition of batteries.

The rate of climb at Maximum Power (MP) and Maximum Continuous Power (MCP) in relation to aircraft weight are illustrated in Figure 7-1.

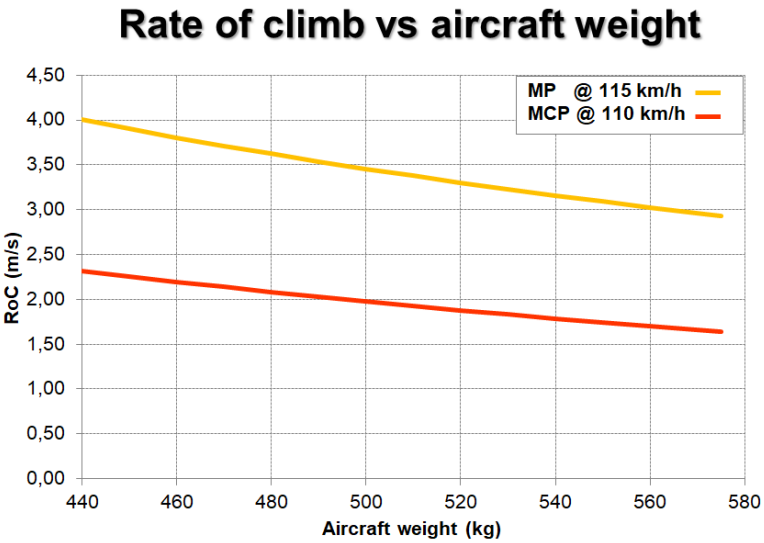


Figure 18 Rate of climb vs aircraft weight at ISA conditions

Figure 19 illustrates the recommended take-off profile for the JS-3 RES in 18m configuration at maximum weight.

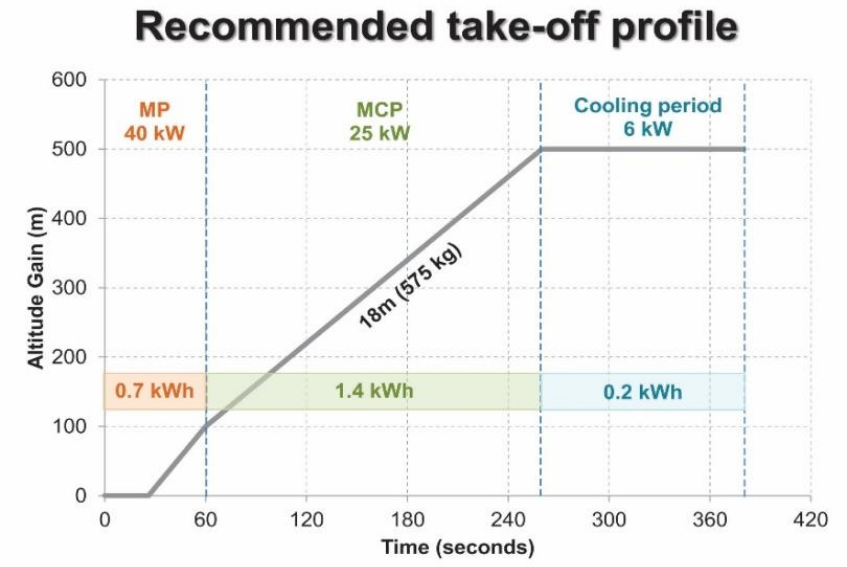


Figure 19 Recommended Take-off profile at maximum weight

WARNING: The data presented are for sea-level standard atmospheric conditions. With reduced air-density (higher temperature or higher altitude) the propeller RPM will increase with the risk of exceeding the maximum propeller RPM. Ensure the RPM remains within the operating limits at all times by reducing the throttle to a lower power setting.

7.2 Sustained Performance (dual battery)

Table Performance-12 provides performance data for sustained flight with dual HV battery operation when fully charged.

Sustained performance with dual batteries	
Reference Mass	480 kg (1058 lbs)
Max Continuous Power (MCP)	25 kW (33.5 hp)
Rate of Climb at MCP	2.4 m/s (472 ft/min)
Max altitude gain (approx.)	2000 m (6562 ft)
Max sustained range in 18m (approx.)	157 km (98 mi)
Max demonstrated sustainable altitude	~2850 m (~9350 ft)

Table Performance-12 Sustained Performance (dual battery)

Figure 20 illustrates the flight profile including RES HV battery temperature variation.

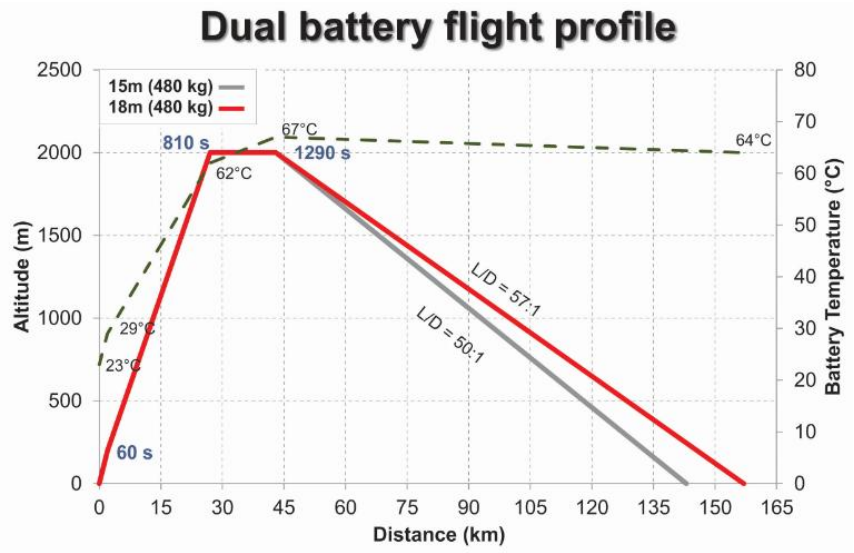


Figure 20 Optimum flight profile for dual battery operation

NOTE: The sustained range is reduced by approximately 25% following a self-launch to 450 m (1410 ft).

7.3 Sustained Performance (single battery)

Table 13 provides performance data for sustained flight with single HV battery operation (valid for both 15m and 18m configuration).

Sustained performance with single battery	
Reference mass	460 kg (1014 lbs)
Climb rate at MP = MCP (12.5 kW)	0.8 m/s (157 ft/min)
Max altitude gain (approx.)	~900 m (~3000 ft)
Max sustained range (approx.)	~81 km (~50 mi)
Max demonstrated sustainable altitude	~2850 m (~9350 ft)

Table 13 Sustained Performance (single battery)

Figure Performance-21 illustrates the flight profile including RES HV battery temperature variation.

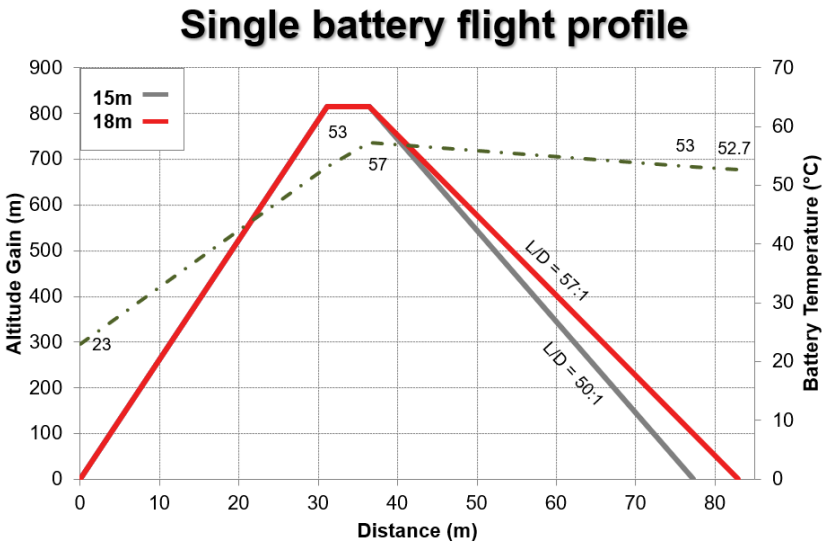


Figure Performance-21 Optimum flight profile for single battery operation

7.4 Cruise flight – level flight minimum power

Table 14 provides level flight performance data. Optimum cruise speed is 120 km/h (65 kts) with flap in position three.

Cruise flight performance	
Reference mass	480 kg (1058 lbs)
Power setting for level flight	~ 8 kW (10.7 hp)
Cruise Speed (TAS)	120 km/h (65 kts)
Sustained range – 2 batteries	~ 120 km (74.5 mi)
Sustained range – 1 battery	~ 55 km (34.2 mi)

Table 14 Cruise Flight Performance

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8 System Description

This chapter describes the sailplane, its systems and provides standard equipment with instructions for use.

8.1 Kinematic System

The kinematic system is driven by a 12-volt electromechanical linear actuator (spindle drive) with integral limit switches. The actuator, which is located in the bottom of the fuselage aft of the landing gear, is controlled by the Retraction & Fuse Unit (RFU) and operates the pylon via a pushrod link. The motor bay door opening/closing mechanism is linked to the pylon.

8.2 Powerplant

8.2.1 Electric Propulsion System

The SOLO Electric Propulsion System 8000/400 powerplant consists of the following main components:

- Emectric BM 384 HV batteries
- Emrax 208 electric motor
- Motor Controller
- Display and Control Unit (DCU)
- Retraction & Fuse Unit (RFU)

8.2.2 Propeller

Manufacturer:	Technoflug
Model:	KS-1C-120-R-065-S
Maximum RPM:	4350

8.2.3 Batteries

The JS-3 RES can be operated as a pure glider without batteries, one battery for sustained flight only, or two batteries for self-launching capability. Batteries are identical except for the locking bracket – therefore, left and right batteries shall be installed with their brackets towards their respective latches at the sides of the motor bay walls.

Figure 22 Emectric HV battery

Apart from the exhaust nozzle, the batteries are sealed to minimise the risk of fire or gas propagation. The Li-Ion cells used are sensitive to excessive heat and may spontaneously ignite at temperatures above 150 °C (302 °F). High temperatures also reduce cell life; operation above 60 °C (140 °F) should be avoided.

The battery pack is designed to prevent the propagation of fire between adjacent cells. If a cell ignites, approximately 12 litres (0.4 ft^3) of high-temperature, toxic gases will be released instantaneously. These gases are directed via the battery exhaust nozzles and fuselage elbows to the outside of the aircraft.

CAUTION: Weight and Balance is affected by battery configuration changes – ensure aircraft CG is within limits before take-off.

WARNING: Do not inhale any fumes or gases resulting from a battery fire.

Table 15 provides technical data of the RES HV batteries.

Battery technical data	
Manufacturer	Emectric GmbH
Type	BM 384
Configuration	96S4P
Battery Voltage	270V-400V
Nominal Voltage	350V
Max continuous current	60 A
Usable Energy (available energy decreases with high power settings)	~ 3.8 kWh per battery
Battery Weight (each)	~ 24.9 kg (54.8 lbs)
Dimensions (each)	725 x 347 x 82 mm (28.5 x 13.7 x 3.2 in)

Table 15 HV Battery Technical Data

NOTE: When operating the RES at higher power settings, the voltage drop is greater and the minimum cell voltage will be reached, even though more energy is still available in the battery. Reducing the electrical load (via power setting) will result in a rise in the measured cell voltage.

8.3 Electrical System

A detailed description of the RES electrical system can be found in the JS-MD 3 RES AMM Supplement.

8.3.1 System Overview

The RES consists of the components illustrated in the following schematic diagram.

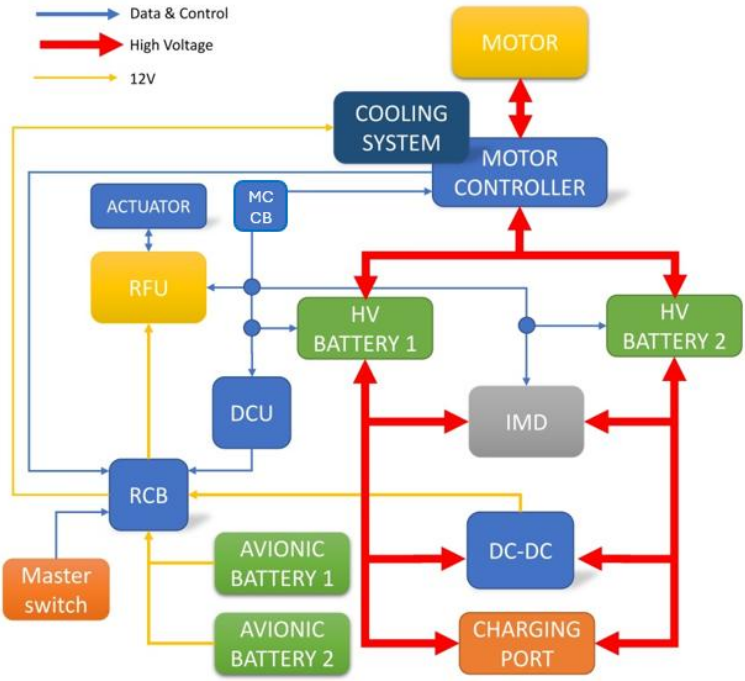

Figure 23 System Overview

8.4 Fire Warning System

The independent system is powered by a 9 V battery in a dedicated compartment, located at the right side of the binnacle below the instrument panel. The battery must be replaced every two years (as part of the documented maintenance) or any time it fails a pre-flight test - whichever occurs sooner.

The red LED on the panel illuminates and the audible buzzer activates by one of three methods:

- Closing the circuit by pressing the TEST momentary push button located next to the LED on the instrument panel.
- Closing of the temperature switch(es) in the motor compartment by exposure to heat.
- Closing the circuit via one (or both) of the heat trace cables in the motor compartment being exposed to enough heat to melt the separation material within the cable core and allowing the internal conductor wires to make contact.

NOTE: LED and buzzer activation via the temperature switches is reversible – once the switch cools the circuit will simply re-open and the LED will turn off. During annual inspection, the function of each switch must be tested via local warming of each switch using a hair-dryer (or heat gun on a low setting).

NOTE: LED and buzzer activation via the heat trace cable(s) is permanent. Do not apply artificial heat to the cables. Only the cable connections should be inspected during annual maintenance. If unintentionally heated, they must be replaced.

NOTE: The fire warning system audible buzzer can be silenced via the dedicated circuit breaker or via removal of the 9 V battery from its compartment.

8.5 Miscellaneous Equipment

8.5.1 Battery Charger

The battery charger is specifically configured for the SOLO 80400 RES system. Refer to Section 6.1 for battery charging.

Figure 24 RES HV battery charger

Refer to the battery charging instruction sheet located inside the lid of the charger case for additional information.

CAUTION: In addition to the large cylindrical contact pins, the charging plugs also contain smaller data communication pins. Ensure the pins are protected when the charger case is being transported - as pin damage may occur if the plug ends are free to come into contact with other components within the case.

8.5.2 Termination Plugs

Refer to Section 6.1 for the use of terminal connectors to ensure no HV live terminal connectors are exposed and cause a risk of electrical shock.

WARNING: Always assume and treat the RES connectors and terminals as electrically “live” even when the system is off.

9 HV Battery Handling, Care, and Transport

This chapter contains the manufacturer's recommended procedures for proper handling and care of the RES batteries. It also identifies certain inspection and maintenance activities, which are needed to retain performance and reliability.

9.1 Battery Care

Batteries should be treated with care to obtain the designed performance and expected life from the battery.

- Always store the batteries in a safe location away from temperature extremes, solar radiation and precipitation (Do not leave batteries inside a car on a sunny day or outside exposed to rain!)
- Handle the batteries with extreme care.
- Do not expose the batteries to high acceleration (Do not drop the batteries!)
- Do not expose batteries to high-moisture environments. Prolonged exposure may lead to internal condensation and subsequent battery damage.
- High rates of discharge shorten the life of the cell.
- Do not discharge the cells below 2.5 V per cell.
- Do not store batteries fully charged or empty.
- Do not charge the batteries too fast
- Comply with long term storage specifications.

NOTE: Single battery take-offs are not allowed as the high discharge rate will reduce battery life noticeably.

9.1.1 Ground Handling/Road Transport

Batteries should be left inside the fuselage during transportation or carried in suitable safe transport containers. Batteries should not be transported unprotected laying in the beds of all-terrain vehicles, golf carts, or pick-up trucks!

WARNING: HV batteries are sensitive to ground handling. Exposure to shock loads or mishandling must be avoided, as this may lead to battery failures or fires and void the warranty.

WARNING: It is highly discouraged to leave batteries in a glider parked outside. If there is no alternative, ensure the aircraft is fully covered with waterproof, all-weather covers **or** seal the motor bay door gaps completely with tape to prevent water ingress. Lightweight outdoor covers and hangar dust covers are insufficient for outdoor protection. Always inspect the motor bay and tailboom interior for water accumulation, and verify that the motor bay drain holes are clear.

9.1.2 Long Term Storage

It is recommended to remove RES batteries and store them in a dry place with the following conditions:

State of Charge:	35 - 50%
Temperature:	10 – 23 °C (50 – 73 °F)
Humidity:	< 75%

Check the state of charge of the batteries at least every 60 days to ensure the cell voltage does not drop below the minimum limit.

CAUTION: Do not leave the battery SOC condition unchecked for extended periods. Comply with the minimum SOC checking interval listed above.

CAUTION: Exposing the batteries to temperatures above 35 °C (95 °F) or below 5 °C (41°F) for prolonged periods will shorten the battery life and reduce the capacity.

9.1.3 Inspections

The following inspections should be performed on a regular basis – typically prior to installing the batteries into the fuselage:

- Verify the lifting handles on top of each battery are securely attached to the hard-shell case with no indication of detaching or signs of loose fasteners.
- Verify the latch plate at the rear of each battery is firmly attached to the hard-shell case and its fasteners are secure.
- Visually inspect the multi-pin connector at the front of the shell for any sign of contact pin damage or debris. Clean with filtered compressed air and/or electrical contact cleaner spray. Additionally inspect the fasteners that secure the connector to the shell.
- Verify the locator guide pin at the front of the shell is without any play and rigidly attached to the case.
- Verify the integrity of the exhaust port sleeve at the lower front region of the shell.
- Visually check that the low-profile fasteners around the edge of the shell are secure.
- Inspect the entire shell (especially the bottom sliding surface and the corners) for any indication of wear, cracks, or puncturing through the walls.
- Inspect the cover plate and cover plate screws at bottom surface of the battery. Screws should be flush and secure.

9.2 Trailer Considerations

Batteries have a mass of approximately 50 kg (110 lbs) for the pair. Their placement in the trailer (if stored outside the fuselage) can therefore affect the CG of the trailer noticeably. The trailer behaviour on roads and motorways can be made unstable rendering the towing vehicle unsafe to drive.

CAUTION: Always observe trailer manufacturer's guidelines for trailer tongue (drawbar) weight as a percentage of total trailer weight.

10 APPENDIX – List of Warnings/Cautions

The following table shows the priority of the messages.

WARNINGS / ERRORS	
Propeller overspeed !!! Reduce Power"	Reduce torque setting or airspeed.
Interlock Circuit not closed!!! Check Connectors	During system startup the interlock circuit is not closed. Check connectors to batteries and charge port (if installed)
Power Setting Defect !!!	Signal from torque setting not valid. Maybe a broken wire or defect mechanics. Maintenance necessary.
Battery DRAINED No Motor Power Connect Charger!	lowest cell voltage is < 2.5 V. No motor operation possible. Connect charger as soon as possible
All Batteries empty	Remaining motor operation time < 2 min
Supply Voltage too high Shut-off main switch!	Voltage exceeds 15,0 V. Wrong battery type used or voltage control inside DC-DC converter is not adapted or damaged.
No Data from Charger	No CAN-Bus messages from charger.
No Data from Isometer	No CAN-Bus messages from eFlightBox where the isometer is integrated.
Isometer defect!	Self-test of isometer not successful. No measurement of the insulation between LV circuit and HV circuit will be performed. Potential insulation problems cannot be detected and therefore danger of electric shock.
Isometer Wiring Failure!	Isometer detected a bad connection between 0 V and ground, between the isometer and + HV-rail or isometer and -HV rail. No measurements can be performed and therefore danger of electric shock.
Insulation Problem!!! Turn Main Switch Off Maintenance	Insulation result is lower than 500kΩ. This is too low. Danger of electric shock.

No Data from RFU!	No CAN messages from RFU. Do not use the system and check wiring between DCU and RFU. If this issue happens sporadically, check CAN-Bus wires and shielding.
No Data from Motor Controller! Press CMD to stop motor	No CAN messages from Motor Controller. If the motor is running it continues until command button is pressed. Do not use the system and check wiring between DCU and eControl. If this issue happens sporadically, check CAN-Bus wires and shielding.
No Data from Battery A	No CAN messages from left battery. Do not use the system and check wiring between Battery A and DCU. If this issue happens sporadically, check CAN-Bus wires and shielding.
No Data from Battery B	No CAN messages from right battery. Do not use the system and check wiring between Battery B and DCU. If this issue happens sporadically, check CAN bus wires and shielding.
Watchdog Reset!	Detected error in software. DCU restarted automatically.
No Communication!	CAN-Bus Fault. Check wiring.
Supply Voltage too low! Start recharging supply voltage battery!	Supply voltage is below 10,0 V. Switch on recharging process.
Coolant Pump Failure Stop Motor as soon as possible! Press CMD to Resume	Coolant pump is switched on but no tacho signal is received by the RFU. Terminate motor operation as soon as possible. eControl may be damaged by over temperature.
Invalid firmware version	The firmware of one device of the propulsion system does not provide the correct firmware version. After message is acknowledged you can read the last entry in the boot window. It represents the device with the wrong firmware version.
Retraction Mechanism Current overload Wait and try again	The self-resetting fuse of the spindle motor has blown. It cools down in a few seconds then you can try again using the retraction switch.
Retraction Mechanism Error Use emergency retracting switch	Limiting switches at the extended and retracted position of the retraction mechanism show an invalid status. e.g. Both limit switches are open.

Retraction Mechanism Timeout! Spindle blocked?	Spindle was powered longer than OEM-adjustable limit. Operate spindle using emergency operation mechanism and watch propeller
Precharge Timeout! Service Disconnect?	The voltage level at the eControl and the batteries do not level in between 1,5sec. Switch off system and restart.
Warning / Error messages from eControl	
MC: BAD PARAMETER	Possible causes: • Damaged parameter setting • Firmware not valid for the system or firmware damaged Contact manufacturer
MC: POWER FAULT	Overall message of hardware monitoring. Possible causes may be: • Overvoltage across the bus circuit • Driver card voltage monitoring (15 V, 5 V) • Undervoltage monitoring of the supply voltage (< 10 V) • Overtemperature in at least one IGBT module • Dangerous overcurrent (causes may be currents which are too high or oscillating currents, bad controller adjustments, or hardware defects (e.g. IGBT module))
MC: RFE FAULT	Safety circuit faulty (only active with RUN-signal)
MC: BUS TIMEOUT	CAN-Bus timeout
MC: FEEDBACK	Resolver signal faulty or missing
MC: POWER VOLTAGE	Power voltage missing
MC: MOTOR TEMP 1 Reduce Power Instantly!	Motor temperature too high (> 120 °C) Attention, if occurs in flight: Proceed flight, eventually broken sensor wire. Attention, if occurs after maintenance or on ground: switch off the system immediately, possible overspeed of motor within seconds.
MC: DEVICE TEMP Power Reduced	Device temperature too high (> 80°C)

MC: OVERVOLTAGE	Overvoltage (power voltage)
MC: I_PEAK	Overcurrent or strongly oscillating current detected. This error is also often triggered if the power supply has low voltage spikes.
MC: RACEAWAY	Drive races (without command value, wrong direction)
MC: I Sensor	Current measurement error
MC: BALLAST	Ballast circuit overloaded
Warning / Error messages from the batteries *Messages shown are for BATTERY A. Each message also exist for BATTERY B!*	
BATTERY A: Modul Timeout Discharge Only Maintenance!	Error during self-test. Discharge only. Maintenance necessary.
BATTERY A: Cell Connection Discharge Only Maintenance!	Error during self-test. Discharge only. Maintenance necessary.
BATTERY A: Temperature Reg. Discharge Only Maintenance!	Error during self-test. Discharge only. Maintenance necessary.
BATTERY A: Cell Voltage Reg. Discharge Only Maintenance!	Error during self-test. Discharge only. Maintenance necessary.
BATTERY A: No Module Data Discharge Only Maintenance!	Error during self-test. Discharge only. Maintenance necessary.
BATTERY A: Battery TOO HOT Stop Motor !!!	Battery > 70°C.

BATTERY A: Battery Empty !!! Stop Motor !!!	SOC < 3%
BATTERY A: Off! Precharge Error Check wiring and try again!	Only when charger is connected: Batman tries to pre-charge the power bus, but charger shows no voltage data.
BATTERY A: Off! Cell Overvoltage Reset Power Maintenance	Can only happen if charger is connected. Maintenance may be necessary
BATTERY A: Cell voltage difference. Maintenance Required	The battery cell voltage difference is higher than 50mV during boot time and the maximum cell voltage is higher than 4,0 V. Motor can be used after confirming the message.
BATTERY A: Off! Charger Error Check Wiring	Can only happen if charger is connected. Reasons may be: • Communication problem between both batteries • One battery is connected after power on.
BATTERY A: Off! Cell Overvoltage New Precharge. Maintenance	At least one battery cell is higher than 4,2 V. Reset by a new pre-charge after problem is solved.
BATTERY A: Off! Cell Drained Connect Charger!	At least one battery cell voltage is below 2,3 V. It is possible to reset this state by a new pre-charge event.
BATTERY A: Off! -Overcurrent- Reset Power	Hardware shutoff due to high current. Reset by power cycle.
BATTERY A: Off! -Permanent Shutoff- Maintenance Required	At least one battery cell voltage is < 2,0 V. Battery is permanently shut off. Reset only by maintenance personal.
BATTERY A: Off! Critical Overtemperature Possible Fire! Maintenance	Battery temperature > 85°C. Battery is permanently shut off. Reset only by maintenance personal.

BATTERY A: Current too high Decrease power setting immediately!	Battery current > 80 A. Maybe only one battery is connected to he power bus. Probably only one battery is connected unintentionally. Connect only one battery and check which one is working. Maintenance necessary.
Warning / Error messages from the charger	
CHARGER: Hardware Error Remove Charger and try again	General hardware error. Can only be cleared by power reset.
CHARGER: Overtemperature	Charger too hot. Switch charger off until it cools down.
CHARGER: No Battery	Charger cannot detect valid battery voltage.
CHARGER: Communication Timeout	Charger didn't receive control message for five seconds.
CAUTIONS	
CAN Buffer full	This message shouldn't show up in a system with correct parameter setup
One Battery disconnected NO TAKE-OFF !!!	One battery operation. Motor torque is limited to 50%
Battery charge too low. NO TAKE-OFF !!!	Battery charge level is too low for a take-off followed by a 5-minute climb.
Insulation Resistance low. Check Insulation!	Insulation result is lower than 2000kΩ. This is low. Further decrease may lead to the danger of electric shock.
Supply Voltage Low. Recharge supply voltage battery	Supply voltage below 10,5 V
Motor Current Limit! Propeller speed high	Motor controller limits power to the motor. This message shouldn't show up in a system with correct parameter setup
Motor Current Limit! Motor temperature	Motor controller limits power to the motor. This message shouldn't show up in a system with correct parameter setup

Motor Current Limit! Temperature Motor Controller	Motor controller limits power to the motor. This message shouldn't show up in a system with correct parameter setup
Remove Charger !	If in standby motor operation is demanded but the charger is still connected.
Battery Cell voltage low Motor LIMITED !	At least one battery cell voltage is at a low level.
Battery voltage difference too high NO TAKE-OFF !!!!	Battery voltage difference is > 30 V. Battery with lower voltage is disabled, so no take-off is possible.
All Batteries low !	Remaining motor operation time < 5 minutes.
Insulation measuring results bad. Maintenance	Insulation measuring process is disturbed. Possible causes are too much ripple on the HV-rail. If problem persists, get in contact with manufacturer.
Battery B not Connected	DCU does not get any data from Battery B. During operation the battery may get disconnected at any time. At start up battery will stay unconnected.
Battery A not Connected	DCU does not get any data from Battery A. During operation the battery may get disconnected at any time. At start up battery will stay unconnected.
Interlock Warning! Battery or Charger not Connected!	Connectors to batteries, charger or dummy plugs are not fully locked and may fall off at any time.
Retraction Mechanism Pylon angle invalid. Watch Pylon angle.	The limiting switch for the extended position is triggered, but the pylon angle value is too low. Possible causes may be: • angle for fully extended pylon not set correctly • damaged limit switch • damaged angle detection system. See maintenance manual for further steps to adapt the angle detection system to the installation.
Retraction Mechanism Current too high.	Current to spindle exceeds OEM-adjustable limit for 3 seconds. Possible cause may be:

Maintenance	• stiff mechanics • warn or blocked spindle motor
Retraction Mechanism Emergency Operation Watch Propeller	Emergency or Maintenance Retraction switch was triggered. The spindle moves without control by the DCU.
Caution messages from eControl:	
MC: Device detection inconsistent	Device detection is inconsistent. Maintenance
MC: ILLEGAL STATUS	RUN signal disturbed, EMI Maintenance
MC: SAFE_IN	RFE Input not active while RUN is not active) Maintenance
MC: MOTOR TEMP Reduce Power!	Motor temperature high (> 105 °C)
MC: DEVICE TEMP Reduce Power!	Device temperature high (> 75 °C)
MC: insufficient Battery Power	Battery voltage too low to set the motor current that is rated.
MC: I_PEAK	Overcurrent 200%
MC: RACEWAY	Resolution range of the speed measurement reached
MC: 2.Supply Fail	Second 12V supply voltage missing
MC: Secondary Feedback Fail	Secondary resolver signal faulty or missing. Primary resolver signal active.
MC: BALLAST	Ballast circuit > 87 % overloaded
Caution messages from the Batteries: *Messages shown are for BATTERY A. Each message also exists for BATTERY B*	
BATTERY A: Battery Hot !	Maximum battery cell temperature > 60 °C
BATTERY A: Battery Low !	SOC < 10%

BATTERY A: Cell voltage difference too big. Connect Charger!!!	Battery cell voltage difference > 20 mV. Connect charger and let balancing process be finished.
BATTERY A: Temperature Sensors failed See Battery Screen!	More than 5 temperature sensors are defect Maintenance necessary.
BATTERY A: Flash Memory Error Maintenance	No further effect. Maintenance necessary.
BATTERY A: Cell Monitor Chip too hot Balancing is paused.	Wait until chip is cooled down and balancing resumes.
Caution messages from the charger	
CHARGER: No Power!	Charger not connected to the power grid. Charging process resumes automatically when power is back.

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11 Contact

11.1 Type Certificate Holder

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