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TCDS EASA E.237

Engine type: Solo 8000 / 400 and Solo 8000 / 401

Subject: Propulsion reliability affected by EMI Problems, due to connection issues of grounding

Applicability: If the glider is equipped with the SOLO Electric propulsion system 8000 series and during operation or maintenance any of the following failures are logged:

- MC: Power Fault
- MC: BUS TIMEOUT
- MC: FEEDBACK
- MC: I_PEAK
- MC: ILLEGAL STATUS
- MC: I_PEAK
- CHARGER: Communiation Timeout
- No Communication
- No Data from:
 - Isometer
 - RFU
 - Motor controller
 - Battery A
 - Battery B

Reason: Due to damaged cable shielding, loose electrical connectors or even corrosion, the potential of electromagnetic interference (EMI) rises and as a result a risk of loss of engine power or not correct system response was recorded.

The propulsion system uses two independent mechanisms to detect motor position and to control the timing of current delivery required for accurate motor commutation. Due to shielding or grounding issues, additional EMI interference can invalidate the proper information used for timing and cause simultaneous disruption of both position feedback channels, this influences the effectively of the built-in redundancy and leading to false motor positioning.

The spikes can be either induced via the 12V system or HV system. The spikes at the HV system will be coupled by the DC-DC converter into the 12V system.

Due to false positioning, additional spikes can be introduced into the HV system by the motor. Finally, if the calculated motor position differs to much from the real motor position, a sudden power loss of the motor may occur.

Compliance: Service Bulletin must be complied, if any of the above mentioned error messages have been logged on the DCU in the message list. During each annual inspection the DCU message list need to be checked for errors mentioned above.

Instructions: To mitigate this unsafe condition, the following corrective actions must be performed. All actions need to be performed with the DC-DC converter online and the motor in the extended position.

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**Test prior
Release to
Service:**

After performing Action 2 – 4, the following test need to be conducted to verify that the action is successful:

- remove the propeller from the engine
- completely retract the engine, verify the motor stays in position (noise from the motor)
- keep the engine retracted for approx. 1h hour and check for any error indication,
- if no error indication occurs within this period, the system is ready for release to service
- Reinstall the propeller and release the aircraft to service

If the test can be passed, release aircraft to service. In case any specification can not be met or the test can not be passed, Solo is to be contacted for verification.

Action 1:

Using an oscilloscope (100MHz, 1.25 GSa/s, timescale set to display 6 peaks of 16kHz) to verify the EMI characteristics present on the 12V DC supply lines. Connect the oscilloscope probes to the 12V+ and 12V GND at the RES master switch. Access to these lines may be obtained via the Propulsion System Master Switch and the Panel Ground point.

An acceptable result is the presence of a consistent less than +/-10 V peak-to-peak ripple (spike) at a frequency of approximately 16 kHz superimposed on the 12V DC line. This waveform is expected and aligns with the intentional design parameters of the system. Refer to Fig 4 and Fig 5. In case the specification can not be met, or any problems arise, Solo is to be contacted for verification.

Action 2:

If voltage spikes exceeding ± 10 V are observed, refer to Fig 6, perform the following checks:

1. **Ground Continuity Check (Motor to Motor Controller):**

- Visually inspect the ground wire between the motor and the motor controller for mechanical damage, corrosion, or insulation degradation.
- Confirm that the installed wire size is min **AWG10**, if not, replace with cable of wire size min. AWG10.
- Resistance must be less than 100 mΩ measured at:
 - the motor controller housing to the cable end fitting
 - the motor to the cable end fitting
- Resistance must be less than 1Ω, measured between motor and motor controller housing

2. **Ground Continuity Check (Motor Controller to Airframe):**

- Visually inspect the ground wire between the motor and the motor controller for mechanical damage, corrosion, or insulation degradation.
- Confirm that the installed wire size is min.**AWG10** are acceptable, if not, replace with cable of wire size min. AWG10.
- Resistance must be less than 100 mΩ measured at:
 - the motor controller housing to the cable end fitting
 - the airframe ground to the cable end fitting
- Resistance must be less than 1Ω, measured between motor controller and airframe ground

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Action 3: Check for grounding at the resolver cable connector and the motor controller housing between Position 1 and Position 2.

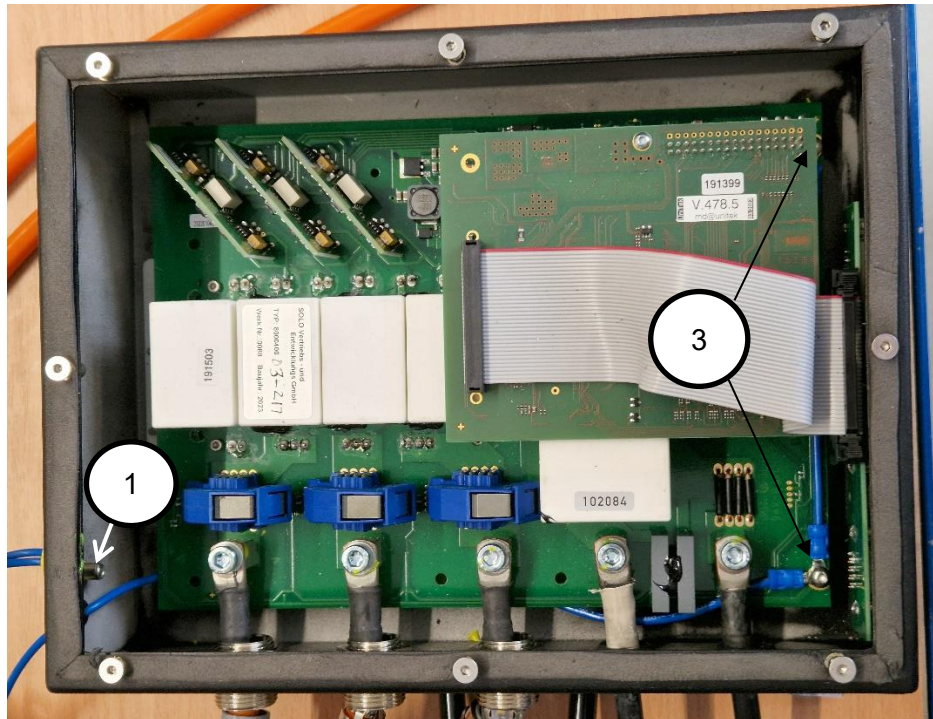


Fig. 1: Motor Controller

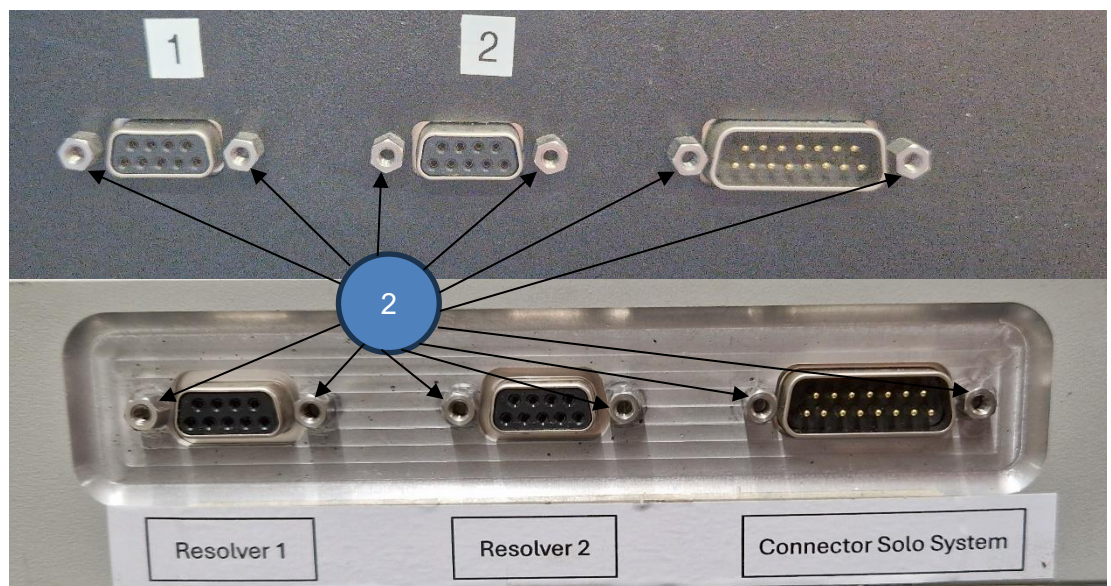


Fig. 2: sideview of connectors

If no grounding is detected, remove the hex stud, remove any kind of corrosion or painting underneath to ensure proper electrical contact.

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- Action 4:** In case of a Motor Controller (MC) Power Fault, check the continuity between the screws at Position 3 in Figure 1: Motor Controller and Position 1. The resistance must be less than 0,2 Ω .
- If grounding issues persist, install grounding studs beneath the controller to improve chassis connection.
- Disconnect batteries
 - Mark all wires
 - Disconnect all wires
 - Remove the ribbon cable of the top controller board
 - Unscrew the top controller boards (2 screws) and remove it
 - Remove the lower controller board, by removal of the four screws between the cooler and the controller
 - If not a SOLO housing is installed, remove the two anchor nuts and install them 90° installed, install four spacers with screws. These parts are available through SOLO.
 - If a SOLO housing is installed, replace 2 studs between the controller board and the controller housing, refer to Fig. 3
 - Perform the steps above in reverse order to assemble the controller again

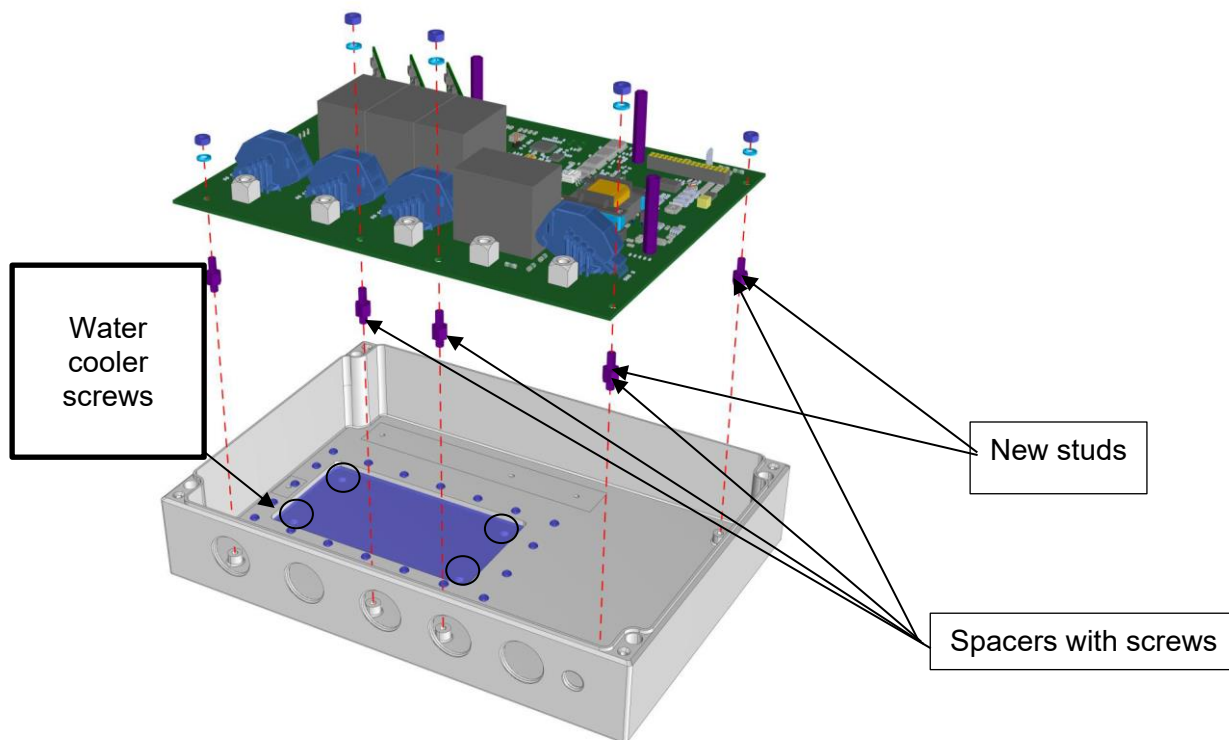


Fig. 3: SOLO housing with studs

Material: Standard material as required:

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Cable:

- HV Cabel: FHLR2GCB2G, min 16mm²
- CAN-Bus, twisted pair e.g.CAN24TST120 or GF120-24CANB-1
- Unshielded Wire, MIL-W-22759/16-XX-Y
 - o XX = AWG Wiresize iaw. Wiring diagram
 - o Y = colour coding:
 - 0 = Black (for DC GND)
 - 2 = Red (for +12V supply)
 - 4 = Yellow
 - 5 = Green
 - 6 = Blue
 - 9 = White (Signal)

Plugs:

Sub-D	Socket Type		Insert / Extraction Tool	Socket Insert AWG20-24	Positioner M22520/1-01	Socket Insert AWG22 - 28	Positioner M22520/2-01
	Magnetic	Non-magnetic					
9	M24308/2-1F	M24308/6-1F	M81696/1-02	M39029/63-368	TP585	M39029/58-30	K42
15	M24308/2-2F	M24308/6-2F					
25	M24308/2-3F	M24308/6-3F					
37	M24308/2-4F	M24308/6-4F					
50	M24308/2-5F	M24308/6-5F					

Sub-D	Pin Type		Insert / Extraction Tool	Socket Insert AWG20-24	Positioner M22520/1-01
	Magnetic	Non-magnetic			
9	M24308/4-1F	M24308/8-1F	M81696/1-04	M39029/64-369	K13/1
15	M24308/4-2F	M24308/8-2F			
25	M24308/4-3F	M24308/8-3F			
37	M24308/4-4F	M24308/8-4F			
50	M24308/4-5F	M24308/8-5F			

Butt Splices:

Part-Number	Single Wire	Multiple Wire Range CMA (mm ²)
M81824/1-1	26 – 20	304 – 1510 (0,15 – 0,75)
M81824/1-2	20 – 16	1058 – 2680 (0,53 – 1,34)
M81824/1-3	16 – 12	2375 – 6755 (1,19 – 3,37)

Shield Termination:

Cable OD		No Preinstalled Lead	Preinstalled Lead Option			
Jacket OD	Shield OD		AWG 20	AWG 22	AWG 24	AWG 26
Max.	Min.					
1,95 [.075]	0,90 [.035]	M83519/1-1	M83519/2-1	M83519/2-6	M83519/2-11	M83519/2-16
2,70 [.105]	1,40 [.055]	M83519/1-2	M83519/2-2	M83519/2-7	M83519/2-12	M83519/2-17
4,30 [.170]	2,15 [.085]	M83519/1-3	M83519/2-3	M83519/2-8	M83519/2-13	M83519/2-18
6,00 [.235]	3,30 [.130]	M83519/1-4	M83519/2-4	M83519/2-9	M83519/2-14	M83519/2-19
7,00 [.275]	4,30 [.170]	M83519/1-5	M83519/2-5	M83519/2-10	M83519/2-15	M83519/2-20

Terminal Ends for Motor:

45° similar to Klauke 43R645, 45° angle, Hole for M6, 16mm² cable diameter EAN 2050001561510

45° similar to Klauke 44R645, 45° angle, Hole for M6, 25mm² cable diameter EAN 2050001561534

90° similar to Klauke 43R6, 90° angle, Hole for M6, 16mm² cable diameter EAN 2050001561640

90° similar to Klauke 44R6, 90° angle, Hole for M6, 25mm² cable diameter EAN 2050001561664

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180° similar to Klauke 3R6, 180° angle, Hole for M6, 16mm² cable diameter EAN
2050001416315
180° similar to Klauke 4R6, 180° angle, Hole for M6, 25mm² cable diameter EAN
2050001416346

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Notes: Work must be conducted and released by an appropriately approved organization or personnel.

Currently these are:

SOLO Aircraft Engines GmbH

Industriestrasse 9
D-71069 Sindelfingen

For Jonker aircrafts:

M&D Flugzeugbau GmbH & Co. KG

Streeker Straße 5 b
26446 Friedeburg

DG Aviation GmbH

Otto Lilienthal Weg 2 / Am Flugplatz
76646 Bruchsal

For Schempp-Hirth aircrafts:

Schempp-Hirth Flugzeug-Vertriebs GmbH

Krebenstraße 25
73230 Kirchheim unter Teck

Schempp-Hirth Service GmbH

Nabern/Teck Airport, Neue Str. 109
73230 Kirchheim unter Teck

The following persons are approved for performing maintenance:

Leo Benetti, USA

Marcus Maul, Germany

Sven Koch, Germany

Nils Salberg, Germany

Attention!

This system contains EMI-sensitive components and high-voltage power lines up to 400 V DC. Accidental contact with these lines can result in serious injury or damage.

Before performing any work, ensure that appropriate safety precautions are in place to protect personnel and equipment from exposure to high voltage and electromagnetic interference.

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References:



Fig 4: EMI Spikes at the test bench

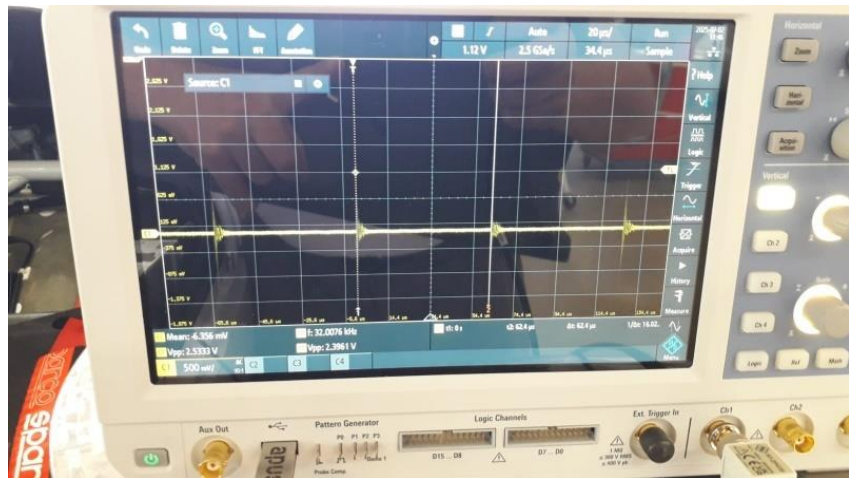


Fig 5: EMI Spikes at a reference glider



Fig 6: EMI spikes at the airframe out of tolerance

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Declaration of Alteration

Hinweis bitte senden Sie den unteren Abschnitt an Solo Aircraft Engines GmbH zurück, sofern die TM erstmal oder zum wiederholten male durchgeführt wird.

Note please submit the record below to Solo Aircraft Engines GmbH if the SB is being carried out for the first time or for the repeated time.

----- SNIP -----

I hereby declare that the aircraft owned by

Name: _____

Address: _____

City / Town: _____

Country: _____

Aircraft SN: _____

AC Callsign: _____

has been altered in accordance with this instruction on

Date : _____

Task performed:

Action 1 ☐ Action 2 ☐ Action 3 ☐ Action 4 ☐

Name of Certifying Staff/Owner : _____

Signature: _____

License No: _____

Send this record to:

Solo Aircraft Engines GmbH
 Industriestrasse 9
 D-71069 Sindelfingen (Germany)
 E-Mail: aircraft@solo-germany.com

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